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# ANATOMICAL AND ECOLOGICAL OBSERVATIONS ON PSAMMO-HALOPHYTES SPECIES (EASTERN PART OF SPAIN)

## OBSERVAȚII ANATOMO-ECOLOGICE LA SPECII DE PSAMO-HALOFITE (PARTEA ESTICĂ A SPANIEI)

GRIGORE M.N.<sup>1</sup>, TOMA C.<sup>1</sup>, BOȘCAIU Monica <sup>2</sup>, ZAMFIRACHE Maria Magdalena<sup>1</sup>, IVĂNESCU Lăcrămioara<sup>1</sup>  
e-mail: mariusgrigorepsyche@yahoo.com

**Abstract.** *In this work, we included preliminary data regarding anatomical and ecological adaptations in species collected from littoral in Spain, during 2010. Species we have anatomically investigated are: Crithmum maritimum L. (Apiaceae), Plantago coronopus L. (Plantaginaceae), Sporobolus pungens (Schreb.) Kunth (Poaceae), Cakile maritima Scop. (Brassicaceae), Bassia hyssopifolia (Pall.) Kuntze, Salsola kali L. (Chenopodiaceae) and Frankenia laevis L. (Frankeniaceae). Several taxa have a deep rooting system (Cakile, Salsola) and others display shoot succulence (Crithmum, Cakile); these features should be regarded as an adaptation to xeric conditions. Species like Sporobolus and Frankenia posses salt glands, special devices involved in removal of concentrated salts.*

**Key words:** halophytes, psammophytes, salinity, adaptations, ecology

**Rezumat.** *În acest studiu, am inclus rezultatele preliminare referitoare la adaptările anatomo-ecologice ale unor specii colectate de pe litoralul maritim din Spania, în anul 2010. Aceste specii sunt: Crithmum maritimum L. (Apiaceae), Plantago coronopus L. (Plantaginaceae), Sporobolus pungens (Schreb.) Kunth (Poaceae), Cakile maritima Scop. (Brassicaceae), Bassia hyssopifolia (Pall.) Kuntze, Salsola kali L. (Chenopodiaceae) și Frankenia laevis L. (Frankeniaceae). Unele specii prezintă sistem radicular foarte profund (Cakile, Salsola) și succulența părților aeriene (Crithmum, Cakile), ca o adaptare la condițiile de xerofitism. Alte specii posedă glande saline (Sporobolus, Frankenia), care intervin în eliminarea excesului de sare.*

**Cuvinte cheie:** halofite, psamofite, salinitate, adaptări, ecologie

## INTRODUCTION

Halophytes are a remarkable ecological group of plants, including very different species in terms of habitats where they vegetate, taxonomical diversity and adaptive strategies (Grigore, 2008a, 2008b; Grigore and Toma, 2010 a, 2010b).

In the current paper, we try to go further in a series of studies focused on adaptations of Mediterranean species; this imply histo-anatomical investigations (Grigore, Toma, Ivănescu, 2011), and especially an integrative ecological approach,

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<sup>1</sup> "Al. I. Cuza" University Iași, Romania

<sup>2</sup> Instituto Agroforestal Mediterráneo, Universidad Politécnica de Valencia, Spain

an issue previously proposed and described in detail (Grigore et al., 2011).

Species restricted to littoral zone are confined to an area making transition from sea to the land; there were several attempts to classify littoral and corresponding vegetation (Warming, 1909; Ranwell, 1972). In this work, we define “littoral zone” as that area, delineated one side by line where the action of waves stops and in the opposite side, by the line where surface covered by sand ends, usually due to an anthropic impact. This is not the case of sand dunes, *stricto sensu*; therefore, in this paper we shall not deal with sand dunes.

Henslow (1895), Schimper (1903), Warming (1906), Chermeson (1910) have sporadically mentioned adaptations of littoral plants in time; but they dealt with plants discussing adaptations regarding only limited aspects of their biology.

The predominant ecological factor in the area that we previously defined is water deficit; this is because the soil is physically or even physiologically dry, due to salty water in the upper part of soil. Water stress could be also related to insolation. Moreover, attention should be paid on salinity influence, regarded both as saline water in the soil, as well as salt spray. These environmental conditions and the nature of adaptations that we discuss here suggest the use of term psammo-halophytes, namely plants that vegetates on maritime sands also exposed to salinity.

## MATERIAL AND METHOD

In this study, we included ecological notes for the follow species: *Crithmum maritimum* L. (*Apiaceae*), *Plantago coronopus* L. (*Plantaginaceae*), *Sporobolus pungens* (Schreb.) Kunth (*Poaceae*), *Cakile maritima* Scop. (*Brassicaceae*), *Bassia hyssopifolia* (Pall.) Kuntze, *Salsola kali* L. (*Chenopodiaceae*) and *Frankenia laevis* L. (*Frankeniaceae*). Field observations and plant material collection for subsequent histo-anatomical investigations were done during July-December 2010 in littoral zone of Valencia Community.

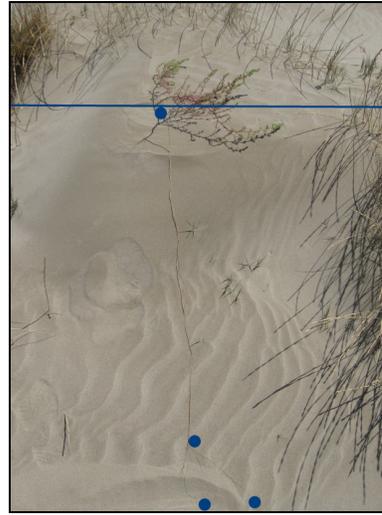
Anatomical investigations were conducted following the standard method fixed by our group working in plant anatomy from Faculty of Biology Iași (for a detailed description of this method, see: Grigore et al., 2010).

## RESULTS AND DISCUSSION

It is worth noting that in the field we made several interesting morphological and ecological observations. Species vegetating on sand, located to a considerable distance from seawater (and therefore free from its direct action) display a deep radicular system, as comparatively to their aerial part. This is the case of *Cakile maritima* (fig. 1) and *Salsola kali* (fig. 2), where principal root has approximately 1.2-1.3 meters in length, while the shoot reaches only 20-30 centimeters. This is an obvious adaptation to xerophytic conditions related to maritime sand that is permeable to water and that does not allows its retaining in the upper layers. Consequently, species that vegetate in this area must develop a deep root system in order to find and reach the water table.



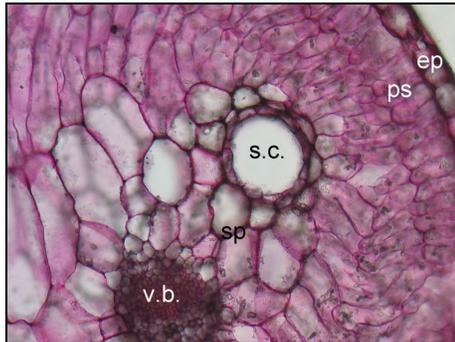
**Fig. 1** - Root/shoot length ratio in *Cakile maritima* (blue line shows the limit between roots and shoot; ending blue point marks the root tip) (original)



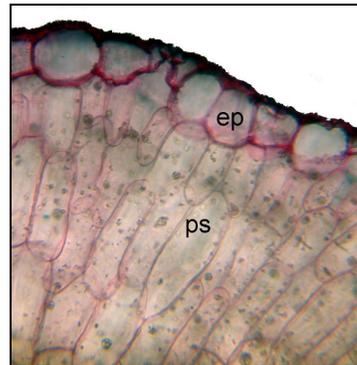
**Fig. 2** - Root/shoot length ratio in *Salsola kali* (blue line shows the limit between roots and shoot; ending blue points mark the root tips) (original)

In addition, *Cakile* is a succulent species (original anatomical results not shown) (Toma et al., 1979), and *Salsola* (*Chenopodiaceae*) has  $C_4$  photosynthetic pathway, a feature with complex ecological and adaptive implications (Grigore, 2008a, b; Grigore et al., 2012). *Crithmum* has also a succulent lamina (fig. 3) and a strong rhizome that we think that this is an adaptation to sandy soil, more compact than in the case of other previously mentioned species.

The lamina of *Plantago coronopus* has a bifacial-heterofacial structure, with palisade tissue under both epidermis (fig. 4) and 2-3 layers of rounded cells in the center.



**Fig. 3** - Cross section through the lamina of *Crithmum maritimum* (X 200); ep – epidermis; ps – palisade tissue; sp – spongy tissue; v.b. – vascular bundle



**Fig. 4** - Cross section through the lamina of *Plantago coronopus* (X 200); ep – epidermis; ps – palisade tissue

A well-developed palisade tissue under both epidermis could be regarded as an adaptation to sandy environment, where the insolation is considerable; moreover, the albedo effect may be also involved, by reflecting radiation of sun to lower epidermis. Moreover, in order to make photosynthesis more efficient, the leaves of *Plantago* are arranged in a basal rosette and approximately parallel to aerial stem; this might be an adaptation to a uniformly exposure to sun radiation affecting the entire surface of lamina.

*Sporobolus pungens* is a typical psammophyte, as an older name of it suggests: *S. arenarius* Duval-Jouve. This species has, as adaptations to sandy environment a repent, extensive, and branched rhizome, with long internodes (fig. 5). The rhizome is usually located in the upper layer of sand soil, forming a dense underground network, easily to note when we tried to extract the aerial stem from sand. In this way, aerial stems are very close each other (fig. 6) and sometimes could be covered by sand in their basal part, due to the wind action. Perhaps this underground network is involved in plant anchoring in the sand, assuring a mechanical resistance to high wind intensity. In addition, as an adaptation to salinity conditions – occurring as saline source in water table or as salt spray – this species presents bicellular salt glands (fig. 7); these structures are involved in removal of concentrated salts (Grigore și Toma, 2010b).



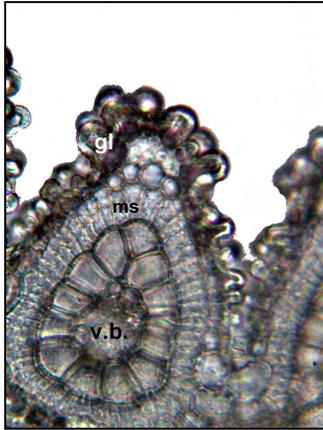
**Fig. 5** - *Sporobolus pungens*: underground and above ground organs



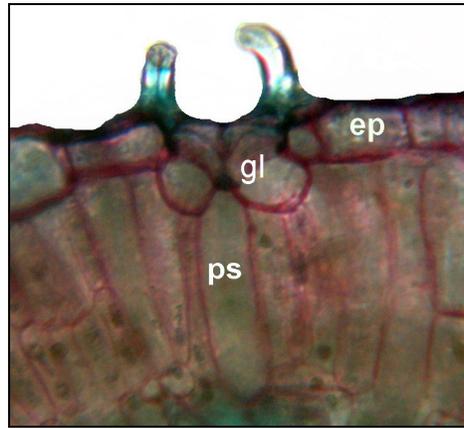
**Fig. 6** - *Sporobolus pungens*: aerial stems

*Frankenia laevis* also presents salt glands; these have a multicellular structure, consisting of six cells (fig. 8).

*Bassia hyssopifolia* vegetates on beaches from Alicante-Santa Pola, as isolated vigorous individuals, preferring relatively shading areas.



**Fig. 7** - Cross section through the lamina of *Sporobolus pungens* (X 200); gl – salt gland; ms – mesophyll; v.b. – vascular bundle



**Fig. 8** - Cross section through the lamina of *Frankenia laevis* (X 400); ep – epidermis; gl – salt gland; ps – palisade tissue

## CONCLUSIONS

Our preliminary observations suggest that here is a close correlation between morpho-anatomical adaptations and ecological factors predominating in coastal ecosystems. These adaptations are of xerophytic and halophytic nature and reflect in fact each major part of environmental convergent factors: hydric deficit and salinity influence, respectively.

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# RESEARCH ON THE VASCULAR FLORA FROM VIIȘOARA MARE AREA - DOLJ (ROMANIA)

## CERCETĂRI ASUPRA FLOREI VASCULARE DIN ZONA VIIȘOARA MARE – DOLJ (ROMANIA)

RĂDUȚOIU D.<sup>1</sup>, POPESCU Maria Ionela<sup>2</sup>

e-mail: radutoiudaniel@yahoo.com

**Abstract:** The studied area is situated at a distance of about 40 km from the city of Craiova, having the following coordinates: N 44°14'553" and E 24°08'549". In terms of geomorphology, Viișoara Mare locality is situated in the central southern part of the Getic Plateau, at the south-western limit with the Olteț piedmont, at its contact with the Olt corridor. Most of the area is formed of relief units resulted from the action of the hydrographic network and especially of the Teslui stream. A wide variety of flora is present in the studied area due mainly to the variety of soil types in this area. Among the many vascular species there are also rare taxa in the Romanian flora, such as: *Lathyrus sphaericus*, *Oenanthe aquatica*, *Camelina rumelica*, *Thlaspi alliaceum* and *Valerianella lasiocarpa*. *Muscari neglectum* var. *sparsiflora* is a new variety that was recently described for the science in this part of the country.

**Keywords:** flora, rarities, Viișoara Mare, Romania.

**Rezumat:** Teritoriul cercetat este situat la o distanță de circa 40 km de municipiul Craiova, având următoarele coordonate: N 44°14'553" și E 24°08'549". Din punct de vedere geomorfologic, teritoriul localității Viișoara Mare se află așezat în partea central sudică a podișului Getic, la limita sud-vestică a piemontului Oltețului, în zona de contact a acestuia cu culoarul Oltului. Cea mai mare parte a suprafeței este ocupată de unitați de relief rezultate în urma acțiunii rețelei hidrografice și în special a pârâului Teslui. Prezența în teritoriul cercetat a unei flore foarte variate se datorează în principal varietății tipurilor de sol din această zonă. Printre numeroasele specii vasculare se numără și taxoni rari în flora României: *Lathyrus sphaericus*, *Oenanthe aquatica*, *Camelina rumelica*, *Thlaspi alliaceum* și *Valerianella lasiocarpa*. Tot din această parte a țării a fost descris de curând o varietate nouă pentru știință: *Muscari neglectum* var. *sparsiflora*.

**Keywords:** floră, rarități, Viișoara Mare, Romania.

### INTRODUCTION

The flora and vegetation studies are missing in this part of Oltenia. The main reason for studying this area was the lack of botanical researches and the presence in the Herbarium of the University of Craiova (CRA) of some sheets with rare plants (*Camelina rumelica*, *Oenanthe aquatica* etc.) from this locality, collected by the illustrious professor Al. Buia.

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<sup>1</sup> University of Craiova, Romania

<sup>2</sup> "Radu Selejan" Secondary School no. 17, Sibiu, Romania

In terms of geomorphology, Viișoara Mare locality is situated in the central southern part of the Getic Plateau, at the south-western limit with the Olteț piedmont, at its contact with the Olt corridor (Posea, 2002). It has the following coordinates: N 44 ° 14'611 "; E 24 ° 08'155" and 170 m.

The locality is crossed by the Teslui stream in the east, a tributary of the Olt River. This stream has a permanent flow, being near the agricultural land.

Under the influence of environmental conditions, the following soil types were formed and evolved in Viișoara Mare locality: *reddish -brown*, scattered in high fields forming the terrace of the Teslui stream and *brown clay illuvial soils*, scattered together with the *reddish -brown* soils on the interfluvial peaks. There are alluvial soils and alluviums in the floodplain.

## MATERIAL AND METHOD

As in any research of this type, the first step was the documentation on the territory that was to be studied. When the literature data are absent, as in this case, there have been studied papers that presented similar areas to that investigated by us (Buia et al., 1952, Cârțu et al., 1972, Dihoru et al., 1970, Păun, 1965, Păun et al., 1980).

After the documentation, numerous field trips were made in different time intervals to capture the vegetation in all phases and to collect suitable material to allow subsequently an accurate identification.

The identification was made using the Romanian and foreign literature (Beldie 1977, 1979, Ciocârlan, 2009, Tutin et al., 1972). The authors' abbreviations of the identified species in the studied area were made after Brummitt and Powell (1992).

## RESULTS AND DISCUSSIONS

Following the researches performed in the Viișoara Mare area a floristic list formed of 141 vascular species was constituted. Some of them are characteristic to the cerris and Hungarian oak forest on the plateau of the studied area, others to the meadows and shrubs situated nearby and other category to the cultivated lands in the floodplain of the Teslui stream that crosses this area.

Their presentation is made in alphabetical order to ease the finding of a taxon by those who are interested, the systematic classification is known from the literature:

*Acer campestre* L. – Field Maple, Ph., Eur.; *Acer tataricum* L. – Tatarian Maple, Ph., Euras. cont.; *Adonis aestivalis* L. Summer pheasant's-eye, T., Euras. cont.; *Agrimonia eupatoria* L. H., Euras.; *Agrostemma githago* L. – Common corncockle, T., Cosm.; *Ajuga reptans* L. – Common bugle, H., Eur.; *Alopecurus pratensis* L. subsp. *pseudonigricans* O. Schwarz – H., Euras.; *Alyssum alyssoides* (L.) L. – Pale alyssum, T.-Ht., Euras. cont.; *Anthemis austriaca* Jacq. – T., Centr. eur. pont.; *Arabidopsis thaliana* (L.) Heynh. – Mouseear cress, T.-Ht. Cosm.; *Arctium lappa* L. Ht., Euras.; *Arenaria serpyllifolia* L. – T., Circ.; *Arum orientale* M. Bieb. – G., Pont.-pan.-balc.; *Asparagus tenuifolius* Lam. – Asparagus, G., Pont.-medit.; *Brachypodium sylvaticum* (Huds.) Beauv. – H., Euras. (submedit.); *Camelina rumelica* Velen. – T., Pont.-medit.; *Cardaria draba* (L.) Desv. – H., Euras. (medit.); *Carex brizoides* L. – G., Centr. eur.; *Carex caryophyllea* Latourr.

–Spring Sedge. G., Euras. (submedit.); *Carex tomentosa* L. – G., Euras.; *Carlina vulgaris* L. – Carline thistle, Ht., Euras.; *Centaurea apiculata* Ledeb. subsp. *spinulosa* (Rochel) Dostál – H., Centr. and SE Eur.; *Centaurea cyanus* L. – Garden cornflower, T.-Ht., Medit., nowadays Cosm.; *Cephalaria transylvanica* (L.) Roem. et Schult. – Ht., Pont.-medit.; *Cerastium glomeratum* Thuill. – T., Cosm.; *Cerasus avium* (L.) Moench.- Sweet cherry, Ph., Submedit.; *Cerinth minor* L. – T.-Ht., Centr. eur. medit.; *Chamaecytisus albus* (Hacq.) Roth. – Drob. Ph., Pont. pan. balc.; *Cirsium arvense* (L.) Scop. – Canada thistle, G., Euras.; *Clinopodium vulgare* L. – H., Circ.; *Conyza canadensis* (L.) Cronquist – T., Adv. (North Am.); *Convolvulus arvensis* L. – G.(H.), Cosm.; *Cornus sanguinea* L. subsp. *australis* (C.A.Mey.) Jáv. – Bloodtwig dogwood, Ph., Daco.-balc.-pan.; *Cornus mas* L. – European Cornel, Ph., Pont.-medit.; *Corydalis solida* (L.) Clairv. – G., Eur.; *Crataegus monogyna* Jacq. – Oneseed hawthorn, Ph., Euras.; *Cruciata laevipes* Opiz – Smooth bedstraw, H., Euras.; *Cruciata pedemontana* (Bellardi) Ehrend. T., Submedit.; *Cydonia oblonga* Mill. – Quince, Subspontan. Ph., SW As.; *Descurainia sophia* (L.) Webb ex Prantl – Herb Sophia, T.-Ht., Euras.; *Digitalis lanata* Ehrh. – Grecian foxglove, Ht.-H., Balc.-pan.; *Dorycnium herbaceum* Vill. Ch., Centr and SE Eur.; *Draba muralis* L. – T.-Ht., Eur.; *Erigeron annuus* (L.) Pers. subsp. *strigosus* (H.L. Muhl. ex Willd.) Wagenitz – T., Ht., H., Adv. (North Am.); *Erodium cicutarium* (L.) L'Hérit – T., Cosm.; *Eryngium campestre* L. – Field eryngo. H., Pont.-medit.; *Euphorbia cyparissias* L. – H., Euras.; *Euphorbia salicifolia* Host – H., Pont.-pan.; *Euphorbia virgata* Waldst. et Kit. – H., Euras.-cont.; *Falcaria vulgaris* Bernh. – Sickweed Ht. (T., H.), Euras. (submedit.); *Festuca heterophylla* Lam. – H., Centr.-eur.-submedit.; *Fragaria vesca* L. – Wild strawberries, H., Euras.; *Fragaria viridis* (Duchesne) Weston – Woodland strawberry, H., Euras.; *Fraxinus ornus* L. – South European Flowering Ash, Ph., Submedit.; *Galium aparine* L. – Stickywilly T., Circ.; *Galium glaucum* L. – H., Centr.-eur.-submedit.; *Galium rubioides* L. – European Bedstraw gaillet, H., Centr.-eur.; *Galium verum* L. Yellow Spring, bedstraw Lady's Bedstraw, H., Euras.; *Genista tinctoria* L. – Dyer's greenweed, Ch., Euras.; *Geranium dissectum* L. – T., Euras.; *Geum urbanum* L. – Wood Avens, H., Circ.; *Glechoma hirsuta* Waldst. et Kit. – H. (Ch.), Pont.-medit.-centr.-eur.; *Hieracium bauhini* Schult. – H., Central and Eastern Eur.; *Hypericum perforatum* L. – St. John's wort, H., Euras.; *Lamium purpureum* L. – Purple deadnettle, T., Euras.; *Lathyrus niger* (L.) Bernh. – G., Central Eur.; *Lathyrus pratensis* L. – Meadow pea, H., Euras.; *Lathyrus sphaericus* Retz. T., Medit.; *Lepidium campestre* (L.) R. Br. – Field Pepperwort, T.-Ht., Eur.; *Ligustrum vulgare* L. – Ph., Eur. (submedit.); *Linaria genistifolia* (L.) Mill. – H., Cont.-eur.; *Lithospermum arvense* L. – Field gromwell, T., Euras.; *Lithospermum purpureocaeruleum* L. – Purple gromwell, H.-G., Submedit.-centr. Eur.-centr.-submedit.; *Lychnis coronaria* (L.) Desr. – Rose campion, H., Centr. SE Eur.; *Lysimachia nummularia* L. – Creeping jenny, Ch., Euras. North Am.; *Matricaria perforata* Merat –Scentless Chamomile, T.-Ht., Euras.; *Medicago minima* (L.) L. – T., Submedit.; *Muscari neglectum* Guss. ex Ten. var. *sparsiflora* Răduțoiu – G., Submedit.; *Myosotis stricta* Link ex Roem. et

Schult. T., Euras.; *Nonea pulla* (L.) DC. — H., Central and South Eastern Eur.; *Oenanthe aquatica* (L.) Poir. — fineleaf waterdropwort, Hd., Euras.; *Ornithogalum boucheanum* (Kunth) Asch. — G., Pont.-pan.-balc.; *Ornithogalum umbellatum* L. — G., Submedit.-centr.-eur.; *Papaver dubium* L. — Opium poppy, T., Eur.; *Plantago media* L. — H., Euras.; *Poa bulbosa* L. — Bulbous bluegrass T.-H., Cosm.; *Poa nemoralis* L. — H., Circ.; *Poa pratensis* L. — H., Circ. (nowadays Cosm.); *Polygonatum latifolium* (Jack.) Desf. — G., Pont.-pan.-balc.; *Potentilla argentea* L. — Silver cinquefoil, H., Euras.; *Potentilla micrantha* Ramond ex. DC. — H., Centr.-eur.-submedit.; *Potentilla recta* L. — Sulphur cinquefoil, H., Euras.; *Prunella vulgaris* L. — H., Cosm.; *Prunus spinosa* L. — Ph., Eur.; *Pyrus pyraster* (L.) Burgds. — Wild pear, Ph., Eur.; *Quercus cerris* L. — Cerris, Ph., Submedit.; *Quercus frainetto* Ten. — Hungarian Oak, Ph., Balc.; *Ranunculus arvensis* L. — Corn buttercup, T., Euras.; *Rorippa sylvestris* (L.) Bess. — Creeping yellow cress, H., Euras.; *Rosa canina* L. — Ph., Eur.; *Rosa gallica* L. — French rose, Ph., Pont.-medit.; *Rubus canescens* DC. — Ph., Centr.-eur.-medit.; *Salvia nemorosa* L. — Woodland sage, H., Pont.-medit.-centr.-eur.; *Sambucus ebulus* L. — Dwarf elderberry, H., Euras. (submedit.); *Sanguisorba minor* Scop. — Small burnet, H., Euras.; *Scorzonera cana* (C.A. Mey.) Hoffm. — G., Pont.-medit.; *Scutellaria altissima* L. — Tall skullcap, H., Pont.-medit.; *Sedum maximum* (L.) Hoffm. — Stonecrop, H., Eur.; *Senecio vernalis* Waldst. et Kit. — T., Euras.-cont.; *Silene vulgaris* (Moench) Garcke — H., Euras.; *Sisymbrium altissimum* L. — T.-Ht., Euras.-cont.; *Stellaria media* (L.) Vill. — Common chickweed, T.-Ht., Cosm.; *Tanacetum corymbosum* (L.) Sch.-Bip. — Corymbflower tansy, H., Euras.; *Taraxacum officinale* Weber ex. F.H. Wigg. — H., Euras.; *Teucrium chamaedrys* L. — Wall germander, Ch., Central Submedit Eur.; *Thlaspi arvense* L. — T.-Ht. Euras.; *Thlaspi perfoliatum* L. — T.-Ht. Euras.; *Thesium dollineri* Murb. T.-H. Balc.-pan.; *Thymus pulegioides* L. — Ch., Eur. (mont.); *Tilia tomentosa* Moench — Ph., Balc.-pan.; *Ulmus glabra* Huds. — Wych elm, Ph., Euras.; *Valerianella lasiocarpa* (Steven) Betcke (Oprea A., 2005) — T. Balc.-pan.-anat. (fig. 1);

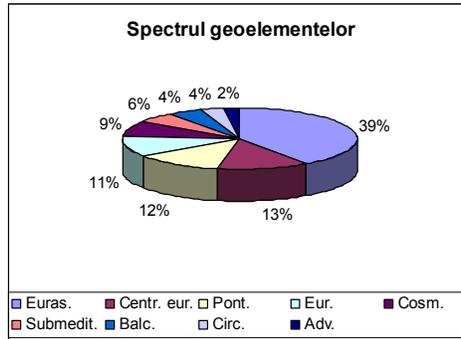


**Fig. 1** - *Valerianella lasiocarpa* (Steven) Betcke - a detail of the inflorescence (orig.)

*Valerianella locusta* (L.) Laterr. em. Betcke — T., Eur.; *Verbascum phlomoides* L. — Ht., Central and South Eastern Eur.; *Verbascum phoeniceum* L. — Purple mullein, H., Euras. cont.; *Verbascum nigrum* L. — Black mullein, H., Euras.; *Veronica arvensis* L. — T., Euras.; *Veronica chamaedrys* L. — Germander

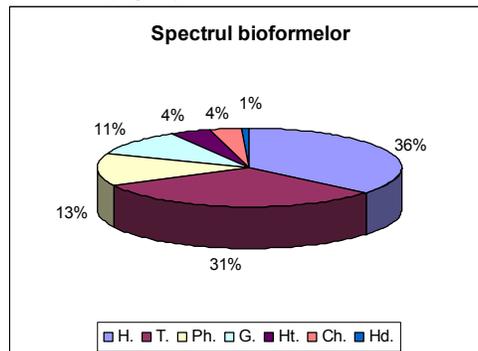
speedwell, H.-Ch., Euras.; *Veronica hederifolia* L. – Ivyleaf speedwell, T., Euras.; *Veronica jacquinii* Baumg. – H., Pont.-centr.-eur.-medit.; *Veronica polita* Fr. – T., Euras.; *Veronica serpyllifolia* L. – H., Cosm.; *Vicia grandiflora* Scop. – T., Pont.-balc.-cauc.; *Vicia lathyroides* L. – T.-Ht., Eur.; *Viola arvensis* Murray – European field pansy, – T., Cosm.; *Viola canina* L. subsp. *ruppilii* (All.) Schübl. et G. Martens – H., Euras.; *Viola elatior* Fr. – H., Euras.; *Viola tricolor* L. var. *lutea* Peterm. – T.-Ht., Euras.; *Xanthium italicum* Moretti – Canada cocklebur, T., South Eur.; *Xeranthemum cylindraceum* Sibth. et Sm. – T., Pont.-medit.

After the spectrum analysis of geoelements there can be seen the high percentage of southern elements (Pontic, Mediterranean and Balkan), and the Eurasian species (fig. 2).



**Fig. 2** - The geoelements spectrum (orig): Euras. – Eurasian, Centr. Eur. - Central Europe, Pont. - Pontic, Eur. – European, Cosm. - Cosmopolite, Submedit. - Submediterranean, Balc. - Balkan, Circ. - Circumpolar, Adv. - Adventive

The high percentage of hemicriptophytes (H) is explained by their presence in large numbers in meadows, plus those within the forest. The good representation of annual species is due to the presence of cultivated and heathened lands near the Teslui stream (fig. 3).



**Fig. 3** - The bioforms spectrum (orig): H. - hemicriptophytes, T. - terophytes, Ph. - Fanerophytes, G. - geophytes, Ht. - Hemiterophytes, Ch - camephytes, Hd. - Hydrophytes.

Unlike other regions of the country where although the number of fanerophytes (Ph.) is low, in this area they give the physiognomy of those places by the large number of specimens, the fanerophytes having a good representation both in number of species and specimens compared to the studied surface.

## CONCLUSIONS

The studied area has a high floristic diversity (141 species). This is explained by the presence of cerris and Hungarian oak forest on the plateau, of hawthorn and blackthorn shrubs on slopes and of xeric meadows and cultivated and heathed lands situated near the main water source area (the Teslui stream).

The aim of our researches represented by filling in a gap on the floristic map of Oltenia and to make additions to the knowledge of the area of some taxa, was fulfilled.

A new taxon *Muscari neglectum* Guss. ex Ten. var. *sparsiflora* (Răduțoiu, 2011) for science was identified in this part of the country.

Numerous specimens of rare species were also found in the flora of Romania: *Lathyrus sphaericus*, *Camelina rumelica*, *Oenanthe aquatica*, *Valerianella lasiocarpa* and new chorological data are added to some taxa of which the growing area is not known in this part of the country (*Alopecurus pratensis subsp. pseudonigricans*, *Nonea pulla* and *Thesium dollineri*).

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# THE INFLUENCE OF PHOSPHORUS AND RHIZOBACTERIA ON SOYBEAN (*GLYCINE MAX. L.*) ROOT GROWTH UNDER SUBOPTIMAL MOISTURE REGIME

## ACȚIUNEA FOSFORULUI ȘI RIZOBACTERIILOR ASUPRA CREȘTERII SISTEMULUI RADICULAR LA SOIA (*GLYCINE MAX. L.*) ÎN CONDIȚII SUBOPTIMALE DE UMIDITATE

ROTARU V.<sup>1</sup>

e-mail: rotaruvlad@yahoo.com

**Abstract.** *The effect of phosphorus and suspension of microorganism's Azotobacter chroococcum and Pseudomonas fluorescens on root growth and phosphorus concentration in soybean plants exposed to a short drought stress was studied in a greenhouse experiment. The suspension of microorganisms was administrated in soil without or with P supply. Control plants were grown at normal moisture conditions 70% WHC (water holding capacity) and other part of plants at flowering stage was subjected to water deficit - 35% WHC. The results shown that drought reduced the morphological root parameters irrespective of level of P. Dry mass of roots, total root length, specific root length and fine roots increased in treatments with microorganisms application, in particular in treatment without P. The content of total P in soybean organs din not change significantly but it was observed an increase of Pi concentration due to P and microorganisms supply.*

**Key words:** *Glycine max.*, drought, rhizobacteria, root growth, phosphorus

**Rezumat.** *S-a efectuat un studiu în scopul elucidării efectului fosforului și a suspensiei tulpinilor bacteriene Azotobacter chroococcum și Pseudomonas fluorescens asupra modificărilor caracterelor morfologice a sistemului radicular și conținutului de fosfor (P) la plantele de soia în condiții de secetă. Fosforul și suspensia de microorganisme s-a aplicat în sol înainte de semănat. Plantele martor s-au cultivat la umiditatea optimă (70% din capacitatea pentru apă a solului, CTA). În faza înfloritului un lot de vase a fost supus regimului suboptimal de umiditate (35% CTA) pe o perioadă de două săptămâni. Seceta a condus la reducerea parametrilor morfologici a rădăcinii indiferent de regimul de nutriție cu P. Masa rădăcinilor, lungimea totală a rădăcinilor, lungimea specifică, cota rădăcinilor fine au înregistrat valori mai mari în varianta cu aplicarea microorganismelor. Concentrația fosforului total din organe nu s-a modificat substanțial însă a crescut conținutul fosforului anorganic în urma aplicării fosforului și microorganismelor.*

**Cuvinte cheie:** *Glycine max.*, rizobacterii, rădăcini, fosfor, secetă

### INTRODUCTION

Phosphorus (P) is an essential macronutrient required for plant growth and development, but plants have to cope with limiting soil P availability in many

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<sup>1</sup> Institute of Genetics and Plant Physiology Moldavian Academy of Sciences, Republic of Moldova

terrestrial ecosystems (Schachtman et al., 1998). In the context of increasing international concern for food and environmental quality, the use of plant growth-promoting rhizobacteria (PGPR) for reducing chemical inputs in agriculture is a potentially important issue. PGPR have been applied to various crops to enhance growth, seed emergence and crop yield (Dey et al., 2004; Herman et al., 2008; Minorsky, 2008). Biofertilizers affect the root growth which in turn influences the uptake capacity of nutrients and water (Adesemoye et al., 2009). It is well known that microorganisms (MO) are involved in a large range of biochemical processes and they have direct implications in transformation of phosphorus compounds in soil and they are integrated components of P cycle (Deubel et al., 2000). In addition to improve plant growth, PGPR are involved in the increase of nitrogen uptake, synthesis of phytohormones, solubilization of minerals such as phosphates and production of siderophores that chelate iron and make it available to the plant root (Lalande et al., 1989; Glick, 1995; Bowen and Rovira, 1999). It has also been reported that PGPR is able to solubilize inorganic and/or organic phosphates in soil (Liu et al., 1992). The rhizobacteria are considered the effective pathway of mineral nutrition improvement of plants. It is documented that *Pseudomonas flourescence* and *Azotobacter chroococum* are mainly components of microbial community of rhizosphere. Among legumes soybean is more sensitive to shortage of moisture and phosphorus deficit. Under such environmental conditions the soybean yield is reduced substantially. In period of energetic crisis and exhaust of non-renewable recourses it is very important to indentify the means for improvement of plant nutrition. Little information is available concerning morphological changes of root in soybean in relation to rhizobacteria and P supply under limited water conditions. One of the research objectives was to determine the impact of phosphorus and rhizobacteria (*Pseudomonus fluroucense* and *Azotobacter chroococum*) supply on modification of morphological characters of roots and phosphorus concentration in soybean plant parts under suboptimal moisture regime of soil.

## MATERIAL AND METHODS

In order to accomplish the research objective it was carried out a factorial pot experiment under semi-controlled environmental conditions with soybean (*Glycine max.L* cultivar Zodiac). The soil was represented by cernoziom carbonated with phosphorus deficit and it was mixed with sand (1:1 v/v). The treatments included variants with microorganisms supply in soil in combination without or with of phosphorus (100 mg P per kg of soil). Three plants were grown in each pot. There were four replications of each treatment. The soybean seeds were inoculated with bacteria strain *Bradyrhizobium japonicum*. Plants were cultivated at two water soil regime 70% WHC (soil water holding capacity) as normal level and 35% WHC as suboptimal level. The suboptimal moisture conditions were imposed at the beginning of flowering for two weeks. Plants were sampled from each treatment two weeks after starting the water stress. Root length was determined by line intersect method according to Tennant D. (1975). Phosphorus was determined calorimetrically by vanadomolybdophosphoric method (Murthy and Riley, 1962). The experimental data

were analyzed by ANOVA and the differences were compared by least Significant Difference Test ( $p=0.05$ ).

## RESULTS AND DISCUSSION

Application of P along with PGPR resulted in significant difference for all morphological parameters that is shoot dry weight, root length, root dry weight and P content. Root biomass was significantly increased for all the treatments with P fertilization and inoculation over control (tab. 1, 2).

Table 1

**Morphological changes of roots of soybean plants at normal water regime of soil (70% WHC) in relation to phosphorus and microorganisms (MO) supply**

Treatments	Root mass, g plant <sup>-3</sup>	Total root length m plant <sup>-3</sup>	Mass of fine roots, g plant <sup>-3</sup>	Fine roots, %
P0	1,71±0,14	136,3±7,4	1,36±0,10	79,5
P20 mg kg <sup>-1</sup> soil	2,92±0,07	187,3±13,3	2,22±0,17	76,0
P100 mg kg <sup>-1</sup> soil	4,21±0,12	263,8±11,8	3,71±0,13	88,7
P0 + MO	2,43±0,11	141,7±13,2	2,06±0,20	84,7
P100 mg kg <sup>-1</sup> soil + MO	4,69±0,07	236,9±13,6	3,77±0,35	80,4

Moisture stress resulted in marked reduction in root growth. Plant fertilization with phosphorus increased the fraction of fine roots that played a major role in acquisition of mineral nutrients and water.

Inoculated plants significantly developed a greater root length and root mass of soybean than plants without inoculation (tab. 1, 2). This fraction was increased by 9,2% due to supplemental nutrition with phosphorus under normal water regime (70% WHC) in comparison to control (P0). The P effect on biomass accumulation of roots was highly significant when the soil had 100 mg P per kg of soil, registering 59,4% increase of biomass over “0” level of P. The amount of biomass accumulated in plants with administration of PGPR was significantly more than the non-inoculated plants.

The root growth was increased significantly in treatment with application of phosphorus in particular under water limiting conditions. Under optimal moisture level the positive effect of rhizobacteria application was established in treatment without P supply and provided an increase by 29,2%, but it was less pronounced in treatment with fertilizer application. The water stress diminished the fraction of fine roots evidently in unfertilized treatment. But the supplemental phosphorus nutrition (100 mg P kg of soil) increased the morphological parameters by two times in plants subjected to drought in comparison with reference treatment.

The largest root system was registered with alone phosphorus application under optimal conditions of humidity. It's necessary to emphasize

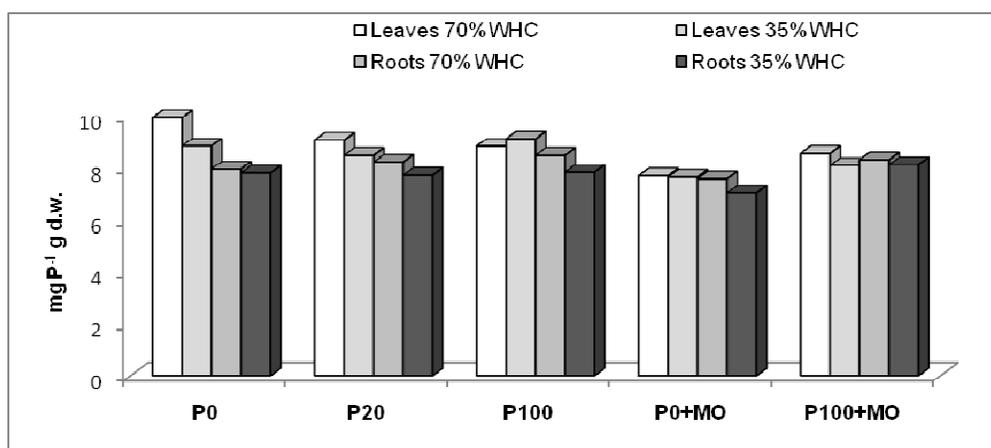
that similar effects of MO were revealed in investigations with corn plants and rape (Krey et al., 2011). The estimation of specific root length is a characteristic for rate of fine roots.

*Table 2*

**Morphological changes of roots of soybean plants at suboptimal water regime of soil (35% WHC) in relation to phosphorus and microorganisms supply**

Treatments	Root mass, g plant <sup>-3</sup>	Total root length m plant <sup>-3</sup>	Specific root length m g <sup>-1</sup> d.w.	Mass of fine roots, g plant <sup>-3</sup>	Fine roots, %
P0	1,36±0,15	94,2±2,9	69,3	0,91±0,21	66,9
P20 mg kg <sup>-1</sup> soil	1,85±0,20	151,8±4,8	82,1	1,18±0,09	63,8
P100 mg kg <sup>-1</sup> soil	2,73±0,38	246,5±17,5	90,3	2,09±0,26	76,5
P0 + MO	1,51±0,11	136,3±5,3	90,3	1,10±0,10	72,8
P100 mg kg <sup>-1</sup> + MO	2,98±0,19	229,5±11,5	76,9	2,36±0,18	79,2

The supply of rhizobacteria strains increased the specific root length under subnormal water conditions from 69,3 to 90 m g<sup>-1</sup> dry weight in treatment without fertilizer supply (tab. 2).



**Fig. 1** - Concentration of total phosphorus in leaves and roots as affected by microorganisms (MO) and phosphorus supply in relation to soil water regime

The use of MO in combination with sufficient phosphorus nutrition did not increase this trait. Thus the results demonstrated that the application of PGPR had a stimulatory effect on accumulation of dry matter in roots under unfavorable conditions of soil moisture. The data established that the use of industrial fertilizers reduces the positive impact of bacteria strains. These data are consistent with findings of other researches (Adesemoye et al., 2009). There are a strong relationship between root development and rate of nutrients and water absorption from soil. The total P concentration in leaves and roots indicated poor changes in comparison with values registered in concentrations of inorganic phosphorus (data are not presented). Also there were not significant change in leaves but it was observed an accumulation of P in roots tissues in control plants by application of MO under normal moisture regime of soil (fig. 1). Marschner and Dell (1994) have noted that application of mycorrhizal fungi increased the absorption and concentration of nutrients particularly in soil with phosphorus deficit, with positive impact on plant growth and development. In present experiment there was an increase of P concentration in plants in treatment with MO application in deficit P soil. Perhaps this result was caused by biological dilution effect because the leaves mass was lower in this treatment. It is necessary to note that the nutrient concentration in roots increased along with increasing the level of P in hydrated normally plants but there were not changes under water deficit (fig. 1).

Legumes have a higher demand for P nutrition comparative with cereals. There is a need to note that in some investigations was present a large number of bacteria with a solubilization potential of phosphorus compounds, and it can fulfils the nutritive needs with the interrelations established at root level. Therefore, it is considered that adequate P nutrition of plants is favorable for plant fortification and nodules formation (Muntean et al., 2003). That's why the establishment of specific relations between MO and root system are benefic for tolerance of organism to unfavorable conditions of water and phosphorus. The application of MO in soil with P deficiency contributes to large allocation of P to aboveground plant parts of soybean.

Further investigations, including efficiency test under field conditions, are needed to clarify the role of PGPR as biofertilizers that exert beneficial effects on plant growth and seed yield. Such researches will be useful for elaboration an integrated nutrient management in agricultural ecosystem through utilization of bacterial strains and fertilizers.

## CONCLUSIONS

1. Our results suggest that plants benefit from the microorganisms symbiosis under dry soil conditions mainly in terms of an improved nutrient uptake.
2. The application of rhizobacteria had a stimulatory effect on root growth without fertilization and increases the soybean tolerance to drought conditions.

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# INFLUENCE OF SOME AQUEOUS EXTRACTS FROM *ANETHUM GRAVEOLENS* L. ON THE GERMINATION

## INFLUENȚA UNOR EXTRACTE APOASE DE *ANETHUM GRAVEOLENS* L. ASUPRA GERMINAȚIEI

*STRATU Anișoara*<sup>1</sup>, *TIMOFTE Elena*<sup>1</sup>, *COSTICĂ Naela*<sup>1</sup>  
email: anisoara\_stratu@yahoo.com

**Abstract.** *The paper presents the results of a study regarding the influence of aqueous extracts obtained from different organs (stems, leaves, inflorescences, fruits) of *Anethum graveolens* on seeds germination and seedlings growth in *Raphanus sativus* L. and *Cucumis sativus* L. species. The following parameters have been determined: the pH value of aqueous extracts; the pH value, the germination percentage between 24-72 hours, and the average length of the root and the hypocotyl. The results of the investigations that were carried out reveal the germination percentage and the average length of the root and hypocotyl present specific value variations according to the extract's concentration, the type of extract and the test species that was used.*

**Key words:** aqueous extracts, *Anethum graveolens*, germination.

**Rezumat.** *În lucrare se prezintă rezultatele unui studiu privind influența extractelor apoase obținute din organe diferite (fructe, frunze, tulpini, inflorescențe) de *Anethum graveolens* asupra germinației semințelor și creșterii preplantulelor la speciile *Raphanus sativus* L. și *Cucumis sativus* L. S-au determinat următorii parametri: pH-ul extractelor apoase; procentajul de germinație în intervalul 24 - 72 ore; lungimea medie a rădăcinii și hipocotilului. Rezultatele investigațiilor efectuate evidențiază următoarele aspecte: extractele apoase au un pH slab acid-neutru; procentajul de germinație și lungimea medie a radiclei și hipocotilului prezintă variații valorice specifice funcție de concentrația extractului, tipul de extract și de specia test utilizată.*

**Cuvinte cheie:** extracte apoase, *Anethum graveolens*, germinație.

### INTRODUCTION

In the specialty literature there are given evidence of multiple cases of ordinary extracts from different vegetal organs (roots, rhizomes, leaves, fruits and seeds) (Plhák, 1971; Sathiyamoorthy, 1990; Peneva, 2007 ; Benias et al., 2010) which belong to species of plants from different families, with effect of inhibition which is not specific to germination and growth in the first ontogenetic stages. These cases are inserted in the biological phenomenon named by Molisch (1937) „allelopathy”, but which is confined to the problem of specific interrelations during the seeds' germination. The above-mentioned effects are due to the presence in the vegetal organs of certain inhibitory +/- specific substances, with a varied chemical nature (aromatic organic acids, terpenoids, phenolic compounds, coumarins,

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<sup>1</sup> „Alexandru Ioan Cuza” University of Iasi, Romania

furocoumarins, etc) (Bewley and Black, 1978; Bilderback , 1985; Sathiyamoorthy, 1990; Razavi, 2011). The studies in the specialty literature have highlighted that the aqueous extracts obtained from seeds, leaves, stems from different species of umbelliferous plants have an effect of inhibition which is not specific to germination (Mihăilescu, 1958; Fūzi et al., 1966; Lamoureux and Koning, 1998; Stratu et al., 2002) or self-inhibitory effect (Friedman et al., 1982).

Starting from these reasons, in this paper are presented aspects regarding the influence of aqueous extracts obtained from organs different from dill (*Anethum graveolens* L.) regarding the germination of seeds and the growth of preplants at the species of *Raphanus sativus* L and *Cucumis sativus* L.

## MATERIAL AND METHOD

As biological material, we used immature fruits, mature fruits, leaves, stems and inflorescences, fresh, harvested from dill plants (*Anethum graveolens* L.). Were studied two test species: seeds of radish (*Raphanus sativus* L.) - Roşioară variety and cucumber (*Cucumis sativus* L.) - Mapamond variety. The seeds were placed to germinate in Petri dishes, on a filter paper humidified with distilled water (control variant) and aqueous extracts of dill (obtained by hot extraction) with different concentrations (5 % and 10 %). For each test species were used 100 seeds / experimental variant. For each test species were made eleven experimental variants: a control and ten treatment variants ( table 1).

Table 1.

Experimental variants

Variant	The type of extract
Control (M)	distilled water
V1	The aqueous extracts from immature fruits: concentration 5 %
V2	The aqueous extracts from immature fruits: concentration 10 %
V3	The aqueous extracts from mature fruits : concentration 5%
V4	The aqueous extracts from mature fruits : concentration 10%
V5	The aqueous extracts from stems: concentration 5 %
V6	The aqueous extracts from stems: concentration 10 %
V7	The aqueous extracts from leaves: concentration 5 %
V8	The aqueous extracts from leaves: concentration 10 %
V9	The aqueous extracts from inflorescences: concentration 5 %
V10	The aqueous extracts from inflorescences: concentration 10 %

We analyzed the following indicators: the pH of extracts (a CONSORT C532 multiple parameters were used); the percentage of germinated seeds; the length of root and hypocotyl at 72 hours since the experiment beginning. The data obtained from the length of the root and of hypocotyl were interpreted statistically. It was used the unifactorial Anova test and in order to test the difference between averages the Tukey test was used (Zamfirescu and Zamfirescu, 2008). The germination sample and especially the

length of the roots are frequently used as indicators for detecting the existence of certain substances with allelopathic character.

## RESULTS AND DISCUSSIONS

*The germination of seeds.* The germination percentage increases progressively in the analyzed range. At cucumber (fig.1), after 48 hours from the setting up of the experiment, the germination percentage presented values between 89% - 97 % for the treatment variants and 90% for the witness. After 72 hours, the germination percentage presented values between 91-99 % for treatment variants and 94% for the witness. There were noticed little value variations between the control witness and the treatment variants. At radish (fig.1), after 24 hours from the setting up of the experiment, the germination percentage recorded values between 0-89%. At the variant V10 there were not noticed any germinated seeds. After 72 hours, the germination percentage recorded values between 37-97 % between treatment variants and 98% for the witness. Low values of the germination percentage were recorded at variants V1 (41 %), V2 (46 %), V4 (40 %), V8 (43 %),V9 (52 %),V10 (37 %).

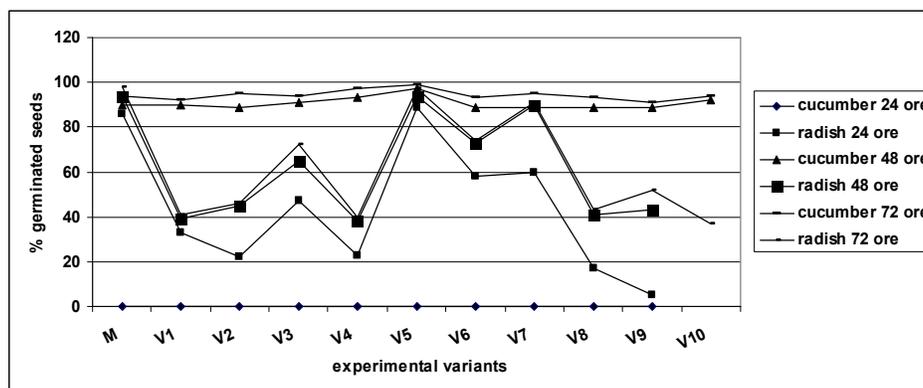


Fig. 1 – The percentaje of germinated seeds of cucumber and radish

From the analysis of the above mentioned results the fact the certain extracts (obtained form inflorescences – both concentrations used: V9, V10; leaves – concentration 10 %: V8; immature fruits - both concentrations: V1, V2; mature fruits – concentration 10 %: V4) slow the germination of seeds at radish.

According to the data from literature, the delay of germination could be due to the substances with inhibitory potential present in different parts of the plant, substances which once entered with the water in the seeds of the test species would determine in the opinion of Mihăilescu (1958) the modification of the activity of enzymes which interfere in the processes of metabolism specific to germination. As determined by Bewey (1978), the natural inhibitors derived from seeds which provoke osmotic effects, pH change, and reduction of respiration, alteration of permeability of the plasmatic membrane, inhibition of the transport of the auxins in the plant and of the synthesis of nucleic acids and proteins. The results obtained might be due to the

chemical composition of the aerial part of the plant, especially to the chemical composition of the volatile oil. The specialty literature mentions the presence in the aerial parts of the plant of a varied range of substances among which we enumerate: volatile oil, fatty acids, proteins, carbohydrates, mineral elements, flavonoids, terpenes, derivatives of the hydroxycinnamic acid, coumarins, furocoumarins, mucilages, etc. (Amin and Sleem, 2007; Ortan et al., 2009). According to Rădulescu and colab. (2010) the main compounds from leaves and flowers are  $\alpha$ -felandren, limonene and anetophuran; the concentration of limonene and anetophuran being larger in flowers than in leaves. In fruits, cis-carvone (75,2%) and limonene (21,56%) are the main compounds; cis carvone is also present in flowers. According to Lamoureux S. and Koning, (1998), the carvone from the composition of the volatile oil from the seeds delays the germinations of the salad seeds.

The pH of the extracts used in treatments presented low acid values (6.75 la V10; 6.99 la V6) and neutral, between 7.20-7.53.

The length of the root. At cucumber (fig. 2), the length of the roots presented values between 20.60 mm and 55.37 mm; the witness had the average value of 45.64 mm. At radish (fig.2), the length of the root presented values between 8.53 mm and 29.96 mm (V7); at the witness there were obtained values close to the maximum value (27.89) mm. With the exception of V7 variant, at all the treatment variants the length of the root presented values inferior to the witness, which denotes the fact that at this test species, the root is sensitive to the treatment with dill extracts. At both species analyzed, the lowest values were obtained at V1 and V4 variants, fact which determines us to declare that the aqueous extracts obtained from immature and mature fruits have a marked delay effect on the growth of the root.

The length of the hypocotyl. At cucumber (fig. 3), the length of the hypocotyl presented average values between 4.93mm and 12.26mm; the witness had an average value of 8.4 mm. At radish (fig.3), the length of the hypocotyls presented average values between 5.17mm and 17.03mm; the witness had the average value of 12.78 mm. The lowest values were obtained at variants V4 (6.66mm) and V8 (4.93mm) for cucumber and at variants V4 (5.17mm) and V10 (5.5mm) for radish.

The statistics of unifactorial Anova test (F calculated : 13.54 – length of rootlet at cucumbers; 3.50 – length of hypocotyl at cucumber; 26.83 – length of rootlet at radish; 17.54 – length of hypocotyl at radish) was higher than the critical value 1.86 for length of rootlet at radish and cucumber, length of hypocotyl at radish; 1.89 for the length of hypocotyl at cucumber), fact which indicates that the dill extracts have a significant influence on the growth in length of the root and of the hypocotyl. The results of the Tukey test in the case of cucumber seeds indicates that: the extract of 5% concentration obtained from immature seeds influences significantly, unfavourably the growth in length of the root compared to the witness and with the other treatment variants; the extract of 10% concentration obtained from leaves influences significantly, unfavourably the

growth in length of the hypocotyl compared to the extracts prepared from immature fruits (5%), stems (5%), inflorescences 10%.

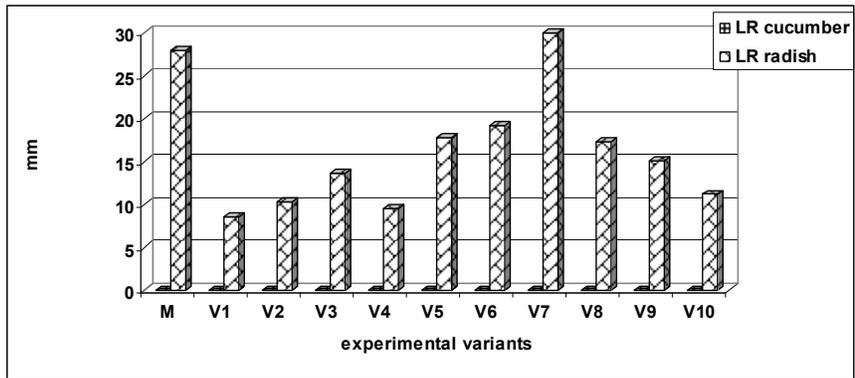


Fig. 2 – The length of the root (LR)

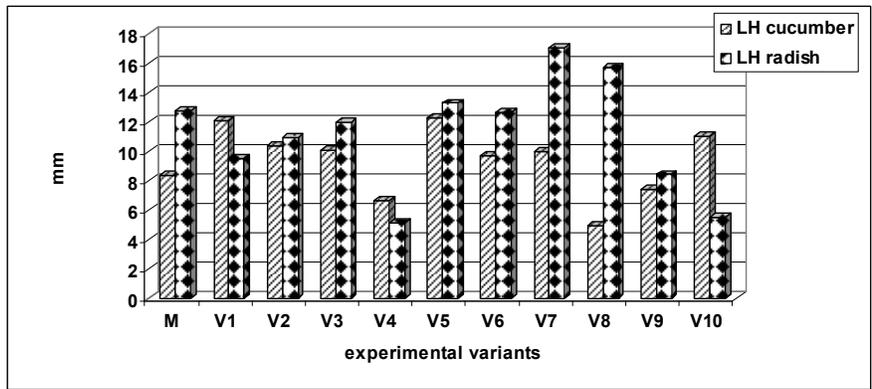


Fig. 3 – The length of the hypocotyl (LH)

The results of Tukey test in the case of radish seeds indicate the fact that: all the extracts (except V7 variant) influence significantly, unfavourably the growth in length of the root compared to the witness; the extracts with a concentration of 10% obtained from immature seeds, 5% and 10% obtained from inflorescences influence significantly, unfavourably the growth in length of the hypocotyls compared to the witness.

## CONCLUSIONS

1. The extracts, in the used concentrations influence specifically the germination and growth processes in the first ontogenetic stages. It was noticed a delay of germination at radish and of the growth in length of the root and of the hypocotyl at both species.

2. Between the two analysed species, the radish was more sensitive to treatment with extracts, in the used concentrations.

3. The results obtained confirm the data from the specialty literature regarding the allelopathic effect of vegetal extracts obtained from the plants belonging to the *Apiaceae* family and the other botanical family.

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# SOME ASPECTS ABOUT USING OF MUTAGENIC AGENTS ON CORIANDER

## ASPECTE PRIVIND FOLOSIREA UNOR AGENȚI MUTAGENI ASUPRA CORIANDRULUI

*LUPU Elena-Ancuța*<sup>1</sup>, *LEONTE C.*<sup>1</sup>, *CREȚU L.*<sup>1</sup>,  
e-mail: elenaancutalupu@yahoo.com

**Abstract.** *When selecting and breeding medicinal herbs with economic importance the first step is obtaining a very diverse biological material by inducing a very large individual variability. For the plant breeding, both spontaneous mutation and induced mutation by using mutagens are important. Thus, the mutagen factors increase the variability coefficient among cultivated species, and from this new biological material it can be isolated useful forms for using them in the creation process of new hybrids and varieties (Leonte, 2011). The purpose of this paper is to present the mutagenesis researches done until today, which have helped to the enriching of the coriander seed material.*

**Key words:** mutation, mutagenic agents, *Coriandrum sativum* L.

**Rezumat.** *În selecția și ameliorarea plantelor cu importanță medicinală și economică un prim pas îl constituie obținerea unui material biologic foarte divers, inducerea unei variabilități individuale de largă amplitudine. Pentru ameliorare un rol important îl au mutațiile apărute spontan, ca și cele declanșate dirijat sub acțiunea factorilor mutageni. Astfel factorii mutageni măresc permanent gradul de variabilitate în cadrul speciilor cultivate, iar din bogăția materialului biologic nou se pot izola formele utile în vederea folosirii acestora în procesul de creare a noi soiuri și hibrizi (Leonte, 2011). Scopul acestei lucrări este de a prezenta cercetările de mutagenză efectuate până în prezent, care au ajutat la îmbogățirea materialului săditor al plantei.*

**Cuvinte cheie:** mutație, agenți mutageni, *Coriandrum sativum* L.

### INTRODUCTION

Originally, coriander is a plant which grows in Asia, on sunny hills' and not very high rainfall areas, used for thousands of years in India, Iran and China. In Romania, coriander only grows cultivated is not spontaneous or in the wild. Traditionally, its seeds are used against gastric and intestinal diseases, but recent studies validate their use in various disorders. Coriander is known from the ancient times, being used for medicinal purposes and flavoring. In the selection and breeding of medicinal plants with economic importance, the first step is getting a very diverse biological material, inducing large individual variability amplitude. It has demonstrated that, the tendency to variability, manifested in any species, increased after intervention with various factors physical, chemical or biological, these being known as mutagenic factors. Chemical mutagens stimulate

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<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

the mutational processes acting on nucleic acids at rest or replicative biosynthesis. Once entered the plants, chemical mutagens, enter in combination with different chemical components and determine the changes in physical and chemical structure of chromosomes.

The tasks of the breeding coriander in Romania are creating varieties with yields and high content in essential oil of good quality, shake and disease resistant and resistant to breaking diachene ([www.regielive.ro](http://www.regielive.ro)).

## MATERIAL AND METHOD

The present study was carried out on the basis of the information available in the literature. Taking into account the mechanisms of action of mutagenic agents and mode of manifestation of mutations in the cells, tissues and organs of the plant, was carried out an analysis of research works on the effect of mutagenic agents on morpho - physiological characters in coriander. Mutagenicity research, through emerging characters increases the variability of the species *Coriandrum sativum*.

## RESULTS AND DISCUSSION

The first book about the coriander appeared in Russian literature in 1784 written by Balatov. In this book show that this plant, called "kişneţ" was widespread in the eastern parts of the USSR (Păun et al., 1986).

But consumption it is still attested in ancient times, the Bible attributed of coriander fruits role of Heavenly Manna. Coriander is also mentioned in some Sanskrit texts. The parts used are the seeds and leaves (Lavédrine, 2006).

The first information about the volatile oil content in the fruits of coriander are mentioned in the pharmacopoeia published in 1537 in Frankfurt am Main (Păun et al., 1986). The volatile oil extracted from coriander fruits was obtained for the first time in the ex USSR in 1885, the first major installation for extracting volatile oil of coriander building in 1896 to Alekseevsk-Voronej (Păun et al., 1986).

Activity for breeding of the coriander was initiated in 1932 in the ex USSR at the experimental station Alekseevsk by Luzina. The first varieties were obtained in 1950 by the method of individual selection, applied in local populations of *Voronej* and *Saratov: Alekseevski 26, Alekseevski 118* and *Alekseevski 247*. All by individual selection in the local population was created later variety *Voznesenski 60*.

By interspecific hybridization between *Coriandrum sativum* and *Foeniculum vulgare* and *Carum carvi* between *Coriandrum sativum* were created *Luci* and *Tminovidnii* varieties; they are valuable in terms of volatile oil content (1.2%) (Păun et al., 1986).

Most countries use the local population coriander culture. In Romania varieties are *Sandra* (1987) and *Omagiu* (2000). *Sandra* variety was created by S.C.P.M.A. Fundulea by selecting individual repeated annually of the population "*of Braila*" and was approved in 1987. The vegetation period ranges from 95-105 days. It is resistant to diseases, falling and shaking, as well as breaking the fruit.

The plant height is greater than the local population of origin and flowering and fruit maturation are uniform (Emilia Constantinescu, 2008).

*Omagiu* variety approved in 2000 was created by S.C.P.M.A. Fundulea (Aglaiia Mogârzan et al., 2010). This variety is more early with 5 days and it is superior to *Sandra*, achieving a production of 13-19 q / ha fruit, containing from 1.18 to 1.24% volatile oil rich in linalool and production of 16 to 22 l / ha of essential oil (Verzea, 2002).

In 1964, S. S. Raghuvanshi and Sheila Joshi studied influence of treatment with colchicine on the tips growth of seedlings of *Coriandrum sativum*. The growing tips of seedlings of *Coriandrum sativum* were treated with 0,2% colchicines for 24 hours which lead to the production of tetraploids, mixoploids and diploid mutants. The mutants showed some characteristics different from the control: height higher, thicker and larger leaves formation of decks in the anaphase.

In 1965 the same authors conducted another study on pollen variability and pollen formation without intervention of meiosis in a variant of *Coriandrum sativum*. *Coriandrum sativum* seedlings were treated with 2% colchicines. Such, seedlings treated was very late in flowering. The cytological studies revealed interesting features. Its chromosome number has been found to be  $2n=22$ . At diakinesis and metaphase I there is a tendency for formation of the chromosome bivalent. At anaphase I out of the 307 cells observed 240 were normal while others showed anomalies.

Also in 1965, Sheila Joshi and S. S. Raghuvanshi studying mutation, polyploidy and pollen variability in coriander. His study focused on morphological and cytological characters following treatment with colchicine from *Coriandrum sativum*. Treatment with colchicines and colchicine-gammexane not only resulted in the production of polyploids but also in obtaining diploid mutants with changed characters.

Studies on mutagenic effect of coriander plants were made in India by V.S. Kothekar in 1987. Thus, the seed of *Coriandrum sativum* Linn. (Sheetal variety and Pusa Selec. 360 variety) were treated with two mutagens: ethyl methane sulphonate and diethyl sulfate of different concentrations and their effects were seen on some parameters: germination, survival, plant height and leaf content of vitamin C. In the case of *C. sativum* varieties there was a general exponential fall in the values of germination, survival and plant height with gradual increase in the concentration of the two mutagens. The values of vitamin C content in variety Sheetal were enhanced at certain doses of EMS treatment. In Pusa Selec. 360 variety, however, no such trend was detectable.

R. Pasquale, A. Rapisarda, MP Germano, S. Ragusa and S. Kirjavainen, in 1995, studied the effects of high levels of cadmium in soil and atmosphere on growth coriander and the active components of it. Plants grown in contaminated soil (0, 10, 100 ppm of cadmium) showed a significant reduction in the length of the stems and roots and the number of the umbels, a yellowing and ultrastructural alterations of the leaves and a significant decrease in the essential oil composition.

The effect of radiation on volatile compounds of green coriander leaves was studied by XT Fan and KJB Sokorai in 2002. Fresh cilantro leaves (*Coriandrum sativum* L.) were irradiated with 0, 1, 2, or 3 kGy gamma radiation and then stored at 3 degreesC up to 14 days. Volatile compounds were extracted using solid-phase microextraction (SPME), followed by gas chromatographic separation and mass spectra detection at 0, 3, 7, and 14 days after irradiation. Most of the volatile compounds identified were aldehydes. Decanal and (E)-2-decenal were the most abundant compounds, accounting for more than 80% of the total amount of identified compounds. The amounts of linalool, dodecanal, and (E)-2-dodecenal in irradiated samples were significantly lower than those in nonirradiated samples at day 14. During storage at 3 degrees C, the amount of most aldehydes peaked at 3 days and then decreased afterward.

Khristova D., I. Ivanova and D. Nenkova, in 2005, demonstrates that biologically active substances PB-31 and XP-55, in doses of 30 ml / da and 20 ml / da, applied coriander have a positive effect resulting increase fruit volatile oil content.

Yasser AH Osman Kareem MK El Tobgy and El Sayed A. El Sherbini, (2009) studied the effect of some helium-neon laser treatments on fennel (*Feoniculum vulgare* Mill) and coriander (*Coriandrum sativum* L.) plants. The dry and wet fruits of fennel and coriander plants were exposed to helium-neon laser for 5, 10 and 20 minutes with power density of 95 mW/cm<sup>2</sup>. In most cases, the tallest plants, the highest number of branches per plant, number of umbels and essential oil percentage were obtained from the treatment of 20 min. helium-neon (He-Ne) laser exposure for wet fruits. The highest fruit yield of fennel was resulted from 5 min of exposure for dry coriander fruits. While in coriander, the highest yield was obtained from 20 min of exposure treatment for wet fruits.

In 2009, MD. Nazrul Islam Bhuiyan, Jaripa Begum and Mahbuba Sultana analysed the essential oil from the leaves and fruits of *Coriandrum sativum* L. using gas chromatography mass spectroscopic (GC-MS). The leaf oil contained 44 compounds mostly of aromatic acids. The seed oil contains 53 compounds where the major compounds are linalool (37.7%), geranyl acetate (17.6%) and  $\gamma$ -terpinene (14.4%). The compositions of both oils varied qualitatively and quantitatively.

In 2010, Kamal Pande Kishore, Lata Pande, Bharat Pande, Atul Pujari and Pankaj Sah have studied composition of essential oil of coriander obtained by hydro distillation at three stages of maturity by GC-MS and GC-FID. Essential oil yields showed marked increase during maturation process and forty one compounds were identified. Geranyl acetate (46.27%), linalool (10.96%), nerol (1.53%) and neral (1.42%) were the main compounds at the first stage of maturity (immature fruits). At the middle stage, linalool (76.33%), *cis* dihydrocarvone (3.21%) and geranyl acetate (2.85%) were reported as the main constituents. Essential oils at the final stage of maturity (mature fruits) consist mainly on linalool (87.54%) and *cis*-dihydrocarvone (2.36%).

## CONCLUSIONS

1. The studies based on the existing research literature have found different results on the importance of mutagenic agents in the process of breeding of coriander.

2. At coriander the main mutagenic agents used in breeding were physical and chemical agents.

3. Because natural or artificial mutations tend to favor species, the starting point for obtaining new forms, we can say that the induction of mutations helps on the evolution of coriander (*Coriandrum sativum* Linn).

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# THE STUDY OF THE VARIABILITY OF THE MAIN PLANTS AND SEEDS CHARACTERS OF DIFFERENT SPECIES BELONGING TO *CACTACEAE*

## STUDIUL VARIABILITĂȚII PRINCIPALELOR CARACTERE ALE PLANTELOR ȘI SEMINȚELOR LA DIFERITE SPECII DE *CACTACEAE*

**MIHALTE Lucica<sup>1</sup>, VÎLCAN Alina<sup>1</sup>, FESZT G.<sup>1</sup>**  
e-mail: mihaltelucica@yahoo.com

**Abstract.** *At Cactaceae family the main characters relied on a botanical classification (systematic method) are: plant diameter, number of spines/areoles, and length of spines, flower diameter, and flower colour, fruits and seeds traits. The analysis of the plants peculiarities showed a relatively low variability of biological material according to genus and species. Within the 60 studied species, the coefficient of variability of the seeds weight was recorded being low. In the present study, it has been revealed a poor germination of seeds, many of the species analyzed had the germination percentage 0.0% (55 species).*

**Key words:** plant traits, seeds, variability, cacti.

**Rezumat.** *Principalele caracteristicile morfologice care pot fi luate în considerare la cactuși, pe baza clasificării botanice (metoda sistematică) sunt: diametrul plantei, numărul de spini/areolă, lungimea lor, diametrul florilor, culoarea florilor, caracteristicile fructelor și a semințelor. Analiza caracteristicilor plantelor a evidențiat o variabilitate relativ redusă a materialului biologic, în funcție de gen și specie. În cadrul celor 60 de specii studiate la nivelul semințelor pe baza coeficienților de variabilitate se poate afirma că variabilitatea caracterului greutatea semințelor a fost mică. În prezentul studiu s-a pus în evidență o germinație slabă a semințelor, multe dintre speciile analizate au avut procentul de germinare 0,0% (55 de specii).*

**Cuvinte cheie:** caracterele plantelor, semințe, variabilitate, cactuși

### INTRODUCTION

In Romania, cacti are scattered mainly in the collections of the botanical gardens or in private collections and due to their characters are the most easily recognizable plants (Feszt and Mihalte, 2009).

Beside the flower traits, the variation in the *Cactaceae* family relies to spines characters and to plant shape and size. Cacti present a wide range of shapes and sizes: cylindrical, globular, or flat (cladode) stems. These traits and the plants' architecture determine their different life forms, which include arborescent, columnar, globular, barreliiform, and articulated forms and give cacti the unique in the plants world.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania

Cacti' economical importance consists mainly in their ornamental value. In addition to the ornamental value, several species have a particular importance in food industry, being natural food resources for the peoples from Mexico, Peru and Chile (Valdez et al., 1992).

In the arid and semi-arid areas of the American continent, located between latitude 35°NS and 5000 m above sea level, was recorded the greatest diversity of cacti (Oldfield, 1997; Anderson, 2001).

The cacti plants have a particular interest to scientists, due to their traits of metamorphosis plants, and secondly because their controversial taxonomy. Thus, Backeberg (1968-1977) established to the *Cactaceae* family 233 genera, Buxbaum (1950) established 156 genera, Barthlott and Hunt (1993) 98 genera, Götz and Gröner (1998) 146 genera, Eggli and Nyffeler (1998) described only 93 genera. The latest attempt of systematizing the *Cactaceae* family was conduct by Anderson (2001), which describes 125 genera, but this taxonomy has not been entirely adopted by botanists, geneticists etc. Based on these considerations, the aim of this study was to obtain information, respectively contributions, to the efforts of merging the four genera (*Aylostera*, *Rebutia*, *Mediolobivia*, *Sulcorebutia*), in single one with the name *Rebutia*, according to the modern classification.

Despite the importance of seed germination, the studies on cactus seed germination are relatively recent (Nobel, 2002). In addition, the present study designed a database with variability of the seed traits and the germination percentage, which can be useful in seed production, to improve the germination and to improve the development of seedling, which are difficult issues to cacti.

## MATERIAL AND METHOD

The cacti plants used in the present study were evaluated for characters such as number of radial spines/areoles, length of spines and diameter of flower. Morphological features of the plants (Gallegos-Vásquez et al., 2011) or of the fruits (Valdez-Cepeda et al., 2003), chemical attributes and frost tolerance (Parish and Felker, 1998) were usually used for classification of different cactus species.

The characters analyzed in the present study were the same as described by the UPOV normative (UPOV, 2004) and ten plants for these measurements, represented as arithmetic mean and grouped in variation classes were used.

The biological material was represented by 247 cacti species and cultivars (genotypes) belonging to four genera of cacti: *Mediolobivia* (Backeb.), *Aylostera* (Speg.), *Rebutia* (K. Schum.) și *Sulcorebutia* (Backeb.). A part of the studied genotypes belonged to the collections of botanical gardens, 49 species from Cluj-Napoca Botanical Garden, 20 species from the collection "Coromandel Cacti", New Zealand and the others (178 genotypes) provided from seed exchange between botanical gardens practiced in the country and abroad. For a precise determination, the following herbaria were consulted (acronyms according to Thiers, 2012): CL (Babes-Bolyai University, Cluj-Napoca), CLA (University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca) and AK (Auckland War Memorial Museum, New Zealand. Auckland).

For a better design, species were divided according to their type of plant material. In this respect, the relevance of the present is based on the peculiarities of grown plants (247 genotypes) and seed peculiarities (60 species belonged to

*Aylostera*, *Medioblobivia* and *Sulcorebutia* genera; the seeds of *Rebutia* genus have not been analyzed in the present study).

## RESULTS AND DISCUSSIONS

The analysis of plants, showed a relatively low variability of biological material, according to genus and species, and according to the analyzed trait. The plant diameter (fig. 1a.), at the analyzed species varied between a minimum of 2 cm (54 species) to a maximum of 8 cm (14 species). The flower diameter varied within the limits of 0.5-2 cm to 5 cm (fig. 1b.). The flowers have presented a wide range of colors, from pink (*A. archibuiningiana*, *A. narvaecensis*) to red (*M. ritterii*, *R. orurensis*) or yellow (*R. marsoneri*), with different shades and tones (Mihalte et al., 2009).

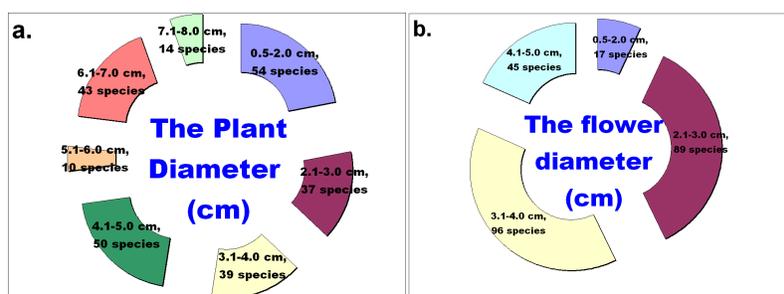


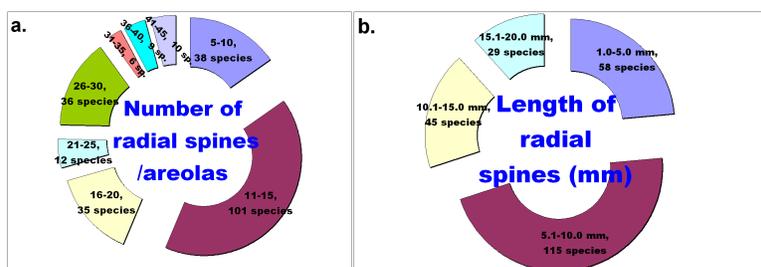
Fig. 1 – The plant diameter (a.) and the flower diameter (b.) at the analyzed cacti species

Generally the spines have a needle shape, consisting from a foot, a body and a top. Depending on the place that the spines occur in the areola may be the following forms: external (radial) spines, disposed in the outer side of the areola and central spines, arranged in the centre of the areola. At the analysed species the central spine was mostly absent or occasionally was present just one similar to radials.

The number of radial spines (fig. 2a.) ranged from 5-10 (38 species) at 40-45 (10 species). The size of the external spines (fig. 2b.) was extremely varied from 1-2 mm to over 20 mm in length.

As it has been shown in the above graphs, the variability between the main characters at *Rebutia* genus, *Aylostera*, *Sulcorebutia* and *Medioblobivia* is quite small and therefore the trend of merge these species in one genus is justified.

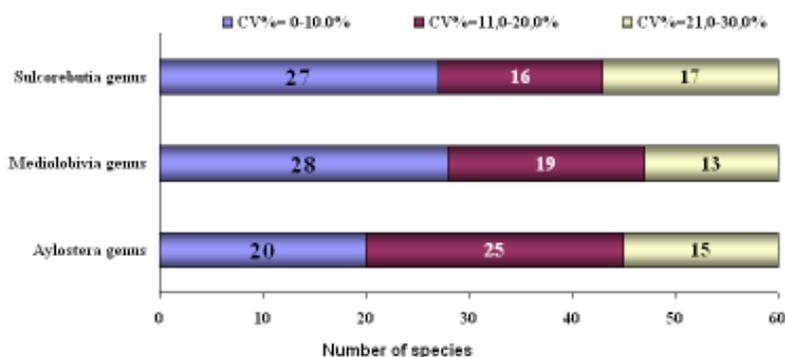
All the studied genera presented sessile and solitary flowers and in all the species of the genera *Rebutia*, *Aylostera*, *Medioblobivia* and *Sulcorebutia*, the hairs, foliar organs, reproductive organs, glochids, and roots developed from areoles. The species from *Rebutia* genus does not present distinctive ribs, but they have regularly arranged small tubercles and they are distinctive because of their small and globular forms. A distinct particularity of the *Sulcorebutia* genus is that the species tend to be more rot-prone and they are not as frost resistant as the *Rebutias* (Grant, 2009).



**Fig. 2** – The number of radial spines/areolas (a.) and the length of radial spines (b.) at the analyzed cacti species

The shape of cactus seeds is greatly varied, spherical, ovoid, prismatic, and kidney-shaped. The seed size also varies in quite wide limits, from seeds of *Parodia*, *Strombocactus*, very small, like dust, to 3-4 mm at *Astrophytum*, *Pachycereus species* or 5-6 mm *Opuntia species*. Likewise, the studied species presented very small seeds and traits like seeds length, or shape were not visible at necked eye.

In the present study, 60 cacti seeds genotypes, mostly originating in Bolivia and Argentina, belonging to three genera (*Aylostera*, *Mediolobivia* and *Sulcorebutia*), classified after Backeberg system (Backeberg, 1968-1977) were analyzed. Within the studied species, the variability of seeds weight was low to medium (28 species of *Mediolobivia* genus having the coefficient of variability between 1-10%). Species with a great variability of seed weight (17 genotypes) mainly belonged to *Mediolobivia* genus (fig. 3).



**Fig. 3** – The coefficient of variability (CV%) of seeds weight at the analyzed cacti species

The obtained results confirmed that poor seed germination (fig. 4) is often a problem to obtaining new cacti plants, thus, many species (55 species), had the germination percentage 0.0%. In this respect the researches in order to improve the cactus seed germination should continue and probably the use of the growth regulators will be a great option (Mihalte et al., 2011). The treatment with gibberellic acid also increases seed germination at *Stenocereus griseus* (Moreno et al., 1992). In the present experiment, no artificial light and no heat treatment were

used for the seeds germination despite that McDonough (1964) revealed the importance of light. However, Zimmer (1969) found that some species do not require light for germination.

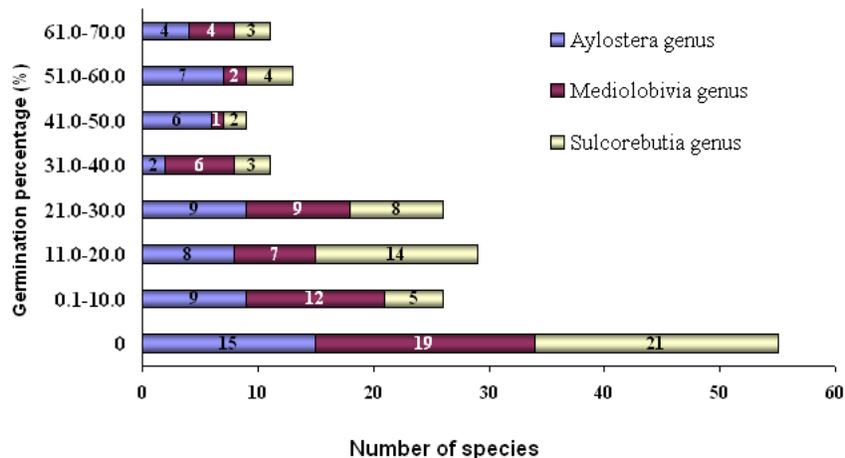


Fig. 4 – The germination percentage at the analyzed cacti species

## CONCLUSIONS

1. The obtained results provide quite poor and imprecisely data and confirm the difficulties in order to classify the species in certain systematic units, only on morphological traits. Such studies are useful and can be add to other studies that aims clarify the *Cactaceae* taxonomy, and to eliminate the confusions about the cacti glossary.

2. The analyzed species in this study showed a poor germination of seeds, 55 species having no seedling at all. In this way, the researches should continue in order to improve the seed germination.

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# RESEARCH ON THE USE OF MUTAGENIC AGENTS ON GROUNDNUT (*ARACHIS HYPOGAEA* L.)

## CERCETĂRI PRIVIND UTILIZAREA UNOR AGENȚI MUTAGENI LA ARAHIDE (*ARACHIS HYPOGAEA* L.)

*SPÂNU Oana*<sup>1</sup>, *LEONTE C.*<sup>1</sup>, *CREȚU L.*<sup>1</sup>, *LUPU Elena-Ancuța*<sup>1</sup>  
e-mail: spanuoana@yahoo.com

**Abstract.** *The importance of mutations for plant breeding lies in their hereditary character and from the fact that, along with genetic recombination, represents the main source of variability of organism (Țirdea, 2002). Knowing the characters variability and traits of a species is particularly important in choosing the best germplasm sources and specifying ways forward in the process of plant breeding. After treatment of biological material with different physical or chemical mutagens, very heterogeneous populations are produced in terms of improvement value (Leonte, 2011). In this literature review we present recent researches concerning mutagenesis in groundnut.*

**Key words:** variability, mutation, mutagenic agents.

**Rezumat.** *Importanța deosebită a mutațiilor pentru ameliorarea plantelor rezidă din caracterul lor ereditar și din faptul că, alături de recombinarea genetică, reprezintă principala sursă de variabilitate a organismelor (Țirdea, 2002). Cunoașterea variabilității caracterelor și însușirilor unei specii este deosebit de importantă în alegerea celor mai potrivite surse de germoplasmă și în precizarea direcțiilor de urmat în procesul de ameliorare. În urma tratamentului materialului biologic cu diferiți agenți mutageni, fizici sau chimici, se obțin populații foarte heterogene în privința valorii ameliorative (Leonte, 2011). Scopul acestei lucrări este de a prezenta cercetările de mutageneză realizate până în prezent la arahide.*

**Cuvinte cheie:** variabilitate, mutație, agenți mutageni.

## INTRODUCTION

Naturally inflicted mutations, as those triggered conducted under the influence of mutagens permanently increase the variability in the cultivated species. Thus, the wealth of new biological material can be isolated forms thereof useful for use in creating new varieties and hybrids (Leonte, 2011).

The breeding peanuts objective is to develop varieties with high yield, early maturity, high protein and oil content, resistant to diseases and insect pests. To achieve these objectives and bring about desired improvement in crop, the most sophisticated technique of mutation breeding can be explored by the plant breeders (Sonone, 2011).

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

Mutation breeding is an important method for inducing new variability, which is an essential requirement of any plant breeding programmer in the changing agricultural pattern of the day (Sonone, 2011).

Groundnuts are considered to be an important source of protein and other nutrients. These can be placed both in seed and in other organs of the plants. So, seeds are containing increased quantities of proteins and fats. In the past few years efforts are being made to improve the quality of groundnut. Studies were initiated to characterize and evaluate some varieties and to select superior ones and to induce genetic variation through X rays radiation (Iancu, 2011).

## **MATERIAL AND METHOD**

The study was conducted based on analysis of information existing in the literature. Were investigated: the significance of specialized terms and mutagenic action of physical and chemical factors used in the mutational peanuts. Mutagenicity investigations have shown that mutations methods challenge the artificially developed and perfected continuously.

## **RESULTS AND DISCUSSIONS**

Groundnut provides considerable amounts of mineral elements to supplement the dietary requirements of humans and farm animals (Asibuo et al., 2008). Groundnut seed contains 44-56 % oil and 22-30 % protein and is a rich source of minerals (phosphorus, calcium, magnesium and potassium) and vitamins (E, K and B group) (Savage și Keenan, 1994) and 9,5-19 % carbohydrates as both soluble and insoluble (Crocker și Barton, 1957, Oke, 1967, Woodroof, 1983).

Groundnut quality could be increased through selection for increased percent of protein or fats in the seed. Using irradiation it can be obtained variability in plants, both morphologically and in chemical composition of the seed. This approach for groundnut crop was applied in different doses between 5000-10000 R and there were identified variants where smaller or bigger doses presented no influence and variants with significant influence (Iancu and Soare, 2011).

Irradiation presents some specific features, determined by the used source and by the plant or body that is subject to the direct or indirect irradiation. Direct irradiation is practiced in whole plants, plant parts, seeds that are at rest or in the process of germination, pollen, ovules, meristems growth. Cereals, pulses, industrial crops, irradiation is more easily if using seeds (Leonte, 2011).

For a better success in plant breeding by mutations a very practical value presents the initial material which begins the mutational process and the organs subjected to irradiation. Doses of irradiations applied to dried seed of groundnut generally accelerated the growth process, having stimulatory effect upon plant development (Iancu and Soare, 2011).

Using mutant forms starting material is the main way to improve the use of useful mutants. The most frequently mutated forms are used as genitors in

hybridization work, for their valuable characteristics to be combined with other genitors, to obtain new varieties with traits and characters harmonized (Leonte, 1996).

In our country, works of induced mutagenesis to groundnuts were made by Pop L., Valeria Marghitu and Chichea I. (quoted by Iancu, 2010), their results confirming the value of this method as a mean of obtaining increase variability, profitable for selection. So, with the help of ionizing radiations it were obtained some groundnut lines, some of them emphasizing yield increase and quality. As concern the influence of gamma radiations upon the pods yield, these increased the yield until 6000 R and those to 10000 R substantially reduced to some varieties. Under the influence of gamma rays it was obtained Tâmburești variety (1983) experimented presently along Venus variety obtained as a result of repeated selection in 1999 by a team of teachers from Agriculture Faculty (Iancu, 2010).

Gamma rays are used for proper storage of groundnuts against infestation by various pests and microbial contamination during storage (Seda et al., 2001, Who, 1988). Therefore it has been proposed as a good alternative to methyl bromide and other fumigants for pest control (Ogbadu, 1980).

Munteanu (2008) states that chemicals were used for the first time with the role of mutagen during the Second World War in Germany, by Auerbach and the former USSR by Rappoport.

Mutations caused by different chemicals are similar to those produced by radiation or other mutagenic factors. Effectiveness of the mutagenic substances depends on each and every body's specific, the sexual stage of cell development that influences the concentration of the substance, the application, physiological condition of the body and environmental factors such as temperature and others (Tirdea, 2002).

In peanut, Ashri and Goldin (1965) reported the mutagenic activity of DES (diethyl sulfate). Later, Ashri (1970) discovered a monogenic dominant mutation with recessive lethal effects in the M1 derived from DES soaked peanut seeds, and Ashri and Herzog (1972) further studied the differential physiological sensitivity of peanut varieties to seed treatments with DES and EMS (ethane methyl sulfonate).

Sivaram et al (1985) and Zhu et al (1997) developed high yielding mutant lines after EMS treatment of peanut seeds. Previous attempts at chemical induced mutation in peanut reported alternations in external characters, but seldom mention if there were also changes in internal quality traits (Jung et al 2000, Wang et al. 2006).

Wang et al (2002) obtained large- podded and small- podded mutants following sodium azide treatment of peanut cultivar L7-1. Undesirable changes in the internal quality of the small-podded mutant were merely detected in subsequent studies using one large-podded mutant, one small-podded mutant and the wild type (Wang et al, 2006).

The mutant plants produced by treatment of sodium azide are capable to survive under various conditions and have improved yields, increased stress

tolerance, longer shelf life and reduced agronomic input in comparison to normal plants (Fahad Al-Quarainy și Salim Khan, 2009).

The successful utilization of sodium azide to generate genetic variability in plant breeding has been reported in barley (Kleinhofs and Sander, 1975) and other crops (Avila și Murty, 1983, Micke, 1988, Routaray et al., 1995).

The most effective dosage for inducing morphological mutation was established at 0,03% sodium azide. The main advantage of mutations breeding is the possibility of improving one or two characters without changing the rest of the genotype (Mensah și Obadony, 2007).

Mutation breeding supplement conventional plant breeding as a source of increasing variability and could confer specific improvement without significantly altering its acceptable phenotype (Ojomo et al., 1979).

## CONCLUSIONS

1. Physical and chemical mutagens are widely used to produce mutations to increase genetic variability in target materials.
2. After treatment with mutagenic agents we obtain numerous mutations that show changes in morphological characters.
3. Under the influence of chemical mutagens, mitotic cell division is modified, causing the morphological changes of plants.
4. Mutagenic chemical substances that got into the body combine with different chemical components and produce changes at a chemical and physical level of the chromosomes.

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# STUDIES REGARDING THE THERAPEUTICAL EFFECT OF THE EXTRACT FROM THE BARK OF *PINUS MARITIMA*

## STUDII PRIVIND ACȚIUNEA TERAPEUTICĂ A EXTRACTULUI DE SCOARȚĂ DE *PINUS MARITIMA*

**PRISĂCARU Cornelia<sup>1</sup>**

e-mail: corneliapris@uaiasi.ro

**Abstract.** *The studies by J.A. Masquelier, professor at the University from Bordeaux, regarding the bark of the maritime pine (Pini Maritimae Cortex) emphasized, in 1947, the content in proanthocyanidins, soluble substances with a strong antiradicalic potential. The standardized extract from the bark of the maritime pine from the French mediterranean region, known in the medical field under the commercial name of Pycnogenol<sup>®</sup>, is used in cardiovascular diseases, cancer, Alzheimer's disease, glaucoma etc. The present experiment evaluates the antioxidant potential of different pharmaceutical formulations of the extract in acrylamide intoxication. The toxicity of acrylamide is based on a free radical, derivative of the free metabolite, glycydamide. The experiment was unfolded on 4 groups of Wistar rats: the reference group, the group intoxicated with acrylamide and other 2 experimental groups that, besides the daily dose of acrylamide, received treatment with hydroalcoholic solution of Pycnogenol, and tablets of Pycnogenol, respectively. After 6 weeks of treatment, blood samples were collected in order to perform the biochemical investigation: serum catalase, superoxide dismutase, glutathione peroxidase and serum concentration of free sulfhydryl groups. The obtained results reveal the significant antioxidant effects of the standardized extract from the bark of Pini maritima.*

**Key words:** acrylamide, Pycnogenol, proanthocyanidins, antioxidant potential

**Rezumat.** *Studiile lui J.A. Masquelier, profesor la universitatea din Bordeaux, asupra scoarței de pin maritim (Pini Maritimae Cortex) au evidențiat în 1947 conținutul acestuia în proantocianidine, substanțe solubile cu o puternică capacitate antiradicalară. Extractul standardizat de scoarță de pin maritim din zona mediteraneană franceză, impus în lumea medicală sub denumirea comercială de Pycnogenol, este în prezent utilizat în afecțiuni cardiovasculare, cancer, maladia Alzheimer, glaucom etc. Experimentul prezentat testează capacitatea antioxidantă a extractului de pin sub diferite forme farmaceutice în intoxicația cu acrilamidă, substanță ce acționează sub forma unui radical liber derivat de unul din metaboliții săi, glicidamida. Testatarea s-a efectuat pe 4 loturi de șobolani albi Wistar: lotul de referință, lotul intoxicat cu acrilamidă și 2 loturi experimentale, care, pe lângă doza zilnică de acrilamidă, au primit și Pycnogenol sub formă de soluție hidro-alcoolică și comprimate. După 6 săptămâni, atât cât a durat experimentul, s-a recoltat sânge de la animalele experimentului și s-a supus investigației biochimice: evaluarea activității catalazei serice, superoxid dismutazei, glutation peroxidazei și determinarea*

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

*concentrației serice de grupări tiolice libere. Rezultatele obținute evidențiază existența unor semnificative efecte antiradicalare a extractului standardizat de scoarță Pini maritima.*

**Cuvinte cheie:** acrilamidă, Pycnogenol, proantocianidine, potential antioxidant

## INTRODUCTION

Pycnogenol® represents the commercial name of the standardized extract from the bark of the maritime pine from the mediterranean region of France (*Pini maritimae cortex*). In 1947, Jacques Arthur Masquelier, professor at the University of Bordeaux, discovered that ceratin active compounds from the bark of *Pinus maritima* hold a strong antioxidant effect. This pharmacological action is due to the proanthocyanidins content, soluble compounds with a flavan-3-ol derived chemical structure characterized by the property of condensation polymerization. The condensation products are found in the grape seeds (*Vitis vinifera*) and are remarkable, as their monomers, through the antioxidant effect (Miron et al., 2002; Istudor, 2001). Due to their antiradicalic action, the proanthocyanidins from the bark of the maritime pine hinder the connection of the reactive oxygen species to the cell components, including DNA (Bowie et Oneill; Packer et al., 1999; Hosseini et al., 2001), and are efficient in preventing or improving the symptoms of severe diseases (cardiovascular diseases, cancer, Alzheimer's disease, inflammatory diseases, bone dystrophies) (Peng et al., 2000; Farid et al., 2004; Sime et Reeve, 2004). Among the food toxicants with high incidence that reclaim antioxidant defence, there can be found acrylamide (2-propenamide), unsaturated substance formed in food products thermally processed by frying, baking, and grilling (fried potatoes, chips, biscuits, toast, coffee etc.) (Burlacu, 2009).

Industrially produced and used since the XIXth century, known for its toxic effects, acrylamide gets into the medical forefront only in 2002, when the studies of a group of researchers from the University of Stockholm emphasize its presence in foods (Dybing et Sannner, 2003; Burlacu et al., 2007). The main mechanism of formation is represented by the Maillard reaction, having as forerunners amino acids, mainly asparagine, and reducing sugars (Mottram et al., 2002). Neurotoxic substance, possessing a carcinogen and mutagen potential, acrylamide manifests its toxicity due to its free epoxide radical, glycidamide, that forms adducts with hemoglobin, proteins with highly specialized functions and DNA (Watts, 2004). The elucidation of its formation mechanisms and its toxicodynamics opens the possibility to discover ways of neutralizing or reducing the toxic effects of acrylic amide.

## MATERIAL AND METHOD

The present experiment joins the direction of finding ways of reducing the toxicity of acrylamide by phytotherapeutical methods (table 1). The standardized extract of the maritime pine formulated as 2 pharmaceutical phytopreparations (Pycnogenol® hydroalcoholic solution and tablets) has been used as antioxidant agent. The experiment was unfolded on white rats, Wistar strain, 4 months old, with an average

body weight of 287.5 g, divided into 4 groups of 5 animals each. The first group represented the reference group, while the second group (control group) offered informations regarding the acrylamide intoxication. The animals of this groups were administered acrylamide in dosis of 10 µg/kg b.w. Each animal of the third group (experimental group 1) was exposed to acrylamide and treated with 0.4285 mg pine extract as titrated powder obtained from the tablets of Pycnogenol®. The last group with acrylamide induced toxicity (experimental group 2) was protected with the same dose of pine extract, using the hydroalcoholic solution of Pycnogenol®. The experiment lasted 6 weeks and ended with the biochemical investigation of the collected blood samples. The biochemical investigation quantified parameters that reflect the antitoxic potential of the organsim: serum catalase (CAT), superoxide dismutase (SOD), glutathione peroxidase (GPx), and free sulfhydryl groups (free –SH groups).

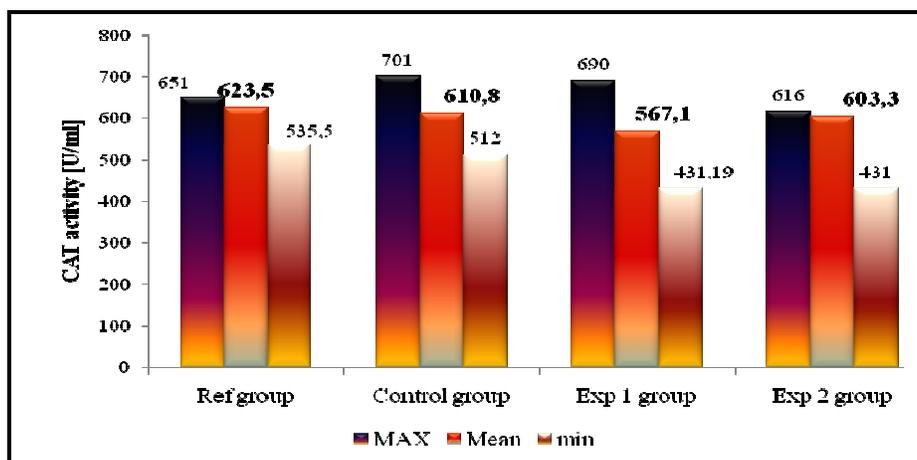
Table 1

Experimental model					
Experiment al groups	Acrylamide [µg/kg b.w./day]	Pycnogenol-tablets [mg/ animal/ day]	Pycnogenol-solution [mg/ animal/ day]	Investigated parameters	Duration of experiment
Reference group	-	-	-	CAT, SOD, G-Px, free – SH groups	6 weeks
Control group	10	-	-		
Experimental group 1	10	0.4285	-		
Experimental group 2	10	-	0.4285		

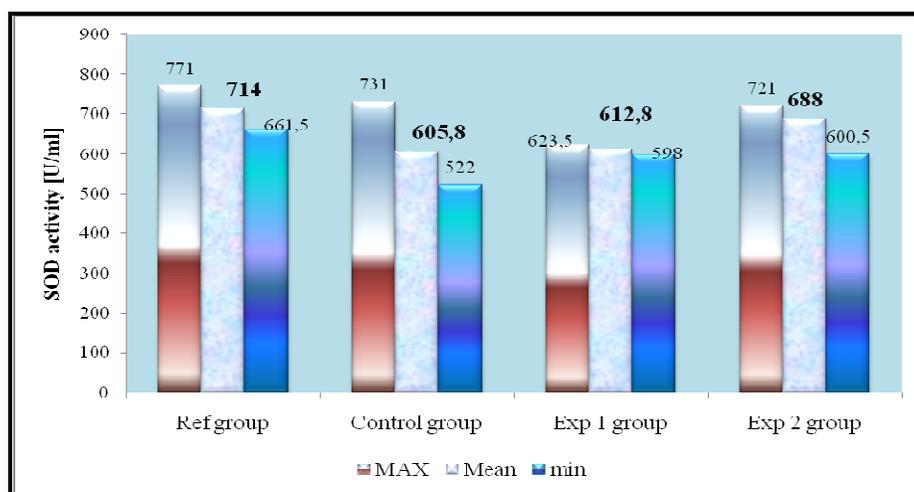
## RESULTS AND DISCUSSIONS

The study of the CAT levels reveal a descending variation from the reference group towards the control group and even to the groups protected with the extract from the bark of the maritime pine. The activity of CAT lowers from 623.5 U/mL ( the value for the reference group) to 610.80 U/mL (the value for the control group) (fig. 1). This decrease can be justified by the presence of the free radicals of glycidamide, the acrylamide attack form, that leads to the consumption of the antioxidant enzyme. The marked decrease of CAT for the groups treated with the extract of *Pinus maritima* is surprising, as a protective intervention had been expected. On the contrary, the value of CAT decreased even under the value for the control group: 567.1 U/ml for the group treated with the Pycnogenol tablets and 603.3 U/ml for the group protected with the hydro alcoholic solution (fig. 1).

Examining the activity of SOD, a predictable evolution, completely different from that of CAT, can be noticed (fig. 2). Therefore, the activity of SOD decreases from 714 U/mL, the value of the reference group, to 605.8 U/mL, value registered for the control group, as a consequence of the consumotion of SOD determined by the presence of the free radicals of glycidamide. Improved values, although situated under those of the reference group, are obtained for the group protected with Pycnogenol® tablets (612.8 U/ml) and with the hydroalcoholic solution (688 U/ml).

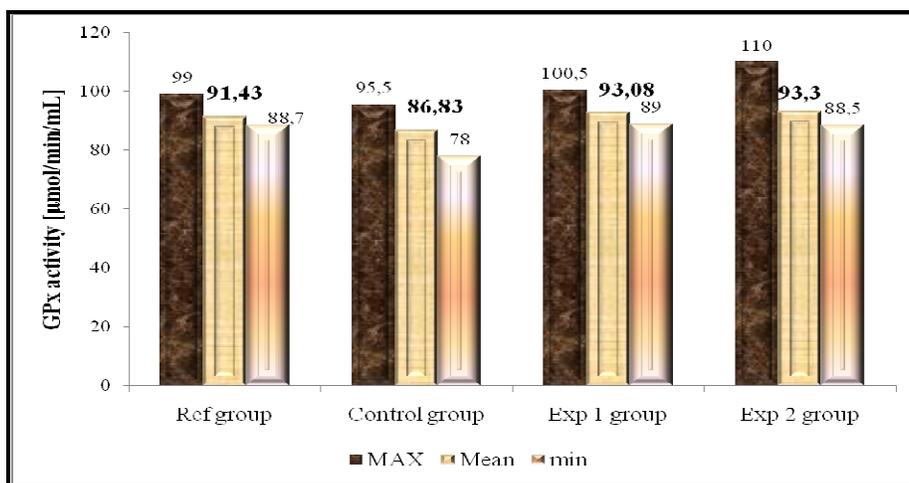


**Fig. 1 – The evolution of serum CAT activity**



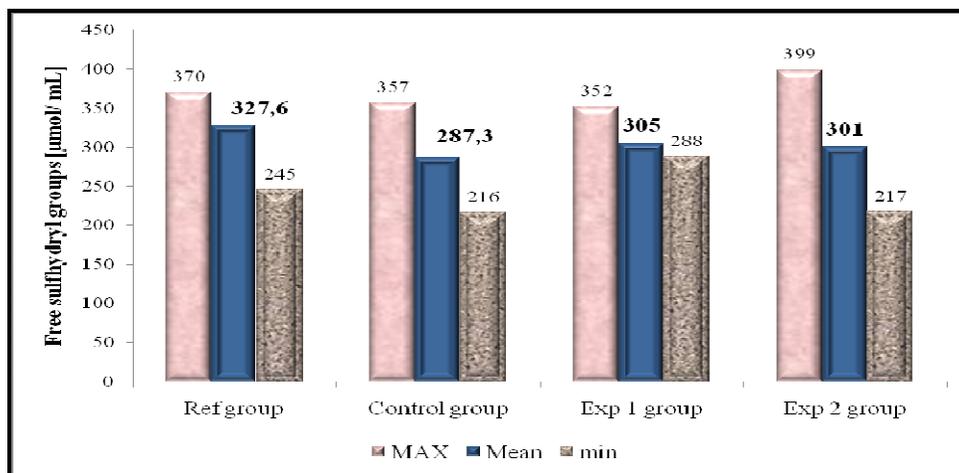
**Fig. 2 – The evolution of SOD activity**

The evolution of glutathione peroxidase, presented in fig. 3, emphasize the protective effect of the extract from the bark of the maritime pine formulated both as tablets and hydroalcoholic solution. This phenomena is argued by the increase of the enzyme activity for the group protected with Pycnogenol tablets (91.43  $\mu\text{mol}/\text{min}/\text{mL}$ ) and for the group treated with Pycnogenol solution, for which the activity raises even to 93.3  $\mu\text{mol}/\text{min}/\text{ml}$ , bothe values being superior to that of the reference group (91.43  $\mu\text{mol}/\text{min}/\text{ml}$ ).



**Fig. 3 – The evolution of GPx activity**

The analysis of the free sulfhydryl groups, as shown in fig. 4, sustains the double role of glutathione (antioxidant and detoxifying). If the value of the free sulfhydryl groups follows an important decrease for the control group (287  $\mu\text{mol/mL}$ ), the antioxidant action of proanthocyanidins from the 2 phytotherapy formulations of Pycnogenol determine a significant improvement of the values in the serum of the animals treated with the hydroalcoholic solution (301  $\mu\text{mol/mL}$ ) and mainly in the serum of the animals treated with Pycnogenol tablets (305  $\mu\text{mol/mL}$ ).



**Fig. 4 – The evolution of GPx activity**

## CONCLUSIONS

1. The evolution of serum catalase is aleatory and doesn't demonstrate the antiradicalic effect of the maritime pine extract.
2. The evolution of SOD and GPx follows similar variations that reveal the antioxidant capacity of the proanthocyanidins from Pycnogenol.
3. The evaluation of the free sulfhydryl groups levels from the serum of the animals sustains the antiradical potential of the phytopreparations obtained from *Pinus maritima*.

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**STUDY CONCERNING BIOCHEMICAL AND STATISTICAL  
CORRELATIONS BETWEEN FREE AND DIFFUSION  
WATER IN BELL - PEPPER (*CAPSICUM ANNUUM*  
GROSUM VARIETY)**

**STUDIU PRIVIND CORELAȚII BIOCHIMICE ȘI STATISTICE ÎNTRE  
APA LIBERĂ ȘI APA DE DIFUZIE LA ARDEI GOGOȘAR  
(*CAPSICUM ANNUUM* VARIETATEA GROSUM)**

**TRINCĂ Lucia Carmen<sup>1</sup>, CĂPRARU Adina Mirela<sup>1</sup>, AROTĂRIȚEI D.<sup>2</sup>,  
CĂLIN M.<sup>1</sup>, CHIRUȚĂ C.<sup>1</sup>**  
e-mail: lctrinca@yahoo.com

**Abstract.** Water is the most important biochemical component (by % weight) of all food substrates. However, the scientific literature has limited and controversial data both in terms of efficiency and methods for determining water content based on the conditions considered in the study. This paper presents the results of a study conducted on the bell-pepper (*Capsicum Annuum*, Grosium Variety), which monitored the free and diffusion water. Processing of data for statistical correlations between highlighted free water and water diffusion will provide the basis for the use of results in various technological studies on the models for the conservation of food substrates.

**Keywords:** bell-pepper, free water, diffusion water, statistical correlations.

**Rezumat.** Apa este cel mai important component biochimic (ca pondere) a substraturilor alimentare. Cu toate acestea, la ora actuală literatura științifică prezintă date limitate și controversate atât în ceea ce privește eficiența metodelor de determinare cât și variația conținutului de apă funcție de condițiile luate în studiu. Lucrarea prezintă rezultatele unui studiu efectuat pe Ardei Gogoșar (*Capsicum Annum*, Varietatea Grosium), pentru care s-a monitorizat apa liberă și apa de difuzie. Prelucrarea datelor nu a evidențiat corelații statistice lineare între apa liberă și apa de difuzie ceea ce asigură baza preliminară pentru folosirea rezultatelor în studiile tehnologice privind modelarea conservării diverselor substraturi alimentare.

**Cuvinte cheie:** ardei gogoșar, apă liberă, apă de difuzie, corelații statistice.

Over the past 30 years, the need for new technology has allowed the development of several drying methods, such as: hot air drying (drying in the oven), osmotic dehydration, microwave dehydration, infrared (IR) dehydration, ultrasonic dewatering, hybrid technologies etc.

Introduction in the food industry of these technologies lead to increase quality of vegetables and dried fruit (Baucour et al., 2000, Ferrando et al., 2001, Derossi et al., 2007, El-Sayed et al., 2010).

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

<sup>2</sup> "Gr T. Popa" University of Medicine and Pharmacy of Iasi, Romania

Water is principal part of the food substrate (vegetable) able to pass both ways the tissue to the outside, through several mechanisms such as capillary circulation, water diffusion due to differences in concentration and pressure (Ibarz et al., 2003, Babalis et al., 2004, Chiralt et al., 2005).

Osmotic dehydration is often used for the partial removal of water from the primary food crop growing substrates (fruits and vegetables) and consists in the transfer of water from the target substrate in a hypertonic solution of known concentration.

This process occurs when vegetables or fruits are placed in hypertonic solution that induces the formation of an osmotic pressure gradient which can lead to the loss of water from plant tissue.

The aim of this work was to monitor for 10 days period the % of free water content and % of diffusion water determined through the process of osmosis that takes place in plant tissue placed in hypertonic (known concentration) solutions of sugar and sodium chloride salt.

## **MATERIAL AND METHOD**

In early November 2011 capsicum peppers were purchased from the city market with weight ranging between 150-220 g and normal, healthy appearance.

Periodic measurements for various types of water monitoring were performed on samples ten stored under the same conditions of temperature and humidity.

### **Methods of biochemical analysis**

#### **1. Determination of free water**

Determination of free water was performed by weighing (every five days) the peppers stored at room temperature (20°C). The difference was attributed to the percentage of the mass of water.

#### **2. Determination of water diffusion in sugar solution and sodium chloride solution**

In two Erlenmeyer flasks were introduced 25 cm<sup>3</sup> sucrose solution. The balloons were weighed before and after the addition of the sucrose solution in order to know with accuracy the sucrose solution introduced mass (M). After adding 4 to 5 g of the sample prepared in advance for each flask, balloons were weighed to the nearest 0,0001 g.

The difference between the weight of the flask with sample and solution and the flask balloon represented the mass of the sample taken for analysis (m). With the help of refractometer was established the initial concentration of the sucrose solution (C<sub>0</sub>), after which the samples were left to stand 1.5 hours and 24 hours.

During the experiment the free water from sample passed under the influence of osmotic pressure in the sucrose solution determining its dilution. The final concentration of sucrose solution (C<sub>f</sub> %) was determined also by refractometer. The amount of water transferred by osmotic diffusion was calculated as:

$$W_1 \% = (C_0 - C_f) M / m$$

**W<sub>1</sub>** - is the water content transferred by osmotic diffusion (%), **C<sub>0</sub>** - initial concentration of sucrose solution (%), **C<sub>f</sub>** - finale concentration of sucrose solution after sample treating (%), **M** - mass sucrose solution used (g), **m** - mass of the sample (g).

Diffusion of water in the vegetable substrate in sodium chloride solution was similar to diffusion in sugar solution, Volhard method being used to determine the concentration of salt (Trincă, 2004).

Initial solutions had concentrations of 30 % sucrose and 3 % sodium chloride solution.

### Methods of statistical analysis

#### Coefficients of correlation

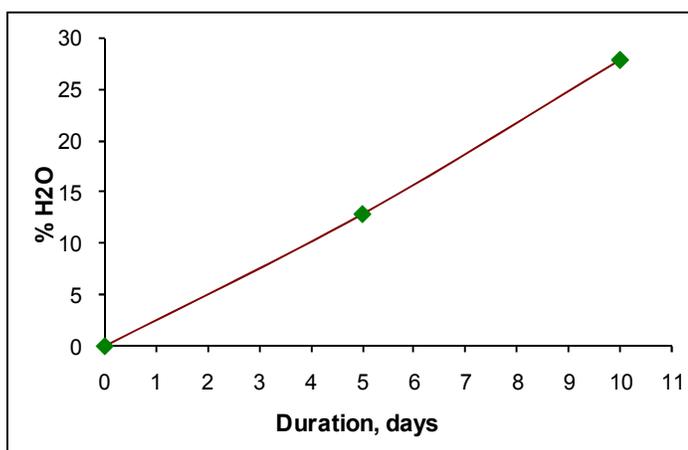
The MATLAB function was used for the coefficients of correlation of samples of peppers analysed in day five and ten for free water, diffusion water in 30 % sugar solution and 3 % sodium chloride salt.

For the statistical analysis of the recorded differences the variances rapport analysis method (X) was used, Pearson correlation coefficient and determination gradient was calculated (by considering  $p < 0.05$  significant statistically).

Statistical evaluation was performed using SYSTAT 13 (SYSTAT SOFTWARE, Inc. CHICAGO).

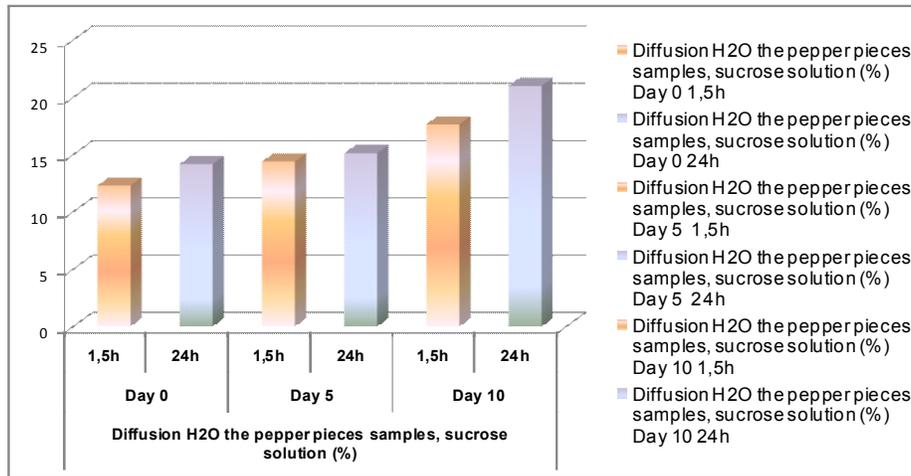
## RESULTS AND DISCUSSION

Regular determinations for monitoring water forms were made on samples ten peppers kept under the same conditions of temperature and humidity. Figure 1 shows the variation of the average value for the experimental period.



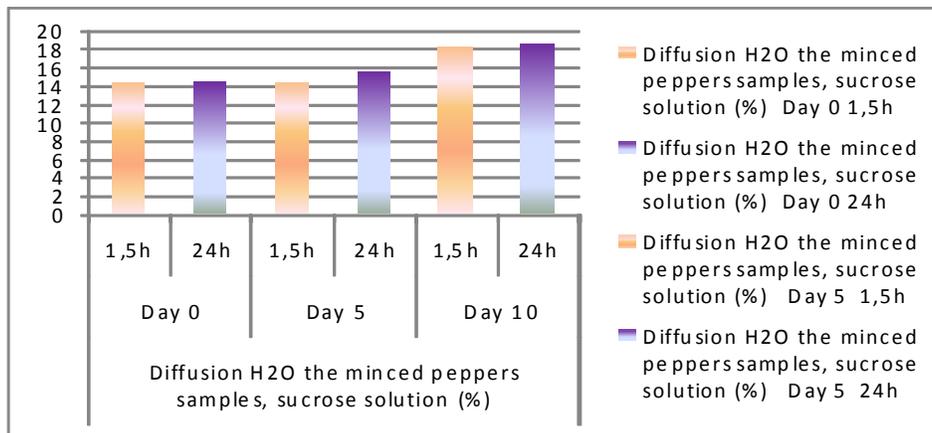
**Fig. 1** - Variation of free water content (mean value) of pepper samples

The monitoring of the levels of water diffusion (mean value) for the sugar solution for the experimental period based on the diffusion time (i.e. 1.5 and 24 h) is shown in Figure 2 (pieces peppers) and 3 (minced peppers):



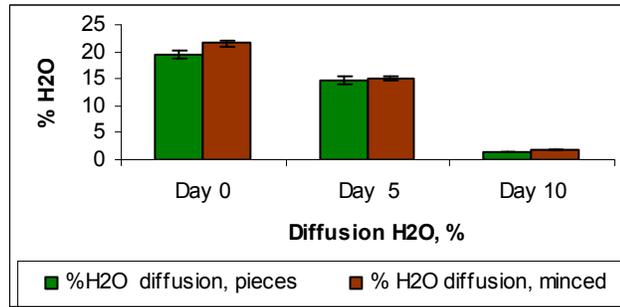
**Fig. 2** - Variation of diffusion water content for the pepper pieces samples (mean value) placed in 30 % sucrose solution at different time diffusion (1.5 and 24 h)

Statistical analysis of the report variant showed insignificant statistical differences ( $p > 0.05$ ) for day five respectively statistically significant differences ( $p < 0.05$ ) for day twenty between the free water and water diffusion (for pepper samples pieces placed in the 30 % sucrose solution).



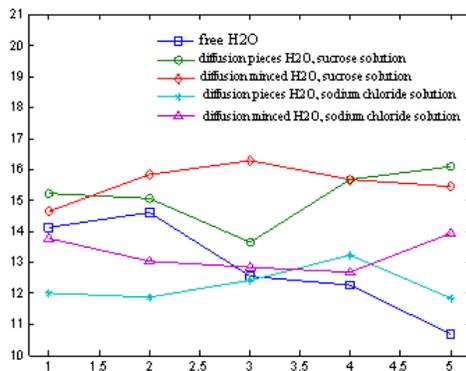
**Fig. 3** - Variation of water diffusion content samples of minced peppers sample (mean value) placed in 30 % sucrose solution at different time of diffusion (1.5 and 24 h)

Statistical analysis of the report variant showed the same sense of variation for minced peppers sample placed 30 % sucrose solution, i.e. insignificant statistically ( $p > 0.05$ ) differences for day five and statistically significant ( $p < 0.05$ ) for day ten.

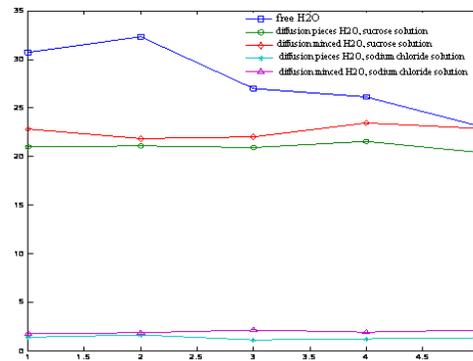


**Fig. 4** - Dynamic changes in water diffusion content (mean value) in 3 % sodium chloride solution for experimental period

Statistical analysis of variant report (X) for pepper samples (pieces compared to minced) showed insignificant statistically differences ( $p > 0.05$ ) for both sodium chloride solution and for sucrose solution, on day five and day ten.



**Fig. 5** - Variation of the main forms of water investigated on day five



**Fig. 6** - Variation of water main forms investigated on day ten

Statistical interpretation of experimental results (and graphical presentation of key parameters to analyze in Fig. 5 and 6) revealed the same threshold for day five correlation ( $r^2 = 0.04$ ) between the free water and water diffusion for the tested pieced or minced peppers samples pieces (sucrose/sodium chloride solution), while in day ten there were no evident linear correlations between investigated water forms.

These results can be explained if it is considered that in day five hydration state of the vegetable substrate ensured a good resistance of cellular walls compared to day ten in which the significantly elimination of free water changed the proportion of diffusible water. At the same time, dehydration affected the cellular wall and released intracellular water which changes the pool of various forms of water in the considered substrate.

## CONCLUSIONS

1. Diffusion process was accomplished similarly in experimental period both for pieces and minced peppers placed either in sodium chloride solution sucrose solution.

2. Comparison and association of biochemical analysis results with statistical ones revealed that the osmotic diffusion process for the peppers placed in sugar or salt solution by osmotic is related with free water transfer only to its original state, while the final results does not showed linear correlations due to issue and interaction between various forms of water from intra and extracellular level.

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# SYNTHESIS AND CHARACTERIZATION FOR SOME PHENOXYACETIC ACID'S SULPHONAMIDE DERIVATIVES

## SINTEZA ȘI CARACTERIZAREA UNOR DERIVAȚI SULFONAMIDAȚI AI ACIDULUI FENOXIACETIC

TROFIN Alina<sup>1</sup>, ONISCU C.<sup>2</sup>, PINTILIE Lucia<sup>3</sup>, UNGUREANU Elena<sup>1</sup>  
e-mail: atrofin@uaiasi.ro

**Abstract.** In the phenoxyacetic acid derivatives class, the introduction of sulphonamide group into the nucleus determined pronouncedly decreased products toxicity and in conjunction with the existing substitutes offered a wide range of biological actions. Many derivatives containing sulphonamide group have revealed other interesting effects due to the number, position and nature of substitutes into the aromatic or heterocyclic nucleus. We aimed to obtain new derivatives with sulphonamide group with broad spectrum, including stimulating and auxinic, growth regulator effects, non-cumulative and biodegradable, with no toxicity towards humans, bees and fish. A new class of compounds was obtained, with auxinic, growth stimulators activity, represented by sulphonamides of the chloro - phenoxy - alkyl carboxylic acids, with very low toxicity. The derivatives were synthesized and characterized further by physical - chemical analyses. Different soluble forms were tested on cultures of sugar beet, tomato, carrot, wheat, with significant results.

**Key words:** phenoxyacetic, sulphonamides, growth stimulators

**Rezumat.** In clasa derivațiilor acidului fenoxiacetic, prin introducerea grupei sulfonamidice în nucleu se obține o scădere pronunțată a toxicității produselor și în corelație cu ceilalți substituenți existenți apare o gama largă de acțiuni biologice. Foarte mulți derivați conținând grupare sulfonamică s-au evidențiat prin alte efecte interesante determinate de numărul, poziția și natura substituenților din nucleul de baza aromatic sau heterociclic. S-a dorit astfel obținerea de noi derivați cu grupare sulfonamică, cu spectru larg de acțiune, incluzând efecte stimulative, reglatoare de creștere și auxinice, lipsite de toxicitate pentru om, albine, pești, necumulative și biodegradabile. S-a obținut o nouă clasă de compuși cu activitate auxinică și stimulative de creștere reprezentată prin sulfonamidele acizilor clor - fenoxi-alchilcarboxilici cu toxicitate foarte redusă. Derivații de bază au fost sintetizați și caracterizați ulterior prin analize fizico-chimice de laborator. Diferite forme de condiționare au fost testate pe culturi de sfeclă de zahăr, tomate, morcov, grâu, cu rezultate semnificative.

**Cuvinte cheie:** fenoxiacetic, sulfonamide, stimulator de creștere

### INTRODUCTION

Sulphonamides are synthetic chemicals obtained through economically viable technologies, which are characterized by extremely valuable biological

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

<sup>2</sup> "Gheorghe Asachi" Technical University of Iasi, Romania

<sup>3</sup> National Institute for Chemical – Pharmaceutical Research and Development, Bucuresti, Romania

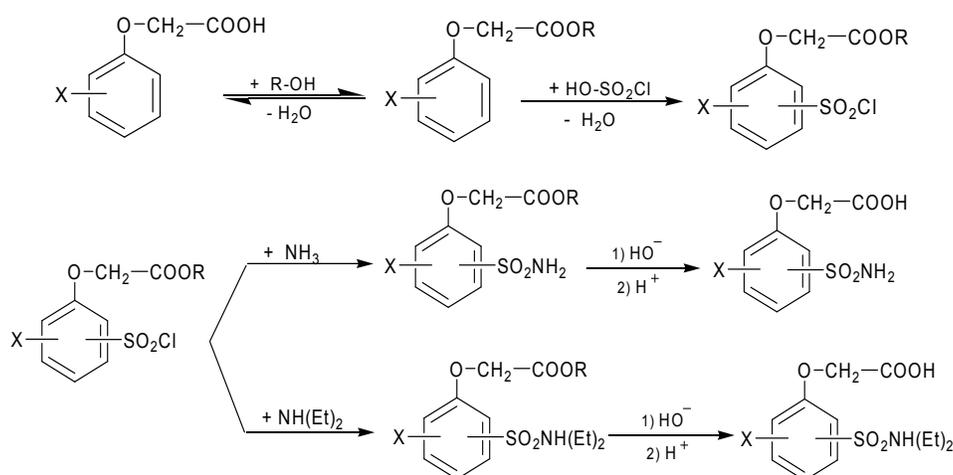
effects, low toxicity, and biodegradability. Put into practice, first as derivatives of 4-amino-benzene sulphonamide with antibacterial effects used in therapy to treat bacterial infections (Oniscu, 1969), sulphonamides have enjoyed great attention, many derivatives containing sulphonamide group per molecule proved other interesting effects due to the number, position and nature of the substitutes in the aromatic or heterocyclic nucleus, leading to their use as anti-seizures (Oniscu, 1988), anti-inflammatory, psychic energizers (Oniscu and Dumitrascu, 2005), diuretics, anti-diabetes (sulfonic ureides), immune modulatory, and more recently, anti-cancer drugs (Fulga et al., 2004)

In an effort to capitalize the phenoxy family auxinic activity, new structures have been designed, that maintain a chlorine atom in the aromatic nucleus and introduce a sulphonamide group, which is expected to increase the auxinic and growth regulating activity and simultaneously to reduce toxicity (Oniscu, 1969; Trofin, 2003).

## MATERIAL AND METHOD

The general scheme for obtaining sulphonamide phenoxy alkyl carboxylic derivatives includes the following steps:

- the synthesis of the R-phenoxyacetic acids from phenols through monochloroacetic acid condensation in alkaline medium (NaOH);
- the synthesis of the methyl or ethyl-esters from the acids;
- the synthesis of the chloro-sulfonic esters;
- the condensation of the chloro-sulfonic esters with ammonia, substituted amines or other compounds with aminic groups in their structure.



**Fig. 1** - Synthesis steps in obtaining sulphonamide phenoxy-alkyl carboxylic derivatives

For the phenoxy acetic acid's esters preparation step, we used o-chloro-phenol and p-chloro-phenol, monochloroacetic acid and sodium hydroxide for the synthesis of the proper chloro-phenoxy-acetic acids, purified in the laboratory, and for the esterification step, 95% purity (volume) methanol. As catalysts, we chose H<sub>2</sub>SO<sub>4</sub> 98 % in ratio of 0,8 % related to the organic acid, in the homogenous process and Dowex-

50 and Amberlite-IR 120 with sulphonic groups (-SO<sub>3</sub>H) in quantities of 3, 5 and 10 g each for the heterogeneous process.

The reaction with the chloro-sulfonic acid takes place with maximum efficiency (80-95%) in molar excess of chloro sulfonic acid of 7: 1, for an hour, at variable temperature depending on the nature of the substrate. Alkaline hydrolysis of the obtained esters, followed by acidification, leads to the corresponding acids.

The general obtaining procedure is:

- over 0.7 chloro sulfonic acid cooled at 0 – 5<sup>o</sup>C in ice, 0.1 mols methyl ester is poured, under continuous stirring, in small portions, so the temperature will not exceed 5<sup>o</sup>C;
- the reaction mass is maintained as the same temperature for 30 – 40 minutes, then the temperature is raised to values specific to the ester type, 30<sup>o</sup>C, respectively 35<sup>o</sup>C, maintaining the temperature for 90 – 100 minute, when the sulpho-chlorine is formed;
- in the last step of the process, the reaction mass is cooled at 5 – 6<sup>o</sup>C and is poured over a water – ice mixture under energetic stirring, in order to destroy the unconsumed chloro-sulphonic acid and to precipitate the sulpho-chlorines;
- the derivative is filtered, washed with water until pH = 6.5 of the waste waters, crystalized again from a water : acetone mixture (2 : 1), then it is dried at temperatures under sub 40<sup>o</sup>C.

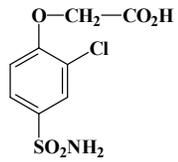
In the next step, the sulpho-chlorines solutions are treated with ammonia, in a ratio of 1 mols: 2 mols, under continuous stirring for 30 minutes, and after the precipitation of the corresponding sulfonamide esters, they are filtered and crystalized again from an alcohol : water mixture (2 : 1). The esters are hydrolysed with NaOH in hot water solution, in a ratio of 1 : 1, 30 minute at reflux; after that, the mass is treated with activated charcoal, which is filtered afterwards. The cooled, clear filtrate is treated with HCl 10% until pH = 2.

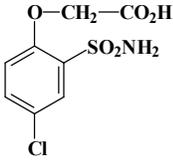
The obtained sulfonamide acids are filtered, dried and crystalized again from an alcohol: water mixture (2 : 1).

## RESULTS AND DISCUSSIONS

The 2-chloro-4-sulphonamide-phenoxyacetic and 4-chloro-2-sulphonamide-phenoxyacetic acids are obtained through chemical synthesis, using accessible and easily controllable methods, which do not generate issues concerning human health and do not release pollutants into the environment. These compounds can be used as products defined by herbicide or growth regulating and auxinic effect or as intermediary derivatives in other syntheses.

There are presented as follows the results for the elemental and spectral analysis for the two obtained acids:

<b>2 - chloro – 4 -sulphonamide – phenoxyacetic acid</b>		
 <p><b>C<sub>8</sub>H<sub>8</sub>ClNSO<sub>5</sub> :</b> <b>M=265.6662g/mol</b></p>	Theoretical values: C: 36.17 % H: 3.03 % N: 5.29 % S: 12.06 % Found values :	<b>Spectral data:</b> FT-IR (ATR in solid, $\nu$ cm <sup>-1</sup> ): $\nu$ NH <sub>2</sub> sulphonamide- 3348 and 3255 cm <sup>-1</sup> , $\nu$ CH phenyl ring – 3090 cm <sup>-1</sup> , $\nu$ COOH - 1737 cm <sup>-1</sup> , $\nu$ C=C phenyl ring – 1586, 1494 cm <sup>-1</sup> , $\nu$ CH <sub>2</sub> – 1429 cm <sup>-1</sup> , $\nu_{as}$ SO <sub>2</sub> -1319 cm <sup>-1</sup> , $\nu_s$ SO <sub>2</sub> -1154 cm <sup>-1</sup> , $\nu$ CH

	C: 37.43 % H: 4.03 % N: 6.57 % S: 13.98 %	aromatic – 1076 cm <sup>-1</sup> , ν S-N – 997 cm <sup>-1</sup> , ν C-Cl -820 cm <sup>-1</sup> .
<b>4 – chloro – 2 - sulphonamide - phenoxyacetic acid</b>		
 <p><b>C<sub>8</sub>H<sub>8</sub>ClNSO<sub>5</sub></b> <b>M=265.6662g/mol</b></p>	Theoretical values: C: 36.17 % H: 3.03% N: 5.29 % S: 12.06 % Found values : C: 36.05 % H: 3.04% N: 5.63 % S: 12.05 %	<b>Spectral data :</b> FT-IR (ATR in solid, ν cm <sup>-1</sup> ): ν NH <sub>2</sub> sulphonamide- 3383 si 3300 cm <sup>-1</sup> , ν CH phenyl ring – 3040 cm <sup>-1</sup> , ν COOH -1725 cm <sup>-1</sup> , ν C=C phenyl ring – 1590, 1581, 1472 cm <sup>-1</sup> , ν CH <sub>2</sub> – 1423 cm <sup>-1</sup> , ν <sub>as</sub> SO <sub>2</sub> -1329 cm <sup>-1</sup> , ν <sub>s</sub> SO <sub>2</sub> -1160 cm <sup>-1</sup> , ν CH aromatic – 1079 cm <sup>-1</sup> , ν S-N – 951 cm <sup>-1</sup> , ν C-Cl -821 cm <sup>-1</sup> .

The compound were tested in a soluble form as sodium, potassium and dimethyl amine salts as growth stimulators for sugar beet, wheat and tomato plants in different development stages and proved to be affordable, with an auxinic biological activity in small concentrations, of 20 respectively 25 ppm for tomato plants and between 12.5 ppm and 50 ppm for wheat. The compounds are stable, easy to apply along with other foliar treatments (fertilization, herbicides application).

## CONCLUSIONS

1. The synthesis of the studied phenoxyacetic sulphonamide derivatives can be performed under easy to control laboratory conditions, without risks;
2. The studied chloro-phenoxyacetic acids' sulphonamides present low toxicity, the DL-50 value being over 6000 mg/kg;
3. Applied as growth stimulators on crops, they lead to significant results: for sugar beet, production increased to 5.2 – 7.14 t sugar/ha compared to 3,21 t sugar/ha for the control; for tomato culture, we registered production increases between 40.6% and 125% and for the wheat, between 14% and 63.9%.

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# THE EFFECTS OF MAGNETITE ON GROWTH DYNAMICS OF CORN PLANTS

## EFFECTUL MAGNETITEI ÎN CREȘTEREA PLANTELOR DE PORUMB

OANCEA Servilia<sup>1</sup>, CAZACU Ana<sup>1</sup>, OANCEA A.V.<sup>2</sup>

e-mail: lioancea@uaiasi.ro

**Abstract.** The aim of this paper is to evaluate the effects of magnetite on corn plant growth. Seeds of corn (*Zea mays*) were put into Petri dishes on double filter paper together with suspensions from anionic clay with Mg, anionic clay containing Fe and magnetite. In addition, we performed a treatment with pure magnetite on corn seeds. The seeds were kept here for 4 days. The dynamic of germination and the growth has been monitorized during the first phenophase of growth. After that, the germinated seed were planted in soil where they continued to growth. The content of photosynthetic pigments has been obtained spectrophotometrically. The best stimulator treatment from point of view of plant growth was the clay containing magnetite. Therefore, a slow release of the active substance from nanocomposite material can be exploited for control release formulation of some plant growth stimulator.

**Keywords:** LDH, magnetite, photosynthetic pigments

**Rezumat.** Obiectivul acestei lucrari este de a evalua efectele magnetitei în creșterea plantelor de porumb. Semințele de porumb (*Zea mays*) au fost puse în sticle Petri cu hârtie de filtru și suspensia de argilă cu Mg, argilă continand Fe și argila continand magnetita. În plus am realizat și un tratament asupra semintelor cu magnetita pura. Semintele fost ținute aici timp de 3 zile. A fost monitorizată dinamica germinației și creșterea plantelor în timpul primar fenofaza de crestere. După aceea semintele germinate au fost plantate în sol unde au continuat să crească. Continutul de pigmenti fotosintetici a fost obținut spectrofotometric. Cel mai stimulator tratament din punct de vedere al creșterii plantelor a fost cel cu argila ce continea magnetita. Astfel o eliberare înceată a unei substanțe active din nanocompozita poate fi folosită pentru controlul stimulatorilor de creștere.

**Cuvinte cheie:** argile anionice, magnetită, pigmenți fotosintetici

## INTRODUCTION

Layered double hydroxides (LDHs) known as anionic clays are an important class of ionic lamellar solids. LDH structure is described with formula  $[M^{2+}_{1-x}M^{3+}_x(OH)_2][A^{n-}_{x/n} \cdot zH_2O]$ , where  $M^{2+}$  is a divalent metal ion such as  $Mg^{2+}$ ,  $Ca^{2+}$ ,  $Zn^{2+}$ , etc,  $M^{3+}$  is a trivalent ion such as  $Al^{3+}$ ,  $Cr^{3+}$ ,  $Fe^{3+}$ ,  $Co^{3+}$  and A is an anion such as  $Cl^-$ ,  $CO_3^{2-}$ ,  $NO_3^-$  etc. The anionic clays exhibit anion sorption, anion diffusion and exchange properties together with surface basicity making them materials of importance for many modern applications

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

<sup>2</sup> “Alexandru Ioan Cuza” University of Iasi, Romania

(Chiriac et al., 2008; Dorante, 2007; Hourı et al., 1999; Salonen et al., 2005; Tsai et al., 2002; You et al., 2001).

Anionic clays, have attracted increasing interest as nanovehicles for delivering genes, drugs, and bio-active molecules into cells. The LDHs clays can be useful in agriculture due their physical and chemical properties, in order to obtain organic products (Chiriac et al., 2008).

Comparative effects of some composites containing anionic clays, Fe<sub>3</sub>O<sub>4</sub> on germination rate, root elongation, stem dimension, and photosynthetic activity have been reported in this paper. Germination rate and root elongation, as a rapid phytotoxicity test method, possess several advantages, such as sensitivity, simplicity, low cost and suitability for unstable chemicals or samples (Lin, 2007; Wang et al., 2001).

## MATERIAL AND METHOD

To study the effect of anionic clays on plant growth, many types of clay have been prepared, but here we sorted the following variants:

1. control;
2. Fe<sub>3</sub>O<sub>4</sub>;
3. MgAl LDH+ Fe<sub>3</sub>O<sub>4</sub>;
4. MgFe LDH;
5. MgAlLDH

30 seeds of corn were put into Petri dishes on double filter paper together with 5 mL treatment solution (a suspension that contains 0.5g of clay and 50mL bidistilled water).

Four days the seeds have been kept in dark and at optimal temperature (20-23°C). Every day we poured bidistilled water for control and treatment solution for the other variants to determine seed germination.

After that the germinated seed were planted in soil where they developed in optimal conditions.

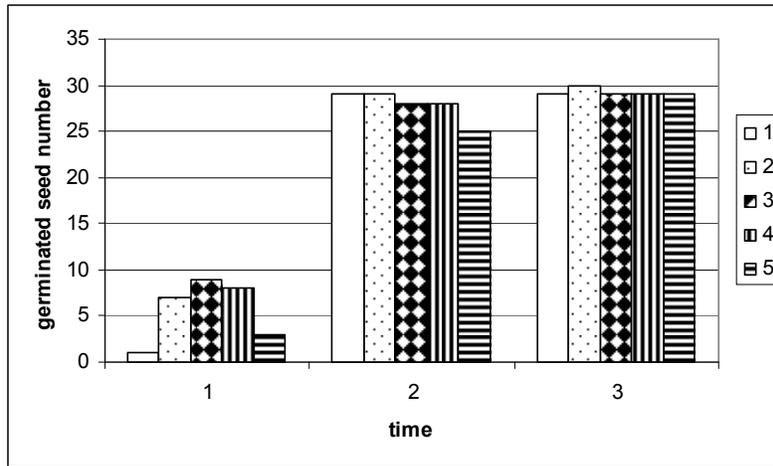
The soil was prepared from celery soil in proportion of ¾ and red peat (produced by Kekkilä Ozi from Tuusula, Finland) in proportion of ¼.

The dynamic of germination and the growth has been monitorized during the first phenophase of growth.

Photosynthetic pigments have been extracted in acetone (Foca et al., 2004; Oancea et al., 2005), measured spectrophotometrically using a spectrophotometer SPECORD 200 produced by Analytik Jena and calculated according to Lichtenthaler formula (Lichtenthaler, 1983).

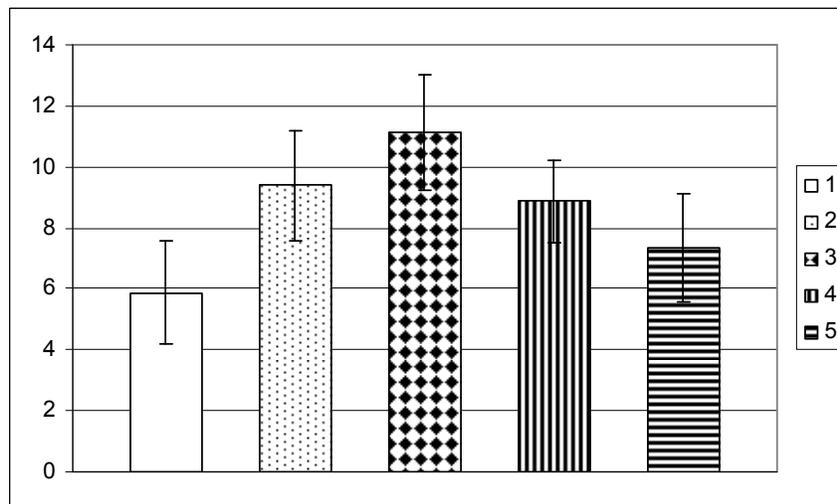
## RESULTS AND DISCUSSIONS

Figure 1 shows the corn seed germination dynamics after 48hours, 72 hours and 86 hours of treatment and figure 2 the root dimension after 4 days.



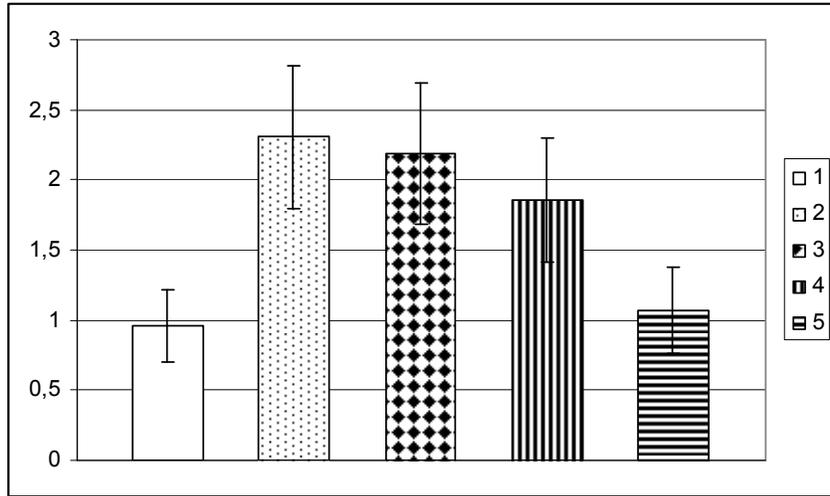
**Fig. 1** – Corn seed germination after 4 days

Figure 1 show that the treated seeds with magnetite or anionic clay germinated faster than the control seeds but after four days the number of germinated seeds is the same.



**Fig. 2** – Total corn root dimensions after 4 days of anionic clay treatments. Error bars are confidence intervals as in [9] and n=10

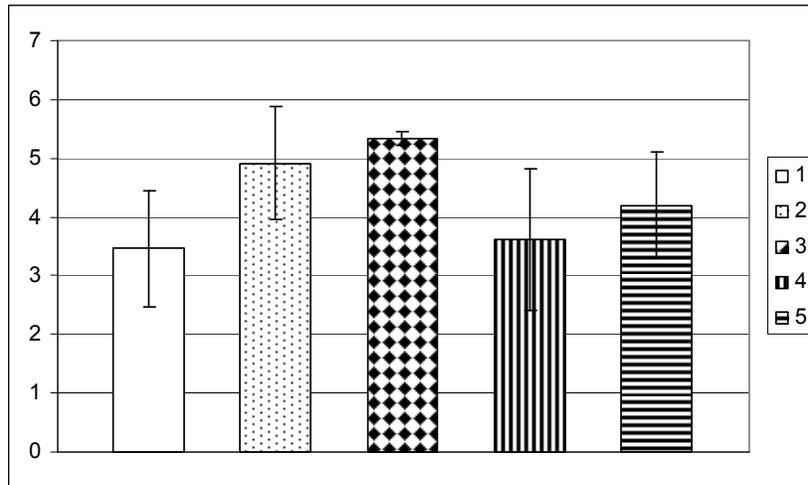
From figure 2 we can see that the corn root of treated plants with magnetite or anionic clay are better developed than the control seeds. Comparing the error bars from treated plants with composite containing magnetite and the control plant, we can see that a significant statistic difference exists between them.



**Fig. 3** – The stem dimensions, after 4 days of treatment with anionic clays

As the figure 3 shows, the corn stems of the treated plants were better developed than the control plants. A significant statistic difference can be put in evidence for treated plant with magnetite and anionic clay containing magnetite and Fe and the control plants.

Figure 4 shows the height of corn plants after 7 days from the treatment.

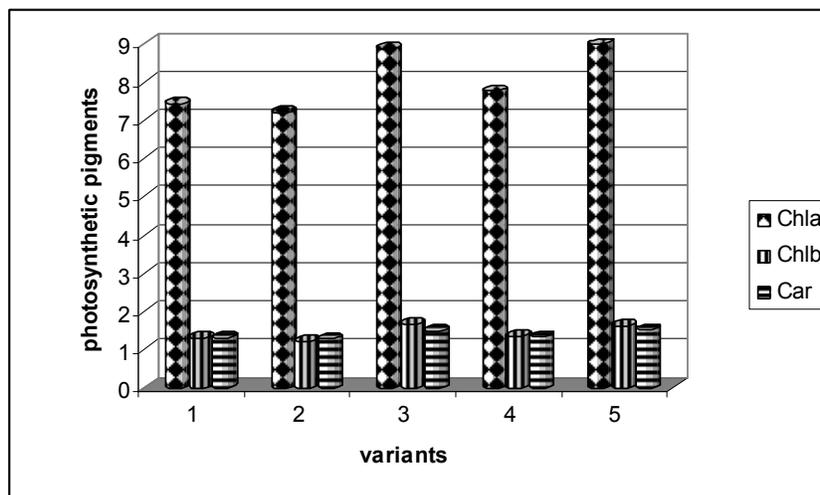


**Fig. 4** – The height of corn plants after 7 days from the treatment

From figure 4 we can see that the errors bars don't overlap only for control plant and the plants treated with the clay containing magnetite; this means a significant difference between these plants. However the ANOVA test, single factor gives a value of  $p=0.003067$ , i.e. a statistical difference between variants.

In addition, the smallest value of the confidence interval for that treated plants with the clay containing magnetite shows that these plants grow uniformly.

Content of photosynthetic pigments, chlorophyll a (Chla), chlorophylls b (Chlb) and carotenoids (Car) from corn leaves is presented in figure 5.



**Fig. 5** – The content of photosynthetic pigments (mg/g fresh tissue) from corn leaves

From figure 5 we can see that the content of chlorophyll a (the most important photosynthetic pigment), for treated plant with anionic clays (especially for anionic clay containing magnetite) is higher than for the control plant leaves. In terms of content of chlorophyll b and carotenoid, these quantities slightly increase for the same treatments.

## CONCLUSIONS

The anionic clays are useful in agriculture due their physical and chemical properties. Our results prove that there are differences between control plants and those treated with anionic clay suspensions. The best anionic clay from point of view of plant growth was the composite containing magnetite. This means the magnetite has a beneficial effect on plant growth. In addition, the structure of LDH offers a good and controlled release of some active substances from nanocomposites to the plant cell.

Our results are in concordance with C. Jiao et al. (2009) work, which recently reported the synergistic effects of  $\text{Fe}_2\text{O}_3$  with layered double hydroxides.

Because are not toxic these composites can be materials of great interest especially in organic agriculture. Therefore, they can substitute some fertilizers or plant growth stimulators, (especially toxic chemical compounds) in order to obtain organic products.

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# CHAOS CONTROL FOR TWO CHEMICAL SYSTEMS

## CONTROLUL HAOSULUI A DOUA SISTEME CHIMICE

*OANCEA Servilia*<sup>1</sup>, *OANCEA A.V.*<sup>2</sup>

e-mail: [lioancea@uaiasi.ro](mailto:lioancea@uaiasi.ro)

**Abstract.** *Over the last years, there has been considerable progress in generalizing the concept of synchronization to include the case of coupled chaotic oscillator's especially technical reasons. When the complete synchronization is achieved, the states of both systems become practically identical, while their dynamics in time remains chaotic. Many examples of synchronization have been documented in the literature, but currently theoretical understanding of the phenomena lags behind experimental studies. The main aim of this paper is to study the synchronization of two chemical chaotic systems (described by Willamowski–Rössler model) based on the adaptive feedback method of control. The transient time until synchronization depends on initial conditions of two systems and on the control strength. Then we can control these chemical chaotic systems in accordance with recent debates of Wang and Chen about full global synchronization and partial synchronization in a system of two or three coupled chemical chaotic oscillators.*

**Key words:** chemical reactions, synchronization, chaos control

**Rezumat.** *In ultimii ani s-a manifestat un progres considerabil în generalizarea conceptului de sincronizare pentru a include cazurile de oscilatori cuplați, în special din motive tehnice. Când este atinsă sincronizarea, starea celor două sisteme devine identică, deși dinamica lor în timp rămâne haotică. În literatură s-au prezentat multe exemple de sincronizare în general teoretic, studii experimentale lipsind însă. Scopul principal al acestui articol este de a studia sincronizarea a două sisteme chimice haotice (descrise de modelul Willamowski–Rössler) pe baza unei metode de control de tip feedback. Timpul de tranziție până la sincronizare depinde de condițiile inițiale ale celor două sisteme și de intensitatea controlorului. Deci putem controla aceste sisteme haotice chimice în acord cu recente dezbateri ale lui Wang și Chen legate de sincronizarea globală și sincronizarea parțială a unui sistem cu doi sau 3 oscilatori chimici cuplați.*

**Cuvinte cheie:** reacții chimice, sincronizare, controlul haosului

## INTRODUCTION

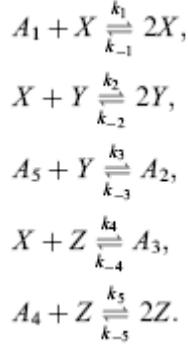
Over the last years, there has been considerable progress in generalizing the concept of synchronization to include the case of coupled chaotic oscillators' especially technical reasons. When the complete synchronization is achieved, the states of both systems become practically identical, while their dynamics in time remains chaotic. Many examples of synchronization have been documented in the literature, but currently theoretical understanding of the phenomena lags behind experimental studies (Chen et Dong, 1998; Grosu, 1997; Grosu et al., 2008; Lerescu et al.,

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

<sup>2</sup> “Alexandru Ioan Cuza” University of Iasi, Romania

2004, 2006; Oancea et al., 2011). The main aim of this paper is to study the synchronization of two chemical chaotic systems based on the adaptive feedback method of control. One of famous ideal chemical models is the Willamowski–Rössler model, which was proposed by Willamowski, Rössler and co-workers (Lei et al., 2005, 2009; Xu et al., 2008). The Willamowski–Rössler model represents some chemical reactions and its mechanism consists in the following elementary steps:



### THEORY

The nondimensionalized chemical dynamical evolution equations of the Willamowski - Rössler system are given as follows:

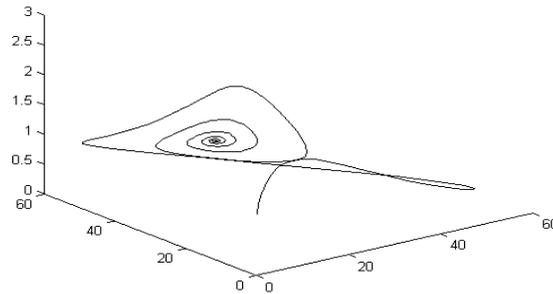
$$\begin{aligned}
 \dot{x}_1 &= -a_1 x_1 - k_{-1} x_1^2 - x_1 x_2 - x_1 x_3 \\
 \dot{x}_2 &= x_1 x_2 - a_5 x_2
 \end{aligned} \tag{1}$$

$$\dot{x}_3 = a_4 - x_1 x_3 - k_{-5} x_3^2 \tag{2}$$

with:  $a_1=30$ ,  $a_4=16.5$ ,  $a_5=10$ ,  $k_{-5}=0.5$

If  $k_{-1}$  is as the control parameter, system (1) can exhibit chaotic attractor when the value of  $k_{-1}$  is selected as 0.5.

Figure 1 shows that the attractor projected onto  $x_1 x_2 x_3$  space for the chaotic system (1) with values from (2) and initial conditions  $x_1(0)=1$ ,  $x_2(0)=1$ ,  $x_3(0)=1$



**Fig. 1** – Phase portrait of  $(x_1, x_2, x_3)$  for Willamowski–Rössler system

To synchronize two Willamowski - Rössler systems we used a simple method for chaos synchronization proposed in (Guo et Li, 2007; Guo et al., 2009).

If the chaotic system (master) is:

$$\dot{x} = f(x) \quad \text{where} \quad x = (x_1, x_2, \dots, x_n) \in R_n$$

$$f(x) = (f_1(x), f_2(x), \dots, f_n(x)) : R^n \rightarrow R^n$$

The slave system is:

$$\dot{y} = f(y) + \varepsilon(y - x)$$

where the functions  $\dot{\varepsilon}_i = -\lambda_i(y_i - x_i)^2$  and  $\lambda_i$  are positive constants

## RESULTS AND DISCUSSION

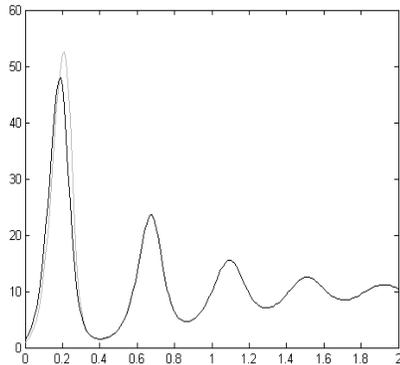
The slave system for the system (1) is:

$$\begin{aligned} \dot{y}_1 &= -30y_1 - 0.5y_1^2 - y_1y_2 - y_1y_3 + z_1(y_1 - x_1) \\ \dot{y}_2 &= y_1y_2 - 10y_2 + z_2(y_2 - x_2) \\ \dot{y}_3 &= 16.5 - y_1y_3 + z_3(y_3 - x_3) \end{aligned} \quad (3)$$

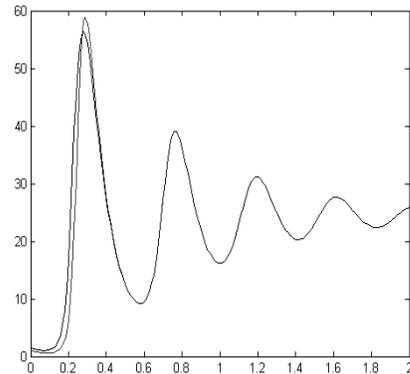
The control strength is of the form:

$$\begin{aligned} \dot{z}_1 &= -(y_1 - x_1)^2 \\ \dot{z}_2 &= -(y_2 - x_2)^2 \\ \dot{z}_3 &= -(y_3 - x_3)^2 \end{aligned} \quad (4)$$

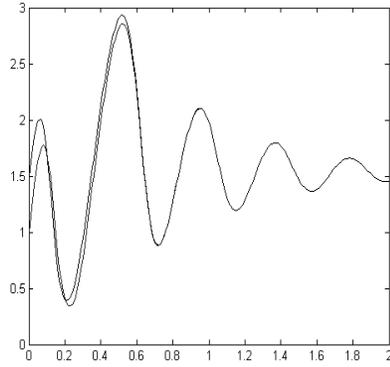
Fig. 2, 3, 4, 5 and 6 show the synchronization of the two systems



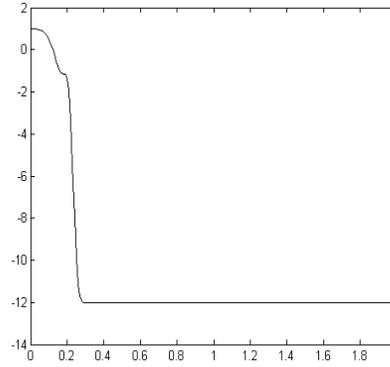
**Fig.2** –  $x_1(t)$ - gray;  $y_1(t)$ - black [ $x_1(0)=1$ ,  $x_2(0)=1$ ,  $x_3(0)=1$ ;  $y_1(0)=1.5$ ;  $y_2(0)=1.5$   $y_3(0)=1.5$ ;  $z_1(0)=1$ ;  $z_2(0)=1$  ;  $z_3(0)=1$ ]



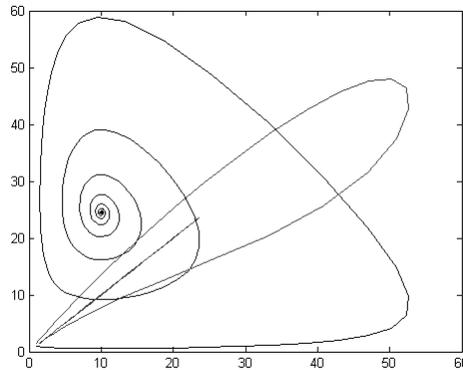
**Fig.3** –  $x_2(t)$ - gray;  $y_2(t)$ - black [ $x_1(0)=1$ ,  $x_2(0)=1$ ,  $x_3(0)=1$ ;  $y_1(0)=1.5$ ;  $y_2(0)=1.5$   $y_3(0)=1.5$ ;  $z_1(0)=1$ ;  $z_2(0)=1$  ;  $z_3(0)=1$ ]



**Fig. 4** –  $x_3(t)$ - gray;  $y_3(t)$ - black [ $x_1(0)=1$ ,  $x_2(0)=1$ ,  $x_3(0)=1$ ;  $y_1(0)=1.5$ ;  $y_2(0)=1.5$   $y_3(0)=1.5$ ;  $z_1(0)=1$ ;  $z_2(0)=1$  ;  $z_3(0)=1$ ]



**Fig. 5** – The control strength  $Z_1$ [ $x_1(0)=1$ ,  $x_2(0)=1$ ,  $x_3(0)=1$ ;  $y_1(0)=1.5$ ;  $y_2(0)=1.5$   $y_3(0)=1.5$ ;  $z_1(0)=1$ ;  $z_2(0)=1$  ;  $z_3(0)=1$ ]



**Fig. 6** – Phase portrait portrait of  $(x, x_2)$  and  $(x, y_1)$  for WR system [ $x_1(0)=1$ ,  $x_2(0)=1$ ,  $x_3(0)=1$ ;  $y_1(0)=1.5$ ;  $y_2(0)=1.5$   $y_3(0)=1.5$ ;  $z_1(0)=1$ ;  $z_2(0)=1$  ;  $z_3(0)=1$ ]

Debin Huang (2005), by testing the chaotic systems including the Lorenz system, Rossler system, Chua’s circuit, and the Sprott’s collection of the simplest chaotic flows found that we can use a single controller to achieve identical synchronization of a three-dimensional system (for Lorenz system this is possible only we add the controller in the second equation).

For the system (1), we achieved the synchronization if one controller is applied; the synchronization is faster if the controller is applied in the first or the second equation than the controller is applied in the third equation of the system. When all controllers are applied, the synchronization is faster than one controller is applied in every equation.

Some modifications of chaotic chemical Willamowski-Rössler system give special behavior of this system.

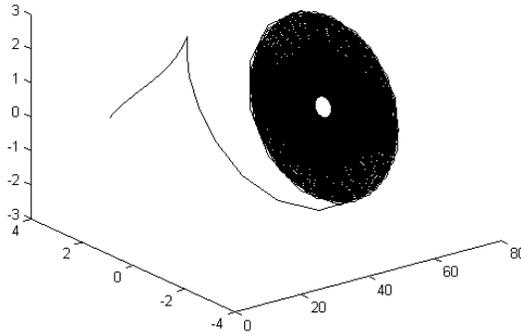
So, if we consider the modified system when variable  $x_2$  and  $x_3$  are inverted we obtain the modified Willamowski-Rössler system the the form:

$$\dot{x}_1 = -30x_1 - 0.5x_1^2 - x_1x_2 - x_1x_3 \quad (5)$$

$$\dot{x}_2 = x_1x_3 - 10x_2$$

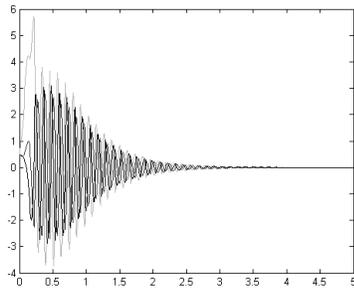
$$\dot{x}_3 = 16.5 - x_1x_2 - 0.5x_2^2$$

and we obtain the attractor from figure 7:

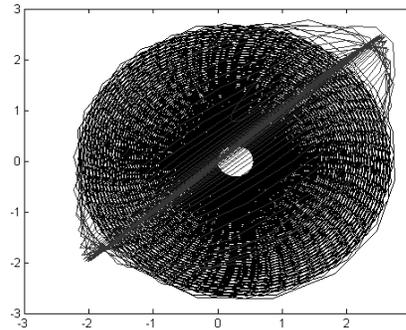


**Fig. 7** – Phase portrait of  $(x_1, x_2, x_3)$  for modified Willamowski–Rössler system

The synchronization of the master with the slave system is given in Fig. 8 and 9:



**Fig. 8** – Synchronization errors between master and slave systems  $[x_1(0)=1, x_2(0)=1, x_3(0)=1; y_1(0)=1.5; y_2(0)=1.5, y_3(0)=1.5; z_1(0)=1; z_2(0)=1; z_3(0)=1]$



**Fig. 9** – Phase portrait of  $(x_2, x_3, y_3)$  and  $(x_2, y_3)$  for WR system  $[x_1(0)=1, x_2(0)=1, x_3(0)=1; y_1(0)=1.5; y_2(0)=1.5, y_3(0)=1.5; z_1(0)=1; z_2(0)=1; z_3(0)=1]$

## CONCLUSIONS

In order to formulate the chaos control, the synchronization of two chaotic chemical systems (described by Willamowski–Rössler model) based on the adaptive feedback method of control is presented in this work. The transient

time until synchronization depends on initial conditions of two systems and on the control strength. Therefore, we can control these chemical chaotic systems in accordance with recent debates of Wang and Chen (2010) about full global synchronization and partial synchronization in a system of two or three coupled chemical chaotic oscillators.

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# ON A NON-STANDARD PROBLEM FOR POROUS MEDIA

## ASUPRA UNEI PROBLEME NESTANDARD PENTRU MEDII POROASE

**BULGARIU E.<sup>1</sup>**

e-mail: bulgariu.emilian@gmail.com

**Abstract:** *The aim of this paper is to study the alternative spatial growth and decay behavior for the motion of a finite or semi-infinite cylinder composed of a non-homogeneous anisotropic linear porous elastic material, subject to null supply terms and null lateral boundary conditions. The motion induced by displacement and volume fraction field prescribed on the base is constrained to have the displacement, velocity, volume fraction and the derivative with respect to time of volume fraction at a given time proportional to their respective initial values. Neither initial data nor the asymptotic behavior at large axial distance are specified. The estimates that are either exponentially grow or decay are derived from a differential inequality depending on cross-sectional energy flux. An explicit bound, in terms of the problem data, is constructed for the amplitude in each decay estimate.*

**Key words:** non-standard problems, porous elastic materials, constrained cylinder, spatial evolution

**Rezumat:** *Scopul acestei lucrari constă în studierea creșterii și descreșterii spațiale pentru mișcarea unui cilindru semi-infinit compus dintr-un material neomogen și anizotrop în cadrul teoriei liniare a mediilor elastice poroase. Corpul nu este supus la încărcări masice, iar condițiile pe frontiera laterală sunt nule. Mișcarea indusă de vectorul deplasare și fracția volumetrică, prescrise pe bază, este constrânsă, în sensul că deplasarea, viteza, fracția volumetrică și derivata acesteia în raport cu timpul, la un anumit moment, sunt direct proporționale cu valorile lor inițiale. Nu sunt prescrise valorile inițiale și nici comportarea asimptotică la distanțe mari. Estimările de creștere sau descreștere exponențială sunt obținute în urma discuției pe marginea unei inecuații diferențiale a unei cantități energetice care depinde de fluxul de energie pe secțiunea transversală. Se obține de asemenea, o margine superioară în termenii datelor problemei pentru cazul cilindrului semi-infinit.*

**Cuvinte cheie:** probleme nestandard, materiale elastice poroase, cilindru constrâns, evoluție spațială

### INTRODUCTION

The study of improperly posed (or *ill-posed*) problems has received considerable recent attention in response to the realization that a number of physical situations lead to these kind of mathematical models. These problems fail to have a global solution or they fail to have a unique solution or the solution does not depend continuously on the data. Over the years many different techniques have been introduced for studying and "solve" such problems. One of

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<sup>1</sup> "Alexandru Ioan Cuza" University of Iasi, Romania

the approach is by altering of the governing equation in such a way as to make such problems well-posed. Others involve constraining solutions to lie in some constraint set. Still others involve changing the initial and/or boundary conditions again in such a way as to make the problems well-posed. By changing the initial conditions we are led to so-called *non-standard problems*. An important monograph on this topic is written by Ames and Straughan (1).

Knops and Payne (8) consider a non-standard problem associated with the theory of classical linear elasticity for a prismatic cylinder and obtain spatial decay and growth exponential estimates with respect to axial variable for some time integrals on the cross-sectional energy, providing the elasticity tensor to be positive definite. The initial conditions are replaced with some constraint conditions in which the displacement and velocity at a given time are considered proportional to the respective initial values and the displacement is prescribed on the base. Possible applications are indicated in (8) for various practical problems in geology, soil engineering or structural engineering. The spatial estimates are obtained by Knops and Payne (8) for proportionality parameters  $\alpha$  and  $\beta$  satisfying conditions  $|\alpha| < 1$ ,  $|\beta| < 1$  or  $|\alpha| > 1$ ,  $|\beta| > 1$ .

Later, Chiriță and Ciarletta (4) studied the spatial behavior for some non-standard problems in linear thermoelasticity without energy dissipation. Similar problems are considered by Bulgariu (2) for the non-homogeneous anisotropic linear elastic material with voids and (3) in the context of linear thermo-microstretch elastic materials, theory that is a part of the generalized models of continua.

In (9) and (5), Nunziato and Cowin have presented a general theory of materials with voids (porous). Previously, Goodman and Cowin (6) had developed a continuum theory of granular materials. In this theory, the bulk density is written as the product of two scalar fields, the matrix material density and the volume fraction field. In the book of Ieșan (7), the theory of thermoelastic materials with voids is deeply investigated. Although it is the simplest extension of the classical theory of elasticity, it is worth recalling that porous materials have applications in many fields of engineering such as petroleum industry, material science, biology, etc.

In this paper we consider a non-standard problem associated with the theory of porous elastic materials. In the same way like Knops and Payne (8), we obtain spatial decay and growth exponential estimates with respect to axial variable for some time integrals on the cross-sectional energy, providing that the internal energy density per unit of volume is a positive definite quadratic form.

### **A NON-STANDARD PROBLEM FOR A POROUS ELASTIC CYLINDER**

We consider a prismatic cylinder  $B \subset \mathbb{R}^3$  of length  $L$  occupied by an anisotropic compressible thermoelastic material. We assume that the bounded uniform cross-section  $D \subset \mathbb{R}^2$  has piecewise continuously differentiable boundary  $\partial D$ . The

origin of a rectangular Cartesian coordinate system is located in the cylinder's base and the pointwise  $x_3$ -axis is directed along that of the cylinder (Figure 1).

The standard convention of summation over repeated suffixes is adopted and a subscript comma denote the spatial partial differentiation. Greek subscripts vary over  $\{1,2\}$  and Latin subscripts vary over  $\{1,2,3\}$ . The Greek letter  $\eta$  is reserved for use as a time integration variable.

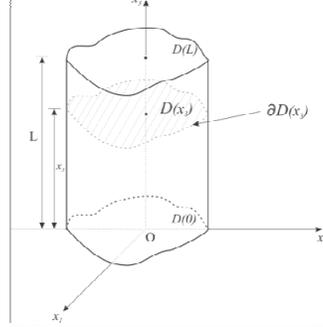


Fig. 1 – Cylinder B

For convenience we introduce the following abbreviations

$$B(z, \eta) = \{x \in B : z > x_3 \text{ at the moment } \eta\} \quad (1.1)$$

and by  $D(x_3, \eta)$  we indicate that relevant quantities are to be evaluated over the cross-section whose distance from the origin is  $x_3$  at the moment  $\eta$ .

The non-standard problem (P) considered by us is specified by the equations

$$(C_{ijkl}u_{k,l} + B_{ij}\varphi + D_{ijk}\varphi_{,k})_{,j} = \rho\dot{u}_i, \quad (\mathbf{x}, t) \in B \times (0, t_0) \quad (1.2)$$

$$(A_{ij}\varphi_{,j} + D_{rsi}u_{r,s} + d_i\varphi)_{,i} - B_{ij}u_{i,j} - \xi\varphi - d_i\varphi_{,i} - \tau\dot{\varphi} = J\ddot{\varphi}, \quad (\mathbf{x}, t) \in B \times (0, t_0) \quad (1.3)$$

subject to the lateral boundary conditions

$$\begin{aligned} \dot{u}_i n_\alpha (C_{i\alpha k l} u_{k,l} + B_{i\alpha} \varphi + D_{i\alpha k} \varphi_{,k}) &= 0 \\ \dot{\varphi} n_\alpha (A_{\alpha j} \varphi_{,j} + D_{rs\alpha} u_{r,s} + d_\alpha \varphi) &= 0, \quad (\mathbf{x}, t) \in (\partial D \times [0, L]) \times [0, t_0] \end{aligned} \quad (1.4)$$

with conditions on the base

$$\begin{aligned} u_i(\mathbf{x}, t) &= f_i(x_\alpha, t) \\ \varphi(\mathbf{x}, t) &= p(x_\alpha, t), \quad (\mathbf{x}, t) \in D(0) \times [0, t_0] \end{aligned} \quad (1.5)$$

and a combination of the initial values of the displacement, velocity, volume fraction and the derivative with respect to time of volume fraction with their respective values at a later time  $t_0$ , in the form

$$\begin{aligned} u_i(\mathbf{x}, t_0) &= \lambda u_i(\mathbf{x}, 0), \quad \varphi(\mathbf{x}, t_0) = \lambda \varphi(\mathbf{x}, 0) \\ \dot{u}_i(\mathbf{x}, t_0) &= \mu \dot{u}_i(\mathbf{x}, 0), \quad \dot{\varphi}(\mathbf{x}, t_0) = \chi \dot{\varphi}(\mathbf{x}, 0), \quad \mathbf{x} \in B \end{aligned} \quad (1.6)$$

where  $f_i(x_\alpha, t)$  and  $p(x_\alpha, t)$  are prescribed differentiable functions compatible with the initial and lateral boundary conditions and  $\lambda$ ,  $\mu$  and  $\nu$  are given parameters satisfying the conditions

$$|\lambda| > 1, |\mu| > 1, |\chi| > 1 \quad (1.7)$$

Constitutive coefficients satisfy the symmetry relations

$$C_{ijkl} = C_{jikl} = C_{klij}, \quad A_{ij} = A_{ji}, \quad B_{ij} = B_{ji}, \quad D_{ijk} = D_{jik} \quad (1.8)$$

and the porous dissipation coefficient  $\tau$  satisfies

$$\tau \geq 0, \quad \mathbf{x} \in B \quad (1.9)$$

We are interested in the study of the spatial behavior of the solution  $(u_i, \varphi)$  of the above boundary-initial value problem given by (1.2)-(1.6).

A possible application of this problem is in the study of a pile driven into a rigid foundation for preventing movement of the lateral boundary. The time-dependent displacement and volume fraction field prescribed on the base end constrains the motion such that the displacement, velocity, volume fraction and the derivative with respect to time of volume fraction at some given time are proportional to their unknown initial values. It is desired to predict the deformation at each cross-section of the pile in terms of base displacement and volume fraction field.

### SPATIAL BEHAVIOR OF SOLUTIONS

In this section we determine a range of values for the parameters  $\lambda$ ,  $\mu$  and  $\chi$  for which the problem is well-posed and we obtain spatial estimates describing how the displacement and volume fraction field evolve with respect to the axial distance to the cylinder's base.

We will use the notations  $\aleph = \{\psi_{ij}, \chi, \sigma_i\}$  and  $\Theta = \{\Psi_{ij}, \Pi, \Sigma_i\}$ . We assume that the internal energy density per unit of volume  $W$  is a positive definite quadratic form. Thus, there are two positive constants  $c_m$  and  $c_M$  satisfying

$$c_m(\psi_{ij}\psi_{ij} + \chi^2 + \varepsilon\sigma_i\sigma_i) \leq 2W(\aleph) \leq c_M(\psi_{ij}\psi_{ij} + \chi^2 + \varepsilon\sigma_i\sigma_i) \quad (2.1)$$

for any  $\psi_{ij} = \psi_{ji}, \chi, \sigma_i$ . The quantity  $\varepsilon = \frac{J}{\rho}$  is introduced for the compatibility of dimensions of the quantities involved in (2.1) and

$$2W(\aleph) = C_{ijkl}\psi_{ij}\psi_{kl} + \xi\chi^2 + A_{ij}\sigma_i\sigma_j + 2B_{ij}\chi\psi_{ij} + 2D_{ijr}\psi_{ij}\sigma_r + 2d_i\chi\sigma_i \quad (2.2)$$

The initial displacement, velocity, volume fraction and the derivative with respect to time of volume fraction are not prescribed. The conditions specified on the end  $D(L, \eta)$  for a finite cylinder, or at asymptotically large axial distance for the semi-infinite cylinder, are also not prescribed.

Let  $E(\tilde{\mathbf{n}}; \zeta) = 2W(\tilde{\mathbf{n}}) + \xi\zeta^2 \geq 0$ . We denote by

$$\begin{aligned} E(\aleph, \Theta; \omega, \Gamma) = & C_{ijkl}\psi_{ij}\Psi_{kl} + \xi\chi\Pi + A_{ij}\sigma_i\Sigma_j + B_{ij}[\chi\Psi_{ij} + \psi_{ij}\Pi] \\ & + d_i[\chi\Sigma_i + \sigma_i\Pi] + D_{ijr}[\sigma_r\Psi_{ij} + \psi_{ij}\Sigma_r] + \xi\omega\Gamma \end{aligned} \quad (2.3)$$

We can remark that  $E(\tilde{n}, \tilde{n}; \zeta, \zeta) = E(\tilde{n}; \zeta)$ . By the Cauchy-Schwarz inequality, we have

$$E(\aleph, \Theta; \gamma, \Gamma) \leq [E(\aleph; \gamma)]^{1/2} [E(\Theta; \Gamma)]^{1/2} \quad (2.4)$$

We consider the functions depending on the cross-sectional energy flux

$$K(x_3) = \int_0^{t_0} \int_{D(x_3, \eta)} (t_{3i} u_i + h_3 \dot{\phi}) dad\eta \quad (2.5)$$

$$L(x_3) = \int_0^{t_0} \int_{D(x_3, \eta)} (T - \eta)(t_{3i} \dot{u}_i + h_3 \dot{\phi}) dad\eta \quad (2.6)$$

for  $x_3 \in [0, L]$  and the linear combination

$$M(x_3) = L(x_3) + \gamma K(x_3), \quad 0 \leq x_3 \leq L \quad (2.7)$$

With a method described in (2), one can obtain the differential inequality

$$\sigma |M(x_3)| \leq \frac{dM}{dx_3}(x_3), \quad 0 \leq x_3 \leq L \quad (2.8)$$

where  $\sigma = [(t_0 + \gamma)\omega]^{-1}$ ,  $\omega = \max\left(\delta, \frac{c_M^* \tau}{2\omega\rho\xi\gamma}\right)$ ,  $\delta = \max\left(\frac{c_M^*}{\omega\rho}, \varpi\right)$ ,

$\gamma = (t_0 + \kappa) \max\left(\frac{1}{\mu^2 - 1}, \frac{1}{\chi^2 - 1}, \frac{1}{\lambda^2 - 1}\right)$  and  $\kappa$  is a constant to be choose later.

Now we will discuss the the integration of (2.8). We suppose first that  $M(z) \geq 0$  for a fixed  $z \in [0, L]$  which leads to the growth estimate

$$M(x_3) \geq M(z) \exp[\sigma(x_3 - z)], \quad z \leq x_3 \leq L \quad (2.9)$$

and the asymptotic behavior

$$\lim_{x_3 \rightarrow \infty} \left\{ \exp(-\sigma x_3) \left[ \kappa_1 \int_z^{x_3} U(\zeta, 0) d\zeta + \int_0^{t_0} \int_z^{x_3} U(\zeta, \eta) d\zeta d\eta \right. \right. \\ \left. \left. + (t_0 + \gamma) \int_0^{t_0} \int_{B(z, x_3)} \tau \dot{\phi}^2 dv d\eta \right] \right\} = M_1 \quad (2.10)$$

with  $M_1$  a positive bounded constant and  $\kappa_1 = \max(\gamma(\lambda^2 - 1), \gamma(\chi^2 - 1), \gamma(\mu^2 - 1))$ .

We next suppose that  $M(x_3) \leq 0$  for all  $x_3 \in [0, L]$  and we obtain the alternative decay estimate

$$-M(x_3) \leq -M(0) \exp(-\sigma x_3), \quad 0 \leq x_3 \leq L \quad (2.11)$$

An immediate consequence of (2.11) for semi-infinite cylinder is that  $M(x_3)$  vanishes as  $x_3 \rightarrow \infty$ , which in combination with (2.11) leads to the following decay estimate for the total energy

$$\kappa \int_{x_3}^{\infty} U(\zeta, 0) d\zeta + \int_0^{t_0} \int_{x_3}^{\infty} U(\zeta, \eta) d\zeta d\eta \\ + (t_0 + \gamma) \int_0^{t_0} \int_{x_3}^{\infty} \int_{D(\zeta, \eta)} \tau \dot{\phi}^2 dad\zeta d\eta \leq -M(0) \exp(-\sigma x_3), \quad x_3 \geq 0 \quad (2.12)$$

The desired upper bound for the amplitude  $-M(0)$  is

$$\begin{aligned}
& [-M(0)]^{1/2} \leq \sqrt{2} \left[ \int_0^{t_0} \int_{D(0,\eta)} \left( \dot{f}_i \dot{f}_i + \frac{J}{\rho} \dot{p}^2 \right) dad\eta \right]^{1/4} \\
& \times \left\{ \sqrt{\rho} \max(q_1^{-1}, q_2^{-1})^{1/2} \left[ \int_0^{t_0} \int_{D(0,\eta)} \left( \dot{f}_i \dot{f}_i + \frac{J}{\rho} \dot{p}^2 \right) dad\eta \right]^{1/4} + (t_0 + \gamma) \sqrt{\xi} \theta \right. \\
& \left. \times \left[ \int_0^{t_0} \int_{D(0,\eta)} \left( \dot{f}_{i,\alpha} \dot{f}_{i,\alpha} + \frac{\rho}{\xi} \ddot{f}_i \ddot{f}_i + 2 \frac{J}{\rho} \dot{p}_{,\alpha} \dot{p}_{,\alpha} + 2 \frac{J}{\xi} \ddot{p}^2 + 2 q_2^{-2} \frac{\rho}{J} \dot{p}^2 \right) dad\eta \right]^{1/4} \right\} \quad (2.13)
\end{aligned}$$

where  $q_1$  and  $q_2$  are some computable positive constants. This upper bound depends only upon the geometry of  $D$ , the base data functions  $f_i$  and  $p$  and material parameters and  $c_M$ .

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# EQUAL OPPORTUNITIES EMPLOYMENT: THE UEMPLOY PROJECT SOLUTIONS

## PENTRU ȘANSE EGALE PE PIAȚA MUNCII: PROIECTUL UEMPLOY ȘI SOLUȚIILE SALE

**COLIBABA Anca Cristina<sup>1</sup>, COLIBABA Cintia<sup>2</sup>,  
MIHOCI Oana<sup>3</sup>, COCĂRȚĂ ANDREI Luminița<sup>4</sup>**  
e-mail: anca\_colibaba@yahoo.com

**Abstract.** *Many companies realize that inclusive employment is an effective strategy to meet their social responsibility but the majority of employers have no real experience of employing a disabled person. Proactive cooperation with employers is needed to counteract stereotypes and encourage them to understand skills and capacities of people with disabilities. For disabled the project will facilitate greater involvement in their organizations' strategic planning; improve independence, self-confidence, accountability, flexibility and sociability; improve employment inclusion and ensure full equality in employment practices; gain positive experiences from the process; receive better services from service providers*

**Key words:** equal opportunities, consultancy, employment, disability.

**Rezumat** *.Multe dintre companii își dau seama că egalitatea de șanse pe piața muncii este o strategie eficientă pentru a contribui la imaginea responsabilității sociale a firmei, dar majoritatea angajatorilor nu au nicio experiență reală de angajare a unei persoane cu dizabilități. Este nevoie de cooperare proactivă cu angajatorii pentru a contracara stereotipurile și a-i ajuta să înțeleagă capacitățile și abilitățile pe care le au persoanele cu dizabilități. În ceea ce privește persoanele cu dizabilități proiectul va încuraja o implicare mai semnificativă a acestora în administrarea strategică în cadrul organizațiilor din care aceștia fac parte; va promova creșterea independenței, încrederii în sine, a sentimentului de responsabilitate, a flexibilității și a sociabilității; va sprijini integrarea pe piața muncii a persoanelor cu dizabilități și va asigura egalitate deplină în practicile de angajare; va oferi experiențe pozitive pe durata derulării procesului; va contribui la îmbunătățirea serviciilor oferite de diverși furnizori.*

**Cuvinte cheie:** egalitatea de șanse , consultanță, piața muncii, dizabilitate.

## INTRODUCTION

The current economic climate is an especially difficult time for employers as they are facing new and greater challenges. The need for innovation and alternatives has never been greater. One vast and largely untapped resource is citizens with disabilities (Bruce, 2009). Time after time, disabled workers have

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<sup>1</sup> "Grigore T. Popa" University of Medicine and Pharmacy of Iasi, Romania

<sup>2</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

<sup>3</sup> EuroEd Foundation Iași, Romania

<sup>4</sup> „Alexandru Ioan Cuza" University of Iași, Romania

demonstrated that - with appropriate selection and support - they have the ability to display higher levels of productivity, commitment and adaptability in the open labour market (Council Directives).

For disabled persons the ability to find and retain work is fundamental to their development. Employment is more than simply being able to earn money for a task performed. It is seen as central to human identity and development and is an essential constituent of personal identity. Work is central to the dignity, self-confidence and social meaning of individuals. Work gives people a valued identity and a sense of sociological belonging (Colibaba et al., 2011).

Making the transition from dependence and institutionalization to independence and contributory citizenship has almost universally been viewed as participation of people with disabilities in the life of a society (Bruce, 2010). It was important, therefore that societies now increasingly understand the seriousness of the participation of people with disabilities in the life of a country. The “social model of disability” promotes the disabled person as a value added to the society and especially the community he/she belongs to.

## **MATERIAL AND METHOD**

The UEmploy project (510784-LLP-1-2010-1-RO-LEONARDO-LMP), supported by the Leonardo da Vinci program, is based on quantitative and qualitative research carried out within the project partnership. It is based on the identified significant implementation gaps for European companies around issues of Equal Opportunities (EO) and work rights for disabled people. The project brings together expertise of seven partner organizations from Romania, Bulgaria, Hungary, Finland and Ireland to develop, test and introduce a consultancy model to promote effective employment outcomes for European citizens with disabilities

## **RESULTS AND DISCUSSIONS**

*UEmploy project* addresses two long term target groups of an open and sustainable labour market: disabled people and employers.

The evidence from across the world is that people with disabilities usually have difficulties in finding suitable employment due to unsuccessful approaches to strategy, which in turn may be based on negative public perceptions of disability and over-medicalization in such service provision as exists.

As a result, their skills and abilities are often underestimated and they either can hardly find a job at all or are offered inappropriate job positions. This makes their eventual employment unstable. Services proposed by the project will help to improve this unfair situation.

Regarding employers, the project aims to provide a mechanism to guarantee effective selection processes so that to match the employer’s need with the skills or qualifications of an applicant with disabilities. The use of this mechanism paves the way for how companies are helped to become ready to hire and train disabled persons workforce for job specific positions – a specialized consultancy service for how to efficiently employ the disabled workforce.

The consultancy process provides a structured decision making/risk analysis procedure which offers solutions for people with disabilities and employers to choose the best working positions and job profiles for the appropriate type of disability.

### **UEmploy Consultancy Model (fig. 1)**

The following actions are performed during the consultancy process:

#### **Preparation for the audit and interviews:**

The UEmploy consultant visits the company, meets key stakeholders of the selected work process, video records the selected work process and collects information about quality and safety issues and practices. After the analysis of the collected information the consultant prepares questions for interviews with line management. A competency checklist is also compiled in order to select critical competencies of the selected work process.

#### **Interviews:**

The consultant runs 5 interviews with line managers, the safety officer, the HR manager and the appointed GP of the company. Interviewed participants fill out a competency checklists and rank individual work process related competencies.

#### **Field trip:**

The consultant visits the workshop area with the safety officer, walks down the usual pathways workers use every day, checks dining rooms, toilets corridors, stairs and other facilities to find unsafe conditions and potential hazards people with disabilities may face when being employed in company locations.

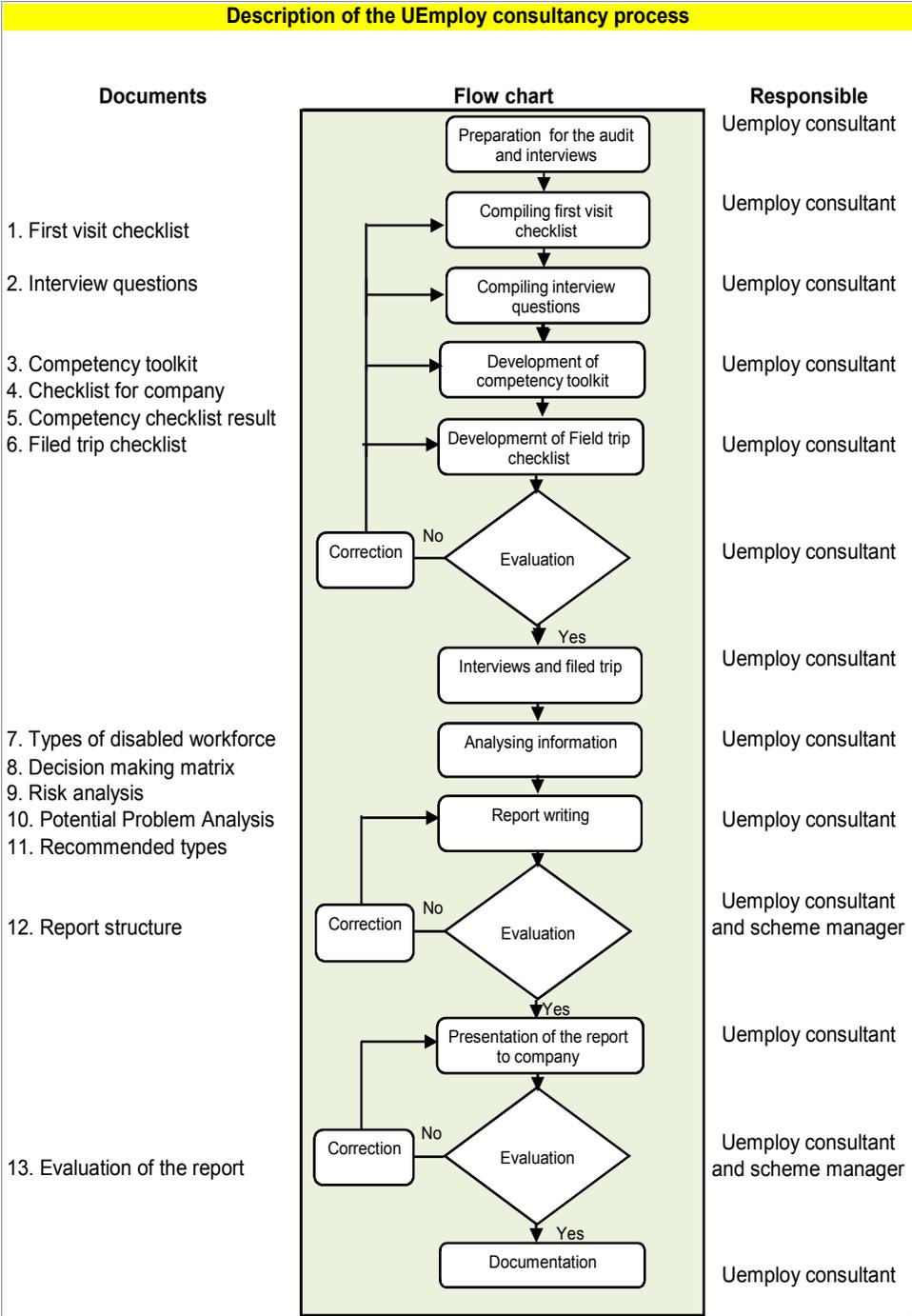
#### **Analyzing information:**

Collected information is analysed in details with the following steps:

- Critical competencies of the selected work process are identified
- A decision making matrix is compiled to list critical competencies and match them with different categories of people with disabilities
- A risk analysis is made to minimize hazards and potential accidents when people with disability are employed
- A Potential Problem Analysis is compiled to work out preventive measures to avoid accidents and quality and other problems.
- Proper categories of people with disability are selected as the result of the analysis

#### **Presentation of the report:**

A slide presentation is designed for the line management to introduce the results of the audit.



**Fig. 1 - UEmploy Consultancy Model**

### **Report writing**

A report is written to the MD and other stakeholders of the company. The report contains proper types of people with disability who can be employed in different steps of the selected work process with minimized risks. The report lists recommendations to be implemented to make the location safer and more appropriate for people with disability.

### **Evaluation**

The company has an opportunity to provide feedback of the consultancy process and the final written report.

### **Ensuring the quality of the UEmploy consultancy services**

Quality is ensured by a Quality Management System which is controlled by Scheme Managers in each partner country who received Scheme Managers training.

Scheme Managers are responsible for the performance of the auditors. They evaluate auditor's activities step by step.

The audited company provides an evaluation of the consultancy process which will improve and enhance the future development of the consultancy process.

The consultancy process has potential benefits to employers. Employers have the opportunity to:

- Employ people with disabilities with minimized risks
- Enhance Corporate Social Responsibility
- Manage and retain a more diverse workforce
- Manage change within the organisation
- Manage effectively an aging workforce
- Promote inclusion and equality
- Meet national quota systems- for particular countries i.e. Romania, Bulgaria and Hungary

## **CONCLUSIONS**

*UEmploy* project promotes equal opportunities for disabled work inclusion without impacting quality or profitability.

The model we propose is supporting both the supply and demand sides of the issue around equality of opportunity and labour market employability for disabled citizens. Our comprehensive approach is focused on considering and targeting not only the supply (talent, abilities, skills) side (disabled people) but also the demand side(employers). From this perspectives, inclusive employment means:

- reconciliation of the different perspectives and interests of employers and employees

- finding a variety of job opportunities for people with disabilities focusing on abilities and capacities rather than on the disabilities and difficulties
- matching individual skills and preferences to job requirements
- consultancy services for employers and practical guidance on improving the working environment

European Union strategy stresses the need for approaches that focus on the removal of barriers, which prevent people with disabilities from achieving full citizenship. European employment strategy for those with disabilities is strongly focused on rights, equality of opportunity, social partnership and anti-discrimination legislation. The foundation of this is the *Directive for Equal Treatment in Employment (2000/78/EC)* adopted in November 2000.

Inclusion of disabled workers/citizens will never happen effectively calling for equal rights and adopting laws to promote and protect them; we need to open our minds to new paradigms and methods. It is time to now move on from the discrimination approach (segregation, medical and charity model of disabled people) to a modern vision of society construction that goes beyond inclusion - to solutions of open access and sustainable growth for all.

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# LANGUAGE PROFILES IN EUROPE: AN OVERVIEW OF NATIONAL LEVEL AND EUROPEAN LEVEL RESEARCH

## PROFILE LINGVISTICE ÎN EUROPA: O PERSPECTIVĂ LA NIVEL NAȚIONAL ȘI EUROPEAN

*COLIBABA Anca Cristina*<sup>1</sup>, *VLAD Monica*<sup>2</sup>, *COLIBABA Șt.*<sup>3</sup>, *DINU Claudia*<sup>1</sup>  
e-mail: anca\_colibaba@yahoo.com

**Abstract.** *This article presents a research carried out in the framework of the Language Rich Europe project with the goal to create an overview of the situation of national and minorities' languages in European countries and to illustrate policies and good practices initiated for the promotion of multilingualism. The research is not finalized at this stage and the article thus presents the research methodology and the envisaged results.*

**Key words:** multilingualism, minorities languages, language policies

**Rezumat.** *Acest articol prezintă o cercetare din cadrul proiectului Language Rich Europe, realizate cu scopul de a crea o imagine de ansamblu a situației limbilor naționale și a celor ale minorităților din Europa. Rezultatele obținute includ date cu privire la politicile la nivel național și exemple de bună practică în promovarea multilingvistului. Această cercetare nu este încă finalizată, acest articol prezentând metodologia din spatele cercetării și rezultatele estimate.*

**Cuvinte cheie:** multilingvism, limbile minorităților naționale, politici lingvistice

### INTRODUCTION

The Language Rich Europe (LRE) project is co-funded by the European Union and its main aim is to undertake a comparative analysis of countries' performance against the European multilingualism policy. The background for this project being needed is that although states in the European Union have responded to increasing mobility and migration through social inclusion measures, these 2 phenomena are not adressed by language policies and practices to promote linguistic diversity. Moreover, according to Eurobarometer, 83% of Europeans value knowing other languages but 44% cannot speak a second language. The range of languages learned within the EU is narrow and insufficient resources are allocated to language learning. The Council of Europe survey "Language requirements for adult migrants in CoE Member States" found that many countries do not yet have a language environment encouraging integration. The Euridice 2008 Report "Key data on teaching languages at school in Europe" shows a lack of diversity in the education system. The LRE project

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<sup>1</sup> "Grigore T. Popa" University of Medicine and Pharmacy of Iasi, Romania

<sup>2</sup> EuroEd Foundation Iași, Romania

<sup>3</sup> „Alexandru Ioan Cuza" University of Iași, Romania

will create a network of 960 decision makers from 14 Member States and 2 regions that will share good practice in language teaching and learning and cooperate on improving language policies and practices. The network formed, with organizations representing government, business, public services, the media and migrant associations will learn from each other and create practical guidance on how to develop more language learning friendly environments, increase linguistic diversity and enhance intercultural dialogue and social cohesion through language teaching and learning. The good practice initiatives will be available on the project's interactive website and the partners' networks.

## **MATERIAL AND METHOD**

The comparative analysis is based on a series of researches carried out in 14 states and 2 regions, the result envisaged being an Index of Language Policies and Practices in Europe containing 120 indicators. The Index will be published this year. The categories of the national and regional research are the country/regional context, how languages are considered in official documents and legislation, languages in pre-primary, primary and secondary education.

The index analyzes, for each country if there are official data collection mechanisms regarding the types of languages, at the regional and national level. For each country in which the research has taken place, the existence of policy documents promoting languages has been analyzed as well as the existing legislation on languages. The research also included an analysis on whether support in the national language was given to newcomers before and during mainstream education (at the pre-primary, primary and secondary levels). The index also analyzes the number of regional / minority languages in every country and to what extent (if any) they are provided in education.

## **RESULTS AND DISCUSSIONS**

The research presents the most widely taught foreign languages and the educational offers in every country, referring both to EU and non-EU (world) languages. The research also includes an overview on the profile of the language educators and the language education training available to them: whether they are qualified language teachers, generally qualified classroom teachers or teachers with no specific qualification and whether a country or region actively recruits language teachers where there is a shortage. Also in terms of teacher training, the index presents levels of support to language teachers' mobility offered by the several countries in primary and secondary education (there is support provided, provided only on demand, no support provided) and what is the level of competence required from foreign language teachers. In terms of language students' mobility, the index also analyzes how universities handle mobility in the country of the language they are learning (whether it is compulsory or not).

The foreign language offer is also analyzed at the levels of education (VET and universities) and the extent to which the CEFR is used in foreign language education and language training for staff in companies. As far as the use of foreign languages in the media is concerned, the index makes an overview on the use of subtitling and dubbing on TV and at the cinema. The data for the 120

indicators has been collected in each country with the help of questionnaires distributed to identified sources. All the data has been peer-reviewed by a national expert. Among the data used for acquiring information for the index were legal provisions such as the Constitutions of the countries involved in the research and Statutes of regions where applicable, the European Charter for Regional or Minority Languages.

When it will be finalized, the index will be available in 18 languages; 13 national, 3 regional (Catalan, Welsh, Frisian) and 2 immigrant languages (Arabic and Turkish). The index will include comparative results for each of the indicators it presents (mentioned above). In addition to the index, within the *Language Rich Europe framework for language policies and practices*, country essays will be published which will reflect specific national contexts and country profiles including an interactive spider graph, an explanation for usage and country essays with good practice examples.

The country essays analyze the specific language environment, highlighting good practice and describing challenges. In addition to the index, the LRE project has also developed 48 national interdisciplinary workshops, 2 international conferences, a resource bank of good practice examples on the website and an on-line forum. The LRE project has also created a framework of standards of policies and practices to support multilingualism. This has been done through a preliminary desk research and a piloting process of research has been carried out in order to test the feasibility of the research parameters chosen (guidance on data collection and the rating system, guidelines for country essays and questionnaires with indicators).

The project promoted cooperation in developing policies – assessing countries' performances at national workshops and designing transversal action planning. The project also contributed to raising awareness of EU multilingualism policy and the scores represented in a spider graph will enable visual comparisons and facilitate peer review and benchmarking.

## CONCLUSIONS

1. Through the publication of the Index and the other instruments within the *Language Rich Europe framework for language policies and practices*, the LRE project hopes to achieve a better understanding of good practices in language teaching and learning for social inclusion and intercultural dialogue, to enhance cooperation for improving language policies and practices, to create a sustainable European benchmarking tool for evaluating policies and practices.

2. In terms of impact, the LRE project reached out to the main categories of decision makers from education, public services, business, the media and immigrant associations. Twenty representatives of the education field will be members of the target group (ministry officials, policy advisors, curriculum designers, teacher trainers, head teachers, managers in adult learning, teacher associations, immigrant associations, learners' representatives), twenty representaives of public services and spaces – representatives from public

administration, health services, legal services, NGOs involved in social inclusion, HR managers, immigrant associations.

3. Moreover, 10 representatives of the business environment will be recruited – ministry officials, CEOs, HR managers, recruitment agencies, immigrant associations and 10 representatives of the media – editors, journalists, television executives. These decision makers are reached through the members of the LRE consortium who have contacted representative networks for recruiting the selected stakeholders. The target group has been involved through their contribution with data and examples of good practice for the comparative analysis, their participation in the national launch events of the Index, through working collaboratively to develop action plans at the national level, based on the good practices identified.

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# CURRICULUM ELABORATED IN THE SCHOOL – THE POSSIBILITY OF ADAPTATION OF EDUCATION TO THE LOCAL CONTEXT

## CURRICULUM-UL ELABORAT ÎN ȘCOALĂ - POSIBILITATE DE ADAPTARE A OFERTEI EDUCAȚIONALE LA CONTEXTUL LOCAL

*DURBACA Nicoleta<sup>1</sup>, STRATU Anișoara<sup>2</sup>*  
e-mail: durbaca.nicoleta@yahoo.com

**Abstract.** *The Curriculum elaborated in the school is a part of the curriculum school boards decision and involve different types of optional courses. Starting from high school profile (Natural resources and environmental protection) and considering the importance of water and its current problems we proposed a draft curriculum for an optional course titled „Water in nature.” The optional course aims to study various aspects referring to water: properties, classifications, importance, sources of pollution, types of pollutants, ecological consequences of water pollution, water protection.*

**Key words:** curriculum elaborated in the school, water resources.

**Rezumat.** *Curriculum-ul elaborat în școală este o parte a curriculum-ului la decizia școlii și cuprinde diferite cursuri opționale. Pornind de la profilul liceului (Resurse naturale și protecția mediului) și având în vedere importanța apei și problematica actuală a acesteia am propus un proiect de programă pentru un curs opțional intitulat „Apa în natură”. Opționalul își propune să studieze diferite aspecte privind apa: proprietăți, clasificare, importanță, surse de poluare, tipuri de poluanți, consecințe ecologice ale poluării apei, protecția apei.*

**Cuvinte cheie:** curriculum elaborat în școală, resurse de apă.

### INTRODUCTION

The importance of the community development is incontestable, and people represent the driving force of evolution. In this context, the challenge falls on the growing generation, due to the high degree of receptivity and flexibility, open-mindedness, generation that rejects the conservatism and adopts a constructive position. It is important that the young become aware of the affiliation to community, the necessity to be involved for the common good. According to Weggelaar H. (2007), pupils must be prepared in order to deal with challenges generated by new situations, and schools are to offer them support in this sense. One of the possibilities that school has in training its pupils is to offer an adequate curriculum, adapted in order to satisfy the requirements commanded by the social change, by the multiplication and diversity of information.

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<sup>1</sup> School Group „Petru Rareș” of Botoșani, Romania

<sup>2</sup> „Alexandru Ioan Cuza” University of Iasi, Romania

The curriculum elaborated in the school is a part of the curriculum at school decision (CSD) and comprises different optional courses. In order to realise the offer of CSD, schools must take into account a series of references and criteria: the context in which school develops its activity, pupils' needs and interests, community's needs, requirements on the labor market, school's human and material resources and the possibilities to attract other human and material resources (Iliescu et al., 2003; Bennet, 2007).

The most outspread substance on the Terra is water: of the total surface of the Earth, water represents 70.8 % (Pișotă et al., 2010). Water is the sole substance that can occur in nature, depending on temperature and pressure, in all the three aggregation states: liquid (shape that covers 2/3 of the surface of the earth), solid and gaseous. After air, water is the most mobile substance. In nature, it is in a continuous state of movement, concretized through different well-determined circuits. Water is an essential constituent of all the live organisms. Water has favored the occurrence and development of life on our planet and has contributed to the development of the human society; it represents a fundamental natural resource, every field of economy depending on it (Măruță and Chiriac, 1981; Gavrilăscu, 2008). According to Mălăcea I., (1969), knowing water pollutants and their effects, the self-purification phenomenon, the role of live organisms in the self-purification contributes to conceiving some techniques of cleaning waters, to the elaboration of the legislation of protection of the aquatic environment.

Multiple rivers, lakes and slops were drained in order to make place for the built areas. A reduced number of rivers and streams that go through towns maintain waters clean downstream; sometimes, due to the high degree of pollution, it presents a risk for human health and affects the aquatic ecosystems. This is the case of the Ganges for several towns in India and of other streams and rivers of Terra ([www.sdimedia.com](http://www.sdimedia.com); Gâștescu, 1990).

Based on the above-mentioned data and taking into account the profile of the high school (Natural resources and environmental protection) we have proposed a project of syllabus for an optional course entitled "*Water in the nature*".

## MATERIAL AND METHOD

For the elaboration of the syllabus there were taken into account several references and criteria provided in the methodology for the application of the CSD.

The project of the syllabus of the optional discipline "*Water in the nature*" for the 10<sup>th</sup> grade includes: the argument; specific competences and thematic contents; values and skills; methodological suggestions.

The optional discipline has as main object the study of water and comprises: general data regarding water resources, general properties of water, importance of water, pollution of water and its protection.

## RESULTS AND DISCUSSIONS

**Argument.** The syllabus project - „*Water in the nature*” – has been elaborated by taking into account various aspects: pupils' interest manifested through numerous questions during the class hours; local resources of training (the material base of the

school group; the station of water treatment of Bucecea and Cătămărăști, the treatment plant of the used water of Răchiți) and the school syllabus for the superior cycle of the high school (where pupils shall study several disciplines referring to the quality of the natural, potable, used and underground water).

In Botosani county there are economic units (with food, commercial, construction profiles etc.) which in 2011 have overflowed the used waters not enough purified in the water courses ([www.apeprut.ro](http://www.apeprut.ro)). Furthermore, in Botosani county are mentioned 77 localities vulnerable at the pollution with nitrates of agricultural activities (Ordinul 1552 / 743 din 2008 emis de Ministerul Mediului și Dezvoltării Durabile și Ministerul Agriculturii și Dezvoltării Rurale pentru aprobarea listei localităților pe județe unde există surse de nitrați din activități agricole). Several pupils of “Petru Rares” Vocation School of Botosani come from the rural environment, from localities where: there is/there is not a network for the supply with potable water, there is no canalization network; there are families for whom agriculture and animals breeding are the main preoccupations; there is practiced the non-controlled and punctual storage of wastes on the margins of water courses or lakes. The proposed course might become a factor of positive influence and namely to contribute to the increase of the degree of responsibility regarding the protection of waters (through pupils, indirectly on their families).

The course “*Water in the nature*” is studied one hour a week, during a school year and addresses the 10<sup>th</sup> grade pupils, the inferior cycle of the high school, technological field, training field on the basis: Environmental protection; it is considered a new discipline. The proposed optional course completes the pupils’ knowledge in ecology, chemistry and proposes the introduction of some basic concepts referring to the water resources, their pollution, and protection. The list of skills units, which must be built up during the proposed curriculum, has the following structure: key skills units (solving problems); units of general competence (environmental protection, especially water protection). In table 1 are rendered the specific skills and the corresponding thematic contents.

Table 1

**Table for the correlation of skills with contents**

<b>Specific skills</b>	<b>Thematic competences</b>
C.S.1 Acquiring some knowledge regarding the water resources and their characteristics.	General data regarding the water resources: characteristic definitions, classification; water resources of the globe; water resources of Romania; water circuit in nature.
C.S.2 Differentiation on given criteria of general properties of water.	General properties: physical and organoleptic; chemical; biological and bacteriological.
C.S.3 Establishing the importance of water as environmental factor and for social – economical activities.	Importance of water: - importance as environmental factor (role in the biological, geophysical, and geochemical processes; in the modeling of the relief; influence on the climate); - importance for the social – economical activities (source of potable water, source of food and raw

Specific skills	Thematic competences
	materials, usages in the industry, agriculture and zooculture, roadway, source of energy, recreational activities, tourism and health protection).
C.S. 4 The formation of habits of documentation and communication regarding the pollution of water, through the elaboration and presentation of papers during the project-oriented activities.	Water pollution: - (natural and anthropic) sources of water pollution at global and local levels; - types of pollutants and their effects (classification of pollutants; physical, chemical, biological pollutants and their ecological effects)
C.S.5 Acquaintance with the main modalities of water protection  C.S.6 Being aware of the importance of the measures for the protection of waters and for the aquatic ecosystems, human health and planet's health.	Water protection: - water self-purification; - legislative measures; - technological measures (technologies for the purification of used waters, technologies for making water potable); - water protection in Romania.

### List of contents:

1. General data regarding the water resources:
  - definitions, characteristics, classification;
  - water resources of the globe;
  - water resources of Romania;
  - water circuit in the nature.
2. General properties of water:
  - physical and organoleptic properties;
  - chemical properties;
  - biological and bacteriological properties.
3. Importance of water:
  - importance of water as environmental factor (role in the biological, geophysical and geochemical processes; in the modeling of the relief, has influence on the climate)
  - importance of water for the social – economical activities (source of potable water, source of food and raw materials, usages in the industry, agriculture and zooculture, roadway, recreation activities, tourism and health protection).
4. Water pollution:
  - natural and anthropic sources of water pollution at global and local levels;
  - types of pollutants and their effects (classification of pollutants; physical, chemical, biological pollutants and their ecological effects).
5. Water protection :
  - water self-purification;
  - legislative measures;

- technological measures (technologies for the purification of used waters, technologies for making water potable);
- water protection in Romania.

**Values and attitudes.** The curriculum of the optional “*Water in the nature*” for the 10<sup>th</sup> grade aims the shaping of the following values and attitudes: completing the acquired knowledge at the specialty disciplines in the common core curriculum; the motivation for applying the acquired knowledge in the everyday life; stimulation of pupils’ interest for knowledge; acquiring a positive attitude towards study, information and permanent documentation; motivation for the protection of environment, especially for the protection of waters.

**Methodological suggestions.** The didactic methods that can be approached for teaching, learning and achieving the objectives in the syllabus are the following: the heuristic conversation; learning by discovering; observation; experiment; questioning; study case; brainstorming; project; watching some documentary movies with thematic regarding water pollution; visit at the station of water treatment and to the treatment plant of the used water.

We consider that the recommended methodological suggestions fully satisfy the achievement of the general and specific skills, every teacher having the possibility of bringing his / her personal contribution at the type of approach.

**Modalities of evaluation.** The evaluation represents the final part of the didactic projecting through which the professor measures the efficiency of the entire instructive-educative process. The evaluation can be:

- *continuous, during the module* – through types of continuous evaluation of the learning results. In this case, there can be used different methods of evaluation to confer the forming character of the pupil: classical methods, but especially alternative, such as the systematic observation of the pupil, investigation, project and pupil’s portfolio;

- *final* – achieved through a paper with applicative and integrated character, at the end of the teaching-learning process. This type of evaluation informs about the achievement of criteria of realization of knowledge, skills and attitudes.

The self-evaluation is often used, as pupils can express own opinions and can defend and motivate their proposals. The evaluation and self-evaluation tests can be conceived under the form of observation sheets, self-evaluation sheets, evaluation sheets (tests) comprising objective, semi-objective and subjective items.

The advantages of the proposed optional course – “*Water in the nature*” are the following: extends the occupational horizon of pupils and deepen key skills besides the general and specialized technical skills; contributes at the formation of an open personality, adaptable to innovations; facilitates the transition of pupils from school to the active life through the adaptation of the professional training of the pupils at the needs of the labor market at a local level; contributes at a higher receptivity of the school with regard to the needs of the local community; creates opportunities for the formation of relations between school and local labor market.

## CONCLUSIONS

1. The theme of the proposed optional course is of actuality; the optional course completes the pupils' knowledge of ecology and chemistry with fundamental concepts referring to water resources and their pollution and protection.

2. The curriculum proposed for the 10<sup>th</sup> grade can contribute at: pupils' initiation with specific technical languages; formation of professional knowledge established by standards of professional training; development of the scientific spirit of research; enhancement of the creative capacities; creation of opportunities so that pupils acquire additional skills required by the local labor market; formation of motivation for the environmental protection, especially for water protection.

3. The present curriculum allows the teacher the freedom of choosing selective methods and activities for reaching specific competences for the type of approach of the lesson, and for the type of activities.

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# STRATEGIES TO OPTIMIZE THE EDUCATIONAL PROCESS: TACKLING EARLY SCHOOL LEAVING AND BULLYING

## STRATEGII DE OPTIMIZARE A PROCESULUI INSTRUCTIV-EDUCATIV: LUPTA ÎMPOTRIVA ABSENTEISMULUI ȘI A VIOLENȚEI ȘCOLARE

*GHEORGHIU Irina<sup>1</sup>, COLIBABA Șt.<sup>2</sup>, CLEMINTE Andreea<sup>3</sup>,  
MUNTEANU Nicoleta<sup>4</sup>*

e-mail: irina\_gheorghiu16@yahoo.com

**Abstract.** *A common challenge for the European school systems is the prevention of early school leaving and prevention of the bullying phenomenon. Many surveys carried out at European level highlight how the phenomenon of bullying and early school leaving is involving an increasing number of pupils. This situation describes a scenario where two fundamental rights of pupils are menaced: educational rights and personal security rights. Two European projects: Stay @ School and I am not scared have set out to find solutions to these stringent problems.*

**Key words:** educational system, strategies, early school leaving, bullying

**Rezumat.** *O provocare comună pentru sistemele de învățământ europene este prevenirea părăsirii timpurii a școlii și prevenirea fenomenului de violență școlară. Cercetarea desfășurată la nivel european scot în evidență faptul că fenomenul de părăsire timpurie a școlii și fenomenul violenței școlare implică un număr tot mai mare de elevi. Această situație descrie un scenariu în care două drepturi fundamentale ale copiilor sunt încălcate: dreptul la educație și dreptul la securitate personală. Două proiecte europene: Stay @ School și I am not scared și-au propus găsirea de soluții pentru aceste probleme stringente.*

**Cuvinte cheie:** sistem educațional, strategii, abandon școlar, violență școlară

### INTRODUCTION

As the early school leaving and the bullying phenomenon are ones of the main challenges that all European educational systems have to deal with, the “Stay@school” (<http://projects.pixel-online.org/stayatschool/info/>) and “I am not scared” (<http://iamnotscared.pixel-online.org/>) projects intends to identify the best European strategies to prevent and combat the school leaving and bullying phenomenon and involve secondary school and vocational education teachers, directors, pupils, parents and key policy makers in the field of education in a common reflection based on a bottom-up approach for a transnational sharing

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<sup>1</sup> "Albert Ludwigs" Freiburg University, Germany

<sup>2</sup> "Alexandru Ioan Cuza" University Iasi, Romania

<sup>3</sup> EuroEd Foundation Iasi, Romania

<sup>4</sup> National College Iasi, Romania

of the dynamics that can cause the emerging and consolidating of these two worrying phenomenon's and of the most effective strategies and behaviour to tackle it available at European level.

The School Inclusion N° 134309-LLP-1-2007-1-IT-Comenius -CMP, financed in the framework of the Life Long Programme, Comenius subprogramme has given evidence to the fact that teachers are suffering from a lack of skills and competences, and consequently of motivation in understanding and dealing with pupils at risk of school abandoning. Teachers often are not able to identify with the necessary anticipation the manifesting of the risk factors leading drop out and to the necessary initiatives to give effective answers.

The Stay@School project objectives are to provide an effective answer to the needs of the teachers outlined above, intends to transfer the successful experience of the School Inclusion project, evaluated positively both by the European Commission and by the external evaluator: "the main contents of the teachers' training programme provides the necessary skills and tools to fight students' drop out and prevent early school leaving".

The project aims to improve the portal developed during the School Inclusion project in order to transfer its contents on a Geographical basis, focusing on the involvement of teachers from different countries that the ones that were involved in the previous project and as far as Italy is concerned, spreading the use of the School Inclusion Portal in different regions.

## **MATERIAL AND METHOD**

**The project intends to transfer the main products of the School Inclusion project:**

- The online training course aimed at preparing teachers to identify students at risk of early dropout and provide them with skills to prevent the problem.
- The database of 240 reviews of the most important European publications on the topic of scholastic drop out.
- The collection of 25 Case Studies of students who have dropped out of school and direct experiences of 52 teachers who have been successful in preventing the problem of dropping out of school.

**For the following subjects:**

- 80 new teachers in higher education, technical institutes and Italian vocational institutes in 3 different regions: Tuscany (with other schools not already involved in the School Inclusion Projects) Veneto and Lazio.
- 60 new teachers in high schools, technical institutes and vocational institutes from 3 different European countries: Romania, Spain, and Belgium.

**Through the following activities:**

- Translation Portal in Italian
- Translation of the training course in 3 new languages: Romanian, French, and Spanish.
- The organization's use of the course in a "Blended Learning" mode, supported by the organization of virtual conferences during which teachers can share their experiences and opinions.
- The integration of the publication database with new reviews

- The integration of the collection of experiences of teachers with new contributions both to describe new cases and to discuss the existing ones (cooperative learning).

- The creation of a collection of 35 reviews of training events for teachers on the issue of dropping out of school. Each event will be described in its main functions in order to highlight the strengths and elements useful to a potential transfer.

- The involvement of teachers in the production of educational and informational materials aimed at teachers and students on the theme of prevention and fight against school drop-out, as the practical application of "learning by doing" is learned during the course.

#### **The Training Package consists of:**

1. Five on-line course modules focusing firstly on how to identify students at risk and then on strategies which can be used to address the problem: communication techniques, teaching methodologies promoting an active participation, evaluation of educational processes and finally on external resources and support for teachers and students.

2. Teachers Forum to comment and receive further information on each of the modules. Teachers are invited to use the Forum to interact with each other and to contact the authors of the course. On the Forum, the authors of each of the course modules answer questions and provide clarification or further information about the contents of the module they have developed.

3. Reports on the current educational systems, current 'drop out' situations and the current 'drop out' national trends, in five European countries, Germany, Greece, Ireland, Italy and the United Kingdom. Each report identifies the recognised causes, current preventative strategies in operation or planned, and best practices identified, in respect of early school leaving issues.

4. Reviews of Publications a database of relevant material available in 4 different European countries on the topic of early school leaving. The reviews of books, studies, educational papers, statistics, official documents, web sites etc., were produced by the partners and experts involved in the School Inclusion project.

5. Presentation of Case Studies focusing on real life examples of young students who dropped out of school before completing their compulsory education. Each example is presented with an introductory description followed by an analysis of the causes that led to early school leaving by the student, the strategy adopted to deal the problem and the successful solution (if any) identified.

6. Interviews were undertaken, in five different European countries, with politicians in charge of educational policies, school directors, teachers, students and parents on the subject of early school leaving.

7. Description of Experiences of teachers in dealing with the problem of early school leaving. This interactive space provides teachers with the opportunity to share experiences and learn from the approaches and techniques used by other teachers facing the same problem of students at risk of dropping out.

#### **The teachers training course is organized in 5 modules:**

Module 1: Identification of Students at Risk Author: Wilsthorpe Business & Enterprise College (England)

Module 2: Communication Author: Zepf (Germany)

Module 3: Teaching methods Author: C.I.P.A.T. (Italy)

Module 4: Educational Evaluation and early school leaving prevention Author: ASPETE (Greece)

Module 5: External support and cooperation Author: Mayo Education Centre (Ireland)

The first module Identification of students at risk aims to help teachers and other educational professionals to identify young people at risk of dropping out of education. The module is based on a small number of case study interviews with young people, parents, teachers, Head teachers, Public Officers and has been produced after extensive research undertaken in the production of the National Report in the project partner' countries. For the purpose of this module the identification factors to look for which can lead to school 'drop outs' or early course leavers, have been divided into four chapters, educational, personal, family and community.

The second module Communication provides practical proposals on how to facilitate communication with difficult students. This module identifies the best ways to prevent communication difficulties which may lead to a student dropping out from school. The module also offers suggestions on how to deal with students who are at risk of school dropping out, and suggestions on how to react to the first signs of absenteeism. Finally the module offers practical ideas on how to prepare and carry out an effective conversation with young people and their parents as well as on the actions to be taken after this conversation has taken place.

The third module Teaching Methods focuses on effective teaching strategies that foster the active involvement of all students in productive educational pathways. The strategies proposed include active teaching and learning, cooperative learning, peer education and the effective application of creativity to education.

The fourth module Educational Evaluation and early school leaving prevention focuses on Evaluation which is a dynamic feature of any educational process. In the case of the early school leaving prevention, evaluation is strongly related to the pupils' needs assessment before their engagement in a learning activity in order to identify in time their learning difficulties. Teachers need to be acquainted with the modern meaning of evaluation, evaluation types and forms, evaluation models, techniques and tools in order to become able to use them effectively in their school classes to achieve, among other educational objectives, the prevention of early school leaving.

The fifth module External support and cooperation examines external resources and supports for teachers and students to help them in the prevention of early school leaving. The module includes an introduction to authentic scenarios for reflection, an exploration of a variety of teacher responses to students in danger of leaving school early, an exploration of the level of risk of particular students, a description of the range of support available to help with the problem and the examination of the different types of support available for students with varying needs.

## RESULTS AND DISCUSSIONS

**Expected results of the Stay@School project** (co-funded by the European Commission under the Life Long Learning Programme, Leonardo Da Vinci Subprogramme – Multilateral Project Transfer of Innovation, 2011-1-IT1-LEO05-01961):

- Reducing the number of school dropouts and student who skip school.
- Teachers will learn to use efficient communication strategies (they will be more assertive, empathetic and they will be better at expressing their emotions)
- Teacher will incorporate the approach and solving methods of dealing with interpersonal conflicts; they will demonstrate conflict negotiation abilities, compromise in solving conflicts and they will transfer these newly learned skills to their students and the parents

- Teacher will be able to point out their abilities, as well as flaws, they will have a realistic image, correct by comparison to those around them.
- Teachers will train their students 'defense abilities, so that they will be able to defend their rights in the family, school and community.
- Teachers will practice the assertive and empathetic skill of interaction with those around them ;
- Teacher will be able to build a set of polite behavior rules to be respected in school and outside of the school environment;
- Teachers will be convinced that it is mandatory to respect school rules and legislation in general;
- Teacher will use the conflict rejection skills they have learn, they will demonstrate an empathetic and assertive behavior and they will pass this on to the students and parents.

As it was mentioned in the first part of the article the Stay@School project is closely related with another project I am not scared which intends to identify the best strategies to prevent and combat the bullying phenomenon and provide Secondary school and Vocational Education teachers, Directors Pupils, Parents and key policy makers in the field of education with a better understanding of the dynamics that can lead to the emerging and consolidating of the bullying phenomenon.

**Expected results of the I am not scared project** (co-funded by the European Commission under the Life Long Learning Programme, KA1 Policy Cooperation and Innovation Studies and comparative research, 511645-LLP-1-2010-1-IT-KA1-KA1SCR):

- Review of publications addressing the bullying phenomenon available in the 8 countries involved (IT, BE, BG, LT, GR, RO, ES and UK)
- Review of initiatives addressing the theme of Bullying phenomenon prevention
- Case studies aiming at analysing bullying episodes from all the possible points of view of the different actors (students, teachers, schools' directors, parents of the students, and key policy makers)
- Participation of the teachers involved (those objects of the case studies) in a peer to peer based knowledge sharing experience, with which they will comment the case studies of the other countries
- National Reports presenting the results of the activities described above and defining each country state of art and of a Transnational Report presenting in a comparative logic, similarities and main differences
- Development of a European strategy to be implemented in order to combat the bullying phenomenon based on the best practices in the field emerging in the different countries.

## **CONCLUSIONS**

The projects contributes to the success and effectiveness of lifelong learning policies as it tackles the school leaving and bullying phenomenon that highly affects the rights of pupils to receive education. Being a victim of bullying can be a cause of school abandoning, can lead to social exclusion and passivity of individuals. The projects provides a solution to tackle this by the development of a high quality strategy to be used by all actors of the school systems to better understand and tackle these situations and remove those related obstacles that threaten students' chances to be active and wary citizens.

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# ENVIRONMENTAL EDUCATION IN RURAL AREAS - A REAL SUPPORT FOR SUSTAINABLE DEVELOPMENT

## EDUCAȚIA ECOLOGICĂ ÎN SPAȚIILE RURALE – UN SUPTOR REAL PENTRU DEZVOLTAREA DURABILĂ

*GHIURCĂ Ana-Andreea<sup>1</sup>, LĂMĂȘANU Andreea<sup>1</sup>, MIHAI F.C.<sup>1</sup>*  
e-mail: anaandreeaghiurca@yahoo.com

**Abstract.** *Sustainable development represents the future for Romanian rural areas and a viable solution to solve the environmental problems. This concept can be put into practice through the interaction between economic, sociocultural, environmental and political-institutional dimension. In this interaction an important role has the ecological education of citizens from rural areas and their involvement in environmental policy decisions. So, a low level of ecological education in rural areas leads to a permanent degradation of environmental factors. In this research we showed some negative environmental practices related to the inhabitants of rural areas. Citizen's education in environmental spirit should promote the principles of prevention, conservation and recycling.*

**Key words:** sustainable development, ecological education, rural space.

**Rezumat.** *Dezvoltarea durabilă reprezintă viitorul spațiilor rurale românești și o soluție viabilă pentru rezolvarea problemelor de mediu. Acest concept poate fi pus în practică prin interacțiunea dintre dimensiunea economică, socio-culturală, de mediu și politico-instituțională. În această interacțiune un rol important îl joacă educația ecologică a locuitorilor din spațiile rurale precum și implicarea acestora în deciziile politicii de mediu. Astfel, un nivel scăzut al educației ecologice în spațiile rurale conduce la degradarea continuă a factorilor de mediu. În acest studiu am surprins câteva practici ale locuitorilor din mediul rural, care afectează calitatea mediului natural. Educația ecologică a cetățenilor ar trebui să promoveze principiile de prevenire, conservare și reciclare.*

**Cuvinte cheie:** dezvoltare durabilă rurală, educație ecologică, spațiu rural.

### INTRODUCTION

The study of rural areas from the sustainable development perspective requires a complex and detail analysis of the interaction between economic, socio-cultural, environmental and political-institutional dimensions. Sustainable rural development is a multidimensional and inter-temporal process, which is based on the concepts of equity, sustainability, competitiveness and governance (Sepúlveda, 2008).

Reshaping the Romanian rural area is a difficult task for contemporary society because it involves the establishment of a balance between rural

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<sup>1</sup> "Alexandru Ioan Cuza" University of Iasi, Romania

conservation and upgrading rural lifestyle (Păun et al, 2006). European environment policies are difficult to apply in rural areas due to economic and social reasons.

## MATERIAL AND METHOD

The present study aims to identify environmental problems faced by the rural population in Suceava and Neamț County, with direct examples of Gârcina and Râșca commune. For Râșca commune we made field observations in two seasons (April and September 2011), by highlighting the degradation of environmental factors in time.

For the county level research we used data from the past 10 years, made available by local Environmental Protection Agencies. In rural areas studied, we identified, following observations in various aspects of land degradation, high environmental factors degradation. Thus, we observed improper practices like: waste dumping (forest residues and animal waste), burning of agricultural debris and producing charcoal by rudimentary techniques. All these activities lead to degradation of air, water and soil, affecting the local natural resources.

## RESULTS AND DISCUSSIONS

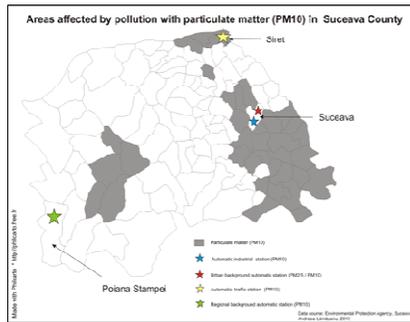
The degree of the environmental factors degradation is correlated with the ecological education degree of the rural population. Often, education is not the only cause that contributes to environmental pollution; the economic situation and the disinterest of local authorities for environmental issues are in most cases responsible for the existing reality on the field. In this research we highlighted some negative environmental practices, carried out by population of rural areas.



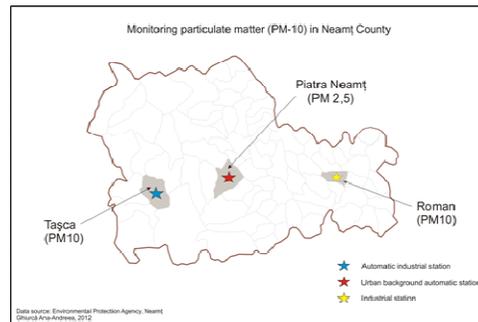
A first example is represented by air pollution through charcoal production and agricultural waste burning. The charcoal production through rudimentary techniques and equipment represents a source of income for some people, but the generated smoke leads to air local environmental pollution. In Râșca commune these illegal activities are practiced in unimproved spaces, close to living space, affecting the air quality (fig 1).

**Fig. 1** - Air pollution by producing charcoal

In rural areas of Suceava County, the air quality is no longer monitored due to the introduction of automatic stations, in 2008 and 2010, in only four locations. So, the latest information about particulate matter (PM-10), in rural areas, which the Environmental Protection Agency from Suceava gave, was since 2007. It is observed that air pollution was much more intense in areas of hills and plateaus due to the higher density of the population in rural areas (fig. 2). As regards the Neamț County, air quality is not monitored at the rural level, automatic stations being located in urban areas (fig. 3).



**Fig. 2** – Areas affected by pollution with particulate matter (PM-10) and the location of automatic stations in Suceava County



**Fig. 3** - Monitoring particulate matter (PM - 10) in Neamț County

The water pollution is caused by uncontrolled waste deposits located in river banks (Fig. 4). The categories of waste are varying from the biodegradable to the products result from primary processing of wood (sawdust, shavings) or construction.



**Fig. 4** – Uncontrolled waste in Cujești and Râșca riverbeds

In the Suceava and Neamț County most rural mountain areas are affected by illegal deposits of sawdust situated in the immediate approach of rivers or even in their banks. In time, the sawdust degradation leads to changes the chemical composition of water, affecting aquatic wildlife by reducing the

percentage of oxygen dissolved in water and accelerating the eutrophication process (Chiriac, 2011).

April September

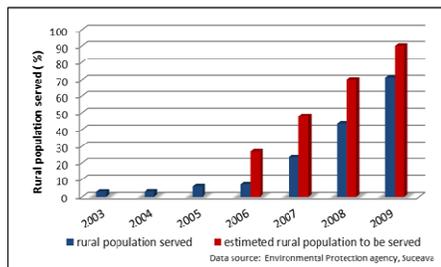


In Râșca commune, the field observations from April 2011 and September showed that the volume of generated and uncollected waste significantly grew in a short time (fig. 5). In order to avoid as far as possible environmental pollution, the European Union has ordered the construction of organic deposits and closing the old ones until 16 July 2009. Building new storages in Romania has not been completed by that date, creating an unpleasant situation, the sanitation services costs have increased due to the necessity of waste transportation to landfill nearby.

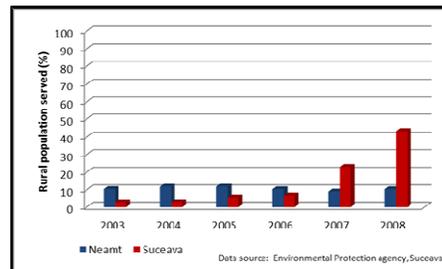
**Fig. 5** – Field observations about waste stored in the river beds – Râșca commune

Most affected are rural areas, where some local authorities have abandoned the sanitation services for financial reasons (Lămășanu and Mihai, 2011).

According to data provided by the Environmental Protection Agency, the percentage of rural population served by sanitation services, in Suceava County, grew at 2.85% in 2003 to 71.2 % in 2009, but has not reached the levels predicted by the local authorities that estimate for 2009 a rate of 90% (fig. 6). In Neamț County, the number of rural population served by sanitation services remained constant in the last 10 years, so that in 2008, only 10% of population benefits of waste collection services (fig. 7).



**Fig. 6** – Actual and estimated rural population served by sanitation services in Suceava County



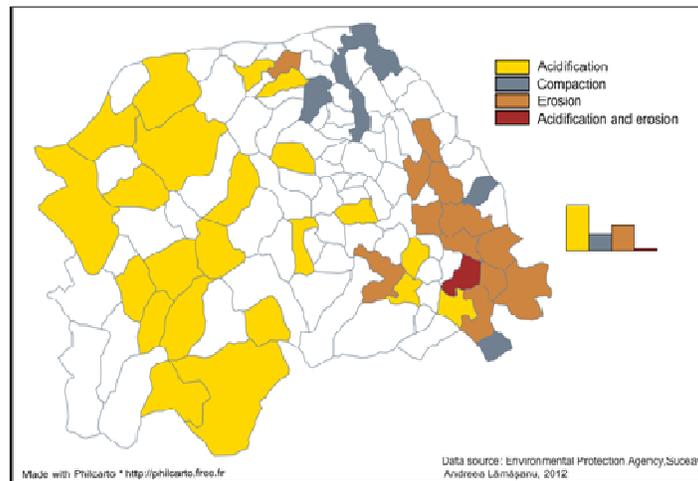
**Fig. 7** – Actual rural population served by sanitation services in Suceava and Neamț County

The improper storage of animal waste and forestry residues from primary wood processing affects the soil quality (fig. 8). The degradation takes place through infiltration of large amounts of nitrates and through acidification.



**Fig. 8** – Uncontrolled waste directly stored on the soil in Gârcina and Râșca Commune

Another environmental issue that affects the quality of the soil is represented by the incorrect agricultural practices. Thus, the soil degradation by acidification, compaction and erosion is a proof of the low degree of the environmental education among farmers. According to data collected by the Environmental Protection Agency, in 2007, in Suceava County many areas are affected by soil degradation through acidification, compaction and erosion (fig. 9). It is noted that in rural mountain areas, the soil degradation is mainly due to acidification, which may be the result of uncontrolled storage wood exploited.



**Fig. 9** – Soil degradation through acidification, compaction and erosion in Suceava County

Public awareness on environmental protection can be done through greening campaign, introducing ecological courses in schools. Educating children is a major task for teachers, who are trainers of future generations, through educational projects to support sustainable development (Castillo et al, 2002).

## CONCLUSIONS

1. As it has been remarked in the rural areas, the lack of education is not only responsible for environmental issues, but also the economic situation and the interests of local authorities for the protection of the environment.

2. The quality of environmental factors in the areas analyzed is affected by pollution caused by inappropriate behavior of the locals, but also because of local authority's disinterest. As we have seen in the field observation from Râșca commune, the environmental pollution can be achieved in a short time (six months) but its effects will be felt for a long time.

3. The studied communes are one of many examples of rural areas which are facing problems related to pollution of air, water, soil, but in particular with the management of waste; improvements and their solution can be achieved only with the support of the local population and through financial support, resulting from the implementation of environmental projects.

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# ISPY – GAMES FOR LEARNING FOREIGN LANGUAGES

## ISPY - JOCURI PENTRU ÎNVĂȚARE DE LIMBI STRĂINE

*PETRESCU Elena Lucia*<sup>1</sup>, *COLIBABA Anca Cristina*<sup>2</sup>, *DINU Claudia*<sup>2</sup>  
e-mail: lucia.petrescu@euroed.ro

**Abstract.** *ISPY is a Partnership Project which aims to develop an Online Networking Platform for Language Learning. Apart from teachers and lecturers who can access the database, the Platform is also designed for beginners (A1-A2), learners involved in general, and vocational training programs. The project takes into account not only the interactive flash application environment that assists the language acquisition, but it has also in view the educational aspects to ensure full integration of best practices.*

**Key words:** online games, language learning, Moodle platform

**Rezumat.** *Proiectul ISPY are ca obiectiv major dezvoltarea unei platforme online pentru studiul limbilor străine. Platforma prezintă activități în format Flash dezvoltate de către echipa internațională. Profesorii au posibilitatea de a completa baza de date cu activitățile proprii, desfășurate la clasă. Acest lucru permite prezentarea la nivel internațional a unor modele de bună practică din cadrul țărilor participante în proiect și precum și a altor viitori beneficiari.*

**Cuvinte cheie:** jocuri online, invatare de limbi straine, platforma Moodle

### INTRODUCTION

I SPY (Project number 511558—LLP-1– 2010—1- UK-KA2—KA2MP) develops an Online Networking Platform for Language Learning ([www.ispy-project.eu](http://www.ispy-project.eu)). Apart from teachers and lecturers who can access the database, the Platform is also designed for beginners (A1-A2) involved in general and vocational training programs. The project takes into account not only the interactive flash application environment (Osborn, 2000) that assists the language acquisition, but it also has in view the educational aspects to ensure full integration of best practices.

This platform has been developed by an international partnership including the University of Wolverhampton (the project coordinator) and five other institutions from Holland, Germany, Poland, Spain and Romania. The platform encourages interaction between learners from different countries who can work both individually and in teams/ pairs to learn a new language via problem-solving challenges and tasks. In doing so, learners will be able to develop general and vocational language skills for use in both formal and informal situations (Blake, 2008).

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<sup>1</sup> EuroEd Foundation Iași, Romania

<sup>2</sup> "Grigore T. Popa" University of Medicine and Pharmacy of Iasi, Romania

## **MATERIAL AND METHOD**

The course the international partnership has developed is structured in ten missions which focus on various language aspects. These missions are meant not only to introduce the learner to the foreign language and provide practice opportunities. They also present cultural aspects related to the foreign language studied. Thus, the activities developed are contextualised and completed with both visual and audio images to better accommodate the learner in the virtual, online space.

Language learning is structured on topics and is added a rather large variety of exercises which guide the learner through the ten missions.

The real-time platform is aimed at upper secondary school learners and those in both general and pre-vocational education and training, who will trial the new platform alongside teachers and trainers. Guidelines will also be developed as part of the project to support teacher training. Language learning is interactive, fun and happens through a virtual environment which encourages learners to communicate with peers across Europe. This innovative project aims to have a positive impact on developing language and intercultural skills and it is focused on improving intercultural dialogue in Europe and on reinforcing language skills that are relevant to the workplace

The project has a theme of espionage and learners who log in on the platform undertake a set of ten modules. The modules are developed in each of the project languages and learners can select the target language of their choice. Each module consists of a range of activities including photo stories, web quests, short tasks, quizzes, listening tasks and extended tasks that call for collaboration through a moderated forum. Once learners have completed all of the modules they "graduate" as a qualified spy! Each country will also have the option to add additional activities to keep the content fresh thus add to the ten missions already developed by the international partnership.

The partners have tested the first missions in English version set up in the Moodle platform. The first missions were assessed in connection to proposed environments, general story and scripts. Each mission begins with a scene/context setting exercise which has a strong cultural focus. For example, in Mission 1 it consists of identification of landmarks from the relevant location e.g. London and the task of finding out more about them. Within each mission section in Moodle extra games, activities and additional documents can be added in Moodle. The overall story of each mission is consistent across all target languages: English, German, Romanian, Spanish, Polish and Dutch.

Teachers of foreign languages can be part of the project both as facilitators, presenting and using the platform with their students, and as direct beneficiaries themselves, using the methodological guide which is to be added to the platform.

## **RESULTS AND DISCUSSIONS**

In the early stages of the ISPY Project a research and contextualization stage was carried out by all the partners. The aim of this was to contextualize language learning within the wider educational, political, economic, social and cultural dimensions of each partner country.

The reports subsequently produced are based on the information provided by partners in relation to their country specific situation and associated data. These reports are being used (by the project team) to inform the development of the platform and mission content.

An Executive Summary has also been produced and it presents an overview of the specific findings. This concise document provides an overview of the key themes in relation to the current state of languages education and national policies supporting language learning and current implementation models in the countries of the project partners. It also identifies current training and professional development of teachers and trainers, use of technology and cultural influences. The Executive Summary can be accessed at [www.ispy-project.eu](http://www.ispy-project.eu)

The Platform provides interactive methods, diverse and attractive teaching materials and it enhances the participants' motivation to learn and tests their competences in learning and practicing formal and informal language structures. The basic topic of the project is "spying": the learners will log in and have to work on about 10 Modules, described as "Training for Spies".

Each module will be available in the six target languages and it will contain a background story, a photo-story, web links, short assignments, a quiz, listening tasks, gap texts and an extensive assignment that will be moderated on the forum. Once a learner has completed all 10 modules s/he will be recognized as "trained spy" in every country and the creators of the game, teachers and trainers will have the chance to add new activities to the content of the current assignments. On the one hand, this aims to foster competition between participants by increasing the learners' interest and motivation for taking responsibility for the dissemination of effective learning materials.

The ISPY Project has an Advisory Steering Board (ASB) to strategically steer the project's development and ensure relevance at local and transnational levels. The board gathers experts professionals in their field and includes representation from all the partner countries. The key objectives of the ASB include:

- providing quality assurance for the project plans and outcomes;
- offering expert advice and guidance, and act as a 'critical friend';
- assisting with dissemination of the project within their networks and contacts;
- facilitating cross-country collaboration and the sharing of good practice.

The first of two virtual meetings took place in November 2011 and allowed the board to comment on the project progress to date and make specific suggestions for the future direction. The board is informed of the project progress on a regular basis and will feedback on an ad hoc and informal basis whenever relevant.

## **CONCLUSIONS**

Developing the materials for an online, multilingual platform has of course been accompanied by challenges in setting the right balance between content and language level so as to produce a final material appropriate for the end beneficiary.

The members of the international partnership have commonly developpe the developmental frame for the ten missions and then each of the national teams have adapted the missions to their national language.

Material production in ISPY has been a complex process which included research, material development, testing and piloting, feedback collecting and material improvement according to the feedback received.

ISPY team continues to work on the platform further developing and improving materials. The platform can also be customised by teachers interested to personalise the ISPY ten missions to the specific learning needs of their students.

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# INCENTIVES FOR LIFELONG LEARNING MYSTORY, ESEDI AND CVE PROJECTS

## MOTIVARE PENTRU ÎNVĂȚARE PE TOT PARCURSUL VIEȚII: PROIECTELE MYSTORY, ESEDI ȘI CVE

*PETRESCU Elena Lucia*<sup>1</sup>, *COLIBABA Șt.*<sup>2</sup>,  
*COLIBABA Anca Cristina*<sup>3</sup>, *CREȚU Ioana*<sup>3</sup>  
e-mail: lucia.petrescu@euroed.ro

**Abstract.** *Motivation is a key ingredient to ensure constant and relevant Lifelong Learning activities. Motivating beneficiaries within the same age category or at intergenerational level becomes efficient only when benefits can be easily illustrated. Practical activities are most often convincing examples and represent incentives for Lifelong Learning.*

**Key words:** intergenerational collaboration, corporate volunteering, non-formal learning.

**Rezumat.** *Motivatia este un element cheie în invatarea pe tot parcursul vieții pentru a asigura o activitate constantă. Motivarea beneficiarilor la nivelul unei singure categorii de vârstă sau/si intergenerational devine cu adevărat eficientă doar în măsura în care beneficiile pot fi ușor ilustrate. Activitățile practice reprezintă de multe ori exemple convingătoare care activează beneficiarii în învățarea pe tot parcursul vieții.*

**Cuvinte cheie:** colaborare intergenerațională, voluntariat corporatist, învățare non-formală.

### INTRODUCTION

Lifelong learning as a self-initiated process can only function on the basis of a motivated, self-driven learner / beneficiary who is aware of the benefits of the process she engages into. But motivating adults already actively involved in daily professional / personal life can most of the times present great challenges both for the provider and the receiver.

Motivation changes its value from purely interest-related and builds its actions and focus up, towards activating beneficiaries, helping them establish a routine schedule including it in their daily activity system. Motivation is no longer the element which brings the beneficiaries into the LLP – it is the one element which has to keep them involved, active and aware of their constant progress and of the steps to be taken further on for their personal/ professional development.

Motivation is to be considered and approached differently not only considering age of professional field but also looking into intergenerational

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<sup>1</sup> EuroEd Foundation Iași, Romania

<sup>2</sup> "Alexandru Ioan Cuza" University Iasi, Romania

<sup>3</sup> "Grigore T. Popa" University of Medicine and Pharmacy of Iasi, Romania

collaboration and in the inter-relations within different professional fields (Mackay, 2007).

## **MATERIAL AND METHOD**

**MyStory** project (511641-LLP-1-2010-1-RO-KA3-KA3MP) uses technology and stories of the past as a starting point to engage the elderly and representatives of the young generation in personal development within the structure of intergenerational learning.

The international partnership has already been developing training materials and has implemented research to establish a common international base for the development and implementation of the project activities so that all beneficiaries, at the level of the five countries involved in the project, are motivated in manners, which are relevant for and connected to the national contexts and local specificities.

Materials used for the international research were developed within the international partnership and then implemented at the level of each country in the partnership thus collecting relevant information which was then included in the international research on intergenerational collaboration in Finland, Lithuania, Romania, Slovenia and UK.

**ESEDI** project (511451-2010-LLP-ES-KA2-KA2MP) focuses on using drama and elements of theatrical studies to enhance language study and activate learners. The international partnership has also developed an international research to look into the manner in which Spanish language in particular is being studied in the five countries involved in the project: Bulgaria, France, Germany, Romania and Spain.

The questionnaires in both these projects have been centralised at the level of the partnership and the conclusions have served for the development of national trainings for teachers and students.

Each of the countries in the project develops a part of the theatre play which is then performed bilingually. The aim is to encourage learners to engage into foreign language classes and motivate them through the various theatre performance techniques which elicit their more than their language focus and help develop attitudes and behaviours towards performing in a foreign language.

**CVE** project (517833-LLP-1-2011-1-PL-COMENIUS-CMP) supports the development and implementation of corporate volunteering activities at the level of the international partnership in the following countries: Italy, Poland, Portugal, Romania, Spain, Turkey and UK. This project aims to build and extend knowledge among school leaders, teachers and other people working in secondary schools, about the possibilities of Corporate Volunteering, which involves cooperation between schools and the world of the work.

One of the ways that the project builds and extends knowledge is by collecting examples of good practice collaboration between Corporate Volunteers and secondary schools in all the partner countries. A database is created and used as part of the training materials and will soon be available on the project website.

## **RESULTS AND DISCUSSIONS**

### **Expected results of the MyStory project:**

- Develop training materials for the young people acting as story collectors/ interview takers.

- Develop training materials to train the elderly in basic computer and internet use.
- Develop a common archiving system for the materials collected – interview and films which will further on be used as a source of information for the future potential beneficiaries of these materials (museums, libraries, schools, film makers, researchers).
- Develop intergenerational collaboration skills and abilities within both age categories which the project focuses on.
- Raise awareness upon past events and specificities of past social, political and historical aspects.

**Expected results of the ESEDI project:**

- Raising awareness upon the functionality of drama elements within language study.
- Developing training kit focusing on national specificities and the learning needs of beneficiaries in each country within the international partnership.
- Creating practice opportunities during which ESEDI teaching and learning methodology can be clearly illustrated; seminars and trainings have already been delivered some of the project countries and will be implemented in Romania by the end of May 2012.
- Presenting the products of the project to the wide public in the form of theatre performances at national level (face-to-face) and at international level (in electronic format and online).
- Developing a project KIT which collates the work of all countries in the partnership. This is an important resource for the teachers of Spanish as a foreign language but also for those teaching other languages.

**Expected results of the CVE project:**

- Developing awareness at national level on the concept of corporate volunteering.
- Developing teacher training and materials for the teachers training in collaboration with representatives of the work market.
- Developing good practice database and materials for the development of the database.
- Delivering teacher training in all the countries of the partnership and establishing a collaboration channel between the work market and schools so as to enhance relevant study and skill development for the students.

## **CONCLUSIONS**

Motivating beneficiaries so as to actively and independently engage them in LLP projects needs to be closely focused on the different interests of the beneficiaries (Norman, 2003). The aim of these projects is not to only engage and activate beneficiaries within the project but to use the funded life

of the projects to develop skills and abilities which can then be implemented and valorised independently so as to build onto a continuous process of personal and professional development.

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# REFLEXIVITY IN DIDACTIC DESIGN

## REFLEXIVITATE ÎN PROIECTAREA DIDACTICĂ

STANCIU M.<sup>1</sup>

e-mail: mstanciu@uaiasi.ro

**Abstract.** *The research conducted on the issue of teacher training showed a significant contradiction in what concerns the paradigm of initial and continuous training, on the one hand, and the very complex world we live in, on the other. We live in a context of globalization and the most often used metaphors to describe this phenomenon are "global village" and "flat world" (Yong Zhao, 2010). Paradoxically, the teacher training programs are anchored in particular in local needs and less anchored in this comprehensive approach of the world. Nowadays, the paradigm underpinning the teacher education programs is the reflective type. Our study makes practical suggestions regarding the design of curriculum type of the didactic activity, addressed in a reflective framework. We intend, especially, to offer methodological suggestions to those in the initial training as well as for teachers who enrol on continuous training.*

**Key words:** reflection, reflective teacher, didactic design, initial and continuous training of teachers.

**Rezumat.** *Cercetările efectuate pe problematica formării profesorilor au evidențiat o contradicție importantă în ceea ce privește paradigma formării inițiale și continue, pe de o parte, și lumea extrem de complexă în care trăim, pe de altă parte. Trăim într-un context al globalizării și metaforele cele mai des folosite pentru a descrie acest fenomen sunt cele de „sat global” și «lume plată» (Yong Zhao, 2010). Paradoxal, programele de formare a profesorilor sunt ancorate mai ales unor nevoi locale și mai puțin sunt ancorate în această abordare globală a lumii. Paradigma care fundamentează azi programele de formare a profesorilor este cea de tip reflexiv. Comunicarea noastră face sugestii practice privind proiectarea de tip curricular a activității didactice, abordată într-un cadru de tip reflexiv. Avem în vedere, mai ales, să oferim sugestii metodologice celor aflați în procesul de formare inițială, precum și profesorilor care se înscriu pe traiectoria formării continue.*

**Cuvinte cheie:** reflexivitate; profesorul reflexiv; proiectarea didactică; formarea inițială și continuă a profesorilor.

## INTRODUCTION

### Reflection-in-act

The philosophical meditation has made a major issue from the reflective activity. From that warning written on the temple at Delphi ("Know yourself!"), to Descartes' doubt, the issue of reflection in act was theorized by two American philosophers: John Dewey and then, Donald Schön (1930-1997). Schön developed the reflective practice in learning organizations and communities. He worked closely with Chris Argyris, publishing together three key-publications

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

(1974, 1978, 1996). Schön was part of the first wave of theorists who approached the issue of a learning society (with Hutchins, 1970, Etzioni, 1968; Husen, 1974). Schön criticised, among others, the gap between school and life (1987).

By the notion of "reflection-in-action" (Schön, 1983, 1987), he describes the fact that the best professional practice is based on the interdependence of thinking and action („the thinking what they are doing while are doing it.”, Schön, 1987b).

Reflexivity is a kind of philosopher's stone (Marc Romainville, 2006), one of the aspects of the articulation of theory and practice of teaching, one of the paradigms of initial and continuous training of teachers (Heimberg, 2006, Gather Thurler, 2006).

Reflexivity is tacked in a general register: as process of experimentation in practical context (Donald Schön, 1983), as a problem solving process (Capeland, Birmingham, La Cruz, Lewin, 1993, Cruckshand, 1987); as a metacognitive process of action control (Saussez, Paquay, 1996, McAlpine, Weston, Beauchamp, Wiseman, 1999); as a learning process (Schön, 1987, Karthagen, 1993, Saussez, Allal) (*apud* Stanciu, Dumitriu, 2011). The reflexive teacher is essentially an analyst of educational situations seen in their singularity and a factor of reflective decision.

Paradoxically, the programmes of teacher training are anchored more in local needs and less in this global approach of the world (Longview Foundation, 2008).

## MATERIAL AND METHOD

The educational-teaching activity, like any human activity, involves an effort for design, of anticipation of the action. The need of designing comes from *praxiological* reasons. "Before you step on the road, you must see it", highlighted a Polish philosopher and logician (Kotarbinski, 1976). From *pedagogical* perspective of the systemic, curriculum-type approach, a training and education situation involves the interaction of several components, the participation of various factors, taking into account the conditions, resources and restrictions. Also, the teaching and educational activities have a conscious, systematic, organized and complex character. On this basis, the school – as educational institution – tries to fulfil the functions which the society has entrusted to them. It follows that the educational activities should be planned, anticipated. It can not be left to the improvisation of the moment, given the consequences of the implications of the achievement for individual and society development. *Psychologically*, the design puts the students in different learning situations, to boost the motivation and the other dimensions of personality (Joita, 1998).

The expression of this need to design the educational plan is the appearance of *instructional design* as a distinct field of pedagogical concerns. Speaking about this issue, the pedagogue Robert Gagne stressed that the key factor of *instructional design* is to design the training. The design issues evolved, being distinguished two **models of action** involved in its accomplishment: the traditional and the curriculum type (Cristea, 1998). The traditional design defines "a restrictive, closed, directive, unilateral teaching activity"; primarily aims at information targets; the assessment is based on fixed criteria and leads to a selection of pupils. The curriculum design takes into account the interdependence of teaching / learning and evaluation components of the educational process and insists mainly on the formative objectives.

The pedagogical design includes "operations of anticipative defining of the objectives, content, learning management strategies, evaluations and especially their

relationships, under specific conditions of a way of organizing the educational process" (Cerghit and Vlasceanu, coord., 1988).

Depending on the time taken for reference, there is an overall design and an echeloned design. **Overall design** is made for a longer period of time (year of study, school cycle), operates with objectives, content and evaluation criteria that have a higher degree of generality; it creates the limits and possibilities of a echeloned design. **Echeloned design** consists in "developing discipline-specific training programs and then a lesson applicable to a classroom". (Cerghit and Vlasceanu, coord., 1988) Normally the teachers operate at this level. The activity is focused on developing training programs. A *training program* shall be identified by: a) components: objectives, content, teaching/learning strategies, assessment methods and techniques; b) relationships between components, which are set on the criterion of optimality (which considers "the expected and achieved level of performance obtained by students in learning"(Cerghit and Vlasceanu, coord., 1988); specify of conditions: educational, psychological and social of design achievement.

## RESULTS AND DISCUSSIONS

### Levels of educational design

1) A first level of design is the *yearly* one, when it is outlined the didactic approach in the school or in a class by teachers (so do some experienced countries) or, usually, in November the teacher is projecting broadly this approach to the subject he teaches. For this, the teacher will review the curriculum, will opt for a certain type of curriculum (core, extended or depth). From this perspective, he will consult the curriculum and analyze the objectives and the reference of discipline, thematic content, learning activities and curriculum standards. The annual designing may have the following form:

Table 1

Annual design					
Semester	Learning units	No. hours	Distribution of hours on types of lessons		
			Teaching/learning	Review/Systematization	Evaluation

2) *Design per semester* is a continuation of the annual design and consists essentially of: programming units of learning on periods of time; establishing the necessary educational resources for teaching/ learning each unit of teaching/learning, assessment methods. It may have the following form:

Table 2

Design per semester							
No. crt.	Learning unit	Specific competences	No. hours	Succession of units	Date	Type of lesson	Notes

3) *designing on learning units* has several advantages (*apud* MECTS): creates a coherent learning environment where the students' expectations are clear on medium and long term; involves the students in "personal learning projects" on medium and long term; it involves the teacher in a teaching project in medium

and long term; gives perspective to the lessons, so that they integrate into larger units (learning units). The table for designing a learning unit can have the following form:

Table 3

Design of the learning unit					
Contents (details)	Specific competences	Learning activities	No. hours	Means of education	Evaluation (methods and techniques)

The design of the learning unit should be a pragmatic tool for anticipating a student-centred teaching approach. Depending on the experience of each teacher and the discipline they teach, some fields may disappear or others should be introduced.

4) *Designing the lesson* requires (Cerghit coord., 1983): an analysis of the specific task of learning within the unit (task analysis); estimating the intellectual and physical potential of the classrooms (level of knowledge, skills necessary for the transition to a higher level of learning, motivation to learn, work rate and discipline of the class etc.). The teacher should harmonize "the learning objective, way of teaching and the way of evaluating the result." (Gagné and Briggs, 1977)

The teacher has to face several assumptions, alternatives, practices and assessment. He must take several *decisions*, and results in the following sequence of actions:

- ✓ Clear specification of the operational objectives (which show the effects noticed at the end of the lesson);
- ✓ Organization of teaching and learning resources. The means (resources) can be designed in three ways:
  - as values (scientific, literary, artistic, social, action etc.) and which stands for the lesson content;
  - as material tools (teaching aids);
  - as teaching / learning processes (methods, procedures, forms of organization of students, etc.).
- ✓ Adapting the appropriate teaching strategy: an approach to learning (problem-solving, heuristic etc.); as an option for a way to organize the students; as a way of conducting phases and stages (events / training sequences);
- ✓ Developing assessment tools and tests.

The entire action of design is reflected in the drafting of the **teaching project**. It must meet several qualities:

- ❑ To be *completed*, providing "a global and complete overview on the lesson, on the sequence of phases and events to go, time division and use of appropriate means, subordinated as functional whole, final requirements." (Cerghit coord., 1983).
- ❑ To be *feasible* (in terms of content, time, means of education and expected results).

- ❑ To be *realistic* (given the variables of a concrete situation to be achieved).
- ❑ To be *operational* (easy to use and not complicated, taking more time to plan).
- ❑ To be *flexible* (allowing decisions to be taken during the lesson).
- ❑ Have a *strategic structure*; the decision on a change of sequence is based on permanent *feedback* on the quality of the proposed approach).

The lesson can be presented in table form (not necessarily), to express the systemic tackling at an actional level (curriculum type) of the components of the educational process:

Table 4

#### Lesson design

Sequences of the lesson (time)	Operational objectives	Educational content	Strategies of teaching/ learning			Evaluation
			Methods	Means of learning.	Ways of organization.	

### CONCLUSIONS

1. The programs of initial and continuous training for teachers must be more rooted in issues of our world, through a greater openness to global problems, challenges for the future society

2. The paradigm of "reflection-in-act" will allow greater individual anchoring in contemporary world issues and to find, on this basis, viable solutions in specific contexts. We believe that both decision-makers and teachers need more than ever, a clear vision, even in the medium term.

3. In this context, we located the considerations related to teaching design, providing a systemic perspective on it, that will allow the teacher to articulate the main components of the education process so that the process be coherent and efficient.

4. We offered practical reflections on the design per year, per semester, per learning unit and lesson design, in order to eliminate the redundant information and to outline the effective design tools.

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# FACTORS GENERATING DISSATISFACTION IN THE EMERGENCY HOSPITALS IN ROMANIA

## FACTORI GENERATORI DE INSATISFACTIE ÎN SPITALELE DE URGENȚĂ DIN ROMÂNIA

ONEA Angelica-Nicoleta<sup>1</sup>, GEORGEANU V. Al.<sup>2</sup>

e-mail: anonea@uaic.ro

**Abstract.** *Against the general dysfunctionalities of public health, physicians from the emergency hospitals accuse various reasons of dissatisfaction. Some are based on material factors; others are caused by a number of psychological factors. Our analysis emphasizes these factors as well as their consequences. Furthermore, we suggest some recommendations for improvement in emergency hospitals, by providing the appropriate importance to the human factor.*

**Key words:** satisfaction, medical personnel, emergency hospitals, public sector

**Rezumat.** *Pe fondul disfuncționalităților generale din sistemul public de sănătate, medicii din spitalele de urgență reclamă diverse motive de insatisfacție. Unele au la bază factori de natură materială, altele sunt cauzate de o serie de factori psihologici. Analiza noastră pune în evidență acești factori, precum și consecințele lor. Mai mult, sugerăm unele recomandări de ameliorare a situației în spitalele de urgență, prin acordarea importanței cuvenite factorului uman.*

**Cuvinte cheie:** satisfacție, personal medical, spitale de urgență, sector public

### INTRODUCTION

The problem of sub-funding the public health system is still without solution, affecting the professional activity of physicians. It manifests strongly in emergency hospitals, whose activities have some peculiarities arising from the special nature of the cases. On this background, a number of dissatisfaction reasons arise among the medical staff (we will refer in this article only to physicians) with negative consequences at various levels, including on the medical system as a whole. It is important to know these dissatisfaction reasons when there are developed strategies to eliminate / reduce them, with positive effects on increasing the performance of doctors' professional work.

The analysis is based on Herzberg's dual factors theory and equity theory of Adams (Nica et Iftimescu, 2004; Pânișoară et Pânișoară, 2005; Prodan, 1999; Amstrong, 2003; Johns, 1998). The first theory takes into account the hygiene and motivator factors, and the second one involves comparison of the relationships between outcomes (received rewards) and input (effort). A dashboard was shaped starting with these theoretical data and data were

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<sup>1</sup> "Alexandru Ioan Cuza" University of Iasi, Romania

<sup>2</sup> "Carol Davila" University of Medicine and Pharmacy of Bucharest, Romania

processed in accordance to it, leading to inventorying the causes that generate dissatisfaction among the doctors in emergency hospitals. Obviously, the area of motivational theories is very broad (theory of hierarchy of needs, expectations theory, etc.), but for the present study we considered relevant the two theories.

Before presenting the results of research, we will analyze, briefly, the situational context of the investigated facts for a better understanding and justification.

For Romania, data on public health funding do not honour it. Expenditure on health per capita is situated around 200 EUR, less than a tenth as in the Western Europe countries (National Institute of Public Health, 2010).

Other problems facing the Romanian public health are related to *the coverage level with medical personnel*. According to the *Health Statistical Breviary* (p. 15), in 2010 there were 24.4 physicians allocated to 10,000 inhabitants, 411 people to a doctor, given that Romania has one of the highest rates of hospitalization from EU and even the world.

The migration tendency still shows an upward trend, mainly due to revenue reductions following the measures generated by the economic crisis; therefore we can say that Romania has become a provider of medical specialists in Western Europe, specialists trained from public funds.

The emergency hospitals are facing this problem acutely because these specialists, characterized by a high level of professionalism, have great chances to get jobs that provide them a decent living, not only on the external labour market, but also in the private health system.

## **MATERIAL AND METHOD**

Motivational research show that motivation at work is influenced by two categories of factors: 1. hygiene factors, related to working conditions, 2. motivator factors, related to work's content.

The presence of the factors from the first category (company's management and policy, quality supervision, working conditions, salaries, status, job security, quality of interpersonal relations) removes dissatisfaction, but only the presence of the second category (work's features, responsibility, achievements, career advancement opportunities, fair assessment of performance, rewards based on performance level) creates satisfaction.

On the other hand, the perception of equity is another motivator factor. On this aspect there are considered the effort-reward ratio and the comparison with other colleagues and / or professional categories.

Data that underlie the analysis in this article were collected on participative and non-participative observation and semi-structured interview. The interview was applied to primary doctors, specialists and residents from an emergency hospital in Bucharest whose description upon socio-professional variables is presented in Table 1.

These data collection techniques, qualitative dominant, allowed us to inventory the reasons for dissatisfaction, to deepen the research and to find out the respondents' views on consequences and their severity.

Table 1

## Features of the participants to the interview

Structural variables	Categories	Frequency	Percent (%)
Professional category	Primary Doctor	13	76.47
	Specialist Doctor	2	11.76
	Resident Doctor	2	11.76
Department	Orthopaedics	7	41.18
	Surgery	3	17.65
	Internal Medicine	2	11.76
	Obstetrics and Gynaecology	3	17.65
	Anaesthesia and Surgical Intensive Care	2	11.76
	Experience in the emergency hospital	≤5	3
	6-10	2	11.76
	11-15	3	17.65
	>15	9	52.94
Didactic degree	University Assistant	5	29.41
	Senior Lecturer	3	17.65
	Principal Lecturer	2	11.76
	Without teaching degree	7	41.18
Age	25-35	4	23.53
	36-45	10	58.82
	>45	3	17.65
Gender	M	13	76.47
	F	4	23.53

## RESULTS AND DISCUSSIONS

Following data collection and analysis, the results related to the dissatisfaction reasons of physicians in emergency hospitals, by category of factors (hygiene and motivator ones) are as follows (Table 2, Table 3):

A) Reasons for dissatisfaction generated by *hygiene factors*:

Table 2

## Reasons for dissatisfaction generated by hygiene factors

Hygiene factors	
<b>Policies and administration of Health Unit</b>	political involvement at managerial level; mismanagement; bureaucracy;
<b>Quality of supervision</b>	financially conditioned supervision of treatment schemes (un-favouring the maximum standards);
<b>Working conditions</b>	continuous degradation both of hospital hotelier conditions for patients and activity spaces for the medical staff; lack of medical supplies (drugs, implants, devices, etc.);

<b>Salaries</b>	Material motivation absolutely degrading that does not provide any medical performance reward (very low income reported on the nature and volume of work);
<b>Status</b>	discrepancy between the acquired professional status and opportunities of material support;  negative image because of ethical problems generated by the material compromises, but also because of the defamation campaigns waged by mass-media, which deviate from the problem core;
<b>Interpersonal relations</b>	relations with medical and administrative staff - conflicts arise caused by high workload, bureaucracy, informal payment system etc.;  doctor-patient relations – the pressure put on the doctor by the patient while the last one pays health insurance for a long time and when they should benefit of this payment, the necessary funds are not available; the doctor represents the system-patient interface, therefore they become the target of patient's discontents.

B) Reasons for dissatisfaction caused by *motivator factors*

Table 3

**Reasons for dissatisfaction caused by motivator factors**

<b>Motivator factors</b>	
<b>Work</b>	high workload, due to staff shortages and over-undertaking tasks, due to the lack of qualified medical personnel;  involvement in didactic activities increases workload, without justifying the effort;  stress-generating work due to the permanent need to improvise and find solutions;  increased occupational risk (on their own health, but also on the patient's one);
<b>Responsibility</b>	great responsibility, due to the severity of cases, with strong psychological effects;  lack of institutional concern to protect the doctors - the risk of being accused of malpractice;
<b>Achievements</b>	the poorer and poorer quality of the medical care itself (a consequence of the lack of hygiene factors);
<b>Acknowledgment</b>	lack of appreciation for professional merits;  weak correlation between income and performance or assuming the merits by the chiefs;  unclear or inconsistent evaluation criteria with the specific of the work itself;
<b>Advancement</b>	blocked positions and their limited number in the academic

	environment;
	changes that make impossible a career planning;
<b>Professional progress</b>	lack of support at institutional level.

The analysis revealed the specific characteristics of emergency hospital activities, such as: 1. Seriousness of the cases that come into the hospital; 2. Speed of response required by limit cases which induces additional stress; 3. High workload; 4. Need for a multidisciplinary approach; 5. High cost of investigations and treatments.

These distinct elements generate additional pressures, and, by taking into account the rather uniform remuneration of doctors in the system, it leads to reasons for dissatisfaction, perceived in terms of inequity. Moreover, the analysis of personal growth, efforts of education and specialization, compared with wages and working conditions reflects an imbalance that should bring attention of policy makers. The comparison reveals also inequity when other occupational categories are taken into account.

Consequences:

- Dissatisfaction, correlated with the high degree of professionalism of doctors in emergency hospital and with the high demand of these specializations on the market, contributes to a continuous leaving of the system;
- Lack of satisfaction diminishes work performance;
- Lack of performance, correlated with other problems from the system, leads to dissatisfaction among patients.

The main causes of the problems that generate dissatisfaction, claimed by physicians, are the following (ranked in the order of importance):

- Sub-funding at budget level;
- Working conditions and technical equipment;
- Mismanagement.

Analyzing the causes of the core problems from emergency hospital, we conclude that only an adequate funding process can enhance the attractiveness of the system and eliminate the problems of material type.

According to the outlined reasons for dissatisfaction, there are factors not strictly related to the above mentioned cases, but ones that could motivate physicians. We suggest some recommendations in this regard:

- Fair and transparent professional performance evaluation systems;
- International projects / partnerships that open the opportunity to the physicians to improve and to excel professionally;
- Recognition / appreciation of professional merits;
- Enabling career advancement;
- Institutional support granted to the physicians, by a common assumption of risks and concluding insurances.

## CONCLUSIONS

1. The public health system, although in scripting it proclaims focus on patient's needs, it is unable to care for its own people, the main resource that could lead to achieving this goal. This leads to various reasons for dissatisfaction, not only among doctors, but also among the entire personnel. Although our attention has focused on detecting the reasons for dissatisfaction of physicians from hospital emergency, the reality reveals the most serious consequence of sub-funding the system: leaving of professionals in favour of external labour market or private system.

2. Reasons for dissatisfaction are related both to the hygiene factors (salaries and working conditions being the most frequently and strongly claimed factors) and to the motivator ones, including:

- Lack of consideration of professional merits at institutional level;
- Barriers encountered in career development;
- Lack of fairness and transparency of the evaluation systems.

3. The only factor which does not raise problems is job security, an unimportant hygiene factor for physicians from emergency hospitals, due to the lack of personnel and their migration trend.

4. All raised issues, but also the particularities arising from the fact that in emergency hospitals appear, in general, cases at limit, have effects on performance and motivation of doctors.

According to the above noted aspects, we appreciate that governmental speeches about patient's satisfaction and focusing on their needs have no basis in fact. Solving the issues of the system must start with motivation and support of its own personnel

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# STUDY CONCERNING THE EMPLOYMENT IN THE ROMANIAN TOURISM AND TRAVEL INDUSTRY

## STUDIU PRIVIND OCUPAREA ÎN INDUSTRIA TURISMULUI DIN ROMÂNIA

**TĂTĂRUȘANU Maria<sup>1</sup>**

e-mail: tmari@uaic.ro

**Abstract.** *The increased development of tourism in recent years has been a major concern among researchers, institutions and others interested in this field: what is the real contribution of tourism to the overall development of the countries, regions and the contribution to the increase of employability of the working population. This paper aims to analyse the types of vacancies created in the tourism industry in Romania. The raised objectives relate to: a critical analysis of literature regarding employment and tourism; studying the number and type of vacancies created by this sector in Romania, based on statistical analysis and interpretation of recruitment notices posted on specialized web sites, from February to December 2011. The results indicate a wide variety of the created job types, the importance of experience when filling certain vacancies and of some evidence of a qualification (tourism certificate). Such information is useful in formulating policies on tourism in a certain region / country, according to the aimed objectives.*

**Key words:** tourism industry, employment, jobs, characteristics.

**Rezumat.** *Dezvoltarea accentuată a turismului din ultimii ani a adus o preocupare majoră în rândul cercetătorilor, instituțiilor și altor persoane interesate de acest domeniu: care este contribuția reală a turismului la dezvoltarea de ansamblu a țărilor, regiunilor și contribuția la creșterea gradului de ocupare a populației active. Scopul lucrării este de a analiza tipurile de locuri de muncă create în industria turismului din România. Obiectivele care derivă se referă la : analiza critică a literaturii de specialitate în ceea ce privește ocuparea și turismul ; studierea numărului și tipului de locuri de muncă create de acest sector în România, pe baza analizei și interpretării statistice a anunșurilor de recrutare postate pe site-urile web specializate, în perioada februarie – decembrie 2011. Rezultatele indică existența unei mari varietăți a tipurilor de locuri de muncă create, importanța experienței la ocuparea anumitor posturi și a unor documente care atestă o calificare (brevet de turism). Astfel de informații sunt utile la elaborarea politicilor privind turismul într-o anumită regiune/țară, în funcție de obiectivele vizate.*

**Cuvinte cheie:** industria turismului, ocupare, locuri de muncă, caracteristici.

### INTRODUCTION

According to statistics from the World Travel and Tourism Council, based on data provided by 181 countries around the world, the contribution of the travel and tourism sector to total employment of the labour force is 235,758 million jobs, which

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<sup>1</sup> "Alexandru Ioan Cuza" University of Iasi, Romania

represented 8,1 per cent of the total occupied workforce in 2010 (WTTC, 2010). Forecasts made by the same body indicate an increase of the labour absorption to 9,2 per cent in 2020. Given these data, one cannot deny the travel and tourism industry's role as an extremely important employer in many countries.

For a long period, the tourism sector represented the last option for people seeking employment, not only because of the seasonality influences and the difficulties of building a career, but also because of the low level of wages compared to other industries and sectors of the economy (Tătărușanu, 2011). Jobs created in the travel and tourism industry are either direct or indirect jobs as a result of the multiplier effect that takes place throughout the economy (tourism development involves the development of other economic sectors or industries that are complementary). They are measured separately by the World Travel and Tourism Council, based on a methodology developed by this body, named The Tourism Satellite Account.

## **MATERIAL AND METHOD**

The main purpose of this study is to analyse the types of jobs created in the tourism industry in Romania, in the context of increase the role of this industry as a potential item in reducing the unemployment and improving the employability of the working population. The targeted objectives concern the following: critical analysis of the literature with regard to employment and tourism; examining the characteristics of the jobs created by this sector in Romania.

The used research methods are: analysis and synthesis to achieve a review of studies and articles available for this issue and statistical processing and interpretation of data that derived from the posted ads on the Romanian specialized recruitment websites, from February to December 2011. 95 recruitment ads were examined, data being summarized upon: job title, qualification / studies requirements, experience, age and gender specifications, the offered salary, other benefits, information on future career within the company.

## **RESULTS AND DISCUSSIONS**

Jobs created in tourism are influenced by the conditions of growth and tourist planning in the receiving areas, the utilized forms of tourism, and the governmental policies in this field. These all have certain characteristics: seasonality, territorial and professional mobility, social mobility, the skill level and low income, temporary nature and high risk of unemployment, and psychological constraints (Pascariu, 2006).

Studies show that employees of companies with activities in the tourism sector are mainly women. Thus, according to Eurostat, in 2007 over 60 per cent of employees within the tourism sector were women, compared to 45 per cent in other sectors of the economy (Eurostat, 2007). In Romania, according to the same bulletin, in 2007 72 per cent of the employees from hotels and other accommodation establishments were women, while the proportion was 69 per cent in Germany and, at the opposite end, Malta with 38 per cent.

The age of the employees at the travel companies is another important

aspect. Hotels, restaurants and the accommodation sector provide jobs especially for young people. Thus, 48 per cent of employees from hotels and restaurants and 43 per cent of employees from the accommodation sector were under the age of 35 in Europe in 2007 (Eurostat, 2008). Cyprus is the only country where the age profile of employees from the tourism sector differs markedly, with only 28 per cent under the age 35 according to the same study.

The statistics show that the skill level of employment in tourism is low, indicating a significant proportion of unskilled labour in the travel and tourism industry, wages (being lower than those from the industry and other services. According to the Eurostat study, in 2007, 36 per cent of the employees from the accommodation sector had not completed high school compared with the overall average ratio of 25 per cent for European employees (Eurostat, 2008). It is also noted that employees from this sector have low IT skills, with only 36 per cent of them using a computer at work (Eurostat, 2008).

Another study, made by the International Labour Office described the general characteristics of the jobs from the hotel industry (Vellas, 2005): low level of qualification for certain basic positions from hotels and restaurants: porters, chambermaids, aid cooks, valets etc.; high mobility of the personnel and high turnover (which is even 100 per cent at the restaurants from some hotel chains as Holyday Inn in the U.S.) in counter-time work (weekends, days of rest, holidays) causing difficulties in recruiting human resources, working hours, teamwork, work in night shifts, etc., physical fatigue (especially for the kitchen vacancies), psychological constraints (some positions require knowledge of several languages, diplomacy, strong character) (Tătăruşanu, 2011).

An important and widely discussed item in the literature is the effects of the development of communication technologies, especially the Internet, upon the jobs created in the tourism industry. It appears that the number of employees for a room in hotels remains high only in developing countries because labour is cheap (1.5 person and even more) and even higher, with a decreasing trend in all countries. In developed countries, the percentage is much lower, located between 0.5 and 1 (SFRPC, 2008).

If one takes into account the example of Romania, the study shows that the average wage is far below the one of other industries. Thus, according to the National Institute of Statistics, in October 2011 the average gross earnings in hotels and restaurants were 270 Euro per month, the lowest from the entire economy (INSS, 2012).

In addition, there is a major difference between employees' incomes in tourism from underdeveloped countries and countries with a developed economy (Pascariu, 2006). For example, the wage cost of the Hilton hotel chain is only 20 per cent of its turnover in less developed countries compared with 30 to 40 per cent in North America.

The turnover ratio is higher in companies that develop their activities in the travel and tourism industry. It has been ascertained that job stability is lower than in other sectors; on average the length of employment at tourism companies is six years,

compared to ten years in the overall economy in Europe in 2007 (Eurostat, 2008).

The specifics of tourism activities, in particular periods of intense activity, bring psychological constraints. Thus, employees from the tourism sector must often work outside of scheduled hours, compared with the normal working time programme of other companies. Furthermore, during periods in which the number of tourists is very high, the workload is correspondingly high; as a result many employees must make considerable effort in withstanding the high physical and mental demands placed upon them (Pascariu, 2006).

Direct contact with tourists requires that employees possess special skills to cope with the psychological constraints imposed by working in tourism. Finally team work ability is required because is standardization of services is very difficult to achieve in the service sector (Niță and Butnaru, 2005).

In order to identify the types of job created in the travel and tourism industry of Romania, and the requirements specified for their employment, the author carried out a study based on 95 vacancies posted on several specialised websites: ejobs.ro, bizoo.ro, infotravelromania.ro; from February to December 2011.

Analysis of the recruitment advertisements allowed the identification of several characteristics of the jobs:

1. There is a wide variety of jobs in the travel and tourism industry, both for management and executive positions;

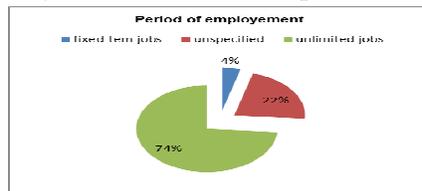


Fig. 1 – Period of employment



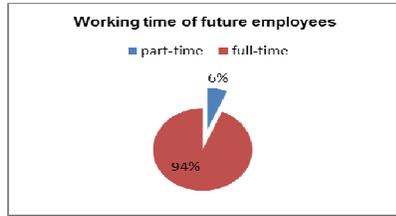
Fig. 2 – Training requirements for jobs in tourism industry

2. Four announcements were related to fixed-term jobs (travel agency director, tour leader, waiter, tourist guide) (fig. 1). If, however, the 21 jobs on cruise ships are included, where the exact employment period is not specified but one assumes a contract for a determined time, then the percentage of fixed-term jobs increases significantly (22%);

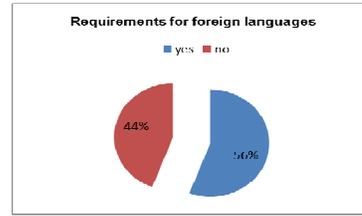
3. Experience is more important than the candidates' studies (fig. 2) in most cases (doesn't matter if a candidate graduated a faculty in tourism area or not, it is more important him/her experience in a similar job). Thus, the specific studies (a specific school, faculty, specialization) are required for 34 positions (36% of posts), whereas experience is a prerequisite for candidates in 61 positions (64%);

4. Being a compulsory condition to opening a hotel or travel agency, in Romania is required, often, as the occupant of a post of tourism agency director to have the tourism certificate (7% of cases). The Tourism Certificate is a certificate which attests the ability to perform the specific activities to the position of director of a travel agency or hotel. Conforming to the Romanian regulations, every person who wants to work as a director in a hotel or a travel agency must

obtain this certificate issued by the Ministry of Tourism (G.O. no. 238, 2001).



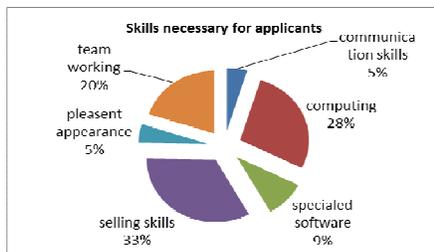
**Fig. 3 - Working time for future employees**



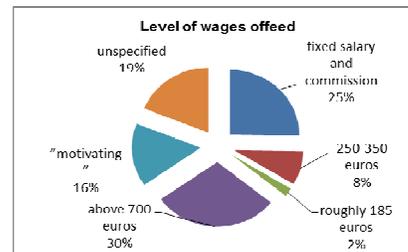
**Fig. 3 – Requirements for knowledge of foreign languages**

5. Six of the advertisements (6%) refer to part-time jobs: salesperson, tour operator etc. (fig. 3);

6. 56% of the vacancies require knowledge of foreign languages, most often fluent English (fig. 3), and for 40% of the vacancies a second language is required or considered an advantage;



**Fig. 5 – Requirements concerning the skills of the applicants**



**Fig. 6 – Level of wages offered**

7. The skills mentioned by employers as requirements for applicants include (fig. 5): communication skills (5% of advertisements specify this), computing (28%), knowledge of specialised software (9%), team working (20%), selling skills (33%) and pleasant appearance (5%);

8. 26.9 % of the advertisements specify certain conditions on age (up to 35 years, 22-35, 20-40);

9. In terms of wages, 25% of the advertisements refer to a fixed salary and commission; 8% offer between 250-350 Euros, 2% provide roughly 185 Euros, 30% are waged above 700 Euros, 16% make a vague reference to a salary level offered for the promoted jobs ("motivating" etc.), and 19% contain no reference to wages or benefits; rarely is the opportunity for career progression for candidates;

10. An inadequate promotion of job vacancies was also evident. Most advertisements refer only to the requirements for candidates, with little or no indication of the working environment, tasks and responsibilities of the job.

## CONCLUSIONS

1. Studies regarding the types of jobs from the travel and tourism industry show a certain "precariousness" of these vacancies, given the relatively low level

of qualification for various jobs, lower wages than in other sectors of the economy, the predominance of youth in this area. It should be noted, however, that these studies do not include, in general, employment in transport and other tourism - directly or indirectly - related activities.

2. The study of recruitment notices posted on the Romanian specialized sites in tourism shows that employers prefer young people, they are more interested in experience in a similar position rather than a certain specialization (mostly employers want the employees have a tourism certificate), they offer lower wages than the average salary and rarely they refer to a future career of the employee within the company. Also, important for candidates are abilities as communication skills, team working, pleasant appearance and "*the ability to sell*".

3. There are limits of such a research, given the chosen research method, the period in which data were analysed (the economic crisis has made that 2011 provide a lower number of vacancies, less attractive ones), the non-inclusion in the study of vacancies from the transport and indirect sectors. Such a study is useful in understanding some features of the employment in tourism, but should be complemented with data from other future studies that include indirect jobs created by tourism.

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# INFLUENCE OF PAVSTIM ON THE GROWTH AND DEVELOPMENT OF ORGANIC TOMATO CROP FROM POLYTUNNELS

## INFLUENȚA PAVSTIMULUI ASUPRA CREȘTERII ȘI DEZVOLTĂRII TOMATELOR ECOLOGICE ÎN SOLAR

AVASILOAIEI D.I.<sup>1</sup>, MUNTEANU N.<sup>1</sup>, STOLERU V.<sup>1</sup>  
e-mail: avasiloaiei\_dan\_ioan@yahoo.com

**Abstract.** *Pavstim is a natural bioregulator substance with steroidal glycoside structure extracted from foxglove plant (*Digitalis purpurea*). The paper aim is to evaluate the influence of this bioactive substance, used in two concentrations (0.001% and 0.0015%) on two tomato hybrids: Winona F1 and Primadona F1. The variants were compared with the experimental average. The results highlighted the V<sub>1</sub> and V<sub>4</sub> variants (the untreated variants), with negative differences distinctly significant (-7.7 t / ha), respectively significant (-5.2 t / ha) and the V<sub>6</sub> variant (Pavstim applied in 0.0015% on Winona F1 hybrid) with significant positive difference (6.31 t / ha).*

**Key words:** organic tomatoes growing, natural substances, steroidal glycoside structure.

**Rezumat.** *Pavstimul este o substanță bioregulatorie naturală cu structură glicozidsteroidală extras din planta degetarul roșu (*Digitalis purpurea*). Lucrarea își propune să evalueze influența acestei substanțe bioactive, utilizată în două concentrații (0.001% și 0.0015%) asupra a doi hibridi de tomate: Winona F1 și Primadona F1. Variantele au fost comparate cu media experienței. Rezultatele au evidențiat variantele V<sub>1</sub> și V<sub>4</sub> (variantele netratate), cu diferențe negative distinct semnificative (-7.7 t/ha), respectiv semnificative (-5.2 t/ha) și varianta V<sub>6</sub> (Pavstim aplicat în conc. 0.0015% la hibridul Winona F1) cu diferență pozitivă semnificativă (+6.31 t/ha).*

**Cuvinte cheie:** cultura organică a tomatelor, substanțe naturale, structură glicozidsteroidală.

### INTRODUCTION

Over the last decades of vegetable practice, the bioactive stimulating substances acquired a central role due to their positive contribution on physiological processes and therefore on final products by increasing precocity, quantity and quality of yield, while ensuring high economic efficiency (Stan et al., 1996).

Pavstim is such a bioactive substance, with steroidal glycoside structure, extracted from foxglove plant (*Digitalis purpurea* L.), a biennial herbaceous plant, and belonging to the *Plantaginaceae* botanical family, native in Europe. In

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

molecular biology, the plant is used for digoxigenin (a steroid found in flowers, leaves and seeds of *D. purpurea* and *D. lanata* plant) as a molecular probe for detecting DNA or RNA. In medicine, the extract of *D. purpurea* is called digoxin or digitalis, and it is used to treat different types of heart failure, accompanied by atrial fibrillation.

The favorable effect of Pavstim over the vegetable crops is presented by Chintea et al., 1998: although they were sown in soil infested with different fungal pathogens, the treated seeds of tomatoes and cucumbers have generated healthy plants, with an accumulation of biomass and an increased rate growth of vegetative organs, compared with plants obtained from untreated seeds (control). Also, biochemically, treated plants recorded higher concentrations of total carbohydrate.

## MATERIAL AND METHOD

The research was carried in the experimental vegetable field from "V. Adamachi" farm, part of U.S.A.M.V Iasi, in 2011. The tomato culture was established in a polytunnel of 400 m<sup>2</sup>, using a set of two hybrids of Israeli origin: Winona F1 and Primadona F1. It was cultivated in 2<sup>nd</sup> cycle, by seedlings produced in alveolar trays (without subculturing procedure). The experience included six variants, determined by differential application of Pavstim (0.001% and 0.0015%) on the two hybrids, alongside the untreated variants:

$V_1 = a_1b_1$  untreated x Primadona F1;

$V_2 = a_1b_2$  Pavstim 0.001% x Primadona F1;

$V_3 = a_1b_3$  Pavstim 0.0015% x Primadona F1;

$V_4 = a_2b_1$  untreated x Winona F1;

$V_5 = a_2b_2$  Pavstim 0.001% x Winona F1;

$V_6 = a_2b_3$  Pavstim 0.0015% x Winona F1;

The treatments were performed with a Vermorel sprayer device, by spraying fine and uniform solution throughout the whole plant, weekly. The first treatment was carried out two weeks after planting.

The experience has been organized in a randomized block device with three repetitions, each repetition parcel containing five plants.

The treatment effectiveness was emphasized by observations and biometric measurements over the plant's height, number of inflorescences, number of flowers and fruits, average fruit weight as well as by total yield for each variant.

The results were analyzed comparing them with the experience's average.

## RESULTS AND DISCUSSIONS

Following the observations and measurements that we have taken, it stood out the positive influence of Pavstim treatment over tomato culture in polytunnels.

The measurements regarding the plant growth and development index took place in the first decade of September, two days before the first harvest.

The dynamics of plant growth in height highlights, for both hybrids, the variants on which has been applied greater Pavstim concentration (0.0015%), the difference to the untreated variants being of 10.87 cm for Primadona F1 hybrid, respectively 25.53 cm for Winona F1 hybrid. In contrast, the variants treated with

Pavstim 0.001% reveal insignificant height differences, of only 2.87 cm for Primadonna F1 and 5.6 cm for Winona F1.

In terms of influence over the number of inflorescences/plant, are highlighted V5 (Winona F1 x Pavstim 0.001) and V6 (Winona F1 x Pavstim 0.0015) variants, with increases of +0.61, respectively +1.01 than the experience's average, which recorded 5.86 flowers / plant.

If we refer to the number of flowers/plant, we note that the experience's average was 13.54, emphasizing positively in this case the V3 and V6 variants (Pavstim 0.0015% variants), with increases of +2.64, respectively +2.06 flowers / plant.

The results concerning the number of fruit/plant and average fruit weight shows prevail of the cultivar's influence, revealed by the antithesis between the variants belonging to the two hybrids used in the experience. Thus, all Primadonna F1 variants have recorded a lower number of fruit / plant than control variant, but offset by the average fruit weight which has been higher at most variants (except V1 variant). The situation is opposite at Winona F1 variants: the number of fruit has been higher than the control variant, however, their average weight being lower in all three variants.

Besides the influence of the cultivar, it also stands out the influence of Pavstim's treatments. Therefore, within the two hybrid variants, the number of fruit/plant and average fruit weight increased proportionally with the dose of Pavstim applied.

The effect of Pavstim's treatments on the growth and development of tomatoes is illustrated in table 1:

*Table 1*

**The impact of Pavstim's treatments on the growth and development of tomatoes**

Variant		Growth and development index				
No.	Specification	Hight (cm)	No. of inflorescence/plant	No. of flowers	No. of fruits	Average fruit weight (g)
1.	Primadona F1	102.53	4.67	12.21	9.2	83.13
2.	Primadona F1 x Pavstim 0.001	105.40	5.6	14	10.86	94.3
3.	Primadona F1 x Pavstim 0.0015	113.40	6.15	16.18	12.78	97.87
4.	Winona F1	135.47	5.4	10.2	16.73	66.59
5.	Winona F1 x Pavstim 0.001	141.07	6.47	13.06	19	81.03
6.	Winona F1 x Pavstim 0.0015	161	6.87	15.6	20.27	82.66
7.	Media (Mt)	126.47	5.86	13.54	14.81	84.26

The dynamics of the production (table 2), highlights an extra yield recorded at the second and, especially at the third harvest (from a total of

four), periods that correspond with full physiological maturity of the studied hybrids, practically.

Table 2

The yield dynamics (t/ha)

Variant		The harvest appreciation date				
No.	Specification	7 IX	23 IX	9 X	20 X	Total
1.	Primadona F1	8.14	11.83	15.69	10.03	45.69
2.	Primadona F1 x Pavstim 0.001	9.81	13.74	18.13	12.46	54.14
3.	Primadona F1 x Pavstim 0.0015	10.17	14.54	17.98	13.72	56.41
4.	Winona F1	9.55	13.21	15.49	9.94	48.19
5.	Winona F1 x Pavstim 0.001	11.37	15.56	18.94	10.39	56.26
6.	Winona F1 x Pavstim 0.0015	12.27	15.74	19.11	12.59	59.71
7.	Average (C)	10.22	14.10	17.56	11.52	53.4

Regarding the significance of total production and differences in production, table 3 reveals that untreated variants recorded a lower total production compared to the control variant of -7.7 t / ha for Primadonna F1 hybrid, respectively -5.2 t / ha for F1 Winona F1 hybrid, differences in production being negative distinctly significant for V1 variant and significant for V4 variant. Positively speaking, it stands out variant 6 (Pavstim 0.0015% x Winona F1), with a total production of 59.71 t / ha, the difference from control version being significant positive.

Also, the relative production highlights the same V6 variant (Winona F1 x Pavstim 0.0015) with an increase of 11.81% than the control version.

Table 3

The variant's yield analysis

Variant		Total production (t/ha)	Difference over the control (t/ha)	Relative production (%)	Significance
No.	Specification				
1.	Primadona F1	45.69	-7.7	85.56	00
2.	Primadona F1 x Pavstim 0.001	54.14	0.7	101.38	
3.	Primadona F1 x Pavstim 0.0015	56.41	3.0	105.63	
4.	Winona F1	48.19	-5.2	90.24	0
5.	Winona F1 x Pavstim 0.001	56.26	2.86	105.35	
6.	Winona F1 x Pavstim 0.0015	59.71	6.31	111.81	*
7.	Media (Mt)	53.40			

LSD 5% = 4.93 t/ha  
 LSD 1% = 7.01 t/ha  
 LSD 0.1% = 10.14 t/ha

In terms of quality, the tomato fruits, regardless of the hybrid or the concentration of Pavstim, fell within a percentage above 70% into extra grade, 23% in first quality class and a percentage between 1.25% and 7% in second quality class (table 4).

Table 4

Fruit quality (according to STAS no. 1421-81)

Variant		Extra quality (%)	First quality (%)	Second quality (%)
No.	Specification			
1.	Primadona F1	70.50	22.50	7.00
2.	Primadona F1 x Pavstim 0.001	73.75	22.75	3.50
3.	Primadona F1 x Pavstim 0.0015	74.25	24.50	1.25
4.	Winona F1	72.25	21.75	6.00
5.	Winona F1 x Pavstim 0.001	74.00	23.00	4.00
6.	Winona F1 x Pavstim 0.0015	75.25	23.25	1.50
7.	Average (C)	73.30	22.90	3.80

## CONCLUSIONS

1. The dynamics of plant growth in height points out that it is directly proportional to the increase in Pavstim's concentration, variants upon which has been applied the highest concentration showing a vigorous growth compared with untreated variants.

2. Variants treated with Pavstim showed a higher number of inflorescences, flowers and fruits than the untreated variants, indicating the positive effect of the treatments.

3. The main indicator of the treatment's effectiveness proved to be the average fruit weight, all the treated variants presenting an average weight of about 10g higher than the untreated variants.

4. Total and relative production has been higher at the variants treated with Pavstim, the difference to the control version being positive. The only variants with a negative difference to the control version were the untreated variants.

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# RESULTS REGARDING „*IN VITRO*” MICROPROPAGATION OF JERUSALEM ARTICHOKE (*HELIANTHUS TUBEROSUS* L.)

## REZULTATE PRIVIND MICROPROPAGAREA „*IN VITRO*” LA TOPINAMBURUL LEGUMICOL (*HELIANTHUS TUBEROSUS* L.)

DASCĂLU T.<sup>1</sup>, GUTIERREZ Patricia<sup>2</sup>, MUNTEANU N.<sup>1</sup>  
e-mail: dascalu\_teofil@yahoo.com

**Abstract.** *In vitro*, clonal micro propagation of the Jerusalem artichoke, (*Helianthus tuberosus* L.) „Violleto” cultivar was realized by isolating the explants right from the level of the young sprouts, that have been formed on the tuber, after they have been forced to grow kept in dark conditions for three days. The inoculation of the explants was realized on 12 types of MS medium; differentiate among themselves by the concentration of cytokines, gibberellins, auxines, and the presence of active carbon. Measurements and plant determinations have been taken during the experiment, keeping track of the initial and final number of sprouts, the height of the plants as well as some morphological aspects: color and length of leaves, length of the internodes as well as the appearance of the senescent phenomenon. The results have relieved the superiority of the version having P6 medium of culture, which is recommended in the technology of “*in vitro*” micro propagation.

**Key words:** Jerusalem artichoke, culture medium, micro propagation.

**Rezumat.** Micropropagarea clonală „*in vitro*” a topinamburului legumicol, cultivarul „Violleto” (*Helianthus tuberosus* L.) s-a realizat prin izolarea explantelor de la nivelul lăstarilor tineri, formați pe tuberculi, după ce aceștia au stat o perioadă de trei zile la forțat în condiții de întuneric. Inocularea explantelor s-a realizat pe 12 tipuri de medii de cultură, de tip MS, diferențiate prin concentrația în citokinine, gibereline, auxine și prezența carbonului activ. Pe timpul experimentării au fost efectuate măsurători și determinări asupra plantelor, urmărindu-se numărul de lăstari inițiali și finali, înălțimea plantelor și unele aspecte morfologice: culoarea și lungimea frunzelor, lungimea internodiilor precum și apariția fenomenului de senescență. Rezultatele au pus în evidență superioritatea variantei cu mediul de cultură P6, care se recomandă în tehnologia de micropropagare „*in vitro*”.

**Cuvinte cheie:** topinambur, mediu de cultură, micropropagarea.

## INTRODUCTION

When talking about cultivating plants there is a direct association with growing plants in the field, green house, green pots, etc. and it is divided in different disciplines such as: agriculture, horticulture, tropical agriculture, forestry etc. In 1904, Håning developed a new method for growing plants called embryo culture. He isolated immature embryo „*in vitro*” and he obtained viable plantlets in the case

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine, Iași, Romania

<sup>2</sup> Tuscia University, Viterbo, Italy

of some species of cruciferous plants. Starting with 1920, many types of „in vitro” types became known: planting orchid seeds „in vitro”, cultivation of callus, cultivation of plant organs etc. After 1945 all these culture methods mentioned above have been grouped under one collective term: plant tissue culture.

It is known that, plants can be bred in two ways: vegetative (asexual, also called cloning) and sexual; (using seeds), but both types of breeding, in some circumstances can be impossible to realize.

If the sexual breeding method doesn't give any results or is impossible to realize, in the case of the species or cultivars which do not form seeds or form too little seeds or in case they form seeds but they are unable to germinate, then vegetative breeding becomes the only solution.

Another case where generative breeding is not satisfactory appears in the case where the number of heterogeneous descendents is very big.

In „in vivo” conditions, vegetative breeding (realized with stem cuttings, splitting of the plant, stools, underground organs, grafting etc.) , had a tremendous role for a big period of time for many species and especially for fruit trees, vineyard, ornamental species, leguminous species, species with flowers and many others. Vegetative breeding is also very important in breeding techniques to keep the characters of the genitor line, in the gene banks or to obtain mutant forms and maintain them.

Classic vegetative breeding methods are not sufficient since most of the times they are either too difficult to realize, they take a long time to obtain good planting material, or are absolutely impossible to use for some species.

Since lately, the technique of „in vitro” breeding has become less expensive; trials are made to introduce this technology within commercial labs. At this moment vegetative breeding is possible using „in vitro” cultures for some species which have a difficult „in vivo” breeding.

There are many methods used for vegetative breeding in „in vitro” conditions: „single node” method, „axillary branching” method, adventives organ regeneration, adventives root forming, adventives stem forming, obtaining callus, somatic embryo-genesis, plant regeneration from a single cell and obtaining artificial seed.

In this paper the results of an experiment which had as aim finding the most suitable culture medium and micro multiplication of the Jerusalem artichoke, are described.

The growing and development „in vitro” is determined by a number of four groups of complex factors:

1. The gene pool
2. Chemical compounds: macro and micro elements, carbohydrates, water
3. Factors which affect plant physiology: light, temperature, pH, O<sub>2</sub>, CO<sub>2</sub>
4. Organic substances: growth regulators, vitamins etc

Explants in „in vitro” conditions needs more chemical compounds for growth and development, exemplified in table 1. It can be inferred from the table

that compounds are necessary in „*in vivo*” conditions as well (water, macro and micro-elements).

Organic substances and unidentified mixtures are necessary only in „*in vitro*” conditions, in other words „*in vitro*” plats are heterotrophic.

Table 1

**Requirements for *in vitro* cultures for nutritious elements and hormones**

Water		pH
Organic substances	Macro- and Micro-elements	
Carbohydrates	N Fe Co	
Amino acids	P Zn NI	
Vitamins	K B Al	
Auxins	Ca Mn Mo	
Cytokinins	Mg Cu I	
Gibberellins	S	
Abscisic acid		
Ethylene		
Unidentified organic mixtures	Mold extract Coconut milk Plant extracts Casein Hydrolysate Pepton and trypton	

**MATERIAL AND METHOD**

In order to achieve our goal we used De Fossard's suggestion (1976) using a basic medium, with a changed concentration of the components, vital for enabling “*in vitro*” growth conditions. The culture medium that has been used, based on macro and micro elements, was Murashige-Skoog (MS) .

The experience was polyfactorial, type 6x3x3x2 where:

- A factor: cytokine's concentration BAP: 0 mg/l, 0,1mg/l, 0,25 mg/l, 0,5mg/l, 1 mg/l
- B factor: gibberellins concentration: GA3: 0 mg/l, 4 mg/l, 5 mg/l
- C factor: auxines concentration: NAA- 0 mg/l, 0,1 mg/l, 0,05 mg/l
- D factor: active carbon presence.

During the experiment we worked with „Violetto” cultivar of Jerusalem artichoke. From the 102 possible mediums, we have finally used 12 culture media (table 2).

Table 2

**Culture mediums used**

mg/l	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
NAA	0	0,05	0,05	0,05	0,05	0,05	0,1	0,05	0,05	0,05	0,05	0,1	0,1
BAP	0	0,1	0,1	0,25	0,25	0,4	0,4	0,5	0,5	0,5	0,5	1	1
GA3	0	4	5	4	5	4	4	5	5	0	0	0	0
C. A	0	0	0	0	0	0	0	1%	0	1%	0	1%	0

Tubers have been used as biological work material, thus increasing infection risk which made it necessary for the material to be sterile. This is why any remains of dirt or dead tissue have been removed off the tubercles, which have then been washed with clean water in order to remove any possible sources of contamination.

Only after these steps had been followed the sterilization took place. The tubers were immersed in 70% concentration of alcohol liquid for a few seconds in order to eliminate air bubbles and next they were introduced in NaCl 1% solution for 25 minutes. Next, the tubers had been immersed 3 times in distilled water for 2, 5 and respectively 15 minutes in order to remove any traces of hypochlorite off the tubers.

Once the sterilization procedure has been finished it has been proceeded to cut the tubercles into segments (slices) so as every section should contain 2-3 buds. This phase took place in sterile conditions inside the lab provided with laminar air flux.

The isolation of the explants was made at the level of the young sprouts, formed on the tubercle, after they have been forced (in darkness conditions) for a three day period, in the culture chamber, being treated with GA3 and BAP solution.

Observations and plant determinations have been taken during the experiment, keeping track of the initial and final number of sprouts, the height of the plants as well as some morphological aspects: color and length of leaves, length of the internodes as well as the appearance of the senescent phenomenon (premature aging).

## RESULTS AND DISCUSSIONS

The results regarding the main determinations regarding the evolution of the biologic material are shown in tables 3 and 4.

Table 3

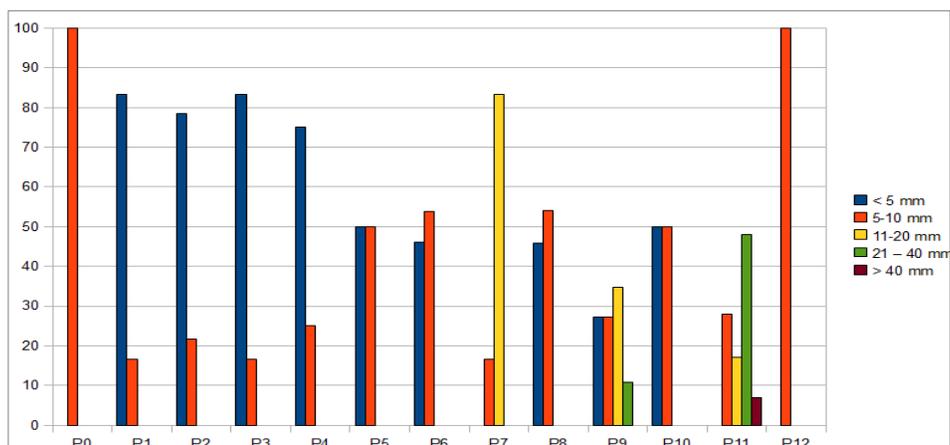
**The distribution of the plants height according to the sublayer of culture for “Violetteo” cultivar**

Hight	Culture Mediums												
	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
< 5mm	0	83	78	83	75	50	46	0	46	27	50	0	0
5-10 mm	100	17	22	17	25	50	54	17	54	27	50	28	100
11-20 mm	0	0	0	0	0	0	0	83	0	35	0	17	0
21-40 mm	0	0	0	0	0	0	0	0	0	11	0	48	0
> 40 mm	0	0	0	0	0	0	0	0	0	0	0	7	0

It can be determined that for the Violetteo clone the height of the shoots, in „*in vitro*” conditions, varied according to the culture medium from 5 mm up to 40

mm. it can be noticed in fig. 1 that when using P7 culture medium the height of the plants in high proportion varied between 11-20 mm values, having a very good multiplication report (number of final sprouts / number of initial sprouts) of 2,5, this way the conditions necessary for the internodes are being met, conditions necessary to obtaining micro tubers in a further phase of the experiment.

In case there is need for rapid multiplication of the „Violleto” clone the P6 culture medium will be used, having a multiplication report of 4,17, and which provides a reasonable height in order to enable a subculture in optimal conditions.



**Fig. 1** - Graphical representation for the distribution of plants' height according to the sublayer of culture for "Violleto" cultivar

Table 4

**Phenotype characteristics of the plants in "in vitro" conditions for the Violleto cultivar**

Culture mediums used	Characteristics			
	Leaf color	Leaf size	Internodes size	Senescence
<b>P0</b>	Green/ yellow	close	Short	yes
<b>P1</b>	Yellow / white	Small	Short	yes
<b>P2</b>	Yellow / white	Small	Short	yes
<b>P3</b>	Yellow / white	Small	Short	yes
<b>P4</b>	Yellow / white	Small oval	Short	yes
<b>P5</b>	Light green	Small oval	Short	Yes/ no
<b>P6</b>	Light green	Small oval	Short	yes
<b>P7</b>	Dark green	Medium	Medium	no
<b>P8</b>	Light green	Small	Short	yes
<b>P9</b>	Dark green	Medium long	Long	no
<b>P10</b>	Dark green	Medium oval	Medium	no
<b>P11</b>	Green	Medium	Medium	no
<b>P12</b>	Green	Close	Short	no

## CONCLUSIONS

1. Successful micro propagation is possible by using two culture media: one to provide the subculture (multiplication) and the second (which contains active coal) provides growth and height so that the length of the internodes is sufficient for obtaining micro tubercles.

2. Using culture media in „*in vitro*” culture for species *H. tuberosus* L. can lead to the appearance of the senescence phenomenon (premature aging).

3. After the experiment there have been identified culture mediums appropriate for producing internodes segments to be used further on a future experiment for obtaining micro tubers.

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# STUDY OF SOME TOMATO VARIETIES ORIGINATING IN ENGLAND IN THE PEDOCLIMATIC CONDITION OF SOUTH-EASTERN ROMANIA - BRAILA COUNTY

## STUDIUL ADAPTABILITĂȚII UNOR SOIURI DE TOMATE DIN ANGLIA ÎN CONDITIILE PEDOCLIMATICE DIN SUD-ESTUL ROMÂNIEI - JUDETUL BRĂILA

GALAN C.<sup>1</sup>, COTIANU R.D.<sup>1</sup>, BOLOLOI Mihaela<sup>1</sup>, EREMIA Florentina<sup>1</sup>  
e-mail: cotianu\_razvan@yahoo.com

**Abstract.** *The study has as the main target the testing of some Tomato varieties originating in England in the pedoclimatic condition South-Eastern Romania from Braila region. For this first stage of the project they are not of special interest the technical economical parameters (costs, productivity, profit etc.), these following to be the object of a different study. They have been studied six „cherry“ tomatos varieties. (Solanum lycopersicum var. cerasiforme): Cherry White (C.W.), Cherry Black (C.Bk.), Cherry Brown Berry (C.Br.), Cherry Gold Nugget (C.Gn.), Cherry Cerise (C.Cr.), Cherry Riesentraube (C.Rs.) The biotechnical parameters of the cultivated varieties were monitorized along the whole vegetative period, ierespectively May 29<sup>th</sup> 2011, the planting date in open field, and until October 22<sup>nd</sup>, the date of the experimental plot land clearing.*

**Key words:** „cherry“ tomatos, *Solanum lycopersicum* var. *cerasiforme*.

**Rezumat.** *Studiul are ca scop principal testarea adaptabilității unor soiuri de tomate din Anglia la condițiile pedo-climatice din regiunea Brăilei. Pentru acest prim stadiu al proiectului nu au prezentat interes deosebit parametri tehnico-economici (costuri, productivitate, profit etc.), acestia urmând să facă obiectul unui studiu separat. Au fost luate în studiu șase soiuri de tomate tip „cherry“ (Solanum lycopersicum var. cerasiforme): Cherry White (C.W.), Cherry Black (C.Bk.), Cherry Brown Berry (C.Br.), Cherry Gold Nugget (C.Gn.), Cherry Cerise (C.Cr.) și Cherry Riesentraube (C.Rs.) Parametrii biotehnologici ai soiurilor cultivate au fost monitorizati pe întreaga perioadă de vegetatie respectiv 29 mai 2011, data plantării în câmp deschis, și până la 22 octombrie 2011, data defrisării lotului experimental.*

**Cuvinte cheie:** tomate tip „cherry“, *Solanum lycopersicum* var. *cerasiforme*

### INTRODUCTION

*Description of varieties tested.* The varieties tested are described by the supplier as follows (<http://www.premierseeds.co.za/vegetable-seeds/tomato.html> and [http://stores.ebay.co.uk/Premier-Seeds-Direct/Tomatoes/\\_i.html?\\_fsub=9717831](http://stores.ebay.co.uk/Premier-Seeds-Direct/Tomatoes/_i.html?_fsub=9717831)):

1. - Cherry Snow White (C.W.)

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<sup>1</sup> Bioterra University of Bucharest, Romania

Very pretty cherry tomato that matures to a cream color. Plants are highly productive and the fruits are sweet. The ivory-cream color persists throughout the fruit when cut. Indeterminate. Maturity: 65-75 Days. Origin: Exact origin unknown, but originally from the United States.

2. - Cherry Black (C.Bk.)

Round, true cherry tomato, one of the only having black skin. Color is a deep red, with blackish hues. Flavor is sweet, much like other cherry tomatoes, and very full-flavored. This variety is fairly rare. Indeterminate. Maturity: 65 Days. Origin: Unknown.

3. - Cherry Brown Berry (C.Br.)

A very unique cherry-like tomato bearing large „cherry” fruits. This strange variety ripens to a dark red-brown color unlike any other cherry tomato you'll see. Fruits have a rich, deep fruity flavor. Plant produce heavily. Indeterminate. Maturity: 75 days.

4. - Cherry Gold Nugget (C.Gn.)

A delightful cherry-like tomato with large (for a cherry tomato) fruits that ripen to a golden yellow. The fruits have a very mild and sweet flavor with minimal acid. Some fruits, particularly the early ripening ones are seedless. The plants are quite heavy bearing for their compact size, which grow to 2-3ft at the most. Determinate, Resistant to Fusarium and Verticillium Wilt. Maturity: 55-60 Days. Origin: Unknown.

5. - Cherry Cerise (C.Cr.)

An heirloom tomato from Norbert Parreira, Helliner, France in 1992. Our Tomatofest organic tomato seeds produce indeterminate, big, sprawling, regular leaf tomato plants that yield huge amounts of tiny, 1/2-inch, red-orange cherry tomatoes with a subtle striping borne in large clusters. A tomato with big, wonderful, well-balanced, sweet taste, bursting with a fruity sweetness similar to the very popular Sungold cherry tomato, but lower in acid. Indeterminate.

6. - Cherry Riesentraube (C.Rs.)

An extremely prolific grape tomato bearing bite sized fruits to 1" around, in large clusters of up to 20-40 each. The name translates to "bunches of grapes" and along with its prolific fruiting habit, the fruits have a very good, sweet flavor that is excellent for fresh eating. Plants are very heavy bearers. The fruits have a distinctive but small point at their blossom ends. The germination time of the seeds tends to be a bit longer than that of other varieties. Indeterminate. Maturity: 70-80 days. Origin: A European (German) heirloom dating back to at least the 1800's and possibly earlier. It was known in the United States as early as 1856, grown by the Pennsylvania Dutch.

## MATERIAL AND METHOD

The experimental plot has been established in Chiscani, a locality placed 2 km from Danube and 11 km South of Braila City, all varieties enjoying the same pedoclimatic conditions.

Braila County is between the following geographical coordinates: 44° 44' and 45° 30' N, 27° 04' and 28° 10' S. It is located in southeast side of Romania, occupying the

north-eastern Romanian Plain and the Big Island of Braila, the largest embanked site of the Danube River. The relief is generally flat, the only „land accident” being the rivers, and lake depressions. Among the relief units, in the North side the county includes a part of Lower Siret River Meadow, towards the West it includes small parts of Salcioara Plain and Buzaului Plain, and towards the East the Lower Danube River Meadow.

The relief of Braila County is of cumulative, sedimentary origin, the loess deposits having a thickness ranging from 10 to 20 m. About 75% of county’s surface is covered of chernozem. These soils formed in the continental semiarid climate conditions and of loess deposits, on silt and sand, on the ground of a steppe vegetation and surface groundwater sources.

The most spread chernozem soils are:

- Brown chernozem;
- Chocolate chernozem;
- Carbonate chernozem;
- Leachade chernozem.

Braila County climate is temperate continental with shades of aridity. Solar radiation has a relatively uniform distribution, totaling between 122,5 and 125 kcal/cm<sup>2</sup> and about 2,200 hours of real sunburn, out of which 72% is in the period April-September.

The high temperatures during the summer frequently exceed 30-35°C, being typical for the temperate continental climate. During the cold season, along about 110 days, it occurs the ground frost, out of which 80 days occurs only at night.

Concerning the precipitation, the annual average is 465 l/m<sup>2</sup>, most precipitation being recorded during May-August, and the least in autumn and winter.

Researches are part of a larger project that runs over two years.

In the first year (2011), it is intended to test the degree of adaptability biological varieties pedo-climatic conditions in our country, and during the second year (2012) will be quantified technical and economic performance (cost, productivity, profit etc.).

The first stage of the research was conducted during May-October 2011, in an experimental group organized Chiscani locality (Latitude: 45°11' North, Longitude: 27°56' East), located 2 km from the Danube and 11 km south of the city of Braila, all varieties benefit from the same climatic conditions. As biological material has been used six cultivation (varieties) of tomato (*Solanum lycopersicum* var. *cerasiforme*) imported from England. Seed supplier was PREMIER SEEDS, a British company and importer and manufacturer seedlings was firm Lancer Studio Ltd based in Bucharest, sector 6.

Concerning the used culture materials and methods, they have been covered the following steps/technological links:

» In order to shorten the acclimatization period and to reduce the losses from transplanting, the six varieties have been imported from England as seeds, the seedlings being produced in Romania. The seeds supplier was PREMIER SEEDS, a British company.

Date of planting in pots was May 1<sup>st</sup> 2011, and the date of planting in the opened field was May 29<sup>th</sup> 2011, the efficiency being of 96 %.

» The field where it has been established the experimental plot, have been prepared in advance by making a spring plowing at 30 cm, and use of the combinator for raising and leveling (Popescu and Popescu, 2003; Indrea et al., 2007). The land modeling have been manually performed by open 70 cm wide furrows.

» Before planting in the field (Ciofu et al., 2004 ; Dumitrescu et al., 1998) it was given Metiocarb (2% a.i.) as granules in order to control the fen cricket (*Gryllotalpa gryllotalpa*) and other harmful insects.

» Planting distances were the same for all varieties, 70 cm between rows and 30 cm between plants on row, resulting a density of 47,619.0 plants/hectar.

» The tomatoes grown in opened field, in intensive system, having a steam suporting system and flooding irrigation furrows (Atanasiu, 2007).

» The plants were periodically removed of side-shoots but not pinched out. Five out of the six analyzed varieties shown an excelent force of growth along the summer, reaching about 1.60 m 60 days after the planting (fig. 1). The sixth variety, Cherry Gold Nugget (C.Gn.) shown a determined growth.



**Fig. 1** – Plant height 60 days after planting

» Weeds control have been performed manually by hoeing between rows and by pulling weeds between plants on row. They were not used herbicides. They have been performed four hoeings every 15-20 days.

» Concerning the irrigations, thanks to the frequent rains registered in the period May 30<sup>th</sup> – July<sup>th</sup> 2011, the water consumption was reduced, the irrigations being intensified in August at a 3-4 days interval.

## **RESULTS AND DISCUSSIONS**

The biotechnologic parameters of the cultivated varieties where monitored along the whole vegetative period (Oprea and Galan, 2009; Drăghici, 2002), respectively May 29<sup>th</sup> 2011, date of planting in the opened field, and until October 22<sup>nd</sup> 2011, clearing date of the experimental plot.

The performed observations can be synthetized as it follows:

» The varieties C.Br., C.Cr., and C.W. shown a special vigour of the shoots resulted from side-shoots.

» Despite the large inflorescences, the variety C.Bk. shown a high sensitivity to pollination, the yield obtained being low (fig. 2).

» Although they have been periodically performed criptogamic treatments, the variety C.Br. shown an high sensitivity to black spot - *Alternaria spp.*



**Fig. 2** – Inflorescences of the Cherry Black variety (C.Bk.)

» On reaching the physiological maturity, the berries of the variety C.Rs. shown uneven ripening and thus a commercial derogatory aspect too (fig. 3).



**Fig. 3** – Berries of the Cherry Riesentraube variety (C.Rs.)

» The only variety with a detemined growth (C.Gn.), registered an average yield of 0.480 kg/plant, plant height being of only 60-70 cm. It results an average yield per hectare of 22,857.12 kg, level reached 70-75 days after planting (fig. 4).



**Fig. 4** – Cherry Gold Nugget Variety (C.Gn.) when it reached the maximum yield

» Although the berries of the C.W. variety shown uniformity and a special commercial aspect, it showed sensitivity to cracking, phenomenon amplified during the transport.

» The C.Cr. variety adapted excelent showing a high growth force, a long growing season, and a special quality of berries (fig. 5).



Fig. 5 – Cherry Cerise Variety (C.Cr.)

## CONCLUSIONS

1. All the analyzed varieties adapted well in the pedoclimatic condition of SE Romania;
2. The chosen culture system didn't cause special problem concerning the adaptability and productivity;
3. Five out the six varieties shown a special growth vigour during the summer and a long vegetative period;
4. Concerning the yield quality, the obtained results with the varieties C.Bk. and C.Br. were unsatisfactory;
5. At the C.Rs. variety the berries' ripening uniformity was poor;
6. The best results concerning the relation productivity / quality were registered by the varieties C.Cr., C.Gn., and C.W.

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# MORPHOLOGICAL AND PHENOLOGICAL ASPECTS OF SOME ORNAMENTAL KALE FORMS

## ASPECTE MORFOLOGICE ȘI FENOLOGICE ALE UNOR FORME ORNAMENTALE LA VARZA DE FRUNZE

MUNTEAN Delia<sup>1</sup>, MUNTEANU N.<sup>1</sup>,  
BALCĂU Simina<sup>2</sup>, LAZĂR (NECHITA) Adriana<sup>1</sup>  
e-mail: mundelia@yahoo.com

**Abstract.** *This paper presents a short morphological and phenological characterization of an assortment of eight hybrids of ornamental cabbage as kale forms (*Brassica oleracea* var. *acephala* D.C.). The research was conducted at the Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine, Iași, in the experimental field of it, in 2011. Purpose of the research was to highlight the value of ornamental forms studied to enrich knowledge about these varieties as a premise for introduction and using them in landscape. The results revealed morphological and phenological diversity of the hybrids studied. Thus, in November, plant height ranged from 80.5 cm (White Peacock hybrid) to 97.2 cm (Crane Bicolor hybrid); ornamental rosette diameter ranged from 22.8 cm (Crane Red hybrid) to 31.7 cm (Red Peacock hybrid). At the same time vegetative mass ranged from 654 g (Crane Pink hybrid) to 870 g (Red Peacock hybrid). Concerning to ornamental foliage color, it was: cream with pink accents, red, pink, white and violet with purple accents.*

**Key words:** *Brassica* genus, morphology, phenology, ornamental value, biological evolution.

**Rezumat.** *Lucrarea prezintă o scurtă caracterizare morfologică și fenologică a unui sortiment de opt hibrizi de varză ornamentală, ca forme ale verzei de frunze (*Brassica oleracea* var. *acephala* D.C.). Cercetările au fost efectuate la Facultatea de Horticultură a Universității de Științe agricole și Medicină veterinară Iași, în cadrul câmpului experimental de legumicultură, în anul 2011. Scopul cercetărilor a fost de a pune în evidență valoarea ornamentală a formelor studiate în vederea îmbogățirii cunoștințelor acestor varietăți ca o premisă a introducerii și valorificării lor în peisagistică. Rezultatele au pus în evidență diversitatea sub aspect morfologic și fenologic a hibrizilor studiați. Astfel, în luna noiembrie înălțimea plantelor a variat de la 80,5 cm (la hibridul White Peacock) la 97,2 cm (la hibridul Crane Bicolor); diametrul rozetei ornamentale a variat de la 22,8 cm (la hibridul Crane Red) la 31,7 cm (la hibridul Red Peacock). În același timp masa vegetativă a variat de la 654 g (la hibridul Crane Pink) la 870 g (la hibridul Red Peacock). Referitor la culoarea frunzelor ornamentale, aceasta a fost: crem cu accente de roz, roșie, roz, albă, violetă cu accente lila.*

**Cuvinte cheie:** Genul *Brassica*, morfologie, fenologie, valoare ornamentală, evoluție biologică.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iași, Romania

<sup>2</sup> University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania

## INTRODUCTION

Ornamental cabbage (*Brassica oleracea* var. *acephala* D.C.) is a decorative plant with special meaning that began to establish themselves in the Romanian landscape. This plant is largely similar to kale and shows a great diversity in terms of features which gives it beauty value in parks and gardens.

Research conducted in countries of great tradition, such as Japan, Holland, Germany, was focused on areas of major importance in promoting a culture: genetics and breeding, seed production, technology and cultural practices, plant protection or landscaping. Following these investigations, ornamental cabbage cultivated forms are remarkable diverse and they have been developed cultivation methods and techniques of decorative spaces.

In our country, ornamental cabbage is known only as a way of presenting the collection, especially in private gardens. Its importance must be analyzed by decorative scientific methods which underline the cultivation in floriculture landscape.

These forms came recently into knowledge, but not in a systematic form, not based on solid knowledge of agrobiological and less used to exploit the ornamental potential.

Our studies aim to highlight some elements on the morphology and phenology of a variety of ornamental cabbage based on its efficient use in landscape areas.

## MATERIAL AND METHOD

The research has been accomplished in the experimental field on discipline of vegetable horticulture at the University of Agricultural Sciences and Veterinary Medicine „Ion Ionescu de la Brad”, Iași, in 2011. Climatic conditions were characterized by chernozem soil, leaching medium at pH 6.5 to 6.8, organic matter 3.2%, annual average temperature of 14,84°C and a rainfall of 489 mm wide. Optimum soil moisture during fruiting is 70-75% of field water capacity (Indrea et al., 2009).

In terms of weather the main value of parameters (temperature, humidity, precipitation) were within normal multiannual limits.

The study was to evaluate morphology and phenology of a variety of eight hybrids of ornamental cabbage, organized in a linear order from the company Nicky's Nursery Ltd., England.

The culture was established by seedlings produced in greenhouses sown in alveolar blades by 15 March. Planting in the field was made on 10 May. During the vegetation were made current care works recommended in the literature (Stan and Munteanu, 2001). Vegetation period lasted to all the cultivars from time emergence until the cancellation culture (in December).

With an eye to describe the morphological observation and measurements were performed on: dynamics of plant height, dynamic of diameter rosette, number of leaves, leaf size, plant age, vegetative mass.

For the phenological plants, study were taken into account following: time periods of planting, time of ornamental plant with rosette leaves, time branching of the stem and training duration of flowering shoots.

Experimental data were processed by appropriate statistical methods and summarizes in the chart.

## **RESULTS AND DISCUSSIONS**

Table 1 presents the main features of the eight ornamental cabbage hybrids studied. From the table it can see that plant height ranged from 12.2 cm at Glamour Red hybrid to 150.5 cm at Red Crane hybrid. The average height of the eight ornamental cabbage hybrids was 59.53 cm. As the number of leaves on the stem, it fluctuated between four leaves at Pink Crane hybrid in June and 56 leaves at Red Peacock hybrid in December, with an average of 20.14 in the number of leaves.

It was observed that higher plants don't have a large number of leaves. Rosette diameter of leaves, usually large, had an average of 22.17 cm. The smallest diameter was reported in June at White Peacock hybrid, and highest in December at Red Peacock hybrid: 9.7 cm, respectively 35.5 cm.

Measurements effectuated when planting seedling (table 2) showed that they were within the limits of quality seedlings, but in some hybrid growth was slightly weaker.

Vegetative weight averaged to 472.3 g, the lowest vegetative mass containing 89g at Coral Prince hybrid and the largest vegetative mass containing 1000g at Glamour Red and Coral Queen hybrids.

The average leaf size of those eight hybrids, ranged from 1.5 cm at Coral Queen hybrid to 26.9 cm at White Peacock hybrid.

Table 1

## Results on the dynamics of ornamental cabbage plants in 2011

Variety	June 5, 2011			July 3, 2011			August 4, 2011			September 5, 2011			October 3, 2011			November 4, 2011			December 5, 2011		
	Plant height (cm)	No of leaf	Rosete diam. (cm)	Plant height (cm)	No of leaf	Rosete diam. (cm)	Plant height (cm)	No of leaf	Rosete diam. (cm)	Plant height (cm)	No of leaf	Rosete diam. (cm)	Plant height (cm)	No of leaf	Rosete diam. (cm)	Plant height (cm)	No of leaf	Rosete diam. (cm)	Plant height (cm)	No of leaf	Rosete diam. (cm)
Glamo ur Red F <sub>1</sub>	12,2	12	14,2	19,3	15	18,3	27,2	19	20,1	36,4	24	22,5	52,1	29	24,2	86,1	37	27,3	139,2	48	30,5
Red Peacock F <sub>1</sub>	14,0	15	13,1	21,5	19	18	29,7	23	20,2	38,1	28	24,7	58,4	32	29,9	83,6	44	31,7	142,6	56	35,5
White Peacock F <sub>1</sub>	16,3	9	9,7	23,4	13	12,7	34,5	18	16,4	42,7	22	19,5	61,2	25	23,5	80,5	29	27,2	145,3	36	30,7
Crane Red F <sub>1</sub>	17,1	5	10,2	24,8	6	12,4	38,5	9	15,2	50,3	11	18,9	72,4	14	20,9	91,8	19	22,8	150,5	27	25,7
Crane Pink F <sub>1</sub>	19,2	4	13,1	28,1	7	16,1	36,9	8	19,2	45,3	10	21,9	79,5	12	24,7	95,3	19	26,3	148,3	26	29,8
Crane Bicolor F <sub>1</sub>	17,2	5	12,3	25,3	7	15	31,3	10	17,5	47,5	12	19,8	76,1	17	22,5	97,2	20	25,4	146,9	25	28,3
Coral Queen F <sub>1</sub>	16,3	7	16,2	23,2	9	19	39,1	11	21,6	45,2	14	24,2	63,7	24	26,8	88,5	36	29,6	141,7	43	31,2
Coral Prince F <sub>1</sub>	15,5	6	18,1	24,2	8	21	33,7	10	24,5	41,6	15	26,1	59,5	28	29,7	90,4	39	31,5	147,5	52	34,2
Average	15,97	7,88	13,36	23,73	10,5	16,56	33,86	13,5	19,34	43,39	17	22,2	65,36	22,62	25,27	89,17	30,38	27,73	145,25	39,12	30,74

Table 2

## Results on the dynamics of ornamental cabbage plants in 2011

Variety	June 5, 2011		July 3, 2011		August 4, 2011		September 5, 2011		October 4, 2011		November 3, 2011		December 5, 2011	
	Veg. mass (g)	Leaf size(L)	Veg. mass (g)	Leaf size(L)	Veg. mass (g)	Leaf size(L)	Veg. mass (g)	Leaf size(L)	Veg. mass (g)	Leaf size(L)	Veg. mass (g)	Leaf size(L)	Veg. mass (g)	Leaf size(L)
Glamour Red F <sub>1</sub>	90	3	180	5,5	270	7,5	430	9,3	670	14,2	850	20,5	1000	25,4
Red Peacock F <sub>1</sub>	160	2	250	4,2	360	6,8	580	8,1	750	14,1	870	19,5	950	24,8
White Peacock F <sub>1</sub>	143	3	196	5,7	285	7,8	490	9,5	690	14,6	820	20,3	970	26,9
Crane Red F <sub>1</sub>	134	2	185	4,5	240	6,3	387	8,7	525	13,6	670	18,6	750	23,2
Crane Pink F <sub>1</sub>	162	1,6	179	3,5	298	5,7	410	7,8	540	11,7	654	16,3	752	21,5
Crane Bicolor F <sub>1</sub>	122	1,7	194	3,8	245	5,4	315	7,5	470	12,5	684	17,4	810	22,7
Coral Queen F <sub>1</sub>	96	1,5	190	3,6	321	5,2	427	7,5	553	13,2	795	19,9	1000	25,5
Coral Prince F <sub>1</sub>	89	2	160	4,9	310	6,2	430	8,4	578	14,1	780	20,1	990	26,4
Average	124,5	2,1	191,7	4,46	291,12	6,36	433,6	8,3	597	13,5	765,38	19,07	902,75	24,55

## CONCLUSIONS

1. Main morphological analysis (plant height, number of leaves, rosette diameter, vegetative mass, leaf size) in 2011, in different phenophases showed a progressive increase of values recorded by them.

2. Following the results we can say that there were significant differences between ornamental cabbage hybrids. Seedlings were vigorous, showing an average height of 2.5 cm and a mean number of leaves of 1.04.

3. Plant height ranged from 12.2 cm at Glamour Red hybrid to 150.5 cm at Red Crane hybrid. The average height of the eight ornamental cabbage hybrids was 59.53 cm. It was observed that higher plants don't have a large number of leaves. Rosette diameter of leaves, usually large, had an average of 22.17 cm.

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# THE INFLUENCE OF CULTIVAR AND DENSITY ON EARLY CABBAGE

## INFLUENȚA CULTIVARULUI ȘI A DENSITĂȚII LA VARZA ALBĂ TIMPURIE

*STOLERU Carmen*<sup>1</sup>, *STOLERU V.*<sup>1</sup>, *STAN T.*<sup>1</sup>, *AVASILOAIEI D.I.*<sup>1</sup>

e-mail: vstoleru@uaiasi.ro

**Abstract.** *The topic under study aims at establishing the most appropriate varieties for area of the Romanian and the most appropriate density in the organic. The highest early cabbage production during 2006-2008 were obtained from cultivar K001 F1, respectively 32,00 t/ha. Regarding the influence of planting density on total production in early cabbage, the highest yield were carried out in variant when it was planted 47,619 pl. / Ha, where 31.76 t / ha. Regarding the influence of combinations of cultivar and planting density can be said that the highest yields were obtained when K001 F1 cultivar planted at distances of 70 cm x 30 cm, carried out the production of 33.54 t / ha.*  
**Key words:** cabbage, cultivar, densities, production, organic sistem

**Rezumat.** *Tema luată în studiu are ca scop stabilirea celor mai adecvate cultivare pentru zona de NE a României și stabilirea celor mai adecvate densități în funcție de cultivar, în cadrul sistemului ecologic de cultivare. Cele mai ridicate producții la varza timpurie, în perioada 2006-2008, au fost obținute de cultivarul K001 F1, respective, 32,00 t / ha. În ce privește influența densităților de plantare asupra producției totale la varza albă timpurie, cele mai ridicate producții au fost realizate în varianta când s-au plantat 47.619 plante/ha, caz în care producția a fost de 31,76 t/ha. Referitor la influența combinațiilor dintre cultivar și densitatea de plantare se poate spune că cele mai ridicate producții au fost obținute în cazul cultivarului K001 F1, plantat la distanțe de 70 cm x 30 cm, producția realizată fiind de 33,54 t/ha.*

**Cuvinte cheie:** varza albă, cultivar, densități, producție, sistem ecologic

### INTRODUCTION

The role of organic system is to produce cleaner food, more appropriate to human metabolism, in the fully correlation with environmental development and conservation (Munteanu and Stoleru, 2012).

Achieving crop for early white cabbage, under optimal conditions, mean primarily, satisfy the requirements under the best environmental factors to the plants. Therefore, cultural practices should provide technological factors and their values, which to satisfy these requirements, based on ecological cultivation system, which is very restrictive.

The successful of organic cabbage crop in the open field depends heavily on a number of links means of technology, properly applied such as:

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine, Iași, Romania

land choosing, crop rotation, cultivar selection, planting time, planting distances, fertilization and crop protection against weeds, pathogens and pests.

As is known, the main environmental requirements of the cabbage crop are: temperature, light, soil, air and nutrients. Meet the best of the requirements of cabbage to the above environmental factors, should be given the natural circumstances of growing medium because it is almost impossible to ensure optimal plant conditions they need.

The technology can only regulate, to adjust or correct the values of environmental factors, specific measures, which mean the establishment of optimal indices of some technological factors.

Also, if one takes into account the biological and genetic characteristics of species, that this factor can be adjusted by proper choice cultivars. All this motivates the base carrying out research, optimizing some technological factors of early organic cabbage crop in field conditions.

Among the factors that depend on productivity and quality of vegetables the cultivar is the most important because its biological potential will be expressed in terms of appropriate technologies (Stan, 1999, Ciofu, 2003, Munteanu, 2003).

When choosing the most suitable cultivar for head cabbage, will take into account the following criteria: climate and soil conditions, growing place, the goods: fresh consumption, industrialization, seeding date, planting and harvesting period, resistance or tolerance to pests and diseases, adaptation to extreme environmental conditions, extreme temperatures, high salt tolerance levels, economic use of natural fertilizers, consumer preferences on appearance, taste, size etc.

Of course, a cultivar can't have all these requirements, but depending on the goods and the requirement of both consumers and farmers preferences, will choose the most appropriate in the circumstances (Dejeu, 1997).

## **MATERIAL SI METHOD**

In view of reasons set out, the subject under study aims at establishing the most appropriate density and cultivation in ecological system in the NE area of Romania.

In order to achieve the goal, was organized an experience, which included the following objectives: influence of cultivar, planting density and the influence of combinations of two factors on early white cabbage production.

To achieve its purpose at "V. Adamachi "Teaching Station Iasi, between 2006-2008 has been made in the open field experience, the crop of white cabbage, the proposed technological factors were studied by work objectives.

The biological material used for early white cabbage crop was represented by cultivars, adapted to the microclimate of the NE area of Romania: Timpurie de Vidra (fig. 1.), Dittmark, Golden Acre și K001 F1 (fig. 2.);

Experimental plot design used in the experiments was randomized blocks type (Săulescu, 1967, Jitoreanu, 1994). Harvested area of experimental plots covered the 30 plants.



**Fig. 1** - Early cabbage – Timpurie de Vidra (original)



**Fig. 2** - Early cabbage – K001 F1 (original)

Considering the importance studying factors in the growing technology, their ability to change, need to study a large number of repetitions each experimental factors, but also taking into account the possibilities of organizing experience, established hierarchy of factors, as follows:

1. A factor – cultivar, with four graduations: Timpurie de Vidra, Dittmark, Golden Acre, K001 F1;
2. B factor – (crop density) with three graduation: 50.000 pl./ha - (80 x 25 cm); 47.619 pl./ha (70 x 30 cm) si 41.666 pl./ha (60 x 40 cm).

The seedlings were produced in the UASVM Iasi greenhouse, at the discipline of vegetable growing, in the cellular trays, with trunk pyramid-shaped of 68 cm<sup>3</sup> volume. The crop was performed on a level ground, well flattened for application of drip irrigation. The soil is a cambic chernozem leached medium, pelic, epicalcaric, well supplied in nutrients (Stoleru, 2010). Prepare the ground was done in stages, in autumn and spring, according to the literature.

The crop establishes was carried out by planting seedlings, at distances specified in the second decade of April.

The cabbage crop was care according to technology arising from the literature consulted (Stoian, 2005, Munteanu, 2008), care being taken the major technological measures: aerates soil, weed control, pathogens and pest control, fertilization and irrigation. Harvesting was done manually, at best time of maturity for consumption, since by 10.06 to 15.07.

**Collection and processing the experimental data.** The experimental data collection was carried out observations and biometric measurements, according to the experimental technique used in experiments.

The experimental variants were compared to with the average experience, the percentage reporting and differences. The influence of experimental factors was assessed using ANOVA. The significance of differences was assessed on the basis of differences limit for three degrees of confidence (95%, 99%, 99,9%) (Săulescu, 1967).

## **RESULTS AND DISCUSSION**

**The influence of cultivar on total production at early cabbages.** Regarding to the influence of cultivar on total yield of early cabbage crop, during

2006-2008, it ranged from 27.86 t / ha at Timpurie de Vidra to 32.00 t / ha on K001 cultivar (table 1).

As with differences obtained from the average experience, one can say that K001 F1 hybrid achieved a significant production, compared with Timpurie de Vidra variety, which showed significant differences distinctly negative, respectively -2.17 t / ha.

The greatest difference between the two varieties was registered, when comparing the K001 with Timpurie de Vidra, the difference being 4.14 t / ha.

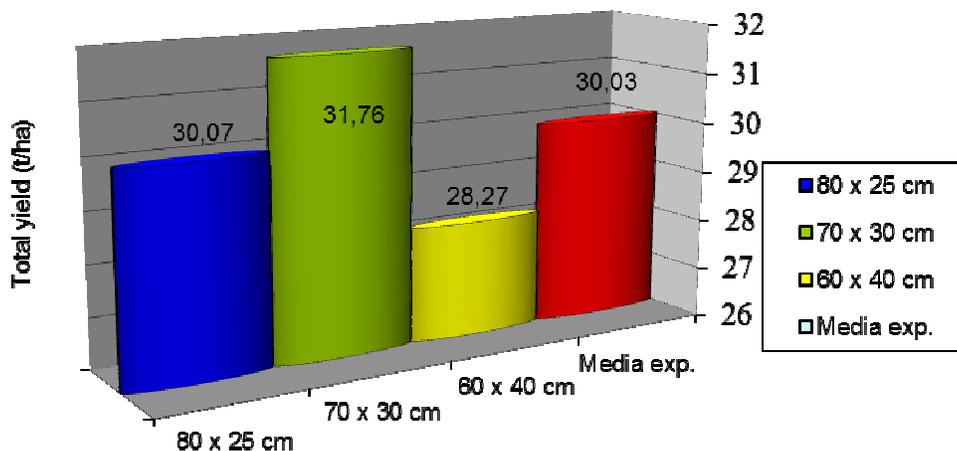
Table 1

**Influence of cultivar on production from organic early cabbage (2006-2008)**

Variants		Total yield			
		t/ha	% to the average	differences to the average (t/ha)	significance of differences
1	Timpurie de Vidra	27,86	93	-2,17	00
2	Dittmark	29,52	98	-0,15	-
3	Golden Acre	30,74	102	0,71	-
4	K001 F1	32,00	107	1,97	*
x	Average	30,03	100	0,00	-

LSD 5%=1,46 t/ha, LSD 1%=2,13 t/ha, LSD 0,1%=3,69 t/ha.

**The influence of planting distance on early cabbage production.** Distance between plants in the row and between rows is a technological factor influencing crop density, which is number of plants per unit area. This technological factor, determined directly from the feeding soil surface, light regime etc.



LSD 5%=1,56 t/ha, LSD 1%=2,34 t/ha, LSD 0,1%=3,67 t/ha

Fig. 3 - Graphical representation the influence of planting distance on white cabbage yield

The total production obtained in case of a crop of early cabbage ranged from 28.27 t/ha for distances of 60 cm x 40 cm to 31.76 t/ha, for distances of 70 cm x 30 cm.

The differences obtained between experimental variants and average experience, ranged from -1.76 t / ha for distances of 60 cm x 40 cm, up to 1.73 t / ha for 70 cm x 30 cm variant, the difference obtained was considered positive significant (fig. 3).

**The influence of cultivar x planting distance on total production in early cabbages.** The total production ranged from 27.06 t / ha for Timpurie de Vidra planted at distance of 60 cm x 40 cm, up to 33.54 t / ha for K001 F1 cultivar, planted at distances of 70 cm x 30 cm, the difference being statistically assured 99%.

Positive differences compared to the average have been obtained when K001 F1 cultivar planted at distances of 80 cm x 25 cm and the cultivar Golden Acre, planted at distances of 70 cm x 30 cm. Negative differences distinct significant and significant were obtained the Timpurie de Vidra variety, planted at distances of 60 cm x 40 cm and 80 cm x 25 cm and Dittmark, planted at 60 cm x 40 cm (table 2).

Table 2

**The influence of cultivar x planting density on total yield of organic early cabbages**

Variants		Total yield			
no.	specification	t/ha	% to the average	difference to average (t/ha)	significance of differences
1	Timpurie de Vidra x 50.000 pl./ha	27,60	92	-2,43	0
2	Timpurie de Vidra x 47.619 pl./ha	28,96	96	-1,07	-
3	Timpurie de Vidra x 41.666 pl./ha	27,06	90	-2,97	00
4	Dittmark x 50.000 pl./ha	29,15	97	-0,88	-
5	Dittmark x 47.619 pl./ha	31,66	105	1,63	-
6	Dittmark x 41.666 pl./ha	27,75	92	-2,28	0
7	Golden Acre x 50.000 pl./ha	30,74	102	0,71	-
8	Golden Acre x 47.619 pl./ha	32,84	109	2,81	**
9	Golden Acre x 41.666 pl./ha	28,65	95	-1,38	-
10	K001 F1 x 50.000 pl./ha	32,80	109	2,77	**
11	K001 F1 x 47.619 pl./ha	33,54	112	3,51	**
12	K001 F1 x 41.666 pl./ha	29,64	99	-0,39	-
x	Media experientei	30,03	100	0,00	-

LSD 5%=1,67 t/ha,

LSD 1%=2,75 t/ha,

LSD 0,1%=3,57 t/ha

## CONCLUSIONS

1. Regarding the influence of cultivar on total production in early crop, during 2006-2008, it ranged from 27.86 t / ha at Timpurie de Vidra to 32.00 t / ha K001 cultivar.

2. The total production obtained for early cabbage crop, ranged from 28.27 t / ha for density of 41,666 pl./ha to 31.76 t / ha for density of 47,619 pl./ha.

3. The total production ranged from 27.06 t /ha for the Timpurie de Vidra planted at distances of 60 cm x 40 cm, up to 33.54 t /ha for K001 F1 cultivar, planted at distances of 70 cm x 30 cm, the difference is statistically assured 99%.

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# THE INFLUENCE OF TECHNOLOGICAL FACTORS ON EARLY WHITE CABBAGE PRODUCTION IN NE OF ROMANIA

## INFLUENȚA UNOR FACTORI TEHNOLOGICI ASUPRA PRODUCȚIEI LA VARZA ALBĂ TIMPURIE ÎN NE ROMÂNIEI

**STOLERU V.<sup>1</sup>, MUNTEANU N.<sup>1</sup>, STOLERU Carmen<sup>1</sup>**  
e-mail: vstoleru@uaiasi.ro

**Abstract.** *The concept of organic farming aims mainly agricultural ecosystems conservation and getting healthy products for consumers. The premise of obtaining them is influenced primarily by biotope and applied technology. Making crop system of early white cabbage, in optimal conditions, means first satisfying the requirements under best plants to environmental factors. The study aims to address an older problem related to growing white cabbage, but in the implementation of those measures and technological resources in a sustainable system growing, namely, the organic system. The highest early cabbage production during 2006-2008 were obtained from cultivar K001 F1, respectively 32,00 t/ha. Regarding to planting time on early cabbage production, we can say that for the NE area influenced very slightly production,, best results were obtained when planting took place at 07 April, yield being 31,01 t/ha. The best results regarding to the influence of cultivar and planting time, were obtained when K001 F1 cultivar, planted on 07 April (32.84 t/ha).*

**Key words:** cabbage, cultivar, crop establish, yield

**Rezumat.** *Conceptul de agricultură ecologică are ca scop principal conservarea ecosistemelor agricole și obținerea de produse sănătoase pentru consumatori. Premiza obținerii acestora este influențată în principal de biotop și de tehnologia aplicată. Realizarea culturii de varză albă în sistem timpuriu, în condiții optime, înseamnă în primul rând satisfacerea în condiții mai bune a cerințelor plantelor față de factorii de mediu. Studiul are ca scop abordarea unei probleme mai vechi legată de cultivarea verzei albe. Reconsiderarea acestei probleme este făcută în contextul implementării acelor măsuri și mijloace tehnologice specifice unui sistem sustenabil de cultivare, și anume, sistemul ecologic. Cele mai ridicate producții la cultura de varză timpurie în perioada 2006-2008, au fost obținute folosind cultivarul K001 F1, respectiv 32,00 t/ha. În ceea ce privește influența epocii de înființare asupra producției la varza timpurie, aceasta este relativ redusă pentru zona de NE a României, dar rezultatele cele mai bune au fost obținute când plantarea s-a efectuat la 07.04, producția fiind de 31,01 t/ha. Influența combinației dintre cultivar și epocă de plantare a scos în evidență că cele mai bune rezultate au fost obținute în cazul cultivarului K001 F1, plantat la data de 07.04. (32,84 t/ha).*

**Cuvinte cheie:** varza albă, cultivar, epocă de plantare, producție

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

## INTRODUCTION

The successful of organic cabbage crop in open field is highly dependent on compliance with of technological links, properly applied such as land choice and crop rotation, cultivar selection, establishing time, planting distance, fertilization and crop protection against weeds, pests and pathogenic agents. Cultivation technology should provide technological factors and their values to satisfy the requirements set by ecological growing system, which is very restrictive.

Satisfying the best of the requirements of cabbage to the above environmental factors should be given the natural circumstances of the crop ecosystem, because it is almost impossible to ensure optimal plant conditions they need. Technology can only regulate, to adjust or correct the values of environmental factors, specific measures, which means the establishment of optimal indices of some technological factors.

Also, if we take account the biological and genetic characteristics of the species, shows that this factor can be adjusted by proper choice of cultivars. All this reasons the topic conducting research, optimizing some technological factors of early organic cabbage crop in field conditions. Given the reasons stated, the subject under study is aimed at addressing a problem related to growing older white cabbage, but in the implementation of those measures and technological resources in a sustainable system growing, namely, the ecological system.

Choice of cultivars is one of the most important technological measures that we have to consider the establishment of vegetable crops, mainly due to the climate system in which production is obtained. It should be noted that choosing the most suitable cultivar for a particular vegetable area, does not increase the cost of production, or does it shall costs anything extra for the farmer.

Among the factors that depend on productivity and quality of vegetables is the most important cultivar because its biological and technological potential will be expressed in conditions of appropriate technologies (Stan, 1999, Ciofu, 2003, Munteanu, 2003).

On choosing the most suitable cultivar for head cabbage, will take into account the following criterion: climate and soil conditions, growing place, the goods: fresh consumption, industrialization, seeding dates, planting and harvesting period, resistance or tolerance to pests and diseases, adaptation to extreme environmental conditions, excessive temperatures, high salt tolerance levels, economic use of natural fertilizers, consumer preferences on appearance, taste, size etc.

Certainly, a cultivar can't have all these requirements, but depending on the goods and the requirement of both consumers and farmers preferences, will choose the most appropriate in the circumstances (Dejeu, 1997).

## MATERIAL AND METHODS

To achieve its purpose at "V. Adamachi "Teaching Station Iasi, between 2005-2008 has been made in the open field experience, the crop of white cabbage head, the proposed technological factors were studied by work objectives.

For achieving the goal, we plan to make a series of experiences for cabbage crop, with the following objectives:

A.1. The influence of cabbage cultivar on total production;

A.2. The influence of planting time on total production;

A.3. The influence of cabbage cultivar x planting time combinations for the total production;

The biological material used for early white cabbage crop was represented by cultivars, adapted to the microclimate of the NE area of Romania and achieve proposed objectives: Timpurie de Vidra (fig.1.), Dittmark, Golden Acre și K001 F1 (fig.2.);



**Fig. 1** - Early cabbage – Timpurie de Vidra (original)



**Fig. 2** - Early cabbage – K001 F1 (original)

The experimental designs used in the experiments were such bifactorial experiences adapted goals and objectives which have considered the following factors: cultivar and establishing time (Săulescu, 1967, Jităreanu, 1994).

Considering the importance studying factors in the growing technology, their ability to change, need to study a large number of repetitions each experimental factors, but also taking into account the possibilities of organizing experience for the first series of experience established hierarchy of factors, as follows:

1. A factor – cultivar, with four graduations: Timpurie de Vidra, Dittmark, Golden Acre, K001 F1;
2. B factor – planting time with three graduations: 01.04., 07.04., 15.04.

#### **Collection and processing the experimental data**

The trials field crop have been conducted according to technology arising out of the literature consulted (Stan, 2001; Ciofu Ruxandra, Stan N., 2004, Stoian L., 2005), regard being had to key technological measures: land choice, land preparation, crop establishment, the care and harvesting work.

The crop was performed on a level ground, well flattened for application of drip irrigation. The soil is a cambic chernozem leached medium, pelic, epicalcaric, well supplied in nutrients. Prepare the ground was done in stages, in autumn and spring, according to the literature.

Crop establishing was carried out by planting seedlings, at distances and periods specified as experimental variants, about 2 cm depth of above package. Harvested area of experimental plots covered the 30 plants.

The seedlings were produced in the UASVM Iasi greenhouse, at the discipline of vegetable growing, in the cellular trays, with trunk pyramid-shaped of 68 cm<sup>3</sup>. Harvesting was done manually, at best time of maturity for consumption, since by 10.06 to 15.07.

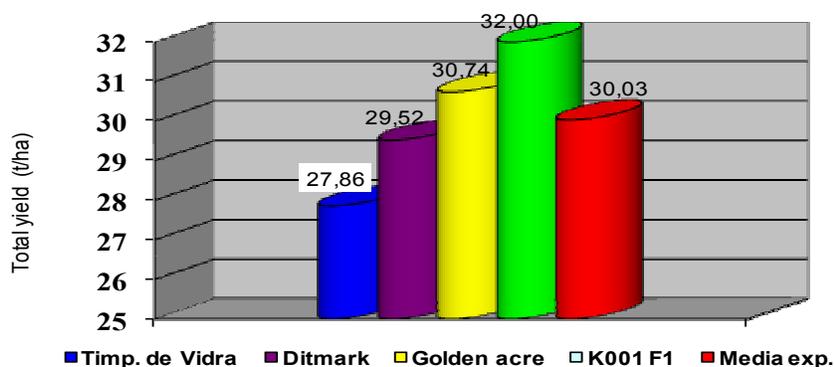
The experimental data collection was carried out observations and biometric measurements, according to the experimental technique used in experiments. The experimental variants were compared to with the average experience, the percentage reporting and differences. The influence of experimental factors was assessed using ANOVA. The significance of differences was assessed on the basis of differences limit for three degrees of confidence (95%, 99%, 99,9%) (Săulescu, 1967).

## RESULTS AND DISCUSSIONS

Regarding to the influence of cultivar on total yield of early cabbage crop, during 2006-2008, it ranged from 27.86 t / ha at Timpurie de Vidra to 32.00 t / ha on K001 cultivar.

As with differences obtained from the average experience, one can say that K001 F1 hybrid achieved a significant production, compared with the Timpurie de Vidra, which showed significant differences distinctly negative, respectively - 2.17 t / ha.

The biggest difference between the two cultivars was registered, if comparing the 001 cultivar with Timpurie de Vidra, the difference being 4.14 t/ha. (fig. 3).



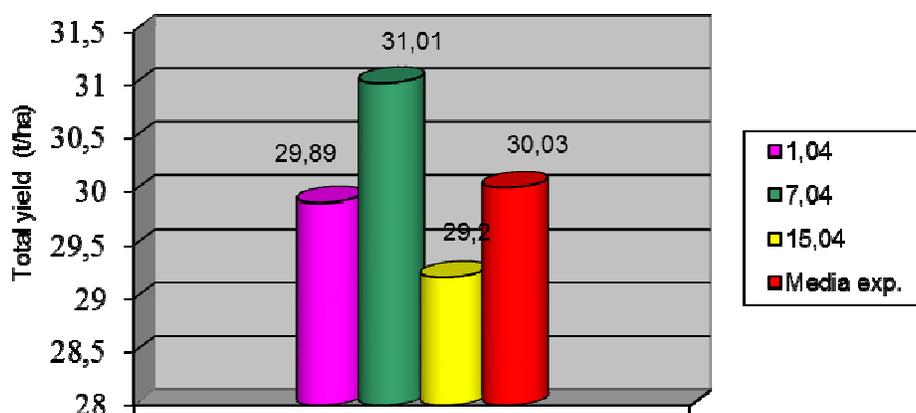
LSD 5%=1,46 t/ha,      LSD 1%=2,13 t/ha,      LSD 0,1%=3,69 t/ha.

**Fig. 3** - Graphic representation of the influence of cabbage cultivar on the early production

### **The influence of planting time on total production from early cabbage**

For early cabbage crop, the established periods have been established for the NE area of the country from: 01.04., 07.04., 15.04.

The results regarding to the influence of established time on early cabbage production are presented in table 2 and fig. 4.



LSD 5%=0,97 t/ha, LSD 1%=1,69 t/ha, LSD 0,1%=2,78 t/ha.

**Fig. 4** - Graphic representation the influence of planting time on early cabbage yield

Regarding to the establishing time on early cabbage production, we can say that it ranged from 29.89 t / ha from 31.01 t / ha. So, the planting time does not significantly influenced total production setting than in a very small extent.

The effect of interaction of cultivar and planting period on total production from early crop is shown in table 1. The results presented in the table confirm the interpretation given by the analysis of variance, with large and significant differences.

Table 1

**The influence of cultivar x planting time for early cabbages production (2006-2008)**

no.	Variant specification	Total yield			
		t/ha	% to the average	differences to the average (t/ha)	significance of differences
1	Timpurie de Vidra x 01.04	27,11	90	-2,92	00
2	Timpurie de Vidra x 07.04	28,99	97	-1,04	-
3	Timpurie de Vidra x 15.04	27,53	92	-2,50	0
4	Dittmark x 01.04	29,72	99	-0,31	-
5	Dittmark x 07.04	30,40	101	0,37	-
6	Dittmark x 15.04	28,43	95	-1,60	-
7	Golden Acre x 01.04	30,94	103	0,91	-
8	Golden Acre x 07.04	31,80	106	1,77	*
9	Golden Acre x 15.04	29,48	98	-0,55	-
10	K001 F1 x 01.04	31,80	106	1,77	*
11	K001 F1 x 07.04	32,84	109	2,81	**
12	K001 F1 x 15.04	31,36	104	1,33	-
x	Media experientei	30,03	100	0,00	-

LSD 5%=1,74 t/ha, LSD 1%=2,67 t/ha, LSD 0,1%=3,87 t/ha

In the total production, varied between 27.11 t/ha if Timpurie de Vidra was planted on 01.04., from 32.84 t/ha if K001 F1 cultivar, planted on 07.04. Commercial production difference obtained between the two combinations of factors was 5.73 t / ha. Positive differences to the average were obtained if K001 F1 cultivar, planted on 01.04. and cultivar Golden Acre, planted on 07.04.

The Dittmark cultivar production achieved exceeds the average experience when the planting time made at 07.04. Significant and distinct significant negative differences were obtained if the Timpurie de Vidra was planted at 01.04 and 15.04.

## CONCLUSIONS

1. Regarding to the influence of cultivar on total yield from early crop, during 2006-2008, it varied between 27.86 t / ha from Timpurie de Vidra up to 32.00 t / ha K001 cultivar.

2. In to set up period on early cabbage production, we can say that it varied between 29.89 t / ha to 31.01 t / ha.

3. Regarding the influence of cultivar and planting time on total yield, this varied between 27.11 t / ha if Timpurie de Vidra was planted on 01.04. to 32.84 t / ha at K001 cultivar, planted on 07.04.

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# **CUCUMIS METULIFERUS, A NEW ACCLIMATIZED AND BREEDED SPECIES AT V.R.D.S. BUZĂU**

## **CUCUMIS METULIFERUS, O SPECIE NOUĂ, ACLIMATIZATĂ ȘI AMELIORATĂ LA S.C.D.L. BUZĂU**

**VÎNĂTORU C.<sup>1</sup>, TEODORESCU Eliza<sup>1</sup>, ZAMFIR Bianca<sup>1</sup>**  
e-mail: costel\_vinatoru@yahoo.com

**Abstract:** *There were more activities concerning the acclimatization and breeding of this new species in different geographical areas from the origin area, whereas intensive studies were carried out after 1980, when the first concrete results were given to publicity. In our country the first research on studying this species started after 1990 at V.R.D.S. Buzău. During 20 years of studies and research of Breeding Laboratory in the station, the proposed objectives were reached. The station presently disposes of genetical adapted and diversified material for our country and also were elaborated specific crop technologies both for protected areas and open field. Also it detains a rich germplasm source composed of 8 genetical stabilized distinct lines and an enhanced amount of information concerning this species. L 1 was registered at I.S.T.I.S. Romania towards approval and patenting in 2012.*

**Key words:** acclimatization, breeding, segregation, phenotype, genotype.

**Rezumat:** *Preocupări pentru aclimatizarea și ameliorarea acestei specii în alte areale geografice diferite de zona de origine au existat de mult, însă în mod intensiv, după anul 1980, când au fost date publicității primele rezultate concrete. La noi în țară, cercetările privind studierea acestei specii au debutat la Stațiunea de Cercetare și Dezvoltare pentru Legumicultură Buzău după anul 1990. În cei peste 20 de ani de studii și cercetări în cadrul Laboratorului de Ameliorare al unității, obiectivele propuse au fost atinse. Unitatea dispune în prezent de material genetic adaptat și variat pentru țara noastră, au fost elaborate tehnologiile specifice de cultură pentru spații protejate și câmp, deține o bază solidă de germoplasmă compusă din 8 linii distincte stabilizate genetic și un volum mare de informații privind cunoașterea acestei specii. În anul 2012, L1 a fost înscrisă la ISTIS România în vederea omologării și brevetării.*

**Cuvinte cheie:** aclimatizare, ameliorare, segregare, fenotip, genotip.

## **INTRODUCTION**

*Cucumis metuliferus* is an annual herb with seed propagation, which can be cultivated in similar conditions as melons or cucumbers. The plant is native from Africa, Kalahari desert, successfully cultivated in tropical and subtropical regions, mostly in hot areas because the species does not tolerate low temperatures. This species is known under different names such as: “African horned cucumber”, “kiwano” in New Zealand, also with international spreading. It is also called “Jelly melon”, “melano”, “pikano”, etc.

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<sup>1</sup> Vegetable Research and Development Station Buzău, Romania

Breeding and acclimatization research of this species in other geographical areas were carried out in the past but intensively after 1980 year. This species is successfully cultivated in Kenia, New Zealand, Senegal, Somalia, Yemen, South Africa, Botswana, Zimbabwe, California, Israel, Australia, France, Spain, Japan, S.U.A. and even Croatia. In our country, research concerning acclimatization of this species have intensified after 1990 year. The first significant results were obtained at V.R.D.S. Buzău, at the Plants Amelioration Laboratory in 1996. A significant contribution has had prof. C. Petrescu from University of Agronomic Sciences and Veterinary Medicine of Bucharest.

The main objectives of this study were:

- acclimatization of this species in Romania;
- applying the specific crop technology for protected spaces and open field;
- breeding of this species in order to obtain new varieties with different phenotypical characters.

## **MATERIAL AND METHOD**

Biological material utilized in this study was purchased from the native area of the plant in 1992 when the research started. The species showed genetical potential and high adaptability to the climatic conditions of our country, especially in protected areas. After many studies and research, in 1996 was elaborated the crop technology and were obtained the first significant results concerning acclimatization and cultivation.

The main features of the studied biological material are:

- Vigorous annual plant, with climbing and trailing stems;
- Strong root system with large roots, resistant at breaking, slightly elastic and in drought conditions explores deep the soil.
- The stems reach 2-3 m length covered with stiff, bristly hairs. The stem has single tendrils of 4-10 cm.
- The leaves are altern ovate or slightly pentagonal with a stalk of 3-12 cm.
- The flowers are monoecious, single or two grouped at the leaf axil. There are two types of flowers, staminate flowers typically appearing several days before pistillate flowers. After pollination the flowers dry and die. The pistillate flowers are larger and have an inferior ovary tiny fruit shaped at the corolla base covered with rough spines.(fig. 1 și 3)
- Fruits are elongated, slightly cylindrical, 6-16 cm long, 3-9 cm diameter. These are tapered ends covered with strong spiny out-growth of 1-1,5 cm long, dark green spotted specific colour and turns into bright yellow at physiological maturity with highlighted circles around spines. The fruits are covered with bloom along the entire vegetation period. After harvest shelf life is very long. If the ripened fruits are not crushed, their shelf life can be 360 days, practically from one year to another. The fruit is pendulous hanged by a resistant thin stem, 2-7 cm. (fig. 2).
- The seeds are ovate, smaller than common cucumber seeds, 3-5 cm long and 3-4 mm width, with round ends, flattened, covered with a bright fine down.



**Fig. 1** – Female flower ( ♀ ) → **Fig. 2** – Fruit evolution ← **Fig. 3** – Male flower ( ♂ )

These species crop technology is similar with common cucumbers crop technology. In this study were used two variants to set up the culture: by seedling and direct sowing. The two variants demonstrated effectiveness both in protected ground and open field. The cucumber plants were distributed in rows spaced 1,4 m apart and 40-50 plant spacing in open field and 50-60 cm for protected ground. Both for open field and protected ground, a particular attention should be paid on climbing plants vertically on strings. If the plant grows horizontally on the ground, the results are not conclusive. Care works are similar with the ones for common cucumbers, only that this plant is far more resistant at pathogens, pests and diseases attack and needs few treatments. Therefore, we registered the main phenological and yield data (tab. 1).

*Table 1*

**The main phenological and yield data obtained**

Culture systems	Sowing date	Spring date	Bloom date	Green fruits	Yellow fruits	Harvest	Yield t/ha
<b>Greenhouse</b>	5.04	12.04	15.06	25.07	10.08	1.09	42
<b>Open field</b>	10.05	22.05	18.07	20.08	12.09	25.09	21

Concerning breeding, although was started from a single phenotype which showed genetical stability for six years after applying conservative selection correctly and segregation appeared because of the environment stress, especially in greenhouse. After a careful evaluation and lineage examination of the main characters, were obtained eight new distinct phenotypes and a number of eliminated intermediary forms. The eight obtained families were separated and lineage studied for many years.

## RESULTS AND DISCUSSIONS

The proposed objectives of this study have been met. The species was acclimatized successfully in our country, it could be cultivated all over the country in protected ground or open field in hot areas, especially south regions. Concerning crop technology, this plant does not require special treatment, it can be cultivated in many technological variants in what concerns culture setting.

The species can be cultivated in ecological system. A special attention should be paid to nutrition and development space required and vegetation factors optimal ensuring, especially temperature and sunlight. Breeding works ended obtaining distinct phenotypical expression at eight new genotypes as regards fruits characters (tab. 2). The main fruits characters of the new obtained families are presented in tab. 3.

Table 2

Fruit details of new obtaining biotypes

Line	Longitudinal section	Cross section
 <p>L 1</p>		
 <p>L 2</p>		
 <p>L 3</p>		
 <p>L 4</p>		
 <p>L 5</p>		
 <p>L 6</p>		
 <p>L 7</p>		
 <p>L 8</p>		

Table 3

## The main fruit characters at new obtained families

Studied character/ Line	L 1	L 2	L 3	L 4	L 5	L 6	L 7	L 8
<b>Fruit weight (g)</b>	338	96,6	157,5	321	358,6	278,9	301	370
<b>Fruit length (cm)</b>	12	6	11	17	16	12	12	11,4
<b>Fruit diameter (cm)</b>	7,2	5,5	5,7	6	10,2	6,7	6,6	7
<b>Pericarp thickness (mm)</b>	6	4	3	5	6	6	6	6
<b>Spines length (mm)</b>	6	2	7	4	4	5	6	5
<b>Spines no./fruit</b>	42	38	68	62	42	66	65	52
<b>Fruits no./plant</b>	22	41	34	25	20	29	24	18
<b>Ribes no./fruit</b>	weak	absent	absent	weak	present	weak	present	present
<b>Bloom degree</b>	medium	medium	strong	medium	medium	strong	medium	medium
<b>Unripened fruit colour</b>	Spotted green	Spotted green	Dark green	Spotted green	Slightly striped	Dark green	Light green	Spotted green
<b>Ripened fruit colour</b>	orange	yellow	orange	Yellowish orange	Yellowish orange	orange	orange	Spotted orange
<b>Seed no./fruit</b>	406	82	209	214	194	339	517	400
<b>Seed weight/fruit</b>	5,5	1	3,3	3,2	3,3	5,2	7,9	6,3

## CONCLUSIONS

1. *Cucumis metuliferus* was acclimatized for climatic conditions of our country and can be cultivated in all country areas but not allowing decreasing temperature under 12 °C and under 8 °C when seed germination is completely inhibited.

2. In our country climatic conditions it manifests as medium late plant with 110 days vegetation period.

3. Because of the valuable genetical heritage it can be cultivated ecologically. New obtained lines seeds were promotional distributed to all over the interested country growers.

4. The research will continue aiming breeding for obtaining new valuable genotypes.

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# NEW AGROTEHNICAL PROCEDURES FOR IMPLEMENTATION IN ORCHARDS

## PROCEDEE AGROTEHNICE NOI PENTRU APLICARE ÎN LIVEZI

**BOGDAN I.<sup>1</sup>**

e-mail: psava2110@rambler.ru

**Abstract:** *In the article it described the new processes: of the directional formation of the roots is provided by the limitation of their blocking off their expansion through with a plastic film and their cutting, cultivation of the soil by using stimulation of the cutting of the roots.*

**Key words:** Perennial plant, roots, blocking, cutting, mulching soil.

**Rezumat.** *În prezentul articol se descrie un procedee noi: formarea direcționată a sistemului radicular la plantă prin limitarea mixtă și eșalonată pe ani a răspândirii radiale a rădăcinilor orizontale, și anume, în anul plantării în dreptul tulpinei plantei cât și de prelucrare a solului cu scopul stimulării creșterii rădăcinilor prin tăierea periodică a lor.*

**Cuvinte cheie:** plante multianuale, rădăcini, limitarea, tăierea, mulcirea solului.

### INTRODUCTION

If the care of the aerial part of the multi-party plant is direct, meaning that the agrotechnical procedures directly acts on the organs of the plant, then the part in the ground they can influence only through the soil. Hence, the energy costs required to care for their root systems are doomed to be incomparably greater than those of crown care, for example the tree. On the other hand, biological and economic effects of agro-technical processes are more delayed and less sentient when relations between horticulture and plant are mediated by something (soil) compared with the case when it lacks such mediation.

Economic and organizational conditions that are characteristic for this stage of development of horticulture strongly require the rationalization of the technologies of growing perennial. The most important reserves in this aspect are hidden in the complex agrotechnical processes related to soil. It is obvious that technological operations of maintenance (care) of the land should be directed not all over the land that the plantation occupies (as practiced today), but only on certain portions (strips). Only thus can obtain a substantial reduction in expenses of any kind. Decisive circumstance that compels us to tackle the problem in this particular argumentative context is the extremely high prices of fuels and lubricants.

As you know, horizontal roots of plants tend to grow rapidly in the soil all over the land available to plant, according to distance planting, "leaving behind"

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<sup>1</sup> Scientifico-Practical Institute of Horticulture and Food Technologies, Chișinău, Republic of Moldova

significant soil layers unused that only after many years after planting, they will necessarily occupy. Horticulturalist, however, can interfere with the formation of roots for the optimization (and compliance) architectonics root system taking into account new requirements ahead of agrotechnical procedures that are used in plantations.

Actually possible given the required characteristics of root systems by limiting the spread of radial roots in the early years after planting. Summary of the process of training directed to the root system is to use the following phenomenon: if the limitation is part of radial spreading horizontal roots, the plant is forced to push the development and spread of other parts of horizontal roots. This results in straightening roots spread in certain directions and soil layers and strips of land where the action is expected to concentrate the care of the plantation agro-technical measures.

An important part of the complex of agrotechnical measures, used in orchards, is the soil management. If you care to tree crowns from a technology perspective, is adjusted relatively well to the requirements of the developing stage of fruit growing, the soil processing still requires considerable research efforts to rationalize. Priority direction of improving the technology of tillage must be determined taking into account the need to halt the loss of humus in the soil from excessive processing of the orchards.

Therefore, growers vision researchers, the first priority now is solving the problem of minimizing soil processing.

This article includes description of agro-technical processes: training targeted to the perennial plant root system (Z 157 patents MD 2010.03.31), tillage in perennial plantations (Case no. 6730 AGEPI of Moldova from 27.10.2010 to grant a patent).

## **MATERIAL AND METHOD**

During the elaboration of agrotechnical procedures were used plastics such as polyethylene film and plant debris. Their achievement has been the application of agricultural machines produced in series. They also used specific research methods and analysis of fruit growing literature required for certification.

## **RESULTS AND DISCUSSIONS**

### **Directed training process of the plant root system.**

The problem solved by the process, the invention is to simplify technology training targeted to plant root systems and the extraction of ground at the end of the operation of the plantation, the polythene used as limiter display horizontal roots.

Summary of the process, which removes the disadvantages mentioned above, the invention is directed formation of the plant root system by limiting mixed and spread over years of radial spreading horizontal roots, namely, in planting the right plant stem from remoteness 25 - 30 inches of it buried in the soil vertical screen crescent shaped limiter (height 60 cm, width 75 cm and 8

cm thick), and since year six after planting, then every three years, the limit applies cutting horizontal roots. However, limiting screen is made of polyethylene and filled with plant debris in a package, until the end of the operation of the plantation, rot and provide substantial relief without digging and full manual extraction of the film avoiding soil pollution pieces of plastic. In turn, shaped package limitation screen is manufactured using a rectangular wooden boxes in which to install polyethylene film, which then is filled with plant debris soft stuff, already formed after the package is extracted from the box.

Claimed process provides considerable decrease in energy expenditure by decreasing 3 times the amount of polyethylene used as screen limitation and reduction of 2 times the number of cutting operations by limiting the roots.

The result is a higher level of control over the conditions for growth and development of plants, increase productivity and considerable decrease in the cost of agricultural production.

The procedure is performed as follows. First, the time limitation are made screens. The rectangular wooden box install polyethylene. The cavity thus formed is filled with soft vegetable scraps, then forms package, which will act as screen limitation, which has the following dimensions: height-60 cm, width-75 cm, thickness-8 cm. When planting the plant in the planting hole to install screen vertically limited to 25-30 cm away from it. After sealing the grave soil and tamp it down takes time structure (texture) should be kept operating throughout the plantation. Horizontal roots of the plant, reaching limiting screen, walk around him. Thus they are forced to locate the volumes (layers) of soil in the area established by planting strips of land which are targeted to expand. The horizontal roots coming out of the perimeter strip is subject to mechanized harvesting (applying machine type, Vibrolaz-80E ") than every three years since six plants after planting. Under certain technological scheme for implementing this process called targeted training to avoid cutting the root system roots thicker than 10 mm (agrotechnics requirement in force and which aims to minimize stress caused plant). If no such limitation applies in planting screens would need to start cutting limiting horizontal roots from the third year after planting and more often (than every two years) to meet the above requirement of agricultural technique. Towards the end of the operation of the plant remains plantation screens limiting decay forming a nearly empty cavity that is easily and without digging manually, fully extracted polyethylene film avoiding soil pollution with plastic pieces.

#### **Method for processing multi-plantation soil.**

The problem solved by the process is: avoid excessive decomposition of humus in the soil and thereby ensure the stabilization of humus content of soil fertility dependent, reducing costs of care in planting soil, simplifying interpretation of agricultural technology, raising the plant responsiveness agrotechnical measures applied, using the full potential fertility of the soil by plants.

Summary of the process, which removes the disadvantages mentioned

above according to the invention, consists in that in order to minimize soil in plantation processing multi-processing is carried out soil to stimulate root branching horizontal grower use mass produced, which is adapting the installation frame with a passive knife on the edge, which cut the roots at the depth of 40 cm, and the knife with the distance of 5 cm to install two blades rippers that scarify the soil to a depth of 30 cm before securing the realization of such tillage in strip width 55 cm.

Tillage to stimulate root branching parallel horizontal row of plants is made only in years 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23 and 25 after planting the plant line following the line distance: year 3 to 0.5 m, year 5 to 0.7 m, year 7 to 0.9 m, year 9 to 1.1 m, year 11 to 1.3 m, year 13 to 1.5 m, year 17 - 1.9 m, year 19 to 2.1 m, year 21 to 2.3 m, year 23 to 2.5 m, year 25 to 2.7 m. Last working to stimulate the horizontal roots branching out depending on the distances between rows of plants in coming years from their planting as follows: the distance between rows 8 m - in 25, 7 m - in 23, 6 m - year 21, 5 meters - in 17, 4 m - in 15, 3 m - in 13.

The process, if the orchard planting distances 5 x 3 m is achieved as follows.

First, for performing the procedure, accommodate one of the cultivators in series production for perennial plantings, such as KSG - 5 (Ru), KSM 5 (Ru) and PRVN (Ru), depending on the distance between rows of plants. The accommodation consists in that the grower elected to the frame to install passive knife (or cultivator equipped with knife function to exclude deviations from the direction of motion, it changes with the particular), which can cut the roots depth of 40 cm and two scarifiers blades from the cultivator equipment and for each the working width is 24 cm. The distance between the knife and the first scarifier leg is 5 cm. Thus adjusted, the cultivator can perform scarification to stimulate branching in the strip of land with the width of 55cm. The knife cut the roots up to 40 cm depth and scarify soil paws up to 30 cm depth by creating conditions that stimulate an additional branches (due to the facts that : the action of roots falling knife which is thicker than 5 mm wich regenerates easy and guaranteed by designing the branch in November, is loosen up the soil) more often, horizontal roots.

Scarification is carried over each year fall in October, or spring, as soon as soil physical condition allows, starting from the third year after planting. Strip of land where the soil is subject to special scarification to stimulate root branching horizontal moves each time (over each year), to the center of the interval between rows of plants at a distance 20 cm. Thus, if the distance between rows plantations of 5 m, scarifying the soil to stimulate root branching is performed parallel to the row following the row line distances in those years after planting plants: year 3 to 0.5 m, year 5 to 0.7 m, year 7 to 0.9 m, year 9 to 1.1 m, year 11 to 1.3 m, year 13 to 1.5 m, year 17 to 1.9 m. Last tillage to stimulate horizontal roots branching out depending on the distances between rows of plants in the years after planting as follows: the distance

between rows 8 m - in 25; 7m - in 23, 6 m - in 21, 5 meters - in 17, 4 m in 15, 3 m - in 13. After these years of the process, horizontal roots spread radially freely, not further subject to regular cutting. Following soil scarification to stimulate root branching system, for example the tree, acquires a specific architecture. Root of the skeleton placed in 10-30 cm soil layer, the subject cut in the 3 year after planting, thereafter evolves by growth in a branch system, which is extremely high, often lies in the soil layer 10-40 cm - the most fertile layer. This circumstance is residing with positive processes of plant growth and fruition, because it improves plant nutrient provision. However, plants possess and skeleton roots, semi-horizontal frame, which were not subject to the branch cut in 40-60 cm soil layer.

Some of the roots of skeleton branches are oriented mainly to the ground, others are aimed at soil depths. In case of excessive drought can rely on plant roots located in the deeper soil layers, which are relatively wetter than the superficial layers. In plantations where the expected application of this procedure every year, instead of the usual deep plowing (18-20 cm) in autumn shallow processing is applied by the autumn planting or cultivation depth of 6-8 cm. In October, the first interpretation is performed scarification technology described above, and then, immediately or over several days the cultivation of the soil surface to a depth of 6-8 cm, the full width of the interval between rows. To do this procedure can accommodate large cultivators with working width (3.0 to 3.5 - 4.0 to 4.5 m) that can be deep soil scarification to stimulate branching roots while growing superficial of the full width of the interval. Because the replacement of ordinary deep plowing, which provides returning arable layer with the surface treatment that provides no return layers (cultivation, harrowing), is reached to avoid excessive decomposition and humus content of the soil to stabilize the multi plantation.

## CONCLUSIONS

Agrotechnical procedures directed training new root systems and tillage in order to stimulate growth by cutting regular roots, can be applied not only in apple orchards and to other tree species. So they can be applied in vineyards, forest and dendrological.

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# SHOOTS AND LEAFS GROWTH RESPONSES TO LIGHT MICROENVIRONMENT AND SUBSTRATE IN RASPBERRY AND BLACKBERRY CULTIVARS

## INFLUENȚA CONTROLULUI LUMINII ȘI A SUBSTRATULUI DE CULTURĂ ASUPRA CREȘTERII LĂSTARILOR ȘI FRUNZELOR LA UNELE SOIURI DE ZMEUR ȘI MUR

*DASCĂLU M.<sup>1</sup>, CĂULEȚ Raluca<sup>1</sup>, MORARIU Aliona<sup>1</sup>,  
NEGREA Roxana<sup>1</sup>, PASCU D.<sup>1</sup>, SFICHI-DUKE Liliana<sup>1</sup>*  
e-mail: mdascalu2000@yahoo.com

**Abstract:** *Raspberry and blackberry bush are cultivated species in the North East of Romania, but the two species occupy small areas and small productions are recorded. For this reason, the discipline of Fruit Trees culture has conducted an experiment to determine the most appropriate technological chains for raspberry and blackberry bushes, and that cultures to become profitable.*

**Key words:** *Raspberry, Blackberry, Technological chains*

**Rezumat:** *Zmeurul și murul suntr specii cultivate în yona de Nord Est a României, dar cele 2 specii ocupa suprafețe reduse, iar producțiile înregistrate sunt mici. Din acest considerent, în cadrul disciplinei de Pomicultură s-a realizat un experiment pentru a stabili cele mai adecvate verigi tehnologice, astfel încat cultura zmeurului și murului sa devina rentabilă*

**Cuvinte cheie:** *zmeur, mur, agrotehnica*

### INTRODUCTION

The dependence of shoot behavior and leaf area on light microenvironment and substrate was examined in three cultivars of red raspberry (Opal, Cayuga and Ruvi) and two cultivars on blackberry (Thornfree and Lochness), growing on an experimental field from June to October 2011.

Plants were cultured in two conditions of light, namely 100% sunlight and 25% sunlight and two conditions of growth substrate, namely soil and a soil/peat mixture. Several parameters such as leaf area, number of shoots, and number of leaves per shoot, photosynthetic pigments and photosynthetic capacity were analyzed. All raspberry cultivars developed larger leaves on a soil/peat mixture than on soil (Pritts et al., 1999).

Contrary, blackberry cultivars showed smaller and less leaves on a soil/peat mixture than on soil, mainly in shade conditions (Hanson et al., 2005). Among raspberry cultivars, Opal showed the highest number of shoots in full sunlit on a soil/peat mixture. Genotypic variations in the accumulation of photosynthetic pigments and photosynthetic capacity in response to substrate

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

and light in response were also found. The significance of light and substrate conditions on raspberry and blackberry growth and development is discussed (Yao and Rosen, 2011).

## MATERIAL AND METHOD

The experience was made, from 2011, in the experimental field of Fruit trees culture.

The species studied were:

1. Raspberry with varieties: Opal, Cayuga and Ruvi

2. Blackberry with varieties: Thornfree and Lochness

Both varieties have been grown on and a mixture of soil - peat (50:50) , both under natural light conditions as well as shading ( shade net ) (25 %).

Each variety was an experimental variant, and for each was taken 5 repetitions.

Biometric measurements were made on leaf size, number of shoots per plant, average number of leaves on the shoot. Also, to plant photosynthetic capacity expressed by determining spectrophotometric of chlorophyll (Lichtenthaler method) and photosynthesis rate with your LiCOR 2000.

## RESULTS AND DISCUSSIONS:

Analyzing the number of shoots emitted at variety Cayuga could observe that when using soil - peat substrate, their number and number of leaves on the shoot are similar. In daylight conditions, appeared more shoots when using soil as substrate and leaf number increased when the amount of light was diminished (fig. 1 and 2).

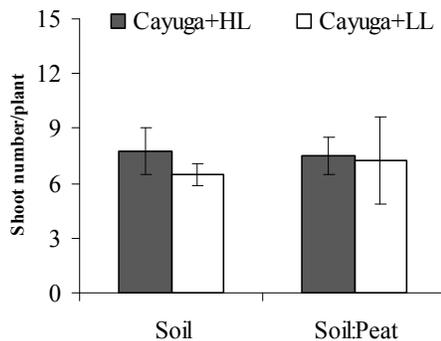


Fig.1 – Shoot number/plant-Cayuga variety

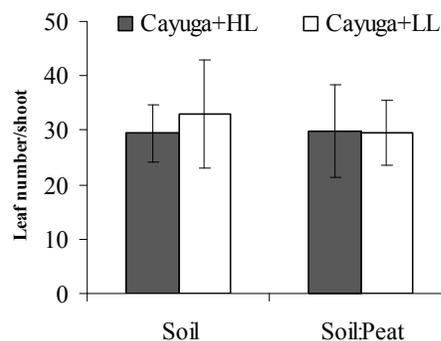


Fig. 2 – Leaf number/shoot-Cayuga variety

For the variety Opal can be seen a significant increase in the number of shoots in case of plants grown in soil-peat substrate. Number of leaves on shoots was higher in case when the light was diminished (fig. 3 and 4).

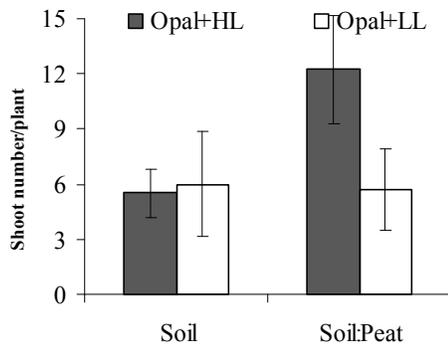


Fig. 3 – Shoot number/plant-Opal variety

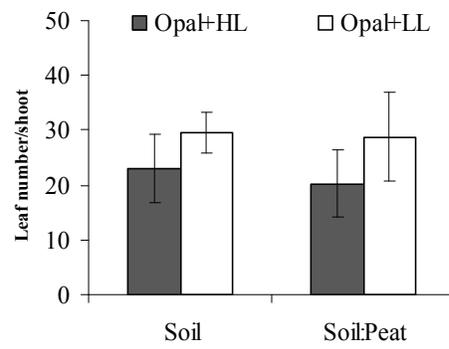


Fig. 4 – Leaf number/shoot-Opal variety

Variety Ruvi reacted in the same way at the light factor on both types of substrate. Both leaf number and shoot length were higher in reduced light (fig. 5 and 6).

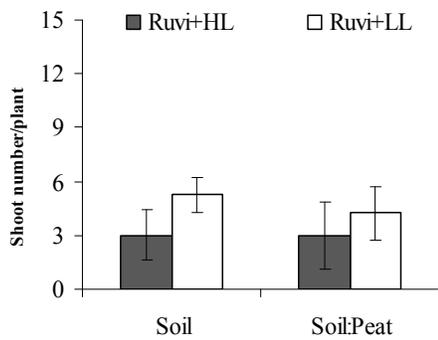


Fig. 5 – Shoot number/plant - Ruvi variety

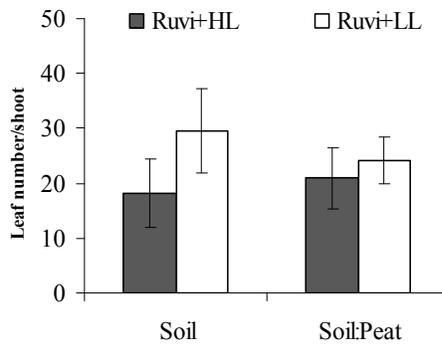


Fig. 6 – Leaf number/shoot - Ruvi variety

For blackberry, the variety Lochness shoots number was lower when compared to normal soil cultivation on the version that the light was dimmed, and in case of soil - peat substrate, the phenomenon is reversed.

Number of leaves was higher in soil cultivation variant with natural light (fig. 7 and 8).

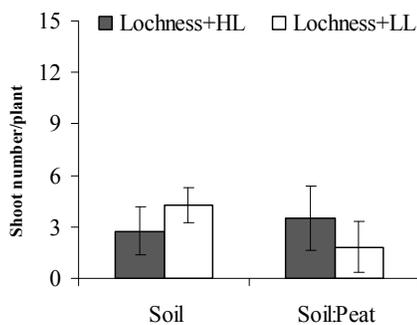


Fig. 7–Shoot number/plant-Lochness variety

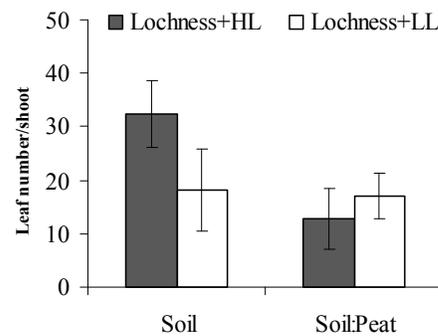
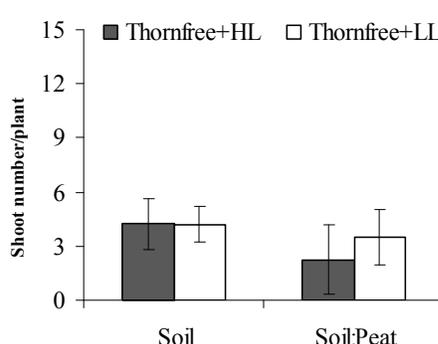
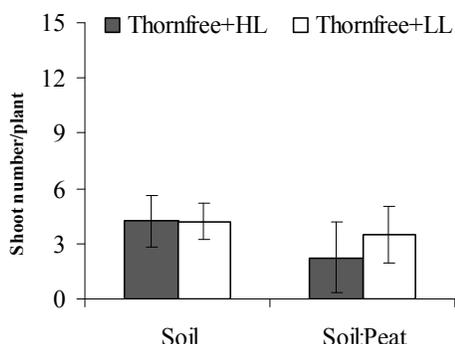


Fig. 8–Leaf number/shoot-Lochness variety

Variety Thornfree recorded approximately the same values for the number of shoots on the ground cultivation. For shading, the number of shoots on soil - peat substrate was higher. Leaf number was relatively equal for cultivating the soil, and their number increased in shade (fig. 9 and 10).



**Fig. 9**–Shoot number/plant-Thornfree variety **Fig. 10**–Leaf number/shoot-Thornfree variety

## CONCLUSIONS

1. Both species and all varieties have different reactions depending on the substrate used and how enlightening the aerial part.

2. In low light conditions, is recommended Opal and Ruvi raspberry varieties cultivation, they managed to form a vegetative biomass to compensate the absence of this factor.

3. Cayuga raspberry variety and blackberry varieties are recommended to be grown in sunny areas, on all soil types.

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# STUDY ON RATIONAL USE OF HERBICIDES IN INTENSIVE PLANTATIONS OF APPLE

## STUDIU PRIVIND UTILIZAREA RAȚIONALĂ A ERBICIDELOR ÎN PLANTAȚIILE INTENSIVE DE MĂR

*ISTRATE M.<sup>1</sup>, CÂRDEI E.<sup>2</sup>, DASCĂLU M.<sup>1</sup>, PRISECARU L.<sup>2</sup>*

e-mail: mistrate@uaiasi.ro

**Abstract:** Experience was organized during 2009 - 2010, at SCDP Iasi research base (Velnița), in intensive apple plantation, located on land with low slope, on cambic chernozem soil type. Dicotyledonous weed species with highest frequency are: *Amaranthus retroflexus*, *Chenopodium album*, *Convolvulus arvensis*, *Taraxacum officinale*, *Sonchus arvensis*, *Polygonum ssp*, *Stellaria media* and *Cirsium arvense*. Monocotyledonous species of very high frequency meet: *Elynes repens*, *Echinochloa crus-galli*, *Sorghum halepense*, *Digitaria sanguinalis*, *Cynodon dactylon* and *Setaria glauca*. The selective herbicides used and studied was: Roundup, Touchdown Sanglypho and were well tolerated by apple species. There were no reported symptoms of phytotoxicity in any variant or variety (note 1 EWRS scale). In terms of effectiveness (degree of destruction of weeds) best results has the experimental variants were noted V3-herbicide + -mechanical works, where weed control was 94.6% grade 1-2 EWRS scale and V6 herbicide Touchdown System with 3 l / ha.

**Key words:** technology, system maintenance soil, apple, herbicides

**Rezumat:** Experiența au fost organizată în perioada 2009 – 2010, la Baza de cercetare – dezvoltare Velnița a S.C.D.P.Iași, într-o plantație intensivă de măr, amplasată pe un teren cu pantă redusă, pe un sol de tip cernoziom cambic. Dintre speciile de buruieni dicotiledonate cu frecvența cea mai ridicată sunt: *Amaranthus retroflexus*, *Chenopodium album*, *Convolvulus arvensis*, *Taraxacum officinale*, *Sonchus arvensis*, *Polygonum ssp.*, *Stellaria media* și *Cirsium arvense*. Dintre speciile monocotiledonate cu frecvență foarte mare se întâlnesc: *Elynes repens*, *Echinochloa crus-galli*, *Sorghum halepense*, *Digitaria sanguinalis*, *Setaria glauca* și *Cynodon dactylon*. În ce privește selectivitatea erbicidelor s-a constata că erbicidele luate în studiu: Roundup, Sanglypho și Touchdown au fost bine tolerate de specia măr. Nu au fost semnalate simptome de fitotoxicitate în nici o variantă sau soi (nota 1 pe scara EWRS). Sub aspectul eficacității (grad de distrugere a buruienilor) dintre variantele experimentale s-au remarcat V<sub>3</sub>, unde controlul buruienilor a fost de 94,6 % nota 1-2 pe scara EWRS și V<sub>6</sub> erbicidul Touchdown.

**Cuvinte cheie:** tehnologie, sistem de întreținere a solului, măr, erbicide

### INTRODUCTION

The main purpose of using herbicides in fruit growing is their effectiveness on weeds. The application of herbicides in years with heavy

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

<sup>2</sup> Research and Development Station for Fruit Tree Growing of Iași, Romania

rainfall on weeding land protects the culture of weed competition in critical periods in which the mechanic methods are not possible (Perianu, 2004; Prica and Prica, 1984)

In fruit growing there are used large amounts of organic fertilizers, from the preparatory work of land, at planting and fazial fertilization during fructification period. Whenever such fertilizers are used, occurs a strong weeding, in the fertilized plantations appear weed species usually difficult to refute such as *Agropyron repens*, *Cirsium arvense*, *Convolvulus arvensis* etc. (Lazar, 1974; Platon and Dumitrache, 1990).

Since the range of herbicides in recent years has become much diversified, the SCDP Iasi, between 2009-2010, has experienced a number of herbicides for weed control in apple orchards.

## MATERIAL AND METHOD

The experiments were held during 2009 – 2010, at the research base – Velnița development centre, SCDP Iași, in an intensive apple plantation, located on land with low slope, soil type on cambic chernozem.

Biological material was represented by two apple varieties: Golden Delicious and Idared, grafted on MM 106. Planting distance were 4 x 4 m, with a density of 624 trees/ha. Crown shape: oblique arms palmate.

Variants experience:

V1 – untreated-manual work;

V2 – untreated-mechanical works;

V3 – Herbicide + mechanical works;

V4 – Herbicide Roundup 3 l / ha;

V5 – Herbicide Sanglypho 4 l / ha;

V6 – Touchdown herbicide System 3 l / ha.

Herbicide application was made with the vermorel, on a band of 1.2 to 2.0 m width, when the weeds have reached 10-15 cm height. There were used 150 l/ha solution.

Climatic conditions were different in the years 2009-2010 as a whole, creating a favourable development of the main groups of weeds. Overall average monthly temperatures in April-September period were within the normal range, except some absolute maximum recorded in July and August which exceeded 35° C.

Yearly average temperature was 9.6° C and yearly precipitation totalled 520 mm. The plantation has a gentle land slope of 3.5% average soil is chernozem leached without irrigation possibilities. Soil system maintenance between tree rows was black field alternating with grass bands. On the tree row there were used herbicides. Weed mapping itself is determining the number of weeds per m<sup>2</sup> (metric frame with side 1 m) in 4 repetitions diagonal plot (10 determinations from 1 ha) and gravimetric method. Weeding degree was expressed as a percentage of the number of weeds per m<sup>2</sup> or as weed dry weight per m<sup>2</sup> to the maximum number or weight of weeds registered in the version that received no treatment.

## RESULTS AND DISCUSSIONS

***Data on weed mapping in apple orchards:*** Mapping is determining the number of weeds on m<sup>2</sup> and helps us to know the species, weed associations and groups that will determine the dominant biological control measures.

They also offer important information on: weeding forecast, herbicide rotation, herbicide or combination of herbicides, monocotyledonous and dicotyledonous weeds ratio, annual and perennial weeds. Also it highlights the presence of large groups of perennial weeds that can be controlled by special methods, limited to those areas.

The determinations made in the experimental plot found that monocotyledonous weed species represent 40% and dicotyledonous 60%. Dicotyledonous weed species with highest frequency are: *Amaranthus retroflexus*, *Chenopodium album*, *Convolvulus arvensis*, *Taraxacum officinale*, *Sonchus arvensis*, *Polygonum ssp*, *Stellaria media* and *Cirsium arvense*. Monocotyledonous species of very high frequency we found: *Elynes repens*, *Echinochloa crus-galli*, *Sorghum halepense*, *Digitaria sanguinalis*, *Cynodon dactylon* and *Settings glauca*.

In the second half of the vegetation period a new generation rises from seeds of annual weeds, dominated by: *Digitaria sanguinalis*, *Amaranthus retroflexus*, *Solanum nigrum*, *Chenopodium album* and others species which if not removed will disseminate a huge number of seeds hard to controlled in coming years.

**Data on the efficacy of new herbicides in weed control:** In the experiments performed there were used the following herbicides: Roundup, Touchdown Sanglypho and that have the same active substance (glyphosat), but with a different trade name depending on the origin.

Concerning the herbicides selectiveness there was found that the studied herbicides: Roundup, Touchdown and Sanglypho were well tolerated by apple specie. There were no reported symptoms of phyto-toxicity in any variant or variety (grade 1 on EWRS scale) (table 1).

In terms of effectiveness (degree of weeds destruction) from the experimental variants V3 stands out, where weed control was 94.6%, grade 1-2 on EWRS scale and V6 - Touchdown herbicide.

At Touchdown herbicide, the active substance translocation process from plant to rhizomes occurs slowly compared with the other two products.

After 40 days from the application appeared some annual weed from seeds. Roundup herbicide has very good efficacy against perennial weeds, after its application recovers some annual weed seed species that invade the land.

Optimal use of herbicides within their minimum and maximum limits approved by eliminating trends of unjustified overdose, spare us of the waste and negative impact on the environment (table 1). Products used for weed control efficacy was assessed by grades from 1-9 according to EWRS scale.

Tree-weed competition when out of control, especially when infestation with "weed problem" is over 30%, although the negative effect is not immediately visible, lower fruit production, trees are suffering, especially during critical periods (binding fruit, intense growth of shoots, fruit maturation) and yields will be of lower quality and quantity. During experimental fruit harvest was reduced due to weed-problem

infestation and high degrees of weeding, note 9 on EWRS scale recorded in V1-untreated variant, 30% decrease.

Table 1

**Influence of soil maintenance methods on the row og trees upon the production, selectivity and efficacy of weed control in apple orchard**

Variants	Dose l/ha	Time of application	Notes EWRS		Weeds control	
			Select.	Effect	Annual	Perennial
<b>Golden Delicious</b>						
V <sub>1</sub> Untreated + manual work	-	-	-	1	100.0	92.0
V <sub>2</sub> Untreated + mechanical work	-	-	-	1	98.0	90.3
V <sub>3</sub> -sprayer + mechanical work	3.0	Postem.	1	1	100.0	98.0
V <sub>4</sub> -sprayer with Roundup	3.0	Postem.	1	1	100.0	96.4
V <sub>5</sub> - sprayer with Sanglypho	4.0	Postem.	1	1	100.0	98.4
V <sub>6</sub> - sprayer with Touchdown	3.0	Postem.	1	1	98.2	88.1
<b>Idared</b>						
V <sub>1</sub> Untreated + manual work	-	-	-	1	98.4	92.0
V <sub>2</sub> Untreated + mechanical work	-	-	-	1	95.2	81.6
V <sub>3</sub> -sprayer + mechanical work	3.0	Postem.	1	1	100.0	98.8
V <sub>4</sub> -sprayer with Roundup	3.0	Postem.	1	1	95.6	94.6
V <sub>5</sub> - sprayer with Sanglypho	4.0	Postem.	1	1	100.0	98.8
V <sub>6</sub> - sprayer with Touchdown	3.0	Postem.	1	1	98.5	90.3

There are not big differences between experimental variants concerning the obtained average production in the two apple varieties studied, between variants of herbicide soil system maintenance and control variant based mainly on manual work.

Table 2

**The influence of soil system maintenance methods on fruit production and quality**

Variants	Average production t/ha	Quality /t	
		Extra+quality I	II <sup>nd</sup> quality
<b>Golden Delicious</b>			
V <sub>1</sub> Untreated + manual work	26.34	17.97	8.37
V <sub>2</sub> Untreated + mechanical work	24.8	17.70	7.1
V <sub>3</sub> -sprayer + mechanical work	27.50	21.01	6.49
V <sub>4</sub> -sprayer with Roundup	26.22	18.03	8.19
V <sub>5</sub> - sprayer with Sanglypho	27.10	19.88	7.22
V <sub>6</sub> - sprayer with Touchdown	26.12	19.97	8.15
<b>Idared</b>			
V <sub>1</sub> Untreated + manual work	17.7	13.70	3.98
V <sub>2</sub> Untreated + mechanical work	26.62	19.32	7.30
V <sub>3</sub> -sprayer + mechanical work	27.78	21.33	6.45
V <sub>4</sub> -sprayer with Roundup	27.50	21.01	6.49
V <sub>5</sub> - sprayer with Sanglypho	27.00	19.64	7.36
V <sub>6</sub> - sprayer with Touchdown	26.62	19.32	7.30

Next we present an estimation of costs and profitability for improved technology per hectare of apple intensive orchard where were applied post emergent herbicides from Glyphosat group (during vegetation), when the weeds were 15-20 cm height. Touchdown- System 4 herbicide with total systemic action, biodegradable 3 litres/ha dose, in 150 litres of water/ha was applied in May-June and the second treatment at the same dose only post emergent on the large groups of weeds, in August. All the observations were compared with standard technology. Bo be mentioned that for all calculation elements was used the 2004 dollar value of 33.500 lei (3.35 RON). The table 3 clearly shows the superiority of the improved technology using only herbicides to control weeds on the row of trees, the profitability showing economic efficiency, from 8.8 lei/ha to 19 800 euro/ha in case of the improved technology.

Table 3

**Retention of herbicides used in the apple orchard - Velnița - SCDP Iasi**

<b>Nr. crt.</b>	<b>Trade name</b>	<b>The active substance</b>	<b>Conc. g/l</b>	<b>Toxicity group</b>	<b>Remaining</b>
<b>1</b>	Roundup	glyphosat	360	IV	0
<b>2</b>	Sanglypho	glyphosat	360	IV	0
<b>3</b>	Touchdown	glyphosat + trimesium	480	IV	0

As a basis of comparison there was used variant 1, which is now considered as representative for the orchards and farms and consists of digging soil on the trees row in the fall, followed by 2 +3 manual cultivations during the growing season.

As the results, in table 4, we can observe that the highest costs are made in variant 1, with 35.540 thousand lei/ha (classic variant), and lowest cost of soil system maintaining method on the trees row was registered in variant 4 with two application of Roundup herbicide in May and in August localized applied on large groups of weeds. Advantages of using herbicides on the row of trees do not stop only to the economic advantages; they offer a range of social privileges on labour productivity and ergonomics, making the timely and easy to work.

Table 4

**Estimated anti-calculation costs and profitability in apple**

<b>Nr.crt.</b>	<b>Economic efficiency</b>	<b>Standard technology thousands lei/ha</b>	<b>Improved technology using herbicides thousands lei/ha</b>
<b>1</b>	<i>Production costs</i>	35.540	39.150
<b>2</b>	<i>Cost of production</i>	7.095	7.950
<b>3</b>	<i>Average price of delivery</i>	7.500	9.150
<b>4</b>	<i>Income</i>	38.000	46.100
<b>5</b>	<i>The profit rate</i>	8.80	19.80

Manual soil system maintenance on the row of trees require large amounts of labour, is expensive and may be due to the climate of labour shortages in certain periods, works are carried out from the optimal technology.

The efficiency benefit of a rational herbicide each year, which has a dynamic, cumulative dose of herbicide, can be reduced by 20-30%, without affecting the efficacy of weed control. Application version works mechanical sprayers + (V3), although costs incurred are higher relative to other types of herbicides, is justified by the creation of favourable conditions (soil loosening and aeration) for microorganisms activity in soil, root system growth due to soil mobilization by mechanical works. (tab. 5).

Data analysis leads us to understand that economic evidence is the key factor that depends on choosing the most useful options to maintain soil on the row of trees and weeds control.

Table 5

Soil system maintenance expenses per apple trees row (lei / ha)

<b>Variants</b>	<b>Materials</b>	<b>Manual work</b>	<b>Mechanical work</b>	<b>Total Thousand lei/ha</b>
<i>V<sub>1</sub> Untreated + manual work</i>	-	3.540	-	3.540
<i>V<sub>2</sub> Untreated + mechanical work</i>	-	-	1163	1163
<i>V<sub>3</sub> sprayer + mechanical work</i>	900	190	522	1612
<i>V<sub>4</sub> – sprayer with Roundup</i>	887	190	-	1.077
<i>V<sub>5</sub> – sprayer with Sanglypho</i>	1.118	190	-	1308
<i>V<sub>6</sub> – sprayer with Touchdown</i>	1.092	190	-	1.282

## CONCLUSIONS

1. Factors influencing weeding and pest thresholds are: state plantations, the number of goals in the plantations, tree vigour, climatic conditions that year, in terms of orchard weed vigour, so it is very difficult to provide fixed data on economic threshold pest.

2. By applying a rational herbicide every year, there is a cumulative effect in dynamic doses of herbicide can be reduced by 20-30%.

3. For weed control in the forms of resistance do not occur, we recommend alternating some herbicides belonging to different chemical groups and have different mechanisms of action.

4. The economic consequences of herbicide use in apple orchards and elsewhere are very positive. Most favourable effects recorded by applying herbicides row of trees when required by the maintenance costs are reduced by 35-55% and the economy of manual labour may amount to 18-25 days per man/ha.

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# THE SWEET CHERRY TREE CULTIVAR ‘VAN’ AND ITS DESCENDANTS

## SOIUL DE CIREȘ „VAN” ȘI DESCENDENȚII LUI

IUREA Elena<sup>1</sup>, GRĂDINARIU G.<sup>2</sup>, CORNEANU G.<sup>1</sup>,  
SÎRBU Sorina<sup>1</sup>, PANDELE A.<sup>2</sup>  
e-mail: iurea\_elena@yahoo.com

**Abstract:** This paper presents the value of ‘Van’ as cultivar used as maternal or paternal genitor in the breeding works at SCDP Iași. As result of these works, 14 of 24 new sweet cherry cultivars obtained at SCDP Iași have as genitor the cultivar ‘Van’. In 34 years of existence of The Research and Development Station for Fruit Growing Iași, the breeders had as main objective the replacement of the inferior cultivars, with new, superior cultivars, created in the station or introduced from the worldwide assortment. The new sweet cherry cultivars got remarked through very early ripening time (Cetățuia), early (Cătălina), self-fertility (Maria), low vigor (Golia and Tereza), high productivity and quality of fruits (Golia, Bucium, Iașirom, Ștefan, Ludovic, Lucia, Iosif), late ripening time (Margo) and resistance to stress factors (Oana, Radu).

**Key words:** sweet cherry tree, hybrid combinations, cultivar, genitor, fruit.

**Rezumat:** Această lucrare prezintă valoarea soiului ‘Van’ utilizat ca genitor matern sau patern în lucrările de ameliorare la SCDP Iași. Ca rezultat al acestor lucrări, din cele 24 soiuri noi de cireș obținute la SCDP Iași, 14 au ca genitor soiul ‘Van’. În cei 34 ani de existență a Stațiunii de Cercetare – Dezvoltare pentru Pomicultură Iași, amelioratorii au avut ca principală preocupare înlocuirea soiurilor inferioare, cu soiuri noi, superioare, create în stațiune sau introduse din sortimentul mondial. Soiurile noi de cireș s-au remarcat prin extratimpurietate (Cetățuia), timpurietate (Cătălina), autofertilitate (Maria), vigoare scăzută (Golia și Tereza), productivitate și calitate deosebită a fructelor (Golia, Bucium, Iașirom, Ștefan, Ludovic, Lucia, Iosif), tardivitate (Margo) și rezistență la factorii de stres (Oana, Radu).

**Cuvinte cheie:** cireș, combinații hibride, soi, genitor, fruct.

## INTRODUCTION

‘Van’ is a Canadian cultivar, obtained through free pollination of the ‘Empress Eugenia’ in 1936 (Dale, 1990; Grădinaru, 2002).

It acquired a large distribution, being multiplied in substantial proportions in all the countries with sharing in the sweet cherry tree culture, proving a large ecological plasticity (Budan and Grădinaru, 2000).

In Iași, based on national program, the improvement of the sweet cherry tree cultivars with clearly defined objectives has grown in the same time with the

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<sup>1</sup> Research and Development Station for Fruit Tree Growing of Iași, Romania

<sup>2</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

Research-Development for Fruit Growing Station Iași, in 1977, being started by the breeders' dr. eng. Ioachim Bodi and dr. eng. Ludovic Petre.

The followed aims for creating new sweet cherry tree cultivars have in mind the continuing improvement of the assortment in the Iași area, with precocious, self- fertile, resistant at *Coccomyces sp.* and *Monilinia sp.*, of reduced vigour, with quality fruits, resistant at fruits cracking, with different time of maturation and consumption and for industrial processing, with productive fruit growing trees, resistant at drought and frozen (Cociu et al., 1999; Petre, 2002).

In 34 years of existence of SCDP Iași, the breeders had as main objective the replacement of the inferior cultivars, with new superior ones, created in the station or introduced from the worldwide assortment (Budan et. al., 1997; Petre and Corneanu, 2007).

This paper work present the value of the 'Van' cultivar used as mother or father genitor in the breeding works at SCDP Iași. As a result of these works, 14 of 24 new sweet cherry tree cultivars obtained at SCDP Iași, have as genitor the 'Van' cultivar.

## MATERIAL AND METHOD

The research method was the simple intraspecific hybridization, starting with 1980.

The obtained material resulted from the hybridization of the genitors 'Van', 'Stella', 'Boambe de Cotnari', 'Ebony', 'Muncheberger Fruhe' and 'Lapins'. After the selection process, the hybrid elites were studied in micro cultures and comparative cultures.

The trees are grafted on mahaleb as rootstock and planted at a distance of 5x4 m. There were planted 10 trees from every cultivar. The applied agro technical works were those specific to sweet cherry tree culture and the trees were taken as free fan shaped crown, without any support system.

There have been made observations, concerning the trees vigour, their precocity, the main fructification phases, the self-fertility, the behaviour to the limitative factors of the production (frozen, drought and the specific diseases of the sweet cherry tree), the fruits production, the quality of the fresh fruits for consumption and industrial processing as compote, jam or cherries liqueurs.

## RESULTS AND DISCUSSIONS

The 'Van' cultivar was firstly used in 1980, being even today one of the most used cultivar in the breeding works for sweet cherry tree at SCDP Iași (table 1).

Starting with 1991, there were obtained the first 14 cultivars of sweet cherry tree that have as mother or father genitor the cultivar 'Van' (tab. 1).

The cultivar 'Van' is very valuable in sweet cherry tree amelioration because it has average vigour, good productivity, good quality of fruits, it is precocious with a very good ecological plasticity. These features are transmited in descendance, as a result of combinations with other genitors.

*Table 1*

**The use of ‘Van’ cultivar in the amelioration program of the sweet cherry tree at  
SCDP Iași in 1980-2011**

Between the years:	Nr. of combinations in which the cultivar ‘Van’ is genitor:			Flowers after pollination -nr-	Harvested fruits -nr-	Obtained hybrid seeds -nr-
	♀	♂	Total			
1980-1990	32	22	54	58904	12508	10321
1991-2000	15	21	36	47903	6762	4605
2001-2011	4	13	17	15990	4120	3126

From the combinations from 1983-1988, having as genitor the cultivar ‘Van’, there have been selected 14 hybrid elites, being approved as cultivars in 1999-2011: ‘Cetățuia’, ‘Cătălina’, ‘Golia’, ‘Maria’, ‘Bucium’, ‘Ștefan’, ‘Tereza’, ‘Iașirom’, ‘Radu’, ‘Oana’, ‘Lucia’, ‘Ludovic’, ‘Margo’ and ‘Iosif’ (tab. 2).

*Table 2*

**New cultivars obtained by use as genitor the cultivar ‘Van’**

Cultivar	Year of hybridization	Genitors		Year of approval	Year of patent
		♀	♂		
Cetățuia	1984	Van	B.de Cotnari	1999	2008
Maria	1984	Van	Stella	1999	2009
Golia	1984	Van	B. de Cotnari	2001	2008
Cătălina	1984	Van	B. de Cotnari	2001	2008
Bucium	1984	Van	B. de Cotnari	2006	2009
Iașirom	1984	Van	B. de Cotnari	2006	2009
Ștefan	1984	Van	B. de Cotnari	2006	2009
Tereza	1983	Van	Ebony	2006	2009
Oana	1984	Van	B. de Cotnari	2007	-
Radu	1984	Van	B. de Cotnari	2007	-
Lucia	1984	Van	Muncheberger Fruhe	2007	-
Ludovic	1984	Van	B. de Cotnari	2010	-
Margo	1987	Free pollination for the cultivar ‘Van’	-	2010	-
Iosif	1988	Van	Lapins	2011	-

The cultivar ‘Cetățuia’ was the first approved cultivar, in 1999 and patented in 2008, as a result of hybridisations, from 1984, between ‘Van’ and ‘Boambe de Cotnari’ (tab. 2).

In the same combination and of the same year of hybridisation, there have been approved in 2001 cultivars ‘Golia’ and ‘Cătălina’, in 2006 cultivars ‘Bucium’ and ‘Ștefan’, in 2007 cultivars ‘Oana’ and ‘Radu’ and in 2010, the

cultivar 'Ludovic' (tab. 2). These cultivars, although from the same combination of genitors, are very different between them.

The cultivar 'Cetățuia' is very early, with an average weight for the fruit of 5,9 g and with a dark red colour (tab. 3). The similarity with the cultivar 'Van' consists only in the middle vigour of trees, length and thickness of the peduncle and the difference consists in the very earliness of the cultivar (fruit ripening in the 3<sup>rd</sup> decade of May).

The cultivar 'Golia' has the same period of ripeness and size of the fruit, but it is distinguished by the dark red colour of the fruit and the low vigour of trees. 'Cătălina' is similar by precocity, resistance to diseases and frost but it is distinguished by fruit's shape and earliness ripening time (tab. 3).

The cultivars 'Bucium', 'Iașirom', 'Ștefan', 'Oana', 'Radu' and 'Ludovic' are similar at the trees vigour, firm flesh and the period of maturation, but they are distinguished by the colour, shape and the weight of the fruit. 'Oana' and 'Radu' are distinguished by the superior resistance at cracking, colour and shape of fruits.

The cultivar 'Maria', approved in 1999, patented subsequently with the name 'Romaria' in 2009 has as genitors the species 'Van' and 'Stella'. It is very similar as appearance with the cultivar 'Van', having the shining red fruit and the short and thick stalk, but it is distinguished by the fruit shape the cultivar is self-fertile (tab. 3).

The cultivar 'Ludovic', approved in 2010 is similar with the cultivar 'Van' at the average vigour of trees, the firm flesh and the period of maturation and the difference consists in the size and the shape of the fruits (it is much bigger than 'Van'), its colour and the resistance at fruit cracking.

The cultivar 'Margo' was approved in 2010 and obtained by free pollination of the cultivar 'Van'. It is similar with the cultivar 'Van' by its precocity to fruit-bearing, firm flesh and the not adhering of the kernel to the flesh of the fruit and the difference consists in the size and the fruit shape, its colour and the period of maturation ('Margo' is with late ripening time cultivar) (tab. 3).

The cultivars 'Lucia' and 'Iosif' are similar to 'Van' by the trees average vigour and the firm flesh. The difference consists in the shape and the fruit's colour, and the cultivar 'Iosif' has a very good fruit weight (tab. 3).

Table 3

The characterization of the new sweet cherry cultivars, descendant from the cultivar 'Van'

Cultivar	Tree vigour	Ripening time	Fruit shape	Fruit weight (g)	Fruit colour	Comparisons with the cultivar 'Van'	
						Similarities	Differences
Cetățuia	medium	very early	flattened kidney	5,9	dark red to black	Tree vigour, length and thickness of peduncle	Smaller fruit, very early
Maria	medium	medium	elongated heart-shaped	7,4-8,3	shining red	Ripening time, resistance at fruit's cracking and colour, stalk length	Cultivar's self-fertility, fruit's shape
Golia	small	medium	elongated heart-shaped	7,5-8	dark red	Ripening time, fruit size	Small vigour, fruit's shape
Cătălina	medium	early	elongated heart-shaped	7,4-8,4	dark red	Precocity, resistance to diseases and frost	Early cultivar, fruit's shape
Bucium	medium	medium	flattened heart-shaped	8-8,5	dark red	Vigour, flesh firmness, not adhering stone to flesh	Fruit's shape and size
Iașirom	medium	medium	flattened heart-shaped	7,7-8,1	dark red	Medium vigour, flesh firmness, ripening time	Fruit's shape, resistant at specific diseases for sweet cherry tree
Ștefan	medium	medium	flattened heart-shaped	7,7-8	dark red	Vigour, fruit thickness, ripening time	Fruit's shape, stalk's length and thickness
Tereza	small	medium	flattened heart-shaped	7,5-7,8	dark red	Fruit resistance at cracking, ripening time	Small vigour of tree, fruit's shape
Oana	medium	medium	round flattened	7,6	dark red	Vigour, not adhering stone to flesh, resistance to frost and drought	Fruit's shape and colour
Radu	medium	medium	kidney	6,6	dark red	Precocity, resistance to frost, drought, age of ripening	Fruit's shape, resistance at cracking
Lucia	medium	medium	elongated heart-shaped	8,0	dark red	Vigour, resistance at fruits cracking	Fruit's shape and colour
Ludovic	medium	medium	kidney	11,4	dark red	Vigour, flesh firmness, age of ripening	Fruit's shape and size, fruit's resistance at cracking
Margo	medium	late	heart-shaped	8,9-9,5	whitish yellow	Precocity, flesh firmness, not adhering pips to flesh	Ripening time, fruit's size, colour and shape
Iosif	medium	medium	heart-shaped flattened	9-9,3	dark red	Vigour, flesh firmness	Fruit's size, colour and shape

## CONCLUSIONS

1. The cultivar 'Van' was efficiently used in sweet cherry tree breeding works and it can be appreciated as a very good genitor for productivity and for fruit quality.

2. From the combinations from 1983-1988 with the cultivar 'Van' as genitor, there have been selected 14 sweet cherry tree hybrid elites, which have been approved as cultivars in 1999-2011: 'Cetățuia', 'Maria', 'Golia', 'Cătălina', 'Bucium', 'Iașirom', 'Ștefan', 'Tereza', 'Oana', 'Radu', 'Lucia', 'Ludovic', 'Margo' and 'Iosif'.

3. The new sweet cherry tree cultivars got remarked through very earliness ('Cetățuia'), earliness ('Cătălina'), self-fertility ('Maria'), low trees vigour ('Golia' and 'Tereza'), productivity and excellent fruits quality ('Golia', 'Bucium', 'Iașirom', 'Ștefan', 'Ludovic', 'Lucia', 'Iosif'), late ripening time ('Margo') and resistance at stress factors ('Oana', 'Radu').

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# THE EVALUATION OF POLLEN'S VIABILITY AND THE GERMINATION CAPACITY FOR SOME SWEET CHERRY CULTIVARS CREATED AT S.C.D.P. IAȘI

## EVALUAREA VIABILITĂȚII POLENULUI ȘI CAPACITATEA DE GERMINARE LA UNELE SOIURI DE CIREȘ CREATE LA S.C.D.P. IAȘI

IUREA Elena<sup>1</sup>, GRĂDINARIU G.<sup>2</sup>, MORARIU Aliona<sup>2</sup>,  
CORNEANU G.<sup>1</sup>, SÎRBU Sorina<sup>1</sup>  
e-mail: iurea\_elena@yahoo.com

**Abstract:** The aim of this paper was to evaluate the pollen's quality for some cultivars of sweet cherry tree (13 cultivars) obtained at SCDP Iași, to establish their possibility of use as pollinators. The pollen's germination was realised on solid nutritive medium. The pollen's viability was determined through the carmine-acetic method. The most sweet cherry tree cultivars (10 of 13 cultivars taken for study) had a high range of pollen germination of above 40%, a percent considered by other authors as satisfying for a normal fructification for the sweet cherry cultivars, so, from this point of view they can be recommended as potential genitors for future breeding works. The pollen's viability was higher than the germination concerning all the studied cultivars, the values of this indicator ranged between 80,56% for the 'Tereza' cultivar and 99,33% for the 'Oana' cultivar, so all the cultivars could be used from this point of view as genitors in breeding works.

**Key words:** sweet cherry tree, hybrid combinations, cultivar, genitor, fruit.

**Rezumat:** În această lucrare ne-am propus evaluarea calității polenului la unele soiuri de cireș (13 soiuri) obținute la SCDP Iași în vederea stabilirii posibilității lor de utilizare ca și polenizatori. Germinarea polenului s-a realizat pe mediu nutritiv solid. Viabilitatea polenului a fost determinată prin metoda carmin-acetică. Majoritatea soiurilor de cireș (10 din 13 soiuri luate în studiu) au avut un grad ridicat de germinare a polenului de peste 40%, un procent considerat de către alți autori ca fiind satisfăcător pentru o fructificare normală la specia cireș, astfel, din acest punct de vedere pot fi recomandate ca genitori potențiali în viitoarele lucrări de ameliorare. Viabilitatea polenului a fost mai mare decât germinabilitatea în cazul tuturor soiurilor studiate, valorile acestui indicator au variat între 80,56 % la soiul Tereza și 99,33 % la soiul Oana, toate soiurile putând fi folosite din acest punct de vedere ca genitori în lucrările de hibridare artificială.

**Cuvinte cheie:** soiuri, cireș, polen, capacitate de germinare, viabilitate

## INTRODUCTION

Fertility successfully can be done at sweet cherry tree only by use of cultivars shedding pollen within the quality of the period of flowering synchronized with the other cultivars period and producing a large quantity of

<sup>1</sup> Research and Development Station for Fruit Tree Growing of Iași, Romania

<sup>2</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

viable and compatible pollen. To be sure the results of pollination will be positive, it is necessary to be known the intrinsic value of the pollen.

Evaluation of the quality pollen is realized, usually by tests carried out "in vitro" through morphological homogeneity which is to be determined, the viability and the pollen's germination as well as the rate of increase of the pollen tube.

The determination of the germinating capacity has an aim to know the biological value of the pollen used in hybridizations, the detection of disorders caused by diseases of gametes (monilioză), and the determination of the pollen's viability has as aim the knowledge of one cultivar's value as shedding pollen in inter fertile combinations, pretesting the anomalies from the genotype, the appraisal physiological status, the pretesting of some factors that affect the pollen's quality (Cociu and Oprea, 1989).

In this paper we proposed to ourselves the evaluation of the pollen's quality at some sweet cherry cultivars obtained at SCDP Iași for establishing their possibility of using as pollinators.

## MATERIAL AND METHOD

The vegetal material consisted in pollen from 13 sweet cherry cultivars ('Cetățuia', 'Cătălina', 'Maria', 'Ștefan', 'Radu', 'Oana', 'Iașiom', 'Tereza', 'Paul', 'Iosif', 'George', 'Amar Maxut' and 'Amar Galata') created at SCDP Iași. The flowers have been harvested in the spring of 2011, at the stage of inflated bloom, from the bearer of the 19<sup>th</sup> year from planting.

Excised anthers were kept in Petri boxes 24 hours at room's temperature for releasing the pollen. The pollen germination got realised on a solid nutritive medium, composed of 15% sucrose, 1,5% agar-agar and 2% boric acid (Pirlak L. & Bolat I., 1999). Each Petri box contained 10 ml of medium, on which the pollen has been allocated as uniformly.

For the pollen's germination, the boxes were maintained at temperatures of 20°C, the moisture of 70-90%, in dark for 4 hours after which the increasing of the pollen tube was stopped by the chloroform.

For each cultivar there were made three Petri boxes and quantifying the extent of germination has been achieved by counting to 5 random fields (number of quantified grains of pollen was of minimum 1000) for each Petri box. The examination was made at the light microscope Motic with the objective of 4X and 10X. The pollen tube length has been evaluated with the photo camera's software and it has been expressed in  $\mu\text{m}$ .

For the pollen's viability estimation it has been fixed in Carnoy fixer 12 hours, after which it was preserved in a fridge in alcohol 70%. The fixed pollen has been colored with acetic carmine and viewed in the light microscope. The viable pollen, colored in red carmine has been quantified in 10-15 visual fields (the number of quantified pollen grains was of minimum 1000) and each stage was done in three repetitions (Cociu and Oprea, 1989; Botu and Botu, 1997).

For the statistic interpretation of the dates, it was calculated the coefficient of variation (s%) for which it is allowed arbitrary the next values:

- 0 – 10% - coefficient of low variation;
- 10 - 20% - coefficient of average variation;
- 20 - 30 % - coefficient of big variation.

## RESULTS AND DISCUSSIONS

In the case of fruit growing species, the germinability and the increasing rate of the pollen tube are the most important features for the evaluation of the pollen's quality, because for an efficient fertilisation it is necessary a high capacity of pollen's germination and a high increasing rate of the pollen tubes. In the case of some fruit tree cultivars with an excessively small rate of germination or of increasing of the pollen tubes it is possible a deficiency of tying of the fruit caused by the degradation ovule before the pollen tube to reach the ovary (Cheung, 1996; Stosser et al., 1996; Sharafi and Bahmani, 2010) or it could be cause of some biotically or abiotic factors influence (Beppu et al., 2005).

In the case of our researches, we observed high differences between cultivars in what it concerns the germination capacity of the pollen (table 1), the values being between 9,63% at the cultivar 'Cătălina' and 74,36% at the cultivar 'Paul', at which even the pollen's viability was very high (95,27%) (table 2), the value of the variation coefficient indicating a high value of this feature (35,20%) (tab. 1).

*Table 1*

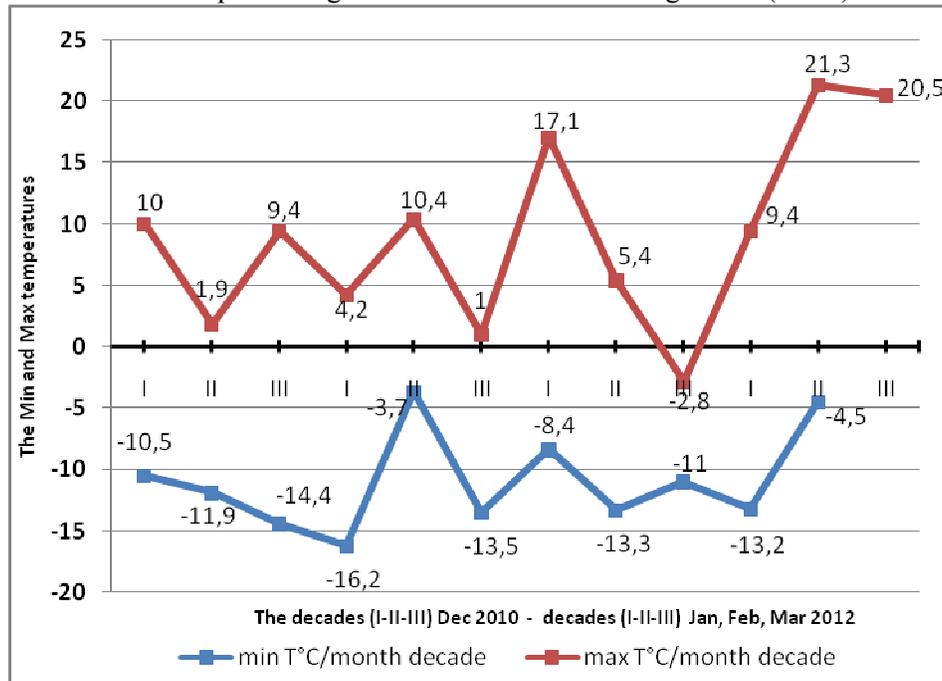
**The capacity of germination and the length of the pollen tube at sweet cherry tree (2011)**

Cultivar	Provenance	The germination capacity %	-µm-	
			Average	Standard deviation
Cetățuia	SCDP Iași	56,74	58,52	±15,74
Cătălina	SCDP Iași	9,63	56,43	±13,29
Maria	SCDP Iași	70,04	78,24	±12,68
Ștefan	SCDP Iași	61,47	33,32	±10,90
Radu	SCDP Iași	61,90	68,93	±21,28
Oana	SCDP Iași	55,40	100,30	±20,81
Iașirom	SCDP Iași	47,10	53,5	±15,36
Tereza	SCDP Iași	36,04	126,44	±16,20
Paul	SCDP Iași	74,36	76,83	±17,19
Iosif	SCDP Iași	23,17	57,53	±17,30
George	SCDP Iași	50,37	74,46	±12,12
Amar Maxut	SCDP Iași	44,39	64,44	±16,76
Amar Galata	SCDP Iași	56,09	68,21	±18,09
Average		49,75		
Standard deviation %		17,46		
Variation coefficient %		35,10		

The low results obtained at the cultivar 'Cătălina' (9,63%), 'Iosif' (23,17%) and 'Tereza' (36,04%) can be determined by the abiotic factors influence (the thermal fluctuations from the period of vegetative rest and the differences of temperature day-night of approximately -15°C) on the pollen's germination capacity (fig. 1).

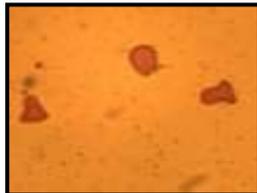
The majority of sweet cherry tree cultivars (10 of 13 cultivars kept in study) had a high degree of pollen germination over 40%, a percent considered by other

authors (Cheung, 1996; Sharafi and Bahmani, 2010) as satisfying for a normal fructification for the sweet cherry cultivars, so, from this point of view, they can be recommended as potential genitors in the future breeding works (tab. 1).



**Fig. 1** – The dynamics of air temperature on decades in the period December 2010 – March 2011

At cultivars with a very high germination it wasn't obligatory observed a high rate of increasing of the pollen tube. The cultivars 'Tereza' (126,44  $\mu\text{m}$ ) and 'Oana' (100,30  $\mu\text{m}$ ) had the highest length of pollen tube and the cultivar 'Ștefan' had the smallest one with only 33,32  $\mu\text{m}$  (table 1).



**Fig. 2** – The pollen germination 'in situ' at the cultivar 'Cetățuia'

The pollen grains go through a stage of hydration in the interior of the anthers at the final of the maturation stage (Lord and Russell, 2002). Although normally the pollen doesn't germinate before reaching other flower pestle's stigma, in the literature there are presented germination cases 'in situ' (in the interior of the anther) at some fruit growing cultivars as apple tree or peanut tree (Koul et al., 1985). In the case of our researches, a similar phenomenon was observed at the cultivar 'Cetățuia' (fig. 2).

The pollen viability was higher than the germination in the case of all the studied cultivars, result which is in agreement with those obtained by other authors (Pearson and Harney, 1984; Parfitt and Ganeshan, 1989).

Table 2

The pollen viability at sweet cherry tree (2011)

Cultivar	Provenience	Pollen viability %
Cetățuia	SCDP Iași	96,31
Cătălina	SCDP Iași	89,75
Maria	SCDP Iași	91,11
Ștefan	SCDP Iași	87,5
Radu	SCDP Iași	90,79
Oana	SCDP Iași	99,33
Iașirom	SCDP Iași	98,47
Tereza	SCDP Iași	80,56
Paul	SCDP Iași	95,27
Iosif	SCDP Iași	90,77
George	SCDP Iași	96,69
Amar Maxut	SCDP Iași	98,99
Amar Galata	SCDP Iași	99,21
Average		93,44
Standard deviation %		5,41
Variation coefficient %		5,79

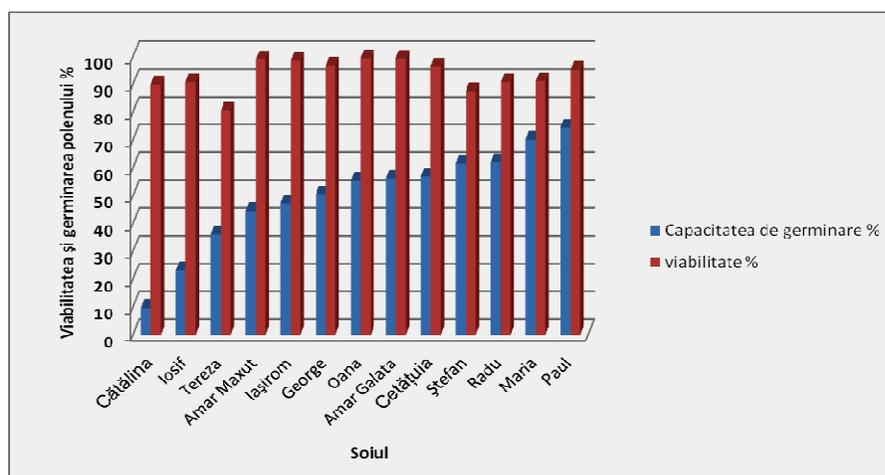


Fig. 3 – The dynamics of the pollen viability and of the germination capacity at 13 cultivars of sweet cherry tree

This indicator's values have varied between 80,56% at the cultivar 'Tereza' and 99,33% at the cultivar 'Oana'. The obtained results showed that the pollen viability had very high values, all the cultivars can be used as genitors from this point of view in papers of artificial hybridisation (tab. 2), (fig. 3).

## CONCLUSIONS

1. The obtained results highlight the fact that the majority of sweet cherry cultivars can be used successfully as potential genitors in future amelioration papers.

2. As a result of the fluctuation of minimum and maximum registered temperatures in March (minimum -13,2°C, maximum +21,3°C), the cultivars 'Cătălina', 'Iosif' and 'Tereza' can be considered as cultivars with low resistance to frost.

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# RESEARCH ON THE VT 92.01.10 HYBRID FOR THE AMELIORATION OF APRICOT IN DOBROGEA

## CERCETĂRI ASUPRA HIBRIDULUI VT 92.01.10 IN VEDEREA ÎMBUNĂTĂȚIRII SORTIMENTULUI DE CAIS ÎN DOBROGEA

**OPRIȚĂ V. A.<sup>1</sup>**

e-mail: olaviani@yahoo.co.uk

**Abstract.** *The expansion of apricot consumption depends on the marketing, the quality of the fruit upon harvesting and on their cost. Market trends that have an impact upon apricot consumption are: globalization, the need for year round supplies of produce, the high cost labour, the diversification of the safety issues of pesticide use and bacterial contamination of fresh fruit. These pressures have renewed the interest in production systems in order to extend the harvest season, to reduce chemical inputs and to ensure a consistent fruit quality. Therefore, our efforts were focused on developing new varieties with high quality of fruit, higher levels of production, a greater diversity of fruit types to market and the adaptation to climate changes which have recently begun to occur. In this paper we studied the characteristics of the VT 92.01.10 hybrid, having as witness the variety CR 2-63. The experimental determination was conducted the at Research Station for Fruit Growing Constanta between 2008 and 2011. The hybrid VT 92.01.10 proved to be superior to the witness in terms of weight of the fruit, their firmness, the dry matter and the colour of the skin. According to the obtained results, we can recommend the hybrid for homologation, in order to extend the consumption period of apricots. Also, it has a high qualitative potential compared to the existent apricot varieties, which recommend it for cultivation.*

**Key words:** *Prunus armeniaca*, assortment, variety, promotion.

**Rezumat.** *Creșterea consumului de caise depinde de comercializarea, calitatea fructelor la recoltare cât și de costul acestora. Tendințele pieței care au impact asupra consumului de caise sunt globalizarea și necesitatea suplimentării cu produse proaspete tot timpul anului, costurile cu forța de muncă, diversificarea pesticidelor folosite și contaminarea bacteriană a produselor proaspete. Aceste presiuni au reînnoit interesul în sistemele de producție pentru a extinde perioada de recoltare, pentru a reduce inputurile chimice, precum și pentru a asigura o calitate superioară a fructelor. Prin urmare eforturile noastre s-au concentrat pe dezvoltarea de noi soiuri de cais cu calitate superioară a fructelor, niveluri de producție ridicate, o diversitate mai mare de tipuri de fructe pe piață și adaptarea la schimbările climatice care au apărut în ultimul timp. În această lucrare am studiat caracteristicile calitative ale hibridului VT 92.01.10 având ca martor soiul CR 2-63. Determinările experimentale s-au efectuat la SCDP Constanța în perioada 2008 – 2011. Hibridul VT 92.01.10 s-a evidențiat față de martor prin greutatea fructelor, fermitate, substanță uscată, culoarea fructelor.*

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<sup>1</sup> Research and Development Station for Fruit Tree Growing of Constanța, Romania

*Conform rezultatelor obținute putem susține introducerea hibridului pentru omologare în vederea extinderii perioadei de consum, deoarece potențialul calitativ mare pe care îl are față de soiurile deja existente îl recomandă.*

**Cuvinte cheie:** *Prunus armeniaca*, sortiment, soi, promovare.

## INTRODUCTION

Throughout the entire world the research carried out concerning the apricot trees have among its main objectives the relationship between the climatic conditions and the cultivation of apricot trees. In our country, this relationship has been studied by many authors, among which we should mention the results obtained (Botu and Botu, 1987).

The results obtained by all these studies corresponded to a certain period of time and to a certain assortment of varieties, thus creating the link between the biology of the apricot tree and the climatic conditions in the area where it is cultivated (Topor, 2009).

The purpose of this paper is to study the apricot tree hybrid VT 92.01.10 as concerns its phenological phases, its growth and productivity as well as the quality of the fruit, in order to improve the assortment of apricot trees in the climatic conditions of Dobrogea.

## MATERIAL AND METHOD

The studies were carried out between 2008 and 2011 at the Research Station for Fruit Growing Constanta, within the Breeding Apricot Tree Laboratory. The biological material consisted of 12 apricot tree hybrids, with a blossoming period ranging from very early to very late, part of a contest crop planted in 2003. For the VT 95.03.49 hybrid the Umberto variety was used as witness. Each hybrid is represented by 10 trees, planted at a distance of 4/4, with the shape of the head being a free flat palm in the direction of the row. The applied culture technology is that specific to apricot trees, containing fructification cuts, phytosanitary treatments, soil works, irrigation, harvesting, conditioning and capitalisation of the fruit. In order to construe the data, observation were made concerning the triggering and the evolution of the vegetative and fructification stages, as well as the quantity and quality of the fruit production. The determination of physical and organoleptical characteristics was performed according to the regular methodology for the study of varieties, as follows: the weight of the fruit was determined by weighing all fruit within a sample (25 fruit) and the average weight was calculated in g/fruit; the colour of the fruit and of the pulp was established through direct visualizing, with the aid of colour codes (plastic tags with specific colours); the fruit's content of dry substance was determined by means of a digital refractometer, in Brix degrees.

The main chemical components were determined within the Chemistry Laboratory of ICDP Pitesti, as follows: the total quantity of sugar through the Fehling volumetric method; the total acidity through the titrimetric method, using phenolphthalein as indicator.

The results were statistically processed by means of variance.

## RESULTS AND DISCUSSIONS

In order for the blossoming phenophase to begin in the pedoclimatic conditions of SCDP Constanta, the VT 92.01.10 hybrid required 237 – 261°C and a period of 9 to 13 days, enough for the pollination and the fertilization. For the VT 92.01.10, the blossoming took place in 2009 on the 04<sup>th</sup> of April, two days earlier than the witness variety CR 2-63, and in 2011 on the 12<sup>th</sup> of April (tab.1). The date when the fruit become ripen is a biological characteristic for the VT 92.01.10; this stage took place in 2010 on the 20<sup>th</sup> of June, seven and eight days respectively earlier than the witness variety CR 2-63, proving that it belongs in the category containing varieties with extra-early ripening of the fruit (until the 30<sup>th</sup> of June) (tab. 1).

*Table 1*

<b>Main fructification phenophases (2009-2011)</b>									
Variety	Year	Beginning of blossoming		Ending of blossoming		Duration of the bloss. (days)	Ripening of the fruit		Duration of ripen. (days)
		Date	Σ°C	Date	Σ°C		Date	Σ°C	
VT 92.01.10	2009	04.04	237	14.04	321	11	19.06	1411	77
	2010	03.04	260	11.04	342	9	20.06	1515	79
	2011	12.04	261	24.04	331	13	24.06	1424	73
CR2-63 mt.	2009	06.04	256	15.04	332	10	23.06	1499	79
	2010	05.04	280	14.04	369	10	26.06	1628	83
	2011	13.04	232	26.04	354	14	26.06	1461	75

The vigour of the trees' growth, represented by the growth in thickness of the trunk and the total growth of the annual sprouts between 2009 and 2011 (vegetative years V - VII) reveal a lower vigour for the VT 92.01.10, as compared to the witness variety CR 2-63, this hybrid being considered as having a medium vigour (tab. 2).

*Table 2*

<b>Surface of the trunk section and the total growth of annual sprouts Years V-VII since cultivation (2009-2011)</b>														
Variety	Surface of the trunk section cm <sup>2</sup>				Growth rate 2009 - 2011			Average growth rate	Average number of sprouts/tree			Total growth of annual sprouts linear meters		
	2008	2009	2010	2011	2009	2010	2011		2009	2010	2011	2009	2010	2011
VT 92.01.10	87	108	133	141	21	25	8	18	70	40	79	18,3	17,3	21,9
CR2-63mt	70	98	119	129	18	21	10	16	58	60	93	21,2	31,7	34,8

Considering the tree as a whole and judging by the surface of the trunk section, the rate of the growth in thickness and the sum of the annual vegetative growth, it is revealed that the VT 92.01.10 has the tendency of having a moderate

habitat, the fructification occurring mostly on branches that are 1 year old – mixed branches and May bouquets.

Analysing the average fruit production over the three years, we can state that the VT 92.01.10 fits in the category of productive varieties, its production ranging from 13 to 15 t/ha. Thus, it proves that it is worth being taken into account due to this quality (tab. 3).

Table 3

**Fruit production over the period 2009-2011**

Variety	Year	Average prod. 2009-2011		Diff. comp. to the withn. +-	Signif.	Production dex kg/cm trunk sect.
		Kg/tree	t/ha			
VT 92.01.10	2009	27,1	15,04	+4,94	x	0,250
	2010	25,2	13,98	+9,82	xx	0,189
	2011	26,3	14,59	+6,05	x	0,186
	Average	26,2	14,54	+6,94	x	
CR 2-63	2009	18,2	10,10	-	-	
	2010	7,5	4,16	-	-	
	2011	15,4	8,54	-	-	
	Average	13,7	7,60			

LSD. 5% = 4,81; LSD.1% = 7,10; LSD. 0.1% = ,98

From the determinations that were carried out, the conclusion was the fruit's loss of weight was a consequence of the draught in 2010. This hybrid managed to accumulate an average quantity of 13.7g/100g S.P. total sugar and 15.9% S.U.T., (tab. 4) which is a predominant characteristic of chosen genitors.

Table 4

**Main physical and chemical characteristics**

Variety	Year	Average weight of the fruit g.	% core	S.U.T. %	Total sugar g/100gS.P.
VT 92.01.10	2009	51,7	5,2	14.5	10.8
	2010	53,2	4.8	16.0	14.5
	2011	49,6	5,0	17.3	15.8
	Average	51,5	5,0	15.9	13.7
CR 2-63	2009	55,6	5,3	14.5	10.3
	2010	52,8	6,4	14.2	12.5
	2011	50,1	6,5	14.5	12.9
	Average	52,8	6,1	14.4	11.9

The fruit which ripens early has a small to medium size, it is symmetrical and round (tab. 5). The main colour of the skin is orange with carmine on the sunny side. The pulp is light orange, with a smooth texture and a soft consistency and it does not adhere to the core.

Table 5

**Shape and size of the fruit**

Variety	D	d	H	Shape index (mm)
VT 92.01.10	48	40	55	1.1
CR 2-63	41	37	53	1.2

According to the value of the attack degree of the frequency, the VT 92.01.10 hybrid fits into the resistance group 1=easily attacked in the conditions of the performance of phytosanitary treatments.

Table 6

Appreciation of the resistance to *Stigmia carpophila* (2009-2011)

Variety	Frequency of attack %				Intensity of attack %			Resistance group			Degree of attack		
	2009	2010	2011	Average	2009	2010	2011	2009	2010	2011	2009	2010	2011
VT 92.01.10	4.8	4.8	1.5	3.7	+	+	+	1	1	1	0.1	0.4	0.01
Mt.	6.5	3.2	1.3	3.6	+	+	+	1	1	1	0.3	0.1	0.01

In order to establish the resistance to disease of the VT 92.01.10, the relative resistance index was calculated,  $R=0.8$ , which proves that its value is higher than 0.7, this being a resistant variety (tab 6).

Another criterion that influences that promotion of a variety into the assortment is the resistance to cold and temperature variations. Between 2009 and 2011, before the beginning of the vegetation, observations were carried out on over 800 blossoming buds pertaining to this hybrid. It can be stated that the VT 92.01.10 is fairly resistant to low temperatures and medium resistant to comeback colds, the average percentage of destroyed buds over a period of three years being of 4.3%, compared to 5.1% for the witness variety (fig. 1).

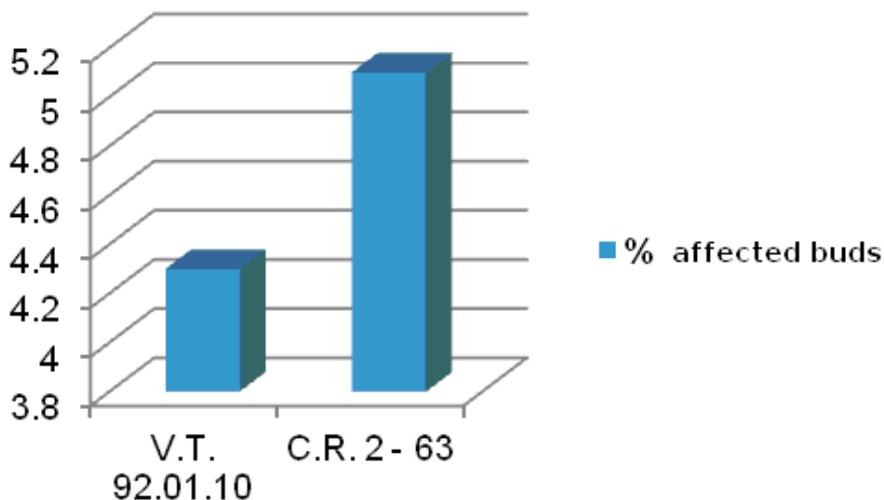


Fig. 1 – Resistance to cold of the blossoming buds

Thus, we can appreciate that according to the ripening fit for harvesting in the period between 2009 and 2011, this elite fits into the group of varieties with late ripening of the fruit (up to the 30th of June), the ripening occurring with 7 to 8 days earlier compared to the witness variety CR 2-63, in the pedoclimatic conditions of SCDP Constanta.

## CONCLUSIONS

1. The VT 92.01.10 hybrid can be considered a variety with early ripening and it can improve the structure of the current assortment which still lacks in early varieties (in the area). In the district of Constanta, with the aid of the VT 92.01.10, the apricot season between the 19<sup>th</sup> and the 24<sup>th</sup> of June become more diverse as concerns the consumption of fresh fruit, this variety being considered a perspective one.

2. This hybrid offers for the first time in this area the possibility of extending the consumption of early fresh fruit, given the fact that the fruit become ripen until the 24<sup>th</sup> of June (beginning with the second decade of the month of June) compared to the witness variety CR 2-63. Thus, the hybrid is superior in terms of elements such as: the ripening precocity, the productivity, the commercial aspect, the resistance to diseases, organoleptical traits.

3. The guarantee for this variety's value is its adaptability to local conditions of climate and soil, expressed through its increased resistance to extreme temperatures in the area, to diseases and pests, which recommends its homologation as variety and its extension in cultivation.

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# RESEARCH ON THE VT 95.03.49 HYBRID IN ORDER TO IMPROVE THE ASSORTMENT OF APRICOT TREES IN DOBROGEA

## CERCETĂRI ASUPRA HIBRIDULUI VT 95.03.49 ÎN VEDEREA ÎMBUNĂTĂȚIRII SORTIMENTULUI DE CAIS ÎN DOBROGEA

**OPRIȚĂ V.A.<sup>1</sup>**

e-mail: olaviani@yahoo.co.uk

**Abstract.** Fruit quality is an ensemble of specific features and characteristics which, together with other traits, stands for the selection and promotion of varieties according to the market demand and destination. In the breeding work, this characteristic is a major objective in the selection of new genotypes. The studies were carried out between 2008 – 2011 at the Research Station for Fruit Growing Constanta, within the Breeding Apricot Tree Laboratory, on a number of 11 hybrids. The following observations were performed: the ripening period, the size of fruit, the shape, the colour of the skin, the taste and flavour and the content of nutrients, according to the present demands on the European market. The study of these hybrids has as aim the obtaining of new varieties with superior qualities, being considered for the improvement of the assortment of apricot trees in this area.

**Key words:** *Prunus armeniaca*, assortment, variety, promotion.

**Rezumat.** Calitatea fructelor este un ansamblu de însușiri și caracteristici specifice care, alături de alte criterii, stă la baza alegerii și promovării sortimentului în funcție de cerințele pieței de consum. La fel în ameliorarea genetică această însușire constituie obiectiv major în selecția noilor genotipuri în dependență de destinația fructelor. Studiile s-au efectuat în perioada 2008 – 2011 la SCDP Constanța, în cadrul Laboratorului de ameliorare cais pe un număr de 11 hibrizi. La aceștia s-au făcut următoarele observații și determinări: perioada de coacere, mărimea fructului, forma, culoare pielii, aroma și gustul, conținutul în substanțe utile. Studiul asupra acestor hibrizi dorește crearea de noi soiuri cu însușiri organoleptice superioare, fiind considerate de perspectivă pentru îmbunătățirea sortimentului de cais în condițiile zonei de studiu.

**Cuvinte cheie:** *Prunus armeniaca*, sortiment, soi, promovare.

### INTRODUCTION

In the national strategy within the domain of research and development for the period between 2007 and 2013, sustainable agriculture must be in accordance with the demand for healthy and qualitatively superior food, thus meeting the general and specific needs of the market. (Braniște et al., 2008)

The fruit quality as concerns the apricot trees depends on a wide range of elements, such as: shape, size, colour of the skin, taste, flavour, content of sugar and

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<sup>1</sup> Research and Development Station for Fruit Tree Growing of Constanța, Romania

acidity within the pulp, adherence of the core to the pulp. According to the manner in which these elements are combined, a general appreciation of the quality of the fruit can be performed. By combining data following organoleptical appreciations with those obtained from chemical analyses regarding the fruit's composition of useful substances, their nutrient value and the possibility of their being processed, there can be made recommendations concerning the destination of a variety or a hybrid, as well as the using of fruit for fresh consumption or for industrial processing through dehydration, distillation and so on. (Butac and Bulgaru, 2001).

## **MATERIAL AND METHOD**

The studies were carried out between 2008 and 2011 at the Research Station for Fruit Growing Constanta, within the Breeding Apricot Tree Laboratory. The biological material consisted of 11 apricot tree hybrids, with a blossoming period ranging from very early to very late, part of a contest crop planted in 2003. For the VT 95.03.49 hybrid the Umberto variety was used as witness. Each hybrid is represented by 28 trees, planted at a distance of 4/4, with the shape of the head being a free flat palm in the direction of the row. The applied culture technology is that specific to apricot trees, containing fructification cuts, phytosanitary treatments, soil works, irrigation, harvesting, conditioning and capitalisation of the fruit. In order to construe the data, observation were made concerning the triggering and the evolution of the vegetative and fructification stages, as well as the quantity and quality of the fruit production. The determination of physical and organoleptical characteristics was performed according to the regular methodology for the study of varieties, as follows: the weight of the fruit was determined by weighing all fruit within a sample (25 fruit) and the average weight was calculated in g/fruit; the colour of the fruit and of the pulp was established through direct visualizing, with the aid of colour codes (plastic tags with specific colours); the fruit's content of dry substance was determined by means of a digital refractometer, in Brix degrees.

The main chemical components were determined within the Chemistry Laboratory of ICDP Pitești, as follows: the total quantity of sugar through the Fehling volumetric method; the total acidity through the titrimetric method, using phenolphthalein as indicator. The results were statistically processed by means of variance. (Botu and Botu, 1997)

## **RESULTS AND DISCUSSIONS**

The VT 95.03.49 hybrid displays an intense fructification characteristic on short formations type May bouquets with an average growth over a period of 4 years of 98 linear meters (table 1), which means that they are smaller than those of the Umberto variety which acted as witness (103.2 linear meters), having a smaller growth vigour as well.

The VT 95.03.49 hybrid manifested its vigour through the growth of the trunk section, statistically displaying quite significant differences compared to the witness variety Umberto, a hybrid which is considered to be having a rather average vigour, leaning towards small (table 2).

The swelling of the vegetative buds (table 3) began on the 16<sup>th</sup> of March and lasted until the 9<sup>th</sup> of April, while the blossoming began on the 23<sup>rd</sup> of March and lasted until the 13<sup>th</sup> of April.

Table 1

## Volume of the head and the sum of vegetative growths (2008 - 2011)

Variety	Volume of the head – m <sup>3</sup>				Average 2008-2011	+- compared to the witness	Signifi- cance	Total growth of annual sprouts linear meters						
	2008	2009	2010	2011				2008	2009	2010	2011	Avera- ge 2008- 2011	+- comp- ared to the witne- ss	Signi- fican- ce
VT.95.03.4	15.3	17.2	21.5	24.4	19.6	-6	000	83	107	135	67	98	- 5.2	-
Umberto (witness)	20.4	24.5	27.3	30.3	25.6	-	-	98	117	160	38	103,2	-	-
					LSD 5% 2.45								34.8	
					LSD 1% 3.33								47.3	
					LSD 0.1% 4.46								63.3	

Table 2

## Growth of the trunk in thickness (years V - VIII after planting)

Variety	Surface of the trunk section -cm <sup>2</sup>						Growth rate in thickness – cm <sup>2</sup>									
	2008	2009	2010	2011	+- comp. to the witn.	Signif.	2009		2010		2011		Media 2009-2011			
							cm	Signif.	cm	Signif.	cm	Signif.	cm	+- comp. to the witn.	Signif.	
VT95.03.49	130	154	177	185	-26	000	24	000	23	-	8	-	18,3	-6	-	
Umberto (witness)	138	178	203	211	-	-	40	-	25	-	8	-	24,3	-	-	
					LSD 5% 6.6			7.16		5.42		3.5		10.6		
					LSD 1% 9.08			10.41		7.9		4.76		14.6		
					LSD 0.1% 12.5			15.62		11.84		6.38		20.1		

Table 3

**Main vegetative phenophases and active thermal sum (average 2008 - 2011)**

Variety	Swelling of the buds		Blossoming		Beginning of sprout growth		Ending of sprout growth	Ending of the vegetative period		Duration of the veg. period (days)
	Data	t°C	Data	t°C	Data	t°C	Data	Data	t°C	
VT.95.03.49	16.03-5.04	121-129	23.03-13.04	174-236	04.04-26.04	321-387	04.07-27.07	23.10-13.11	3632-4081	200-242
Umberto (witness)	18.03-06.04	121-148	24.03-13.04	174-227	04.04-25.04	340-371	04.07-18.07	24.10-13.11	3645-4075	203-240

The beginning of sprout growth for the VT 95.03.49 hybrid was identical to the beginning of sprout growth for the witness variety.

The beginning of blossoming for the VT 95.03.49 hybrid (table 4) occurred between the 22<sup>nd</sup> of March and the 9<sup>th</sup> of April, while the ending of the blossoming occurred between the 31<sup>st</sup> of March and the 19<sup>th</sup> of April.

Table 4

**Observations and determinations concerning the fructification phenophases (average 2008-2011)**

Variety	Beginning of blossoming		Ending of blossoming		Duration (days)	Ripening of the fruit		Duration of the fruct. stage (days)	Average t°C
	Data	t°C	Data	t°C		Data	t°C		
VT.95.03.49	22.03-9.04	153-188	31.03-19.04	257-303	8-10	28.07-10.08	1473-1550	134-148	1525
Umberto (witness)	21.03-8.04	167-233	29.03-18.04	268-311	8-9	25.07-05.08	1586-1715	131-143	

The blossoming takes up to 8-10 days, which is enough for the realisation of the pollination and the fertilisation.

As concerns the ripening of the fruit, the VT 95.03.49 proved to be tardier than the Umberto variety, which ripens in the same climatic and soil conditions with 6-10 days earlier. In the 4 studied years, the VT 95.03.49 reached the ripening stage between the 28<sup>th</sup> of July and the 10<sup>th</sup> of August, the earliest being in 2008 (28<sup>th</sup> of July) and the latest in 2011 (10<sup>th</sup> of August).

The VT 95.03.49 hybrid has a high coefficient of natural fertility (table 5 – 30.7%), being superior to the witness variety Umberto (29.8%). The fruit production of this hybrid is positively influenced by the fertility percentage.

Table 5

**Behaviour during the pollination and fertilisation process (average 2009-2011)**

Variety	Autofertility %				Natural fertility %			
	2009	2010	2011	Average	2009	2010	2011	Average
VT 95.03.49	5.6	9.4	12.0	9.0	28.8	25.2	38.2	30.7
Umberto (witness)	0.5	0.5	1.1	0.7	21.0	31.8	36.2	29.8

As concerns the fruit production (table 6), it has been observed that in favourable years, its values are higher than those of the witness variety.

Table 6

Fruit production between 2007 and 2011 (year IX of vegetation)

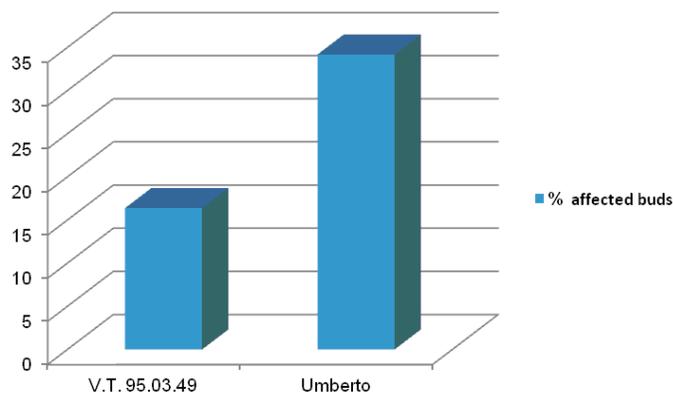
Period		V.T. 95.03.49	Umberto	
2007	kg/tree	14	21	LSD 5%=3.70; LSD 1%=5.04 LSD 0,1%=6.75
	t/ha	8.7 <sup>o</sup>	13.1	
2008	kg/tree	30	20.7	LSD 5%=6.37; LSD 1%=8.76 LSD 0,1%=12.6
	t/ha	18.7 <sup>oo</sup>	12.9	
2009	kg/tree	5.1	1.4	LSD 5%=0.78; LSD 1%=1.06 LSD 0,1%=1.42
	t/ha	3.1	0.9	
2010	kg/tree	20.8	13.5	LSD 5%=0.84; LSD 1%=1.14 LSD 0,1%=1.53
	t/ha	12.8 <sup>oo</sup>	8.4	
2011	kg/tree	21	16	LSD 5%=4.20; LSD 1%=4.470 LSD 0,1%=7.60
	t/ha	13.1	10.0	
Average 2007- 2011	kg/tree	18.1	14.5	
	t/ha	11.3	9.0	
	+ - comp. to the witn. signif.	2.3	-	
		-	-	

The year 2008 is considered to have been favourable for the fruit production from a climatic point of view, the lower temperatures during the blossoming (5.7 – 12.6° C) leading to a delay in this phenophase and implicitly, to a good tying, thus realizing a greater production (18.7 t/ha), the difference being significantly positive when compared to the witness variety. The year 2009 was unfavourable to the cultivation of apricot trees because of the climatic accidents that occurred during the blossoming stage (-2.9°C in the air and -5°C on the ground), which led to the destruction of the tied fruit; however, this hybrid proved to be more resistant, the production being of 3.1 t/ha. The year 2010 was not quite favourable for the apricot tree because of the extended draught from the previous year, thus determining a production of 12.8 t/ha of the VT 95.03.49. The value was fairly positively significant compared to the witness (8.4 t/ha), which demonstrates its ability to adapt to the climatic conditions characterised by an extended draught in the previous year.

In 2011, the VT 95.03.49 realised an average production of 13.1 t/ha and it is safe to say that it has remade its productive potential faster than the witness variety.

Analysing the average of the fruit production over a period of 5 years and taking into account the year 2009, when the production was quite low, we can state that this hybrid realized an average production of over 11 t/ha.

A criterion based on which a variety is promoted into the assortment is the appreciation of the resistance to cold and variations in temperature (fig. 1).



**Fig. 1 – Resistance to cold of flowering buds**

Between 2007 and 2011, before the beginning of the vegetative stage, observations for this hybrid were performed on over 820 flowering buds. We can state that the VT 95.03.49 is highly resistant to low temperatures and fairly resistant to comeback cold periods, the average percentage of destroyed buds over a period of 4 years being of 16.4%, as compared to 34.2% for the witness variety.

## CONCLUSIONS

1. The VT 95.03.49 hybrid can be considered a variety with a late ripening stage and it can improve the structure of the current assortment, which is still lacking in tardy varieties (in the area).

2. This hybrid outlines for the first time the consumption of tardy fresh fruit, given the fact that the ripening stage occurs 10 days later than at the witness variety Umberto (beginning with the first 10 days of August), thus making the hybrid superior to the witness variety.

3. The guarantee of this variety's value is also given by its adaptability to local climatic and soil conditions, expressed through its high resistance to the extreme temperatures specific to this area, to diseases and pests, which recommends its homologation as variety and its extension within crops.

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# ROOTS DEVELOPMENT CAPACITY OF RASPBERRY PLANTS

## CAPACITATEA DE DEZVOLTARE RĂDĂCINILOR LA PLANTELE DE ZMEUR

*SAVA Parascovia*<sup>1</sup>

e-mail: psava2110@gmail.com

**Abstract** Investigations on capacity development and location of raspberry root system growing in new conditions were performed in the experimental field plantation located in the Institute of Horticulture in 2008. Study of the objectives was to evaluate the development length and location of root mass in soil on raspberry varieties Delbard Magnific. Strain of raspberry plant is steeped in the soil up to 4 cm, followed by about 7 cm height root, which then directs lateral and in depth. Most roots penetrate the soil to a depth of 45-60 cm. The location of raspberry on the horizon of most roots, the stem in part, on the side is for a radius of 30 cm, Ø 1-2 mm roots extend further a range of 40-50 cm. The total length of roots of the raspberry cultivar studied was taken as the value of 2121.7 cm and 381.8 g mass.

**Key word:** gooseberry, variety, roots, weight, length.

**Rezumat.** Investigațiile referitoare la capacitatea de dezvoltare și amplasare a sistemului radicular al zmeurului în condiții noi de cultivare au fost efectuate în plantația de zmeur în câmpul experimental al Institutului de Horticultură, în anul 2008. Obiectivele studiului au fost aprecierea lungimii și masei rădăcinilor, dezvoltarea și amplasarea lor în sol, la soiurile de zmeur Delbard Magnific, Rubiin bulgăresc. Sistemul radicular a plantelor de zmeu, format dint-un rizom multianual ( tulpina subterană), de circa 11 cm, de la care rădăcinile se ramifică, orientându-se lateral și în adâncime. Majoritatea rădăcinilor pătrund în sol la adâncimea de 45-60 cm. Amplasarea majorității rădăcinilor de zmeur pe orizontală, de la tulpină în părți, pe lateral are loc pe o rază de 30 cm, iar rădăcinile cu Ø de 1-2 mm se extind mai departe, pe o rază de 40-50 cm. Lungimea totală a rădăcinilor de zmeur la soiul studiat a fost stabilit la nivelul valorii de 2121,7 cm, iar masa - 381,8 g. iar la soiul Rubiin bulgăresc corespunzător 1893,5 cm și 330,9 g.

**Cuvinte cheie:** zmeur, soi, rădăcina, masa, lungimea.

## INTRODUCTION

The root system of raspberry bush is well branched. Main roots are placed horizontally at a depth of 20-60 cm, according to Siberia. The root system of raspberry plants is composed the rhizome (underground stem) of the horizontal and vertical branching roots. Most of the root is at depth of 20-30 cm on the young plant fruit until it enters the economic and 20-60 cm during the fruit. Growth and root development depends on soil fertility.

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<sup>1</sup> Scientifico-Practical Institute of Horticulture and Food Technologies, Chișinău, Republic of Moldova

Thus the low productive heavy soils roots grow weak, but the most fertile can increase up to a depth of 1.5 m horizontal spread of roots in young plants occurs on a diameter of 60 cm and a plant bearing diameter 100-150 cm.

The roots length average small fraction of raspberry plants are 93-98% from the total length. Excavations raspberry roots in young plantations bearing roots showed that large fractions of 5-15 and 2-5 mm diameter were only several layers from the depth of 10-30 cm and very few in the lower layers, but at a distance of 60-80 cm from the centre of the row, large roots in soil layers below 20 cm were not practical. Small fraction of roots with diameter of 1-2 and more than 1 mm was significantly more in all soil layers from 10 to 100 cm and 30 cm apart at a distance from the centre row. This is the fraction of roots absorbing the most active and growing. In layers below 30-to 100 cm small root fractions are considerably less, even in fruit plantations (Belish et al., 2004). Top of the raspberry bush is represented by a rhizome (stem) of soil to start roots located at a depth of 10-80 cm. Each year, the buds on the rhizome shoots appear (suckers) that strains are fertile and began living at the expense mother plant, its roots and become independent after training (Chira, 2000).

The distribution of root system of raspberry depends on many factors and primarily, soil conditions and plant age. The raspberry bush fallow roots reach a depth of 96-175 cm and are spread to a distance of 125-180 cm at planting. Most root mass (90-95%) is concentrated in the 40-50 cm layer. (Iaroslavțev, 1987; Ianovschii, 2009).

Placing the shallow roots of raspberry plants caused great requirement of the crops on soil fertility and water. In the absence of soil humidity the raspberry ability of suckers decreases significantly, thus, reduce and harvest (Julea, 1973). The raspberry root system is fasciculate the most roots are located at a depth of 40 cm. In the roots are spread lateral to 2 -3 m from the bush, but most of them located in the root to a diameter of 50-60 cm. Superficial location of the root mass base that explains the low resistance raspberry bush insufficient soil moisture (Hapova, 2003, Ianovschii, 2009).

Most roots are in the top layers of soil to a depth of 30-40 cm, thus the raspberry bush is great need nutritive. However substances in water and fertile soils and mild roots can penetrate to a depth of 90 cm. On heavy soils, low productivity, most viable roots are in the top layer - the depth of 15-25 cm. Well developed root system, allow the formation of vigorous annual aerial part, which ensures high yield plant. Length of roots depends on soil type, her mechanical composition and fertility (Alexandrova, 1989).

## **MATERIAL AND METHOD**

Investigations concerning the development and location of raspberry root system, on the new conditions of cultivation were performed in 2006 in the Field experimental plantation mounted in the Scientific and Practical Research Institute of Horticulture, Chisinau Republic of Moldova.

The investigations were performed according to methods established for studying roots systems (Colesnicov, 1972). This can be established as a result of

scientific research. Raspberry bush studying root system by digging on the Scientific and Practical Research Institute of Horticulture established a way of locating roots in the soil in the Central Zone of the Republic of Moldova.

The study was made on the root system of raspberry plants on varieties Delbard Magnific and Rubin bulgarian

## RESULTS AND DISCUSSIONS

Gooseberry varieties created Moldova's conditions are. Introduced varieties, growing conditions, we studied other than those for which they were created, they can adapt different, being more or less resistant to the climatic conditions may be higher or lower harvest, the fruits can be higher quality or vice versa.

The location in soil of raspberry plant root system to Delbard Magnific variety is presented in figure 1.



**Fig. 1** - Raspberry root system location in soil, variety Delbard Magnific.

The location in soil of raspberry plant root system to Rubin bulgarian variety is presented in figure 2.



**Fig. 2** - Raspberry root system location in soil, variety Rubin bulgarian.

As shown in figure 1 and 2, on the root stock of the raspberry plants are located rhizomes (underground stem), which develops roots that turn sideways in the layers of soil from the surface.

On the horizontal roots shoots is placed the buds, which are developing other young plants, suckers. The roots, which are shifting horizontally, successfully penetrate in the depth.

The greater the forces of growth and the suckers plant roots, the greater the mass and root length. Well developed raspberry root system to favour vigorous annual aerial part formation, which can ensure high harvest and plant quality.

The results of the investigations it was established that the root system of raspberry plants consists of one long-term rhizome (underground stem, about 11 cm), from which roots branch off, focusing on lateral and depth.

The root system consists of one non raspberry plants a multi rhizome (underground stem, about 11 cm), from which roots branch off, focusing on lateral and depth.

Most roots penetrate the soil to a depth of 45-60 cm. Placing the horizon majority raspberry roots, stems in part from the side is for a radius of 30 cm, and  $\varnothing$  1-2 mm roots extend further a range of 40-50 cm.

Research in raspberry plantation allowed for identify the distribution of roots in soil, and findings are presented in table 1.

Table 1

**Raspberry root length and weight depending on variety,  
year of plantation 2000**

Variety	Roots length, cm				Root weight, g			
	Ø 0,5-0,6 mm	Ø 0,25-0,45 mm	Ø 0,1-0,2 mm	amount	Ø 0,5-0,6 mm	Ø 0,25-0,45 mm	Ø 0,1-0,2 mm	amount
Delbard Magnific	98,2	347,3	1676,2	2121,7	17,6	62,5	301,7	381,8
Rubin bulgarian	44,2	333,4	1515,9	1893,5	7,7	58,3	264,9	330,9

According to the data presented in table 1 we can say that the root system, plants of raspberry variety Delbard Magnific is more vigorous in development, and the roots are more developed. The total roots length of this variety is 2121,7 cm, and their mass is 381,8 g. Roots thick, Ø 0.5-0.6 mm in length of 98.2 cm and weight-17.6 g thin Roots, Ø 0,10 and 0,20 mm reach a length of up to 1676,2 cm, with a mass of thick Roots 301,7 g. medium Ø 0,25-0,45 mm have a length of 347,3 cm, and the mass of 62,5 g.

Plants of raspberry variety Rubin Bulgarian is less vigorous in development, and the roots are more poorly developed. The total length of this variety is 1893,5 cm, roots and their weight is 330,9 g. Roots thick, Ø 0.5-0.6 mm in length of 44.2 cm and weight-7.7 g thin Roots, Ø 0,10 and 0,20 mm reach a length of up to 1515,9 cm, with a mass of 264,9 g medium-thick Roots., Ø 0,25-0,45 mm, a length of 333 cm d: 43.4 cm, and the mass of 58.3 g.

### CONCLUSIONS

So, research conducted to study root system Delbard Magnificent raspberry bush varieties, Bulgarian Rubin allowed us to determine that:

1. In developing the basic roots of raspberry plants largely influence the particularity of variety. The greater forces of growth, the greater root mass and length, allowing good growth of plants, increased harvest.

2. The root system of raspberry plants consists of one long-term rhizome (underground stem, about 11 cm), from which roots branch off, focusing on lateral and depth..

3. Most roots penetrate the soil to a depth of 45-60 cm. The location of raspberry on the horizon of most roots, the stem in part, on the side is for a radius of 30 cm, Ø 1-2 mm roots extend further a range of 40-50 cm.

4. The total length of roots of the raspberry variety Delbard Magnific, was taken as the value of 2121.7 cm and weight - 381.8 g, while the variety Rubin Bulgarian those parameters have lower values, properly 1893.5 cm and 330.9 g.

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# FORMATION OF GRAFT UNION IN PLUM: A HISTOLOGICAL STUDY BY USING LIGHT MICROSCOPY

## INVESTIGAȚII ALE ZONEI DE ALTOIRE LA PRUN: STUDIU HISTOLOGIC FOLOSIND MICROSCOPIA OPTICĂ

ZLATI Cristina<sup>1</sup>, GRĂDINARIU G.<sup>1</sup>, ISTRATE M.<sup>1</sup>, NEGREA Roxana<sup>1</sup>

e-mail: zlaticris@uaiasi.ro

**Abstract:** During grafting, phenolic compounds from the cut surface cells oxidize and produce necrotic layer isolating the surfaces. Callus cells formed from the xylem medullar ray and secondary shell cells destroy the necrotic layers on the cut surfaces. Then, the cavity between the rootstock and scion is filled and reestablish the connection between them. After this stage, the transport of water and nutrients through the grafting area occurs (Buttner, 1979). For a successful grafting it is important to pursue the anatomical development between tissue of scion and rootstock after grafting. The anatomical structure of graft unions was investigated in plum varieties 'Stanley', 'Centenar', 'Tuleu gras' and 'Pescarus' grafted on cherry plum (*Prunus cerasifera* Ehrh) seedlings. This research was aimed to determine the anatomical structure of graft union in some graft combinations of plum using chip-budding grafting technique. The study was carried out in 2007-2009 in University of Agricultural Sciences and Veterinary Medicine Iasi Experimental orchard. Tissue samples from graft unions were taken one year after grafting and fixed in formalin/glacial acetic acid/ethanol solution. Scattered brown necrotic layers were identified, as a result of enzymatic reactions in the junctional tissue. By analysing the pattern of the development of vascular tissues we can estimate the compatibility of the graft combination and control the grafting process (Ermel, 1997). The results are beneficial in nursery plant production for new rootstocks selections.

**Keywords:** grafting, compatibility, plum, anatomy

**Rezumat:** În timpul altoirii, compușii fenolici produși de celulele de la suprafața secțiunilor oxidează și formează un strat necrotic izolator. Ulterior, țesutul de calus format distruge straturile necrotice din zona de contact, iar cavitatea dintre portaltoi și altoi se umple și începe restabilirea legăturilor vasculare. După această etapă, transportul apei și a nutrienților prin zona de altoire poate are loc în limite normale (Buttner, 1979). Pentru o bună prindere este important să continue dezvoltarea anatomică corespunzătoare în zona de altoire. Astfel, s-a investigat structura anatomică a zonei de altoire la soiurile de prun "Stanley", "Centenar", "Tuleu gras" și "Pescăruș", altoite pe *Prunus cerasifera* Ehrh. Scopul acestor cercetări a fost determinarea structurii anatomice a zonei de altoire la combinațiile altoi-portaltoi alese, folosind tehnica chip-budding ca metodă de altoire. Studiul a fost efectuat în câmpul experimental al Universității de Științe Agricole și Medicină Veterinară Iași, în perioada 2008-2011. Probele de țesut au fost prelevate din zona de altoire la un an după altoire și fixate în formol/acid acetic glacial/soluție de etanol. În urma observațiilor microscopice au fost identificate straturi necrotice de culoare maro, ca urmare a unor reacții enzimatice în țesutul de joncțiune. Prin analiza modelului de dezvoltare a țesuturilor vasculare se consideră că se poate estima gradul de compatibilitate a asociației altoite, putând astfel controla procesul de altoire (Ermel,

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

1997). *Rezultatele își găesc utilitatea în sfera producerii de material săditor pomicol și în selecția unor noi portaltoi.*

**Cuvinte cheie:** altoire, compatibilitate, prun, anatomie

## INTRODUCTION

Plants produced from seeds are frequently used as roostock for plum in the production of nursery plants. In Romania, *Prunus cerasifera* and numerous clones of this specie are used in high percentage in grafting plum varieties. In this way, are occurring many differences in the development of nursery plants owing to genetic heterogeneity of rootstocks. Besides the problems as overheight and long juvenile period, grafting incompatibility is another serious problem of nursery production (Errea et al., 1994). Knowing the changes that occur at the grafting area makes us understand better the incompatibility mechanism and allow us to engraft a larger number of varieties on a compatible rootstock.

In this paper there was determined the anatomical structure of graft union in some combination of plum varieties with *Prunus cerasifera* and find the implications that could explain graft compatibility-incompatibility between some varieties and rootstocks. From analyzed combinations samples we had, from the anatomical structure of graft union area, was observed that new cambium, xylem and phloem tissues were formed and there was needed longer time for continuous cambial merging. Some abnormalities were seen at graft union area at some combinations and it was suggested that there could be a not very good compatibility for these graft combinations (Dolgum et al., 2008; Tekintas et al., 1996).

The general aim of this study is the possibility to find and to apply an early selection method that could predict the future of a determinate combination long before the external symptoms can be observed.

## MATERIAL AND METHOD

**Anatomo-morphologic observations** were made using fresh material, taken during the vegetation period (July-August 2010). The probes consisted of 3-4 cm stem fragments of the grafting area, which were fixed afterwards in ethylic alcohol 70°.

The variants were four plum varieties (Stanley, Pescăruș, Centenar and Tuleu gras) with different compatibility level at grafting on *Prunus cerasifera*.

In order to diagnostic some aspects of grafting incompatibility there were taken samples from three different parts of the grafted area: above and under the grafted area and from the joining area. The sections were made using microtome CUT 6062 Slee Mainz, and there were performed transversal and longitudinal sections through the joining area. Sections thickness varied between 15 – 22 μ. The sections were fixed in glacial acetic acid 1% time for 20 minutes. After colouring in metilene blue solution for 20 minutes, probes were washed with distillate water and included in gelatine glycerinate. The probes we obtained were analyzed at Motic microscope with size unit 10x18 and objectives 4/0.10 and 10/0.25.

On micro sections there were made observations concerning:

- xylem vessels orientation;
- vessels way of arrangement, if they are linear or if they present involution and sinuous aspect, if xylem fascicle is continuous or if it's interrupted in the joining area;
- vessels frequency determination in transversal section in comparison with other anatomical elements (the was also determined the number of vessels in the grafting area);

- the presence of lacunars area;
- medullar rays width;
- medullar rays continuity or discontinuity;
- determination of histological elements size (average diameter of xylem vessels) (Zlati et al., 2011).

## RESULTS AND DISCUSSIONS

The macroscopic observations made after grafting at incompatible combinations highlighted differences in scion and rootstock diameter, deviations from vessels normal longitudinal orientation, weak resistance at the joining area, development of brown layer of separation between scion and rootstock by generating at the incision place of a scarring suberous (photo 1), which as is known, is formed of cells whose walls are impregnated with polyphenolic substances, which confers impermeability (Gurrieri et al., 2001).

Data on the new vascular elements formed in the grafting area at plum varieties grafted on *Prunus cerasifera* are presented in table 1 and can be noticed a higher number of vessels at those varieties who had good compatibility with the rootstock without big differences between scion and rootstock (Stanley registered 57.6 vessels above the grafting area and 54.2 vessels under the grafting area). While in incompatible varieties could be noticed big differences in vessels number above and under the grafting area (Tuleu gras registered 60.2 vessels above the grafting area and 23.9 vessels under the grafting area). These negative differences may explain vessels discontinuity between scion and rootstock and the blockage in water and nutrients transport (Cristoferi et al., 1965).

Table 1

**Xylem vessels number in three analyzed areas  
at plum varieties grafted on *Prunus cerasifera***

Variety/ Rootstock	Vessel number per mm <sup>2</sup> in the rootstock under the graft union	Signif.	Vessel number per mm <sup>2</sup> in the graft union	Signif.	Vessel number per mm <sup>2</sup> in the scion above the graft union	Signif.
Stanley	54.20	xxx	44.10	-	57.60	-
Pescăruș	49.20	xx	46.80	x	54.70	-
Centenar	28.10	00	41.40	-	63.30	-
Tuleu gras	23.90	000	34.70	00	60.20	-
Control	38.85	-	41.75	-	58.95	-

LSD 5% = 5.68                      LSD 5% = 4.53                      LSD 5% = 4.60  
 LSD 1% = 8.60                      LSD 1% = 6.86                      LSD 1% = 6.97  
 LSD 0,1% = 13.82                  LSD 0,1% = 11.02                  LSD 0,1% = 11.20  
 vessels                                  vessels                                  vessels

Regarding vessel diameter, distinctly significant differences were recorded in the same varieties, Pescăruș and Tuleu gras (in the joining area) and Pescăruș and Centenar above the grafting area (tab. 2).

In plum, microscopic symptom of incompatibility which has been frequently observed was the presence of undifferentiated parenchyma tissues along with vascular tissues, which had a clear line of separation that prevents re-establishment of vessels

continuity in the grafting area. In some cases, in this mass of parenchymatic cells could be observed necrotic spots both in cross and longitudinal sections (photo 2).

Table 2

**Xylem vessels diameter in three analyzed areas at plum varieties grafted on *Prunus cerasifera***

Variety/ Rootstock	Vessel diameter in the rootstock under the graft union (µm)	Signif.	Vessel diameter within the graft union (µm)	Signif.	Vessel diameter in the scion above the graft union (µm)	Signif.
Stanley	34.5	-	27.1	-	33.0	-
Pescăruş	30.2	-	31.2	xx	36.1	x
Centenar	36.2	-	27.8	-	29.0	00
Tuleu gras	28.6	-	22.1	00	34.2	-
Control	32.3	-	27.0	-	33.0	-

LSD 5% = 6.10

LSD 1% = 9.20

LSD 0,1% = 14.90 µ

LSD 5% = 2.60

LSD 1% = 4.00

LSD 0,1% = 6.50 µ

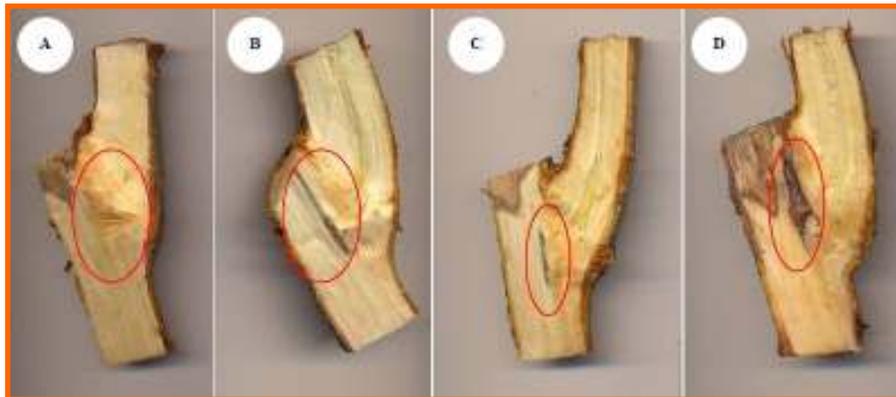
LSD 5% = 2.40

LSD 1% = 3.70

LSD 0,1% = 5.90 µ

However, the most serious symptom of incompatibility observed at plum was large lacunar areas that, in addition to the disturbances they produce in assimilate transportation, weaken trees mechanical resistance (photo 3). This symptom was manifested especially in the grafting area, but it could be also observed in the samples that were taken from the scion and rootstock tissues. Tissues defective developing at incompatible plum varieties grafted on *Prunus cerasifera* was characterized by the presence of necrotic areas, which were supposed to be the lack of callus response to stimuli for differentiation.

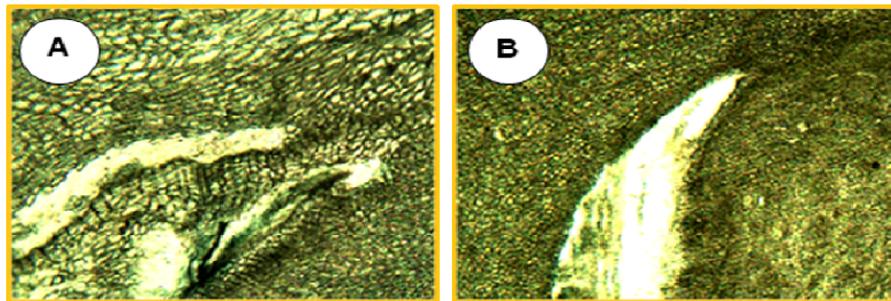
Another aspect observed in microscopic sections was that the new xylem vessels that were formed had a nearly horizontal orientation, turning from the normal vertical orientation (photo 5). Other researches but concerning sweet cherry varieties noticed the same aspect in heterograft combinations.



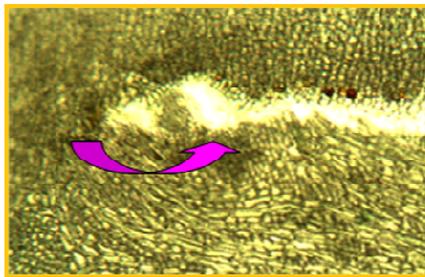
**Fig. 1** - Macroscopic observations of the grafting area at plum varieties grafted on *Prunus cerasifera*: A - Stanley, B - Centenar, C - Pescăruş, D - Tuleu gras.

In photo 6 can be observed xylem vessels aspect in cross section and the big differences existent in vessels number above and under grafting area at Centenar variety (29.0 vessels above and 36.2 vessels under the grafting area) at Centenar variety. Also in some cases could be observed, in cross section, vessels discontinuity (photo 4 and 5) caused by undifferentiated parenchyma inclusions.

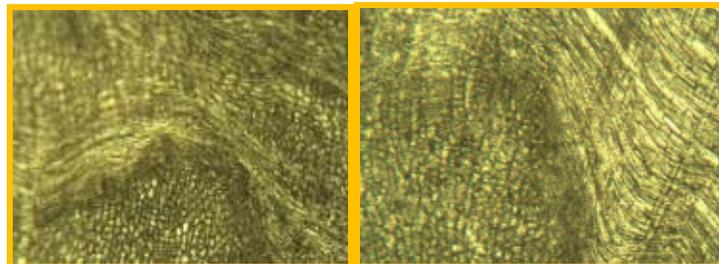
By comparison, there were used samples from a compatible combination, Stanley variety grafted on *Prunus cerasifera* where could be observed the normal aspect of the vessels both in longitudinal and transversal section, vessels right alignment and the absence of necrotic spots and lacunar areas.



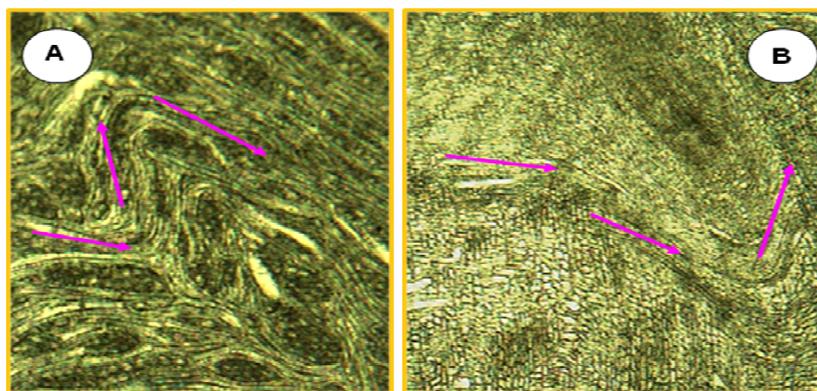
**Fig. 2** - Transversal section through the joining area at Centenar variety; lacunar areas presence: A-lens 10 x, B-lens 4x



**Fig. 3** - Transversal section through the joining area at Tuleu Gras variety; the presence of the lacunar areas



**Fig. 4** - Cross section through the grafting area at Tuleu Gras variety, can be seen vessels discontinuity in the joining area



**Fig.5** - Xylem vessels sinuous trajectory in the joining area at Tuleu Gras variety – longitudinal section (arrows indicate changes in vessels normal orientation): A-lens 10 x, B-lens 4x.

## CONCLUSIONS

1. In compatible combinations the examined tissues were well developed, new cambium, xylem and phloem tissues were formed and there was needed longer time for continuous cambial merging.

2. Some abnormalities were seen at graft union area at some combinations and it was suggested that there could be a not very good compatibility for these graft combinations, symptoms also observed in research we performed for other grafting combinations in pear (Zlati et al., 2011).

3. Tissues hypertrophy and large lacunar area were more obvious symptoms observed at plum varieties.

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# RESEARCH CONCERNING VEGETATIVE MULTIPLICATION AT *CACTUS* GENERA

## CERCETĂRI PRIVIND ÎNMULȚIREA VEGETATIVĂ LA GENURI ALE FAMILIEI *CACTACEAE*

*CANTOR Maria*<sup>1</sup>, *BUTA Erzsebet*<sup>1</sup>,  
*HORT Denisa*<sup>1</sup>, *ANDRIESCU Ioana*<sup>1</sup>  
e-mail: marcantor@yahoo.com

**Abstract.** *Cacti inhabit diverse regions, from coastal plains to high mountain areas. Cacti have a variety of uses: some species are used as ornamental plants, others are grown for fodder or forage, others for food (particularly their fruit). The studies and researches conducted in this work has tried to highlight the technological and environmental factors influence the rooting of cuttings Cactaceae genera: Opuntia, Mamillaria, Cereus taking into account their length, the substrate used in planting and processing with different rizogene products containing substances to stimulate root cuttings. Throughout the research were aimed to ensure the optimum environmental factors that influenced rooting cuttings. In period 2010-2012 were made numerous observations and measurements necessary to characterize the biological material used for interpreting the results of rooting cuttings, on 30 plants from each variety. The study found that the results best results were obtained for short cuttings using perlite + sand and sand substrate, making root of 17 cuttings from 30. Average was calculated for the statistical analyze using LSD test.*

**Key words:** rooting, cuttings, genus, substrate, diversification

**Rezumat.** *Cactușii trăiesc în diverse regiuni, de la câmpiile de coastă până în zonele înalte. Cactușii au multiple utilizări: unele specii sunt utilizate ca plante ornamentale, altele sunt cultivate pentru furaje iar altele pentru produsele alimentare (în special fructele lor). Prin studiile și cercetarile efectuate în cadrul experienței s-a încercat să se evidențieze influența factorilor tehnologici și de mediu asupra înrădăcinării butașilor de cactacee din genurile: Opuntia, Mamillaria, Cereus, luând în considerare lungimea acestora, substratul folosit la plantare și tratarea cu diferite substanțe rizogene în vederea stimulării înrădăcinării butașilor. Pe parcursul cercetarilor s-a urmărit asigurarea la valori optime a factorilor de mediu care au influențat înrădăcinarea butașilor. S-au făcut o serie de observații și determinări necesare pentru caracterizarea materialului biologic folosit și pentru interpretarea rezultatelor privind înrădăcinarea butașilor, în perioada 2010-2012, pe 30 de butași din fiecare variantă. În urma studiului s-a constatat că rezultatele cele mai bune s-au obținut în cazul folosirii butașilor scurți în substrat de perlit+nisip și nisip, înrădăcinând în medie 17 butași din 30. Mediile au fost utilizate pentru interpretarea statistică, folosind testul DL.*

**Cuvinte cheie:** înrădăcinare, butași, genuri, substrat, diversificare

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania

## INTRODUCTION

Cactus is a member of the family *Cactaceae*. *Cactaceae* are original plant on the American continent, occupying a vast phytogeographic area.

Cacti first came from North America or South America. Cristopher Columbus brought the first cactus to Europe (Copaceascu, 2001).

Scientist and gardeners became very interested in cactus. From the start of the 20th century interest in cactus has grown. Every year, scientists discover new kinds of cactus. A bad effect of this bigger interest has been the digging up of many cacti from the wild, making some kinds endangered. Family *Cactaceae* contains more than 200 genera (Toma, 2009). Some of them are very common: *Cereus*, *Echinocactus*, *Mammillaria*, *Opuntia*, *Schlumbergera* etc.

There are some 1.500–1.800 species of cacti, most of which fall into one of two groups of "opuntias" (subfamily *Opuntioideae*) and "cactoids" (subfamily *Cactoideae*) (<http://ro.wikipedia.org/wiki/Cactus>).

There are many shapes and sizes of cacti. Some are short and round; others are tall and thin. Many cactus flowers are big and beautiful. Some cactus flowers bloom at night and are pollinated by moth and bats. Some cactus fruits are brightly coloured and good to eat (Draghia and Chelariu, 2011). Cacti are commonly grown as houseplants. They are pretty and easy to grow. Some cacti are grown in gardens, especially in dry areas (Cantor and Pop, 2008). Cactus can be used as a living fence. The wood of dead cactus is sometimes used for building. People eat the fruit of some kinds of cactus.

## MATERIAL AND METHOD

The researches were made on the didactical collection in greenhouse of Floriculture Department of UASVM Cluj-Napoca in the period of 2010 – 2011.

The objectives of the experiment were to establish the best method for vegetative multiplication (rooting substrate, length of cuttings etc) of cactus and in order to extend the culture of some genus.

Biological materials were represented by three species: *Cereus* sp., *Mammillaria* sp. and *Opuntia* sp.

***Cereus* sp.** - is a cacti with very elongated bodies, including columnar growth (fig.1).

***Mammillaria* sp.** - the plants are usually small, globose to elongated, the stems from 1 cm to 20 cm in diameter and from 1 cm to 40 cm tall (fig.2).

***Opuntia* sp.** - is a globular plant or having cylindrical form, rather than flattened, stem segments with the large barbed spines. The most commonly culinary species is the *O. ficus-indica* (fig.3).

Data were synthesized by LSD test analysis to illustrate the differences between these varieties (Ardelean et al., 2007).



**Fig. 1** - *Cereus* sp. plants and flower



**Fig. 3** - Plants and flower of *Mammillaria* sp.



**Fig. 3** - *Opuntia* sp. buds, flowers and fruits

## RESULTS AND DISCUSSIONS

The results obtained in the experiment were presented in the next tables.

Table 1

**The influence of cuttings length and culture substrate on cacti genera**

No. crt.	Genera	Length of cuttings	Culture substrate	No. cuttings	Rooted cuttings
1	<i>CEREUS</i> sp.	Long	peat+sand	30	11
2			perlite+sand	30	13
3			sand	30	12
4		Short	peat+sand	30	19
5			perlite+sand	30	21
6			sand	30	20
7		Medium	peat+sand	30	13
8			perlite+sand	30	15
9			sand	30	14
10	<i>OPUNTIA</i> sp.	Long	peat+sand	30	15
11			perlite+sand	30	17
12			sand	30	16
13		Short	peat+sand	30	20
14			perlite+sand	30	21
15			sand	30	19
16		Medium	peat+sand	30	18
17			perlite+sand	30	20
18			sand	30	19
19	<i>MAMILLARIA</i> sp.	Long	peat+sand	30	11
20			perlite+sand	30	16
21			sand	30	14
22		Short	peat+sand	30	18
23			perlite+sand	30	20
24			sand	30	19
25		Medium	peat+sand	30	13
26			perlite+sand	30	15
27			sand	30	14
	Average			30	17

The analysis of the table 1 shows that in terms of rooting was founded to have rooting cuttings in an average of 17 cuttings of 30 for cacti genera, and variability is between 11 *Cereus* sp. - V<sub>1</sub>, *Mamillaria* sp. - V<sub>19</sub>) and 21 (*Opuntia* sp. - V<sub>14</sub>).

Analyzing the influence of length of cuttings and substrate, the data from table 2, shows that short cutting present significant difference of 5.8 cm comparing with the control (long cuttings). If the data are compared with the average of experiment, result that short variant archive positive difference of 3.3 cm, but is not assured statistically.

Table 2

## Influence of length of cuttings of rooting capacity

Variants	Absolute Number	Relative %	$\pm d$	Significant difference	Relative %	$\pm d$	Significant difference
Long (Control)	13,9	100	-	-	84,8	-2,5	-
Short	19,7	141,7	5,8	*	120,2	+3,3	-
Medium	15,7	112,9	1,8	-	95,7	-0,7	-
Average of experiment (Control)	16,4	-	-	-	100,0	-	-

LSD 5% = 5.6

LSD 1% = 9.2

LSD 0.1% = 17.3

In the table 3 are presented the data concerning the influence of rooting substrate of cacti genera.

Statistical interpretation shows that distinct significant differences are registered in case of perlite+sand (2.2 cm), comparing with the control of experiences (peat+sand). The substrate consist in sand achieve significant differences.

When the data are compared with the average of experiences, can conclude that distinct significant difference are registered only in case of perlite+sand (1.1 cm). The other substrates achieved negative differences.

Table 3

## Influence of culture substrate of rooting capacity

Variants	Absolute Number	Relative %	$\pm d$	Significant difference	Relative %	$\pm d$	Significant difference
Peat+sand (Control)	15,3	100	-	-	93,3	-1,1	-
Perlite+sand	17,5	114,4	2,2	**	106,7	+1,1	**
Sand	16,3	106,6	1	*	99,4	-0,1	-
Average of experiment (Control)	16,4	-	-	-	100,0	-	-

LSD 5% = 0.36

LSD 1% = 0.6

LSD 0.1% = 1.1

## CONCLUSIONS

1. Using perlite + sand mixture as rooting substrate caused an increase of 10% of the total number of rooted cuttings compared with control, sand substrate.
2. Use small cuttings (short) increase the number of rooted cuttings.
3. To obtain biological material for multiplication having quality and good percentage of rooting, the use of small cuttings and the rooting substrate, perlite + sand or sand are recommended.

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# EVALUATION OF POTENTIAL MORPHO-DECORATIVE IN SOME VARIETIES OF *FREESIA HYBRIDA*

## EVALUAREA POTENȚIALULUI MORFO-DECORATIV LA UNELE SOIURI DE *FREESIA HYBRIDA*

**CANTOR Maria<sup>1</sup>, BUTA Erzsebet<sup>1</sup>,  
HORT Denisa<sup>1</sup>, ANDRIESCU Ioana<sup>1</sup>**  
email: marcantor@yahoo.com

**Abstract.** *Freesia* originates from South Africa and got its name in honour of Friedrich Heinrich Theodor Freese. *Freesia hybrida* is the member of the Iridaceae family. This paper presents six varieties of *Freesia hybrida* and the importance of these flowers in our life. This plant is one of the most famous one for the majority of people. It is available in white, yellow, lavender, mauve, orange, gold, pink, red, velvet shades colors. The biological materials were studied in didactical greenhouse at Floriculture department of UASVM Cluj-Napoca. The next varieties 'El Dorado', 'Apollo', 'Corona', 'Romany', 'Balerina' and 'Margaret' were analysed concerning their main morpho-decorative characteristics, following to be recommended for promoting in our country. The observations and measurements were made in the years 2010-2011 on 30 plants from each variety. Were analyzed the next characteristics: colors of flowers, height of plant, length of stem, number of florets/inflorescence and the number of simultaneous flower open. The statistical analyze of the characters was do using LSD test.

**Key words:** new varieties, statistical analyze, floral characteristics, diversification

**Rezumat.** Freziile provin din Africa de Sud și-au primit numele în cinstea lui Friedrich Heinrich Theodor Freese. *Freesia hybrida* aparține familiei Iridaceae. Această lucrare prezintă șase soiuri de *Freesia hybrida* și importanța acestor flori în viața noastră. Această plantă este una dintre cele mai apreciate pentru majoritatea oamenilor. Acesta floare este cunoscută în diferite culori alb, galben, lavanda, mov, portocaliu, auriu, roz, nuanțe de catifea roșie. Materialul biologic a fost studiat în sera didactică a disciplinei de Floricultură de la USAMV Cluj-Napoca. Următoarele soiuri au fost studiate cu privire la principalele lor caracteristici morfo-decorative: 'El Dorado', 'Apollo', 'Corona', 'Romany', 'Balerina' și 'Margaret', urmând să fie recomandate pentru promovarea în țara noastră cele mai valoroase. Observații și măsurători au fost făcute în anii 2010-2011 la 30 de plante din fiecare soi. S-au analizat caracteristicile următoare: culoarea florilor, înălțimea plantelor, lungimea tijeii florale, numărul de flori/inflorescență și a numărului de flori deschise simultan. Mediile au fost utilizate pentru interpretarea statistică, folosind testul DL.

**Cuvinte cheie:** noi varietăți, analiza statistică, caracteristici florale, diversificare

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania

## INTRODUCTION

Floriculture in recent decades and especially in our country since 1990 has sought to promote new technologies to ensure the sustainability of horticultural production and ultimately lead to safe and steady profits with minimum effect on the environment. This is possible by maximizing production capacity per unit area on one hand and reduces costs per unit, on the other hand (Draghia and Chelariu, 2011). In horticultural practice is necessary to improve the assortment of flower plants with the latest ones, created in our country or internationally, and improvement of some effective crop technologies in order to obtain qualitative and quantitative production. The transition to a market economy for our country is a highly complex process requiring profound changes regarding the restructuranc of horticultural production in line with consumer requirements actual and potential, both in the internal and external market (Toma, 2009).

The interest of foreign specialists in the Netherlands, Germany, France, Israel, or East, it manifests to improve the assortment of flower plants for understanding the ecology and for grounding appropriate culture technologies, and it is diversifying more and more every day (Vargane, 1990).

*Freesia hybrida* is a floricultural species that is grown on thousands of hectares worldwide, ranked among the top six of the most sold flowers and in Romania unfortunately is grown on small areas (because of the lack modern culture areas or because of the high costs of production), but it has upward trend in private firms that are building modern greenhouses / solariums using European funds (Şelaru, 2002).

Studying *Freesia hybrida* species is justified because this floricultural plant is very popular and it is appreciated by many people especially for elegance, delicacy and fragrance.

Also, the growth trends of *Freesia* consumption in our country, ranking 4 place after carnations, chrysanthemums and roses, justifies the research for finding technological solutions for controlled conditions climate and tracking the behavior in terms of qualitative and quantitative assortments novelties ([http://www.desert-tropicals.com/Plants/Iridaceae/Freesia\\_hybrida.html](http://www.desert-tropicals.com/Plants/Iridaceae/Freesia_hybrida.html)).

## MATERIAL AND METHOD

The experiments were performed in the greenhouse of UASVM Cluj-Napoca, Romania, Ornamentals department, in 2010-2011 periods. The next varieties 'El Dorado', Apollo', 'Corona', 'Romany', 'Balerina' and 'Margaret' were analysed concerning their main morfo-decorative characteristics. 'El Dorado' was used for contro. The experience was such monofactorial randomized blocks with six variants and three repetitions and were applied to all technological measures specific to this plant.

Phenological and morfo-decorative observations were made on plant:

- Height of plant (cm)
- Diameter of flower (cm)
- Number of flowers \ inflorescence
- Distance between first and second flower (cm)

- Length of inflorescence (cm)
- Color of flower.

Processing and interpretation of statistical data were analyzed using the mean characteristics for each variety studied. All data were statistically interpreted for each character, and test significance of differences between the test versions using using the LSD test (Ardelean et al., 2007).

## RESULTS AND DISCUSSIONS

The experimental data for the *Freesia* cultivars were presented in the next tables.

Table 1

Plants's height (cm) of *Freesia* cultivars in 2010-2011

No. crt.	Variety	Average height (cm)	Relative height (%)	± d	Significant difference
1.	El Dorado (Control)	49.5	100	-	-
2.	Corona	46.0	92.9	-3.5	-
3.	Romany	58.5	116.2	+9.0	**
4.	Balerina	44.3	89.5	-5.2	-
5.	Margaret	56.5	114.1	+7.0	-
6.	Apollo	53.1	107.3	+3.6	-

LSD 5% = 7.6 cm    LSD 1% = 8.5 cm    LSD 0.1% = 14.5 cm

The analysis of the table 1 shows that average height of plant varied within the limits of 44.3 cm at 'Balerina' and 57.5 cm at 'Romany' cultivar.

As statistically point of view, there are distinct significant positive differences at the 'Romany' cultivars, but and the other cultivars ('Corona', 'Balerina', 'Margaret' and 'Apollo') are not significant regarding the average height of plant compared to the control variant 'El Dorado'.

Table 2

Diameter of flower (cm) of *Freesia* cultivars in 2010-2011

No. crt.	Variety	Average diameter of flower (cm)	Relative average diameter (%)	± d	Significant difference
1.	El Dorado (Control)	4.8	100	-	-
2.	Corona	4.5	91.7	-0.3	-
3.	Romany	5.2	106.3	+0.4	*
4.	Balerina	4.6	95.8	-0.2	-
5.	Margaret	5.0	104.2	+0.2	-
6.	Apollo	4.8	100	0.0	-

LSD 5% = 0.4 cm    LSD 1% = 0.5 cm    LSD 0.1% = 0.7 cm

The table 2 indicate that the diameter of flower varies on the analyzed cultivars from 4.5 cm ('Corona') to 5.2 cm ('Romany'). In terms of statistics, the

cultivar 'Romany' has a significant positive difference while the other cultivars are not significant regarding the average diameter of flower.

Table 3  
Number of flowers\inflorescence of *Freesia* cultivars in 2010-2011

No. crt.	Variety	Average number of flower\infl.	Relative number flower\infl. (%)	± d	Significant difference
1.	<b>El Dorado</b> (Control)	8.0	100	-	-
2.	Corona	7.8	88.9	-0.2	-
3.	Romany	10.2	75.6	+2.2	***
4.	Balerina	8.8	97.8	0.8	-
5.	Margaret	8.5	94.4	0.5	-
6.	Apollo	8.8	97.8	0.8	-

LSD 5% = 1.1    LSD 1% = 1.5    LSD 0.1% = 2.0

The data on this character are summarized in table 3 that indicating that the number of flowers\inflorescence analyzed cultivars varies from 7.8 to 'Corona' to 10.2 at 'Romany'. Statistically analyzing the obtained data shows the 'Romany' cultivar proved to be very significant positive and 'Corona', 'Balerina', 'Margaret' and 'Apollo' are not significant compared to the control cultivar.

Table 4  
Distance between I-II flowers (cm) of *Freesia* cultivars in 2010-2011

No. crt.	Variety	Average Dist. I-II flower (cm)	Relative Dist. I-II flower (%)	± d	Significant difference
1.	<b>El Dorado</b> (Control)	2.3	100	-	-
2.	Corona	1.6	69.6	-0.7	o
3.	Romany	1.5	65.2	-0.8	o
4.	Balerina	3.5	47.8	+1.2	**
5.	Margaret	2.9	73.9	+0.6	*
6.	Apollo	3.0	69.6	+0.7	*

LSD 5% = 0.6 cm    LSD 1% = 0.9 cm    LSD 0.1% = 1.2 cm

Analyzing the behavior of *Freesia* cultivars studied compared to 'El Dorado', control variant, can conclude that the best results concerning the distance between first and second flower indicate that the average was 3.5 cm to 'Balerina', this presented a distinct significant positive while 'Margaret' and 'Apollo' cultivars are significant positive for this character.

'Corona' and 'Romany' present a difference negative compared with control variant.

The data on this character are summarized in table 5 that indicating that the length of the inflorescence of analyzed cultivars varies from 5.1 cm to 'Romany' to 8.1 cm at 'Margaret'.

In terms of length of inflorescence, 'Margaret' was not significant, 'Apollo' was significantly negative difference and cultivars 'Corona', 'Romany' and 'Balerina' presented differences distinct significant negative.

Table 5

Length of inflorescence (cm) of *Freesia* cultivars in 2010-2011

No. crt.	Variety	Average length of infl.(cm)	Relative length (%)	± d	Significant difference
1.	El Dorado (Control)	7.8	100	-	-
2.	Corona	5.7	73.1	-2.1	oo
3.	Romany	5.1	65.4	-2.7	oo
4.	Balerina	5.5	70.5	-2.3	oo
5.	Margaret	8.1	94.9	0.3	-
6.	Apollo	6.3	80.8	-1.5	o

LSD 5% = 1.5 cm    LSD 1% = 2.1 cm    LSD 0.1% = 2.8 cm

Table 6

Coefficient of variation of *Freesia* cultivars

No. crt.	Variety	Color of flower		Height plant (cm)	Diam. Flower (cm)	No fl.\ infl.	Dist.I-II flower (cm)	Length of infl. (cm)
1.	El Dorado	yellow	S	11.7	0.3	1.8	0.5	3.2
			S%	23.6	6.3	20.0	21.7	41.03
2.	Corona	yellow	S	11.9	0.97	2.9	0.53	1.97
			S%	25.9	22.1	36.3	33.1	34.6
3.	Romany	purple	S	14.2	0.81	3.3	0.84	2.2
			S%	24.7	15.8	48.6	55.8	43.1
4.	Balerina	cream	S	6.5	1.0	1.3	0.37	0.4
			S%	14.6	21.7	14.2	33.2	7.3
5.	Margaret	red	S	4.1	0.94	1.9	1.1	1.7
			S%	6.3	19.0	22.4	64.7	23.0
6.	Apollo	white	S	6.1	0.4	1.9	0.06	1.5
			S%	11.5	8.3	21.6	23.8	23.8

In terms of plant height coefficient of variation is less than 10% of the variety 'Margaret', so variability is small and this character is stable. Varieties 'Corona' and 'Romany' presents a high variability (table 6).

In terms of flower diameter coefficient of variation varies widely from the lowest (the variety 'Apollo') to the largest at the 'Corona'.

The data obtained on the number of flowers show that the coefficient of variation is greater than 20% resulting in high variability.

As the distance between the first and second flower and inflorescence length coefficient of variation is greater than 20%, so variability is high.

## CONCLUSIONS

The study was performed on six varieties of *Freesia* showed differences between varieties concerning the main characteristics.

Flower color varieties it covers a wide range of colors one color or multicolored petals with rounded or slightly sharp edge.

Because morphological characteristics decorative top, *Freesia* varieties studied have real opportunities to be extended in production in our country. Calculating coefficients of variation for the analyzed characters gives us clues about their genetic determinism, knowing that small values can be trusted to strengthen the character. This remark especially cultivars: 'Romany', 'Ballerina', 'Margaret', they are characterized by abundant flowers, crisp, intense, large flower, long and rigid flower stem, which can be used for works of improvement.

The most important cultivars are: 'Romany', 'Ballerina', 'Margaret', these are characterized by abundant flowers, crisp, intense, large flower, long and rigid flower stem, which can be used for works of improvement.

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# ASPECTS REGARDING CULTIVATION OF *FESTUCA GLAUCA* IN THE PEDO-CLIMATIC CONDITIONS OF N-E AREA OF ROMANIA

## ASPECTE PRIVIND CULTIVAREA SPECIEI *FESTUCA GLAUCA* ÎN CONDIȚIILE PEDOCLIMATICE DIN N-E ROMÂNIEI

**CHELARIU Elena-Liliana**<sup>1</sup>

e-mail: julia@uaiasi.ro

**Abstract.** In the current paper are presented the experimental results regarding cultivation of *Festuca glauca* Vill. as ornamental grass, in the pedo-climatic conditions of Iași County, Romania. Were made researches regarding producing of planting material from seeds, using different substrates (V1 – garden soil, V2 – peat, V3 – 1 part garden soil + 2 parts peat, V4 - jiffy-pots) and regarding the behaviour in cropping of the obtained biological material. The best results regarding seedlings production were obtained at variant V3, and in crop at variant V3, followed by V1 and V2.

**Key words:** ornamental grasses, *Festuca glauca* Vill., planting material, Iași

**Rezumat.** În această lucrare sunt prezentate rezultatele experimentale privind cultivarea speciei *Festuca glauca* Vill. ca iarbă ornamentală, în condițiile pedoclimatice din județul Iași, România. S-au făcut cercetări privind producerea materialului săditor din semințe, utilizând diferite substraturi (V1 - pământ de grădină, V2 - turbă, V3 – 1 parte pământ de grădină + 2 părți turbă, V4 - jiffy-pots) și comportarea în cultură a materialului biologic obținut. Rezultatele cele mai bune privind producerea răsadurilor s-au obținut la varianta V3, iar în cultură la varianta V3, urmată de V1 și V2.

**Cuvinte cheie:** ierburi decorative, *Festuca glauca* Vill., material săditor, Iași

### INTRODUCTION

Order *Poales* have a single family, respectively *Poaceae* which have 700-900 sorts with 10000-12000 herbaceous species, annual and perennial, spread from arctic and alpine areas till the ones with tropical climate. In Romania could be found 86 sorts and around 300 species (Sîrbu and Paraschiv, 2005). Those species are used as fodder plants and also for lawns (Vîntu, 2004). At world level various species belonging to this botanic family are cultivated for ornamental purposes and are known under the generic name of ornamental grasses (Ardle, 2007; Dana, 2002).

The assortment of decorative grasses is much diversified; species could be cultivated in different areas of rusticity. The N-E area of Romania is placed in the 5<sup>th</sup> area of rusticity (minimum  $t^0 = -29...-23$  °C) and based on this criteria was selected for study specie *Festuca glauca* Vill. which could be cultivated from 3<sup>rd</sup> (4<sup>th</sup>) area up to 8<sup>th</sup> (9<sup>th</sup>) rusticity area (Ardle, 2007; Chelariu and Draghia, 2011).

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

Specie *Festuca glauca* Vill. belongs to *Festuca* L. gender, subfamily *Festucoideae* Link, family *Poaceae* (R.Br.). It is perennial specie with origin in Central Europe, with a compact bush, dense, height of 25-50 cm and a diameter of 50-75 cm. Leave are linear, thin, with a fine texture and a green blue colour. Flowers are green-mauve, grouped in panicles. It blooms in May-July. Prefer sunny or semi-shadows fields, well drained soils and a reduced humidity. It tolerates draught periods and air pollution. Specie didn't withstand humidity excess (Ardle, 2007; Chelariu, 2011, Chelariu and Draghia, 2011).

Gramineous species could multiply through seeds, vegetative way and by micro-propagation (Cunliffe et al., 2002; Shimomae et al., 2010).

The current paper tries to highlight some aspects regarding seedlings obtaining and cultivation of specie *Festuca glauca* Vill. as ornamental grass in the pedo-climatic conditions of Iași County, Romania.

## MATERIAL AND METHOD

Research took place in the didactic collection of Floriculture discipline from USAMV Iași, during July 2011-May 2012.

Studied material was represented by specie *Festuca glauca* Vill. (fig. 1a). To establish the experiences were used seeds (fig. 1b.) gathered from Botanic Garden of Barcelona, Spain. Seed material was obtained through the courtesy of Mr. Dr. Samuel Pyke. Sowing was realised on 4<sup>th</sup> of July 2011, in four types of substrate (table 1), and establishment of field crops was done on 24<sup>th</sup> of September 2011. Determinations and realised measurements have as goal seeds' germination percentage, plants' growing rhythm and plants' height. The obtained results at our four variants were compared and statistic interpreted, to highlight the most suitable substrate for obtaining the seedling material.

Table 1

Experimental design

Specie	Biologic material	Variant	Substrate for sowing
<i>Festuca glauca</i> Vill.	seeds	V1	garden soil
		V2	peat
		V3	garden soil + peat (1:2)
		V4	jiffy-pots



a) Mother plant (original photo)



b) Seeds (original photo)

Fig. 1 - *Festuca glauca* Vill.

## RESULTS AND DISCUSSIONS

In figure 2 are graphical presented the results regarding seed germination. Percentage of germinated seeds varied between 20% and 85%, maximum values being recorded at variant V3 (1 part garden soil + 2 parts peat), and the minimum ones at V4 (jiffy-pots pills). At variants V1 (garden soil) and V2 (peat) were recorded intermediate values, 70% respectively 60%.

We observed that between variants appeared differences regarding the time of plants' emergence. So at variants V1, V2 and V3 emergence started after ten days from sowing while at variant V4 after 20 days (fig. 3). For a complete emergence the necessary time calculated from sowing was of 42 days at variants V1, V2 and V3, respectively 32 days at variant V4 (fig. 3).

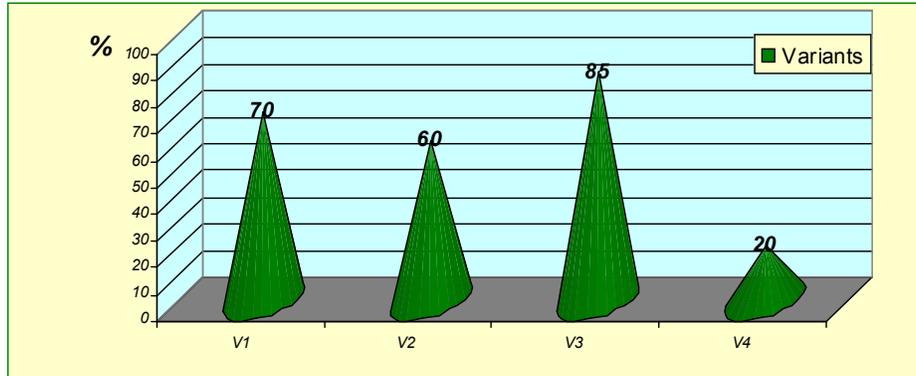


Fig. 2 - Germination percentage (%)

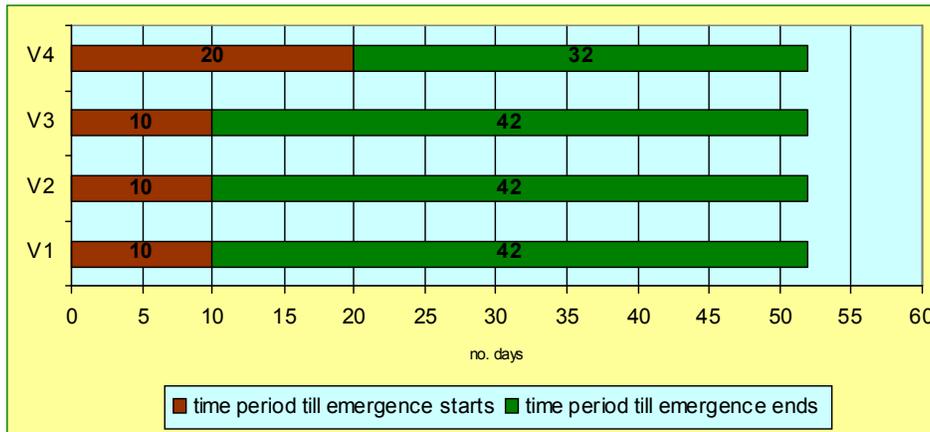


Fig. 3 - Time period for emergence start and complete emergence (no. of days from sowing)

The seedlings which were planted in field have a height between 11.8 cm at V4 and 18.3 cm at V3 and a well formed foliar apparatus (fig.4.), average number of leave per plant varying between 8 and 21 (table 2). Also the average number of roots

was of 4.1 (at V4) up to 8.2 (at V2), and the average length of roots was between 9.1 cm (at V4) and 17.5 cm (at V3) (table 2).

Table 2

Morphological features of the seedlings plated in experimental field				
Variant	Average number of roots/plant	Average length of roots (cm)	Average height of plant (cm)	Nr. leave per plant
V1	7.8	17.4	17.8	18
V2	8.2	16.3	17.2	20
V3	8.0	17.5	18.3	21
V4	4.1	9.1	11.8	8

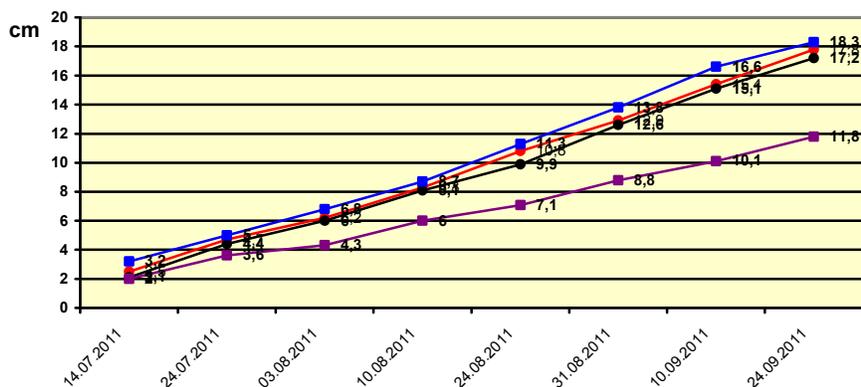


Fig. 4 - Dynamics of seedlings' growing at *Festuca glauca* Vill.

Data regarding seedlings' height (recorded at the last observations in September) were statistically processed. From statistic point of view, difference between variant V1 (control) and variant V3 is very positive significant, fact which show that the substrate formed by 1 part garden soil and 2 parts peat is recommended for obtaining quality seedlings at specie *Festuca glauca* (table 3).

Table 3

Results of plant growth				
Variant	Average height of plant	% face to control	Differences	Signification
V1	17.8	100.00	0.00	control
V2	17.2	96.63	-0.60	00
V3	18.3	102.81	0.50	xx
V4	11.8	66.29	-6.00	000
LSD 5% = 0.2 cm, LSD 1% = 0.3 cm, LSD 0.1% = 0.5 cm				

In experimental field seedlings were planted on 24<sup>th</sup> of September 2011 (fig. 5). Average height of plants at the observations made in field at 31<sup>st</sup> of October 2011 was of 23.4 cm at V3, 23.1 cm at V1, 22.9 cm at V2 and 18.2 cm at V4. In spring *Festuca glauca* started in vegetation at the end of March 2012, in a percentage of 98%, which enlightened that, could be cultivated as a perennial plant in the pedo-climatic conditions of Iași County, Romania.



V1a



V1b



V2a



V2b



V3a



V3b



V4a



V4b

**Fig. 5** - Seedlings at 24<sup>th</sup> of September 2012; a – with soil bowl; b – without soil bowl (original photos)

*Festuca glauca* Vill. (fig. 6) decorates through leaf and port from early spring till the beginning of winter, and through flowers in May-July. It could be used in borders, rocks, ornamental pots.



**Fig. 6 - *Festuca glauca* Vill. (Spring 2012) (original photos)**

## CONCLUSIONS

1. *Festuca glauca* Vill. is a specie which is cultivated as a perennial ornamental plant in the conditions of 3<sup>rd</sup> – 9<sup>th</sup> rusticity areas and can be easily multiply.

2. Substrate formed by 1 part garden soil and 2 parts peat lead to a higher germination percentage (85%) and to obtain seedlings with suitable morphological features (average number of 8 roots/plant, roots' average length of 17.5 cm, plant height of 18.3 cm and 21 leave/plant).

3. *Festuca glauca* started in vegetation at the end of March 2012, in a percentage of 98%, which enlightened the fact that could be cultivated as a perennial plant in the pedo-climatic conditions of Iași County, Romania.

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# SPECIES FROM *CYPERACEAE* FAMILY WITH CULTIVATION POTENTIAL AS ORNAMENTAL GRASSES FROM IAȘI COUNTY, ROMANIA

## SPECII DIN FAMILIA *CYPERACEAE* CU POTENȚIAL DE CULTIVARE CA IERBURI ORNAMENTALE ÎN JUDEȚUL IAȘI, ROMÂNIA

*CHELARIU Elena-Liliana*<sup>1</sup>, *DRAGHIA Lucia*<sup>1</sup>  
e-mail: julia@uaiasi.ro

**Abstract.** Iași County is placed in the 5<sup>th</sup> area of rusticity, with minimum temperatures between -29<sup>o</sup>C and -23<sup>o</sup>C. In this area ornamental grasses are less used in landscape designs. This is the reason why in the current paper is presented an assortment of species belonging to *Cyperaceae* family whose ecologic demands and placement in rusticity area recommend them as possible for a future utilization in vegetal landscape compositions.

**Key words:** ornamental grasses, *Cyperaceae*, landscape design, Iași

**Rezumat.** Județul Iași se încadrează în zona de rusticitate 5, cu temperaturi minime cuprinse între -29<sup>o</sup>C și -23<sup>o</sup>C. În această zonă ierburile ornamentale sunt puțin întâlnite în amenajările peisagere. De aceea în această lucrare este prezentat un sortiment de specii aparținând familiei *Cyperaceae* ale căror cerințe ecologice și încadrarea în zona de rusticitate le recomandă ca posibile pentru utilizare în compozițiile vegetale peisagere.

**Cuvinte cheie:** *Cyperaceae*, ierburi ornamentale, amenajări peisagere, Iași

### INTRODUCTION

Family *Cyperaceae* Juss. is the only botanical family of *Cyperales* Hutch. order and include around 120 genders with over 5000 species. In Romania could be found 15 genders with almost 130 species. Most species belongs to *Carex* gender, namely 89 species found, especially, in spontaneous flora and less cultivated (Sîrbu and Paraschiv, 2005).

Therefore the aim of the current paper is to highlight certain ornamental species, belonging to this gender, which could be cultivated in landscape designs in the conditions of 5<sup>th</sup> rusticity area in which is placed Iași County, Romania.

At world level decorative species belonging to *Carex* gender are know as ornamental grasses. Are named ornamental grasses, mainly, species of *Poaceae* botanic family, but also by association species belonging to *Cyperaceae*, *Juncaceae*, *Typhaceae* families.

### MATERIAL AND METHOD

Research was carried out in the experimental field of Floriculture Discipline from

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

USAMV Iași.

Studied material was represented by four species and cultivars belonging to *Carex* gender, from botanic family *Cyperaceae* (table 1). Establishment of the crops was realised in the spring of 2011, with biological material resulted after division of bushes. Observations regarding the morphological aspects of the plants were realised during vegetation period. Ecological and morphological characterisation of the taxons was correlated with the literature (Ardle 2007; Darke 2007; Graham, 2006; Taylor, 1994).

Table 1

***Cyperaceae* which could be cultivated as ornamental grasses in the pedo-climatic conditions from Iași, Romania**

No.	Name of specie / variety / cultivar	Rusticity area	Source of biological material
1	<i>Carex caryophyllea</i> „The Beatles”	5	plants of 1 year (Holland)
2	<i>Carex dipsacea</i> „Autumn Sedge”	5	plants of 1 year (Hungary)
3	<i>Carex grayi</i>	2	plants of 1 year (Hungary)
4	<i>Carex morrowii</i> „Ice Dance”	5	plants of 1 year (Holland)

North-East area of Romania is in the 5<sup>th</sup> area of rusticity and function of this criteria were selected species from family *Cyperaceae* which could survive in the conditions of minimum temperature of the Z5 area (t°= -29...-23 °C).

## RESULTS AND DISCUSSIONS

*Carex caryophyllea* “The Beatles” (fig. 1) is a perennial plant with a shape of bush, height 20-25 cm. Leave are green, linear narrow. It blossom in May. Have a slow growing rhythm.

It could be found on shadow and semi-shadow lands. Need a higher humidity (Ardle, 2007; Darke, 2007; Graham, 2006; Taylor, 1994).

Decorates through leave and port all the year, due to its persistent leave and could be used near water ponds, in Japanese gardens, alpine gardens, borders, in decorative pots.

*Carex dipsacea* „Autumn Sedge” (green sedge, autumn sedge) (fig. 2) is a perennial species which could grow up to 30-45 cm high. Leave are narrow and arranged in bundle. Have a green olive colour to red orange in autumn-winter. It blossom in June, and the floriferous stems could reach 45-60 cm high and in autumn become dark brown to blackish.

Could be cultivated both on sunny lands and also on shadow ones. It prefers fertile soils with high humidity (Ardle, 2007; Darke, 2007; Graham, 2006; Taylor, 1994).

Specie decorates through leave and port from March-April till November-December, and in winter-autumn also through flowers.

It is used due to the leave colouring and bush shape in landscape designs such as borders, groups, water ponds. It is very appreciated in decorative pots but also as cut flowers.



**Fig. 1 - *Carex caryophylla***  
 “The Beatles” ([www.google.com/images](http://www.google.com/images))



**Fig. 2 - *Carex dipsacea***  
 ([www.google.com/images](http://www.google.com/images))

*Carex grayi* (gray’s sedge) (fig. 3) perennial specie, semi-evergreen. Leave are linear, with a dark green colour, forming bundles of 30-100 cm high. Flowers are very showy, floriferous stems reaching 40-120 cm high. It blossom in May-June.

Specie loves humidity. Need a constant wet soil, especially in hot and dry climate. It could be cultivated in conditions of bright light but also in shadow. Colouring of leave is more intense in shadow conditions (Ardle, 2007; Darke, 2007; Graham, 2006; Taylor, 1994).

Plant is decorative through leave, port and flowers and could be used in water ponds designs, groups, massive, being able to capitalize the spaces underneath tall vegetation.

*Carex morrowii* „Ice Dance” (variegated sedge) (fig. 4) is a perennial plant with a dense bush reaching a height of 35-50 cm, and diameter of 40–60 cm. Leave have a dark green colour with white edges, rigid, streamlined. Flowers are brown, without decorative value. It blossom at the end of spring.

Specie is cultivated on sunny lands but also on shadow and semi-shadow ones. Leave colouring intensify in semi-shadow and shadow conditions. Prefer wet soils, but have also a good development on garden soils with an average humidity (Ardle, 2007; Darke, 2007; Graham, 2006; Taylor, 1994).

Plants decorate through port and leave from spring till the end of autumn and could be used in landscape designs such as borders, water ponds, underneath tall vegetation, in decorative pots.



**Fig. 3 - *Carex grayi***  
(www.google.com/images)



**Fig. 4 - *Carex morrowii* „Ice Dance”**  
(original photo)

## CONCLUSIONS

Ecological particularities of species *Carex caryophyllea* “The Beatles”, *Carex dipsacea* „Autumn Sedge”, *Carex grayi*, *Carex morrowii* „Ice Dance” recommend them for cultivation in the rusticity conditions of NE area of Romania.

The four studied species have a small and medium waist; decorates through port and leave, and could be capitalized as ornamental grasses in landscape compositions such as borders, decorative pots, water ponds, groups and massive, especially in shaded areas.

The studied ornamental grasses have persistent and semi-persistent foliage and could assure the décor in landscape designs for a long period in a year or even permanent in gentle winters.

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# ASPECTS REGARDING THE EFFECT OF RADISTIM GROWTH STIMULATOR ON GERMINATION POWER, GROWTH AND DEVELOPMENT OF THE *THUJA ORIENTALIS* AND *THUJA OCCIDENTALIS* PLANTLETS

## ASPECTE PRIVIND EFECTUL STIMULATORULUI RADISTIM ASUPRA GERMINABILITĂȚII, CREȘTERII ȘI DEZVOLTĂRII PLANTULELOR LA SPECIILE *THUJA ORIENTALIS* ȘI *THUJA OCCIDENTALIS*

*SANDU Tatiana*<sup>1</sup>, *TROFIN Alina*<sup>1</sup>, *BĂDEANU Marinela*<sup>1</sup>  
e-mail: [tatiana\\_sandu69@yahoo.com](mailto:tatiana_sandu69@yahoo.com)

**Abstract.** *Radistim is used to stimulate a faster multiplication and with a more efficient multiplying rate both for generative and vegetative process. Key findings and determinations wanted to highlight any differences between seedlings from seeds treated with Radistim and the untreated control variant. Observations and measurements in the range of observation 02.2008 - 05.2009 showed a clear influence of Radistim on the germination process and the subsequent Thuja orientalis and Thuja occidentalis plant growth and development. Thus, between the variants treated with Radistim and the control variants there was a difference of approx. 20% for T. orientalis to 18% for T. occidentalis in the germination power of the seeds, signaling significant differences in root system development also, between treated and control variants.*

**Key words:** *Thuja*, stimulating substances, germination power, growth.

**Rezumat.** *Preparatul Radistim este folosit pentru stimularea unei înmulțiri mai rapide și cu un procent mai eficient, atât pentru înmulțirea generativă, cât și pentru înmulțirea vegetativă. Principalele observații și determinări au dorit să evidențieze eventualele diferențe dintre plantulele rezultate din semințele tratate cu Radistim și cele din varianta martor netratată. Observațiile și măsurătorile efectuate în intervalul 02.2008 – 05.2009 au evidențiat influența clară a stimulatorului Radistim atât asupra procesului de germinație, cât și asupra creșterii și dezvoltării ulterioare a plantelor de Thuja orientalis și Thuja occidentalis. Astfel, între variantele tratate cu Radistim și variantele martor, s-a demonstrat o diferență de cca. 20% la T. orientalis și 8% la T. occidentalis în ceea ce privește germinabilitatea semințelor, semnalându-se diferențe evidente și în dezvoltarea sistemului radicular între variantele tratate și cele martor.*

**Cuvinte cheie:** *Thuja*, substanțe stimulative, germinație, creștere.

## INTRODUCTION

Ecological plasticity of the genus *Thuja*, its resistant temper to half shade, its soil improving and fixing properties and the decorative foliage and port, lead to the need of extending the ornamental culture of these species. *Thuja* specimens

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

have a remarkable resistance to pollution, as evidenced in Iasi's green spaces, being important for planning urban green areas (Draghia, 2000).

Experience aimed at identifying the possible effect of stimulator RADISTIM on the germination of *Thuja* seeds because this stimulator is often recommended for treating cuttings in order to stimulate rooting, with obvious positive effects (Ieremie et al., 2007).

## MATERIAL AND METHOD

The paper presents the results of a research on the response of species *Thuja occidentalis* and *Thuja orientalis* at treatment with RADISTIM - powder.

**The biological material** used in this experiment is represented by *Thuja orientalis* L. seeds, harvested at full maturity from U.Ş.A.M.V. Iaşi Park (October 2007), properly stored and moistened with cold water before seeding; approximately 2 months after they were seeded in boxes, the plantlets were prick out in cavitary trays, in U.Ş.A.M.V. Iaşi lower greenhouse.

**Used substances:** - RADISTIM powder, in moistened form, beige, insoluble in water.

The double factor experiment took into account the following factors:

Factor A – *Thuja* specie:  $a_1$  – *Thuja occidentalis* and  $a_2$  – *Thuja orientalis*;

Factor B – rooting stimulator:  $b_1$  – untreated control and  $b_2$  - treated with RADISTIM powder.

The data regarding the rooting percentage were processed as a double factor experiment. The seeding was realized on 08.02.2008, using 100 seeds for each variant:  $V_1$  - treated with RADISTIM powder and  $V_m$  – untreated control, mentioning that for *T. orientalis* the seeds were moistened in cold water for 7 days before seeding.

## RESULTS AND DISCUSSIONS

Observations on the emergence and growth of seedlings of the species *Thuja occidentalis* and *Thuja orientalis* were conducted periodically during the observation interval 03.2008 - 04.2009, measurements being recorded weekly. For *Thuja orientalis*, the emergence started on 02.03.2008 (after approx. 22 days after sowing), and for *Thuja occidentalis*, on 17.03.2008 (after 35 days), for this specie the control variant emerged faster than the treated one, but for the control plants, the growing rate slowed down, the seedlings being quite fragile.

Observations and measurements have shown some influence of RADISTIM stimulator on the germination process and the subsequent plant growth and development, especially for *Thuja orientalis* (Rubţov, 1971).

Thus, between treated and control variants, we observed a difference of approx. 20% for *T. orientalis* and 8% for *T. occidentalis* in the seeds germination power, signaling the significant differences in the root system development between treated and control variants.

Observations in May 2008 showed that from the total number of seeds sown in the treated variants, the emergence percentage for *Thuja orientalis* was about 72% and for the *Thuja occidentalis* about 60%.

Table 1 presents the mean values for vegetative growth recorded for the double factor experiment values measured between 23.03.2008 - 19.04.2009. Note that these results aimed to establish correlations between treatments and germination power, plant growth and development of *Thuja*.

Thus, according to the data in table 1, the most significant growths during the observations were registered for *T. orientalis* – V.t. (approx. 17 cm) while the untreated variant's plants had, as average values, an approx. 12 cm growth, the difference of 5.3 cm between variants being distinctly significant.

Table 1

**Plant growth evolution during the experiment**

Variant	Observation date / seedlings growth (mean values - cm)										% compared to control	Difer.	S.
	23. III '08	22. IV '08	16. V '08	13. VI '08	28. VII '08	13. VIII '08	18. IX '08	20. III '09	19. IV '09				
V.t.	T. oc.	0,4	1,3	2,4	3,6	6,9	8,7	9,1	10,7	12,2	120	+2,1	x
	T. or.	1,2	1,9	3,3	5,9	7,8	10,5	12,7	14,8	17,0	144	+5,3	xx
V.m.	T. oc.	0,2	0,8	1,6	2,9	5,7	7	7,3	8,6	10,1	100	-	-
	T. or.	0,8	1,4	2,7	4,4	7,4	8,3	9,5	10,4	11,8	100	-	-

Legend: T. oc. – *Thuja occidentalis*, T. or. – *T. orientalis*. V.t. – treated variant RADISTIM; V.m. – untreated control variant, Difer. – difference, S. – significance.

LSD 5% -1.5%; LSD 1% - 2%; LSD 0.1% - 2.8%

Observations made on about 10 seedlings of each variant which have been extracted from substrate for measurements, provided the mean total length of roots per brood, presented in table 2. Data showed that *Thuja orientalis* seedlings treated with RADISTIM showed a significantly more developed root system than the control variant (+ 6.3).

Table 2

**Root system evolution in experimental seedlings (May 2009)**

Variant	Species		% compared to control		Difference		Significance	
	<i>T. occidentalis</i> (average value – cm)	<i>T. orientalis</i> (average value – cm)	T. oc.	T. or.	T. oc.	T. or.	T.oc	T.or.
Treated variant	76.7	122.5	133.8	157.2	+3.4	+6.3	x	xx
Control variant	57.3	77.9	100	100	-	-	-	-

LSD 5% -1.6%; LSD 1% - 2.5%; LSD 0.1% - 3.6%

Also, the *Thuja orientalis* specimens treated with RADISTIM showed a better plant development, being better complied, with well developed root system whereas the control seedlings showed a slower development.

## CONCLUSIONS

1. Seed germination in the variants treated with RADISTIM powder took place at the earliest (after approx 22 days) for *Thuja orientalis*, 15 days earlier than for the *T. occidentalis* treated seeds, and about 10 days faster than for the control variant of *T. orientalis*.

2. Differences between species in terms of germination power, germination interval and emergence percentage is known as being in favor for *Thuja orientalis* our study wanted to compare these values particularly between the two experimental variants and not between species;

3. The most significant growths during the observations were registered for *T. orientalis* – V.t. (approx. 17 cm) while the untreated variant's plants had, as average values, an approx. 12 cm growth, the difference of 5.3 cm between variants being distinctly significant.

4. *Thuja orientalis* seedlings treated with RADISTIM showed a significantly more developed root system than the control variant (+ 6.3).

5. RADISTIM-powder treatments did not reveal major effects on *Thuja occidentalis* seeds and plants, compared to the untreated variant, considering that the seed treatment with RADISTIM is not recommended as effective for this specie.

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# AN ANALYSIS OF ORNAMENTAL WOODY VEGETATION EXISTING IN IAȘI COUNTY'S GREEN SPACES

## ANALIZA STRUCTURII VEGETAȚIEI LEMNOASE ORNAMENTALE EXISTENTE ÎN SPAȚIILE VERZI DIN MUNICIPIUL IAȘI

*SANDU Tatiana*<sup>1</sup>, *TROFIN Alina-Elena*<sup>1</sup>, *BERNARDIS R.*<sup>1</sup>  
e-mail: tatiana\_sandu69@yahoo.com

**Abstract.** *Iasi has approximately 912 hectares of planted green areas, representing about 23% of the total area of the city. Following assessments conducted periodically since 2002 and so far, we observed some aspects of plant qualitative development and vegetal structure of the urban and suburban green spaces in Iasi city. This paper seeks to present an assessment of structural components for the main plant units of green space and a study of the detection possibilities of improving the value of these green spaces by introducing appropriate arrangement of species in terms of environmental aspect, proper behavior, ornamental and especially the resistance to urban pollution. According to the general structure's evaluation we found that from all the green areas in Iași, approx. 15% are occupied by resin tree, 47% by deciduous trees, 9% by resin shrubs and 29% by deciduous shrubs.*

**Key words:** trees, shrubs, green spaces, structure, Iași

**Rezumat.** *Municipiul Iași deține aproximativ 912 ha de spații verzi plantate, care reprezintă aproximativ 23% din suprafața totală a municipiului. În urma evaluărilor efectuate periodic, începând cu anul 2002 și până în prezent, au reieșit unele aspecte privind evoluția calitativă și structura vegetală a spațiilor verzi urbane și periurbane din municipiul Iași. În lucrare se dorește a fi prezentată o evaluare structurală a componentelor vegetale pentru principalele unități de spațiu verde, precum și efectuarea unui studiu privind depistarea eventualelor posibilități de îmbunătățire a valorii acestor spații verzi prin introducerea în amenajări a unor specii cât mai corespunzătoare din punct de vedere al aspectului ecologic, sanogen, ornamental și mai ales al rezistenței la poluarea urbană. În urma evaluării structurii generale s-a constatat că din totalul suprafețelor cu spații verzi din Iași, cca. 15 % sunt ocupate de arbori rășinoși, 47 % de arborii foioși, 9 % de către arbuștii rășinoși și 29 % de arbuștii foioși.*

**Cuvinte cheie:** arbori, arbuști, spații verzi, structură, Iași

### INTRODUCTION

The existence of green space inside localities is essential especially in

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

urban areas. Green space has no landscape or recreational purposes only, it is a great filter for different pollutants in the environment, helping to improve the environmental quality, reduce noise and thus increase the quality of life. As an indicator of urban development studies show that green spaces should cover about 30% of the city area and their distribution should allow citizens to have access to them in about 15 minutes walking.

This paper aims to present an approximate analysis of the structural situation of the green areas in Iasi city, Romania.

## **MATERIAL AND METHOD**

Analysis of Iasi territory was made between May 2002 - October 2011, through visual monitoring of the current state of green areas in the municipality of Iasi and the surrounding, a more complex observations being made in collaboration with experts from Center for Fruit tree Research and Development Iasi, as part of a broader collaboration.

Collected and processed data were used to arrange the results regarding the structural analysis of vegetation, its health and its placement Iasi's close perimeter in order to shape some conclusions concerning the qualitative evolution and the vegetal structure of urban and suburban green spaces in Iasi.

## **RESULTS AND DISCUSSIONS**

The largest share (about 47%) of green spaces vegetation in Iasi is the deciduous trees. Basically, deciduous trees make up the skeleton of plantations in all functional green spaces in Iasi, being much better adapted to environment under local climatic conditions.

Most species of deciduous trees existing in Iasi are native and grow naturally nearby city and this fact offers Iasi's green spaces the warranty of long term persistence for their "bone structure".

Currently, the total area of green space in the municipality of Iasi is estimated at 912 hectares, of which 363 hectares are green spaces with unrestricted access, 170 hectares of green spaces with limited access, 292 acres of green space with specialized profile, 38 hectares of urban recreational area and 48 hectares of orchards and other green spaces.

Romania's Government adopted through an Emergency Ordinance the regulations by which the local authorities are required to provide an area of at least 26 square meters of green space per capita in urban areas. To acquire this desiderate proposed by the Government, the transition will be gradual, until 31 December 2010 being assured 20 square meters of green space per capita, and by December 31, 2013, 26 square meters of green space for each person in Iasi.

At EU level, the area of green space per capita is at least 26 square feet, and World Health Organization recommendations suggest a minimum of 50 square meters per capita.

So, by early 2014, Iasi local authorities must ensure 26 square meters of green space per capita. One of these projects to increase green areas refer to

building a park on an area of 15 hectares inside Ciric forest area (in progress) and complete PALAS complex project, with about 50,000 sqm green space area. PALAS garden arrangement works - the largest private investment in Romania in a public-purpose space - are ongoing and will be completed this spring.

Even if the area of green space per capita is currently regarded as acceptable (20.6 m / capita), the problem comes from the fact that vegetation zones are unevenly distributed. For example, residents of neighborhoods like Nicolina or Tătărași have no park close, within 15 minutes walking.

**Green spaces with unrestricted access** currently occupies about 44% (about 363 ha) of the total area of green spaces in Iasi and have the following vegetal structure: 31.5% of those 44% are occupied by ornamental woody vegetation which is structured as follows: 29 ha (3.5%) - resin trees, 133 ha (16%) - deciduous trees, 22 ha (2.7%) - resin shrubs and 73 ha (8.8%) - deciduous shrubs.

**Green spaces with limited access** are spread on a surface of 170 ha (21%) of total green areas in Iasi, of which 16.1% is occupied by woody vegetation represented as follows: 1.8% - resin tree, 7.5% - deciduous trees, 1.2% - resin shrubs and 5.6% - deciduous shrubs.

**Street plantations** cover about 38 ha (4.6% of the total green area) and they are 99% composed of deciduous trees, especially from the following species: *Tilia tomentosa*, *Tilia platyphyllos*, *Acer pseudoplatanus*, *Acer platanoides*, *Aesculus hippocastanum*, *Robinia pseudacacia* 'Bessoniana' and 'Umbraculifera', *Populus x canadensis*, *Quercus robur*, *Quercus pedunculiflora*, *Juglans regia* s.o. (Zanoschi et al., 1996).

**Recreational areas** in Iasi occupy an estimated area of 405 ha with the following dominant tree species: *Acer negundo*, *Quercus robur*, *Fraxinus excelsior*, *Robinia pseudacacia*, *Quercus petraea*, *Tilia cordata*, *Tilia tomentosa* s.o.

The dominant tree species for all green spaces in Iasi are:

- Lime trees (*Tilia tomentosa*, *Tilia platyphyllos*, *Tilia cordata*) are native species well adapted to the local climate, with abundant bloom and vigorous growth, with great ornamental and health behavioral value. It should be noted that in Iasi exist some varieties and natural forms, lime trees being Iasi's representative specie (Sîrbu et al., 2011).

- Maples (*Acer platanoides*, *Acer pseudoplatanus*) are native species perfectly adapted to local climate, with vigorous growth and very ornamental foliage, with a high ornamental health behavioral value.

- Oaks (*Quercus robur*, *Quercus pedunculiflora*, *Quercus petraea*) are native species adapted also to the drier climate of Iasi, with great longevity and impressive sizes.

- Poplars (most frequently the Canadian hybrid poplar – *Populus x canadensis*) are present under the form of some cultivars, from which some are of feminine gender, inducing the problematic respiratory allergies. Over the years, there were attempts to replace the Canadian hybrid poplar with the white

poplar (*Populus alba 'Pyramidalis'* and *P. alba 'Nivalis'*). They are found mainly in the lower areas of the city (near swamps on the Bahlui meadow). (Zanoschi et al., 2000)

- Forest pine (*Pinus sylvestris*) has less decorative value but is used successfully on slopes and even on sandy soils.

- Black pine (*Pinus nigra ssp. austriaca*) is one of the coniferous species adapted to Iasi conditions, being more decorative in the first half of its life.

- Pyramid American thuja (*Thuja occidentalis 'Fastigiata'*), very much used in engineering the green spaces in the last 30 years, proves resistant to local climate and with a great ornamental value.

- Acacia (*Robinia pseudacacia 'Bessoniana'* and *'Umbraculifera'*) which vegetates well especially on sunny slopes, is also much appreciated on street alignments and s.o. (Ciocârlan, 2000).

Of all species existing in Iasi green spaces, we consider as appropriate, from the ecologically, health behavior, ornamental and urban pollution resistance point of view the following species (Sandu, 2009), listed in table 1:

Table 1

**Species of trees and shrubs with ornamental, ecological, health behavior, ornamental and pollution resistance value**

<b>Angiosperm trees</b>	<i>Tilia tomentosa, Tilia platyphyllos, Tilia cordata, Acer campestre, Acer platanoides, Acer tataricum, Carpinus betulus, Fraxinus excelsior, Fraxinus angustifolia, Fraxinus ornus, Ulmus foliacea, Sorbus torminali, Quercus robur, Quercus pedunculiflora, .</i>
<b>Angiosperm shrubs</b>	<i>Cotinus coggygria, Cornus mas, Cornus sanguinea, Viburnum lantana, Euonymus europeus, Ligustrum vulgare, Staphylea pinnata, Corylus avellana, Crataegus monogyna, Hedera helix, Mahonia aquifolium, Lonicera sp.</i>
<b>Gymnosperm trees and shrubs</b>	<i>Pinus nigra var. banatica, Abies concolor, Pinus nigra var. nigra, Pinus sylvestris, Taxus baccata</i>

Valuable species in terms of ornamental value existing in Iasi's green spaces are presented in table 2.

Table 2

**Species of trees and shrubs with great ornamental value**

<b>Angiosperm trees</b>	<i>Acer platanoides, A. negundo, Acer pseudoplatanus, Aesculus hippocastanum, Albizzia julibrissin, Betula pendula, Carpinus betulus, Cercis canadensis, Cercis siliquastrum, Fraxinus excelsior, Fraxinus angustifolia, Koelreuteria paniculata, Liriodendron tulipifera, Magnolia acuminata, Paulownia tomentosa, Platanus x acerifolia, Populus x canadensis, Populus alba 'Pyramidalis', Populus alba 'Nivalis', Quercus robur, Quercus pedunculiflora, Quercus rubra, Salix babylonica, Sophora japonica, Sorbus aria, Tilia tomentosa, Tilia platyphyllos, Tilia cordata, Ulmus pumila 'pinnato-ramosa'</i>
<b>Angiosperm</b>	<i>Berberis vulgaris, Buddleia alternifolia, Buxus sempervirens,</i>

<b>shrubs</b>	<i>Campsis adicans, Chaenomeles japonica, Colutea arborescens, Cornus sanguinea, Cotinus coggygria, Deutzia crenata, Diervilla florida, Euonymus fortunei, Fosythia suspensa, Fosythia viridissima, Hibiscus syriacus, Hydrangea arborescens, Kolkwitzia amabilis, Ligustrum ovalifolium, Lonicera sp., Mahonia aquifolium, Philadelphus coronarius, Pyracantha coccinea, Rhus typhina, Rosa sp., Spiraea sp., Symphoricarpos orbiculatus, Symphoricarpos albus, Tamarix sp., Viburnum opulus 'Roseum'.</i>
<b>Gymnosperm trees</b>	<i>Abies concolor, Chamaecyparis lawsoniana (divers cultivars), Ginkgo biloba, Juniperus virginiana, Larix decidua, Picea pungens "Argentea", Pinus nigra var. banatica, Pinus nigra var. nigra, Pinus strobus, Pinus sylvestris, Pseudotsuga menziesii, Thuja occidentalis (divers cultivars), Thuja plicata.</i>
<b>Gymnosperm shrubs</b>	<i>Juniperus communis 'Suecica', Juniperus communis 'Hibernica', Juniperus horizontalis, Juniperus sabina, Taxus baccata, Thuja occidentalis 'Globosa compacta', Thuja orientalis 'Globosa'.</i>

The most valuable species in terms of resistance to exhaust existing in Iasi green spaces are presented in table 3.

Table3

**Species of trees and shrubs with resistance to exhaust**

<b>Species resistant to sulfur dioxide</b>	<i>Quercus rubra, Acer negundo, Morus alba, Ulmus foliacea, Sambucus nigra, Lonicera sp., Buxus sempervirens, Thuja occidentalis, Thuja orientalis, Juniperus communis, Juniperus horizontalis, Juniperus sabina.</i>
<b>Species resistant to hydrofluoric acid</b>	<i>Euonymus europeus, Quercus robur, Sambucus racemosa, Rosa rugosa.</i>
<b>Species resistant to hydrochloric acid</b>	<i>Populus tremula, Robinia pseudacacia, Picea pungens, Pinus nigra.</i>
<b>Species resistant to ammonia</b>	<i>Robinia pseudacacia, Quercus robur, Acer pseudoplatanus, Pinus nigra.</i>

**CONCLUSIONS**

1. From the total area with green spaces in Iasi, approx. 15% are occupied by tree resin, 47% by deciduous trees, 9% by resin shrubs and 29% by deciduous shrubs.

2. After browsing the land there was noted that the largest share, about 47%, is occupied by the deciduous trees.

3. Inside Iasi urban green spaces are present around 256 taxa, of which 192 are taxa of angiosperms (broadleaf) and approx. 64 taxa of gymnosperms (softwoods).

4. Iasi dominant trees in green areas appear to be varieties of lime (*Tilia tomenosa, T. platyphyllos, T. cordata*), followed by the species: *Acer platanoides, Acer pseudoplatanus, Quercus robur, Quercus pedunculiflora, Quercus petraea, Populus x canadensis, Populus alba 'Pyramidalis', Populus*

*alba 'Nivalis', Pinus sylvestris, Pinus nigra ssp. Austriaca, Thuja occidentalis 'Fastigiata', Robinia pseudacacia 'Bessoniana' and 'Umbraculifera', s.o.*

5. Among the shrub species (50 taxa), going into hedges, alignments or used as flowering shrubs, we meet with a high frequency: American thuja (*Thuja occidentalis*), Oriental thuja (*Thuja orientalis*), honeysuckle (*Spiraea x vanhouttei*), different species and cultivars of roses (*Rosa species*), silver carp (*Cornus sanguinea*), boxwood (*Buxus sempervirens*), lilac tree (*Syringa vulgaris*), privet (*Ligustrum vulgare*) and forsythia (*Forsythia sp.*) s.o.

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# ASPECTS REGARDING THE “EX SITU” PROPAGATION OF SOME WILD PLANTS IN ORDER TO INTRODUCE THEM INTO THE CULTURE

## ASPECTE PRIVIND ÎNMULȚIREA “EX SITU” A UNOR PLANTE SĂLBATICE, ÎN VEDEREA INTRODUCERII LOR ÎN CULTURĂ

ZAHARIA Alina<sup>1</sup>, DRAGHIA Lucia<sup>1</sup>, CHELARIU Elena Liliana<sup>1</sup>  
e-mail: alina\_catri@yahoo.com

**Abstract.** *This paperwork presents aspects of seed propagation of wild plants with ornamental characters, in order to introduce them into the culture. There were studied three species of wild flora identified in the Curvature Sub-Carpathians, Buzau county (Centaurea orientalis L. Melica ciliata ssp. ciliata L. and Silene nutans ssp. nutans). The experimental cultures were established using as planting material transplanted seedling and untransplanted seedling. The experiences aimed not only the best option for crop establishment, but also keeping the ornamental character. The results obtained showed that for Centaurea orientalis and Melica ciliata ssp. ciliata it can be used both transplanted seedling and untransplanted seedling, while for Silene nutans ssp. nutans transplanted seedling should be avoided, given the sensitivity of this species to transplanting.*

**Key words:** wild plants, ornamental value, Centaurea, Silene, Melica, seeds propagation.

**Rezumat.** *Lucrarea prezintă aspecte privind înmulțirea prin semințe a unor plante sălbatice cu caractere ornamentale, în vederea introducerii lor în cultură. Au fost studiate trei specii identificate în flora spontană din zona Subcarpaților de Curbură din județul Buzău (Centaurea orientalis L., Melica ciliata ssp. ciliata L. și Silene nutans ssp. nutans), specii la care s-au înființat culturile experimentale utilizând ca material săditor răsad repicat și nerepicat. Experiențele au urmărit nu numai varianta optimă de înființare a culturilor, ci și păstrarea caracterelor ornamentale. Rezultatele obținute au demonstrat faptul că la Centaurea orientalis și Melica ciliata ssp. ciliata se poate folosi atât răsad repicat, cât și nerepicat, în timp ce la Silene nutans ssp. nutans se recomandă evitarea repicării răsadului, având în vedere sensibilitatea acestei specii la transplantare.*

**Cuvinte cheie:** plante sălbatice, valoare ornamentală, Centaurea, Silene, Melica, înmulțire prin semințe.

### INTRODUCTION

In spontaneous flora can be found many ornamental plants with special properties that can be successfully used into the culture, provided to establish an appropriate culture technology and in particular, the effective propagation methods that meet certain requirements imposed by this species.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

Introduction of wild plants in culture aims, on the one hand, recovery and conservation of wild flora biodiversity, and on the other hand, expanding the range of native ornamental plants. In recent years, similar studies have been conducted on the value of ornamental plants from the spontaneous flora of Romania, especially in the south and southeast (Draghia et al, 2010, 2011; Chelariu et al, 2010, 2011). In this paperwork it is analyzed the ability of copying and maintaining the ornamental performance of three wild plant species identified in the SE of Romania: *Centaurea orientalis* L., *Melica ciliata* ssp. *ciliata* L. și *Silene nutans* ssp. *nutans* L. The studied species are interesting because of the morphology of the flowers, the form and the arrangement of the leaves and stems.

*Centaurea orientalis* L. (sin. *C. rubescens* Besser) of the family Asteraceae is one of the perennial species of the genus, being particularly prevalent in Southern Europe (Wagenitz and Hellwig, 1996; Greuter et al. 2001, cited by Koutecky, 2007). In Romania it can be found in the sunny and dry steppe zones (Ciocârlan, 2000). It is an herbaceous plant with erect edged stems, simple or slightly branched in top, with a height of 1 - 1.5 m. Leaves are 1-2 times pinnate divided and are green or pale greenish skin and shiny on the bottom. The flowers are grouped in globular flowering heads, creamy - yellow, 20-25 mm diameter (Ciocârlan, 2000).

*Melica ciliata* ssp. *ciliata* L. (bead) is a perennial and herbaceous plant, from Poaceae family, widespread in Romania from the steppe to the beech floor. It has a fasciculate root and erect stem, smooth, high of 10 - 100 cm. The leaves are linear, rigid, without prominent median rib. Upper leaf sheaths and lamina are smooth. Panicle is erect, one-sided and lax. It blooms in May-June (Ciocârlan, 2000).

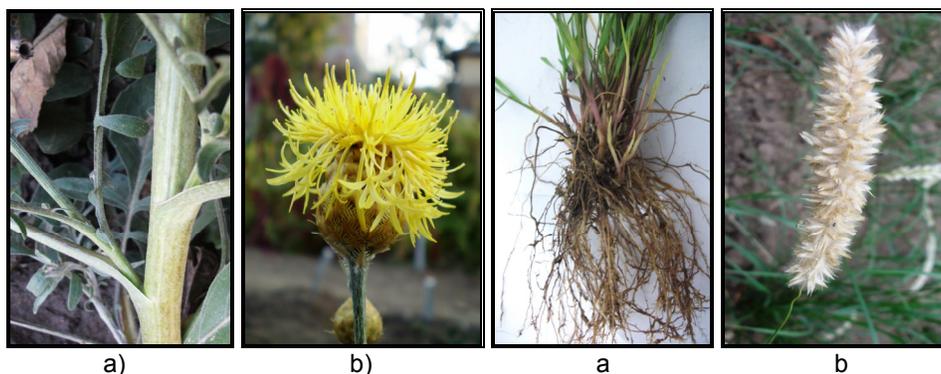
*Silene nutans* ssp. *nutans* L. (pigeon crop) from *Caryophyllaceae* family is a perennial, herbaceous plant, often spread in Romania in grasslands of the steppe to the beech forest. Strain reaches 30-60 cm tall, the bottom is with small hairs, wrinkled. The leaves are pubescent, the flowers are hermaphrodite, with yellowish-white petals. It blooms in May-June (Ciocârlan, 2000).

## MATERIAL AND METHOD

The experiments were conducted in the experimental field of Floriculture discipline at the University of Agricultural Sciences and Veterinary Medicine.

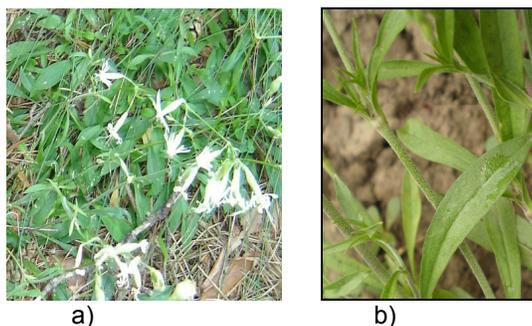
Establishment of experimental variants was conducted with seeds collected from three plant species of wild flora identified in Buzau (Plaiul Nucului and Pâcle - Mud Volcanoes):

- *Centaurea orientalis* L. (sin. *C. rubescens* Besser), Asteraceae family (fig. 1), with the natural habitat in Pâcle (Mud Volcanoes);
- *Melica ciliata* ssp. *ciliata* L. (fig. 2), Poaceae family, with the natural habitat at Plaiul Nucului;
- *Silene nutans* ssp. *nutans* L. (fig. 3), the Caryophyllaceae family with the natural habitat at Plaiul Nucului.



**Fig. 1** – *Centaurea orientalis*: a) stem with leaves; b) inflorescence (original)

**Fig. 2** – *Melica ciliata* ssp. *ciliata*: a) root b) inflorescence (original)



**Fig. 3** – *Silene nutans* ssp. *nutans*: plants in natural habitat (Draghia, 2010); b) plants in culture (original)

The two natural areas from which biological material is used in experiments geographically belong to the Subcarpathians from Buzau County. The Pacle zone (village Berca) is at an altitude of approx. 300 m, where there is average rainfall of between 400- 600 mm. The studied ecosystem was the natural grasslands near Mud Volcanoes on clay soils with low fertility. Plaiul Nucului plateau from Lopatari village, is located on Slănic Valley at an altitude of approx. 800 m, with average annual rainfall of 700-800 mm. Plants were found in a forest ecosystem (pine forest), characterized by the presence of districambosol soil medium textured, acid reaction and medium to low fertility.

**Table 1**

Experimental scheme		
Species	Variant	Specification
<i>Centaurea orientalis</i> L.	V <sub>1</sub>	untransplanted seedling
	V <sub>2</sub>	transplanted seedling
<i>Melica ciliata</i> ssp. <i>ciliata</i> L.	V <sub>1</sub>	untransplanted seedling
	V <sub>2</sub>	transplanted seedling
<i>Silene nutans</i> ssp. <i>nutans</i> L.	V <sub>1</sub>	untransplanted seedling
	-	-

Experimental scheme (table 1) followed the seedlings production of the three wild species for breeding "ex situ" in lasi conditions. For each species were used two experimental variants: with untransplanted seedling ( $V_1$ ) and with transplanted seedling ( $V_2$ ). Exception is *Silene nutans* ssp *nutans* that had only one experimental variant and it was established with transplanted seedling ( $V_1$ ), because plants haven't resisted on transplanting.

The experiments setting up was conducted in the spring of 2011. It was sown in the greenhouse, in vane pockets, in a substrate composed of peat and garden soil, the volumetric ratio being 1:3 for *Centaurea orientalis* and 1:1 for *Silene nutans* and *Melica ciliata*. Greenhouse temperature was 16-18 °C. From the plants obtained were built two variants. Sowing and planting in field of the seedlings obtained in the two experimental variants was done on the same date. The experiments were organized in randomized blocks with three repetitions.

The dates regarding experimental crops establishing are presented in table 2.

**Table 2**

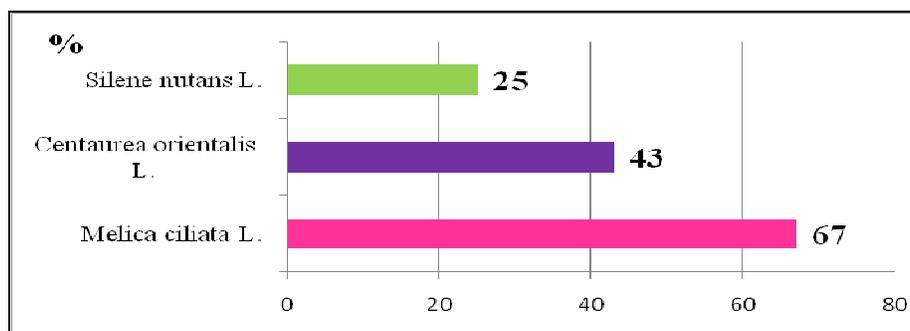
**Dates regarding experimental cultures establishing**

Species	No. of seeds sown	Sowing date	Date of emergence	Date of transplantation	Date of field planting
<i>Centaurea orientalis</i>	70	23.03.2011	26.03.2011	14.04.2011	31.05.2011
<i>Melica ciliata</i> ssp. <i>ciliata</i>	100	23.03.2011	28.03.2011	18.04.2011	31.05.2011
<i>Silene nutans</i> ssp. <i>nutans</i>	20	23.03.2011	1.04.2011	22.04.2011	31.05.2011

Observations and measurements made targeted different aspects of plant behavior under "ex situ" conditions: seed germination (germination faculty and germination time), young plants ability to withstand transplanting, height growth dynamics of plants and their flowering ability depending on the seed used to set up cultures.

## RESULTS AND DISCUSSIONS

Aspects regarding seed germination (germination faculty and germination time) highlights a number of differences between species. Largest differences were recorded in terms of percentage of germination, which ranged from 67% to *Melica ciliata* ssp. *ciliata* and 25% in *Silene nutans* ssp. *nutans* (fig. 4).



**Fig. 4 - Seed germination (%)**

Germination time was between 3 and 7 days: *Centaurea orientalis* germinated in 3 days, *Melica ciliata* ssp. *ciliata* in 5 days and *Silene nutans* ssp. *nutans* in 7 days (table 2).

There was pursued height growth dynamics for the plants both from untransplanted seedling and the transplanted seedling, according to the experimental scheme. Observations were conducted from April to August. At *Centaurea orientalis* it was observed that untransplanted plants had a dynamic in height growth better than transplanted plants (fig. 5), but the differences were insignificant variations. Similarly behaved *Melica ciliata* ssp. *ciliata* plants (fig. 6).

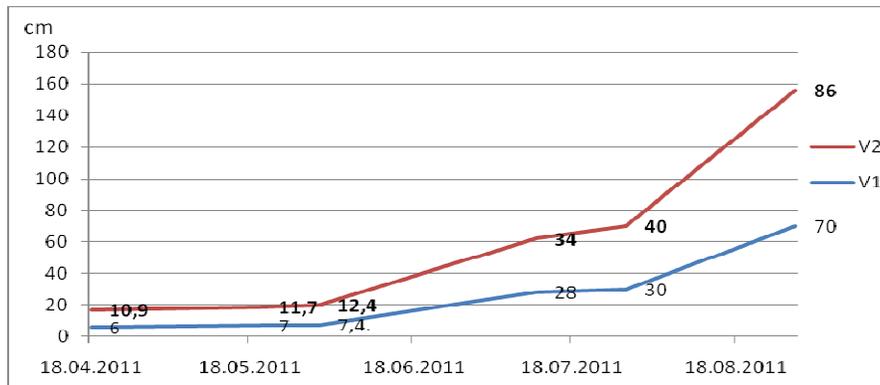


Fig. 5 - Height growth dynamics for the plants of *Centaurea orientalis*

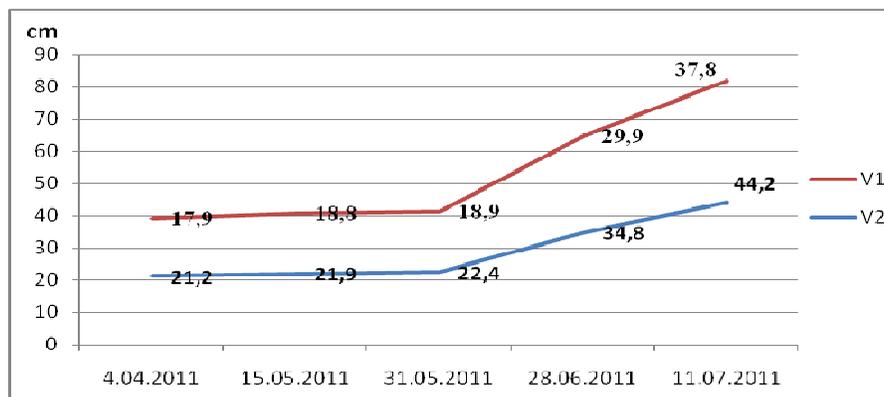


Fig. 6 - Height growth dynamics for the plants of *Melica ciliata* ssp. *ciliata*

The height of *Silene nutans* ssp. *nutans* plants (exclusively obtained from untransplanted seedling) recorded averages of 4 cm (in the first year plants form only a leaves rosette, flowering taking place in the second year).

At the crops established in field were made measurements also regarding the number of inflorescences formed, comparing the two experimental variants (table 3). The differences between the two variants are insignificant the type of seedlings used in establishing cultures for the two species uninfluencing plants ornamental value.

Table 3

## Results regarding plants flowering

Species	Var.	Number of infl./plant	% related to control	Differences	Signification
<i>Centaurea orientalis</i> LSD 5%=2,4; LSD 1%=5,5; LSD 0.1%=17,4 buc.	V <sub>1</sub>	13,8	-	-	-
	V <sub>2</sub>	15,2	110,14	+1,4	-
<i>Melica ciliata</i> ssp. <i>ciliata</i> LSD 5%=0,5; LSD 1%=1,1; LSD 0.1%=3,6 buc.	V <sub>1</sub>	5,6	-	-	-
	V <sub>2</sub>	6,0	107,17	+0,4	-

## CONCLUSIONS

1. The studied plants indicated a good adaptability to climatic conditions in the Iasi area.

2. Best seed germination percentage was recorded by *Melica ciliata* ssp. *ciliata* with 67%, followed by *Centaurea orientalis* 43% and the lowest percentage of germination was recorded by *Silene nutans* ssp. *nutans* (25%).

3. *Silene nutans* ssp. *nutans* don't bear transplanting and consequently it is recommended direct seeding in permanent place or untransplanted seedling production.

4. At *Centaurea orientalis* and *Melica ciliata* ssp. *ciliata* both strains height and number of inflorescences indicated higher values for the plants obtained from untransplanted seedling compared to those obtained from transplanted seedling, but the differences were insignificant. Therefore, for the two species, as seedlings can be used both transplanted seedling and untransplanted seedling.

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# INFLUENCE OF SOME TREATMENTS WITH BIOSTIMULATING SUBSTANCES ON PRODUCTIVITY OF GELU TABLE GRAPES VARIETY, GROWN IN THE VINEYARD AREA OF IASSY

## INFLUENȚA UNOR TRATAMENTE CU SUBSTANȚE BIOSTIMULATOARE ASUPRA PRODUCTIVITĂȚII SOIULUI DE STRUGURI DE MASĂ GELU, CULTIVAT IN AREALUL PODGORIEI IAȘI

*COTOVANU FILIMON Roxana*<sup>1</sup>, *ROTARU Liliana*<sup>1</sup>, *FILIMON V. R.*<sup>1</sup>  
e-mail: roxanacotovanu@yahoo.com

**Abstract.** *By introducing in the table grapes cultivation technology of the biostimulating hormonal treatments can be provide outstanding increases of production that contributes to the quality of marketed production. This paper aims to establish the optimal doses of biostimulating substances that can be applied to obtain an increase production yield of table grapes and improve their quality parameters. Were used commercial products Cropmax, Kelpak, Gibberellin Acid (GA<sub>3</sub>), in different concentrations and was found that Gelu variety react differently depending on the biostimulating substance, dose and moment of application. The best option was variant two, treated with 50 ppm of GA<sub>3</sub>.*

**Key words:** biostimulating hormonal treatments, Gelu variety, GA<sub>3</sub>, Iasi vineyard.

**Rezumat.** *Prin introducerea tratamentelor hormonale biostimulatoare în cadrul tehnologiilor de cultură la soiurile de vița de vie pentru struguri de masă se pot asigura sporuri de producție remarcabile ce contribuie la creșterea calitativă a producției marfă. Lucrarea are ca scop stabilirea dozelor optime de substanțe biostimulatoare care pot fi aplicate în vederea obținerii unui randament crescut al producției de struguri de masă și îmbunătățirea parametrilor calitativi ai acestora. S-au folosit produsele comerciale Cropmax, Kelpak și acid giberelinic (AG<sub>3</sub>) în diferite concentrații și s-a constatat că soiul Gelu, reacționează diferit în funcție de substanța biostimulatoare, doza și momentul aplicării. Cea mai bună opțiune a fost reprezentată de varianta tratată cu AG<sub>3</sub>, în concentrație de 50 ppm.*

**Cuvinte cheie:** tratamente cu substanțe biostimulatoare, AG<sub>3</sub>, soiul Gelu, podgoria Iași.

### INTRODUCTION

Plant growth and development is controlled by genetic factors and certain endogenous substances that are part of the plant hormones group. They are true chemical messengers that promote plant capacity to respond to environmental conditions (Toma and Jităreanu, 2007).

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

Plant hormones (phytohormones) are a class of organic substances that at low concentrations affect physiological processes of growth, differentiation and development of plants. Recent research shows that phytohormones are polyfunctional substances that participate in regulating of many physiological processes. Also, they are not acting on all cells, but only on those whom they are compatible. Compatibility and the ability to react is determined by the presence of protein receptors on cells (Davies, 2004).

This work aims to study the influences of treatments with biostimulators on productivity of Gelu table grapes variety, grown in Iassy vineyard area.

Observations have been made to improve current technology culture of vine, which allows to obtain higher production, quantitatively and qualitatively.

## MATERIAL AND METHOD

The study was conducted at Gelu table grape variety grown in the Ampelographic Collection of Faculty of Horticulture belonging to the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", Iassy. Rootstock used was Berlandieri x Riparia Kober 5 BB. Planting distances were 2.2 / 1.2 m, half high leading form, bilateral cord with cutting in fruit links. Soil maintenance is done in the form of "black field", and maintenance operations of vines are specific to industrial vineyard ecosystem.

The research was conducted in 2011, the experience scheme was as follows: Control sample- H<sub>2</sub>O; Cropmax V<sub>1</sub>-10 ml, Cropmax V<sub>2</sub>-25 ml, Cropmax V<sub>3</sub>-50 ml; Kelpak V<sub>1</sub>-50 ml, Kelpak V<sub>2</sub>-100 ml, Kelpak V<sub>3</sub>-150 ml; gibberellinic acid (GA<sub>3</sub>)V<sub>1</sub> - 25 ppm; GA<sub>3</sub>V<sub>2</sub>-50 ppm; GA<sub>3</sub>V<sub>3</sub>-100 ppm.

The experience was organized in three repetitions, with five stocks in each plot. Commercial substances Kelpak and Cropmax were applied foliar, first before flowering, after shaking of flowers, and second time at the berries formation phenophase. Gibberellinic acid (GA<sub>3</sub>) application was performed by spraying inflorescences in the flowering phenophase, when 70% of the corollas are fallen.

Results are average of three determinations and have calculated standard deviation.

## RESULTS AND DISCUSSIONS

Gelus is the first variety with blue-purple grapes that ripen in the N- E area of Romania, and is characterized by high yields, diversifying assortment of table grape varieties in areas with low thermal resources. Grapes have medium size (275-304 g), cylindrical-conical form, semi-compact. Berries size are medium to large (4 g), elliptical, with blue-purple skin color covered with pruine. The pulp is colored, flavored, semi-crispy, with pleasantly and harmonious taste. Is a variety with medium vegetation period 165-172 days, buds opening from 25 April to 05 May, blooms from 10 to 18 June, and the full maturation of the grapes is done at the end of August from the 20th VIII, variety fits in the third period of grapes maturation. Produces high yields of grapes 22 t/ha, of which 92% is the percentage of commercial grapes (Țârdea and Rotaru, 2003).

After applying the biostimulating treatments, produced grapes were medium size, cylindrical, conical and half compact. At the control variant, the

average weight of a grape was 260.35 g, berries on the cluster reaching 254.22 g and rachis weight was 6.13 g (table 1).

*Table 1*

**Physico-chemical properties of the control sample grapes and the samples treated with gibberellinic acid (GA<sub>3</sub>)**

Indicator	Control variant	GA <sub>3</sub> V <sub>1</sub>	GA <sub>3</sub> V <sub>2</sub>	GA <sub>3</sub> V <sub>3</sub>
Production / vine stock (kg)	6.769	6.944	7.055	6.483
Number of grapes on stock	26.00	25.00	25.00	26.00
Grapes weight (g)	260.35	277.79	282.21	249.36
Number of berries/rachis	76.00	60.67	54.00	73.67
Berry weigh (g)	3.43	4.58	5.22	3.38
Weight of 100 berries (g)	343.58	457.89	522.00	338.50
Rachis weight (g)	6.13	5.76	5.95	7.52
Number of seeds/berry	1.67	2.07	2.00	1.67
Structure index	41.50	47.25	46.43	32.17
Berry grapes index	29.15	21.84	19.16	29.54
Skin weight (g)	0.65	0.60	0.67	0.44
Pulp weight (g)	2.78	3.98	4.55	2.94
Compozition index	4.27	6.68	6.79	6.68
Sugars (g/L)	151.00	158.00	164.00	143.00
Titratable acidity (g/ L tartaric acid)	6.83	7.41	7.16	6.25

Index structure of the cluster, represented by the ratio of berries grapes weight and clusterweight was 41.5. The number of normally developed berries grapes on the cluster was 67, and undeveloped berries grapes 9. Berries had different sizes, are elliptical, purple-blue, covered with a thin layer of pruine, which increases the commercial value and enhances the appearance of grapes (fig. 1).

Berry grapes index represented the number of berries per 100 g grapes (Constantinescu et al., 1970) had a value of 29.15. Index composition of berry, representing the weight of pulp/skin weight, reached 4.27. Weight of 100 berries grapes was 343.5 g, and the average production in the control sample was 6, 769 kg/wine stock. Sugar content value recorded was 151 g/L, with a titratable acidity of 6.83 g/L tartaric acid.

Table 2

**Physico-chemical properties and structure of grapes treated with biostimulating substances Cropmax and Kelpak**

Indicator	Cropmax CV <sub>1</sub>	Cropmax CV <sub>2</sub>	Cropmax CV <sub>3</sub>	Kelpak KV <sub>1</sub>	Kelpak KV <sub>2</sub>	Kelpak KV <sub>3</sub>
Production / vine stock (kg)	5.990	5.738	4.854	2.531	2.548	3.635
Number of grapes on stock	23.60	21.30	17.30	13.30	12.60	16.60
Grapes weight (g)	253.81	269.42	280.60	190.30	202.22	219.02
Number of berries/rachis	82.00	72.67	90.76	79.00	86.00	84.00
Berry weigh (g)	3.08	3.71	3.09	2.41	2.35	2.61
Weight of 100 berries (g)	308.00	370.76	309.16	240.89	235.14	260.73
Rachis weight (g)	6.52	8.18	7.63	5.31	9.45	9.40
Number of seeds/berry	2.00	2.33	1.67	2.00	1.73	2.00
Structure index	37.95	31.95	35.78	34.84	20.40	22.30
Berry grapes index	32.47	26.97	32.35	41.51	42.53	38.35
Skin weight (g)	0.41	0.46	0.37	0.29	0.28	0.33
Pulp weight (g)	2.67	3.24	2.72	2.12	2.07	2.28
Compozition index	6.49	7.00	7.33	7.33	7.47	7.00
Sugars (g/L)	147.00	144.00	151.00	159.00	163.00	162.00
Titratable acidity (g/L tartaric acid)	5.70	4.50	5.35	6.83	7.10	6.67

Treatments with Cropmax product were applied in three doses at three different phenophases: before flowering, 14 days after flowering and 35 days after flowering.

It is noted that the values obtained after treatments with Cropmax were generally lower than those obtained at control sample at production yield and the number of grapes per vine stock.

Production of grapes per vine stock ranged from 5.990 kg at sample CV<sub>1</sub> to 4.854 kg at sample CV<sub>3</sub>. It was found that an increasing amount of grapes production per vine stock was inversely correlated to the dose applied, so at high Cropmax doses ( $\geq 50$  mL), were recorded lower production yields.



**Fig. 1** - Influence of growth regulators Cropmax on the grapes of Gelu variety

The number of normally developed berries in the cluster has not exceeded 76, and the number of undeveloped berries ranged between 12-14. Berry index value was highest at samples CV<sub>1</sub> and CV<sub>3</sub> (32), at sample CV<sub>2</sub> the value was 26.9. Index composition of berry grapes was in the range of 6.49 at CV<sub>1</sub> and 7, 33 CV<sub>3</sub> sample. Sugar content ranged from 144 g/L at CV<sub>2</sub> and 151 g/L in CV<sub>3</sub> samples, in the context of the titratable acidity with values between 4.5 (CV<sub>2</sub>) and 5.7 (CV<sub>1</sub>) g/L tartaric acid.

Values obtained after treatments with Kelpak solution were much lower than those obtained from control sample in term of production from the grape vine and cluster number. Production of grapes per stock ranged from 2.531 kg to 3.635 kg at sample KV<sub>1</sub> respectively to sample KV<sub>3</sub> (table 2). It was found that using the biostimulator Kelpak grape production on the stock increases with the applied dose. Index cluster structure showed maximum value at sample KV<sub>1</sub> (34.84) and minimum value at KV<sub>2</sub> sample (20.40).

The number of normally developed berries in the cluster it was not higher than 76, undeveloped berries exceeding 13. Weight of 100 berries ranged from 235.14 g and 260.73 g at samples KV<sub>2</sub> and KV<sub>3</sub>.

Berry index value was highest at KV<sub>2</sub> (42.53) and KV<sub>3</sub> sample was 38.3. The higher value of this index were influenced by the berries size and their weight per rachis the berry composition index had values above 7 at all three variants.

It can be pointed that under the influence of gibberellinic acid the mass of grapes was growing on the stock vine to 6.944 kg (GA<sub>3</sub>-25 ppm) and 7.055 kg (GA<sub>3</sub>-50 ppm), berries weight and increasing the cluster bunch weight compared to control variant (table 1).

The number of berries per cluster was lower than control version, leading to an appreciation of the index structure to GA<sub>3</sub>V<sub>1</sub> and GA<sub>3</sub>V<sub>2</sub> samples, but the number of normally developed berries on the rachis does not exceed 50.

Decreasing of berries number in the cluster has increased the weight of 100 berries, the highest value (522.0 g) was registered at the variant treated with gibberellinic acid 50 ppm. Berry index has the most important value at variant V<sub>3</sub> (29.5), and the berry index composition ranged between 6.68 at variants V<sub>1</sub> and V<sub>3</sub>, respectively 6.79 to version V<sub>2</sub>.

Following correlations made regarding the production of grapes and the doses applied, the value of R<sup>2</sup>=0.972 for variants treated with Cropmax, 0.761 for those treated with Kelpak and 0.655 for the variants treated with GA<sub>3</sub>.

## CONCLUSIONS

1. After observations and measurements was found that the variety Gelu respond better to treatment with gibberellinic acid and optimal concentration was 50 ppm, this dose can be successfully introduced in the cultivation technology to increase productivity yield at this variety.

2. Inflorescences treatment with gibberellinic acid contributed to the growth of berries size and 100 berries weight, but did not influence the percentage of seedless grapes.

3. Commercial product Cropmax is recommended to be applied in low concentrations, because the higher doses used do not increase the productivity.

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## THE CROP YIELD BEHAVIOUR OF SOME ELITE HYBRID VARIETIES OBTAINED AT S.C.D.V.V. BLAJ

### COMPORTAREA ÎN PRODUCȚIE A UNOR ELITE HIBRIDE OBȚINUTE LA S.C.D.V.V. BLAJ

*CRISTEA C.C.<sup>1</sup>, COMȘA Maria<sup>1</sup>,  
CUDUR Florina<sup>1</sup>, COMȘA A.<sup>1</sup>, CUDUR C.F.<sup>1</sup>*  
e-mail: cristec2002@yahoo.com

**Abstract:** *Improving grapevine variety at S.C.D.V.V. Blaj is a traditional process and it has continuity. Sexuate hybridisations were carried out with a view to obtaining new varieties of very good quality, with high concentration of sugar accumulation and acidity, which could ensure high wine quality. Following hybridisation, elite hybrids were selected, which today can be found in comparative competitive plantations, 200 block vine of elite vine varieties in each plantation. The elite hybrid varieties designated as 5-26; 6-10; 6-4-4 and 110 were examined compared to the control samples Feteasca Regala - 21 Bj (Elite varieties no. 6-10, 6-110, 4-4) and Pink Traminer -60 Bj (Elite variety no. 5-26). As a result of the study, it was found that the elite varieties have a good sugar/acidity balance, of which, numbers 5-26 and 6-110 stood out.*

**Key words:** Hybrid elite varieties, sugar accumulation, high acidity, quality

**Rezumat:** *Ameliorarea soiurilor de viță de vie la S.C.D.V.V. Blaj este de tradiție și are continuitate. Au fost efectuate hibridări sexuate în vederea obținerii de soiuri noi de calitate foarte bună, cu concentrația acumulărilor în zahăr și aciditate ridicată, care să asigure o calitate deosebită a vinurilor obținute. În urma hibridărilor au fost selecționate elite hibride, care astăzi se găsesc în plantațiile comparative de concurs, câte 200 butuci din fiecare elită. S-au studiat elitele hibride 5-26; 6-10; 6-110 și 4-4 comparativ cu martorul Fetească regală-21 Bj (Elitele 6-10; 6-110; 4-4) și cu martorul Traminer roz-60 Bj (Elita 5-26). În urma efectuării studiului asupra elitelor hibride comparativ cu martorii amintiți, s-a constatat că elitele au un raport zahăr/aciditate bun. Se remarcă elitele hibride 5-26 și 6-110.*

**Cuvinte cheie:** Elite hibride, acumulări de zahăr, aciditate ridicată, calitate

## INTRODUCTION

Since consumer demands for quality grapes and wines are always growing, research in improving quality and crop yield in grape vines remains opportune (Oprea and Moldovan, 2007). Productivity and quality of grapevine varieties are very complex features, which depend on the genetic traits (inherited genotype or dowry) of each variety, on the environmental conditions and on the interaction between genotype and environment (Sestraș, 2004).

Ampelographic characteristics: The elite varieties 5-26, 6-10, 6-110, 4-4 are potential new varieties of grapes with a high yield and high quality, given by a high concentration of sugar in the must.

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<sup>1</sup> The Vine and Wine Research and Development Station Blaj, Romania

**The elite variety 5-26** resulted from hybridisation between the hybrid elite variety 8-33-44 (Iordana x Pink Traminer) and the 51-19 elite variety (Raisin de Saint Pierre x Perla de Csaba) followed by selection in the greenhouse. Given the similarity with Pink Traminer, the elite variety 5-26 was studied in comparison with the above-mentioned variety taken as a control sample. The shoots are brown with small, brown inflorescences and well developed tendrils, with a slower vegetative growth like Pink Traminer 60 Bl. (the control sample) (fig. 2). The leaf is medium size with reddish veins, embossed, dark metallic green, with prominent teeth and less clear lobes (fig. 1).



**Fig. 1** - Elite variety 5-26.



**Fig. 2** - Pink Traminer-60 Bl.

**The Elite variety 6-10** resulted from hybridisation between two elite varieties of the Laboratory for grape vine improvement of SCDVV Blaj. The following elite varieties were crossed 9-35-10 (Pink Traminer x Iordana) and 51-19 (Raisin de Saint Pierre x Perla de Csaba). It should be noted that elite variety 9-35-10 has a great crop yield with very modest accumulation of sugar and the 51-19 elite variety has a lower but early yield, with high levels of sugar in the must.

The elite variety 6-10 shows a brownish growth bud, green large inflorescences, moderate growth similar to Fetească regală -21 Bl. (the control sample) (fig. 3).



**Fig. 3** - Fetească regală-21 Bl.

The elite variety also has an early veraison, as the grapes begin to enter the veraison stage in the first half of August. The grape berries are round and

thick as with Fetească regală, with a large number of grapes per vine. The leaf is yellowish green, with similar reddish shoots per cane. The berries are thick but not compact, spherical, translucent with a thin skin and pleasant taste especially at veraison. Sometimes, the yield of the grape variety is extremely high and cannot be supported by the grape vine; therefore, during dry periods in late summer, it can be seriously affected. The grapes greatly resemble the Feteasca regala control sample-21 Bl, but they enter veraison much earlier and have higher sugar concentration. The elite variety should be harvested in mid-September, when technological maturity is reached. The elite variety can be grown in northern areas of the country as well (Lechința vineyard), where it reaches technological maturity in late September (fig. 5).

**The elite variety 6-110** belongs to the same hybrid combination as elite variety 6-10. Its growth is strong; the growing shoots are erect with long internodes. The shoots are reddish in their early stage and reddish brown during adulthood. The leaves have long stalks, red as the main veins, with dark green sharp teeth. The grapes are large with semi-compact berries placed on the rachis, which sometimes become rusty at veraison; the rachis is reddish, long, and branched (fig. 4).



**Fig. 4 - Elite variety 6-110**



**Fig. 5 - Elite variety 6-10**



**Fig. 6 - Elite variety 4-4**

The elite variety 4-4 belongs to the same hybrid combination as the variety 6-10. After a liny bud break, the shoots are brownish green with medium sized inflorescences and strong tendrils. It has strong growth with large leaves, embossed, dark green and poorly indented. The leaf has five lobes or almost complete, the grapes are the size of the Feteasca regala control sample-21 Bl. The berry is bigger than the control sample's, spherical, translucent-looking and thicker skin (pleasant taste, balanced, good for fresh consumption). In undergoes an early veraison in the first decade of August (fig. 6).

## MATERIAL AND METHOD

The study of elite varieties 6-10, 6-110 and 4-4 versus Fetească regală 21 Bl. and of the elite variety 5-26 versus Pink Traminer-60 Bl was resumed. Three hybrid elites belong to the combination of hybrids 9-35-10 (Pink Traminer x lordana) x 51-19 (Raisin de Saint Pierre x Perlă de Csaba). The varieties 6-10, 6-110 and 4-4 were studied according to all the improvement plan options allowed by our experimental technical standards, and compared with the basic variety from the Târnave Vineyard - Fetească regală-21 Bl.

The elite variety 5-26 (fig. 2) obtained under the same conditions was studied in comparison with another control sample - basic variety from the Târnave Vineyard - Pink Traminer-60 Bl. In order to establish the value of the hybrid elite varieties, observations and measurements were performed to determine the ampelographic characteristics, the agro-biological characteristics as well as the quantity and quality of the grape crop yield (Ardelean, 1994).

## RESULTS AND DISCUSSIONS

**Weather conditions.** The year 2011 was different as compared to the average of years, characterized by two periods of drought (table 1). The first period was recorded in April and May, when the vines did not suffer much. In June, high amounts of rainfall were recorded, which brought soil moisture to normal levels. July maintained humidity within normal parameters as there was important rainfall. Grape vine development was almost normal until August, which was a droughty month, due to which the vegetation period was reduced.

Table 1

Weather conditions during the vegetation period in 2011, at SCDVV Blaj

Month	Average monthly temperatures (° C)		Extreme temperatures (° C)		Temperatures sum (° C)			Rainfall sum (mm)	
	Multi-annual	Real	Min.	Max.	global	active	useful	Multi-annual	Real
March	4.7	5.6	-9.8	21.8	143.8	76.8	6.8	23.9	9.4
April	10.4	11.3	-1.4	23.9	339.4	254.5	64.5	68.3	23.6
May	15.2	15.6	0.1	29.7	482.8	460.8	180.8	80.2	45.6
June	18.3	19.5	8.5	34.1	585.8	585.8	285.8	93.6	116.4
July	19.8	21.2	9.9	35.3	656.7	656.7	346.7	99.0	44.0
August	19.3	21.1	8.6	35.4	653.1	653.1	343.1	64.0	4.6
September	15.1	18.6	6.8	32.9	556.8	556.8	256.8	56.7	8.2

A second drought was felt in August and September and extended through October, time during which there was almost no precipitation. As compared to the sum of multiannual precipitation of 120.7 mm, only 12.3 mm rainfall was recorded during the two months (table 1).

Vine growth and development was favourable until veraison, when drought was fully felt by the plant. The veraison period began about two weeks earlier than in normal years. In the last days of September, wilting of the grape vine began, followed by wilting of the grapes.

**Fertility and productivity.** The relative fertility coefficient ranged from 0.3 recorded in Pink Traminer-60 Bl control sample for the elite variety 5-26 to 1.2 for the variety Fetească regală-21 Bl, taken as control sample for the white elite varieties (6-10, 6-110, 4-4). The absolute fertility coefficient ranged between 1.2 for the elite variety 4-4 and 1.8 for the elite variety 5-26. The weight of 100 berries was highest at elite variety 6-110 (305 g), as compared to control sample Fetească regală-21 Bl which had a weight of 184 g. The elite variety 5-26 (100 berries) weighed 195 g compared to 172 g for Pink Traminer-60 (table 2).

The weight of one grape cluster for the variety Fetească regală-21 Bl. was of 110 g and of 141 g for the elite variety 6-110. 6-10 had similar size and weight grapes as Fetească regală-21 Bl. The weight of a grape cluster from the elite variety 5-26 was 124 g and the sample control Pink Traminer 60-Bl registered 96 g.

The relative productivity index reached a maximum value of 137 at the elite variety 5-26, a very high value compared to that recorded with Pink Traminer-60 Bl (28). The 6-110 elite variety with the value 127 came close to the control sample Fetească regală-21 Bl, which showed a relative productivity index value of 132. Elite variety 5-26 recorded a high value (224) of the absolute productivity index compared with the Pink Traminer variety-60 Bl (125). Of the elite varieties for white wines, the elite variety 6-110 recorded the highest value of the absolute productivity index, and namely 198, higher even than the control sample that recorded a value of 176 (table 2).

Table 2

The fertility and productivity of elite variety hybrids created at SCDVV Blaj

Elite variety hybrid	Fertile shoots %	Fertility coefficient		Weight of 100 berries (g)	Average weight of a grape bunch (g)	Productivity index	
		Relative	Absolute			Relative	Absolute
6-10	67	1.0	1.5	240	97	97	146
6-110	31	0.9	1.4	305	141	127	198
4-4	69	0.8	1.2	291	123	99	148
Fetească regală -21 Bl. (Co.)	74	1.2	1.6	184	110	132	176
5-26	66	1.1	1.8	195	124	137	224
Pink Traminer -60 Bl. (Co.)	22	0.3	1.3	172	96	28	125

**Grape quality and yield.** The studied elite varieties recorded in 2011 crop yields that exceeded those of the control samples. The elite variety 6-110

recorded a high yield with 10,001 kg/ha, while the elite variety 5-26 yielded the best crop, 16,001 kg/ha, much more than the control sample Pink Traminer-60 Bl, which yielded only 7,334 kg/ha.

The recorded concentration of sugars in grapes was highest with elite variety 4-4 with a value of 226 g/l and with the 6-10 elite varieties with 222 g/l, concentrations much higher than that of Fetească regală Bl-21 (187 g/l). The 5-26 elite varieties accumulated a quantity of 225 g/l sugars, which was significantly exceeded by the control sample Pink Traminer-60 Bl, which accumulated 248 g/l sugars in the must.

The elite variety 6-110 recorded a total acidity of must of 4.1 g/l H<sub>2</sub>SO<sub>4</sub>, value that was similar to that of Fetească regală -21 Bl (control sample). Instead, elite varieties 6-10 and 4-4 showed a lower total acidity of must, of 3.5 g/l H<sub>2</sub>SO<sub>4</sub> respectively 3.6 g/l H<sub>2</sub>SO<sub>4</sub>.

The highest total must acidity was registered by the elite variety 5-26 (5.2 g/l H<sub>2</sub>SO<sub>4</sub>), which exceeded the Pink Traminer control sample-60 Bl. by much (3.7 g/l H<sub>2</sub>SO<sub>4</sub>). This high acidity shows that the 5-26 elite varieties had a high potential for the accumulation of sugars in grapes but was harvested quite early (table 3).

Table 3

The production of grapes and quality of must

Elite variety hybrid	No. of grape vine bunches on vine block	Yield		Quality of must	
		kg/vine block	kg/ha	Sugar g/l	Acidity g/l H <sub>2</sub> SO <sub>4</sub>
6-10	22	2.13	8.820	222	3.5
6-110	17	2.40	10.001	219	4.1
4-4	18	2.20	9.167	226	3.6
Fetească regală-21 Bl. (Co.)	32	2.04	8.334	187	4.1
5-26	31	3.84	16.001	225	5.2
Pink Traminer-60 Bl. (Co.)	19	1.76	7.334	248	3.7

## CONCLUSIONS

1. Of the elite varieties studied, 6-110 stands out and must be further researched so as to suggest its homologation.
2. Elite variety 5-26, which was also studied in previous years, confirms the good results and will be proposed for homologation.
3. The 6-10 and 4-4 elite varieties show a high potential for crop yield and quality, so they will be studied in the following years.

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# AGROBIOLOGICAL PARTICULARITIES AND TEHNOLOGICAL ELEMENTS OF CULTIVATION OF GUZUN TABLE GRAPE VARIETY

## PARTICULARITĂȚILE AGROBIOLOGICE ȘI ELEMENTELE TEHNOLOGICE LA CULTIVAREA SOIULUI DE MASĂ GUZUN

*CUCU Valentina*<sup>1</sup>

e-mail: valea\_lu@yahoo.co

**Abstract.** *Taking into account the actual preoccupation in the world regarding the extension of table grape varieties cultivation using new valuable and highly appreciated by consumer varieties, the present paper have the objectives: - selection of new varieties for completion of actual assortment and ensuring more superior production quantity and especially quality with the purpose of its promotion in production; - efficient application of inflorescences rate setting in combination with the number of buds after cutting.*

**Key words:** table grapevine varieties, agrobiologie, length of pruning, green operations

**Rezumat.** *Având în vedere preocupările existente pe plan mondial privind extinderea culturii soiurilor de struguri pentru masă, prin folosirea creațiilor noi, valoroase, cu însușiri apreciate de consumator, prin această lucrare s-a urmărit: alegerea soiurilor noi care să completeze actualul sortiment și să asigure obținerea unor producții superioare din punct de vedere cantitativ și mai ales, calitativ, cu scopul promovării lor în cultură; aplicarea eficientă a normării numărului de inflorescențe în combinație cu încărcătura de ochi lăsată la tăiere.*

**Cuvinte cheie:** soiuri de masă, agrobiologie, lungimea de tăiere, operațiuni în verde

### INTRODUCTION

Recently is attested an important growth of consumption of fresh grapes due to general tendency oriented to healthy alimentation, richer in vegetable resources. Development of culture of cultivation of table grapes varieties according the actual and future requirement must be based on knowledge of productive characteristics of these varieties and of reaction of to various climatic factors and agro technical operations. Between principal uvological characteristics can be mentioned: commercial aspects, firm flesh, harmonious taste, thin and comestible skin, seedlessness, resistance to fungal diseases, suitable for

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<sup>1</sup> Scientifico-Practical Institute of Horticulture and Food Technologies, Chișinău, Republic of Moldova

transportation and long term storage. Varieties with muscat flavor or expressed fruitiness, with notes of lemon, flowers, and caramel are demanded by consumers.

## MATERIAL AND METHOD

As biological material for observations and measurements was selected table grape variety Guzun with medium-late time of full berry maturity. Planting distances are 2,8 x 1,5 m, training system is horizontal bilateral cordon vines form type Cazenave. Experimental plot have 1-5° slope with South-West orientation and 150 m altitude. The soil is medium eroded cambial chernozem. The experiment was organized in 5 variants in 3 repetitions by 10 plants each:

V1 – cutting length 2+2, bud load 24 buds/vine (cane + spur);

V2 – cutting length 2+3-4, bud load 34 buds/vine;

V3 – cutting length 2+5-6, bud load 44 buds/vine

V4 – one inflorescence at 2 shoots formed on the vine;

V5 - one inflorescence at 1,5 shoots formed on the vine.

Observations and measurements have been performed by comparison of variants and included: production of grapes per vine, average weight of a grape, sugar and acid total content of must, glucoacidimetric index. Experience was organized in Central zone of republic on experimental plots of STE Vierul in plantations established in 2005.

## RESULTS AND DISCUSSIONS



Fig. 1 – Variety Guzun

Guzun (Muscat Derbenskii x Muscat de Saint Vallier) - variety created by the National Institute of Viticulture and Winemaking, homologated in 2004. Grapes are cylindrical-conical, with an average weight of 300-400 g. Berry is medium large, with green-yellow skin, slightly firm flesh and musket flavor. Vine vigor is medium. The variety has advanced resistance to winter conditions, mildew, bean, gray rot and mildew. Average crop production is 12-13 t/ha. Grape maturity is achieved in the third decade of September and accumulates about 180 g/L sugars and total acidity of 7.0-8.0 g/L H<sub>2</sub>SO<sub>4</sub>, tasting note is 9 points. Resistance to frosts and winter is very good (-23...-

24°C). Grapes have good resistance to transport and can be stored in refrigerators until January-February. It is recommended to be used in vine-growing regions of Central and South of Moldova.

Cuttings are the most important vegetative surgical operations undergone by vine plants in the actual culture system, which smooth and improve crop quality (Jianu, 2000). Fertility characterized agro biological value and determines the production of grape varieties. Fertility expressed as the percentage of fertile shoots depends on the biological nature of the variety and vary depending on the load of fruit attributed by cutting (Perstnirov, 2000). Variant with short and medium length cutting is observed an increasing percentage of growing shoots - 96-97%, and 76-78% of fertile shoots, compared with 67% on long cutting (tab. 1). The bud load is the main factor that determines the expression of the agro-productive characteristics of the vine varieties, as well as biological equilibrium between vegetative development - fruitiness and quantity – quality proportion. The three bud loads significantly influenced the grape harvest, which is obviously higher in the variant with 44 buds/vine. Cutting scheme 2+3-4 with bud load of 45 buds/vine, was revealed, to which the total production per hectare was 24.0 t/ha and 80% shareware. Short cutting also have good results, but there was a decrease in the percentage of fertile shoots, which allows concluding that bud load decreased the yield.

Table 1

**Elements of fruit and productivity at variety Guzun when cutting with different bud load**

Indices of production	Variant		
	V1	V2	V3
Percentage of shoots start in vegetation	96	97	89
Fertile shoots (%)	78	76	67
Number of inflorescences	22	30	34
Weight of the grapes (g)	320	400	300
Yield (kg/vine)	9,3	12,0	10,2
Yield (t/ha)	18,6	24,0	20,4
Sugar content, g/l	180	178	162
Acidity, g/l H <sub>2</sub> SO <sub>4</sub>	6,1	6,5	7,1
Glucose-acidimetry Index	39	27	23
Ware,%	77	80	70

Table vines can become profitable only when the grapes have both taste qualities, as well as commercial aspects. One of green operations, which will lead to improving the quality of grapes, is standardization of the number of inflorescences on the block (Condrea, 1972). Reducing the number of inflorescences on the block, has primarily the effect of increasing the weight of grapes (30-40%), normal development and growth of global production of grain by 10-15%. This ensures a high % ware (Țârdea, 1995).

The research has been taken to task hub version of 34 eyes (tab.2), on which the normalization of inflorescences. Inversion 15 inflorescence at harvest block was 15.4 t/ha with a production of 90% freight, here is an increase in weight of 520 g grapes reaching values, sugars - 188 g/L. The normalization with

20 inflorescences harvest was 19.2 t/ha and 85% commodity production. In version control, without standardization maximum yield was 24.0 t/ha and 80% commodity production.

The data tables 1 and 2 shows that the control (V2 in table 1), inflorescence number is 30-50% higher, while other elements (the weight of grape, sugars) are comparatively low. In the climate conditions of Moldova overloading vine varieties semi tardive, as Guzun variety, not all owing uniform ripening grapes and wood chords. Therefore normalization of 15-20 inflorescences in influencing the number - (developing of grain, the increasing mass of grapes, sugar accumulation).

Table 2

Quality yield after thinning inflorescences at variety of Guzun

Indices of production	Variant	
	V4	V5
Number of shoots after weeding	30	30
Inflorescence after thinning	15	20
Weight of the grapes (g)	520	480
Yield (kg/vine)	7,7	9,6
Yield (t/ha)	15,4	19,2
Sugar content, g/l	188	180
Acidity, g/l H2SO4	6,0	6,1
Glucose-acidimetry Index	31	29
Ware, %	90	85

## CONCLUSIONS

1. New table grape variety of Guzun is characterized by high production quality and taste, it can be cultivated with unprotected system in the southern and central parts of the Republic of Moldova.

2. This variety responds to short cutting and moderate load average vine inflorescences while standardization. A negative one is overloading, leading to decreasing of production of goods and reduce shoot growth. In favorable years the best cutting length is 2+3-4 with moderate load, average load figure 2+5-6 apply after cold winters when a large number of eye loss.

3. Application thinning inflorescences constitutes an important technological link as superior quality is obtained only in case of non-application. Grape production is obtained although quantitatively less compensated by the percentage of ware.

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# ASPECTS OF BEHAVIOR OF WINE GRAPES IN THE DEALU BUJORULUI VINEYARD IN TERMS OF CLIMATE CHANGE

## ASPECTE PRIVIND COMPORTAREA UNOR SOIURI DE STRUGURI DE VIN IN PODGORIA DEALU BUJORULUI IN CONDITII DE SCHIMBARI CLIMATICE

*ENACHE Viorica<sup>1</sup>, DONICI Alina<sup>1</sup>*  
e-mail: enache\_scdvv@yahoo.com

***Abstract.** Recent years have seen a trend of climate change, with impacts on vine behavior. Climatic data analysis showed an increase in mean annual temperature. They observed changes in thermal regime of extreme values .Following the more pronounced warming and a growing deficit in the summer hydric, intensified aridity phenomenon. Amid the trend of climate change in a study on the behavior of wine grapes in the Dealu Bujorului vineyard.*

**Key words:** climate parameters, vine, variety, production, quality.

***Rezumat.** În ultimii ani s-a observat o tendință de modificare a climei, cu influențe asupra comportării viței de vie. Analiza datelor climatologice a evidențiat o creștere a temperaturii medii anuale. S-au observat schimbări în regimul unor valori termice extreme. Urmare a încălzirii mai pronunțate și a unui deficit hidric în creștere în timpul verii, s-a intensificat fenomenul de aridizare. Pe fondul tendinței de modificare a climei s-a realizat un studiu asupra comportării unor soiuri de struguri de vin în podgoria Dealu Bujorului.*

**Cuvinte cheie:** elemente climatice, viță de vie, soi, producție, calitate.

### INTRODUCTION

Since the 80s and until now, we face a warming trend. Expected changes in temperature and precipitation is likely to lead to periods of vegetation change, the zoning varieties and many other changes that do not currently provide but which may grow in time (Enache, 2010). Predictions based on global climate models show we can expect a more frequent occurrence of extreme weather events and associated risks and damage can become significant. Reduction and better crops and damage grape vines in vineyards as a result of climatic events (frost early fall, late spring frosts, excessive negative temperatures, rainfall etc.) lead to significant losses for wine heritage (Alexandrescu, 1994, Târdea, 1995).

### MATERIAL AND METHOD

The research was conducted in an experimental polygon within RDSVV Bujoru, in 2008-2010. Observations were made to three varieties of grape for wine: Merlot,

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<sup>1</sup> Research and Development Station for Viticulture and Winemaking Bujoru, Romania

Aligote and Fetească neagră. Monitoring of climatic factors was performed on the RDSVV Bujoru Weather Station, with an AGROEXPERT system. They made observations and measurements, the varieties of grape production and quality.

## RESULTS AND DISCUSSION

They analyzed data from a period of three years (2008-2010) to investigate the behavior of wine grape varieties in the context of global climate change in Dealu Bujorului Vineyard, where they stand and Development Research Station for Viticulture and Winemaking Bujoru. Climatic factors in the period studied correspond to drought years (table 1).

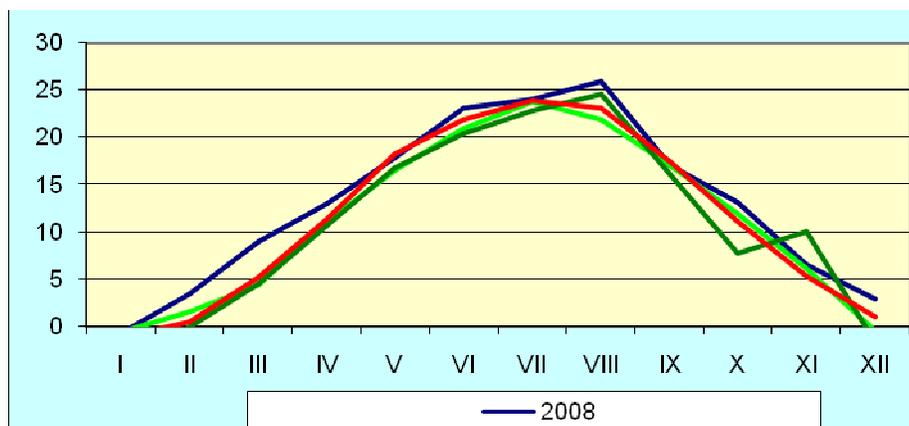
*Table 1*

**The main Climate Parameters at Bujoru Research and Development Station for Viticulture and Vinification in the period 2008-2010**

<b>Climate Parameter</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Global Thermic Balance, ( $\Sigma t^{\circ}g$ )	3694,9	3664,2	3067,4
Active Thermic Balance, ( $\Sigma t^{\circ}a$ )	3645,3	3510,9	2949,1
Net Thermic Balance, ( $\Sigma t^{\circ}u$ )	1875,3	1660,9	1537,5
$\Sigma$ Annual Rainfalls, mm	364,7	357,4	624
$\Sigma$ Rainfalls during the Vegetation Period, mm	224,8	174,6	415,6
$\Sigma$ Number of Insolation Hours in the Vegetation Period, hours	1332,7	1560,6	1357,9
Average Annual Temperature, °C	12,9	11,2	10,6
Average Temp. in the month of – July, °C	24,0	23,8	22,8
– August, °C	25,9	22,1	24,6
– September, °C	17,1	17,2	16,1
Air Absolute Minimum Temperature, °C	-14,5	-15,2	-25,2
Data	5,1	9,1	26,1
The Maximum Temperature in the Month of August, °C	32,0	30,8	31,7
Average Temperature in the I-st and II-nd decades of the month of June	21,9	20,5	21,4
Wind Speed (km/hour)	2,0	2,5	2,1
Relative Air Humidity (%)	54	74,1	76
Nebulosity	6,2	3,3	6
No. Of days with Maximum Temperatures > 30°C	52	44	40
Length of Bioactive Period, days	177	186	189
Real Heliothermic Index	2,50	2,56	2,09
Hydrothermic Coefficient	0,6	0,49	1,41
Vine Bioclimate Index	11,8	17,0	5,09
Index of Oenological Ability	5003,2	5149,1	4141,4
Annual Aridity Index	15,92	16,85	16,6
Characterization of the year	Slightly dry	dry	dry

Dealu Bujorului vineyard is located in the south of Moldova, dry character area, with annual average temperature of 11,5°C and in the vegetation period of 19,3°C. During 2008-2010 there is a decrease in mean annual

temperature. We note that only 2009 monthly average temperature is maximum in July, in 2008 and 2010 it is recorded in August. Average maximum temperatures in August ranged between 30,8 and 32,0 ° C. Absolute minimum temperatures generally are recorded in January and absolute minimum was -25,2 ° C/26.01.2010. A synthetic indicator value (real heliothermic index, vine bioclimatic index and index of oenological ability) indicates an area favorable for vines, balanced and very good favorability red and white varieties. Monthly evolution of air temperature (fig. 1) reveals that only in 2008 on the vegetation period were recorded multiannual average higher values, in 2009 and 2010 average temperatures are lower than multi-year, except August in 2010.



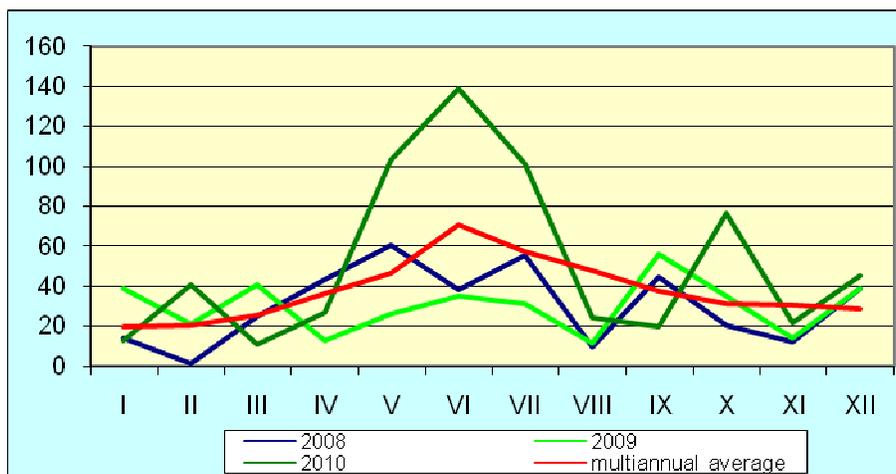
**Fig. 1** - Montly Evolution of Air Temperature during the period 2008-2010

Global heat balance of the vegetation has values between 3067,4 - 3694,9°C and show that the Dealu Bujorului Vineyard are provided with the ripening of the grapes to age V and VI, VII era precautions. Active and useful heat balance shows a downward trend during the period studied.

During the analyzed, rainfall had a patchy distribution, with more heavy rain falling for long periods of deficient rainfall. In the 2008-2009 annual rainfall had both deficit and the growing season. In 2010 the amount exceeds the annual average rainfall in May, June and July and in August-September there was a strong hydric deficit (fig. 2). Although the amount of rainfall in 2010 exceeded the annual average, year can be characterized as dry.

Deficit rainfall during the growing season, combined with excessive temperatures for short periods of time leads to increased hydric deficit during that period, influenced the culture of vine. For cultivation of vines often do media / annual amounts have major importance, but extreme values of some indicators (absolute minimum temperature, maximum temperatures in July and August, average temperature of decades I and II of June, the number of days with air temperature higher 30,0° C etc.).

To climatic elements in the period studied, varieties reacted differently, depending on each specific genetic, cultural measures applied, the size of production achieved in previous years etc.



**Fig. 2** - The monthly Evolution of Rainfalls during the years 2008-2010

In climatic conditions of the year 2008, the varieties taken in observation productions have been carried out between 2,39 kg /hub vine and 2,67 kg / hub (fig. 3). Severe drought in 2008 and 2009 led to a drop in production in 2009. Productions in the 2010 were lower and were influenced by both the hydric deficit in August / September and excessive negative temperatures in late January that affected the main buds.

Throughout the period analyzed, the climatic conditions of 2009 have most influenced the production of Merlot that was most sensitive. Note that low production Merlot was influenced by that culture technology has been applied in "organic farming system".

Productivity depending on the hub, the classification of studied varieties, in descending order is: Aligoté, Fetească neagră and Merlot. Note the influence of 2006, 2007, 2008 on production in 2009.

Small grape production made to reflect the quality of grapes (weight of 100 grains, sugar content and acidity must). Qualitative indices of production valued, in sugar content and total acidity of must, have evolved depending on variety and climatic conditions (fig. 3, 4, 5, 6).

Low potential for accumulation of sugars showed variety Aligoté, followed by Merlot and Fetească neagră. Acidity is in inverse relationship to sugar content.

Weight of 100 grains is influenced by fluid intake during the growing season and plant health of planting. Considering the evolution of varieties during 2008-2010, Fetească neagră and Aligoté variety was balanced out productions.

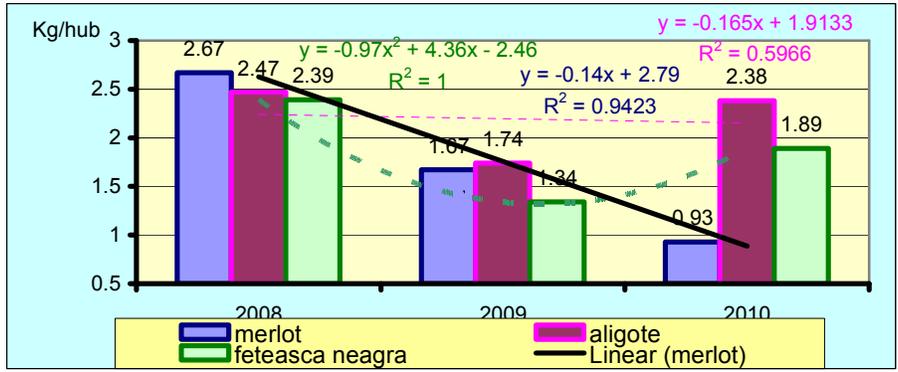


Fig. 3 - Grape Production during the period 2008-2010

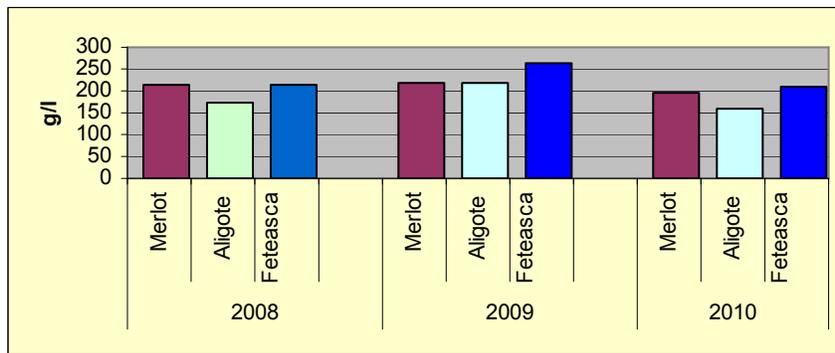


Fig. 4 - Grape Sugar Content (g/l)

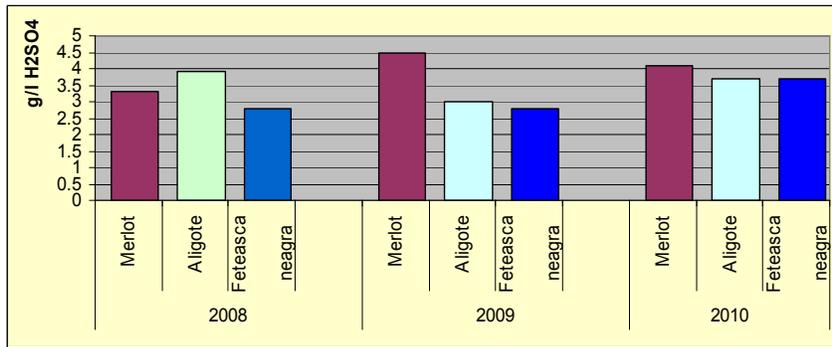
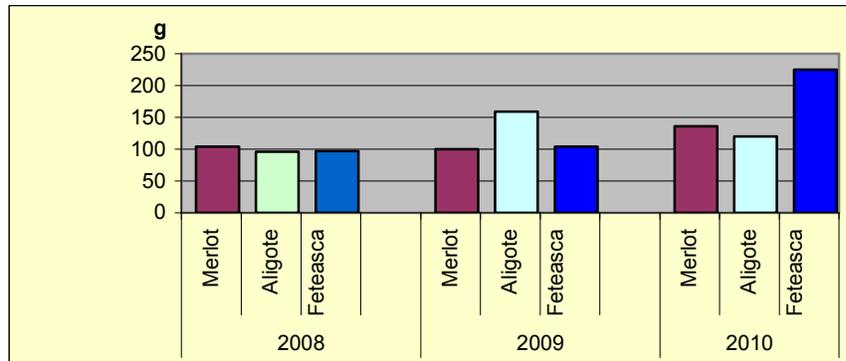


Fig. 5 - Must Acidity (g/l H<sub>2</sub>SO<sub>4</sub>)



**Fig. 6** - Weight of 100 grains (g)

## CONCLUSIONS

1. In the period 2008-2010 are obvious trends in the evolution of climatic factors with direct impact on production and quality potential of varieties.

2. In recent years we are witnessing a trend of reduced annual rainfall and in the vegetation period in alternation with excess precipitation. Increased heavy rains lead to reduced recovery of rainfall and hence the gain aridisation.

3. Average annual air temperature is down slightly (average annual air temperature from 11,2° C to 10,6° C), average maximum temperatures during the growing season have a tendency to shift from July to August

4. Registration of atypical values of climatic parameters (absolute minimum excessive temperature extremes etc.) was reflected directly on production and quality of grapes.

5. Considering the evolution of varieties in 2008-2010, Fetească neagră and Aligoté variety performed quantitative and qualitative balance, variety being the most sensitive Merlot.

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# THE BEHAVIOR OF SOME GRAPEVINE VARIETIES FOR WHITE WINES REGARDING FROST RESISTANCE ON 2011/2012 WINTER IN IAȘI AND COTNARI VINEYARDS

## COMPORTAREA UNOR SOIURI DE VIȚĂ DE VIE PENTRU VINURI ALBE PRIVIND REZISTENȚA LA GER ÎN IARNA ANULUI 2011/2012 ÎN PODGORILE IAȘI ȘI COTNARI

*HARAS Diana Gabriela<sup>1</sup>, ROTARU Liliana<sup>1</sup>*  
e-mail: arasdia@yahoo.com

**Abstract.** *In this paper we present the behavior of some grapevine varieties for white wines from Iași and Cotnari vineyards: Fetească albă, Grasă de Cotnari, Frâncușă, Tămâioasă românească, Risling italian, Fetească regală și Băbească gri at low temperatures that occurred during 2011/2012 winter. It was discovered that a large amount of main winter buds have been affected by the harmful low temperatures, fact that will have major implication on production levels this year.*

**Key words:** grapevine varieties, Iași, Cotnari, vineyard, winter buds.

**Rezumat.** *În lucrare se prezintă comportarea unor soiuri de viță de vie pentru vinuri albe din arealul podgoriei Iași și Cotnari: Fetească albă, Grasă de Cotnari, Frâncușă, Tămâioasă românească, Risling italian, Fetească regală și Băbească gri la temperaturi scăzute înregistrate în iarna anului 2011/2012. S-a constatat distrugerea unui număr mare de muguri de rod principali afectați de temperaturile minime nocive, fapt ce va avea implicații majore asupra nivelurilor de producție din acest an.*

**Cuvinte cheie:** soiuri de viță de vie, Iași, Cotnari, podgorie, mugure de rod.

### INTRODUCTION

In the temperate climate conditions of our country, grapevine is located at the north limit of economic culture, therefore, negative low temperatures resistance in winter, is the concern of many wine growers and it is the object of various research studies (Cichi, 2006).

The frequency of cold winters with critical minimum temperatures for grapevine is relatively high, therefore is necessary to establish new technologies and the selection of new grapevine varieties better adapted to that environmental conditions. Several research have shown that most varieties cannot face temperatures lower than -20°C, during the latent period of vegetation. The most sensitive to low winter temperatures are the winter buds and the diaphragm. The principal bud of winter bud have the lowest resistance; lateral buds have a higher resistance than principales buds, and the sprig buds are the most resistant (Dejeu, 2010). The resistance level depends on several factors such as: intensity and frost period, the occurring

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

period in relation to the vine stock preparing level (quenching), strings maturation level, low and high temperatures alternation, the size of grape harvest and culture technologies performed in the previous year (Rotaru et al., 2010).

Grapevine varieties for wine have a low frost resistance between  $-20^{\circ}\text{C}$  ..... $-22^{\circ}\text{C}$ , while the buds have a lower resistance, minimum starts at  $-8^{\circ}\text{C}$ . The most damage is caused by the sudden temperatures drops occurred to late winter, when the vines lose strength (Cotea and Cotea, 1996).

## **MATERIAL AND METHOD**

In 2011/2012 winter in vineyard area from the study (Cotnari, Iasi) there were slightly higher than the multiannual average in December, so that in January and February to witness a severe cooling. This phenomenon manifested between January 26 – February 20 2012, when the absolute minimum temperatures dropped below the strength of the vine, extreme values were being recorded over about 20 days.

In order to study the frost's negative effects in the winter of 2011/2012, observation to winter buds were made. The testing of buds viability was done by direct method, longitudinal winter bud sectioning and bud complex examination to binocular magnifier. Were used one year sprout from the seven varieties, representing 1% of all vines in experimental plots. Samples were maintained in water at  $20-24^{\circ}\text{C}$ , for 48 hours, for tissue rehydration, and for more precise observation between damaged and viable tissue it used binocular magnifier. The biological material used was the grapevines varieties from Iasi and Cotnari vineyard. Climatic data were provided by weather station Iasi and Cotnari.

## **RESULTS AND DISCUSSION**

Due to low winter temperatures, the vine ends up with winter buds loss, which is variable depending on the temperatures level and duration. The longer the low temperatures last, the higher the damage level becomes, being destroyed not only low resistance organs (winter buds), but also the ones with a better resistance (annual sprout, multiannual wood). The level at which the vine is affected depends on species, variety, applied technology and the level of hardening and nutrients reserve accumulation during the vegetation.

The climatic conditions, especially the air temperature, directly affect the buds viability. The harmful minimum temperatures for winter buds were registered in January and February (table 1 and 2). The first heat shock occurred in the last decade of January, when temperature dropped to  $-21,7^{\circ}\text{C}$ , followed by a decline even more pronounced till  $-28,4^{\circ}\text{C}$ , period that caused significant buds loss, especially since in this period were recorded extremely low temperatures successively. It is noted that in Cotnari vineyard in the recorded critical interval, the thermic balance of values below resistance limit was  $-389,3^{\circ}\text{C}$ , for a total of over 14 days. The minimum temperature in January in Iasi vineyard was  $-17,9^{\circ}\text{C}$ , registered in last decade. On the other hand the frost effects were also felt in February, in first and second decade, when temperatures reached to  $-26,6^{\circ}\text{C}$ . For Iasi vineyard the heat balance of values below the vine resistance limit was  $-339,3^{\circ}\text{C}$ , cumulated over a period of 16 days.

Table 1

The absolute minimum temperatures recorded in air,  
for 2011/2012 winter, in Cotnari vineyard

Luna	Decade	The sum and no. of days with temperatures of :			Absolute minimum value/date
		-15... -20 <sup>o</sup> C	-20...-25 <sup>o</sup> C	-25... -30 <sup>o</sup> C	
January	I	-	-	-	-6,2/08.01.12
	II	-	-	-	-10,2/18.01.12
	III	-70,7/4	-21,7/1	-	-21,7/29.01.12
February	I	-15,4/1	-48,3/2	-128,5/3	-28,4/02.02.12
	II	-53,0/3	-24,4/1	-27,3/1	-27,3/13.02.12
	III	-	-	-	-10,3/21.02.10

Table 2

The absolute minimum temperatures recorded in air,  
for 2011/2012 winter, in Iași vineyard

Luna	Decade	The sum and no. of days with temperatures of :			Absolute minimum value/date
		-15... -20 <sup>o</sup> C	-20...-25 <sup>o</sup> C	-25... -30 <sup>o</sup> C	
January	I	-	-	-	-5,9/01.01.12
	II	-	-	-	-11,2/19.01.12
	III	-68,2/4	-	-	-17,9/29.01.12
February	I	-34,2/2	-113,5/5	-	-24,6/02.02.12
	II	-50,8/3	-20,4/1	-52,2/2	-26,6/12.02.12
	III	-	-	-	-10,3/21.02.10

As a consequence, buds losses were significant. For this there have been made buds viability tests, deciding upon the percentage viable (primary and secondary) winter buds according to winter buds position on the sprig (1-3; 1-6; 1-12) and the winter buds losses to, depending on variety (table 3). Following analysis, to the most varieties, there was a higher viability to the chords top.

Table 3

The buds viability situation to studied varieties, in 2011/2012 winter

Variety	Vineyard	% of viable winter buds-chord position								
		1-3			1-6			1-12		
		Pr	Sec	% potent fert.	Pr	Sec	% potent fert.	Pr	Sec	% potent fert.
Fetească albă	Cotnari	14	32	32	14	37	37	12	49	49
	Iași	25	85	85	19	80	80	16	71	71
Fetească regală	Iași	7	29	29	7	41	41	15	44	46
Riesling italian	Iași	42	57	57	30	57	57	27	63	63
Băbească gri	Iași	11	18	19	6	22	22	10	62	32
Frâncușă	Iași	55	60	60	42	55	55	45	62	62
	Cotnari	42	57	57	30	57	57	27	63	63
Grasă de Cotnari	Iași	22	42	42	19	48	48	19	55	55
	Cotnari	14	32	32	14	37	37	12	49	49
Tămâioasă românească	Iași	11	18	19	6	22	22	10	62	32
	Cotnari	7	17	17	3	25	25	3	34	34

In the analysis of the buds viability situation it was found that the lowest frost resistance was recorded at Feteasca regala variety, cultivated in Iasi vineyard, where the percentage of principal viable buds was of 7-15%, but also the Tămâioasă românească variety which was most affected (fig. 1), the principal buds were affected over 80% in both vineyards. A low viability was recorded also to Babească gri variety, cultivated in Iasi vineyard, the dead bourgeons are above 75%. The best behavior to frost was recorded to Fetească albă variety, with short vegetation period, where the main buds were destroyed at a rate of 61-83%, the higher losses were recorded in Cotnari vineyard.

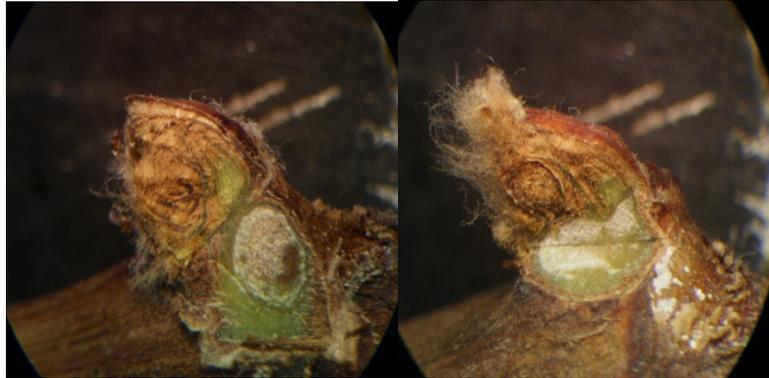


Fig. 1 - Various degrees of damage to the winter bud complex

## CONCLUSIONS

1. The absolute minimum temperatures recorded in 2011/2012 winter affected the vines by their cumulative effect leading to important buds losses.
2. North – eastern Romania, in last years, has seen an increase in extreme wheater phenomena, dry summers and severe winters, threatening unprotected vine culture.
3. Among studied varieties the most resistant is the Fetească albă variety, and the Tămâioasă românească variety has the lowest frost resistance, suffering major buds losses in both vineyards Iasi and Cotnari.

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**INFLUENCE OF SOME VITICULTURAL PRACTICES ON  
THE POLYPHENOLIC CONTENT  
OF GRAPES AND WINES PRODUCED FROM  
CV. AGIORGITIKO (*VITIS VINIFERA* L.)**

**INFLUENȚA UNOR PRACTICI VITICOLE ASUPRA CONȚINUTULUI  
DE POLIFENOLI AI STRUGURILOR ȘI VINURILOR DIN SOIUL  
AGIORGITIKO (*VITIS VINIFERA* L.)**

**PAVLIDIS M.<sup>1</sup>, KYRALEOU Maria<sup>1</sup>, KALLITHRAKA Stamatina<sup>1</sup>,  
PROXENIA N.<sup>1</sup>, KOUNDOURAS S.<sup>2</sup>, KOTSERIDIS G.<sup>1</sup>**

e-mail: stamatina@aua.gr

***Abstract:** The aim of this work was to investigate the influences of some commonly applied viticultural practices on the polyphenolic content of cv. Agiorgitiko, an indigenous Greek grape variety. Two viticultural practices (leaf removal, irrigation as well as combination of both) were applied on cv. Agiorgitiko in the Nemea wine region and the phenolic content of the grapes and wines produced was compared. The results showed that when irrigation was combined with leaf removal a significant increase in the anthocyanin extractability was observed. Leaf removal caused a significant increase of the grape anthocyanin and tannin content. As far as the wines were concerned, color intensity, tannin content and antioxidant activity were increased due to leaf removal. The combination of irrigation and leaf removal resulted in wines with the highest individual anthocyanin concentration. The study showed that increasing bunch sun exposure of Agiorgitiko vines may be beneficial to the quality of the wine.*

**Key words:** cv. Agiorgitiko, polyphenols, tannin, leaf removal, irrigation

***Rezumat:** Scopul studiului actual este evaluarea influenței unor practici viticole uzuale asupra conținutului de polifenoli din strugurii și vinurile obținute din cv. Agiorgitiko, un soi tradițional greces, în regiunea viticolă Nemea. Rezultatele obținute au demonstrat că, atunci când, irigarea a fost combinată cu desfrunzirea, s-a remarcat o creștere semnificativă a extractibilității antocianilor. Desfrunzirea a dus la o creștere semnificativă a conținutului de antociani și tanini din struguri. La vinuri, desfrunzitul a rezultat într-o creștere a intensității culorii, conținutului de tanin și a activității antioxidante. Complexul de măsuri irigare și desfrunzit a condus la obținerea de vinuri cu cea mai mare concentrație de antociani. Studiul a demonstrat că expunerea la soare a ciorchinilor de struguri din soiul Agiorgitiko influențează în mod pozitiv calitatea vinului obținut.*

**Cuvinte cheie:** cv. Agiorgitiko, polifenoli, tanin, desfrunzire, irigare

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<sup>1</sup> Department of Food Science & Technology, Agricultural University of Athens, Greece

<sup>2</sup> Laboratory of Viticulture, School of Agriculture, Aristotle University of Thessaloniki, Greece

## INTRODUCTION

Several strategies for increasing the content of phenolic compounds in wine have been made during the process of wine making and grape growing. Most of the viticultural practices applied in the vineyards are targeting on the increase of light penetration and air circulation into the canopy due to the benefits that they present: reducing humidity (Haselgrove et al., 2000), reducing the risk of fungal and bacterial infection (Emmett et al., 1992), increasing berry temperature and possibly increasing vine development and wine quality (Bordelon et al., 2008).

In cool climates, increased light penetration is related to enhanced anthocyanin and phenolic production (Ristic et al., 2007). However, it is under consideration whether this practice can be beneficial to wine quality in warm to hot and sunny climates, since extended bunch exposure could sharply increase bunch temperature and thus reduce the anthocyanin content of grapes (Lorrain et al., 2011).

Irrigation management seems to be another important factor in determining grape and wine quality, especially in arid and semi-arid areas, with the primary focus on grape phenolic compounds. However, limited data exist regarding the effect of vine water status on grape-derived metabolites. Moreover, water effects on berry components are often contrasting, mainly because of different irrigation volumes and environmental conditions, leading to variations in water availability.

The wine region of Nemea has a Mediterranean type climate, characterized by high temperatures and water deficiency during the summer season. There is a lack of information concerning the relationship between irrigation and leaf removal and wine quality due to the uniqueness of this grape variety.

In this study, the above practices were applied in the vineyard and the quality of the produced wines was determined based on two quality parameters of red wines; anthocyanin content and tannin composition.

## MATERIAL AND METHOD

**Grapes** of cv. Agiorgitiko were sampled in triplicate at maturity in September 2010 from Nemea region. Four different conditions were applied:

- Control (C10),
- Irrigation (I10),
- Leaf Removal (LR10),
- Combination of Irrigation & Leaf removal (I/LR10).

Wines were produced using the classical red vinification technique, in triplicates.

Berries were homogenized and Ribereau Gayon & Stonestreet, (1966) and Iland, (2004) methods were applied for the quantification of total anthocyanins, tannins and anthocyanin extractability.

Seeds and skins were extracted using acetone-water (80:20, v/v) followed by methanol-water (60:40, v/v) and the residue was diluted in model wine for the quantification of total phenols (Follin-Ciocalteau), antioxidant activity (DPPH) and tannin content.

In wines color intensity, total tannins, total anthocyanins and antioxidant activity (DPPH) were determined.

**Determination of individual anthocyanins by High-Performance Liquid Chromatography (HPLC):**

A lot of 100 berries from each plot was weighted and manually skinned, and the skins were weighed and freeze-dried.

The freeze-dried tissues were then extracted with 100 mL of 1% HCl in Methanol.

Extraction was carried out under stirring for 48 h and repeated 3 times in triplicate.

Anthocyanin analysis was carried out according to Arnous et al. (2002).

## RESULTS AND DISCUSSION

Total anthocyanins, total phenolics and anthocyanin extractability of berries are given in table 1.

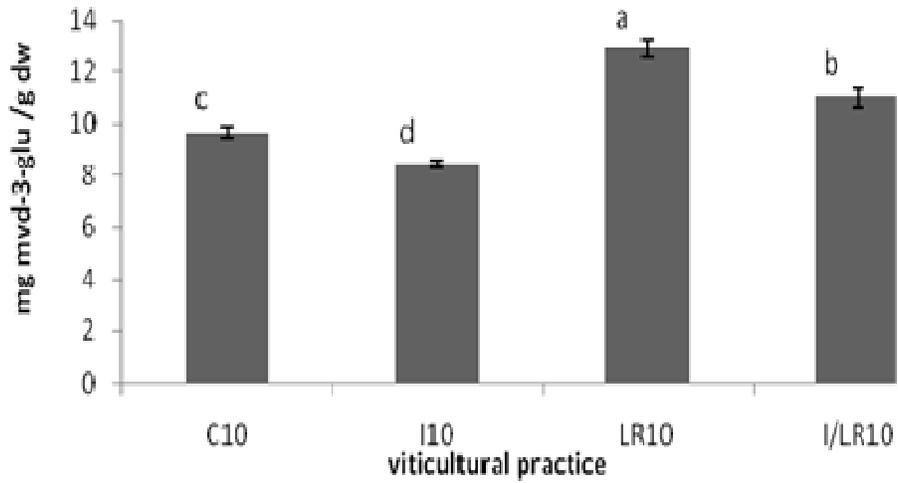
*Table 1*

**Total phenolic content, anthocyanin concentration and extractability in homogenized berries**

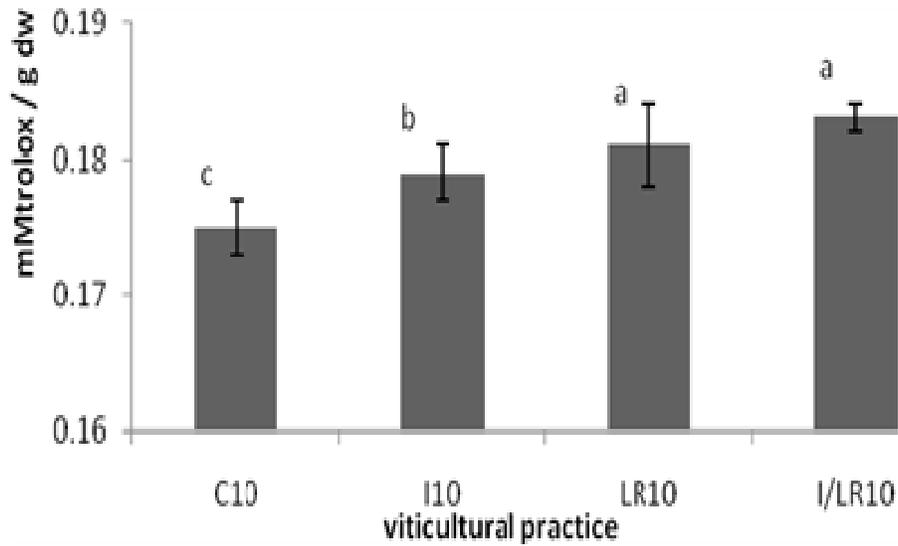
Specification	C10	I10	LR10	I/LR10
Anthocyanins (mg/bery)	1,553± 0,02 <sup>b</sup>	1,472± 0,04 <sup>b</sup>	1,714± 0,05 <sup>a</sup>	1,558±0,04 <sup>b</sup>
Total phenols (au/bery)	2,27± 0,05 <sup>b</sup>	2,32± 0,06 <sup>b</sup>	2,60± 0,078 <sup>a</sup>	2,43±0,05 <sup>a,b</sup>
Anthocyanin extractability (AE%)	27,012±0,89 <sup>b,c</sup>	35,966±1,37 <sup>a</sup>	30,969±1,03 <sup>b</sup>	24,84±0,76 <sup>c</sup>

When irrigation was combined with leaf removal, grapes exhibited a higher “cellular maturity” expressed as anthocyanin extractability (AE%). On the contrary, when only leaf removal was applied, total anthocyanin concentration (table 1) and malvidin-3-O-glucoside content of skin extracts (0,1%HCl/Methanol) were increased (figure 1).

No significant effect of these practices was observed regarding antioxidant activity and phenolic composition of skin extracts (results not appear). The concentration of total phenols (results not appear) in seed extracts was higher when irrigation was applied while when irrigation was combined with leaf removal resulted in higher antioxidant activity (figure 2).



**Fig. 1** - Concentration of malvidin-3-glucoside (mg/g dry weight) in skin extracts



**Fig. 2** - Antioxidant activity of seed extracts (mM trolox/ g dry weight)

Regarding wines, the applied practices did not affect significantly total anthocyanin content. However, leaf removal resulted in wines with higher color intensity. Since these wines also contained higher concentrations of tannins, this observation might be attributed to the tannin-anthocyanin complexes which are known to increase color intensity and stability. In

addition, leaf removal increased wine antioxidant activity possibly due to the elevated tannin content.

Table 2

Phenolic composition and antioxidant activity of wines

Specification	C10	I10	LR10	I/LR10
<b>Total anthocyanins (mg/L)</b>	306,92±11,34 <sup>a</sup>	301,70±4,84 <sup>a</sup>	337,32±11,67 <sup>a</sup>	336,96±4,93 <sup>a</sup>
<b>Color intensity</b>	4,71± 0,08 <sup>c</sup>	4,74± 0,02 <sup>c</sup>	7,73± 0,34 <sup>a</sup>	5,83± 0,12 <sup>b</sup>
<b>Malv-3-glu (mg/L)</b>	68,08± 2,77 <sup>b</sup>	79,34±0,58 <sup>a,b</sup>	77,94±4,58 <sup>a,b</sup>	83,69±1,03 <sup>a</sup>
<b>Total tannins (g/L)</b>	1,432± 0,03 <sup>c</sup>	1,414±0,03 <sup>c</sup>	2,027± 0,06 <sup>a</sup>	1,862±0,09 <sup>b</sup>
<b>Antioxidant activity (mMtrollox)</b>	5,97± 0,21 <sup>c</sup>	5,785± 0,1 <sup>c</sup>	8,012± 0,09 <sup>a</sup>	7,213± 0,02 <sup>b</sup>

## CONCLUSIONS

This work demonstrates that the leaf removal of vines cv. Agiorgitiko resulted in higher color intensity, antioxidant activity and total tannin concentration in the produced wines. In addition, when irrigation was combined with leaf removal anthocyanin extractability increased significantly.

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# PHOTOSYNTHESIS AND RESPIRATION INTENSITY VARIATION OF FETEASCA NEAGRA VARIETY UNDER THE INFLUENCE OF APPLYING A SET OF AGROPHYTOTECNICAL MEASURES

## VARIAȚIA INTENSITĂȚII FOTOSINTEZEI ȘI A RESPIRAȚIEI LA SOIUL FETEASCĂ NEAGRĂ, SUB INFLUENȚA APLICĂRII UNUI COMPLEX DE MĂSURI AGROFITOTEHNICE

*PETREA T.M.<sup>1</sup>, ROTARU Liliana<sup>1</sup>, CĂULEȚ Raluca<sup>1</sup>*  
e-mail: t\_m\_petrea@yahoo.com

**Abstract.** *The introduction of a new variety in a vineyard requires detailed studies regarding its physiological behavior to vineyard conditions. Through photosynthesis, carbon dioxide from the atmosphere is fixed by green plants (with chlorophyll) in the presence of sunlight, with the elimination of oxygen and formation of organic compounds (carbohydrates, lipids, proteins) which are very varied, hence the importance of tracking the parameters registered by it. Measurements were made on respiration and photosynthesis intensity for each variant of experience mounted in the field. The interpretation of the values found, indicates the best solution recommended to the application of agrophytotechnical measures.*

**Key words:** intensity, respiration, photosynthesis

**Rezumat.** *Introducerea unui soi nou într-o podgorie, necesită studii amănuntite în ceea ce privește comportarea acestuia din punct de vedere fiziologic la condițiile podgoriei. Prin fotosinteză, se fixează dioxidul de carbon din atmosferă de către plantele verzi (cu clorofilă), în prezența radiațiilor solare, cu eliminare de oxigen și formare de compuși organici (glucide, lipide, proteine) foarte variați, de unde și importanța urmării parametrilor înregistrați de aceasta. S-au efectuat măsurători ale intensității respirației și a fotosintezei pentru fiecare variantă din experiența montată în câmp. Interpretarea valorilor găsite, indică varianta optimă care se recomandă la aplicarea măsurilor agrophytotehnice.*

**Cuvinte cheie:** intensitate, respirație, fotosinteză

### INTRODUCTION

It is known that the final productivity of plants is largely determined by the overall activity of all processes, including a role which belongs to photosynthesis and growth (Seiculescu, 1996).

Growth and photosynthesis determine processes of adaptation to the conditions of the external environment during their various stages. With the end of intensive growth of shoots and the crossing of plants in profound sleep, some organic compounds produced as a result of the photosynthetic apparatus activity is deposited in tissues of the outgrowth string, the process becoming

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

even more pronounced after the end of the growth and of the harvest of the grapes during the intensive preparation and training of the plants to tolerate winter cold (Dobrei et al., 2005).

The vineyards main products of photosynthesis are sugars (sucrose, glucose, fructose and raffinose). In smaller quantities of organic acids are formed (oxalic acid, tartaric acid, citric acid, malic acid, succinic acid) and amino acids (cystine, histidine, alanine, asparagic acid, proline, methionine, valine, lysine etc.), (Milică et al., 1982).

The quality of the grapes at harvest is influenced by the number of days with heatstroke, the foliage surface, and thus the intensity of respiration and photosynthesis (Iolteanu et al., 2004).

This paper aims to clarify the relationship between the differential application of the works and operations in green and the intensity of the respiration and photosynthesis.

### MATERIAL AND METHOD

The research was conducted on the farm No.4 belonging to SC Cotnari SA, on a plantation of Feteasca neagra grafted on the SO4 rootstock.

The installation of the experiment in the field took place between 24 rows in 8 versions including a witness version, arranged in three repetitions (fig. 1). Each variant comprises a number of 25 stocks that are set depending on the type of cutting and loading the outgrowth, watching both versions in parallel at the drill cutting, variants denoted by "a" and the "Guyot" cutting, noted in this case with "b".

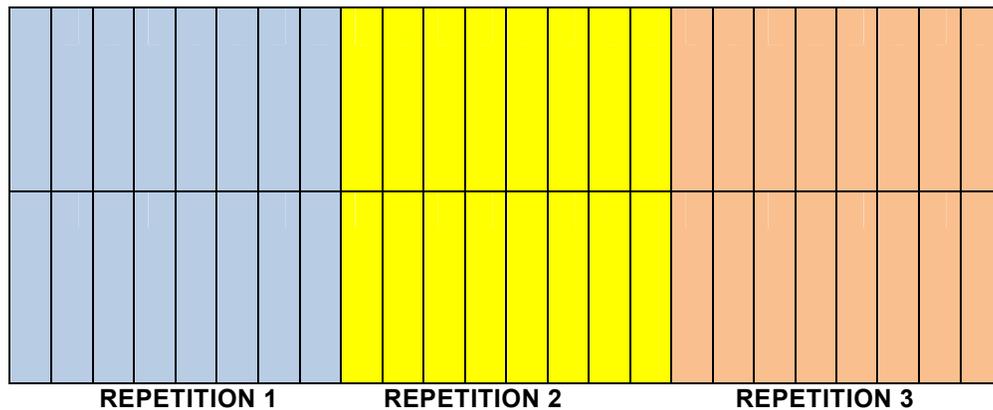


Fig.1 - The placement of the experiment in the field

Variants denoted by V0 are witness variants that in addition to outgrowing cuts fruition on these occasions had never been interfered with any operation on the entire growing season.

At variants denoted by V 1 has been occurred only with weeding of the shoots in a 30%, the variants V 2 and V 3 intervening with shoots pinched works, that leafless.

At variants V 4, V 5 and V 6 were have been combined works such as: weeding and pinching, weeding and defoliation, that pinched and defoliation.

At the latter, V 7 there was, they applied all the work, namely besides outgrowing cuts were made following works and operations: weeding, pinching and leafless.

The method used to determine the intensity of photosynthesis and respiration is non destructive (the leaves are not detached from the plant).

For this we used a foliar gas analyzer CIRAS-2 which allowed the simultaneous determination of multiple physiological and environmental indicators:

- the rate of photosynthesis expressed in  $\mu\text{molm}^{-2}\text{s}^{-1}$ ;
- stomatits conductance and transpiration rate expressed in  $\text{mmolm}^{-2}\text{s}^{-1}$ ;
- the concentration of substomatal ppm  $\text{CO}_2$ ;
- water vapor pressure deficit in millibars;
- photosynthetic active radiation;
- expressed also in  $\mu\text{molm}^{-2}\text{s}^{-1}$ ;
- ambient temperature and leaf temperature in  $^{\circ}\text{C}$ ;
- evapotranspiration in  $\text{mmolm}^{-2}\text{s}^{-1}$ , etc.

## RESULTS AND DISCUSSION

At the basis of the elaboration of the synthesis products from vineyard, there is photosynthesis, the largest share of reserve substances being owned by sugars (in the grape dominates the glucose and fructose, and in the string the starch).

Under normal conditions, the metabolic processes of vines take place in favor for the accumulation of vegetable matter, which represents synthesized biomass, of which only a certain part of the product is a useful viticultural production (the grapes or the vines for propagation).

The results were complex, depending on the operation in vegetation applied to the Feteasca neagra variety.

From the analysis of tabel 1 is shown that the highest values of photosynthesis rates were recorded in variants 1 or 2, where it has been occurred with only 30% of shoots weeding and picking sprouts.

Therefore, the leaf area not being allowed to be reduced allowed the plant to achieve a much higher value of photosynthesis rate than in versions 5 or 7. The ones being applied with the whole complex of works applied in green (variant 7), also had the lowest rate of photosynthesis recorded.

Regarding to the transpiration rate, the lowest values were recorded also in version 7, where due to repeated interventions over the foliar apparatus resulted the greatest reduction on the surface.

From there it can be concluded that there is a positive correlation between leaf area and the high rates of photosynthesis, recorded and the low transpiration rates.

Table 1

The main physiological parameters registered for Feteasca neagra variety, after the application works and operations in green

	PAR	A/E	ci	E	gs	A
V0	9.21	0.47	3.39	0.17	0.02	0.08
V1	8.549585	0.467682	3.132655	0.158186	0.021328856	0.073981
V2	8.766344	0.468592	3.203571	0.161797	0.021887852	0.075817
V3	8.144009	0.467461	2.963697	0.149816	0.020346418	0.070033
V4	8.347145	0.467974	3.028194	0.15313	0.020870985	0.071661
V5	7.880643	0.467588	2.870396	0.145442	0.019683507	0.068007
V6	8.216021	0.469771	3.010483	0.151927	0.020509146	0.071371
V7	7.912541	0.470323	2.894324	0.146077	0.019762182	0.068701

Legend:

PAR = photosynthetic active radiation

A / E = rate of photosynthesis ( $\mu\text{mol m}^{-2} \text{s}^{-1}$ ) / transpiration rate ( $\text{mmol m}^{-2} \text{s}^{-1}$ )

ci = substomatal CO<sub>2</sub> (vol / mass)

E = transpiration rate ( $\text{mmol m}^{-2} \text{s}^{-1}$ )

gs = stomatits conductivity of water ( $\text{mol}^{-2} \text{s}^{-1}$ )

A = photosynthesis rate ( $\mu\text{mol m}^{-2} \text{s}^{-1}$ )

Regarding the photosynthesis rate, as it is shown in Figure 2, the large leaf surface favors the photosynthesis rate, which implicitly leads to increased accumulation of organic matter in the plant. These accumulations can be in the form of carbohydrates, which have importance for the quality of the grapes, by increasing the sugar content, or starch content in string, which improves the resistance of the varieties to freezing in winter.

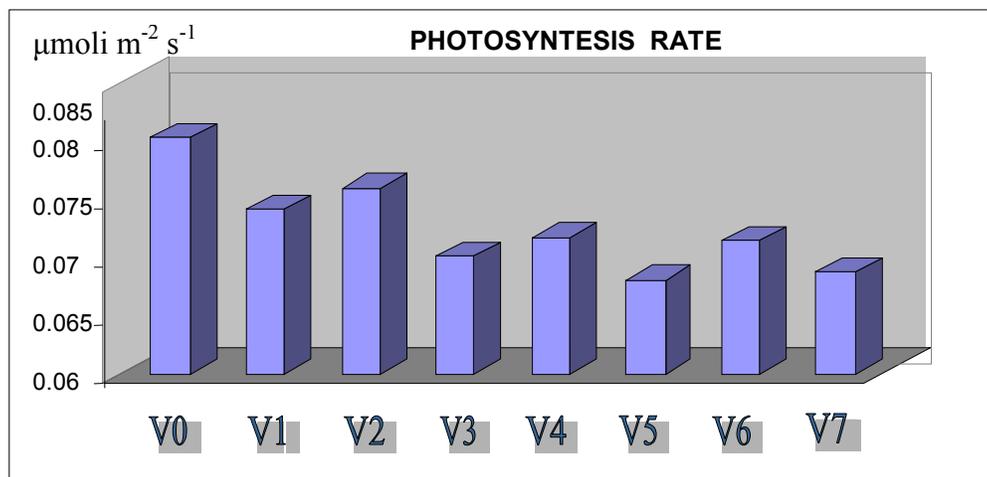
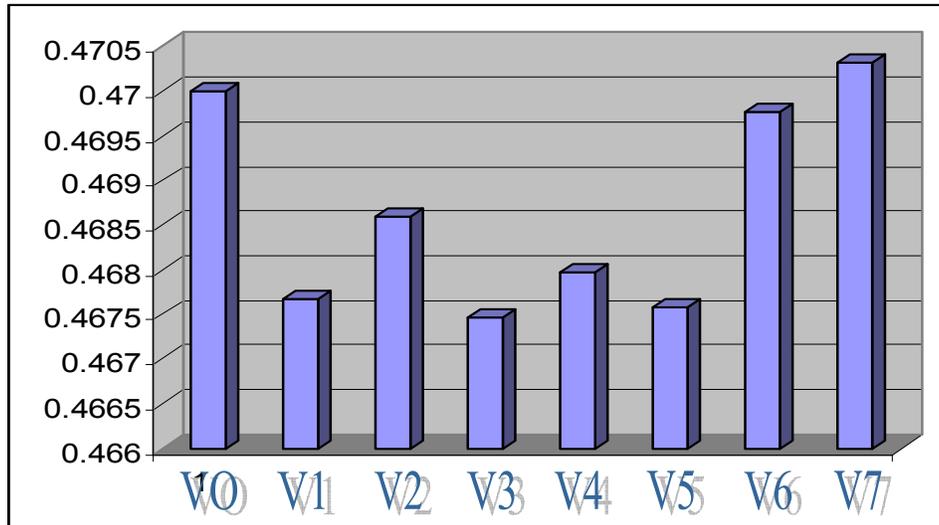


Fig. 2 - The rate of photosynthesis

The interpretation of results must take into account the relationship between photosynthetic rate and transpiration rate, shown in Figure 3, because here you can see the maximum efficiency of the works in vegetation period and the operations carried out.



**Fig. 3** - Photosynthesis rate (micromol m<sup>-2</sup> s<sup>-1</sup>) / transpiration rate (mmol m<sup>-2</sup> s<sup>-1</sup>)

Here you can see, that although on the variant V7 were applied works of weeding, pinching and defoliation, in the consequence, the foliar surface was drastically reduced, the ratio between photosynthesis and the transpiration rate is in favor of the firstone. This probably explains the fact that with the decreasing of the leaf device, there is a strongly reduced transpiration rate, which is favorable to the accumulation of nutrients.

## CONCLUSIONS

1. There are being revealed correlations between the existing leaf area on the block and the intensity of the photosynthesis and of the respiration after the application of the works and operations in the vegetation period.

2. The highest photosynthesis rate was recorded for the V2 variant, the vegetation operations were confined only to pinching.

3. The lowest transpiration rate was recorded for the V7 variant, which had the smallest leaf surfaces, due to the application of weeding, picking and defoliation.

4. The best choices proved to be V6 and V7, as they have the highest values of the ratio of photosynthesis and transpiration rates.

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# METHODOLOGY FOR DELIMITING THE VITICULTURAL TERROIR UNITS BY THE ECOPEDOLOGICAL FACTORS IN VALEA CALUGAREASCA VITICULTURAL CENTER

## METODOLOGIA DE DELIMITARE A UNITATILOR TERROIR VITICOL IN FUNCȚIE DE FACTORII ECOPEDOLOGICI DIN CENTRUL VITICOL VALEA CALUGAREASCA

*PÎRCĂLABU Liliana*<sup>1</sup>, *TUDORACHE Aurelia*<sup>1</sup>, *ȘERDINESCU A.*<sup>1</sup>, *ION M.*<sup>1</sup>  
e-mail: lilianapircalabu@yahoo.com

**Abstract.** *The viticultural terroir represents the unit for managing the national viticultural patrimony. The spatial entity with which the methodology operates is the viticultural plot identified by a numerical code "UT" (territorial unit). The stapes of the methodology were the following ones: extraction of the thematic maps for soil and the subsequent storage of this information in a file of Shapefiles type and an attribute table; extraction of the information specific for the physical environment (geology, soil) from the attribute table, the attribute being a parameter for the soil characterization. Coded information was quantified in a system of points by assigning a number for the class and the attribute, each datum corresponding to a score given by the product of them. The table of the attribute points was subject to analysis in the main components, which aims at diminishing the dimensionality of the data and at grouping the close values into classes. Considering the classes established by analyzing the main components, the viticultural terroir units were identified and the map of their delimitation was accomplished for the Valea Calugareasca viticultural center.*

**Key words:** mapping, attribute, principal component analysis

**Rezumat.** *Terroir-ul viticol reprezintă unitatea de gestionare a patrimoniului viticol național. Entitatea spațială cu care operează metodologia de delimitare este parcela viticolă, identificată printr-un cod numeric „UT” (unitate teritorială). Etapele metodologiei au fost: extragerea hărților tematice privind pedologia parcelei viticole și stocarea lor într-un fișier Shapefiles și un tabel atribut; extragerea informațiilor specifice mediului fizic (geologie, sol) din tabelul atribut, atributul fiind un parametru de caracterizare a solului. Informația codificată a fost cuantificată într-un sistem de puncte atribuindu-se un număr clasei și un număr atributului, fiecărei date revenindu-i un punctaj dat de produsul dintre acestea. Tabelul de puncte de atribut a fost supus analizei în compoziți principali, cu scopul de a reduce dimensionalitatea datelor și de a grupa valorile apropiate în clase. Pe baza claselor stabilite prin analiza în compoziți principali au fost identificate unitățile de terroir viticol realizându-se harta delimitării lor în centrul viticol Valea Călugărească.*

**Cuvinte cheie:** cartografiere, atribut, analiza în compoziți principali

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<sup>1</sup> Research Institute for Viticulture and Enology, Valea Călugărească, Romania

## INTRODUCTION

Although the concept of „terroir” is relatively recent, within the last three decades he has been the attention to vine growers and wine producers, especially to those of Europe which use the oenological potential of distinguish viticultural areas well definite in terms of climate and soil conditions, have been intended to obtain grapes and wines with recognized and inimitable organoleptic quality (Vandour, 2003; Asselin and Morlat, 1993).

In this respect has appeared as a necessity the development of an unitary and interrogative technology, for the identification, characterisation and delimitation of the viticultural terroir units from a distinct geographic area (Morlat, 1989, 1996; Lebon, 1993; Laville and Mesnier, 1991).

Considering the different opinions concerning these aspects the present paper aims to present an original methodology for the delimitation of terroir units based on the use of geographical information systems (GIS) and the processing of technical data by the „analysis in the main components” (ACP).

## MATERIAL AND METHOD

Researches have been realized in Valea Călugărească viticultural center, representative for Dealu Mare vineyard. The spatial entity with which to operate is the viticultural plot which is identified by a numerical code "UT" (territorial unit). Elaboration of the methodology for determining the viticultural terroir units supposed more stages: extraction of the spatial information out of the informatic system of vineyard cadastre, extraction of the information specific for the physical environment (geology, soil, relief and climate). All the pieces of information extracted were recorded in an attribute table, the attribute being a parameter for the soil characterization. The following attributes were used: class of soil, soil texture, total porosity, active humidity index, content of humus, soil pH, the total nitrogen content, phosphorus, potassium, total and active calcium carbonate. The data in the table represent attribute values; they will be transformed into table of classes, identified by the color code or class code. Coded information was quantified in a system of points, by assigning a number and the attribute is also assigned a number. Each datum has returned to a score given by the class number multiplied by the attribute number. The table of the attribute points was subject to analysis in the main components (ACP). On the basis of the classes established by analyzing the main components the viticultural terroir units was identified and the map of their delimitation may be accomplished.

## RESULTS AND DISCUSSION

Following the analysis of cadastral layer was found that viticultural patrimony of Valea Călugărească viticultural center is constituted of 2904 vine plots, regarded as territorial units (UT) and defined by a code number.

The attribute of the soil on vine plots have been extracted from the “Determination condition and ecopedological parameters of grapevine in the Dealu Mare vineyard” realized by ICPA Bucharest.

It was made the attribute table and the vineyard area mapping obtaining 13 soil maps for all specific attributes to be taken into account in elaboration of the methodology for delimitation the viticultural terroir units (fig. 1).

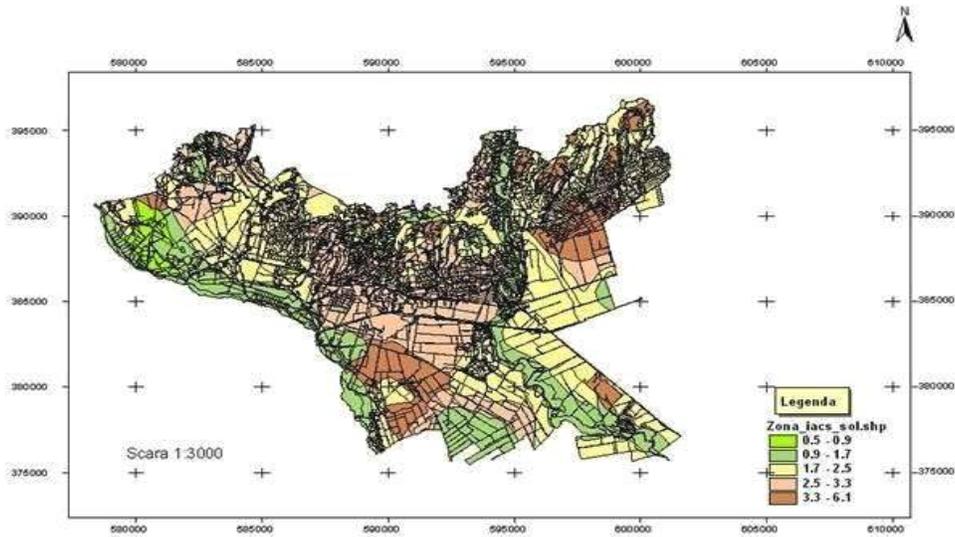


Fig. 1- The map of humus content of soils in Valea Călugărească viticultural center

For each plot from a map database it was extract the class code realizing the table with attributes coded (table 1).

Table 1

The pedological attribute of the viticultural terroir units

UT Cod	Pedological attribute (points)								
	Class	Texture	Humus	pH	Total nitro gen	Phosp horus mobil	Potas sium mobil	Total CaCO <sub>3</sub>	Active CaCO <sub>3</sub>
8321	2	17	4	3	4	3	4	2	2
8322	2	17	4	3	4	3	4	2	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8330	2	17	4	3	4	3	4	2	2
8331	2	5	4	4	2	4	4	2	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11205	6	4	2	5	1	2	1	5	5
11206	9	19	2	5	1	2	1	4	3
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11223	2	4	3	2	2	3	4	3	2

The information coded was quantified in a points system using the formula:

$$Pct = k * i^{[3.1]}$$

where:

k = the number which indicates the attribute

i = the code attribute

So has been obtained the table with pedological attribute expressed in terms of points (table 2).

Table 2

UT cod	Pedological attribute (points)								
	Class	Texture	Humus	pH	Total nitrogen	Phosphorus mobil	Potassium mobil	Total CaCO <sub>3</sub>	Active CaCO <sub>3</sub>
8321	2	34	20	18	28	24	36	20	22
8322	2	34	20	18	28	24	36	20	22
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8330	2	34	20	18	28	24	36	20	22
8331	2	10	20	24	14	32	36	20	22
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11205	6	8	10	30	7	16	9	50	55
11206	9	38	10	30	7	16	9	40	33
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11223	2	8	15	12	14	24	36	30	22

The data in the table have been processed through analysis in the main components following which resulted in a score of main components for each viticultural terroir units (table 3).

Table 3

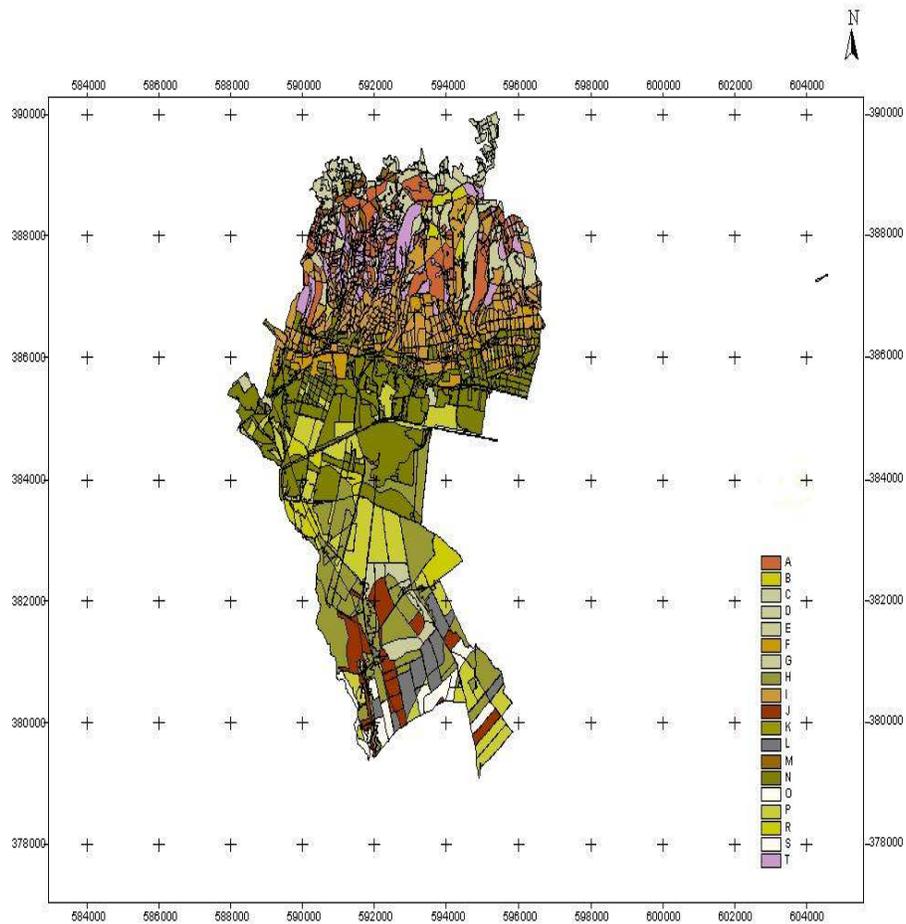
The score obtained in the main components									
UT Cod	Pca 1	PCA 2	PCA 5	PCA 6	PCA 7	PCA 8	PCA 9	PCA 10	PCA 11
1	-13.69	8.78	11.99	-4.50	-0.98	0.63	0.19	2.29	0.37
2	-13.69	8.78	11.99	-4.50	-0.98	0.63	0.19	2.29	0.37
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2885	32.73	-25.51	-2.69	8.50	-11.80	6.68	-5.43	-0.03	-0.83
2886	17.77	-5.94	10.82	-2.12	-0.28	-4.40	-1.17	-1.16	-1.07
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2900	1.31	7.51	8.32	-0.92	-5.60	3.52	-1.13	-7.00	2.08
2901	-13.69	8.78	11.99	-4.50	-0.98	0.63	0.19	2.29	0.37
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2904	-13.89	-11.78	2.88	-0.33	3.83	2.04	-0.54	-1.77	-0.64

The principal components are represented as a linear combination between of the variables (attributes) that are characterized by a value and the variance (%). The number of the components depends on the amount retained variance to be greater than 70%.

The first principal component extracted is a linear combination of extracted variables that take the maximum possible variance of initial data, respectively 48.66%. The second principal component takes up less variance, respectively 22.01%, and so on. The first two principal components took 70.67% of the variance of initial data, and then the purpose of reducing the dimensionality to two components has been achieved.

The first component achieved positive correlations with total and active  $\text{CaCO}_3$  (0.946) and negative with active index humidity (0.279) and total nitrogen content (0.010). The second component is positive relationships with soil texture (0.852), total nitrogen (0.523), mobile potassium (0.512), total and active  $\text{CaCO}_3$  (0.070), respectively (0.113) and negative with the soil class (-0.517), total porosity (-0.256), active index humidity (-0.228), pH (-0.476) and mobile phosphorus (-0.488).

The score obtained for each relationship was used to differentiate the 18 classes corresponding viticultural terroir units, which were assigned an alphabetical code (from A to T) and different colors. Once identified and established the viticultural terroir units could be achieved the cadastral map of these units (fig. 2).



**Fig. 2** – The map of viticultural terroir units in Valea Călugărească village

## CONCLUSIONS

1. The identification of the viticultural terroir units was established on the basis of the score and the classes obtained by analyses in main components;
2. The analysis in the principal components had purpose reducing the dimensionality of data by grouping similar characteristics in the elementary units and placed the 2904 viticultural territorial units in 18 classes corresponding to the viticultural terroir units
3. The methodology of delimitation viticultural terroir units has a general character and can be applied at any level of zoning viticultural region, viticultural centre, vineyard, wine growing region.

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# INFLUENCE OF THE ABSOLUTE MINIMUM TEMPERATURES RECORDED IN THE PERIOD OF JANUARY-FEBRUARY 2012 ON THE VINE PLANTATIONS IN THE COPOU-IASI VINEYARD CENTER

## INFLUENȚA TEMPERATURILOR MINIME ABSOLUTE ÎNREGISTRATE ÎN PERIOADA IANUARIE - FEBRUARIE 2012 ASUPRA PLANTAȚIILOR DE VIȚĂ DE VIE DIN CENTRUL VITICOL COPOU-IAȘI

*ZALDEA Gabi<sup>1</sup>, DAMIAN Doina<sup>1</sup>, PETREA Gabriela<sup>1</sup>, SAVIN C.<sup>1</sup>, NECHITA Ancuța<sup>1</sup>*  
e-mail: gabizaldea@yahoo.com

**Abstract.** *The analysis of the absolute minimum temperatures below freezing resistance limit of the vine for a period of 50 years (1961 - 2010), shows that their frequency is of 28 % and that they have a periodicity of 3.6 years (Zaldea Gabi et al.2010). These temperatures have led to recording large losses of the main buds, annual and multiannual wood damage and, thus, lower grape production. During the period of January - February 2012 have been recorded absolute minimum temperatures of -26,7 °C in the air and -33,0 °C at the soil surface. The influence of these temperatures on the vine plantations and the rehabilitation measures will be presented in this paper.*

**Key words:** absolute minimum temperatures, vine, winter buds

**Rezumat.** *Din analiza temperaturilor minime absolute situate sub limita de rezistență la îngheț a viței de vie, pe o perioadă de 50 de ani (1961-2010), s-a constatat faptul că frecvența acestora este de 28% și au o periodicitate de 3,6 ani (Zaldea Gabi și colab. 2010). Aceste temperaturi au condus la înregistrarea unor pierderi mari de muguri principali, afectarea lemnului anual și multianual și implicit la scăderea producției de struguri. În perioada ianuarie-februarie 2012 s-au înregistrat temperaturi minime absolute de până la -26,7°C în aer și de -33,0°C la suprafața solului. Influența acestor temperaturi asupra plantațiilor viticole și măsurile de refacere vor fi prezentate în lucrarea de față.*

**Cuvinte cheie:** temperaturi minime absolute, viță de vie, muguri de rod.

### INTRODUCTION

The cultivation of the vine trunks, in the conditions of the vineyards from the North-East of Moldova, is possible in a semiprotected system. Through this system the tendrils that grow out of the main stem are buried in the ground (Pițuc et al., 1992). When there are minimum temperatures that are under the freezing limit of the vine, that affect the main vine bud and the annual wood, will be used the tendrils that grow out of the main stems in order to compensate the fruit load and to refresh the trunks and the affected tendrils. Some years ago people used to

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<sup>1</sup> Research and Development Station for Viticulture and Vinifications Iasi, Romania

bury the tendrils but lately they noticed that the expenses for this kind of procedure were bigger than the eventual losses (Amăriucăi et al., 2003).

During 1961 – 2011 were registered very low temperatures and in the years: 1963, 1985, 1987, 1996, 2006, 2010 (Zaldea et al., 2010) there was between  $-25^{\circ}\text{C}$  and  $-27^{\circ}\text{C}$  in the air and between  $-30,4^{\circ}\text{C}$  and  $-35^{\circ}\text{C}$  at the surface of the ground.

The minimum absolute temperatures that are a climatic accident, registered in January-February 2012, lead to a high frequency of negative temperatures that will make serious damages in the vine plantations.

## MATERIAL AND METHOD

In order to develop the researches there were used the climatic data that was registered at the weather station and AgroExpert, an automatic registration system, of the Research Development Station for Viticulture and Vinification Iași (minimum absolute temperatures in the air and at the surface of the ground), as well as those from the Regional Weather Center Moldova Iași. In order to test the viability of the buds it was used the method of the longitudinal sectioning of the loop on the length of the tendril, starting from the base towards the top and by examining them with a binocular eyeglass.

## RESULTS AND DISCUSSIONS

From the analysis of the minimum absolute temperatures that were recorded in January 2012, in the vine center Copou Iași, was noticed the fact that, the minimum temperatures were of  $-17,8^{\circ}\text{C}$  in the air and  $-21,8^{\circ}\text{C}$  at the surface of the ground (29.01.2012), values that are at freezing limit of the vine buds for the table varieties. These very low temperatures were also registered in the first two days of February reaching to  $-24,7^{\circ}\text{C}$  in the air and  $-28,1^{\circ}\text{C}$  at the surface of the ground (02.02.2012). The second freezing wave was registered during 8-12 February, when the minimum absolute temperatures were very much under the freezing limit of the vine, being registered  $-21,6^{\circ}\text{C}$ ... $-26,7^{\circ}\text{C}$  in the air and between  $-27,0^{\circ}\text{C}$ ... $-33,0^{\circ}\text{C}$  at the surface of the ground (table 1). Keep in mind the fact that from the beginning of the first 12th days of February 2012, seven days had temperatures under the freezing limit of the vine ( $-18\pm 3^{\circ}\text{C}$  for the fruit buds and  $-21 \pm 3^{\circ}\text{C}$  for the annual wood) (Martin T. 1972).

*Table 1*

**The minimum absolute temperatures registered during 8-12 February 2012**

Date	The minimum absolute temperatures in air, °C	The minimum absolute temperatures at the ground, °C
8.02.2012	-23,4	-33,0
9.02.2012	-22,9	-27,6
10.02.2012	-21,6	-27,0
11.02.2012	-24,4	-28,0
12.02.2012	-26,7	-32,6

We mention the fact that the absolute minimum temperature in the last 51 years (1960–2011) was of  $-27,2^{\circ}\text{C}$ , in December 1996, and the minimum absolute temperature at the ground was of  $-35,0^{\circ}\text{C}$  in January 2010. These

temperatures caused serious damages in the vine plantations (Zaldea et al., 2010).

In these conditions at the Research Development Station for Viticulture and Vinification Iași were performed viability analysis of the buds through a longitudinal section of the bud and observing it with a binocular eyeglass; in this way being established the percentage of viable loops (main and secondary) according to the position of the loops on the tendril (1-3; 1-6; 1-12) and the loop losses according to variety and the position on the flank (table 2). Following the analysis, that was performed on most varieties, it was noticed a higher viability towards the top of the tendrils.

Table 2

Viability of winter buds in Copou - Iasi viticultural center

Variety	Location	% Eye viable - string position								
		1 - 3			1 - 6			1 - 12		
		P	S	P + S	P	S	P + S	P	S	P + S
Aligoté	tray	49	66	66	38	61	61	38	66	66
Aligoté	middle slope	17	61	61	14	54	54	14	63	63
Aligoté	basic slope	2	17	17	2	32	32	7	56	57
Aromat de Iași	tray	22	42	42	19	48	48	19	55	55
Chasselas doré	tray	1	12	12	1	29	29	15	74	74
Cabernet Sauvignon 4	middle slope	56	67	67	36	58	58	38	60	60
Chardonnay	tray	11	18	19	6	22	22	10	62	32
Feteasca regală	tray	47	75	75	33	71	71	27	69	69
Fetească regală	middle slope	14	32	32	14	37	37	12	49	49
Feteasca regală	basic slope	7	22	22	7	34	34	6	49	49
Fetească albă	tray	39	89	89	25	81	81	17	75	75
Fetească albă	middle slope	25	85	85	19	80	80	16	71	71
Fetească albă	basic slope	7	17	17	3	25	25	3	34	34
Gelu	tray	7	29	29	7	41	41	15	44	46
Golia	tray	83	100	100	83	100	100	83	100	100
Merlot	tray	26	52	52	23	59	59	22	59	59
Muscat Ottonel	tray	60	81	81	49	76	78	59	84	86
Muscat Ottonel	basic slope	42	57	57	30	57	57	27	63	63
Pinot gris	tray	14	32	32	13	44	44	29	67	67
Perla de Csaba	middle slope	4	9	9	4	14	14	5	30	30
Sauvignon blanc	tray	55	60	60	42	55	55	45	62	62

The biggest loss of main buds from 2012 was registered on the North, North-East lots and at the basis of the versants, being situated between 73-97%. Also, a great deal of losses were registered at the middle of the flanks, between 62-95%, and on these plateaus were a slightly few losses, between 41- 90%. The most affected varieties were Feteasca Albă, Feteasca Regală and Aligoté that are mostly in Copou's vine center. A better resistance at freezing temperatures manifested Golia, Muscat Ottonel and Sauvignon Blanc. The Golia variety created at SCDVV Iași, reconfirmed the variety's resistance at cold, this having 83% of its main buds.

Keeping in mind the viability of the buds it will be taken the following measures:

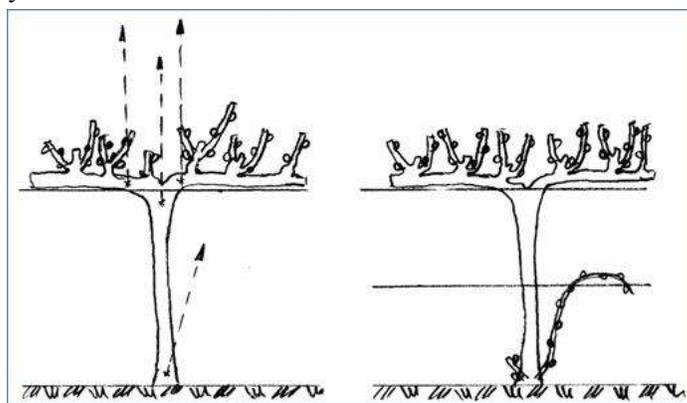
- Establishing the load of loops taking into consideration the secondary viable buds, keeping in mind that at the most varieties half of them may be fertile;

- The dry cutting will be done by giving a compensated load by leaving 1-2 fruit links on the tendril, 1-2 tendrils from the basis of the vine stock, if are there any;
- The cutting will be done differentiated depending on variety, speronat (in main stems) or in fruit links, according to the position of the viable loops on the length of the tendrils (1-3; 1-6; 1-12);
- The length of the fruit element will be usually higher with 2-4 loops;
- Once with the dry cutting the basis of the stock will be punctured with the tip of the scissors and also the curve of the tendrils in order to simulate the vegetation start of the sleeping loops;
- During the vegetation period procedures in green (pinching the sterile shoots and directing and forming the tendrils) will be done that will help both at refreshing the stocks as well as getting some productions of grapes that will partially allow the coverage of the expenses and the restarting of the production cycle.

In what the recovering of the vegetative and of the productive potential is concerned of the vines that were affected by freezing temperatures for 2012 we suggest the following:

1. Recovering cuttings of the vegetative and of the productive potential of the stocks with loop losses of more than 50%. In case that there will be performed cuttings for compensation of the fruit load, taking into account the loop losses recorded for each variety, by leaving 1-2 fruit links extra on the tendrils, 1-2 tendrils for compensation from the main stems from the basis of the stock (fig. 1). Also one must have to take into account that the loads of fruit induce the denudation of the tendrils. That is why the loads must not go over 60 loops/stock for sensitive varieties (Muscat Ottonel, Sauvignon Blanc, Chardonnay) and 80-100 loops/stock at varieties with medium and high viability (Aligoté, Feteasca Regală, Feteasca Albă), in the case of plantations with a distance of 2,2 m between rows.

During the growing season will start pinching shoots from secondary buds, and angular, ensuring buds herbaceous issue that will be used to season the following year the seams.



**Fig.1** - Compensation cutting of the fruit load.

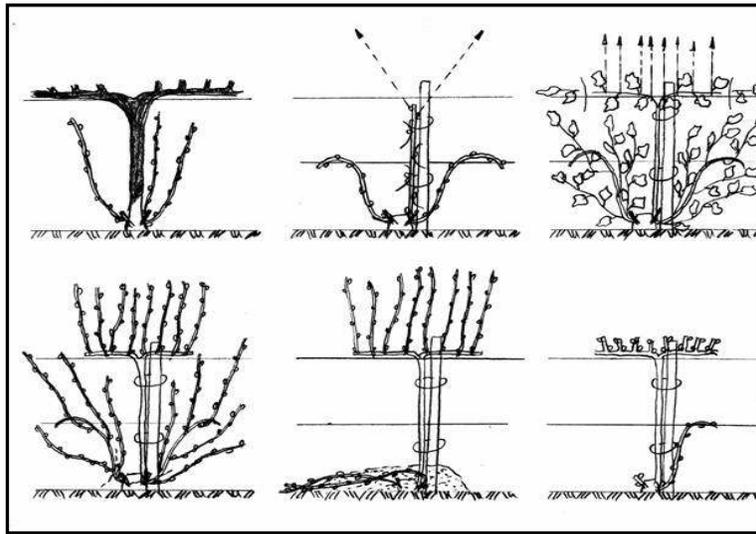
2. Recovery cutting of the stocks and of the cords from tendrils growing from main stems and from shoots starting that are growing from the basis of the stocks.

a) *The recovery of the stocks from tendrils that are growing from the main stems with the projection in green of the cords.* From the tendrils that grew from the main stems will be picked one for the formation of a new trunk and 1-2 tendrils for the compensation of the production of grapes.

The chosen tendril for the formation of the trunk will be shortened down to the level of the bearer wire and it will be tied by the old trunk.

During the vegetation the shoots will be removed from the trunk, except for two last shoots from the superior part that will be used for the green formation of the tendrils (fig. 2).

When they will get at half distance from the stock their tip will be cut off, in this way encouraging growth of shoots that will assure the fruits for next year.



**Fig. 2** - Recovery of the stocks from tendrils formed on the main stems with the green projection of the cords.

b) *The recovery of the stocks from shoots that came from their basis.* 3-4 shoots will be kept from the ones that came out of the sleeping loops from the basis of the stocks and the other ones are extirpated. One of the shoots will be used for the formation of the stock and the others having the role of equilibrating the plants will be pinched at 3-4 leaves. The shoots that come out will loosely be tied by their guardian, following to be used in the next year at assuring 1-2 tendrils for the compensation of the production. The shoot that was chosen for the green formation of the trunk will be tied by its guardian and it will be pinched from under the bearer wire. From the resulted shoots on the superior part of the new trunk, in the next year, half of the length of the tendrils will be dried and the rest will be green (fig. 3).

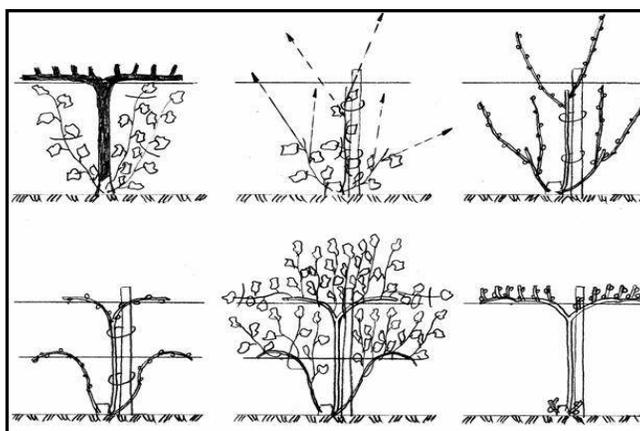


Fig. 3 - The recovery of the stocks from shoots that grow at their base.

## CONCLUSIONS

1. The dropping of the minimum absolute temperature in the air under the resistance limit of the vine and keeping the vine longer affected a lot the viability of the winter buds in February 2012.

2. The greater losses of main buds were registered on the Northern lots, North-East and at the basis of the versants, between 73-97%, 62-95% at the middle of the flanks and smaller on plateaus, between 41-90%.

3. The most affected varieties were Feteasca Albă, Feteasca Regală and Aligoté, which are predominant varieties in the vine plantations of the Research Development Station for Viticulture and Vinification Iasi. A better conduct concerning freezing temperatures manifested the following varieties: Golia, Muscat Ottonel and Sauvignon Blanc.

4. Some years ago, in order to protect the stocks from freezing, people used to burry the tendrils that grew out of the main stems but they noticed that the expenses for this procedure were higher than the eventual loss. The fact is that the frequency of years with minimum absolute temperatures grew and imposed finding some efficient methods for protecting the vine culture over winter.

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# INFLUENCE OF ECOLOGICAL CULTURE SYSTEM ON THE DYNAMICS AND BIODIVERSITY OF NON-SACCHAROMYCES AUTOCHTHONOUS WINE YEASTS

## INFLUENȚA SISTEMULUI DE CULTURĂ ECOLOGICĂ ASUPRA DINAMICII ȘI BIODIVERSITĂȚII DROJDIILOR AUTOCHTONE DE VINIFICAȚIE NON-SACCHAROMYCES

**BRÎNDUȘE Elena<sup>1</sup>, TUDORACHE Aurelia<sup>1</sup>, FOTESCU Laura<sup>1</sup>**  
e-mail:elabrinduse@yahoo.com

**Abstract.** This study evaluated the dynamics and diversity of non-Saccharomyces yeast species during spontaneous fermentation of musts obtained from grapes harvested from ecological and conventional plantations. The studies were performed during 3 harvest years, respectively 2008, 2009 and 2010 in Dealu Mare vineyard, Valea Calugărească center, on the Cabernet Sauvignon variety. A total of 119 yeasts representing 18 species were isolated. The dynamics of non-Saccharomyces yeasts was similar with a difference of about 3.0 log Colony Forming Units/ml, in a negative way in the fermentations performed with grapes obtained from conventional plantation. In ecological plantation, on the grape surface and in the first fermentation phase the dominant species has been *Candida utilis*, while in the conventional plantation the dominant species is *Candida famata*. In the middle and in the end of fermentation non-Saccharomyces yeasts belonging to *Candida*, *Klavispora*, *Pichia* and *Torulaspora* were identified.

**Key words:** Non-Saccharomyces, yeasts, fermentation, wine

**Rezumat.** Prezentul studiu a evaluat dinamica și diversitatea speciilor de drojdii non-Saccharomyces în cursul fermentației spontane a mustului obținut din struguri recoltați din plantații viticole ecologică și clasică. Studiile au fost realizate timp de 3 ani consecutiv 2008, 2009 și 2010, pe soiul Cabernet Sauvignon în podgoria Dealu Mare, centrul viticol Valea Călugărească. Au fost izolate, în total, 119 tulpini de drojdii încadrate în 18 specii. Dinamica drojdiilor non-Saccharomyces izolate din must obținut din struguri cultivați în sistem ecologic și clasic a fost similară, cu o diferență de aprox. 3.0 log Unități Formatoare de Colonii/ml, în sens negativ în fermentațiile realizate cu struguri obținuți din plantația clasică. În plantația ecologică, pe boabele de struguri și în prima fază a fermentației, specia dominantă a fost *Candida utilis*, în timp ce în plantația clasică specia dominantă a fost *Candida famata*. La mijlocul și sfârșitul fermentației au fost identificate drojdii non-Saccharomyces, din genurile *Candida*, *Klavispora*, *Pichia* și *Torulaspora*.

**Cuvinte cheie:** non-Saccharomyces, drojdii, fermentație, vin

### INTRODUCTION

The role of non-Saccharomyces yeasts in wine fermentation has been debated extensively. Numerous studies conducted in recent years have revealed

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<sup>1</sup> Research Institute for Viticulture and Enology, Valea Călugărească, Romania

the potential of some autochthonous non-*Saccharomyces* wine yeasts to produce or secrete several enzymes (esterases, glycosidases, lipases,  $\beta$ -glucosidases, proteases, cellulases, etc), compounds that play an important role on the final organoleptic properties of the wines (Charoenchai et al., 1997; Jolly et al., 2006, Mendoza and Farias, 2010; Moreira, 2005; Strauss et al., 2001, Viana et al., 2008).

The number and diversity of yeasts species on grape berries surface and during the fermentation process are influenced by several factors, including the quantity and the quality of plant phytosanitary protection products (Gheorghe et al., 2010; Raspor et al., 2006).

In this work, the influence of ecological culture system on the dynamics and diversity of non-*Saccharomyces* autochthonous wine yeasts was evaluated.

## MATERIAL AND METHOD

Grapes of Cabernet Sauvignon variety were collected at the full ripening from the ecological and conventional plantations located in Dealu Mare vineyard, Valea Calugarească viticultural center, during the 2008–2009-2010 vintages.

The samples have been collected in sterile bags from 3 points of the plot, from different levels of the cane: base, middle and top.

In order to collect the yeasts from the grape surface the berries were introduced in an Erlenmeyer with sterile distilled water and shaken. After 24 hours the suspensions have been inoculated on the sterile plates with YPG medium and cultivated during 48–72 hours at 27°C.

In order to isolate and identify the non-*Saccharomyces* yeasts during the fermentation process, the berries have been crushed in aseptic conditions and the natural fermentation has occurred. Samples of musts, were taken and cultivated at different serial decimal dilution in triplicate on YPG medium (1% yeast extract, 1% peptone, 3% glucose and 2% agar) at three different stages of fermentation: at the beginning, at the middle and at the end of the fermentation. Plates were incubated at 27°C for 48–72 hours. From each sample 30 – 35 colonies were randomly picked.

In order to not destroy the autochthons non-*Saccharomyces* yeasts population, the crushed grapes were not treated with SO<sub>2</sub>.

The identification and characterization of the yeast strains were carried out by using the morphological characteristics analysis (shape and size of the cells, after 3 days cultivation on liquid and solid media at 25°C, the pseudomycelia formation on potato-agar media after 12 cultivation days, the sporulation on sintetic Gorodkova media) and the physiological characteristics (fermentation and assimilation of different carbohydrates, nitrogen utilization, using ethanol as the sole carbon source, arbutin split).

The taxonomic identification of the isolated yeast strains was carried out according to the procedures described by Barnett et al. (2000).

## RESULTS AND DISCUSSIONS

### Non—*Saccharomyces* yeast dynamics

In the ecological plantation the total number of non—*Saccharomyces* yeasts on the grapes surface, at the fully ripening resulted in about 6.08 log CFU/ml, slightly decreased at the beginning of the fermentation, increased in the

middle of fermentation up to 7.03 log CFU/ml and then decreased until the end of fermentation up to 2.99 log CFU/ml.

In the control samples the evolution was similar, with a difference up to 3.0 log CFU/ml in a negative way.

#### Non—*Saccharomyces* yeast biodiversity

One hundred nineteen non-*Saccharomyces* yeast strains were isolated, purified and further identified: 23 yeast strains from the grapes surface, 45 yeast strains during the spontaneous fermentation of the must obtained from grapes harvested from conventional plantation and 51 yeast strains during the spontaneous fermentation of the must obtained from grapes harvested from ecological plantation.

Non-*Saccharomyces* yeast strains representing about 45% of the total number of yeasts which were isolated from the grapes surface, purified and identified during the 2008–2009-2010 vintages.

Taxonomic analysis of these strains allowed to their classification in two phylogenetic groups: *Ascomycota* and *Basidiomycota*. 18 species belonging to 4 families and 8 genus were identified (tab. 1).

Table 1

**Taxonomy of Non-*Saccharomyces* yeast strains isolated from Dealu Mare vineyard, Valea Călugărească center**

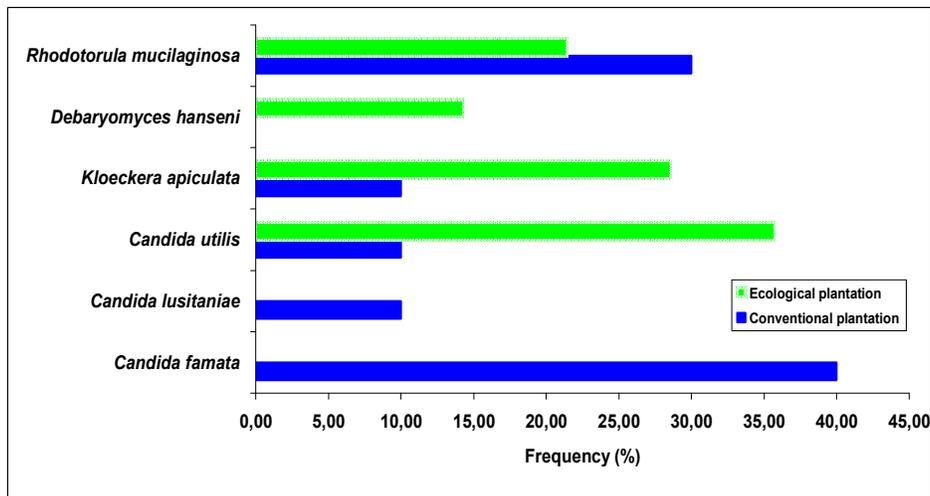
Phylogenetic group	Class	Order	Family	Genus	Species			
<i>Ascomycota</i>	<i>Hemiascomycetes</i>	<i>Saccharomycetales</i>	<i>Candidaceae</i>	<i>Candida</i>	<i>colliculosa</i>			
					<i>Geotrichum</i>	<i>famata</i>		
						<i>lusitaniae</i>		
						<i>magnoliae</i>		
						<i>pelliculosa</i>		
						<i>sphaerica</i>		
				<i>utilis</i>				
				<i>Metschnikowiaceae</i>	<i>Clavispora</i>	<i>penicillatum</i>		
						<i>apiculata</i>		
						<i>Saccharomycetales</i>	<i>Pichia</i>	<i>lusitaniae</i>
								<i>anomala</i>
								<i>jadinii</i>
								<i>ohmeri</i>
<i>Debaryomyces</i>	<i>hansenii</i>							
<i>Torulasporea</i>	<i>delbruecki</i>							
<i>Basidiomycota</i>	<i>Urediniomycetes</i>	<i>Sporidiales</i>	<i>Sporidiobolaceae</i>	<i>Rhodotorula</i>	<i>glutinis</i>			
					<i>minuta</i>			
					<i>mucilaginosa</i>			

From the ecological plantation twelve yeast strains have been isolated from the grapes surface, representing 19% of the total number of non-*Saccharomyces* yeast strains.

The dominant species was *Candida utilis* followed by *Kloeckera apiculata* *Rhodotorula mucilaginosa* and *Debaryomyces hansenii*.

In the conventional plantation, the dominant species was *Candida famata* followed by *Rhodotorula mucilaginosa*.

*Candida lusitanae*, *Candida utilis* and *Kloeckera apiculata* species were identified in a lower frequency (10%) (fig. 1).



**Fig. 1** - Non-*Saccharomyces* yeast biodiversity on the grapes surface in the ecological and conventional plantations

Similar results obtained by other researchers have shown the presence of the apiculate yeasts (*Hanseniaspora uvarum/Kloeckera apiculata*) and oxidative species (*Candida*, *Rhodotorula*, *Pichia*) on the grape berries surface (Jolly et al., 2006; Tofalo et al., 2011).

During the alcoholic fermentation the non-*Saccharomyces* ratio decreased. The dominant species became *Saccharomyces cerevisiae* which participate in the fermentation at a rate of 50-78%. The non-*Saccharomyces* species which have been identified belong to the genera *Candida*, *Klavispora*, *Pichia*, *Torulospora*.

In the first phase of fermentation, in the must obtained from grapes harvested from conventional plantation, remained the same species as dominant, *Candida famata* (20.5%), while in the ecological plantation, the dominant were *Candida utilis* and *Rhodotorula mucilaginosa* (9.8%), aside were identified in a lower percentage *Kloeckera apiculata* (7.8%) and *Debaryomyces hansenii* (5.9%).

Species belonging to *Candida* and *Rhodotorula* genera kept the dominant position in the middle phase of fermentation.

Non-*Saccharomyces* yeast strains belonging to the genera *Candida*, *Clavispora*, *Debaryomyces*, *Torulaspota* and *Rhodotorula*, survived in a small percentage until the end of fermentation (tab. 2).

Table 2

**Non-Saccharomyces yeast biodiversity during alcoholic fermentation  
in Valea Calugareasca center, Dealu Mare vineyard**

Species	Beginning of fermentation				Middle of fermentation				End of fermentation			
	EcP*		CP**		EcP*		CP**		EcP*		CP**	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<i>Candida colliculosa</i>					2	4.5			2	4.5	2	3.9
<i>Candida famata</i>	9	20.5			5	11.4	3	5.9				
<i>Candida lusitaniae</i>							2	3.9				
<i>Candida magnoliae</i>	1	2.3					1	2.0				
<i>Candida pelliculosa</i>							3	5.9	1	2.3		
<i>Candida sphaerica</i>							2	3.9				
<i>Candida utilis</i>			5	9.8	2	4.5						
<i>Geotrichum penicillatum</i>					1	2.3						
<i>Kloeckera apiculata</i>	2	4.5	4	7.8								
<i>Clavispora lusitaniae</i>											1	2.0
<i>Pichia ohmeri</i>					1	2.3	1	2.0				
<i>Pichia jadinii</i>							1	2.0				
<i>Pichia anomala</i>							4	7.8				
<i>Debaryomyces hansenii</i>	2	4.5	3	5.9					4	9.1		
<i>Torulaspota delbruecki</i>							5	9.8			4	7.8
<i>Rhodotorula glutinis</i>					2	4.5			2	4.5		
<i>Rhodotorula minuta</i>	5	11.4			3	6.8						
<i>Rhodotorula mucilaginosa</i>			5	9.8			5	9.8				

\* EcP – Ecological plantation; \*\* CP – Conventional plantation

## CONCLUSIONS

1. During 2008 - 2010 there have been isolated, purified and identified 119 non-*Saccharomyces* yeast strains belonging to two phylogenetic groups:

*Ascomycota* and *Basidiomycota*. 18 species belonging to 4 families and 8 genus were identified.

2. The dynamics of non-*Saccharomyces* yeasts originated from musts obtained from grapes grown in ecological and conventional systems was similar, with a difference up to 3.0 log CFU/ml in a negative way in the fermentations performed with grapes obtained from conventional plantation.

3. The biodiversity of non-*Saccharomyces* yeasts was different under the two culture systems. In the ecological system, the dominant species belonging to the *Candida*, *Rhodotorula* and *Debaryomyces* genera, while in the conventional system prevailing species belonging to the *Candida* and *Torulaspota* genera.

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# PRINTESA COVURLUIULUI WINE OBTAIN FROM THE ITALIAN RIESLING VARIETY AT S.C.D.V.V. BUJORU

## PRINȚESA COVURLUIULUI, VIN OBȚINUT DIN SOIUL RIESLING ITALIAN LA S.C.D.V.V. BUJORU

CIUBUCĂ A.<sup>1</sup>, POSTOLACHE Elena<sup>1</sup>, BÎRLIGA N.<sup>1</sup>

e-mail: aurel.ciubuca@gmail.com

**Abstract.** *This wine falls into the category of sweet wines such minimum reducing sugar 50g / L, with an alcoholic strength exceeding 12% vol. alcohol, is straw -yellow to golden yellow, the smell of "boisée" taste of toast and floral nuances. Attempted use of technological possibilities we have to produce this wine, which is the emblem and to represent the area and not only here but also into the panoply of international wines. Experimentation and implementation of technology for obtaining the Princess of Covurlui wine began in 2006, when been established strategy of wine from grapes ripened collection of Italian Riesling variety, ennobled by noble rot.*

**Key words:** sweet wines, overripe grapes, noble rot.

**Rezumat.** *Acest vin se încadrează în categoria vinurilor de tip reducător dulci cu minim în zaharuri de 50g/L, cu o tărie alcoolică mai mare de 12% vol alcool, are culoarea galben-pai până la galben-aurie, miros de "boisée" cu gust de pâine prăjită și nuanțe florale. S-a încercat utilizarea posibilităților tehnologice de care dispunem pentru a elabora acest vin, care să constituie emblema și să reprezinte zona și nu numai aici ci și în panoplia vinurilor internaționale. Experimentarea și implementarea tehnologiei de obținere a vinului "Prințesa Covurluiului" a început în anul 2006, când s-a stabilit strategia de realizare a vinului de colecție rezultat din strugurii supramaturați ai soiului Riesling italian, înnobilați de putregaiul nobil.*

**Cuvinte cheie:** vinuri dulci, struguri supramaturați, putregai nobil

### INTRODUCTION

Similarity to obtain this wine at a nationally (Murfatlar wine, Cotnari wine) and internationally Sauterne - France and Tokaj - Hungary is the harvest of overripe grapes at a concentration of sugars over 260g/kg at enrichment of grapes with noble rot (Cotea, 2001). The Technological elements to obtain the type Cotnari D.O.C. sweet white wines from overripe grapes were presented by (Cotea et al., 1982), which helped to establish the technology. Description, and all eco climatic of vineyard in S-E France were highlighted by (Cotea, 1992), presenting and technological elements of Sauternes - Barsac wine.

The enrichment of the grapes with noble rot occurs frequently into Dealu Bujorului vineyards, which class the vineyard Bujoru for the possibility of obtaining similar wine with similar features of famous national and international wines.

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<sup>1</sup> Research and Development Station for Viticulture and Winemaking Bujoru, Romania

The differences between the wines resulting from their breeding, the use of certain technological links, but not only but also the recommended varieties, of the planting exhibition, vintage, eco soil conditions. Another reported difference in obtaining of sweet wines for this area is used of unclarified juice from grapes as such pulp, compared with clarification of juice from grapes musts before fermentation (for wines Murfatlar, Cotnari). It was considered that this operation is not as desirable because it would eliminate dowry enzyme and aromatic nuances of mushroom products, just what make that surplus compared to other sweet wines. This would be one link in achieving technological that customizes this wine. The difference is the extension of the pulp maceration up to 72 hours to facilitate the extraction of flavorings and substances in beans.

## MATERIAL AND METHOD

To achieve this type of wine were used overripe grapes of Italian Riesling variety, enriched by noble rot. The processing of raw materials was achieved by using mixed technologies, combining traditional with modern technology.

## RESULTS AND DISCUSSIONS

Late autumn grape harvest was performed at a concentration sugars of 260-300g/kg, the grape acidity 3,5-4,0-5,0 g/L tartaric acid, the pH of 3.4. Grape acidity correction was made with 1.5 g/L tartaric acid. At harvest grapes are dried (dehydrated) and a yellow-red - scarlet depending on the degree of damage to beans noble rot (fig. 1).



**Fig. 1** -The overripe grapes and enriched with noble rot

The raw material processing was performed with low capacity smashing. The fresh grape resulted from crushing the grape was spared the physico-chemical subject, resulting: pH, concentration of sugars and acidity must. There must be a correlation between sugar concentration and acidity that wine must be balanced in the sense that the latter should be higher.

The maceration and fermentation was done early in wooden tubs, adding enzyme for extract of varietal flavors and selected yeasts. The antioxidant protection was achieved by administration of sulfur dioxide (50 mg/L total SO<sub>2</sub>) to limit the enzymatic oxidations that are exacerbated by the action of enzymes

produced by noble rot during overripe grapes. This process was limited to 2-3 days, during which mixed well the juice of grapes stimulating alcoholic fermentation and extraction of varietal aromas.

The pressing pulp was achieved spared a small hydraulic press capacity of 300 bar. (fig. 2) gradually to allow the flow of juice through the husks of the grapes.



**Fig. 2 - The Hydraulic Pressing**

Completion of the fermentation was done in stainless steel tanks of 350 L (fig. 3), will monitor the temperature of fermentation and the dynamic of sugars. Fermentation was carried out slowly for about a month at a temperature up to 20°C and a density of 1041 for the juice of grapes, so to ensure the sugar concentration determined for this type of wine.



**Fig. 3 - The fermentation in stainless steel tanks**

The clarification and stabilization of wine was achieved by bentonisation (1g / L) and sulphitation (250 mg/L total SO<sub>2</sub>). Sulphite is to stop the fermentative at the alcohol concentration and at desired proposed sugar content.

Aging wine was made in new oak barrels of 225 L to obtain the desired taste (minimum 6 months), in each month tasting in order to choose the right time of the taste of "boisée", so looking at big brand wines; the wooden vessels brings new flavors private, such as (odor of coconut of freshly cut green wood, vanilla, clove, toast, pepper, caramel, coffee). This attitude is given by oxidation-

reduction intensified about the micro-oxygenation through the pores of barrels that are coupled with extraction of elago-tannins from oak wood.

The natural tartaric stabilization was achieved in winter.

The filtering of the wine was made in stages, from coarse to sterile.

The bottling of the wine was achieved using a manual tool.

The wine aging was performed in 750 ml bottles, to the cellar.

The physic - chemical properties of the finished wine falls within the following limits: 12 to 12.5% vol. alcohol, total acidity 4,5-5,5-6,5 g/L tartaric acid, volatile acidity from 0.60 to 0.80 g/L unreduced acetic acid extract 29-32 g/L reducing sugar 50-80 g/L, pH 3.22 to 3.38, free sulfur dioxide 50-55 mg /L, 250-300 mg total sulfur dioxide.

Distinctions of wine "Princess of Covurlui"

- Italian Riesling Gold Medal 2006 International Wine Competition 8-11.05.2008, Bucharest (Fig.7);

- Gold Medal - vintage 2009 International Wine Contest Bucharest 26-29.05.2011;

- Silver Medal - harvest year 2010 Bucharest International Wine Contest 26-29.05.2011.

- Silver Medal - harvest year 2010 National Wine Competition "Gold grape" Alba Iulia 5-7.09.2011;

- Diploma of Excellence for "technology sweet Riesling wine making Italian-Fair Regional Research - Third Edition-Galati, 6 to 8 May 2010, the Chamber of Commerce and Industry - ANCS.

## CONCLUSIONS

1. To obtain this wine were used overripe grapes reached with noble rot Italian Riesling variety in a concentration sugars 260-300 g/kg, 3,5-4,0-5,0 grape acidity g/L tartaric acid, pH 3,4.

2. The features of composition of the finished wine are within the following limits: 12 to 12.5% vol. alcohol, total acidity 4,5-5,5-6,5 g/L tartaric acid, volatile acidity 0.60 to 0.80 g/L acetic, acid non-reductive extract 29-32 g/L reducing sugar 50-80 g/L, pH 3.22 to 3.38.

3. In terms of sensory, the wine was appreciated at national and international competitions.

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# THE EFFECT OF SOME PRE-FERMENTATIVE TREATMENTS ON ALIGOTÉ WINES COMPOSITION

## INFLUENȚA UNOR TRATAMENTE PREFERMENTATIVE ASUPRA COMPOZIȚIEI VINURILOR OBTINUTE DIN SOIUL ALIGOTÉ

**CODREANU Maria<sup>1</sup>, NICULAUA M.<sup>2</sup>, COTEA V.V.<sup>1</sup>,  
COLIBABA Cintia<sup>1</sup>, MORARU .I<sup>1</sup>, CONDORACHI Cristina<sup>1</sup>**  
e-mail: codreanu.maria@yahoo.com

**Abstract:** *This study aims at analysing the Aligoté must subjected to 9 treatments (oxalic acid, succinic acid, lactic acid, silica dioxide, tannins, bentonite, graphen, chitosan, charcoal). The tannin treatment positively influences the level of phenolic compounds content. The used analysis methods for compositional characteristics were: total polyphenolic index (IPT or D280), Folin-Ciocalteu index and CIE Lab 76 for colour analysis.*

**Key words:** Aligoté, phenolic compounds, oxalic acids, prefermentative treatments

**Rezumat.** *În acest studiu, mustul obținut din soiul Aligoté a fost supus unui număr de 9 tratamente (acid oxalic, acid lactic, acid succinic, dioxid de siliciu, tanin, bentonită, grafen, chitosan, cărbune). În urma determinărilor, s-a constatat că tratamentul cu tanin influențează pozitiv nivelul conținutului de compuși fenolici. Metodele de analiză folosite pentru determinarea caracteristicilor de compoziție au fost: indicele de polifenoli totali (IPT sau D280), indicele Folin-Ciocalteu, iar pentru determinarea culorii vinurilor metoda CIE Lab 76.*

**Cuvinte cheie:** Aligoté, compuși fenolici, acid oxalic, tratamente prefermentative

### INTRODUCTION

In modern wine-making, besides the grape processing technology, the treatments applied to the must before fermentation also have an important role in deciding the wine's quality. These have the main aim of preventing, improving or deleting some of the faults of oxidation, excess proteins or enzymes etc. (Pomohaci, 2005). By using these treatments accordingly and in good time, the guarantee of obtaining a quality product is higher (Cotea, 2009). Therefore, wine, in its evolution, will need a lesser number of treatments than a wine obtained from a must that wasn't treated in any way.

### MATERIAL AND METHOD

The analysed wines were obtained from the Aligote variety, processed through the general white wines technology. Before the fermentation, 9 treatments were applied to the: oxalic acid - 0,6 g/L (V<sub>1</sub>), lactic acid – 3 g/L (V<sub>2</sub>), succinic acid – 2 g/L

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<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

<sup>2</sup>Oenology Research Center – Iasi Branch of the Romanian Academy, Romania

(V<sub>3</sub>), silica dioxide - 2,4 g/L (V<sub>4</sub>), tannin – 5 g/hL (V<sub>5</sub>), bentonite – 100 g/hL (V<sub>6</sub>), graphen – 100 g/hL (V<sub>7</sub>), chitosan – 100 g/hL (V<sub>8</sub>) and oenological charcoal – 100 g/hL (V<sub>9</sub>) (Croitoru, 2009). The major physical-chemical parameters were analysed for the obtained wines. The used analytical methods for the above mentioned parameters are in conformity with European standards and those legitimated by OIV. The total polyphenolic index or D<sub>280</sub> – represents a global photometric determination of all the phenolic compounds present in wine, through a direct analysis if the absorbency at 280 nm reported to the absorbency of water. The Folin-Ciocalteu index is determined by the method described by Waterhouse (2002), the reaction taking place directly in the 2 mL vials. The phenolic compounds were expressed with the help of the etalon curves with gallic acid with the following concentrations: 50, 100, 250 and 500 mg/L (Waterhouse, 2002). The sum of the phenolic compounds in wine is oxidised by the Folin–Ciocalteu reagent, a mix of phosphomolybdate and phosphotungstate acids.

After oxidation of phenolic compounds, the mix is reduced to blue tungsten and molybdenum oxides (Ribéreau-Gayon, 2006). This blue colour has an adsorption maximum around 760 nm and is proportional to the total phenolic compounds content.

Measuring of the antioxidants capacity of wines was effectuated using the reductive power method, as in the protocol established at the Vine and Wine Institute, Dijon. Two solutions were prepared: Solution A – in a 50 mL vial, 150 mg ferric ammonium sulphate (iron alum) was dissolved in 2 mL concentrated sulphuric acid and distilled water was added to reach the sign. Solution B – in a 500 mL vial, 500 mg of 2,2'-bipyridyl were dissolved in 40 mL 0.1 N sulphuric acid and distilled water was added to reach the sign. One mL of A solution was mixed with 39 mL of B solution.

The reaction took place in 2 mL vials, pipetting 3 mL of the AB mix and 37.5 µL of the wine sample. The absorbency was read at 510 nm. MINOLTA CT-210 spectrophotometer was used to determine the chromatic characteristics according to CIE Lab 76.

## RESULTS AND DISCUSSIONS

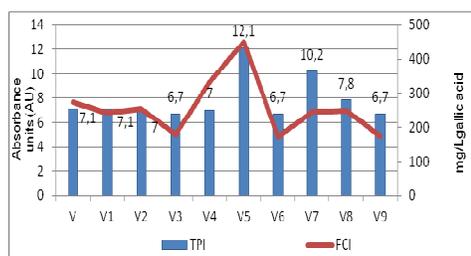
The determined physical-chemical parameters show that the obtained wines are dry and can be classified as superior table wines (VMS) and superior quality wines (VS).

Table 1

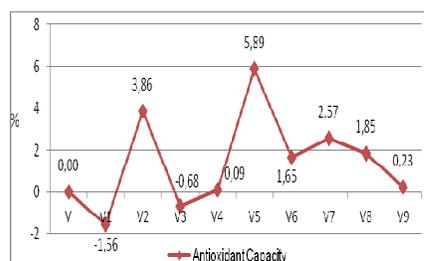
Physical-chemical characteristics of Aligoté wines

Sam- ple	Volatile acidity g acetic acid /L	Total acidity g tartaric acid /L	pH	Alcohol concentra tion % v/v	Reductive substances g/L	Total dry extract g/L	Non- reductive extract g/L
V	0.34	7.66	3.03	9.57	0.90	20.9	20.00
V <sub>1</sub>	0.32	7.96	2.95	9.89	0.83	19.3	18.47
V <sub>2</sub>	0.31	9.73	3.01	10.2	0.95	21.6	20.65
V <sub>3</sub>	0.28	8.15	3.08	9.81	0.71	20.9	20.19
V <sub>4</sub>	0.26	4.47	3.45	9.8	0.82	20.1	19.28
V <sub>5</sub>	0.28	6.89	3.13	9.77	2.56	20.9	18.34
V <sub>6</sub>	0.28	7.08	3.12	10.13	0.66	18.3	17.64
V <sub>7</sub>	0.28	5.53	3.17	9.89	0.83	18.5	17.67
V <sub>8</sub>	0.45	6.02	3.11	10.27	0.92	18.8	17.88
V <sub>9</sub>	0.96	5.81	3.06	9.75	0.87	19.0	18.30

The volatile acidity's values, expressed in acetic acid g/L range between a minimal values of 0.26 g/L for the sample treated with silica dioxide (V<sub>4</sub>) and a maximal value of 0.96 g/L, at the sample treated with oenological charcoal. The total acidity's values vary between 4.47 g/L tartaric acid (V<sub>4</sub>) and 9.73 g/L tartaric acid (V<sub>2</sub>), the increase being due to the lactic acid addition. As a consequence of chitosan treatment (V<sub>8</sub>), the alcoholic concentration grew compared to the control sample. The total dry extract and the non-reductive extract have the smallest values at the bentonite treated samples. It was observed that the wines are dry, the reductive substances having small quantities. Figure 1 represents the evolution of total phenolic compounds (TPI) and compounds with reductive properties (IFC). If the level of total phenolic compounds and compounds with reductive properties grew due to tannin addition (V<sub>5</sub>), the use of the other treatments did not significantly influence the values compared to the control sample, in general. An increase in TPI values compared to the control sample can be observed in the sample treated with graphen.



**Fig. 1 - Evolution of TPI and FCI parameters**



**Fig. 2 - Percentage-wise evolution of antioxidant capacity**

At the wines obtained with pre-fermentative methods, the antioxidant capacity was measured using reductive power method. In order to be able to portray the influence of the studied treatments on the antioxidant capacity, this parameter was represented through percentages (fig. 2). Significant increases of 3.86% and 5.89% compared to the control sample are registered in the samples treated with lactic acid and tannins. Variants V<sub>1</sub> and V<sub>3</sub> have negative values because of the loss of compounds with antioxidant properties.

*Table 2*

**Chromatic parameters in Aligoté wines where different treatments were applied**

Sample	Clarity L (0-opaque; 100-transparent)	Chromaticity		ΔE overall colorimetric difference	ΔH difference of tone
		a red/green component	b yellow/blue component		
V	98.0	-1.27	21.13		
V <sub>1</sub>	93.6	1.47	29.64	9.96	2.71
V <sub>2</sub>	93.2	1.53	26.56	7.81	2.76
V <sub>3</sub>	97.0	-0.97	23.92	2.98	0.38
V <sub>4</sub>	99.5	-2.18	18.39	3.24	1.17
V <sub>5</sub>	95.3	0.83	25.47	5.53	2.14
V <sub>6</sub>	94.7	0.60	23.88	4.70	1.90
V <sub>7</sub>	93.7	1.59	25.75	6.94	2.83
V <sub>8</sub>	101.8	-3.07	13.46	8.71	2.81
V <sub>9</sub>	102.3	-1.30	6.25	15.49	1.72

The chromatic parameters of the wine samples were calculated according to the CIE Lab 76 methods, according to the registered absorption spectrum of each wine sample (Țârdea, 2007). The values of L parameter show that the wines obtained by applying chitosan and charcoal are the most clear. Generally the colour of the wines is yellow greenish (tab. 2).

Major hue differences are found in the samples treated with oxalic acid, lactic acid, graphen and chitosan, while in the case of colorimetric differences the biggest variation is registered in the case of V<sub>9</sub>.(fig. 3).

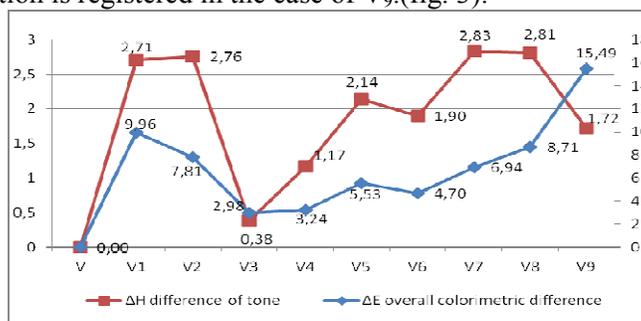


Fig. 3. Variation of colorimetric and hue differences compared to the control

## CONCLUSIONS

The determined physical-chemical parameters show that the obtained wines are dry and can be classified as superior table wines (VMS) and superior quality wines (VS).

The level of total polyphenolic compounds and of those with reductive properties grew after applying the tannins treatment. The oxidation potential grew in samples treated with lactic acid and tannins. The chitosan and oenological charcoal treatments lead to obtaining clear and light wines.

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# THE PROJECTION OF THE ANALYTICAL DATE BANK ASSOCIATED TO CONTROLLED APPELLATION OF ORIGIN WINE'S «MILLESIME» IN DEALU MARE-VALEA CALUGĂREASCĂ VINEYARD

## PROIECTAREA BĂNCII DE DATE ANALITICE ASOCIATE MILEZIMEI VINULUI D.O.C. DEALU MARE - VALEA CĂLUGĂREASCĂ

*FOTESCU Laura<sup>1</sup>, TUDORACHE Aurelia<sup>1</sup>, BRÎNDUȘE Elena<sup>1</sup>*  
e-mail: laurafotescu@yahoo.com

**Abstract.** *The “millésime” of a wine is defined as the year vintage of grapes from which the wine was obtained, the year associated and mentions of wine quality. In order to evaluate the quality of wine's vintage, the database associated to the controlled appellation of origin wine's “millésime” of Dealu Mare-Valea Calugareasca vineyard was designed. The informations to related wine's “millésime” were specific organized in a relational database type, in which all these informations were collected, inventoried and organized. The database is an homogeneous collection of databases, each database representing a way of the informations storing on hard disk, with rapidly retrievable information. Six databases were designed, namely: control plots, vineyard climate, wine phenology, and maturation of grapes, grape harvest and controlled appellation of origin wine production. The analysis of information associated to databases was performed by using specific methods (the comparison and the reference to normal “millésime” and/or based of same indicators) for each group.*

**Key words:** “millésime”, database, data bank

**Rezumat.** *Milezima unui vin este definită ca fiind anul de recoltă al strugurilor din care s-a obținut vinul, anului i se asociază și mențiuni privind calitatea vinului. Pentru a evalua calitatea anului viticol a fost proiectată banca de date asociată milezimei vinului cu denumire de origine controlată Dealu Mare-Valea Călugărească. Informațiile specifice milezimei vinului au fost organizate într-o bancă de date de tip relațional, în care s-au colectat, inventariat și organizat toate aceste informații. Banca de date este o colecție omogenă de baze de date, fiecare reprezentând o modalitate de stocare a informațiilor pe suport informatic, cu posibilitatea regăsirii rapide a acestora. Au fost proiectate șase baze de date și anume: parcela de control, climatul viticol, fenologia viticolă, maturarea strugurilor, recolta de struguri și producția de vinuri cu denumire de origine controlată. Analiza informației asociată bazelor de date s-a făcut prin metode specifice (de comparare și raportare la milezima normală și/sau pe baza unor indicatori) fiecărei grupe.*

**Cuvinte cheie:** milezimă, bază de date, bancă de date

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<sup>1</sup>Research and Development Institute for Viticulture and Enology, Valea Călugărească, Romania

## INTRODUCTION

The data bank of wines's "millesime" is a unitary collection of databases, each of them representing a way to stock up the informatios on an electronic support with the possibility to their rapid retrieval. The aim of this work was to define the quality of wines in relation with the vintage year, grape varieties and wine growing areas. The "millésime" of a wine is defined as the year of grapevine vintage from which the wine was obtained, associated with the informations regarding the quality of wine. The qualitative level of annual wine production is evaluated based on the folowing criteria: climate of vineyard, ripening of the grapes and quality of wines. The maximum quality level is achieved if the following percentages are performed: 30% for the climate of vineyard, 30% for the ripening of the grapes and 40% for the quality of wines (Tudorache, 2001). The informations associated to wines's millesime are annually produced by three techniques such as: data collection, observations and analysis using specific methods.

## MATERIAL AND METHOD

In order to achieve the data bank associated to wine's "millesime" the following studies were performed:

1. Technical and scientific substantiation of wine's "millesime";

2. The structure and interface of the data bank associated to wine's "millesime"

The analysis of informations associated to wine's "millesime" was performed by using specific methods: the comparison and the reporting to a millesime with a medium quality, the using of defined indicators and methodologies customized by The Research and Development Institute for Viticulture and Enology, Valea Calugareasca. The systems from which the informations have been collected are The national system for the management/Register and local system for monitoring the climate of vineyard.

## RESULTS AND DISCUSSIONS

The data bank was projected for the Dealu Mare, Valea Calugareasca center viticulture area. The wines with controlled appellation of origin „Dealu Mare” are those wines which are obtained only in the Dealu Mare vineyard's perimeter (Axente et al., 2004; \*\*\*2003; \*\*\* 2007). The quality and characteristics of these wines are essentialy due to the geographical environment with specific natural and human factors (\*\* 1999).

The design of the analytical data bank associated to DOC wine's millesime was made in two steps. The first was the technical and scientific substantiation of wine's "millesime" and the second, the presentation of the structure and interface of the data bank associated to the controlled appellation of origin wine's "millesime" of Dealu Mare-Valea Calugareasca vineyard.

### **1. Technical and scientific substantiation of wine's "millesime"**

The activities that characterized the "millésime" of wines, presented in Figure 1, are the following: the design of the analytical data bank, the production

of the informations generated from the data bank, the collection of the primary data and the loading of the data bank with specific informations. The data bank associated to wine's "millesime" is formed by six databases containing informations about: the control plot, climate of vineyard, grapevine phenology, ripening of the grapes, grapes harverst and wine production (fig. 1).

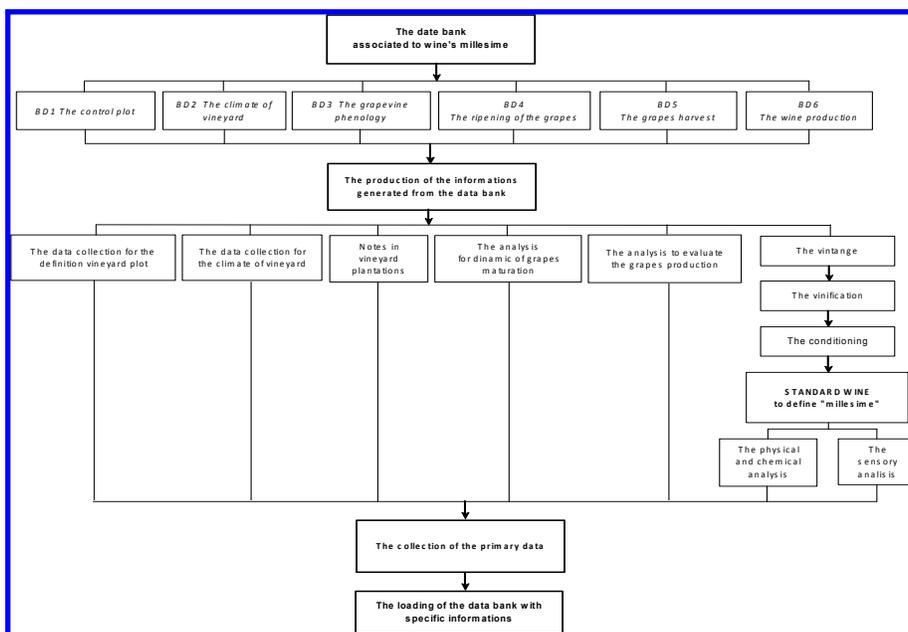


Fig. 1 – The presentation of data bank associated with wine's millesime

The informations associated to wines's millesime are annually produced by three techniques such as: data collection, observations and analysis. The systems from which the informations have been collected are The national system for the management/Register and local system for monitoring the climate of vineyard.

Observations, measurements, vinifications, physico-chemical and organoleptic analysis are performed in the experimental plots. The vinification is realized using a standard winemaking scheme which was elaborated from The Research and Development Institute for Viticulture and Enology, Valea Calugareasca in order to guarantee the origin and varietal tipicity of wines. This wine is named "STANDARD WINE" for millesime. The physico-chemical analysis of grapes and wines are based on standard or specific methods for vitivincultural field.

The primary data for millesime are collected on the sheets and the specific informations are loaded in the data bank.

## 2. The structure and interface of the data bank associated to the wine's "millesime"

The data bank associated to DOC Dealu Mare, Valea Calugareasca wine's millesime is formed by six sheets representing the databases. The informations

presented in table 1 are related to: the vine plot (entity BD\_PARCELEC), the climate of vineyard (entity BD\_CLIMVIT), the potential of vineyard (entity BD\_FENOLOGIE), the dynamics of grapes maturation (entity BD\_DINMATST), the grape harvest potential (entity BD\_RECOLSTR) and the production of wine (entity BD\_PRODVIN).

Table 1

The structure of the data bank associated to the wine's "millesime"

Database name	Entity	Attributes
The database for vine plot	BD_PARCELEC	the cadastral number, the administrative location (the county, the communal/the city, the village), vineyard location (the controlled sub/appellation of origin and vine plot), orographic characterization and the characterization of system culture.
The database for climate of vineyard	BD_CLIMVIT	the year, the month, the average temperature, the precipitation, days number with precipitation, sunshine duration, the air temperatures (average, minimum and absolute maximum) and the sum of global, active and available temperatures.
The database for the potential of vineyard	BD_FENOLOGIE	the variety, the phenophases name (bud breaking, flowering, veraison, full ripening grain, leaf fall) and the phenophase date.
The database for the dynamics of grapes maturation	BD_DINMATST	the date, the variety, vine plot, sugar, total acidity, weight of 100 grapes, anthocyanin content of the grapes, index of total polyphenols și anthocyanin extractability .
The database for the grape harvest potential	BD_RECOLSTR	the variety, the vine plot, the production of grapes (at vine and at hectare) and the characteristics for must of grapes (sugar, acidity)
The database for the production of wine	BD_PRODVIN	The variety, productivity at vinification (to hL/q), acquired alcohol strength, total acidity, pH, sugar, unreducător extract, ash, IC/DO 420, total polyphenols, anthocyanins.

In order to facilely use the data bank, a friendly interface was designed. This is formed from recording and data handling sheets (fig. 2) through which are possible to directly operate on the produced information.

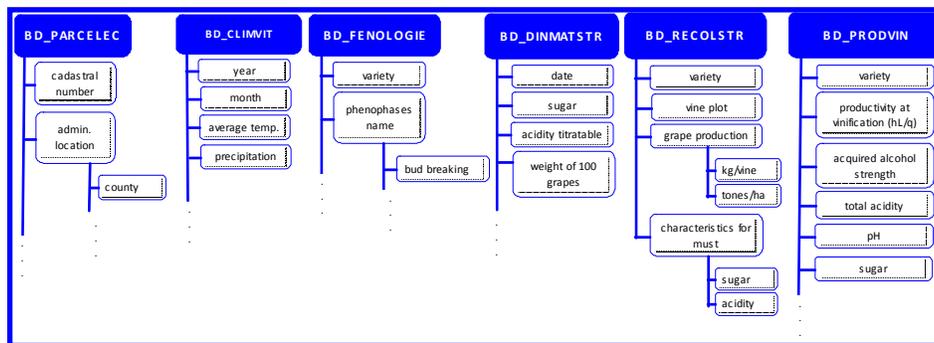


Fig. 2 - The interface of the data bank associated to the wine's "millesime"

The entity BD\_PARCELEC presented in the figure 2 characterized the viticulture Dealu Mare, Valea Calugareasca area at the vine plot level. The elements used for the characterization of the vine plot are: administrative and viticulture locatings, orographic and system culture characterizations.

The climate of vineyard is annually characterized during the conventional vegetative period through the entity BD\_CLIMVIT (fig. 2). The climatic factors (temperature, relative umidity, sunstroke and rainfall) were defined in relation with the thermic and energetic regimes and the nature of the grapevine's water resources. Their evaluation was performed based on the viticulture bioclimatic indices, with the ability to differentiate and demarcate the viticulture areas in correlation with the designed objectives. The informations about the climate of vineyard are analyzed by the comparison and the reporting to a millesime with a medium quality.

The potential of vineyard represente the element through which the quality of the plot was annually evaluated and characterized by the phenology (entity BD\_FENOLOGIE). The grapevine's phenophases are: bud breaking, flowering, veraison, full ripening grain and leaf fall. The phenologic information was analized based on the phenology indicators which allow to evaluate the millesime's precocity, normality or tardiness.

A very important element for the quality of DOC wine obtained in Dealu Mare vineyard, Valea Calugareasca center is the maturation of grapes. The grapevine varieties reach the maturity stage according to their biological nature and the evolution of the climate conditions of the harvest year. The entity for the maturation of grapes databases is BD\_DINMATSTR. The analysis of the stage concerning the maturation of grapes is realized by the comparison with an ordinary millesime.

The grape harvest potential has been given by the characteristics of grapes (quantity and quality) at harvesting.

The DOC wine production in Dealu Mare, Valea Calugareasca area is quantitatively and qualitatively characterized. The interface for BD\_PRODVIN entity was presented in the figure 2. The quality of wines is evaluated based on the synthetic indicator of quality (Tudorache, 2001). The DOC grapes and wines production in Dealu Mare, Valea Calugareasca area was made by the comparison to a millesime with a medium quality.

## CONCLUSIONS

1. The data bank of wines's "millesime" was projected based on a specific concept, using a friendly interface through which the centralization of informations is done. These informations were used to define the quality of wine in relation with the vintage year, grapevine varieties and wine growing areas.

2. The evaluation of the quality level of the annual production of wines was based on three criteria: climate of vineyard, ripening of the grapes and quality of wines.

3. The data bank was projected in order to assess the statistics studies regarding the favorability of the harvest years in Dealu Mare, Valea Calugareasca area and to underlie the vitiviniculture strategies at the regional and national level.

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# MODERN PROCESSES RESEARCH OF ACCELERATED AGING INTO RED WINES PRODUCED IN „VALUL LUI TRAIAN” WINE REGION

## CERCETĂRI PRIVIND PROCEDEELE MODERNE DE MATURARE ACCELERATĂ A VINURILOR ROȘII PRODUSE ÎN CENTRUL VITICOL „VALUL LUI TRAIAN”

*GHERCIU-MUSTEAȚĂ Lidia<sup>1</sup>, COLUN Cristina<sup>1</sup>*  
e-mail: coluncristina@yahoo.com

**Abstract.** *In present work there were studied two technological procedures of accelerated aging into red wines by maintaining of wine on oak chips from different geographical region and by adding of oenological tannin and their influence on polyphenolic complex of red wine, produced in „Valul lui Traian” wine region. It was noticed that Romanian and French chips using allow the best stabilization of color substances, but using the American chips increases the flavor. The adding of oenological tannin at aging period has the effect of color intensity and total polyphenolic index increasing and in consequence color stabilization by antocian-tannin complex forming, the aromatic profile has assessed insignificant.*

**Key words:** red wine, oak chips, oenological tannin, polyphenolic complex, color intensity.

**Rezumat.** *În lucrare sunt prezentate rezultatele studiului a două procedee tehnologice de maturare accelerată a vinurilor roșii prin menținerea vinului pe chips-uri de stejar de diferită proveniență geografică și prin administrarea taninului oenologic, și influența acestora asupra complexului polifenolic al vinului roșu, produs în centrul viticol „Valul lui Traian”. Se constată că utilizarea chips-urilor românești și a celor franceze permite cel mai bine stabilizarea substanțelor colorante, iar folosirea chips-urilor americane intensifică aroma. Administrarea în vin a taninului oenologic la etapa de maturare are ca efect creșterea intensității colorante, a indicelui IPT și în consecință stabilizarea culorii prin formarea complexelor antocian-tanin, profilul aromatic evoluând nesemnificativ.*

**Cuvinte cheie:** vin roșu, chips-uri de stejar, tanin oenologic, complex polifenolic, intensitate colorantă.

### INTRODUCTION

The red wine with originality, flavor and delicate aroma can be obtained only by maturation and aging long enough properly.

Once formed, the wine enters in the maturation stage, where is continued a part of physico-chemical processes from the previous period of formation,

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<sup>1</sup> Technical University of Moldova, Chișinău, Republic of Moldova

supplemented by the complex chemical changes caused by the wood and oxygen's action on the wine.

As an alternative to traditional aging in oak barrels is considered the technology that provides maceration of oak materials as shavings, slides, chips and, more recently, the addition of liquid extracts from oak wood. These technologies allow the wine enrichment with substances from the oak wood. However, kinetics and extraction mechanism differ considerably from the classical method. (Cotea et al., 1988; Ribéreau-Gayon et al., 1998). Using the oak chips contribute to the wine enrichment with specific flavors derived from oak, to rounding and represents a simple technology that is easy to control at an attractive price.

Simultaneously with the oak using, another technology involves using of the purified oenological tannins for character conferring of "aging in oak barrels". The tannin intensifies the color and the phenolate flavor of red wines (Țârdea et al, 2000).

To respond to the demand of red wines consumers from worldwide is imperative the research of modern accelerated aging methods, such as keeping the wine on oak chips or oak strips, micro-oxygenation of wine or oenological tannin adding.

## MATERIAL AND METHOD

As an object of analysis was used Merlot, the quality wine raw material with Geographical Indication, produced in the wine region "Valul lui Traian", in which were added oak chips from France, USA, and Romania, as well as an ellagic tannin, sold local market.

In 4 Full Box recipients of 100 daL were added oak chips in 1,5 g/L doses.

In another batch of raw material wine was added ellagic tannin in the following doses: A -10 mg/L, B - 20 mg/L, C - 30 mg/L, D - 40 mg/L, E - 40 mg/L, F - 60 mg/L.

Then, every 10 days for 30 days of wine keeping on oak chips and after tannins adding were determined the basic physical-chemical indicators, the specific indicators by spectrophotometer method and organoleptic characteristics of wine.

The aim of present work consists in comparing of two technological methods of red wine accelerated aging, as oak chips and oenological tannin using

## RESULTS AND DISSCUTIONS

The wine material raw Merlot taken for research presented the basic physico-chemical indicators from the table 1.

Table 1

The phisico-chemical indicators of wine material raw Merlot

Indicator	Alcohol conc., % vol.	Sugars, g/L	Titrateable acidity, g/L tartaric acid	Volatile acidity, g/L acetic acid	Dry unreductibile extract, g/L	SO <sub>2</sub> , total/free mg/L	Fe, mg/L
Values	11,8	2	6,2	0,53	18,2	120/23	7

Table 2 reflects the specific indicators of control sample:

Table 2

Specific indicators of raw material wine Merlot

Indicators	Total polyphenolic index, TPI	Phenolic compounds, mg/L	Anthocyanins, mg/L	Colour intensity, Ci, units	Colour nuance, CN, units	Relation anthocyanins/tannins A/T * 100
Values	25	1070	98	0,942	0,645	9,16

During wine maintaining on the chips take place a series of physico-chemical reactions that lead to changes of red wine specific indicators, conditioned largely by the presence of both of its tannins as well as those extracted from oak wood. First, of course, increases the concentration of total phenol substances. Therefore, if the TPI value of control sample remains practically unchanged, in all versions take place the tannins accumulation, which causes some increase of TPI values (fig. 1).

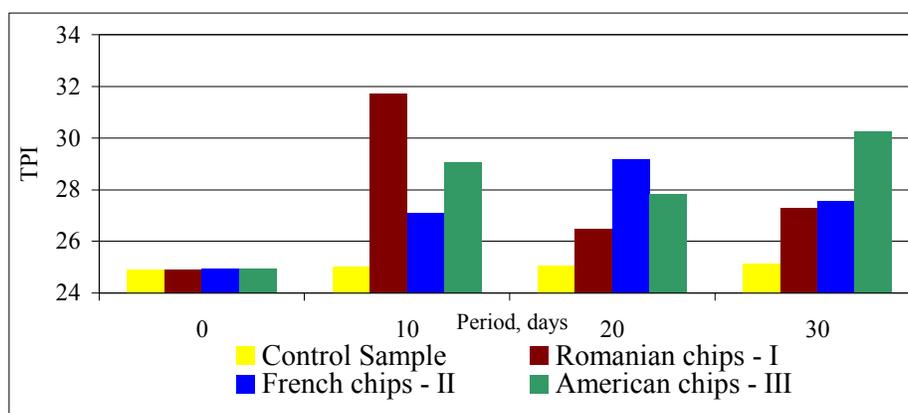


Fig. 1 - Evolution of total polyphenolic index on wine maintaining on oak chips

The concentration of phenol compounds increases after 10 days of keeping the wine on oak chips. The most intense extraction takes place from Romanian chips (I) and American (III), in which the TPI's values have increased by 27 and 12%, a slower extraction registering into sample II.

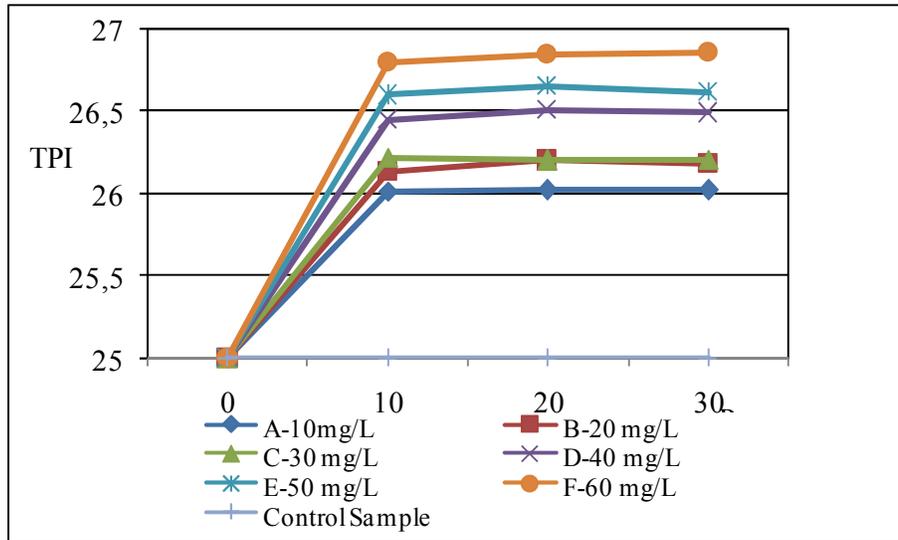
The highest values of TPI are recorded in samples III and II after a month of keeping the wine in contact with the oak chips. Therefore, it was observed that Romanian chips enrich wine with phenol compounds in higher proportions than those of French and American origin. These results confirm data previously obtained (Musteață et al., 2010).

At the same time, with phenol compounds accumulation and some complexes formation with other wine compounds it changes the color intensity of these. The value of color intensity increased by 0.2 units for all samples after 10

days. Color intensity remains virtually constant after 20 days, but on the 30th day it grows in all cases, the highest value recorded for the Romanian chips using.

Based on obtained results it was revealed that for maximum stabilization of color substances, as confirmed by the anthocyanins / tannin relation (A / T), the optimal period of French and Romanian chips maintaining is reduced to 30 days, and for those American - 20 days (Musteață, 2010).

To compare two modern practices applied to red wine aging was added the oenological tannin extracted from oak wood in the same wine, in various doses recommended by the manufacturer and was followed the evolution of wine qualities in the same period. Evolution of the specific indicators is illustrated in figures 2-4.

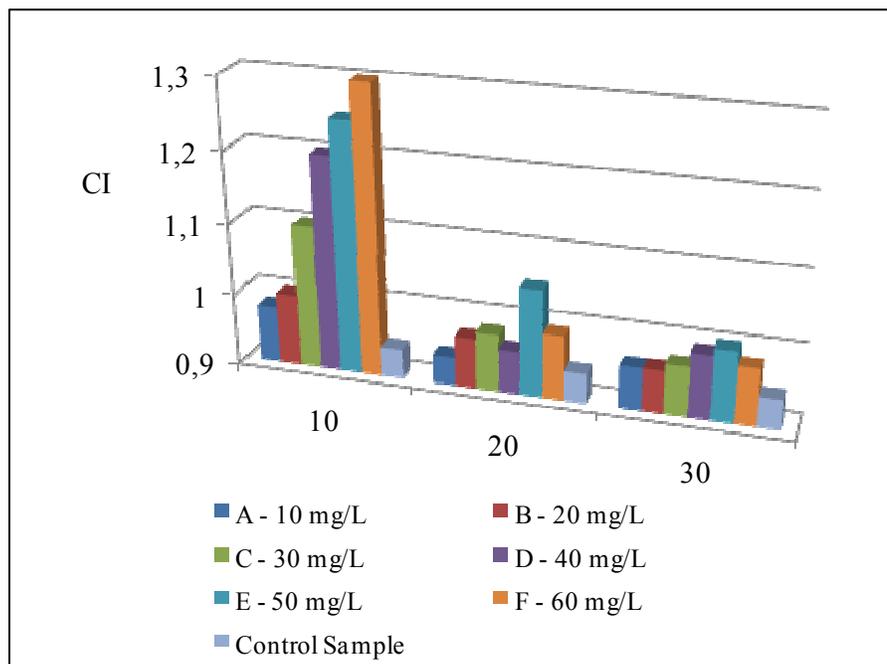


**Fig. 2** - Evolution of the total polyphenolic index (TPI) on tannin adding in wine

Figure 2 shows the total polyphenolic index of the control sample remained virtually constant during 30 days. It is evident the TPI's growth in all variants of tannin adding after 10 days. Mostly has increased the value of the F variant (60 mg/ L dosage) with 7.2% (from 6,4% at 50 mg/L, and 6,0 or 4% at 40 and respectively 10 mg/L, dosages) compared to baseline values in the control sample. On 20 and 30 days, the TPI index continued to rise in all samples, depending on the added dosage. Obviously, the bigger tannin dosage was introduced in wine, so increased the index value TPI.

It is known that the color stability of wine and other indices depend not only on the content of phenol compounds, but also their shapes, the interaction method with other wine compounds (Ribéreau-Gayon et al., 1998).

The color intensity changing in wines is based on polyphenolic complex enrichment with phenol compounds of oak wood and combining them with colored pigments.



**Fig. 3** - Evolution of colour intensity (CI) on tannin adding in wine

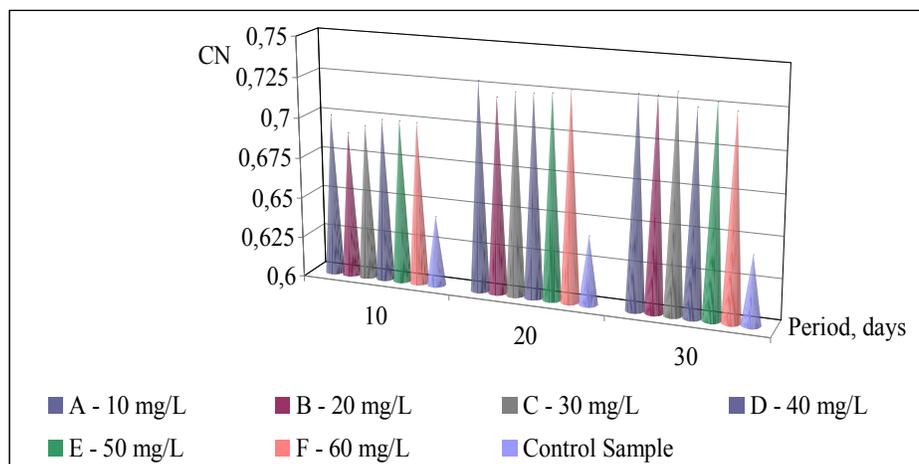
As a result of condensation reactions, both color intensity, as well as wine's color nuance is changing.

Fig. 3 shows that after 10 days of contact with oenological tannin color intensity sharply increased in all the cases, the values ranging between 0,98 and 1,3 units, which is by 4,14 and 38,15% more than baseline value.

At 20 days it was considerably reduced, so that at 30 days after tannins adding to increase slightly, stabilizing the values are between 0,96 -1,0. This is probably due to formation of complexes between anthocyanins and tannins in wine, after condensation and polymerization reactions, at some point, leading to color stabilization.

Because anthocyanins co-polymerization, color intensity increased. Anthocyanins disappearance in the free state makes foreground appear the yellowish color (the leuco-anthocyanins) and therefore the color nuance changes from ruby red to red-brick (Ribéreau-Gayon et al., 1998).

The evolution of this quite important index in organoleptic plan is shown in fig. 4.



**Fig. 4** - Variation of colour nuance (CN) on tannin adding in wine

## CONCLUSIONS

Using the Romanian and the French chips allow to stabilize the best color substances by forming of more stable complexes of wine anthocyanins and extracted tannins from oak chips. Worst evolved the polyphenolic complex for chips coming from the U.S.A.

To keep in the wine flavor the varietal nuances of wines, taste complexity and color stability of recommend the 40 mg/L dosage of oenological tannins, because it provides an increase of color intensity similar to 50 and 60 mg/L dosages, and the color nuance is changed the least.

Recommend for this wine the technological options of accelerated aging by keeping it on Romanian and French chips in 1,5 g/L dosage for 30 days or oenological tannins adding in a dose of 40 mg/L.

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# DIMETHYL SULFIDE: AN ENHANCER OR AN IMPORTANT COMPOUND OF VARIETAL AROMA?

## SULFURA DE DIMETIL: POTENȚATOR SAU COMPUS IMPORTANT AL AROMEI VARIETALE?

*KYRALEOU Maria*<sup>1</sup>, *GARDE-CERDAN Teresa*<sup>2</sup>,  
*TARANTILIS P.*<sup>3</sup>, *KOMAITIS M.*<sup>1</sup>, *KOTSERIDIS Y.*<sup>1</sup>  
e-mail: mkyraleou@yahoo.gr

**Abstract:** *In this study, dimethyl sulfide (DMS) quantification was performed in red (VQPRD Naoussa) and rosé wines from Xinomavro variety. The research was carried out with wine samples of different vintages from wineries of North Greece located in Naoussa and Amyntaio. Potential dimethyl sulfide (PDMS) content was also quantified since it is considered to be transformed into the free form, after ageing. The quantification of the wine DMS and PDMS (estimated indirectly after the release of free DMS by heating in alkaline conditions) content was accomplished by solid-phase micro extraction (SPME) followed by gas chromatography coupled to mass spectrometry (GC-MS). The ageing effect, according to wine type and vintage was studied. The results showed that DMS and PDMS were characterized by a tendency to increase and decrease respectively, with ageing.*

**Key words:** dimethyl sulfide, Xinomavro variety, potential dimethyl sulfide, wine aging

**Rezumat:** *Acest studiu are ca scop principal cunatificarea sulfurii de dimetil (DMS) din vinuri roșii (VQPRD Naoussa) și rosé obținute din soiul Xinomavro. Au fost folosite vinuri din diverși ani de recoltă și diverse podgorii ale Greciei de Nord, din zona Naoussa și Amyntaio. Conținutul potențial în sulfura de dimetil (PDMS) a fost cuantificat, considerându-se că, în procesul de învechire, trece în formă liberă. Cuantificarea DMS și PDMS din vinuri s-a făcut prin micro-extracție în fază solidă (SPME) urmată de gazcromatografie cuplată cu spectrometrie de masă (GC-MS). A fost studiat procesul de învechire în funcție de tipul și anul de recoltă a vinului. Rezultatele au demonstrat că DMS și PDMS cresc și, respectiv, decresc, o dată cu învechirea.*

**Cuvinte cheie:** sulfura de dimetil, soiul Xinomavro, conținutul potențial de sulfura de dimetil, învechirea vinului.

### INTRODUCTION

The role of dimethylsulfide (DMS) in white and red wines aroma was identified and investigated by many researchers (Loubser & Du Plessis, 1977 ; Marais, 1979, Spedding, Eschenbruch & Purdie, 1980 ; Spedding & Raut, 1982 ; De Mora et al., 1987 ; Ferreira et al., 2003 ; Segurel et al., 2004 ; Ségurel et al., 2005 ;

<sup>1</sup> Department of Food Science & Technology, Agricultural University of Athens, Greece

<sup>2</sup> Cátedra de Química Agrícola, E.T.S.I. Agrónomos, Universidad de Castilla-La Mancha, Albacete, Spain

<sup>3</sup> Department of Science, Agricultural University of Athens, Greece

Escudero et al., 2007). Although the aroma of DMS was described as corn, cabbage, asparagus and molasses (Mestres et al. 2000), it has been demonstrated as an enhancer of the berry fruit note in red wines (Segurel et al. 2004 ; Escudero et al. 2007). The positive or negative effect at the bouquet depends on the concentration in the wines and relates to the grape variety (Spedding & Raut, 1982; De Mora et al., 1987; Segurel et al., 2004; Swan, 2000). The perception threshold is 24 µg/l for white wines and 27 µg/l for red wines (De Mora et al., 1986).

DMS levels increase during wine aging in the bottle (Marais, 1979, Spedding et al., 1980, Segurel et al., 2005, Fedrizzi et al., 2007).

High levels of DMS were reported in the wines of the Greek Cultivar cv. Xinomavro Anocibar, (Kotseridis and Bertrand, 1996). According to these results the levels in these wines were exceeding the perception threshold. The target of our current research was to validate these previous findings by using a deuterated internal standard (Segurel et al., 2004) as also to examine the DMS precursors levels of both the wines and grapes of this variety (Segurel et al., 2004, Segurel et al., 2005, Swan, 2000).

## MATERIAL AND METHOD

**Wine samples.** Wine samples of Xinomavro, 15 red wines and 3 rosé wines from this variety but from different vintages were analysed. Red wines, vintages: 1992-2008. Rosé wines, vintages: 2006 - 2008.

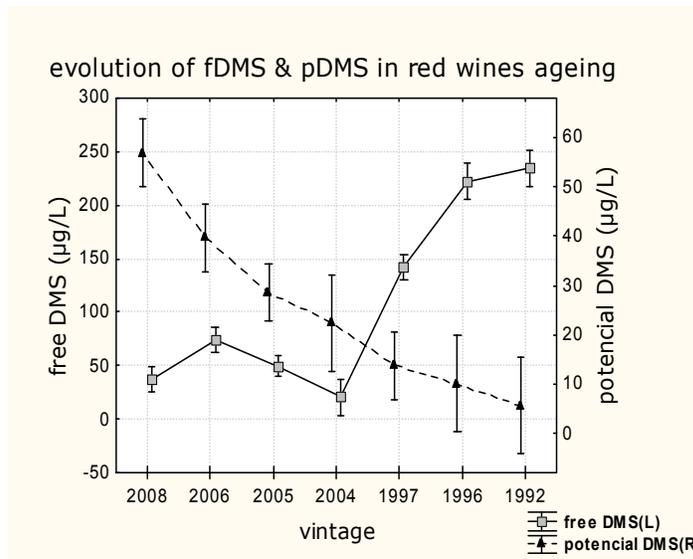
**Analysis of free and potential DMS.** Free and potential DMS were analyzed using a method based on that described by Segurel et al. (2004) with some modifications. *Sample preparation for free DMS.* 25 ml of wine and 2.5µg [<sup>2</sup>H]<sub>6</sub>-DMS were placed to a 40 ml vial at 20 °C with 3 g NaCl and a magnetic stir bar. The vial was sealed with a screw-top cap with silicon septa.

*Sample preparation for potential DMS.* 25 ml of wine were placed to a 40 ml vial at 20°C with a magnetic stir bar. Free DMS that already exist in the sample was removed by bubbling nitrogen at 100 ml/min flow rate for 15 min with a magnetic stirring at 750 rpm. pDMS was released by heat-alkaline treatment. After the solution got cold, 2.5 µg [<sup>2</sup>H]<sub>6</sub>-DMS were added through the septa. The solution was equilibrated by magnetic stirring at 750 rpm for 5 min at 30°C. Then the SPME needle inserted manually through the vial septum and the fiber (CAR/PDMS 75 µm) was exposed to the headspace of the sample for 30 min at 30°C.

The analysis of DMS was performed using a Hewlett-Packard 5890 II GC, equipped with a Hewlett-Packard 5972 MS detector.

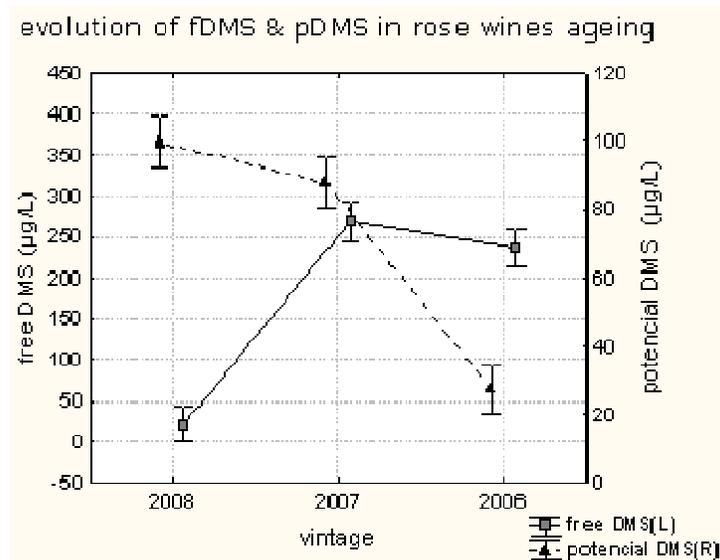
## RESULTS AND DISCUSSIONS

As observed in fig. 1 the levels of DMS tend to rise during the ageing, which is in accordance with the relative bibliographic references. Especially after 10 years of ageing the levels found to be superior than 100 µg/L, which means that this volatile compound plays an important role to the wine aroma. On the other hand potential DMS tends to be reduced during the years which means that it is transformed to free DMS.



**Fig. 1** - Evolution during ageing of DMS and DMS liberated by its precursors (potential DMS) in Xinomavro red wines

Concerning the rosé wines, a similar trend has been found as shown at figure 2.



**Fig. 2** - Evolution during ageing of DMS and DMS liberated by its precursors (potential DMS) in Xinomavro rosé wines

## CONCLUSIONS

It is noteworthy that the levels of free DMS are getting significantly higher than those of red wines for the corresponding vintages. This could be explained by the different technological methods used for the production of rosé and red wines.

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# TESTING GELLAN-GUM BIOPOLYMER AS MATRIX FOR INCLUSION OF YEAST USED IN THE SPARKLING WINES PREPARATION

## TESTAREA BIOPOLIMERULUI GELAN-GUM CA MATRICE PENTRU ENTRAPAREA LEVURILOR UTILIZATE ÎN PREPARAREA VINURILOR SPUMATE

MĂNTĂLUȚĂ Alina<sup>1</sup>, COJOCARU D.<sup>2</sup>, SAVIN C.<sup>1</sup>,  
NECHITA Ancuța<sup>1</sup>, PAȘA Rodica<sup>1</sup>  
e-mail: mantalutaa@yahoo.com

**Abstract.** Obtaining sparkling wines through the champenoise method, using free yeast cells, is made through several stages, from which the operation of riddling requires greater time and qualified staff. The operation of riddling can be removed using different biocatalysts obtained by immobilization in different matrices such as alginate, carragenan, polyvinyl alcohol. However, producers of sparkling wines show a reluctance to using the obtained biocatalysts, arguing the possibility of some residues from the matrices used as support for inclusion of yeasts involving in the wine. We believe that this can be overcome by using the gellan-gum biopolymer as a matrix, which is allowed by FAO in food, pharmaceuticals and cosmetics. In this paper, we present the efficiency of biocatalysts obtained with gellan-gum biopolymer used as a matrix, in the preparation of sparkling wines through the champenoise method.

**Key words:** yeasts, gellan-gum, inclusion, sparkling wine

**Rezumat.** Prepararea vinurilor spumante prin metoda champenoise, folosind celule de levuri libere, parcurge mai multe etape, din care operațiunea de remuaj necesită o perioadă de timp mare și personal calificat. Operațiunea de remuaj se poate elimina folosind biocatalizatori obținuți prin imobilizarea în diferite matrici ca alginat, carragenan, polivinil alcool. Însă, producătorii de vinuri spumante manifestă o rețineră pentru utilizarea biocatalizatorilor obținuți, motivând posibilitatea antrenării în vin a unor reziduuri din matricile utilizate ca suport pentru entraparea levurilor. Acest aspect credem că poate fi depășit prin utilizarea ca matrice a biopolimerului gelan-gum care este admis de FAO în industria alimentară, farmaceutică și cosmetică. În această lucrare, prezentăm eficiența biocatalizatorului obținut prin utilizarea biopolimerului gelan-gum ca matrice, în procesul de preparare a vinurilor spumante prin metoda champenoise.

**Cuvinte cheie:** levuri, gelan-gum, imobilizare, vinuri spumante.

### INTRODUCTION

Studies regarding the use of gellan as a matrix for the immobilization of yeasts were done by Yuguchi et al. (2002), Desimone et al. (2002), Sun et al. (2007). The mentioned authors did researches on the role of cations in the aggregation

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<sup>1</sup> Research and Development Station for Viticulture and Vinification Iasi, Romania

<sup>2</sup> "Alexandru Ioan Cuza" University of Iasi, Romania

and stabilization of the gellan-gum matrix, the resistance of the gel to enzymes, to the degradation generated by heat, to extreme pH and microorganisms. Sook et al. (2011) studied the feasibility of the immobilization of yeast cells in gellan-gum, by means of emulsification. The authors evaluated the efficiency of the bio-catalyser obtained in the continuous alcoholic fermentation for the achievement of bio-ethanol as well as the possibility of using it in several cycles. This information from the specialized literature led to the idea of preparing and testing a bio-catalyser with yeast cells immobilized in gellan-gum, with the purpose of using it in preparing sparkling wines.

The purpose of researches was of demonstrating the possibility of preparing a bio-catalyser with cells immobilized in gellan-gum and the efficiency of using it in preparing sparkling wines in bottles, as the qualities of the bio-catalyser manifest themselves in the alcoholic fermentation process and especially in the riddling operation, which can be excluded. This aspect was also approached by authors that used for the immobilization of yeasts different matrices such as alginate, carrageenan, polyvinyl alcohol: Fumi (1998), Godia (1991), Tiță (2003), Silva (2002), Kourkouta (2004), Efremenco (2006).

## **MATERIAL AND METHOD**

The yeast strain used in the experiment, with the code MNO14, was isolated from the vineyard in Iași – Copou viticultural centre. The biomass of yeast necessary for the immobilization in gellan-gum was obtained using the liquid culture environment made of: glucose 4%, peptone 1%,  $K_2HPO_4$  0.2%,  $MgSO_4$  0.2% and yeast extract 0.55. For 72 hours the temperature was maintained at 25°C, the yeast cells were centrifuged at 5,000 rpm and washed with sterile distilled water. A 10% suspension was made of the biomass of yeast cells, which was used in the inclusion in the gellan matrix.

The GG-MNO14 biocatalyser (cells included in gellan-gum) was made by using a 0.5% solution of gellan-gum and 16 mL 10% yeast cell suspension. After the homogenization of the gellan-gum gel/ yeast cell suspension, it was extruded through a capillary in order to obtain pearls with a 1.5-2 mm diameter. In order to be stabilized, the pearls were introduced in a 2%  $CaCl_2$  solution. After six hours, the pearls were washed with sterile distilled water to remove the bivalent calcium ion.

The obtained biocatalyser was tested in the second alcoholic fermentation, thus determining the behaviour of the pearls during the alcoholic fermentation in cylinders, the time (days) of completion of the fermentative processes, the time (days, seconds) for the achievement of the rotation and the physical-chemical characterization of the sparkling wines obtained. The physical-chemical determinations were carried out according to the methods of the International Organization of Vine and Wine. The pressure in cylinders was determined with an aphrometer.

## **RESULTS AND DISCUSSIONS**

In this experiment, two lots of 35 cylinders with the volume of 750 mL, namely a control lot in which to the mix draft free yeast cells were added and an experimental lot in which pearls were introduced, namely the GG-MNO14 biocatalyser with cells immobilized in gellan-gum.

In order to appreciate the catalytic activity of the yeast strain with free cells and with immobilized cells, in the secondary alcoholic fermentation, identical fermentation conditions were ensured. In preparing the draft mix for the control lot, base wine was used to which the quantity of draft liquor was added in order to obtain the concentration of 24 g sugars/bottles and 2 mL of 10% yeast cell suspension, which may ensure the yeast concentration in the experimental lot for the preparation of 10 g of pearls with immobilized cells.

The draft mix for the experimental lot was made of the same raw matter wine of the variety Fetească regală, to which the same quantity of draft liqueur and 10 g of pearls of the GG-MNO14 catalyser were added.

In order to measure the pressure in the bottles and monitor it in time, an aphrometer was attached to one cylinder of each lot. Taking into account the fact that the pressure created by the accumulation of carbon dioxide in cylinders does not affect the evolution of the fermentative process, it was considered that the records of this parameter for 18 days, every day, and then every three days, during the experiment, offer information regarding the time (in days) necessary for the activation of alcoholic fermentations and the time (in days) in which these processes were finalized. On the same time periods, a cylinder was taken out from each lot and its concentration of sugars was determined.

The physical-chemical characteristics of the base wine are mentioned in tab. 1.

Table 1

**Physical-chemical characteristics of the base wine**

Alcohol % vol	Sugars, g/L	Total acidity, g/L C <sub>4</sub> O <sub>6</sub> H <sub>6</sub>	Volatile acidity, g/L CH <sub>3</sub> COOH	Free sulphurous anhydride, mg/L	Total sulphurous anhydride, mg/L	pH
10,6	1,5	6,9	0,32	26	78	3,41

The physical-chemical composition of the draft mix is rendered in table 2.

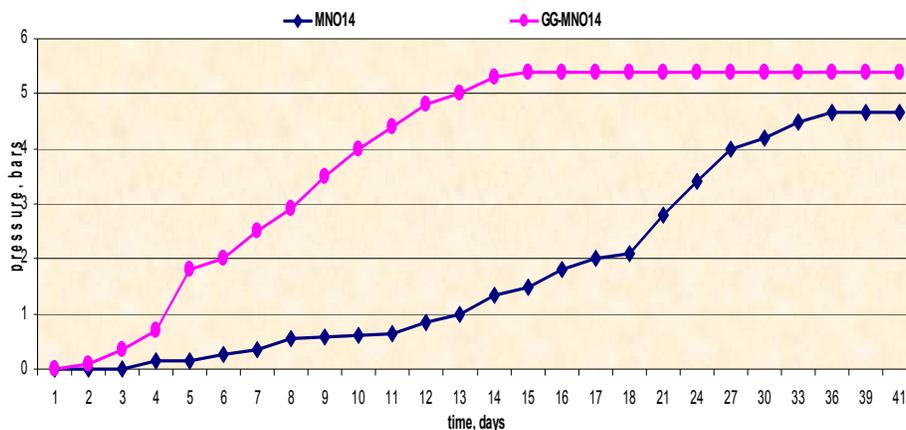
Table 2

**The physical-chemical composition of the draft mix**

Alcohol % vol	Sugars, g/L	Total acidity, g/L C <sub>4</sub> O <sub>6</sub> H <sub>6</sub>	Volatile acidity, g/L CH <sub>3</sub> COOH	Free sulphurous anhydride, mg/L	Total sulphurous anhydride, mg/L	pH
10,4	24,0	7,3	0,31	25	75	3,35

The outcomes of this experiment offer the possibility of characterizing the catalytic activity of the yeast strain in the secondary alcoholic fermentation in bottles, using free cells or immobilized cells.

Figure 1 reveals the dynamics of the consumption of sugars and the evolution of the pressure in bottles during the alcoholic fermentation, for 41 days.



**Fig. 1** – The dynamics of the accumulation of pressure in cylinders, during the alcoholic fermentations achieved by the free cells MNO14 (control) and the GG-MNO14 biocatalyser

The graphic representation of data regarding the consumption of sugars and the record of the pressure values reveals, in comparison to the control, that the activation of the alcoholic fermentation in cylinders happened faster than with the biocatalyser with immobilized cells, namely after two days. The process of alcoholic fermentation in the cylinders with free yeast strain occurred after three days. This behaviour in the catalytic evolution of the immobilized yeast was determined by the protection offered by the gellan-gum matrix against the stress of the high concentration of alcohol from the draft mix, which was not ensured for the free cells.

The alcoholic fermentation achieved in the presence of the biocatalyser with immobilized cells was intense between the 6<sup>th</sup> and the 12<sup>th</sup> day, being completed after 14 days, when the maximum pressure of 5.5 bars is achieved.

The secondary alcoholic fermentation in the control cylinders, after three days from the activation, evolved slowly for 11 days, after which it crossed two stages, between the 12<sup>th</sup> and the 18<sup>th</sup> day and the 18<sup>th</sup> and 33<sup>rd</sup> day with an intense evolution, and the process completed in the 36<sup>th</sup> day from the experiment, at a pressure of 5.1 bars.

The first ascertainment of this experiment is that, due to the immobilization of the yeast cells in gellan-gum, the time of secondary alcoholic fermentation is reduced by 60%, in comparison to the time of completion of the alcoholic fermentation achieved with free cells.

The biocatalyser pearls did not lead, from the time of their addition to the draft mix and during the process of the alcoholic fermentation, to the apparition of floating pearls, which is a very important aspect, as their presence would make the riddling and degorging operations impossible.

The riddling operation for the bottles from the experimental lot was carried out in a few seconds, and the pearls formed a stable deposit on the cylinder cork. For the cylinders with free cells, the same operation was carried out after nine

days, as the deposit of fine beads deposited on the cylinder cork needed every three days operations typical for this stage. The degorging operation was carried out in optimum conditions in both bottles lots.

The gross sparkling wines obtained in the alcoholic fermentations with free cells or immobilized cells had a clear crystalline brilliant aspect.

The physical-chemical tests for the characterization of gross sparkling wines were carried out on three bottles from each lot. The average values of the studies parameters are graphically represented in fig. 2.

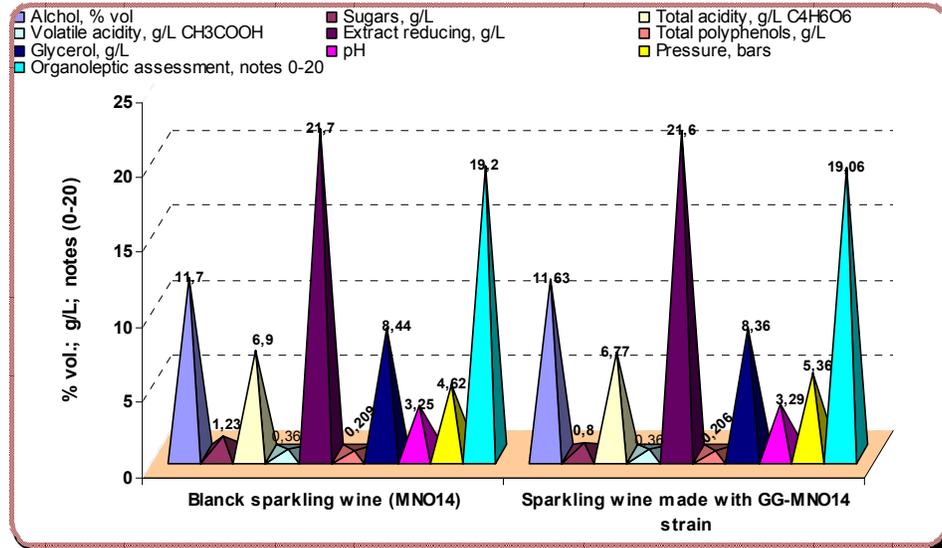


Fig. 2 – The quality of sparkling wines obtained by using free MNO14 cells and GG-MNO14 immobilized cells

According to the graphic representation of data, there are average values higher as regards the alcohol concentration in the gross sparkling wine obtained with free cells of yeasts, but the difference is not significant. Also, the tested parameters: total acidity, volatile acidity, pH, pressure, had different average values insignificant in the two lots of bottles, which was also asserted by others authors, such as: Tataridis et al. (2005), who did a compared study using free cells and the biocatalyser with cells of yeasts immobilized in alginate.

In exchange, there was an increase in the concentration of glycerol in both lots of gross sparkling wines, in comparison to the value determined in the base wine, namely 8.44 g/L and 8.36 g/L. This result is in accordance with the data obtained by Ciani et. al. (1996), Ferraro et. al. (2000).

## CONCLUSIONS

1. The gellan-gum gelling agent can serve as a matrix for the immobilization of the yeast cells in order to obtain a biocatalyser corresponding to the criteria for its use in the preparation of sparkling wines.
2. By the immobilization of the yeast cells in gellan-gum, the time of the

secondary alcoholic fermentation is reduced by 60% in comparison to the time of completion of the alcoholic fermentation achieved with free cells.

3. The riddling operation for the bottles for which the biocatalyser with immobilized cells was carried out in a few seconds, which led to optimum conditions for the degorging operation.

4. The use of free yeast cells and yeast cells immobilized in gellan-gum does not modify the composition characteristics of the gross sparkling wines obtained, which means that they were very close, which is a remarkable criterion as regards the inclusion of the immobilized products in the technology of making sparkling wines.

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# INFLUENCE OF TECHNOLOGICAL TREATMENTS ON PHENOLIC COMPLEX AND COLORS INDICES IN RAW RED WINES

## STUDIUL INFLUENȚEI TRATĂRILOR TEHNOLOGICE A VINURILOR ROȘII SECI ASUPRA COMPLEXULUI FENOLIC ȘI INDICILOR DE CULOARE

**MORARI B<sup>1</sup>, ȚĂRAN N.<sup>1</sup>, SOLDATENCO Eugenia<sup>1</sup>,  
STOLEICOVA Svetlana<sup>1</sup>, SOLDATENCO Olga<sup>1</sup>**  
e-mail: boriska1@front.ru

**Abstract:** *The present work was the study of technological treatments adjuvant materials the content of phenolic substances and indices of sparkling dry red. This is due to the nature of adjuvant material absorbing phenolic complex macromolecules on its surface active which then settles and loses. For removal system with clearing and setting wine winemaking process treatment using adjuvant materials: (fish glue bentonite gelatin polyvinylpyrrolidone (PVP)). This process is an important tool in the hands of a modern winemaker and like any tool must be used wisely.*

**Key words:** red wines, technological treatment, adjuvant materials, phenols

**Rezumat:** *În lucrare a fost efectuat studiul asupra tratărilor tehnologice cu materiale adjuvante, asupra conținutului de substanțe fenolice și indicilor de culoare roșie, seci, pentru spumante. Acest fapt fiind datorat naturii materialului adjuvant ce absoarbe macromoleculele a complexului fenolic pe suprafața sa activă, care ulterior se sedimentează și se pierd din sistem odată cu înlăturarea sedimentului. Pentru limpezirea și stabilizarea vinului în industria vinicolă se utilizează procedeul de tratare cu materiale adjuvante: clei de pește, bentonita, gelatina, polivinilpirolidonă (PVP). Acest procedeu este un instrument important modern și care trebuie să fie utilizat cu atenție.*

**Cuvinte cheie:** vin roșu, tratări tehnologice, materiale adjuvante, substanțe fenolice.

## INTRODUCTION

Dry red wine production is directly influenced by the quality of raw materials, the technology, the technological equipment used and arrangements for handling and storage of the wine. Phenolic compounds are a large group of compounds with importance as red wine. Content and composition of these components significantly affect the sensory quality and nutritional value of wine (Cozub and Rusu, 1996).

Important processes in dry red wines are treatments technological and adjuvant materials, which are administered in order to facilitate wine clarification and stabilization. Today there is a complex of adjuvant substances that are used in the

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<sup>1</sup> Scientific-Practical Institute of Horticulture and Food Technology, Chișinău, Republic of Moldova

wine industry, differing in nature and specific properties. Most macromolecular compounds adsorb on their surface or facilitate conglomerate formation, what it brings to their sedimentation and therefore the wine is clarified quickly, so they protect against disorders. But while it removes unwanted substances and polyphenolic complex, which is one of the basic parameters of dry red wine quality. Also, the influence of material is not fixed as adjuvant and its dose of polyphenolic complex (Macarov, 2008). That is what is addressed to study the influence of technological treatments on complex of dry red wine phenolic and color indices.

## MATERIAL AND METHOD

Research has been conducted in the laboratory "Sparkling and Microbiology", section "Microvinificație" Scientific and Practical Institute of Horticulture and Food Technology (ISPHTA) in the years 2010-2011. As objects of research were used dry red wines made from Merlot. As adjuvant materials in technological treatments were used: bentonite, gelatin, isinglass and PVP (polyvinylpyrrolidone). In conducting research methods were applied to analyze physico-chemical indices recommended by the International Vine and Wine and the change in the ISPHTA (Târdea 2007; Macarov, 2008). Physico-chemical indices of dry red wine before treatment technologies are presented in tab. 1.

Table 1

Physico-chemical indices of dry red wine made from grapes of Merlot (vintage 2010)

alcohol concentration, % vol.	Titrateable acidity, g/L	Volatile acidity, g/L	pH	Potential OR, mV	Amount of phenolic compounds, mg/L	Anthocyanins concentration, mg/L
12,5	6,9	0.33	3.2	191	1802	227

To determine the influence of different adjuvant materials on the physico-chemical indices, content of coloring and phenolic substances. Technological treatments were subjected to red wine after 6 months of maturity.

## RESULTS AND DISCUSSION

Based on the results we conclude that technological treatments have insignificant influence on alcohol concentration, mass concentration, titrateable acidity, volatile acidity and pH. Appreciably affect on the polyphenolic compound and color indices. Results are presented in tab. 2.

In the results, presented in table 2 demonstrated that the use of bentonite contributes to the reduction of the phenolic compound and chromatic indices. There was a dose-dependent, the greatest reduction was recorded after administration of 1,2 g/L, where the content of phenolic substances decreased by 122 mg/L, respectively 261 mg/L compared with the control sample. When using bentonite at doses of 3 g/L content of phenols is lowering with 48 mg/L compared with Scheme 10 (2 g/L of bentonite). The same dynamics is on anthocyanins.

Table 2

**Treatment regimes with adjuvant materials and content of coloring and phenolic substances in red wines after treatment**

№ scheme	Treatment scheme				The content of phenolic substances and color indices in studied wine after treatment			
	bentonite g/L	PVP g/L	gelatin g/L	fish glue g/L	Color intensity, (Ic=A <sub>420</sub> + A <sub>520</sub> +A <sub>620</sub> )	Tone color, (Nc=A <sub>420</sub> mm/ A <sub>520</sub> mm)	Amount of phenolic compounds, mg/ L	Anthocyan concentration, mg/L
1	control sample				12,7	0,56	1802	227
2	-	0,15	-	-	9,5	0,57	1622	225
3	-	0,25	-	-	9,6	0,54	1547	224
4	-	0,4	-	-	9,4	0,54	1495	171
5	-	-	0,1	-	10,1	0,57	1698	217
6	-	-	0,15	-	9,8	0,55	1628	216
7	-	-	-	0,075	9,8	0,55	1651	217
8	-	-	-	0,1	10	0,53	1633	208
9	1	-	-	-	7,6	0,60	1680	187
10	2	-	-	-	6,1	0,66	1541	148
11	3	-	-	-	5,6	0,67	1493	132
12	1	0,25	-	-	8,1	0,57	1529	186
13	2	0,25	-	-	7,2	0,6	1471	144
14	3	0,25	-	-	7,5	0,6	1442	127
15	1	-	0,1	-	7,2	0,62	1541	135
16	2	-	0,1	-	6,3	0,67	1506	115
17	3	-	0,1	-	5,1	0,71	1422	85
18	1	-	0,15	-	7,1	0,61	1512	128
19	2	-	0,15	-	5,7	0,63	1437	107
20	3	-	0,15	-	4,9	0,69	1325	79
21	1	-	-	0,075	7,4	0,61	1592	157
22	2	-	-	0,075	6,4	0,73	1535	148
23	3	-	-	0,075	6,2	0,69	1512	131
24	1	-	-	0,1	7	0,62	1564	152
25	2	-	-	0,1	6,6	0,62	1524	138
26	3	-	-	0,1	5,3	0,7	1396	89

Use separate fish glue and gelatin have minor influence on the content of phenols and anthocyanins. The PVP treatment with doses from 0.15 to 0.25 g/L basically content of anthocyanins remains unchanged, but the dose of 0.4 mg/L decreased this parameter by 24.6%.

Was also studied the influence of complex technological treatments in different combination with gelatin, bentonite, fish glue and PVP. Phenolic substances content decreased compared with the control sample (tabel 1), from 238 mg/L up to 477 mg/L, in depending of adjuvant materials and its nature. So with increasing bentonite doses in all cases brought to lowering phenolic compound and chromatic indices.

The largest decreases were recorded for complex treatments with bentonite 3 g/L and gelatin 0.15 g/L, content of phenolic substances reaching the concentration of 1325 mg/L, with 32.5% less than control sample and anthocyanins content reaching 79 mg/L, 61% less than baseline.

The study determined that the secondary material of the treatment has a major influence on the content of phenolic substances witch is used in doses much smaller then bentonite. And therefore we determined that bentonite in combination with gelatin brought to the greatest decreases of anthocyanins and chromatic index followed by fish glue that has relatively good result. PVP has affected approximately equally content of phenolic substances but helped to preserve anthocyanins in the wine. The color intensity showed higher values compared to samples treated only with bentonite. Decreased hue that shows that PVP facilitates sedimentation brown polymerized phenols and affect anthocyanins easier than experiences where we used bentonite +gelatin/fish glue.

## CONCLUSIONS

1. Comparative study of adjuvant materials used depending on the dose and influence on the content of phenolic substances and chromatic indexes showed that the treatment regimes for dry red wine has a direct influence on the content he phenolic substances, anthocyanins and chromatic indices.

2. Gelatin, fish glue and PVP lead to the smallest decrease of phenolic substances and chromatic indexes. While treatment with bentonite significantly influence their value in wines

3. The complex treatments is achieved the greatest decrease in concentration of phenolic substances, the most significant reductions are recorded in treatments with bentonite + gelatin followed by treatments with bentonite + fish glue and is directly influenced by increasing administrated dose.

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# CORRELATION BETWEEN OXIDATION-REDUCTION POTENTIAL VALUES AND WOOD MATURATION PROCESSES OF RED WINES

## RAPORTUL DE CORELARE ÎNTRE VALOAREA POTENȚIALULUI OXIDO-REDUCĂTOR A VINURILOR ROȘII ȘI PROCESUL DE MATURARE

*MUSTEAȚĂ GR.<sup>1</sup>, POPOV V.<sup>1</sup>, URSU Sorina<sup>1</sup>*

e-mail: sorina\_ursu@mail.ru

**Abstract.** *Following the study performed has proved that there is a strong correlation between the content of phenol compounds and redox potential value of red wines during wood maturation processes. The best correlation was shown between the oxidation-reduction potential value and the amount of tannins in wine. Our results obtained by mathematical method indicate that multiple coefficient of determination  $R^2= 0.9684$ , shows that, 96.84% of the variance indicator is determined by studied factors: duration of contact (X1) and dose of chips (X2).*

**Key words:** wood maturation, redox potential, red wine, wood shaving.

**Rezumat.** *În urma studiului efectuat s-a dovedit că există o strânsă legătură între conținutul compușilor fenolici și valoarea potențialului redox în timpul maturării vinurilor roșii. Cel mai bun raport de corelare a fost evidențiat între valoarea potențialul oxido-reducător și cantitatea taninurilor din vin. Rezultatele obținute prin metoda matematică indică că coeficientul multiplu de determinare este  $R^2= 0,9684$ , rezultă că, 96,84% din variația indicatorului este determinată de factorii studiați: durata de contact (X1) și doza de administrare a chipsului (X2).*

**Cuvinte cheie:** maturare, potențial redox, vin roșu, chipsuri.

### INTRODUCTION

Actually, as a cheaper alternative to traditional aging in a barrel is considered technology that provides maceration of oak materials or direct administration of soluble forms. These technologies enable the enrichment of wine or distillate with oak substances. However, kinetics and extraction mechanism differ considerably from the classical method (Yıldırım et al., 2005).

Also, the wine put in contact with oak material does not receive oxygen analogically as slow oxidizing conditions at the classic aging (Croitoru, 2009).

One of the most popular alternative systems is oak chips maturing (Antoce, 2007). For wines maturation is recommended to use doses between 0,5 și 4 g/L. Also, note that the specific character of the aged wines in oak chips are influenced by administered doses of oak chips. In this case, it is recommended to appreciate the precise dose by performing a test (Croitoru, 2009).

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<sup>1</sup> Technical University of Moldova, Republic of Moldova

## MATERIAL AND METHOD

The aim of this article was to study and to emphasize the influence of oak tannins on the antioxidant properties of red wines.

As research objects served untreated red wines: Rară Neagră, Cabernet Sauvignon and Syrah, produced in the south of Moldova, Cahul, harvest of 2011. Red wines were obtained by the red wine production technology.

This paper presents the results obtaining after maintaining red wines on oak chips: Moldavian and Romanian, in doses of: 0.3 g / L, 0.6 g / L and 0.9 g / L respectively for all samples wines.

The effect of oak tannins on the redox potential of red wine samples was investigated over 180 days, and every 7 days was determine specific and chromatic indices by spectrophotometric method.

## RESULTS AND DISCUSSION

The extracted tannins from wood, especially ellagic tannins, have a great affinity for oxygen. They participate in oxidation-reduction processes using dissolved oxygen; they are electroactive substances that can be titrated by direct potentiometry methods (Țârdea, 2007).

Initially, it have determined the basic physical and chemical, and color specific indeces in samples of red wines Rară Neagră (Băbeasca Neagră), Cabernet Sauvignon and Syrah, the results are presented in table 1 and table 2.

Table 1

Physical and chemical indices of red wines

Wine	Alc, % vol.	Sugar, g/L	TA, g/L	VA, g/L	SO <sub>2</sub> free/total, mg/L	Fe, mg/L	Dry extract, g/L
Rară Neagră	11,2	0,9	7,2	0,24	28/90	3	20
Syrah	13	0,5	6,5	0,42	38/104	3	22,3
Cabernet Sauvignon	11,2	0,9	6,7	0,36	50/90	3	22,6

It notice that the Cabernet Sauvignon wine is presented with a high content of phenolic substances, according to results presented in the table 1, which is approx. 52% higher than Rară Neagră wine and 44% higher than Syrah wine.

Also, Cabernet Sauvignon wine has the highest value of dye intensity of 2.57 a.u., and Rară Neagră wine has the highest hue value of 0.90 a.u., which is approx. 45.56% higher than Cabernet Sauvignon wine. Syrah wine is characterized by intermediate hue values from Cabernet Sauvignon and Rară Neagră. Syrah sample are characterized by the lowest redox potential of 99 mV and rH is 10.82 mV, which confirms that the wine stand in reduced state.

Table 2

## Specific și chromatic indices of red wines

Wines	$E_{H_2}$ , mV	rH, mV	TPI	Color intensity, u. a.	Color hue, u. a.	Total phenolic substances, expressed as gallic acid; mg/L	Total phenolic substances, expressed as catechin; mg/L	Cinamine substances, expressed as caffeic acid; mg/L	Total anthocyanins, mg/L
Rară Neagră	149	12,31	49,70	0,57	0,90	959	1971	153	284
Syrah	99	10,82	48,85	1,67	0,52	1106	2292	174	463
Cabernet Sauvignon	132	11,60	58,75	2,57	0,49	1726	4101	183	644

Remark: u.a. – units of absorption.

According to bibliographical study (Cotea et al., 2009) normal values of rH in wines is between 17-20. Small values of rH correspond to reducing environment in the wine and large values of oxidising environment.

The modification of redox potential values, according to figure 1, Rară Neagră wine within 180 days of aging decreased most sharply from baseline after 20 days approx. 37%. Then, there is an increase of redox potential value to approx. 19.6% at 30 day and maintaining them over time.

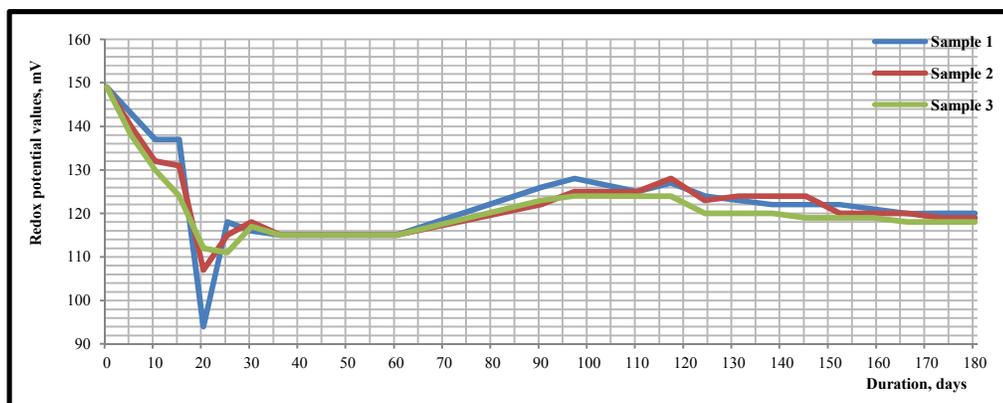
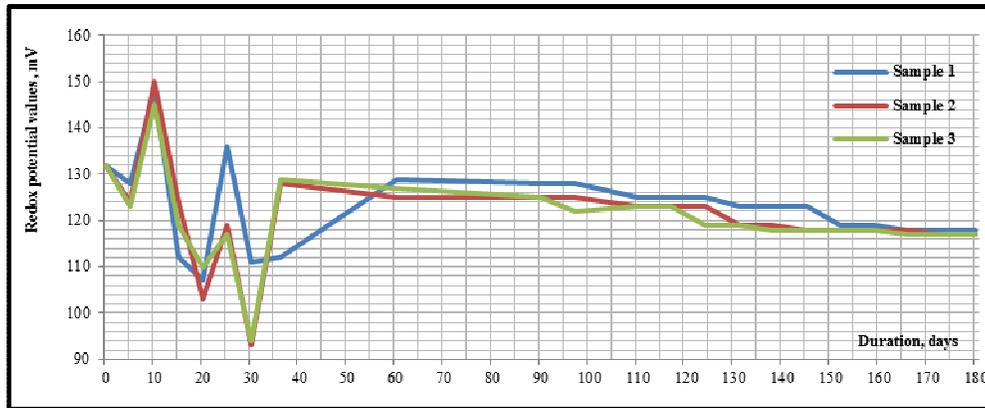


Fig. 1 - Modification of redox potential values at Rară Neagră wine while maintaining on the moldavian oak wood shaving.

Sample 1: 0,5 g/L; Sample 2: 1,2 g/L; Sample 3: 2 g/L.

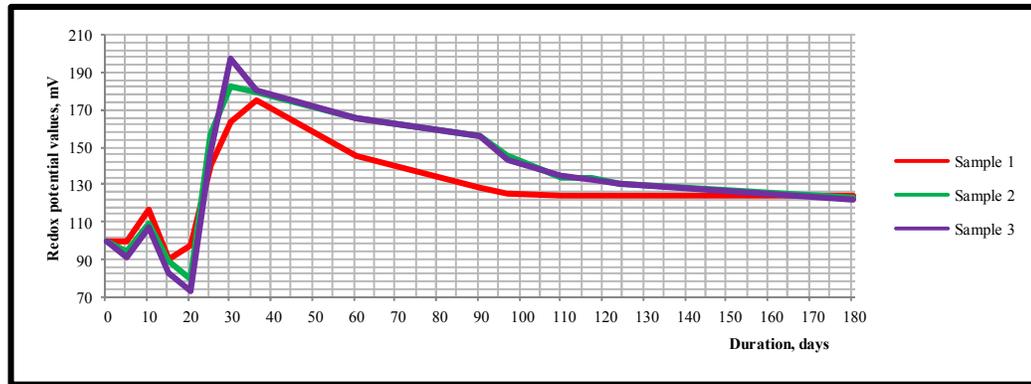
The modification of redox potential values on Cabernet Sauvignon wine while 180 days of aging is different in comparison with samples Rară Neagră

wine (fig. 2). According to the chart, it see that redox potential values decreases and increases. The maximum value is observed after 10 days of contact wine with wood shaving is 150 mV and the lowest after 30 days and is 93 mV. Then Cabernet Sauvignon wine increases its redox potential values by about 15.15 % after 60 day, and then maintaining it throughout till 180 day.



**Fig. 2 -** Modification of redox potential values at Cabernet-Sauvignon wine while maintaining on the romanian oak wood shaving.  
*Sample 1: 0,3 g/L; Sample 2: 0,6 g/L; Sample 3 – 0,9 g/L.*

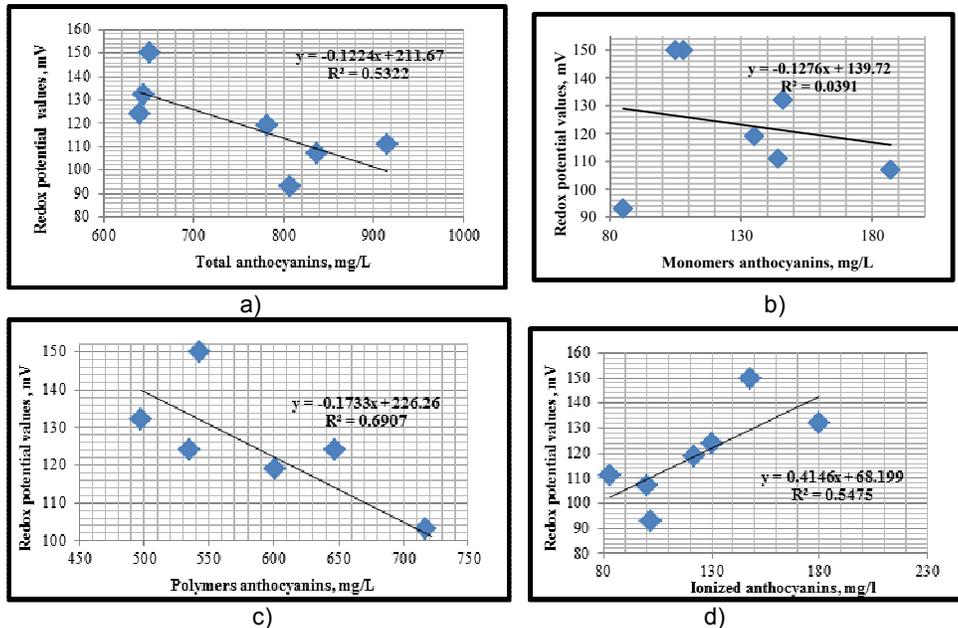
Changing the redox potential of Syrah wine while 180 days of aging tends to increase continuously, fig. 3. After 20 days the amount of redox potential bears a slight decrease by approx. 26.3 % compared to 10 days and there is a sudden rise, which also shows that Syrah wine was aerated prior to measurement of redox potential value.



**Fig. 3 -** Modification of redox potential values at Syrah wine while maintaining on the moldavian oak wood shaving.  
*Sample 1: 0,3 g/L; Sample 2: 0,6 g/L; Sample 3 – 0,9 g/L.*

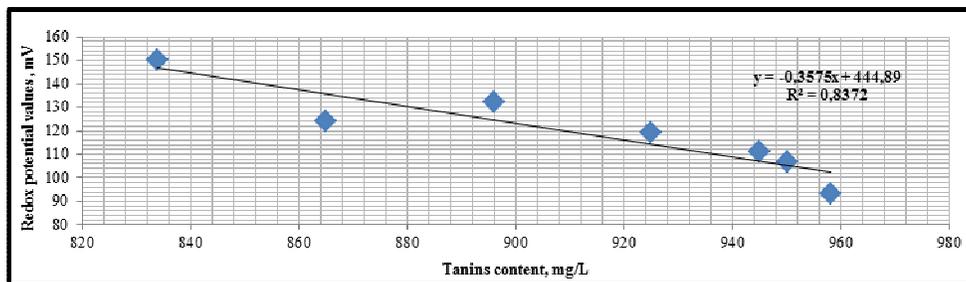
The most obvious correlation was recorded between redox potential values and composition of anthocyanins - anthocyanins polymers, a result of  $R^2 =$

0.6907, according to the results shown in figure 4. Relationship between redox potential values and total anthocyanins, ionized anthocyanins presented in the following:  $R^2=0.5322$ , and respectively  $R^2 = 0.5475$ . The weakest relationship was highlighted by the correlation between redox potential values and monomers anthocyanins constituting only  $R^2 = 0.0391$ .



**Fig. 4** - Correlation between redox potential values and anthocyanin composition of Cabernet Sauvignon wine. Remark: a) total anthocyanins; b) monomers anthocyanins; c) polymers anthocyanins; d) ionized anthocyanins.

Figure 5 presents the correlation relationship between tannins contents and redox potential values, based on the results we found that with increasing of tannins content decreases the redox potential values of wine due to antioxidant properties that occur during maintenance of red wines on oak wood chips.



**Fig. 5** - Correlation between redox potential values and tannins content of Cabernet-Sauvignon wine

After processing the data, it obtained the following multiple regression equation:

$$Y = 225,9 - 0,21 \cdot X_1 + 0,017 \cdot X_2 + 0,044 \cdot X_3$$

Meaning of regression coefficients can be interpreted as follows:

- to a increase of the tannins amount with 1 mg/L, the redox potential value will decrease by 0.21 mV;
- to a increase of the phenolic substances amount with 1 mg/L potential will increase by 0.017, value not significantly influence the regression equation.

Multiple correlation coefficient  $R = 0.9841092$ , so the outcome index is determined by studied factors: duration of contact ( $X_1$ ) and dose of chips ( $X_2$ ). The equation is valid by Fisher criteria.

## CONCLUSIONS

Redox potential values depending on the content of phenolic compounds have the following: total phenols> tannins> anthocyanin polymers> anthocyanins ionized> anthocyanin monomers.

The best dependence is occurred between redox potential values and composition of anthocyanins - anthocyanins polymers, represented by the correlation coefficient  $R^2 = 0.6907$ . It was found that the monomers do not significantly influence the oxidation-reduction potential values, because the correlation coefficient value is  $R^2 < 0.01$ .

The obtained regression equation is linnear which confirms that the dose of chips administered and duration of maintenance directly influence oxidation-reduction potential values.

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# STUDY ON AROMA COMPLEX OF WINES OBTAINED FROM NEW MOLDAVIAN SELECTION VARIETY FLORICICA

## STUDIU PRIVIND COMPLEXUL AROMATIC AL VINURILOR OBȚINUTE DIN SOIUL NOU DE SELECȚIE MOLDOVENEASCĂ FLORICICA

*RUSU E.<sup>1</sup>, OBADĂ Leonora<sup>1</sup>, DUMANOV Veronica<sup>1</sup>,  
CIBUC Mariana<sup>1</sup>, GUGUCICHINA Tatiana<sup>2</sup>*

e-mail: oenologie\_vdo@mail.ru

**Abstract:** *The aroma complex of new variety of Moldavian selection Floricica was researched. The research demonstrated that the composition of wine aroma from variety Floricica is very complex and is constituted from compounds of different categories: aldehydes, ketones, higher alcohols, esters, terpenes, organic acids, lactones etc. The higher alcohols isoamyl and 2-phenylethanol are the main aroma compounds, and their percentage share is 54.5%. These compounds form the basis (nucleus) of the wine aroma, which is completed by other aroma compounds like esters, terpenes, acetals etc. We consider that the floral character of investigated wine aroma is determined more by the interaction of aroma compounds, which are present in a fairly significant number on the background of the main constituents - isoamyl and 2-phenylethanol alcohols.*

**Key words:** aroma complex, Floricica - new variety of Moldavian selection, aldehydes, ketones, higher alcohols, esters, terpenes, organic acids.

**Rezumat:** *A fost supus cercetărilor complexul aromatic al vinului obținut din soiul nou de selecție moldovenească Floricica. Cercetările au arătat că compoziția aromei vinului de soiul Floricica este foarte complexă și constituită din compuși de diferite categorii: aldehide, cetone, alcoolii superiori, esteri, terpeni, acizi organici, lactone etc. Principalii compuși ai aromei sunt alcoolii superiori izoamilic și 2-feniletanol, ponderea procentuală a cărora este de 54,5%. Acești compuși alcătuiesc baza (nucleul) aromei vinului, care este completată de alți compuși aromatici ca esterii, terpenii, acetalii etc. Considerăm că caracterul floral al aromei vinului investigat este determinat mai mult de interacțiunea compușilor aromatici, ce se află într-un număr destul de mare pe fundalul principalilor constituienți – alcoolii izoamilic și 2-feniletanolul.*

**Cuvinte cheie:** complex aromatic, soi nou de selecție moldovenească Floricica, aldehide, cetone, alcoolii superiori, esteri, terpeni, acizi organici.

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<sup>1</sup> Scientifico-Practical Institute of Horticulture and Food Technologies, Chișinău, Republic of Moldova

<sup>2</sup> Zonal Scientific Research Institute in Wine and Fruit Growing in the North Caucasus of Russian Agricultural Academy, Krasnodar, Russian Federation

## INTRODUCTION

When creating quality wine greatly affects the chemical composition of the juice of berries, especially the aromatic complex, located on their husks. It is known that the general flavor of young wine from grapes is due to volatile compounds, which pass into the must during their processing and components that are formed during alcoholic fermentation. However, the character variety is determined mainly by certain volatile compounds belonging to the primary complex of grapes (Fregoni, 1998). In turn, complex aroma of wine is rich and consists of substances belong to different classes. Thus, Gamova et al. aromatic substances identified in the composition of the wine of new varieties of selection aldehydes, ketones, esters, complex, free terpenes, furans (Gamova et al., 1992).

On the other hand, research recently confirmed that the character variety is determined by a substance or a small group of substances. For example, Duboudien D. et al., Malcolm I. et al. (quoted by Pomohaci N. et al.) believes that the quality of aromatic varieties such as Sauvignon etc., semiaromat, contributes nonterpene compounds such as 4-mercapto-4-methylpentane-2-one and metoxipirazinele (Pomohaci et al., 2000). Note that currently determine the natural aromatics of the wine, to it is through gas chromatography coupled with mass spectrometer, which allows detection of many compounds and their identification is based a library of aromatics mass spectrometer (Scorbanovet al., 2008, Sîrghi et al., 2009).

Since the present instrumental methods of analysis of volatile compounds in wine are much better, do consider relevant study of the complex aromatic wines from new varieties to optimize the technology for obtaining them.

## MATERIAL AND METHOD

Subjected of researches was the dry wine made from variety selection in wine campaign in 2010.

For a depth research to complex aromatic wine obtained was passed through a cartridge type consisting of polystyrene extra reticulat DIAPAC hydrophobic nature activated after a specific treatment regimen. Elution of aromatic substances adsorbed on the surface of the cartridge was achieved with a mixture consisting of etylacetat and pentane in a 1:1 ratio. Eluent analysis was performed on gas chromatograph mass spectrometer Clarus600 T-WAX ETR column length of 50 m and diameter of 0.32 mm. Analysis conditions: helium carrier gas vapor room temperature - 220 °C the column - 75 °C between temperatures- 4 °C/min up to temperature of 225°C. Identification of chromatographic peaks was performed according to general library NIST mass spectrometer.

The proportion of compounds that are part of the flavor composition was performed by determining the area of peak a particular compound which is directly proportional it percentage concentration of all aromatic substances amount of eluent.

Research has been conducted in laboratory Oenology and Wine with Designation of Origin of the Institute of Scientific and Practical Horticulture and Food Technology Research Institute Scientific Area and Fruit Viticulture North Caucasus of Russian Agricultural Academy.

## RESULTS AND DISCUSSION

Note that in terms of smell, characteristic Floricica wine is rich and intense floral aroma with notes of wild flowers delivered. In this context we tried to determine the compounds responsible for floral aroma extract obtained by chromatographic analysis of the wine. Table 1 presents the volatile compounds determined and the proportion in the composition of each extract. The analysis result 115 compounds were determined. These compounds belong to various groups: aldehydes, ketones alcohols, esters, terpenes saturated and unsaturated organic acids indoles furans oxides, lactones etc.

Table 1

**Determined volatile compounds in wine aroma Floricica extract.**

Compound name	Percentage %	Category
Acetaldehyde	0,004	Aldehyde
Acetone	0,039	Ketone
1,1 dietoximetan	0,029	Acetals
2-butanone	2,642	Ketones
3-methyl-2-butanone	0,532	Ketones
2,4,5-trimethyl-1,3-dioxolane	0,043	Oxides odorant
Ethyl propanoate	0,871	Esters
Ethyl-2-methyl propanoate	0,004	Esters
Propyl acetate	0,010	Esters
Butyl acetate	0,018	Esters
2-pentanone	0,019	Ketones
2-methyl-3-pentanone	0,019	Ketones
2-butanol	0,127	Alcohols
2-methyl-3-buten-2ol	0,014	Alcohols
3-methyl-2-pentanone	0,009	Ketones
Propanol	0,189	Alcohols
1,1-diethoxy butane	0,004	Acetals
Ethyl butirate	0,044	Esters
Butylacetat	0,021	Esters
Isobutanol	1,571	Alcohols
3-ethoxy-2-butanone	0,012	Ketones
Izoamylacetate	0,740	Esters
Butanol	0,074	Alcohols
2,2-dimethyl-4-hydroxy-3-hexanone	0,003	Ketones
$\beta$ -mircen	0,003	Terpenes
ethylcrotonate	0,003	Esters
2-heptanone	0,022	Ketones
Isoamylol	28,450	Alcohols
Limonene	0,003	Terpenes
Pentanol	0,015	Alcohols
3-methyl-3-buten -1ol	0,002	Alcohols
hexylacetate	0,009	Esters
Ethylpiruvate	0,011	Esters
2-heptanol	12,407	Standard solution
3-methyl pentanol	0,046	Alcohols
Hexanol	0,096	Alcohols

Ethylactate	1,146	Esters
<i>trans</i> -3-hexanol	0,014	Alcohols
3-pentanol	0,003	Alcohols
3-etoxypropanol-1	0,014	Alcohols
<i>cis</i> -3-hexenol	0,014	Alcohols
1-methoxy-1-octen-4-one	0,019	Ketones
Nonanal	0,008	Aldehyde
Etiloctanoate	0,145	Esters
Heptanol	0,009	Alcohols
<i>cis</i> -Linalool-oxyde	0,003	Terpenols aciclic
acetic acid	8,885	Acids
Furfural	0,001	Aldehyde
Ethyl-3-hidroxybutanoate	0,029	Esters
Linalool	0,058	Terpenols
2,3-butandiol	0,108	Alcohols
Ethyl-3-hidroxybutanoate	0,005	Esters
1-octanol	0,002	Alcohols
Benzaldehyde	0,001	Aldehyde
2-methyltetrahydroxytiefen-3-ol	0,021	Sulfur compounds
Acetoin	0,019	Ketones
2-methyl-etoxy-1-etanol	0,009	Alcohols
Hotrienol	0,027	Terpenols
1-metoxy-2-butanol	0,007	Alcohols
<i>trans</i> -4-hydroxymethyl-2-methyl-1,3-dioxolane	0,005	Oxids odorant
Ethyldecanoate	0,079	Esters
Ethyl-2-furanoate	0,001	Furanic compounds
Ethylmethylsuccinate	0,001	Esters
n-butanoic acid	0,259	Acids
4-methylbenzaldehyde	0,001	Aldehyds aromatic
r-butyrolactone	0,063	Lactones
Diethylsuccinate	0,311	Esters
3-methyl-butanoic acid	0,353	Acids
<i>cis</i> -4-hydroxymethyl-2-methyl-1,3-dioxolane	0,002	Oxids odorant
Ethyl-9-decenoate	0,012	Esters
2,6-dimethyl-3,7-octadiene-2,6-diol	0,039	Alcohols
Terpineol	0,039	Alcohols
3-Methylthyo-1-propanol	0,013	Thyoether + alcohol
1,3-propandiol diacetate	0,140	Esters
2,7-dimethyl-4,5-octandiol	0,012	Alcohols
Diethylglutarate	0,001	Esters
<i>i</i> -butiric acid	0,029	Acids
Ethyl phenyacetate	0,002	Esters
Ethyl-4-hydroxybutanoate	0,758	Esters
Methyl-2-hydroxybenzoat	0,015	Esters
2-phenylethyl acetate	0,290	Esters
Geraniol	0,015	Terpenols
2,4-dimethylbenzaldehyde	0,03	Aldehyde
Hexenoic acid	1,580	Acids
N-3-methylbutyl acetamide	0,434	Amides
2,3-butandyoldiacetate	0,113	Esters

Phenylmethanol	0,010	Alcohols
Ethyl-3-methylbutyl succinate	0,004	Esters
2-phenylethanol	26,069	Alcohols
3,7-dimethyl-7-octen-1,6-diol	0,019	Diols
(S)-N-(1-cyclohexanethyl)acetamid	0,004	Amides
Methyl-5-oxohexanoat	0,013	Esters
2,5-dimethyl-4-hydroxy-3(2H)-furanol	0,002	Furans
Diethyl malate	0,344	Esters
Octanoic acid	2,342	Acids
cis-terpin hydrate	0,003	Alcohols
3,7-dimethyl-2,7-octadien-1,6-diol	0,020	Alcohols
Ethylacetamino acetate	0,013	Amines
Diethyl-2-hydroxypentanedioate	0,110	Esters
2-methoxy-4-vinilphenol	0,094	Phenols volatile
5-Oxotetrahydrofuran-2-carboxylic ethyl acid	0,476	Acids
Decanoic acid	0,648	Acids
3-hydroxy-4-phenyl-2-butanone	0,007	Ketones
Ethyl-2-hydroxy-3-phenylpropanoate	0,068	Esters
Phenylethanal	0,024	Aldehydes benzoic
9-decenoic acid	0,228	Acids
Geranic acid	0,029	Acids
Ethyl hydrogen succinate	5,326	Esters
2,3-dihydrobenzofuran	0,271	Furans
3-indolyl acetic	0,005	Compounds indole
Benzoic acid	0,123	Acids aromatic
2-phenylacetic acid	0,034	Acids
N-(2-phenylethyl) –acetamide	0,057	Nitrogen compounds
Ethyl-5-oxo-2-pyrolidinedicarboxylate	0,360	Esters

Aromatic substances examined contained the highest percentage share is the higher alcohols, namely isoamyl alcohol - 28.45% and 2 fenilethanol - 26.06%. But the olfactory characteristics of these two alcohols are not far from roses. Isoamyl alcohol is distinguished by its fruitiness and 2-fenilethanol has a nice overall flavor. According to Cotea et al. (2009) 2-fenilethanol presence in wine seems to be essential in the formation of wine flavor.

Of the total number of compounds identified 32 back esters those with greater weight being ethylpropanoate, isoamylacetate, ethyl lactate, 2-phenylethylacetate, diethylmalate. Of these esters the isoamylacetate have banana flavor, pear, the ethyllactate - smell pleasant and fine, the ethyloctanoate - baked apple, pineapple, pear, the diethylsuccinate - bunch of maturity, the 2-fenylethylacetate – honey.

An essential contribution to the character of flavor has terpenes compounds although their content is small. In the flavor of the investigated wine were identified the terpenes:  $\beta$  - mircen, limonene, cis-linalool oxide, linalool, hotryenol, 2,6-dimethyl-3,7-octadien-2,6-diol,  $\alpha$ -terpineol, geraniol. Aromas of tissue compounds have pleasant Muscat, coriander, the smell of lilacs, rose and positively affects wine flavor.

Of ketones identified in investigated wine aroma are mentioned 1-methoxy-1-octen-4-one and acetoin, both has fragrant, 2-heptanone – fruity smell. The categories of aldehydes in addition to aldehyde were identified nonanal which has smell rose and mandarin, furfural - fragrant fresh bread, benzaldehyde - bitter almonds and 4-methylbenzaldehyde - pleasant aroma.

In extracts investigated have been an identified and organic acid which of them is the largest acetic acid percentage share. The presence of acetic acid in relatively high is good for wine flavor quantities because in his opinion Cotea et al. (2009) it is a good solvent for oils, amplified their olfactory sense. Others saturated and unsaturated acids monocarbonic influences less composition of flavor. Although furan compounds are in the small amounts they influence the olfactory qualities of wine (Cotea, 2009).

## CONCLUSIONS

The study showed that wine flavor composition is very complex Floricica varieties and consists of different categories of compounds: aldehydes, ketones alcohols, esters, terpenes, organic acids, lactones etc. The main flavor compounds are higher alcohols isoamyl and 2-phenylethanol whose weight percentage is 54.5%. Nominated compounds form the basis of (core) wine flavor which is complemented by other aromatic compounds. It was found that a class representative and quantitative numerical in the wine aroma is esters. Although weight of terpenes in aromatic composition is small their contribution to the flavor character is not negligible. We believe that floral character of wine flavor investigated is determined more by the interaction of aromatic compounds find in a large number in the background of the main constituents – isoamylol and 2-phenylethanol.

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# TECHNOLOGICAL APPRECIATION OF STRAINS YEAST FOR DRY WHITE WINES PRODUCTION

## APRECIEREA TEHNOLOGICĂ A SUȘELOR DE LEVURI PENTRU PRODUCEREA VINURILOR ALBE SECI

**SOLDATENCO Olga<sup>1</sup>**  
e-mail: olea\_g@rambler.ru

**Abstract:** *For dry white wines, it is necessary to select strains of yeast able to ferment in specific conditions: at low temperatures; in short time; with the ability to flocculate precipitate, that does not require additional technologies for clarification or filtration of wine; with maximum and medium foam, as an indicator of the presence of surface active substances and fermentative power. In this paper, the technological appreciation of local yeast strains for the production of dry white wines was investigated.*

**Key words:** local yeast, dry white wine, technological evaluation

**Rezumat:** *Pentru producerea vinurilor albe seci este necesară selecția de sușe de levuri capabile să fermenteze în condiții specifice: la temperaturi joase; în timp scurt; cu capacitatea de a flocula precipitatul, ceea ce nu necesită tehnologii suplimentare de limpezire sau filtrarea vinului; cu capacitatea de a forma spumă maximală sau mijlocie ca un indicator de prezență a substanțelor superficiale active și a puterii fermentative. În lucrarea dată a fost efectuată aprecierea tehnologică a sușelor de levuri locale, evidențiate din centrul vitivinicol „Cricova”, destinate producerii vinurilor albe seci.*

**Cuvinte cheie:** levuri locale, vinuri albe seci, apreciere tehnologică

### INTRODUCTION

Yeasts responsible for alcoholic fermentation in wine, usually penetrate the surface of must grapes, used equipment or direct administration of specific yeasts (Fleet, 1993, Ciani, 1997).

The fermentation process can be conducted both natural - without inoculation of selected yeasts, and the administration in must the yeast form or active dry yeast (Heard, 1985). Currently active dry yeasts are widespread in many countries, and using their excellent results are obtained (Fleet, 1993), but, ultimately, higher quality wine is achieved when it is done with the use of indigenous yeasts (Fleet, 1993, Riberon Gayon, 1985).

In recent years, increased interest in using local yeast strains identified in fermented must, which have some specific metabolic characteristics and can positively influence the quality of the product (Redagon, 1997).

Although commercial yeasts are widely used for must fermenting, is considered using local yeasts can be more effective (Degradig, 1989, Querol, 1992),

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<sup>1</sup> Scientifico-Practical Institute of Horticulture and Food Technologies, Chișinău, Republic of Moldova

so it is assumed that they will be more competitive. This proves that they have a dominant potential in the wine fermentation process. In addition, using local yeasts needs to ensure typical sensory properties for wines produced in some centers (Redagon, 1997).

Diversity of yeasts present in wine is a useful tool for selecting new strains dominate during the fermentation process and to increase expression in wine organoleptic characteristics (Guerra, 1999). Purpose of research is assessing technological local yeast strains, shown in the center of wine "Cricova" for dry white wines.

## MATERIAL AND METHOD

### ***Strains of yeast.***

In the present paper were studied local yeast strains (Cricova Ch (2), Cricova Ch (3), Cricova Ch (4), 1S, 1VT, 3VT), shown in the center of wine "Cricova". Studies on its morphological, cultural and physiological-biochemical allowed, using the identifier after Kudreavțeva (Burian, 2003), to establish that yeast strains identified belong to the species *Saccharomyces vini*.

### ***Ability of flocculent precipitate.***

Ability of flocculent precipitate was determined visually in YPG liquid medium, used as control strains of yeasts and non-flocculant flocculant.

### ***Killer factor.***

To determine the phenotype was used method (Sangorin, 2001).

### ***Foaming.***

Foam height was measured daily during alcoholic fermentation. According to Martínez-Rodríguez (Martinez-Rodriguez, 2001) yeast strains were classified into three categories, depending on the height of foam: low = 2 mm foam, foam middle between 2 and 4 mm and abundant foam, more 4 mm.

***Resistance to SO<sub>2</sub>*** was determined on solid agar medium on must with different doses of SO<sub>2</sub> (100-150 mg/L), distributed in Petri dishes, incubating yeast with constant temperature of 27 °C. Sowing biological material fermented mash (2 days) depletion loop method revealed that the cultures have grown faster (Burian, 2003).

### ***Criotolerance.***

To determine the physiological properties by studying resistance in cold fermenting yeast strains was analyzed dynamic fermentation must at a temperature 10°C (Burian, 2003).

Determination of sugars in musts was made with the densimeter, according to GOST 13192-73;

Determination of sugars in wine was performed by indirect titration method according to GOST 13192-73;

## RESULTS AND DISCUSSIONS

It was found that the behavior of yeast strains to low temperature and SO<sub>2</sub> varies with the strain of yeast. It was also established that the ability to form foam and the capacity to flocculent precipitate, different, depending on the strain of yeast used. Results of these investigations are presented in table 1.

In the results, the yeast strains studied can be divided into several groups.

Consistent resistance at low temperatures, in three groups:

- Resistance – low temperature (+++): Cricova Chardonnay (2), 1VT.
- Relatively strong (++): Cricova Chardonnay (3), Cricova Chardonnay (4), 3VT.
- Less resistant (+): 1S

Consistent resistance to SO<sub>2</sub> into two groups:

- Resistant (+++): Cricova Chardonnay (2), 1VT, 3VT.
- Relatively strong (++): Cricova Chardonnay (3), Cricova Chardonnay (4), 1S.

After foaming, the three groups (Martinez-Rodriguez et al., 2001):

- The maximum formation of foam: 3VT
- The middle foam formation: 1VT, Cricova Chardonnay (2)
- The minimum formation of foam: Cricova Chardonnay (3), Cricova Chardonnay (4), 1S.

After the flocculant capacity, the two groups (Mar Vilanova, 2005):

- flocculation: Cricova Chardonnay (2), 1S, 1VT, 3VT
- Non-flocculation: Cricova Chardonnay (3), Cricova Chardonnay (4)

Table 1

**Assessment of technological indices of local yeast strains.**

Denumirea sușei de levuri	<sup>(a)</sup> Foaming (mm)	<sup>(b)</sup> resistance at low temperatures	<sup>(c)</sup> flocculant capacity	<sup>(d)</sup> resistance to SO <sub>2</sub>	pheno-type
Cricova Chardonnay (2)	++		+		Neutral
Cricova Chardonnay (3)	+	++	–	++	Neutral
Cricova Chardonnay (4)	+	++	–	++	Neutral
1S	+	+	+	++	Neutral
1VT	++	+++	+	+++	Neutral
3VT	+++	++	+	+++	Neutral

Legendă: (a) +++ maximum foaming, ++ medium, + minimum  
 (b) +++resistant, ++ relatively resistant, + less resistant  
 (c) + flocculation, – Non-flocculation  
 (d) +++ resistant to SO<sub>2</sub>, ++ relatively resistant

Our study showed that all strains of yeasts are highlighted Neutral phenotype, not disappear in the presence of killer phenotype strains and strains not suppress the activity of sensitive phenotype.

Thus, for dry white wines need to select strains of yeast able to ferment in specific circumstances, for this purpose were selected these criteria following local yeast strains: Cricova Chardonnay (2) and 1VT.

## CONCLUSIONS

1. Technology assessment is the first step to select the most competitive local yeast strains for producing dry white wines.
2. Additional information is necessary to know about secondary compounds of alcoholic fermentation, which have a very important value informing the wine.
3. Experimental results have practical value, so that there is real opportunity to improve the quality of dry white wines.

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# INFLUENCE OF YEAST STRAINS ON AROMATIC POTENTIAL FOR DRY WHITE WINES

## INFLUENȚA SUȘELOR DE LEVURI ASUPRA POTENȚIALULUI AROMATIC A VINURILOR ALBE SECI

ȚĂRAN N.<sup>1</sup>, SOLDATENCO Olga<sup>1</sup>

e-mail: olea\_g@rambler.ru

**Abstract:** *In recent years, consumers consider that the taste and aroma of wine are the main characteristics in the choice of wine, that define its quality. Flavour is the most important distinguishing characteristic of wine. Wine flavour is classified according to the sources of the different compounds contributing to it. This includes varietal flavour, fermentative flavour and post-fermentative flavour. In order to study the influence of yeast strains on the aromatic potential in dry white wines, some volatile substances were determined by gas chromatography method. The obtained results show that the content of volatile substances in dry white wines varies, depending on the strain of yeast used.*

**Key words:** aroma of wine, yeast strain, volatile substances

**Rezumat:** *În ultimul timp, consumatorii consideră că aromă și gustul vinului sunt principalele caracteristici care determină calitatea și valoarea produsului. Aromă vinului este un amestec unic de compuși volatili proveniți din strugurii inițiali (arome varietale), produse secundare formate în timpul fermentației mustului (arome fermentative) și de maturare (arome post-fermentative). În scopul studierii influenței sușelor de levuri asupra potențialului aromatic al vinurilor albe seci au fost determinate unele substanțe volatile, prin metoda gaz-cromatografiei. Rezultatele obținute demonstrează că conținutul substanțelor volatile a vinurilor albe seci variază în dependență de sușa de levuri utilizată.*

**Cuvinte cheie:** aroma vinului, sușe de levuri, substanțe volatile

### INTRODUCTION

Previous studies have shown that yeast strains have a large impact on wine chemical composition (Ripon, 1997) and found that the volatile composition could be an alternative method for characterization of yeasts used in wine production (Mar Vilanova et al., 2005).

Some authors use synthesis of different amounts of acetylmethylcarbinol, 2,3-butadiene or acetic acid as a base for studying the genetic strain variability of the genus *Saccharomyces*, which can serve as a way to improve the quality of wine or fermentative properties of yeasts (Romano, 1998).

During alcoholic fermentation yeasts form and other alcohols, except ethanol, so-called higher alcohols, mainly represented by n-propanol, isobutanol,

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<sup>1</sup> Scientifico-Practical Institute of Horticulture and Food Technologies, Chișinău, Republic of Moldova

isopentanol etc. They may derive directly from the corresponding amino acids or sugars in the environment. Each strain of yeast *Saccharomyces* genus has its own capacity to produce these secondary compounds of fermentation. Yeast strains producing of higher alcohols behave differently depending on musts studied (Pomohaci, 2000, Saint Crieg, 1999).

Esters formation in wine is made in two ways: biological esterification occurs during alcoholic fermentation, malolactic and / or esterification of acetic by chemical or enzymatic reactions that occur very slowly during storage / aging of wine. Both ways may occur depending on the technological and almost equal participation in the formation of esters in wine (Târdea, 2007).

## MATERIAL AND METHOD

**Strains of yeast.** In the present paper were studied local yeast strains (Cricova Ch (2), Cricova Ch (3), Cricova Ch (4), 1S, 1VT, 3VT), allocated in the wine center "Cricova". Studies performed on the morphological, cultural and physiological-biochemical properties permitted, using identifier by Kudreavţeva (Burian, 2003), establishing that yeast strains identified belong to the species *Saccharomyces vini*. As a control was studied industrial dry active yeast: LittoLevureChardonnay (France), yeast selected from the National Collection of Microorganisms for the Wine Industry: strain no. 29.

As a raw material was used grape must of the variety Chardonnay harvest of 2011. Initial physico-chemical characteristics of the grape are presented in table 1.

Table 1.

Physico-chemical characteristics of the grape (harvest 2011)

Grape variety and conditions	sugar, g/L	Titratable acidity, g/L tartaric acid	pH	Potential OR, mV
Chardonnay (microvinification)	195	8,8	3,09	216,9

**Determination** of volatile substances was performed by gas chromatography method.

## RESULTS AND DISCUSSION

Comparative analysis of aromatic content of Chardonnay dry white wine (harvest 2011) achieved by classical technology using different yeast strains allowed the establishment of significant differences. The results obtained are shown in table 2.

The results presented in table 2 demonstrate that the content of volatile substances in dry white wines Chardonnay (harvest 2011) varies depending on the strain of yeast used.

Acetic aldehyde concentration limit values vary from 2.1 up to 18.9 mg/L. Obviously yeast strain has a significant influence on the content of acetic aldehyde, which can be explained by the specific characteristics of each yeast strain to eliminate relatively large or small quantities of this substance.

Table 2

**Content of volatile substances in fermented dry white wine  
different strains of yeast (mg / L).**

Substance	Yeast strain							
	Cricova Ch(2)	Cricova Ch(3)	Cricova Ch(4)	1S	1VT	3VT	Nr.29	LittoLevure (France)
Acetic aldehyde	4,8	3,4	2,5	2,7	3,4	18,9	2,1	15,6
ethyl acetate	24,9	23,4	20,4	22,6	19,8	23,7	25,8	16,7
isoamyl acetate	0,53	0,42	0,38	0,40	0,55	0,45	0,47	0,38
methyl alcohol, g/L	0,02	0,02	0,02	0,02	0,015	0,02	0,01	0,02
<b>Higher alcohols</b>								
2-butanol	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5
n-propanol	15,1	9,9	10,0	12,9	10,1	7,4	6,0	10,1
Isobutanol	20,3	20,9	32,4	31,3	23,0	30,4	30,9	23,8
n-butanol	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5
Isopentanol	141,1	171,9	155,6	171,1	148,0	169,2	167,0	187,0
sum of higher alcohols	177,5	203,7	199,0	216,3	182,1	208,0	204,9	186,6

For example: the use of yeast strain No.29 acetic aldehyde concentration is 2.1 mg/L (minimum), and the use of yeast strain 3VT acetic aldehyde concentration is 18.9 mg/L (maximum).

Less significant influence yeasts have studied the content of n-butanol and 2-butanol, where the determined values were below 0.5 mg/L.

Isobutanol concentration in dry white wines vary depending on the strain type of yeast used and the variation range of values is quite wide and is up from 20.3 to 32.4 mg / L. Maximal concentrations of isobutanol have been established in yeast strain used Cricova Chardonnay (4).

Changes in concentrations of n-propanol in wine raw material is within the range 6.0 to 15.1 mg / L. Isopentanol concentration in dry white wines studied is about 60% of the sum of the higher alcohols, and the difference value is 45.9 mg / L. The highest concentration of isopentanol was found in wine achieved with dry active yeast strain (LittoLevure).

Isoamyl acetate content, that gives a hint of banana, varies slightly between 0.38 to 0.55 mg/L.

Another important component that forms the must fermentation is ethyl acetate, which directly influence the organoleptic properties of wine obtained.

It is known that ethyl acetate is part of the group mean fatty acid esters, and most of the ester group enanthic assign a strong sense of fruit wine.

Therefore, ethyl acetate directly participates in the formation of wine aroma obtained. In addition, ethyl acetate affects the taste of wine. At concentrations higher than the olfactory perception, he gives a stringent flavor. All wines contain healthy ethyl acetate, formed during fermentation, up to 160 mg/L.

In our case, values of ethyl acetate are in the range of 16.7 to 25.8 mg/L, respectively lowest concentration was found in wine obtained by using active dry of yeasts (LittoLevure) and highest in wine obtained by using yeast strain No. 29, but this difference is insignificant in this period.

The analysis of complex volatile dry white wines studied, we can conclude that in all wines the methyl alcohol content is about 0.02 mg/dm<sup>3</sup>, which proves that nature of yeast does not affect methyl alcohol concentration.

## CONCLUSIONS

1. Higher alcohols, esters, aldehydes, volatile acids and other substances formed during fermentation of must in the manufacture of dry white wine contribute to the formation of complex flavors.

2. Specified yeast strains are able to positively or negatively influence the aromatic content of wines.

3. Our results show that knowledge of the biochemical properties of yeast strain used for producing dry white wines can have a decisive role.

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# ON THE PECTIC POLYSACCHARIDES IN WINE

## POLIZAHARIDELE PECTICE DIN VIN

ȚÂRDEA C.<sup>1</sup>

e-mail: ctardea@uaiasi.ro

**Abstract.** *The pectic polysaccharides in wine, which belong in the ramnogalacturonan class, are characterized by a low degree of polymerization (~30) and a molecular mass of 5.3 KDa. They form chelatic bonds with the metal cations in wine and yield stable insoluble chemical compounds. They are little known in our literature and their technological implications for wine are commonly ignored.*

**Key words:** polyssacharides, ramnogalacturonans, pectine chaine, chelats.

**Rezumat.** *Polizaharidele pectice din vin, fac parte din clasa Ramnogalacturanilor și se caracterizează printr-un grad mic de polimerizare (~30) și masa moleculară de 5,3 KDa. Sunt macromolecule puternic ramificate. Formează cu metalele grele din vin compuși chelatici stabili. Sunt mai puțin cunoscute în literatură noastră de specialitate și implicațiile lor tehnologice în vin, adesea ignorate.*

**Cuvinte cheie:** polizaharide, ramnogalacturani, lanț pectinic, chelați.

## INTRODUCTION

The pectic polyssacharides – neutral or acid – appear during the maturation period of grapes and do not disintegrate during the alcoholic fermentation of the must, consequently they will all make their way into the wine (Țârdea, 2007).

They are macromolecular compounds (mixed polyuronides), which following hydrolysis yield uronic acids of various types: D – galacturonic, D – glucuronic, D – octulosonic, D – deoxy – heptulosaric, L – aceric, as well as monosaccharides – ramnopyranose, mabinofuranose, galactopyranose, xylopyranose, apiofuranose a.o.

The pectic polysaccharides in wine are not sweet. They are part of the structure of the pectins and vegetable gums and mucilages (Brillonet et al., 1990).

Although they exist in small amounts, their presence has important technological implications: the proteic stability of wines; the formation of chelatic compounds with the metals in wines and the filtration of wines (Pellerin and O'Neill, 1998).

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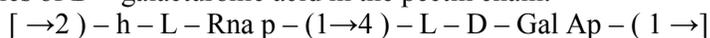
<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iași, Romania

## RESULTS AND DISCUSSIONS

We have isolated the pectic polysaccharides neutral and acid, of the ramnogalacturonic type and an aply branched out molecule, which makes for their great chemical stability.

Structure: one main chaine made up of L-D-galacturonic acid and monosaccharides ( $\alpha$  - L- ramnose) through 1  $\rightarrow$  4 glycosidic bonds, on which are grafted the lateral monosaccharine, mainly rhamnose, chains. The overall structure is aply branched out and this confers ramnogalacturonans a complex chemical stability. According to their respective complexity, ramnogalacturonans fall into two main types: RGI and RGII.

Type I ramnogalacturonans (RGI) are neutral pectic polysaccharides, which result from the insertion of  $\alpha$  - 1- ramnopyranose remains between the molecules of D - galacturonic acid in the pectin chain:



Substitution in the position 1 - 4 of hall of the molecules of - L ramnopyranose by other monosaccharides (arabinose, galactose, xilose) or by means of lateral chains of arabanes, galactans and arabinogalactans (neutral polysaccharides) yields amply branched out RGIs. RGI have been found only in red wines, in amount of < 20 mg/l; they have not been found in white ones (Gerband, 1996).

Type II Ramnogalacturonans (RGII) prevail in wines. These are acid pectic polysaccharides of much greater complexity, being anionic macromolecules. Their main chain is made up of 8 D - galacturonic acid molecules linked by  $\alpha$  bonds (1 $\rightarrow$ 4 ) on which are grafted 4 other lateral oligosaccharides chains (branches), well defined, 2 disaccharides and 2 octosaccharides. Their molecules contain a series of rare saccharides ( $\alpha$  - L - fucose,  $\alpha$  - D - xylose ,  $\alpha$  - D - galactose,  $\beta$  - D - apiose) and rare acids ( $\beta$  - D - glucuronic,  $\beta$  - D - heptulosaric,  $\beta$  - L - aceric), plus ramified chains with  $\alpha$  and  $\beta$  galacturonic acids. The structural pattern is shown in Fig. 1.

Type II ramnogalacturonans (RGII) yield reticulated dimmers with the boric acid esters and are consequently abbreviated as dRGII (d = dimer). They exist in wines in larger amounts which vary within wide limits: 20-50 mg/L in white wines to 100-150 mg/l in red wines. Homogalacturonans made up of identical monomers are found in direct producer hybrid wines and in the wines produced with enzyme mixtures.

### Technological implications

Pectic polysaccharides influence the technological filtration of wine (the clearing up of wine through filtration). The most important result in their interaction with the metals in wine and the formation of stable chelatic compounds.



The chelation of the metal cations in wine by the dRGII is highly specific and depends on the physio-chemical proprieties of the cations: +2 or + 3 valence; ion radius  $> 0.95 \text{ \AA}$ ; weak ionization energy and an affinity for oxygen yielding ligands (Pellerin, O'Neil, 1998). The cations with which they yield stable chelatic compounds are those of heavy metals ( $\text{Pb}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ) as well of those of lanthanides/rare metals ( $\text{La}^{3+}$ ,  $\text{Er}^{3+}$ ,  $\text{Ce}^{3+}$ ,  $\text{Pr}^{3+}$ ,  $\text{Nd}^{3+}$ ). There are exclusive essential cations, e.g.  $\text{Fe}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Yn}^{2+}$  and  $\text{Mg}^{2+}$ .

Because  $\text{Pb}^{2+}$  is toxic as a result of fixing by means of dRGII, its bioavailability in wines is reduced in the interest in human health (Pellerin et al., 1997).

## CONCLUSIONS

To date there is no research on the pectic polysaccharides in the wines produced in the Romanian vineyards. Also, there is no research on the lead content in wines, its bioavailability and its intrinsic toxicity for the human organism.

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# STUDIES ON THE DYNAMICS OF PESTICIDE RESIDUES CONTENT DURING THE TECHNOLOGICAL PROCESS OF OBTAINING TOMATO JUICE AT SC CONTEC FOODS SRL TECUCI

## STUDII ASUPRA DINAMICII CONȚINUTULUI UNOR REZIDUURI DE PESTICIDE PE PARCURSUL FLUXULUI TEHNOLOGIC DE OBȚINERE A SUCULUI DE TOMATE LA SC CONTEC FOODS SRL TECUCI

ANDREI Corina<sup>1</sup>, ȚÂRCĂ Felicia<sup>2</sup>, BARCAN (BĂETU) Alina<sup>1</sup>, BĂETU M.M.<sup>1</sup>  
e-mail: corinandrei84@yahoo.com

**Abstract.** *The purpose of this study was to monitor residues of organochlorine pesticides (DDT and its metabolites, the total HCH and its metabolites) and residues of organophosphorus pesticide (ethion, diazinon, methyl parathion) on tomatoes as raw materials for industrialization at SC Contec FOODS SRL Tecuci. The performed analyses were aimed at evaluating the dynamics of the level of pesticide residues in raw materials, the samples taken during the technological process and the finished good. Pesticide residues were quantified by using the gas-chromatographic method. In the skin of the seed produced according to the manufacturing process, the contents of the  $\alpha$ -HCH was under the limit of detection. In the seed and skin residues were found the highest levels of (op'+pp') DDT namely 0,0056 mg/kg. The boil at 60-70<sup>0</sup>C and the concentration process followed by pasteurization at 94-96<sup>0</sup>C resulted in increased levels of pesticide residues in the finished good. Concentrations obtained were below the maximum limit admitted by law.*

**Key words:** residues, organochlorine pesticides, tomatoes

**Rezumat.** *Scopul acestui studiu a fost monitorizarea reziduurilor de pesticide organoclorurate (DDT-ul și metaboliții săi, HCH-ul total și metaboliții săi) și al reziduurilor de pesticide organofosforice (etion, diazinon, paration metil) din tomatele materie primă pentru industrializare în cadrul SC Contec FOODS SRL Tecuci. Analizele efectuate au vizat evaluarea dinamicii nivelului reziduurilor de pesticide din materia primă, probele prelevate pe fluxul tehnologic și produsul finit. Reziduurile de pesticide au fost cuantificate prin metoda gaz-cromatografică. În pielița și semințele obținute după procesul de prelucrare, conținutul în  $\alpha$ -HCH a fost sub limita de detecției. În reziduu de sămânță și pieliță s-au găsit cele mai înalte niveluri de (op'+pp') DDT și anume 0,0056 mg/kg. Fierberea la 60-70<sup>0</sup>C precum și procesul de concentrare urmat de pasteurizare la 94-96<sup>0</sup>C au dus la creșterea nivelurilor de reziduuri de pesticide în produsul finit. Concentrațiile obținute au fost sub limitele maxime admise de legislația în vigoare.*

**Cuvinte cheie:** reziduuri, pesticide organoclorurate, tomate

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

<sup>2</sup> The National Sanitar Veterinary and Food Safety, Iași-branch, Romania

## INTRODUCTION

Pesticides are an important tool in crop management practices and are widely used throughout the world. Although pesticides are deliberately added to improve the conditions for growth of tomatoes intended for processing, the excessive use of such abuse chemical compounds likely to constitute a danger to human health due to toxic residue ingested by eating food (Hura et al., 2011).

Pesticides organochlorine (based on HCH hexachlorocyclohexane and DDT-pp-diclorfenil-trichloroethane) and the organophosphorus (methyl-, ethyl-parathion, malathion) have been replaced because of their high persistence and remanence in soils and crops, with other compounds - pyrethroids, which was considered for a time that would be less harmful to the environment and humans.

DDT is used as an insecticide for the control of insects in hygiene and agriculture. Commercial DDT is a mixture of several closely related compounds in which the balance is made up of dichloro-diphenyl dichloroethylene (DDE) and dichloro-diphenyl dichloroethane (DDD). DDE and DDD major metabolites are also and degradation in the environment.

Commercial DDT has been proven to be a mixture of 14 substances: DDT itself is 65-80%, op 'DDT 15-20% and DDD can be up to 14%.

Hexachlorocyclohexane (HCH) was marketed as a mixture of isomers, but mostly of  $\beta$ -isomer, and  $\gamma$ -HCH or lindane. HCH isomer has similar properties to other pesticides organochlorine, but is less polar and water-soluble (7 mg/l). Concentrates of HCH were used for controlling pests in agriculture.

Most of the organochlorine pesticides have high toxicity, because of this, in theory, they are not recommended for use.

Pesticides organophosphorus are more readily degradable than pesticides organochlorine, the presence of residues in tomatoes is largely accidental. Leading representatives of these groups are chemicals: parathion, malathion, ethion etc.

In terms of remanence, parathion and diazinon have the ability to persist longer into the ground than when it is applied directly on the tomatoes. On tomato and leaves, parathion remaining is between 7-21 days, depending on the meteorological factors and enzyme activity of plants (Rusu et al., 2005; Alloway and Ayres, 1997).

By industrial processing, the extent to which pesticides residues are removed depends on a variety of factors, such chemical properties of pesticides, nature of the product horticultural type of product processing stage and the length of time of contact of pesticides with horticultural products (Ma Jesús Chavarri, Antonio Herrera and Agustín Ariño, 2005).

The purpose was to assess the extent to which the various phases of the technological flow of tomato juice can influence both the upside and the decrease level of pesticides residues in the final product.

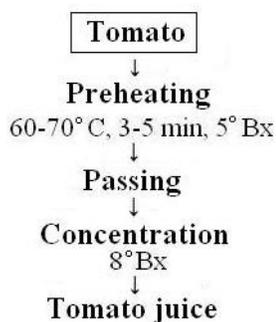
## MATERIAL AND METHOD

Biological material used for the analyses was the tomatoes harvested at

maturity, in Tulcea County, and for recovery within the SC Contec FOODS SRL Tecuci. Samples were collected in October 2011. Immediately after sampling, the samples were put in polyethylene bags sealed with aluminium clips and stored at -20°C and liquid samples in glass containers, hermetically sealed and clean, stored at 4°C until extraction for pesticides residues.

In the study were determined organochlorine pesticides residues (10 active substances) and organophosphorus (3 active substances) from raw material, continuing with samples taken from the technological flow and reaching the final at the finished product.

Defining stages of processing as the tipping point for sampling in the analysis of the dynamics of content of pesticides residues are shown in fig. 1.



**Fig. 1** - Stages of processing tomatoes for tomato juice

Determination of residues of pesticides has been carried out in accordance with the standards as follows: SR EN 12393-1, 2, 3: 2009-Food of plant origin. Multireziduu methods for the determination of pesticide residues by GC.

For the qualitative and quantitative determination of residues of POcl and POph study carried out within the same apparatus used as gas-chromatograph, Varian type 450, coupled with TSD detector, where they were injected automatically separated and purified samples after a preliminary processing of samples by extraction with organic solvents (acetonitrile, petroleum ether).

Following the results obtained, the correlations were calculated on the toxicity of pesticides on tomatoes, with their limits for admissibility laid down by the regulations of the European Commission. These limits are expressed in mg/kg, by Order No. 12 of January 23, 2006 are presented in table 1.

*Table 1*

**Pesticide residues in tomatoes and maximum level (mg/kg)**

<b>Pesticide</b>	<b>The maximum permitted level of pesticides (mg/kg)</b>
DDT (amount of pp'-DDT, op'-DDT, pp'-DDE, expressed as DDT)	0,05
HCH (alfa, gama, beta, delta)	0,01
Ethion	0,1
Diazinon	0,01
Methyl parathion	0,05

## RESULTS AND DISCUSSION

The results for the contents in residues of DDT (op'+pp') and major metabolites in samples of different tomatoes collected after processing operations are shown in figure 2.

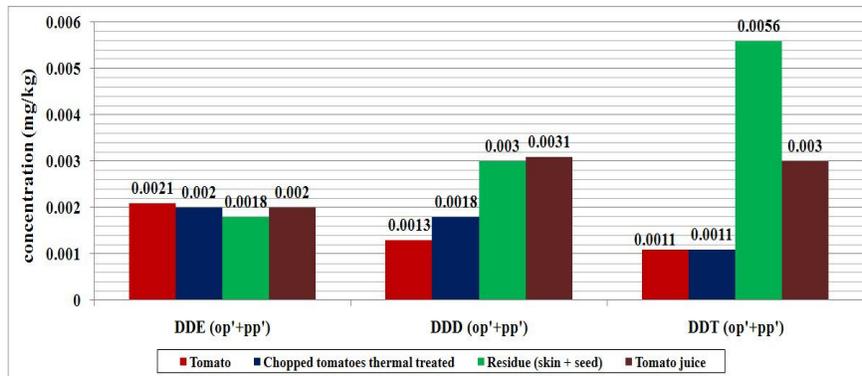


Fig. 2 - The effect of processing on the content of DDT and its metabolites, mg/kg

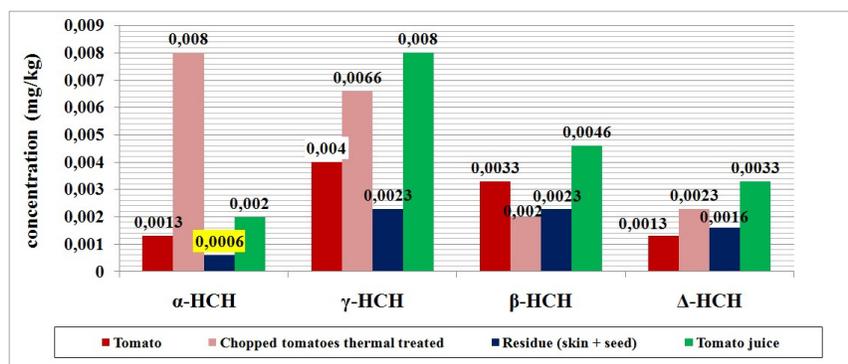
The level of residues of DDE (op'+pp') of tomatoes fell by 4.7% after washing and preheating at 60-70°C, the level remains constant and the juice of the tomatoes, finished product, due to its high stability to thermal processes (Abou-Arab, A. A. K., 1999).

Analysis on contents of DDD (op'+pp') of tomatoes highlight all samples of growth through their processing tomato with juicing. The level of residues after blanching increased by 38%, and between the tomatoes and the finished product has increased by approximately 2.5 times the original 0.0013 mg/kg.

Residues of DDT (op'+pp') of tomatoes and chop heat treated did not increase as a result of washing (2 washes and 2 showers with cold water) and chips, compared to the final product, where values have increased by 2.5 times, starting from a level of 0.0011 mg/kg. The highest content of DDT (op'+pp') are preserved in the seed produced cuticle, such as residues of processing tomatoes.

The levels of residues of tomato juice depend on the partitioning of their properties of peel/pulp and juice.

The effectiveness of the processing steps for decreasing concentrations of DDT and its metabolites also depends on their remanence in plant products. It is characterised by an extremely high persistence (after 17 years finding himself still 39% of the initial quantity), so that the amount of residue that can be removed by working decreases and residues tend to move into bloom or into deeper layers (often tomatoes pulp includes part of penetrating the skin, while retaining a substantial proportion of residues lipophile) (Ma Jesús Chavarri et al., 2005; Holland et al., 1994). This category of chemical contaminants has a reduced tendency to move from waxy layers.

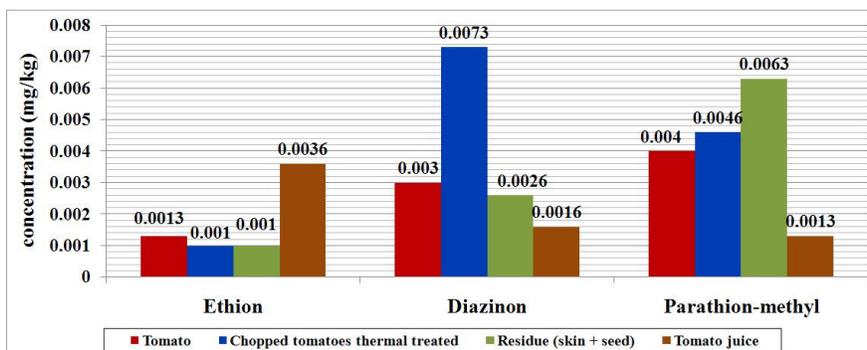


**Fig. 3** - The effect of processing on the levels of HCH isomers, mg/kg

The effect of processing on the HCH isomers in tomatoes is shown in fig. 3.

Concentration of  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ -HCH has not been removed by processing tomatoes, this leads to an increase in concentration in the finished product. Effect of washing and thermal treatments, led to the concentration of pesticides in the tomato juice. This could be due to the strong absorption of plant tissues and/or low water solubility in this category of appropriate pesticides.

The contents of the isomer  $\alpha$ -HCH, was below the limit of detection in the residue of hang and seed.



**Fig. 4** - The effect of processing on the content of diazinon, ethion, parathion-methyl, mg/kg

The level of reduction of concentrations of diazinon and parathion-methyl on the stages of processing tomatoes, was higher due to the low stability to heat treatment and properties of water soluble to the values recorded for concentrations of ethion (fig. 4).

Residue level for ethion not dropped by the working class of the finished product, although after washing and thermal treatment of chop registered a decrease in apparent with only 23%. The sequence of heat treatments on the raw juice has led to an increase in concentration level for ethion 2.7 times, starting from a level originally 0.0013 mg/kg in tomatoes.

Influence of washing over the tomatoes, followed by heat treatment of chop on residues of diazinon has increased 2.5 times from an initial level of 0.003 mg/kg of tomatoes, which subsequently decreased by 46% in tomato juice.

Analysis of content of tomatoes on residues of parathion-methyl, led to an increase in heat treated chop with 15%, and then decreased to 32% by removing the residue of seed and hang and focus the raw juice followed by concentrated juice pasteurisation for packaging.

## CONCLUSIONS

1. Influence of heat treatment processing through chop of 60-70°C, the phase of raw juice concentration at 8.5° Bx followed by pasteurization, resulted in increased concentrations of DDT and its metabolites and HCH's total, due to the high stability at high temperatures;

2. Because tomatoes are rich in vegetable waxes, pesticides are organochlorine and solvate in shell removal efficiency greatly decreased their (often tomatoes pulp including part of the reconstructed), contributing to the high content of the finished product;

3. Processing technological content in parathion-methyl and diazinon has been reduced, but did not place their total removal;

4. In all samples analysed, the levels of pesticides residues organochlorine and organophosphorus have been subject to the maximum extent permitted by applicable law.

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# STUDIES ON THE DYNAMICS OF HEAVY METALS CONTENT DURING THE PROCESS FLOW FOR OBTAINING TOMATO JUICE AT SC CONTEC FOODS SRL TECUCI

## STUDII ASUPRA DINAMICII CONȚINUTULUI ÎN METALE GRELE PE PARCURSUL FLUXULUI TEHNOLOGIC DE OBȚINERE A SUCULUI DE TOMATE LA SC CONTEC FOODS SRL TECUCI

ANDREI Corina<sup>1</sup>, ȚÂRCĂ Felicia<sup>2</sup>, BARCAN (BĂETU) Alina<sup>1</sup>, BĂETU M.M.<sup>1</sup>  
e-mail: corinandrei84@yahoo.com

**Abstract.** *The purpose of this study was to monitor the concentrations of Pb, Cd, Cu, Zn, Fe and Mn (essential elements) by physico-chemical determinations on raw material samples within the technological and the finished product to assess the dynamics the levels of metals. Analyses were performed by atomic absorption spectrophotometry with flame (SAAF), in the mineralized sample by dry with nitric acid. The results of this study showed that the average concentrations detected ranged from  $0.41 \pm 0.74$ ,  $0.01 \pm 0.09$ ,  $16.6 \pm 20.15$ ,  $19.15 \pm 25.07$ ,  $88.87 \pm 98.37$  and  $82.15 \pm 103.07$  mg/kg for Pb, Cd, Cu, Zn, Fe and Mn. The highest average levels of essential elements and/or potentially toxic samples were detected in seed and skin and tomato juice finished product. Processing of raw tomatoes has increased the level of these elements in the finished product without exceeding the maximum allowed by applicable law.*

**Key words:** heavy metals, tomatoes, tomato juice

**Rezumat.** *Scopul acestui studiu a fost monitorizarea concentrațiilor de Pb, Cd, Cu, Zn, Fe și Mn (elemente esențiale) prin determinări fizico-chimice asupra materiei prime, probelor prelevate pe fluxul tehnologic și produsului finit, în vederea evaluării dinamicii nivelului de metale. Analizele au fost efectuate prin spectrofotometrie de absorbție atomică prin flacără (SAAF), din proba mineralizată pe cale uscată cu acid azotic. Rezultatele acestui studiu au arătat că, concentrațiile medii detectate au variat între  $0,41 \pm 0,74$ ,  $0,01 \pm 0,09$ ,  $16,6 \pm 20,15$ ,  $19,15 \pm 25,07$ ,  $88,87 \pm 98,37$  și  $103,07 \pm 82,15$  mg/kg pentru Pb, Cd, Cu, Zn, Fe și Mn. Cele mai ridicate niveluri medii de elemente esențiale și/sau potențial toxice au fost detectate în probele de sămânță și pielită și în sucul de tomate produs finit. Procesul de prelucrare al tomatelor materie primă a dus la creșterea nivelului acestor elemente în produsul finit, fără a depăși însă nivelul maxim admis de legislația în vigoare.*

**Cuvinte cheie:** metale grele, tomate, suc de tomate

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

<sup>2</sup> The National Sanitar Veterinary and Food Safety, Iași-branch, Romania

## INTRODUCTION

Absorption and accumulation of heavy metals in vegetables and fruits is conditioned by the reaction of the soil, organic matter content, in particular by organic compounds, not so strong to the humification, the quantity and nature of the mineral colloids, soil moisture conditions and intensity of the activity of micro-organisms.

Organic matter has important role in the collapse of metals chelated by complex formation, from which they have varying degrees of access to plants. Essential heavy metals (Fe, Mn, Zn and Cu), are essential for growth and development bodies, being toxic in case of their accumulation in large concentrations. Other heavy metals (Cd and Pb) are toxic to plants, affects a large number of biochemical and physiological processes, such as nutrition, photosynthesis, breath, growth, development and yield per harvest.

However, you can add other sources of agricultural technologies, such as: irrigation with waste water, organic fertilizer management and mineral impurities of heavy metals, or the application of pesticides containing chemical elements in their structure (fungicides containing mercury, copper, arsenic, zinc etc) (Gergen et al., 2000).

Lead used in petroleum and additive enter into the composition of pesticides that have been banned; main anthropogenic sources of Cd are fertilizers (Cd is found in many products and is used as a fungicides), and zinc originates from the use of insecticides and fungicides based organic compounds of Zn, leading to contamination of tomatoes (Hussam, 2009).

Copper is a normal nutrient with a representation in soils of our country, but in smaller concentrations of Fe and Mn, close to or higher than that of Zn. Tomatoes contain copper, level 3-20 mg/kg of normal levels and s.u. in plant tissues are less than those of Fe and Mn (Rusu et al., 2005).

Processing, preservation and packaging, food can enrich toxic metals. Potentially toxic metals (Pb, Cd, Zn, Cu) chemical elements are very stable, not heat or chemically degrade, but depending on how they can link to migrate.

Stages of technological process of processing tomatoes which can be changed in composition in micro-nutrients (and heavy metals) are: washing, cleaning, shelling, hot moulding, pasteurization and sterilization. Also, washing vegetables and allow diffusion of ions in the apoplast (Andrei, 2011).

Heavy metals in general are not biodegradable, have long biological half life period and potential accumulation in different organs of the body that lead to undesirable side-effects (Mohamed and Ahmed, 2006).

## MATERIAL AND METHOD

Biological material used for the analyses was the tomatoes harvested at maturity, in Tulcea County, and for recovery within the SC Contec Foods Ltd Tecuci.

Samples were collected in October 2011. Immediately after sampling, the samples were put polyethylene bags and stored at -20°C, and the liquid samples in glass containers, hermetically sealed and clean storage at any time up to the roasting time.

Determination of heavy metal contents in tomato, chop treated, heat the residue of hang and seed and tomato juice, the finished product was carried out by atomic absorption spectrophotometry by flame (SAAF) of dry sample digested by ( $450^{\circ}\pm 10^{\circ}\text{C}$  calcination and dissolution in mineral acids). Calibration curves were made with concentration standards Merk 1000mg/kg, at different levels, depending on the concentration of metal in question. He has worked with the following wavelengths: Pb:283,3 nm, Cd:228,8 nm, Cu:327,4 nm, Zn:213,9 nm, Fe:372 nm, Mn:280,1 nm. Interpretation of the results was done in mg/kg.

For the determination of Pb, Cd, Cu, Zn, Fe and Mn in fresh and processed tomatoes applied standard SR EN 14082:2003-food. Determination of heavy metals by flame atomic absorption spectrometry (AAS) in roasting.

Defining stages of processing as a critical point of sampling in order to analyse the dynamics of content in metals are shown in fig. 1.

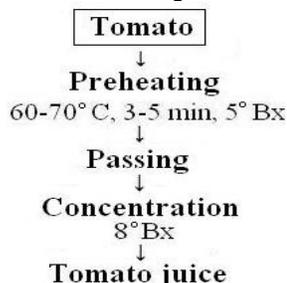


Fig. 1 - Stages of processing tomatoes for tomato juice

Following the results obtained, the correlations were calculated on the contents of elements in samples taken in the study with employment eligibility limits regulated in national legislation, in accordance with Order No. 975/1998 of the Romanian Ministry of Public Health.

## RESULTS AND DISCUSSION

Comparison of the content of Pb in tomato during processing, technological operations with the maximum permissible concentration for Pb, show this through processing solutions with 2.6%, tomato juice in the finished product (fig. 2). Pb level of tomatoes have increased by up to 10% after washing and preheating at 60-70°C. The contents of Pb in the cuticle and keep seeds obtained as a residue from the processing of tomatoes.

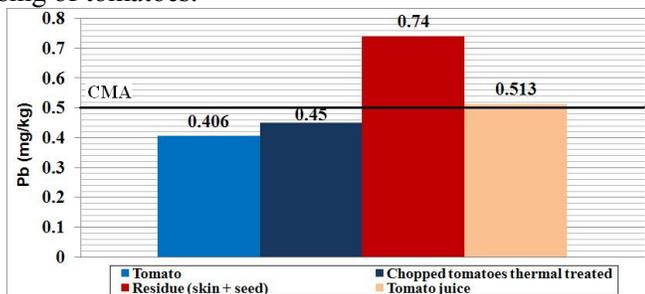
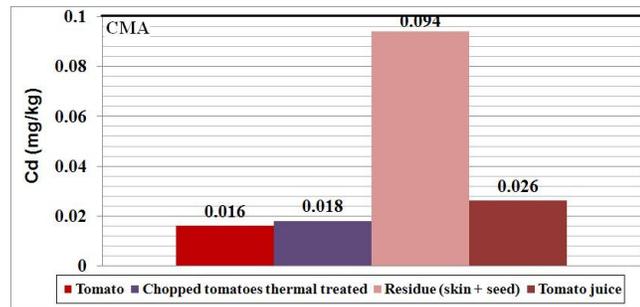


Fig. 2 - The influence of technological stages of processing tomatoes on average Pb content, compared with the maximum permissible concentration \*(CMA)

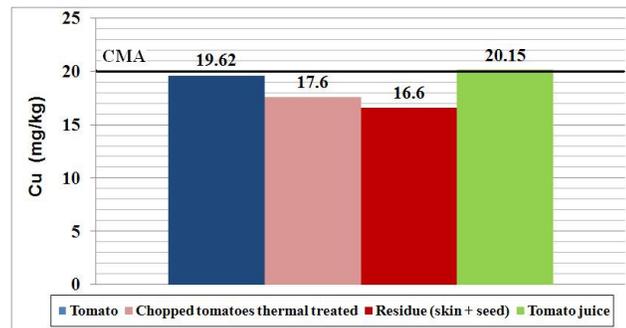
\*Maximum permissible concentration: 0.5 mg/kg of tomatoes

If the contents of the Cd were recorded under the maximum permitted concentration values for both raw tomatoes for industrialization took low values below 0.1 mg/kg (maximum permissible concentration for tomatoes), and tomato juice with CMA for this element is 0.2 mg/kg (fig. 3).



**Fig. 3** - The influence of technological stages of processing tomatoes on average Cd content, compared with the maximum permissible concentration \*(CMA)  
 \*Maximum permissible concentration of 0,1 mg/kg of tomatoes

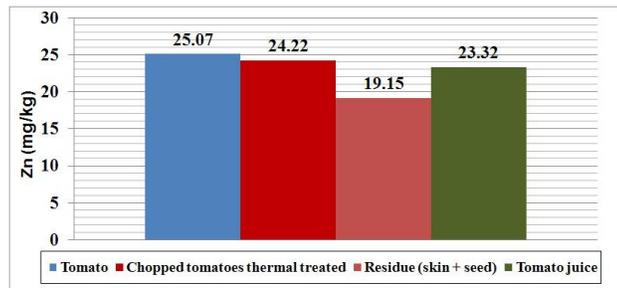
Effect of heat treatments on tomato, resulted in raising tomato juice Cd in, due to the strong absorption of plant tissues and/or low solubility in water on this category of elements. Remarkable is the fact that the contents of the Cd, and to be kept high and the seed produced cuticle as residue from the processing of tomatoes. Comparing the values obtained with the legislation in force, it is observed that tomato juice does not raise problems in relation to quality for the consumer.



**Fig. 4** - The influence of technological stages of processing tomatoes on average Cu content, compared with the maximum permissible concentration \*(CMA)  
 \*Maximum permissible concentration: 20 mg/kg of tomatoes

Analysis on strength with the tomato was employed less than 20 mg/kg, the juice of tomato product had value beyond the CMA of the legislation in force, recording 20.15 mg/kg (fig. 4). The contents of the lowest for this element is found in the residue of skin and seed. Copper is a metal that can be potentially

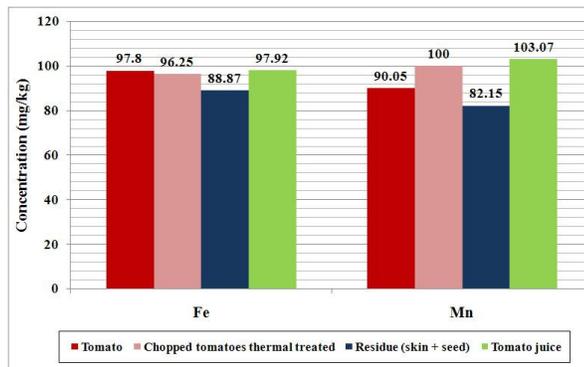
toxic, used as plant-protection products on the treatment of cuprice tomatoes (manna), and very stable, not degrade.



**Fig. 5** - The influence of technological stages of processing tomatoes on average Zn content

Element analysis, zinc, could be considered both heavy metal and nutrient substance, depending on the physiological roles in plants and contents.

For this metal, has not been able to establish certain values for the maximum permissible limits (fig. 5). However, you may notice a decrease in Zn content during technological flow, which culminates with 23.32 mg/kg, registered in the tomato juice finished product.



**Fig. 5** - The influence of technological stages of processing tomatoes on average Fe and Mn content

Tomatoes and even their component tissues have a characteristic mineral substances (fig. 6). Soil, climate and culture technology determines them significant variations, within limits.

Iron is considered to be the element that makes switching between micro- and macroelements. Fe content of tomatoes (reckoned from the dry substance) is 100 mg/kg.

Tomatoes respond well to applying fertilizers with magnesium. For this element, it was not an average for tomatoes.

On the stages of processing, Fe and Mn content has not been altered significantly in tomato juice (Beceanu, 2010; Davidescu and Davidescu, 1992).

## CONCLUSIONS

1. Analysis of Pb and Cd in the tomatoes at all stages of technological highlights an increase in the values of these elements during processing of tomatoes. During processing, the concentration of Pb only exceeded permissible maximum mass by 2.6%. The juice of the tomatoes result had values of cadmium in the value of 0.03 mg/kg, where CMA for this metal is 0.1 mg/kg;

2. The high content of Pb and Cd was retained in the skin and seed obtained as residue from processing tomatoes;

3. Tomato juice has been obtained with less than CMA values for Cu, values that do not adversely affect quality of tomato juice consumption;

4. During the stages of study in technological content in Zn recorded a decrease of the content on this item;

5. Influence of processing tomatoes did not change significantly in the Fe and Mn content.

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# INFLUENCE OF TECHNOLOGICAL PROCESS CONTENT OF ASCORBIC ACID ON RED BEETROOT SALAD

## INFLUENȚA PROCESULUI TEHNOLOGIC ASUPRA CONȚINUTULUI ÎN ACID ASCORBIC LA SALATA DE SFECLĂ ROȘIE

**BARCAN (BĂȚETU) Alina<sup>1</sup>, PATRAȘ Antoanela<sup>1</sup>, ANGHEL Roxana<sup>1</sup>, ANDREI Corina<sup>1</sup>, BĂȚETU M.M.<sup>1</sup>, FILIMON V.R.<sup>1</sup>**  
e-mail: alina\_brcn@yahoo.fr

**Abstract.** Vitamin C content of horticultural products may be influenced by various factors, such as genetic differences, climatic conditions and agricultural practices, processes of maturation and harvesting techniques, as well as the type of post-harvest handling. During processing, depending on the operations flow technology, the content of vitamin C decreases considerably, reaching sometimes insignificant quantities in the finished product. The purpose of this study is to monitor the dynamics of ascorbic acid during technological flow of red beetroot salad by acidification artificial. Analyses were performed in the following samples: beetroot-raw, beetroot taken on the technological and beetroot salad. There were determined simultaneously two other parameters that influence the content in ascorbic acid: the pH and ascorbate oxidase content.

**Key words:** ascorbic acid, ascorbatoxidase, beetroot, technological process

**Rezumat.** Conținutul de vitamina C al produselor horticole poate fi influențat de diverși factori, precum: diferențele genotipice, condițiile climatice și practicile agricole, procedeele de maturare și tehnicile de recoltare, precum și de tipul de manipulare după recoltare. În timpul prelucrării, în funcție de operațiunile fluxului tehnologic, conținutul de vitamina C scade considerabil, ajungând uneori în cantități infime în produsul finit. Scopul acestui studiu este de a monitoriza dinamica acidului ascorbic pe parcursul fluxului tehnologic de obținere a salatei de sfeclă roșie, prin acidifiere artificială. Analizele s-au efectuat la următoarele probe: sfeclă roșie – materie primă, sfeclă roșie prelevată de pe fluxul tehnologic cât și salată de sfeclă roșie. Au fost determinați de asemenea și alți doi parametri care influențează conținutul în acid ascorbic: pH-ul și conținutul în ascorbat oxidază.

**Cuvinte cheie:** acid ascorbic, ascorbatoxidază, sfeclă roșie, proces tehnologic

### INTRODUCTION

Most products change their organoleptic properties and chemical composition, if they are not kept in optimal conditions after harvesting or are not properly preserved.

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<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

Various methods of preservation are ways to intervene in order to maintain unchanged the organoleptic properties and nutritional value of a product as long as possible. (Cuciureanu, 2002)

Knowledge of physical, chemical and biological properties occurring in a food product, since obtaining it, is necessary to apply the most appropriate methods of food storage and preservation. (Cuciureanu, 2010)

Conservation through artificial acidification is based on principle of acidoanabiosei and in practice, this type of storage is performed using vinegar.

The conservation agent action is dependent by:

- the liquid coating concentration in which are to be preserved the beetroots: acetic acid solution, whose concentration varies between 0,6 and 4% have a bacteriostatic action, and over 4% becomes bactericidal action; (Beceanu, 2009)

- species of microorganisms: bacteria are less resistant in acid medium. In concentrations of up to 4%, the acetic acid inhibits the growth of saprophytic bacteria; between 4 and 6% the spores forms are destroyed, and over 6% the spores are destroyed. Molds and yeasts have a greater resistance to acid;

- the pH of the food to which has been added the acetic acid. Acetic acid dissociation having a higher degree than lactic acid, it follows that the concentration of hydrogen will be higher and a lower pH.

- the concentration of NaCl and sugar – these two substances are raising the preservative effect of acetic acid. (Banu, 2008)

Industrial preparation of pasteurized or sterilized canning, carried out in the absence of air, it keeps a high content of ascorbic acid. Blanching vegetables in water decrease levels of vitamin C with 10÷50%, and blanching with water vapour, the losses are only 10 to 30%. These losses are due to vitamin C oxidation and dissolution in water. (Cuciureanu, 2010)

## **MATERIAL AND METHOD**

The analyzed material was collected from the S.C. Contec Foods S.R.L. Tecuci. Samples were analyzed in the raw material (the first stage of technology-reception), a second set of samples has been collected by boiling the beetroots, third set of samples has been collected at the end of the technological process. Also it was examined and the beetroot salad after 3 months of storage at a temperature of 20° C and relative humidity of 75%. The samples have been shipped in vacuum polyethylene bags at low temperature, and then stored in a refrigerator at 2 to 4° C until analysis.

Technological process of obtaining beetroot salad includes the following phases: reception, cleaning, sorting, splitting, cleaning, cooking, preparation of the container (conservation vessels), preparation of vinegar solution, placing slices of beetroots in jars, adding vinegar solution, pasteurization, sealing, wrapping, storage and delivery of the finished product.

In the elaboration of this study the following methods were used:

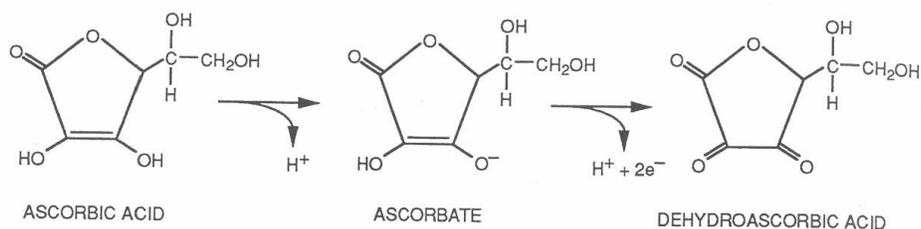
- to calculate the content of ascorbic acid has been used the titrimetric method in accordance with STAS 5950;
- the pH has been set using the pH meter according to SR EN 1132;
- for the determination of ascorbatoxidase has been used titrimetric method with potassium iodate;
- the salt content has been determined using Mohr's method.

## RESULTS AND DISCUSSIONS

The results of the tests, carried out on the product under study, are shown in the following figures.

Ascorbatoxidase is an important enzyme in the class of oxidoreductase with copper-protein structure, is also called L-ascorbate oxygen oxidoreductase (EC. 1.10.3.3).

Ascorbatoxidaza catalyzes the oxidation reaction of L-ascorbic acid into dehydroascorbic acid, which (under the action of a reductase whose specific coin is glutationul) may be reversible reduced to ascorbic acid (figure 1).



**Fig.1** - Ascorbic acid and its oxidation in ascorbate and dehydroascorbic acid

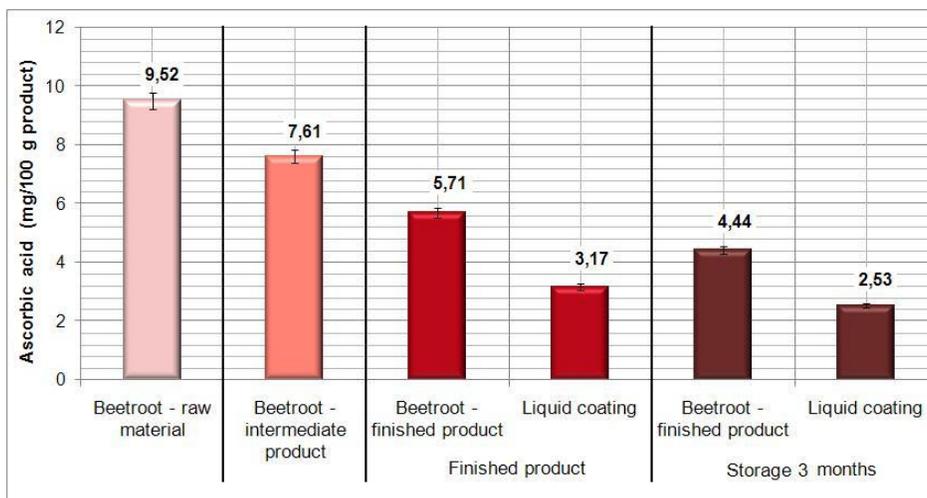
In animal organisms, in which the enzyme is missing, the oxidation of L-ascorbic acid is made to the system citocromic.

The ascorbic acid act as biological transporter of hydrogen through redox processes.

The ascorbic acid oxidises especially to alkaline pH, and the neutral should be the ascorbatoxidase intervention.

In figure 2 is the variation in vitamin C content during processing of beetroots.

In within the method was determined the content of interfering substances, so the values obtained refer only to the total ascorbic acid content. The raw material from the technological flow has a ascorbic acid content of 9,52 mg/100g product. Ascorbic acid content, during processing, is influenced by technological stages, the processing method, preserving temperature and storage conditions before dispatch.



**Fig. 2** - Ascorbic acid content during the technological flow

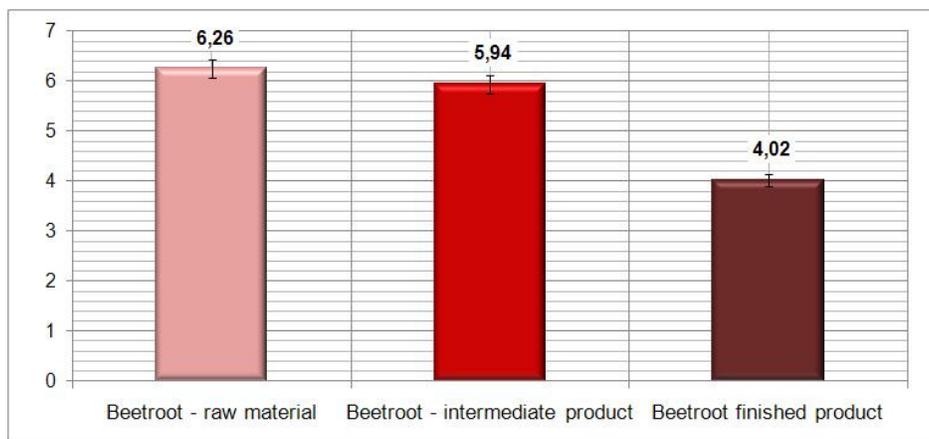
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As a result of the determinations carried out it was concluded that until boiling technological stage end, there have been losses in ascorbic acid of 1,91mg/100 g product, and at the end of the technological process the content of ascorbic acid were 5,71mg/100 g product. After a storage period of 3 months at 20° C and 75% humidity, ascorbic acid content decreased to 4,44 mg/100 g product in the solid part and 2,53 mg/100 ml in the coverage liquid. Water that has been boiled the beetroot, is reused as liquid coatings. By adding salt and vinegar, its reduce the losses of ascorbic acid.

A factor, which affects to a large extent the content of ascorbic acid, is pH of the raw material and the environment in which it is preserved.

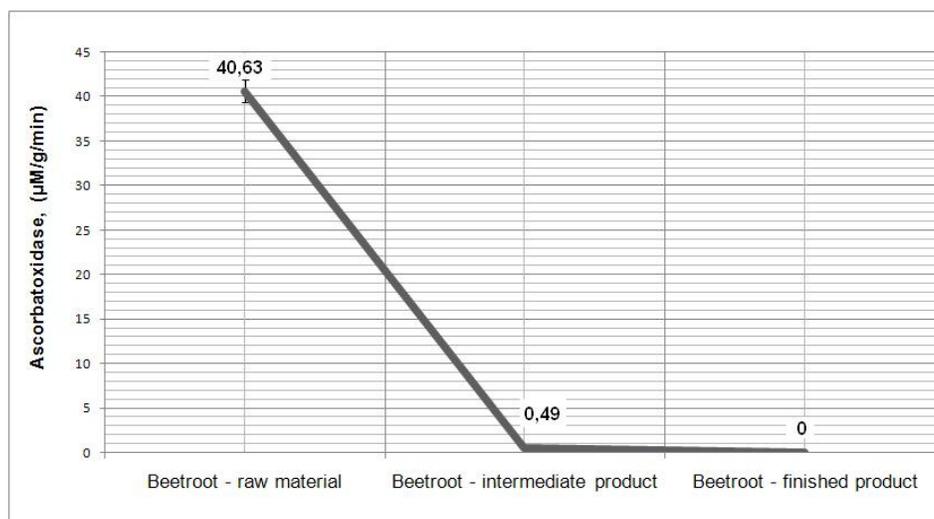
In figure 3 is the dynamics of pH depending on the stage of technological flow.

Red beetroot as raw material, has a pH value of 6,26. During processing the ph value declines, so after boiling the beetroot followed by cooling, vacuum packing and storage in the refrigerator until analysis, pH reaches 5,94. From samples taken at the end of the technological process has been obtained value is 4,02. This decrease is due to the vinegar added, thereby ensuring the conservation.



**Fig. 3 – The variation of pH value**

In figure 4 is another parameter that affects the content of ascorbic acid, which is ascorbatoxidase.

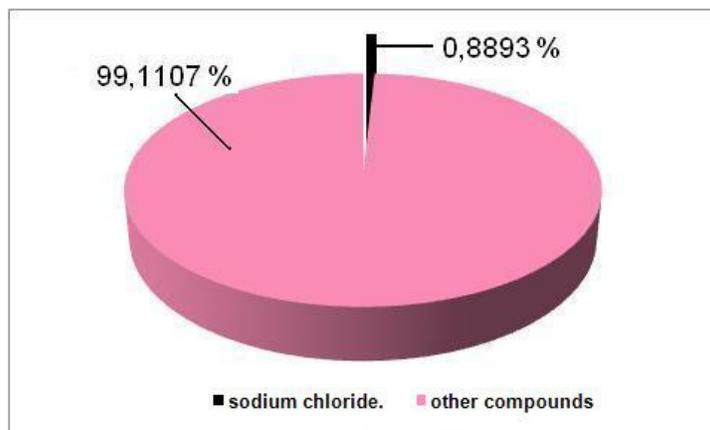


**Fig. 4 - The graphic representation of ascorbatoxidases dynamics**

During the process flow is highlighted the destruction of this enzyme due to heat treatment. So at the raw materials it was determined that the value of ascorbatoxidase is 40,63 µM/g/min, greatly decreases after blanching operation of beetroots and at the end of the technological process this is totally destroyed.

The amount of sodium chloride added to preserve the beetroot salad has a great influence on the content of ascorbic acid. The more sodium chloride is higher, the lower is ascorbic acid content. From the analyses carried out it was

revealed that beetroot salad has a content 0,8893% sodium chloride (figure 5). At this concentration, along with artificial acidification shall ensure the preservation of the finished product and gives pleasant taste.



**Fig. 5** - Sodium chloride content in red beetroot salad, (%)

## CONCLUSIONS

1. In the food industry a decisive factor for the retention of nutrients is the nature of the technological process; as it requires high temperatures and long processing time, so more the content in nutrients is diminished.

2. Ascorbic acid content was reduced during processing at the rate of approximately 40%.

3. The ascorbatoxidase is totally destroyed by heat treatment.

4. The pH value of beetroots at the beginning of the technological flow is near that of neutral, but during the process its decreases due to the vinegar added, thus ensuring the preservation of the product.

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# CHANGES OF THE ASCORBIC ACID CONTENT IN CABBAGE AS RESULT OF PROCESSING

## MODIFICAREA CONȚINUTULUI ÎN ACID ASCORBIC LA VARZĂ CA URMARE A PROCESĂRII

**BARCAN (BĂETU) Alina<sup>1</sup>, PATRAȘ Antoanela<sup>1</sup>, ANGHEL Roxana<sup>1</sup>,  
ANDREI Corina<sup>1</sup>, ARION Cristina<sup>1</sup>, BĂETU M.M.<sup>1</sup>**  
e-mail: alina\_brcn@yahoo.fr

**Abstract.** Ascorbic acid, an antioxidant important for human diet, found in many horticultural products, its contents depending on interaction with other chemical compounds present, correlated with maturation period and conditions of storage and processing. Determination of vitamin C was performed on one variety of cabbage, cabbage - raw, cabbage samples taken from the technological process and the finished product. Vitamin C content was determined by reflectometry method using Reflectoquant meter. Were measured and other parameters such as pH, acidity, salt content. Processing involves followed by lactofermentation process, knowing the literature that it reduces the ascorbic acid content, this is confirmed by the results. Following analyzes showed that ascorbic acid was decreased from 47,61 mg/100 g raw material to 22,53 mg/100g finished product.

**Key words:** ascorbic acid, ascorbatoxidase, lactofermentation, cabbage

**Rezumat.** Acidul ascorbic, un antioxidant important pentru alimentația omului, se găsește în numeroase produse horticole, conținutul său depinzând de interacțiunea cu ceilalți compuși chimici prezenți, corelat cu perioada și condițiile de maturare, de depozitare și de prelucrare. Determinarea vitaminei C a fost efectuată pe un singur soi de varză, varza – materie prima, probe de varză prelevată de pe fluxul tehnologic cât și la produsul finit. Conținutul în vitamina C a fost determinat prin metoda reflectometrică, folosind aparatul de măsură Reflectoquant. Au fost determinați și alți parametri cum ar fi: pH-ul, aciditatea, conținutul în sare. Procesarea urmărită implică un proces de lactofermentare, cunoscându-se din literatura de specialitate că acesta reduce conținutul în acid ascorbic, acest fapt este confirmat și de rezultatele obținute. În urma analizelor efectuate s-a evidențiat ca acidul ascorbic a scăzut de la 47,61 mg/100 g materie primă la 22,53 mg/100g produs finit.

**Cuvinte cheie:** acid ascorbic, ascorbatoxidază, lactofermentare, varză

### INTRODUCTION

L-ascorbic acid occurs in fruits and many vegetables. In plants, L-ascorbic acid is essential for photosynthetic activity during the detoxification of superoxide and hydrogen peroxide in chloroplasts, in the absence of catalase. L-ascorbic acid is also involved in the regeneration of  $\alpha$ -tocopherol.

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<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

L-ascorbic acid is an anti-darkening substance in food, because of its antioxidation properties (Cioroi, 2007).

Vitamin C plays a major role in the manufacture and defense of our connective tissue, the elaborate matrix that holds the body together. It serves as a primary ingredient of collagen, a glue-like substance that binds cells together to form tissues (Gaby and Singh, 1991).

Vitamin C helps the immune system to fight against foreign invaders and tumour cells. Vitamin C also supports the cardiovascular system by facilitating the metabolism of fats and protecting tissues from free radical damages, and it assists the nervous system by converting certain amino acids into neurotransmitters (Schectman, 1991).

As an antioxidant, Vitamin C's primary role is to neutralize free radicals. Since ascorbic acid is water soluble, it can work both inside and outside the cells to control free radical damages (Cioroi, 2007).

Lactic fermentation is an aerobic process that fermentable glucides are metabolized by the action of microorganisms enzyme equipment in lactic acid, as the main product, and secondary products, such as diacetyl: acetoin, acetic acid, ethanol and CO<sub>2</sub> (Banu, 2008).

NaCl solution creates an osmotic pressure difference. Some of the glucides existing in the cabbage (3 to 6%) pass in the salty liquid, forming a favorable environment to start the lactic fermentation (Beceanu, 2010).

Lactic fermentation has three phases: heterofermentative phase (turbulent); homofermentative phase (slow) and the final phase (without training the CO<sub>2</sub>).

The first phase is characterized by the presence of heterofermentative bacteria (*Leuconostoc mesenteroides*, *Bacterium coli*), which convert glucides into lactic acid, acetic acid, ethanol, and mannitol, with obvious CO<sub>2</sub> release, metabolizing a part of proteins. The titratable acidity increase to 0,7-1% (expressed as lactic acid) forming esters that prints the specific flavor of pickled. The first phase is called turbulent, sparkling, preliminary and lasts 4-6 days, after which heterofermentative bacteria ceases its activity, being inhibited by increasing pH and and its catabolic products (acids, alcohols). The tripping Optimal temperature is 15-20° C, below 15° C the process starts more difficult (but the pickles shall remain strong), over 30° C the fermentation process is too short and causing the phenomenon of autolyzer (softening).

Phase two (proper fermentation) is provided only by the homofermentative bacteria (*Lactobacillus plantarum*, *L. cucumeris*), which converts the remaining glucides and the mannitol into lactic acid, with a low CO<sub>2</sub> emission. The acidity increases up to 1,5-2%, and the pH decreases ultimately to 4,1-4,2, destroying the bacteria active by this time. The phase is also called primary or extended and lasts 3 to 4 weeks. Typically require lower temperatures and ventilation (decanting). With the second phase may be considered the pickling finished.

The third phase (alteration) is the result of bacteria (*Lactobacillus brevis* and *L. pentoaceticus*), which also may raise the acidity up to 2,5%. In the end can be observed the formation of pellicular yeast - "flower" (*Oidium lactis*), which gradually consumes the lactic acid content and causes acidity decrease, gradually reducing the conservability. At temperatures of 5-10° C the process is slowed (Beceanu, 2008).

## MATERIAL AND METHOD

The analyzed material was collected from the S.C. Contec Foods S.R.L. Tecuci. In this study were determined the ascorbic acid content, the ascorbatoxidase, the pH and salt content. Samples were analyzed in the raw material (the first stage of technology-reception), during fermentation process and from the finished product. The samples have been shipped in vacuum polyethylene bags at low temperature, and then stored in a refrigerator at 2 to 4°C until analysis.

Technological process of pickled cabbage includes the following phases: reception, sorting, cleaning, calibration, washing, cutting, preparation of fermentation vessels), preparation of brine fermentation vessels loading, brine adding, closure of fermentation vessels, fermentation, decanting, the control and assessment of fermentation, conditioning, storage and delivery of the finished product.

In the elaboration of this study the following methods were used:

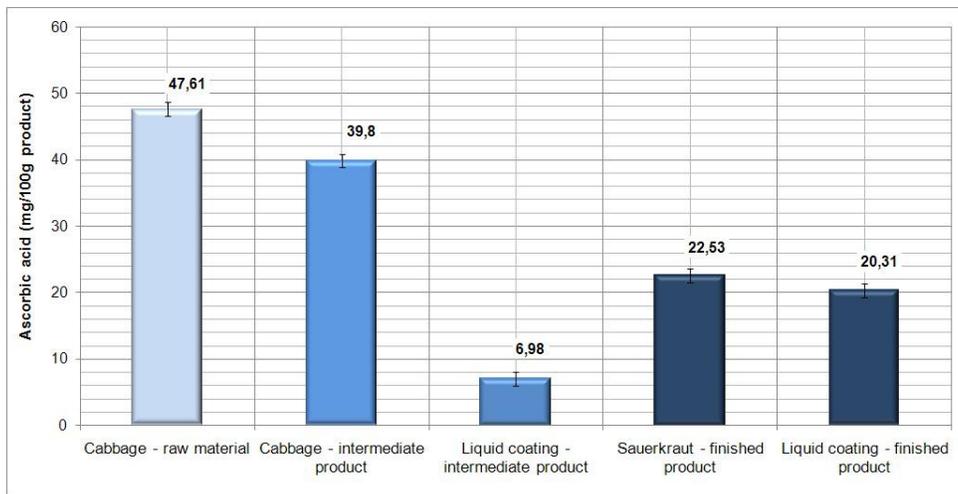
- to calculate the content of ascorbic acid has been used the titrimetric method in accordance with STAS 5950;
- the pH has been set using the pH meter according to SR EN 1132;
- for the determination of ascorbatoxidase has been used titrimetric method with potassium iodate;
- the salt content has been determined using Mohr's method.

## RESULTS AND DISCUSSIONS

The nutritional value products consevated by lactofermentation and hiperchlorunation its lower, because the strongly saline solutions used dissolve the vitamins, the aminoacids and the mineral salts. Applied desalting process contribute to a reduction content of minerals salts, water-soluble vitamins and other water-soluble components. As part of this process takes place also changing the food organic properties: changing the color and consistency.

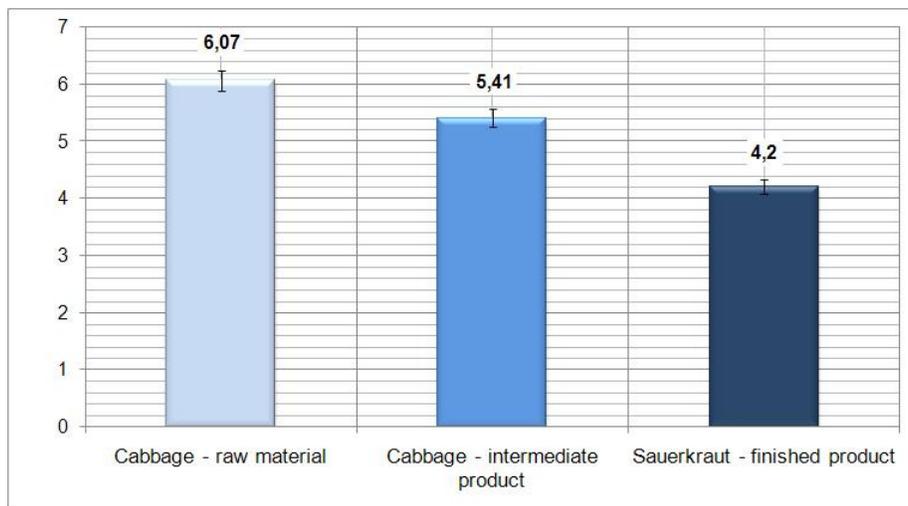
In figure 1 is represented the ascorbic acid dynamics. Ascorbic acid content is influenced by the process of fermentation and salt content.

The content of ascorbic acid in cabbage, raw material, is 47,61 mg/100 g product. During the lactofermentation process is recorded a decrease of vitamin C content, which is due to its oxidation and dilution in liquid fermentation. So after three weeks since the introduction of cabbage in fermentation tanks, the ascorbic acid content dropped to 39,8 mg/100 g product, and in the liquid fermentation the ascorbic acid is 6,98 mg/100 g. At the end of the technological process, the content of ascorbic acid for pickled cabbage reach 22,53 mg/100 g, and in the covering liquid is 20,31 mg/100 g (fig. 1).



**Fig. 1** - Ascorbic acid content during the technological flow

In figure 2, is the development of lactic acid formation in the flow path. According to the literature, at a pH between 4,1-4,2, it is considered completed the obtaining of pickled cabbage.

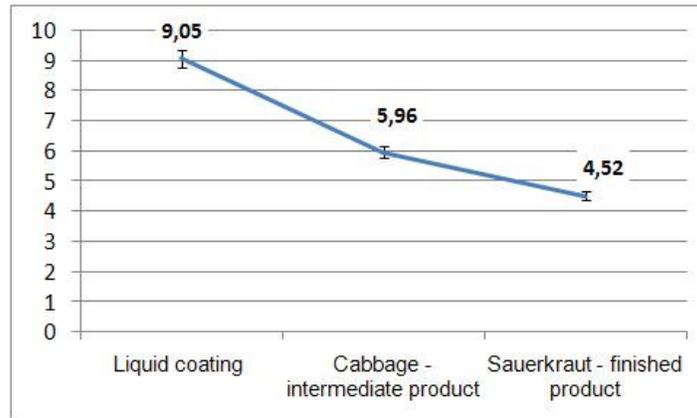


**Fig. 2** – The variation of pH value

At the raw material is recorded a pH of 6,07, and during lactic fermentation, its decreases to a value of 5,41 and to the end of the process it reaches at 4,2.

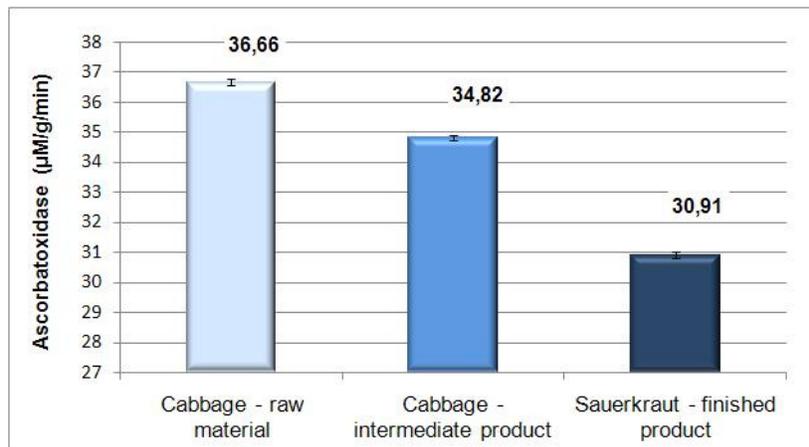
From the chart above, we can see that after determining the pH of the finished product, its value is within the allowed limits.

High concentrations of NaCl increases osmotic pressure and changes in nutrient balance. In this case stops the growth of microorganisms through microbial cell dehydration and metabolic processes disorders.



**Fig. 3** – The graphic representation of NaCl

As can be seen in figure 3, the initial solution has a concentration of 9,05% sodium chloride. For intermediate product, was obtained a value of 5,96% sodium chloride and 4,52% for the finished product.



**Fig. 4** - The graphic representation of ascorbatoxidases dynamics

The ascorbatoxidase activity is present and registered a decrease during the technological flow. At the raw material was determined a activity of 36,66µM/g/min and until to achieve pickled cabbage, the enzyme diminuation is almost insignificant (30,91µM/g/min for the pickled cabbage).

## CONCLUSIONS

1. By processing the cabbage as pickled cabbage, unlike other technological processes, the ascorbic acid content is kept in excess and it can be found in product and liquid coatings.
2. Through lactic acid fermentation, the medium becomes due to the formation of lactic acid thus ensuring conservability to the product
3. The ascorbatoxidase activity is reduced during the process flow and its can be found also in the finished product.

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# STORAGE INFLUENCE ON THE ANTIOXIDANT ACTIVITY OF DIFFERENT PLUM CULTIVARS

## INFLUENȚA PĂSTRĂRII ASUPRA ACTIVITĂȚII ANTIOXIDANTE A DIFERITE SOIURI DE PRUNE

**MIHALACHE ARION Cristina<sup>1</sup>, FILIMON V.R.<sup>1</sup>, BARCAN BĂETU Alina<sup>1</sup>**

e-mail: cristina\_mihalache82@yahoo.com

**Abstract.** *The antioxidant properties of different plum cultivars during storage were studied. Total phenolics and total anthocyanins content were also determined. Total phenolics ranged from 60.54 mg/100g GAE (BN68) to 364.21 mg/100g GAE (Record) in the case of fresh samples and from 128.67 mg/100g GAE (BN68) to 563.88 (Blue free) in the case of samples kept at 4°C during 10 days. The antioxidant activity of the samples was evaluated through several biochemical assays: DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging activity, ORAC (oxygen radical absorbance capacity). The plum cultivars with high antioxidant potential are Carpatin, Stanley, Blue free and Joris plum. There were obtained good correlation among the antioxidant activities measured by ORAC and DPPH, suggesting that these methods have similar predictive capacity for antioxidant activities of plum samples. Antioxidant activity varied greatly among the plum cultivars used in this study and during the storage.*

**Keywords:** plum antioxidant activity, phenolics, DPPH.

**Rezumat.** *In această lucrare au fost determinate proprietățile antioxidante ale diferite soiuri de prune în timpul păstrării la 4°C timp de 10 zile. Conținutul de compuși fenolici totali și conținutul de antociani a fost de asemenea determinat. Conținutul de compuși fenolici totali a variat de la 60.54 mg/100g GAE (BN68) la 364.21 mg/100g GAE (Record) în cazul prunelor proaspete și de la 128.67 mg/100g GAE (BN68) la 563.88 (Blue free) în cazul prunelor păstrate la 4°C timp de 10 zile. Activitatea antioxidantă a probelor de prune a fost evaluată cu ajutorul următoarelor metode: DPPH (radical liber 1,1 difenil - 2- picrilhidrazil) și ORAC (capacitatea de absorbție a radicalilor de oxigen). Printre soiurile de prune cu un potențial antioxidant ridicat s-au numărat: Carpatin, Stanley, Blue free and Joris plum. S-au obținut corelații bune între activitatea antioxidantă determinată cu DPPH și ORAC, fapt care sugerează că cele două metode folosite au o capacitate de predicție similară în cazul activității antioxidante a prunelor. S-a înregistrat o mare variabilitate a soiurilor studiate în ceea ce privește activitatea antioxidantă pe perioada păstrării.*

**Cuvinte cheie:** activitatea antioxidantă a prunelor, fenoli, DPPH.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

## INTRODUCTION

Fruit have long been promoted for their health benefits in preventing various cancers and age-related diseases (Prior and Cao, 2000; Wargovich, 2000). In the recent years antioxidant activity and the content of total phenolic compounds of several plum cultivars have been investigated in order to suggest plum varieties rich in antioxidants, which may possibly exert beneficial effects on human health. (Janja et. al., 2011)

Plums demonstrated very good scavenger activity against oxygen-derived free radicals such as hydroxyl and peroxy radicals (Murcia et al., 2001). Plums contain copious amounts of natural phenolic phytochemicals, such as flavonoids and phenolic acids, which may function as effective natural antioxidants in our daily diet. Wang, Cao, and Prior (1996) demonstrated that plums had 4.4 times higher total antioxidant capacities than apples, the latter being one of the most commonly consumed fruits in our diet.

Plums are an important common stone fruit in Romania. No literature on the changes occurring in the bioactive compounds during storage of plum is available. The main objective of our study it was to investigate the antioxidant potential of different plum cultivars during storage. The changes of bioactive compounds like phenols and anthocyanins were also evaluated.

## MATERIAL AND METHOD

Twelve plum cultivars (Carpatin, Silvia, BN7 237-7, Tuleu gras, Superb, Dâmbovița, D'agen, Stanley, Record, Blue free, Joris plum, BN68) were picked at commercial maturity from Research Station Miroslava, Iasi. The samples were split in two series after they were washed and after stone removal, first series was used for the determination of the antiradical potential and phenolic and anthocyanins content, the second series was kept at 4 °C during 10 days.

For the extract, 1 g of the plum was grounded with 10 mL of extraction solvent: acetone (70%), water (28%), acetic acid (2%) (Counet, 2003). The mixture was shaken for 1 h at 4 °C and centrifuged at 17000g for 15 min. The supernatant was removed, and the pellet was extracted again with 10 mL of the same solvent, incubated for 15 min, and centrifuged using the same procedure. The extract obtained was kept at -30°C until analyses. Each sample was independently extracted in triplicate.

Total phenolic contents were determined according to the Folin–Ciocalteu method (Caboni, 1997). Appropriately diluted extracts (3.6 mL) were mixed with 0.2 mL of Folin–Ciocalteu reagent, and 3 min later, 0.8 mL of sodium carbonate (20% w/v) was added. The mixture was heated at 30 °C for 1 hour. After cooling, the absorbance at 750 nm was measured. Gallic acid (Sigma) was used as standard, and results were expressed as milligrams of Gallic acid equivalents (GAE) per 100 g of sample. Analyses were performed in duplicate on each sample.

Antioxidant capacity was determined by scavenging of the radical 2,2-diphenyl-1-picrylhydrazyl (DPPH) as described by Tadolini et al. (2000). Trolox was used as a standard and methanol as a blank. The absorbance at 517 nm using an Uvikon 931 spectrophotometer (BIOTEK Instruments) of samples, standards, and blanks was determined after 5 min. The results were expressed as micromolar Trolox equivalents (TE) per 100 g of sample. Analyses were performed in duplicate.

ORAC assays were carried out on a Victor 3 (PerkinElmer) at 37°C. Procedures were based on the method of Wu, Gu, Prior, and McKay (2004). Procedures were based on the method of Wu et al. (2004). Briefly, AAPH was used as peroxy radical generator, Trolox as standard, and fluorescein as fluorescent probe. Fluorescence filters were used for an excitation wavelength of 485 nm and an emission wavelength of 520 nm. 25 of diluted sample, blank, or Trolox calibration solutions were mixed with 150  $\mu\text{L}$  of 4  $\mu\text{M}$  fluorescein and incubated for 15 min at 37°C before injection of 25  $\mu\text{L}$  of AAPH solution. All samples were analyzed in duplicate at three different dilutions. The final ORAC values were calculated using the net area under the decay curves and were expressed as micromolar Trolox equivalents (TE) per 100 g of sample.

Anthocyanin quantification was performed by the pH-differential method (Guisti, et al., 2001). The extract was diluted in a pH 1.0 solution (0.1 M HCl, 25 mM KCl) and in a pH 4.5 solution (0.4 M  $\text{CH}_3\text{COONa}$ ). The absorbance of the mixtures was then measured at 534 and 700 nm against distilled water. The value  $(\text{Abs}_{535} - \text{Abs}_{700})_{\text{pH}1.0} - (\text{Abs}_{535} - \text{Abs}_{700})_{\text{pH}4.5}$  corresponds to the absorbance due to the anthocyanins. Results were expressed as milligrams of cyanidin 3-glucoside equivalents per 100 g of sample.

Descriptive statistical analysis was performed using Microsoft Excel. Results were expressed as mean values  $\pm$  standard error. Differences was considered statistically significant at the level of  $p < 0.05$ .

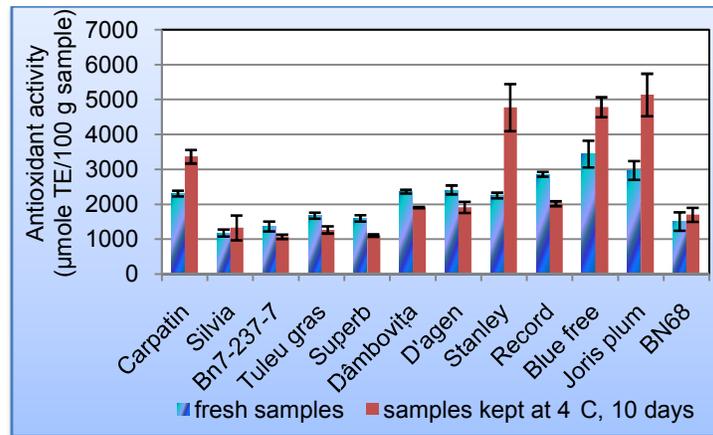
## RESULTS AND DISCUSSIONS

Fruits and vegetables have been receiving increased interest from consumers and researchers for their beneficial health effects on human diseases, mainly due to their antioxidant activity (Danesi and Bordoni, 2008).

There are many assays used for determination of antioxidant activity of fruits and vegetables. We evaluate the antioxidant activity of plum cultivars with two very used *in vitro* methods ORAC and DPPH. ORAC assay measures the reaction between antioxidants and the peroxy radicalas (Patthamakanokporn et. al., 2008).

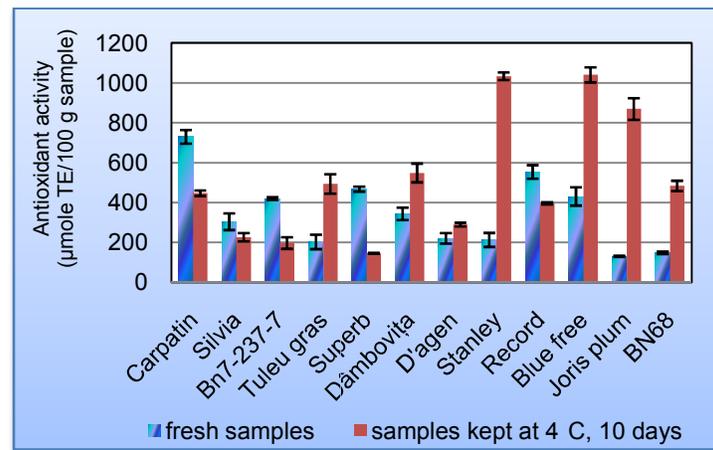
Figure 1 present the results for antioxidant activity determined by ORAC assay. Among fresh plum fruits, Blue free had the highest antioxidant activity ( $3444 \pm 381$   $\mu\text{mole TE}/100$  g fresh sample) and was followed by Joris plum ( $2975 \pm 271$   $\mu\text{mole TE}/100$  g fresh weight) and Record ( $2865 \pm 67$   $\mu\text{mole TE}/100$  g fresh weight). BN7-237-7 and Silvia cultivars presented the lowest antioxidant activity ( $1371 \pm 142$   $\mu\text{mole TE}/100$  g fresh weight and  $1181 \pm 101$   $\mu\text{mole TE}/100$  g fresh weights, respectively).

There are significant differences between fresh samples and those kept at 4°C during 10 days for the following plum cultivars: Carpatin, Superb, Record, Joris plum, Tuleu gras, Dâmbovița, Stanley, Blue free, BN68. The samples refrigerated, Carpatin, Stanley, Blue free, Joris plum, Silvia and BN68 increased their antioxidant potential during storage.



**Fig. 1** - Antioxidant activity of plums, measured by ORAC assay.

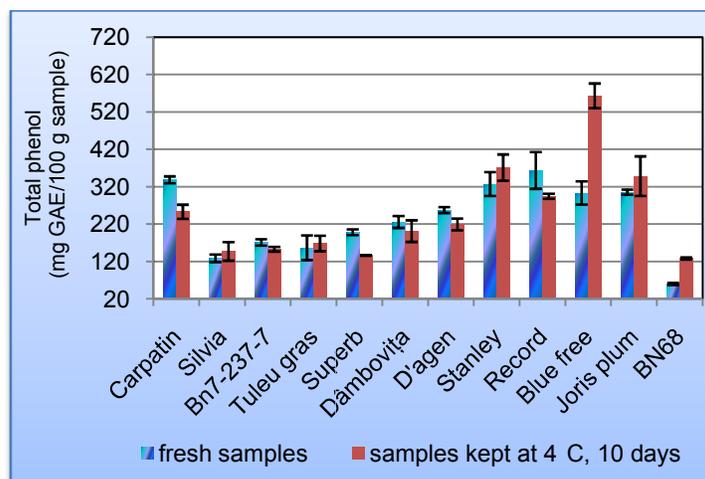
The antiradical potential measured by DPPH method (fig. 2), was higher in Carpatin, fresh samples (730 µmole TE/100 g fresh weights), Record (554 µmole TE/100 g fresh weight) and Superb (468 µmole TE/100 g fresh weight).



**Fig. 2** - Antioxidant activity of plums, measured by DPPH method

For antioxidant activity, we can observed that Blue free surprisingly increased the antioxidant potential almost three times during storage and Stanley increased by almost five times, results obtained by ORAC assays. Excepting D'agen and Silvia, all plum cultivars showed significant differences between fresh and refrigerated samples.

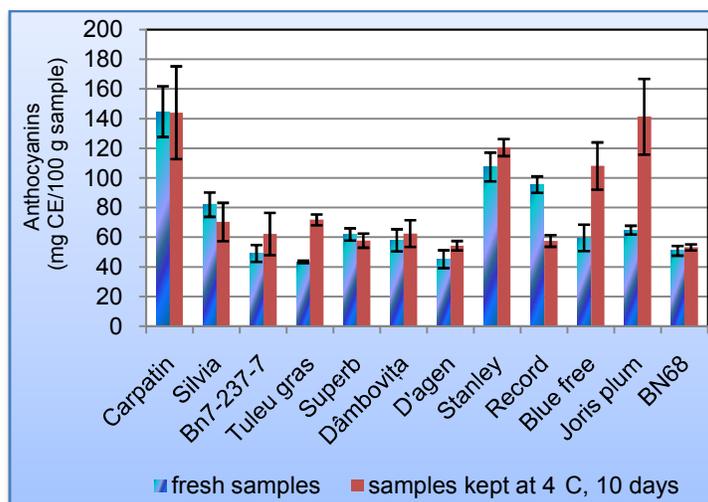
Total phenolic content (fig. 3) of the fresh plum ranged from 60.5 mg GAE/100g fresh weight (BN68) to 364 mg GAE/100g fresh weight (Record). In the case of refrigerated samples (4 °C, 10 days), total phenolic content ranged from 129 ± 3 mg GAE/100g sample weight (BN68) to 564 ± 33 mg GAE/100g sample weight (Blue free).



**Fig. 3** - Total phenolic compounds of the samples.

For anthocyanins content, we can observe that Tuleu gras and BN7-237-7 ( $45.3 \pm 0.8$  and  $49.1 \pm 5.7$  mg CE/100 g fresh weight, respectively) cultivar presented the smallest value of anthocyanins in the case of fresh samples (fig.4).

The biggest anthocyanin content was registered by the Carpatin cultivar, both fresh and stored sample ( $145 \pm 17$  and  $144 \pm 31$  mg CE/100 g sample weight, respectively). BN68 ( $53.2 \pm 2.0$  mg CE/100 g sample weight) showed the smallest anthocyanins content for the refrigerated samples. Most of plum cultivars increased their anthocyanins content during storage, except Carpatin, Silvia and Record.



**Fig. 4** - Anthocyanins content of the plum cultivars

## CONCLUSIONS

1. The results obtained suggest that plums, even after a storage period of 10 days at 4 °C, could be a good source of antioxidants, which may provide health-promoting effects for humans.
2. Stanley, Blue free and Joris plum are the plum cultivars that increased their antioxidant activity during storage, in the case of both methods used, ORAC and DPPH.
3. Carpatin and Stanley seems to have the richest anthocyanins content from all the plum cultivars analyzed.

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# ANTIOXIDANT ACTIVITY OF EXTERNAL AND INTERNAL LEAVES OF WHITE AND RED CABBAGE CULTIVARS DURING STORAGE

## ACTIVITATEA ANTIOXIDANTĂ A FRUNZELOR EXTERNE ȘI INTERNE A SOIURILOR DE VARZĂ ALBĂ ȘI ROȘIE ÎN TIMPUL PĂSTRĂRII

**MIHALACHE ARION Cristina<sup>1</sup>, FILIMON V.R.<sup>1</sup>,  
BARCAN BĂETU Alina<sup>1</sup>, PATRAȘ Antoanela<sup>1</sup>**  
e-mail: cristina\_mihalache82@yahoo.com

**Abstract.** *This study was carried out to determine the changes in the antioxidant activity and phenolic content of the external and internal leaves of different cabbage cultivars during storage. It is also evaluated the anthocyanins content of the red cabbage. The methods used for the determination of antioxidant capacity were : DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging activity and ORAC (oxygen radical absorbance capacity). Trolox, a vitamin E analog, was used as standard antioxidant. Among the cabbage cultivars, red cabbage showed the highest antioxidant potential and the highest phenolic content, both cases, fresh samples and samples kept at 4°C during 10 days. There were not found significant differences between antioxidant activity of the external and internal leaves of the cabbage cultivars studied.*

**Keywords:** antioxidant activity, ORAC, cabbage.

**Rezumat.** *Acest studiu a fost realizat pentru a determina schimbările care intervin în timpul păstrării asupra activității antioxidante și a conținutului de compuși fenolici la frunzele externe și interne ale diferite soiuri de varză. A fost determinat, de asemenea, și conținutul de antociani la varza roșie. Capacitatea antioxidantă a soiurilor de varză a fost determinată cu metodele: DPPH (radical liber 1,1 difenil - 2- picrilhidrazil) și ORAC (capacitatea de absorbție a radicalilor de oxigen). Trolox, un analog al vitaminei E, a fost folosit ca antioxidant standard. Varza roșie a arătat cel mai mare potențial antioxidant și conținut de compuși fenolici, dintre toate soiurile studiate, atât la probele proaspete cât și la cele păstrate la 4°C timp de 10 zile. Nu s-au găsit diferențe semnificative între activitatea antioxidantă a frunzelor externe și interne a soiurilor de varză analizate.*

**Cuvinte cheie:** activitatea antioxidantă, ORAC, varză.

## INTRODUCTION

Cruciferous vegetables are among the most important dietary vegetables consumed in Europe, owing to their availability in local markets, affordability and consumer preference. Due to its anti-inflammatory and antibacterial properties, cabbage has widespread use in traditional medicine, in alleviation of symptoms associated with gastrointestinal disorders (gastritis, peptic and

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

duodenal ulcers, irritable bowel syndrome) as well as in treatment of minor cuts and wounds.

Numerous studies have highlighted the potential importance of *Brassica* vegetables as a source of antibacterial (Kyung and Fleming, 1994; Hu et al., 2004; Ayaz et al., 2008) and antioxidant substance (Zhou and Yu, 2006; Andarwulan et al., 2010; Isabelle et al., 2010). Cruciferous vegetables, including cabbage (*Brassica oleracea* convar. *capitata* var. *capitata*), have a high nutritional value and contain organo-sulphur phytochemicals that increase their antioxidant capacity, which may have anticarcinogenic effects (Kim et al., 2004; Kurilich et al., 1999).

The aim of this research was to establish the content of compounds with antioxidant properties, i.e. polyphenols and anthocyanins, in selected cabbage cultivars, and the degree to which these substances are active as antioxidants. Because these vegetables are often stored before eaten, the influence of storage on these parameters was investigated.

## MATERIAL AND METHOD

One white cabbage and one red cabbage cultivars, fresh and stored at 4 °C during 10 days, were analyzed for the antioxidant potential. The white cabbage and the red cabbage were purchased from a local market.

For the extract, 1 g of the cabbage was grounded with 10 mL of extraction solvent: acetone (70%), water (28%), acetic acid (2%) (Counet, 2003). The mixture was shaken for 1 h at 4 °C and centrifuged at 17000g for 15 min. The supernatant was removed, and the pellet was extracted again with 10 mL of the same solvent, incubated for 15 min, and centrifuged using the same procedure. The extract obtained was kept at -30 °C until analyses. Each sample was independently extracted in triplicate.

Total phenolic contents were determined according to the Folin–Ciocalteu method (Caboni, 1997). Appropriately diluted extracts (3.6 mL) were mixed with 0.2 mL of Folin–Ciocalteu reagent, and 3 min later, 0.8 mL of sodium carbonate (20% w/v) was added. The mixture was heated at 30 °C for 1 hour. After cooling, the absorbance at 750 nm was measured. Gallic acid (Sigma) was used as standard, and results were expressed as milligrams of Gallic acid equivalents (GAE) per 100 g of sample. Analyses were performed in duplicate on each sample.

Antioxidant capacity was determined by scavenging of the radical 2,2-diphenyl-1-picrylhydrazyl (DPPH) as described by Tadolini et al. (2000). Trolox was used as a standard and methanol as a blank. The absorbance at 517 nm using an Uvikon 931 spectrophotometer (BIOTEK Instruments) of samples, standards, and blanks was determined after 5 min. The results were expressed as micromolar Trolox equivalents (TE) per 100 g of sample. Analyses were performed in duplicate.

ORAC assay was carried out on a fluoroskan Ascent FL Thermolabsystems (Finland) plate reader. The temperature of the incubator was set to 37 °C. Procedures were based on the method of Wu et al. (2004). Briefly, AAPH was used as peroxy radical generator, Trolox as standard, and fluorescein as fluorescent probe. Fluorescence filters were used for an excitation wavelength of 485 nm and an emission wavelength of 520 nm. 25 of diluted sample, blank, or Trolox calibration solutions were mixed with 150  $\mu$ L of 4  $\mu$ M fluorescein and incubated for 15 min at 37 °C before injection of 25  $\mu$ L of AAPH solution. All samples were

analyzed in duplicate at three different dilutions. The final ORAC values were calculated using the net area under the decay curves and were expressed as micromolar Trolox equivalents (TE) per 100 g of sample.

Anthocyanin quantification was performed by the pH-differential method (Guisti et al., 2001). The extract was diluted in a pH 1.0 solution (0.1 M HCl, 25 mM KCl) and in a pH 4.5 solution (0.4 M CH<sub>3</sub>COONa). The absorbance of the mixtures was then measured at 534 and 700 nm against distilled water. The value (Abs535 – Abs700) pH1.0 – (Abs535 – Abs700) pH4.5 corresponds to the absorbance due to the anthocyanins. Results were expressed as milligrams of cyanidin 3-glucoside equivalents per 100 g of sample.

Descriptive statistical analysis was performed using Microsoft Excel. Results were expressed as mean values ± standard error.

## RESULTS AND DISCUSSIONS

Table 1 lists the total phenolic content (expressed as Gallic acid equivalents) and the antiradical activity measured by ORAC and DPPH (expressed as  $\mu\text{mole TE}$ ). Oxygen radical absorbance capacity (ORAC) assay is selected for antioxidant capacity measurement as it is the current method widely used by researchers as well as food and supplement industry (Huang et al., 2005).

The amounts of antioxidant activity are very similar to those found with the same method (ORAC) by Isabelle et al., 2010 in the case of cabbage round and red cabbage. Antioxidant activity, measured by ORAC method, of external leaves-white cabbage present an decreasing during the storage while the internal leaves increase their activity. In the case of red cabbage, the internal leaves showed the highest antioxidant activity 5264  $\mu\text{mol TE}/100\text{ g}$  fresh sample.

This antioxidant activity decrease during storage until the value of 3514.28  $\mu\text{mol TE}/100\text{ g}$  sample. The antioxidant activity of the red cabbage external leaves increase from 2949.42 5264  $\mu\text{mol TE}/100\text{ g}$  fresh sample to 3833.12  $\mu\text{mol TE}/100\text{ g}$  sample during 10 days at 4°C. In the case of fresh samples, antioxidant activity of the white cabbage external leaves is bigger than internal leaves, at red cabbage the internal leaves present higher antioxidant activity than external leaves. We did not found the same changes in the case of the samples kept at 4°C-10 days. The antioxidant activity of the external leaves of white cabbage presented a lower value than internal one and the red cabbage external leaves presented a bigger value than the internal one.

Regarding the antiradical activity of the fresh samples, determined with DPPH method, the value ranged from 48  $\mu\text{mol TE}/100\text{ g}$  sample (white cabbage - external leaves) to 1429  $\mu\text{mol TE}/100\text{ g}$  sample (red cabbage - external leaves). Both external and internal leaves of the white cabbage increase their antioxidant activity during storage.

Table 1

## Antioxidant activity and total phenolics content of the sample

Sam- ples	Morpho- logical aspects	Fresh samples			Samples kept at 4°C – 10 days		
		ORAC ( $\mu$ M TE/100 g sample)	DPPH ( $\mu$ M TE/100 g sample)	Total phenolics (mg of GAE/100 g sample)	ORAC ( $\mu$ M TE/100 g sample)	DPPH ( $\mu$ M TE/100 g sample)	Total phenolics (mg of GAE/100 g sample)
De Buzău	Ext. leaves	862.84 $\pm$ 14	48 $\pm$ 3.21	29 $\pm$ 6.2	597.66 $\pm$ 102	73.79 $\pm$ 3.9	33.64 $\pm$ 29
	Int. leaves	378 $\pm$ 19	68.09 $\pm$ 6.8	37 $\pm$ 19	806.73 $\pm$ 165	71.21 $\pm$ 2.9	38.95 $\pm$ 6.5
Red cabba- ge	Ext. leaves	2949.42 $\pm$ 439	1429 $\pm$ 74.4	263 $\pm$ 13	3833.12 $\pm$ 543	865.55 $\pm$ 36	293.02 $\pm$ 16
	Int. leaves	5264 $\pm$ 846	735 $\pm$ 90.4	256 $\pm$ 59	3514.28 $\pm$ 45	1672 $\pm$ 1.1	211.04 $\pm$ 12.8

Red cabbage presented a decreasing of the external leaves antioxidant capacity and an increasing of the internal leaves antioxidant capacity during storage.

Red cabbage exhibits the highest content of total phenolics. The content of total phenolics registered an increase during the storage, except the case of the red cabbage internal leaves which decrease from 256 mg of GAE/100 g sample to 211 mg of GAE/100 g sample.

White cabbage cultivar showed a bigger amount of total phenolics in the internal leaves than the external leaves during the storage. In the case of red cabbage the external leaves seems to present more total phenolic content than the internal leaves. Variation in the antioxidant contents of *Brassica* vegetables is caused by many factors: variety, maturity at harvest, growing condition, soil state, and condition of post-harvest storage (Jeffery et al., 2003; Kurilich et al., 1999).

Table 2

## Anthocyanins content of the red cabbage (mg CE/100 g sample)

Samples	Morphological aspects	Fresh samples	Samples kept at 4°C, 10 days
Red cabbage	Ext. leaves	345.44 $\pm$ 25.6	295.73 $\pm$ 8.26
	Int. leaves	202.25 $\pm$ 13.24	224.9 $\pm$ 16.04

The anthocyanins content (table 2) of the fresh external leaves decrease during storage from 345.44 mg CE/100 g samples to 295.73 mg CE/100 g samples, instead the content of the internal leaves is increasing.

Table 3

## Correlations between antioxidant activity and total phenolics

Corellations	Fresh samples	Samples kept at 4°C, 10 days
ORAC - TP	R <sup>2</sup> = 0.791	R <sup>2</sup> = 0.964
DPPH - TP	R <sup>2</sup> = 0.829	R <sup>2</sup> = 0.577

Table 3 present the correlations between antioxidant activity, determined by ORAC and DPPH methods, and total phenolics. At fresh samples it was found a good correlation between DPPH and TP ( $R^2 = 0.829$ ) and at stored samples corellatioms between ORAC and TP registered a high value ( $R^2 = 0.964$ ). These correlations proves that TP are the major contributors to the antiradical activity of the cabbage samples analyzed.

## CONCLUSIONS

1. Red cabbage had bigger antioxidant activity than white cabbage cultivar, in both methods tested.

2. Antioxidant activity of the external and internal leaves varied greatly among the cabbage cultivars used in this study and during the storage

3. Red cabbage is an important source of phenolic compounds and anthocyanins also.

4. Very good correlations were obtained between antioxidant activity, measured by ORAC assay, and total phenolics, in the case of samples stored. We can conclude that the 10 days storage at 4 °C improved antioxidant potential of the cabbage.

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# BIOCHEMICAL MODIFICATIONS IN SOME HORTICULTURAL PRODUCTS AS CONSEQUENCE OF THERMAL PROCESSING

## MODIFICĂRI BIOCHIMICE ÎN UNELE PRODUSE HORTICOLE CA URMARE A PROCESĂRII TERMICE

*PATRAȘ Antoanela<sup>1</sup>, BĂETU Alina Loredana<sup>1</sup>, ARION Cristina<sup>1</sup>,  
FILIMON V.R.<sup>1</sup>, BĂETU M.M.<sup>1</sup>, LUCHIAN Camelia Elena<sup>1</sup>*  
e-mail: apatras@uaiasi.ro

*Abstract.* In all horticultural products, the majority of biochemical characteristics change as consequence of processing, especially of thermal processing. In the present article, we present Kapia pepper and cauliflower. Among the studied characteristics, we mention acidity, content of ascorbic acid and ascorbatoxidase activity.

**Key words:** Kapia pepper, cauliflower, baking, blanching

*Rezumat.* La toate produsele horticole se modifică majoritatea caracteristicilor biochimice în urma procesării, în special a procesării termice. În prezenta lucrare ne-am oprit la ardei roșu și conopidă. Dintre caracteristicile studiate, menționăm aciditatea, conținutul în acid ascorbic și activitatea ascorbatoxidazei.

**Cuvinte cheie:** ardei Kapia, conopidă, coacere, blanșare.

### INTRODUCTION

Thermal treatments are widely used in the food industry because of benefits like: destruction of microorganisms and inactivation of enzymes that may affect the products qualities by catalyzing different unwanted processes as oxidation and fermentation (Banu, 2008). Thermal processing can be achieved by many technological processes (as blanching, baking and others), adapted to the nature of the horticultural product and the expected characteristics of the final product (Cuciureanu, 2002, 2010).

Blanching, beside the inactivation of the microorganisms and the enzymes, also facilitate degassing of the product and the stabilization of the pigments and of the remaining ascorbic acid (Beceanu, 2010). Baking is a thermal treatment used mostly for peppers and eggplants, which, besides the other benefits, also confers special gustative qualities to the product.

As a consequence of thermal processing, the majority of biochemical characteristics of the horticultural products change. In the present article, we study the modifications of the humidity, soluble dry matter, malic acidity, content of ascorbic acid and activity of ascorbatoxidase in baked Kapia pepper and blanched cauliflower, compared to the raw material.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

## MATERIAL AND METHOD

The analyzed materials were provided by the company S.C. Contec Foods S.R.L. Tecuci and consist in:

- Kapia pepper – raw material and Kapia pepper baked 30 minutes;
- Cauliflower cultivar Aviso – raw material and blanched cauliflower in hot water at 95°C for 8 minutes.

Water content (humidity) was determined by drying at 105°C (STAS 3183 – 90).

Soluble dry matter was determined refractometrically, using Zeiss refractometer (STAS 3183 – 90).

Acidity was measured titrimetrically and expressed as malic acidity.

Ascorbic acid content was determined by titration with 2, 6 – dichlorophenolindophenol, according to STAS 595.

The activity of ascorbatoxidase was determined by titration with potassium iodate (Artenie and Tănase, 1981).

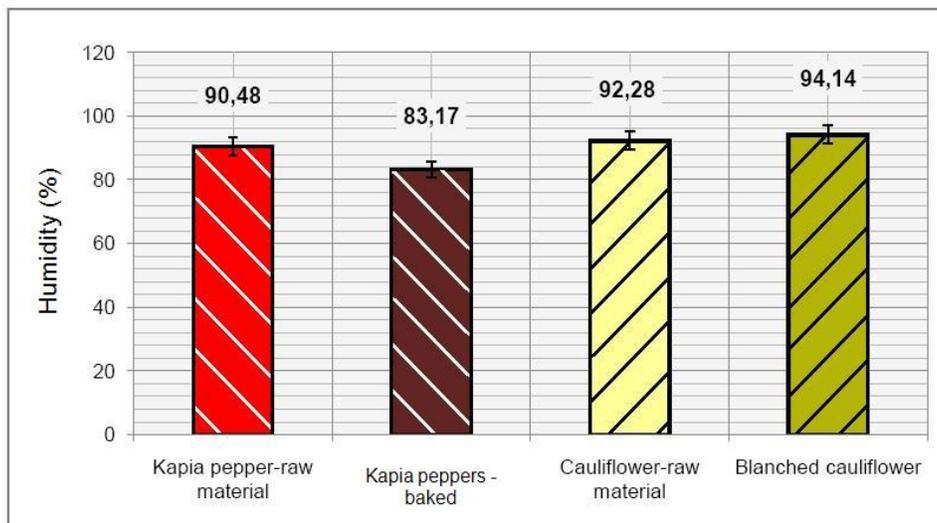
Statistical analysis was performed using Student test (Snedecor and Cochran, 1984).

## RESULTS AND DISCUSSIONS

According to previous studies (Bodea and Enăchescu, 1984), the Kapia peppers contains about 90 – 91 % water, which is confirmed by our results (90.48%).

After baking, the humidity decrease with 7.31% because of the water evaporation (fig.1).

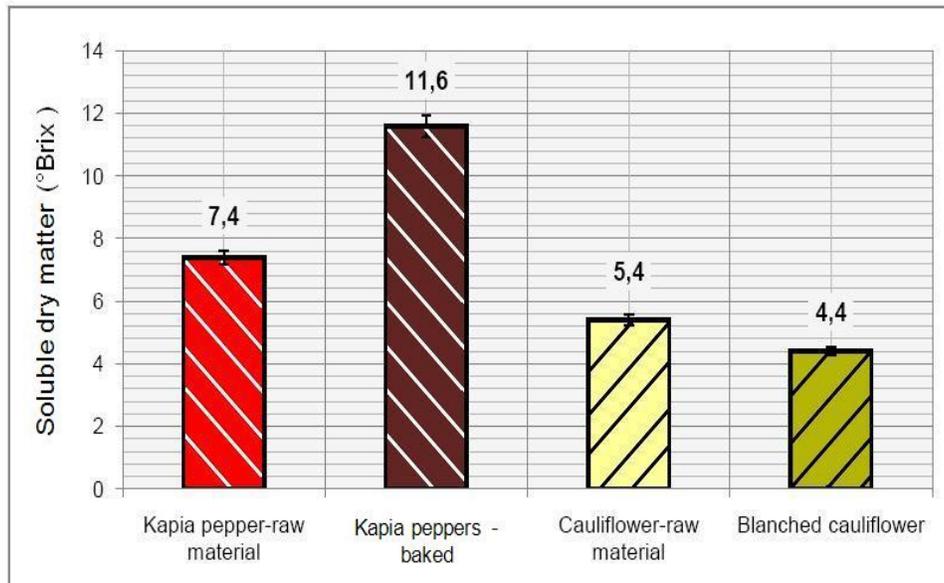
We found the humidity of the fresh cauliflower 92.28%, value in concordance with the literature (Bodea and Enăchescu, 1984 - 92%). As consequence of the immersion of cauliflower in hot water for 8 minutes during the blanching process, the humidity increases with 1.86% (fig. 1).



**Fig. 1** - Modifications of the humidity determined by thermal treatments in Kapia pepper and cauliflower

The soluble dry matter contains soluble glucides and soluble non-glucidic substances. Its variation is correlated in each sample with the humidity. By baking the Kapia pepper loses the water and, as consequence, the soluble substances are concentrating and their content increases. Another possible explanation of the increase of the soluble mater could be the thermal transformation of some non-soluble compounds in soluble ones.

In the cauliflower case, because of the blanching process, a part of the soluble substances may diffuse in the hot water and consequently, their content in the sample decreases (fig. 2).

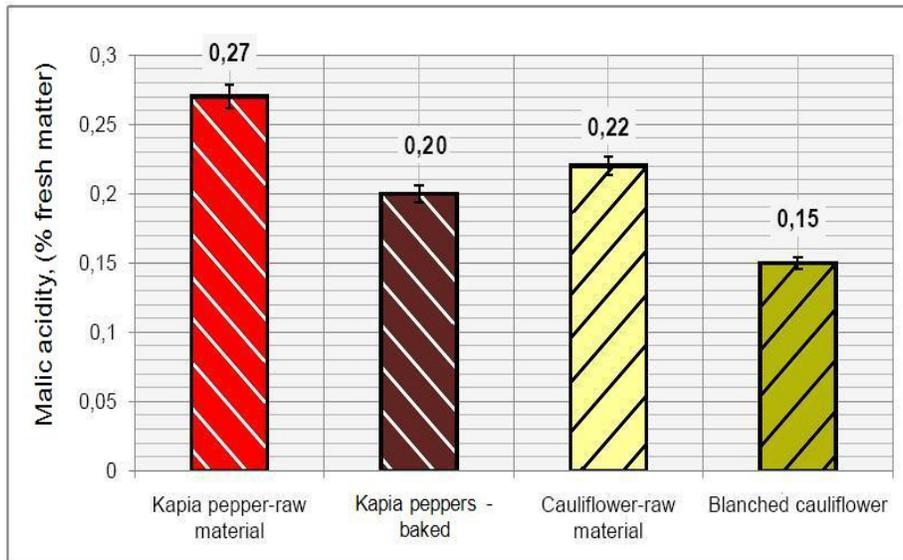


**Fig. 2** - Modifications of the soluble dry mater content determined by thermal treatments in Kapia pepper and cauliflower

The acidity contributes to the right appreciation of the quality and physiological condition of the products. It can be influenced by a lot of factors as preservation conditions and duration and processing technologies.

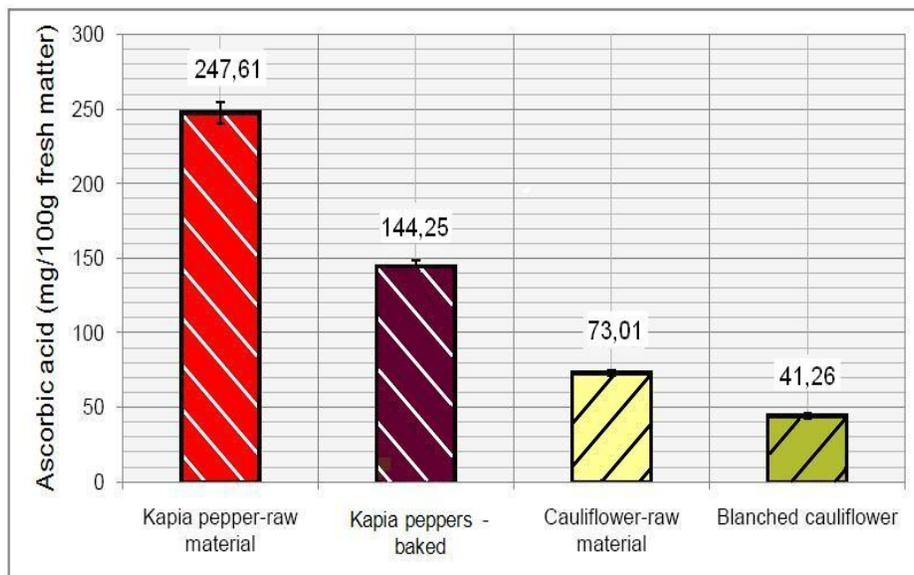
The acidity decreases after the thermal treatments that we studied (baking and blanching), as it can be seen in the figure 3. In the case of baked peppers, the decrease is 25.9% and in the case of the blanched cauliflower, the decrease is 31.8%.

It is known that the ascorbic acid content decreases after the thermal processing of the raw material and our results confirm this affirmation (fig. 4).



**Fig. 3** - Modifications of the malic acidity determined by thermal treatments in Kapia pepper and cauliflower

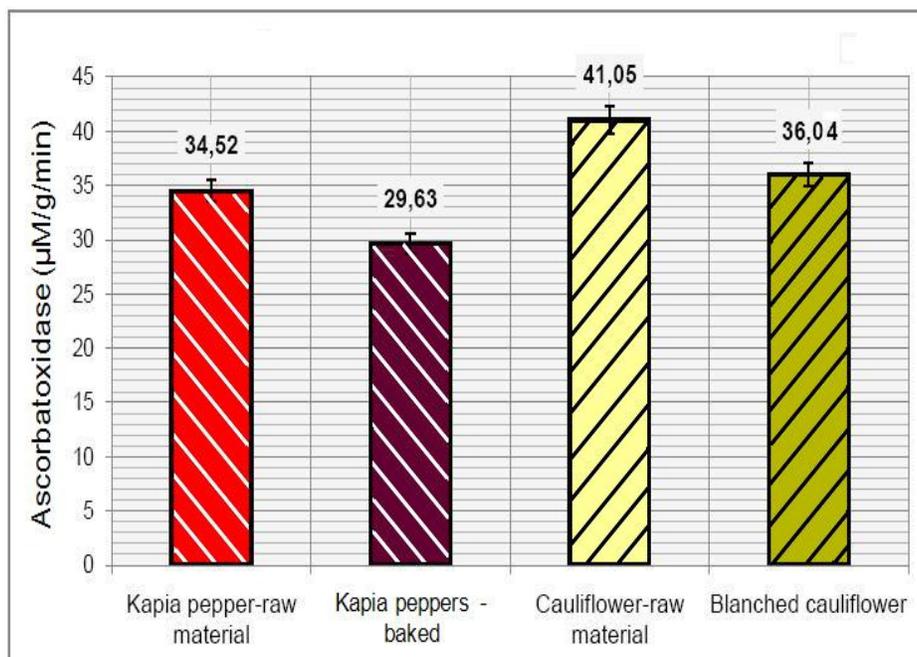
In the case of baked Kapia peppers, the final ascorbic acid content is 58.25% compared with the raw material and in the case of blanched cauliflower, the final content is 56.51%. The benefit is that the ascorbic acid remained after this technological procedure keeps better in time than the ascorbic acid of the samples untreated thermal.



**Fig. 4** - Modifications of the ascorbic acid content determined by thermal treatments in Kapia pepper and cauliflower

As we expected, we found a decrease of the ascorbatoxidase activity after the thermal treatments applied to both vegetables (fig. 5).

This decrease is beneficial because the activity of ascorbatoxidase (as well as other's oxidases) is extremely unwanted during the conservation, because of the instability of the formed dehydroascorbate and the diminution of the nutritive value of the products. In the case of the baked Kapia peppers, the decrease of the ascorbatoxidase activity is 14.16% and in the case of the blanched cauliflower, the decrease is 12.20%.



**Fig. 5** - Modifications of the ascorbatoxidase activity determined by thermal treatments in Kapia pepper and cauliflower

## CONCLUSIONS

1. Baking determines the decrease of the humidity and the increase of the soluble dry matter content at Kapia peppers, while blanching has an opposite effect: the increase of the humidity and the decrease of the soluble dry matter content at cauliflower.

2. Malic acidity, ascorbic acid content and ascorbatoxidase activity decrease for both types of thermal treatments.

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# THE USAGE OF NATURAL FERTILIZERS - A PRACTICE THAT FAVORS THE ECOLOGICAL AGRICULTURE DEVELOPMENT IN ROMANIA

## UTILIZAREA ÎNGRĂȘĂMINTELOR NATURALE – O PRACTICĂ CE FAVORIZEAZĂ DEZVOLTAREA AGRICULTURII ECOLOGICE ÎN ROMÂNIA

*GHIURCĂ Ana-Andreea<sup>1</sup>, LĂMĂȘANU Andreea<sup>1</sup>, MIHAI F. C.<sup>1</sup>*  
e-mail: anaandreeaghiurca@yahoo.com

**Abstract.** *Natural fertilizers were used in agriculture since ancient times and are still the best method of soil fertilization. Traditional agriculture, practiced in rural areas of Romania, contributes to the maintenance of soils fertilization ecological practices. Our research shows the evolution of the quantity of natural fertilizers used in the past 20 years at the national level and at the level of Neamț County captures the evolution over the seven years of natural fertilizers areas. In the analyzed period, the quantity of natural fertilizers on agricultural land is growing, but fertilized land record low values, showing that it has increased the average quantity of natural fertilizers per hectare.*

**Key words:** organic fertilizer, ecological agriculture, rural space.

**Rezumat.** *Îngrășămintele naturale au fost utilizate în agricultură din cele mai vechi timpuri și reprezintă încă cea mai bună metodă de fertilizare a solului. Agricultură tradițională, practică în spațiile rurale din România, contribuie la menținerea practicilor ecologice de fertilizare a solurilor. Cercetarea noastră evidențiază evoluția cantității de îngrășăminte naturale utilizate în ultimii 20 de ani la nivel național, iar la nivelul județului Neamț surprinde evoluția pe parcursul a șapte ani a suprafețelor fertilizate cu îngrășăminte naturale. În perioada analizată, cantitatea de îngrășăminte naturale aplicată pe terenurile agricole este în creștere, însă suprafețele fertilizate înregistrează valori scăzute, ceea ce demonstrează că a crescut cantitatea medie de îngrășăminte naturale la hectar.*

**Cuvinte cheie:** îngrășământ natural, agricultură ecologică, spațiu rural.

### INTRODUCTION

Organic farming is a practice that encourages the sustainable production, with a low impact on the quality of environmental factors and attempts to replace the model of intensive agricultural production. Organic production is focuses on developing sustainable agricultural systems, which protect both, the environment and consumers. Thus, organic farming represents a solution to protect soil resources by using natural fertilizers

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<sup>1</sup> “Alexandru Ioan Cuza” University of Iasi, Romania

(Mäder et al., 2002). Organic fertilizer represents “the fertilizer made from different natural products with organic origin through a simple training or through composting” (Research Institute for Soil Science and Agrochemistry, 2002). A proper application of natural fertilizers improves soil quality and maintains potential by introducing the nutrients.

Using natural fertilizers on agricultural soils, in significant amounts in Romania, makes our country to hold a high potential for practicing sustainable agriculture. However, one aspect that should be taken into account is the dose of fertilizer applying on farmland, which must not exceed the concentrations that could lead to an impairment of the soil quality. Soil pollution by nitrates can be a direct consequence of improper usage of natural fertilizers by farmers, and this happens frequently in rural areas in Romania, due to the lack of environmental education.

The idea of development the organic farming practices appeared in Europe as an alternative, that follow the principles of sustainable development by removing the aggressive practices of intensive agriculture, mechanized (Roman et al., 2008). In addition to environmental protection, it has been taken into account the fact that sustainable agriculture contributes to improving the quality of food and is reflecting on human health.

## **MATERIAL AND METHOD**

This research represents the correlation between the usage of organic fertilizers and organic farming by analyzing the European space, in general, and local and national territory, in particular. At the European level we analyzed the evolution in time of land areas used for organic farming, with statistical data for the period 2005-2010, made available by the Research Institute of Organic Agriculture (FiBL) from Switzerland. This was accomplished in the Philcarto program, a cartographical material based on multivariate analysis and hierarchical ascending classification method. The European States have been divided into five typological classes, each class referring to the European average.

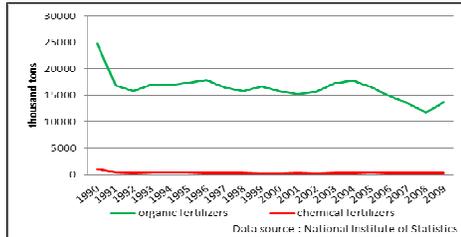
The evolution of the amount of natural fertilizers used at national level in the past 20 years, and at local level in the past seven years is highlighted by graphs made using statistics provided by National Institute of Statistics and the Environmental Protection Agency Neamț. Analysis of the amount of fertilizer used in European and national level is achieved through graphs.

Regarding the organic agriculture development in Romania, with data provided by the Ministry of Agriculture and Rural Development, at the level of 2011, we made illustrative graphics and cartographic materials. From the data available for Neamț County level, we made a number of correlations about practicing organic farming in the area and the ecological education level of farmers.

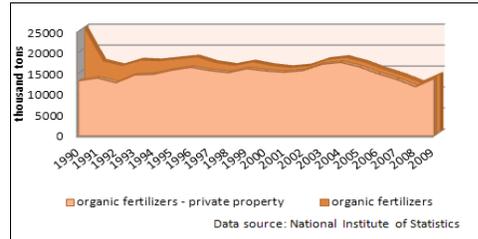
Thus, on the one hand, we have been highlighted in time the evolution of the natural fertilizers quantity used and the area that it was submitted, and on the other hand, we have been correlated the vulnerable areas to nitrates pollution with operators registered in organic farming, in 2011.

## RESULTS AND DISCUSSIONS

From the total of fertilizers used on cropland in Romania, natural fertilizers are used in quantities much higher than chemical fertilizers. The chemical fertilizers were used in much larger quantities in the early 1990s, especially on areas owned by the state. (fig. 1). It can be seen that during the past 20 years, the quantity of natural fertilizers used has remained relatively constant. The share of the natural fertilizers used by private property is majority; therefore farmers prefer natural fertilizers against the chemical manures (fig. 2).

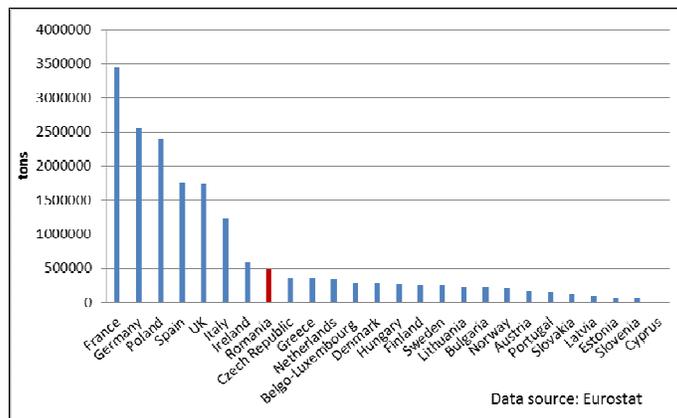


**Fig. 1** – The quantity of natural and chemical fertilizers used in Romania



**Fig. 2** – The quantity of natural fertilizers used in Romania

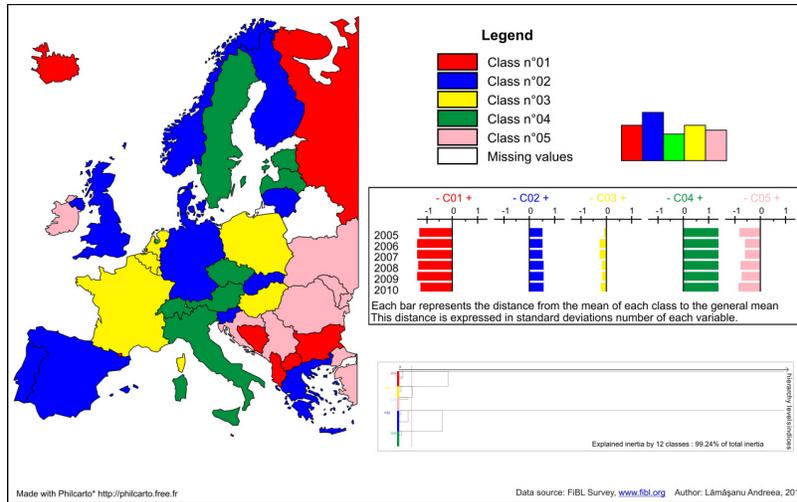
According to data provided by Eurostat, regarding the consumption of chemical fertilizers at European level, Romania uses a smaller amount of such fertilizers, so the soil resources available to agriculture can be used in organic agricultural production (fig. 3).



**Fig. 3** – Consumption of chemical fertilizers in European countries, 2009

In Europe, the share of land used in organic farming, from the total agricultural land, has increased in the past five years, some countries giving particular attention to these practices. Following the multivariate analysis, the European States are included into five typological classes, depending on the deviations to the European average. Thus, the states represented in green and blue

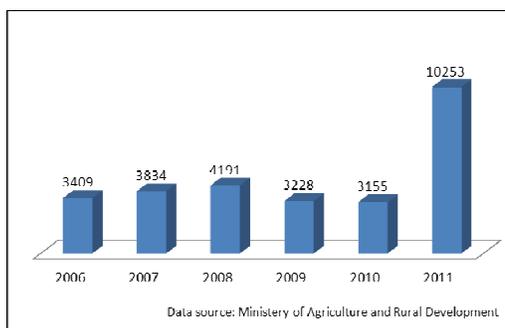
shades (Italy, Austria, Switzerland, Spain, Portugal, Sweden, Norway, Finland etc.) have large areas of land used in organic farming (over 10% of the total agricultural area) which are growing. The states represented in yellow and pink shades (Belgium, France, Netherlands, Poland, Romania, Ukraine etc.) have smaller areas introduced in organic farming (less than 5% of the total agricultural area), but in steadily growing, thus, the potential development of these practices is high. The largest deviation compared to the European average is represented by states in red shades (Iceland, Russia, Bulgaria etc.), where organic farming is very poorly developed, and future prospects are not encouraging.



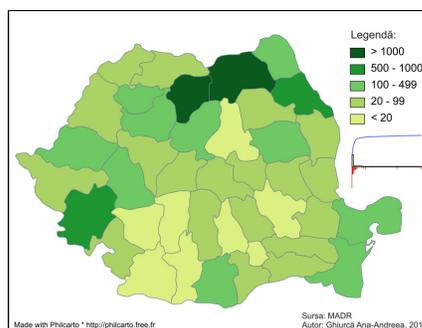
**Fig. 4** – The share of land used in organic farming of the total cropland at European level, 2005-2010

Organic fertilizers are essential for practicing organic farming, and Romania understood that it presents a high potential. Thus, an increasing number of Romanian farmers, supported and encouraged by the European Union have started using ecological techniques. This fact is evidenced by the number of registered organic operators, which has grown in recent years, the highest value being recorded in 2011 (fig. 5).

Development of ecological agriculture in Romania, in recent years is due to the subsidies granted by the European Union, which have encouraged farmers to adopt new practices for processing cropland. Thus, at the level of 2011 it has been registered at the Ministry of Agriculture and Rural Development over 10000 operators in organic farming, the Suceava and Bistrița-Năsăud County being the most well represented (fig. 6).



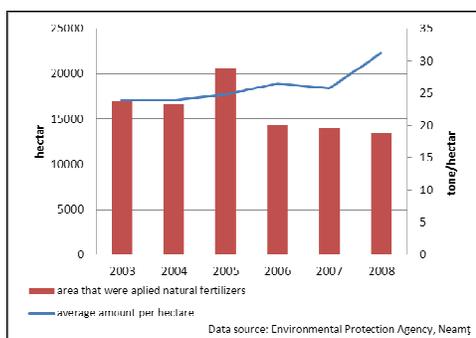
**Fig. 5** – The number of registered organic operators at national level, 2006-2011



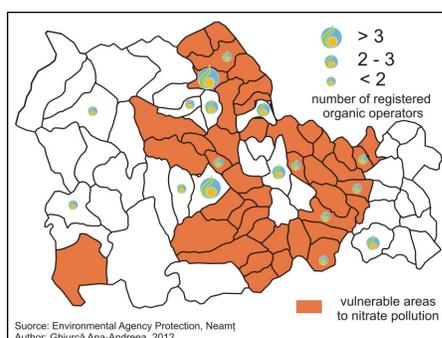
**Fig. 6** – The number of operators registered on counties in organic farming, 2011

The same trend, as at the national level, was observed in Neamț County, so natural fertilizers consumption increased, especially in recent years. The surfaces that were used natural fertilizers is in a slight decrease in the period 2003-2008, in contrast, the average quantity applied per hectare is increased, which could lead to a higher level of nitrates in soil (fig. 7).

According to data provided by the Environmental Protection Agency Neamț, in 2009, we have been identified a number of 40 vulnerable commune to nitrate pollution. Inappropriate agricultural practices, represented by the usage of high quantities of natural fertilizers, have led to soil degradation in extended areas (fig. 8).



**Fig. 7** – Area where natural fertilizers were applied and the average quantity per hectares (in Neamț County)



**Fig. 8** – Vulnerable communes to nitrate pollution and the number of registered organic operators in Neamț County, 2011

Correlation between vulnerable areas to nitrate pollution and the distribution of registered organic operators in the organic farming shows that a part of them operate on sensitive land, indicating that the practices are not friendly with the environment, because they are used for work polluted soils.

## CONCLUSIONS

1. The major role of natural fertilizers application on cropland is reflected in the environmental education level of farmers, who are increasingly interested in organic farming and sustainable exploitation of natural resources in rural areas.

2. This dynamic sector is increasing in Romania, improving the environmental conditions and promoting the consumption of organic products, but in the same time supports the restoration of rural areas by creating new jobs and opportunities.

3. Practicing organic farming is encouraged at European level, but the effective implementation is not an easy process because, as can be seen in the Neamț County, some croplands are already vulnerable to pollution by nitrates.

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# UTILIZATION OF ORGANIC FERTILIZERS ON ERODED SOILS FROM THE REPUBLIC OF MOLDOVA

## UTILIZAREA ÎNGRĂȘĂMINTELOR ORGANICE PE SOLURILE ERODATE DIN REPUBLICA MOLDOVA

**SIURIS A.<sup>1</sup>**

e-mail: ipaps\_dimo@mtc.md

**Abstract.** *Chernozem soils with high fertility prevail in the Republic of Moldova. Yet, 500.000 hectares are exposed to erosion of high and moderate degree, a fact which decreases their fertility and the economic potential by 30-60% compared to non-eroded soils. Measures to improve soils affected by erosion by means of organic fertilizers are suggested in the present paper. The application of organic fertilizers impacts on soil fertility and the increase of crop yields.*

**Key words:** organic fertilizers, eroded soils, erosion, fertility

**Rezumat.** *În Republica Moldova predomină cernoziomuri cu o fertilitate ridicată. Din ele 500 mii hectare sunt supuse proceselor de eroziune de grad moderat și puternic, ce contribuie la reducerea fertilității și a potențialului economic cu 30-60 % în comparație cu solurile neerodate. În prezenta lucrare se propun procedee de regenerare a solurilor afectate de eroziune prin antrenarea îngrășămintelor organice. Aplicarea acestora determină creșterea fertilității solului și majorarea recoltei culturilor agricole.*

**Cuvinte cheie:** îngrășămintă organice, soluri erodate, eroziune, fertilitatea

### INTRODUCTION

Soil erosion represents one of the main causes of immense agricultural areas degradation. It has been estimated that over 76 milliard tons of fertile soil are annually being lost through erosion at world level (Savu, 1992). In the Republic of Moldova this type of loss constitutes about 26 million tons (19 t/ha) (Complex program for the recovery of deteriorated lands and soil fertility increase, 2004). To combat soil erosion has special significance for the agriculture and the country's economy in general. Soil regeneration affected by erosion is possible through the rational use of organic fertilizers on a well-set anti-erosion background. They have a multilateral and complex impact due to the contents of organic matter, which serves to restore the humus and all necessary elements for plant nutrition.

The organic fertilizers are composed of various residual materials derived from animal farming, plant production, and the processing industry of agricultural raw materials. In the conditions of our country, the greatest part of these fertilizers comes from the livestock sector, which is the most important

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<sup>1</sup> Institute of Pedology, Agrochemistry and Soil Protection "N. Dimo", Chișinău, Republic of Moldova

provider of organic fertilizers (bovine, porcine, ovine, caprine, caballine and poultry droppings).

A second important source is formed of agricultural plant residues (straw, corn stalks, sunflower sticks, horticulture and vine wastes, leaves, green fertilizers etc.). The composts made of different organic wastes mentioned above are of no less importance. All these residues originate from agriculture, from soil. In order to maintain a benefic biological circuit between the human and natural activity, the organic wastes should be returned to the earth. Otherwise, these materials will pollute the environment.

The aim of the research is to restore the fertility of eroded arable soils through the application of organic fertilizers. In order to meet the planned goal, the following objectives have been set: to determine the changes in the contents of total humus, of mobile phosphorus and changeable potassium in the soil; to estimate the impact of organic fertilizers on the agro-physical indicators; to determine the yield of crops depending on the doses of applied fertilizers.

## **MATERIAL AND METHOD**

The research was carried out in the period 1996-2006 at the experimental station of pedology and erosion of the Institute of Pedology, Agrochemistry and Soil Protection named after „Nicolae Dimo” situated in the village Lebedenco, Cahul district. The experimental field is a slope of 5-7° with a north-east inclination. The study object is moderately eroded common chernozem possessing a clay texture and the content of humus of 2.07 – 2.54 %, mobile phosphorus 1.54 – 1.93 mg/100 g soil, changeable potassium 15.3 – 1.8 mg/100 g soil and a weak alkaline reaction (pH 7.5 – 7.8).

The experiment was carried out in three phases. The surface of the plot is 6 m x 40 m = 240 m<sup>2</sup>. The parcels are placed in a single row across the slope. The long sides of the slope are oriented along the slope.

Variants were designed to determine the optimal dose and frequency of the applied manure. Two annual doses are being tested (12.5 and 25.0 t/ha). The first is regarded as optimal dose for the preservation of humus, the second – is planned as a dose for the increase of soil fertility.

The possibility of regenerating the soil fertility through straw application variant and of specially made manure compost 80% plus alluvial soil 20% variant was also studied within the experiment. Straw is an important source of organic matter for the soil and can be used as organic fertilizer without a preliminary composting or transformation into manure (Lixandru, 2006; Rusu, 2009). The straw was incorporated into the soil with the addition of nitrogen fertilizers (10 kg N/t straw) in order to reduce the C:N proportion, after which the plots were disked and ploughed.

## **RESULTS AND DISCUSSIONS**

The carried out research has demonstrated that organic fertilization with manure contributed to the improvement of the state of soil provision with humus, mobile phosphorus and changeable potassium (table 1).

In the second year of impact, the humus contents was of 2.07 – 2.54% in the variants, before the application of fertilizers. The highest increase was

observed on the variants in which 150 t/ha and 200 t/ha of manure was administered. In the sixth and eighth years of impact, and the increase of humus contents on the fertilized variants was respectively the following: 3.07 and 2.89%; the increases consists: 0.63 and 0.72%. Simultaneously, the increase of mobile phosphorus in comparison with the initial one increased respectively in the tenth year of impact by 1.44 – 2.03 mg/100 g soil on the variant fertilized with manure in different doses and periods. The changeable potassium values increased in the tenth year of impact by 2.9 -8.3 mg/100 g soil.

Table 1

**Impact of manure on the contents of total humus, mobile phosphorus and changeable potassium in the 0-20 cm of moderately eroded common chernozem**

Fertilized variant	total humus		mobile phosphorus		changeable potassium	
	%		mg/100 g soil			
	contents	increase	contents	increase	contents	increase
1996, before the incorporation of fertilizers						
Unfertilized control	2.07	-	1.89	-	16.7	-*
Manure, 50 t/ha once in 2 years	2.09	-	1.54	-	16.1	-
Manure, 100 t/ha once in 4 years	2.54	-	1.80	-	16.5	-
Manure 150 t/ha once in 6 years	2.44	-	1.85	-	17.8	--
Manure, 200 t/ha once in 8 years	2.17	-	1.78	-	16.8	-
2006, the tenth year of impact						
Unfertilized control	2.11	0.04	2.04	0.15	16.8	0.13
Manure, 50 t/ha once in 2 years	2.56	0.47	3.27	1.73	19.0	2.9
Manure, 100 t/ha once in 4 years	2.95	0.41	3.34	1.54	21.3	4.8
Manure, 150 t/ha once in 6 years	3.07	0.63	3.88	2.03	24.3	6.5
Manure, 200 t/ha once in 8 years	2.89	0.72	3.22	1.44	25.1	8.3

The application of manure in quantities of 50-100 t/ha led to the reduction of clod fractions (>10 mm) by 22.9 - 25.5 % increasing simultaneously the structural formations with the diameter under 0.25 mm by 9.6 – 14.8 % (table 2).

Table 2

**Modification of moderately eroded common chernozem structure under the impact of manure in the 0 – 20 cm layer (2007)**

Fertilized variant	Structural elements contents (%) with the diameter (mm)				Quality of structure (dry sieving)	Hydro-stability (humid sieving)
	>10	<0.25	$\Sigma$ 10-0.25	>10+<0.25		
Unfertilized control	<u>49.5</u> -	<u>3.6</u> 72.5	<u>47.0</u> 27.5	<u>53.1</u> 72.5	average	low
Manure, 50 t/ha once in 4 years	<u>22.9</u> -	<u>14.8</u> 71.6	<u>62.3</u> 28.4	<u>37.7</u> 71.6	good	low
Manure, 100 t/ha once in 4 years	<u>25.5</u> -	<u>9.6</u> 71.0	<u>62.9</u> 29.0	<u>37.1</u> 71.0	good	low

*Numerator* – total contents of aggregates (dry sieving)

*Denominator* – contents of hydro-stable aggregates (humid sieving)

Fertilization with manure of moderately eroded chernozem contributes to the formation of structural elements that have agronomic value. So, if the sum of fractions within 10 – 0.25 mm constitutes 47% in the control variant, in the variants treated with manure the latter increased by about 16% (table 2).

Both the content of fine clay and that of physical clay is constant in all the variants treated with manure. The dusty clay-argillaceous texture can be evaluated as extremely favorable, due to the fact that it provides normal conditions for the growing of culture plants. The clay-argyles soils are treated easily when having physical maturity humidity (table 3).

Table 3

**Impact of manure on the physical indicators of moderately eroded ordinary chernozem in the ploughed layer**

Fertilized variant	Fractions, %		Density g/cm <sup>3</sup>	Apparent density, g/cm <sup>3</sup>	Poro- sity, %	Penetration resistance, kg F/cm <sup>2</sup>
	<0,001 mm	<0,01 mm				
Unfertilized control	25.9	45.9	2.66	1.26	52.6	23.4
Manure, 50 t/ha once in 4 years	26.3	45.4	2.64	1.22	53.8	20.1
Manure, 100 t/ha once in 4 years	25.8	45.7	2.63	1.18	55.1	13.3

The increase of the organic matter contents in the fertilized variants results in the decrease of density and the soil apparent density. These modifications have led to the increase of the lacunar space up to 55 %, value that refers the soil to the “high” class. The penetration resistance value decreased by about 10 kg F/cm<sup>2</sup> or by 43 % compared to the control variant.

The improvement of agro-physical and agro-chemical indicators of the moderately eroded common chernozem through the application of organic fertilizers conditioned the increase of crop yield (table 4).

Table 4

The impact of organic fertilizers on agricultural crops production grown on moderately eroded common chernozem, q/ha

Fertilized variant	Control variant yield and the increase on the fertilized variants									
	1997 winter barley	1998 corn for seeds	1999 mash (oats + peas)	2000 winter wheat	2001 corn for seeds	2002 winter barley	2003 corn for seeds	2004 sun-flower	2005 winter wheat	total cereal units for 9 years
Unfertilized control	29.6	33.3	56.6	12.4	31.7	14.3	34.2	12.7	14.3	198.7
Straw, 4 t/ha once in 4 years + N <sub>60</sub> P <sub>60</sub>	6.4	11.0	24.0	2.4	5.2	2.7	7.3	3.1	3.1	46.9
N <sub>60</sub> P <sub>60</sub>	6.6	-	8.3	1.3	5.5	2.4	5.2	1.2	2.1	39.9
Manure, 50 t/ha once in 2 years	7.6	12.8	11.1	5.3	12.8	7.1	15.3	7.4	6.7	78.5
manure, 50 t/ha once in 4 years	7.4	8.6	8.6	4.2	10.4	8.2	11.3	6.3	8.6	67.7
Manure, 50 t/ha once in 4 years + + N <sub>60</sub> P <sub>60</sub>	9.5	10.7	70.8	6.5	13.3	9.4	12.4	7.1	9.4	92.6
Manure, 100 t/ha once in 4 years	17.7	11.7	26.9	8.0	10.8	11.3	10.1	8.2	10.0	96.4
Manure, 150 t/ha once in 6 years	10.3	15.9	41.4	11.4	11.4	10.4	16.2	9.2	11.7	107.7
Manure, 200 t/ha once in 8 years	7.8	17.5	48.6	13.7	13.5	12.3	8.3	7.5	10.5	103.3
Compost, 100 t/ha (prepared from manure, 80% and alluvial soil, 20%)	6.2	13.7	26.6	11.1	7.2	3.1	5.8	3.9	2.6	60.1

## CONCLUSIONS

1. The applied organic fertilizers on the given soils led to an essential increase of the humus contents. The increase of the humus contents on the fertilized variants for the period of ten years constituted 0.41-0.72%. The mobile forms of nutritive elements increased. The increase of mobile phosphorus and changeable potassium increased by 1.73-2.03 mg/100g and 2.9-8.3 mg/100g of soil, respectively.

2. Organic fertilization of moderately eroded ordinary chernozem has also led to the reduction of clod fractions (>10 mm) by 24.0-26.6%, thus increasing simultaneously the structural formations by 6.0-11.2%. The mechanical properties of the soil have improved as well. The penetration resistance value decreased by 43% compared to the control variant.

3. In the course of nine years of impact, an increase in the crop yield by 46.9 -107.7 q/ha cereal units was observed on all the variants.

4. It has been established that on the soils affected by erosion a dose of 50 t/ha of manure should be applied once in four years.

5. The manure originating from any animals, sludge, solid residues coming from the agricultural production processing and other organic wastes can be used as organic fertilizers.

6. In the case of insufficient resources for organic fertilizers, it is recommended to use a type of compost mixed with alluvium soil. The obtained compost made of 80 % manure + 20 % alluvial soil should be applied in a dose of 100 t/ ha once in 4-6 years.

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# STUDIES ON THE INFLUENCE OF NITROGEN FERTILIZATION AND SOIL TYPE ON CORN PRODUCTION IN CONDITIONS OF NE BĂRĂGAN

## STUDII PRIVIND INFLUENȚA FERTILIZĂRII CU AZOT ȘI A TIPULUI DE SOL ASUPRA PRODUCȚIEI DE PORUMB BOABE ÎN CONDIȚIILE BĂRĂGANULUI DE NORD- EST

*RÎȘNOVENU Luxița<sup>1</sup>, CIOROMELE Alina<sup>1</sup>*

e-mail: dnastase78@gmail.com

**Abstract.** *To achieve the objectives and field experiences are conducted in the period 2010 -2011, the Braila county soil types vary in climatic conditions of the agricultural year, which was characterized as favorable in terms of rainfall, for corn, aimed to influence the dose of nitrogen fertilization and soil type on maize production. Following the results achieved it was found that an important role in the increased production of corn to nitrogen fertilization was level. The highest production was recorded on cambic chernozem soil at doses of  $N_{80}$  kg/ha, which resulted in a significant production increase of 46.6% compared to version control, unfertilized*

**Key words:** corn, nitrogen fertilisation, soil types

**Rezumat.** *Pentru realizarea obiectivelor propuse s-au efectuat experiențe de câmp în perioada 2010 -2011, pe teritoriul județului Braila, tipurile de sol fiind diferite. În condițiile climatice ale anului agricol 2010 -2011, care s-a caracterizat ca fiind favorabil din punct de vedere al precipitațiilor, pentru cultura porumbului, s-a urmărit influența dozei de fertilizare cu azot și a tipului de sol asupra producției de porumb. În urma rezultatelor înregistrate s-a constatat că, un rol important în creșterea producției de porumb l-a avut nivelul de fertilizare cu azot. Cea mai mare producție a fost înregistrată pe solul cernoziom cambic la doze de  $N_{80}$  kg/ha s.a , ceea ce a determinat la un spor de producție semnificativ de 46.6 % față de varianta martor, nefertilizată.*

**Cuvinte cheie :** porumb, fertilizare cu azot, tipuri de sol

### INTRODUCTION

Crop fertilization is an important link in which acts directly on production efficiency. (Borlan et al., 1994) Thus, the intake of nutrients as fertilizers applied to most plants, the soil types in our country, nitrogen was and who strongly influenced the production of corn that is mainly induced by nitrogen fertilizers and yet closely interrelated with the specific conditions of culture and state of vegetation (Calancea, 1990; Goian et al., 2004).

Thus, agricultural production, both natural factors and those by which man comes not act in isolation, but together. (Dimancea, 1966), leading to consistent conclusion that inorganic fertilizers exerts a strong influence on growth processes, development of plants. (Stefano et al. 2004).

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<sup>1</sup> University "Dunarea de Jos" of Galați, Romania

Research executed into agriculture in this area have had to establish an optimal nitrogen fertilization based on soil type, the natural fertility of their.

### MATERIAL AND METHOD

Research has been conducted in the period 2010-2011, the agricultural area Baraganul de nord-est on different soil types. The first experimental field was located on cambic chernozem soil the second field on aluviosol. The biological material used was the hybrid PR37Y12.

The experimentally variants

Factor A - soil type (chernozem cambic and aluviosol)

Factor B - level of fertilization (unfertilized, N<sub>40</sub> kg / ha, N<sub>80</sub> kg / ha).

As a method of settlement of experiments has been used subdivided parcels,

Interpretation of results was done using analysis of variance and multiple comparison (MSTAT-C), regressions and correlations (statistical package SAS / SAT, PASW).

### RESULTS AND DISCUSSIONS

The two types of soil chemical analyzes were performed on the ground watching the percentage of total nitrogen, pH, amount of mobile phosphorus and humus on the tread depth of 0-40 cm. Media obtained from analysis of the main agrochemical soil is shown in table 1.

Table 1

Principal agrochemical properties of soils

Type of soil	pH	Humus %	N total (%)	P <sub>mobil</sub> ppm	K <sub>mobil</sub> ppm
cambic chernozem	8,20	3,2	0,202	49,3	237,1
aluviosol	8,1	4,61	0,264	76,4	262,2

According to agrochemical analysis of soils under study shows that soil reaction is slightly alkaline, with values ranging between 8.1 and 8.2.

Soil with humus supply proved to be well stocked at aluviosol 4.61% while the cambic cermoziomul supply was low to medium, with values 3.2%.

Two soil types have been a good supply of nutrients (middle nitrogen and good phosphorus and potassium).

A major role in growth and development of the corn had recorded precipitation during the growing season (fig. 1).

In all the years of experimentation, the total average intake of 515 mm rainfall was above the multiannual (446.9 mm) to 67.9 mm, testifying in favor of this crop year, but unevenly distributed precipitation.

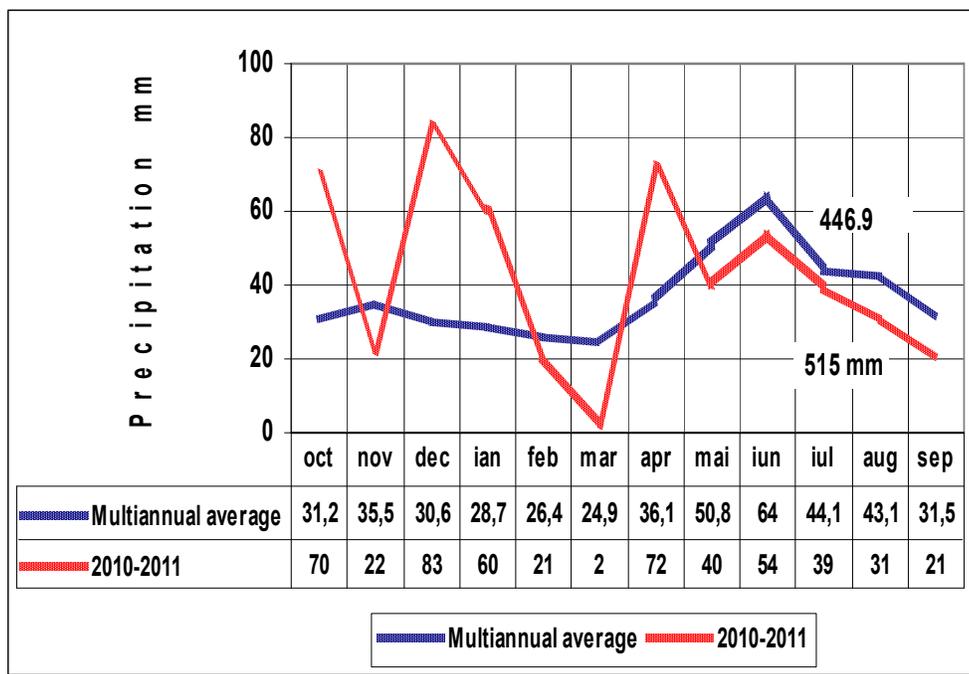


Fig 1 - Precipitation recorded in the experimental field

Analysis of variance (table 2) for the production of maize revealed significant action of the soil type. It also highlights the very significant action of nitrogen fertilization and soil type interaction with fertilization with this type of fertilizer applied to corn.

Table 2

Analysis of variance

variability	SP	GL	S <sup>2</sup>	test F
repetition	0.211	2	0.006	-
Soil	0.580	1	0.580	36.175 *
error	0.032	2	0.016	
level fertilization	18.204	2	9.101	1108..623 **
Soil x nitrogen fertilization level	0.668	2	0.334	40.478 **
error	0.427	8	0.053	

Table 3 shows the area under agriculture Bărăganul de sud-est toward superiority aluvisol cambic chernozem soil with a production increase of 5.4%, in the context of applying the same levels of fertilization.

Table 3

## Influence of soil type on production

Variants	Production (t/ha)	Production %	Difference		Significance
			t/ha	%	
Cambic Chernozem	7.57	105.4	0.39	5.4	*
Aluviosol	7,18	100	mt	100	Control

LSD 5% = 0.444t/ha      LSD 1% = 0.635t/ha      LSD 0.1% = 0.890t/ha

Fertilization level (table 4) significantly affect maize production. It is noted that regardless of the type of soil applied fertilizare increase corn production was significant ( $R = 0.9866$  \*\*\*) of 30.4 kg per kg N applied.

The highest growth of 38.3% recorded productive dose of  $N_{80}$  kg / ha, while having the highest insurance statistics from unfertilized variant. An intermediate position is occupied by kg  $N_{40}$  / ha crop with a significant increase of 13.9%

Table 4

## Influence of fertilization on production

Variants	Production (t/ha)	Difference		Significance
		t/ha	%	
N0	6.26	Martor	100	Control
N40	7.13	0.87	13.9	**
N80	8.69	2.40	38.3	***
$Y = 0.0304x + 6.145$ $R = 0.9738$ $R^2 = 0.9866$ ***				

LSD 5% = 0.168 t/ha      LSD 1% = 0.246      LSD 0.1% = 0.351 t/ha

Analyzing factors interaction with the type of soil nitrogen fertilization was found regardless of soil type fertilization increased dose resulted in statistically harvest increases (fig. 2).

It also shows that soil type makes different realization corn yields under application difertelor nitrogen fertilization levels.

Thus cambic chernozem soil determines the largest production increase statistically ( $R = 0.9883$  \*\*\*) per kg of nitrogen applied to 36.4 kg while the soil is also achieved growth aluviosol asigutat but 25 kg per kg of nitrogen applied.

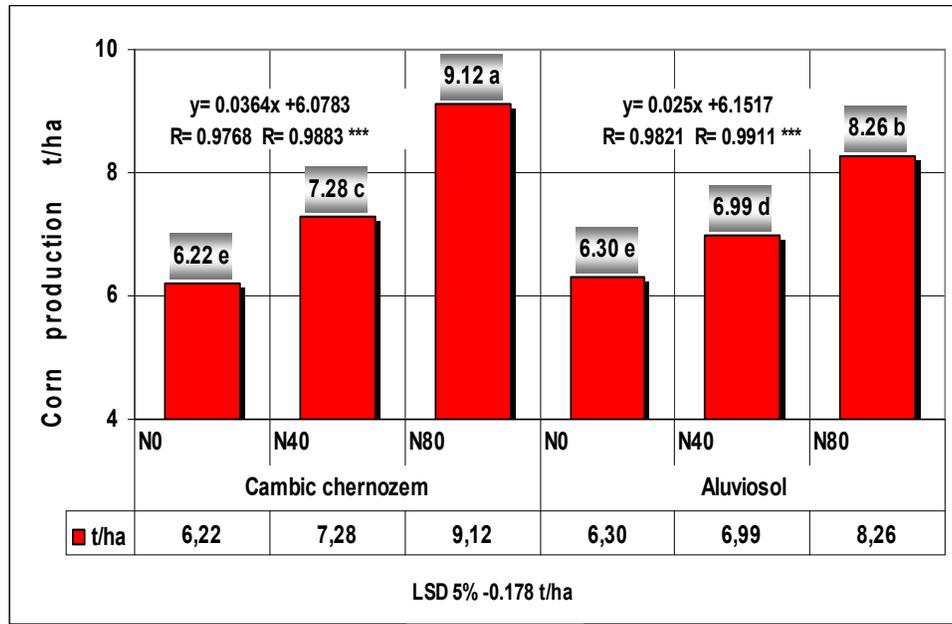


Fig. 2 - Influence of soil type and fertilization level on the production of corn

This difference in increase of yield is mainly due to different natural fertility of these soils. Thus cambic chernozem soil nutrients less insured reaction more strongly to the chemical fertilizer nitrogen application.

Thus the first level of significance lies  $N_{80}$  on cambic chernozem soil with a production of 9.12 t / ha followed by the same dose of nitrogen in the soil aluviosol with 8.26 t / ha

The third stage of meaning lays  $N_{40}$  cambic chernozem soil applied, because  $N_{40}$  is applied aluviosol ranks the fourth of significance.

## CONCLUSIONS

1. Corn found optimal growth and development in the conditions of land agricultural area NE Bărăgan.

2. Type of soil is cultivated corn, its natural fertility status is essential in the determination of the nitrogen fertilization

3 The assured production increases due to nitrogen fertilization is done on cambic chernozem soil which results in increased production of corn by 5.4% compared other type of soil considered.

4. The optimum level of fertilization with nitrogen is  $N_{80}$  in both studied soils, which determine the highest and insured corn production.

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# CONSEQUENCES OF THE UNREASONABLE GRAZING ON THE SURFACES WITH DRAINING WORKS, OF THE DRAINAGE AREA OF MOLDOVA RIVER, SUCEAVA COUNTY

## CONSECINȚE ALE PĂȘUNATULUI NERAȚIONAL PE SUPRAFETELE AMENAJATE CU LUCRĂRI DE DESECARE-DRENAJ, DIN BAZINUL HIDROGRAFIC AL RÂULUI MOLDOVA, JUDEȚUL SUCEAVA

**RADU O.**<sup>1</sup>,  
e-mail: opricaradu@yahoo.com

**Abstract.** *The draining improvements were performed on the fields of Moldova River meadow, Suceava County, in order to remove the excess water, from the soil surface and from its upper horizons, deriving from rainfall, ground water and from the surface runoffs on the higher bordering areas. The operation and exploitation of the drainage network produce mainly banks erosion and the silting of channels bottom. Banks erosion and the silting of channels sections are influenced by the speed of the water, banks stability, their degree of coverage with grass and, last but not least, by the category of use of the surfaces serviced by channels. This paper highlights the fact that the unreasonable grazing and the uncontrolled channels crossing by animals over the periods with highly wet soil, lead to the acceleration of bank erosion and, implicitly, to channels silting, this one occurring with an average annual rate of 3-4 cm, almost double compared to the channels servicing the surfaces used as arable and grass land. The silting of channels sections in a higher ratio than 60-70% leads to the overflow of the water collected over the periods with abundant rainfall, the flooding of the bordering fields, the extension of the humidity excess, the settlement of the higrophile vegetation and the disturbance of the drainage network operation in the neighboring areas.*

**Key words:** excessive humidity, drying-draining system, geometric and hydraulic parameters of the drying network.

**Rezumat.** *Amenajările de desecare-drenaj au fost executate pe terenurile din lunca râului Moldova, județul Suceava, în vederea eliminării excesului de apă, de la suprafața solului și din orizonturile superioare ale acestuia, provenit din precipitații, apa freatică și din scurgerile de suprafață de pe zonele limitrofe mai înalte. Prin funcționarea și exploatarea rețelei de desecare se produce, cu precădere, eroziunea malurilor și colmatarea fundului canalelor. Erodarea malurilor și colmatarea secțiunii canalelor sunt influențate de viteza apei, stabilitatea taluzurilor, de gradul de înierbare al acestora și, nu în ultimul rând, de categoria de folosință a suprafețelor deservite de canale. În lucrarea de față se pune în evidență că, pășunatul nerațional și traversarea necontrolată a canalelor de către animale în perioadele cu solul supraumezit, determină accelerarea eroziunii de mal și, implicit, colmatarea canalelor, aceasta producându-se cu o rată medie anuală de 3-4 cm, aproximativ dublă față de*

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

*cea a canalelor ce deserveșc suprafețele utilizate ca arabil și fâneășă. Colmatarea secțiunii canalelor în proporție mai mare de 60-70% duce la revărsarea apei colectate în perioadele cu precipitații abundente, la inundarea terenurilor limitrofe, prelungirea excesului de umiditate, instalarea vegetației higrofile și perturbarea funcționării rețelei de desecare-drenaj din zonele învecinate.*

**Cuvinte cheie:** exces de umiditate, sistem de desecare-drenaj, elemente geometrice și hidraulice ale rețelei de desecare.

## INTRODUCTION

Among the main limiting factors of the agricultural production, which occur depending on the local pedoclimatic conditions, we could mention excessive humidity, floods, low permeability and soil compaction, erosion, sliding and others.

For the proper excessive water removal after the construction of the drying-draining systems, special attention should be paid to their operation and behavior over time, also considering the new private land ownership conditions.

## MATERIAL AND METHOD

The excessive humidity, which occurs in the Moldova River basin and which is due to rain and/or ground water and to water system overflows, has manifested itself under various forms and at different intensities, on both horizontal and sloped land.

The natural conditions of the Baia piedmont plain support the occurrence and maintenance of excessive underground and surface humidity. The Moldova River meadow and 1.5 km-wide slip-shaped terraces, which are almost parallel with the Moldova River bed and which run north-west and south-east, with small 1-5% slopes, with flat areas and many small depressions, facilitate water stagnation.

In the wet climate of the Moldova River basin, the heavy precipitations fallen over 1-5 consecutive days and the low evapotranspiration rate make up the main excessive humidity cause in low permeability soils (Nitu et al., 1985).

The precipitations fallen throughout the year exhibit an uneven distribution, with considerable amounts fallen in 24 hours or after long-lasting heavy rains, which cause surface overflows that carry along soil particles, thus enhancing bank erosion and hence clogging the channels (Radu, 2009).

Three drying-draining systems (Rotopănești-Rădășeni-Fântâna Mare, Drăgoiești-Berchișești, Bogdănești-Baia) and the Băișești-Dumbrava irrigation-drying system with a total drained area of 8761 ha, of which 3059 ha of underground draining works, were built between 1978 and 1980 in order to achieve the maximum production capacity of the Moldova River meadow and terraces land.

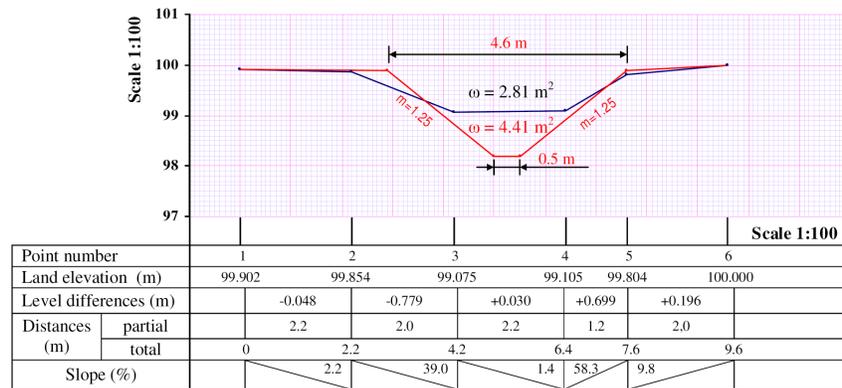
The actual drying channels network includes master collecting channels, secondary collecting channels, sector collecting channels and belt channels. The 1.5-2.0 m deep belt channels were located 20-50 m from the edge of the slopes, their role being to protect the dried-drained surface by catching the overflows from the higher neighboring areas.

The belt channel (CC<sub>1</sub>) of the Rotopănești-Rădășeni-Fântâna Mare system catches the water coming from the slope of a north-east 37.50 ha area crest facing Rotopănești, which is currently used as grazing ground and which was used as grassland before 1992.

In order to determine the geometric and hydraulic parameters of the belt channel (CC<sub>1</sub>), high precision geometric leveling survey measurements were conducted using the radiation and the traversing combined with radiation methods; these measurements enabled us to draft transverse and longitudinal profiles that were compared to the initial profiles of this channel. The leveling survey data were gathered using an average precision Zeiss Ni-030 level and the surveying rod with centimeter marks, and the level differences were determined bases on two levels of the surveying instrument.

## RESULTS AND DISCUSSIONS

The upper channels of the drying-draining systems were sized on sections, depending on the slope and outflow of that channel. The section of the CC<sub>1</sub> belt channel that we analyzed, located about 700 m downstream from the end of the channel, initially had the following geometric and constructive parameters: mean depth – 1.73 m, channel bottom width – 0.50 m, channel light – 4.60 m, slope coefficient – 1.25 and channel section – 4.41 m<sup>2</sup> (fig. 1). Relying on the measurements done in 2007, we calculated a mean flow section value of 2.81 m<sup>2</sup>, which was about 36% lower than the initial one.



**Fig. 1 – Cross section in the CC<sub>1</sub> belt channel, 700 m downstream from the end of the channel, on its completion and in 2007**

27 years after its completion, the channel exhibited about one meter high clogging (mean deposit rate of 3.7 cm/year) and the channel bottom width was 2.20 m, i.e. 4 times bigger than the initial one. The clogging of the channel on this section is caused both by excessive grazing along the channel and by the animals crossing the channel back and forth in the wrong spots, as this land has been exclusively grazing ground since 1992.

The cross sections performed after 5 years on this section, every 25 m, in the check points P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>, reveal the uninterrupted clogging of the channel, the layer of deposits being 9 to 15 cm high (fig. 2, 3, 4 and 5). Also, the deposit thickness was found to be about 10 cm higher on the right side of the channel bottom, due to the slit carried along from the left side by the water coming from the higher neighboring areas.

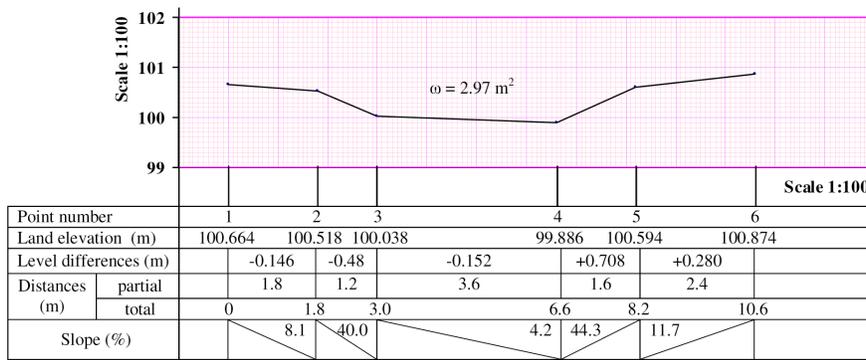


Fig. 2 – Cross-section in the CC<sub>1</sub> belt channel, in point P<sub>1</sub>

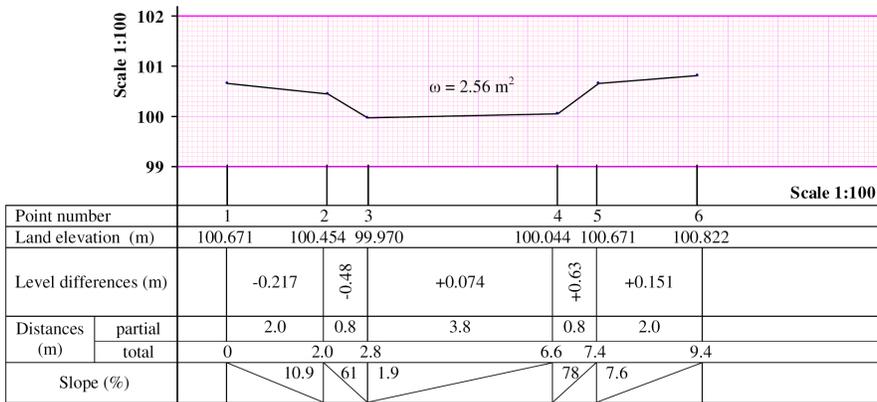


Fig. 3 – Cross-section in the CC<sub>1</sub> belt channel, in point P<sub>2</sub>

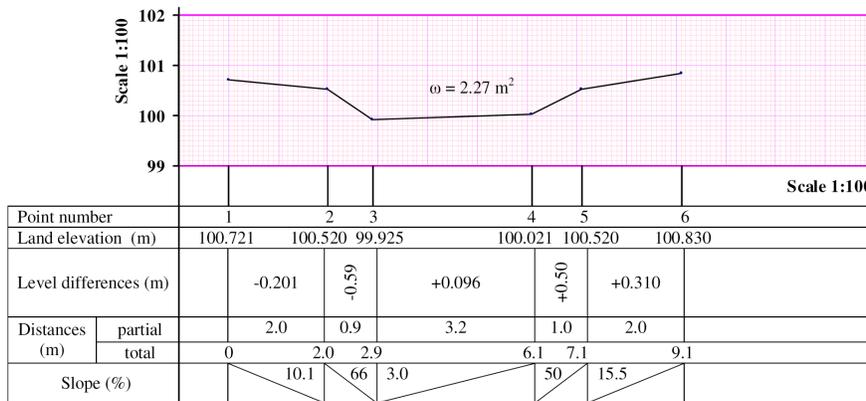
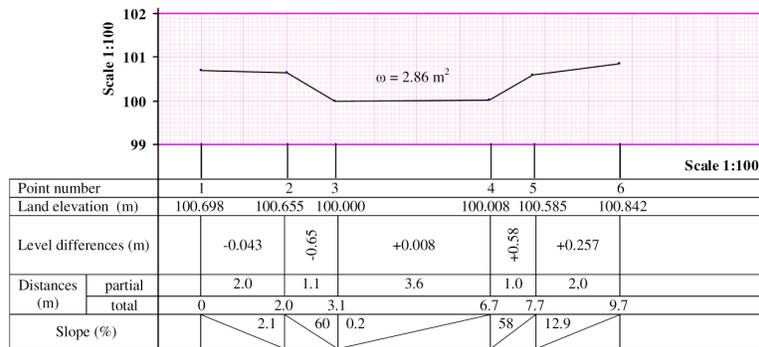


Fig. 4 – Cross-section in the CC<sub>1</sub> belt channel, in point P<sub>3</sub>

The average 12.5 cm thick deposits reveal a mean clogging rate of 2.5 cm/year, which is 1.2 cm/year lower than the one reported over the 27 years duration.

The channel flowing section exhibits values ranging from 2.27 m<sup>2</sup> in point P<sub>3</sub> to 2.97 m<sup>2</sup> in point P<sub>1</sub>, the mean channel section on this section being 2.67 m<sup>2</sup>, which means a 40% diminution after 32 years of operation. Over the last 5 years of operation, the channel flowing section decreased by 4% as compared to the one measured in 2007, yet the light and width at the bottom of the channel increased considerably. The channel light reaches its maximum 6.4 m value in the checkpoint P<sub>1</sub>, which means a 1.00 m increase since 2007 and a 1.80 m increase as compared to the initial value. The maximum value of the channel bottom width is 3.80 m in the section P<sub>2</sub>, i.e. 1.60 m higher than in 2007 and 3.30 m higher than the initial value.



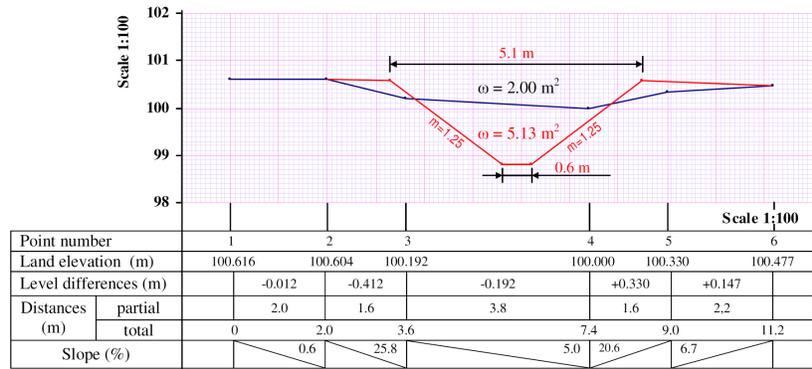
**Fig. 5** – Cross-section in the CC<sub>1</sub> belt channel, in point P<sub>4</sub>

These changes detected in the geometric and hydraulic parameters of the channel reveal the bank erosion caused by the animals repeatedly crossing the channel back and forth, by the grazing carried out along the channel where the soil is overwatered, as the water stagnates in the channel because of the longitudinal slope decrease and of the hygrophilous vegetation.

We measured a 1.40 m high clogging in the cross-section of the CC<sub>1</sub> belt channel performed 1200 m from the upstream end, in 2007, which determined the increase of the channel bottom width from 0.60 m to 2.30 m and the decrease of the cross-section by 67%, from 5.13 m<sup>2</sup> to 1.71 m<sup>2</sup>. These changes and the complete obstructing of a footbridge located 2100 m from the upstream end prevents the transfer of the water coming from the slope into the Şomuzel master collecting channel, which determines the overflow of the collected water and the formation of a pool of about 1.00 ha located about 1500 m from the upstream end. This overflowing water floods the neighboring land, extending excessive humidity, supporting hygrophilous vegetation growth and decreasing grazing ground quality.

The cross section performed, in 2012, 20 m upstream from the pool formed because of overflow also reveals the changes occurred in the geometric and hydraulic parameters of this channel (fig. 6).

The initial geometric and hydraulic parameters in this section were: channel depth – 1.80 m, bottom width – 0.60 m, channel light – 5.10 m, slope coefficient – 1.25 and channel section – 5.13 m<sup>2</sup>.



**Fig. 6** – Cross section in the CC<sub>1</sub> belt channel, 1500 m downstream from the end of the channel, on its completion and in 2012

After 32 years of operation, the measurements reveal a 1.43 m high channel clogging and a 2.00 m<sup>2</sup> flow section, which means a 61% decrease as compared to the initial values. This cross section also reveals a significant increase in the channel bottom width to 3.80 m and in the channel light to 7.00 m. In this case, the alteration of the geometric and hydraulic parameters was also accelerated by the grazing done along the channel and by the animals, especially cattle, crossing it back and forth. The neighboring land is used for cattle grazing during the summer and for sheep grazing the rest of the year.

## CONCLUSIONS

1. Intensive grazing and animals, especially cattle, crossing the channel back and forth have led to substantial changes in the geometric and hydraulic parameters of the CC<sub>1</sub> belt channel.
2. The mean clogging rate is 3-4 cm/year in the section under survey and it is due especially to bank erosion caused by animals repeatedly crossing it back and forth.
3. The diminution of the channel flow section by 60% and the complete obstructing of a footbridge have resulted in the overflowing of the collected water, in the disruption of the operation of the draining network, in the extension of the excessive humidity period and in the support of hygrophilous vegetation growth on the areas dried by open channels.

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# EXCESS WATER REMOVAL OF BAIA AGRICULTURAL DRAINS EXPERIMENTAL FIELD, SUCEAVA COUNTY, AFTER 34 YEARS OF OPERATION

## ELIMINAREA EXCESULUI DE APĂ DIN CÂMPUL EXPERIMENTAL DE DRENAJE AGRICOLE BAIA, JUDEȚUL SUCEAVA, DUPĂ 34 ANI DE FUNCȚIONARE

**RADU O.<sup>1</sup>, FILIPOV F.<sup>1</sup>**  
e-mail: opricaradu@yahoo.com

**Abstract.** *The exploitation of the production capacity of the agricultural fields and mainly of the arable areas was performed over the time by their improvement with drainage, banking-regulation, underground drainage, soil erosion control and other types of works. According to the data supplied by A.N.I.F., in Suceava County, there is a surface of 44,904 ha with drainage works, of which 27,455 ha with drain works. The results of the research carried out within the pedoclimatic conditions of the drainage area of Moldova River showed that within 48 hours from the rainfall, in the case of the absorbing drain lines disposed at a distance of 15 m, the higher water content of the soil was obtained on the draining ditch, the content increasing once with the depth, thanks to the water inflow created towards the drain filter and to the permeability of the filter layer at 34 years of operation. At the absorbing drains disposed at a distance of 20 m, the higher value was obtained at the mid-distance between the drains. In both cases, the lowest average water content of the soil was recorded in the checkpoint located at 2 m from the absorbing drain lines. Modeling the field in ridge bands at the drains located at a distance of 20 m leads to a better removal of the excess water; the values of the average water content of the soil decrease from the drain line towards the mid-distance between them.*

**Key words:** moisture excess, drying-draining system, modeling in strips with ridges, soil water content

**Rezumat.** *Valorificarea capacității de producție a terenurilor agricole și, în mod special, a suprafețelor de teren arabil, s-a realizat în decursul timpului prin amenajarea acestora cu lucrări de desecare, de îndiguire-regularizare, de drenaj subteran, de combatere a eroziunii solului și altele. În județul Suceava, după datele A.N.I.F., există o suprafață de 44.904 ha cu lucrări de desecare, din care 27.455 ha cu lucrări de drenaj. Rezultatele cercetărilor efectuate în condițiile pedoclimatice din bazinul hidrografic al râului Moldova au arătat că la 48 ore de la înregistrarea precipitațiilor, în cazul liniilor de drenuri absorbante distanțate la 15 m, cel mai mare conținut de apă al solului s-a obținut pe tranșea de drenaj, acesta crescând odată cu adâncimea, datorită afluxului de apă creat spre filtrul drenului și a reducerii permeabilității stratului filtrant în 34 ani de funcționare. La drenurile absorbante distanțate la 20 m valoarea cea mai mare s-a obținut la mijlocul distanței dintre drenuri. În*

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

*ambele cazuri cel mai mic conținut mediu de apă al solului s-a înregistrat în punctul de control situat la 2 m față de liniile de drenuri absorbante. Prin modelarea terenului în benzi cu coame la drenurile distanțate la 20 m se realizează o mai bună eliminare a excesului de apă, valorile conținutului mediu de apă al solului descrescând de pe linia de dren spre mijlocul distanței dintre acestea.*

**Cuvinte cheie:** exces de umiditate, sistem de desecare-drenaj, modelare în benzi cu coame, conținut de apă al solului

## INTRODUCTION

The soil quality is less or more affected by one or more restrictions and namely: drought, periodic humidity excess, erosion, landslides etc. Their harmful influences are reflected in the damaging the soil characteristics and functions, in their bio-productive capacity, respectively in affecting the agricultural product quality and food safety with consequences on human life quality (Moca et al., 2000). These restrictions are determined either by natural factors or by agricultural and industrial anthropic actions that can synergically act in a negative way (Radu, 2009).

## MATERIAL AND METHOD

Given the pedoclimatic conditions of the moist zone of the Suceava county, respectively, in the meadow and the river basin of the Moldova river, the area has been equipped with experimental shallow drainage field patches, as the major solution for fighting the temporary excess of moisture derived from rainfall, locally associated with various improving agro-pedoclimatic works.

The hydrotechnic layout of the experimental drainage field of Baia stretches across 3.00 hectares divided in plots, in two repetitions of three versions each, in which the following issues were emphasized: the distance between the lines of drainage (12, 15, and 20 meters), the average pipe laying depth (0.80 and 1.00 meter), the nature and the diameter of drainage pipes, the nature and the thickness of filtering materials.

In order to determine the momentary water component of the soil, samples of soil were collected using a tubular probe, in 10 cm layers, down to 0.8 m and to 1.00 m respectively. The samples were probed 48 hours after the soil received 32 mm of rainwater, the control points being situated upon the drainage trench at 2.00 m distance from the latter and half-distance between the absorbing drains.

## RESULTS AND DISCUSSIONS

Analyzing the water content in the soil, determined at 48 hours after receiving 32 mm of rainfall, one notices that, in the case of those drains placed 15.00 m apart, the water content within the soil increases half-way between drains down to the 30-40 cm depth and decreases afterwards due to a less permeable layer (fig. 1, 2, 3, 4).

Upon the drainage trench, the water content within the soil decreases, in general, consistent with the depth, due to the created water inflow to the drain's filter and the reduction in the permeability of the filtering layer in 34 years of operation.

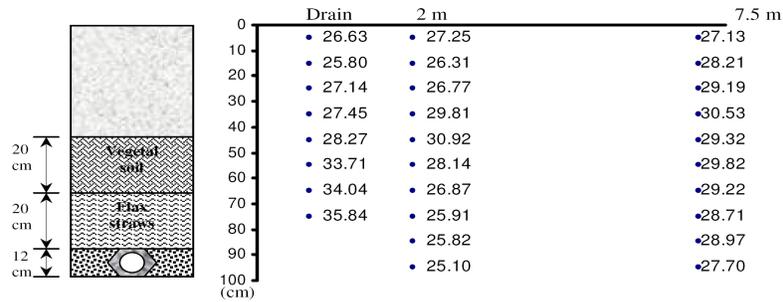


Fig. 1 - The soil water content in relation to depth, measured on drain D<sub>5</sub>

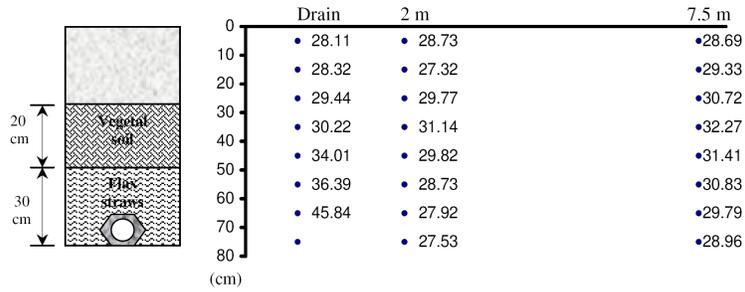


Fig. 2 - The soil water content in relation to depth, measured on drain D<sub>13</sub>

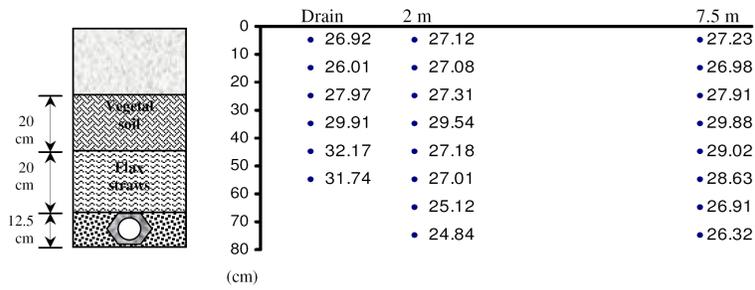


Fig. 3 - The soil water content in relation to depth, measured on drain D<sub>14</sub>

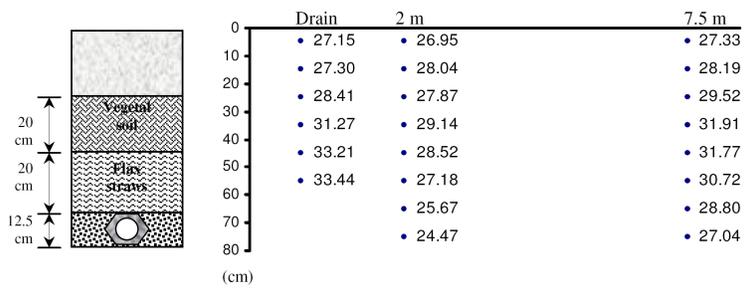


Fig. 4 - The soil water content in relation to depth, measured on drain D<sub>15</sub>

In the case of the  $D_3$  absorbing drain, having a distance between drainage lines of 20.00 m, a pipe laying depth of 1.00 m, and the surface serviced modeled in strips with ridges, the values of water content at the control points set 2.00 m apart and at half-distance between drains (10.00 m) increased down to 40-50 cm depth due to the contribution of the earth-like materials of which the strips with ridges are made (fig. 5).

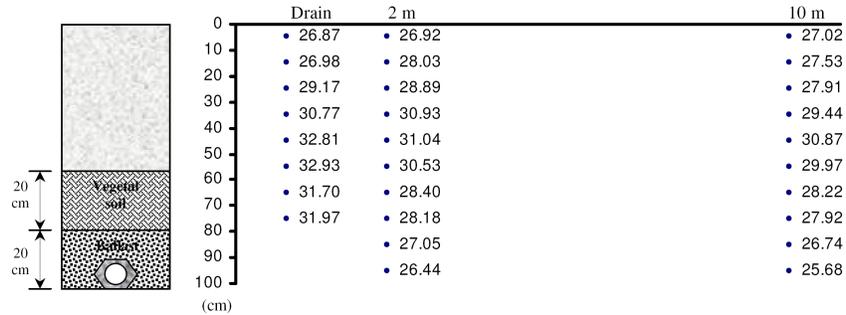


Fig. 5 - The soil water content in relation to depth, measured on drain  $D_3$

In the case of the  $D_{12}$  absorbing drainage, set 20.00 m apart, yet with the serviced area not modeled in strips with ridges, the values of the momentary water content increase down to 30-40 cm in control points set 2.00 m apart and 10.00 m from the drainage line respectively, and within the drainage trench they decrease in relation to depth (fig. 6)

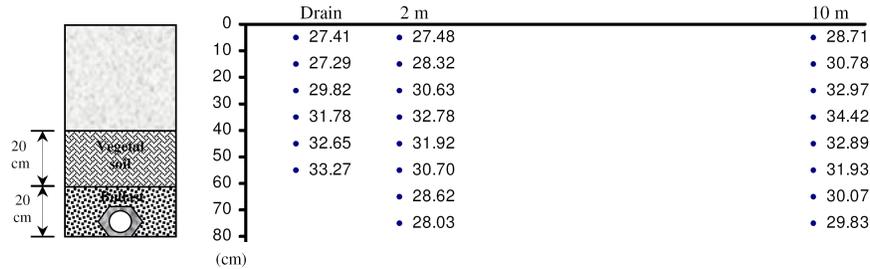
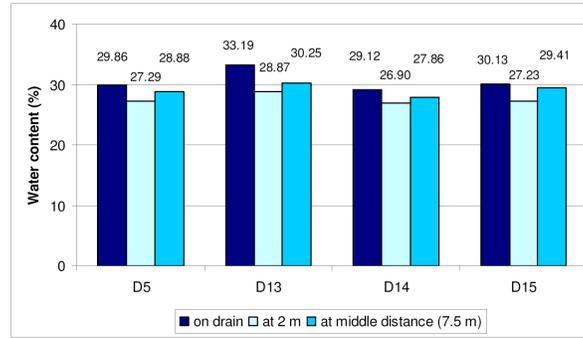


Fig. 6 - The soil water content in relation to depth, measured on drain  $D_{12}$

The average water content within the soil upon the control points measured 48 hours following a 32 mm rainfall, in the case of drains spaced 15.00 m apart, is the lowest at the control point situated at 2.00 m from the drain line and highest on the drainage trench. That fact highlights the operating mode of drainage lines and the creation of water inflow towards the drain's filter during the time of operation (fig. 7)

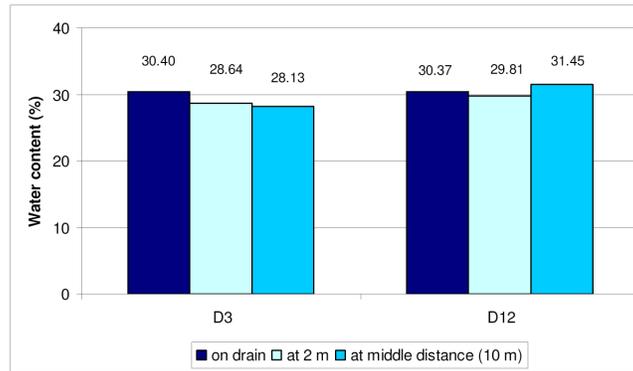
At the  $D_3$  absorbing drain, having a distance between drainage lines of 20.00 and modeled in strips with ridges, the mean values of the water content

within the soil at control points decreases towards the mean distance between drains (fig. 8)



**Fig. 7** - The mean content of water within the soil at control points, in the case of drains spaced 15.00 m apart

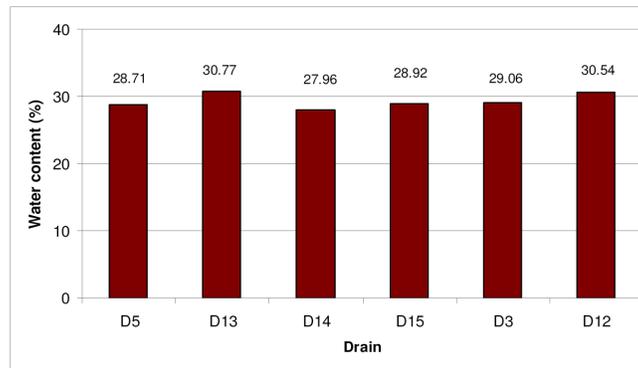
The lowest value measured half-distance between drains (10.00 m) is due to the water inflow created towards the drain's filter and due to water flowing towards the drainage lines, the drain making a better water interception within the first hours and days of water discharge.



**Fig. 8** - The mean content of water within the soil at control points, in the case of drains spaced 20.00 m apart

Orienting the surface water flow towards the drainage line, in the case of the D<sub>3</sub> drain is also revealed through the analysis of the mean water content at the control points placed upon the surface serviced by the un-modeled D<sub>12</sub> drain, where the highest value is measured half-distance between drains.

Analyzing the mean values of the water content within the soil upon the studied drains control section (fig. 9), one may ascertain that the highest values are measured at the D<sub>13</sub> and D<sub>12</sub> drains (30.77% and 30.54%), and the lowest at the D<sub>14</sub> drain (27.96%) spaced at 15.00 m and having the filtering layer made of gravel and flax stalks. The high value measured at the D<sub>13</sub> drain is due to the reduction in the filtering layer permeability by its ongoing conversion into organic matter, the latter being initially made merely of flax stalks.



**Fig. 9** - The soil mean water content within the controlled section

By modeling the terrain into strips with ridges at the D<sub>3</sub> drain, having a mean distance between drainage lines of 20.00 m, the water in excess is better driven out, the water content values being comparatively close to the ones measured at the 15.00 m apart spaced drains except for drain D<sub>13</sub>.

## CONCLUSIONS

1. In the case of 15.00 m apart spaced drains, at 48 hours from receiving 32.00 mm of rainfall, the lowest value of the mean water content is measured at the point of control spaced 2.00 m from the drainage line and the highest value upon the draining trench, due to the created water inflow to the drain's filter and due to the reduction in the filtering layer's permeability during the time of operation.

2. In the case of 20.00 m apart spaced drains, the highest value of the mean water content within the soil was measured at half-distance between drains and the lowest at the control point set at 2.00 m.

3. By modeling the terrain in strips with ridges, at the 20.00 m apart spaced drains, the water drainage process works better, the mean values of the soil water content decreasing towards the mid-distance between drains. The lowest value measured at mid-distance between drains (10.00 m) is due to the created water inflow to the drain's filter and due to causing the surface waters to flow towards the drainage lines, the drain making a better water interception within the first hours and days of water discharge.

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# INFLUENCE OF INTENSIVE FLOWER CULTIVATION ON SOME SOIL RESOURCES CHARACTERISTICS FROM GREENHOUSE VÂNĂTORI NEAMȚ

## INFLUENȚA CULTIVĂRII INTENSIVE A SPECIILOR FLORICOLE ASUPRA UNOR ÎNSUȘIRI ALE RESURSELOR DE SOL DIN SERA VÂNĂTORI NEAMȚ

**FILIPOV F.<sup>1</sup>, BĂDEANU Marilena<sup>1</sup>, TOMIȚĂ O.<sup>1</sup>**  
e-mail: ffilipov@uaiasi.ro

**Abstract.** Genesis and evolution of soils in greenhouses are influenced to a greater extent by human intervention than the soils developed in the field. Positive temperature values associated with the absence of freezing and mass air flow winds that favors soil air renewal requires the application of special technologies for plants growing in in order to prevent soil compaction. Intensive exploitation of greenhouse determine the degradation of morphological, physical and chemical characteristics of soil resources, and diminishing of obtained yield and therefore lower profits. A case study started in Vânători-Neamț greenhouse showed that the under ploughed soil layer is moderately compact and prevents plant roots penetration. Water stagnation over the compacted soil horizon requires amelioration works without reversal soil horizons. In this paper are presented the effects of intensive flower cultivation on some soil properties and the execution steps of amelioration work.

**Key words:** compacted soil, greenhouses, salinization, amelioration.

**Rezumat.** Formarea și evoluția solurilor din sere este influențată în măsura mai mare de către intervențiile antropice decât solurile evoluat în câmp deschis. Menținerea temperaturii la valori pozitive și lipsa înghețului asociată cu absența curenților de aer care să favorizeze primenirea aerului din sol impune aplicarea unor tehnologii de cultivare a plantelor în sere și solarii prin care să se evite tasarea și compactarea solului. Exploatarea intensivă a solului are ca efect degradarea însușirilor morfologice, fizice și chimice ale resurselor de sol, diminuarea producției obținute etc. Un studiu de caz inițiat în sera Vânători-Neamț, destinată cultivării intensive a plantelor ornamentale și decorative, a evidențiat că în stratul subarabil solul se prezintă moderat compact, și este restrictiv pentru pătrunderea rădăcinilor de plante. Stagnarea apei deasupra acestui orizont impune realizarea unor lucrări de afânare adâncă fără inversarea orizonturilor pedogenetice. În această lucrare sunt prezentate efectele cultivării intensive a plantelor ornamentale și decorative asupra unor însușiri ale solului și etapele de execuție a lucrărilor de afânare adâncă a solului fără inversarea orizonturilor pedogenetice.

**Cuvinte cheie:** solurile tasate, sere, salinizarea, ameliorarea.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

## INTRODUCTION

Frequently greenhouses are located near sources of heat and water. Another important criterion taken into account in determining the location of a greenhouse is to be located at a short distance from the center of outlet in order to reduce the costs of transport. Under these circumstances suitability of soil resources for horticultural plants to be grown is often ignored. However, after the application of ameliorative works satisfactory results are obtained a given period.

The frequent use of a high quantity of organic fertilizers (barnyard manure, compost etc.) in the greenhouses has some positive effects on soil such as an additional supply of nitrogen, greater availability of phosphorous and micronutrients due to the complexation, increased moisture retention, improved soil structure, increased pH, buffer capacity and soil organic matter, etc.

After intense mineralization of organic matter, due to favorable moisture and temperature condition for activity of microorganism, a high amount of organic acids results. The soluble organic acids are leached from the surface to lower soil horizons after a combination of these acids with calcium cations new compounds result. The precipitation of these compounds facilitates the building up of an impermeable horizon for air and water and the penetration of roots as well as sandstone (Davidescu, 1992).

The impermeable horizon has been identified both in acid soils (Planosol) and neutral soils (Hortic Anthrosols) from greenhouses (Conea, 1976, Filipov, 2001).

The new greenhouses soil properties may not be related to lithology and another initial soil formation factors. The arrangement technologies of protected areas and the exploitation methods require, both the modification of pedogeochemical characteristics of initial soils (over which are set the greenhouses and solariums), often to the almost complete blurring of their characteristics, and the continuous changes of pedogeochemical properties during of these soils exploitation (Mănescu, 1984; Davidescu and Davidescu, 1992; Voican and Lăcătuș, 1998).

The main objective of this paper is to present a method for improving soils with slight permeable horizons with a low humus located at small depth.

## MATERIAL AND METHOD

Investigations concern to the influence of intensive flower cultivation on some soil resources characteristics were conducted on the greenhouse Vânători –Neamț.

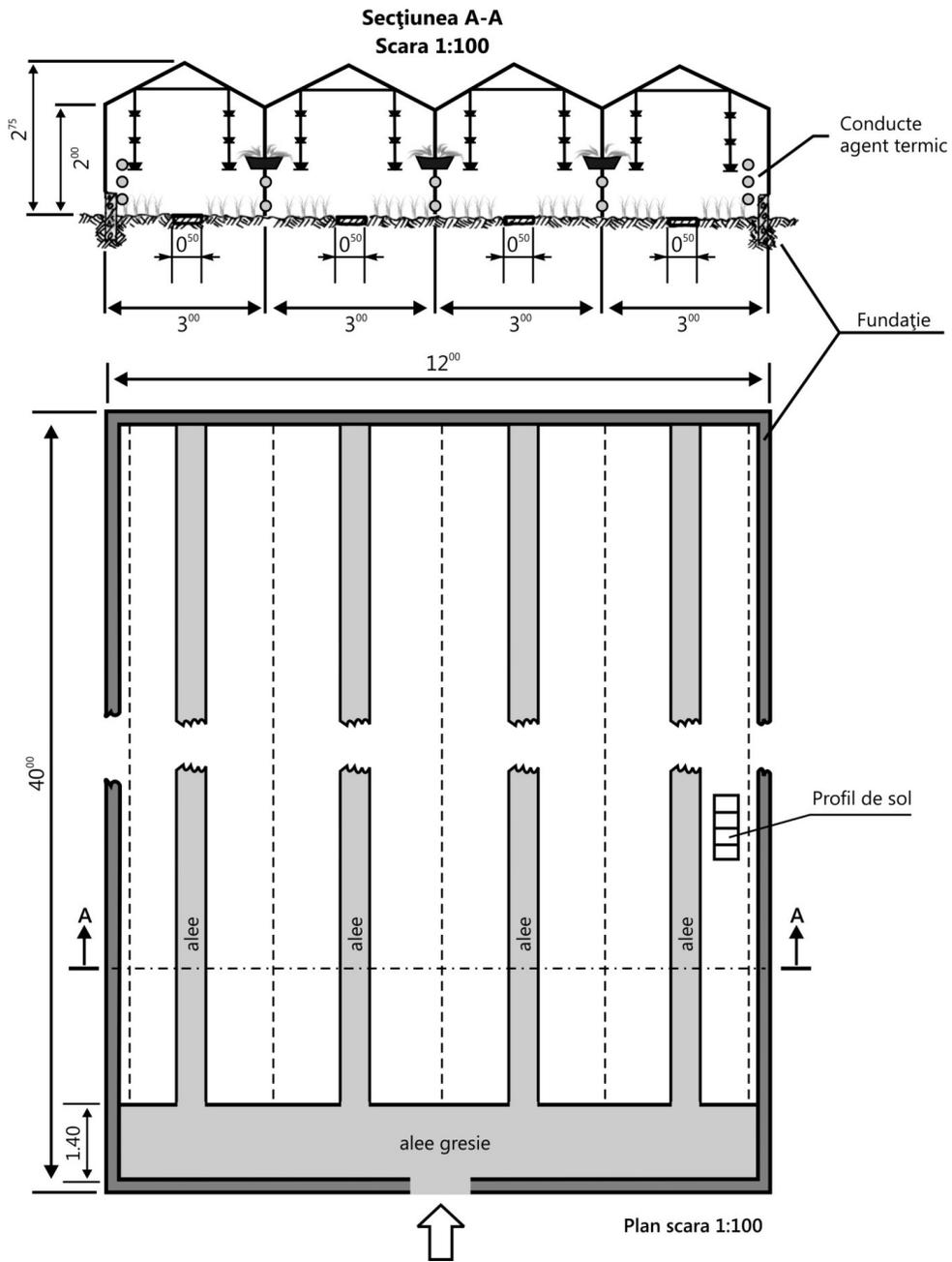
Some soil profiles were made inside of greenhouse. These profiles were morphologically described according to the Methodology of soil survey elaborated by the Research Institute for Soil Science and Agrochemistry, Bucharest (Florea 1987; 2003,2012; Munteanu, 2009).

After morphological description, undisturbed samples from every soil horizon were collected. In the lab, the bulk density were determined.

Disturbed samples from the soil profiles were also taken. These samples were used to determine the total soil organic matter by potassium dichromate method (Walkley-Black), total nitrogen content by Kjeldahl method, pH by potitionmetric method,

size particle by Kacinski method, soluble salts by conductometric method. The chemical analyses in three replicates for each depth were independently performed.

To underline the effect of intensive flower cultivation on some soil resources characteristics were chosen only a representative soil profile (fig.1).

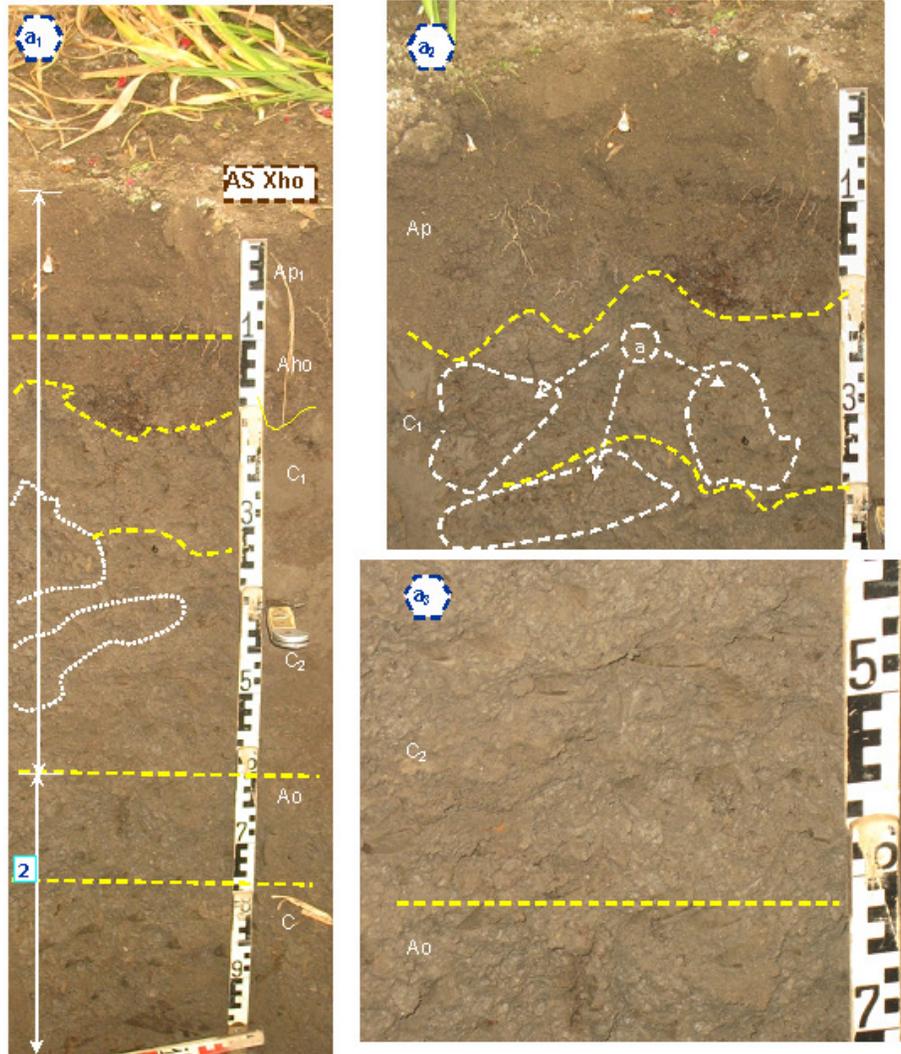


**Fig. 1** - Greenhouse for growing of ornamental and decorative plants from Vânători Neamț and location of representative soil profile

## RESULTS AND DISCUSSIONS

After morphological description the soil is diagnosed as hipohortic Aluviosol. Soil consists of ploughed horizon (Ap), hipohortic horizon (aho) with high content of heterogeneous organic matter and C horizon (fig. 2). The presence of frequent earthworm channels suggest a great biological activity. The absence of earthworm organism on the soil profile highlight a worsening of biological activity, the presence of earthworm channels being only a remanent effect.

The soil texture is loam on the upper part of soil profile and sandy loam in the subjacent ploughed horizon.



**Fig. 2** - Hipohortic (Xho) Aluviosolul (AS) with earthworm channels (a<sub>1</sub>), developed on the entic aluviosol (2). The earthworm channels- remanent effect of great biological activity.

Under hipohortic horizon (Aho) soil became moderately compact and favors temporary water stagnation. The presence of rot fibrous organic mater suggests that microbiological soil activity is low. The compaction of c horizon is evidenced by the medium bulk density value of 1,54 g/cm<sup>3</sup> (table 1). The high value of carbon/nitrogen another indicator of low microorganisms' activity.

Table 1

Some physical and chemical propertie of hipohortic Aluviosol

Depth (cm)	Horizon	Texture	pH	BD g/cm <sup>3</sup>	OM %	CEC me/100g	C/N
0-10	Ap <sub>1</sub>	*L	6,2	1,31	6,37	25,2	9,3
10 -15 (18)	Aho	L	6,7	1,45	11,65	29,1	16,8
15 (18) -30 36	C <sub>1</sub>	SL	6,9	1,54	4,2	22,37	12,4

BD-Bulk density (g/cm<sup>3</sup>); OM Organic matter (%); CEC – Cation exchange capacity; L-Loamy texture; SL – Sandy loam texture; Ap – ploughed horizon; Aho-hortic horizon

After following the intensive cultivation of ornamental and decorative plants a slight soil salinization is evidenced. The highest content of soluble salts is evidenced near the heat register

Table 1

Contents of the souble salts of hipohortic Aluviosol

Depth (cm)	Horizon	Soluble salts %		
		RP	BR	HR
0-10	Ap <sub>1</sub>	0,,147	0,178	0,259
10 -15 (18)	Aho	0,127	0,134	0,143
15 (18) -30 36	C <sub>1</sub>	0,152	0,193	0,187

RP-plants rows;BR – between rows; HR Heat register

The main improving soils with slight permeable horizons with a low humus located at small depth. The amelioration of the the compacted soil horizon and the improvement of internal drainage is possible by deep loosening works without reversal soil horizons (fig.3)

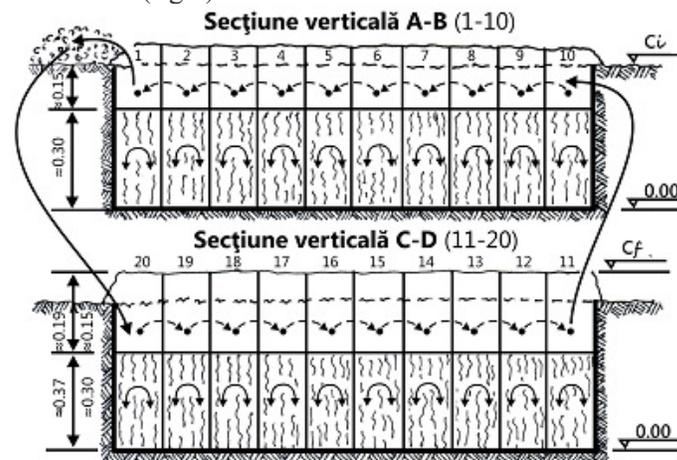


Fig. 3 - Steps of amelioration copaction soil works without reversal soil horizon

## CONCLUSIONS

1. The presence of frequent earthworm channels suggests a great biological activity. The absence of earthworm organism on the soil profile highlights a worsening of biological activity, the presence of earthworm channels being only a remanent effect.

2. After following the intensive cultivation of ornamental and decorative plants a slight soil salinization is evidenced. The highest content of soluble salts is evidenced near the heat register.

3. The amelioration of the compacted soil horizon and the improvement of internal drainage is possible by deep loosening works without reversal soil horizons.

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# DEGRADATION OF SOME PHYSICAL SOIL PROPERTIES AFTER INTENSIVE EXPLOITATION OF GREENHOUSES DUMBRAVA-NEAMŢ

## DEGRADAREA UNOR ÎNSUŞIRI FIZICE ALE RESURSELOR DE SOL DIN SOLARIILE DUMBRAVA-NEAMŢ

*FILIPOV F.<sup>1</sup>, RADU O.<sup>1</sup>, CHIORESCU Esmeralda<sup>1</sup>*  
e-mail: ffilipov@uaiasi.ro

**Abstract.** Getting early production, plant protection against natural risk factors (hail, frost, frost, etc.) are the main advantages of planting vegetables in greenhouses. Implementations of modern technologies for growing plants without knowing the soil characteristics determines degradation of soil resources and reduce the qualitative and quantitative obtained yields. Researches carried out on greenhouses soils allowed us to detach some conclusions: (i) soil cover with plastic favored increasing compaction within the area between rows, (ii) reduce the aeration porosity, (iii) decrease plant vigor and production obtained.

**Key words:** soil properties, greenhouse, degradation of soil

**Rezumat.** Formarea și evoluția solurilor din sere este influențată în măsura mai mare de Obținerea de producție timpurie, protecția plantelor împotriva unor factori de risc natural (grindină, brumă, îngheț, etc) sunt principalele avantaje ale cultivării lor legumicole în solarii. Implementarea unor tehnologii moderne de cultivare a plantelor fără cunoașterea însușirilor resurselor de sol are ca efect accentuarea proceselor de degradare a solului și implicit diminuarea calitativă și cantitativă a producțiilor obținute. Cecetările efectuate asupra solurilor din sere și solarii ne-au permis să desprindem unele concluzii: (i) acoperirea solului cu folie de plastic a favorizat creșterea gradului de tasare în zona aflată între rânduri; (ii) micșorarea porozității de aeraj; (iii) scăderea vigoriei plantelor și a producției obținute.

**Cuvinte cheie:** proprietăți ale solului, seră, degradarea solului

### INTRODUCTION

The main criteria for the location of the greenhouses are the existence of heating and water sources. Due to the compulsory location imposed by the above conditions, many greenhouses were placed on soils considered with a low capability (Filipov, 2001, 2002, 2004) but then through the application of land improvement works satisfactory results have obtained (Canarache, 1995).

The greenhouse soils must have a medium texture (clay- 12-20%), without coarse rock fragments and present a good water and air permeability (Florea, 1987, Canarache, 1973).

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<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

The intensive technology for growing the horticultural plants, high irrigation requirement and the high soil moisture, specially with low internal drainage, favor on short term the degradation of morphological, physical and chemical properties of the greenhouse soils. After 7 years of intensive exploitation of Dumbrava-greenhouse one discontinuous compact impermeable horizon was formed. This horizon represents a barrier for roots penetration, water and air movement and favors also high accumulation of soluble salts.

The growing of the legumes plants in the greenhouses or plastic tunnels has some advantages such as obtaining of early production, plant protections against of some natural risk factors (hailstone, hoar frost, frost etc.). The surface of plastic tunnels are extended significant in the last period (2000 - 2008) due to improving of plants growing technology such as using of plastic mulch, drip irrigation. It is well known that plastic mulch have some advantages: increase soil temperature and diminishes diurnal amplitude of temperature,, reduce leaching of fertilizers, conserve moisture, increase nutrients bioavailability, decrease losses of nitrogen compounds.

Our investigation concern to the greenhouses soils horticulture Dumbrava evidenced that plastic mulch have some negative influence on the soil properties and production quality (fig.1): increasing of soil compaction between plant rows, decrease air porosity, and cucumber seed production.

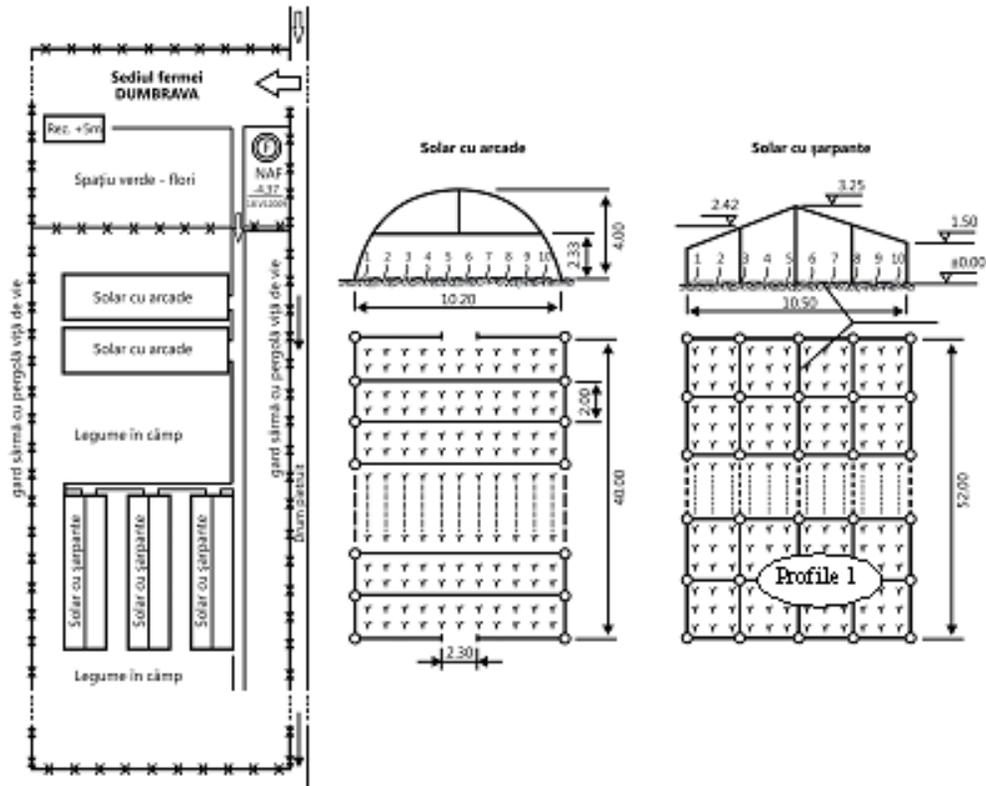


**Fig. 1** - The negative effects of plastic mulch and moisture excess on the tomato plants

Water stagnation over the compacted soil horizon requires amelioration works. Improvement the soil fertility can be obtain by deep loosening without reversal soil horizons and avoid soil cover with plastic mulch.

## MATERIAL AND METHOD

In the horticultur farm Dumbrava there are 5 greenhouses (fig. 2), each of them has almost 450 m<sup>2</sup>.



**Fig. 2** - Location of different greenhouses type on Dumbrava farm. Placement of representative soil profile

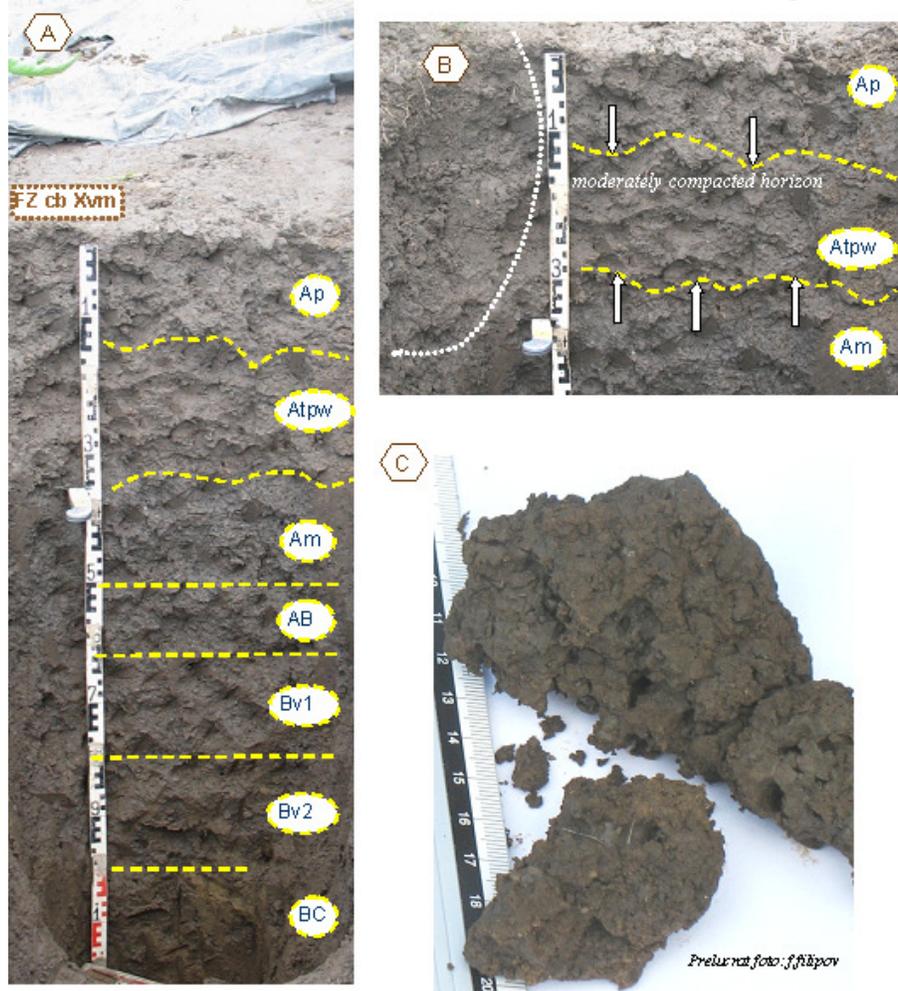
The greenhouse was located on a plain surface, the slope present the possibility of a landslide. The soils from the first class capability for greenhouses must have in 0-50 cm layer a humus reserve higher than 300 t/ha, slightly acid reaction and a low content of soluble salts and exchangeable sodium less than 5% of cation exchangeable capacity.

Four soil profiles were also studied. After morphological characteristics soil diagnosis is hipohortic vermic Faeoziom (after Romanian Soil Taxonomy-2003, 2009) For this study one representative soils profile have been selected. After morphological description, undisturbed samples from 10 to 10 cm were collected down to, the depth of 50 cm. In the lab, the bulk density and water content was determined. The physical analyses in four replicates for each depth were independently performed.

Disturbed samples from the soil profiles were also taken. These samples were used to determine the total soil organic matter by potassium dichromate method (Walkley-Black), total nitrogen content by Kjeldahl method, pH by potentiometric method, size particle by Kacinski method. The chemical analyses in three replicates for each depth were independently performed.

## RESULTS AND DISCUSSIONS

After morphological description the soil is diagnosed as hipohortic hipovermic Faeoziom. Soil consists of one loose ploughed horizon (Ap1), one moderately compacted horizon (Atp) with high content of organic matter, mollic horizon (am), slight weathered horizon (B cambic) and C horizon (fig. 3).



**Fig. 3 - A-** Hipohortic (Xho) cambic (cb)Faeozioms (FZ); **B-** Moderately compacted soil horizon suited between plant rows and slight loose soil horizon on the plant rows; **C-** High biological activity evidenced by presence of special biological soil formation.

The presence of frequent earthworm channels suggests a great biological activity. The soil texture is loamy clay. The soil is slight drained due to plain surface of greenhouse and to moderately compacted horizon on the upper part of soil profile (Atpw). The bulk density intervals values are between 1,25 and 1,59 g/cm<sup>3</sup>. The highest bulk density values is registered on the marginal yone of plastic tunells and shows a stronger soil compaction.

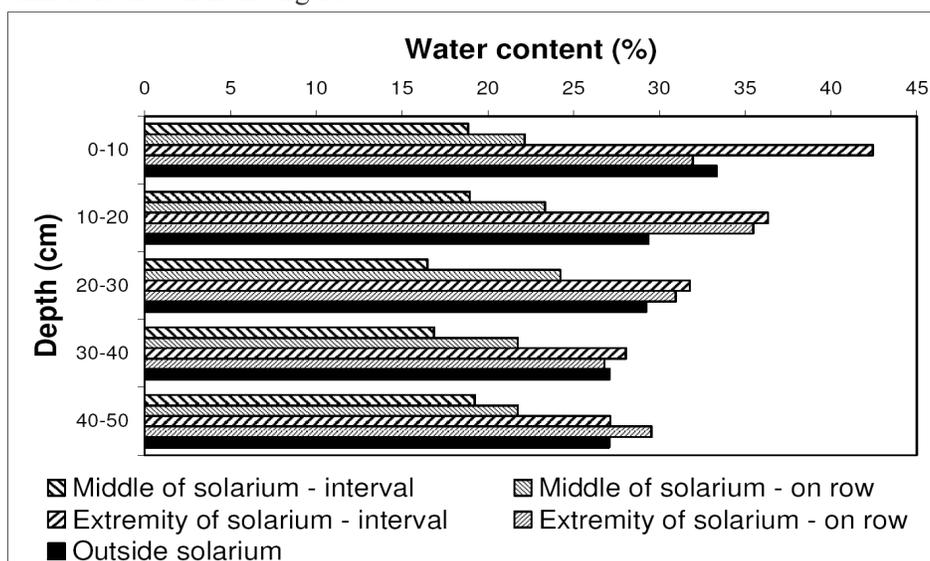
Table 1

The bulk density medium values of the upper part of soil from greenhouse  
Dumbrava

Depth (cm)	Horizon	Bulk density g/cm <sup>3</sup>			
		RP <sub>c</sub>	BR <sub>c</sub>	RP <sub>m</sub>	BR <sub>m</sub>
5-10	Ap <sub>1</sub>	1,25	1,33	1,35	1,43
15-20	Ap <sub>1</sub>	1,29	1,38	1,41	1,47
20-25	Atpw	1,35	1,52	1,41	1,57
30-35	Atpw	1,33	1,47	1,43	1,59
45-50	Am	1,32	1,36	1,39	1,42

**Legend:** RP<sub>c</sub>-plants rows; BR<sub>c</sub>- between rows; c - central part of plastic tunnels; m – marginal zone of plastic tunnels

Uneven distribution of water content on the soil from Dumbrava plastic tunnels is shown in the figure 5.



**Fig. 5** - Water content from soil according to depths and zones in the classical-type solarium

For avoiding the formation of water excess at the extremity of classical-type solariums, during the periods with abundant rainfall, we recommend the achievement of ditches that collect and evacuate water runoff from the top of solarium.

Another recommended measure are deep loosening works without reversal soil horizons and avoid soil cover with plastic mulch which prevent water evaporation loose and increase the period of water stagnation.

## CONCLUSIONS

1. A discontinuous compacted horizon has been formed at the depth of 15 – 40. The more frequent alternations of the wetting and drying processes favor a

closed packing of soil aggregates. The improvement of the soil properties could be realized by deep loosening works without reversal soil horizons.

2. For avoiding the formation of water excess at the extremity of classical-type solariums, during the periods with abundant rainfall, we recommend the achievement of ditches that collect and evacuate water runoff from the top of solarium and prevent moisture excess on the marginal solarium zone.

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# STUDIES ON TRANSFORMATION OF HEAVY METALS IN ERODED CARBONATIC CHERNOZEMS

## STUDII ASUPRA TRANSFORMĂRII METALELOR GRELE ÎN CERNOZIOMURI CARBONATICE ERODATE

*LEAH Tamara*<sup>1</sup>

e-mail: tamaraleah09@gmail.com

**Abstract.** *It presents the results concerning the content and transformation of chemical forms of Co, Ni, Cu, and Zn in eroded carbonatic chernozems. The total content of heavy metals is directly proportional to the soil erosion degree. The transformation of chemical forms of heavy metals in eroded soils depends on the quantity of organic matter, carbonates, Fe-Mn oxides and clay minerals.*

**Key words:** eroded soils, heavy metals, content, transformation

**Rezumat.** *Sunt prezentate rezultatele cercetării conținutului și transformării formelor chimice ale Co, Ni, Cu, Zn în cernoziomurile carbonatice erodate. Conținutul total al metalelor grele este direct proporțional cu gradul de erodare al solurilor. Transformarea formelor chimice a metalelor grele depinde de conținutul cantitativ al materiei organice, carbonaților, oxizilor Fe-Mn și mineralelor argiloase din sol.*

**Cuvinte cheie:** soluri erodate, metale grele, conținut, transformare

### INTRODUCTION

Environmental pollution is one of the most pressing problems. Avoid it completely is impossible, because pollution is a consequence of the functioning of our society, however, be able to assess, predict and deal with negative consequences is possible. A special group of polluting elements constitute the heavy metals (Co, Ni, Cu, Zn, etc.), which have the highest rates of pollution and toxicity. In view of his position, the characteristics of the composition and structure of the soil plays the regulator role of geochemical cyclic of mass flows of heavy metal. Their regulation is a combination process of migration, transformation and accumulation in the soils. To understand the mechanisms of the behavior of the heavy metals in soils and establishment the true criterion of toxicity not sufficient to determine only their total content. There is an objective necessity in the differentiation of their chemical forms, depending on soil properties and its ability to keep the metals in the absorbed state.

To assess the migratory ability of heavy metals in the food chain should take into account not only the chemical forms of metals, but also their transformation, as well as the ability of plants to withstand pollution. Despite to intensive research, many issues of absorption and transformation of heavy metals in soils remain unresolved, and this determines the relevance of this work.

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<sup>1</sup> Institute of Pedology, Agrochemistry and Soil Protection "N. Dimo", Chișinău, Republic of Moldova

Purpose is investigate the transformation of chemical forms of copper, zinc, cobalt and nickel in the eroded carbonatic chernozems; determine the effect of carbonates and humus on the transformation of heavy metals in the soils.

## MATERIAL AND METHOD

Soils subject to researches are chernozems calcareous from chain (slope) with different degree of erosion: none eroded, weakly eroded, moderately eroded, strongly eroded and accumulative (deluvial) soils. The diluvial soils include the soils formed as a result of pedolit deposits accumulation from slops in rapidly erosion processes.

Determination of heavy metals in soil samples was performed by atomic absorption spectrophotometer methods. The total (global) content of heavy metals was determined by the classical decomposition with hydrofluoric acid in combination with sulfuric acid. The chemical forms of heavy metals in soils were determined in different solutions:

- Mobile and accessible forms – ammonium acetate at pH 4,8;
- Forms from compounds with organic matter – 0,1n NaOH;
- Forms from compounds with carbonates – 1n HCl;
- Forms from compounds with Fe-Mn oxides – Mehra Jackson method;
- Forms from compounds with primary minerals: the difference between the total content of the element and its content in 20% HCl solution after incineration at 500 t°C;
- Forms from compounds with clay minerals: the difference between the content in 20% HCl solution after incineration at 500 t°C and sum content of forms with organic matter, oxides and carbonates.

## RESULTS AND DISCUSSIONS

Eroded soils in Republic of Moldova occupy 80% of the total agriculture area and are most vulnerability to degradation processes. Losses of organic matter and nutrients from eroded land are considerable and have become an environmental issue for agricultural production. In result of erosion processes the weakly eroded carbonatic chernozems losses about 17% of humus, moderately eroded – 30%; strongly eroded – 52% (Leah, 2010). Losses humus materials from soils on the slopes are accumulated in the bottom on the valley. In deluvial soils the content of humus consists 3,4% (table 1).

The content of carbonates in the investigated soils show that erosion processes increased their quantity in dependence of erosion degree. The content of carbonates increased in strongly eroded soil in 6 times. A significant content of carbonates are accumulated in deluvial soil – 3,4% (table 1).

Research concerning the content of trace elements in soils has developed lately as to verify the available content for plants (studies in agrochemistry) and total determination in biogeochemical aims. Other chemical forms of trace elements in soils and their transformation under degradation factors were not studies. In the table 2-5 are presented the results of determination the amount and chemical forms of Co, Ni, Cu, Zn in eroded carbonatic chernozems.

Table 1

## The content of humus and carbonates in calcareous chernozems

Depth, cm	Non eroded	Weakly eroded	Moderately eroded	Strongly eroded	Deluvial soil
<b>Humus, %</b>					
0-10	3,84	3,17	2,70	1,85	3,41
10-20	3,19	3,10	2,65	1,75	3,34
20-30	3,11	2,88	2,10	1,23	2,75
30-40	3,00	2,64	1,45	0,81	2,85
40-50	2,45	1,99	1,05	0,76	3,96
50-60	2,10	1,45	0,97	0,58	3,86
60-70	1,66	1,10	0,66	0,51	3,34
70-80	1,40	0,97	0,49	0,45	2,70
80-90	1,14	0,72	0,42	0,41	2,07
90-100	0,90	0,66	0,40	0,34	1,90
<b>CaCO<sub>3</sub>, %</b>					
0-10	1,2	2,7	4,5	6,9	2,0
10-20	1,7	2,9	4,7	7,0	2,2
20-30	1,4	3,4	6,2	9,2	2,5
30-40	3,1	6,1	10,9	10,5	1,5
40-50	4,7	8,6	12,5	11,4	1,8
50-60	4,8	10,	13,8	11,1	1,5
60-70	6,3	12,2	14,7	10,9	2,3
70-80	10,2	11,4	15,4	11,4	2,0
80-90	11,6	11,3	12,3	9,9	5,0
90-100	12,1	14,0	12,1	9,1	6,0

**The total content of heavy metals in eroded calcareous chernozems.** The total content of elements includes all forms of chemical elements in soil, inclusively: available for plants and currently inaccessible for plants. Their accumulation in surface horizons is the result of different factors, but firstly the concentration in these horizons is result of bioaccumulation and contemporaneous actions. The calculation of the reserves of studies trace elements in the eroded carbonatic chernozems shows that their content in humic horizons is below that the average concentrations for chernozems (Leah, 2005a, 2005b).

Losses of heavy metals expressed in total forms consists in strongly eroded soils: Co – 18%, Zn – 31%, Cu – 35% of the total content of none eroded soil. The total content of Ni increases with erosion degree, in the non eroded soil contain 48,9 mg/kg, in strongly eroded – 83,5 mg/kg, which confirm that a quantity of Ni is associated primary and secondary minerals of soil (table 2-5).

Chemical forms of heavy metals in agricultural soils are studies more intensively nowadays. Studies in this context are reduced to the following. Soil components involved in the absorption of chemical elements are Fe-Mn oxides, organic matter, carbonates and clay minerals (Leah, 2005a, 2005b). These components are considered the important groups which influence chemical processes in soils, involved and competed with each other in absorption of

elements. By trying to know these processes it brings a supplement in studies about pedogeochemical land includes in agriculture cycle.

*Table 2*

**Content and chemical forms of Co in carbonatic chernozems, mg/kg, 0-20 cm**

Chernozem carbonatic	Co total	mobile forms	Chemical forms of Co compounds with				
			carbo nates	organic matter	Fe-Mn oxides	minerals	
						clay	primary
Non eroded	21,0	0,18	2,4	0,10	13,0	3,0	2,5
Weakly eroded	19,5	0,25	2,3	0,10	14,0	2,0	2,3
Moderately eroded	18,0	0,30	2,1	0,10	15,0	1,5	1,8
Strongly eroded	17,3	0,35	2,0	0,10	17,0	1,0	1,2
Cumulative soil	19,7	0,40	3,3	0,10	19,0	9,0	1,7

*Table 3*

**Content and chemical forms of Ni in carbonatic chernozems, mg/kg, 0-20 cm**

Chernozem carbonatic	Ni total	mobile forms	Chemical forms of Ni compounds with				
			carbo nates	organic matter	Fe-Mn oxides	minerals	
						clay	primary
Non eroded	48,9	3,30	3,3	0,53	43,0	1,7	10,9
Weakly eroded	51,9	3,10	3,0	0,50	36,0	8,4	18,9
Moderately eroded	77,6	3,00	2,5	0,45	35,5	35,1	48,6
Strongly eroded	83,5	3,00	2,5	0,42	29,0	48,5	55,0
Cumulative soil	41,0	5,00	11,1	0,22	21,3	8,7	11,1

*Table 4*

**Content and chemical forms of Cu in carbonatic chernozems, mg/kg, 0-20 cm**

Chernozem carbonatic	Cu total	mobile forms	Chemical forms of Cu compounds with				
			carbo nates	organic matter	Fe-Mn oxides	minerals	
						clay	primary
Non eroded	22,7	1,75	3,8	0,42	10,6	2,7	5,7
Weakly eroded	20,8	1,54	3,7	0,25	10,2	2,5	4,8
Moderately eroded	18,1	1,32	3,3	0,23	9,2	2,4	4,0
Strongly eroded	14,7	1,00	3,0	0,21	8,3	3,2	5,5
Cumulative soil	15,0	1,00	4,0	1,00	6,5	2,0	2,4

*Table 5*

**Content and chemical forms of Zn in carbonatic chernozems, mg/kg, 0-20 cm**

Chernozem carbonatic	Zn total	mobile forms	Chemical forms of Zn compounds with				
			carbo nates	organic matter	Fe-Mn oxides	minerals	
						clay	primary
Non eroded	76,4	2,45	3,2	0,60	40,0	23,4	12,4
Weakly eroded	63,2	1,34	3,0	0,55	45,0	21,0	23,6
Moderately eroded	60,6	1,32	2,4	0,50	50,0	16,6	29,7
Strongly eroded	52,7	1,30	1,7	0,45	56,0	10,5	51,2
Cumulative soil	41,4	3,85	5,5	0,10	22,0	20,0	13,5

**Mobile and plant accessible** chemical forms consist in none eroded soils 0,2-3,0 mg/kg or 1-7% from total forms. Increasing erosion has led to their distribution in eroded soils, but accumulation occurs in deluvial soil as result of migration with humic matter. These forms have a proportional correlation with total content. Ions of these elements can be easily settled by sulfites, carbonates and hydroxides; as a result they are poorly mobile in the soil.

**Chemical forms current inaccessible** for plants are found as highly insoluble or practically insolubly salts, organic and organic-mineral compounds, primary and secondary minerals. They consist about 70-80% in the soils [1]. Some of the current inaccessible forms of heavy metals may become gradually over the time inaccessible for plants by physical, chemical and biochemical processes of mobilization from heavy soluble to easily soluble, ionic forms (as chemical forms associated with carbonates, organic matter, Fe-Mn oxides). They constitute potential of mobilized reserves. But, insoluble salts and crystal lattices of minerals are nutrients locked in accessible positions which constitute immobilization reserves of chemical elements (chemical forms related to primary minerals).

Chemical forms associated with carbonates. The carbonates are a common component of soils where evaporation prevails over the amount of rainfall. Thus  $\text{Ca}^{++}$  is a cation which is found in soil solution. The most widespread and mobile form of calcium carbonate in soils is calcite, which has a high dispersion and action very much the soil acidity, therefore, and the behavior of trace elements in soils. Thus, the chemical elements can be sediment by carbonates. Chemical forms associated with carbonates consists 2,4-3,8 mg/kg. There is a proportional decreasing of these forms with the degree of erosion. In the deluvial soils these forms consists up 13 to 27% from total forms. Chemical forms of the carbonates compounds forming in chernozems average 5-25% of the total. The increase in carbonate content of the soil leads to more stable fixation of heavy metals by reducing their accumulation in the metabolic forms of sorption of carbonates and Fe-Mn oxides.

Chemical forms associated with organic matter. The organic matter contained in different links all necessary plant nutrients. Ability of organic compounds associated the helatic chemical elements is know before. Most organic compounds formed soluble and insoluble complexes and this association maintenance capacity of the elements in the soil solution that depends on the nature and amount of soil organic matter. Formation of organic complexes has significant practical importance for managing biological accessibility and migration of elements in the soil. The content of heavy metals associated with organic matter is reduced, due to the increasing degree of humus mineralization. Content of heavy metals associated with organic compounds make up 0,1 to 0,8 mg/kg in the 0-20 cm horizon of carbonatic chernozems or 0,4 to 1,8% of the total content. The cumulative soil have from 0,1 to 0,2 mg/kg of these forms. In the deluvial soils can accumulate other forms organically and mineral compounds in result of increasing the content of soil carbonates.

Chemical forms associated with oxides of Fe-Mn. Soils oxides are specific components of the soil and have important meaning in retaining of trace elements in soils. A considerable amount of heavy metals is always adsorbed Fe-Mn oxides. Chernozems calcareous none eroded contain 11-13 mg/kg of Co and Cu; 40-43 mg/kg Ni and Zn associated by oxides. With erosion degree the content of these forms increase for Co, Zn, and decrease for Cu, Ni. In deluvial soil these forms do not accumulated.

Chemical associated with clay (secondary) and primary minerals. All mineral of soil have capacity to adsorption the elements ions in solution, especially in soils with high mineral content. Clay minerals in the soils are the most important mineral. Though high dispersion degree and physical-chemical characteristics clay minerals are the most active fraction of mineral soil as natural and ecological factors. Together with humus, these minerals form clay-humic soil complex. Therefore, a considerable amount of heavy metals is always associated with clay minerals. The chemical forms of Co, Ni, Cu associated in clay minerals consist in none eroded soil about 1,7-3,0 mg/kg; Zn – 23 mg/kg. Most of primary minerals can associate heavy metals in the forms inaccessible for plants that are most resistant forms in the soils, the content is 2,5-10,9 mg/kg.

The features transformation of the compounds of heavy metals in soils can be used to assess the environmental impact of anthropogenic emissions to the environment. The established mechanisms of interaction of heavy metals with soil components may serve to develop effective methods of remediation of contaminated of eroded soils.

## CONCLUSIONS

1. Absorption and transformation of compounds of heavy metals in eroded soils depends on the composition of metals, as well as the properties of the soil. In the eroded soils the distribution of heavy metals on fractions of the compounds changes that can serve as a diagnostic criterion in determining of pollution.

2. Under contamination the accumulation of heavy metals in plants may be reduced due to antagonism of compounds and functioning of physiological and biochemical barriers. Carbonates in the soil contribute to the fixation of heavy metals by reducing the content of their exchange forms of sorption on the surface of the carbonates and increase adsorption capacity Fe-Mn oxides.

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# STATIC ANALYSIS OF CONTINUOUS BEAM WITH NUMERICAL METHOD (FEM)

## ANALIZA STATICĂ A GRINZILOR CONTINUE FOLOSIND METODA NUMERICĂ (FEM)

**FETEA M.<sup>1</sup>, ZAHARIA A.<sup>2</sup>**  
e-mail: marius\_fetea@yahoo.com

**Abstract.** *Finite element method is a method of analysis and simulation of current real phenomena. This paper focuses on this method, applied through finite element analysis program Matlab, presenting a structural analysis application useful in the field of forest, mechanical and structural engineering. Program designed by the authors using the finite element tool engineer put in hand work necessary to optimize the design, with positive effects on the complete analysis of stress and tensions in continuous beams.*

**Keywords:** Engineering, finite, element, beam, methods.

**Rezumat.** *Metoda elementului finit reprezintă metoda de analiză și simulare a fenomenelor reale. Lucrarea bazată pe metoda enunțată și programul de calcul nemic Matlab, prezintă posibilitatea de efectuarea a analizelor structurale în domeniul forestier, mecanic și civil. Programul conceput de către autori, folosind metoda elementului finit, permite optimizarea muncii de proiectare, având efecte pozitive în ceea ce privește analiza tensiunilor și eforturilor ce apar în secțiunile transversale ale grinzilor continue.*

**Cuvinte cheie:** Inginerie, element finit, metodă, grindă.

### INTRODUCTION

In the finite-element method, a distributed physical system to be analysed is divided into a number (often large) of discrete elements. The division into elements may partly correspond to natural subdivisions of the structure. Most or all of the model parameters have very direct relationships to the structure and material properties of the system (Fletcher, 1959; Gheorghiu, 1999; Glazman and Liubici, 1980)

### MATERIAL AND METHOD

This paper presents the calculation of flat structures with rigid nodes using finite element method. In this case there are no inertial or damping effects, or at least they are negligible (Bors, 2007; Jianming and Douglas, 2009; Leissa, 1962).

Flat structure is modeled as a simple continuous beam with simply supports and 1 articulated support located at the left end of the structure. This type of structure is composed of bars with 2 nodes and 3 degrees of freedom on each node (Barsan, 1983; Ilie and Soare, 1983; Fletcher, 1959; Gheorghiu, 1999).

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<sup>1</sup>University of Oradea, Romania

<sup>2</sup> University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Romania

The three degrees of freedom per node are the horizontally and vertically displacements and also the rotated section. It aims to determine the nodals elastic equilibrium equations using the displacements method (Catarg et al.,1978; Manescu, 2005; Timoshenko and Goodier, 1970; Szilard, 1974). The analysis requires two reference systems (Pantel, 2002; Petrilu,1987) one local that is attached to each element of the bar and a global for the analysis of the entire structure of bars.

## RESULTS AND DISCUSSION

Generalized displacement and generalized forces vectors of a beam element are (Fletcher, 1959; Fetea, 2010; Bors, 2007).

$$\{d\} = \{u_i, v_i, \varphi_i, u_j, v_j, \varphi_j\}^T, \{f\} = \{N_i, T_i, M_i, N_j, T_j, M_j\}$$

Stiffness matrix elements are determined by applying displacements on each degree of freedom and blocking the corresponding the other remaining degrees of freedom. At each applied displacement nodes produce at the ends of bar sectional efforts on the 6 degrees of freedom (Jianming and Douglas, 2009; Pantel, 2002). By applying the 6 successive displacements and using the principle of superposition, determine the relationship between generalized displacement and generalized forces vector . Stiffness matrix contains terms that depend on the geometry of the beam and physical-mechanical properties of the material.

Orthogonal matrix that connects the components of a vector in global and local reference system is a transformation matrix and is of the form (Glazman and Liubici 1980; Manescu, 2005).

The displacement and efforts at the ends of bars is determinate by applying conditions and solving the system equations of the nodal equilibrium. By applying the superposition principle (Via et al., 1983; Catarg and Petrina, 1978), we determined the relation between the sectional efforts to ends beam, when were applied nodal displacements  $(u, v, \varphi)$  in each node on the 3 degrees of freedom. This is the equilibrium equation of beam elements in the local reference system.

Initial data of beam studies are: force is applied to the beam in node 8 having the coordinates  $x = 800[mm], y = 0[mm]$ ; Section height is  $h = 100[mm]$ ; Young's modulus  $E = 2.1 \cdot 10^5 [N/mm^2]$ ; Transverse modulus of the material  $E = 8 \cdot 10^4 [N/mm^2]$ ; Tensile-compressive stiffness of the structure  $E \cdot A = 100^2$ ; Bending stiffness of the structure.  $E \cdot I_z = 100^4 / 12, F_y = 10^3 [N]$ .

```
The numerical program.
% Continuous beam is considered. Required to determine the nodal displacements, stresses and sectional efforts at the ends of bars.
nodes= [0 0
        200 0
        400 0
        600 0
        800 0
        1000 0
        1200 0
        1400 0
        1600 0
        1800 0]
clear; clc;
%Cartesian coordinates of the nodes expressed in [mm]
% x y
```

```

2000 0]
% Finite element matrix
elem=[ 1  2  100
       2  3  100
       3  4  100
       4  5  100
       5  6  100]
% Young's modulus [N/mm^2]
E=2.1*10^5
% Transverse modulus of the material
[N/mm^2]
G=8*10^4
% Tensile-compressive and bending
stiffness of the structure.
ea=100^2 eiz=100^4/12
%Number of nodes of the structure
nnd=length(noduri(:,2))
cond=[ 1  1  1  0
       3  0  1  0
       5  0  1  0]
% Determine the number of forces and
boundary conditions applied to the
structure
nnf=length(forte(:,1))
ncond=length(cond(:,2))
% Axes x and y coordinates of the node
structure
cx=noduri(:,1) cy=noduri(:,2)
%Number of degrees of freedom per
node (ngn),element (nel) and the total
number of degrees of freedom (nec)
ngn=3 ngel=2*ngn nec=nnd*ngn
% Initialization to zero for MR, F and
index
MR=zeros(nec,nec)      F=zeros(nec)
index=zeros(2*ngn)
% The calculation of the beam with rigid
nodes
for i=1:nel
mrel=[e1 0 0 e1 0 0
      0 e2 e3 0 -e2 e3
      0 e3 e4 0 -e3 e5
      -e1 0 0 e1 0 0
      0 -e2 -e3 0 e2 -e3
      0 e3 e5 0 -e3 e4]
% Transformation matrix
% elem nod1 nod2 h(section height)
      6  7  100
      7  8  100
      8  9  100
      9 10  100
     10 11  100]
% Number of elements of structure
nel=length(elem(:,2))
% Forces applied to the beam
% node fx fy momz
forte=[ 8 0 -1000 0]
% Boundary conditions applied to the
beam
% node bx by brz
      7  0  1  0
      9  0  1  0
     11  0  1  0]
nod1=elem(i,1)      nod2=elem(i,2)
h(i)=elem(i,3)
for ii=1:ngn
index(ii)=ngn*(nod1-1)+ii
end
for iii=ngn+1:2*ngn
index(iii)=ngn*(nod2-2)+iii
end
% Length of beam finite elements
le=sqrt((cx(nod2)-
cx(nod1))^2+(cy(nod2)-cy(nod1))^2)
% Cosines directors of beam elements.
c=(cx(nod2)-cx(nod1))/le s=(cy(nod2)-
cy(nod1))/le length(i)=le'
% Vectors cosine directors
vc(i)=c vs(i)=s
% Matrix elements stiffness
e1=ea/le e2=12*eiz/le^3 e3=6*eiz/le^2
e4=4*eiz/le e5=2*eiz/le
c1=[c -s 0]' c2=[s c 0]' c3=[0 0 1]' c0=[0
0 0]'
T=[c1 c2 c3 c0 c0 c0
   c0 c0 c0 c1 c2 c3]
% Stiffness matrix in global reference
system
mrel=T'*mrel*T

```

```

% Assembling the stiffness matrices of elements
for i1=1:ngel
j1=index(i1)
for i2=1:ngel
j2=index(i2)
MR(j1,j2)=MR(j1,j2)+mrel(i1,i2)
% Set up vector of nodal loads
for i=1:nmf
% Forces nodes
n=forte(i,1)
if forte(i,2)~=0
f=forte(i,2)
n=cond(i,1) end
% Implementation of the conditions with zero displacement on x direction
if cond(i,2)==1
MR(ngn*(n-1)+1,:)=zeros(1,nec)
MR(:,ngn*(n-1)+1)=zeros(nec,1)
MR(ngn*(n-1)+1,ngn*(n-1)+1)=1
F(ngn*(n-1)+1)=0
end
% Implementation of the conditions with zero displacement on y direction
if cond(i,3)==1
MR(ngn*(n-1)+2,:)=zeros(1,nec)
MR(:,ngn*(n-1)+2)=zeros(nec,1)
MR(ngn*(n-1)+2,ngn*(n-1)+2)=1
F(ngn*(n-1)+2)=0
end
% Implementation of the conditions with zero rotations around z axes
if cond(i,3)==1
MR(ngn*(n-1)+3,:)=zeros(1,nec)
MR(:,ngn*(n-1)+3)=zeros(nec,1)
MR(ngn*(n-1)+3,ngn*(n-1)+3)=1
F(ngn*(n-1)+3)=0
end
% Determination of initial unknowns represented by nodal displacements by solving the system of elastic nodal equations
% Format long e
depl=MR\F
for i=1:nnd
u(i)=depl(ngn*(i-1)+1) v(i)=depl(ngn*(i-1)+2) rotz(i)=depl(ngn*(i-1)+3)
F(ngn*(n-1)+1)=F(ngn*(n-1)+1)+f
end
if forte(i,3)~=0
f=forte(i,3)
F(ngn*(n-1)+2)=F(ngn*(n-1)+2)+f
end
if forte(i,4)~=0
f=forte(i,4)
F(ngn*(n-1)+3)=F(ngn*(n-1)+3)+f
end
% Applying boundary conditions
for i=1:ncond
% Nodes with displacement zero
end
% Display the primary unknowns (nodal displacements)
fprintf('nod u(mm) v(mm) rotz(rad)\n')
for i=1:nnd
fprintf(' %2.f %2.5f %2.5f\n',i,u(i),v(i),rotz(i))
end
fprintf('\n')
pause
%Determination of strains and tensions in ends of each beam finite element
for i=1:nel
% Redefining nodes
nod1=elem(i,1) nod2=elem(i,2)
% Calculation of beam lengths of all finite elements
le=sqrt((cx(nod2)-cx(nod1))^2+(cy(nod2)-cy(nod1))^2)
% Determine the cosine directors of each beam finite element
c=(cx(nod2)-cx(nod1))/le s=(cy(nod2)-cy(nod1))/le
% Determination of global displacement of each beam finite element
ue1=depl(elem(i,1)*ngn-2,1)
ue2=depl(elem(i,1)*ngn-1,1)
ue3=depl(elem(i,1)*ngn,1)
ue4=depl(elem(i,2)*ngn-2,1)
ue5=depl(elem(i,2)*ngn-1,1)
ue6=depl(elem(i,2)*ngn,1)
%Determination of nodal displacements for each beam finite element in local reference system

```

```

ul1=c*ue1+s*ue2    ul2=(-s)*ue1+c*ue2    % Display nodal unknowns tension and
ul3=ue3    ul4=c*ue4+s*ue5    ul5=(-    maximum stress on each beam finite
s)*ue4+c*ue5    ul6=ue6    elements
% Calculation of stress from the first end    fprintf('\n')
of the beam    fprintf('element %2.f\n',i)
% Strain from tensile (compressive)    fprintf('node %2.f stressnod1 stressnod2
e11=(ul4-ul1)/le    maxstressnode1 \n',elem(i,1))
% Strain from the bending deformation    fprintf(' %2.5f %2.5f
e12=h(i)/(2*le^2)*(-6*ul2-    %2.5f\n',stress(1),stress(2),STRESS1)
4*ul3*le+6*ul5-2*ul6*le) stress(1)=(e11-    fprintf('node %2.f stressnod2 stressnod2
e12)*elem(i,3)    maxstressnode2 \n',elem(i,2))
stress(2)=(e11+e12)*elem(i,3)    fprintf(' %2.5f %2.5f
%The maximum stress to the first end of    %2.5f\n',stress(3),stress(4),STRESS2)
the beam    fprintf('Maximum stress on element)
STRESS1=max(abs([stress(1),stress(2)]))    fprintf(' %2.5f\n', Stresselem)
% Calculation of stress at the second end    end
of the beam    for i=1:nel
% Strain from tensile (compressive)    % Redefining nodes
e21=(ul4-ul1)/le    nod1=elem(i,1) nod2=elem(i,2)
% Strain from the bending deformation    % Calculation of beam lengths of all
e22=h(i)/(2*le^2)*(6*ul2+2*ul3*le-    finite elements
6*ul5+4*ul6*le) stress(3)=(e21-    le=sqrt((cx(nod2)-
e22)*elem(i,3)    cx(nod1))^2+(cy(nod2)-cy(nod1))^2)
stress(4)=(e21+e12)*elem(i,3)    %Determine the cosine directors of each
% The maximum stress to the first end of    finite element
the beam    c=(cx(nod2)-cx(nod1))/le s=(cy(nod2)-
STRESS2=max(abs([stress(3),stress(4)]))    cy(nod1))/le
%Maximum stress on each finite element    % Stiffness matrix of element
beam    e1=ea/le e2=12*eiz/le^3 e3=6*eiz/le^2
Stresselem=max(abs([STRESS1,STRESS    e4=4*eiz/le e5=2*eiz/le
2])) tensmax(i)=Stresselem
mrel=[e1 0 0 e1 0 0    -e1 0 0 e1 0 0
      0 e2 e3 0 -e2 e3    0 -e2 -e3 0 e2 -e3
      0 e3 e4 0 -e3 e5    0 e3 e5 0 -e3 e4]
% Transformation matrix of elements    ef=mrel*deplel nx(1,i)=-ef(1)
c1=[c -s 0]' c2=[s c 0]' c3=[0 0 1]' c0=[0    nx(2,i)=ef(4) ty(1,i)=-ef(2) ty(2,i)=ef(5)
0 0]'    mz(1,i)=-ef(3) mz(2,i)=ef(6)
T=[c1 c2 c3 c0 c0 c0    % Display the sectional efforts
  c0 c0 c0 c1 c2 c3]    fprintf('\n')
% Stiffness matrix in global reference    fprintf('elementul %2.f\n',i)
system    fprintf('nod %2.f Fx Fy Mz \n',elem(i,1))
mrel=T'*mrel*T    fprintf(' %2.5f %2.5f
% The vector displacement for finite    %2.5f\n',ef(1),ef(2),ef(3))
element beam    fprintf('nod %2.f Fx Fy Mz \n',elem(i,2))
deplel=[u(nod1,v(nod1,rotz(nod1)),u(nod2)    fprintf(' %2.5f %2.5f
),v(nod2),rotz(nod2)]'    %2.5f\n',ef(4),ef(5),ef(6))end
% Sectional efforts vector

```

## CONCLUSIONS

Numerical method has the advantage that the computer program developed by the author, leads to solutions of the problem that converge to the "exact" solution. The paper presented, is a novelty in terms of adapting to a full calculation of continuous beams regardless of physical-mechanical properties of materials they are made.

The main steps that were followed in this program by the authors are:

1. Stiffness matrices-writing of the elements composing the structure of the continuous beam;
2. Calculation of the cosine directors and transformation matrices;
3. Matrix assembly of each beam in the global stiffness matrix of the structure;
4. Establishment of nodal forces for the entire structure;
5. Application related conditions;
6. Determining the nodal equilibrium equations system;
7. Determining the efforts and the tension at each beam ends.

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# RESEARCHES REGARDING THE DESIGNING, ACHIEVEMENT AND TESTING OF A LABORATORY TEST RIG FOR DRYING AGRICULTURAL AND FOOD PRODUCTS

## CERCETĂRI PRIVIND PROIECTAREA, REALIZAREA ȘI EXPERIMENTAREA UNUI STAND DE LABORATOR PENTRU USCAREA PRODUSELOR AGROALIMENTARE

ȚENU I.<sup>1</sup>, ROȘCA R.<sup>1</sup>, CÂRLESCU P.<sup>1</sup>,  
e-mail: pcarlescu@yahoo.com

**Abstract.** *The drying process is affected both by the complex thermo physical processes (diffusion, thermal diffusion etc.) that take place inside the particles forming the product which is dehydrated and by the mass and heat transfer in the boundary layer that separates the surface of the solid body from the thermodynamic agent, also called drying agent. In order to study the drying process of the agricultural and food products and to optimize the parameters of the dehydration process a laboratory test rig was designed and built. The rig allows the surveillance of the parameters involved in the drying process of the solid state agro-alimentary products. The following parameters are continuously measured and recorded: ambient air temperature and humidity, the temperature and humidity of the drying agent, the weight of the sample to be dried. The unit is equipped with a specialized microprocessor which allows the continuous adjustment of the speed of the drying agent and also the administration of the working process data, including their transfer to an external PC.*

**Key words:** drying, laboratory test rig, solid agro alimentary products

**Rezumat.** *Mecanismul uscării depinde de procesele termofizice complexe care au loc în interiorul particulelor produsului supus deshidratării (difuziune, termodifuziune) și de transferul simultan de masă și căldură din stratul limită ce separă suprafața corpului solid de agentul termodinamic, care este denumit agent de uscare. Pentru studiul mecanismului uscării produselor agroalimentare, în vederea optimizării parametrilor de deshidratare, s-a proiectat și realizat un stand de laborator complex. Prin intermediul acestui stand se pot monitoriza toți parametrii care concurează la realizarea procesului de lucru pentru uscarea produselor agroalimentare aflate în stare solidă. Astfel, instalația permite măsurarea și monitorizarea continuă, atât la intrare cât și la ieșire, a următorilor parametri: umiditatea și temperatura aerului, umiditatea și temperatura agentului de uscare, masa probei supusă uscării. Instalația este echipată cu un microprocesor specializat, care permite reglarea continuă a vitezei agentului de uscare, dar și gestionarea datelor privind procesul de lucru (inclusiv transferul de date către un PC exterior).*

**Cuvinte cheie:** uscare, stand de laborator, produse agroalimentare solide.

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<sup>1</sup>University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

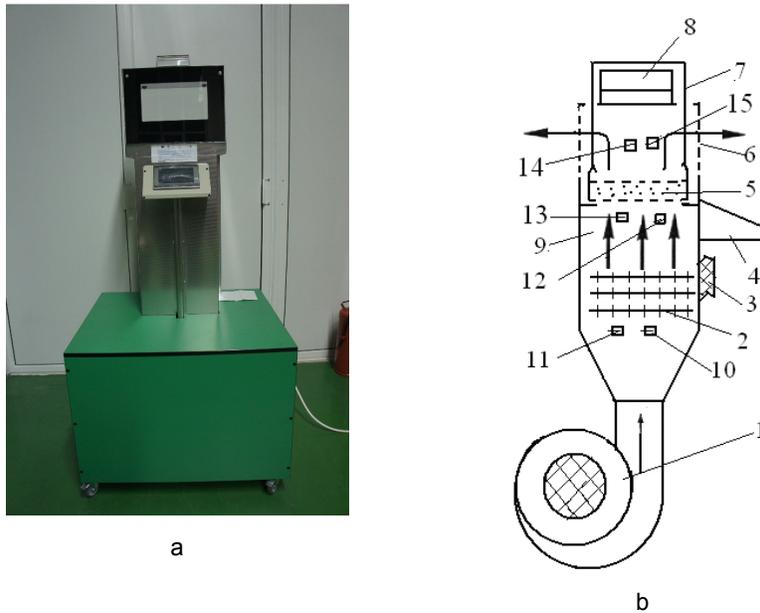
## INTRODUCTION

Drying operation based technology is reducing the water content, respectively substance soluble concentration growth to levels that stabilize food storage. Removing water from foods should be directed so that hydrophilic colloids to maintain rehydration capacity. If fruits and vegetables, drying natural moisture content is reduced to a level that would prevent activity of microorganisms without tissue damage or to depreciate the value of their food.

The mechanism for drying process it is determined by some complex thermophysical processes occurring inside the particles undergo dehydration product (diffusion termodiffusion) and simultaneous mass and heat transfer in the boundary layer separating the solid body surface thermodynamic agent, which is called drying agent (hot air, flue gas or a mixture of gas and air etc). This determines that the work is complex and dynamic drying time. (Baehr and Karl, 2006; Incopera et. al., 2007).

## MATERIAL AND METHOD

Laboratory test rig (fig. 1) for drying various products (cereals, vegetables, fruits) is based on heat transfer by convection.



**Fig. 1** - Laboratory test rig to study drying food products:  
a – general view; b – Functional diagram dryers.

1 – fan; 2 – electric resistance air heating; 3 - insulation, 4 - operator interface "touch screen", 5 - box dried product, 6 - windows evacuation drying agent used; 7 - box support rods; 8 - electronic scale; 9 - inside the dryer; 10, 12 and 15 sensors for measuring ambient air temperatures, and hot air drying agent used; 11, 13 and 14 - sensors for measuring humidity of the ambient air, hot air and agent used drying.



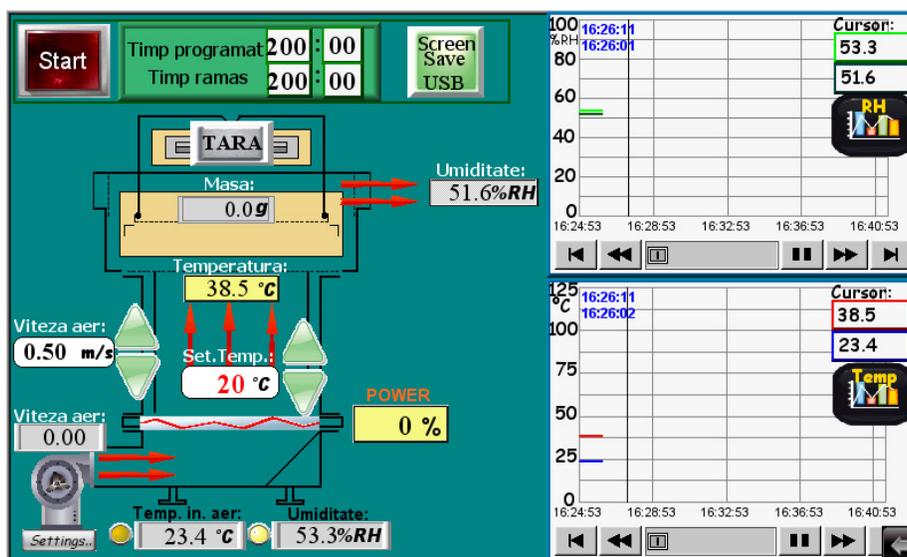


Fig. 3 - Monitoring workflow parameters by a microprocessor type controller "touch screen"

Table 1

Monitoring workflow parameters

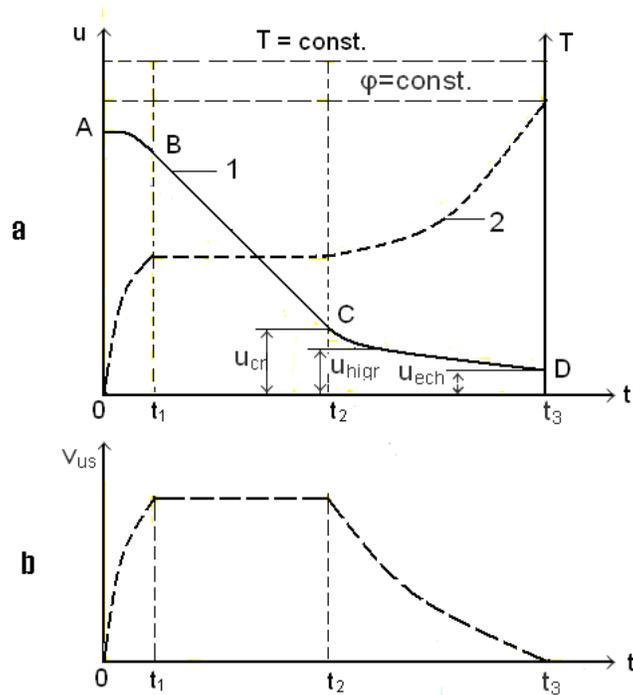
Parameter	Working range	Observations
Air velocity (m/s)	0.5 – 2.5	Set by speed electric motor.
Air inlet temperature (°C)	0 – 150	Ambient temperature.
Inlet air humidity (%RH)	0 – 100	External humidity environment.
Air temperature during drying (°C)	20 - 120	Temperature of the air entering the drying box.
Air humidity out of the dryer (%RH)	0 – 100	Humidity coming out of the dryer.
Load energy factor (%)	0 – 100	Depending on fan speed and temperature of the drying.
Weight (g)	0.0– 1000.0	Continuous measurement of mass product drying box

The laboratory test rig achieved can be used for both dry grain and vegetables and fruit.

If the initial grain moisture at harvest depends on weather conditions and harvesting. Such moisture can be 11 to 14% for cereals harvested when fully ripe and dry weather, and in case of harvesting during rainy humidity can reach 18 to 22%. To ensure conservation conditions, grain moisture should be below 14 to 15%. By entering the box product migrates outwards and grain moisture from the surface by evaporation. During drying occur simultaneously two distinct processes, namely a internal diffusion and external diffusion. Drying is all these two basic processes and speed the drying time of the slowest speed of elementary processes.

Diagram convective drying kinetics is variation in time of drying parameters. The analysis of the two graphs in (fig. 4) shows that the breast drying three distinct phases:

- The time heating of cereals, where speed of drying is an increasing trend;
- constant rate drying period;
- decreasing speed drying time.



**Fig. 4** - Variation of kinetic parameters defining the convective drying process: a - temperature and humidity chart: 1 – humidity curve; 2 – changes in product temperature. b - variation speed drying.

Grains to drying products are introduced into the chimney and flue weight and temperature parameters of the product and humidity are monitored continuously. Fruits and vegetables according to their structure and texture are cut into pieces to be distributed as evenly drying basket. Processes monitoring important parameters in the drying process are identical to those of the dry grain.

At the completion of the drying process monitored parameters (temperature wet weight) are transferred AUB numerical form or in the form of graphs on a PC.

## CONCLUSIONS

1. Laboratory test rig is a complex installation, which can optimize workflow parameters, namely: drying temperature, drying time, drying speed etc.
2. Laboratory bench can be used for drying various agricultural products (vegetables, fruits, grains, malt etc.).
3. Registration experimental data can be transferred to external PC, including graphs of temperature and humidity evolution drying agent (input and output).

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# RESEARCHES REGARDING THE ATTACK OF *SCLEROTINIA SCLEROTIORUM* ON THE *BRASSICA NAPUS* LEAVES

## CERCETĂRI PRIVIND ATACUL AGENTULUI PATOGEN *SCLEROTINIA SCLEROTIORUM* PE FRUNZELE DE RAPIȚĂ (*BRASSICA NAPUS* L.)

CALISTRU Anca – Elena<sup>1</sup>, LEONTE C.<sup>1</sup>, LĂZĂRESCU E.<sup>1</sup>,  
LIPȘA F.<sup>1</sup>, LUPU Ancuța- Elena<sup>1</sup>  
e-mail: ancaelenacalistru@gmail.com

**Abstract.** *Sclerotinia sclerotiorum* is one of the rapeseed pathogens that causes important yield losses (Saharan et al., 2008). Until now, there weren't identified resistant cultivars to this pathogen. There were examined 20 rapeseed cultivars, in controlled environmental conditions, using the detached leaf assay (Bradley et al., 2006), with mycelium cultivated on PDA, from 2 different isolates of the pathogen. The diameter of the lesions was measured, and the results were statistically analysed. The cultivars responded differently, depending on the isolate used.

**Key words:** *Sclerotinia sclerotiorum*, artificial infection, *Brassica napus*

**Rezumat.** *Sclerotinia sclerotiorum* se numără printre agenții patogeni ai rapiței care produce pierderi de producție importante (Saharan et al., 2008). Până în prezent, nu au fost identificate cultivare rezistente la boala produsă de acesta. Au fost evaluate 20 de cultivare de rapiță, în condiții de laborator, utilizându-se metoda de infecție artificială pe frunze detașate (Bradley et al., 2006), cu miceliu cultivat pe mediu PDA, de la 2 izolate ale agentului patogen. A fost măsurată dimensiunea leziunilor produse în urma infecției, iar rezultatele au fost prelucrate statistic. Cultivarele s-au comportat diferit, în funcție de izolatul utilizat.

**Cuvinte cheie:** *Sclerotinia sclerotiorum*, rezistență, *Brassica napus*

### INTRODUCTION

Stem rot of oilseed rape, caused by the fungus *Sclerotinia sclerotiorum* is one of the most important diseases of the crop and leads to high losses of production worldwide. Depending of the environmental conditions, the yield losses can get up to 100% (Sarahan et al., 2008).

No oilseed rape cultivars are marked as having resistance to this disease. According to Garg et al., (2008), strategies for selecting resistant host are considered the most economic and sustainable control means. To develop resistant or tolerant genotypes, oilseed rape breeders have focused on morphological (e.g. stem diameter, Li et al., 2006; or epicuticular wax, Skoropad and Tewari, 1977) and physiological (e.g. phytoalexins, Toal and

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

Jones, 1999, or oxalate oxidase enzyme, Dong et al., 2008) traits of host genotypes to improve resistance to stem rot in oilseed rape (Rahmanpour et al., 2011).

Several methods have been used to identify resistance to *Sclerotinia sclerotiorum* in rapeseed. They include screening against oxalic acid, which is a fairly well-known pathogenicity factor for the pathogen (Cessna et al., 2000), petiole inoculation (Zhao et al., 2004; Bradley et al., 2006), leaf inoculation; stem inoculation (Chaocai, 1995; Li et al., 2006), and more recently, cotyledon assay (Garg et al., 2008). Variability of responses of oilseed rape germplasm to *Sclerotinia* stem rot using different methods and experiments is common (Wegulo et al., 1998).

Field evaluations for resistance to *Sclerotinia sclerotiorum* are important; however, problems can be associated with field evaluations. Disease pressure may not be uniform in a field situation, which may lead to wrong results.

The objective of this study was to characterize the level of resistance to *Sclerotinia sclerotiorum* on 20 cultivars of rapeseed, using a detached leaf assay.

## MATERIAL AND METHOD

The tested rapeseed genotypes were provided by the Centre of Genetic Resources of Netherlands.

For the artificial infection, there were used 2 isolates of *Sclerotinia sclerotiorum*, one collected from Germany (Giessen) and one from the Romania (Ezareni).

For the inoculum production, a single sclerotium of *Sclerotinia sclerotiorum* was surface sterilised in 1% (v/v) sodium hypochlorite and 70 % ethanol for 4 min followed by two washes in sterile distilled water for 1 min (Clarkson et al., 2003).

The sclerotium was cut in half and placed on potato dextrose agar (PDA). The fungus was subcultured and maintained in an incubator at 20° Con PDA. For the inoculation, were used 3 days-old colonies.

Young, fully expanded leaves were detached from plants grown in the controlled environmental room and transferred to the laboratory.

There were used 6 leaves for every cultivar, 5 for infection and 1 for control.

These leaves were placed in trays with gauze covering the petiole and kept in darkness, at 22 -24° C and humidity of 70 – 80 %.

On each leaf, there were put 2 plug discs of PDA medium with mycelia near the main vein.

On the control leaf there were put 2 discs of PDA medium, without mycelia.

The diameter of the lesions was measured 24 h, 48 h and 72 h after inoculation (fig. 1).

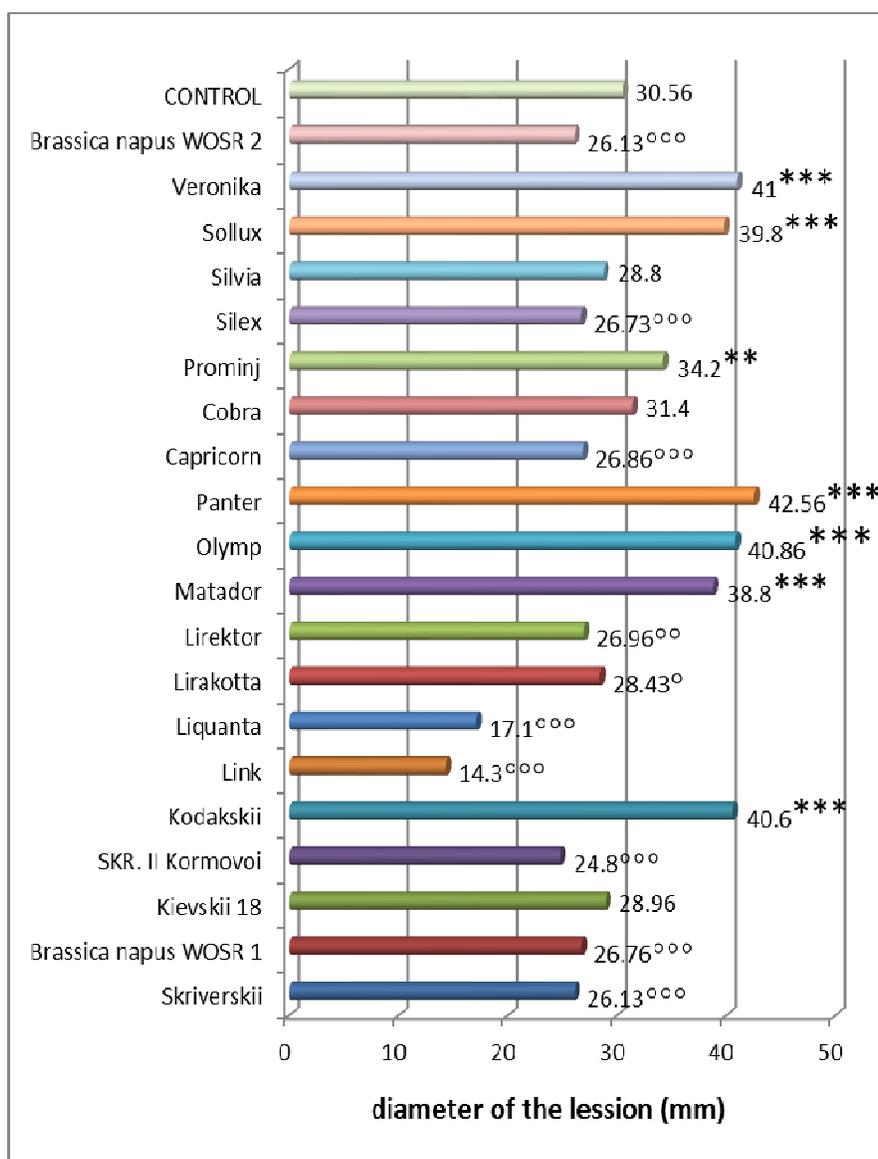


**Fig. 1** - Tray with leaves inoculated with PDA discs with mycelia (original)

## RESULTS AND DISCUSSIONS

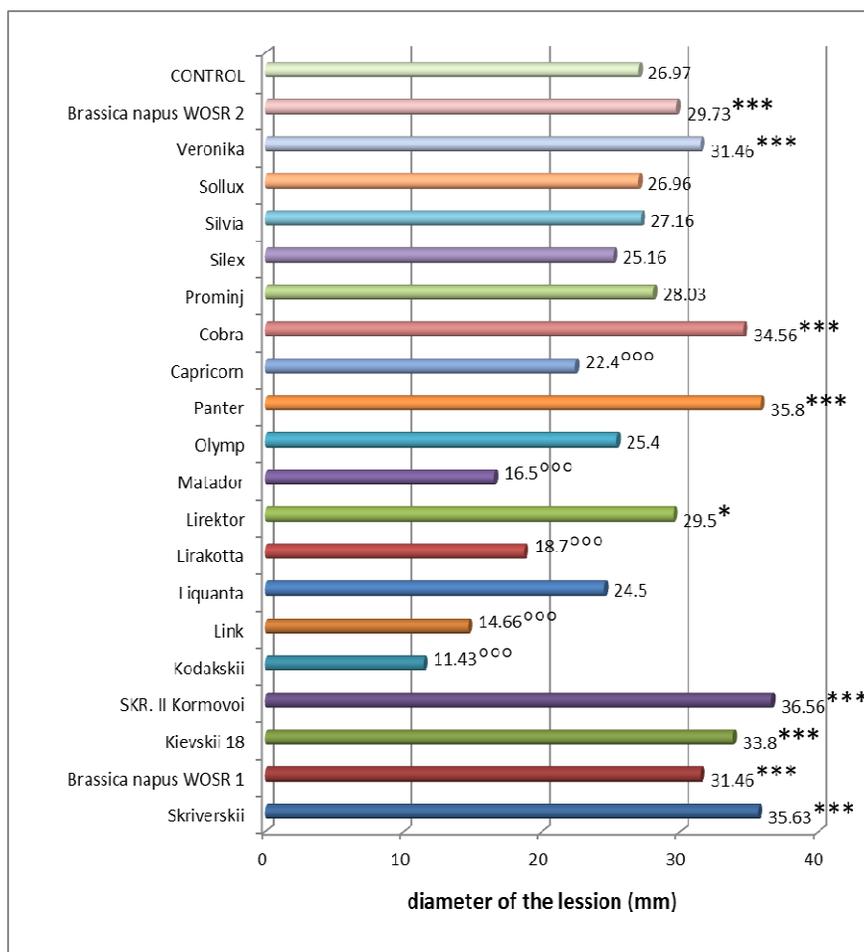
For the artificial infection with the Giessen isolate, typical necrotic lesions appeared on the leaves of susceptible genotypes. The size of the lesions varied between the tested genotypes (fig. 2), from 14.3 mm for the Link cultivar, to 42,56 mm for the Panter cultivar. 7 cultivars (Skriverskii, *Brassica napus* WOSR 1, SKR. II Kormovoi, Link, Liquanta, Silex and *Brassica napus* group WOSR 2) presented very significant differences compared to the control of 30.56 mm (the average of the values for the isolate), which means that these cultivars have a better tolerance against the pathogen. 2 cultivars (Lirektor si Capricorn) had distinct significant differences and the Lirakotta cultivar presented significant difference compared to the control. These cultivars presented a lower tolerance against *Sclerotinia sclerotiorum*. The Kodakskii, Matador, Olymp, Panter, Sollux and Veronika cultivars proved to be hypersensitive, having distinct significant values compared to the control. The other cultivars presented statistical uninsured differences.

For the artificial infection with the Ezareni isolate, the diameter of the lesions varied from 11.43 mm for the Kodakskii cultivar to 36.56 mm for the SKR. II Kormovoi cultivar (fig. 3). 5 cultivars (Kodakskii, Link, Lirakotta, Matado and Capricorn) had highly significant differences, compared to the control of 26.97 (the average of the values for the isolate), which means that these cultivars had a better tolerance against the pathogen. The Liquanta cultivar had a significant difference compared to the control.



**Fig. 2** - Diameter of the lesions for the artificial infection for the Giessen isolate

8 cultivars (Skriverskii, *Brassica napus* WOSR 1, Kievskii 18, SKR. II Kormovoi, Panter, Cobra, Veronika and *Brassica napus* WOSR 2) proved to be very sensitive to the artificial infection with the Ezareni isolate, having highly significant differences compared to the control. The Direktor cultivar presented sensitive reaction, with a significant difference compared to the control.



**Fig. 3** - Diameter of the lesions for the artificial infection for the Ezareni isolate

## CONCLUSIONS

1. For the artificial infection with the Giessen isolate, 7 cultivars (Skriverskii, *Brassica napus* WOSR 1, SKR. II Kormovoi, Link, Liquanta, Silex and *Brassica napus* group WOSR 2) presented better tolerance against *Sclerotinia sclerotiorum*.

2. For the Ezareni isolate, 5 cultivars (Kodakskii, Link, Lirakotta, Matado and Capricorn) presented better tolerance against the pathogen

3. The detached leaf assay proved to be a good screening method for the resistance against *Sclerotinia* stem rot in rapeseed.

*Acknowledgments: The work is part of the project No ID 714 POS CCE - Studies of molecular genetics regarding the adaptation of rapeseed to conditions of biotic and abiotic stress, and the optimization of cultivation technology for the extension of cultivating /GENOBRASS, funded by the EU*

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# RESEARCH ON SOME PATHOGENIC FUNGI INVOLVED IN THE BIOLOGICAL DECLINE OF THE GRAPEVINE AT THE BLAJ VITICULTURAL CENTRE

## CERCETĂRI PRIVIND CIUPERCILE PATOGENE IMPLICATE ÎN PROCESUL DE DECLIN BIOLOGIC AL VIȚEI DE VIE, ÎN CENTRUL VITICOL BLAJ

COMȘA Maria<sup>1</sup>, TOMOIAGĂ Liliana<sup>1</sup>,  
CUDUR Florina<sup>1</sup>, CUDUR C.<sup>1</sup>, CRISTEA C.<sup>1</sup>  
e-mail: comsa\_m@yahoo.com

**Abstract:** *This paper presents aspects related to the action of pathogenic lignicole fungi that play a major role in the decline of the grape vine. The experiments were performed in the vineyards of the Research and Development Station for Viticulture and Vinification Blaj, between 2009 and 2011. The viticultural plantations in which the pathogenic fungi *Eutypa lata*, *Phomopsis viticola* and *Stereum hirsutum* were frequently present were monitored. These are wound fungi that enter the plant through wounds of the arms and trunk. Generally, vines infected with these fungi vegetate poorly. In spring, portions of the trunk do not begin their vegetation period, they have dead arms, bud break is delayed, sometimes there is a strong proliferation of shoots, with an abnormal evolution during the growing season.*

**Key words:** decline, the *Eutypa* dieback, the cane and leaf spot, Esca

**Rezumat:** *În această lucrare sunt prezentate aspecte legate de acțiunea ciupercilor patogene lignicole cu rol major în procesul de declin al viței de vie. Experimentele s-au efectuat în plantațiile viticole ale Stațiunii de Cercetare Dezvoltare pentru Viticultură și Vinificație Blaj, în perioada 2009 - 2011. Au fost urmărite plantațiile viticole în care se manifestă frecvent micoze cunoscute ca patogene: *Eutypa lata*, *Phomopsis viticola* și *Stereum hirsutum*. Acestea sunt ciuperci de rană, care pătrund în plantă prin rănilor existente pe butuc și coarde. În general butucii infectați cu aceste micoze vegetează slab. Primăvara, porțiuni ale butucului nu mai pornesc în vegetație, prezintă brațe moarte, dezmușuritul este întârziat, iar uneori se produce o proliferare puternică a lăstarilor, cu o evoluție anormală pe parcursul perioadei de vegetație.*

**Cuvinte cheie:** declin, eutipoză, excorioza, esca

### INTRODUCTION

The biological decline of the grape vine was first reported a long time ago in the vineyards of Romania. Given the importance of damage caused to the vine by wood diseases, they have been continuously studied by Romanian experts in the field (Tomoiaga, 2006). Epidemiological studies revealed that the lignicole fungi *Eutypa lata*, *Phomopsis viticola*, *Stereum hirsutum*, associated with biological decline in correlation with climate conditions and some disease control

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<sup>1</sup> Research and Development Station for Viticulture and Vinifications Blaj, Romania

measures. Due to technology and environmental changes, the grape vine stocks have become susceptible to lignicole pathogen infestations. Once inside the wood, the lignicole pathogens have negative effects on plant metabolism, resulting in premature wilting of grape vines (Oprea and Dumitru, 1989).

## MATERIAL AND METHOD

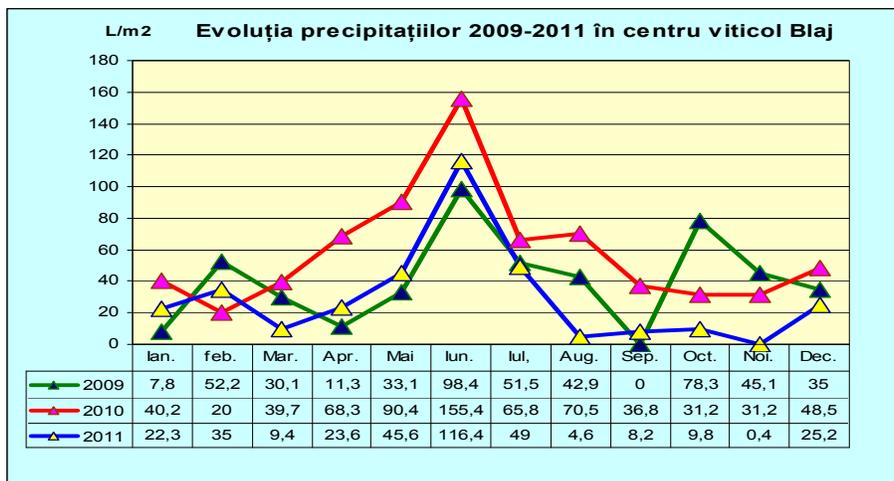
Research on pathogenic fungi involved in the decline of the grape vine was carried out at the Viticultural Centre Blaj, from 2009 to 2011. The land parcels with symptoms of premature death were identified and located. Observations were conducted on varieties representative for the Târnavă vineyard: Fetească regală, Muscat Ottonel, Italian Riesling and Sauvignon Blanc. From each variety, 1,000 block vines were monitored. The frequency and intensity of the phenomenon caused by the main lignicole pathogenic fungi *Eutypa lata*, *Phomopsis viticola* and *Stereum hirsutum* was monitored.

Samples were gathered in order to run laboratory tests, which consisted of diseased tendrils, wilted or wilting stocks. The labelled biological material was transported to the laboratory to identify fungi involved in the decline. It was held in a moisture room for 18 to 21 days until the fructifications emerged. They were then studied under binocular magnifier and microscope to reveal the biological fungi involved in the grape vine decline.

Climatic factors were evaluated and their role in the evolution of the vine lignicole fungi.

## RESULTS AND DISCUSSIONS

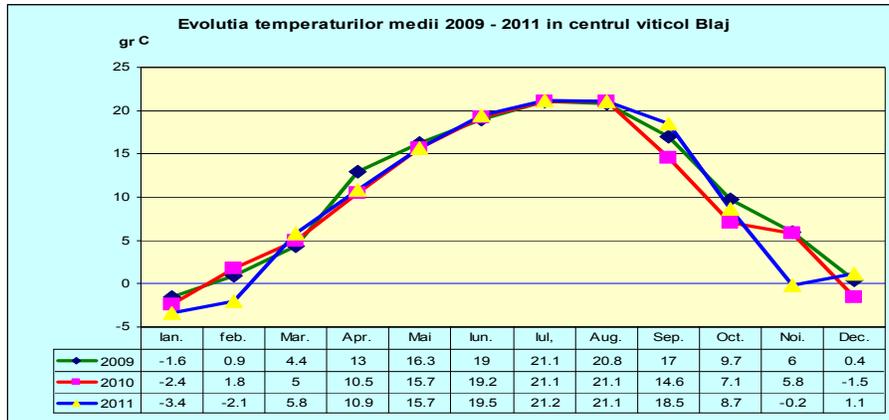
The first signs of the biological decline can be noticed in spring, when the grape vine begins to grow. The block vines that presented a decline syndrome were infested with three fungi, and namely *Eutypa lata*, *Phomopsis viticola* and *Stereum hirsutum*. An important role in the evolution of these diseases is played by weather conditions, namely rainfall (fig. 1) and temperature (fig. 2).



**Fig. 1** - The evolution of rainfall in 2009 – 2011 at the viticultural centre Blaj

Frosty winters and rainy springs favourably influence the development of lignicole pathogens. The year 2009 was characterized as a normal year in terms of

weather. Year 2010 was a particularly challenging year for viticulture. Winter temperatures exceeded the vines' resistance to frost. In spring, after the grape vine started to grow, heavy rain and cold weather was recorded. This favoured the development of the vine fungi. Year 2011 was characterized as a dry year, and the grape vines were affected by this phenomenon.



**Fig. 2** - The evolution of average monthly temperatures in 2009 – 2011 in the viticultural centre Blaj

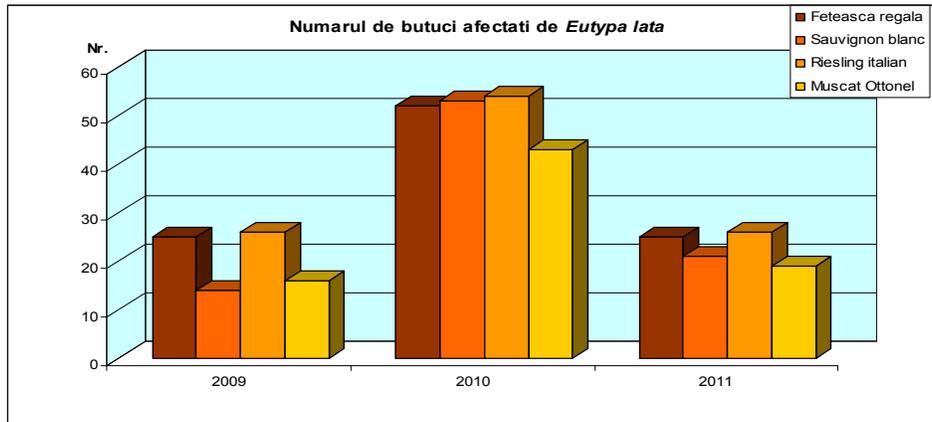
Following observations on site and in the laboratory, the *Eutypa* dieback is quite frequent. The disease is caused by an infection with the fungus *Eutypa lata*, which leads to stunted development of grape vines. The wood shows V-shaped necrosis (fig. 3).



**Fig. 3** - *Eutypa lata*

The leaves remain small, undergoing chlorosis, deformed with ragged margins. The disease mainly spreads due to the ascospores formed in the perithecia on dry wood. They can remain fertile for up to five years and that is

why the stocks infected with *Eutypa* become a source of infection for a long time. Infections occur in late autumn and early spring, favourably influenced by rain fall. In the spring of 2010, amid bad weather, the number of block vines affected by the *Eutypa* dieback was higher than in 2009 and 2011 (fig. 4).



**Fig. 4** - Number of stocks affected by *Eutypa lata* in the period 2009 - 2011

The cane and leaf spot is the second major pathogenic fungus involved in the biological decline of grape vine plantations. The infection is caused by the fungus *Phomopsis viticola* (fig. 5).

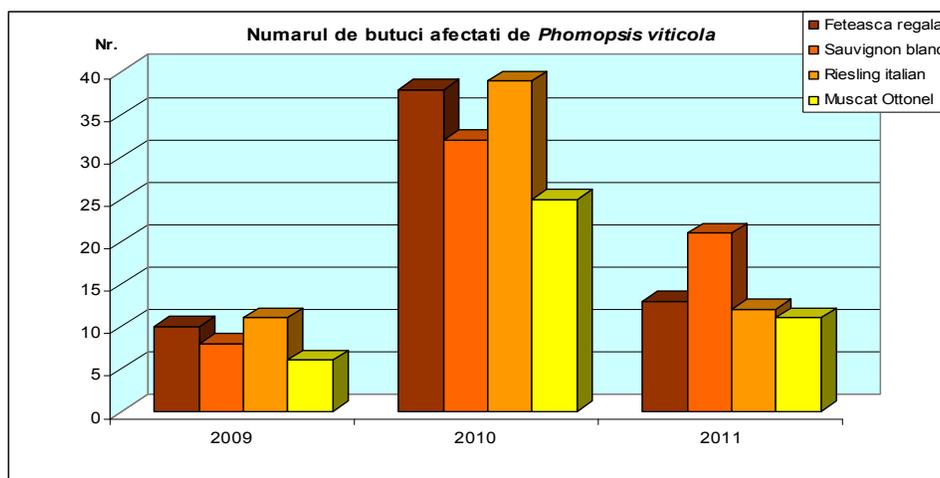


**Fig. 5** - *Phomopsis viticola*

The first symptoms appear in early spring with the growing season, when bud break is delayed. The buds located on the cordons do not start to grow, causing denudation of canes. Black small round or linear, more or less deep lesions appear in the shoots. Round spots, up to 1.5 cm in

diameter, blackish brown with a yellow-orange halo emerge on the leaves. After the grapes enter veraison, the berries rot and are covered by fungi fructifications. The infections are favoured by cold and wet weather.

In the studied period, *Phomopsis viticola* had a higher intensity in the vineyard in 2010 (fig. 7). This allowed us to establish correlations between disease intensity and weather conditions.



**Fig. 6** - Number of stocks affected by *Phomopsis viticola*, in the period 2009-2011

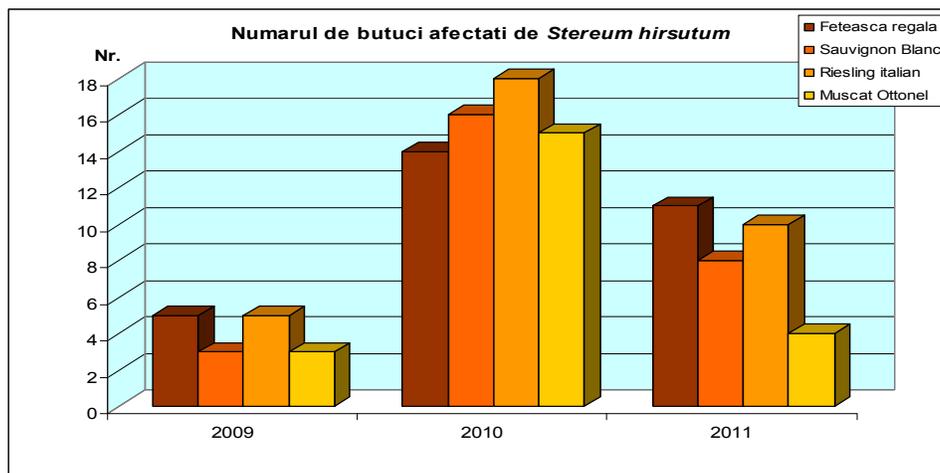
Another fungus present in the analysed grape vines is *Stereum hirsutum* (fig. 5)



**Fig. 7** - Esca symptoms on vine leaves

The symptoms present different aspects because the death of the trunk can be slow, over several years, or sudden. The infected stocks grow slowly, the leaves have a yellowish tint, and the tissues become necrotic

between the veins. Plants are fed less sap, portions of the trunk do not start to grow, and finally the plant dies. The fast type of the disease, also called apoplexy, usually occurs in the hot summer months, right after heavy rainfall. The pathogen enters the plant through wounds arising from pruning or other accidents. Dead tissue is invaded by the fungus mycelium, conidia and sclerotia, essential elements for the spread of the disease. Due to heavy rains and extreme temperatures during summer, a more extensive attack of the Esca disease took place in 2010 (fig. 8).



**Fig. 8** - Number of block vines affected by *Stereum hirsutum*, in the period 2009 - 2011

## CONCLUSIONS

1. Lignicole pathogens occurred with higher frequency and intensity in the vine growing year 2010, which allowed a strong correlation between the decline phenomenon and weather conditions.

2. The varieties Fetească regală, Italian Riesling and Sauvignon Blanc are susceptible to the attack of lignicole pathogens. Muscat Ottonel proved to be a quite disease-resistant variety.

3. *Eutypa lata*, *Phomopsis viticola* and *Stereum hirsutum* are wound fungi, as they invade the plant through existing wounds on the stock; infections spread the most in autumn and spring.

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# THE EVOLUTION OF THE SPATIAL STRUCTURE OF CANCER ATTACKS PRODUCED BY FUNGI OF THE *NECTRIA* SP. IN SUCEAVA PLATEAU

## EVOLUȚIA STRUCTURII SPAȚIALE A ATACURILOR DE CANCER PRODUSE DE CIUPERCILE GENULUI *NECTRIA* SP. DIN PODIȘUL SUCEVEI

CREȚAN Ana- Maria<sup>1</sup>, GRUDNICKI Margareta<sup>2</sup>  
e-mail: ana33cre@yahoo.com

**Abstract.** The research was made in a virgin beech forest in Suceava Plateau (Old growth beech forest of Humosu), based on two successive inventories. The first one was made in 2006 and the second one in 2011. The purpose of this paper is to capture the spatial structure evolution of cancer produced by fungal attacks of the *Nectria* genus. To carry out this object were made three punctual processes composed from healthy trees (H), medium affected trees (M) and severely affected trees (S).

**Key words:** spatial dynamics, beech cancer, *Fagus sylvatica*

**Rezumat.** Cercetarea a fost realizată într-un arboret virgin de fag din Podișul Sucevei (Făgetul Secular Humosu), pe baza a două inventarii succesive, una realizată în anul 2006, iar cea de a doua în 2011. Obiectul prezentului articol este de a surprinde evoluția structurii spațiale a cancerului produs de atacul ciupercilor din genul *Nectria*. Pentru îndeplinirea acestui scop s-au realizat trei procese punctuale constituite din arbori sănătoși (H), arbori mediu afectați (M) și arbori sever afectați (S).

**Cuvinte cheie:** dinamică spațială, cancerul fagului, *Fagus sylvatica*

### INTRODUCTION

In Suceava Plateau, *Fagus sylvatica* is the main species, covering an area of 20,598.1 ha and offering a volume of 3,464,715 m<sup>3</sup>. From pest category we have taken into analysis *Nectria ditissima* Tul. F.C. with *Cylindrocarpon willkommii* (lind.) Wr form, that produces beech cancer.

This study aims to explain the evolution of spatial structure of the cancer attacks produced by fungi of the *Nectria* genus in a natural beech stand in Suceava Plateau.

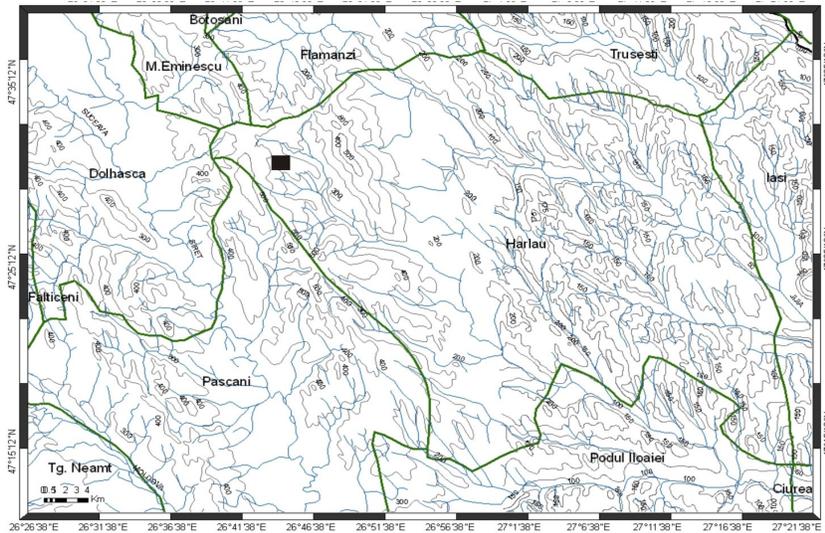
### MATERIAL AND METHOD

„Old growth beech forest of Humosu”, the object of study of this paper, is located in Hârlău Forest District of Iasi Forest Administration., stand having the status of natural reserve, with an area of 73.3 ha, plots 62 and 64 (fig. 1).

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<sup>1</sup> Forest Administration of Suceava, „Ștefan cel Mare” University of Suceava, Romania

<sup>2</sup> „Ștefan cel Mare” University of Suceava, Romania



**Fig.1 - Location of sample plot**

Method of study is based on observation and experiment. In order to surprise spatial structure was used simulation, as a modern method of analysis. To fulfill purposed objectives was adopted experimental method based on biometric successive measurements, in a natural beech stand.

The practical part of this study consist from a general recognition of land. Also, inside of stand was chosen and, at random, an evidence experimental permanent area, rectangular area of 1.0 ha, in 2006.

In 2011 the same area was re-inventoried with the aim of study the spatial evolution of cancer attacks produced by *Nectria* fungus. Location, demarcation, inventory and re-inventory of trees in the experimental area was installed in accordance with established methodology for studying the structure of forest ecosystems through structural profiles (Giurgiu, 1979; Cenușă, 1986; Roibu, 2010).

At successive inventory of stands were registered some characteristics:

- species; diameter of 1.30 (cm) - were measured two perpendicular diameters; increasing samples (2006); total height (m); prune height (m); positional class (lower floor, middle, upper); quality class (grades I-IV);
- crown shape (broom, bucket, flag); diameter crown (m); presence of cancer in the crown (6 classes, percentage of trunk surface): K0: 0 (no cancer) :1-20% K1, K2: 21-40%; K3: 41-60% :60-85% K4, K5:> 85%; branch angle insertion (degrees) (0-90°); rhytidom presence (4 classes, percentage of trunk surface): R1: <25%, R2 :26-50% :51-75% R3, R4:> 76%; cartesian coordinates (x, y) for each tree.

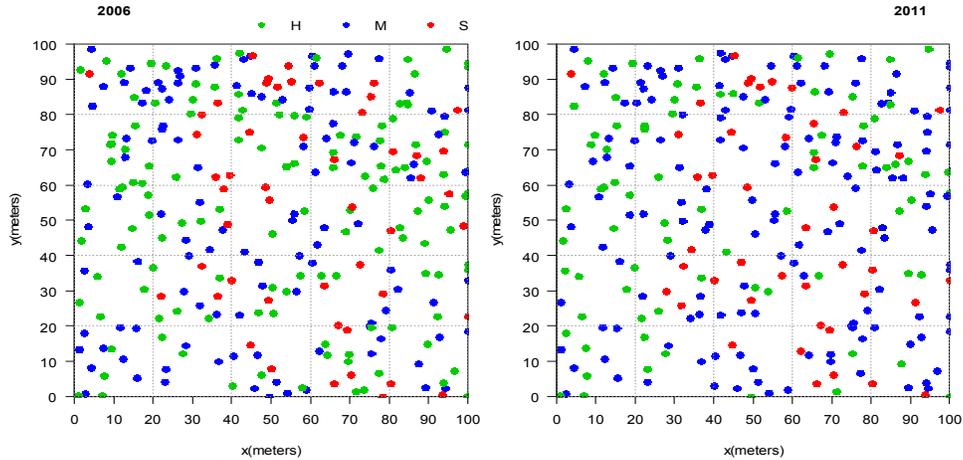
Among the methods used in achieving objectives were applied four punctual processes, Ripley K. In spatial analysis techniques, Ripley K function showed us if we have aggregate, random or regular structure (Ripley, 1976).

Ripley K function is a tool for analyzing and quantifying the intensity of second order punctual process completely positioned that is known the position in space to all events. Confidence interval for the theoretical process is obtained by Monte Carlo simulation of a number of 100 punctual processes to a probability of 95% coverage (Hardisty, 1999).

## RESULTS AND DISCUSSION

Successive inventories performed can give valuable information on the dynamics of cancer attacks, concentrating attacks, the manner of spreading spores, establishing a united front of tree mortality and possibilities of restoring the stand. Having regard that research has been performed in a natural stand, constituted as a nature reserve, we have the certainty that the results are not distorted by human intervention with direct effects on stand structure.

In these conditions were realized three punctual processes composed by: healthy trees (H), medium affected trees (M) and severely affected trees (S) (fig. 2).



**Fig. 2 - Dynamic of the cancer attack during the study period**

In the period elapsing between the two inventories was emphasized around the nucleus severe in 2006 a significant increase in intermediate-infected trees proceeds predominantly among healthy trees. The consent of the previously stated, the average distance between two neighboring trees with strong infection provides important information to establish front attack (tab. 1).

*Table 1*

**Distance between attacked trees**

Inventory year	Distance between trees with different degrees of intensity of attack (m)		
	H	M	S
2006	4.82	5.34	7.69
2011	6.34	4.67	8.32

We observe that the distances between healthy trees have increased from the first stage of the count from 4.82 m to 6.34 m (2011). This modification indicates, primarily a reduction in the number of healthy trees, and secondly a weakening of the core consists of resistance forms. Instead, the distance between trees with intermediate attacks diminished as a result of enrollment of new trees in this category, proceeds from among the healthy. If trees with severe infections,

the average distance to nearest neighbor increased. At trees with severe infections case, the average distance to nearest neighbor increased. This change can be attributed to natural removal of trees reached the limit of physiological longevity. Although the disappearance of severely attacked trees has led to increasing distance of closest neighbors, should not be considered as a reduction of the infestation. On the contrary, eliminated trees (standing dead, felled or broken by wind or snow trees) is a source of spreading the fungus spores.

Another explanation for the reduction of distance between trees with moderate infections can be attributed to woolly scale attack woolly (*Cryptococcus fagisuga*). We meet it on bark of beech branches and stems. Scale insects suck sap and cause dryness and bark falling associated with fungus attack *N. coccinea* / *N. ditissima* (Nechwatal et al., 2011, Way et al., 2012).

These scales are transported by wind or birds settling new trees in the vicinity of the infected, creating favorable conditions for the installation of wood decay fungi, front infections being increasingly more virulent.

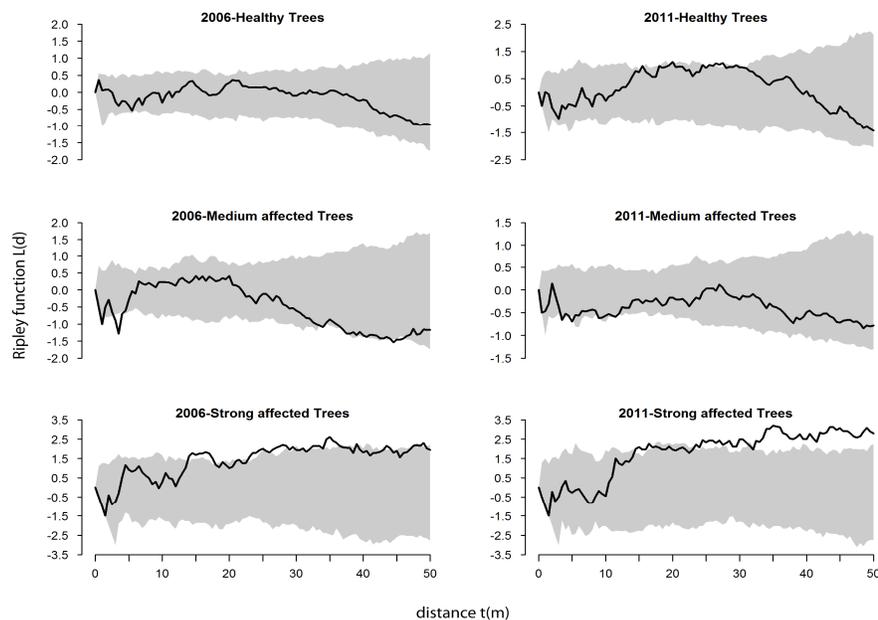
If in the first case of stand spatial organization judged only after the relative position of trees, quantifying spatial structure needs a higher requiring (Roibu and Popa, 2007). Achieving this objective involves the use of specific mathematical models. Ripley K function is a tool for analyzing and quantifying the intensity of second order point process completely positioned, or position in space is known to all events (Ripley, 1977, cited by Roibu, 2010).

In the spatial analysis techniques Ripley function showed us if we have aggregate, random or regular structure (Ripley, 1976).

First punctually process, consisting of healthy trees, has a random structure over the entire distance. In 2006 the spatial pattern was more stable, as confirmed by the confidence interval (much lower). Instead, at the second inventory (2011) stability of spatial model is reduced significantly, mainly due to reduction of healthy trees studied (fig. 3).

Spatial organization of the medium affected trees follows a typical pattern for a uniform distance of 4 m. After this value, the point is randomly distributed. In a period of five years, the trends of average uniformity of infested trees disappear, the whole distance being randomized. Emphasizing a regular structure is considered quite rare in special literature (Pielou, 1960; Boşcaiu and Lungu, 1982) and specific to a large stand of trees between which establish strong viable relationships in competition for space (Pielou, 1960). Greig-Smith (1952) believes that all wood species indicate trends for regular distributions, even if they remain vague.

The process of space includes all trees with severe infections presents a very interesting spatial structure. In 2006, the pattern is predominantly random, with some short intervals of aggregation. However, during the second inventory, the major pattern observed is aggregate. This has highlighted the rapidity changes the spatial organization of outbreaks, front spread spores becoming increasingly virulent. Thus it was highlighted celerity of changes in spatial organization of the outbreaks, front spread spores becoming increasingly virulent.



**Fig. 3 - Ripley function**

## CONCLUSIONS

1. Successive inventories performed can provide valuable information on cancer attacks dynamics, focus attacks, the manner of spreading spores, establishing a united front of tree mortality and possibilities of restoring the stand.

2. Were made up three processes off healthy trees (H), medium affected trees (M) and severely affected trees (S). The first major aspect that was noted in the study refers to the resistance nucleus of cancer attack - causing fungus, consisting of healthy trees reduced gradually being replaced by medium intensity forms of the attack.

3. Average distance between neighboring trees with infections help to explain the dynamics of cancer attacks caused by fungus and provides important information to establish the front attack.

4. Quantifying the spatial structure involved using specific mathematical models, such as Ripley K function, which indicated us the structure type: aggregate, random or regular.

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# EVALUATING THE EFFECTIVENESS OF CERTAIN PLANT PROTECTION PRODUCTS USED TO PROTECTING THE VINES IN THE ECOSYSTEM VINEYARD COPOU IAȘI-2011

## EVALUAREA EFICACITĂȚII UNOR PRODUSE FITOSANITARE UTILIZATE ÎN PROTECȚIA VIȚEI DE VIE ÎN ECOSISTEMUL VITICOL COPOU IAȘI-2011

**PETREA Gabriela<sup>1</sup>, ZALDEA Gabi<sup>1</sup>, DAMIAN Doina<sup>1</sup>, SAVIN C.<sup>1</sup>**  
e-mail: g\_iliescu@yahoo.com

**Abstract.** *The type of action of certain chemical products for combating pests and diseases requires a thorough knowledge of the negative consequences that can arise after using them in the vineyards. Lately, the focus has increased upon the use of some bio-preparation with non-toxic effects on the environment and on the grape production. The 2011 wine year for the ecosystem vineyard Copou-Iasi is considered to be, in terms of climate conditions, convenient for the culture of the vine. In this way, the treatment schemes have been planned following the forecast and warning bulletins that had been issued. The treatments have been performed at different times of the vegetation, depending on the evolution of the climate conditions, on the biology of the pathogens and on the development of the phenological stages of the analyzed assortment.*

**Key words:** pests and diseases, chemical products, vineyard.

**Rezumat.** *Modul de acțiune al unor produse chimice de combatere a bolilor și dăunătorilor necesită o cunoaștere temeinică a consecințelor negative ce pot să apară în urma utilizării lor asupra plantațiilor viticole. În ultimul timp se pune accent tot mai mult pe folosirea unor biopreparate cu efecte non-toxice asupra mediului și producției de struguri. Anul viticol 2011 pentru ecosistemul viticol Copou-Iași este considerat, din punct de vedere al condițiilor climatice, favorabil culturii viței de vie. În acest sens schemele de tratament au fost întocmite după buletinele de prognoză și avertizare emise. Tratamentele s-au efectuat în diferite momente ale vegetației în funcție de evoluția condițiilor climatice, biologia agenților patogeni și desfășurarea fazelor fenologice ale soiului analizat.*

**Cuvinte cheie:** boli și dăunători, produse chimice, viță de vie

### INTRODUCTION

Nowadays it is inconceivable to obtain high yields per unit of area without taking into account the following factors: phytopathogenic agents and weeds whose counter is a part of every cultures technology (Șandru, 1996).

In this sense it is required a good knowledge of the ecological factors that are being in favor or unfavour of the pathogen of the pest kept under observation.

The rich assortment of fungicides offered every year by different companies is making more and more difficult to evaluate in a correct mode their

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<sup>1</sup> Research and Development Station for Viticulture and Vinifications Iasi, Romania

effectiveness against the vine's pathogens. The action of these fungicides requires a thorough knowledge of how to integrate the ecosystem; this complex, host-plant pathogen, can cause undesirable effects if the fungicides are not correctly used (Turcanu, 1997).

This paper presents the results obtaining from testing the effectiveness of some fungicides against manna and gray mold on the vines from the "Viticulture and Winemaking/Vinification Research and Development Station" experimental polygon, in the year 2011, and the recommendations of the usage in the production of the most efficient fungicides.

## MATERIAL AND METHOD

The experiment has been organized in the polygon affiliated to the plant protection laboratory of Viticulture and Winemaking/Vinification Research and Development Station, and was performed on the Aligoté variety which was grafted on Kober 5 BB. The distance between the rows is 2.2 meters, and between hubs in row is 1.2 meters. The experimental polygon was established on a surface of one hectare, with a S-V exposition and a 2-3% slope.

The culture system practiced in the wine area Copou-lasi is a semi-protected one, and the gaps between the rows are alternately maintained grassing / field work. For the optimal performance timing of the treatments, climatic elements were carefully monitored, both from its own weather station and from the sensor AGROEXPERT, having into consideration: maximum and minimum air temperature, soil temperature, the recorded rainfall, heatstroke and hygroscopicity, taking into account the weather warnings as too. Based on this data and taking into account the biological reserve of the main pathogens and pests there have been established specific treatment regimens. The works in green and the ones for the maintenance of the soil, at a time and in between the gaps on throughout the growing season had come in addition to the plant treatment; there had been executed five treatments for the two pathogens, *Plasmopara viticola* and *Botrytis cinerea* (Tomoiagă, 2006); the phenophase and the frequency of the treatment applications are presented in table 1.

The experimental variants were represented by four products against the manna of the vine and a product used against gray mold of grapes. Against manna was used Amisulbrom SC 200, in combination with two products against manna in a different concentration; each variant is reported to a standard product, Moltovin, 3 l/ha and an witness untreated for this pathogen. Treatment for gray rot of grapes was used as standard product, the Switch, 0.6 l / ha, and the report was made to an untreated witness. In the "late flowering" phenophase it has been made the first treatment with the tested products (BBCH 71), for the two pathogens and the following treatments were made every 12-14 days until the entry of the grapes in ripe (BBCH 81).

Table 1

The phenological and calendaristic time of the treatment application

The treatment / phenophase	Date
T1/ BBCH 71 end of the flowering	21.06.2011
T2 /BBCH 73 formation of the grains	04.07.2011
T3 / BBCH 75 the grain growth	20.07.2011
T4 / BBCH 77 the compact of the bunches	05.08.2011
T5 / BBCH 81 entry into first fruits	19.08.2011

With in the experimental polygon, the observations were made upon the frequency, intensity and degree of the attack, the methodology applied in the forecasting and warning stations (Ilişescu, 2003). The highlight of the pathogens of vines and their numerical density assessment were performed by field surveys, sampling, by sampling strings, leaves and bunches. The laboratory determinations were made under binocular magnifying glass and by making microscopic preparations and the field observations were conducted in correlation with covering the phenological spectrum in conjunction with the development of the climatic factors (Iacob et al., 2000).

## RESULTS AND DISCUSSION

In the wine center Copou-Iasi, the year 2011 was considered to be favorable for the vine culture, the propagation of the pathogens *Plasmopara viticola* and *Botrytis cinerea* being limited by special weather conditions (table 2).

Table 2

Meteorological data recorded during the vegetation period of the 2011

Month	Average monthly (t°C)		Maximum (t°C)	Low (t°C)	Rainfall (l/m <sup>2</sup> )		Hygroscopticity (%)		Insolation (hours)	
	Normal	2011			Normal	2011	Normal	2011	Normal	2011
IV	10,1	9,8	23,3	1,0	40,3	73,0	62	60	171,3	191,3
V	16,1	16,2	29,4	2,2	52,5	54,7	62	60	220,9	252,0
VI	19,4	19,8	32,5	11,3	75,1	136,3	63	63	264,6	227,7
VII	21,3	21,4	33,5	10,8	69,2	72,4	62	66	294,4	279,9
VIII	20,6	20,9	30,6	10,6	57,6	33,0	63	56	272,2	299,7
IX	16,3	17,8	30,4	7,3	40,8	21,4	66	59	215,4	221,8

During the testing the average temperature in the growing season ranged between 20.9 and 21.4 °C, June being the only month when has been exceeded the recorded rainfall, 136,3-21,4 l/m<sup>2</sup> compared with normal 75,1 l/m<sup>2</sup>. By the end of July there were recorded 72.4 l/m<sup>2</sup>, the normal value of the month precipitation being 69.2 l/m<sup>2</sup> and the average temperature was 21.4<sup>0</sup> C. In August, temperatures were quite high, and the total rainfall was 33 l/m<sup>2</sup>, thereby limiting the emergence of fungi. In the figures 1 and 2 there are presented general aspects of the emergence and spread of pathogens *Plasmopara viticola* and *Botrytis cinerea* in favorable climatic conditions (Ilişescu, 1999).



Fig. 1 - The manna vine (attack on leaves)



Fig. 2 - The gray rot (attack on clusters)

The quantities of commercial product applied per unit of area were different: product Amisulbrom 200 SC was applied firstly at a dose of 0.375 kg /

ha and then combined with the products Mancozeb (in two doses 1.6 kg and 2.0 kg / ha) and Folpet a dose of 0.940 kg/ha. The product for grey rot, MCW 3858 (cyprodinil and tebuconazole) was tested in a single dose of 1.6 l/ha. The observations were made throughout the whole testing period, before starting the treatment and after their application, and on the appreciation of the attack, made at the grapes compaction (BBCH 77), we found that it was insignificant, the values recorded being very low.

The determinations made at the entry of the grapes in ripe (BBCH 81) were made by counting the organs of the vine (leaves and clusters), which showed signs of attack, for the determination of the frequency, intensity and degree of attack; the notes were made using a scale from 1-6, (Rafaila, 1980), tables 3 and 4. Treatments were made with a spraying device Matabi SUPERGREEN 16, using the normal volume of fluid per hectare. The results obtained in the experimental group on the effectiveness of the products tested according to the degree of attack recorded, compared with the untreated witness and the standard products are shown in figure 3. When calculating the effectiveness of the products the following formula was used:

$$E\% = \frac{\text{Gam} - \text{Gav}}{\text{Gam}} \times 100, \text{ where:}$$

Gam- the degree of version control procedures;

Gav- the degree of attack variant;

Table 3

The traits recorded on variants treated against manna

The product	Variante code	Dose l/kg/ha	Rep.	BBCH 80-85 (entry into firstfruits) / date: 06.09.2011.					
				F%		I%		Ga%	
				Grap.	Leav.	Grap.	Leav.	Grap.	Leav.
Amisulbrom 200 SC	V1	0,375l/ha	1	0	9,29	0	3,66	0	0,34
			2	0	7,74	0	3,63	0	0,28
			3	0	7,4	0	4,16	0	0,3
			4	0	5,63	0	8,87	0	0,49
			Med	0	7,51	0	5,08	0	0,38
Amisulbrom 200 SC+ Mancozeb 750	V2	0,3 l/ha+1,6 kg/ha	1	0	4,66	0	4,27	0	0,19
			2	0	7,93	0	4,4	0	0,34
			3	0	5,66	0	4,16	0	0,23
			4	0	3,84	0	2,75	0	0,1
			Med	0	5,52	0	3,89	0	0,21
Amisulbrom 200 SC + Mancozeb 750	V3	0,3 l/ha+2,0 kg/ha	1	0	4,76	0	4,9	0	0,23
			2	0	3,84	0	3	0	0,11
			3	0	5,81	0	3	0	0,17
			4	0	2,77	0	6,5	0	0,18
			Med	0	4,29	0	4,35	0	0,18
Amisulbrom 200 SC+Folpet	V4	0,3 l/ha+0,94 kg/ha	1	0	5,4	0	3	0	0,16
			2	0	5,47	0	3,63	0	0,19
			3	0	0	0	0	0	0
			4	0	2,38	0	3	0	0,1
			Med	0	3,31	0	2,4	0	0,07
Moltovin Standard	V5	3.0 l/ha	1	0	2	0	3	0	0,06
			2	0	0	0	0	0	0
			3	0	0	0	0	0	0
			4	0	3,5	0	3,1	0	0,1
			Med	0	1,37	0	1,52	0	0,02
Martor (net.)	V6		Med	0	22,36	0	18,47	0	4,12

Table 4

## The traits recorded on variants treated to control gray rot

The product	Variante code	Dose l/ha	The inflorescences attacked		The grapes attacked	
			GA%	E%	GA%	E%
MCW 3858, (cyprodinil+tebuconazol)	V7	1,6	-	-	0,36	93,18
Switch (standard)	V8	0,6	-	-	0,16	97,00
witness (untreated)	V9	-	-	-	5,28	-



Fig. 3 - The determining the effectiveness of the degree of attack each variant analyzed (manna and gray rot)

From figure 3 it can be seen that the degree of attack recorded in the two pathogens was reduced, due to the climatic conditions, that haven't favored their propagation, on the one hand, and on the other due to the effectiveness of the products tested. This shows that the fungicides above had wheel protected the leaves and the grapes, with a very good fungal effect, shown by over 93% of effectiveness.

From the four possible treatments against manna the best results occurred for the combination of Amisulbrom 0.375 kg /ha with Folpet 0.94 kg / ha, the effectiveness being 98%. For the product against the gray rot of grapes (MCW 3858), the effectiveness value recorded was 93%. The two products, following the favorable results obtained, were presented for approval.

The quantity and quality of the grape harvest was the specific for the variety, with the influence of the tested fungicides (tab. 5). Must had a normal fermentation (spontaneous fermentation), and the wines obtained also had normal qualitative values.

Table 5

The effects of the tested fungicides on the quantity and quality of the grapes

Nr. crt.	The treatment option	Concentration %	The quantity of the grapes / hub (kg)	The sugars content g/L	Total acidity g/L H <sub>2</sub> SO <sub>4</sub>
1.	Amisulbrom 200 SC	0,037	4,40	177	5,2
2.	Amisulbrom 200 SC + Mancozeb 750-	0,037+0,16	4,60	182	5,7
3.	Amisulbrom 200 SC + Mancozeb 750	0,037+0,20	4,80	178	5,6
4.	Amisulbrom 200 SC + Folpet	0,037+0,094	5,10	192	6,1
5.	Moltovin Standard	0,30	5,20	194	6,7
6.	Martor (net.)	-	4,10	176	5,4
7.	MCW 3858, (cyprodinil + tebuconazol)	0,16	4,80	185	5,8
8.	Switch (standard)	0,06	5,00	192	6,2
9.	Martor (netratat)	-	4,60	179	5,2

### CONCLUSIONS

1. In the year 2011 there have been recorded very favorable climatic conditions for the wine growing, in the Viticultural Centre Copou-Iasi.

2. All versions of the products used to combat the *Plasmopara viticola* pathogen showed good results, standing out the combination of Amisulbrom and Folpet, with an effectiveness of 98% and recommended for approval.

3. For the test of the product against the gray rot of grapes, the degree of attack was 0.36%, and the effectiveness of 93%, recommended to be used for combating this pathogen.

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# DIVERSITY OF FUNGI ASSOCIATED WITH *RIBES NIGRUM* L. CROP IN THE SOUTH OF ROMANIA

## DIVERSITATEA CIUPERCILOR ASOCIATE CULTURII DE *RIBES NIGRUM* L. ÎN SUDUL ROMÂNIEI

**PETRESCU Eugenia<sup>1</sup>, OPREA Maria<sup>1</sup>**

e-mail: petrescu\_eugenia@yahoo.com

**Abstract:** Black currant (*Ribes nigrum* L.) there is one of the most valuable medicinal plants for the nourishment and therapeutically value of fruits, buds, leaves and seeds. From the organs of the black currant there have been isolated some species of pathogenic fungi and some mycotoxicogenic fungi which could alter the quality of the raw material. Fungi with an antagonistic potential were identified too. This isolates of fungi may be further investigated in order to establish which of them will be suitable for biological control of the black currant culture.

**Key words:** medicinal plants, phytopathogenic fungi, antagonistic fungi, phylloplane

**Rezumat:** Coacăzul negru (*Ribes nigrum* L.) este unul dintre arbuștii fructiferi extrem de apreciați pentru valoarea alimentară și terapeutică a fructelor, mugurilor, frunzelor și semințelor. De pe organe ale plantei au fost izolate specii de ciuperci saprofite potențial patogene, dar și unele ciuperci micotoxicogene care ar putea deprecia calitatea materiei prime. Au fost identificate și specii de ciuperci cu potențial antagonist. Aceste izolate de ciuperci ar putea fi investigate ulterior pentru a stabili care dintre acestea să fie folosite în controlul biologic al culturii de coacăz negru.

**Cuvinte cheie:** plante medicinale, ciuperci patogene, ciuperci antagoniste, filoplan

### INTRODUCTION

Black currant (*Ribes nigrum* L.) is a highly valuable medicinal plant. Fruits and buds, leaves, seeds, are used for their therapeutic value (Bojor, 2003, Raiciu, 2011).

Currant plantation is affected by a large number of pathogens, especially fungi (Rădulescu, 1972). The phylloplane of the plants is populated by the microorganisms included in the category of micromycetes, bacteria and actinomycetes. Between these microorganisms, there occur relationships of competition for space and food. These useful relations, which are designed to naturally keep pathogens in check, can be investigated and exploited for the establishment of biological control measures. Studies carried out by Romanian and foreign researchers have shown that application of different chemical treatments changes the composition of useful mycoflora that acts in

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<sup>1</sup> Research-Development Institute for Plant Protection Bucharest, Romania

phylloplane an antagonistic role (Fokkema, 1978; Drăgoescu, 1983; Oprea, 1987; Palaghiciuc, 2007).

The researches, conducted in 2009-2011 period in experimental plots of S.C. Hofigal Export-Import S.A. of Bucharest, aimed at identification and isolation of both some strains of pathogenic fungi of black currant crop, which could weaken the quality of the row material and some strains of saprophytic fungi which acting in the phyllosphera and which could be used for biological control of these currant pathogens. Alternative non-polluting control methods would be the only clean solution to obtain phytopharmaceutical products, with no toxicity for humans.

## MATERIAL AND METHOD

The biological material was the plant organs of black currant shrubs in experimental plots of S.C. Hofigal S.A. in Bucharest. For the microscopic examination, there were collected in sterile sample bags the leaves, buds, branches, flowers or fruits, according to phenophase.

The vegetal organs that showed characteristic lesions were directly subjected to microscopic analysis. If the reproductive structures were not cured, the leaves or fragments of branches with visible signs of attack were kept at the wet room first for stimulation of spore formation and then examined under a microscope. Larger leaves or branches were cut into fragments. Buds, leaves, fragments of leaves and fruits were placed in Petri vessels on the surface of water-agar culture medium to stimulate sporulation, the method used by the Romanian researchers (Oprea, 1987; Palaghiciuc, 2007).

The petri plates were incubated at room temperature and after 10 days, they have been examined microscopically to identify resulting mycoflora. Isolation of fungi in leaf mycoflora was made by transfer under sterile conditions of spores on culture media rich in nutrients, such as PDA (potato-dextrose-agar) medium and MEA (malt-extract-agar) medium. For the identification of fungal genera and species, there have been used both macroscopic examination of fungal colonies and microscopic examination methods.

## RESULTS AND DISCUSSIONS

On the leaves, the evolution of the number of genera of fungal genera has varied in relation with the degree of leaf maturation (tab. 1).

In certain periods of development, after the microscopic examination, structures with a role in phytopatogenic fungi spreading, such as conidia and cleistothecia of the fungus *Sphaerotheca mors-uvae* (fig. 1d), conidia of *Alternaria tenuissima* (fig. 1o,p), picnidia with picnospores or perithecia with asci of fungus *Mycosphaerella grossulariae* (fig. 1h), conidia of *Gloeosporium ribis* (anamorph of the fungus *Drepanopeziza ribis*), uredospores and teleutospores of the patogen *Cronartium ribicola* (tab. 1).

Table 1

Evolution of the number of genera and species of micromycetes during the vegetation period of the plants of *Ribes nigrum* L. under pedo-climatic conditions of Bucharest area

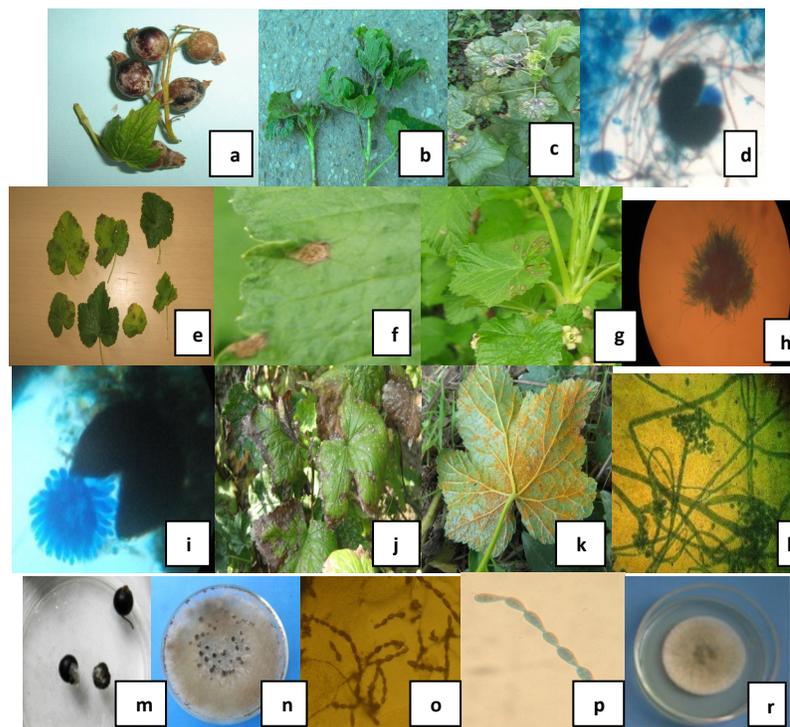
Micromicete	Frequency			
	at the first leaflet	before flowering	at maturation of the leaves	on senescence
MICROMICETE PARAZITE				
<i>Sphaerotheca mors-uvae</i>	+++	+++	+ (conidia and perithecia)	+ (perithecia)
<i>Alternaria tenuissima</i>	-	-	++ (conidia)	+
<i>Mycosphaerella grossulariae</i>	-	-	+++ picnidia)	++
<i>Gloeosporium ribis</i>	-	-	++ (conidia)	+++ (perithecia)
<i>Cronartium ribicola</i>	-	-	++ (uredospores)	++ (teleutospores)
<i>Botrytis cinerea</i>	-	-	-	-
MICROMICETE SAPROFITE				
<i>Trichoderma viride</i>	-	++	+	+
<i>Trichotecium roseum</i>	-	++	++	++
<i>Clonostachys rosea</i>	-	+	+	+
<i>Epicoccum nigrum</i>	-	-	++	++
<i>Chaetomium globosum</i>	-	+	++	+
<i>Alternaria spp.</i>	+	++	+++	++
<i>Alternaria alternata</i>	+	++	+++	+++
<i>Cephalosporium spp.</i>	+	++	-	-
<i>Cladosporium herbarum</i>	-	++	++	+
<i>Penicillium spp.</i>	+	++	-	+
<i>Penicillium frequentans</i>	-	-	+	++
<i>Fusarium oxysporum</i>	-	+	++	+
<i>Ulocladium spp.</i>	-	-	+	+
<i>Chladomyces spp.</i>	-	+	+	-
<i>Chaetomyces spp.</i>	-	+	+	+
<i>Pericornia spp.</i>	-	+	+	+
<i>Monospora spp.</i>	-	+	+	+
<i>Humicola grisea</i>	-	++	+	-
<i>Papularia spp.</i>	-	+	-	++
<i>Memnispora spp.</i>	-	-	++	-

Legend: +++ high frequency  
 ++ middle frequency  
 + slight frequency

The first signs of American mildew fungus *Sphaerotheca mors-uvae* have appeared in spring at the first appearance of shoots of only formed leaves.

These leaves and small twigs remained were deformed and twisted and dried up. The brown mycelium with cleistothecia appeared in mid-June (fig. 1b, fig. 1c). Under strong attack, in 2009, the brown mycelium of *S. mors-uvae* with

cleistothecia was found on the mature fruit, which suffered from cracking and rotting on the parts affected (fig. 1a).

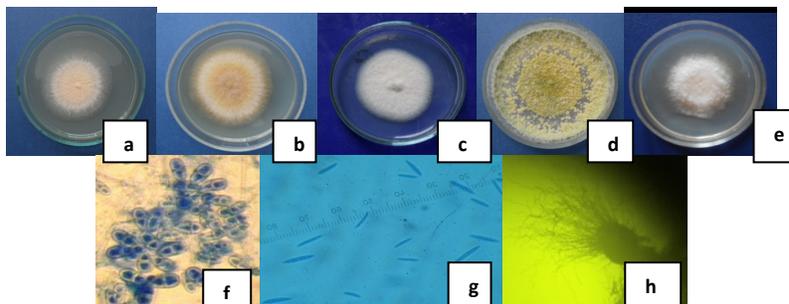


**Fig. 1** – Pathogenic micromycetes of the black currant culture: macroscopic, microscopic and culture *in vitro* aspects

*D. ribis* was manifested on the leaves (fig. 1j). Since July, on the infected leaf blade, there appeared reddish brown spots, circular or irregular, at the beginning 1-2 mm diameter. Over time the stains were increased, becoming confluent and occupied a large portion of the leaf blade. In the spring 2010 in the plantation of S.C. Hofigal S.A., on the fallen leaves from the ground surface perithecia of fungus *M. grossulariae* containing asci with ascospores were observed (fig. 1i). In the second half of April, in the flowering phenophase, the first spots appeared on the leaves (fig. 1e, fig. 1f, fig. 1g). In the center of the spots picnidia with picnosporos were identified (fig. 1h). The number of dots on the attacked leaves varied from 1 to 19 dots. To the end of vegetation period, the number of dots on the attacked leaves increased, on a leaf being even 200 dots. It was noticed the confluence of dots in certain cases, but also the phenomenon of the perforation of the leaves (fig. 1e). The fungus manifested with a high frequency in July and August months at maturation of the leaves (tab. 1).

Alternaria black spot disease, caused by the fungus *Alternaria tenuissima* (fig. 1o-r) appeared in June, on the leaves, as brown-gray spots with lighter edges.

Current rust, produced by *Cronartium ribicola*, was observed in late summer, on the underside of the leaf blade as yellow-orange cylindrical columns of teleutospores (fig. 1k). Gray mold fungus *Botrytis cinerea* produced fruit rot. In high humidity, especially on the surface of fruits kept in the laboratory after harvest, there was a heavy gray coat (fig. 1l), composed of mycelium, conidiophores and conidia of fungus (fig. 1n).



**Fig 2** - Isolated saprophyte micromycetes of the phylloplan of the black currant culture: macroscopic, microscopic and culture *in vitro* aspects

Leaf mycoflora was dominated by saprophytic species, such as species of *Alternaria* spp, *Cladosporium herbarum*, *Penicillium* spp, *Fusarium oxysporum* (fig. 2g), *Cephalosporium* spp. Among the fungi known to act in phylloplane an antagonistic role against of plant pathogens of different crops (Şesan, 1997) have been identified and isolated saprophytic fungi (tab. 1) like *T. viridae* (fig. 2d), *E. nigrum* (fig. 2b), *C. globosum* (fig. 2h), *Gliocladium roseum* (fig. 2c), *T. roseum* (fig. 2a, fig. 2f). The isolated of fungi were used to prepare a collection of potential antagonistic strains for to research the *in vitro* relations between them and the strains of pathogenic fungi in order to identify methods of biological control of pathogens. In leaves with no signs of attack, have been also identified fungi that develop in phylloplane toxins that could impair the quality of raw material and could damage of humans consuming products from these materials, such as *Alternaria* spp. producing alternariol, *Penicillium frequentans* frequentic acid producing (Hulea, 1995).

## CONCLUSIONS

1. In the vegetation period, *Ribes nigrum* leaves were inhabited by fungi (micromycetes) and some species of bacteria and actinomycetes were also present;
2. Saprophytic micromycetes predominated, being represented by species of *Alternaria* spp., *Cladosporium herbarum*, *Penicillium* spp., *Fusarium oxysporum*, *Cephalosporium* spp.;

3. Saprophytic fungi have been developed with the antagonistic role in phylloplane as *T. viridae*, *E. nigrum*, *C. globosum*, *Clonostachys rosea*, *T. roseum* were isolated in order to establish a collection of fungi;

4. In phylloplane are present saprophytic fungal species that developing in phylloplane, which could alter quality of raw material and could damage humans consuming products obtained from these materials;

5. In certain periods of plant development were identified pathogenic fungi such as: *S. mors-uvae*, *A. tenuissima*, *M. grossulariae*, *D. ribis*, *C. ribicola*

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# MICROBIOLOGICAL MEANS OF PLANT PROTECTION, SUSTAINABLE ALTERNATIVE AT CHEMICALS

## MIJLOACE MICROBIOLOGICE DE PROTECTIA PLANTELOR, ALTERNATIVĂ DURABILĂ LA PRODUSELE CHIMICE

*CONSTANTINESCU Florica<sup>1</sup>, SICUIA Oana<sup>1</sup>, DINU Sorina<sup>1</sup>*

e-mail: cflori@yahoo.com

**Abstract:** *Large use of pesticides triggered several negative effects including harmful agents resistance to active ingredients. The researches focused on selection and formulation of some bacterial strains with beneficial qualities for crops and fungicides reduction in „damping –off” soil borne fungi control in vegetables. Selection of the strains was based on their antagonistic activity in vitro, capacity to produce enzymes, like cellulase, amylase and lactonase, swimming and swarming mobility and in vivo efficacy against targeted phytopathogens. The strains were formulated as retard microorganisms release granules and microemulsion. The results showed good efficacy of the bioproducts (65-90%) in controlling the diseases.*

**Key words:** biological control, soil borne fungi, useful microorganisms, biopesticides.

**Rezumat:** *Utilizarea pe scară largă a pesticidelor a determinat numeroase efecte negative, inclusiv apariția unor agenți de dăunare problemă. Cercetările efectuate au urmărit selecția și formularea unor tulpini bacteriene cu calități benefice pentru plantele cultivate și reducerea utilizării fungicidelor în combaterea ciupercilor fitopatogene de sol care determină căderea răsadurilor de legume. Selecția s-a realizat pe baza activității antagoniste in vitro, a capacității de a produce enzime, cum ar fi celulaza, amilaza și lactonaza, a mobilității de migrare și de agregare și a eficacității de combatere a fitopatogenilor in vivo. Tulpinile au fost formulate sub formă de granule cu eliberare treptată a microorganismelor și sub formă de microemulsie. Rezultatele au evidențiat o eficacitate de combatere a fitopatogenilor studiată între 65-90%.*

**Cuvinte cheie:** combatere biologică, ciuperci fitopatogene de sol, microorganisme utile, biopesticide.

### INTRODUCTION

Intensive use of chemicals and the increasing number of treatments for crop plants diseases and pest control lead to occurrence of negative effects in ecosystems, like groundwater pollution and pathogens resistance. In addition, the price of pesticides and the demand of consumers for healthy food, free of toxic residues, stimulated in the last decades the researches on alternative control means, such as biological control, enabling sustainable use of resources and reduction of chemicals use in agriculture (Cook, 1983).

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<sup>1</sup> Research Development Institute for Plant Protection, Bucharest, Romania

Soil borne phytopathogenic fungi which cause seedlings “damping off” in favourable temperature (20-25<sup>0</sup>C) and humidity (>70%) conditions, can generate important vegetable seedlings loss (40-50%) mainly in greenhouses but also in field conditions.

The aim of this study was to isolate, characterize and select bacterial strains with biological control qualities and to formulate the biomass as biopreparations for soil borne phytopathogenic fungi control in vegetable crops.

## MATERIAL AND METHOD

**Isolation and selection of microorganisms** - Microorganisms isolation consisted in removal of 1 g rhizosphere from each vegetal sample followed by grinding it in 1 ml sterile distilled water and 100 µl from the suspension were distributed on Luria Bertani Agar medium in Petri dishes and incubated at 28<sup>0</sup>C for 24 hours. Isolated colonies were purified by usual microbiological techniques on Nutrient Agar medium.

Microorganisms selection was based on (i) antagonistic activity *in vitro*, (ii) enzymes production as cellulase, amylase and lactonase, (iii) swimming and swarming motility, (iv) *in vivo* test of the microorganisms efficacy on controlling the studied phytopathogens.

The *in vitro* antagonistic activity of the strains was tested by double culture method. The phytopathogenic fungi *R. solani*, *P. debarianum* and *F. oxisporum f. sp. radialis-lycopersici* were grown on PDA (potato-dextrose-agar) and CDA (Czapek-Dox agar). Briefly, the test consisted in placing in the middle of the Petri dishes, with fresh PDA medium, qualibrated micelium discs (5 mm diameter) and at 2 cm on both sides the bacterial strains were streaked. The plates were incubated at 28<sup>0</sup>C. Each variant had 3 repetitions. The plates were analyzed for fungal growth inhibition at 24, 48 and 72 hours.

Cellulase activity was determined by the breakdown of the substrate carboxy-methyl cellulose (CMC). For this, the strains were grown on medium suplimented with 1% CMC and incubated at 28<sup>0</sup>C for 5 days. Cellulase activity was revealed by flooding the plates with 0,3% Congo Red for 30 minutes, subsequently rinsed with tap water and the dye was fixed by incubation with a 10% acetic acid solution for 15 min. at 28<sup>0</sup>C.

Amylase production was cheked by streaking the bacterial strains on Nutrient Agar medium + 0,4% soluble starch. Plates were incubated at 28<sup>0</sup>C for 48 -72 hours, after that were flooded with iodine solution in potassium iodine. Iodine will react with starch, and form a complex colored in dark blue. Clear areas around bacterial growth after adding iodine solution will indicate the decomposition of starch in the medium and therefore the production of amylase.

For the lactonase production test, the bacterial strains were inoculated in 2 ml of Luria Bertani (LB) broth medium containing 5 µM of C6-hexanoyl homoserine lactone (C6-HHL) and grown overnight at 28<sup>0</sup>C and 150 rpm. As a negative control (to see if the media could cause lactolysis) the same media without bacteria was also incubated under these conditions. After 12 hours, Petri dishes with LBA medium containing 50 µg/ml kanamycin was overlaid with *Chromobacterium violaceum* CV026 (McClellan *et al.*, 1997). Wells were punctured into the plate (5 mm ø) and filled with a 100 µl of bacterial culture. The plates were incubated at 28<sup>0</sup>C and scored for the presence or absence of purple halos. Absence of purple halos indicates that all of the C6-HHL was degraded.

Swimming and swarming motility of the strains was tested on LB agar medium containing 0,3% (swimming) or 0,5% (swarming) agar. Each plate was

toothpick inoculated and scored for swimming and swarming motility after 18 h incubation at 28°C. A negative control, a non-motile derivative of *Pseudomonas putida* strain PCL1760 (Validov et. al., 2007) was used to check the results.

**Conditioning of the selected bacterial strains** – Two types of biomass formulation was experimented: sodium alginate beads and microemulsion.

For the **granular** formulation the following recipe was used: broth bacterial culture, saline phosphate buffer (PBS), sodium alginate 2%, calcium chloride 2% and sterile saline solution 0,8%.

The strains were refreshed on LBA medium by ooze epuization technique. After 24 hours incubation at 28°C single colonies from each strain were used to inoculate 100 ml LB broth / Erlenmayer flask. The liquid cultures were incubated for 48 hours at 28°C and 150 rpm. In order to separate the biomass from the media the cultures were spin at 3000xg for 20 min. at 10°C. The pellet was washed with PBS and resuspended to a final concentration of 10<sup>8</sup> cfu/ml. Twenty ml of 10<sup>8</sup> cfu/ml bacterial suspension was mixed with 2% sodium alginate and homogenized for 15 min. follow by dripping it in 2% CaCl<sub>2</sub> solution.

For the **microemulsion** formulation the following recipe was used: spores biomass from the Gram positive strains, sucrose, Soprofor FL, tristirilphenol phosphate ethoxylated neutralized with triethanolamine, emulsifier CL3, C<sub>12-14</sub> etoxylated with 3 moles of ethylenoxid; poliethylenglycol 400, carboximetilcellulose 5%, sodium benzoate. In a first stage the organic phase was prepared by mixing 30g solvent, 9,6 g Soprofor FL and 2,4 g emulsifier CL3. In the same time, the aqueous solution was prepared by mixing 10 g of bacterial biomass, 5 g sucrose, 0,2 g sodium benzoate, 3 g poliethylenglycol, 5 g carboximetilcellulose 5% and ~ 80% of the amount of water required. The microemulsion was achieved by adding the organic phase gradually over the aqueous phase and continue stirring. This resulted in 100 ml microemulsion biopreparation.

**In vivo test of the biopreparations** – The biopreparations were tested in *in vivo*, in growth chamber conditions, in order to establish the efficacy in *R. solani*, *P. debarianum* and *F. oxysporum f. sp. radialis-lycopersici* control in tomato and cucumber crops.

In vivo test of the sodium alginate granular biopreparations against *Fusarium oxysporum f. sp. radialis lycopersici* in tomato crop: *Fusarium oxysporum f. sp. radialis lycopersici* (*Forl*) inoculum, strain ZUM 2407 (IPO-DLO, Wageningen) was refreshed on PDA medium (Difco). After 4-5 days grown at 28°C, the mycelium was cutted in small pieces and used to inoculate 200 ml Czapek-Dox medium follow by incubation at 28°C and 150 rpm. for 4-5 days. The spores were separated from mycelium by filtration through a sterile cloth.

Tomato seeds (Heintz 2274 variety) were sown in sterile soil (universal peat “FLORIMO”) sterilized by irradiation at 25Kgrey, infected with *Forl* at 2 x 10<sup>6</sup> spores/kg soil. Each variat had 3 repetitions and a total of 30 plants. The growth chamber was setted at 21–24°C and 70% relative humidity.

The experiment consisted in 7 variants as follow: V1-OS17, V2-OS15, V3-Usa2, V4-Salc2, V6- chemical control TOPSIN®500sc 0,25%, V7- negative control (infected, nontreated) and V8– positive control.

The biopreparations were distributed in soil at sowing. After 4 weeks, the roots and the crown of each tomato plant was analized for tipical crown and root rot symptoms and the attack degree and the treatments efficacy was calculated.

In vivo test of the biopreparations formulated as microemulsion against *R. solani* – DSM 63002 and *P. debarianum* DSM 62946 in tomato and cucumber crops: The fungal inoculum was obtained on double sterilized oat seeds (1 atm., 20 min.) distributed in Roux plates. These were uniformly inoculated with fresh mycelium and

incubated for 5 days at 27°C. Tomato (Heintz 2274 variety) and cucumber (Cornichon variety) sterile seeds were treated by immersion for 15-20 min. in the microemulsions. Universal peat "FLORIMO" soil, sterilized by irradiation, was inoculated with the pathogenic fungi at 1:9 (v/v). The experiment had 7 variants, similar to those described above. After 4 weeks, the experiments were assessed on the efficacy of the applied biological treatments.

## RESULTS AND DISCUSSIONS

Of all vegetal samples, from wild and cultivated plants, 74 bacterial isolates from rhizosphere were subjected to selection in order to obtain biopreparations useful for soil borne phytopathogenic fungi control. Of these, 5 strains with biological control agents' qualities were selected for formulation. The selected strains are presented in table 1.

Table 1

**Taxonomy and the provenience of the selected bacterial strains**

Isolate code	Taxonomy (BIOLOG system)	Provenience/Strain characteristics
Us.a2	<i>Bacillus subtilis</i>	Garlic rhizosphere, antagonistic activity <i>in vitro</i> against several phytopatogenic soil borne fungi.
98a	<i>Bacillus subtilis</i>	Wheat rhizosphere, antagonistic activity <i>in vitro</i> against several phytopatogenic soil borne fungi.
OS.17	<i>Bacillus subtilis</i>	Onion rhizosphere, antagonistic activity <i>in vitro</i> against several phytopatogenic soil borne fungi.
OS.15	<i>Bacillus subtilis</i>	Onion rhizosphere, antagonistic activity <i>in vitro</i> against several phytopatogenic soil borne fungi.
salc2	<i>Pseudomonas chlororaphis</i>	Lettuce rhizosphere, antagonistic activity <i>in vitro</i> against several phytopatogenic soil borne fungi.

Of the 5 bacterial strains, the highest inhibition zone *in vitro* against *Forl*, which cause the foot and root rot of tomato plants, were achieved in the variant of *B. subtilis* Usa2 and *P. chlororaphis* salc2. Strain Usa2 induced the highest inhibition zones (9 mm) against *R. solani* being followed by the strains OS.17 and salc2 (7 mm). Against *P. debarianum* the most significant inhibition zone was noticed in the *P. chlororaphis* salc2 variant (7 mm).

Table 2

**Biological characteristics of the selected bacterial strains**

Isolate code	<i>In vitro</i> antagonistic activity after 48 hours incubation at 28°C (mm)			Strains motility		Enzymes production		
	<i>Forl</i> *	<i>Rs</i> *	<i>Pdb</i> *	swimming	swarming	cellulase	amylase	lactonase
Us.a2	8	9	6	+	+	+	+	+
98a	5	5	6	+	+	+	+	+
OS.17	5	7	5	+	+	+	+	+
OS.15	6	6	5	+	+	+	+	+
salc2	8	7	7	+	-	-	+	-

Legend: \*- *Forl*= *Fusarium oxysporum* f. sp. *radicis-lycopersici*; *Rs*= *Rhizoctonia solani* ; *Pdb*= *Pythium debarianum*

Selected *B. subtilis* strains showed both swimming and swarming motility and produced cellulase, amylase and lactonase (table 2).

Table 3

**Granular biopreparations efficacy against *F.oxysporum* f. sp. *radicis lycopersici* in tomato crop**

Variants	Efficacy % (ABOTT)	
	V1- Usa2	71
V2- 98a	57	
V3- OS.15	75	
V4- OS.17	79	
V5- salc2	71	
V6- Chemical control- Topsin 500SC 0,25%	96	
V7- Negative control - <i>Forl</i>	0	
V8- Positive control	100	

*In vivo* test of the granular biopreparations against *F.oxysporum* f. sp. *radicis lycopersici* in tomato crop, highlighted the variant of OS.17 biopreparation were it was registered the highest disease control efficacy (79%). This was followed by the variant treated with the OS.15 biopreparation (75%) (table 3).

Table 4

**Efficacy of the microemulsions biopreparations against *R. solani* in tomato and cucumber crops**

Variants	Efficacy % (ABOTT)	
	tomato	cucumber
V1- Usa2	76	80
V2- 98a	60	65
V3- OS.15	81	78
V4- OS.17	76	85
V5- salc2	68	54
V6- Chemical control- Topsin 500SC 0,25%	96	98
V7- Negative control – <i>R. solani</i>	0	0
V8- Positive control	100	100

From the microemulsion biopreparations, against *R. solani* in tomato and cucumber crops, the variant treated with the biopreparation based on *B. subtilis* OS.15 showed the highest efficacy (81%) in tomato crop and in cucumber crop the highest efficacy was obtained in the variant treated with the biopreparation based on *B. subtilis* OS.17 (85%) followed by Usa2 (80%) (table 4).

The test of microemulsion biopreparations against *P. debarianum* highlighted the variant treated with the *P. chlororaphis* salc2 microemulsion (75%) in tomato, and in cucumber the variant treated with the *B. subtilis* OS.15 microemulsion (70%) (table 5).

**Efficacy of the microemulsions biopreparations against  
*P. debarianum* in tomato and cucumber crops**

Variants	Efficacy % (ABOTT)	
	tomato	cucumber
V1- Usa2	65	33
V2- 98a	54	37
V3- OS.15	68	70
V4- OS.17	48	41
V5- salc2	75	63
V6- Chemical control- Topsin 500SC 0,25%	98	96
V7- Negative control – <i>P. debarianum</i>	0	0
V8- Positive control	100	100

### CONCLUSIONS

1. The 5 bacterial strains selected on their biological traits, belonged to *B. subtilis* and *P. chlororaphis* species.

2. Granular and microemulsion biopreparations significantly protected the tomato and cucumber plants against *F.oxysporum* f. sp. *radicis lycopersici*, *R. solani* and *P. debarianum*, in some experimental variants being insignificant differences between the chemical control and the biological treatments.

3. Useful microorganisms included in the two types of formulations preserved their biological qualities during the *in vivo* trials, which indicate the possibility of their use in ecological agricultural systems.

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**RESEARCH ON EARTHWORM BIODIVERSITY  
(*OLIGOCHAETA-LUMBRICIDAE*) IN DECIDUOUS FOREST  
SOILS UNDER THE ECOLOGICAL CONDITIONS IN THE  
YEAR 2011**

**CERCETĂRI PRIVIND BIODIVERSITATEA SPECIILOR DE  
LUMBRICIDE (*OLIGOCHAETA-LUMBRICIDAE*) DIN SOLURILE  
PĂDURILOR DE FOIOASE, ÎN CONDIȚIILE ECOLOGICE ALE  
ANULUI 2011**

**BĂDEANU Marinela<sup>1</sup>**

e-mail: badeanumarinela@yahoo.com

**Abstract.** *Knowing the species of animals that compose a given area requires fauna of observations extending over many years. In the previous year (2010) I started the investigation of earthworm soil fauna in deciduous forests in the Eastern Carpathians. Observations and analyses have continued in 2011 and will continue, the target being to accurately determine the earthworms species that inhabits these soils, tracing the dynamics of population of each particular species and species evolution, referencing the evolvement of environmental factors and specific food source, represented by organic material provided by deciduous species that make up the dominant vegetation. Associations include deciduous up to 10 species, dominant being *Fagus sylvatica*; *Fraxinus excelsior* and *Carpinus betulus*. As regards the structure of the earthworms species identified, it includes 9 species, 6 species existing in the previous year and 3 species identified for the first time in such research.*

**Key words:** earthworm, biodiversity, dynamic of population, fauna, organic material

**Rezumat.** *Cunoașterea speciilor animale care compun fauna unui areal dat necesită observații care se întind pe mai mulți ani. În anul anterior (2010) am demarat investigarea faunei de lumbricide din solul unei păduri de foioase aflată în Carpații orientali, în județul Suceava. Observațiile și analizele au continuat și în anul 2011 și vor continua în următorii ani, ținta acestora fiind stabilirea exactă a speciilor de lumbricide care populează solurile respective, urmărirea dinamicii populaționale a fiecărei specii și corelarea evoluției particulare a speciilor cu evoluția factorilor de mediu dar și cu specificul sursei de hrană, reprezentată prin material organic furnizat de speciile de foioase care compun predominant vegetația. Asociațiile de foioase cercetate cuprind până la 10 specii, dominante fiind: fagul- *Fagus sylvatica*; frasinul- *Fraxinus excelsior* și carpenul- *Carpinus betulus*. În ce privește structura speciilor de lumbricide identificate, ea cuprinde în anul 2011 – 9 specii, 6 existente și în anul anterior și 3 specii identificate pentru prima dată în aceste cercetări.*

**Cuvinte cheie:** lumbricide, biodiversitate, dinamica populației, fauna, materie organică

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

## INTRODUCTION

Earthworms (*Oligochaeta, Lumbricidae*) are true soil engineers, their presence are many positive effects. Abundance and large number of individuals in soil, indicate that soil is rich in humic substances.

For safety information, observations and determinations are made for many years.

## MATERIAL AND METHOD

Observations and taking biological samples were made on the forest area Râșca, Suceava, in a forest with local associations of 8-12 species, dominant species are beech (*Fagus sylvatica* L.), ash (*Fraxinus excelsior* L.) and hornbeam (*Carpinus betulus* L.).

Average yearly temperature in region is 8.8°C, with high variations in the summer and the amount of annual rainfall exceeds 600 l / m.

For biological sampling were established in the previous year (2010) 4 sites (denoted L1, L2, L3 and L4), spaced in a circular area of 1 km diameter, are preferred over surfaces with mixed species of trees and surface soil covered with dense herbaceous vegetation. Each biological sampling spot was a circle with a radius of 5 m and from each location was taken at five soil samples (about center and four directions, opposite two by two).

Sampling of biological material was carried out twice a month, from April until October 2011. Soil taken from the 20 holes was sifted and collected biological material was sorted and recorded, then determined. Living individuals (adults and juveniles) were killed on the spot, for better conservation, then brought to the laboratory and determined (Pop, 1949).

Cocoons were only counted and registered. To determine the species and to estimate the number of individuals of each species were used only adult individuals, they are the only species that determination can be done correctly.

Taxonomic identification was performed by morphological and anatomical laboratory studies. The classification system used is that proposed by Pop, 2005, 2006 with some modifications.

## RESULTS AND DISCUSSIONS

The area studied in 2011 was reported 15 species of earthworms (*Oligochaeta, Lumbricidae*), namely: *Allolobophora caliginosa* Sav, *Allolobophora rosea* Sav, *Allolobophora dugesi* Pop, *Dendrobaena octaedra* var. *typica* Sav, *Dendrobaena alpina* var. *Typica* Sav, *Lumbricus terrestris* L., *Eisenia fetida* Sav, *Eisenia submontana* Vejd., *Eisenia lucens* L., *Dendrobaena rubida* Rosa, *Octolassium lissaense* Mich., *Octolassium lacteum* Orley, *Eiseniella tetraedra typica* Sav., *Lumbricus rubellus* Hoff., *Lumbricus castaneus* Sav. (table 1).

As can be seen from the table above, of the 15 species reported in the area studied, 9 species are present everywhere, in all locations (60%), a species is present in three locations (6, 66%), two species are present in two locations (13, 33%) and 3 species are present in one location (20%).

Thus 9 of the 15 species were found in all samples one non all sites surveyed, thus having a frequency of 100%. These species are *Allolobophora*

*caliginosa* Sav., *Allolobophora rosea* Sav., *Allolobophora dugesi* var. *Dacica* Pop, *Dendrobaena octaedra* var. *Typica* Sav., *Eisenia fetida* Sav., *Eisenia submontana* Vejd., *Lumbricus terrestris* Sav., *Lumbricus rubellus* Hoff., *Octolassium lacteum* Orley.

Table 1

**Earthworm species collected in 2011**

Nr. crt	Species	No. individuals collected	Feature
1	<i>Allolobophora caliginosa</i> Sav.	56	Common
2	<i>Allolobophora rosea</i> Sav.	44	Common in soil
3	<i>Allolobophora dugesi</i> var. <i>Dacica</i> Pop	12	Common in soil
4	<i>Dendrobaena octaedra</i> var. <i>Typica</i> Sav.	31	Common in soil
5	<i>Dendrobaena alpina</i> var. <i>Typica</i> Sav.	2	Common in soil
6	<i>Dendrobaena rubida</i> ( Rosa)	45	Common In garbage
7	<i>Eisenia fetida</i> Sav.	103	Common In garbage
8	<i>Eisenia submontana</i> Vejd.	62	Common in soil
9	<i>Eisenia lucens</i> L.	5	Rare
10	<i>Eiseniella tetraedra typica</i> Sav.	27	amphibious
11	<i>Lumbricus terrestris</i> Sav.	47	Common in soil
12	<i>Lumbricus rubellus</i> Hoff.	116	Common in soil
13	<i>Lumbricus castaneus</i> Sav.	6	Common in soil
14	<i>Octolassium lissaense</i> Mich.	28	Common in soil
15	<i>Octolassium lacteum</i> Orley	96	Common in soil

In terms of dominance, following investigations we found that: - Of the 15 species collected three species are eudominant species (*Octolassium lacteum* Orley, *Lumbricus rubellus* Hoff, *Eisenia fetida* Sav) - 5 are the dominant species (*Lumbricus terrestris* Sav., *Eisenia submontana* Vejd, *Dendrobaena rubida*( Rosa), *Allolobophora rosea* Sav, *Allolobophora caliginosa* Sav.) - 3 species are sudominant (*Octolassium lissaense* Mich., *Eiseniella tetraedra typica* Sav., *Dendrobaena octaedra* var. *Typica* Sav.) - a species is recedent (*Allolobophora dugesi* var. *Dacica* Pop) - 3 species are surecedent (*Lumbricus castaneus* Sav., *Eisenia lucens*, *Dendrobaena alpina* var. *Typica* Sav.).

In terms of constancy of species analyzed is as follows: - 9 species are euconstant (60% of total species) - a species is constant (6.66%) - 2 accessory species (13.33%) - 3 accidental species (20 %).

**CONCLUSIONS**

From field observations and measurements made during the year 2011 we could collect a larger number of species than the previous year.

Species determined were then analyzed in terms of key environmental parameters, resulting in the following: to 9 of the 15 species are euconstant, being

present at all sites and species is constantly being reported in over 75% of sites that 2/3 of the species are constant or euconstant and only 1/3 are incidental or accidental.

The largest number of individuals collected was reported in the species *Lumbricus rubellus* Hoff (116) and the lowest number of individuals was reported in species *Dendrobaena alpina* var. *Typica* Sav. (2).

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**CONTRIBUTIONS TO THE STUDY OF EASTERN  
CARPATHIANS EARTHWORMS (*OLIGOCHAETA-  
LUMBRICIDAE*) - BIODIVERSITY RESEARCH TO  
EARTHWORMS IN SOIL FOR VEGETABLE CULTURE  
SIHLA NEAMT MONASTERY**

**CONTRIBUȚII LA STUDIUL LUMBRICIDELOR DIN CARPAȚII  
ORIENTALI - CERCETĂRI PRIVIND BIODIVERSITATEA  
LUMBRICIDELOR DIN SOLUL DESTINAT CULTURII DE LEGUME  
DE LA SCHITUL SIHLA-NEAMȚ**

**BĂDEANU Marinela<sup>1</sup>, FILIPOV F.<sup>1</sup>, ȘUTEU Daniela<sup>2</sup>, SANDU Tatiana<sup>1</sup>**  
e-mail: badeanumarinela@yahoo.com

**Abstract.** *Cultivated soil biodiversity study of Sihla Neamt county is part of a complex program of study and monitor the role of earthworms species in the soil, the diversity of existing species, correlated with plant elements from different levels and types of existing soil, with the final goal to establish a fauna of soil type and soil biological diagnosis. In this diagnosis are study the earthworms species from the mountains Neamt, in cultivated soils with vegetables in unsafe conditions by monks hermitage Sihla. Earthworms were collected with soil and vegetation studies. Monastery Sihla is located in Subcarpathians Great Eastern, 1000 m altitude, in a remote area, rich in fauna and flora elements, but with poor soils, difficult to cultivate. Little land available for cultivation has proved rich in species of earthworms, whose development was certainly favored by the species richness of plants and trees in the area that provided organic material for food and the excess moisture.*

**Key words:** biodiversity, soil, vegetation, lumbricidae, fauna.

**Rezumat.** *Studiul biodiversității lumbricidelor din solul cultivat al Schitului Sihla din județul Neamț face parte dintr-un program mai complex de studii și urmărește rolul acestor specii în sol, diversitatea speciilor existente corelată cu diversitatea elementelor vegetale din diferite etaje și cu tipurile de sol existente, având drept scop final stabilirea faunei specifice unui anumit tip de sol și o diagnoză biologică a solurilor. În această diagnoză sunt prezentate speciile de lumbricide din zona montană Neamț, din solurile cultivate cu zarzavaturi și legume, în condiții neprotejate, de către călugării schitului Sihla. Lumbricidele au fost colectate odată cu cercetările pedologice și concomitent cu studiile de vegetație din zona limitrofă. Schitul Sihla este situat pe Dealul Mare din Subcarpații Orientali (Obcinile Bucovinei), la altitudinea de 1000 m, într-o zonă izolată, bogată în elemente de faună și floră specifice, dar cu soluri sărace, greu de cultivat. Puținul sol disponibil pentru cultură s-a dovedit bogat în specii de lumbricide, a căror dezvoltare a fost cu siguranță favorizată și de*

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

<sup>2</sup> “Gheorghe Asachi” Technical University of Iași, Romania

*bogăția speciilor de plante și arbori din zonă, care au furnizat materia organică pentru hrană cât și de excesul de umiditate, preferat de lumbricide.*  
**Cuvinte cheie:** biodiversitate, sol, vegetație; lumbricide; faună.

## INTRODUCTION

Earthworms are as group of invertebrate animals with the largest biomass in the temperate zone, and as having a decisive role in processes of pedogenesis.

Information earthworms community as well as high mountain regions of mixed forests of beech Carpathian spruce tree we find only the work of Pop (1933-1949) and Pop (1972-2007). These include the Earthworms structure, the Earthworms communities and the Earthworms –vegetation- soil relationships.

Due to their age and mobility, earthworms spread on all surfaces globe, regardless of soil type and its fertility.

## MATERIAL AND METHOD

Biological research material as represented by earthworms collected from the land for vegetable cultivation Sihla Monastery, Neamt County.

It is located 28 km from the town of Neamt, at an altitude of 1000 m in the Mountains Stânișoara. Vegetation consists of large trees that pine and deciduous trees of varying sizes and several grass species. The plant species existing in site are: *Pinus sylvestris*, *Picea abies*, *Abies alba*, *Pinus nugo*, *Fagus sylvatica*, *Alnus sp.*, *Sorbus sp.*, *Crataegus sp.*, *Coryllus avellana*, *Cornus sp.*, *Viburnum sp.*, *Latyrus sp.*, *Centaurea sp.*, *Linum sp.*, *Hypericum sp.*

Elements of vegetation structure indicate a large amount of organic matter, therefore a rich source of food for earthworms.

The soil type determined predominate in the area are brown acid with moderate mull, podzolic brown soils, but there are humic-calcareous soils.

The Earthworms are collected and sorting manually. They are collected from topsoil (0-50 cm depth) and under rocks and fallen trunks. After collecting individuals were switched immediately into ethyl alcohol 70%, during which death occurred instantly.

Analysis and classification by the earthworms are active after: body pigmentation, by size etc. The basic classifications on earthworm made the link between individuals and work that out in the ground and show the effects of this activity on land.

Starting from the depth to which they are active, they can be active in soil ( endogee), active at the soil surface ( epigee) and anecic. Epigeic earthworms live at the soil surface is variable groups are as abundant, live in areas rich in food and is a source for predators and another part is exposed to occasional adverse conditions at this level. Endogeic earthworms live permanently in the soil and feed on organic matter. They live and feed on soil poor in organic matter; in soil rich medium which ingest organic particles.

Anecic earthworms are large worms with vertical galleries and that are involved in soil organic waste and feed the manure.

When body size are two categories: large species and small species. Each category stated above is particularly important in soil to which it inhabits. It should be noted that as soil characteristics and influence it, especially organic matter content influences the size of earthworms. Thus individuals of the same species will be lower in soils poor in organic matter and will be larger in rich soils.

The area analyzed was a single collection, the first summer (the end of May).  
 Were collected 39 individuals of 6 species namely *Eisenia submontana* Veijd.,  
*Lumbricus rubellus* Hoff., *Eiseniella tetraedra typica* Sav., *Lumbricus terrestris* L.  
*Eisenia foetida* Sav., *Octolasion lissaense* Orley, (table 1).

Table 1

**Earthworm species collected in Sihla Monastery**

Nr. crt.	The species	No. Individual collected	Coloration	Life environment
1	<i>Eisenia submontana</i> Veijd.	11	Dorsal and lateral stripes Purple Red	Under rotten wood waste
2	<i>Lumbricus rubellus</i> Hoff.	4	Iridescent purple brown	Land under logs
3	<i>Eiseniella tetraedra typica</i> Sav.	11	Reddish brown, intense dorsal	Amphibious,
4	<i>Lumbricus terrestris</i> L.	2	Purple red	Land
5	<i>Eisenia foetida</i> Sav.	4	Dorsal and lateral stripes Purple Red	Manure
6	<i>Octolasion lissaense</i> Orley	7	without pigment	Land

**RESULTS AND DISCUSSIONS**

Collected individuals belonging to 6 species, 5 with red pigment and one without pigment. Tree species are large and constantly active in soil layer 90-120 cm: *Lumbricus terrestris* L., *Lumbricus tubellus* Hoff and *Octolasion lisaense* Orley.

A species is amphibious: *Eiseniella tetraedra typica* Sav. Two species are epigee, loving big banks under stones are long present: *Eisenia submontana* Veijd. and *Eisenia foetida* Sav. (table 2).

Table 2

**The main morphological features of individuals collected**

Nr. crt.	Species	No. Ind.	Length variations (mm)	Diameter variation (mm)	Clitelum position (segm)	No. body segments
1	<i>Eisenia submontana</i> Veijd.	11	130-180	5-6	24- 33	115-130
2	<i>Lumbricus rubellus</i> Hoff.	4	130-150	5-6	24-33	134-145
3	<i>Eiseniella tetraedra typica</i> Sav.	11	50-100	2-4	23-36	70-90
4	<i>Octolasion lissaense</i> Orley	7	50-170	3-7	30-36	97- 170
5	<i>Eisenia foetida</i> Sav.	4	30-130	3-4	24-33	87-120
6	<i>Lumbricus terrestris</i> L.	2	90-300	5-7	27-36	110-180

The comparative analysis of the size of individuals collected was found that body length varied (overall levels) very large (30 -300 mm), the predominant individuals of 120-150 mm in size, that of medium to large, determined the abundance and quality of food.

## CONCLUSIONS

1. After collecting and analyzing biological material Sihla Neamt Monastery site have revealed the presence of a number of six earthworm species namely : *Eisenia submontana* Veijd., *Lumbricus rubellus* Hoff., *Eiseniella tetraedra typica* Sav., *Lumbricus terrestris* L. *Eisenia foetida* Sav., *Octolasion lissaense* Orley.

2. In the acid brown soil was reported *Octolasion lissaense* Orley species, which is active in this type of soil. The entire forest area is *Eisenia submontana* Veijd species, which is the pilgrim species with greater mobility and increased capacity for dissemination.

3. Were also reported species *Lumbricus terrestris* L., *Lumbricus rubellus* Hoff. and *Eisenia foetida* Sav. specific care especially soils grazed by cattle, rich in manure. Their role is to recycle these materials and incorporate them in to the ground.

4. Species *Eiseniella tetraedra typica* Sav. is a common amphibious soils on the mountain streams.

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# RESEARCH INTO THE BIOLOGY AND CONTROL OF SAN JOSE SCALE AT S.C.D.P. IAȘI

## CERCETĂRI CU PRIVIRE LA BIOLOGIA ȘI COMBATERICA PĂDUCHELUI ȚESTOS DIN SAN JOSE LA S.C.D.P. IAȘI

**BEȘLEAGĂ Ramona<sup>1</sup>, CÎRDEI E.<sup>1</sup>, TĂLMACIU M.<sup>2</sup>**

e-mail: k\_ramona2006@yahoo.com

**Abstract.** *In period of 2010-2011, at the SCDP Iasi, organized research on the biology and control tests in San Jose Scale (*Quadraspidiotus perniciosus* Comst). The experiments effectuated on the plantations, of apple cultivars: Idared, Golden delicious si Florina. In development of complex control has been considered to determine the effectiveness of insecticides: Reldan, Novadim, Pyrinex, Movento, Proteus and Decis 25 WG.*

**Key words:** fungicides, control, warning, effectiveness, biology

**Rezumat.** *În perioada 2010-2011, la SCDP Iași s-au efectuat cercetări cu privire la biologia și combaterea păduchelui țestos din San Jose (*Quadraspidiotus perniciosus* Comst). Experimentele s-a desfășurat pe o plantație de măr la soiurile: Idared, Golden delicious și Florina. În elaborarea complexelor de combatere s-a avut în vedere determinarea eficacității insecticidelor: Reldan, Novadim, Pyrinex, Movento, Proteus și Decis 25 WG.*

**Cuvinte cheie:** insectofungicide, combatere, avertizare, eficacitate, biologie

### INTRODUCTION

San Jose Scale is a harmful hunger, attacking over 200 plant species. It colonizes the plant, and his presence is felt on plant organs (shoots, branches, leaves, fruits) by easily visible protective distinctive shield. It feeds on the plant cell juice and mean while it's toxic saliva is injected into the plant. (Badescu and Mutafa, 2001; Cardei, 2001).

The attack on young trees can lead it to drying in 2-3 years, while on the adults can lead to their weakening. Regarding fruits, attack is affecting their size and commercial value (Beșleagă et al., 2006; Simeria, 2001).

This paper presents research results, at S.C.D.P. Iași, on the biology and control of San Jose Scale.

### MATERIAL AND METHOD

Research into the the biology and control, of San Jose Scale where performed in experimental polygon, in an orchard of apple varieties including: Idared, Golden delicious and Florina, with trees were planted at 3x4 m distance, and against it were tested tow control schemes:

–V1: T1GI – Reldan 0,15%, T2GI –Novadim 0,15%

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<sup>1</sup> Research and Development Station for Fruit Tree Growing of Iași, Romania

<sup>2</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

T1GII – Pyrinex 48 EC 0,2%, T2GII – Decis 25 WG 0,003%;  
 –V2: T1GI – Reldan 0,15%, T2GI – Novadim 0,15%  
 T1GII – Reldan 0,15%, T2GII – Movento 100SC 0,125%

To determine the evolution of pest biology major climatic factors were followed (temperature, precipitation and humidity).

Phytosanitary treatments were applied to the warning, using specific products to combat Scale tests of San Jose and also, insecticides and fungicides used to control other pests and pathogens.

Observation and measurements were made at the end of each generation, when we determined the percentage of attacked fruits.

## RESULTS AND DISSCUTION

Climatic conditions during testing were very favorable development of the pest (tab.1). So, maximum and average temperatures during May-June caused an accumulation of effective temperatures over the biological threshold of 511°C, which causes appearance of the first mobile larvae.

Table 1

**Climatic characterization of the years 2010-2011 at S.C.D.P. Iași**

Month	Temperature °C			Precipitation	Humidity
	Mean	Low	High		
October	18,1	-3,7	6,7	47,8	84
November	9,9	-1,1	22,6	52,6	76
December	-1,5	-17,9	15,8	50,0	87
January	-2,2	-16,2	10,4	15,8	73
February	-2,6	-5,8	0,9	6,0	76
March	3,5	-1,3	8,7	13,2	69
April	10,0	4,8	15,1	81,2	61
May	15,8	2,3	30,1	39,0	68
June	19,6	8,7	33,5	98,4	68
July	21,8	9,6	34,1	72,4	72
August	20,4	8,9	30,9	38,8	61
September	17,7	5,5	30,4	18,4	62
Total	10,8	-17,9	34,1	533,6	71,4

Table 2

**Biological stage in development of San – Jose Scale  
 (*Quadraspidiotus perniciosus* Comst.) in 2011 at S.C.D.P. Iași**

	Biological stage	First appearance	Last appearance	∑ effective temperatures
<b>First Generation</b>	Primary larva	7.06	17.06	680,44
	Secondary larva	10.06	16.07	1080,58
	Adult	3.07	23.07	1199,18
<b>Second Generation</b>	Primary larva	24.07	26.08	1698,35
		30.08	hibernate	hibernate

In 2011, at S.C.D.P Iași, have followed the evolution of San Jose Scale. The results of observations on biological pest stages are presented in table 2.

From the observation in generation I, it was found that mobile larvae first appearance took place on June 7, and the last on June 17, when the effective temperatures was 680,44<sup>0</sup>C, in generation II, first mobile larvae appeared on July 27, and the last on August 26, when the effective temperatures was 1698,35<sup>0</sup>C.

From the data table, results, that in Iași conditions, species *Quadraspidiotus perniciosus* has two generations per year: first generation in June–July, and second generation in July–August.

Based on the biological data and the first appearance of mobile larvae in each generation, were set warning periods (table 3).

Table 3

Warning periods in 2011

Year	First Generation		Second Generation	
	First mobile larvae	Warning periods	First mobile larvae	Warning periods
2011	june 7	june 10-13	july 24	july 30 – august 2

To combat San Jose Scale in each generation were applied two chemical treatments:

- First treatment was performed for the periods indicated in table 3;
- Second treatment at distance of 8 to 14 days from the first.

The results on phytosanitary treatments efficacy are presented in table 4;

Table 4

Treatment effectiveness in combating species *Quadraspidiotus perniciosus* Comst.

Used products	Variety	San Jose Scale %fructe atacate	
		First Generation	Second Generation
<b>Version I</b>			
T1GI- Reldan	Idared	2,0	1,7
T2GI -Novadim	Golden delicious	2,3	2,0
T1GII –Pyrinex 48EC	Florina	2,4	2,0
T2GII –Decis 25WG			
Mn - Idared			80,1
<b>Version II</b>			
T1GI- Reldan	Idared	2,1	1,9
T2GI –Novadim	Golden delicious	2,1	2,0
T1GII -Reldan	Florina	2,4	2,1
T2GII –Movento			
Mn - Idared			74,5

So, from table 4 results that untreated control was recorded a percentage of attacked fruits between 74,5%-80,1% in second generation. For treated varieties we have values of 2,0-2,4% attacked apple in first generation and 1,7-2,0% in second generation (at harvest).

Regarding to the products used for combating San Jose Scale, best results were obtained in Idared variety, with a percentage of attacked fruits by 1,7%.

## CONCLUSIONS

1. Climatic conditions have favored the evolution and attack of San Jose Scale (*Quadraspidiotus perniciosus* Comst).
2. In climatic conditions of Iași area, *Quadraspidiotus perniciosus* species presented two generations per year: first generation in June – July and second generation in July - August.
3. Best results in pest control were obtained from Idared variety, with a percentage of attacked fruits by 1,7%.
4. Control scheme applied 2+2 led to a good fight against San Jose Scale in apple orchards.

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# BIOLOGICAL INSECTICIDE INOCULUM FOR PLANT PROTECTION AGAINST ROOT PESTS

## INSECTICIDE BIOLOGICE INOCULANTE DESTINATE PROTECȚIEI PLANTELOR FAȚĂ DE ATACUL DĂUNĂTORILOR DE RĂDĂCINĂ

*FĂTU Ana-Cristina*<sup>1</sup>, *CIORNEI C.*<sup>2</sup>, *FĂTU V.*<sup>1</sup>,  
*LUPĂȘTEAN Daniela*<sup>3</sup>, *PAVEL Otilia*<sup>4</sup>, *ANDREI Ana-Maria*<sup>1</sup>

**Abstract.** *Entomopathogenic microorganisms isolated from natural outbreaks were tested both in laboratory and field conditions in order to evaluate the possibility of their usage as inoculative bioinsecticides for root pest control. The laboratory results lead to a selection of some autochthonous Beauveria brongniartii strains with bio-ecological potential, adapted to romanian pedoclimatic conditions and identified as the principal source of biological material for the bioinsecticides production. Field tests were conducted in moldavian forest nurseries located in different regions and infested with Melolontha melolontha. In this paper we present the results concerning the method of entomopathogenic bioinsecticides application and their biological efficacy in European cockchafer control.*

**Key words:** *Beauveria brongniartii, Melolontha melolontha, bioinsecticides*

**Rezumat.** *Microorganismele entomopatogene izolate din focare epizootice naturale au fost testate în condiții de laborator și câmp, în vederea evaluării posibilității de utilizare a acestora sub formă de biopreparate inoculante destinate combaterii unor dăunători de rădăcină. Rezultatele experimentelor desfășurate în condiții de laborator vizează selecția unor tulpini autohtone de Beauveria brongniartii, cu potențial bio-ecologic adaptat condițiilor pedoclimatice din România, identificate ca sursă de material biologic pentru obținerea de biopreparate. Testele de câmp s-au desfășurat în pepiniere silvice din județul Suceava, situate în diferite condiții staționale și infestate cu Melolontha melolontha. În lucrare sunt prezentate rezultate privind metoda de aplicare a biopreparatelor entomopatogene și eficacitatea biologică a acestora în combaterea cărăbușului de mai.*

**Cuvinte cheie:** *Beauveria brongniartii, Melolontha melolontha, bioinsecticide*

### INTRODUCTION

Among root pests, beetle species belonging to Scarabeidae family are now the first biotic stress factors in forest nurseries. In the last two decades *Melolontha melolontha* L. (May cockchafer) recorded mass propagation and produced significant damage in Romania.

The limited use of chemical insecticides to control these pest categories imposed a special focus on integrated control measures and among these, on

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<sup>1</sup> Research-Development Institute for Plant Protection, Bucharest, Romania

<sup>2</sup> Forestry Research Station, Bacău, Romania

<sup>3</sup> „Ștefan cel Mare” University, Suceava, Romania

<sup>4</sup> Museum of Natural Sciences, Bacău, Romania

biological control using entomopathogenic microorganisms (Ferron, 1978). The most effective biopesticides used in Europe for *M. melolontha* control are based on entomopathogenic fungi, *Beauveria brongniartii* (Sacc.) Petch. being recognized in this respect (Ciornei et al., 2010).

## MATERIAL AND METHOD

Obtaining the biological insecticides

*Beauveria brongniartii* "wild" strains were isolated from *Melolontha melolontha* larvae covered by fungal mycelium, in natural epizootic outbreaks (tab. 1).

Selection of the biological material source for bioinsecticide production was assessed by measuring the biological potential of each monosporal isolate through a method involving the estimation of specific biological parameters, including germination percentage of spores, sporulation on insects, insect mortality rate and mortality distribution, life cycle of the isolated organism.

Table 1

***B. brongniartii* biotypes tested for fungal strains selection**

Strain	Date of isolation	Place of isolation	Source of isolation
Bg01	18.05.2007	Roman nursery (Neamț county)	<i>M.melolontha</i> (L <sub>2</sub> )
Bg02	25.05.2007	Tg. Neamț - Dumbra nursery (Neamț county)	<i>M.melolontha</i> (L <sub>3</sub> )
Bg03	26.06.2008	Gura Humorului nursery (Suceava county)	soil

In order to obtain fungal biomass, multiplication of the monosporale fungal isolates was made in two steps:

(1) Vegetative mycelium (fungal inoculum liquid) was obtained from microbiologically pure colonies, inoculated on solid artificial medium, incubated at 25°C, until complete sporulation and then transferred into liquid culture medium based on glucose, corn extract and salts, that was distributed in fermentation flasks and incubated under agitated conditions, 24 hours at 27°C.

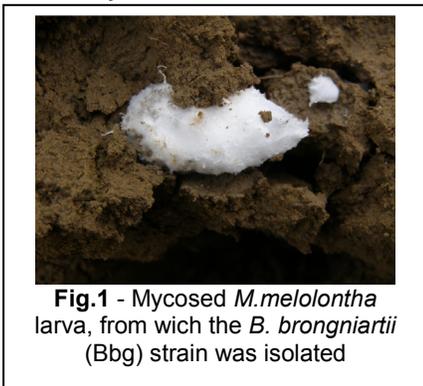
(2) Sporulated mycelium (solid fungal inoculum) was obtained by inoculation of a natural solid substrate (barley seeds) with vegetative mycelium (liquid fungal inoculum). To do so: barley seeds were weighed, washed under running water and distributed in autoclavable plastic bags; after sterilization (121°C, 30 min.), the substrate was inoculated with 1.6% fungal inoculum liquid obtained in the previous stage; inoculated natural substrate was then incubated under stationary conditions at 25°C for 25 days.

Biological insecticides testing under field conditions. Pest infestation of root forest nurseries in Moldova was established by performing soil surveys. Entomopathogenic bioformulations were applied in different variants (doses), in nurseries located in different site conditions.

Experimental devices were latin rectangle type, including the control area. Treatment was made by manual spreading on soil surface. The soil preparation before the biological treatment as well as the incorporation of the biological insecticides into the soil was made with a motor hoe, when the treatment was done between rows of seedlings, ie disk cutter or drill towed by tractor, when treatments were applied over the entire experimental field. The biological efficacy of the treatment was assessed by comparing the number of dead larvae infected by *B. brongniartii* to the total number of living larvae initially present in the soil.

## RESULTS AND DISCUSSIONS

A *B. brongniartii* strain isolated in Roman nursery, Neamt county, from a second instar *M. melolontha* larva (fig. 1) was selected for multiplication in laboratory conditions in order to obtain biological insecticide (Andrei, 2004).



After 6 days incubation at 25°C, on artificial solid medium, Bbg was presented in the form of lanose colonies, velvety to powdery, at first white, then yellow; on potato-glucose-agar (PDA) medium, reverse colony was white, and a red pigment was diffused in the medium; exudate absent. Microscopically, they revealed hyphae hyaline, septate, with regular contour, conidiogenous basal cells, unicellular predominantly ellipsoidal conidia, hydrophobic, small (approx. 4 µm)

with a zigzag-shaped rachis.

Production and formulation technology of Bbg strain to obtain biological insecticide included the following steps:

(I) Obtaining a "stock culture" of *B. brongniartii* (Bbg). Bbg monosporale strain from original isolate, kept in glass tubes at 4°C on standard mycological medium (PDA) and being periodically transferred on fresh medium was analyzed in terms of biological key parameters. The following values were obtained: 100% microbiological purity, 92% sporulation after 72 hours, 156 g / l biomass, 89% *Tenebrio molitor* (Andrei et al., 2001) test insect mortality (biological titer of the fungal suspension was  $12.5 \times 10^9$  conidia / ml).

(II) Production of „inoculum units” took place in two stages: (II.1) obtaining of laboratory inoculum by multiplication of biological material from the stock culture on agarised medium, seeding a total of 30 tubes/strain, followed by incubation (72 hours, 25°C); (II.2) obtaining the batch inoculum by inoculation of laboratory inoculum on liquid medium, under agitation conditions (48 hours, 27°C).

(III) Obtaining of biologically active fungal biomass by pouring the liquid fungal inoculum on solid nutrient substrate (barley grains) to obtain conidia, the fungal bioactive substance.

(IV) At the end of incubation period, when the nutrient substrate fermentation was complete, the bioinsecticidequality control was performed by measuring virulence on test insects.

The results of biological characterization of experimental bioformulation batches based on *B.brongniartii* obtained at the RDIPP is indicated in Table 2; the results shown that the average conidia production per gram of final product was  $1.55 \times 10^{10}$ , the percentage of conidia viability ranged between 88-99%; the results of the pathogenicity test on insects showed that an 86% average percentage of larval mortality corresponded to 98.5% average percentage of mycosis induced by the "active substance "of fungal bioformulation.

Table 2

Biological characterization of experimental bioformulation batches (*B. brongniartii*) obtained in the year 2010

Batch number/ Data	Conidia viability (%)	Conidia number x 10 <sup>10</sup> /g	(%) Insect mortality / mycosis	Batch number/ Data	Conidia viability (%)	Conidia number x 10 <sup>10</sup> /g	(%) Insect mortality / mycosis
1/9.01	97	1,6	89/100	9/16.02	92	1,7	92/100
2/16.01	99	1,8	92/100	10/22.02	97	1,5	86/100
3/18.01	96	1,9	83/95	11/27.02	88	1,2	93/100
4/22.01	93	1,5	88/90	12/2.03	93	1,8	74/100
5/27.01	95	1,5	94/100	13/11.03	90	1,6	79/100
6/30.01	97	1,2	73/100	14/24.04	97	1,6	91/97
7/2.02	95	1,4	90/100	15/2.05	96	1,7	93/100
8/7.02	98	1,7	87/95	16/13.05	94	1,2	89/100

Experimental biological control in nurseries located in the hill mountain area. In the course of the year 2011 the treatments were made to control may cockhafer by using biological insecticide based on *B.brongniartii*. Treatments were applied in nurseries located in different site conditions, using different doses:  $V_1 = 100 \text{ kg / ha}$ ,  $V_2 = 150 \text{ kg / ha}$  and  $V_3 = 200 \text{ kg / ha}$ .

In Cerbărie nursery (Fig. 2), Malini forest district (Suceava), biological insecticide was tested in an experimental device (500 sqm x 3 variants and a control surface of 160 sqm).



Fig. 2 – Experimental device in Cerbarie nursery (altitude 420 m)

Bioinsecticide (fig. 3) was applied at 20.04.2011.



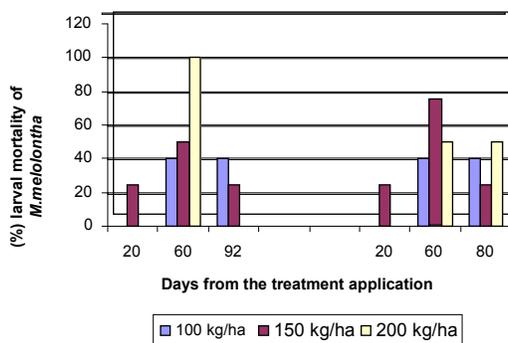
**Fig. 3 - Bioinsecticide weighed for application**

First observations showed that the *M. melolontha* larvae infestation was strong ( $1.0 \text{ L}_3/\text{m}^2$  in  $V_2$  and control) and very strong ( $1.7 \text{ L}_3/\text{m}^2$  in  $V_1$  and  $1.3 \text{ L}_3/\text{m}^2$  in  $V_3$ ). Treatment efficacy results can be found in fig. 5.

In Tărnicioara nursery from Suceava district (700 m altitude), the treatment was conducted on 30.04.2011. Each variant consisted of 350 sqm and the control surface measured 100 sqm for. At the time of the first observations of efficacy (05.30.2011), 30 days respectively after the biological treatment, *M. melolontha* infestation was very strong in all variants:  $1.7 \text{ L}_3/\text{m}^2$  in  $V_1$  and control,  $1.3 \text{ L}_3/\text{m}^2$  in  $V_2$  and  $2.0 \text{ L}_3/\text{m}^2$  in  $V_3$ . Mortality caused by biological treatment was considered when dead larvae were covered by the fungal mycelium (fig. 4).



**Fig. 4 – *M. melolontha* larvae covered by the fungal mycelium after the treatment**



**Fig. 5 – Treatment efficacy at different time (20-92 days, in Cerbarie nursery, 20-80 days in Tărnicioara nursery respectively)**

## CONCLUSIONS

1. Surveys on the *B. brongniartii* occurrence revealed natural epizootic outbreaks in northern Romanian forest nurseries.

2. A technology solution of the process for obtaining fungal biomass with the increase of *B. brongniartii* active substance has been streamlined, on the one hand by using as source of biological material for the production of biological insecticides local strains of *B. brongniartii*, with a high bio-ecological, biotechnological and pathological potential and on the other hand, by exploiting the microcyclic character of fungal strains sporogenesis, in order to obtain high yields of spores (conidia) in a short time.

3. The biological treatment efficacy occurred in all experimental variants. There was a positive correlation between application dose and effect. Dose of 100 kg / ha registered 80% effectiveness. Doses of 150 kg / ha and 200 kg / ha were 100% effective, causing mortality to the third instar larvae. Maximum effectiveness occurred after 60 days, in both experimental fields.

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# BIOLOGICAL SOLUTIONS TO PREVENT AND DECREASE THE ATTACK PHYLLOXERA (*PHYLLOXERA VASTATRIX*)

## SOLUȚII BIOLOGICE DE PREVENIRE ȘI DIMINUARE A ATACULUI DE FILOXERA (*PHYLLOXERA VASTATRIX*)

**FÎCIU Lidia<sup>1</sup>, DEJEU L.<sup>1</sup>**

e-mail: ficiulidia@yahoo.com

**Abstract.** To prevent and decrease the attack of phylloxera was tested a technology based on amplifying the suppressive properties of soil on phylloxera attack by improving the fertility and biological activity of the soil. Biopreparats with *Beauveria sp.* fungi have been used in granular form on organic support (grains of wheat and barley) as an active substance for *Beauveria*. The organic fertilizer such as manure and compost introduced in soil represent the support used for fungal strains multiplication and spread. The results obtained showed that the symptoms produced by the phylloxera on roots, are more numerous in the case of compost (20 t/ha) used as organic supports compared to the manure (20 t/ha), mixed with 50 kg/ha biopreparat administered at a depth greater than 20 cm. In the case we used a quantity of 20 t/ha manure mixed with 200 kg/ha biopreparat introduced in soil at 10 cm depth, the frequency of symptoms has been greatly reduced.

**Key words:** viticulture, phylloxera, suppressive effects

**Rezumat.** Pentru prevenirea și diminuarea atacului de filoxera s-a testat o tehnologie de amplificare a însușirilor represive ale solurilor asupra filoxerei prin sporirea fertilității și activității lor biologice. S-au folosit biopreparate sub formă de granule pe suport organic (boabe de grâu și orz), care au ca substanță activă fungi de *Beauveria sp.* Produsele organice de fertilizare mranîța și compostul introduse în sol reprezintă substraturile pe care tulpinile fungice le exploatează în procesul de multiplicare și conidiogeneză, asigurând răspândirea patogenului. Din observațiile făcute s-a constatat că simptomele produse de filoxera pe rădăcini, sunt mult mai numeroase la variantele în care s-a utilizat compostul (20 t/ha) ca suport organic în amestec cu 50 kg/ha biopreparat administrat la o adâncime de 40 cm, față de variantele unde s-a folosit ca suport organic mranîța (20 t/ha). În cazul utilizării unei cantități de 20 t/ha mranîță în amestec cu 200 kg/ha biopreparat, administrat la 20 cm adâncime, frecvența simptomelor a fost mult diminuată.

**Cuvinte cheie:** viticultură, filoxera, efect represiv

### INTRODUCTION

The phylloxera was discovered in 1868, its attack causing the biggest disaster know (Bazille et al., 1868).

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Bucharest, România

In Romania, as well as worldwide, phylloxera is the most important pest in the vineyard, for which there aren't the effective methods of control, but only to avoid the damage.

Climate change (warm winters, high temperatures, low rainfall), cultural techniques of non-compliant (planting too deeply rooted grafts) will facilitate appearance of some strains with a high degree of pest and enhancing the area of spread of the pest (Ray, 2006; Sabbour and Abbass, 2006). From observations and determinations made to found an increase in aggressiveness and virulence, an increase in the number of generations and a worrying attack of galicole form a growing number of *vinifera* varieties (Jeffrey and Andrew Walker, 2001).

*Beauveria* genus as of fact and other genus of fungal entomopathogenic for good growth broadcasting and spore is in need of the organic matter. It is also one of the reasons for which fertile soils, rich in organic matter have a suppressive action more than the poor soils, unstructured (Sabbour and Abbass, 2006).

## MATERIAL AND METHOD

For this was realized an experimental device located in vine school from ICDVV Valea Calugareasca where they been planted seedlings of vines for rooting of 38 +/-2 cm of Merlot. The experimental variables were the organic fertilizer and dose of biopreparat. Of their combination resulted 12 variants:

The factor A – vinifera variety - a<sub>1</sub> -Merlot

The factor B – the type of fertilizer - b<sub>1</sub> - manure

- b<sub>2</sub> - compost

- b<sub>3</sub> - chemical fertilizer

- b<sub>4</sub> - unfertilized

The factor C – the quantity of biopreparat - c<sub>1</sub> - 50 kg/ha

- c<sub>2</sub> - 100 kg/ha

- c<sub>3</sub> - 200 kg/ha

The factor D – the depth by incorporation of the mixture biopreparat –fertilizer

- d<sub>1</sub> – 10 cm

- d<sub>2</sub> – 20 cm

The planting was done in simple billon, rich microbiological fertilizer management (calculated per unit of area) has realized with the cutting billon. By the planting in the field to follow the behaviour in natural conditions of biopreparat which contains strains of *Beauveria bassiana*, and on the other the cumulative effect of organic fertilizer combination x biopreparat x application rate on phylloxera radicola form.

After 60 days after planting have been taken the soil samples from three points on each variant, at two depths (0-2 and 2-10 cm) after which have been mixed.

In order to quantify the number of colonies, the evaluation of vegetative growth was achieved after about a week of incubation at a temperature of 26 ± 1 °C in the dark.

Counting the colonies has been done using the numerator of Colony Star.

The dates were analyzed using ANOVA test and comparisons between test environments were made using the ANOVA test (ONE WAY and Linear Regression) (p < 0.05) using software Bio Stat 2008.

The repressive potential was achieved by quantifying the symptoms produced by the phylloxera radicola form on roots using a scale from 1-4 (table 1).

Table1

Scale for quantifying the symptoms produced by the *Phylloxera radicola*

Note	Root aspect	Nodosities		Phylloxera (adults, larvae, eggs, colony)
		Dimensione	Number	
1	Not curved	Absent	Absent	Absent
2	Low curved	Small	Fiew	Present in small numbers
3	Curved	Middle	Present	Present medium
4	Very curved	Sea	Many	Colony

For each note was assigned a color. It has been analyzed 5 roots of approximately 10 cm in length and with a diameter of approximately 3-5 mm.

## RESULTS AND DISCUSSION

From the observations that had purpose verifying the behaviour pathogenic strains (table 2) showed that the strains of *Beauveria bassiana*, after a new isolation from organic fertilizers use as nutrient substrates for fungal multiplication shall their viability and virulence.

Table2

Biological parameters of strains of *Beauveria bassiana* after a new isolation of organic fertilizers use as substrates for growing nutrient from fungal contamination

Fungal strain	Vegetative growth/CGA (after 15 days from seeding)		Conyidiogenesis (Conidy number $\times 10^{10}/g$ )	Viability germination (%)
	medium size colonies (number)	average daily growth rate (number)		
Nutrient substrate: compost				
<i>Beauveria bassiana</i>	5,7	0,32	8,6	97
Nutrient substrate: manure				
<i>Beauveria bassiana</i>	6,1	0,4	9,2	99
Standard: nutrient substrate synthetic culture medium (peptona-dextroza-agar)				
<i>Beauveria bassiana</i>	5,9	0,38	2,9 ( $\times 10^{10}/cm^2$ )	100

Following the analysis of soil samples taken from the experimental variants and passing the results by statistical filter (table 3) that there is a significant difference between organic use fertilizer (manure, chemical fertilizer, compost, organic without support) and no between doses of biopreparat.

Table 3

**Results concerning the establishment of organic substrate and of the doses of application of the biopreparat in natural conditions**

Variant	Organic support	<i>Beauveria bassiana</i> dose kg/ha	Number of colonies x 10 <sup>4</sup> / g sol
1	Manure	50	9±1,27
2	Manure	100	20,9±0,05
3	Manure	200	22,8±0,02
4	Compost	50	22±1,14
5	Compost	100	20±0,04
6	Compost	200	81,4±0,21
7	Chemical fertilizer	50	10±1,2
8	Chemical fertilizer	100	14±0,07
9	Chemical fertilizer	200	7±0,08
10	Without organic support	50	16,5±0,18
11	Without organic support	100	37,2±0,25
12	Without organic support	200	18±1,13

As a conclusion, on the basis of the results obtained, we can affirm that the number of the conidy in the ground of persistent field does not depend on the dosage of the biopreparat inoculated. Considering this fact, and the behaviour of the conidy of the *Beauveria bassiana* inoculated into the soil in experimental laboratory conditions, studied previously, we can estimate that the dose of 1, 48x10<sup>12</sup> conidy/ha can ensure microbiological inoculation with *Beauveria bassiana*. To ensure this doses of active substance/ha, it is necessary a quantity of 50 up to 100 kg/ha biopreparat fungi that contain min. 2.7 g active substance/kg.

From the analysis of data concerning the frequency and severity of the attack of phylloxera radicola form (table 4) by inoculating the soil of biopreparat based on *Beauveria bassiana* fungal strains is obtained an increase repressive effect against phylloxera radicola form.

Table 4

**Influence of combined action of fertilizer and biopreparat action on the symptoms produced by the phylloxera radicola form**

Dose/ha/ biopreparat based on strains of <i>Beauveria bassiana</i> fungal	Manure		Compost		Chemical fertilizer		Without fertilizer	
	Note	E%*	Note	E%*	Note	E%*	Note	E%*
50	3,6	36,8	5,7	8,6	5,4	6,3	6,2	5,0
100	3,0	47,4	3,2	43,6	3,2	44,8	4,5	31,8
200	2,6	54,3	3,6	58,6	3,8	34,5	4,2	36,4
Media	3,1	46,1	4,2	36,9	4,1	28,5	5,0	24,4
Without fertilizer and biopreparat (control)	5,7		6,2		5,8		6,6	

\* The efficiency

As we expected, using manure as organic support ensure a good growth, spread and the sporulation of fungal strains based on *Beauveria bassiana* and consequently increase the soil repressively on *Phylloxera radiccicola* form. Average efficiency obtained (calculated from the control) was 46.1%.

When applying a dose of 50 kg biopreparat/ha, mixed with manure, the efficiency is 36.8%, 8.6% with the compost, and only 5% without fertilizer. By increasing the dose to 100 kg biopreparat/ha, respectively 200 kg biopreparat/ha, in addition, the best efficiency we find the mixture with the manure (47.4% and 54.3%). Applying a dose of 200 kg biopreparat /ha achieved an efficiency of 36.4% even the variants without organic support.

As regards the optimal depth of the incorporation of biopreparat-fertilizer mixture has found that by increasing the depth of the administration decrease repressive effects even if increasing the dose of the biopreparat, from 27.2% at a depth of 20 cm to 22.0% at a depth of 40 cm in the administration of 100 kg biopreparat/ha, respectively from 35.0% at a depth of 20 cm to 22.1% at a depth of 40 cm in the administration of 200 kg biopreparat/ha (table 5).

Table 5

**Influence of the depth of biopreparat-fertilizer mixture**

<b>Biopreparat - fertilizer</b>	<b>Note</b>	<b>E % *</b>
Manure 20 t/ha + 100 kg/ha biopreparat to 20 cm depth	5.6	27.2
Manure 20 t/ha + 100 kg/ha biopreparat la 40 cm depth	6.0	22.0
Manure 20 t/ha + 200 kg/ha biopreparat la 20 cm depth	5.0	35.0
Manure 20 t/ha + 200 kg/ha biopreparat la 40 cm depth	6.0	22.1
Without fertilier and withoutbiopreparat (control)	7.7	

\* - The efficiency

## CONCLUSIONS

1. The manure and compost, organic fertilizer products of the vine were colonized with strains of *Beauveria bassiana*, resulting microbiologically rich and fertilizer effect of increasing the repressive potential of the soil compared with phylloxera.

2. The manure and compost have provided the stability properties of pathogenity and the virulence of fungal strains. The contribution of the organic matter enriched microbiological favoured reducing the effects of phylloxera radiccicola form.

3. The optimal dose of application of the biopreparat 20 t/ha manure and compost is 100 kg/ha.

4. The optimal depth of the incorporation of biopreparat-fertilizer mixture is 20 cm.

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# SOME ASPECTS OF POPULATION CONTROL *MELIGETES AENEUS* IN WINTER RAPESEED UNDER AGRICULTURAL NE BĂRĂGAN AREA

## UNELE ASPECTE PRIVIND CONTROLUL POPULAȚIEI *MELIGETES AENEUS* ÎN CULTURA DE RAPIȚĂ DE TOAMNĂ ÎN CONDIȚIILE AREALULUI AGRICOL BĂRĂGANUL DE NORD- EST

*RÎȘNOVEANU Luxița*<sup>1</sup>, *CIOROMELE Alina*<sup>1</sup>, *BURTEA Carmen*<sup>1</sup>  
e-mail: dnastase78@gmail.com

**Abstract.** *Meligethes aeneus* is one of the most dangerous pests of rape, the agricultural area Bărăganul de nord-est, accounting for 25 % of this crop pests. There are significant differences between different mode of action of insecticides according to the active substances entering their composition, their mode of action of this pest on the frequency and efficacy of protection substances *Meligethes aeneus*, particularly the damaging culture of winter rape

**Key words:** *Meligethes aeneus*, insecticide, frequency, efficacy.

**Rezumat** *Meligethes aeneus* este unul din cei mai periculoși dăunători ai rapiței, din arealul agricol Bărăganul de nord, cu o pondere de peste 25 % din populația dăunătorilor acestei culturi. Sunt deosebiri semnificative între modul de acțiune a diferitelor insecticide în funcție de substanțele active care intră în componență lor vizând modul de acțiune a acestora asupra dăunătorului privind frecvența și eficacitatea substanțelor de protecție în combaterea *Meligethes aeneus*.

**Cuvinte cheie :** *Meligethes aeneus*, insecticide, frecvență, eficacitate

### INTRODUCTION

Winter rape is attacked by a large number of insect pests (Alford et al., 2003; Troțuș, 2009, Popov, 2006, 2007,). *Meligethes aeneus* Fab. (Coleoptera, Nitidulidae) is a major pest throughout both Europe and in Romania in large areas growing winter rape (Alford et al., 2003; Rîșnoveanu, 2010).

The trend in the management of this pest that can affect over 35%, and in some years resulting in compromised culture, application of insecticides with minimal effect on the environment constitutes an important part in achieving high yields, stable and quality of winter rape in the Baraganul de nord-est. (Rîșnoveanu, 2010; Buzdugan, 2011)

### MATERIAL AND METHOD

Researches were executed during 2004-2011 in the agricultural area Baraganul de nord-est. In this period, observations and determinations were made on the collection and identification of pests of rapeseed crops.

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<sup>1</sup> Universty of Dunărea de Jos Galați, Romania

To prevent attack of *Meligethes aeneus* to experience a range of insecticides with minimal impact on the environment:

- systemic (thiametoxam 25%)
- non-systemic (alpha-cipermetrin and delatcipermetrin 50 g / l)

Observations and measurements were made on untreated variant frequency pests and the ones that have been applied insecticides mentioned above. Efficacy of insecticides was determined using Abbott's formula

Scientific data obtained were calculated and statistically analyzed using analysis of variance, compared multiple (Newman Keuls), regressions and correlations (statistical package SAS / SAT, PASW)

## RESULTS AND DISCUSSIONS

Analyzing harmful species during growth and development of winter rape spring shows that *Meligethes aeneus* occupies the largest share, 28.4%, of total 3456 individuals / m<sup>2</sup> a major pest of this crop, producing great damage, especially in period buds united, flourished and pods formation (fig. 1)

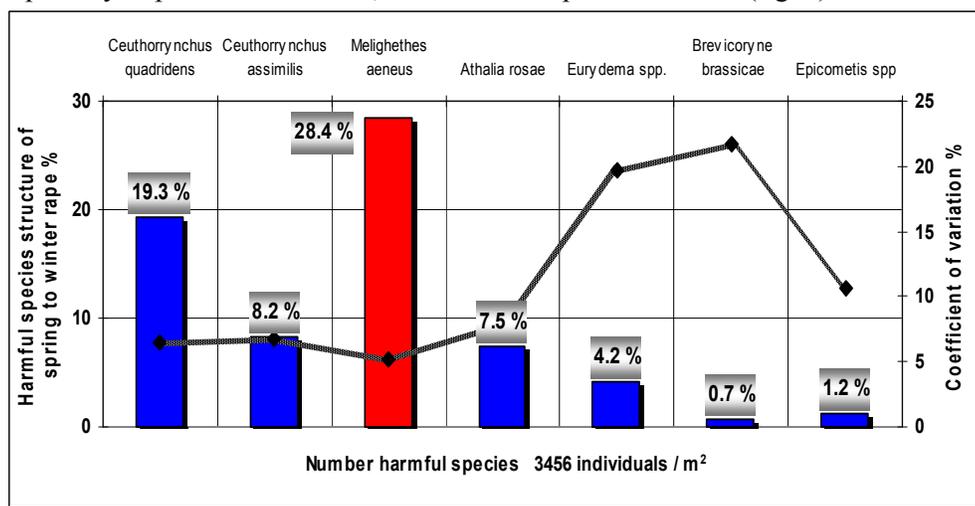


Fig. 1 - Structure spring pest population of winter rape

In effectively combating this dangerous pest great importance is the choice of mode of action insecticide and its translocation in the plant to monitor its population, by maintaining it below economically damaging or total destruction.

Thus in figure 2, that *Meligethes aeneus* is significantly reduced frequency of application of insecticides, regardless of mode of action and translocation of 50.9%.

Systemic insecticides in the same context leads the 9.1% statistical level in the frequency of this pest while having the smallest variation of the effect the research period 7.2% (insignificant)

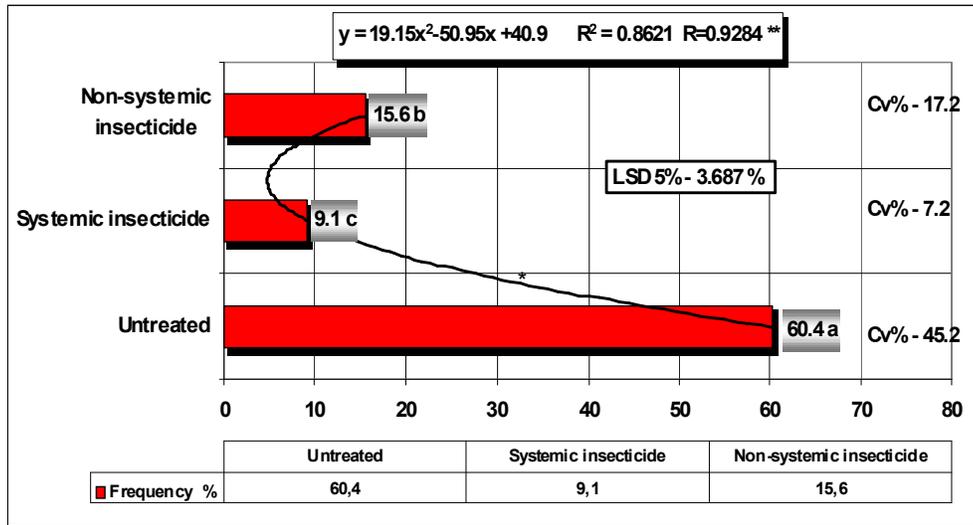


Fig. 2 - Influence the mode of action and translocation of insecticides on frequency *Meligethes aeneus*

In terms of efficacy of these insecticides (fig. 3) is found primarily a significant increase (0.9875 \*\*\*), regardless of its mode of action and their translocare the plant, reaching 97.2%.

Systemic insecticides rank first with a significance level of *Meligethes aeneus* efficacy of 95.6%, with a coefficient of variation of their effect, insignificant 8.7%.

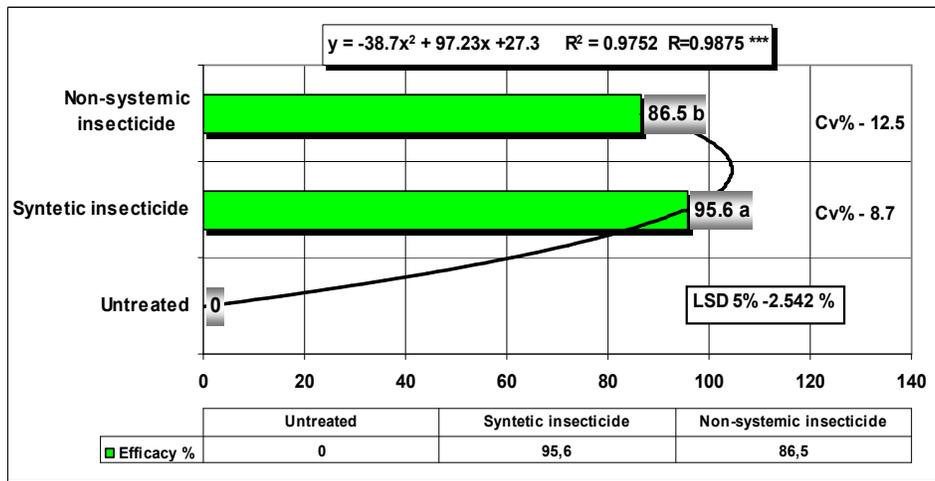


Fig. 3 - Efficacy mode of action and translocation of insecticides on *Meligethes aeneus*

In regard to systemic acting insecticide efficacy (fig.4.) shows that regardless of insecticides considered these results in significant control ( $R = 0.9938$  \*\*\*) of 97,6%.

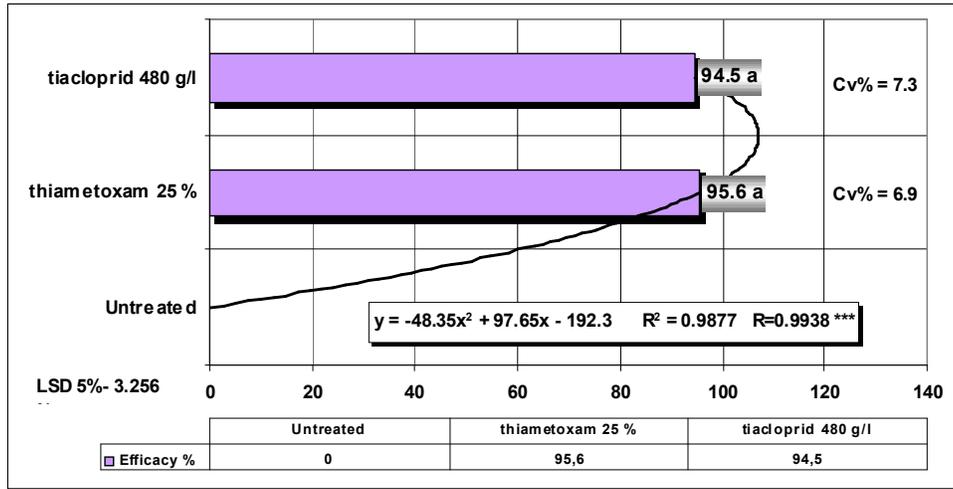


Fig. 4 - Efficacy of systemic insecticides on *Meligethes aeneus*

If non-systemic insecticide effectiveness was less than 89.1% regardless of the substances tested for protection combat of *Meligethes aeneus* the winter rape culture (fig. 5). It also shows that deltamethrin 50 g/l lead to greater effectiveness in combat the *Meligethes aeneus*, to 88.9%, being on the first level of significance.

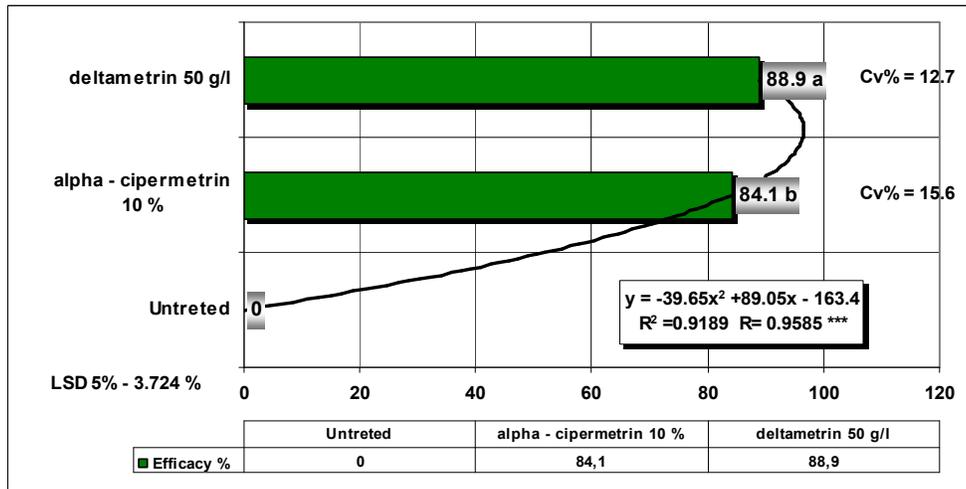


Fig. 5 - Efficacy systemic insecticides on *Meligethes aeneus*

At the same time there is a significant variation 12.7% in time the effect of this very damaging pest of rape culture

Figure 6 shows that regardless of mode of action and translocation of the insecticides tested significantly reduced the frequency of this pest is ( $R = 0.893 *$ ) with 53.4%

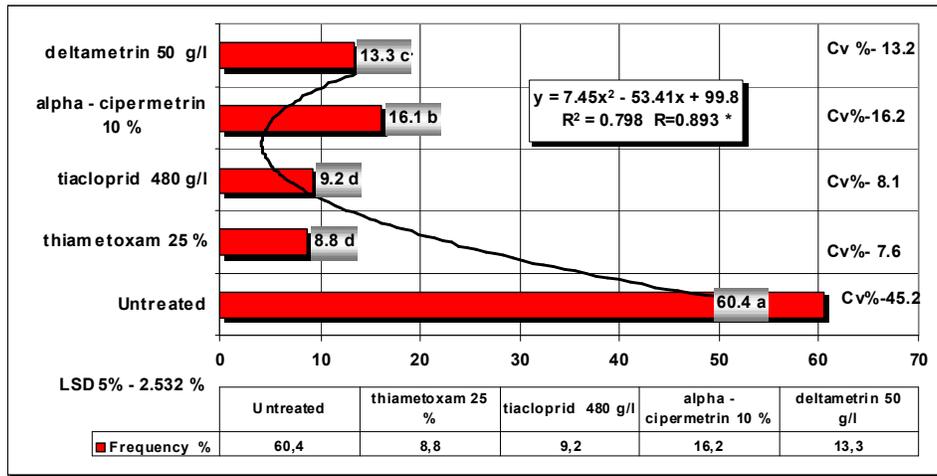


Fig. 6 - Influence of insecticides on the frequency of *Meligethes aeneus*

On the first level of significance is situated systemic insecticides thiametoxam 25% and thiacloprid 480 g / l with a frequency of *Meligethes aeneus* between 8.8-9.2% compared with untreated version where its frequency reaches the 60.4%

On the second level of meaning is situated deltametrin 50 g / l to determine a frequency of 13.3% of this pest with significant variation coefficient 13.2%

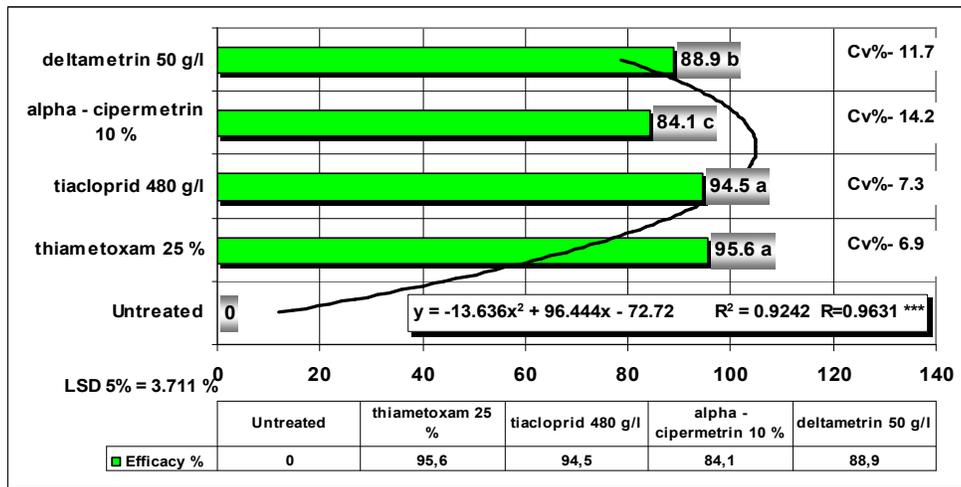


Fig. 7 - Efficacy insecticides on *Meligethes aeneus*

In regard to effectiveness of insecticides with different modes of action and translocation in plants they are found to cause a significant increase ( $R = 0.9631$  \*\*\*) to combat the 96.44% of *Meligethes aeneus* (fig. 7)

The first level of effectiveness of insecticides to combat this pest is situated thiametoxam 25% and thiacloprid 480 g/l with an efficacy of 94.5-95.6% and its variation in time of 6.9-7.3%.

Deltametrin 50 g/l is located on the second level of significance in pest control efficacy of 88.9%, but with a variation of 11.7% of them.

## CONCLUSIONS

1. *Meligethes aeneus* is a major pest of winter rape in the agricultural area Baraganul de nord-est.

2. Mode of action and translocation of insecticides is essential in combating *Meligethes aeneus*.

3. Systemic insecticides thiametoxam 25% and thiacloprid 480 g/l are found to be most effective in combating of *Meligethes aeneus* the efficiency between 94.5-95.6%.

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# CRITICAL ANALYSIS OF SOME URBAN PLANTATIONS IN IAȘI CITY

## ANALIZA CRITICĂ A UNOR PLANTAȚII URBANE IEȘENE

**DASCĂLU Doina Mira**<sup>1</sup>  
e-mail: doinamira@yahoo.com

**Abstract.** *Urban plantation design constitutes an important chapter in landscape architecture. Beyond their sanitation effect, most often emphasized in the specialized literature, the aesthetic appearance of these plantations should help to combat the subtle urban pollution, namely visual pollution. The examples chosen and analyzed in this paper tries to highlight some negative aspects of plantations design that contributes to visual pollution in Iasi city, both by design and execution.*

**Key words:** critical analysis, urban plantations, vegetal composition.

**Rezumat.** *Design-ul plantațiilor urbane constituie un capitol important din arhitectura peisagistică. Dincolo de efectul lor sanogen, subliniat cel mai des în literatura de specialitate, aspectul estetic al acestor plantații ar trebui să contribuie la combaterea unei poluări urbane mai subtile, cea vizuală. Exemplele analizate în această lucrare încearcă să evidențieze aspectele negative ale design-ului unor plantații urbane, care contribuie la poluarea vizuală atât prin concepție, cât și prin execuție.*

**Cuvinte cheie:** analiză critică, plantații urbane, compoziție vegetală.

### INTRODUCTION

Urban plantation design constitutes an important chapter in landscape architecture.

Beyond their sanitation effect, most often emphasized in the specialized literature, the aesthetic appearance of these plantations should help to combat the subtle urban pollution, namely visual pollution.

### MATERIAL AND METHOD

Analysing the urban plantations, we distinguished two different manners of intervention: the routine-formal plantation and the landscape composition of the vegetation. The urban consequences of these two kinds of interventions show that the selection, the placement and the composition of trees require taking into consideration many factors.

Observing many examples of the nowadays urban landscape, we noticed that the plantations strategies balance between aesthetical and ecological purposes, between diversity and uniformity. Most of the results are very important from points of view of urban psychology and sustainable development of urban landscape, being related with different kind of pollution and human diseases.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

The examples chosen and analyzed in this paper try to highlight some negative aspects of plantations design that contribute to visual pollution in Iasi city, both by design and execution.

## RESULTS AND DISCUSSIONS

Among many morphological elements of landscape design, plantations constitute an important part, being the most visible (Dascalu, 2006).

The urban landscape design objectives should be clearly established, taking into account the different kind of sites. Each urban site needs a special vegetal composition because the urban functionality and many particularities impose different design decisions. In the urban space, the visual perception of trees plantations inside the landscape compositions has a very important influence on the human emotional-psychic level and on the human behaviour and personality level. (Dascalu, 2006).

The routine vegetal composition cannot respect the personality of each urban site, therefore the result is often negative (fig. 1.).



**Fig. 1** - Independentei Park of Iasi. Routine composition with large hedgerow hiding the low composition behind (photo D. Dascalu)

Unfortunately, the most frequent urban examples of plantations are either those eclectically composed, or that monotone/uniform composed, usually in squares and parks, but also all along the streets. (fig. 2.)



**Fig. 2-** Independentei Park of Iasi.  
Eclectic composition generating confusion (photo D. Dascalu)

Both kinds of plantations are the result of a routine-formal design, chronically accustomed to create species diversity or uniformity/regularity, as a consequence of the lack of understanding of vegetation design techniques (fig. 3).



**Fig. 3 -** City Hall of Iasi. Monotone-uniform composition with very high density  
(photo D. Dascalu)

In the street tree plantings, the uniformity and regularity of alignment plantations can lead to monotony. For long distances we should avoid monotony because of danger of eyes fatigue, means visual and finally psychic pollution. (Trowbridge and Bassuk, 2004)

We remind here that, in the landscape design, rhythm supposes many important composition elements like: frequency, repetition, succession, gradation. In that context, we can avoid these consequences creating some games of rhythm along the axis, using tree combinations: for example alignments of groups of high trees combined with groups of shrubs or bushes, using dynamic rhythmical combinations: 3, 2, 2, 3, 2, 2, 3; or 3, 2, 3, 2, 3; or 3, 4, 3, 4, 3, etc. – where 3 represents the number of high trees, 2 and 4 are the number of shrubs.

Very important are here, also, some other elements: the trees line-up, sustaining the axis direction and the breather between the trees, materialized through the distances between trees. These elements can create the substance of the composition, or can destroy it if are not judiciously used. Not respecting the

distances between trees lead to a high density and vegetal suffocation and destroy the personality of alignment.



**Fig. 4** - Judicious/armonious alignment composition - example of Exposition Park of Iasi (photo D. Dascalu)

Taking into consideration the need to accentuate the axis of the streets, we should mention also that there are positive effects of uniformity and regularity of alignment plantations on the level of the eyes. (fig. 4). On the psychic level this judicious uniformity and regularity can create a peaceful atmosphere, generating relaxation. Regularity of alignments generates relaxation and tranquillity - monotony does not exist, despite the trees' uniformity. Judicious distances between trees and walkers create a spatial harmony and majesty.



**Fig. 5** - Images of Europa Hotel of Iasi. Eclectic plantation suffocated by its big density (photo D. Dascalu)

Trying to create diversity without unity or without a judicious composition, bring the danger of eclectic plantations, either suffocated by a big density, or dispersed on a large surface. The effects are known as visual confusion and stress. (fig. 5).

Another common mistake in the urban vegetation design composition is the the dilution of images by spreading singular shrubs on big surfaces. (fig. 6).



**Fig.6** - Images of Barboi Park of Iasi - singular shrubs on big surfaces, spread without any aesthetical composition (photo D. Dascalu)

This can generate visual monotony and lack of personality. The insipidity of images can create fatigue, psychic depression, lack of sociability and less desire of public meetings in such spaces. (fig. 7).



**Fig.7** - Images of Independentei Park of Iasi – Lack of aesthetical composition, generating visual confusion/visual pollution (photo D. Dascalu)

Trying to put attention to the problem of “diversity versus uniformity”, some researchers accentuate the existence of some preferences for visual

uniformity, or for species diversity - but they don't specify about whom's "preferences" or "needs" they talk.

It is very important to know and specify if we talk about designers or urban inhabitants preferences, or both preferences. Their preferences or needs will influence the design plantation in urban spaces, or in squares and parks, creating the nowadays urban green aesthetic compositions, or, on the contrary, some eclectic inaesthetic plantations.

In the cases where the landscape designers and horticulture engineers don't take into account the opinions of inhabitants, as a result, their landscape design is responsible in a part of many psychic troubles as the attention diseases, or visual and behavioral diseases.

The lack of the development of such urban studies, based on competent questionnaires among the inhabitants of different urban areas, has a visible negative influence over the nowadays urban landscape.

## CONCLUSIONS

Our proposal is to develop such landscape urban studies with judicious questionnaires, in order to extract from the inhabitant's opinions and preferences the physical, psychic and emotional consequences of the design plantations upon them. These questionnaires extracts will help the landscape designers to create judicious composition recommendations for all kind of urban sites and areas, preventing some forms of urban pollution. We don't mention here many other well known factors, which should be taken into consideration for good results, as visual/esthetical/species compatibility of trees, climate particularities, soil particularities, etc.

These analyses underline just a few elements which are involved to obtain some features in the case of urban plantation design, on small or large surfaces design. Unfortunately, usually these few design elements are considered as "simple routine task".

Therefore we want to draw a warning about the danger of this routine behaviour in the domain of urban plantations, which create many kinds of urban subtle pollution.

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# DECORATIONS OF VEGETAL INSPIRATION USED IN THE STYLISTICS OF THE TRADITIONAL ARCHITECTURE OF BUCOVINA

## DECORAȚIUNI DE INSPIRAȚIE VEGETALĂ FOLOSITE ÎN STILISTICA ARHITECTURII TRADIȚIONALE BUCOVINENE

*MURARIU COJOCARIU Mirela*<sup>1</sup>,  
*POHOAȚĂ LUPU Oana*<sup>1</sup>, *DASCĂLU Doina Mira*<sup>1</sup>  
e-mail: mirelacojocariu@yahoo.com

**Abstract:** *The world of plants has been throughout time a permanent source of inspiration for ornamental patterns. Flowers or parts of flowers, trees or just branches, leaves or fruit, alone or associated in various combinations, have been adopted as decorations and represented both through direct imitation and stylized. Their selection as ornaments has been determined either by the beauty of their form, or by the fact that they have – or they once had – a symbolic value. (Meyer, 1988). Usually, the folk ornamentation has adopted the drawings of the most popular plants, that which form the spontaneous or cultivated flora specific to Romania. The tree of life, the oak leaf, the vine leaf, the branch, the wheat ear, the grape, clover, spindle, along with many floral patterns such as the tulip, rose, daisy, etc. represent the ensemble of the ornamental motifs of vegetal inspiration and define the entire stylistic universe of the traditional Bucovina house, as seen drawn in great detail and with great art on the decor elements, both inside and outside the house.*

**Keywords:** decorations, ornamental patterns, tradition, vegetal motifs

**Rezumat.** *Lumea vegetală a constituit de-a lungul timpului o permanentă sursă de inspirație pentru tiparele ornamentale. Flori sau părți de floare, arbori sau doar ramuri, frunze și fructe, singure sau asociate în diverse combinații, au fost adoptate ca decorații și redatate, atât prin imitare directă cât și stilizată. Alegerea lor ca ornamente a fost determinată fie de frumusețea formei, fie de faptul că au - sau au avut cândva - o încărcătură simbolică. (Meyer, 1988). În mod obișnuit, în ornamentica populară au fost preluate desenele celor mai cunoscute plante, a celor care formează flora, spontană sau cultivată, specifică României. Pomul vieții, frunza de stejar, vița de vie, ramura, spicul de grâu, strugurele, trifoiul, vrejul, alături de numeroase motive florale precum laleaua, trandafirul, margareta etc., compun ansamblul motivelor ornamentale de inspirație vegetală ce definesc și întregesc universul stilistic al casei tradiționale bucovinene și pe care le regăsim redatate cu mare finețe și măiestrie în elementele sale de decor, atât la interior cât și la exterior.*

**Cuvinte cheie:** decorațiuni, tipare ornamentale, tradiție, motive vegetale

### INTRODUCTION

The traditional houses of Bucovina surprise us through the abundance, diversity and pitoresque of the adopted ornamental patterns. There is a large

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

variety, both as pattern and as means of representation. We can find decorations that vary from a flower drawing to various vegetal combinations, from the small, discrete ones, often just suggested – met especially in the case of wooden constructions – houses, gates, fences, wells (fig. 1 a., b.; fig. 2) – to the elaborate ones, real applied laces, as in the case of the plastered houses from Ciocănești (fig. 5).

## MATERIAL AND METHOD

To create this paper we have analyzed several homes from various parts of Bucovina, from the point of view of the decorations used – especially exterior ones of vegetal inspiration.

As research methods we have used: theoretical documentation, the case study method, analysis and synthesis of the obtained data.

## RESULTS AND DISCUSSIONS

Without a question, the decorations of the old wooden houses present good sense in its pure, authentic form. This can be explained by the skills and talent of the folk artists of those times. At the same time, the use of these methods initially had a symbolic nature, especially the role to protect the entire home or to attract positive energy and bring luck, power, well-being and health. (Camilar, 2001) Within this context, the symbolic decorations have been positions in “key” locations and discretely represented. An example to this purpose is present in the Slobozia Sucevei village, where, despite the fact that the symbol of the tulip flower is carved on the side of the gate roof support element, a position that is not quite visible, it still has an evident aesthetical effect (fig. 1 a., b.).



a.)



b.)

**Fig. 1** - a.) Entrance gate in the establishment - Slobozia Sucevei village,  
b.) tulip flower symbol – detail of roof console

The tulip signifies pride, hospitality, power and happiness. Even if it is considered to be a symbol specific for the Transylvanian decoration style, it is often seen in Bucovina, especially in wooden constructions.



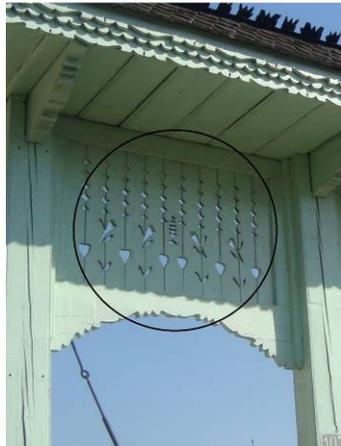
a.)



b.)

**Fig. 2** - Entrance gate in a household from Cacica village, Suceava district, detail

Another suggestive example is presented in fig. 2 where the symbol of the tulip flower is carved, several times, on the wooden fronton above the pedestrian gate. The definitions of the detail, each floral symbol being located at the joining of the boards that make the fronton, offer it a note of elegance. Thus, through the position selected for the location of the carving, a simple constructive detail that of board joining has been offered value. The same method can also be observed in Fig. 3 where the fretted fronton of a Bucovinean gate is presented, a gate that is newer, of painted wood.



a.)

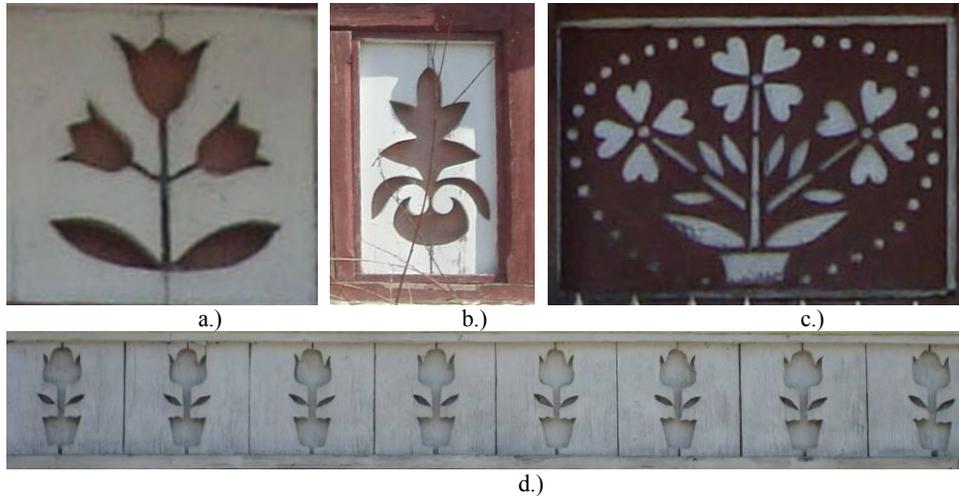


b.)

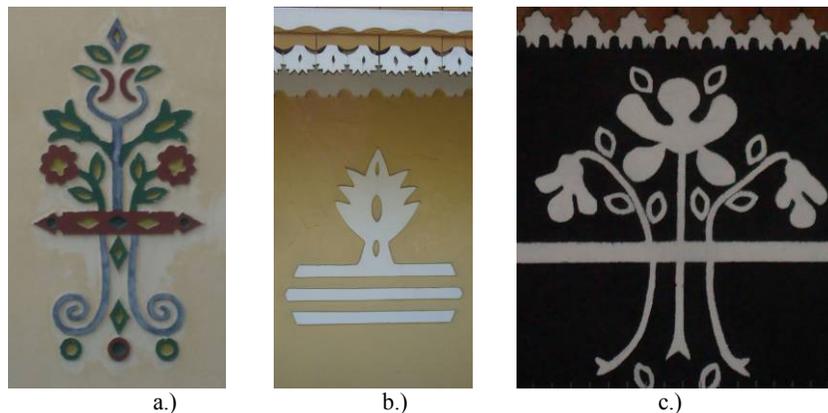
**Fig. 3** - a.) entrance gate to the household - Marginea village Suceava district , b.) detail

Another decorative element, the triforium, is usually symmetrically created, with the central stylized image of the fir, here with the symbol of the tree of life.

A symbol often used in universal stylistics, *the tree of life* is also often met in Bucovinean ornaments. It appears in different ways, as a stem with flowers and leaves, as a flower in a flower pot or as a flower bunch in a vase. In Bucovina we find it under various images, on wood (fig.4) or in the pargeting (fig.5): as a three-headed flower, in symmetry with integral or schematic form. (Camilar M., 2002).



**Fig. 4** - Representations of the tree of life symbol in Bucovinean ornaments (in wood)  
a.) three-headed flower b.) fir c.) flower vase, d.) flower in a pot



**Fig. 5** - Representations of the tree of life symbol in Bucovinean ornaments (in pargeting)  
a.), c.) flower bunch b.) fir

As the houses plastered on the outside started to become a majority in the Bucovinean area, the decoration of the facades has received new dimensions, new meanings. The decorations cover a significant percentage from the area of the facades, but unfortunately some of them have a questionable nature. The embroidery that is specific to the Bucovinean sewing style has been adopted by

the facades of the houses from Ciocanești, the result being a unique image, of high artistic value (fig.6).



**Fig. 6** - Exterior house decorations Ciocanești village, Suceva district

At the same time, the interior of the Bucovinean houses abound in seamings and fabrics with vegetal motifs located both on the walls and on the floor. The

dominant colours are red, black and green, in very live colours. In the old houses that still exist; these still decorate the interior walls of the rooms (fig. 7).



Fig. 7 – Fabrics used to decorate the interior walls of Bucovinean houses.

## CONCLUSIONS

1. The Bucovineans, open and welcoming people, careful with their money and their words, God-fearing people, with respect for work, have kept their traditions from ancient times. Some of the villages of today show very little modern interventions.

2. Making the originality elements known under all forms of their expression is a scientific research mission, which well detailed and documented will help preserve and make these priceless elements public.

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# THE PLACE OF THE GARDEN IN THE ORGANISATION OF THE TRADITIONAL HOUSEHOLD OF BUCOVINA

## LOCUL GRĂDINII ÎN ORGANIZAREA LOTULUI GOSPODĂRIEI TRADIȚIONALE BUCOVINENE

*MURARIU COJOCARIU Mirela<sup>1</sup>,  
POHOAȚĂ LUPU Oana<sup>1</sup>, DASCĂLU Doina Mira<sup>1</sup>*  
e-mail: mirelacojocariu@yahoo.com

**Abstract:** *The ethno-spacial typology of Bucovina's villages has led to the occurrence of some differences among them, concerning the location of households on the ground, the location of the buildings and of course, the way the garden is organized. In the mountain areas, in the scattered households on unlevelled ground, the surface of the garden has been greatly reduced, leaving the natural beauty of the grasslands and forests fully express themselves. The traditional Bucovinean garden is a subject that has not been approached at a large scale, despite the interest it attracts at present. It can be studied both as location and organisation method within the lot, and at the level of the vegetal species used for decoration purposes, which in the end contribute to the creation of a definitive image. The present paper tries to synthesize some detailed scientific researches, being able to underline a traditional typology, which, if properly used and made public, would contribute to the resuscitation and spreading of ancestral traditions with cultural and social-economic benefits for these areas.*

**Key words:** traditional household, organization of the lot, utilitarian garden, typology

**Rezumat:** *Tipologia etno-spațială a satelor bucovinene a condus la apariția unor diferențe între acestea, în ceea ce privește amplasarea gospodăriilor în teren, poziționarea construcțiilor în cadrul acestora și, bineînțeles, modul de organizare al grădinii. În zona de munte, în gospodăriile răsfirate pe teren denivelat, spațiul grădinii s-a redus mult, lăsând frumusețea naturală a fânețelor și pădurilor să se exprime plener. Grădina tradițională bucovineană constituie un subiect foarte puțin abordat, în pofida atracției și interesului pe care le exercită în prezent. Poate fi studiată atât ca amplasare și mod de organizare în cadrul lotului, cât și la nivelul gamei de specii vegetale folosite la decorare care, în final, contribuie la creionarea unei imagini definitive. Lucrarea de față încearcă să sintetizeze câteva cercetări științifice amănunțite, ajungând la cristalizarea unei tipologii tradiționale care, dacă ar fi corect pusă în valoare și mediatizată, ar contribui la resuscitarea și răspândirea tradițiilor ancestrale cu beneficii atât culturale, cât și social-economice pentru aceste zone.*

**Cuvinte cheie:** gospodărie tradițională, organizarea lotului, grădină utilitară, tipologie

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

## INTRODUCTION

Bucovina, Romanian land, temporarily under foreign occupation during the centuries has carefully preserved its customs and traditions, accepting relatively few essential elements from the allogeous populations regarding living and the way the property is organized. The traditional Bucovinean household has been shaped up during the years, starting mainly from functional principals of satisfying the human needs, while at the same time adapting to the existent natural conditions. (<http://alexandrusenciuc.files.wordpress.com/2011/02/brosura-manastirea-humorului-peisaj-cultural.pdf>).

The ethno- spacial typology of the villages has lead to the occurrence of some differences among them, regarding the location of the households on the ground, the positioning of the buildings within them and, of course, the way the garden is organized. In the mountain area, in the households scattered on unlevelled grounds, the area of the garden has been largely reduced. Here, the natural beauty of the grasslands, forests and glades make the wish for additional aesthetical vegetal additions pale.

## MATERIAL AND METHOD

To create this paper we have carried out a study on several households from different areas of Bucovina. To be able to draw up a pattern of the traditional garden, in the analysis carried out we have followed several aspects, namely: the shape of the lot and the locations of the buildings on the lot, the division of the lot, the position of the garden within it, the specifics of the garden, its shape and size, the species used and the way these are located.

As research methods we have used: theoretical documentation, systematic observance, case study method, analysis and synthesis of the obtained data.

## RESULTS AND DISCUSSIONS

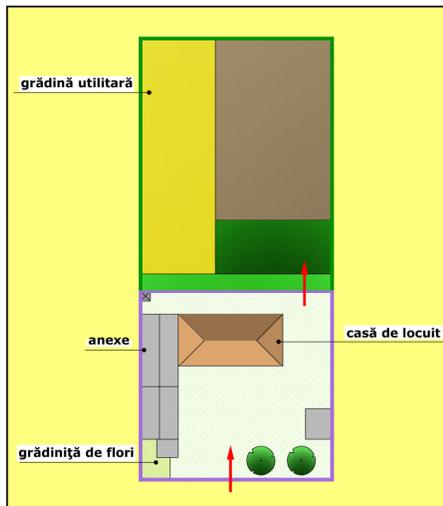
In general, *the lot corresponding to the traditional Bucovinean household* is divided into the *yard and utilitarian garden* behind the house, the connection between the two areas being made in various ways, depending on the area. (Glăman and Mircea, 2003).

*The yard* is located in front of the actual property, with opening to the access way, comprising in it the actual yard, the buildings (house and extensions) and setups with various destinations (such as the flower garden and the mixed garden – flowers, vegetables, trees, herbs, fruit bearing trees).

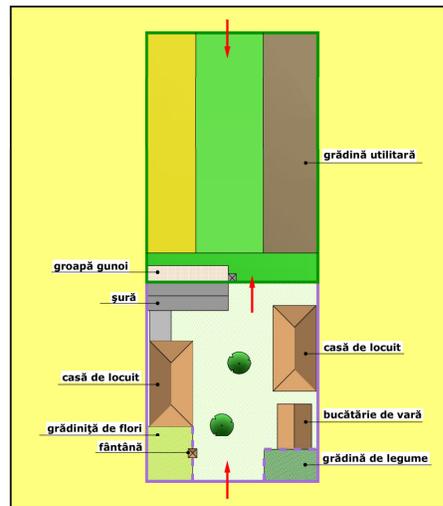
*Utilitarian garden*, located behind the lot, includes various cultures of larger size than that in the yard: an area with potatoes, corn and alfalfa; the vegetable garden – tomatoes, peas, beans, cucumbers, cabbage, and others, and sometimes a small orchard.

The connection between the two areas is made through an access way in the surrounding fence or through a built area (usually the bard) that has double access, thus facilitating the crossing from one part into the other (fig. 1).

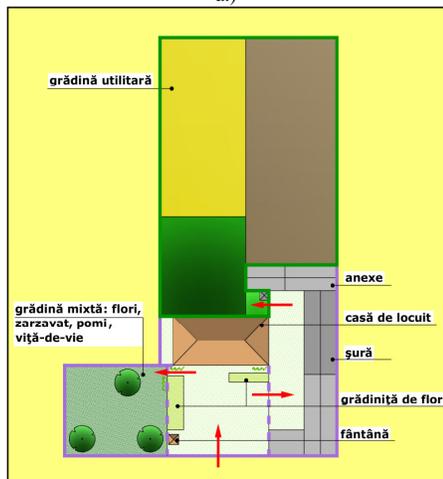
*The flower garden* is almost always present in the traditional Bucovinean household from the hill areas. Of small size, usually shaped as a rectangle, rarely of an irregular shape, it is positioned at the front, between the house and the road, and it is usually fenced so as to be protected against stamping (by man or animals). A larger surface between the house and the gate, usually involves the setup of a mixed garden with flowers and decorative trees, and herbs, vegetables, fruit trees and even vines. The flowers, depending on the location of the garden, are sometimes planted on lines (max. 50 cm high) that symmetrically or asymmetrically accompany an entrance alley, or, in case of older houses, in little bands located in front of the house, on both sides of the entrance porch. At the same time, there are areas setup with flowers and ornamental plants in the vicinity of the house, in front of windows.



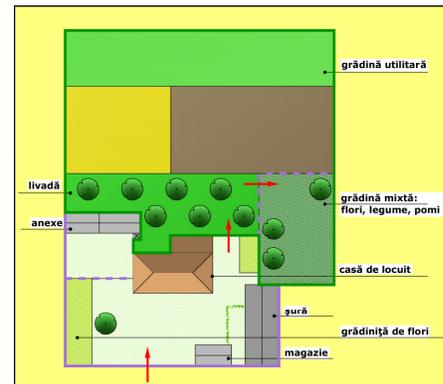
a.)



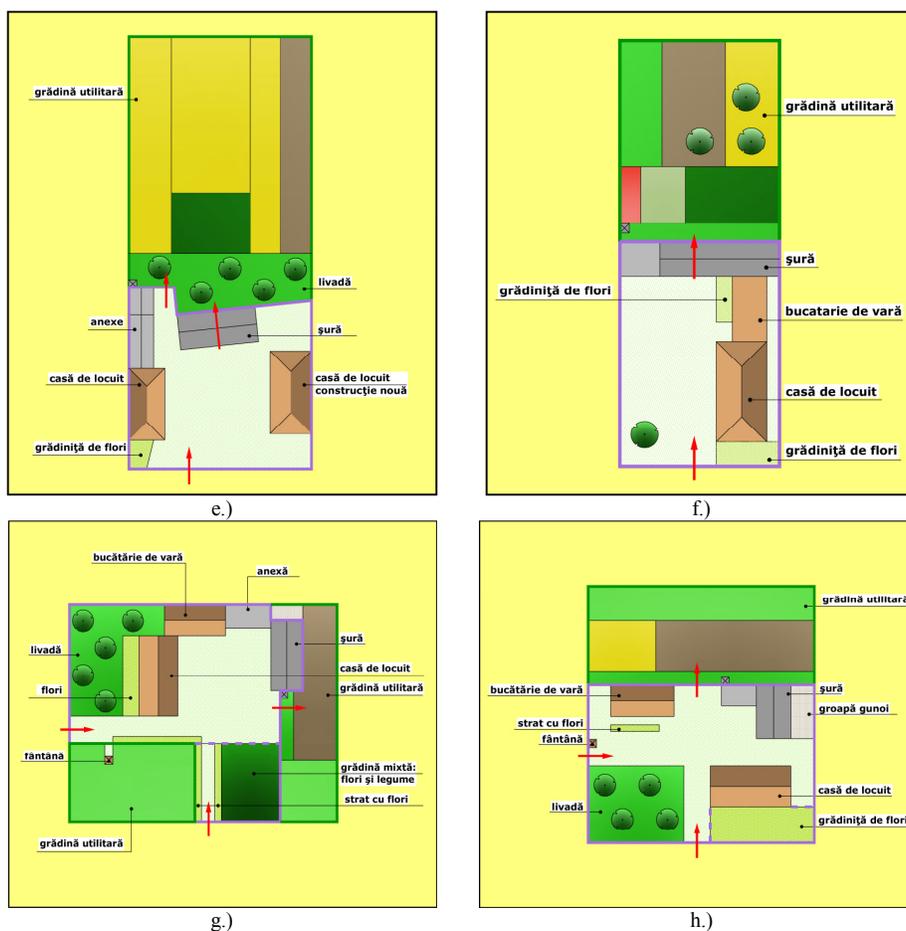
b.)



c.)



d.)



**Fig. 1** - Organisation schemes for the Bucovinean households in hilled areas: a.) Grănicești commune; b.) Brăiești village; c.), d.) Humoreni village; e.) Slobozia Sucevei village; f.) Păltinoasa commune; g.), h.) Frasin city

With the flowers we can also see some decorative trees such as the lilac, rose, jasmine or lianas such as clematis, that come to complete the ornamental plants variety used for the decoration of traditional gardens

In order to obtain a complete overview we must also mention the tree species: - pear, apple, plum and nut trees located either grouped in small orchards, or individually, or in small groups in the yard or mixed gardens, as well as vines, even if this is rarely present in the Bucovinean garden.

The flower species in the traditional garden contains plants from the spontaneous flora (violets, primula, autumn crocus, and other) as well as perennial and annual cultivated species. Even if the variety of perennial plants are not very varied – the most often used are the tulip, daffodil, columbine, peony, lupine, lily, scarlet pimpernel, chrysanthemum, and aster – they are present in all Bucovinean gardens. These, together with the other ornamental species mentioned, lead to the structuring of the traditional Bucovinean garden. The semi-rustic species such as

the gladiola, dahlia, and the annual ones (Jasmine tobacco, sage, snapdragon, poppy, calendula, balsamine, zinnias, asters, morning glories) offer the area they cover a special note, through their colour, fragrance, through the shape and size of the flower, shaping up the garden nicely.

**The positioning of the ornamental species** on the plot does not follow a preset plan or composition principles, but is spontaneous, depending on the wish and skill of the home owners. There are however two tendencies that stand out in the positioning of the flower species within gardens, namely:

- **Free positioning**, especially for the small gardens (fig. 2), covered exclusively by small size flower and tree species;



**Fig. 2** - Flower garden - Sobozia Sucevei village, Suceava district

- **Linear positioning**, both as continuous edging and in small groups, or isolated individuals from the same species, planted in a line, parallel to a side of the house, or along a walkway, or the access way, in case this is differentiated from the rest of the yard by some kind of finishing; this type of positioning is frequently met in mixed gardens (fig. 3), the flower edging being located in perimeters, bordering or separating vegetable rows.



**Fig. 3** - Mixed garden – Marginea village. Suceava district

The beauty of these gardens is given by this mixture of flowers, vegetables, small trees, fruit bearing trees and vines, which can be considered a characteristic feature of the traditional Romanian garden. (Glăman and Mircea, 2003).

In the households scattered on mountain slopes (fig. 4-a.,b,c,d ) we cannot talk about a garden concept, because its area is usually reduced to the minimum and sometimes it's missing altogether from the lot organisation scheme. (Cojocaru, 1983). There the background is provided by nature, pastures, and glades and not by cultivated species.



a.)



b.)



c.)



d.)

**Fig. 4** - Traditional Bucovinean household from the mountain area a.) Valea Putnei village b.) Gura Negri village, c.) Argestru village , d.) Ciocanești village.

## CONCLUSIONS

The traditional Bucovinean garden is a subject that hasn't been largely approached, despite the attraction and interest it draws at present. It can be studied both as positioning and organisational method within the lot and from the point of view of the vegetal species used for decoration purpose, which in the end contribute to the outline of a definitive image. The present paper tries to synthesize some detailed scientific researches, being able to underline a traditional typology, which, if properly used and made public, would contribute to the resuscitation and spreading of ancestral traditions with cultural and social-economic benefits for these areas.

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# PARAMETRIC AND POLYMORPHIC STRUCTURES IN CONTEMPORARY LANDSCAPE DESIGN

## STRUCTURI PARAMETRICE ȘI POLIMORFE UTILIZATE ÎN AMENAJĂRILE PEISAGISTICE CONTEMPORANE

NICA R.M.<sup>1</sup>, PETROVICI Liliana-Mihaela<sup>1</sup>  
e-mail: rmnica@gmail.com

**Abstract:** A novelty of the contemporary landscape architecture is represented by urban furnishings generated exclusively through digital techniques. For these objects the software is not only a way to visualize a three-dimensional model, but an integrated part of the design process. In the parametric design the algorithm controlled by the software platform is meant to develop a spatial structure based on the geometric elements interconnection, resulting free form objects, with a micro-organic infinite repetitive development. The parametric design in the case of the landscape design does not aim to satisfy a concrete function, but to challenge the viewer's imagination and to create an unpredictable and playful pause in the gardens and parks landscape. Spatial continuity and fluidity are generally valid concepts for these studies, sustained in theory through scientific terms from mathematics and biology, with references to abstract notions from philosophy and psychology.

**Key words:** parametric spatial structures, multiform urban furniture, bionic design, contemporary landscape design, digital design, redefining the meaning of green space.

**Rezumat:** O ipostază inedită a arhitecturii peisagistice contemporane este reprezentată de utilizarea obiectelor de mobilier urban generate exclusiv prin tehnici digitale. Pentru generarea acestora, aplicațiile software nu mai sunt o simplă modalitate de vizualizare tridimensională, ci chiar parte integrantă a procesului de proiectare. Algoritmul controlat de o platforma software este menit să dezvolte o structură spațială bazată pe interconectarea de elemente geometrice, obținându-se astfel obiecte cu o formă liberă și cu o dezvoltare micro-organică infinit repetitivă. Utilizarea design-ului parametric în cazul amenajărilor peisagistice nu urmărește satisfacerea unei funcțiuni concrete, ci provocarea imaginației privitorului și realizarea unui popas ludic și imprevizibil în peisajul cotidian al parcurilor și grădinilor. Continuitatea și fluiditatea spațială sunt concepte general valabile pentru aceste studii, susținute în plan teoretic prin termeni științifici din matematică, biologie și cu trimiteri la noțiuni abstracte din filozofie și psihologie.

**Cuvinte cheie:** structuri spațiale parametrice, mobilier urban polimorf, design bionic, amenajări peisagistice contemporane, proiectare digitală, resemantizarea spațiului verde.

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<sup>1</sup>“Gheorghe Asachi” Technical University of Iași, Romania

## INTRODUCTION

The contemporary built environment design is no longer a simple software supported process. The digital design uses the computerized techniques as an integral part of the act of creation, and the role of the specialist- in this case the landscape architect, town planner, designer- is redefined. The man gives up his role as a god-like creator and becomes a supervisor over the digital technique controlled processes. The assimilation of the digital technologies in architectural and landscaping design creates a gap between the contemporary and the prior conventional achievements. Nowadays we can find a considerable number of evolutionary morphogenetic systems, topological geometries and non-linear spatial construction experiments.

Polymorphic and parametric spatial structures imply a multidisciplinary approach (visual arts, architecture, engineering, landscaping, town planning, natural and social sciences) and are more likely to be related to the *public space design art*, unlike any other traditional science. „The marking (...) with an expressive force (...) of the semantic concentration potential places” through these kind of inedited works of art is a complementary effect of these spatial experiments. (Kazmer, 2011) We can find a resemblance with the works of art of Picasso, Calder and Chagall through which the town planners of Chicago „achieve a transformation of anonymous urban spaces to conviviality opportunities.” (Kazmer, 2011).

## MATERIAL AND METHOD

Similar to the traditional building, the garden and the park are perceived in relation with the environment – natural or artificial, social and historical. Their charm resides from the moment’s particularity to be in the same time playful and unusual, because the individual is, eventually, the desire’s and not of the necessity’s creation, as Gaston Bachelard claims. (Bachelard, 2003)

Parametric spatial structures are characterized by a number of common marks: they imply an intimate relation with the environment in which they are located and dissolution of spatial boundaries (interior-exterior, public-private). They ease a multisensorial perception of the space; they imply a smaller intervention scale and allow an easier space personalization. These objects become urban spatial landmarks, with an important role in defining a new meaning for the urban space. Even for a limited period of time, the significances of a place are reconsidered.

## RESULTS AND DISCUSSIONS

Nowadays, in urban landscape, the *green element* is less perceived as a *garden* but incline to the *green space* status – the interstitial planted space, strictly ecological, without a symbolic value:” we design planted spaces from a prevalent technical - utilitarian reflex, meanwhile the different dwelling layer of significance (...) remain stranger to us. The ubiquitous of the green space and the exclusion of the garden show us a change of the perspective of the postindustrial dwelling design.” (Kazmer, 2011).

Through scale reduced intervention such as pavilions, spatial structures, urban furnishing objects, the *green space* gathers a particular dynamic, being transformed into a genuine open space room (fig. 1).



**Fig.1 - Polymorphic and parametric urban furnishing**  
*Crater Lake*, Kobe, Japan, 2011; authors: 24 Studio; *Visual Permeability Pavilion*, NY, SUA; authors: Columbia University  
 Photo credits: © 24 Studio, © Columbia University, www.archdaily.com

The purpose of a parametric spatial structure placed in a garden and urban park is to provide a multifunctional relaxing, meditation and social interaction designed area. Different areas are customized for different types of activities – private relaxation or direct human interaction.

From the impact over the public space and the landscaping design point of view we distinguish two different types of intervention: urban furnishing made through parametric techniques and complex polymorph spatial structures, which in the landscape pathway context create distinctive points of interest. The main difference between them is that of scale and proportion.

In parametric design the urban furnishings are perceived as *systemic design problems* – the furniture is no longer an isolated and standardized object. The human diversity awareness leads to various volumetric expressions design, some of them even concurrent adaptable. The starting point is a complex design process, where the parameter consists in a variety of usage demands and the site's characteristics. Relevant for these types of parametric design methods is the project developed by the Architecture Department of Columbia University,



**Fig.2 - Polymorphic**, NY, SUA, 2011; authors: Columbia University GSAPP  
 Photo credits: © Jennifer Chang, www.archdaily.com  
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consisting in a 119 interconnected wooden frames. This structure has a double oriented relaxation function and its shape can be modified on direct contact. The mobile articulations allow progressive surface waving due to the flexible design (fig. 2).

These kinds of experiments are the implantation of an innovative technical solution, that aims to search the possibilities offered by the digital design-production techniques and the way in which these researches, set in an early stage of development, can become viable solution. The results from these researches are versatile, adaptable according to the context, repeatable and reversible.



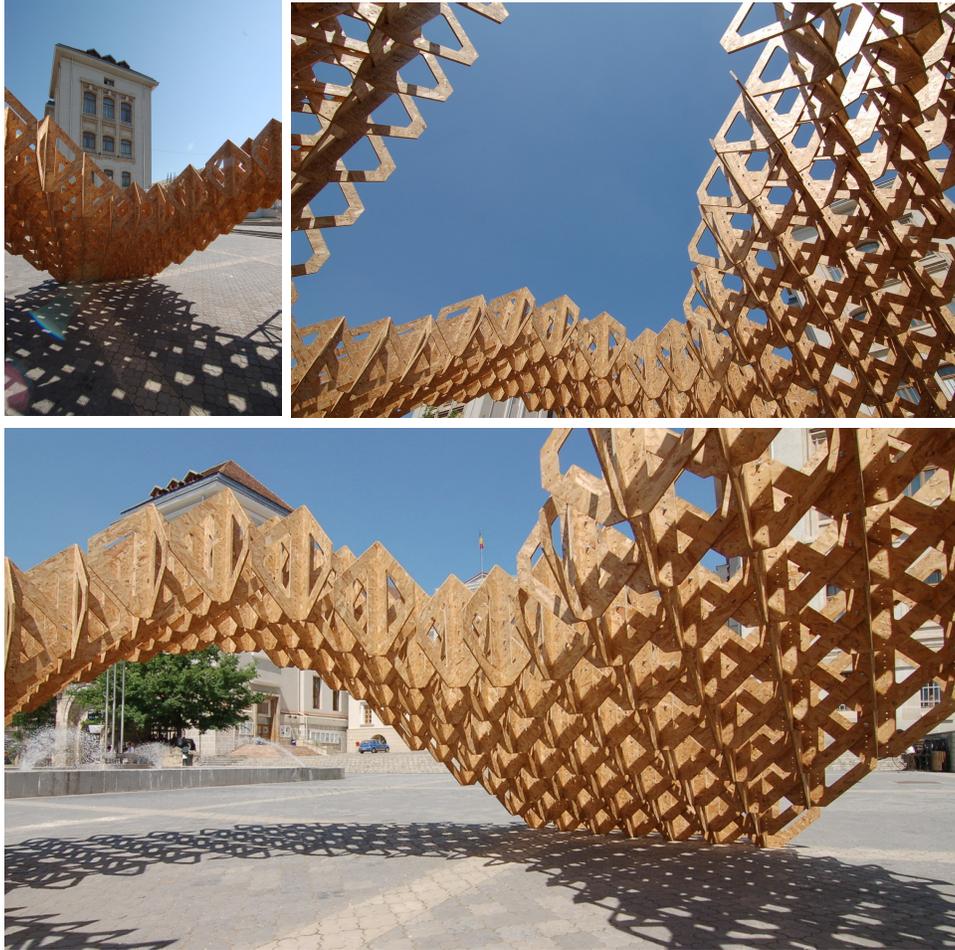
**Fig.3** - *Research Pavilion*, 2011, Stuttgart, Germany; authors: ITKE University of Stuttgart  
Photo credits: © ITKE University of Stuttgart, [www.archdaily.com](http://www.archdaily.com)

At Stuttgart University, in the summer of 2011 was developed a transient spatial structure that had as a starting point a bionic research (fig. 3).

The main target of the project was the transfer of the biological morphological principles of the sand dollar shell to the spatial structure. The digital design, three-dimensional simulation and the production computerized supervision were integral parts in the project. The purposes of this project were to obtain a full integration and a morphological adaptation of the biological cells in the three-dimensional structures design and a real scale testing of the constructive-material system binomial. The attention was directed towards the modular system development which allowed a higher level in adaptability and repetition, similar to the biological structures. The natural base element which inspired the project was a flat body echinoderms skeletal shell that in the design process helped shaping a polygonal board's modular system, using finger-joints. Unlike other lighter traditional structures this type of design system can be applied to a various range of geometries and spatial structures. In the digital design process a number of biological structures specifically characteristics are applied, such as: heterogeneity; anisotropy and hierarchy.

In the complex morphology design and execution, specific to parametric structures, a closed informational loop between the project design, completed elements simulation and the computerized numerical verification, is created. The structural design and the formal expression establishing are closely interconnected (fig. 4).

The functionalist modernism dictum *form follows function* does not apply to the current practice. Parametric design is primarily based on the development of new structural-constructive techniques and on the design morphology system. Thus the formal-esthetic researches pass in the background.



**Fig.4** - Parametric structure, Iasi, Romania, 2012, authors: ASAI – Asociatia studentilor arhitecți din Iași, Photo credits: © Răzvan Nica

The nature and the implications of the parametric design can not be fully highlighted without these concerns being incorporated in the contemporary technological phenomena. *The question regarding the technique* addressed by Martin Heidegger is deeply related to the present, as the design process can not occur without a symbiotic relation with the modern science. Contemporary science is no longer a tool in designing and construction, but becomes a human-built space mediator. In this field, the technology varies between the status of means and *purpose*. Martin Heidegger makes a phenomenological analysis based on the return to the *object itself* and on the denial of the preconceived labels and guides through which the man distance him self from his own

existence essence. He makes a clarification in the difference between the *meaning* and the *essence* of the technique, based on the fact that the essence of the technique is not related to the technical field. The essence of the technique can not be understood through a technical language, but only through a simultaneously and obviously related, the art field.

For the essence discovery, a complete definition of the technique is preliminary necessary. From the anthropological and the instrumental point of view definition portraits the technique as a mean used for different purposes and as a human activity. The two integrant parts (*mean* and *activity*) form an inseparable whole, through which the technique is shown as an ordering method for the built and the usage of tools and machines on one way and on the other way the needs and purposes they meet. The issue is of the man's ability to *master it spiritually* and to prevail over the modern technique. Thus the parametric design must be mastered in such a way that in can become, in the design process, a *mean* for the context conditionings integration and for the beneficiary's multiple requirements. The parametric design is, yet, in an early stage and the structures thus resulted are, often, limited to the *purpose* stage (fig. 4).

## CONCLUSIONS

1. The parametric design can embody, in the development process a more extensive informational content than it is usually possible: the various conditioning created by the physical and social context become parameters and determining factors in the final shape of the structure. Parametric structures have the ability to give an alternative, as a constructive system and even in finishing elements, for architecture and landscaping design and can be a redefining opportunity for an anonymous public space.

2. The use of parametric design in the landscape design does not aims to satisfy a concrete function, but a challenge for the viewers imagination and the marking of a playful and unpredictable pause in the gardens and parks urban landscape.

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# FUNCTION AND MEANING IN CONTEMPORARY LANDSCAPE DESIGN

## SEMNIFICAȚIE ȘI FUNCȚIUNE ÎN ARHITECTURA PEISAGISTĂ CONTEMPORANĂ

**PETROVICI Liliana-Mihaela<sup>1</sup>, NICA R.M.<sup>1</sup>**

e-mail: liliana.petrovici@yahoo.com

**Abstract.** *The functional meaning in landscape architecture refers primarily to the coherence and readability of the spaces of the parks and gardens and their relationship to the built environment of the cities. Secondly, certain morphological elements of landscaping, many of them borrowed from architecture, fall into formal typologies dictated by their utility, and often have symbolic connotations. For example, the stair means the aspiration and ascension; column expresses verticality, support, is a symbol of human or tree of life. The technological development, the evolution of thinking and the need to adapt to the diversity and instability of modern life causes transformation of functional meanings. They are constantly redefined according with the requirements of the changing and complex contemporary life. Currently, architects propose innovative ways of dealing with the utility of the urban environment and even novel association of various functions: parks, gardens - building – infrastructure.*

**Key words:** symbol, meaning, identity, readability, coherence, functional innovation, new functional association, landscape design

**Rezumat.** *În domeniul arhitecturii peisagere, semnificațiile funcționale se referă în primul rând la lizibilitatea și coerența amenajărilor, la asigurarea unor condiții optime pentru utilizarea parcurilor și grădinilor și la relaționarea acestora cu spațiile construite ale orașelor. În al doilea rând, anumite elemente morfologice ale amenajărilor peisagere, multe dintre ele împrumutate din arhitectura clădirilor, se încadrează în tipologii formale dictate de utilitatea lor și au adesea conotații simbolice. De pildă, scara semnifică aspirația și ascensiunea; coloana exprimă verticalitatea, susținerea, este simbol al omului sau al arborelui vieții. Dezvoltarea tehnologiei, evoluția gândirii și nevoia de adaptare la diversitatea și instabilitatea vieții moderne determină transformarea semnificațiilor funcționale. Ele sunt permanent redefinite, în acord cu cerințele atât de schimbătoare și complexe ale vieții contemporane. În prezent, arhitecții propun moduri inovatoare de abordare a aspectelor utilitare ale mediului natural amenajat din cadrul urban, și chiar asocieri inedite dintre diverse programe și funcțiuni: parcuri, grădini – clădire - infrastructură.*

**Cuvinte-cheie:** simbol, semnificație, identitate, lizibilitate, coerență, inovație funcțională, noi asocieri între funcțiuni, design peisager

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<sup>1</sup> “Gheorghe Asachi” Technical University of Iași, Romania

## INTRODUCTION

Functional meanings in landscape design refer primarily to the readability and coherence of the outdoor spaces, the ensuring of optimal conditions in using parks and gardens, their relations with the built environment of the cities.

The functional meanings are communicated by icon or index type signs; through them, the morphological elements of landscape design render readable their purpose, utility and spatial-functional relations. By means of these signs, the outdoor space get ordered, logical and easily to walk through.

## MATERIAL AND METHOD

Cultural and psychological conventions establish formal, spatial or environmental typologies for various types of landscaping or morphological elements within them. They became distinct and get an easy and comfortable use due to the coherence of the planimetric composition, the hierarchisation of the paths, the particular atmosphere and the specific treat of the aesthetic elements. Par example, the distinction between the court of an institution and a playground must be easily observed, because each destination has a certain character that has to be visually expressed through ambiance and scale: monumental and sober or playful and intimate, delicate or coarse, public or private, introverted or extroverted.

## RESULTS AND DISCUSSIONS

### 1. SIGNS AND SYMBOLS ASSOCIATED TO THE MORPHOLOGICAL ELEMENTS IN LANDCAPE DESIGN

Certain morphological elements of landscape architecture communicate their functional meaning in that they fall into formal typologies dictated by their utility, according to some social, cultural, or psychological codes, and often have symbolic connotations. Here are a few examples:

The wall - separates, divides, defends, protects, restricts, or prohibits. The wall represents the taking into possession of a territory; it outlines an outdoor space with a certain identity. Within urban parks and gardens, the wall (de)limits laces and creates a sense of intimacy and psychological protection (fig. 1). Concurrently, the wall directs the paths and focuses the viewer's attention.



**Fig 1** - Arboretum, Gjøvik, Norvegia, Rintala Eggertsson Architects - windcreens creating outdoor spaces for relaxation that give the feeling of intimacy and psychological protection

The wall may also be a communication support in urban spaces, when it becomes a media screen, a billboard, or a graffiti drawing expressing social frustrations. The construction of the Berlin Wall meant a barrage of communication; its break down marked out a symbolic shift in post-modernity, while its graffiti painting represented a way of protest of the society.

**The gate** is a semantic threshold that marks the border between public and private, profane and sacred, between the hectic world of the street and the world full of peace and freshness of a garden. It represents a border between two worlds, a symbolic transition from a reality to another; beyond the gateway we face a different context, the space transforms and takes other coordinates.

The gate is a cutout in the wall which is designed to provide the functional relationships from the outside to the inside of a fenced landscaped area, or between different zones of the same landscaping.

**The tower** symbolizes the perpetual aspiration of the man to the sky (fig. 2). When it presents as a compositional dominant in the landscaping, it plays a role in spatial orientation or in the marking of important areas of the paths.



**Fig. 2** - The white city, Tel-aviv, landscape architect Dani Karavan a tribute to the men who built the city, it uses the symbolism of the primary structures

**The column / pillar** is a basic structural element. It signifies durability, safety, strength. The column is the symbol of verticality, of the human or of the tree of life (Chevalier, 2009). It is the symbol of the support, of the setting or of the lastingness (Eseev, 2001). In modern architecture, the column is often a univocal sign of its structural scope. The freedom of expression during postmodernism has facilitated the association of columns with new and various meanings.

The landscape architecture often takes the column out of its structural context, differing from the tower only by its dimensions, and having an exclusive symbolic function. Therefore, the landscape architect Dani Karavan transforms the column into a poetic metaphor in order to transmit to the society certain social or political messages. The columns that decorate the court of the National German Museum from Nuremberg are engraved with texts from the Declaration of Human Rights. The row of columns that compose the “Way of Peace” through the Sumerian desert in Nitzana, Israel, have inscribed the word „peace” in 100 languages.

The sculptural work „The way of light” created by Karavan for the Olympic Park from Seoul in 1988 (fig. 3), is made of groups of 12 and 2 vertically cut columns, which have semantic and compositional roles. They are a symbol of orientation and compose a solar clock and a calendar. The sectioned columns also represent the 24 letters of the Korean alphabet.



**Fig. 3** - „The way of light”, The Olympic Park, Seoul, 1988 & „The Way of Peace”, Nitzana, Israel, 1996-2000, landscape architect Dani Karavan – the column, a symbol of man

**The stair** corresponds to some parameters of topographic sense, so it represents „a cultural unity which suggests the possibility of a vertical movement” (Eco, 2003). Concurrently, the stair has the semantic of the verticality: aspiration, ascension, rising, releasing (fig. 4). „The stair figuratively embodies the level break that makes possible the passing from a type of existence to another. (...) The escalade or ascension symbolizes the way to the absolute reality” (Eliade, 1994).



**Fig. 4** - Awaji Yumenbutai, Awaji Island, arch. Tadao Ando: the stair – rising, ascension

## 2. THE TRANSFORMATION OF THE FUNCTIONAL MEANINGS IN CONTEMPORARY LANDSCAPE DESIGN

The problem of function is reconsidered according to the continuously changing life and culture of nowadays society. The architects and landscape designers are increasingly concerned with redefining solutions for different architectural or landscaping functions; they reconsider the exterior – interior, public – private relations, and even the relations between morphological elements: wall, ceiling, floor (fig. 5).

The changes within the society, the new stylistic trends, the technological progress and the evolution of thinking during the modern and contemporary period, have determined the reorientation of the aesthetic and functional design options, the evolutions of form, and the enrichment of the meanings for different landscaping types.



**Fig. 5 –** Swimming pool, Vienna, architects Heri & Salli: the annulment of the borders between wall, ceiling and floor

For a better adaptation to the contemporary life needs, the architects and landscape designers propose innovative ways of dealing with utility aspects, and even novel solutions and combinations of different function types within urban environment.

The reconversion project of the former industrial railway West Side from New York composes into a whole two elements considered by then separated: the public park and the infrastructure (fig. 6). The park set up on the existing suspended metallic structure invites the public through numerous accesses from different areas of the city and through a large variety of spaces. The areas designed for relaxation and walking offers panoramic views on the city and the port; they are decorated with green areas inspired from the wild prairie, becoming an element of identity.



**Fig. 6 -** New York Highline, arch. James Corner Foeld Operations, Diller&Scofidio + Renfro, 2003 - a novel combination: industrial infrastructure and landscape architecture -

Shanghai Houtan Park (fig. 7) – the public park built on the brownfield of a former industrial site from Shanghai, designed by the landscape architects from

Turenscape, constitutes a regenerative environment that recycles the existing materials and structures and restore them to the city. The project transforms a degraded landscape into a pleasant and relaxing public place.

Concurrently, this new leisure complex integrates, in a aesthetical and ecological way, instalations of water purification and flood control, setups against erosion and areas for urban agriculture with local specific.



**Fig. 7** - Shanghai Houtan Park, architects Turenscape  
- a regenerative, aesthetic și ecologic environment on a former industrial site -

## CONCLUSIONS

The functional meanings in landscape design are redefined according to the dynamic and complexity of the contemporary life. By means of technical and functional innovations, the landscape architects responds to the changes of the society needs, giving solutions for a pleasant, comfortable and ecologic urban landscaped environment.

The functional design conceived for the real needs of the cities and of the people, according to their particularities, creates identity and ensure physical and psychological comfort.

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# THE COMMUNITY GARDEN – MEANS OF LANDSCAPE AND HUMAN REHABILITATION

## GRĂDINA COMUNITARĂ – MIJLOC DE REABILITARE PEISAGERĂ ȘI UMANĂ

*POHOAȚĂ LUPU Oana*<sup>1</sup>,  
*MURARIU COJOCARIU Mirela*<sup>1</sup>, *DASCĂLU Doina Mira*<sup>1</sup>  
e-mail: lupu\_oana2007@yahoo.com

**Abstract.** *The gardens of a communitarian nature have at their origin various motivational motors, fuelled by political, economic, social, humanitarian, educational, psychological, technological, ecological or relaxation-occupational reasons, freely or constrainedly manifested over the last 200 years. Usually located on ground within or next to the city, under the property and management of local or private authorities and offered for individual use or the use of some groups of people, community gardens are today a saving formula for many counties. The ground assigning practice is adopted both in countries with a developed economy (England, Germany, the Netherlands, USA, Canada, Australia, New Zealand), and in those that are in an economical difficulty (Cuba, Vietnam, the Philippines, Venezuela). In this paper, the study of their evolution over time generates conclusions in comparison to our country.*

**Key words:** community gardens, urban horticulture, urban orchard

**Rezumat.** *Grădinile cu caracter comunitar au la origini diverse motoare motivaționale, alimentate de condiții politice, economice, sociale, umanitare, educaționale, psihologice, tehnologice, ecologice sau recreativ-ocupăționale, manifestate liber sau constrâns în ultimii 200 ani. Amenajate de regulă pe terenuri din perimetrul intra sau peri-urban, aflate în proprietatea și gestionarea autorităților locale sau private și cedate spre folosință individuală sau unor grupuri de oameni, grădinile comunitare reprezintă azi o formulă salvatoare pentru multe țări. Practica alocării de terenuri este îmbrățisată, atât în țările cu economie dezvoltată (Anglia, Germania, Țările de Jos, SUA, Canada, Australia, Noua Zeelandă), cât și în cele aflate într-o oarecare dificultate economică (Cuba, Vietnam, Filipine, Venezuela). În această lucrare, studierea evoluției lor în timp generează concluzii comparative cu țara noastră.*

**Cuvinte cheie:** grădini comunitare, horticultura urbană, livada urbană

## INTRODUCTION

The combination of satisfying some vital life needs with the existence of urban and peri-urban areas, degraded or not, but neutralized, carried out under public or private control and administration, is a simple and practical form of landscape and human rehabilitation.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

## MATERIAL AND METHOD

To draw up this paper, we have carried out study on the evolution of community gardens on world-wide scale during the last 200 years. Stress was laid on, and we have underlined the distinct periods on dominant historical factors that have led to the implementation of the concept, carrying out an eloquent evolution graph in the end „The Cuban experiment” is presented as an exception, one that is remarkable through its authenticity, evolution and international appreciation. As research methods we have used: *systematic and independent observation, the case study method, analysis and synthesis*.

## RESULTS AND DISCUSSIONS

The evolution of community gardens has had its ups and downs due to the numerous influences it had, and there can be identified several relatively distinct development periods: the period from the beginning until the end of the 18<sup>th</sup> century, the 19<sup>th</sup> century, the period of the 20<sup>th</sup> century up to the First World War; the period between the two World Wars, the period after the war, the immigration and reconstruction; the modern and post-modern period after the Second World War; and the meta-modern period from the beginning of the 21<sup>st</sup> century.

**The beginning period** stands out in Great Britain (year 1830, St. Ann’s site, whose orchard still exists today, with patrimony value Nottingham, (Clover, 2008), in Germany (year 1860, Leipzig, Saxony, where the „Schreber Movement” came alive with the help of Prof. Dr. Moritz Schreber paediatric physician, who has advocated the education of children in nature, his ideas being adopted and applied by other German-speaking countries, Austria and Switzerland (Poole, 2006) and in Denmark (community gardens setup outside the fortifications of cities, in year 1778, in Fredericia (Jensen, 1996), a practice also adopted in Switzerland, Norway and Finland. Countries like Spain, Italy, Portugal and Russia have not approached such experiments during this period.

The community gardens of that time have common traits, being divided in lots and rented for symbolic prices. The donors were either from the aristocratic society, the rich landowners or state and culture organizations, and the beneficiaries were usually poor families with many children.

During **the period of industrial development at the beginning of the 20<sup>th</sup> century**, this practice gains an unexpected popularity. The industry brings well-being in a certain way, but it also brings problems, such as the segregation of social classes, urbanisation and excessive agglomeration, pollution, the degradation of health, the increase of tomorrow’s risk. Within this context an ever increasing number of people want an escape oasis, with the price of physical labour and symbolic wages, but one that is certain to insure their living. With the demand, the regulations occur: one lot /family, a fixed surface (which in time got increasingly smaller, so as to please more requesters), cultivation restrictions (fixed constructions not being allowed, not even today), the enforcement of common use areas with various destinations (storage, rest, sanitary areas). Indicative is German’s attitude, that appreciates “*the positive aspect of food*

*safety*”, but also imposes the setup of “*relaxation areas and social meeting areas*) (Senate Department for Urban Development and the Environment of Berlin, 2012).

In Sweden (Stockholm, 1904), the aristocrat Anna Lindhagen, renowned social-democrat leader fought for this concept and its implementation, writing that “*for a family, a lot of land represents a strong union connection, in with all family members can meet, working and relaxing together*” (A. Lindhagen, „*Om kolonitradgardar*”, Stockholm, 1905).

**The period of the two World Wars** has brought on this concept several modifications imposed by the rough conditions following the degradation of the normal living conditions that have climaxed with the general post-war disaster. The number of lots, and the number of those caring for the lots varied a lot, depending on the land, the demographic movements, the defeated or defeating state. In the end, because Europe was buried in disaster and misery, these gardens provided by authorities or benefit institutions, have been the only hope for poor people.

Following the evolution of the war, it is easy to observe and guess how these have been evaluated and perceived. In Germany, for example, before the First World War, community gardens received little interest, largely due to the country status, with major influences on the economic, political and psychological field. Right after the war, and between the two wars, owning a lot in a community garden represented the “*essence of survival*”. England, shaken by both wars, has seen in the practice of assigning lots to people from the urban community represented the possibility of “*rising from the knees*” for the population on the brink of disaster. Thus in 1943, the number of assigned lots reached 1,4 millions (Poole, 2006).

**The period after the Second World War** is that of reconstruction, economic development, migration of the population of African and Asian origin coming from colonies, but also the segregation of Europe in two totally different ideological blocks.

The soviet influence block has not liked this idea of community gardens, and the concept of holding and using a land, be it rented, donated for a precise purpose, had no echo. On the other hand, the countries with a tradition in this practice have continued to evolve.

The first decades after the war have brought serious problems to different governments due to the low-educated, poor immigrants with high crime potential. On the whole, the total number of lots from the community gardens has lowered, as did their surface, this was largely due to the more stressing need for urban areas destined for urban construction and development. A series of laws and regulations to govern their proper distribution have been adopted. The local authorities have been largely involved in the issue, imposing regulations and order criteria, drawing up waiting lists for future applicants, favouring those with social and integration problems. On the other hand, the new society in West Europe needed a “*green*” movement. The effects of pollution, urbanization, city stress, unhealthy eating habits, sedentary lifestyle and physical isolation between city walls were already starting to be felt. The movements for an active lifestyle started to have

more influence on the old people and children and the interest in community gardens started to grow. Since in countries like Germany, England, the Northern Countries and Lower Countries human rights were strictly observed, pressures have been made on the waiting lists, so that unfavoured people, such as the retired, students, women with children in case were registered as priorities.

**The period at the beginning of the 20<sup>th</sup> century** brings new technologies and modern communication means, and also higher requirements, so that the practice of lots assignment becomes global. Some developed counties take on from the experience of others (The United States, Canada, Australia New Zealand), and a part of the counties under economic and social difficulties (Bolivia, Congo, Venezuela) are helped by European countries through FAO.

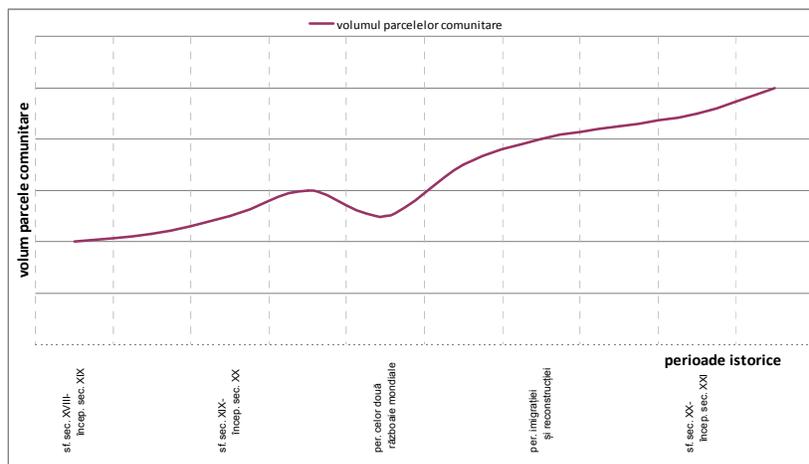
The movement has gained momentum mainly due to the organizations for the defence of the environment and life: in states like the United States, community gardens have a pregnant ecological and protection character, stress being laid on the humanitarian factor, the helping of the self and the others, and on voluntary actions. Thus more factors came to be involved in the community garden: physical and mental health, nourishment, outside movements, the feeling of useful work and respect for nature and the initial values, socialization, relaxation, hobby, irrespective of age and social belonging. The waiting lists and assignments are made centralized, on the national level ([www.cityfarmer.info](http://www.cityfarmer.info)). Amateurs as well as specialists are involved, and the gardens have become useful, aesthetical and more and more demanded.

**„The Cuban experiment”** is an exception in the field of community gardens practices. Though it is more than 50 years old, though it has been „induced” by the great world powers (U.S.A. and Russia), though nobody has anticipated this evolution, the way Cuba attracts the admiration and respect of international organizations, starting with the environmental and ecological ones and ending with that with economic and financial attributions, is more and more remarkable. The embargo imposed on the 60s by the Americans have turned communist Cuba into an less perceptible “island” economically anchored in the old Soviet Block, through the sugar and tobacco trade, against petrol and food. The economy thus constrained has functioned until the 90s when the Soviet Block collapsed drawing Cuba down with it. The life of the every-day Cuban, without basic resources, food and petrol, has become a severe, generalized problem. The only solution, though it represented a great compromise, has been the opening of the borders for the tourists (except for the American ones) and allowing the access of the currency coming from the thousands of immigrants who fled the country. The great problem that was quickly identified was that this beautiful country was no longer of tourist interest because of the famine. Salvation came from an amble movement started at the highest level and influencing the simple Cuban: the assigning of any plot of land, possibly tillable, to any citizen who wanted to get involved, for his/her own benefit. The action involved the lack of taxes or symbolic taxes, without any pretence from the state, but it was well regulated so as to please the majority. The result has been quick and spectacular, the urban

gardens, cultivated with vegetables, fruit, and ornamental plants, start popping out everywhere in urban areas, and Havana becomes a model. Degraded and polluted lands were recovered as communities got involved in their retrieval and improvement. Another detail, the lack of petrol, made the mechanized and chemically fertilized system be impossible, and replaced with a simple, rudimentary but ecological and durable one. „*Organopónicos*” is the Cuban term used for the system of ecologically grown Cuban garden system.

The action has turned into one of national level, so that Cuba receives more than 2 million tourists annually, that is about 20% of the country’s population and Havana is supplied up to 90% by urban community gardens (Staten, 2003).

Despite the fact that the embargo is still valid, it is no longer a burden, and the way the Cubans have risen through this desperate initiative is considered today to be a model of economic sustainability, as FAO presents it in the Havana event on 14-17 May 2012 - „*International seminar on urban and peri-urban agriculture*”.



**Fig. 1 - Evolution of community gardens**

The study of the evolution of community gardens over time can be graphically synthesized, evidencing the tight connection between its historical evolution and human needs (fig. 1).

Though both factors have been variable, the request and interest for the land assigned for individual and family benefit, in community regime, is increasing, and it can be observed that during the last years stress has been laid on ecologic cultures.

## CONCLUSIONS

The process of implementing the community garden concepts, with its utilitarian, aesthetic and ecological values greatly improve the image of the urban landscape in highly developed countries, and to a lower degree, that in the countries that are less developed. Sadly, in Romania, this subject does not raise

the interest of the Government or city officials. Looking for the reason why Romania has not adopted this concept, there are some indications that must be considered, most due to our historical reality. We haven't had an explosion of the industrial development that resulted in overcrowded urban areas, and the two world wars have not destroyed Romanian cities at a scale comparable to that in Great Britain or Germany. We've never had waves of immigrants since the communist regime has completely excluded this idea. Then there is the question why this community gardens concept has not materialized after the 90s, the years of the democracy, the integration and adopting of western values. Analyzing the arguments that have led to the creation of western community gardens, we notice in our case a new row of eluding reality: unhealthy diets and sedentary life, though problems that are more and more discussed, remain at a statistical level, without any remedy actions; the educational institutions do not request "files" with extra-curricular or voluntary activities for registration, they only request the results of the theoretical education; voluntary work is not encouraged, there is no real implication of the authorities or the civil society; the family is more and more indifferent and exhausted, and socialization and communications have abruptly shifted to the virtual environment. The benefits brought to man and landscape by the community gardens are remarkable, and even if their beginning in our country are so far virtual, at the level of informative sites, excessive urban development will have to eventually be stopped by using this ecological, sustainable alternative.

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# THE FRUIT TREES – VEGETAL ELEMENTS WITH MULTIPLE VALUES OF THE RESIDENTIAL GARDENS

## POMII – ELEMENTE VEGETALE PLURIVALORICE ALE GRĂDINILOR REZIDENȚIALE

*POHOAȚĂ LUPU Oana*<sup>1</sup>,  
*MURARIU COJOCARIU Mirela*<sup>1</sup>, *DASCĂLU Doina Mira*<sup>1</sup>  
e-mail: lupu\_oana2007@yahoo.com

**Abstract.** *The residential gardens from the urban or near the urban area represent a mirror of the civilisation and development degree of the inhabitants of a city or suburb, and the attention offered to the aesthetics and functionality of the natural and anthropical elements stretches over the general aspect. The fruit trees, along with the other vegetal elements, through their decorative and utilitarian nature are living organisms that can be modelled, generating not only the structure, but also the binding element of the landscape development. Comparing the two gardens, that within a city and that neighbouring a city, generate distinct landscape development typologies, and knowing these suggests applicative ideas and methods.*

**Key words:** residential gardens, urban orchard, landscape typologies

**Rezumat.** *Grădinile rezidențiale din spațiul urban sau peri-urban reprezintă oglinda gradului de civilizație și dezvoltare a locuitorilor din oraș și suburbii, iar atenția acordată esteticii și funcționalității elementelor naturale și antropice se răsfrânge asupra aspectului general. Pomii, împreună cu celelalte elemente vegetale, prin virtutea lor decorativă și utilitară, sunt organisme vii care se pot modela, generând atât structura, cât și liantul amenajării. Compararea celor două grădini, intra și peri-urbane, generează tipologii distincte de amenajare, iar cunoașterea acestora sugerează idei și modalități aplicative.*

**Cuvinte cheie:** grădini rezidențiale, livadă urbană, tipologii de amenajare

### INTRODUCTION

By analyzing the areas outside homes from the point of view of garden organization, and from the point of view of traditions and customs, and physical nature, we can determine the landscaping typology that differentiates intra and peri-urban gardens.

The extent of the areas, the neighbouring areas, the utilities, restriction, access, surroundings, classification of functions and last but not least the pollution level and own micro-climate are characteristics that define the two concept directions, with their similarities and differences.

### MATERIAL AND METHOD

To draw up this paper we have carried out a study on the evolution of private gardens over the last decade in intra- and peri-urban areas, analyzing the role of fruit

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania



### ***Utilities***

Both for intra-urban and peri-urban lots, the technical – urbanistic equipment are a natural necessity. The vegetal setup and furniture elements must take these equipments and norms into account. The size of the lots and the presence of public utility services – both above and underground – involve larger constraints in the inter-urban area than in the peri-urban area.

### ***Area microclimate and pollution level.***

In both types of gardens, these elements are manifested with subtle differences. It is a known fact that the area is more agglomerated and the street traffic more dense, the pollution degree is higher. Small areas, with higher surroundings and higher buildings have their micro-climate modified, as the dryness and pollution degree are higher.

### ***Utilitarian and decorative functions***

The garden, setup with care and passion, just like the home, represents the owner's "visit card". Following the fulfilment of functions of general nature, through the creation of distinct spaces or merged ones, that satisfy the needs of the family, are the main approach lines.

The fruit trees, together with the other vegetal elements, through their decorative and use virtues are live organisms that can be modelled, generating both the structure and the binder of the setup. Practically, the aspect of the trees in a setup, mainly result from the *directing of the tree top* thus "building" the garden "to be". Even if the treetop forms have different classification, the simplest is that that describe the degree of man's intervention: natural forms, semi natural forms and artistic (Lupescu, 2007).

The fruit trees, due to the flexibility of treetop direction, with evident aesthetic attributes can be used for multiple utility-constructive functions. The so call fruit-bearing fences may have a protection role, but also a physical or visual direction role. The directed trees or bushes bordering a semi-open or open area, may replace some furniture elements becoming green triforiums, such as green curtains or walls, used for the discrete intimation of spaces. We can create green curtains from more individual trees directed on a support or from one tree with umbrella-like top.

Intra- and peri-urban gardens can approach various styling categories and various aesthetical classification categories of fruit trees, following the fulfilment of a function or a set of functions. Far from being neglected, the traditional aspect of cultivating fruit bearing trees in gardens – an ancient wish of most owners-impose the offering of judicious and multifunctional solutions on the landscaper. The dual characteristic of the fruit trees, aesthetic and utilitarian, represents a "multiple value": one does not exclude the other, they are complementary.

Trees have own biological, technological and ecological characteristics, species and variety function, and from the landscaping point of view, and not only, one of the essential conditions is connected to the *health* of the plants. Maintaining it in normal parameters, for all plants used in landscaping, involves a significant effort, and here the owner has to deal with two important aspects: one

would be technical, connected to specific treatment schemes, and the second would be more of a psychological nature, that of the reticence regarding the use of chemical, polluting substances. Sometimes, the correct supply of this information by the specialist is omitted, so as to avoid this subject of a sensitive nature.

With the development of the peri-urban areas during the last decade, the approach tendencies for private landscape have known a great variety, but the lack of landscape culture has left its mark. In Romania, landscaping has been a field that has been largely neglected before 1989. Later on, the population has assimilated, rather chaotically and messy, bits of “inspirations” imported from the West. The economic profit of some companies in the field has largely contributed to implants of bad taste, since many of those involved in landscaping trading, planning and execution are not specialists, merely amateurs. The exotic elements, through interesting and of great aesthetical potential are often used “as a fashion”, and the result is an unsuccessful copy. Within this context, the fruit trees fall into the category of utilitarian plantations, located behind the yard. This is an approach that must be corrected using arguments of scientific and educational nature, by evidencing all the *virtues* of fruit trees.

Adopting some forms that are well trimmed, with a precise shape and reduced volume is indicated for the setup of intra-urban gardens, a solution suggested by more factors. The first one would be one of sensorial perception: if the number of individual trees is increased through rigorously controlled directing, the small place becomes more ample in composition than it really is. The second factor would be that that the city structure involves regulations, order, modulation, directed and supervised diversity, and the inter-urban gardens are extensions of the “street”. An exaggerated naturist approach can turn “natural” into “disorderly and untrimmed”.

Regarding the entire surface of a residential lot as a whole – buildings, garden, surrounding – we notice that the wooded vegetation is located at the middle level concerning the volume, between the high constructions and the low area of grass and trees. In the delimited space, divided by the surroundings and buildings, the wooded vegetation can build both the skeleton and the connection of the garden as a whole.

In intra-urban gardens, the space between the home and the surrounding usually being largely smaller than that in peri-urban gardens, the facade of the buildings may be used as a protection background of the wooded silhouettes. Thus, a “precious” exemplar can equally enhance the construction and the vegetal look of the vegetal level up to the level of the flowers of low bushes, with the intention that the profile be better distinguished. This type of landscapes are often met in intra-urban gardens, where the vegetation, significantly aesthetic, offers a protective buffer between the home and the street, or towards the neighbours, subjected to a possible pollution degree. Due to the restricted space, the number of used elements is quite low, and often “unique” trees are used.

On the other hand, peri-urban gardens offer more space, and the owners, mainly families with children, have other priorities. The garden is a place of rest,

socialization, a place for children's play. The garden becomes an element that draws more and more opposers of the throwaway society, such as the adepts of ecological food. The choice to plant a tree, made by the owner is the direct wish to appreciate its fruits, and the aesthetical factor, with expositional value falls into the background. Still, it is clear that in peri-urban gardens, the landscape horticulturist must take all conditions of the used species into account, biological, and aesthetical.

The horticultural development in Romania, with a vast tradition, offers many species and varieties of fruit trees, and the climate and soil conditions are usually favourable, with the reserve of some variations imposed by well-known biological and ecological particularities.

A healthy tree, for which the culture technology is respected, is full of flowers or fruit, and it offers shade and protection. We can say about it that it is a „nice” and „useful” tree, thus the two attributes, that of biological and aesthetical nature are entwined.

The peak of compositional refinement, reached in the horticultural field, as a last landmark, has been presented at the “World Horticulture Exhibition” Floriade 2012, Venlo, Holland (fig. 3, 4, 5, 6). These approaches eliminate barriers and offer solutions for the future.



**Fig. 3** - Landscape solution, Floriade 2012



**Fig. 4** - Relaxation area, Floriade 2012



**Fig. 5** - Fruit bearing fences in directed perspective, Floriade 2012



**Fig. 6** - Fruit trees in landscape compositions, Floriade 2012

## CONCLUSIONS

The place of trees today is not just in the orchard, conceptions have changed. Bringing them along other traditional aesthetical species, in a balanced and homogenous composition, is a new and courageous solution, of great effect and good taste in the end.

If tree growing will constantly and quickly develop its utilitarian side, landscape comes to evidence the aesthetics and functional, bringing a current and meritorious balance.

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# PSYCHOLOGICAL IMPACT OF REHABILITATION LANDSCAPE AFTERDISASTER USING ALTERNATIVE BUILDING SYSTEMS

## IMPACTUL PSIHOLOGIC AL REABILITĂRII PEISAJULUI DUPĂ DEZASTRE PRIN FOLOSIREA UNOR SISTEME ALTERNATIVE PENTRU CONSTRUCȚII

PURCARU A.<sup>1</sup>, PURCARU (GRECU) Codrina<sup>1</sup>  
e-mail: codrusa@yahoo.com

**Abstract.** *Alternative green building systems can be used for areas damaged by natural disasters, with an important psychological impact on affected population. As the high constructions, how destroyed landscape is gradually restored, has an important contribution to improving the mood of the population.*

**Key words:** natural disasters, affected populations, landscape recovery.

**Rezumat.** *Sistemele alternative pentru construcții ecologice pot fi folosite în cazul zonelor distruse de calamități naturale, având un impact psihologic important asupra populației sinistrate. Pe măsură ce se înalță construcțiile, modul în care peisajul distrus este, treptat, refăcut, are o contribuție importantă la îmbunătățirea stării de spirit a populației.*

**Cuvinte cheie:** dezastre naturale, populație sinistrată, reabilitarea peisajului.

### INTRODUCTION

The paper will highlight aspects of the psychological effects of disasters on people and landscape, and also the effects of the reconstruction along with reconstruction of buildings destroyed, but using unconventional and ecological recovery systems of communities affected.

### MATERIAL AND METHOD

Studies on the psychological impact of disasters on the population shows a wide range of symptoms from stress disorder to posttraumatic stress disorder (PTSD). PTSD occurs as a result of trauma and bring symptoms and reactions that interfere with human ability and the personal life of the professional. It is generally associated with painful memories and other forms of reliving the trauma.

Other manifestations of psychological imbalances products amid disasters are depression and anxiety. Anxiety, including PTSD, can lead to panic attacks, difficulty sleeping, difficulty concentrating, or physical sensations such as respiratory failure, chest pain or dizziness. Symptoms of depression include sadness, insomnia, feelings of guilt, lack of energy, difficulty concentrating. Anxiety tends to be characterized by the appearance of excessive worry while depression is characterized by a feeling of helplessness and lack of hope.

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<sup>1</sup> "Gheorghe Asachi" Technical University of Iași, Romania

The factors that give posttraumatic stress disorder related to disasters are caused by education, gender, race, and the existence of previous trauma. Although you can not necessarily predict the occurrence of such disorders due to a catastrophic event, when occurs it should be considered for such symptoms.

Studies have shown, surprisingly, another factor: people surveyed reported a decrease in social support, low sense of connection with others, a decrease in the belief that you can control what happens around and a decrease in optimism. Such social resources are extremely important for recovery after a disaster, contact friends and family can provide important support to psychological recovery. Damage of these social resources appears to be more common than psychological disorders (Phillips, 2009).

## RESULTS AND DISCUSSIONS

Below, is presented some features of vegetation which are recommended to be the main factor for physical and psychological rehabilitation of territorial and human communities affected by passage through devastating events (natural disasters, accidents or environmental damage and mass distructions generated by wars) or only by management and unsustainable exploitation of natural and human resources in the area.

Among the main functions of vegetation in an ecosystem are outline the next:

- air purification function due to plant capacity to emanate oxygen, essential for life and absorption of carbon dioxide in the atmosphere, dust particles, pollutants or different volatile organic compounds, etc.;
- maintain humidity by the same process of photosynthesis discussed above;
- ionization of the atmosphere in the context of the presence of mirrors of water, rivers or seas;
- maintaining and restoring natural cycles and biomorfological soil structure;
- and not least aesthetic and recreational function both needed a refreshing and sustainable urban environment.

All these features of vegetation support the idea that nature is saving solution to many problems this century and millennium begining, just to have recognition and respect for the genius of nature and willingness to seek and implement solutions for sustainable development.

Harmonious integration of man and his actions with nature allows development of actual human society, without jeopardizing the existence of future generations. Almost always when it comes to reconstruction after disasters, material losses are taken into account at least consistent if not huge, so all those involved in the rescue, cleaning and reconstruction will require considerable resources of construction materials and technologies easy obtained and relatively easy to put into practice. Easiest would be to exploit the natural resources of building materials present in the surrounding affected area. Thus earth, wood, stone or other combinations of these materials can easily become grounds for

sustainable reconstruction in individual living in villages or urban periphery areas, especially if are involved also affected persons by concerning to appropriate the houses with creativity and individual effort. This involvement can be the bridge between despair and depression in disaster for the hope and optimism of creative man, started to carve a new life in a new home.

Certainly from the perspective of modern technology, there are many classic and modern construction solutions and more unconventional systems such as the use of construction or agricultural waste for new materials, how they studied at the Technical University of Iași, in a doctoral study (Pruteanu, 2011). Other conventional solutions would be related to the implementation of reconstruction prefabricated building systems, such as earth blocks or mud rolls (fig. 1), or soil with straw (fig. 2), or other mixtures of crushed material resulting from demolition (Minke, 2006).



**Fig. 1** – Prefabricated blocks of land: a prefabricated industrial Bricks (above); b. handmade adobe (bottom left); c. handmade rolls (bottom right); (Minke, 2006)



**Fig. 2** – Prefabricated blocks of earth with straw (Minke, 2006)

The landscape reconstruction is also practiced with plant species from plants nurseries, specially designed for this purpose (fig. 3).



**Fig. 3** – Nursery trees and shrubs (Periland.ro)

We know that man is a holistic being and his harmonious birth and development is possible and absolutely inseparable from the presence of primary natural elements: sun light and heat, water, land with its wealth of minerals, which all together produce the miracle of plant life and animals. Consequently, when, from catastrophic events occur an imbalance in human symbiosis with nature, he suffers both physically and mentally, not to mention the social and economic sides strongly shaken at times. It must therefore be aware of the essential role it plays in the natural elements of human life and harmonization, especially since the first implementation phase of restoration and reconstruction of damaged areas, so that man may be in permanent contact with the primordial elements of life. Involving people affected in the reconstruction can be a plus not only saving workforce especially in recovering a sense of security, confidence and hope for their better.

## CONCLUSIONS

In conclusion, it is remarkable that although the past decade there have been major technological advances, construction specialists and architects tend to reassess traditional building methods because these are more economical and friendlier to nature, especially in crisis situations when requires rapid reconstruction of areas destroyed by disasters. Involving people affected in the reconstruction, and rapid restoration of the natural state can promote recovery of post-trauma victims to recover confidence and feeling of security.

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# THE INFLUENCE OF NATURAL VENTILATION ON BUILT LANDSCAPE

## INFLUENȚA VENTILAȚIEI NATURALE ASUPRA PEISAJULUI CONSTRUIT

*PURCARU (GRECU) Codrina<sup>1</sup>, PURCARU A.<sup>1</sup>*

e-mail: codrusa@yahoo.com

**Abstract.** *Strategies and methods for building ventilation, its location in a particular geographical area and climate, hygiene and comfort and their control by the occupants, are important elements that determine built landscape design. Volumetric shape and details of the building facade, coupled with exterior landscaping design, generate multiple benefits in the urban landscape, if designed judiciously. Although it is only a part of a building design, natural ventilation system contribute to its success and need to integrate harmoniously into the overall design of all built ensemble.*

**Key words:** thermal comfort, natural ventilation, climatic adptation of buildings, design of built landscape

**Rezumat.** *Strategiile și metodele ventilării unei clădiri, amplasarea ei într-o anumită zona geografică și climatică, condițiile de igienă și confort precum și controlul acestora de către ocupanți, sunt elemente importante ce determină designul peisajului construit. Volumetria și detaliile de fațadă ale clădirilor, corelate cu designul amenajărilor peisagere exterioare, generează multiple efecte benefice în cadrul peisajului urban, dacă sunt proiectate judicios. Deși constituie doar o parte a designului unei clădiri, sistemul de ventilare naturală contribuie la succesul acesteia și este necesar să se integreze armonios în procesul general de proiectare al ansamblului construit.*

**Cuvinte cheie:** confort termic, ventilare naturală, adaptare climatică a clădirilor, designul peisajului construit

### INTRODUCTION

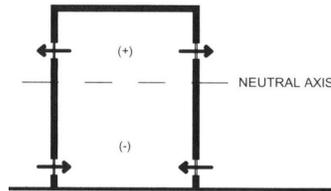
In the most cases the buildings are ment to protect their occupants from the vicissitudes of the environment (extreme temperatures, wind, rain, noise, radiation, etc.), But also to ensure their proper indoor environment for their work and life daily. Buildings adaptable to their climatic location will be those that provide a comfortable indoor environment despite extreme external conditions. (Allard and Ghiaus, 2005). One of the most important factors that ensure comfort and indoor air quality is natural ventilation of buildings. Depending on the few main types of natural ventilation, we will illustrate below how this type of ventilation, orientation or location of buildings may influence their design and surrounding landscape.

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<sup>1</sup> “Gheorghe Asachi” Technical University of Iași, Romania

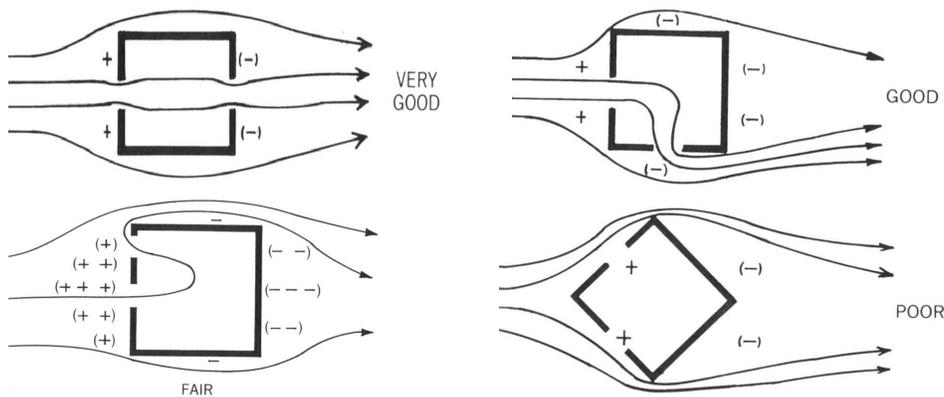
## MATERIAL AND METHOD

Natural ventilation of buildings is based on hot air tends to rise, allowing the cold air to penetrate the lower part of the building. This phenomenon, called natural convection, is caused by temperature and pressure difference between inside and outside the building, also between two openings in the vertical plane of it. If the difference of temperature between the inside openings is greater than that from the outside then it creates so-called stack effect, air moving up as it warms and being evacuated through the top opening of the building (fig. 1) (Lechner, 2009).



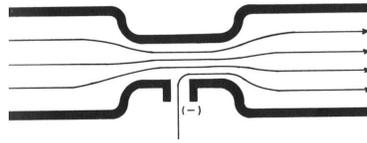
**Fig. 1** - The difference of temperature cause the pressure difference causing vertical circulation heat (Lechner, 2009)

Wind is another factor that can determine the pressure difference, the building subject to wind action with a positive pressure, while the opposite is subject to wind uplift forces of wind, so with negative charge. Air moves from positive charge to negative charge, depending on the position and configuration of the building or through openings and / or its leaks or evoding the building (fig. 2).



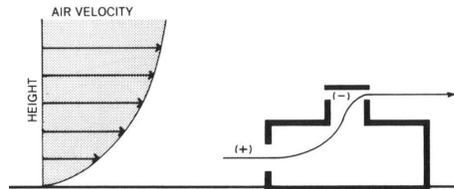
**Fig. 2** - Depending on wind direction and positioning to building configuration, ventilation can be: very good (top left), good (top right), satisfactory (bottom left), weak (bottom right) (Lechner, 2009)

Bernoulli effect is another action, trough witch, growing velocity of the fluid, determines its static pressure decreases. Because of this phenomenon thereis negative pressure in the venturi bottleneck area (fig. 3).



**Fig. 3 - Venturi Tube (Lechner, 2009)**

Ascending air velocity increases rapidly with height above the ground, so the pressure will be lower at roof ridge than that at the groundlevel window, so the air is evacuated through the roof opening (fig. 4).

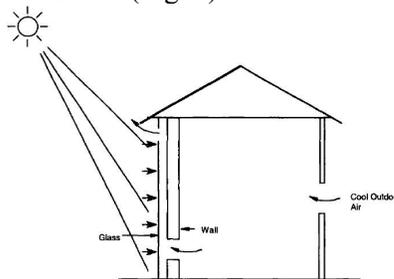


**Fig. 4 - Bernoulli Effect: Air speed increases with height, and static pressure drops to roof ridge, so that the air is evacuated through the upper opening (Lechner, 2009)**

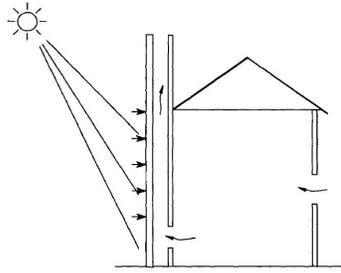
The stack effect advantage compared with Bernoulli effect is that, it is not dependent by wind action, however has the disadvantage that it is very weak, which gives one very slow air movement. To maximize the the stack effect should be a maximum size of openings in the building envelope and a maximum distance as possible between them vertically. However it is more efficient to combine all these effects for better vertically natural ventilation.

## RESULTS AND DISCUSSIONS

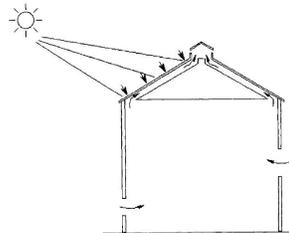
In buildings where one side ventilation or the cross ventilation is not enough, ventilation methods may be used, to improve ventilation rate, through solar and stack effect, in cases of no wind or too small temperature differences between inside and outside. Thus we can mention three such methods of ventilation with solar contribution (Gallo et al., 1988): Trombe wall (fig. 5), solar chimney (fig. 6), solar ventilated roof (Fig. 7).



**Fig. 5 - Ventilator Trombe wall (Gallo et al., 1998)**

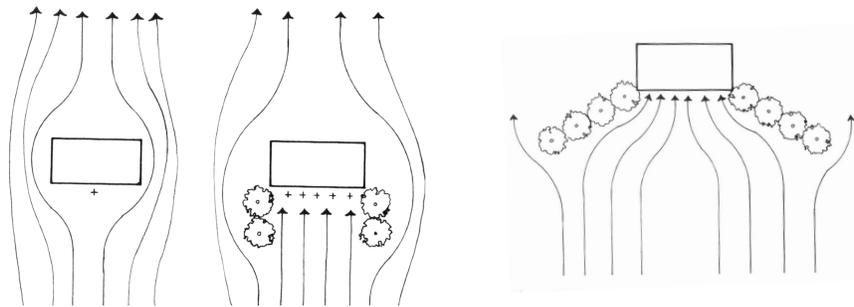


**Fig. 6 - Solar chimney (Gallo et al., 1998)**

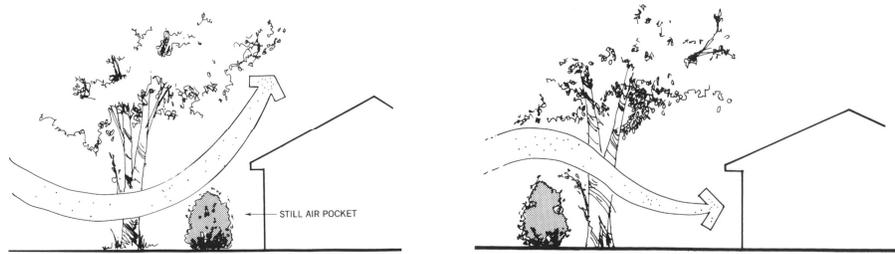


**Fig. 7 - Ventilated solar roof (Gallo et al., 1998)**

The Trombe wall is designed to heat indoor air in winter or to ventilate the room by enhancing the stack effect. An interesting application of stack effect is the solar chimney, which, through its location adjacent to the building, helps to avoid overheating of the interior, to accelerate ascension of hot air and exhaust it through the top opening. The ventilated roof with solar contribution has increased efficiency due to Bernoulli and Venturi effects mentioned above. One very efficient method to influence the ventilation of buildings is arrangement of various types of trees and shrubs in the vicinity of a building or group of buildings. The images in Figure 8 show how two rows of trees oriented properly can channel air flow, more or less, to the building, thus enhancing its natural ventilation.



**Fig. 8 - The influence of vegetation layout on the ventilation of buildings (Lechner, 2009)**

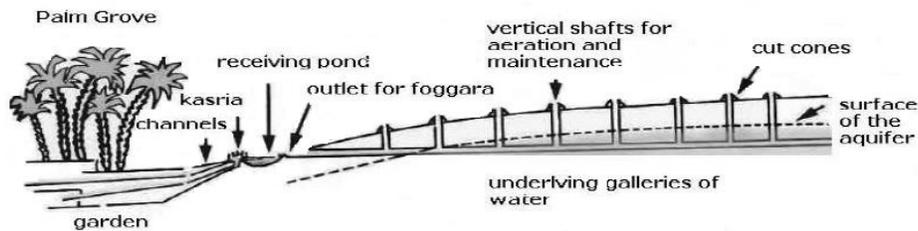


**Fig. 9** -The influence of vegetation on the ventilation building layout: 1) favorable arrangement for the winter but unfavorable to summer ventilation (left), 2) arrangement favorable for summer period (right) (Lechner, 2009)

As shown in the figure 9 pictures, in the first case, the airflow of a prevailing wind can be deflected by the presence of bushes near the house, thus being favorable in winter. In the second case, bush location at some distance from building, beyond the tree strain, favorise air flow entering the house for better ventilation in summer.

In the same way, the dwelling location according to the presence of a lake or river can improve internal air in a dry warm climate, as the same solution may not be recommended in a humid climate.

An interesting example is the so-called "Fouggara" (in Algerian language), a transmission system using groundwater in desert areas of Africa. Figure 10 illustrates the structure and operation principle of this ancient irrigation system and to ensure permanent water.



**Fig. 10** - Fouggara gravitational system transporting water from underground channels groundwater to groundwater irrigated gardens in desert areas of Africa (Amara et al, 2011)

This underground drainage chenals system was related to a Canadian well and proposed, according to (Amara et al., 2011), to conditionate the air of a pilot building at a temperature of 21°C, the extent groundwater temperature in that channel. This would demonstrate the usefulness of an ancient, complex, but ingenious structure, which does not require any other charges than physical labor of those which have worked there, because there are 900 such systems in several countries in Africa, many of them abandoned.

Opportunity for summer cooling and winter heating through building design and surrounding landscape, existed in many forms, from ancient times,

being used successfully today, the subject being treated detail in a previous paper of the author (Purcaru, 2012).

## CONCLUSIONS

In conclusion, natural ventilation in its various forms aims to maintain hygiene and comfort inside the buildings, since ancient times. Nowadays architects and plant engineers concluded that in most cases, is more economical but also more hygienic to use natural ventilation, with all its traditional methods of adapting to the climate Also the use of all possible environmental elements create a favorable environment to life and human activities.

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# URBAN FURNITURE, DESIGN, AND COST PRODUCTION PRINCIPLES USING CAD DEVELOPMENT TOOLS

## MOBILIERUL URBAN, PRINCIPII DE PROIECTARE ȘI ESTIMARE A COSTURILOR DE PRODUCȚIE FOLOSIND TEHNICI C.A.D.

SINGUREANU V.<sup>1</sup>, DUMITRAȘ Adelina<sup>1</sup>, POP Păunița<sup>1</sup>, MOLDOVAN G.<sup>1</sup>

e-mail: singvalentin@yahoo.com

**Abstract.** *Urban furniture viewed as landscape design constitutive element occupies nowadays an increasing prevalent position in systematization and designing principles of urban areas. Used materials and its multifunctionality become pronounced with the advent of economic crisis, when cheap and sustainable solutions represent key factors. The proposed materials for the construction of the urban furniture consisted in imprinted concrete with wood inserts. Urban design models were made with the assistance of SketchUp software. 2D and 2.5D projections were obtained using CorelDraw software. Estimating technical materials, surface and volume calculation was performed using SketchUp. Additional lighting to conceived furniture was done by ArtlantisStudio 3 renderings.*

**Key words:** trellises, bench, trash can, modularity, C.A.D.

**Rezumat.** *Mobilierul urban privit ca și element constitutiv al peisajului urban, ocupă în zilele noastre o poziție din ce în ce mai predominantă în activitatea de sistematizare și amenajare a mediului ambiant. Materialele folosite în construcția acestuia și multifuncționalitatea sa devin mai pregnante odată cu apariția crizei economice, când soluțiile ieftine și durabile reprezintă cheia succesului. Materialele folosite în construcția mobilierului propus au la bază tehnica betonului amprentat cu inserții de lemn. Proiectarea pieselor de mobilier urban a fost executată cu ajutorul programului SketchUP, proiectile 2D și 2,5D au fost executate cu ajutorul programului CorelDraw. Devizul tehnic al materialelor folosite, calculul de suprafață și volum a fost realizat cu ajutorul programului Sketchup. Iluminatul suplimentar al mobilierului creat s-a realizat prin randări în programul ArtlantisStudio 3.*

**Cuvinte cheie:** jardineră, bancă, coș de gunoi, modularitate, C.A.D.

### INTRODUCTION

The proposed urban furniture was created with the guidance of SketchUp software in direct compatibility with CorelDraw and ArtlantisStudio 3 through dwg extension files. 3D projection of the urban furniture was made using push/pull 3D modeling tool in SketchUp. The proposed urban furniture was improved by the author inserting led spot lights oriented downwards. The ornamental value of the urban furniture will be extended through nighttime assuring functionality and esthetic value 24h/day.

### MATERIAL AND METHOD

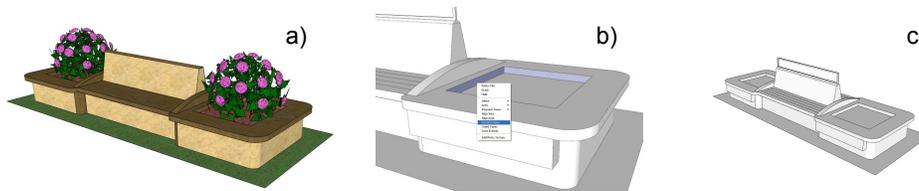
The proposed urban furniture was imported from the general known 3D library 3D Warehouse. The general principles in choosing this kind of urban furniture

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania

consisted in reaching multifunctionality aspects (rest place and plant trellis) considering their implementation in possible pedestrian areas or squares (fig. 1 - a).

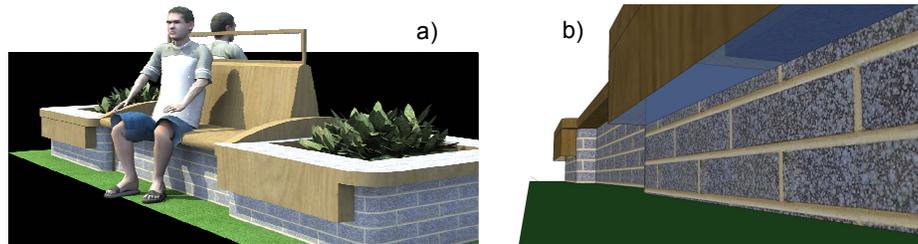
The second stage of design development consisted in verifying that all faces of the object are correct represented using monochrome visualization (fig. 1 - b). As showed in figure 1 all faces of the proposed urban furniture must be colored white facing the user point of view. Blue faces must be reversed because they represent the backside of the 3D object (Rogers et. al., 1988). After this stage, all faces are in correct order and further more improvements can be made. As seen in figure 2, the final projection of the urban furniture is improved with led spotlight oriented downwards, assuring the so called „butterfly effect” during nighttime (Bernatzky, 1975). For assuring the light diffusion properly, we applied translucent properties to some materials as seen in figure 2. After these procedures, the glazing effect will be pregnant and realistic in final render projections.



**Fig. 1** - Original imported bench from 3D Warehouse (a), it's reverse face order (b) and final monochrome view (c)

Because its suggestive implementation to different pedestrian roads or squares, in the middle of the bench we propose the construction of a frame for different adverts exhibition.

Area and distance measurements where made using SketchUP dimensioning tools (Tape measure - Entity info - Dimension).

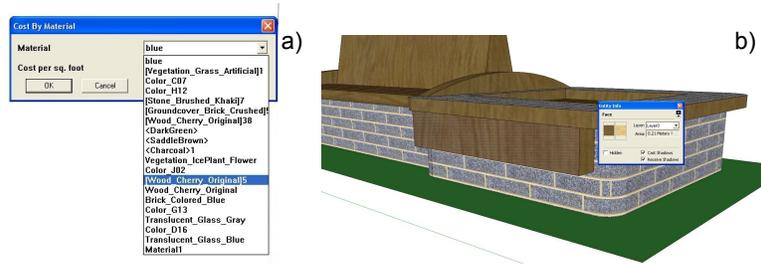


**Fig. 2** - Final rendering of the proposed urban furniture (a), spot light translucent option for better glazing effect and light diffusion (b)

The standard edition of SketchUP software assures free of charge plug-ins such as sandbox or estimating cost tool. Considered in development stages, the estimating cost tool assures expenses defalcation by type of material used in projecting the model.

In most of the cases this tool is accurate, but where we confound with complex poly objects the final solutions stays in adding all the surfaces in a excel work sheet using entity info tool (Paquet et. al., 2010).

For comprehensive understanding, we propose the rendering projection of the skp file in ArtlantisStudio 3 where we can observe the proposed light effect (fig. 4).



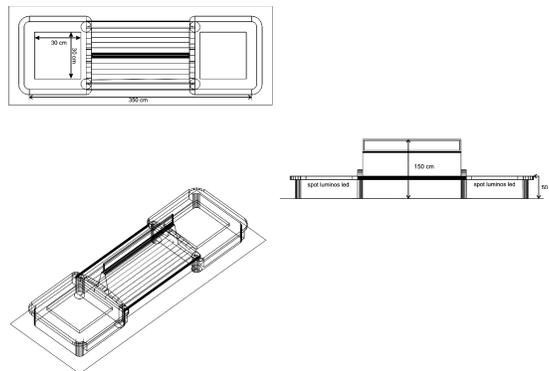
**Fig. 3 - Cost estimation tool by type of used material (a) entity info tool for manual cost estimation (b)**



**Fig. 4 - Final rendering and implementation of the proposed urban furniture during nighttime in ArtlantisStudio 3**

## RESULTS AND DISCUSSIONS

After its render in ArtlantisStudio 3, the bench can be saved in the library of the software as individual entity (aof extension file) used for decorative purposes in different designs as showed in figure 4. The same 3D projection can be exported as dwg extension file and imported in different software's (for example CorelDraw) where are automatically projected to 2D and 2.5D (fig. 5).



**Fig. 5 - 2D and 2.5D projection of the proposed urban furniture in CorelDraw X3**

The light insertion spots where induced in ArtlantisStudio 3 (fig. 6). In this software, we can establish the exact amount of needed spot lights their used power in watts and light diffusion cone.

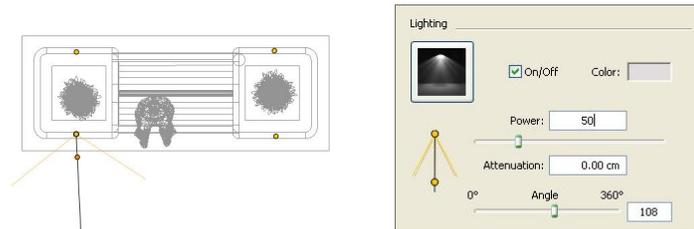


Fig. 6 - Spot light characteristics in ArtlantisStudio 3 and their parameters

## CONCLUSIONS

1. Improvement of 3D models from the general knowned library 3D Warehouse consisted one of the key aspects treated in the present paper. Regarding the aspect the urban furniture was improved with led spotlights and frames for different announces and exhibition works.

2. Cost calculation tool are presented from their efficiency point of view, insisting upon the fact that entity info tool and excel work sheet represent technical solutions for manually calculating these aspects where cost efficiency plug-in does not do this job.

3. The final render of the proposed 3D object in ArtlantisStudio 3 will show how the lights spots are projected and how will work during nighttime. For assuring this light transition target materials must be translucent for optimum light distribution.

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# NATURE BETWEEN IMAGINARY AND REALITY IN POSTMODERN AGE

## NATURA ÎNTRE IMAGINAR ȘI REALITATE ÎN ERA POSTMODERNĂ

CHIRIAC H.C.<sup>1</sup>

email: horiachiriac@yahoo.com

***Abstract.** The present paper aims to discuss the problematic of nature within the Postmodern Age, starting from the fact that Postmodernism questions intensively the concept of reality. Therefore, the concept of nature evolves into a new context, being simultaneously associated with imaginary and reality, while the old and somehow exclusive link that modernity traced between nature and rationality seems to be no longer satisfactory.*

**Key words:** nature, reality, postmodern society

***Rezumat.** Lucrarea de față își propune luarea în discuție a problematicii naturii în cadrul epocii postmoderne, plecând de la faptul că postmodernismul pune intens în discuție conceptual de realitate. De aceea, conceptual de natură evoluează într-un context nou, fiind în același timp asociat imaginarului și realității, în vreme ce vechea și oarecum exclusivă conexiune instituită de modernitate între natură și raționalitate pare să nu mai fie suficientă.*

**Cuvinte cheie:** natură, realitate, societate postmodernă

### INTRODUCTION

The birth of postmodern society is a very complex phenomenon most of all because globalization, as economic process, had major cultural consequences. These consequences regard the generalization and the spreading of a consumer mentality throughout global society and the stratification of social perception of culture, including art (Goulding, 2003). As far as art and philosophy are concerned, such an evolution involved a new attitude towards nature, especially regarding its relations with the concept of reality. As we are going to see, such a relation is mediated by a third concept, whose history was a pretty tormented one throughout different development stages of European philosophy: the concept of imagination.

### MATERIAL AND METHOD

What interests us in the present paper is the understanding of the differences between modernism and postmodernism as regards the relation between nature and reality. Such understanding reflects on multiple levels of nowadays society. Science itself witnessed major changes concerning the importance of scientific realism within the most important theories. Classical attitude of modern scientists towards the features of nature was centered on the assumption that a clear description of them

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<sup>1</sup> Postdoctoral Grant Recipient, Romanian Academy, Iasi Branch

was perfectly compliant with classical realism. Quantum Age in contemporary science introduced a quite uncomfortable gap between scientific account of the features of nature and classical realism. Quantum Mechanics remained up to the present an objective theory, but despite numerous efforts of unifying the various interpretations of its formalism, it remains in a generally complicated and difficult relation with one of the most important philosophical doctrines that radically influenced the rise of modern science: classical scientific realism. Thus, starting from this situation, one can easily observe that nowadays the general coordinates of the relation among nature, imagination and reality changed dramatically in comparison with modern times, due to fundamental changes within ontology of scientific discourse. On another level, the same mutations from modernism to postmodernism affected the triad nature-imagination-reality as regards the evolution of postmodern culture. The consequences were important not only for the fine arts in general, but also as regards the garden art as well. Maybe more than in the case of painting, sculpture or architecture, in landscape and garden art the relation between nature and reality reached in postmodern times a new level, a level in which the intermediating influence of imagination became indispensable for the conceptual pair mentioned above. Furthermore, not only the relation between nature and reality changed in that of conceiving nature as part of reality or in that of conceiving reality in relation with nature. This transformation regards the way in which the link between nature and reality is mediated by human mind with the use of imaginative faculty. In fact, among other historical causes; a profound mutation regarding the meaning of all three concepts influenced decisively the postmodern perspective upon nature, reality and imagination, individualizing it in comparison with the modern one. The very significance of nature changed in its relation with human society, in the same time with important meaning transgressions of imagination and reality. In fact, at the very core of modern perspective upon nature lays the confidence in industrialism, as a rational way of conquering and exploiting nature. (Macfarlane, 2002) In contrast with modern attitude towards nature, postmodern attitude is inspired by the coordinates and specificity of post-industrial society.

## **RESULTS AND DISCUSSIONS**

The relation with nature represents maybe the most important coordinate that changed in postmodern times. For modernism the relation with nature was not a central point in judging the refinement level of a culture. On the contrary, in modern period of time technological progress allowed human society to distance itself from nature, opposing to it the industrial civilization. Nature was regarded primarily as a source of natural resources able to be conquered and exploited by human mind in a rational way, using its imaginative products, be they rational systems of thinking or technologies, scientific theories or ideologies. The paradigm within which such creations were developed was a unitary one in its rationalistic enthusiasm inherited from Enlightenment age, while the postmodern paradigm is a pluralistic one in this respect (Grenz, 1996). Gathering a wide range of attitudes regarding nature and being more focused on environmental ethics, postmodernism favors the multiplication of interpretations concerning the philosophical meaning of the concept of nature. Different cultures become valuable and interesting in postmodern times just because of their specific way of conceiving a certain relation with nature.

This happens because the postmodern attitude towards nature is more refined and complex in its essence than the modern one (Baker Steve, 2008). Nature is regarded as the original and indispensable environment of all terrestrial forms of life. Being the source of life for human beings, nature becomes a vital element for humanity. The rational reductionist attitude towards nature dominant in modern period was replaced by a more open minded attitude that pays attention not only to rational aspects, but also to intuition and other forms of subtle dialogue between human mind and nature. This change in the general attitude towards nature, which is in fact a sign of profound philosophical mutations regarding the positioning of contemporary people in the problem of nature-culture dichotomy, reflected also in the various forms of contemporary Art. Garden Art represented always a domain of artistic expression in which multiple artistic principles are applied, having in the same time strong connections with Aesthetics, with Philosophy in general, but also with Biology and other natural sciences. Starting from here, it becomes obvious that the postmodern tendencies in garden and landscape art become symptomatic for other deep cultural tendencies that define postmodern age. For example, in English Garden history postmodernism can be more easily linked to the classic period dominated by eclectic style than to modernism, mainly because the abstractionist tendencies of modern style in Garden Art didn't face too much enthusiasm in England, where the combination between three fundamental aesthetic concepts - beauty, picturesque and sublime - has long been the ground for cultivating various strategies of creating an explicit meaningful artistic discourse within Garden Art (Turner, 1996). In the same time, the Human Being, as part of nature, proved to be a quite difficult subject for rational description, especially in its complex social behaviors and organizational patterns, giving the fact that rationalistic systems of scientific knowledge failed to solve cultural problems of humanity in Atomic era. Imagination was long misunderstood in its constructive functions regarding the development of rational and objective knowledge. Finally, productive imagination was understood correctly, together with its influence on social level, the term imaginary being used more often. In the same time, reality itself became plural, not only objective and rational for postmodernism, by contrast with rationalistic modern view that claimed the positive value per se of human knowledge, no matter how neutrally moral it was, which led to destructive effects due to the power of human technology used without moral preoccupation.

Up to the XIX-th century physical reality was considered as being unitary, able to be described objectively and somehow unitary by theories like Newtonian and Lagrangean Mechanics, Thermodynamics or Electromagnetism. In the beginning of the XX-th century an important change took place within the main physical theories. Newtonian Mechanics and classical Electrodynamics were replaced by the Restrained Theory of Relativity and classical Thermodynamics was deeply transformed by the introduction of quantum hypothesis. The important mutation that took place concerned mainly the specific properties of the micro-universe and those of the macro-universe. Around the middle of the century

General Relativity was used to describe the properties of physical systems at astronomic scale, while Quantum Mechanics was used to describe the properties of physical systems at quantum scale. Discoveries like Uncertainty Principle, wave-corpucle duality of elementary particles, distance entanglement etc. revealed the fact that each level of organization of matter has its own distinct properties. Therefore, physical reality proved not to be as unitary as the theories of classical natural science assumed. Later on, the situation complicated further by the fact that neither physical theories that describe each level of matter organization proved to be entirely compatible one to the other, nor the four fundamental forces in nature used to explain the dynamics of various physical systems at different levels of matter organization. This way, a unitary description of a unique physical reality seemed to be a much far away ideal than was in the modern period. Simultaneously, the idea of a fractured reality and the difficult relation to it of human mind manifested their influence upon various contemporary disciplines, from psychology to art. As a consequence, postmodern attitude towards reality in general, be that reality physical, psychological, or symbolic in the artistic sense, became very distinct from the modern one. Reality is plural and non-linear in its manifestations for the postmodern culture, in which it can be signified and decrypted in various ways, depending on axiological options, personal identity or social history of individuals. The postmodern correspondent tendency in Gardening Art was that of mixing various design elements into a narration with elaborated significance that provoke the viewer to decrypt it (Turner, 1996). A process of adaptation to individual wishes and preferences of each individual in respect of his strategy of signifying and "building" reality for himself took place as well in postmodern Garden Art. Within such a process a major part plays the imaginative faculty of human mind. But imagination itself as a concept registered an important transformation throughout the XX-th century together with some quite recent mutations in cultural anthropology. Gradually, a process of translation and replacement of the term "imagination" with the term "imaginary" took place. There are two main reasons for that change. First of all, imagination was for a long time despised and avoided as term in what regards its possible link to knowledge, be the last one religious or scientific. Fictional products of imagination were considered equally dangerous for religious knowledge as they were for objective, rational knowledge of reality cultivated by platonic tradition. That is why fictions were considered elements of heresy in Middle Age or pure speculative discursive entities in the period of modern science arousal (Védrine, 1990). The solely exception in this respect could be considered the cultivation of Aristotelian "phantasia" in Renaissance by refined intellectuals as Marsilio Ficino or Giordano Bruno. Long ago philosophers seem to consider imagination as inappropriate for philosophical investigation of reality as it was for religious understanding of human existence or for the objective description of nature in natural sciences. However, by the end of the XX-th century a decisive mutation took place in this regard, and the term "imaginary" was considered suitable to describe the collective dynamics of

representations within communities and social networks by authors of French School like Gaston Bachelard, Gilbert Durand, Jacques Le Goff and , more recently, Jean Jacques Wunemburger. This trend increased steadily in magnitude and imaginary became a favorite subject for many historians and anthropologists preoccupied with cultural evolution and history of mentalities. In contrast with imagination, which functioned like an individual faculty of mind, imaginary refers to the social dynamics of representations within a specific community or group of people. Since its products help people to represent themselves in the middle of their own reality well-defined in cultural and scientific sense, imaginary become an indispensable element of adherence to their own collective identity. Each culture and each community, be it a scientific one, an artistic one or of other kind has its own specific set of collective representations regarding the structure of the world, the narrative pattern of its religion or its own place in history. Following the occurrence and the evolution of these representations within the main works of that community, one can identify the crucial points in its evolution. Giving all these aspects, there is no surprise that each cultural epoch, each artistic trend, each scientific theory has its own specific imaginary. Therefore, the translation from modernism to postmodernism involves profound mutations as regards the relation between imaginary and reality, especially in case of nature. Postmodern understanding of nature inherits its richness, its diversity and its locality from the very core of postmodern culture, which on his turn is less rationalistic and unitary than the modern one (Grenz, 1996). All these changes are reflected on Postmodern Garden Art as a generally favorable attitude towards mixed irregular shapes, simplicity and explicit meaning of artistic discourse, in contrast with modern preference for straight lines, angular shapes and abstract character of artistic discourse (Turner, 1996). Beyond all these, the lack of a profound spiritual meaning of life could be considered the major cultural problem of postmodern society. One of the main causes of that is represented by the real gap between the external meaning of life centered on false needs – for example the obsession of gathering things, as it is promoted by advertising culture - , and individual need for an autonomous, more profound sense of existence (Encyclopaedia Britannica, 2000). This has important social consequences as regards the specific sensitivity of the general public towards postmodern artistic discourse. “Protests against rationality and uniformity are seen, as well, in the successive waves of youth cultures and religious revivals that have marked late industrial society. Objectively, it is clear that the large-scale bureaucratic institutions of society continue to give the main direction to national life. All revolts break against their indispensability to modern society. But subjectively these institutions are incapable of satisfying the emotional and social needs of individuals. The consequence is the repeated rise of subcultures, often of bizarre mystical or hedonistic kinds, which aim in their practice to reverse the main features of modernity and which give their members a sense of participation and belonging of an almost tribal nature”(Encyclopaedia Britannica, 2000). An interesting aspect of those subcultures is represented by their local and non-local characteristics. There are big differences between modern

society and postmodern society in this respect. For example, the local specific features of different communities in the American society determined The Carnegie Commission named by the Congress to adopt the Localism Principle concerning the national strategy in media cultural policy. Localism has long been considered as one of the central guiding principles in American communications policymaking and has been a fundamental principle of broadcast even since the Radio Act of 1927 (Napoli and Philip, 2000).

## CONCLUSIONS

The collision between geographical stratification of society and its non-spatial "virtual" stratification is characteristic for postmodern period. As a consequence, contemporary aesthetic frames and aesthetic mentalities have a complex genealogy, because postmodern cultural trends combine local traditions and local usage of artistic imagination with non-local ones. To understand better such a complexity, we should not forget the work of art has a central communicational purpose: the dialogue between the individuality of the artist and the eclectic postmodern public, which is very often a non-spatial defined public. As a conclusion, recent postmodern tendencies within non-local stratification process of contemporary society determine the unique complexity and diversity of recent aesthetic trends and aesthetic mentalities that reflect in Garden Art domain the new coordinates of the relation among nature, imaginary and reality.

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# ASPECTS REGARDING THE BEHAVIOR OF SOME *LILIUM* HYBRIDS IN DIFFERENT CULTURE SYSTEMS

## ASPECTE PRIVIND COMPORTAREA UNOR HIBRIZI DE *LILIUM* ÎN DIFERITE SISTEME DE CULTURĂ

**CÂRSTEA Oana Mariana**<sup>1</sup>  
e-mail: carsteaom@yahoo.com

**Abstract:** *In the reasearch paper shown above are presented three asian hybrids of the Lilium sp.: Gironde, Lolly Pop and Crimson Pixie grown in tunnels and pots. The determinations and observations carried out on the height of the plants, the number and size of the flowers and the time needed from seeding to the occurance of the flower buds and the conclusion of the flowering process have proven that in case of pot cultures there is a reduction of the flower stems and a prolonging of the period from the occurence of the buds until the conclusion of the flowering process, especially for Gironde and Lolly Pop.*

**Key words:** *Lilium, hybrids, culture systems*

**Rezumat.** *În lucrarea de față sunt prezentați trei hibrizi asiatici de Lilium: Gironde, Lolly Pop și Crimson Pixie cultivați în solar și la ghivece. Determinările și observațiile efectuate asupra înălțimii plantelor, numărului și dimensiunii florilor și duratei de timp necesare de la plantare până la apariția bobocilor floriferi și încheierea înfloririi au demonstrat faptul că în cazul culturii la ghivece se produce o reducere a înălțimii tijelor florifere și o prelungire a perioadei de la apariția bobocilor până la încheierea înflorii, îndeosebi la Gironde și Lolly Pop.*

**Cuvinte cheie:** *genul Lilium, hibrizi, sisteme de cultură*

### INTRODUCTION

Lilies are plants that are found either in cultivars or in the local flora, which have a multiple use in different domains of activity but their main use is as decorative flowers. In the past few years, in many parts of the world, *Lilium* have gained popularity and it s a very common plant used in the flower industry as a cut flower and pot plant, because of it s distinct characteristics that include the diversity of coloration, the scent of the flowers, the capacity of keeping the flowers for a longer period of time, the capacity of endurance long transports as cut flowers (this includes the capacity of rehydration after a long transport).

Species of the *Lilium* family are common found in the Orient and in Europe. This genus comprise of species that are native to the temperate northern hemisphere, though their range extends into the northern subtropics, and can be also found in America and Africa. All the species are tall, leafy stemmed herbs that form naked or tunic-less scaly underground bulbs which are their

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

overwintering organs that will assure the vegetative multiplication. Flowers have their floral layer borne in a raceme or umbel at the tip of the stem, with six tepals spreading or reflexed, and come in a range of colors different from species to species. The form and the position of the flowers regarding the floral ax is the criteria that divide the groups into species (Şelaru, 2007):

- group of species with the flower that resembles a trumpet and which is found in a perpendicular position on the ax, group from which most of the common cultivars belong (the white lily- *Lilium candidum* L. , imperial lily-*Lilium regale* Wilson. *Lilium longiflorum* Thunb., *Lilium auratum* Lindl);
- group of species with the long wide open, peduncular flower with a pendular position regarding the ax, (*Lilium speciosum* Thunb., *Lilium tigrinum* K.G., *Lilium superbum* L.);
- group of species with the flowers assembling a goblet (*L. aurantiacum* L., *Lilium bulbiferum* L.)
- group of species with the flowers similar to a long large tube that are wide open at the superior part ,which include some species with low importance to horticulture.

In the last past years a large number of *Lilium* hybrids were introduced:

LA type hybrids ( interspecific hybrids *Lilium longiflorum* x *Lilium elegans*), Oriental hybrids or LO (as a result of a mix from *Lilium longiflorum* x *Lilium orientalis*), asian hybrids (Mareş, 2005). Studies on the species and hybrids of *Lilium* were made on the systematic aspect and morphological particularity (Mareş, 2005; Şelaru, 2007), and as well as regarding the lily physiology: biodegradation of the substances from the bulbs (Treder, 2002), physiology of the blooming condition in different temperatures and light conditions (Wilkins, 1997), the dormans stage and the maturity of the bulbs (Roh, 1999). The conventional vegetative multiplication thru bulbs, it is the main method of multiplication used in the commercial cultivars, but to satisfy the increasing demand of plant material, modern techniques of tissue and cell cultures in vitro are used as an alternative method using different explants, with different types and concentrations of growth regulators or by cryopreservation of excised meristems (Kapoor, 2008; Kumar, 2009; Roh, 2010). The use of fertilizers and growth regulators substances, also the possibility of using herbicides to control the weed infestation in the bulb production industry, is an important part of the reasearch done on lilys (Wilfert, 1999). This research paper wants to establish the possibility of growing of some *Lilium* hybrids in different culture systems in tunnels and pots, with the purpose of understanding which one of the two methods assures the best exploitation of both cut and potted flowers

## MATERIAL AND METHOD

The experiments took place in the experimental field of the Floriculture discipline of the University of Agronomic Science and Veterinary Medicine in Iasi.

The biologic material used for the establishment of the experimental field were represented by three types of Asian hybrid bulbs of *Lilium*: *Gironde*, *Lolly pop* and *Crimson pixie* (fig. 1 a, b, c).

Experiments were made in randomized blocks, in a three repetitions process, of planting 33 bulbs for each repetition. Planting in tunnels was made at a 25 cm distance between the bulbs and 15 cm deep. In pots, planting was made using one bulb ( $\varnothing$  pot =10 cm), in a mixture of garden soil and peat (3:1). Before the planting the bulbs were kept for a period of 30 minutes in 0,3% Topsin solution. The date of the establishment of the experiment was 22 of march 2011. In the tunnels no intervention of suplimentar heating was induce, and the pots wore kept in the greenhouse at a temperature of 18-24°C.

Experimental scheme shown in table 1.



Fig. 1 - Asian hybrids used in the experiment: a) *Gironde* b) *Lolly pop* c) *Crimson pixie*

Table 1

Experimental scheme

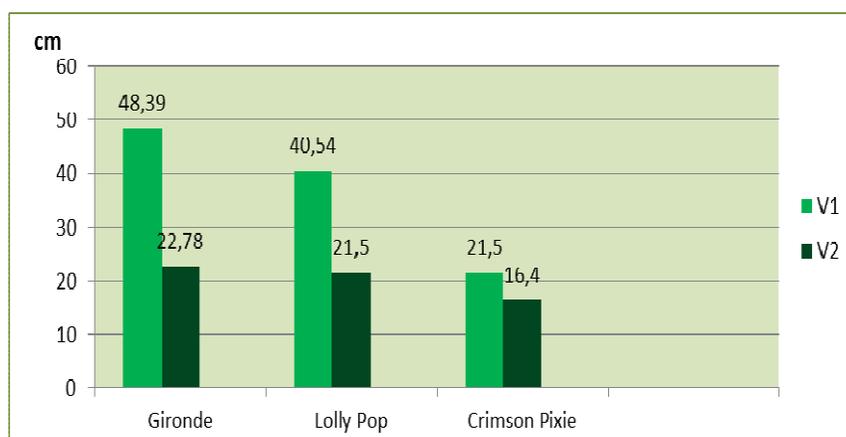
Hybrid	Variant	Specifications
<i>Gironde</i>	V <sub>1</sub>	Tunnel culture
	V <sub>2</sub>	Pot culture
<i>Lolly pop</i>	V <sub>1</sub>	Tunnel culture
	V <sub>2</sub>	Pot culture
<i>Crimson Pixie</i>	V <sub>1</sub>	Tunnel culture
	V <sub>2</sub>	Pot culture

The establishment and maintenance work was specific to every variant, in consideration to the recomanded technology for each culture system.

During the period of the experiment, determinations wore made regarding the beginning of vegetation , the lenght of the stems and the number and size of the flowers as well as the period of flowering.

## RESULTS AND DISCUSSIONS

After establishing crops in tunnel and in pots there were made determinations on height growth of floriferous stems. At 43 days after planting bulbs, at the start of appearance flowering buds, strains height was different according to variety and variant. It is indicated from the graphical representation (fig. 2) that the plants from variant V2 (grown in pots) had the tendency to reduce the height by almost 50% in *Gironde* and *Lolly pop* varieties. Thus, at *Gironde* height reduction was 53% and at *Lolly pop* 47%. For *Pixie Crimson* variety, variety with small height, the difference in height between variants is only 24%.



**Fig. 2 - Floriferous stems height (at 43 days after planting)**

Regarding the average number of flowers/plant it turns out that at *Lolly Pop* and *Crimson Pixie* varieties differences to variants average is insignificant, while at the *Gironde* variety, the number of flowers for the plants grown in tunnel was higher than for those grown in pots, the difference in relation to variants average being distinctly significant (tab. 2).

Table 2

**Number of flowers per plant**

Hybrid	Var.	No. of flowers per plant	% to the average	Difference	Significance
<i>Gironde</i> LSD 5%=0,2; LSD 1%=0,6; LSD 0.1%=1,8 unit.	V <sub>1</sub>	6,7	117,54	1,05	XX
	V <sub>2</sub>	4,6	80,70	-1,05	00
	X	5,7	100,00	-	witness
<i>Lolly Pop</i> LSD 5%=0,9; LSD 1%=2,1; LSD 0.1%=6,6 unit	V <sub>1</sub>	4,0	105,26	0,2	-
	V <sub>2</sub>	3,6	94,74	-0,2	-
	X	3,8	100,0	-	witness
<i>Crimson Pixie</i> LSD 5%=0,2; LSD 1%=0,6; LSD 0.1%=1,8 unit.	V <sub>1</sub>	3,9	102,5	0,1	-
	V <sub>2</sub>	4,1	97,5	-0,1	-
	X	4,0	100,0	-	witness

Flower size (diameter) has not recorded significant differences between the experimental variants. Even among varieties differences were not big, average values ranging between 13.2 and 11.3 cm (tab. 3).

Analyzing the dates of flowering buds appearance on the three hybrids studied, it turns out that *Lolly Pop* and *Pixie Crimson* are earlier hybrids, to which the occurrence of buds was recorded after about 60 days after planting.

At the *Gironde* hybrid the flowering buds occurred at approx. 30 days later, respectively after 76-91 days from planting, depending on the variant (tab. 4, fig. 3).

Table3

Flowers diameter					
Hybrid	Var.	Diameter (cm)	% to the average	Difference	Significance
<i>Gironde</i> LSD 5%=2,6; LSD 1%=6,0; LSD 0.1%=19,0 cm	V <sub>1</sub>	12,2	101,67	0,15	-
	V <sub>2</sub>	11,9	99,17	-0,15	-
	X	12,05	100,00	-	witness
<i>Lolly Pop</i> LSD 5%=1,6; LSD 1%=3,8; LSD 0.1%=12,0 cm	V <sub>1</sub>	11,3	97,41	-0,3	-
	V <sub>2</sub>	11,9	102,59	0,3	-
	X	11,6	100,00	-	witness
<i>Crimson Pixie</i> LSD 5%=1,1; LSD 1%=2,5; LSD 0.1%=8,0 cm	V <sub>1</sub>	13,2	105,60	0,75	-
	V <sub>2</sub>	11,7	93,60	-0,75	-
	X	12,45	100,00	-	witness

Between variants, larger differences were recorded to the *Gironde* hybrid, to which, for the plants grown in the solar (V<sub>1</sub>) were required 91 days from bulbs planting to buds occurrence, and for the plants grown in pots and kept in the greenhouse (V<sub>2</sub>), 76 days (table 4, fig. 3). Since the buds occurrence and up to the end of flowering, the time recorded was between 8 and 35 days. At all three hybrids, plants grown in pots and ended flowering later than those grown in the solar, the differences between the variants depending also on the hybrid. Thus, for *Gironde*, the difference was 6 days, for *Lolly Pop* 18 days and for *Crimson Pixie* only 3 days (tab. 4, fig. 4).

Table 4

Dates of flowering buds occurrence and duration of flowering			
Hybrid	Variant	Flowering buds occurrence	The end of flowering
<i>Gironde</i>	V <sub>1</sub>	21.06.2011	16.07.2011
	V <sub>2</sub>	6.06.2011	11.07.2011
<i>Lolly Pop</i>	V <sub>1</sub>	20.05.2011	31.05.2011
	V <sub>2</sub>	23.05.2011	21.06.2011
<i>Crimson Pixie</i>	V <sub>1</sub>	23.05.2011	31.05.2011
	V <sub>2</sub>	20.05.2011	31.05.2011

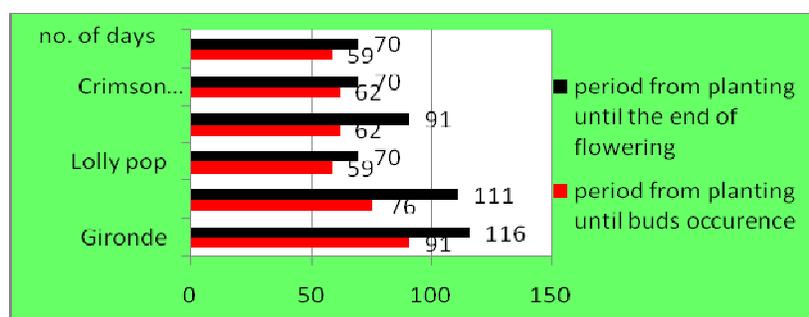
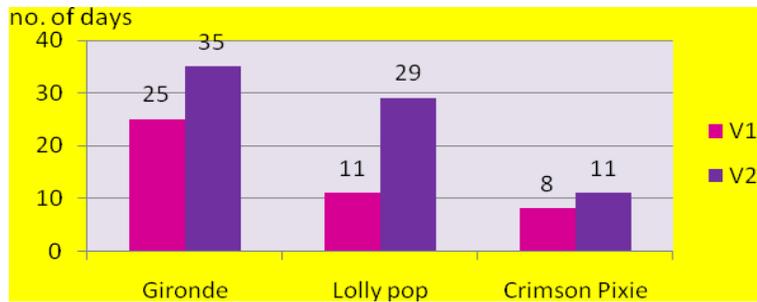


Fig. 3 - The duration from planting to flowering buds occurrence and the ending of flowering (days)



**Fig. 4** - Flowering duration(from buds occurrence until the end of flowering - days)

## CONCLUSIONS

1.Plants grown in pots recorded decreases in height growth than those grown in the tunnel (with 23 to 53%), more obvious at high varieties (*Gironde* and *Lolly Pop*).

2. Number of flowers per plant indicated distinct significant differences in favor of plants grown in the tunnel) at the *Gironde* variety.

3. Place cultivation of studied lilies had no influence on flowers size.

4. For the plants grown in pots there it is observed a longer duration recorded from the flowering buds appearance until the end of flowering, the greatest differences between the variants occurring at *Lolly Pop* (18 days) and *Gironde* (10 days).

5. The results obtained recommend using the studied hybrids both for cut flowers and as potted plants, depending on the height of floriferous stems.

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# OBSERVATIONS REGARDING THE EFFICACY OF PYRINEX 25 CS PRODUCT TO FIGHT AGAINST *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE SPECIES FROM MAIZE CROPS

## OBSERVAȚII CU PRIVIRE LA EFICACITATEA PRODUSULUI PYRINEX 25 CS ÎN COMBATAREA SPECIEI *DIABROTICA VIRGIFERA* *VIRGIFERA* LE CONTE DIN CULTURILE DE PORUMB

**BODESCU C.I.<sup>1</sup>, TĂLMACIU Nela<sup>1</sup>, TĂLMACIU M.<sup>1</sup>**

e-mail: bodescuciprianionel1978@yahoo.com

**Abstract.** *Experiments were made at INCDA Fundulea and Agricultural Research and Development of the ASAS resorts, where there were applied 1-2 treatments in a corn crop during the growing season. The treatments were applied when there was a warning, during the sign of panicle, having a density over 10 adults/square m, density determined after performing the survey and 7 adults/yellow trap nonspecific/day. In all stationary of testing, the efficiency was very good, with values between 89.4% and 90.7% at a dose of use of 1.5 l/ha of commercial product. At the untreated subject, the efficiency values were between 12.3% and 27.6% and the average in the three stationary were 19.5%. No recorded of phytotoxicity phenomena affecting crop.*

**Key words:** maize, vegetation treatment, efficacy.

**Rezumat.** *Experiențele au fost făcute la INCDA Fundulea și la Stațiunile de Cercetare-Dezvoltare Agricolă din cadrul ASAS, într-o cultură de porumb în care s-au aplicat 1-2 tratamente în cursul perioadei de vegetație. Referitor la momentul aplicării tratamentelor, acesta s-a făcut la avertizare, în perioada de mătăsire- apariția paniculului, la densități de peste 10 adulți/m<sup>2</sup>, densitate stabilită în urma efectuării de sondaje și la 7 adulți/capcană galbenă nespecifică/zi. În toate staționarele de experimentare, eficacitatea a fost foarte bună, având valori cuprinse între 89,4 % și 90,7 %, la o doză de utilizare de 1,5 l/ha de produs comercial. La martorul netratat, valorile eficacității au fost cuprinse între 12,3 % și 27,6 % iar media în cele 3 staționare a fost de 19,5 %. Nu s-au înregistrat fenomene de fitotoxicitate care să afecteze culturile.*

**Cuvinte cheie:** porumb; tratament în vegetație; eficacitate.

### INTRODUCTION

The maize is originally from Central America, cultivated today in many regions of the world as a food, industrial and forage plant, it represents together with the wheat 80% of cereal production.

According to Rosca, 2003 and 2007 in the maize crops from Romania, cause damages the polyphagia pests such as: mole cricket (*Gryllotalpa* spp.), white worms (*Scarabaeidae*), wire worms (*Elateridae*), caterpillars of ground

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

(*Noctuidae*), black worms (*Tipulidae*), slugs (*Limacidae*) and gnawers (*Cricetidae*). The seeds and the embryos are attacked by *Harpalus distinguendus* Duftsch. (the seeds bug). The plants just raised are attacked by *Pentodon idiota* Hb. (the black beetle), *Microtus* spp., *Citellus* spp. (mice, ground squirrels), *Oscinella frit* L. (the black fly of oats), *Chaetocnema aridula* Gyll. (black flea cereals), *Tanymecus dilaticollis* Gyll., *Agrotis segetum* Schiff. (eagle crops), *Diabrotica virgifera virgifera* Le Conte (western corn wormroots) etc. It is also known the attack of some pests on the roots, being quoted as pests, the nematodes or the aphid *Tetraneura ulmi* L. (pink lice of the gramineae roots) etc. During the period of formation of grains or ripening, the maize it is also attacked by *Sitotroga cerealella* Oliv. (moth cereals), *Apamea sordens* Hfn. (eagle wheat grains) etc.

In the present paper are presented some aspects related with the pest *Diabrotica virgifera virgifera* Le Conte- western corn wormroots.

## MATERIAL AND METHOD

In 2011 have been made tests of the Pyrinex 25 CS product in combating the species *Diabrotica virgifera virgifera* Le Conte from maize crops, having as active substance chlorpyrifos product 250 g/l, conditioning form CS, the producing company is Makhtesim Agan and the experimentation place is INCDA Fundulea and the Agriculture Development Research Stations from the network ASAS, namely: SCDA Lovrin, Grabați and Turda.

The location of the experience was made in the form of randomized blocks containing six repetitions, the parcel size is about 100 m<sup>2</sup>. It have been applied 1-2 treatments between July 29th – August 7th using a dose of 1,5 l/ha. We mention that the climatic conditions in the year of experimentations favored the evolution of *Diabrotica virgifera virgifera* Le Conte pest, the observation date beeing at 24-48 hours after the application of the treatment.

Concerning the moment of the treatment application, this was done at warning, in the silk period - the appearance of panicle, at densities of more than 10 adults/m<sup>2</sup>, density determined after performing surveys and at 7 adults/ yellow nonspecific trap/day. The assessments of the results were made by comparison in those 3 stations, making also their average but in comparison with the untreated control.

## RESULTS AND DISCUSSIONS

Short presentation of the biology and ecology of the pest. Bărbulescu (2000) based on an extensive specialized literature makes an excellent summary of the biology and ecology of the pest showing that the species *Diabrotica virgifera virgifera* Le Conte has both in USA, in the maize belt, and in Yugoslavia, Hungary and in Romania the same biology (Grozea, 2000). The pest has one generation/year, winters in the egg stage in eggs that could be found from the middle of July until the end of June from the next year (about 10 months). Gentle winters, without precipitations and strong winds, weeds and vegetable remains favor the survival of eggs. The hatching of eggs and the occurrence of larva starts at the middle of May and ends at the beginning of August. The first pupas appear at the end of June and can be found until the end of August, when appear the adults. The adults are present in the

maize crops from August until October. The mass appearance is registered starting with the middle of July and continues in August. They are more active 2-3 hours before sunrise and 2-3 hours before sunset. The first adults that are mating are found at 7 days from the appearance. The laying eggs begin at the middle of July and reaches maximum values in August. A female can lay 400-1087 eggs, especially at the base of maize plant and in the cracks soil, to the depth of 35 cm, the majority up to 15 cm. For the normal development, in order to cross the period of, are necessary two weeks with temperatures above 11°C. The laying eggs take place almost exclusively in maize crops. The exposure of eggs immediately after laying at a cold period, without a pre-cooling prior period is harmful for eggs, the survival decrease with the long exposure at -5°C and is about 50% in conditions of 7 days at -10°C, the egg being destroyed at -15°C or lower.

The fight against pest is based on application of chemical method. In practice, are applied soil insecticides to combat larva, but most of the insecticides applied during seeding are preventive, without knowing the density of the pest, not fully combat the pest, annually from treated fields at sowing or at the first breeding, appear adults that spread in crop.

The fight against adults is performed only in certain years or when is followed the combat of the pest on large areas, being based on monitoring, knowing the biology of the pest and economic threshold of damage (PED).

In this paper are presented some experimental results in combating the adults of *Diabrotica virgifera virgifera* Le Conte species. The moment of application the treatment, was on warning, in the silk period - the appearance of panicle, at densities of more than 10 adults/m<sup>2</sup>, density determined after performing surveys and at 7 adults/ yellow nonspecific trap/day.

The assessments of the results were made by comparison in those 3 stations, making also their average but in comparison with the untreated control.

In table 1 are presented the data obtained for combating the adults of *Diabrotica virgifera virgifera* Le Conte (western worm of maize) in maize crops with the Pyrinex 25 CS product, based on bifenthrin, by splashing in vegetation.

Analyzing the data from the table, it is found that Pyrinex 25 CS product applied in dose of 1,5 l/ha, has determined a high efficacy, in all the 3 experimental points – Lovrin (County Timiș), Grabați (County Caraș Severin) and Turda (County Cluj). On average, the efficacy was 89,4%, in terms of medium densities of 19,5 adults/m<sup>2</sup>. In those 3 stations the situations is: at Lovrin, the efficacy was 90,7%, being the highest one, at Grabați, the efficacy was 87,9%, was the lowest, and at Turda the efficacy was 89,4% beeing between the other two amounts, the highest one and the lowest one. The highest density of the adults of *Diabrotica virgifera virgifera* Le Conte species was recorded at Grabați, 27,6 adults/m<sup>2</sup>, in average followed by Lovrinmwith 18,5 adults/m<sup>2</sup> and Turda, were was registered the lowesr density of adults – 12,3 adults/m<sup>2</sup>.

It can be appreciated that, through the treatment applied with the Pyrinex 25 CS product it has been assured high level of protection against the attack of

adults of *Diabrotica virgifera virgifera*, in maize crops, fact conferment by the results obtained in batch verification, in terms of productions.

There were no registered phytotoxic phenomenon.

Table 1

**The efficacy of Pyrinex 25 CS product in fight against *Diabrotica virgifera virgifera* Le Conte species**

Version	Dose	Efficacy %			
		Lovrin	Grabați	Turda	Average
Pyrinex 25 CS	1,5 l/ha	90,7	87,9	89,4	89,4
Untreated(specimens/m <sup>2</sup> )		18,5	27,6	12,3	19,5

## CONCLUSIONS

1. The experiments made at INCDA Fundulea and at the Agriculture Development Research Stations part of the ASAS, in a maize crop where were applied 1-2 treatments during the vegetation period.

2. The moment of application of treatments, this was made on warning, in silk period- the appearance of panicle, at densities of more than 10 adults/m<sup>2</sup>, density determined after performing surveys and at 7 adults/ yellow nonspecific trap/day.

3. In all the experimental stations, the efficacy was very good, with values between 89,4% and 90,7%, at a dose utilization of 1,5 l/ha of commercial product.

4. At the untreated control, the values of the efficacy were between 12,3% and 27,6%, and the average in those 3 stations was 19,5%.

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# OBSERVATIONS REGARDING THE EFFICACY OF THE SEEDOPRID 600 FS PRODUCT TO COMBAT *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE SPECIES FROM MAIZE CROPS

## OBSERVAȚII CU PRIVIRE LA EFICACITATEA PRODUSULUI SEEDOPRID 600 FS ÎN COMBATAREA SPECIEI *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE DIN CULTURILE DE PORUMB

**BODESCU C.I.<sup>1</sup>, TĂLMACIU Nela<sup>1</sup>, TĂLMACIU M.<sup>1</sup>**  
e-mail: bodescuciprianionel1978@yahoo.com

**Abstract.** *Experiments have been organized at INCDA Fundulea, at the Agriculture Development Research Stations Livada, Lovrin and Oradea. The efficacy of the Seedoprid 600 FS product was analysed in comparison with the Cruiser 350 FS product, for the seed treatment at a dose of 10 l/t and 18 l/t. The assesment of the efficacy was made in comparaisn with the version control, without seed treatment. This was very good at those two products, the average being 7,37 at Seedoprid 600 FS product and 7,17% at Cruiser 350 FS product. At the untreated control, the frecquency of the attack was about 23,36%, and there are significantly loss of production. There weren't recorded any phytotoxicity phenomena that affects the crops.*

**Key words:** maize, seed treatment, efficacy

**Rezumat.** *Experiențele au fost organizate în cadrul INCDA Fundulea, la Stațiunile de Cercetare și Dezvoltare Agricolă Livada, Lovrin și Oradea. Eficacitatea produsului Seedoprid 600 FS a fost analizată comparativ cu produsul Cruiser 350 FS, pentru tratament la sămânță în doze de 10 l/t, respectiv 18 l/t. Aprecierea eficacității s-a făcut și comparativ cu varianta martor, fără tratament la sămânță. Aceasta a fost foarte bună, la cele două produse, media fiind de 7,37 la produsul Seedoprid 600 FS și de 7,17 % la produsul Cruiser 350 FS. La martorul netratat, frecvența atacului a fost de 23,36 %, existând pierderi importante de producție. Nu s-au înregistrat fenomene de fitotoxicitate care să afecteze culturile.*

**Cuvinte cheie:** porumb; tratament la sămânță; eficacitate

### INTRODUCTION

At those approximately 25 species of pests economically important from Romania, it is to add, from the year 1996, *Diabrotica virgifera virgifera* Le Conte species – the western corn rootworm (Roșca, 2004).

In USA, the pest is considered as one of the most important 4 pests of maize crops. The losses caused in USA by genus are between 60 and 85 million USD/year. The cost of pesticides applied for combating larva or adults to which is added the crop losses due to the attack of the pest, is around 1000 million USD.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

The species is signaled in Romania from 1996 and on the territory of Romania in Nădlac, county Arad. So far, it has not produced obvious damages, but there are all chances that in the coming years, the pest to become one of the main factors of drastic decrease in maize yields, limited even on maize crop (Grozea, 2003).

The pest was detected in county Timiș, in 1997, when Bărbulescu (2000) there were started the adults flight tracking activities. First bent plants, features produced by the larva attack were in 1999, near Jimbolia, in Grabași, county Timiș (Rosca, 2004).

Gradually, the western corn rootworm advanced to south, center and north of the country. Thus, in 1997, this was present in the counties Arad, Timiș, Caraș-Severin and Mehedinți. In 1998, was signaled the presence of pest in others counties, such as: Bihor, Hunedoara, in Dolj in 1999, and in 2000 in Satu Mare, Sălaj, Alba, Gorj and Olt. The number of catches in yellow traps, Multigarb, Cucurbitacin and with sexual pheromone, from an average of 181 individuals in 1997 to 654,3 in 2000.

## **MATERIAL AND METHOD**

The experiments have been organized at INCDA Fundulea, at the Agriculture Development Research Stations Livada, Lovrin and Oradea. The efficacy of the the Seedoprid 600 FS product was analysed in comparasion with the Cruiser 350 FS product, for the seed treatment at a dose of 10 l/t and 18 l/t. The active substance of the Seedoprid 600 FS product is imidacloprid 600g/l, conditioning form FS, the producing company is Makhtesim Agan.

The tests were performed in 2011, when there were made a total number of 3 tests in those 3 stations. SCDA Livada, SCDA Lovrin and SCDA Oradea on a hybrid of maize, Fundulea 376. To carry out the tests, it has been organized an experiment in randomized blocks, the size of experimental parcel was about 100 m<sup>2</sup>, it was made with 2-3 days before maize seeding, which was made between April 24th – May 13rd.

The observations have been taken throughout the vegetation period, being examined the plants with symptoms of “Gooseneck” and by determining the mark on the IOWA scale (an undamaged plant – 6 plants strongly attacked). In terms of product application equipment on seeds, it was used a porzolator with a capacity of 5 kg, and the seeding has been done manually.

The climatic conditions favored the evolutions of the pest, the experiments being placed in conditions of monoculture maize, with moderate infestations, expressed by an average percent in those 3 stations of 23,36 % plants with symptoms “Gooseneck”, Oradea (28,80%), Lovrin (13,35%) and Livada (27,93) and through mark 4,33 on IOWA scale, 4,88 (Oradea), 3,35 (Lovrin) and 4,76 (Livada).

## **RESULTS AND DISCUSSIONS**

An essential role in establishing the strategy to combat the western corn rootworm has the forecast of pest occurrence, which is based on the number of adults, eggs and larva, taking into consideration both the density of the pest and climatic conditions, especially the cultivation system in the area.

It is emphasized in this sense, especially, the high capacity of extension of the pest, similar to the butterflies. Reported for the first time in Europe, in Yugoslavia at Surcin in July 1992, the pest is signaled in 1996, to more than 100

km distance, pointing in this respect that *Hyphantria cunea* species introduced in August 1940 at Budapest, came after 8 years at Subotica, at a distance of 100 km from the pointing of departure. The pest monitoring is made watching either adults or larva. For this are used different methods, yellow sticky baits, special traps, extractant plants and sexual pheromones (Rosca and Bărbulescu, 1993).

In this paper, are presented the results obtained in combating *Diabrotica virgifera virgifera* Le Conte species performed by treatment of seeds. In tables 1 and 2 are listed the results obtained from biological testing corn with the Seedoprid 600 FS product based on imidacloprid 600g/l.

Table 1 shows that the product Seedoprid 600 FS applied on a dose of 10 l/t, determined a significant reduction of larva attack of western corn rootworm on plants, expressed through the frequency of plants strongly attacked, in all those three experimental points, respectively Oradea (from 28,80 to 8,89%), Lovrin (from 13,35 to 4,06%) and Livada (from 27,93 to 9,17%). On average, this reduction of the attack, from 23,36% in untreated version to 7,37%, expressed as frequency of attacked plants, identified by characteristic symptom, „Gooseneck”, can be expressed by an efficiency of 68,46%, being similar to standard version Cruiser 350 FS (69,31%).

Table 1

**FS 600 Seedoprid efficacy in fighting *Diabrotica virgifera virgifera* Le Conte species from maize crops, expressed by the frequency of attacked plants**

Version	Dose	Frequency of attacked plants %			
		Oradea	Lovrin	Livada	Average
Seedoprid 600 FS	10 l/t	8,69	4,06	9,17	7,37
Cruiser 350 FS	18,0l/t	8,35	4,07	9,11	7,17
Untreated		28,80	13,35	27,93	23,36

Table 2 shows the efficacy analysis of Seedoprid FS 600, by recording the level of pest attack on the root, expressed by IOWA scale (in grades from 1 to 6), the maximum attack is 6. This parameter indicates a satisfactory level of potency, expressed by reducing the attack, from 4,88 to 1,87 (Oradea), from 3,35 to 1,77 (Lovrin) and 4,76 to 1,23 (Livada).

The average grade of 4,33 on the IOWA scale at the untreated version and 1,61, on the same scale, in the experimental field can be expressed by an efficiency of 63,05%, being similar to the standard Cruiser 350 FS (63,38%).

Table 2

**FS 600 Seedoprid efficacy in fighting *Diabrotica virgifera virgifera* Le Conte species from maize crops expressed by the degree of attack on the root**

Version	Dose	Degree of attack on IOWA scale 1-6			
		Oradea	Lovrin	Livada	Average
Seedoprid 600 FS	10 l/t	1,87	1,77	1,23	1,61
Cruiser 350 FS	18,0l/t	1,95	1,64	1,19	1,59
Untreated		4,88	3,35	4,76	4,33

From the data results a better potency in combating Seedoprid FS 600, *Diabrotica virgifera virgifera* Le Conte species (western corn rootworm), from corn crops, thus ensuring an adequate protection, respectively a degree of attack under 2,5 on IOWA scale, considered PED.

Summarizing the results presented in the two tables, concerned the value of 68,46%, which represents the average effective rate expressed through the frequency of strongly attacked plants, identified by characteristic symptom, „Gooseneck”, and the value of 63,05%, which is the average efficiency expressed by the attack on the root (highlighted on IOWA scale), results an overall average of 65,76% which is the effectiveness of maize seed treatment with the Seedoprid 600 FS product providing satisfactory protection on the maize crop, to the attack of *Diabrotica virgifera virgifera* Le Conte species (western corn rootworm), representing a protection solution in situations of growing corn in the first year of monoculture. This experimental results are also confirmed by the test results obtained in batch verification in production conditions. We also mention that there were't phytotoxicity phenomena to affect the crops.

## CONCLUSIONS

1. Pest *Diabrotica virgifera virgifera* Le Conte (western corn rootworm) reported in Romania in 1997 in Nădlac, county Arad is spreading quite rapidly, occupying in our country growing areas, although preventive measures are taken.

2. The experiences organized for pest control by seed treatment with FS 600 Seedoprid product have given good results compared with standard product version Cruiser 350 FS and with the untreated version.

3. Effectiveness of the seed treatment product when using Seedoprid FS 600 was good or very good, the average frequency of the attacked plants being 7,37 compared with the standard product version Cruiser 350 FS and the untreated control, of 23,36%.

4. Regarding the degree of the attack on roots (expressed by IOWA scale attack notes 1-6) had low values of 1,23 (Livada) to 1.83 (Oradea) compared with the standard product which had values of 1,19 (Livada), 1,95 (Oradea). The untreated control, took notes on the same scale, values of 3,35 in Lovrin, 4,76 in Livada stationary, 4,88 Oradea stationary.

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**Vasile VÎNTU**

**Tehnoredactori:**

**Liliana ROTARU  
Liliana Elena CHELARIU**

**Corectori:**

**Lucia DRAGHIA  
Liliana ROTARU  
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**Vasile VÎNTU**

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**Lucia DRAGHIA  
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