ISSN–L=1454-7376
(Print)-ISSN 1454-7376
(Online)=ISSN 2069-8275
(CD-ROM) = ISSN 2069 – 847X

UNIVERSITATEA DE ŞTIINȚE AGRICOLE ŞI MEDICINĂ VETERINARĂ "ION IONESCU DE LA BRAD" IAŞI

LUCRĂRI ŞTIINȚIFICE

Vol. 56

NR. 1

SERIA HORTICULTURĂ

EDITURA "ION IONESCU DE LA BRAD"

IAŞI 2013

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ISSN–L=1454-7376
(Print)-ISSN 1454-7376
(Online)=ISSN 2069-8275
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ISSN–L=1454-7376
(Print)-ISSN 1454-7376
(Online)=ISSN 2069-8275
(CD-ROM) = ISSN 2069 – 847X

CONTENT

CUPRINS

NICOLAE BUCUR'S CONTRIBUTION TO CREATE AN ORIGINAL SYSTEM OF HALOPHYTES CLASSIFICATION, AN EXAMPLE OF HOLISTIC ECOLOGICAL VISION

CONTRIBUȚIA LUI NICOLAE BUCUR LA REALIZAREA UNUI SISTEM ORIGINAL DE CLASIFICARE A HALOFITELOR, UN EXEMPLU DE VIZIUNE ECOLOGICĂ HOLISTICĂ

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Abstract. *Halophytes definition and classifications still represent a matter of debate and even a controversial issue. Existing classifications, belonging either to Romanian or foreign researchers are generally based only on subjective or arbitrary criteria. Sometimes, several classifications have been adapted and reformulated starting from previous classifications. Nicolae Bucur' results related to salt-affinity of plants vegetating in salinized meadows led to a new classification of plants, according to their preference for soil salinity. This classification, supported by objective, strictly quantifiable criteria is, as far as we know, the first and perhaps the single existing worldwide. The aim of this paper is to reveal Bucur's significant contribution to halophytes classifications, emphasizing its great potential in the field of international literature referring on halophytes. Moreover, we intend to promote in the scientific media his entire ecological vision about halophytes; unfortunately, we found that, until now, it is almost unknown to the great majority of scientists dealing with halophytes.*
Key words: *halophytes, salinity, ecology*

Rezumat. *Definiția şi clasificarea halofitelor reprezintă un subiect încă intens disputat şi chiar controversat. Majoritatea clasificărilor existente, fie ale autorilor români, fie străini, sunt bazate pe criterii pur subiective sau arbitrare. În alte situații, unele clasificări sunt doar preluări şi adaptări ale unor sisteme deja existente. Rezultatele lui Nicolae Bucur şi colaboratorilor referitoare la halofilia unor plante din pășuni şi fânețe de sărătură au condus la crearea unui nou sistem de clasificare a plantelor în funcție de afinitatea pentru salinitatea solului. Această clasificare, bazată deci pe criterii obiective, strict cuantificabile, este, din ceea ce cunoaştem, printre singurele de acest fel din lume. Scopul acestei lucrări este de a releva importanța contribuției lui Bucur la clasificarea halofitelor, accentuând rolul acesteia în literatura mondială de specialitate. În acest mod, se doreşte promovarea întregii viziuni ecologice despre halofite a lui Nicolae Bucur în comunitatea ştiințifică internațională, câtă vreme aceasta este, din nefericire, practic necunoscută.*
Cuvinte cheie: *halofite, salinitate, ecologie*

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INTRODUCTION

Halophytes represent a complex and heterogeneous ecological group of plants, including very different species in terms of habitats, taxonomic diversity and adaptive features (Grigore, 2008a, 2008b; 2012; Grigore and Toma, 2010 a, 2010b).

Although they have certainly been recognized since the time of Goethe (ca. 1790, cf. Flowers et al, 1986), halophytes were taken into scientific attention through the promoting papers of Schimper (1903) and especially Warming (1897; 1909); however, even in nowadays there are many controversies regarding halophytes' definition and classifications (Grigore, 2008b; Grigore and Toma, 2010a).

All these issues related to their definitions and classifications, ranging from semantic to physiological level, have been recently reviewed and largely discussed (Grigore, 2012). In this mentioned work, 45 definitions of halophytes are debated, while in others (Grigore, 2008b, Grigore and Toma, 2010a), the existing classifications systems are critically commented.

In the present work, we try to discuss Nicolae Bucur's contribution to create an original classification system of halophytes; in addition, our intention is to find its place among existing classifications – formulated before, and especially after that proposed by Bucur and its colleagues.

It is not our intention to deal with Bucur's biography or with its achievements in the soil science area or academic field. Those interested in could address to other papers (Cotea, 2002). Based on our experience in halophytes area, we try to properly place the results obtained by Bucur in the frame of Romanian botanical literature and, especially in that from abroad, which is often so indifferent to Romanian scientific accomplishments.

MATERIAL AND METHODS

For subsequent discussions regarding the Bucur's contribution for developing a system of halophytes classification, we carefully analyzed its papers (Bucur et al., 1957, 1960, 1961), as well the entire literature existing on our disposal, both from Romania and from abroad (Grigore, 2008a, 2008b; 2012; Grigore and Toma, 2010a, 2010b). The last mentioned has been used as a comparative element and as a general historic and chronologic frame, where the Bucur's results were considered. Attention should be paid that the syntagm "Nicolae Bucur's contribution" is being used for didactic reasons, in order to facilitate the text style. In fact, the papers we are discussing about are the results of a collective work, where also activated other researchers, Bucur's collaborators.

RESULTS AND DISCUSSIONS

Existing halophytes classifications, until that proposed by Bucur (1957) are generally based on arbitrary, subjective criteria (Grigore, 2012); this situation is true for the papers worldwide. Despite that several classification systems may be based on quantifiable, numerical criteria, their ecological value is still a matter of debate. This is because some salinity thresholds proposed for different groups of halophytes are chosen purely on descriptive values, and not on experimental

research. Moreover, it is well known that in nature, ecological factors (soil salinity) are not constant, but they are continuously changing, showing the interrelations established between environmental factors (Grigore and Toma, 2010a). In this category, we can consider several papers (Stocker, 1928; Iversen, 1936; Van Eijk, 1939; Chapman, 1942), which delineate their classifications especially considering the NaCl concentration, as a criterion for various groups of halophytes.

The Romanian classic classifications until that created by Bucur are not based on numerical tolerance thresholds; they are mainly derived from intuition, ecological vision or large professional experience of some botanists. For instance, Guşuleac (1933) provides a halophytes classification depending by „*natural colonization of salinized areas with plants"*; Prodan (1939) classify plants from saline habitats in three categories, taking into account „*the way in which plants support salt"*. Ţopa (1939), in its PhD thesis, chooses as a criterion „*the behavior of plants in relation to salinized environments*". It is very important to underline Ţopa's classification (1939), taken then into attention in 1954; this was considered the most representative and intensely cited classification in Romanian botanical field. We emphasized, several times that all further classifications except for Bucur's, represent, in fact, takes on Ţopa's systems, and sometimes slightly adaptations (Grigore, 2012). Thus, Ţopa (1939), classifies halophytes in: *obligatory, preferential, supporting and accidental*.

Ţopa's classification represents a pivotal point in the entire Romanian botanical literature referring on halophytes; it is, as far as we know, the single paper cited in the works from abroad (Waisel, 1972). However, if comparing with Bucur's classification, a key-explanation must be delineated. In a footnote of its PhD thesis, Ţopa (1939) cited several Romanian and foreign authors, who used in their classifications some terms also found in the Ţopa's classification. Of course, this is not a discussion about origin and originality of its system and associated nomenclature, but it is a very important observation in the entire context when dealing with Bucur's classification.

Bucur's classification (1957) is astonishing, because it is the logic and natural result of scientific activity that is impressive through its vision, conception and harmonious way in which the obtained data are correlated and interpreted. Bucur investigated the salinity thresholds for over 400 species vegetating in salinized meadows and pastures from Jijia-Bahlui depression; in this way, the obtained results, and the derived classification have a high fidelity and consistency. Due to these features, the study conducted by Bucur (1957, 1960, and 1961) is the first of this kind from Romania, and, as far as we know, even the first from worldwide.

For establishing the salt-affinity of species belonging to plant associations with halophytes, the authors used two investigation methods. The first is based on the variation of plant biomass in accordance to salinity changes in the rhizosphere; this method has been used for establishing salinity tolerance for plants cultivated on salinized areas, without irrigation. The second method is

based on the variation of species frequency in the plant communities from salinized meadows.

After applying these methods and obtaining the results (salinity thresholds) for each species, several logic and interesting conclusions have been drawn; these actually offer valuable data about the ecology of species. Thus:

1. In several species, the biomass increases according to the increasing soil salinity in the rhizosphere; here are described two sub-groups.

2. In other species, the biomass decreases according to the increasing soil salinity nearby the roots; two sub-groups are also described.

But the authors of this study go further with their deductions. Briefly, salt plants are divided in:

a. obligatory halophytes (strictly halophytes, or halophytes); plants that grow only in saline environments: *Salicornia herbacea, Salsola soda, Atriplex hastata, Plantago schwarzenbergiana, Petrosimonia triandra*;

b. facultative halophytes (adaptable halophytes, plants adaptable to salinity); species that develop both in saline habitats and in normal soils. In saline soils, they have a fragile development and can desiccate faster, during dry season or severe droughts: *Lepidium ruderale, Poa bulbosa, Matricaria chamomilla;*

c.halo-phobous: plants whose biomass decreased according to increasing soil salinity.

Using the bio-ecological criterion, plants vegetating on saline soils are divided in:

I. Halophytes (plants vegetating on saline environments).

1) Euhalophytes - halophytes strictly adapted to salinity (strictly *obligate* to salinity) are *exclusively preferential* and grow *only* on salinized environments, with the entire or a part of radicular system, both as seedlings and as mature plants.

2) Neohalophytes - plants able to adapt to salinity; plants to be adapted to halophytic environment; they are *supporting* and *preferential*, living both on non-salinized and salinized media, with the entire or a part of radicular system.

II. Non-halophytes (plants that not grow on saline environments).

They are plants non-adapted to salinized media, non-tolerant to high concentrations of salinity. In relation to concentrations more than 30-40 % milligrams of soluble salts, they could be tolerant and preferential.

The offered explanations are so logical land clearly expressed, that we were able to project an integrated system of equivalency (Grigore, 2008a) between Bucur's system and those proposed by Prodan (1939) and Ţopa (1939).

Bucur's classification is created in an ecological integrative (holistic) context; albeit soil scientist, in his background, Bucur understood that in such classifications the importance of a single environmental factor (soil salinity) must not to be overestimated. Moreover, he emphasized that in nature do not exist "pure" forms of obligatory halophytes or non-halophytes, but there is a continuum of "intermediary" forms, which can vegetate closely related to ecological factors.

A unique and original character of this classification is conferred by the

fact that for plants with different degrees of salt-affinity (euhalophytes, neohalophytes) other ecological factors (apart from soil salinity) are also associated. Thus, the following factors are also considered: the air and soil temperature, light, soil chemical reaction and soil humidity, as secondary factor. In this way, detailed ecological profiles of many species of euhalophytes and neohalophytes are being advanced; therefore, these are described in relation to their preferences for other environmental factors, not only for soil salinity.

As far as we know, in this manner, the most logical and complete system of halophytes classification has been created in the history of Romanian botany. This is as important, as it is derived from the analysis of a very large number of species and their relation with environmental factors.

Actually, the halophytes classification was not the proper goal of study, but rather a natural consequence of obtained results. Unfortunately, this contribution to ecology of halophytes is generally almost completely unknown to scientific literature from abroad. Surprisingly, no other foreign paper consulted by us is as pertinent as these papers really are; actually, we can consider the research conducted by Bucur as a monograph of halophytes ecology. In addition, we can assert that the Bucur's results are less familiar even for the Romanian literature.

The single Romanian classification of halophytes occasionally quoted in abroad literature (Waisel, 1972), is hat of Ţopa (1939); however, as already stated above and in the light of new clarifications, is a matter of debate if this classification is still the most relevant for Romanian botanical literature. Nevertheless, Bucur's work and his classification have to be further promoted and commented in large and diverse scientific fields, since the international scientific community might be receptive and interested in these original contributions (Flowers, personal communication).

CONCLUSIONS

Classification of halophytes, made by Bucur represents for Romanian botany a pivotal moment; this actually opened a new and modern way to deal with an ecological group of plants in an integrative manner. The classification is completely original and, as far as we know, it is among the fewest worldwide. Unfortunately, despite the earlier occurrence of results, the language (Romanian) in which the papers have been written and the limitations of scientific data exchange (imposed by the historical context) had an unexpected, unfavorable effect. This unique monograph about ecology of halophytes remained, in a large extent, undiscovered and un-promoted in international scientific media.

Further comments, underlying the importance of Bucur's results in the international frame of soil science and ecology will strength the prolific value of this Romanian contribution.

REFERENCES

1. **Bucur N., Dobrescu C., Turcu Gh., Lixandru Gh., Teşu C., Dumbravă I., Afusoaie D**., **1957** – Contribuţii la studiul halofiliei plantelor din păşuni şi fânețe de sărătură din Depresiunea Jijia-Bahlui (partea a I-a). Stud. şi Cerc. (Biol. şi Şt. Agr.), Acad. R.P.Române., filiala **Iaşi, 8, 2, p. 277**-317
2. **Bucur N., Dobrescu C., Turcu Gh., Lixandru Gh., Teşu C**., **1960** – Contribuţii la studiul halofiliei plantelor din păşuni şi fânețe de sărătură din Depresiunea Jijia-Bahlui (partea a II-a). Stud. şi Cerc. (Biol. şi Şt. Agr.), Acad. R.P. Române., filiala Iaşi, 11, p. 2 333-347
3. **Bucur N., Dobrescu C., Turcu Gh., Lixandru Gh., Teşu C**., **1961** – Contribuţii la studiul halofiliei plantelor din păşuni şi fânețe de sărătură din Depresiunea Jijia-Bahlui (partea a III-a). Stud. şi Cerc.(Biol. şi Şt. Agr.), Acad. R.P. Române, filiala Iaşi, 12, 1, p. 169-190
4. **Chapman V. J**. , **1942** – The new perspective in the halophytes. Quart. Rev. Biol., 17, 4, p. 291-311
5. **Cotea D**. **V**., **2002** – Nicolae Bucur (1910-1969), personalitate marcantă a ştiinței agronomice româneşti. În *Profiluri în timp*, Edit. Cantes, p. 112-116
6. **Flowers T.J., Hajibagheri M.A., Clipson N.J.W**., **1986** – Halophytes. Quart. Rev. Biol., 61, p. 313-337
7. **Grigore M. N**., **2008a** - *Halofitotaxonomia. Lista plantelor de sărătură din România.* Edit. Pim, Iaşi
8. **Grigore M. N**., **2008b** – *Introducere în Halofitologie. Elemente de anatomie integrativă*. Edit. Pim, Iaşi
9. **Grigore M. N**., **2012** – *Romanian salt tolerant plants. Taxonomy and Ecology*. Edit. Tehnopress, Iasi
10. **Grigore M. N., Toma C**., **2010a** - *Halofitele. Aspecte de anatomie ecologică*. Edit. Univ. „Al. I. Cuza", Iaşi
11. **Grigore M. N., Toma C., 2010b** - *Structuri secretoare de săruri la halofite. O abordare integrativă.* Edit. Academiei Române, Bucureşti
12. **Guşuleac M**., **1933** – *Urme de vegetație halofilă în Bucovina*. Bul. Fac. Şt. Cernăuți, 7, 1-2, p. 329-339
13. **Iversen J., 1936** - Biologische Pflanzentypen als Hilfsmittel in der Vegetationsforschung. Dissertation. Medd. fra Skalling Laboratoriet, Copenhagen
14. **Prodan I**., **1939** – *Flora pentru determinarea şi descrierea plantelor ce cresc în România*, *2* (ediția a II-a), Ed. Cartea Românească, Cluj
15. **Schimper A. F.W**., **1903** - *Plant geography upon a physiological basis*. Clarendon Press, Oxford
16. **Stocker O., 1928** – Das Halophytenproblem. Ergeb. Biol., 3, p. 265-353
17. **Ţopa E., 1939** – *Vegetația halofitelor din nordul României în legătură cu cea din restul țării.* Bul. Fac. Şt. Cernăuți, 13, p. 1-78 (+ planşe)
18. **Van Eijk M**., **1939** – Analyse der Wirkung des NaCl auf die Entwicklung Sukkulenze und Transpiration bei *Salicornia herbacea*, sowie Untersuchungen über den Einfluss der Salzaufnahme auf die Wurzelatmung bei *Aster tripolium.* Rec. Trav. Bot. Neerl., 36, p. 559-657
19. **Waisel Y**., **1972** – *Biology of halophytes*. Academic Press, New York, London
20. **Warming E**., **1897** – Halophyt-studier. D. Kgl. Danske Vidensk. Selsk. Skr., 6, Raekke, naturvidenskabeling og mathematisk Afd. VIII, 4, p. 173-272
21. **Warming E**., **1909** – *Oecology of Plants. An introduction to the study of plant-communities.* Clarendon Press, Oxford

HISTO-ANATOMICAL ASPECTS REFERRING TO THE VEGETATIVE ORGANS ON SOME HALOPHYTES FROM ROMANIA

ASPECTE HISTO-ANATOMICE REFERITOARE LA ORGANELE VEGETATIVE ALE UNOR SPECII DE HALOFITE DIN ROMÂNIA

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Abstract. *The vegetative organs of halophyte species from Romanian flora have been histo-anatomically investigated in this study. Limonium gmelinii (Willd.) O. Kuntze (Plumbaginaceae), Bassia sedoides (Pall.) Asch. (Chenopodiaceae) and Spergularia media (L.) C. Presl (Caryophyllaceae) species have been collected and their organs subjected to standard procedure used in anatomical investigation. These species were collected from different saline habitats from Dobrogea. In this work, anatomical features were described and some peculiar adaptations were also evidenced: successive cambia phenomenon, succulence and typical salt glands. These adaptations found in halophytes organs attest the affinity with botanical families, and the very close relationships between plants and environmental conditions.*
Key words: *halophytes, salt glands, succulence, adaptation.*

Rezumat. *În acest studiu, am investigat din punct de vedere anatomic organele vegetative de la câteva specii de halofite din România. Speciile Limonium gmelinii (Willd.) O. Kuntze (Plumbaginaceae), Bassia sedoides (Pall.) Asch. (Chenopodiaceae) şi Spergularia media (L.) C. Presl (Caryophyllaceae) au fost colectate, iar organele lor supuse procedurii standard folosite în investigaţiile de anatomie vegetală. Speciile au fost colectate din diferite habitate salinizate din Dobrogea. În această lucrare am descris trăsăturile anatomice ale organelor vegetative evidenţiind unele adaptări particulare: fenomenul de policambie, suculenţa, glande saline tipice. Aceste adaptări atestă afinitatea speciilor de halofite faţă de familiile botanice, precum şi strânsa inter-relaţie dintre plante şi factorii de mediu.*
Cuvinte cheie: *halofite, glande saline, suculenţă, adaptare.*

INTRODUCTION

Plants that naturally grow on soils affected by salinity have developed over time a variety of morphological and anatomical adaptive features in order to considerable extend the time in which they are exposed to a high pressure of the habitat selection like: high salinity and aridity (Hameed and Ashraf, 2008).

Generally, during the development cycle the halophytes are facing two problem situations: the tolerance to high concentrations of salt in the habitat and the ability to absorb water from the soil with low potential (Grigore and Toma, 2008).

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The histo-anatomical characteristics can be theoretical and presumptive considered, adaptations to the abiotic stress conditions. These features can be one important point in the addition of halophyte species to an ecological group. The adaptation and evolution process has occurred under the consistent and prolonged action of the abiotic factors. The combination of high soil salinity and humidity was remarked chronologically with a major impact on anatomical structures.

MATERIAL AND METHOD

The plant material was represented by the halophyte species from the Romanian flora, adapted to complete their life cycle on the saline soils.

The investigated species were collected in anthesis, during the summer of 2012, from different saline habitats from Dobrogea, along the Black Sea shore (*Limonium gmelinii* Willd. O. Kuntze, *Plumbaginaceae*) and near salt marshes from Sulina (*Spergularia media* (L.) C. Presl, *Caryophyllaceae*) and Histria (*Bassia sedoides* Pall. Asch., *Chenopodiaceae*). Fixing the collected biological material was carried out in 70% ethyl alcohol, being preserved until the sectioning moment. The collected plant material has been fixed and preserved in ethanol 70 %.

The cross sections through the vegetative organs were performed using the hand microtome and the botanical razor. The sections obtained were then subjected to immersion in sodium hypochlorite for 20-30 minutes, washed with tap water, then staining: in the first stage with iodine green (1 minute) and then washed with ethanol; in the second step the sections were stained with carmine red (for 20 minutes), washed with water and, finally, fitting them in glycerol gelatin (Toma et al., 2000).

Subsequently, after obtaining the permanent slides were performed microphotographs using the NOVEX photon microscopy (Holland) and the digital camera Canon.

RESULTS AND DISCUSSION

The species investigated have special mechanisms of adaptation that allow them to cope with the harsh life conditions (increased salinity of the soil).

The cross sections through the root of all investigated species reveals a secondary structure resulting from the activity of both lateral meristems: cambium and phellogen.

In *B. sedoides,* the central cylinder is extremely thick, derived both from the activity of normal cambium, as well from that of successive cambia (Fig 1). Successive cambia phenomenon is a typical characteristic of many halophytic species (Grigore and Toma, 2006; Grigore andToma, 2010a).

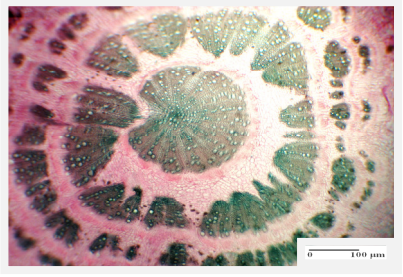

Fig.1 - Cross-section through the root of *Bassia sedoides*

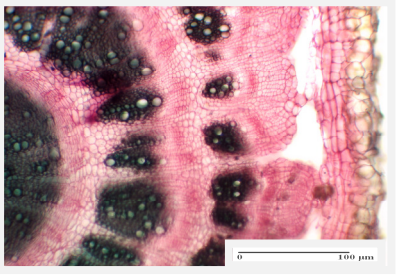

Fig.2 - Cross-section through the root of *Bassia sedoides*

From the activity of the additional cambia have resulted three rings of vascular bundles, of collateral type, close to each other, separated by parenchymatic- cellulosic rays. The size-of bundles decreases from the internal to the external ring (in which the tracheogenesis process is still noticeable).

The salinity can influence the degree of lignification in the root affected by additional cambia, while in the stem this lignification is less important (Grigore and Toma, 2006).

The primary root cortex in the species *Bassia sedoides* and *Spergularia media* is parenchymatic-cellulosic, with many large air-storing cavities (aerenchyma), more or less developed in the underground organs (Fig 2., Fig 3.). In *Limonium gemelinii* root, sclerenchymatic elements, sclereides-isolated or grouped can be observed (Fig 4.).

Fig.3 - Cross-section through the root of *Spegularia media*

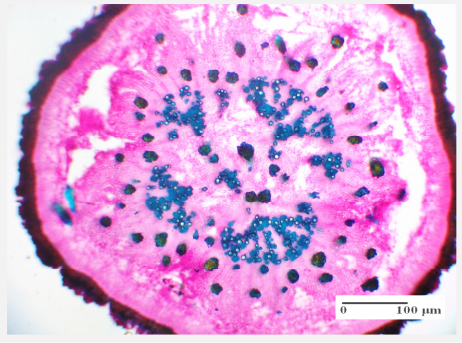

Fig.4 - Cross-section through root at *Limonium gmelini*

For the species *Limonium gmelinii* some cells that are part of the suberin roots contain tannin. The thickening degree of the walls and cell size decreases from the periphery to the center. This particular type of suberin is rarely mentioned in the literature (Metcalfe, 1972).

The rhizome of the species *Limonium gmelinii* has a root epiderma with a secondary structure both the to the periphery and the in the central cylinder which is very thick, having the conductive elements arranged in the form of concentric rings (Fig.5.)

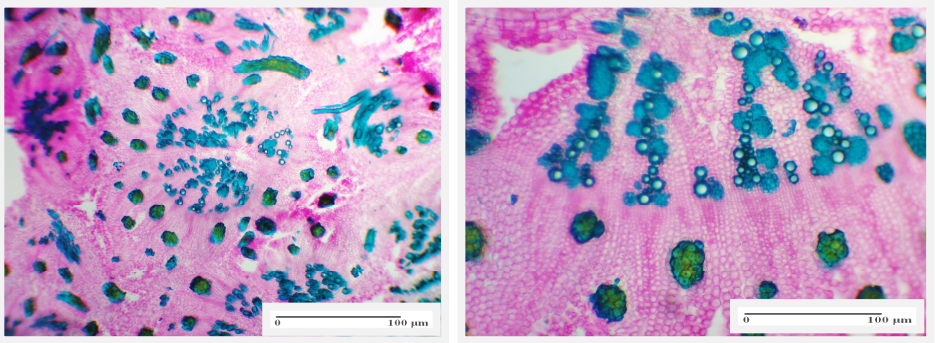

Fig.5 - Cross sections through the rhiyome of *Limonium gmelini*

The contour of the cross section of the stem of *Bassia sedoides* is circular, with protuberances. The epidermis has small cells, isodiametrical, with the external wall bulging. Tri-cellular protecting hairs, with very long terminal cell can be observed at this level. The cortex and medulla contain many cells with oxaliferous sand or druses of calcium oxalate (Fig.6.).

Fig.6 - Cross section through the stem of *Bassia sedoides*

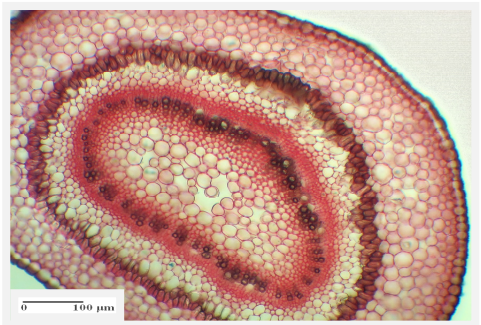

Fig.7 - Cross section through the stem of *Spegularia media*

The contour of the cross section of the stem of *Spergularia media* is rectangular-trapezoidal, and the structure is primary. This presents a sclerenchymatic pericycle in its outer side (Fig 7.).

The outline of the leaf lamina section for the species *Bassia sedoides* and *Spergularia media* is elliptic. In all the investigated species the midrib is slightly prominent on the underside of the lamina (Fig. 8., Fig. 9.). The epidermis has, in addition to normal, isodiametrical cells.

Stomata and long tri-cellular protecting hairs, with very long terminal cell in *Bassia sedoides*, while in *Spergularia* and *Limonium* the presence of the protecting hairs is not observed (Fig. 9., Fig. 10).

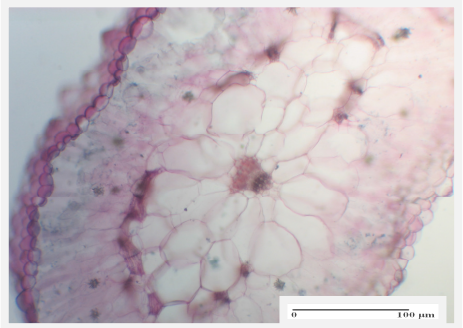

Fig. 8. Cross-section through the lamina of *Bassia sedoides*

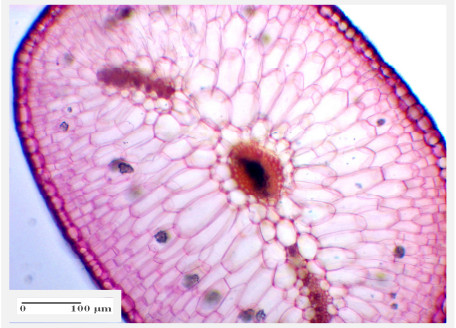

Fig. 9. Cross-section through the lamina of *Spergularia media*

For the investigated species (*Bassia, Spergularia*) the mesophyll is differentiated into palisade tissue, composed of cells whose size increases towards the center of the lamina (is observed islands with druses of calcium oxalate) and water storage parenchyma (3-4 layers of isodiametric cells, reduced for the

species *Limonium gmelini*). In the thickness of the mesophyll there are large mechanical idioblasts (Fig. 9). In the epidermis of *Limonium gmelini* Licopoli organs (secreting $CaCO_3$) can be noticed; these have a eight cells structure, consisting of four internal cells that transcribe a meatus and four external cells involved in the salt secretion adjusting also the transpiration (Fig. 11., Fig. 12.).

The halophyte species *Limonium gmelini* is adapted to uptake large amounts of salts from the soil, but it eliminates them on the surface of the leaf area, due to the presence of a large numbers of salt glands.

On dry weather, on the leaf surface, a layer of dry salt can be observed, blown by the wind or washed by rain (Grigore M.N.,Toma C., 2010b).

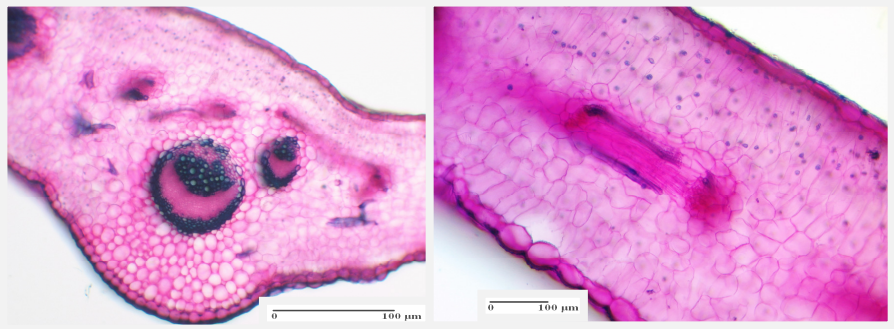

Fig. 10 - Cross-section through the lamina of *Limonium gmelini*

Fig. 11 - Lower epidermis of lamina of *Limonium gmelini* (surface view)

Fig. 12 - Image of the uper epidermis of *Limonium gmelini*

The succulence is an adaptive feature, present in the structure of the lamina of the investigated species (*Bassia* and *Spergularia*) and represents, generally, one of the main features involved in tolerance of plants on saline soils.

The halophytes accumulate large amounts of salts in the air organs; therefore they have the highest degree of succulence.

Further, the succulence has a dilution of the salts accumulated in plants, of toxic ions from cells, allowing the plant to cope with the large quantities of salt.

CONCLUSIONS

The investigated species have well established mechanisms that allow them to cope with the harsh conditions of life (excessive salinity of the soil, dryness).

The analysis of all these observations could lead to some preliminary ecological conclusions: the species *Bassia sedoides* and *Spergularia media* are meso-hygro halophyte and the species *Limonium gmelini* is xero-mesohalophyte.

The presence of mechanical elements (sclereids) in the organs structure for the species *Limonium gmelini* was also evidenced.

The anatomical characteristics of the analyzed species can be correlated with the environmental features in which plants grow. Therefore, the investigated species can be nominated as obligatory halophytes, being adapted to survive to high salinity of the soil.

The analyzed species have differences in the anatomical structure, but their adaptations may be considered converged to the environmental factors. *Bassia* presents the successive cambia phenomenon in the root level (typical for the most species of the *Chenopodaceae* family), the succulence of the lamina (particularly to *Bassia* and *Spergularia*) and the presence of the salt glands at *Limonium* (typical for the species of this genus). Therefore, the analyzed species in terms of histo-anatomical point of view show different strategies to adapt to the same stressful factors.

REFERENCES

1. **Grigore M.N., Toma C., 2006** - *Evidencing the successive cambia phenomenon on some halophylous representatives among Chenopodiaceae and its possible ecological-adaptive implications*. Stud. Com. Complexul Muzeal Şt. Nat. „Ion Borcea" Bacău, 21, p. 87-93;
2. **Grigore M.N., Toma C., 2008** - *Ecological anatomy investigation related to some halophyte species from Moldavia*. Rom. J. Biol. Plant Biol., 53 (1), p. 23-30;
3. **Grigore M.N.,Toma C., 2010a -** *The halophytes. Aspects of ecological anatomy*, Edit. Univ. „Al. I. Cuza", Iaşi, p. 10-50;
4. **Grigore M.N.,Toma C., 2010b -** *Salt secreting structures to halophytes.* An integrative approach*,* Edit. Academiei Române, Bucureşti p. 11-84; 173-211;
5. **Hameed M., Ashraf M., 2008 -** *Physiological and biochemical adaptations of Cynodon dactylon (L.) Pers. from the Salt Range (Pakistan) to salinity stress. Flora*. 203, p. 683-694;
6. **Metcalfe C.R., Chalk L., 1972** - *Anatomy of the Dicotyledons,* 1-2, Clarendon Press, Oxford, p. 147-153, 1053-1059;
7. **Toma C., Niță M., Rugină R., Ivănescu I., Costică N., 2000 -** *Morfologia şi anatomia plantelor. Manual de lucrări practice***.** Ed. Univ. „Al. I. Cuza" Iaşi, p. 350-108.

BIOLOGICAL EFFECTS OF FERITE CONTAINING NICKEL ON GROWTH DYNAMICS OF CORN PLANTS

EFECTUL BIOLOGIC AL FERITEI CE CONTINE NICHEL IN DINAMICA CRESTERERII PLANTELOR DE PORUMB

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Abstract. *The aim of this paper is to evaluate the effects of ferite containing nichel on corn plant growth. Seeds of corn (Zea mais) were put into Petri dishes on double filter paper together with suspensions from ferite containing nickel. The seeds were kept here for 4 day. The dynamic of germination and root growth have been monitorized. After that the germinated corn seed were planted in soil where they continued to growth. Two weeks later the content of photosynthetic pigments has been obtained spectrophotometrically. The stimulator effect from point of view of plant germination has been established for ferrite containing nickel. Therefore, a slow release of the active substance from nanocomposite material can be exploited for control release formulation of some plant growth stimulator.*
Key words: *Ni ferrite, root growth, photosynthetic pigments*

Rezumat*. Scopul acestei lucrari este de a evalua efectul unei ferite ce contine nichel in cresterea plantelor de porumb. Semintele de porumb au fost puse in sticle Petri cu hartie de filtru si o suspensie realizata cu o ferita continand nichel. Semintele au fost tinute in intuneric timp de 4 zile. Dinamica germinarii s cresterea radacinilor a fost monitorizata. Apoi semintele de porumb germinate au fost plantate in sol unde acestea au continuat sa creasca. Dupa circa 2 saptamani a fost determinat continutul de pigmenti fotosintetici din frunzeprintr-o metoda spectrofotometrica. Din punct de vedere al germinarii plantelor a fost stabilit un efect stimulator al feritei continand nichel. Astfel o eliberare inceata a substantei active din materialul nanocompozit poate fi folosit pentru analiza calitatii unui stimulator de crestere.*
Cuvinte cheie*: ferită cu Ni, creşterea rădăcinilor, pigmenţi fotosintetici*

INTRODUCTION

Nanomagnetic materials (specially the mixed-ferrites MFe_2O_4 where M=Co, Mn, Ni, Zn) have attracted special attention because of their low cost, ease of synthesis, physical and chemical stabilities and suitable magnetic properties. Among all spinel ferrites, Ni and Ni–Zn ferrites are one of the most useful materials due to its high electromagnetic performance, moderate saturation magnetization, low coercivity and good chemical stability. From biological point of view, experimental evidences for the effects of $NiFe_2O_4$ are missing because the effect of nickel on plant metabolism is controversial and poorly understood

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(Ahmad et al, 2011), (Gajewska and Skłodowska, 2009), (Khoshgoftarmanesh, 2011). Comparative effects of some composites containing Ni ferrite 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 Ni ferrite ($NiFe_3O_4$) on plant growth, we sorted the following variants:

1. control;
2. suspension containing 0.25g/100ml distilled water
3. suspension containing 0.25g/50 ml distilled water

100 seeds of corn were put into Petri dishes on double filter paper together with 5 mL treatment solution. Four days the seeds have been kept in dark and at optimal temperature (20-23^{0}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 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 Iena and calculated according to Lichtenthaler formula (Lichtenthaler and Wellburn, 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.

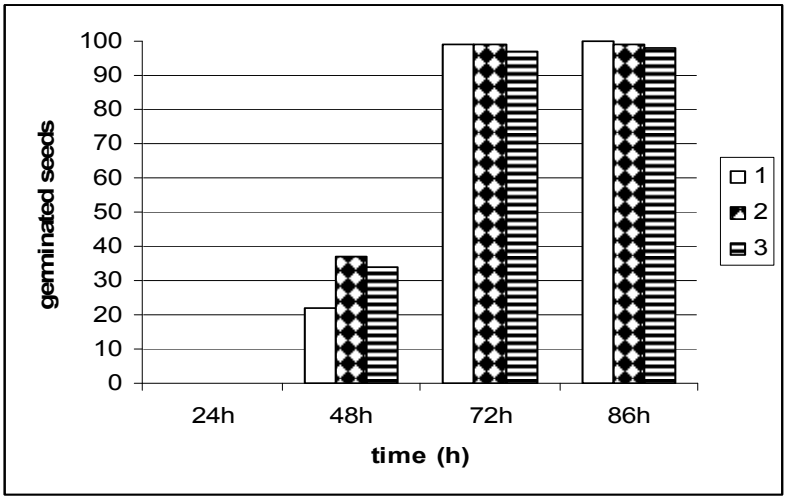

Fig. 1 – Corn seed germination after 4 days

Figure 1 show that the treated seeds with a suspension containing 0.25g/100ml distilled water or 0.25g/50ml distilled water germinated faster than the control seeds (the best was the first treatment) but after fours days the number of germinated seeds is the same.

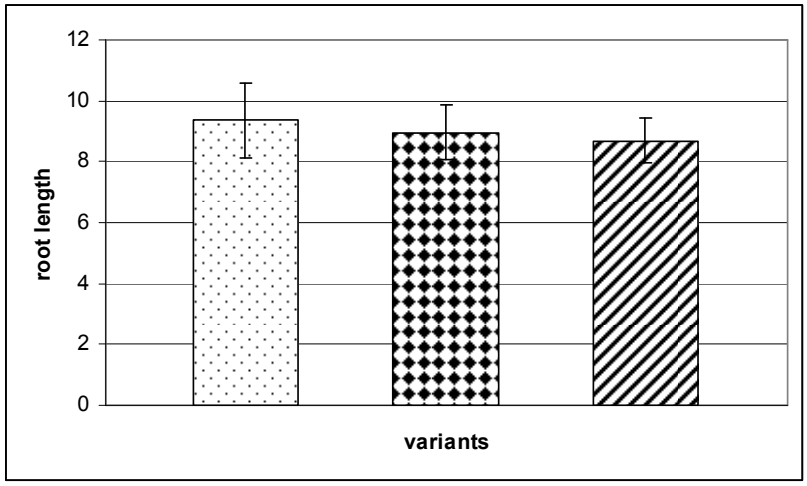

Fig. 2 – Total corn root dimensions after 4 days of Ni ferrite treatments. Error bars are confidence intervals as in (Oancea, 2007) and n=20

By contrary, from figure 2 we can see that the corn roots of control plants are better developed than the treated seeds. Comparing the error bars from treated plants with the control plant, we can see that a significant statistic difference did'n exist between them.

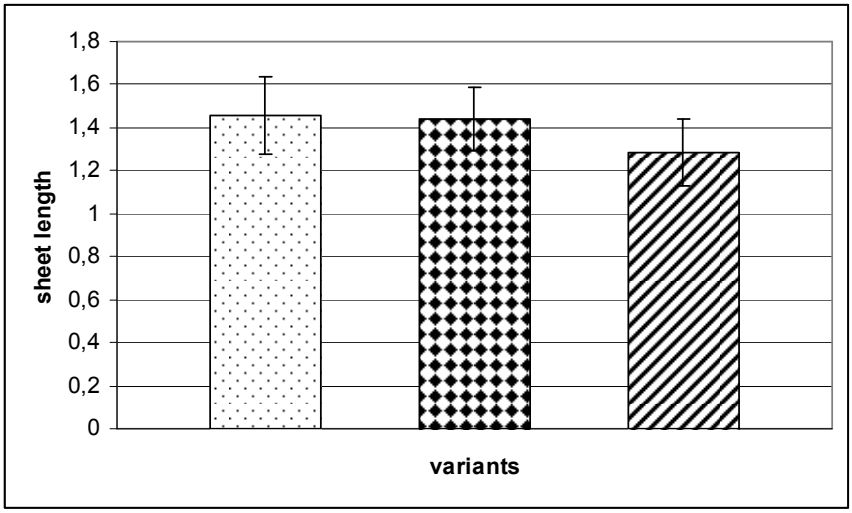

Fig. 3 – The stem dimensions, after 4 days of treatment with Ni ferrite

As the figure 3 shows, the corn stems of control plants were better developed than thetreated ones. A significant statistic difference can be put in evidence for treated plant and the control plants.

Figure 4 shows the height of corn plants after 14 days from the treatment.

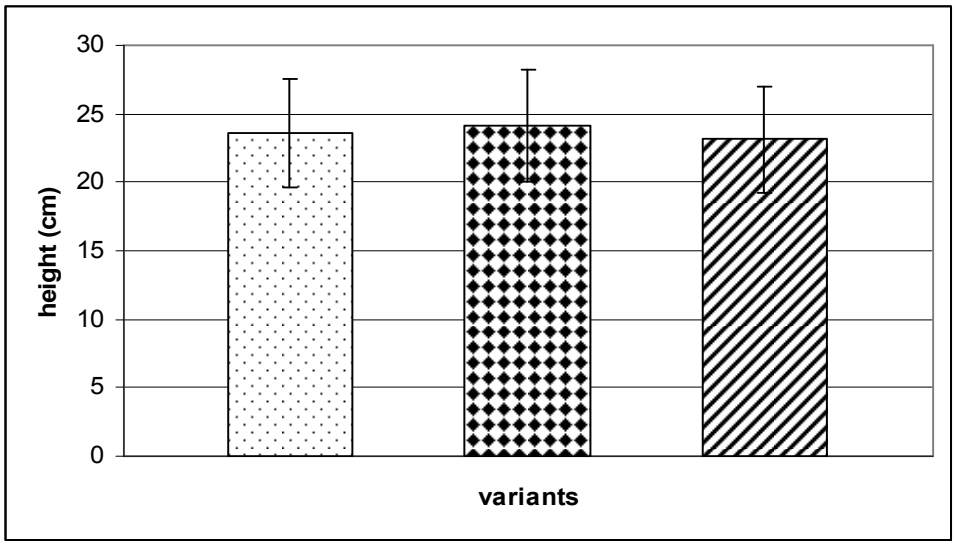

Fig. 4 – The height of corn plants after 14 days from the treatment

From figure 4 we can see that the errors bars overlap for control plant and the plants treated with the suspension containing nickel; this means a significant difference did not exist between these plants. In addition, the constant value of the confidence interval for that treated plants and the control shows that these plants grow uniformly.

Content of photosynthetic pigments, chlorophyll a (chla) and clorophyll b (chlb) and carotenoids (Car) from corn leaves is presented in figure 5 and 6.

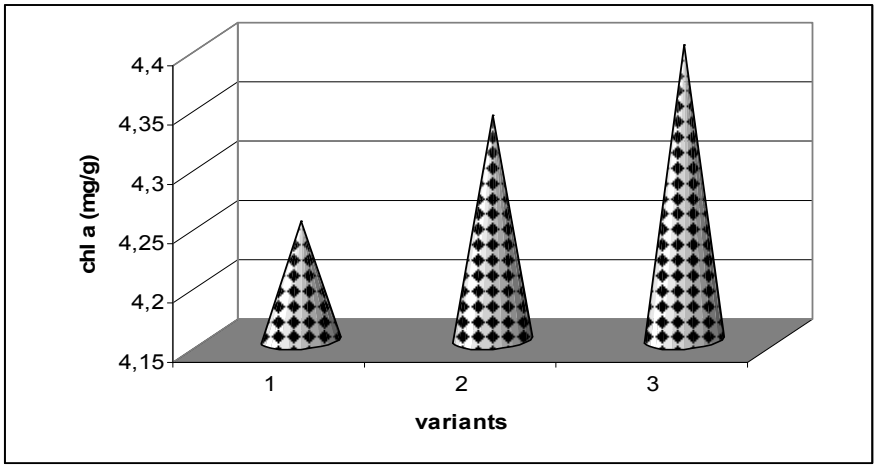

Fig. 5 – The content of chlorophyll a (mg/g fresh tissue) from corn leaves

From figure 5 we can see that the content of chlorophyll a (the most important photosynthetic pigment), for treated plant with ferrite is higher than for the control plant leaves; that means a good resistance to chemical stress of the plants.

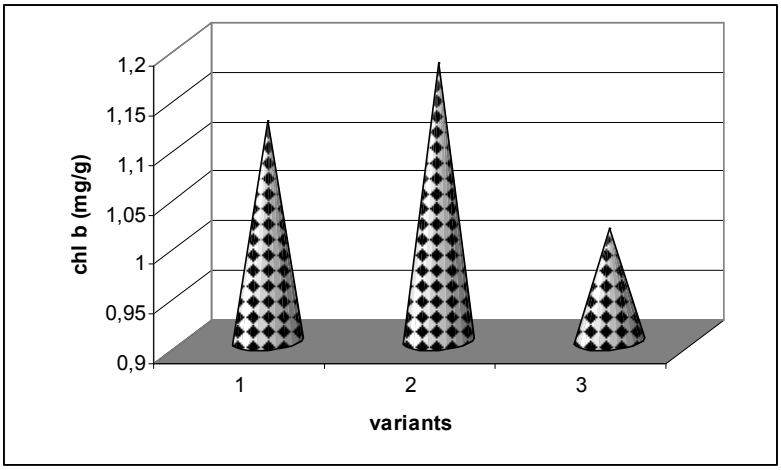

Fig. 6 – The content of chlorophyll b (mg/g fresh tissue) from corn leaves

In terms of content of chlorophyll b a slightly increase for the first treatment can be observed and afterwards a decrease of the same pigment. This behavior is complete inverse by comparison with the carotenoid content, as figure 7 shows.

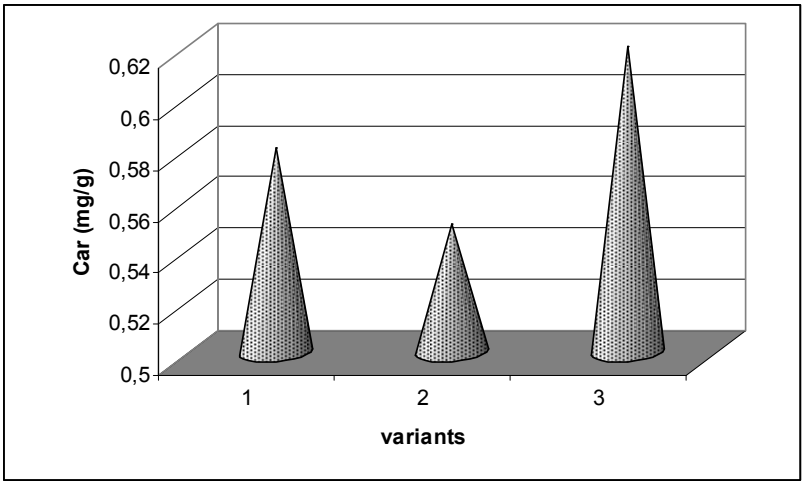

Fig. 7 – The content of carotenoids (mg/g fresh tissue) from corn leaves

CONCLUSIONS

The ferrites are important due their physical and chemical properties. Our results prove that there are not differences between control plants and those

treated with ferrite suspensions. The nanocomposites containing ferrite has a good effect on plant germination. From point of view of plant growth a slightly decrease of treated plants is observed. The increase of content of chlorophyll a for treated plants shows that those plants have a good resistance to chemical stress.

Because of these unusual effects on plant growth, we suggest that these ferrites show a great interest and require new test in this domain.

REFERENCES

1. **Ahmad M.S.A., Ashraf M., Hussain M., 2011 -** *Phytotoxic effects of nickel on yield and concentration of macro- and micro-nutrients in sunflower (Helianthus annuus L.) achenes*, Journal of Hazardous Materials 185, p. 1295–1303
2. **Foca N., Oancea S., Condurache D., 2004 -** *Growth and photosynthetic activity for tomato plants treated with different cations,* Molecular crystals and Liquid crystals Journal, 418, p. 971-981
3. **Gajewska E., Skłodowska M., 2009** - *Nickel-induced changes in nitrogen metabolism in wheat shoots*, Journal ofPlantPhysiology, 166, p. 1034 -1044
4. **Khoshgoftarmanesh A.H., Hosseini F., Afyuni M., 2011 -** *Nickel supplementation effect on the growth, urease activity and urea and nitrate concentrations in lettuce supplied with different nitrogen sources*, Scientia Horticulturae, 130, p. 381–385
5. **Lichtenthaler H.K., Wellburn A.R., 1983 -** *Determinations of total carotenoids and chlorophylls a and b of leaf extracts in different solvents*, Biochemical Society Transactions, 11, p. 591 – 592
6. **Lin D. B., 2007** - *Phytotoxicity of nanoparticles: Inhibition of seed germination and root growth,* Environmental Pollution, 150(2), p. 243-250
7. **Oancea S., 2007** - *Ghid de prelucrare rapidă a datelor experimentale*, Editura Performantica, Iasi
8. **Oancea S., Foca N., Airinei A., 2005 -** *Effects of heavy metals on plant growth and photosynthetic activity,* Analele Univ. Al. I. Cuza, Tom I, s, Biofizica, Fizică medicală şi Fizica mediului, p. 107-110
9. **Wang X., Sun C., Gao S., Wang L., Shuokui H., 2001 -** *Validation of germination rate and root elongation as indicator to assess phytotoxicity with Cucumis sativus,* Chemosphere, 44(8), p. 1711-1721

CLIMATE EVOLUTION IN ROMANIA IN THE GLOBAL CLIMATE CHANGE USING DATEABASES

EVOLUȚIA CLIMEI DIN ROMÂNIA ÎN CONTEXTUL SCHIMBĂRILOR CLIMATICE GLOBALE UTILIZÂND BAZE DE DATE

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Abstract *Present brings several environmental problems for people. Many of these are closely related, but by far the most important problem is the climate change. In the course of Earth evolution, climate has changed many times, sometimes dramatically. Warmer eras always replaced and were in turn replaced by glacial ones. However, the climate of the past almost ten thousand years has been very stable. During this period human civilization has also developed. In the past nearly 100 years - since the beginning of industrialization - the global average temperature has increased by approx. 0.6° C (after IPCC (Intergovernmental Panel on Climate Change), faster than at any time in the last 1000 years.*
Key words*: basin, confluence, decay, wastes, pollution, environment*

Rezumat. *Prezentul aduce in fața oamenilor multiple probleme privind mediul. Multe dintre acestea fiind strâns corelate între ele, însă de departe cea mai importantă problemă este, aşa cum au arătat-o rezultatele sondajelor din anii anteriori, al cărui subiecți au fost experți în domeniu, schimbarea climei. În cursul evoluției Pământului, clima s-a schimbat de multe ori, uneori chiar în mod dramatic. Erele mai calde au înlocuit şi au fost înlocuite mereu de ere glaciare. Totuşi, clima din ultimii aproximativ zece mii de ani a fost deosebit de stabilă. În această perioadă s-a dezvoltat şi civilizația umană. În ultimii circa 100 de ani – de la începutul industrializării – temperatura medie la nivel global a crescut cu cca. 0,6°C (după IPCC (Intergovernmental Panel on Climate Change), mai repede decât oricând în ultimii 1 000 de ani.*
Cuvinte cheie: *climate, environment, climate change, temperature*

INTRODUCTION

Global warming affects our country, the most pronounced effects being hot and dry winters. In Romania there is a significant increase in the frequency of rare and extreme weather events: hot summers, tornadoes, floods. Weather records for more than 100 years show a clear trend of desertification in an area of 3 million hectares in the eastern part of the country (Dobrogea), East Muntenia and southern Moldova, of which 2.8 million ha of arable land (20% of Romania's agricultural background).

For the past century it has been highlighted up to an average temperature increase of 0.3 ° C, with an increase reported after 1960. The increase is more

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pronounced and differentiated in the southeast regions with values of 0.8 ° C at stations as Bucharest, Constanta and Filaret. Increases are lower in the central and northern part of the country except Baia Mare depression where values of 0.7 ° C were highlighted.(Sandoiu, 2005)**.**

Data recorded at the main meteorological stations in the country and weather stations in Western Carpathians, located at altitudes between 1090 and 2504 m for the period 1961 to 2000 reveal the following:

- An increasing trend in global average air temperature at the earth's surface, accelerated in the last 25 years;
- A slight increase in mean annual temperature and decreased rainfall mountainous areas;
- A slight increase in annual mean temperature stations Omu Peak (2504 m) and a clear increase in Stana de Vale for the period 1979-2000;
- Melting glaciers Scărişoara and reducing it to 2.0 m in the last 100 years, of which the largest reduction was reported in the past 25 years;
- Increasing the water level in different sections located on the Black Sea coast with up to 45 cm in a period of 130 years;
- occurrence of extreme temperatures, such as those recorded on 5 July 2000 data station Giurgiu 43.5 º C and 42.4 C in Bucharest since 1984 (Sandoiu, 2005).

Examples of changes in climate. 2000 was the year characterized by widespread drought and excessive heat. The summer of 2000 was the driest in the last 100 years, preceded by the spring which was also very dry. In terms of precipitation, significant regional differences indicate a slight increase in the south, west and east and the rest of annual quantities decline.

It is obvious stress the torrential rainfall which is manifested by loss of large amounts of rainfall in short periods followed by long periods of drought. Even in dry years rainfall produced extensive flooding during the spring when combined with snowmelt and summer heat (Dima and Stefan, 2008).

Rapid alternation of rainy periods with dry periods were frequent and a significant example in this respect was 2000 when after a spring in which there were major floods, a very dry period in June and July followed.

MATERIAL AND METHOD

Climate reference period is the period during which the time series are formed, according to continuous and homogeneous meteorological observations, which are found in the databases. This period length was fixed by WMO (World Meteorological Organization) at 30 years. Currently the reference period used is during 1951 - 1980, but the following statistics will be based on the period 1961 - 1990. In this article there were used databases from 1971 to 2000 for drawing the maps.(Dima 2008)

Characteristics of the main climatic elements in Romania

The average air temperature ranges in our country between 11 °C and 8 °C from South to North. Isothermal annual average is 11 ° C and this delimits a wide strip of 20-30 km along the Danube valley. On coastline and Delta average temperatures are exceeding this value. Most of the North Dobrogea and Tisza Plain

have average annual temperatures from 10^0 C to 11 ° C. From 10 ° C isotherm to the highlands, average annual temperatures decrease with the altitude, reaching the 0 °C isotherm at 2000 m altitude. The annual average values are lower in the north and north-exposed slopes while along the large river valleys, average temperatures are higher than in the corresponding high (Figure 1).

Extreme temperatures (maximum and minimum) also highlights continental climate in our country. The highest levels (above 40 °C) were recorded in Baragan, and the lower (below 0 °C) in the region Gheorghieni –Ciuc, Braşov.

Rainfall. Climatological database analysis led to the determination of the 637 mm average annual rainfall which occurs in our country. If we analyze the geographical distribution of rainfall, significant differences are to be noticed: thus, there are differences between western regions subject to invasions of moist air, and the eastern, drier, between the highlands, with high rainfall (1000 - 1400 mm), and bass poorer rainfall between slopes with different orientations. Signals are different in the case of depressions sheltered from Western currents (Gheorghieni, Ciuc, Braşov) where quantities fall below 600 mm. In the Getic Plateau quantities fall below 600 mm, and in Northern and Central Moldavian Plateau they are between 500 and 600 mm. In the south of the Plateau, in Baragan and Dobrogea the fall is below 500 mm, and in the Danube Delta and the coastal region it is below 400 mm. The annual fall in Tisa Plain is about 600 mm, and in the Western Hills it is between 700 and 800 mm.

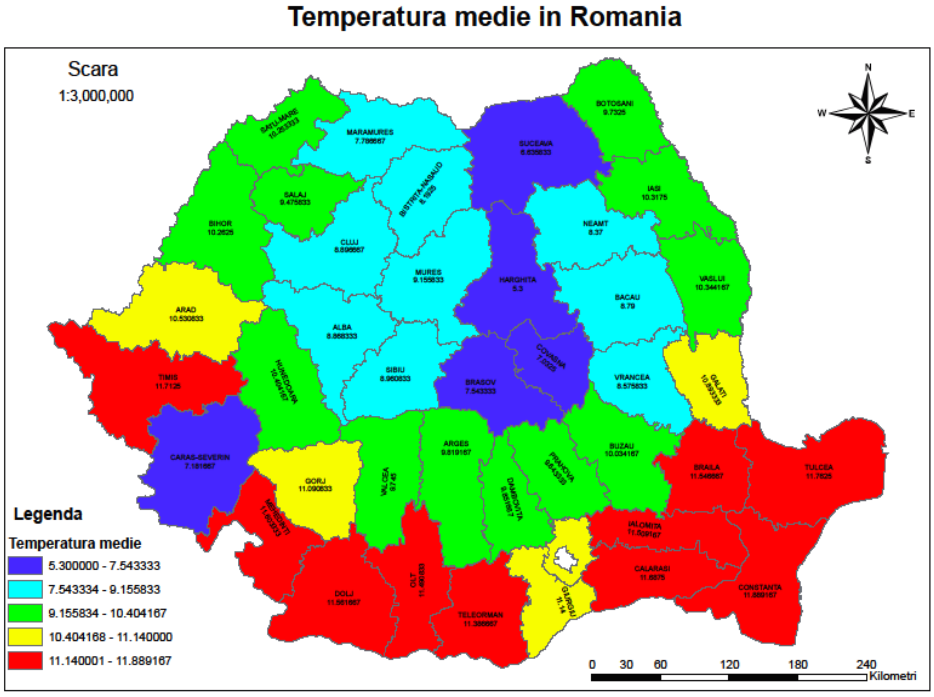

Fig. 1 - Average temperatures in Romania

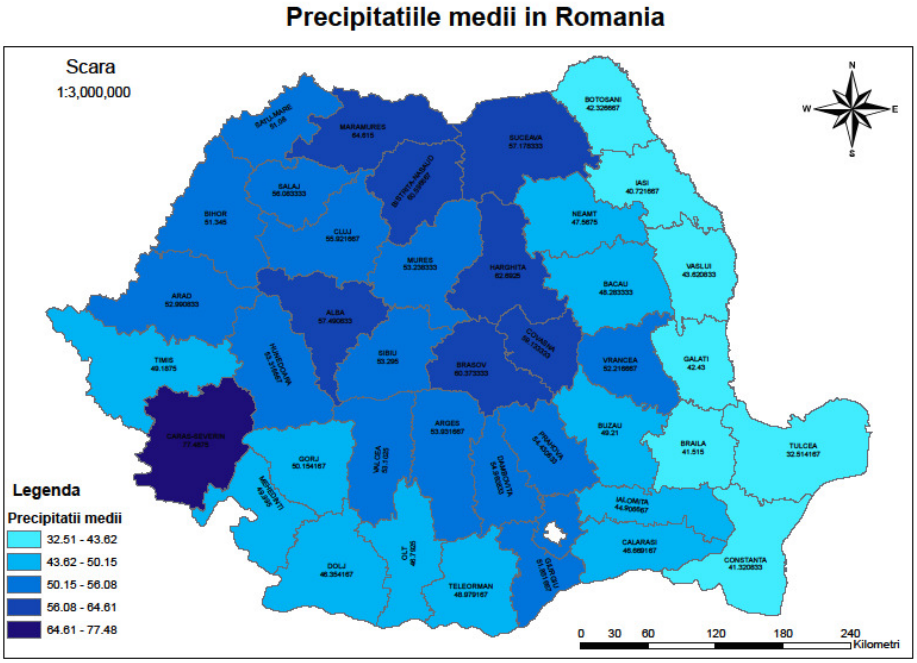

Fig. 2 - Average annual rainfall

Rainfall is the parameter with the greatest variability in time and space and this is supported by the special amounts to multiannual average recorded in some years. Thus, in regions characterized by moderate amounts of precipitation, such as the Romanian Plain, it has values of 1160 mm (otter), 1048 mm (Mărculeşti), 1014 mm Rm Sarat, etc.. In dry years rainfall quantities in the Romanian Plain summed up only 120 mm (Drăgăneşti-Vlaşca, Tămădău). (Figure 2)

Another problem, already mentioned, is the heavy rains, common especially during the summer, giving exceptional amounts of water and producing enhance thermal convection. One can remember the exceptional values recorded on June 26, 1925 Ciuperceni Dolj (349 mm), on August 17, 1900 at Negru Voda, Constanta (320 mm) and on days 29th to 30th of August 1924, when there were recorded 690 mm within 24 hours.

The analysis database was created and cloud maps (Figure 3) or sunshine duration maps (Figure 4) are shown in the figures below.

Nebulozitatea in Romania

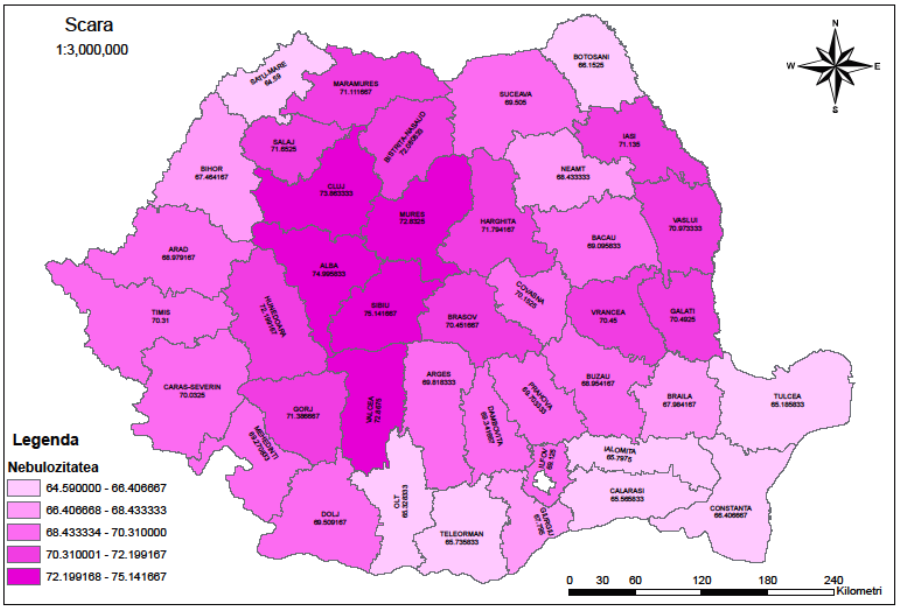

Fig. 3 - Cloud in Romania

Stralucirea soarelui in Romania

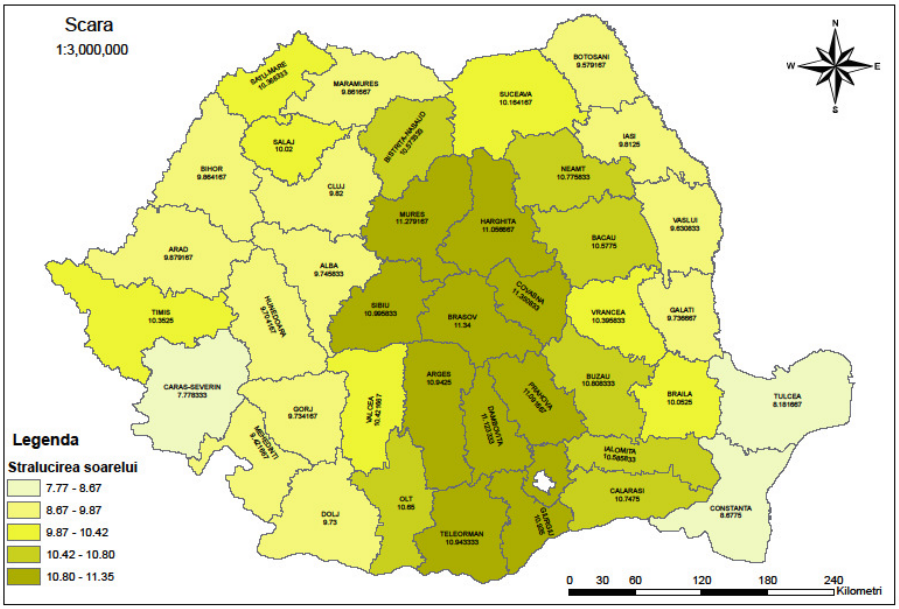

Fig. 4 - Sunshine in Romania

RESULTS AND DISCUSSION

Romania has an area of approximately 240,000 km^2 and the relief is characterized by variety, proportion and symmetry. The geographical position gives a temperate climate with four seasons prominently heat and rainfall.

The most important role in thermal distribution is relief and altitude and orientation also. In terms of rainfall throughout the landscape plays an important role. Rainfall decreases from the plain to the Danube Delta. And the most significant rainfall is June.

CONCLUSIONS

1. Romania, by its geographical position in Europe, is in the temperate climate zone of the Northern hemisphere and its climate has varying degrees of continentalism;

2. The climate of the country is due to the peculiarities of atmospheric circulation and of the physic-geographical conditions;

3. The climate is characterized by a difference of the average temperature of 13^0C;

4. Rainfall analysis shows that there are fluctuations between dry and rainy periods.

REFERENCES

1. **Dima, M., Ştefan S** , **2008** – *Fizica schimbărilor climatice*, Ed. Ars Docendi, Universitatea din Bucureşti
2. **IPCC, 2007** - *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA
3. **Săndoiu, Ileana**,**2005** - *Fizica Factorilor de Mediu*, Ed. Elisavaros, Bucureşti,

THE EFFICIENCY OF APITHERAPY TREATMENT UPON THE EVOLUTION OF MINERALS IN CARBON TETRACHLORIDE INDUCED HEPATOPATHY

EFICIENȚA TRATAMENTULUI APITERAPIC ASUPRA EVOLUȚIEI MINERALELOR ÎN HEPATOPATIA INDUSA CU TETRACLORURĂ DE CARBON

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Abstract. *The objective of the present experiment is to evaluate the influence of apitherapy diet on minerals' levels (iron, potassium, serum and ionized calcium) in carbon tetrachloride induced hepatopathy in Wistar rats. In order to reduce the factors that produce the modification of minerals' values, apitherapy diet and apitherapy diet in combination with royal jelly has been administered. The apitherapy diet consisted of 4 products produced by Stupina LLC. The hepatoprotective effects of apitherapy diet have been evaluated, thus leading to new perspectives of treatment. The administration of carbon tetrachloride to laboratory animals (group IV) results in the increase of iron and decrease of serum and ionized calcium. Administration of apitherapy diet, in comparison with the untreated group, leads to the decrease of iron (277.8 ± 77.8 vs. 173.1 ± 69.27), increase of serum calcium (7.83 ± 0.4 vs. 9.58 ± 0.49) and ionized calcium (3.54 ± 0.49 vs. 4.2 ± 0.1). Administration of apitherapy diet in combination with royal jelly produces, in comparison with the untreated group, the decrease of iron (277.8 ± 77.8 vs. 124.5 ± 32.19) and the increase of serum calcium (7.83 ± 0.4 vs. 10.15 ± 0.6) and ionized calcium (3.54 ± 0.49 vs. 4.38 ± 0.15).*
Key words: *iron, potassium, calcium, hepatopathy, apitherapy*

Rezumat. *Scopul acestui experiment a constat în studiul influenței apidietei asupra mineralelor (fier, potasiu, calciu seric şi calciu ionic) în afectarea hepatică indusă de tetraclorura de carbon la şobolani rasa Wistar. În scopul reducerii factorilor care produc modificărilor mineralelor am administrat apidietă şi apidietă în combinație cu lăptişor de matcă. Apidieta a constat din 4 preparate apiterapice procurate de la firma Stupina. Am urmărit efectele hepatoprotectoare ale administrării apidietei, deschizând astfel noi perspective de tratament. Administrarea tetraclorurii de carbon animalelor de experiență produce creşterea fierului şi scăderea calciului seric şi ionic. Administrarea apidietei, comparativ cu lotul netratat, conduce la scăderea fierului (277.8 ± 77.8 vs. 173.1 ± 69.27) şi creşterea calciului seric (7.83 ± 0.4 vs. 9.58 ± 0.49) şi ionic (3.54 ± 0.49 vs. 4.2 ± 0.1). Administrarea apidietei în combinație cu lăptişor de matcă, comparativ cu lotul netratat, conduce la scăderea fierului*

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(277.8 ± 77.8 vs. 124.5 ± 32.19) şi creşterea calciului seric (7.83 ± 0.4 vs. 10.15 ± 0.6) şi ionic (3.54 ± 0.49 vs. 4.38 ± 0.15).
Cuvinte cheie: *fier, potasiu, calciu, hepatopatie, apiterapie.*

INTRODUCTION

A great interest has been shown lately on the protective role and mechanism of action of certain compounds that are naturally present in the biologcal systems (Bhadauria et al., 2008).

Propolis is considered to interfere positively in the absorption and use of different minerals due to the presence of organic acids derivatives that improve the physiological functions by modulating the enzymatically dependent ionic activity. Haro and colleagues demonstrate the benefic effects of pollen and/or propolis upon the metabolism of iron, calcium, phosphorus and magnesium in nutritional iron deficiency anemia in rats (Haro et al., 2000).

Numerous plasma proteins, including albumin, alpha- and betaglobulins, coagulation factors and transport proteins, are synthesized by the liver. These factors influence the homeostasia (for example, by binding the proteins, these factors modulate the total concentration of circulating Ca^{2+} and Mg^{2+} and also the concentration of other drugs). At the same time, the serum albumin levels regulate the colloid osmotic pressure of plasma, thus influencing the dynamics of fluids between blood and tissues (Jerca et al., 2004).

There are also studies regarding the hepatoprotective effect of other natural products upon experimentally CCl_4 induced hepatopathy: lycopene from tomatoes (Sakin et al., 2011); the diterpenes kahweol and cafestol from coffee (Lee et al., 2007); the flavone luteolin (3′,4′,5,7-tetrahydroxyflavone) (Domitrović et al., 2009); olive oil (Fang et al., 2008); potato peel extract (Singht. et al., 2008); resveratrol (Fan et al., 2009).

This study continues the direction of research regarding the protective and therapeutical effect of different preparations containing natural compounds.

MATERIAL AND METHOD

All the experimental proceedings achieved on laboratory animals (Wistar rats) in this study were in agreement with the international ethics regulations. Hepatic lesion was induced by i.p. injection of carbon tetrachloride (CCl_4) dissolved in paraffin oil, 10% solution. Two ml per 100 g were administered, once at 2 days, for 2 weeks.

The experiment was unfolded on six groups of Wistar rats. The first group served as control, the second one was fed with apitherapy diet, and the third group was given apitherapy diet and royal jelly (RJ). The next three groups of animals were administered CCl_4 and fed with normal food (group IV), apitherapy diet (group V) and apitherapy diet with RJ (group VI). The apitherapy diet consists of four apitherapy products purchased from *STUPINA LLC*, Bălăneşti, Gorj, Romania (*Apiregya, Apilmunomod, Apilmunostim, Apilmunostim Forte*). These products included in their composition honey, royal jelly, propolis, and pollen and were registered to OSIM with number AO 1242. After three weeks of apitherapy treatment, the laboratory animals were anesthesiated with thiopental (dose of 1 ml/100 g from a 0.01% thiopental solution), and blood samples were collected

by the punction of the cord with a Vacuette® system and submitted to biochemical analysis regarding the levels of minerals.

The statistical interpretation of the results was performed with One-Way ANOVA test and Tukey's post-hoc test. The results were given as mean ± standard deviation. The value of $p<0.05$ was considered significant.

RESULTS AND DISCUSSIONS

In animals with CCl_4 induced hepatopathy (group IV) there can be noticed, when compared to: a) control group standard food (group I) - the increase of iron levels (56±4.83 vs. 247.8±77.48) (fig.1), the decrease of serum calcium (8.81±0.96 vs. 7.83±0.4) (fig.3), and the decrease of ionized calcium (4.19±0.13 vs. 3.54±0.49) (fig.4); b) control group apitherapy diet (group II) - the increase of iron levels (69.71±9.01 vs. 247.8±77.48) (fig.1), the decrease of serum calcium (9.78±0.5 vs. 7.83±0.4) (fig.3), and the decrease of ionized calcium (4.427±0.21 vs. 3.54±0.49) (fig.4); c) control group apitherapy diet and RJ (group III) - the increase of iron levels (94±7.91 vs. 247.8±77.48) (fig.1), the decrease of serum calcium (10.5±0.39 vs. 7.83±0.4) (fig.3), and the decrease of ionized calcium (4.58±0.16 vs. 3.54±0.49) (fig.4).

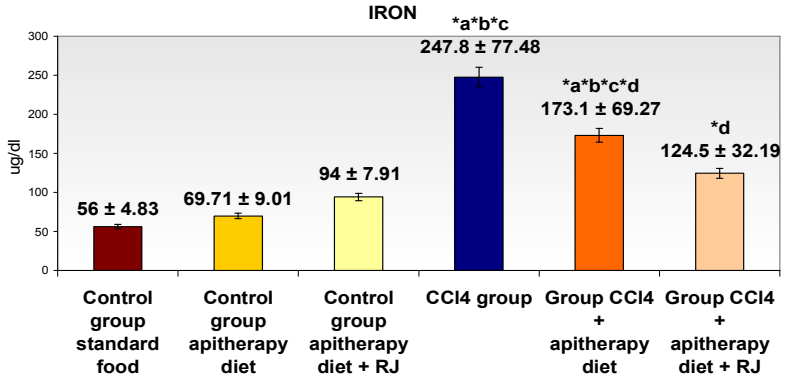

Fig. 1 - Mean values of iron levels and standard deviation
(* a $p<0.05$ vs. control group standard food; * b $p<0.05$ vs. control group apitherapy diet; * c $p<0.05$ vs. control group apitherapy diet + RJ; * d $p<0.05$ vs. CCl_4 group).

Regarding the potassium levels, no statistically significant differences have been obtained. A slight increase for the group that received CCl_4 has been noticed, but the values reached the normal range for the groups treated with apitherapy diet/apitherapy diet and RJ (fig. 2).

Administration of apitherapy diet to animals with CCl_4 induced hepatopathy (group V) produces, in comparison with group IV: decrease of iron levels (247.8±77.48 vs. 173.1±69.27) (fig.1), increase of serum calcium (7.83±0.4 vs. 9.58±0.49) (fig.3), and increase of ionized calcium (3.54±0.49 vs. 4.2±0.1) (fig.4). Administration of apitherapy diet in combination with RJ to animals with CCl_4 induced hepatopathy (group VI), in comparison with group IV,

leads to: decrease of iron levels (247.8±77.48 vs. 124.5±32.19) (fig.1), increase of serum calcium values (7.83±0.4 vs. 10.15±0.6) (fig.3), and increase of ionized calcium levels (3.54±0.49 vs. 4.38±0.15) (fig.4).

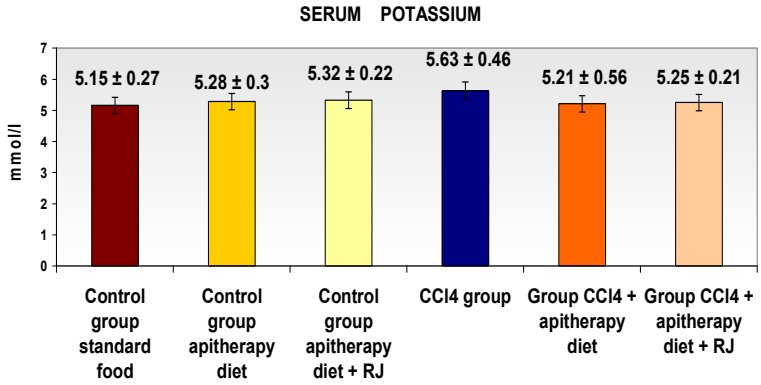

Fig. 2 - Mean values of serum potassium levels and standard deviation

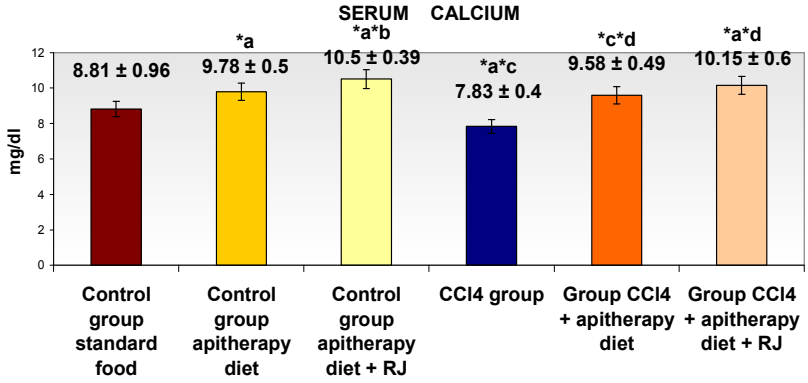

Fig. 3 - Mean values of serum calcium levels and standard deviation (* a $p<0.05$ vs. control group standard food; * b $p<0.0001$ vs. control group apitherapy diet; * c $p<0.05$ vs. control group apitherapy diet + RJ; * d $p<0.0001$ vs. CCl_4 group).

Administration of apitherapy diet/apitherapy diet and RJ to laboratory animals with CCl_4 induced hepatopathy (group V) determines, when compared with the animals that were given CCl_4 without protection: decrease of iron, increase of serum and ionized calcium.

In normal conditions, the intestinal absorption of calcium takes place only in the presence of optimal concentrations of: vitamins A, C and D (in its active form, 1,25-dihydroxyvitamin D_3); minerals such as magnesium, iron, manganese; hormones: parathyroid hormone and calcitonin; proteins, lactose, lactic acid, citric acid, bile salts; acid gastric pH; phosphocalcic balance. The lack of the mentioned compounds, along with the unbalance in the homeostasis of different organs mark the assimilation and bioactive function exerting of this important mineral. This statement can be concluded also from the fact that

women, although they take high doses of calcium and vitamin D_3 for long periods of time, they can not surpass the hypocalcemia, finally reaching to osteoporosis, with all the disorders of the bone and neuroendocrin system (Andriţoiu and Andriţoiu, 2004).

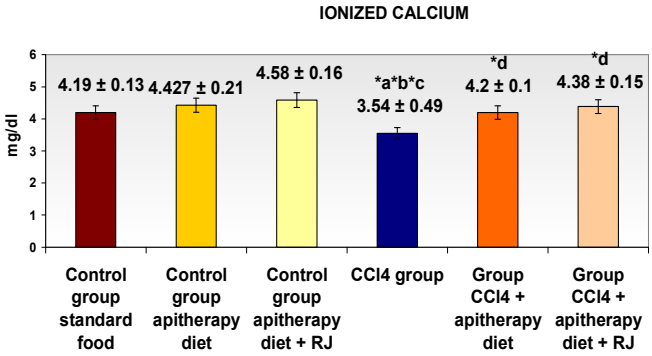

Fig. 4 - Mean values of ionized calcium levels and standard deviation (* a p=0.0001 vs. control group standard food; * b p<0.0001 vs. control group apitherapy diet; * c p<0.0001 vs. control group apitherapy diet + RJ; * d p<0.0001 vs. CCl_4 group).

The alteration of the transmembrane ion transport takes place mainly due to the effects of reactive oxygen species on membranes. It is known that ischemia is associated with alterations of ion exchanges: loss of potassium and entry of calcium into the cells. Further more, the increase of the passive permeabilty of K^+ seems to be correlated with the level of membrane peroxidation (Kehrer, 1993).

The apitherapy products used in this experiment (*Apiregya, ApiImunomod, ApiImunostim, ApiImunostim Forte*), due to their complex chemical composition, improve the intestinal absorption of calcium and the transmembrane ion transport.

Honey raises the absorption of calcium *in vitro* and *in vivo* in laboratory animals. A benefic effect of honey has also been reported in patients with hepatitis A. A sustaining effect has been demonstrated in patients with cancer that, consequently to radiotherapy, show a decrease of mucosis due to the radiations (Bogdanov, 2007).

CONCLUSIONS

1. Administration of the hepatotoxic carbon tetrachloride to laboratory animals leads to the increase of iron levels and the decrease of serum and ionized calcium.

2. Regarding the potassium levels, a slight increase for the group that received the toxic has been noticed, but the values reached the normal range for the groups treated with apitherapy diet/apitherapy diet and RJ

3. Administration of apitherapy products used in this study (*Apiregya, ApiImunomod, ApiImunostim, ApiImunostim Forte*) leads to the improvement of iron, serum and ionized calcium levels.

Acknowledgement. *This paper was supported by the project PERFORM-ERA "Postdoctoral Performance for Integration in the European Research Area" (ID-57649), financed by the European Social Fund and the Romanian Government.*

REFERENCES

1. **Andriţoiu V., Andriţoiu C.V., 2004** - *Compoziţia biochimică a produselor apicole, suport inestimabil în terapia bolilor imunodepresive şi autoimune*, Compendiul Conferinţei Internaţională de Terapii Complementare, Arad, pp. 133-138.
2. **Bhadauria M., Nirala S.K., Shukla S., 2008** - *Multiple treatment of propolis extract ameliorates carbon tetrachloride*, Food Chem Toxicol, 46, pp. 2703-2712.
3. **Bogdanov S., 2007** - *Bee products and health*: a short review, in: Mărghitaş Al L, Dezmirean D (eds), *Apiculture-from science to agribussines and apitherapy*; Editura AcademicPres, Cluj-Napoca, pp. 30-39.
4. **Domitrović R., Jakovac H., Tomac J., Šain I., 2009** - *Liver fibrosis in mice induced by carbon tetrachloride and its reversion by luteoli*n, Toxicol Appl Pharmacol, 241, pp. 311–321.
5. **Fan G., Tang J.J., Bhadauria M., Nirala S.K., Dai F., Zhou B., Li Y., Liu Z.L., 2009** - *Resveratrol ameliorates carbon tetrachloride-induced acute liver injury in mice*, Environ Toxicol Pharmacol, 28, pp. 350–356.
6. **Fang H.L., Lai J.T., Lin W.C., 2008** - *Inhibitory effect of olive oil on fibrosis induced by carbon tetrachloride in rat liver,* Clin Nutr, 27, pp. 900-907.
7. **Haro A., Lopez-Aliaga I., Lisbona F., Barrionuevo M., Alferez M.J.M., Campos M.S., 2000** - *Beneficial effect of pollen and/or propolis on the metabolism of iron, calcium, phosphorus, and magnesium in rats with nutritional ferropenic anemia*, J Agric Food Chem, 48, pp. 5715–5722.
8. **Jerca L., 2004** - *Specii radicalice ale oxigenului*. Biochimia NO, EdituraTehnică, Ştiinţifică şi Didactică CERMI, pp. 59-93.
9. **Kehrer J.P., 1993** - *Free radicals mediators of tissue injury and disease*, Crit Rev Toxicol, 23, pp. 21-48.
10. **Lee K.J., Choi J.H., Jeong H.G., 2007** - *Hepatoprotective and antioxidant effects of the coffee diterpenes kahweol and cafestol on carbon tetrachloride-induced liver damage in mice*, Food Chem Toxicol., 45, pp. 2118–2125.
11. **Sakin F., Bulmuş F.G., Servi K., Popa L., 2011** - *Protective effect of lycopene on oxidative stress induced by different doses of 2,3,7,8-tetrachlorodibenzo-p-dioxin in brain, liver, kidney, and heart tissue of rats*, Farmacia, 59(4), pp. *462-470.*
12. ***Singh N., Kamath V., Narasimhamurthy K., Rajini P.S., 2008*** - *Protective effect of potato peel extract against carbon tetrachloride-induced liver injury in rats*, Environ Toxicol. Pharmacol, 26, pp. 241–246.

CHEMICAL AND SPECTRAL CHARACTERIZATION OF PREHYDROLYSATES OBTINED BY VEGETAL BIOMASS HYDROLYSIS

CARACTERIZAREA CHIMICĂ ŞI SPECTRALĂ A PREHIDROLIZATELOR OBȚINUTE PRIN HIDROLIZA BIOMASEI VEGETALE

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Abstract. *In this paper we studied the effect of temperature on yields reducing substances and yields on dry matter obtained under prehydrolysis batch of rapeseed stalks and beech sawdust function as catalyst. Also we studied the optical characteristics prehydrolysates obtained by hydrolytic treatments. Treatments were performed in the presence of three types of catalysts (demineralized water, 0.5 % sulfuric acid solution and 3 % solution of aluminum sulphate) depending on contact time and temperature. The results showed that in batch mode in the presence of 0.5 % H_2SO_4 solution, yield reaches a maximum at 170 °C (15.2 %) after which it decreases with increasing temperature from 5.94 % (180 °C). The explanation for this, can be given by the expense of decreasing content of carbohydrates, especially due to hemicelluloses hydrolysis that are decomposed at temperatures higher than 170 °C.*
Keywords: *prehydrolysis, batch processes, vegetal materials, fluorescence and UV-VIS spectroscopy.*

Rezumat. *În această lucrare s-a studiat efectul temperaturii asupra randamentelor în substanțe reducătoare şi a randamentelor în substanță uscată obținute prin prehidroliză în regim discontinuu a tulpinilor de rapiță şi rumeguşului de fag funcție de catalizator. S-a studiat de asemenea şi caracteristicile optice ale prehidrolizatelor obținute în urma tratamentelor hidrolitice. Tratamentele au fost efectuate în prezența a trei tipuri de catalizatori (apă demineralizată, soluție 0,5 % acid sulfuric şi soluție de 3 % sulfat de aluminiu) în funcție de durata de reacție şi temperatură. Rezultatele au arătat că în regim discontinuu, în prezența soluției de 0,5 % H_2SO_4, randamentul atinge un maxim la 170 °C (15,21 %) după care acesta scade odată cu creşterea temperaturii la 5,94 % (180 °C). Explicția acestui fapt se datorează micşorării conținutului de hidrați de carbon, mai ales pe seama hidrolizei hemicelulozelor care sunt descompuse la temperatură mai mare 170 °C.*
Cuvinte cheie: *prehidroliza, regim discontinuu, materiale vegetale, spectroscopia de fluorescență şi UV-VIS.*

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INTRODUCTION

Increasing price of conventional materials (oil, natural gas and coal) requires finding new resources, such as biomass, a renewable resource, in order both energy production (biodiesel, ethanol, gas and biogas) and to obtain micro- and macromolecular compounds with potential applications in biological and other chemical synthesis (Cazacu et. al., 2010).

The hydrolysis technology prefers a complex valorization of all chemical components of vegetal material: hemicelluloses in obtaining furfural and celollignin in manufacture of glucose, ethanol or feed yeast (Măluțan, 2008).

Rapeseed crop is an attractive feedstock for bioenergy production. Its seeds can be used to produce biodiesel while the rapeseed straw is good for bioethanol and biohydrogen production (Karakashev et al., 2007).

Rapeseed straw, an agricultural residue in the process of bio-oil extraction, is an abundant and low-cost lignocellulosic material in many European and Asian countries. Utilization of the rapeseed straw gives an added value for this material and a solution for the removal of this abundant waste, solving a problem of the bio-oil industry and increasing the economical yield of the process. Therefore, a double effect is obtained, economic and ecologic (Jeong et al., 2010).

Hydrothermal pre-treatment can be effectively used for releasing sugars from rapeseed straw, needing no chemical others than water (Diaz et. al., 2010).

In batch reactors were used frequently in kinetic investigations of cellulose hydrolysis with acid. Application of high temperature, although in theory would increase efficiency, is simply not possible because of operational difficulties arising from rapid response speed (Rozmarin et al., 1994).

MATERIAL AND METHOD

Obtaining of the prehydrolysate

The batch hydrolysis treatment of rapeseed stalks and beech sawdust was performed with demineralizated water at a range temperature of 150-190 ^{0}C for 120 minutes, using a reactor equipped with a temperature controller and an HPLC pump. The stainless steel digester was heated to the desired temperature and then placed in a sand bath (Liu et al., 2004). After hydrolysis, the prehydrolysate was separated from the biomass treated through filtration in order to establish the content of the reducing substances and the separated fractions (UV-VIS and fluorescence spectroscopy).

Methods of spectral analysis

1. UV-VIS Spectroscopy

The UV-VIS spectra of prehydrolysates were recorded on a spectrophotometer type JASCO 550V, the absorption region in 200÷900 nm, scan speed 200 nm/min and 1 nm resolution.

2. **Fluorescence Spectroscopy**

The fluorescence emissions of prehydrolysates were registered on a luminiscence spectrometer Perking Elmer LS 50B, at wavelength excitation of 350 nm, the absorbtions being evaluated in the 400÷600 nm region, emission slit was 20 nm, scanning speed 500 nm/min.

RESULTS AND DISCUSSION

Effect of hydrolysis temperature on the yields of total reducing substance in the prehydrolysates

In batch mode in the presence of 0.5% H_2SO_4 solution, RS yield reaches a maximum at 170 ˚C (15.21%) after which it decreases with increasing temperature from 5.94% (180 ˚C). The explanation for this, can be given by the expense of decreasing content of carbohydrates, especially due to hemicelluloses hydrolysis that are decomposed at temperatures higher than 170 ˚C. Another observation is that in all three hydrolysis processes carried out in batch mode, the pH prehydrolysates obtained decreases with increasing temperature.

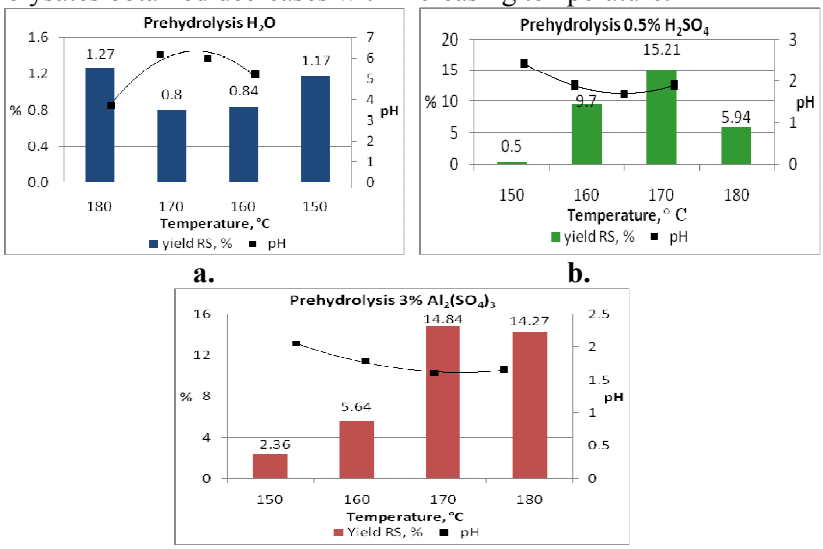

Fig.1 - Yields in RS (reported at oven dried material) and pH of hydrolysates of rapeseed stalks depending on temperature

Experiments on beech sawdust in the autohydrolysis with raising temperature to 140, 150 ˚C under moderate pressure batch (400 atm) yield increases of about 5 times and if not using water pressure increase yield is only 4 times. Criterion values hydrolysis in batch mode for the three types of processes are presented in Tables 1and 4.

Table 1.

Severity factor obtained prehydrolysates of rapeseed stalks in the presence of H_2O

Temperature 150 ˚C		Temperature 160 ˚C		Temperature 170 ˚C		Temperature 180 ˚C	
Time (min)	R_0	Time (min)	R_0	Time (min)	R_0	Time (min)	R_0
130	3856	120	7011	150	13236	120	27207

Table 2.

Severity factor obtained prehydrolysates of rapeseed stalks in the presence of 0.5% H_2SO_4 solution

Temperature 150 °C		Temperature 160 °C		Temperature 170 °C		Temperature 180 °C	
Time (min) = 114		Time(min) = 130		Time (min) = 110		Time (min) = 70	
R_0	CS	R_0	CS	R_0	CS	R_0	CS
3114	1.08	7596	1.99	14962	2.5	15871	2.29

Table 3.

Severity factor obtained prehydrolysates of rapeseed stalks in the presence of 3% $Al_2(S0_4)_3$ solution

Temperature 150 °C		Temperature 160 °C		Temperature 170 °C		Temperature 180 °C	
Time (min) = 110		Time (min) = 110		Time (min) = 110		Time (min) = 130	
R_0	CS	R_0	CS	R_0	CS	R_0	CS
3263	1.46	6427	2.02	12661	2.49	34008	2.87

Table 4.

Severity factor obtained prehydrolysates of beech sawdust in the presence of 0.5 % H_2SO_4 solution

Temperature 150 °C		Temperature 160 °C		Temperature 170 °C		Temperature 180 °C	
Time (min) = 110		Time (min) = 110		Time (min) = 110		Time (min) = 115	
R_0	CS	R_0	CS	R_0	CS	R_0	CS
3263	2.10	6427	2.32	12661	2.67	26073	3.00

Optical analysis of prehydrolysates

Absorption spectra in the UV-VIS and fluorescence recorded for prehydrolysates of rapeseed stalks obtained by prehydrolysis in regime batch are shown in Table 5. These are used to estimate the number of functional groups in particular compounds of lignin structure. Following analyzes of absorption signals were detected at 280 nm, thus confirming the presence of lignin fractions in prehydrolysates.

Table 5

The optical characteristics of the prehydrolysates of rapeseed stalks obtained in batch hydrolysis

Treatment	Temperature (°C)	$\lambda_{emission\ (fluorescence)}$ $\lambda_{excitation}$ = 350 nm	λ, UV-VIS (nm)
Demineralized water	150	410	281
	160	425	280
	170	424	279
	180	423	278

0.5% H_2SO_4 solution	150	430	203 / 282
	160	416	209 / 278
	170	415	204 / 279
	180	417	205 / 273
3 % $Al_2(SO_4)_3$ solution	150	408	214 / 276 / 348
	160	413	206 / 277 / 365
	170	410	206 / 231 / 277 / 372
	180	427	209 / 229 / 278 / 371

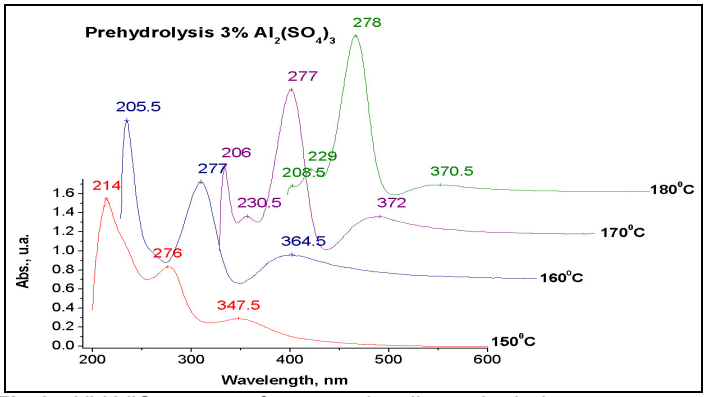

Fig.2 - UV-VIS spectra of rapeseed stalks prehydrolysates obtained by prehydrolysis in regime batch with 3% $Al_2(S0_4)_3$ solution

Recorded fluorescence emission wavelength decreases emission if hydrolysis with 3% $Al_2(SO_4)_3$ solution, and if additional UV-VIS absorption bands appear at 206-229 and 348-372, which is explained by absorption of degradation of compounds different from yields of 0.5% H_2SO_4 solution or water. UV-VIS spectra confirmation may be noticed in HPLC chromatograms. Absorbances when using beech sawdust can be obsevate in Table 6:

Table 6

Optical characteristics of sawdust beech prehydrolysates obtained by prehydrolysis with demineralized water

Temperature (°C)	Treatment	$\lambda_{emission\ (fluorescence)}$ $\lambda_{excitation}$ = 350nm	λ, UV-VIS (nm)
140	hydrolysis of pentosans in batch mode (pressure=400 atm)	431	278
150	hydrolysis of pentosans in discontinuous mode	430	280
150	hydrolysis of pentosans in batch mode (pressure=400 atm)	459	278

If the beech sawdust prehydrolysates, UV-VIS spectra analysis of recorded if the sawdust beech prehydrolysate it shows characteristic bands at 278 nm and 280 nm highlighting the following molecular lignin fractions recorded in solution, alongside sugar degradation compounds (furfural). By analyzing the fluorescence spectra observed a shift of emission maxima at 431 nm (140 ˚C) to

459 nm (150 ˚C). By analyzing the fluorescence spectra observed a displacement of emission maxima at 431 nm (140 ˚C) to 459 nm (150 ˚C).

CONCLUSIONS

1. The behavior vegetal biomass, especially in the hydrolysis of polysaccharides was studied by batch hydrolysis process at different temperature levels.

2. Following UV-VIS spectral analysis and fluorescence we can say that the more accentuated modifications are observed at the prehydrolysates obtained by prehydrolysis with 3 % $Al_2(SO_4)_3$ solution of rapeseed stalks. These modifications are attributed to the presence of sugars at 220 nm and lignin fractions at 280 nm.

Acknowedgements: *This paper was realised with the support of POSDRU CUANTUMDOC "DOCTORAL STUDIES FOR EUROPEAN PERFORMANCES IN RESEARCH AND INOVATION" ID79407 project funded by the European Social Found and Romanian Government.*

REFERENCES

1. Cazacu G., Totolin M.I., Popa V.I., 2010 - *Lignina, sursă de materii prime şi energie.*, Ed. Pim, Iaşi, ISBN: 606-520-716-0, 978-606-520-716-5;

2. Maluțan Th., 2008 - *Valorificarea complexă a biomasei*, Ed. Performantica, Iasi;

3. Karakashev D., Thomsen A.B., Angelidaki I., 2007. *Anaerobic biotechnological approaches for production of liquid energy carriers from biomass.* Biotechnol. Lett. 29, p. 1005–1012;

4. Jeong T.-S., Um B.-H., Kim J.-S., Oh K.-K., 2010 - *Optimizing Dilute-Acid Pretreatment of Rapeseed Straw for Extraction of Hemicellulose*. Appl. Biochem. Biotechnol., 161, p. 22-33;

5. Díaz M.J., Cara C., Ruiz E., Romero I., Moya M., Castro E., 2010 - *Hydrothermal pre-treatment of rapeseed straw.* Bioresour. Technol. 101, p. 2428-2435;

6. Rozmarin Gh., Popa V.I., 1994 - *Tehnologia proceselor hidrolitice şi fermentative*. Ed. Univ. Teh."Gh. Asachi" Iaşi;

7. Liu C.G., Wyman C.E., 2003 - *The effect of flow rate of compressed hot water on xylan, lignin, and total mass removal from corn stover*. Industrial & Engineering Chemistry Research, 42, p. 5409-5416;

8. **Liu C., Wyman C.E, 2004** - *Impact of Fluid velocity on hot water only pretreatment of corn stover in a flowthrough reactor*, Appl. Biochem. Biotechnol., p. 113-116, p. 977-987.

VARIATION OF FLAVONOIDS AND TOTAL POLYPHENOLS CONTENTS IN TWO PARSLEY (*PETROSELINUM CRISPUM*) VARIETIES UNDER SALIN CONDITIONS

VARIAȚIA CONȚINUTULUI DE FLAVONOIDE ŞI POLIFENOLI LA DOUĂ VARIETĂȚI DE PĂTRUNJEL (*PETROSELINUM CRISPUM*) SUB INFLUENȚA STRESULUI SALIN

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Abstract. *The aim of this work was to investigate some of the biochemical responses in two parsley cultivars (cultivated for roots and leaves production) under salt stress. Thus, the total polyphenols and flavonoids contents (well known for acting as antioxidants), were determined in two parsley varieties, in order to study their possible role as biochemical markers for salt stress responses. Three saline treatments were applied to parsley plants, in parallel with a control, free of salt exposure plant series. The level of total phenols and flavonoids varies slightly among parsley varieties cultivated for roots production, under NaCl stress. While NaCl treatments stimulate the total phenols content in parsley variety cultivated for leaves, the flavonoids level was found to be lower, in the same variety.*
Keyords: *parsley, flavonoids, polyphenols, NaCl stress*

Rezumat. *Scopul acestei lucrări a fost investigarea unor răspunsuri biochimice la două soiuri de pătrunjel (cultivat pentru rădăcină şi frunze), sub influența stresului salin. Astfel, conținutul de polifenoli totali şi flavonoide (cunoscuți ca şi antioxidanți) s-a determinat în soiuri de pătrunjel pentru a studia posibilul rol ca markeri biochimici pentru răspunsul la stres. Au fost aplicate trei tratamente saline, plantelor pătrunjel iar în paralel, s-a realizat şi un martor, fără tratament. Nivelul de polifenoli şi flavonoide variază uşor între soiurile de pătrunjel cultivate pentru rădăcină, în condiții de stres salin. În timp ce tratamentul cu NaCl stimulează conținutul total de fenoli la varietatea de pătrunjel pentru frunze, nivelul de flavonoizi a fost mai mic, în cazul aceluiaşi soi.*
Cuvinte cheie: *pătrunjel, flavonoide, polifenoli totali, NaCl stres*

INTRODUCTION

Petroselinum crispum (Mill.) A. W. Hill is a member of *Apiaceae* family that is employed in the food, pharmaceutical and cosmetic industries (Lopez et al., 1999). Parsley has a very high content of vitamins (β-carotene, thiamin, riboflavin, ascorbic acid and tocopherol) and is a rich source of calcium,

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iron and folate; it contains also fatty acids and an essential or volatile oil (Parthasaranthy et al., 2008). Phytochemical screening of parsley *P. crispum* has revealed the presence of several classes of flavonoids (Fejes et al., 2000). The major flavonoids found in parsley and other apiaceous vegetables are flavonols (kaempferol and quercetin) and flavones (apigenin and luteolin), which occur as glycosidic form in nature (Peterson et al., 2006). The predominant mechanism of their biological actions is thought to result from antioxidant activity and the capacity to scavenge free radicals (Lin et al., 2002, Potapovich and Kostyuk, 2003). The antioxidant activity of plants mainly contribute by the active compounds present in them. It is believed that increase in secondary metabolites synthesis in response to stressful conditions protect the cellular structures against oxidation (Chanwitheesuk et al., 2005). In a study by Hinneburg et al., 2006, hydrodistilled extracts from basil, laurel, parsley, juniper, aniseed, fennel, cumin, cardamom and ginger were assessed for their total antioxidant activities by several *in vitro* methods. Although parsley showed the best performance in the iron chelation assay, it was less effective at retarding the oxidation of linoleic acid in the linolenic acid peroxidation assay.

Many researches have reported that phenolic constituents of plant provide protection against oxidation (Amarowicz et al., 2003; Pokorny, 2001). Flavonoids are reported as antioxidant agents by scavenging ROS, which are functioned by virtue of the number and arrangement of their hydroxyl groups attaches to ring structures. Their ability to act as antioxidants depends on the reduction potentials of their radicals and accessibility of the radicals (Rice-Evans, 2006, Heim et al., 2002). Polyphenol synthesis and accumulation is generally stimulated in response to biotic or abiotic stresses (Dixon and Paiva, 1995, Muthukumarasamy et al., 2000). Increase in polyphenol content in different tissues under increasing salinity has also been reported in a number of plants (Parida and Das, 2005, Navarro et al., 2006).

The main aim of the present study was investigation the effect of different concentration of NaCl salt on total polyphenols and flavonoids contents at two parsley varieties (cultivated for roots and leaves).

MATERIAL AND METHOD

Seedling growth conditions

The researches were conducted with two parsley seeds varieties (for roots and leaves). The seeds surface was sterilized with 3% H_2O_2 for three minutes then thoroughly rinsed with distilled water. During the course of experiment, the seeds were placed in plastic pots containing soil and watered every three days with NaCl solution. Thus, for each variety it was used three different concentrations of NaCl (50 mM, 100 mM and 150 mM NaCl). Distilled water, without NaCl addition, was used for control. The watering was carried out for 14 days, after which the plantlets of two parsley varieties were collected for biochemical determinations. At 150 mM NaCl concentration parsley seedling for leaves production did not survives.

Extraction of flavonoid and total polyphenolic content

For determination of total flavonoid and total polyphenolic contents it was used the same extract. Thus, the fresh seedling samples of two parsley varieties were

extracted with the 80% methanol, at room temperature using an orbital shaker set at 200 rpm. The mixture was centrifuged at 1000 g for 15 min.

Total flavonoid content

The total flavonoid content was measured following a spectrophotometric method (Dewanto et al., 2002). Briefly, methanol extract of each parsley cultivar were appropriately diluted with distilled water. Initially, 5% $NaN0_2$ solution was added to each test tube; at five minutes, 10% $AlCl_3$ solution was added and then at six minutes 1.0 M NaOH was added. Finally water was then added to the test tube and mixed well. Absorbance of resulting pink-coloured solution was read at 510 nm against the blank (distilled water). Flavonoid content was expressed as mg catechin equivalents (CE) per g of fresh weight parsley (mg CE/g FW) (R^2 =0,98). Three readings were taken for each sample and the result averaged.

Total polyphenolic content

The total polyphenolic content was determined by using a modified Folin-Ciocalteau method (Singelton *et al*., 1999). The appropriately diluted sample was added Follin-Ciocalteau reagent and mixed thoroughly. After four minutes, 15% Na_2CO_3 was added. The absorbance of resulting bleu-coloured solution was read at 760 nm after two hours, against the blank (distilled water). The amount of the total phenolic content was expressed as mg galic acid equivalents (GAE) per g of fresh weight parsley (mg GAE/g FW) (R^2 =0,99). Three readings were taken for each sample and the result averaged.

Statistical analysis

Statistical analysis of the results was carried out according to student test.

RESULTS AND DISCUSSIONS

Plant phenolics constitute one of the major groups of compounds that may function as antioxidants. Therefore, it was beneficial to determine the amount of phenolics and flavonoids in parsley extracts. From the results present, in figure 1 it was observed that NaCl salinity different influenced the total polyphenol content in plantlets of two parsley varieties. It is evident that total polyphenol content of parsley seedling variety for roots decreased comparatively with control at 50 mM and 150 mM levels of salinity, from 0,671 mg GAE/g FW to 0,577 and 0,774 mg GAE/g FW, respectively. At 100 mM NaCl salinity it was remarked the highest polyphenol content.

Seedling of parsley variety for leaves under the same salinity conditions indicated an increase of total polyphenol level at 50 mM and 100 mM NaCl. This increase of polyphenols content under increasing salinity level possibly shows that the induction of secondary metabolism is one of the defence mechanisms adopted by the plants to face saline environment. The maximum increase in total polyphenols was observed at 50 mM for parsley variety for leaves whereas at the second variety, for roots at 100 mM concentration.

Increase in polyphenol content in different plants tissues under increasing salinity has also been reported in a number of plants like red matured fruits of pepper (Navarro et al., 2006), some mulberry genotypes (Agastian et al., 2000) in mangrove *Aegiceras corniculatum* (Parida et al., 2004).

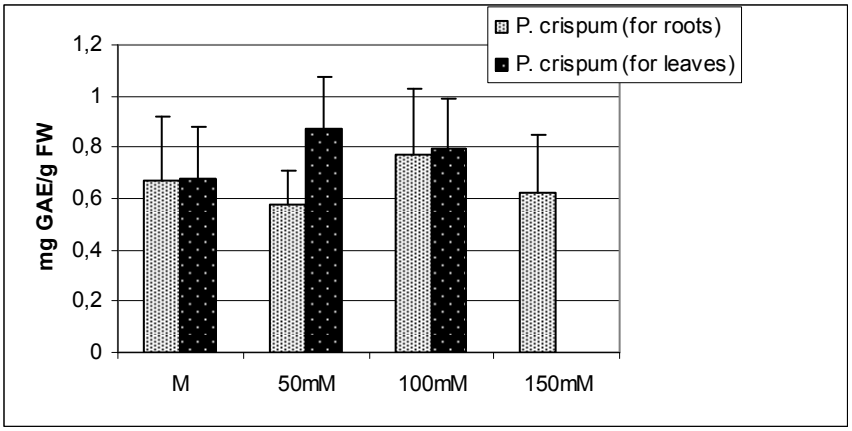

Fig. 1 - Salt stress effects on total polyphenol content in seedling of two *parsley varieties* (for roots and leaves) at 14 day of experiment

The ancient and widespread flavonol metabolism has been widely reported to be mostly involved in the response mechanisms of plants to a wide range of stressful conditions (Winkel-Shirley, 2002). In parsley variety for roots, the salinity concentrations had the similar trend on total flavonoid accumulation like phenolic compunds (Fig. 2).

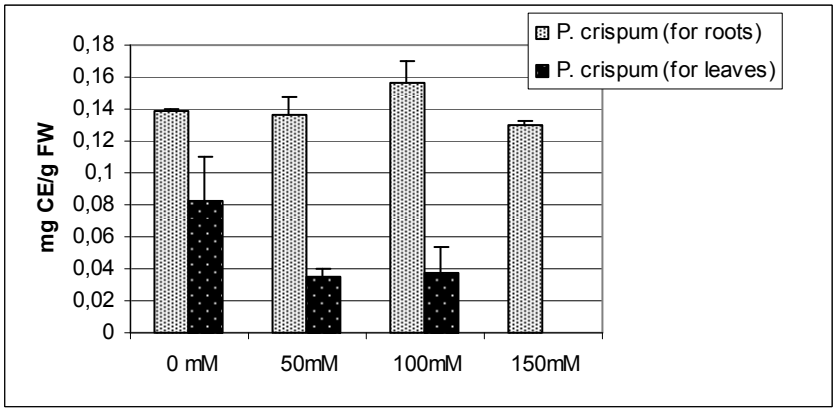

Fig. 2 - Salt stress effects on total flavonoids level in seedling of two *parsley varieties* (for roots and leaves) at 14 day of experiment

Total flavonoid contents in salt-stressed seedling of parsley variety for roots ranged between 0,130 mg - 0,156 mg CE/g FW at concentrations 100 mM and, 50 mM,, respectively. At both low NaCl concentrations, in seedling of parsley variety for leaves, the flavonoid level was actually similar (0,034 mg CE/g FW at 50mM and 0,036 mg CE/g FW at 100mM), being significant reduced comparatively with control (0,082 mg CE/g FW).

CONCLUSIONS

The results regarding nonenzymatic antioxidants responses, at 14 day after the experiment start, in both parsley varieties for roots and leaves, induced by salinity are complex. Thus, at seedling parsley variety for roots, polyphenols and flavonoids contents have had the same variation tendency as regards the salinity effect; only 100 mM concentration has had stimulating effect comparatively with control. The salin effect stimulated the polyphenols contents at seedling parsley variety for leaves but inhibited the flavonoids contents.

REFERENCES

1. **Amarowicz R., Pegg R. B., Rahimi-Moghaddam P., Barl B., Weil J. A., 2004 -** *Freeradical scavenging capacity and antioxidant activity of selected plant species from the Canadian prairie*s, Food Chemistry, 84, p. 551-562.
2. **Chanwitheesuk A., Teerawutgulrag A., Rakariyatham N., 2005 -** *Screening of antioxidant activity and antioxidant compounds of some edible plants of Thailand,* Food Chem., 92, p. 491-497.
3. **Dewanto V., Wu X., Adom K.K., Liu R.H., 2002 -** *Thermal processing enhances the nutritional value of tomatoes by increasing total antioxidant activity*, J. Agric. Food Chem., 50, p. 3010-3014.
4. **Dixon R.A., Paiva N., 1995 -** *Stressed induced phenyl propanoid metabolism*, Plant Cell., 7,p. 1085–1097.
4. **Fejes S.Z., Blazovics A., Lemberkovics E., Petri G., Szoke E., Kery A., 2000 -***Free radical scavenging and membrane protective effects of methanol extracts from Anthriscus cerefolium (Hoffm) L. and Petroselinum crispum (Mill) Nym. Ex A. W. Hill.,* Phytother. Res., 14, p. 362–365.
5. **Heim K.E., Tahliaferro A.R., Bobilya D.J., 2002 -** *Flavonoid antioxidants: chemistry, metabolism and structure-activity relationships*, J. Nutr. Biochem., 13, p. 572-584.
6. **Hinneburg Iris, Damien Dorman H.J., Raimo Hiltunen, 2006 -** *Antioxidant activities of extracts from selected culinary herbs and spices*, Food Chemistry 97,p. 122–129
7. **Lin C.M., Chen C.S., Chen C.T., Liang Y.C., Lin J.K., 2002 -** *Molecular modeling of flavonoids that inhibits XO*, Biochem. Biophys. Res. Commun., 294, p. 167–172.
8. **Lopez M.G., Sanchez-Mendoza I.R., Ochoa-Alejo N., 1999 -** *Compartive study of volatile components and fatty acids of plants and in-vitro cultures of parsley Petroselinum crispum (Mill) nym ex hill,* J. Agric. Food Chem, 47, p. 3292–3296.
9. **Muthukumarasamy M., Gupta S.D., Pannerselvam R., 2000 -** *Enhancement of peroxidase, polyphenol oxidase and superoxide dismutase activities by tridimefon in NaCl stressed Raphanus sativus L.,* Biol Plant, 43, p. 317-20.
10. **Navarro J.M., Flores P., Garrido C., Martinez V., 2006 -** *Changes in the contents of antioxidant compounds in pepper fruits at ripening stages, as affected by salinity*, Food Chem. 96, p. 66-73.
11. **Parida A.K., Das A.B., 2005 -** *Salt tolerance and salinity effects on plants: a review*. Ecotoxicol. Environ. Saf., 60, p. 324-49;
12. **Parida A.K., Das A.B., Sanada Y., Mohanty P., 2004 -** *Effects of salinity on biochemical components of the mangrove, Aegiceras corniculatum*, Aqua. Bot., 80: p. 77-87.
13. **Parthaaranthy V.A., Chempakam B., Zachariah T.J., 2008 -** *Chemistry of Spices*, CAB International, Oxfordshire.
14. **Peterson S., Lampe J.W., Bammler T.K., Gross-Steinmeyer K., Eaton D.L., 2006 -** *Apiaceous vegetable constituents inhibit human cytochrome P-450 1A2 (hCYP1A2)*

activity and hCYP1A2-mediated mutagenicity of aflatoxin B_1, Food Chem. Toxicol., 44, p. 1474–1484.

15. **Pokorny J. 2001 -** Introduction, In J. Pokorny, N. Yanishlieva & M. Gordon, eds. Antioxidants in Food, Practical applications. Woodhead Pulbishing Limited, Cambridge, 1-3.
16. **Potapovich A.I., Kostyuk V.A., 2003 -** *Comparative study of antioxidant properties and cytoprotective activity of flavonoids,* Biochemistry, 68, p. 514-519.
17. **Rice-Evans C.A., Miller N.J., Paganga G., 2006 -** *Structure-antioxidant activity relationships of flavonoids and phenolic acids,* Free Rad. Biol. Med., 335, p. 166-180.
18. **Singleton V.L., Orthofer R., Lamuela-Raventos R.M., 1999 -** *Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent,* Methods Enzymol., 299, p. 152-178.
19. **Winkel-Shirley B., 2002 -** *Biosynthesis of flavonoids and effect on stress,* Curr. Opin Plant Biol., 5, p. 218–223.

THE WOUND-HEALING EFFECT OF SOME NATURAL VEGETAL AND APITHERAPY EXTRACTS IN SKIN LESIONS

EFECTUL CICATRIZANT AL UNOR EXTRACTE VEGETALE SI APITERAPICE ASUPRA LEZIUNILOR DERMICE

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Abstract. *The present experiment evaluates the wound-healing effect of oil extracts of onion, St. John's wort and propolis tested intraoperatively and postoperatively on a cutaneous excision wound model in Wistar rats. The experimental model included five groups of Wistar rats: negative control group (non-treated control group), EUC group (treated with onion oil extract), EUP group (treated with propolis oil extract), EUS group (treated with St John's wort oil extract), and EUSCP group (treated with the mixture of all three extracts). In the end, a specimen sample of tissue removed from the healed skin of all rats was taken in order to be analyzed by histopathological examination. Clinical and histopathological results demonstrate the efficiency of oil extracts of onion, St. John's wort and propolis in the treatment of lesions with loss of cutaneous substance.*
Key words: *skin lesion, onion, St. John's wort, propolis.*

Rezumat. *Prezentul experiment evaluează efectul cicatrizant al extractelor uleioase de ceapă, sunătoare şi propolis testate intraoperator şi postoperator la şobolani Wistar, utilizând un model de afectare dermică de tip excizie. Modelul experimental include cinci loturi de şobolani: lot control (lot martor netratat), lot EUC (lot tratat cu extract uleios de ceapă), lot EUP (lot tratat cu extract uleios de propolis), lot EUS (lot tratat cu extract uleios de sunătoare), lot EUSCP (lot tratat cu amestec de extracte uleioase de ceapă, sunătoare şi propolis). În final, s-au prelevat probe de ţesut dermic din zona reepitelizată pentru efectuarea examenului histopatologic. Rezultatele clinice şi histopatologice demonstrează eficienţa extractelor uleioase de ceapă, sunătoare şi propolis în tratamentul leziunilor dermice cu pierdere de substanţă.*
Cuvinte cheie*: leziune dermică, ceapă, sunătoare, propolis.*

INTRODUCTION

Wounds represent the result of an injury al the level of skin integrity, and if the process of tissue repair following an inadequate treatment fails, they become chronic wounds. Besides the fact that these chronic dermal injuries affect negatively the quality of pacients' life, their management and care need high

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economical resources, a rather important problem especially for the developing countries (Schreml et al., 2010).

The last decades bring the complementary medicine into the medical forefront, having as major role the use of plants in the treatment of different disorders. The concept of *phytotherapy treatment* is reconsidered by achieving *in vivo* and *in vitro* studies regarding the confirmation of the healing effects of plants, the determination of the active principles responsible for these effects, and the elucidation of their mechanism of action (Adetutu et al., 2011).

The present experiment aims to confirm the traditional use of onion, St. John's wort and propolis in the treatment of wounds, by demonstrating the efficacy of their oil extracts in the processes of reepithelization and cicatrisation on an experimental model of excision closed with one surgical suture exerted on Wistar rats.

MATERIAL AND METHOD

Preparation of extracts

Bulbs of *Allium cepa* and aerial parts of *Hypericum perforatum* were collected from the Botanical Garden, Iaşi, Romania and a voucher specimen was identified by the staff of the same institution. Propolis was purchased from *Stupina LLC*, Bălăneşti, Gorj, Romania. The fresh vegetal products (the bulbs of *Allium cepa* and aerial parts of *Hypericum perforatum*) were grounded, weighted (50.00 g) and macerated in 500 mL of virgin olive oil in dark brown jars, at room temperature, for 2 weeks.

The propolis was grounded and 20 mL virgin olive oil was added. The extract was placed on a magnetic stirrer for 72 hours (700 rpm).

In the end, the extracts are filtered through gauze and placed in dark brown jars with stoppers. Furthermore, 150 mL of each filtered extract are mixed in a separate jar on a magnetic stirrer to obtain the mixture of extracts (EUSCP extract).

Experimental model

All the experimental proceedings achieved on laboratory animals (Wistar rats) in this study were in agreement with the guidelines of animal bioethics from the Act on Animal Experimentation and Animal Health and Welfare Act from Romania and were in compliance with the European Council Directive of 24 November 1986 (86/609/EEC).

The experiment included 5 groups of Wistar rats (6 animals per group): negative control group (control group with excisions, not treated), EUC group (treated with onion oil extract), EUP group (treated with propolis oil extract), EUS group (treated with St John's wort oil extract), and EUSCP group (treated with the mixture of all the three oil extracts).

The experimental model was achieved by making two paravertebral excisions (1x1 cm) with a sterile surgical blade through the full thickness of the skin at a distance of 1.5 cm from midline of each side of the vertebral column (Süntar et al., 2010). The wounds were closed with one surgical suture.

During the surgical operation, the natural oil extracts were applied. The postoperative treatment lasted 7 days (1 application per day), until the complete healing of the wound. In the end, a specimen sample of tissue removed from the healed skin of all rats was taken with a 3 mm biopsy punch in order to be analyzed by histopathological examination.

RESULTS AND DISCUSSIONS

Clinical results

The macroscopic evaluation of epidermal lesions for all the 4 experimental treated groups demonstrated the efficacy of the treatment with oil extracts of onion, propolis and St. John's wort. The complete healing occurred after 7 days of treatment, the time needed for reepithelization of the wounded skin being much shorter than in other studies (Akkol et al, 2011) (Table 1).

Histopathological results

In all the 4 treated groups, the epidermis is intact, rectilinium, represented by 3-4 layers (EUSCP group) or 4-5 layers (EUP group). Isolated, there can be noticed areas completely denuded of epithelium, with small foci of regeneration (EUS group) and subepithelial microhemorrhage in the regerating foci. Especially in the regenerating foci, hyperchrome nuclei are to be seen in the basal layer, slightly increased in volume, and also vacuolar degeneration (Table 1).

Discrete or no vascular congestion can be seen in the superficial papillary dermis and the deeper reticular one. Edema is present with different intensities, from discrete (EUS group), to moderate (EUP group) and significant edema (control group) (Fig. 1, Table 1). No edema could be observed in the group treated with onion oil extract and the mixture of all three oil extracts, thus resulting that onion extract exerted the most important anti-inflammatory effect (Fig. 1, Table 1). Lymphocytes and fibroblasts are seen mainly perivascular, but also with diffuse disposition in the superficial and deeper dermis (fig. 2, table 1). As in the case of edema, the most decreased number of lymphocytes and fibroblasts appears in the groups treated with onion oil extract (EUC and EUSCP groups), conducting us to the idea that the wound healing effect has been exerted much faster in these groups (Fig. 2, Table 1). Discrete aspects of collagenisation or fibrosis are seen in some cases (control group) (Table 1). The hair follicles present in biopsies do not show any modification.

The wound healing effects of oil extracts of onion, St. John's wort and propolis are mainly based on the anti-inflammatory, antioxidant and antibacterial effects of their components, as the regulation of inflammation, immunomodulation and oxidation plays an important role in re-establishing the normal function and anatomy of the affected skin (Koltuksuz et al., 2011).

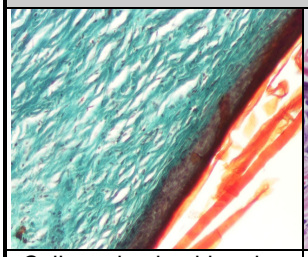
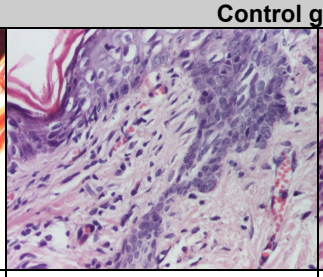
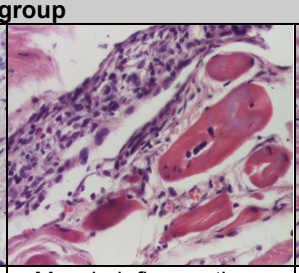
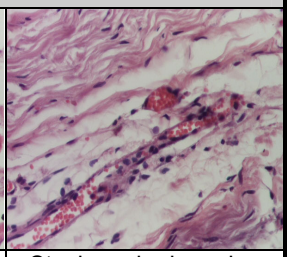
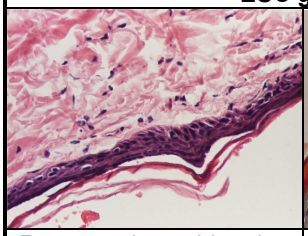
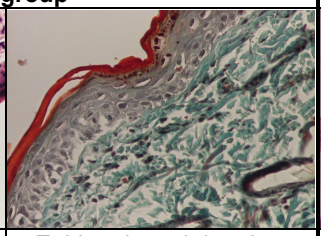
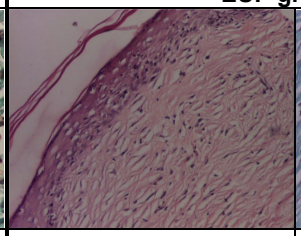
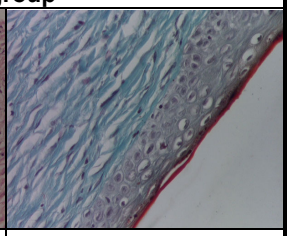
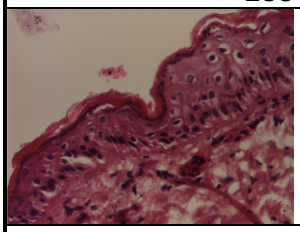
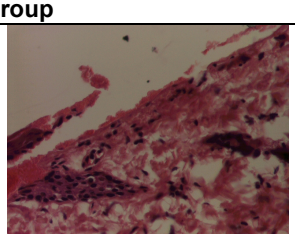
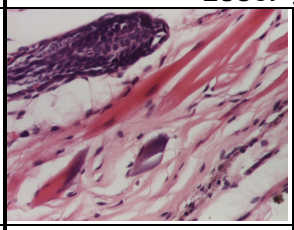
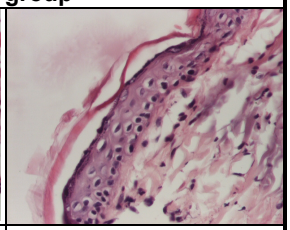
First of all, the tested oil extracts interfere in the first phase of tissue repair process – the inflammatory phase. The anti-inflammatory mechanism is exerted by: 1) quercetin, the major flavonol in onion, that acts by inhibiting cyclooxygenase (COX) and lipoxygenase (LOX) (Singh et al., 2009); 2) quercetin and hyperforin from the oil extract of St. John's wort (Istudor, 1998; Süntar et al., 2010); 3) flavones and caffeic acid phenethyl ester (CAPE), a specific inhibitor of the kappa B transcription nuclear factor, that inhibits LOX-5 by a non-competitive mechanism (Serarslan et al., 2007).

Recent experiments demonstrate the inhibitory effect of hyperforin upon the lymphocyte reaction at the level of epidermal cell and also upon the lymphocyte T proliferation (Schempp et al., 2000). We have also revealed in the present

experiment good results in this regard for the St. John's Wort oil extract, but even better results for the onion oil extract.

Table 1

Histopathological evaluation

MICROGRAPHIES and DESCRIPTION			
Control group			
			
Collagenized epidermis and dermis, edema (Sz x100)	Epidermis and dermis with leukocytes (HEx200)	Muscle inflammation (HEx 200)	Stasis and edema in deep dermis (HEx200)
EUC group		**EUP group**	
			
Regenerating epidermis and dermis (HEx200)	Epidermis and dermis, slight accentuation of basement membrane (Sz x200)	Epidermis and dermis – collagenization and slight edema (HEx100)	Epidermis and dermis – collagenization (Sz x200)
EUS group		**EUSCP group**	
			
Epidermis (HEx200)	Without epidermis (HEx200)	Dermis with appendages and striated muscle (HEx200)	Epithelium (HEx200)

The oil extracts tested in this experiment exert their antibacterial effect by the presence of the following compounds: 1) alliine and compounds of volatile oil from onion (Grigorescu et al., 2001); 2) hyperforin from St. John's wort extract, that has activity against a number of Gram-positive bacteria (*Staphylococcus aureus, Corynebacterium diphtheriae*), its effect being sustained by tannins, hypericine, and volatile oil (Istudor, 1998); 3) flavones from propolis (mainly galangin, pinocembrin and pinostribine), along with acids and aromatic esthers (Dimov et al, 1992).

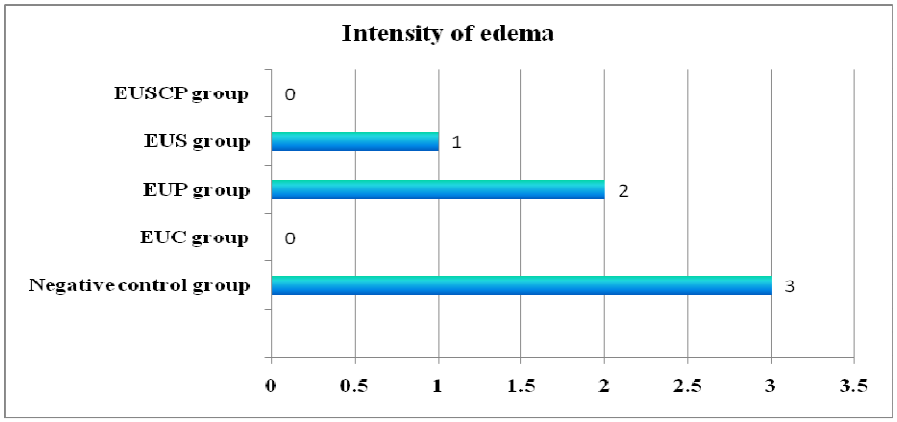


Fig. 1 - Intensity of edema at the end of the treatment
(evaluation scale of edema: 0 – absent; 1 – discrete; 1-2 – moderate edema; >2 – severe edema)

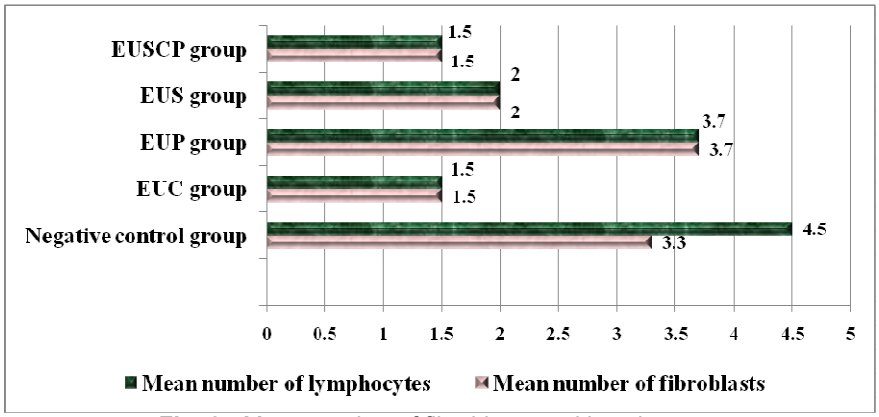


Fig. 2 - Mean number of fibroblasts and lymphocytes

The antioxidant effect of propolis is due to the inhibition of leukocyte myeloperoxidase by the means of its rich content in flavonoids and polyphenols, mainly kaempferol and CAPE (Kujumgiev et al., 1993).

Among the minerals present in onion and St. John's wort, calcium interferes in the wound healing process mainly by regulating the differentiation of keratinocytes, acting in a more discrete manner upon their proliferation (Tu et al., 2001).

It is worth mentioning that the clinical and histological results obtained for onion oil extract (EUC and EUSPC groups) are superior to all the other extracts tested in this experiment, showing regeneration of the epidermis, with minimal, hardly visible scars (Tables 1), no presence of edema (Fig. 1), and reduced number of lymphocytes and fibroblasts (Fig. 2).

Another thing that is worth mentioning is that the number of lymphocytes and fibroblasts has similar values for all the experimental groups, excepting for the negative control group (Fig. 2).

CONCLUSIONS

1. Clinical and histopathological results demonstrate the efficacy of the treatment with oil extracts of onion, propolis and St. John's wort in wound-healing of excision lesions.

2. The complete healing occurred after 7 days of treatment, the results being clearly superior to those cited in other studies

3. Clinical and histological results obtained for onion oil extract are superior to all the other extracts tested in this experiment.

Acknowledgements. *This paper was supported by the project PERFORM-ERA "Postdoctoral Performance for Integration in the European Research Area" (ID-57649), financed by the European Social Fund and the Romanian Government.*
The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013)under grant agreement n°264115 - STREAM.

REFERENCES

1. Adetutu A., Morgan W.A., Corcoran O., 2011 - *Ethnopharmacological survey and in vitro evaluation of wound-healing plants used in South-western Nigeria.* J Ethnopharmacol., 137(1), p. 50-56;
2. Akkol E.K., Suntar I., Keles H., Yesilada E., 2011 - *The potential role of female flowers inflorescence of Typha domingensis Pers. in wound management.* J Ethnopharmacol., 133, p. 1027–1032;
3. Dimov V., Ivanovska N., Bankova V., Popov S., 1992 - *Immunomodulatory action of propolis: Prophylatic activity against Gram-negative infections and adjuvant effect of water-soluble derivative.* Vaccine, 10, p. 817-823;
4. Grigorescu E., Lazăr M. I., Stănescu U., Ciulei I., 2001 - *Index fitoterapic*, Editura Cantes, Iaşi, p. 31;
5. Kujumgiev A., Bankova V., Ignatova A., Popov S., 1993 - *Antibacterial activity of propolis, some of its components and their analogs.* Pharmazie, 48, p. 785-786;
6. Schempp C.M., Winghofer B., Ludtke R., Simon-Haarhaus B., Schopf E., Simon J.C., 2000 - *Topical application of St John's wort (Hypericum perforatum L.) and of its metabolite hyperforin inhibits the allostimulatory capacity of epidermal cells.* British Journal of Dermatology, 142(5), p. 979–984;
7. Schreml S., Szeimies R. M., Prantl L., Landthaler M., Babilas P., 2010 - *Wound healing in the 21st century,* J Am Acad Dermatol, 63(5), p. 866-881;
8. Serarslan G., Altuğ E., Kontas T., Atik E., Avci G., 2007 - *Caffeic acid phenetyl ester accelerates cutaneous wound healing in a rat model and decreases oxidative stress.* Clinical and Experimental Dermatology, 32, p. 709–715;
9. Singh B.N., Singh B.R., Singh R.L., Prakash D., Singh D.P., Sarma B.K., Upadhyay G., Singh H.B., 2009 - *Polyphenolics from various extracts/fractions of red onion (Allium cepa) peel with potent antioxidant and antimutagenic activities.* Food and Chemical Toxicology, 47, p. 1161–1167;
10. Süntar I. P., Akkol E. K., Yılmazer D., Baykal T., Kırmızıbekmez H., Alper M., Yeşilada E., 2010 - *Investigations on the in vivo wound healing potential of Hypericum perforatum L.* J Ethnopharmacol., 127, p. 468–477;
11. Tu C.L., Chang W., Bickle D.D., 2001 - *The extracellular calcium-sensing receptor is required for calcium induced differentiation in human keratinocytes,* J. Biol. Chem., 276(44), p. 41079-41085;

EVALUATION OF THE INFLUENCE OF THE PYCNOGENOL CONTAINING PREPARATIONS UPON THE ANTIOXIDANT POTENTIAL

EVALUAREA INFLUENȚEI PREPARATELOR PE BAZĂ DE PICNOGENOL ASUPRA POTENȚIALULUI ANTIOXIDANT

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Abstract. *Pini maritimae cortex, the vegetal product obtained from the pine tree that grows in the mediterranean area of France, is remarkable through its high content of proanthocyanidins, bioflavonoids that show a strong antiradicalic effect. The extract from the bark of the maritime pine, known under the commercial name of Pycnogenol, is used for its antioxidant and anti-inflammatory effects, as a remedy in preventing and improving the symptoms of cardiovascular and cerebrovascular diseases, cancers, gout. The present experiment evaluates the influence of two pharmaceutical formulations of Pycnogenol (tablets with 0.02000 g extract from the bark of the maritime pine and hydroalcoholic solution containing 85% proanthocyanidin) upon the antioxidant potential of white Wistar rats. The experimental model includes 3 groups of animals: the reference group, Pycnogenol tablets group, and Pycnogenol solution group. The biochemical investigation reveals a significant positive influence of the Pycnogenol solution upon catalase, superoxide dismutase, glutathione peroxidase, but not upon the free sulfhydryl groups. The results also show an improvement for the group treated with Pycnogenol tablets regarding catalase and superoxide dismutase.*
Key words: *Pinus maritima, proanthocyanidins, antioxidant potential, enzymatic and non-enzymatic antioxidants.*

Rezumat. *Pini maritimae cortex, produsul vegetal obținut de la pinul din zona mediteraneană a Franței, se remarcă prin conținutul ridicat în proantocianidine, bioflavonoizi ce manifestă puternică acțiune antiradicalară. Extractul de scoarță de pin maritim, cunoscut sub denumirea comercială de Pycnogenol, se foloseşte ca antioxidant, antiinflamator, remediu în prevenirea şi ameliorarea unor boli cardiovasculare şi cerebrovasculare, unor maladii grave (cancere, gută) şi a unor maladii specifice bătrâneții sub diferite forma farmaceutice. Experimentul redat în acest articol testează influența a două forme farmaceutice cu Pycnogenol (comprimate cu 0,02000 g extract de pin maritim şi soluție hidro-alcoolică titrată conținând 85%proantocianidină) asupra potențialului antioxidant a şobolanului alb din linia Wistar. Experimentul cuprinde 3 loturi de câte 5 animale: lotul de referință, lotul căruia i se administrează prin hrană comprimate cu extractul amintit şi lotul ce a fost tratat cu aceeaşi doză de Pycnogenol sub formă de soluție. Investigația biochimică efectuată pe sângele animalelor evidențiază o influență semnificativ pozitivă a soluției de Pycnogenol asupra CAT, SOD, GPx, dar nu şi asupra*

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grupărilor –SH libere şi o influenţă pozitivă a comprimatelor cu acelaşi extract doar asupra CAT şi SOD.
Cuvinte cheie: *Pinus maritima, proantocianidine, potenţial antioxidant, antioxidanţi enzimatici şi non-enzimatici.*

INTRODUCTION

Proanthocyanidins from the bark of the maritime pine (*Pinus maritima*) are compounds that possess a strong free radical scavenging effect, preventing from the deleterious action of the free radicals that are present in concentrations specific to oxidative stress (Liu, 1998). The extract from the bark of the maritime pine, known under the generic name of Pycnogenol, counteracts the destructive action exerted by the free radicals at the cellular level, translated by binding to the cell constituents, including DNA, and by enzymatic inhibitions. By this way, Pycnogenol delays the aging process, prevents or improves the expression of some severe maladies: cancer, cardiovascular and cerebrovascular diseases (Peng, 2000). Pycnogenol prevents from platelet aggregation, has a positive action upon the circulatory system by increasing the resistance of capillary vessels and by protecting the tissue collagen cross-links, exerts anti-inflammatory, immunostimulating and antiallergy effects (Grimm et al., 2006a; Takano et al., 2011). Starting from these therapeutical virtues of the active compounds from the bark of the maritime pine and from their pharmacokinetic properties (Grimm et al., 2006b) it is considered necessary to test the influence of the intake of different pharmaceutical forms of Pycnogenol upon some enzymatic and non-enzymatic antioxidants from the living organism.

MATERIAL AND METHOD

The present experiment makes a comparative analysis regarding the influence of the active compounds from the maritime pine upon some biochemical parameters with antioxidant effect (table 1).

Two pharmaceutical formulations have been tested: tablets with 0.020 g extract from the bark of the maritime pine and hydroalcoholic solution available in 30 mL bottles, containing 2.000 mg of extract (85% proanthocyanidin). The two pharmaceutical formulations have been tested on female white rats, Wistar breeding, 2 months old, having an average body weight of 312 g.

All the experimental proceedings achieved on laboratory animals (Wistar rats) in this study were in agreement with the international ethics regulations and were approved by the Ethics Commission of the University of Agricultural Sciences and Veterinary Medicine of Iaşi.

The experimental model included 3 groups (5 animals/group), as follows: the first group - the reference group, that was housed and fed in the same standard conditions as the other two experimental groups for 4 weeks; the second group (Pycnogenol tablets group) - the group that was given standard food with Pycnogenol tablets containing 0.020 g extract from the bark of the maritime pine (in dose of 0.1428 mg extract/100 g body weight/day); the third group (Pycnogenol solution group) - the group that was administered the Pycnogenol solution, containing the same dose of extract expressed as 85% proanthocyanidins, e.g. 0.1428 mg extract/100 g body weight/day (Table 1). Both the Pycnogenol solution and Pycnogenol tablets were

administered with food, each day, during the morning. In order to respect the correct doses, each rat was housed in individual cages during the administration of food.

Table 1

Experimental model

Groups	**Pycnogenol tablets** (0.02 g extract of *Pinus maritima*) **(dose of extract/100 g/day)**	**Pycnogenol solution** (85% proanthocyanidins) **(dose of extract/100 g/day)**	**Biochemical parameters**
Reference group	-	-	Catalase Superoxide dismutase Glutathione peroxidase Free sulfhydryl groups
Pycnogenol® tablets group	0.1428 mg extract as titrate powder	-	
Pycnogenol® solution group	-	0.1428 mg extract as titrate solution	

In the end of the experiment that lasted 4 weeks, blood samples were collected and submitted to biochemical analysis: serum catalase (CAT), superoxide dismutase (SOD), glutathione peroxidase (GPx) and free sulfhydryl groups.

RESULTS AND DISCUSSIONS

The evolution of CAT, enzyme found in mitochondria and peroxisomes of all aerobic cells, is presented in fig. 1. The study of these data reveal a significant increase of the activity of this enzyme from 527.05 U/ml, value registered for the reference group, to 567.43 U/ml, the value of CAT for the group that received the treatment with Pycnogenol tablets 0.020 g. A significant increase, but with 4 units less, appears for the group protected with Pycnogenol solution (85% proanthocyanidins). The value for the activity of serum CAT for this group is 551.56 U/ml.

The second enzyme tested in this experiment (SOD) is a metallo enzyme (Zn-Cu-SOD) that annihilates the superoxide radicals ($O_2^{\cdot -}$). Observing the variation of the activity of this enzymatic antioxidant, as it is shown in fig. 2, there can be noticed an evolution similar to catalase, but in a more discrete manner. There has to be remarked that, in the case of SOD, the maximum of the activity is obtained in the serum of the group treated with Pycnogenol hydroalcoholic solution. The activity of SOD increases from 459.1 U/ml (the reference group) to 467.8 U/ml. The evolution of SOD for the group that was given Pycnogenol tablets is also positive, being only 1.05 units smaller than the value of SOD for the previous group.

The results obtained for the third tested enzymatic antioxidant (GPx) are given in fig. 3. From the study of these data, there can be noticed a different evolution when compared to the other two antioxidant enzymes. Therefore, the enzyme registers a decrease from 77.2 U/min/ml (the reference group) to 74 U/min/ml (the group treated with Pycnogenol tablets). In contrast with this unexpected behavior, the evolution of GPx in the serum of the animals treated

with Pycnogenol solution is positive (80.26 U/min/ml), the activity of the enzyme surpassing with 8 units the value of the reference group.

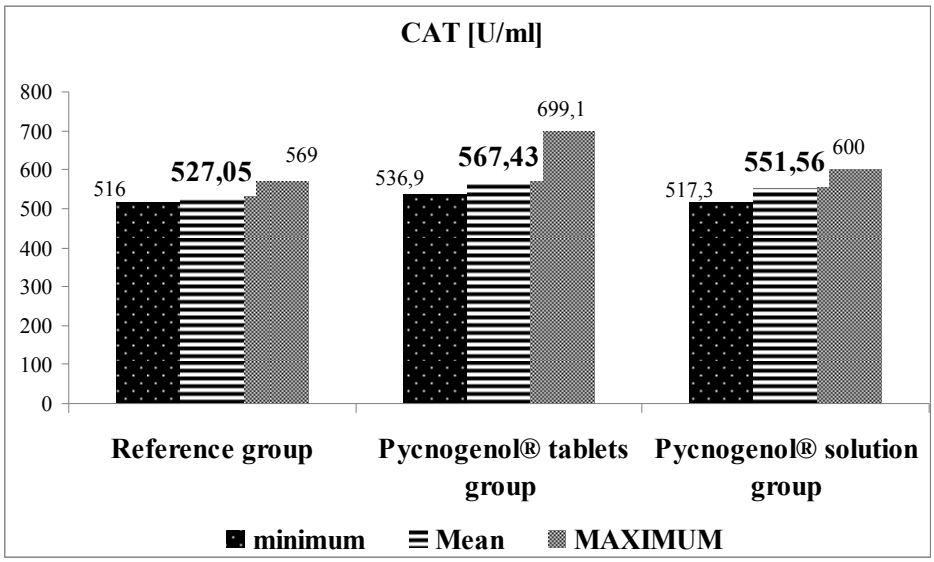

Fig. 1 - Evolution of CAT activity for the 3 experimental groups

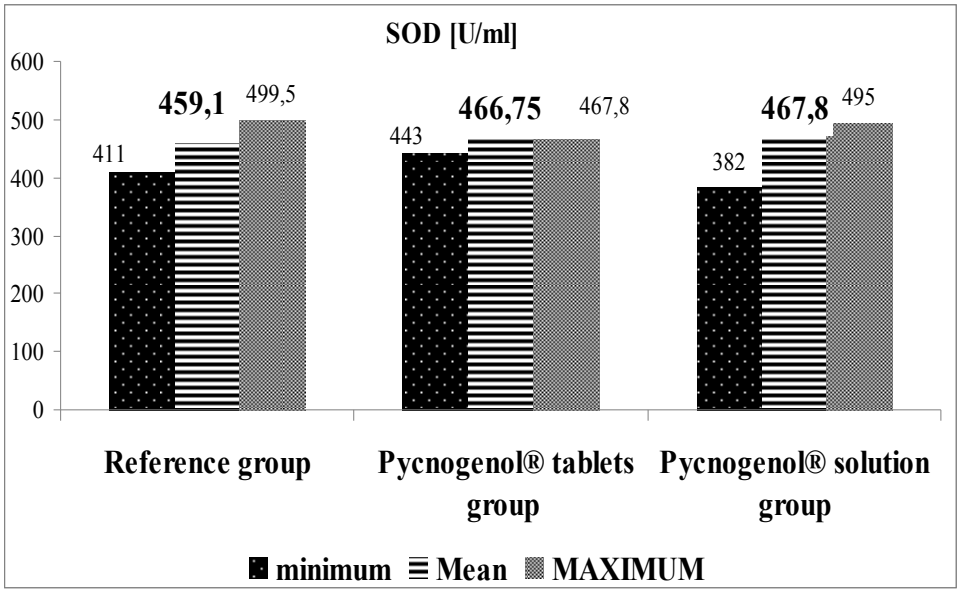

Fig. 2 - Evolution of SOD activity for the 3 experimental groups

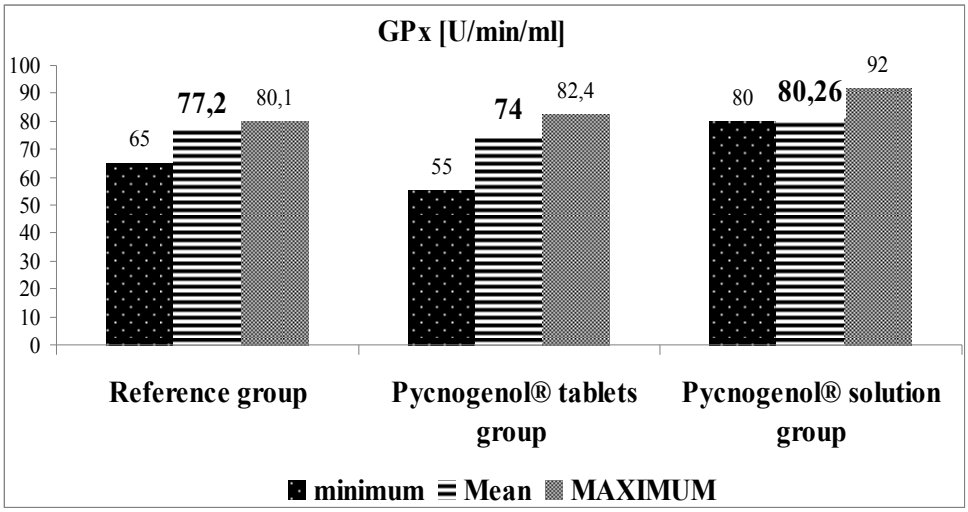

Fig. 3 - Evolution of GPx for the 3 experimental groups

The quantification of the concentrations of the free sulfhydryl groups from the serum of the animals of the three experimental groups are shown in fig. 4. Analyzing these data, there can be noticed a decrease of the concentration of the free sulfhydryl groups for both treated groups. Therefore, the value decreases with 2 units for the group treated with tablets containing the extract of the maritime pine (344 μmol/ml) and with 4.7 units for the group that was administered the Pycnogenol solution (341.3 μmol/ml), when compared with the reference group (346 μmol/ml).

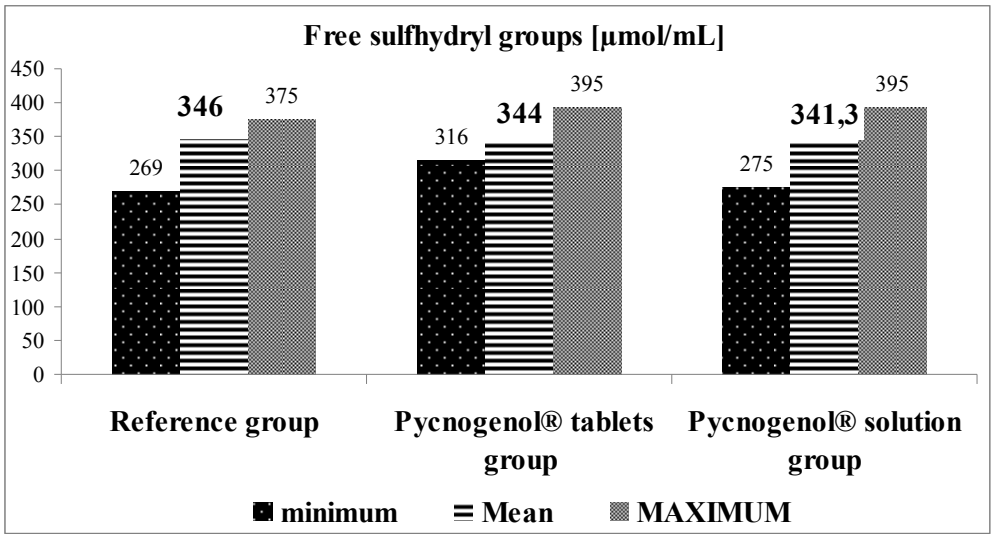

Fig. 4 - Evolution of free sulfhydryl groups for the 3 experimental groups

CONCLUSIONS

1. Administration of the extract of *Pinus maritima* as tablets (0,020 g) influences positively the activity of catalase and superoxide dismutase.

2. The administration of the extract of *Pinus maritima* as hydroalcoholic solution (85% proanthocyanidins) stimulates the activity of catalase, superoxide dismutase, and glutathione peroxidase.

3. The active compounds from the bark of the maritime pine do not influence the concentration of free sulfhydryl groups.

REFERENCES

1. **Grimm T., Chovanová Z., Muchová J., Sumegová K., Liptáková A., Ďuračková Z., Högger P., 2006a** - *Inhibition of NF-kB activation and MMP-9 secretion by plasma of human volunteers after ingestion of maritime pine bark extract (Pycnogenol),* J. Inflamm., 3, p.1.
2. **Grimm T., Skrabala R., Chovanová Z., Muchová J., Sumegová K., Liptáková A., Ďuračková Z., Högger P., 2006b** - *Single and multiple dose pharmacokinetics of maritime pine bark extract (Pycnogenol) after oral administration to healthy*, BMC Clin. Pharmacol., 6, p. 4.
3. **Liu F.J., Zhang Y.X., Lau H.S., 1998** - *Pycnogenol enhances immune and haemopoietic functions in senescence-accelerated mice*, Cell. Mol. Life Sci. 54, p. 1168-1172.
4. **Peng Q., Wei Z., Lau H.S. 2000** - *Pycnogenol inhibits tumor necrosis factor-α-induced nuclear factor kappa B activation and adhesion molecule expression in human vascular endothelial cells*, Cell. Mol. Life Sci., 57(5), p. 834-841.
5. **Takano T., Kozai Y., Kawamata R., Wakao H., Sakurai T., Kashima I., 2011** - *Inhibitory effect of maritime pine extract (Pycnogenol®) on deterioration of bone structure in the distal femoral epiphysis of ovariectomized mice*, Oral Radiol., 27, p. 8-16.

BIOCHEMICAL AND STATISTICAL ANALYSIS OF FREE AND BOND WATER RATIO IN JONATHAN APPLES

ANALIZA BIOCHIMICĂ ŞI STATISTICĂ A RAPORTULUI DINTRE APA LIBERĂ ŞI APA LEGATĂ LA MERELE JONATHAN

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Abstract. *Water may exist as free water and bound water in food substrates. Free water is available for chemical interactions and stimulates the development of microrganisms being-not linked by other biochemical compounds in food substrate. Bound water is retained in the food matrix substrate through interactions with functional groups of biochemical compounds and exhibits limited biological activity. Food substrates with the same water content may exhibit different perishability due to changes in the ratio of free water and bound water, hence for technological practice, the study of water forms, as well as of their relationship, provides useful information to estimate the conditions and period of validity .In this paper status of water content in Jonathan apples was studied. Investigations included physico-chemical analysis methods as well as imaging analysis. Statistical calculation showed strong correlation between free and physico-chemically bound water determined by oven drying for pieced or grinded apples.*
Key words: *free water, bound water, Jonathan apples.*

Rezumat. *Apa din substraturile alimentare poate fi apă liberă şi apă legată. Apa liberă este accesibilă pentru interacţiuni chimice şi asigură dezvoltarea microorganismelor nefiind legată de moleculele altor compuşi biochimici din substratul alimentar. Apa legată este reţinută în matricea substratului alimentar datorită interacţiunilor cu grupările funcţionale ale compuşilor biochimici şi are activitate biologică limitată. Substraturile alimentare cu acelaşi conţinut de apă pot prezenta perisabilitate diferită datorită variaţiei raportului dintre apa liberă şi apa legată, astfel încât pentru practica tehnologică studiul formelor de apă şi a raportului acestora oferă informaţii pentru stabilirea condiţiilor şi a perioadei de valabilitate. Lucrarea prezintă date privind raportul principalelor forme de apă la merele Jonathan. Investigaţiile au cuprins metode de analiză fizico-chimică şi analiză imagistică. Calculul statistic a evidenţiat interdependenţe între apa liberă şi apa legată fizico-chimic determinată prin uscare la etuvă pentru mere bucăţi şi mojarate.*
Cuvinte cheie: *apa liberă, apă legată, mere Jonathan.*

INTRODUCERE

Water may exist as free water and bound water in food substrates.

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(Campeanu et al., 2009). Free water is available for chemical interactions and stimulates the development of microorganisms being-not linked by other biochemical compounds in food substrate. Bound water is retained in the food matrix substrate through interactions with functional groups of biochemical compounds and exhibits limited biological activity.

Food substrates with the same water content may exhibit different perish ability due to changes in the ratio of free water and bound water, hence for technological practice, the study of water forms, as well as of their relationship, provides useful information to estimate the conditions and period of validity (Neamțu et al., 1995).

In this paper status of water content in Jonathan apples was studied. Investigations included physico-chemical analysis methods as well as imaging analysis. Statistical calculation showed strong correlation between free and physico-chemically bound water determined by oven drying for pieced or grinded apples. Water forms and their relationship provides practical information for agriculture, horticulture, biology, medicine (Gherghi et al., 1983). Ratio of free /bound water may be a useful index for assessment of specific physiological processes which characterizing the metabolic condition of a living organism.

MATERIALS AND METHODS

Jonathan apples were purchased from the city market with weight ranging between 81-103 g g and normal, healthy appearance.

Periodic measurements for various types of water monitoring were carried out for 60 apples (by considering the lot of ten apples stored under the same conditions of temperature and humidity).

Determination of free water was performed for twenty days by weighing (every five days) the apples, the difference in mass being attributed to the percentage of free water (Trincă et al., 2013). Bound water was performed by oven drying of the samples. For oven drying. 5 g sample of Jonathan apple (chunks or grinded) have been subjected to drying at 90^0 C temperature until constant mass ($\Delta<10^{-2}$ g).

Water content was determined according to eq.(1):

$$H_2O\ \% = \frac{m - m_1}{m_2} \times 100 \qquad \textbf{(1)}$$

m = mass dish + mass sample before drying, $\mathbf{m_1}$ = mass dish + mass sample after drying, $\mathbf{m_2}$ = mass of the sample.

An AF-S DX Zoom-Nikkon ED 18-70mm, f / 3.5-4.5 G IF was used in order to achieve image processing, while for ensuring the same calibration, photographs were taken by placing apples in a box aiming at keeping the same distance objective - image.

In order to process image analysis the following descriptors were considered: average intensity, smooth, third order moment, uniformity, and entropy, obtained by processing the photos of the apples. The processing stage involved

segmentation, approximation of circle parameters, extraction of circle parameters and extraction of a rectangular area form for the apple (Figure 1).

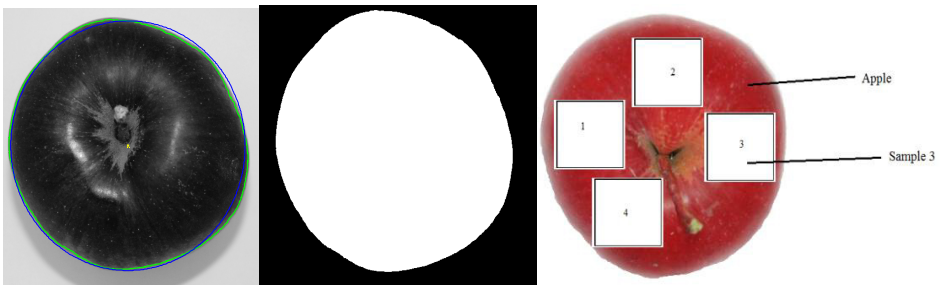

Fig. 1 - The processing stage of Jonathan apples

By MATLAB function the correlation coefficients have been identified for free water versus physico-chemical water in day five and day twenty. For the statistical analysis of the recorded differences it was applied the method of analysis report variances (X) and Pearson correlation coefficient. The determination gradient has been calculated (by considering the case $p < 0.05$ statistically significant). Statistical evaluation was performed using SYSTAT 13 (SYSTAT SOFTWARE, Inc. CHICAGO).

RESULTS AND DISCUSSION

Free water content increased from 1,423% to 5,363 % on the day 20 compared to day 5, which reveals that the main water loss for Jonathan apples variety occurs in the form of free water through perspiration.

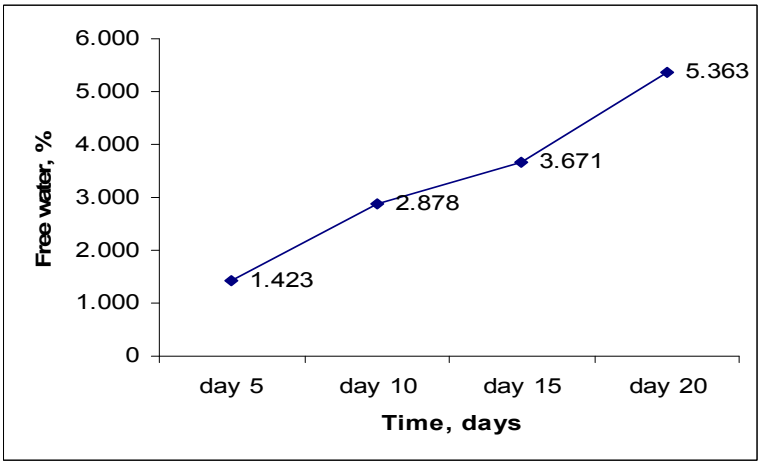

Fig. 2 - Free water loss dynamics of Jonathan apples

Experimental results showed that dehydration of apples was more intense in the first half of the testing period, after which it decreased in intensity, fact noted and in previous experiments (Trincă et al., 2012).

Compared with data from literature (Grădinaru et al., 2006, Slegun et al., 2009, Nistor , 2011, Vesali et al., 2011) in the case of Jonathan apples a moderate loss of free water was registered in the testing period.

The removal of free water highlights the progress of normal metabolic/ physiologic processes in the apples stored.

Free water loss affects the apples freshness by modifying dimensions, skin condition and colour, consistency and juicy or the taste and flavour. (Beceanu, 2010).

Imaging analysis of the main parameters of the texture features (coloration intensity-I, smoothness-S, third ordin moment-μ, density index-DI) showed (fig. 2) a very good correlation (r^2= 0,997) between the loss of free water and the reducing size of apples (DI) and a good correlation (r^2 = 0,886) between the loss of free water and the intensity of the coloration (I) in the experimental period.

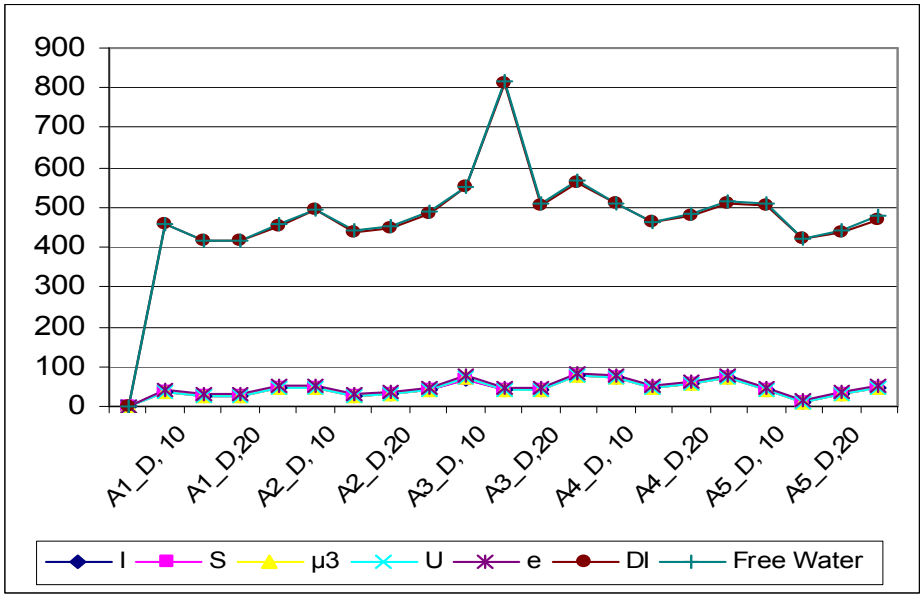

Fig.3 – Variation of the main imagistic parameters related with free water loss in Jonathan apples (Apple_number, Day, number)

Physico-chemical water (determined by oven-drying) decreased with 3,268 % for chunks apples and with 2,676 % for grinded apples on day 20 versus day 5. The analysis of the results revealed as water loss and dehydration increased- also decreased the values of bound water both for grinded and chunks apples.

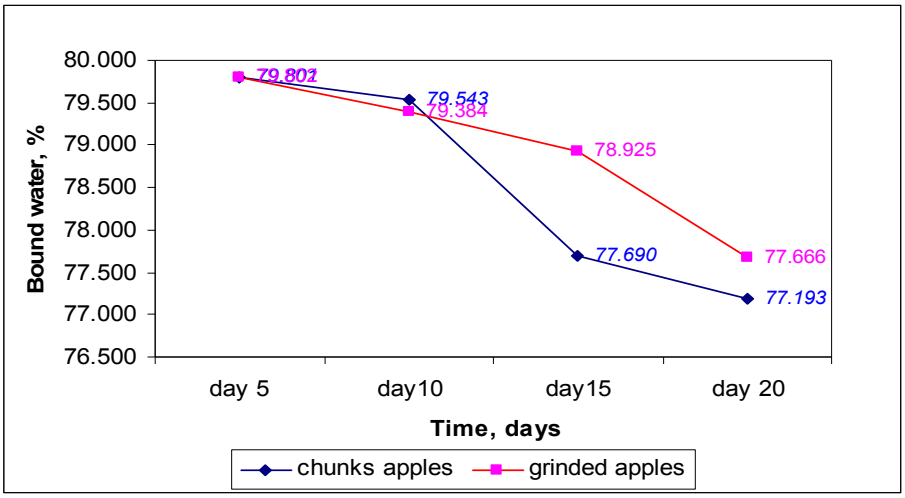

Fig.4 - Bound water loss dynamics (%) of Jonathan apples

Statistical processing of the results for chunk and grinded apples has not revealed a linear correlation between the individual parameters. This fact can be explained by considering the grinding as a process of cellular destruction - difficult to quantify in terms of the amount of intracellular water released. In the case of grinded apples the cellular walls were destroyed - which it caused the release of intracellular water determined as bound water.

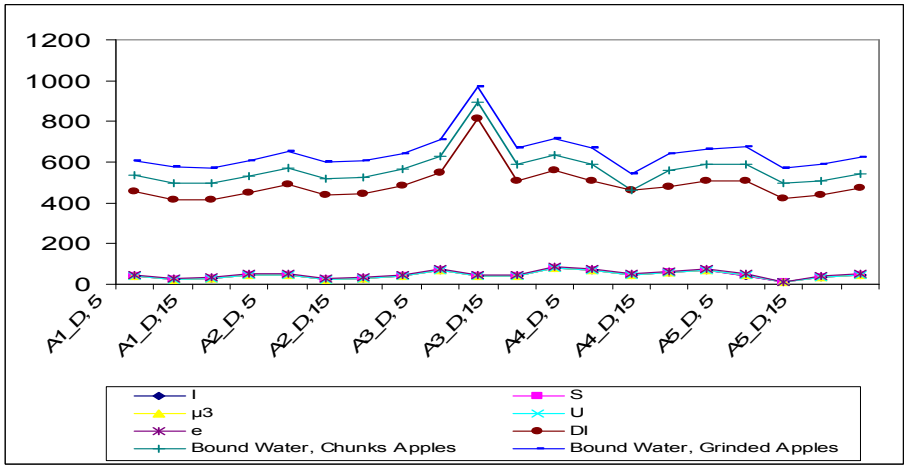

Fig. 5 - Variation of the main imagistic parameters related with bound water in Jonathan apples (Apple_number, Day, number)

Imaging analysis of the texture features (fig. 5) main parameters (coloration intensity-I, smoothness-S, third ordin moment-μ, density index-DI) revealed a very good correlation only between bound water and the reducing size of apples (DI) for both chunks (r^2 = 0,968) and grinded (r^2 = 0,942) apples .

CONCLUSIONS

1. Monitoring of Jonathan apples by imagistic and chemical analysis showed a a very good correlation (r^2= 0,997) between the loss of free water and the reducing size of apples (DI) and a good correlation (r^2 = 0,886) between the loss of free water and the intensity of the coloration (I) in the experimental period.

2. Imaging analysis of the texture feature's parameters revealed a very good correlation only between bound water and the reducing size of apples (DI) for both chunks (r^2 = 0,968) and grinded (r^2 = 0,942) apples .

3. Statistical calculations showed interdependencies between the loss of the free water, content of bound water and the size's changes of Jonathan apples what it may provides the prerequisites for developing predictive models for the considered parameters.

REFERENCES

1. Beceanu D., 2010 - *Tehnologia produselor horticole*, Partea I, Ed. Pim.

2. Campeanu Gh., Neata G., Darjanschi G., 2009 - *Chemical Composition of the Fruits of Several Apple Cultivars Growth as Biological Crop*, Not. Bot. Hort. Agrobot. Cluj 37 (2), Print ISSN 0255 -965X; Electronic ISSN 1842-4309, p. 161-164;

3. Gherghi A., Burzo I., Mărgineanu L., Deneş S., Dobreanu M., Pattantyus K., 1983 - *Biochimia şi fiziologia legumelor şi fructelor*, Editura Academiei Republicii Socialiste România, Bucureşti.

4. Grădinariu G., Istrate M., Zlati C., Dascălu M., 2006 – *Researches concerning the influence of ecological factors upon some apple varieties quality and storage proprieties*, U.Ş.A.M.V., Iasi University Annals, E.S.N.A. XXXVI Annual Meeting, Iasi, Roumania.

5. Neamțu G., Cîmpeanu Gh., Socaciu C., 1993 – *Biochimie vegetală (partea structurală)*, Editura Didactică şi pedagogică, R.A. Bucureşti.

6. Nistor O., 2011 - *Study of the apple parameters variation during refrigeration storage*, The Annals of the University "Dunarea de Jos" Galati.

7. Sleagun G., Popa M., 2009 – *Determination of the moisture content in infrared dried apples,* The Annals of the University "Dunarea de Jos" Galati, Fascicle VI, Food Technology, New Series, Year III, p. 39-44.

8. Trincă L.C., Căpraru A.M, 2013 - *Biochimia Alimentelor, Manual de lucrări practice*, Ed. Pim.

9. Trincă L.C., Căpraru A.M., Arotăriței D., Volf I., 2012 - *Cercetări privind determinarea conținutului de apă pentru merele din soiul Jonathan prin metode clasice şi inovative*, Lucrări Ştiințifice USAMV Iaşi, vol.1 (55), Seria Horticultură, p. 111-116.

10. Vesali F., Gharibkhani M., Komarizadeh M., 2011- *An approach to estimate moisture content of apple with image processing method*, AJCS 5(2), p. 111-115.

CHEMICAL CHARACTERIZATION OF CELLULOSE - LIGNIN WASTE AND THEIR CAPITALIZATION AS NUTRITIOUS SUBSTRATE FOR VEGETABLE SEEDLINGS

CARACTERIZAREA CHIMICĂ A UNOR DEŞEURI CELOLIGNINICE ŞI VALORIFICAREA ACESTORA CA SUBSTRAT NUTRITIV PENTRU RĂSADURI DE LEGUME

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Abstract. *Soil fertility and plants mineral nutrition are primarily conditioned by the nutritive elements released into the biological cycle through organic remains mineralization. Plants' different evolution is the result of the effect, generally stimulating, of the aromatic structure products, expressed on plants growth, development and fructification and also on the metabolism of microorganisms accumulated in the culture medium. Lignin can have multiple applications, as mentioned its use in animal nutrition, soil fertilization and bioremediation processes. The aim is enhancing the cellulose lignin waste through composting and the use of added lignin extracted from wheat straw (L 1) and grass (L 2) as possible nutritive mixture for seedlings. The paper comprises the determination of chemical parameters for the components used in the preparation of compost, the parameters of the resulted substrate and the effect of additional concentration of lignin on the development of cucumber seedlings (Cucumis sativus L.).*
Key words*: lignin, compost, seedlings, nutritious substrate*

Rezumat. *Fertilitatea solurilor şi nutriţia minerală a plantelor sunt condiţionate în primul rând de fondul de elemente nutritive eliberate în cadrul circuitului biologic prin procesul de mineralizare a resturilor organice. Evoluţia diferită a plantelor este rezultatul efectului, în general stimulator, al produselor cu structură aromatică, manifestat asupra creşterii, dezvoltării şi fructificării plantelor, cât şi asupra metabolismului microorganismelor care se acumulează în mediul de cultură. Lignina poate avea aplicaţii multiple, fiind menţionată utilizarea sa în hrana animalelor, în fertilizarea solului, în procese de bioremediere etc. Se urmăreşte revalorificarea deşeurilor celoligninice prin compostare şi folosirea unor adaosuri de lignină extrasă din paie de grâu (L 1) şi iarbă (L 2), ca posibil amestec nutritiv pentru obţinerea de răsaduri. Lucrarea cuprinde determinarea parametrilor chimici pentru componentele utilizate la prepararea compostului, ai celor pentru substratul rezultat şi efectul concentraţiilor suplimentare de lignine asupra dezvoltării răsadurilor de castraveţi cornichon (Cucumis sativus L.).*
Cuvinte cheie*: lignina, compost, răsaduri, substrat nutritiv*

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INTRODUCTION

Due to the provided energy for microorganisms and to the nutrients reserve provided for the plants nutrition, the organic matter accumulated in the soil's surface layer has an extremely important role.

Although organic matter has a reduced contribution to the soil's solid phase, its role in the fertility stage is decisive. Thus, well-formed hummus participates in proportion of 30-40% to the soil's total cationic – change capacity, registering a value of 150-300 mL/100 g, compared to 8-150 mL/100 g, established for clay. Hummus promotes the increase of water retaining capacity, in an equivalent of up to 80-90% of its mass, while clay retains only 15-20% of its own mass. (Totolin et al., 2010).

The organic matter is subjected to a continuous process of biochemical transformation from low nitrogen content organic substances to ones rich in carbon and nitrogen, characterized by the presence of many carboxyl and carbonyl groups, this process being named ***humification*** (Ungureanu et al., 2007)**.**

Lignin is the main substance involved in hummus formation, which takes place as a result of extracellular enzyme activity of the microorganisms, conducting to intermediary products such as vanilin, vanilic acid, ferulic acid etc., which are subjected to oxidation, hydroxylation, decarboxylation processes and form phenolic radicals and hydroquinone. Thus, following these products complex formation with substances resulted from sugars and proteins initial decay, humic substances are formed (Trofin and Ungureanu, 2012).

Under actual conditions when the environment preservation is a priority, it is expected that more and more biological and biochemical processes to be used for the transformation of the polyphenol and lignin products. Through slow microbiological action, lignin from plant debris turns in the soil into organic micro molecular products, which show a physiological action on plants, thus contributing to the improvement of soil fertility (Dumitru et al., 2005).

MATERIAL AND METHOD

The following raw materials were used to prepare the compost:

- sawdust – added in weighed quantities, according to the experimental scheme presented in table 2;
- spruce bark – also added in weighed quantities;
- quartz sand – sieved and added in each variant three times as much as the rest of the mixture, in order to obtain a compost able to retain water for a longer period of time and also for an increased homogeneity;
- vegetable seeds – the tested specie was *Cucumis sativus*, seeds of cornichon cucumbers, in number of five for each blank or treated variant;
- lignin L_1 from wheat straws (100WA-140);
- lignin L_2 from grass (Sarkanda -100SA-140), both provided by the company Granit Recherché Developpement S.A. from Lausanne, with the following characteristics (table 1) (Ungureanu E., 2011):

Table 1

The characteristics of lignin from wheat straws (L1) and grass (L2)

Characteristic	L1	L2
Solubility in acid, (%)	1	2
- COOH , mmolls/g	3.8	3.3
- OH aromatic, mmolls/g	1.7-1.8	1.8-1.9
Polydispersity	10.5	10.8
Nitrogen (%)	1	1.2
pH (10% water suspension)	2.7	3.2
Tsoaking, ^{0}C	170	163
Solubility in furfuryl alcohol (%)	88.5	84.0
Solubility in alkalis, pH=12 (%)	98.5	98.5
Ash, (%)	2.5	4.1
Relative humidity, %	5.00	5.60

The chemical parameters were determined as follows: ash content was calculated by the calcination method in the oven at 550^{0}C, and calculating the difference there was determined the volatile matter and the carbon contents; the total nitrogen was determined by Kjeldahl method.

Compost was prepared after experimental scheme shown in table 2 and wetted continuously for 30 days to obtain a nutrient substrate to allow seed germination and seedling development.

Table 2

Composting mixtures experimental scheme

Crt.no.	Variant	Sawdust %	Spruce bark %	Lignin %
1	Blank	80	20	-
2	L 1 - 2%	78	20	2
3	L 1 - 3%	77	20	3
4	L 1 - 4%	76	20	4
5	L 1 - 5%	75	20	5
6	L 2 - 2%	78	20	2
7	L 2 - 3%	77	20	3
8	L 2 - 4%	76	20	4
9	L 2 - 5%	75	20	5

RESULTS AND DISCUSSIONS

Analyses were performed to determine the ash content, the volatile matter, carbon, total nitrogen contents, as well as C / N ratio for the studied variants where the percentage of added lignin varied between 2 and 5% for both products used. The obtained values for the raw materials used for compost are presented in table 3 and the values for the control without added lignin and studied variants, in table 4:

Table 3

Chemical parameters values for wood waste and used lignins

Parameter	Sawdust	Spruce bark	L1	L2
U%	5.023	5.71	5	5.6
DS%	94.97	94.28	95	94.4
Ash%	2.2047	2.693	2.3	3.05
VS%	97.7653	97.3066	97.69	96.949
C%	54.31	54.0567	54.2722	53.8606
N_t%	5.1167	5.168	1	1.2
P%	31.9791	32.2997	6.25	7.5
C / N	10.6157	10.4603	54.2594	44.8833

Table 4

Chemical parameters values for control and studied variants

Param.	Blank	L1 2%	L1 3%	L1 4%	L1 5%	L2 2%	L2 3%	L2 4%	L2 5%
U%	5.1604	5.15971	5.15971	5.15948	5.15925	5.17194	5.17771	5.18348	5.18925
SU%	94.832	94.8326	94.8329	94.8332	94.8335	94.8206	94.8149	94.8092	94.8035
Cen%	2.30236	2.304266	2.305219	2.306172	2.307125	2.319266	2.327719	2.336172	2.344625
SV%	97.67356	97.67205	97.6713	97.67055	97.6698	97.65723	97.64907	97.64091	97.63275
C%	54.25934	54.25858	54.25821	54.25783	54.25745	54.25035	54.24586	54.24136	54.23687
Nt%	5.12696	5.044626	5.003459	4.962292	4.921125	5.048626	5.009459	4.970292	4.931125
Pb%	32.04322	31.52864	31.27135	31.01406	30.75677	31.55364	31.30885	31.06406	30.81927
C / N	10.582	10.7527	10.8460	10.9409	11.0253	10.7527	10.8342	10.9170	11.0011

After 30 days, variants were seeded with cornichon cucumber seeds that have germinated starting with the third day, having, over the next seven days, the distributions shown in the graphs in figures 1 and 2.

Compared to the blank variants used where soil or compost without lignin added were used as nutritive substrate, it is noticed that even in such short period of time, in some of the variants the height of the seedlings levelled or exceeded the values obtained for the soil control variant.

The obtained compost proved to be able to work as a substitute for soil as a nutritive substrate and in the meantime, to capitalize an important waste source, the sawdust, wood chips and bark.

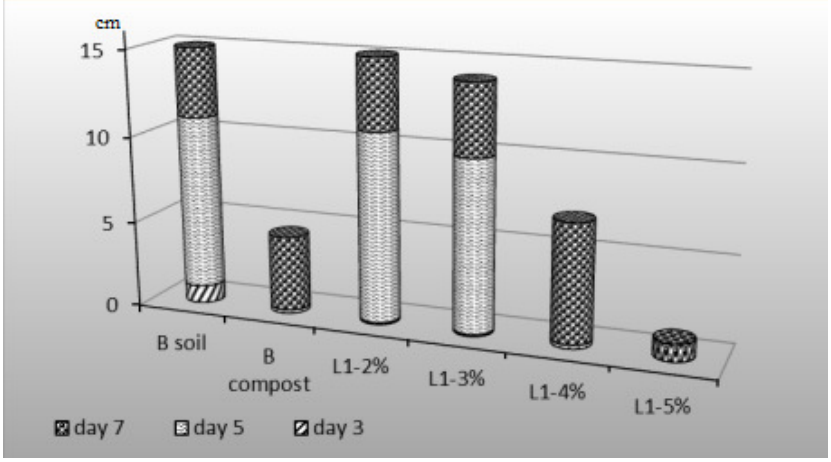

Fig. 1 - Development of L_1 variants' seedlings

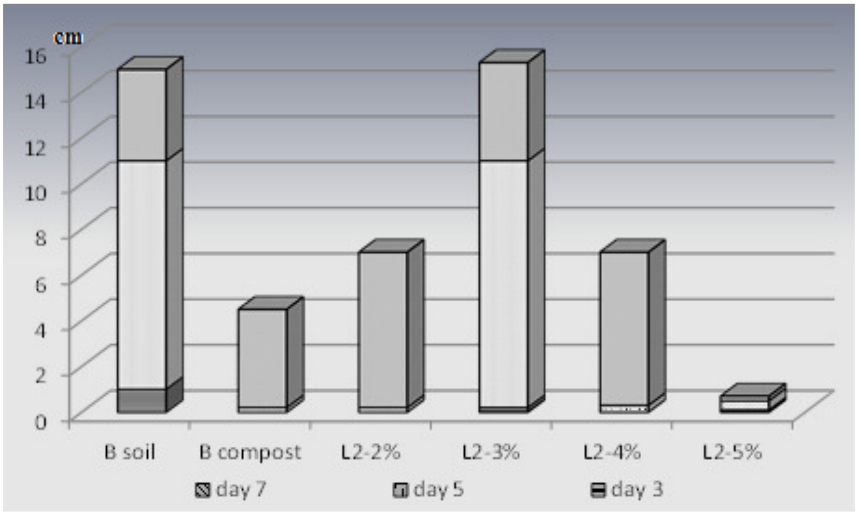

Fig. 2 - Development of L_2 variants' seedlings

CONCLUSIONS

1. From the study of C / N ratio for the variants considered it is noted that they are placed below the maximum of 30, what allows for the composting mixture to be used as germination and development substrate;

2. Following the observations about seed germination, it was found that the addition of lignin had a stimulating effect, especially on seedling height;

3. Spruce sawdust and bark, mixed with quartz sand or plain, may become, in compost, a substitute for soil used as germinating substrate in the seedbeds;

4. Thus, there can be capitalized large quantities of waste from forestry, by reintroducing them into the biological cycle as growth substrate.

REFERENCES

1. **Dumitru M., Ungureanu E., Diaconescu R., 2006** - *The influence of some lignin and polyphenolic products on the characteristics of the soil*, Lucrări Ştiințifice, Seria Horticultură, nr.49 (1), p. 911-916, ISSN:1454-7376.
2. **Totolin I.M., Cazacu G, 2010** - *Adezivi, materiale compozite şi alte aplicații pe bază de lignină*, Ed. PIM, p. 80-90, Iaşi.
3. **Trofin A., Ungureanu E., 2012** - *Fundamentals in Agricultural Chemistry. A Case Study: Use of Complex NPK Fertilizers (Cicer Arietinum Culture) and Sulfonamide Derivatives (Tomatoes Culture)*, in the volume: *Current topics, concepts and research priorities in environmental chemistry*, Ed. Universității ,,Al. I. Cuza" Iași, ISBN volum (I) - 978-973-703-798-5
4. **Ungureanu E., 2011 -** *Lignina, polimer natural aromatic cu ridicat potențial de valorificare*, Editura PIM, Iaşi, ISBN 978-606-13-0384-7.
5. **Ungureanu E., Dumitru M., Nedelcu-Teodorescu G., 2007** - *Aspects concerning the evolution of the bean plants under the influence of some composite structures incorporated in to the soil*, Lucrări Ştiințifice, vol.1, Seria Horticultură, nr.50, p. 321-326, ISSN:1454-7376.

INDIRECT CRITERIA TO DETERMINE THE MICROSPORE DEVELOPMENTAL STAGE IN HEMP ANTHERS

CRITERII INDIRECTE PENTRU DETERMINAREA STADIULUI DE DEZVOLTARE A MICROSPORILOR ÎN ANTERELE CÂNEPEI

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Abstract. *The study was performed to establish if the length of the male floral buds may be considered as an indirect criterion to determine the microspore developmental stage in Cannabis sativa L. anthers. The analyzed cultivars show a normal microsporogenesis, in the climatic chamber growing conditions, with defects in the heterotypic division. There is a significant interaction between the cultivar, floral bud size group and the microspore developmental stage. Yet the male floral buds of the same size, but within different cultivars, don't have the microspores in the same developmental stage.*
Key words: *hemp, microsporogenesis, microspore, floral bud*

Rezumat. *Studiul a fost efectuat pentru a stabili dacă lungimea bobocilor florali masculi poate fi considerată un criteriu indirect pentru determinarea stadiului de dezvoltare a microsporilor în anterele de Cannabis sativa L. Cultivarele analizate prezintă o microsporogeneză normală în condițiile de creștere din laborator, cu defecte ale meiozei în cadrul diviziunii heterotipice. Se constată o interacțiune distinct semnificativă între cultivar, grupa de dimensiune a bobocilor florali și stadiul de dezvoltare al microsporilor. Totuși, bobocii florali masculi de aceeași dimensiune dar din cadrul a diferite cultivare, nu conțin microspori în același stadiu de dezvoltare.*
Cuvinte cheie: *cânepă, microsporogeneză, microspor, boboc floral*

INTRODUCTION

Hemp microsporogenesis takes place normally, with differences between different plants, different floral buds within an inflorescence, and different cells of the same floral bud (Xin et.al., 2008). Some factors such as the hybrid origin of the plant, parthenogenetic propagation, growing conditions, (Medwedewa, 1935), parasite attacks (Asanova, 2002) may determine specific irregularities in the course of microsporogenesis.

During male sexual cells formation, there is a favorable moment for androgenesis induction in plants. As a general rule, this sensitive period of microspores ranges between the uninucleate stage and bicellular pollen around the first mitosis (Segui-Simarro, 2010).

To avoid cytological identification of the microspore developmental stage, indirect criteria can be used, such as the size of the floral bud, the size and color of the anther (Gheorghiță and Nicuță, 2005).

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MATERIAL AND METHOD

Plant material: seven hemp cultivars (*Zenit, Denise, Diana*, *Lovrin 110*, *Lovrin 200*, *SF 200* şi *ZF 314*) were grown at 27-29ºC temperature and 16 hours light / 8 hours dark photoperiod until they reached 2 months. After 2 months the photoperiod was adjusted to 12 hours light / 12 hours dark, for flowering stimulation. Plants were cut above the third pare of true leaves and above the third pare of sprigs leaves for keeping the plants height into the limits imposed by the climatic chamber.

Cytogenetic investigations: male floral buds were harvested at emergence, beginning of flowering and full flowering, measured and classified in 4 size groups, (0.1-2 mm, 2.1- 4 mm, 4.1- 6 mm, 6.1- 8 mm) then fixed in Carnoy I solution and kept at 4ºC. From a male floral bud, an anther was excised and maintained in Carr dye for 30 minutes at room temperature. The anther was displayed using the squash technique and images were digitally retrieved with a built in camera Motic B Series optic microscope, and Motic Images 2.0 program. Inside each cultivar, 5 floral buds were analyzed for each bud size group.

Meiotic stages were analyzed and chromosomal aberrations counted separately. Data were expressed as percentages and arc-sin transformed before ANOVA, to normalize the distribution. Duncan's test was effectuated. For each cultivar, the experiment was designed after the randomized blocks method, 4 x 7, N=140, in 5 replications.

RESULTS AND DISCUSSIONS

Microsporogenesis

Archesporial cells, closely adjoined one another, have irregular, polygonal shape, with a large nucleus and a loosely arranged chromatin. Repeated mitotic divisions that lead to microsporocytes formation take place asynchronously. The sporogenous tissue consists of larger cells than the archesporial ones, with irregular shape (fig. 1, a), and visible nucleolus in interphase fig. 1, b).

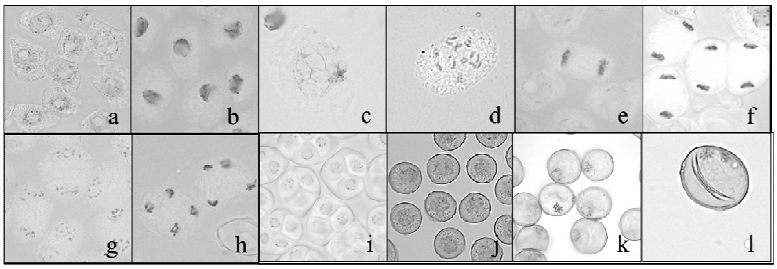

Fig. 1 - Microsporogenesis in *Cannabis sativa* L. a) sporogenous cells; b) interphase; c) prophase I, leptonema; d) prophase I, diakinesis; e) anaphase I; f) telophase I with condensed nuclei; g) prophase II; h) anaphase II; i) tetrad; j) microspores with a double membrane; k) first pollen mitosis, metaphase; l) first pollen mitosis, telophase.

Prophase I is normal (fig. 1, c, d), at diakinesis the diploid chromosome number being easy to determine (fig. 1, d). Metaphase I is characterized by chromosomes spread along the equatorial plate, which then separate and head to

the nuclear spindle poles in anaphase I (fig. 1, e). They condense in easily stainable nuclei, of the same size, towards the end of telophase I (fig. 1, f).

After the fragmentation of nucleoprotein filaments in 10 chromosomes during prophase II (fig. 1, g), the second meiotic division initiates. In anaphase II, the orientation of division spindles is bilateral (fig. 1, h). At the end of meiosis II tetrads are formed, both tetrahedrally and tetragonally arranged (fig. 1, i), the four microspores always being mononuclear. The tetrad membrane disintegrates releasing the young microspores which will shortly form a double membrane and germinative pores (fig. 1, j). They become polarized and the first pollen mitosis begins (fig. 1, k, l).

There have been identified chromosomal aberrations during meiosis only in the heterotypic division, represented by lagging chromosomes and micronuclei formation in metaphase I, lagging chromosomes, simple or multiple bridges in anaphase I, lagging chromosomes, micronuclei formation and discontinued bridges in telophase I.

Intra cultivar analysis. Zenit cultivar has microspores in male floral buds ranging from 2.1 to 6 mm, with significant superior values for 4.1-6 mm bud size group compared with 2.1-4 mm size group ($DS_{5\%}$=22,06) (tab. 1). Uninucleate pollen has significant values for 6.1-8 mm bud size group compared with 4.1-6 mm bud size group ($DS_{5\%}$=21,72).

Table 1

Microspore development stage depending on male bud size, for Zenit cultivar

Bud size (mm)	Development stage						
	Premeiosis	Meiosis1	Meiosis2	Tetrad	Microspore	Uninucleate pollen	Binucleate pollen
0 - 2	84.3 a	7.39 d	0 d	0 d	0 d	0 d	0 d
2,1 - 4	22.93 cd	39.58 c	16.13 d	7.47 d	9.54 d	0 d	0 d
4,1 - 6	0 d	0.36 d	3.24 d	0 d	67.79 ab	16.79 d	3.3 d
6,1 - 8	0 d	0 d	0 d	0 d	0 d	82.12 ab	7.88 d

Difference between each two variants is not significant if followed by the same letter or group of letters; $s_{\square}$ = 6,96; $DS_{5\%}$ = 19,48 – 24,45.

Denise cultivar has microspores in anthers excised from 2.1-4 mm male buds (tab. 2), and uninucleate pollen starting with 2.1-4 mm bud size group to 8 mm buds.

Table 2

Microspore development stage depending on male bud size, for Denis cultivar

Bud size (mm)	Development stage						
	Premeiosis	Meiosis1	Meiosis2	Tetrad	Microspore	Uninucleate pollen	Binucleate pollen
0 – 2	54,12abcd	35,87de	0e	0e	0e	0e	0e
2,1 - 4	0e	0e	9,04e	8,61 e	74,09abc	2,49 e	0e
4,1 - 6	0e	0e	2,29e	0e	0e	84,45a	2,91e
6,1 - 8	0e	0e	0e	0e	0e	81,55ab	8,45e

Difference between each two variants is not significant if followed by the same letter or group of letters; $s_{\square}$ = 11,81; $DS_{5\%}$ = 33,06 – 40,98.

Values corresponding to uninucleate pollen in 2.1-4 mm bud size group are significantly inferior to those in 4.1-6 mm bud size group ($DS_{5\%}$=38,85) and 6.1-8 mm respectively ($DS_{5\%}$=38,38). There are no statistical differences between 4,1-6 mm male buds and 6,1-8 mm male buds regarding the presence of uninucleate pollen ($DS_{5\%}$=33,06).

Table 3

Microspore development stage depending on male bud size, for Diana cultivar

Bud size (mm)	Development stage						
	Premeiosis	Meiosis1	Meiosis2	Tetrad	Microspore	Uninucleate pollen	Binucleate pollen
0 – 2	47,8 b	42,19bc	0 g	0 g	0 g	0 g	0 g
2,1 - 4	0 g	24,11de	22,71def	8,45efg	38,15bcd	0 g	0 g
4,1 – 6	0 g	0 g	3,43 g	0 g	0 g	83,73 a	3,39 g
6,1 - 8	0 g	0 g	0 g	0 g	0 g	78,2 a	11,79efg

Difference between each two variants is not significant if followed by the same letter or group of letters; $s_{\square}$ = 5,68; $DS_{5\%}$ = 15,92 – 19,73.

Diana cultivar shows microspores only in 2.1-4 mm bud size group and uninucleate pollen in 4.1-6 mm and 6.1-8 mm buds, with no significant difference between the two bud size groups (DS5%=15,92) (tab. 3).

In the case of ZF 314 microspores from 4.1-6 mm bud size group have significant superior values than 2.1-4 mm bud size group ($DS_{5\%}$=23,83) (tab.4). Uninucleate pollen is encountered starting with 4.1 mm buds, with significant superior values for the 6.1-8 mm bud size group ($DS_{5\%}$=23,83).

Table 4

Microspore development stage depending on male bud size, for ZF 314 cultivar

Bud size (mm)	Development stage						
	Premeiosis	Meiosis1	Meiosis 2	Tetrad	Microspore	Uninucleate pollen	Binucleate pollen
0 – 2	63,74 ab	25,91cde	0,81 f	0 f	0 f	0 f	0 f
2,1 - 4	0 f	28,86 cd	34,27c	16,67cdef	14,76cdef	0 f	0 f
4,1 - 6	0 f	0 f	7,7 def	0 f	63,52 ab	19,25cdef	0,63f
6,1 - 8	0 f	0 f	0 f	0 f	0 f	77,06 a	12,74cdef

Difference between each two variants is not significant if followed by the same letter or group of letters; $s_{\square}$ = 7,4; $DS_{5\%}$ = 20,72 – 25,68.

Table 5

Microspore development stage depending on male bud size, for SF 200 cultivar

Bud size (mm)	Development stage						
	Premeiosis	Meiosis1	Meiosis2	Tetrad	Microspore	Uninucleate pollen	Binucleate pollen
0 – 2	50,85 a	35,23abcd	5,32 f	0 f	0 f	0 f	0 f
2,1 - 4	0 f	4,15 f	24,58 abcdef	22,47 bcdef	40,87abc	0,97 f	0 f
4,1 - 6	0 f	0,51 f	3,38 f	0 f	34,64 abcde	46,66 ab	6,22 f
6,1 - 8	0 f	0 f	0 f	0 f	0 f	81,8	8,06 f

Difference between each two variants is not significant if followed by the same letter or group of letters; $s_{\square}$ = 8,63; $DS_{5\%}$ = 24,2 – 29,9.

For SF 200 cultivar, analyzed slides indicate the presence of microspores in male floral buds ranging from, 2.1 to 6 mm, with no significant difference between the two bud size groups ($DS_{5\%}$=25,5).

Uninucleate pollen has significant superior values for 6.1-8 mm bud size group from 4.1-6 mm group ($DS_{5\%}$=25,5) and 2,1-4 mm group respectively ($DS_{5\%}$=29,3) (tab. 5).

Lovrin 110 has microspores in 2,1-4 mm and 4,1-6 mm bud size groups, with no significant difference between the observed values ($DS_{5\%}$ = 24,93) (tab. 6). The microspores continue to develop into uninucleate pollen starting with the anthers from 2,1-4mm bud size group.

Table 6

Microspore development stage depending on male bud size, for Lovrin 110 cultivar

Bud size (mm)	Development stage						
	Premeiosis	Meiosis1	Meiosis2	Tetrad	Microspore	Uninucleate pollen	Binucleate pollen
0 – 2	38,81 ab	29,02 abcd	25,32 bcde	0 e	0 e	0 e	0 e
2,1 - 4	0 e	5,85 de	23,38 bcde	25,33 bcde	38,77 abc	4,05 de	0 e
4,1 - 6	0 e	0 e	0 e	9,55 de	23,91bcde	52,54 a	8,42 de
6,1 - 8	0 e	0 e	0 e	0 e	0 e	80,2	9,67 de

Difference between each two variants is not significant if followed by the same letter or group of letters; $s_{\square}$ = 7,99; $DS_{5\%}$ = 22,37 – 27,72.

High values for uninucleate pollen in 6,1-8 mm bud size group are significantly superior to those recorded for 4,1-6 mm ($DS_{5\%}$=22,37) and 2,1-4 mm bud size groups ($DS_{5\%}$=27,08).

Lovrin 200 shows microspores in 2,1-4 mm and 4,1-6 mm bud size groups, with significant superior values for the last group ($DS_{5\%}$ = 23,8). Uninucleate pollen is encountered in 4,1-6 mm and 6,1-8 mm bud size groups, with significant superior values in 6,1-8 mm ($DS_{5\%}$ = 22,9) (tab. 7).

Table 7

Microspore development stage depending on male bud size, for Lovrin 200 cultivar

Bud size (mm)	Stadiul de dezvoltare						
	Premeiosis	Meiosis1	Meiosis2	Tetrad	Microspore	Uninucleate pollen	Binucleate pollen
0 – 2	82,26 a	7,74 e	0 e	0 e	0 e	0 e	0 e
2,1 - 4	23,18 cde	37,76 bc	17,66 cde	7,69 e	11,13 e	0 e	0 e
4,1 - 6	0 e	0 e	2,55 e	0 e	50,79 b	34,84 bcd	2,92 e
6,1 - 8	0 e	0 e	0 e	0 e	0 e	79,74 a	10,26 e

Difference between each two variants is not significant if followed by the same letter or group of letters; $s_{\square}$ = 7,51; $DS_{5\%}$ = 21,02 – 26,05.

Depending on the presence of microspores and uninucleate pollen, for each male bud size group, we classified the analyzed cultivars into three classes (tab. 8).

Table 8

Male floral bud size and microspore developmental stage for the 7 analyzed *Cannabis sativa* L. cultivars

Class no.	Microspores in group size	Uninucleate pollen in group size	Cultivars
1	2,1 – 4 mm	4,1 – 6 mm + 6,1 – 8 mm	Denise, Diana
2	2,1 - 4 mm + 4,1 – 6 mm	6,1 – 8 mm	SF 200, Lovrin 110
3	4,1 – 6 mm	6,1 – 8 mm	Zenit, ZF 314, Lovin 200

CONCLUSIONS

1. Hemp pollen formation is as normal in the experimented growing conditions;

2. Male floral buds of the same size but from different cultivars do not necessary have microspores in the same developmental stage;

3. The male floral bud size can be considered a indirect criteria for determining the microspore developmental stage.

Acknowledgments*: This study was financed by the European Social Fund, POSDRU 2007-2013, project no. 1.5/S/77222 „Perfecționarea și dezvoltarea resurselor umane pentru cercetare și inovare prin școala doctorală”.*

REFERENCES

1. Asanova D. K., 2002 – *Specific features of microsporogenesis in the hemp of the Shu valley,* Biology Bulletin, vol. 29, nr. 6, p 545-550;

2. Ghiorghiță G., Nicuță Petrescu Daniela, 2005 – *Biotechnologies today*, Editura Junimea, Iaşi;

3. Medwedewa G. B., 1935 – *The climatic influences upon the pollen development of the italian hemp*, Genetica, vol. 17, nr. 5-6, p. 461-470;

4. Segui-Simarro J. M., 2010 – *Androgenesis revisited*, Bot. Rev., nr. 76, p. 377-404;

5. Xin Pei-yao, Sun Z., Luo S., He C., 2008 – *Observations on the meiosis and chromosome behavior of pollen mother cell in Cannabis sativa* L., Journal of Henan Agricultural Sciences, 05.

SEASONAL VARIATIONS IN GAS EXCHANGE PARAMETERS IN RED RASPBERRY CULTIVARS GROWN IN FIELD AT DIFFERENT LIGHT INTENSITIES

VARIAȚII SEZONIERE ALE PARAMETRILOR REZULTAȚI DIN MĂSURAREA SCHIMBULUI DE GAZE LA UNELE SOIURI DE ZMEUR CULTIVATE ÎN CÂMP ÎN CONDIȚII DIFERITE DE LUMINĂ

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Abstract. *Variations in photosynthetic responses to summer stress among crop species are poorly understood. In this work we investigated photosynthesis seasonality in three red raspberry cultivars (Ruvi, Opal and Cayuga) grown in the experimental field under 100% and 25% sunlight conditions. Plants were planted in the field on June 2011. After adaptation to field conditions, we placed a net over 50% of the plants which retained 75% sunlight. Photosynthetic rate, transpiration rate, stomatal conductivity, intracellular CO2 concentration and water use efficiency were calculated from gas exchange measurements made from July to September using a portable IRGA system. In plants grown in 100% sunlight the highest photosynthetic rate and water use efficiency were obtained for Opal. At 25% sunlight Ruvi and Cayuga showed higher values of the photosynthetic parameters than Opal. All cultivars exhibited large seasonal variations of gas exchange parameters.*
Key words: *raspberry, photosynthesis, gas exchange, photosynthetically active radiation, temperature*

Rezumat. *Variatiile în parametrii fotosintetici induse de stresul din perioada de vară este un aspect putin investigat la plantele de cultura. În această lucrare s-a investigat variația fotosintezei la trei soiuri de zmeur (Ruvi, Cayuga și Opal), cultivate în câmp în condiții de lumină diferite în perioada iulie-septembrie 2011. După adaptarea la condițiile de cultură, 50% dintre plante au fost acoperite cu o plasă care a reținut 75% din radiația solară. Rata fotosintezei, rata transpirației, conductivitatea stomatală, concentrația de CO_2 intracelular și eficiența utilizării apei au fost calculate din măsurătorile schimbului de gaze determinate cu ajutorul unui sistem de tip IRGA. În cazul plantelor cultivate la 100% lumină, valori maxime ale ratei fotosintezei și eficienței utilizării apei au fost determinate la soiul Opal, în timp ce la 25% radiatie solară valorile acestor parametri au fost mai mari la Cayuga şi Ruvi. În general, toate soiurile au prezentat variații sezoniere mari la toti parametrii calculați*
Cuvinte cheie. *zmeur, fotosinteză, schimb de gaze, radiația activă fotosintetic, temperatură*

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INTRODUCTION

Raspberry is one of the species largely cultured in Northern Hemisphere due to its potential health benefits. Therefore, many studies have been focused on the effects of growth conditions on berry fruit quality and plant productivity.

Although it is stated that raspberries grow best in full sunlight the irradiance level for the optimum photosynthesis at this specie is low (aprox 200-300 μmol $m^{-2}s^{-1}$) (Pritts, 2002). Studies have shown that high light intensities do not increase photosynthesis; instead they may have a heat effect on the leaf and, subsequently harmful effects on plant physiology including alterations in photosynthetic rate (Fernandez and Pritts, 1994) and evapotranspiration (Stafne et al., 2001).

However, when the photosynthetic apparatus absorbs irradiance in excess of the needs for metabolism the photosynthetic activity is depressed by photoinhibition due to the inactivation of photosynthetic reaction centres (Osmond, 1994, Bertaminia et al., 2006). On the other hand, low irradiance decreases ATP synthesis and, subsequently, carbon fixation and carbohydrate biosynthesis. Therefore, understanding plant response to light may improve crop productivity and environmental sustainability.

To date, no studies have been performed on how light intensity affects the physiology of raspberry in a field experiment. This study assesses seasonal variations in photosynthesis, transpiration, stomatal conductance, water use efficiency and internal CO_2 concentration on three red raspberry cultivars (Ruvi, Opal and Cayuga) grown in the experimental field under full (100%) and reduced (25%) sunlight.

MATERIAL AND METHOD

This study was conducted during summer (from July to September) in 2011 in the experimental field of USAVM Iasi.

Three raspberry cultivars (Ruvi, Opal and Cayuga) were planted in the field on June 2011. On July 8, we placed a net over half of the plants which retained 75% of the sunlight (LL, low irradiance) while the other half was exposed to full sunlight (HL, high irradiance). All plants were irrigated when the field capacity decreased below 90%.

Gas exchange measurements were taken at four times named T0 (July 6-8), T1 (on July 20-22), T2 (on August 10-12) and T3 (on September 5-7) on fully uppermost expanded leaves from each plant. Net photosynthetic rate (A), stomatal conductance gs transpiration rate (E), were measured with a portable photosynthesis system (LCi 600, ADC BioScientific Ltd., England) equipped with a leaf chamber with constant-area inserts (6.25 cm^2). Leaf internal CO_2 (iCO2) partial pressure was calculated automatically by the internal program of the device. Water-use efficiency (WUE) was calculated as the ratio between A and E. Photosynthetic active radiation (PAR) and leaf temperature were also measured with an IRGA sensor.

For each experimental category we investigated 5 plants. Data are given as the mean ± standard error (SE) values. Duncan's t-test at $p < 0.05$ for separation of differences between means was performed using SPSS 20.

RESULTS AND DISCUSSIONS

Figure 1 illustrates PAR intensity and leaf temperatures during experiment under full sunlight (HL) and shade (LL) conditions.

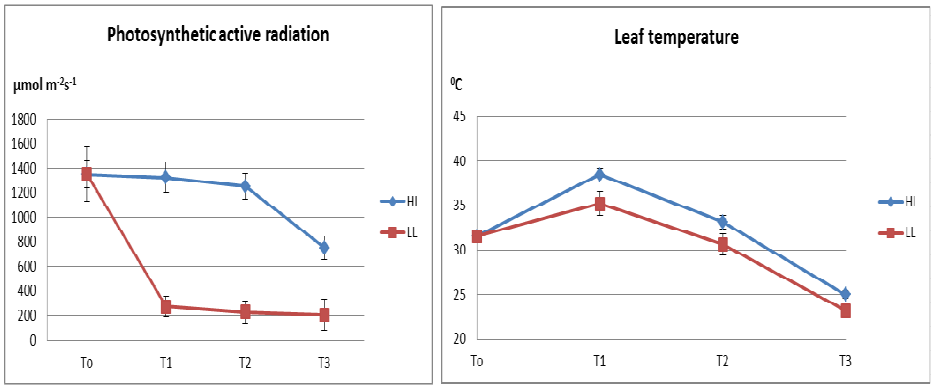

Fig.1 - Variations in PAR intensity and leaf temperature during experiments (for details, see Materials and Methods)

At T0 the highest values of photosynthetic rate (A) were recorded in Cayuga and Ruvi (Fig. 2). Both cultivars showed also higher values of stomatal conductance (gs) (Fig. 2D) which suggests a better CO_2 diffusion in leaf mesophyll (Chaves and Oliveira, 2004). Likewise, water use efficiency (A/E) was about 30% greater in Cayuga and Ruvi than in Opal (Fig. 2C). However, in these two cultivars the internal CO_2 concentration (iCO_2) was lower than in Opal possibly due to an increase in the efficiency of CO_2 assimilation in Calvin cycle (Yu et al., 2004).

During T0-T1 period, all plants were subjected to higher air temperatures (37°C) irrespective of the light treatment (Fig. 1). In all cultivars, the values recorded for A, E and gs at T1 were lower than at T0 (Fig. 2A-B, 2D). For instance, A values decreased about 40% in Opal, 20% in Cayuga and 10% in Ruvi (Fig. 2A). It is well known that in the field, leaf temperatures may exceed the air temperature by as much as 10°C (Haldimann and Feller, 2005).

Therefore these decreases may result from stomatal closure in response to low vapour pressure deficit caused by the heat stress (Zhang, et al 2001). This seems to be the case with Cayuga and Ruvi which showed similar reductions in gs values. However in Opal the gs values did not change while the iCO2 increased (Fig. 2D-E) fact suggesting the presence of non-stomatal limitations of photosynthesis (Dubey, 2005).

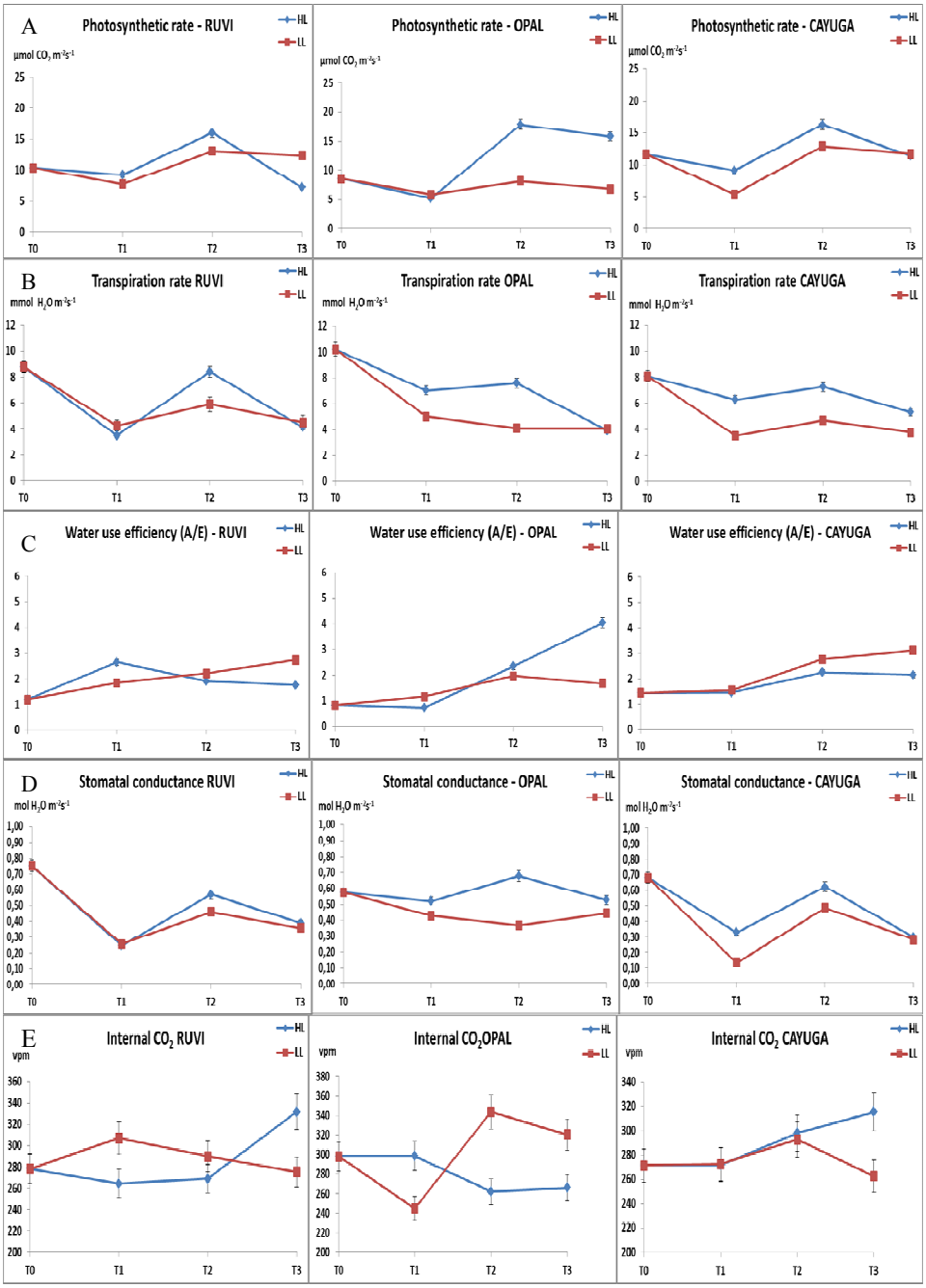

Fig. 2 - Seasonal variations in photosynthetic rates (A), transpiration rates (B), water use efficiency (C), stomatal conductance (D) and internal CO_2 (E) in three red raspberry cultivars grown in the field under full sunlight (HL) and shade (LL) conditions (for details, see Materials and Methods)

During acclimation to low irradiance (T0-T1) there was a different pattern of responses among cultivars. In Cayuga the photosynthetic and transpiration rates and the stomatal conductance decreased, but iCO_2 and WUE did not change. In Ruvi, the stomatal conductance did not change but the iCO_2 increased. Here WUE decreased due to the decrease of photosynthetic rate and a slight increase in the transpiration rate. In Opal, the stomatal conductance, transpiration rate and iCO2 decreased but the WUE slightly increased. All these changes suggest the presence of both stomatal and non-stomatal limitations as regulatory mechanisms of photosynthesis during acclimation to low irradiance (Dubey, 2005).

During the second decade of July leaf temperature decreased to 30°C and most of the gas exchange parameters increased in all plants irrespective of the light treatment. Under full sun conditions higher values of photosynthetic rate, stomatal conductance and water use efficiency were recorded in Opal and Cayuga, which seems to better adapt to field conditions than Ruvi. Under shade conditions, Cayuga and Ruvi showed higher values of photosynthetic rate than Opal. This might be due to an increase in stomatal conductance which allowed a better CO_2 diffusion in leaf mesophyll. Parallel, an increase in the transpiration rate suggests a contribution to leaf cooling thus reducing the negative effect of high temperature. As a consequence the water use efficiency increased and the values were 25% higher in Cayuga than Ruvi. On the other hand, in Opal, the stomatal conductance decreased while iCO_2 increased causing reductions in both transpiration and photosynthetic rates. These responses suggest that Opal has a higher sensitivity to low light intensities.

In the late summer (T3) the PAR intensity decreased to 750 μmol $m^{-2}s^{-2}$ and leaf temperature to 24-26°C. In these conditions, the photosynthetic rate of plants grown in full sunlight decreased in Ruvi (by 55%) and Cayuga (by 40%) and only by 12% in Opal. Ruvi and Cayuga also exhibited significant lower values in stomatal conductance and transpiration rate which resulted in a reduction of water use efficiency. On the contrary, in Opal, there were minor changes in stomatal conductance and photosynthetic rate and the WUE increased. These responses in Ruvi and Cayuga could be induced by changes in PAR and temperature but may also be related to leaf senescence and chlorophyll breakdown.

CONCLUSIONS

The variations in gas exchange parameters were related closely to changes in air temperature and indicate an adaptation of metabolic rates to the temperature variations in all cultivars. The cultivars vary in heat tolerance (when temperature increased over 35°C), with Ruvi being more tolerant to heat stress than Opal, and Cayuga being intermediate. High photosynthetic rates and stomatal conductance, together with low transpiration values, suggest that Cayuga and Ruvi cultivars have also a greater ability of acclimation to low light environments than Opal.

***Acknowledgment**: The present work was supported by the EU-funding grant POSCCE-A2-O2.1.2-2009-2 ID.524, cod SMIS-CSNR 11986.*

REFERENCES

1. **Bertaminia M, Muthuchelianb K, Rubinigga M, Zorera R, Velascoa R.**, **2006** - *Low-night temperature increased the photoinhibition of photosynthesis in grapevine (Vitis vinifera L. cv. Riesling) leaves*., Environ. Exp. Bot., 57 (1 – 2), p. 25 – 31.
2. **Chaves MM, Oliveira MM.**, **2004** - *Mechanisms underlying plant resilience to water deficits: prospects forwater-saving agriculture*, Journal of Experimental Botany, 55, p. 2365–2384.
3. **Dubey R.S.**, **2005** - *Handbook of photosynthesis*. In: Pessarakli ,M. (Ed.), Book sin Soils, Plants, and the Environment. Taylor & Francis, Boca Raton, FL, p. 717–737
4. **Fernandez G.E., Pritts M.P.**, **1994** - *Growth, carbon acquisition and source–sink relationships in 'Titan' red raspberry,* J. Amer. Soc. Hort. Sci., 119, p. 1163–1168.
5. **Haldimann P., Feller U.**, **2005** - *Growth at moderately elevated temperature alters the physiological response of the photosynthetic apparatus to heat stress in pea (Pisum sativum L.) leaves*, Plant Cell Environ., 28, p. 302-317.
6. **Haldimann P., Feller U.**, **2005** - *Growth at moderately elevated temperature alters the physiological response of the photosynthetic apparatus to heat stress in pea (Pisum sativum L.) leaves*, Plant Cell Environ., 28, p. 302-317.
7. **Osmond C. B.**, **1994 -** *What is photoinhibition? Some insights from comparisons of shade and sun plants*. In Photoinhibition of Photosynthesis: From Molecular Mechanisms to the Field . N. R. Baker and J. R. Bowyer, eds., BIOS Scientific, Oxford, p. 1–24.
8. **Pritts M.P.**, **2002** - *From plant to plate: How can we redesign Rubus production system to meet future expectation?* Acta Horticulturae, 585, p. 537-543.
9. **Rama Shanker Dubey**, **2005** - *Photosynthesis in Plants under Stressful Conditions*, in: Handbook of Photosynthesis by Taylor & Francis Group, LLC, p. 712-731.
10. **Stafne E.T., Clark J. R., Rom C. R.**, **2001** - *Leaf gas exchange response of 'Arapaho' blackberry and six red raspberry cultivars to moderate and high temperatures*, HortScience, 36, p. 880–883.

BIOMETRIC AND ECOPHYSIOLOGICAL RESEARCH IN SOME GRAPEVINE VARIETIES GROWN IN COPOU, IAŞI AREA, DURING THE GROWING SEASON OF 2012

CERCETĂRI ECOFIZIOLOGICE ŞI BIOMETRICE LA UNELE SOIURI DE VIȚĂ DE VIE CULTIVATE ÎN ZONA COPOU, IAŞI, ÎN PERIOADA DE VEGETAȚIE A ANULUI 2012

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Abstract. *Drought and high temperatures in recent years have acted negatively on plants, disturbing their metabolism (Dry and Loveys, 1999, Ferrini et al., 1995, Jitareanu et al., 2011). Very high air temperature, relative low humidity, high temperature on the soil surface and the absence of rainfall during the growing season produce an imbalance in the water balance in the plant. Excessive sweating can dehydrate plants foliar level, close stomates and reduces gas exchange in the process of photosynthesis (Lebon et al., 2006). Size of leaf area influences vegetative growth, grape production, accumulation of sugars in the grape and other "noble" products (anthocyanins, flavor, etc.) (Burzo el al., 2002; Irimia, 2012). Since the grapevine is a major consumer of water, with a large and well-developed vegetative apparatus, the optimum soil moisture is an important limiting factor, estimating that lower moisture values are favorable to grape ripening, whereas a high value are favorable to shoots growth.*
Key words: *ecophysiological, grapevine, drought, high temperatures*

Rezumat. *Seceta şi temperaturile ridicate din ultimii ani au acționat negativ asupra plantelor, perturbând metabolismul acestora (Dry and Loveys, 1999, Ferrini et al., 1995, Jitareanu et al., 2011). Temperatura aerului foarte ridicată, umiditatea relativă a aerului scăzută, temperatura la suprafața solului ridicată şi lipsa precipitațiilor în perioada de vegetație produc un dezechilibru al bilanțului hidric în plante. Transpirația excesivă la nivel foliar poate deshidrata plantele, închide ostiolele şi diminuează schimbul de gaze în procesul de fotosinteză (Lebon et al., 2006). Mărimea suprafeței foliare influențează creşterile vegetative, producția de struguri, acumularea zaharurilor în boabe precum şi a altor produşi "nobili" (antociani, arome etc) (Burzo el al., 2002, Irimia, 2012). Având în vedere că vița de vie este un mare consumator de apă, cu un aparat vegetativ mare şi bine dezvoltat, umiditatea optimă a solului reprezintă un important factor limitativ, apreciindu-se că valorile mai mici sunt favorabile maturării boabelor, iar cele mari creşterii lăstarilor.*
Cuvinte cheie: *ecofiziologic, vita de vie, seceta, temperaturi ridicate*

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INTRODUCTION

In the early stages of vegetation, high temperature is a stronger stress factor than lack of water, with a direct and immediate effect on photosynthetic apparatus, acting through degradation of chlorophylls in antenna chlorophyll, especially chlorophyll a and fotoinhibarea of assimilation device.

Eco-physiological response of the vine was assessed by analysis of indicators of the process of photosynthesis: leaf morphogenesis (leaf is the main organ of photosynthesis) and photosynthetic pigment content (chlorophyll and flavonoids).

MATERIAL AND METHOD

As research material were studied four varieties of vine grapes: Gelu, Coarnă neagră, Moldova and Purpuriu cultivated in vineyard Centre Iasi, Farm SDE the U.Ş.A.M.V. Iaşi, the climatic conditions of the growing season of 2012. Temperature and rainfall were recorded every ten days in the spring-autumn season, and the temperatures and average monthly precipitation amount were reported to the average annual values.

The growth of plants was determined by biometric measurements as: leaf area per shoot and leaf area per grapevine plant.

Leaf morphogenesis was assessed by determining in dynamics of the leaf area on the sterile and fertile shoots, measurements were made with apparatus for measuring leaf area AM300, portable instrument, compact, non-destructive measurement method (FJ Montero, 2000).

Foliar pigment content was assessed in the field and determined by CCM200 device plus a portable tool for the determination of chlorophyll content that reveals the chlorophyll content expressed in CCI (Chlorophyll Content Index), measurements being non-destructive and fast.

Measurements were performed in dynamics during the growing season, focused on the main phenophases: in June - intensive shoot growth and flowering, in July - the first stage of fruit growth, in August - phenophase of firstfruits.

RESULTS AND DISCUSSIONS

Changing climate conditions in Copou area, Iaşi in 2012 was estimated by processing and analysis of monthly temperature and rainfall amount compared to the annual average of the monthly temperature.

From the thermal point of view it was found that 2012 was a warmer year than normal, the mean air temperatures Moldova being 0.6 to 5.1^{0}C higher than normal climatological values (Tab. 1).

Table 1

Variation of the monthly average temperatures (ºC) in 2012 compared with the average of multiannual monthly temperature

	I	II	II	IV	V	VI	VII	VIII	IX	X
monthly average	-2.5	-9.5	4.0	13.0	18.2	23.3	26.3	23.1	18.9	12.0
normal	-3,1	-1,2	3,4	10,4	16,3	19,7	21,2	20,5	15,8	10,1
deviation	+0,6	-8,3	+0,6	+2,6	+1,9	+3,2	+5,1	+2,6	+3.1	+1.9

Monthly average temperatures in 2012 had a normal outcome for the geographical location of the study area, with a maximum in July and a minimum in February (Fig. 1). In February and December the monthly average temperatures were 2.9 (December) to 8.3 0C (February) lower than normal.

In terms of precipitation, it was recorded in 2012 poor values specially at the weather stations in the northern half of Moldova.

Table 2

Variation of the monthly amount of precipitation (mm) in 2012 compared with the average of multiannual precipitation amount

	I	II	II	IV	V	VI	VII	VIII	IX	X
monthly amount	12.0	61.0	19.4	56.2	98.2	16.3	22.2	32.1	50.1	34.0
normal	30,5	28,4	32,8	49,1	59,1	88,7	82,8	56,9	52,0	32,8
deviation	-18,5	+32,6	-13,4	+7,1	+39,1	-72,4	-60,6	-24,8	-1,9	+1,2

Regarding the monthly rainfall can be said that, except February, April, May, October and December in all other months they were poor (Table 2). It notes in particular the summer months with a deficit of 72.4 mm and 24.8 mm in June to August. In Copou Iasi, seasonal precipitation amounts are distributed unevenly both within a year and from year to year, changes in precipitation amounts profile share multiannual showing increases and decreases repeated milder or more pronounced (Jităreanu 2011, Marta, 2012).

In February, April and May 2012 the rainfalls recorded have exceeded the multiannual average values (Tab. 2), which in the spring of 2012 contributed to the achievement of an optimum soil moisture for the plants vine. The dryness of the atmosphere was most eloquently expressed by the relative humidity, distribution and evolution characteristics of this element value while presenting meteorological real practical importance.

Annual regime relative humidity ranged between 53% in July and 92% in December, the specific values continental climate regions, indicating the close correlation between this element and temperature climate. Minimum values were recorded in the summer months, June to August, between 69.4-70.6% and the peak in the winter months, up from 92% in December.

Biometric and physiological measurements in grapevine. The increasing of the vine shoots is dependent of the increasing of leaf area, the leaves exporting carbohydrates synthesized by the adult leaves the shoot tip, a process favored by increasing temperature, insolation and solar radiation. The growth rate is achieved in the most intense period of flowering, after flowering carbohydrates products geared towards grape leaves.

Average *shoot leaf area analysis* was performed to measure the leaf surface AM300 device, the device is made of a high-resolution scanner and scanning plate and the measurements can be made on the plate or on a flat surface, high resolution (0.065 mm^2) allowing the accurate measurement and the lower leaves.

During the growing season of 2012 was analyzed both average leaf area per shoot and average leaf area per vine, both having the same behavior.

There is a progressive increase in leaf area from one to another phenophase by Moldova and Purpuriu varieties, with a minimum at flowering (180 and 103.7 dm^2 in Moldova and Purpuriu) and a maximum accumulated in the ripening phenophase (397.8 208.3 dm^2 in Moldova and the Purpuriu), these results are consistent with characteristics of the variety, Moldova having large leaves while Purpuriu is a variety with medium leaves (Târdea and Rotaru, 2003). The leaf area at the Coarnă neagră variety had curve uniapicale behavior with a maximum grain growth phenophase and lower values at flowering and ripening (Fig. 1, Fig. 2).

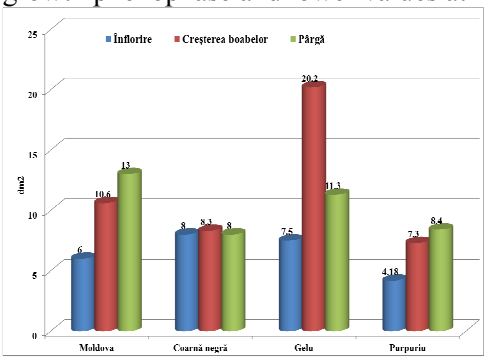

Fig. 1 - Dynamics of average shoot leaf area

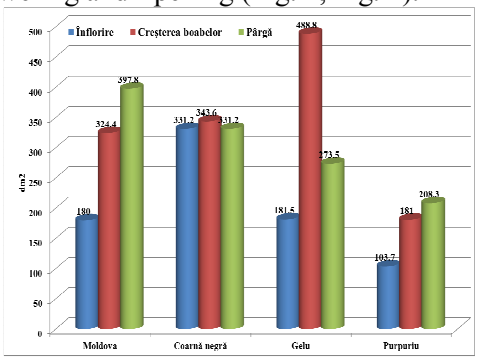

Fig. 2 - Average leaf area dynamics on hub

A different behavior had Gelu variety, with a maximum grain growth phenophase, due to both the large number of shoots per vine and leaf area, one of the characters ampelographic the large leaf area (17-18 cm^2) (Târdea and Rotaru, 2003). The ripening phenophase leaf area of this variety was much lower, Gelu with a maturity period during this time and the accumulation of sugars, anthocyanins and flavors in grapes not allowing the development of the leaves.

The analysis of the leaf area was stopped in the ripening phenophase because in this period the vegetative development of the grapevine has the maximum level.

Eco-physiological reaction of the vine varieties studied, according to global warming-induced climatic conditions, was estimated based on the dynamics of chlorophyll content as an indicator of the processes of photosynthesis and plant resistance to stress conditions.

The foliar pigment content was assessed by field measurements performed with CCM200 plus (portable instrument for the determination of chlorophyll), which revealed chlorophyll content expressed in CCI (Chlorophyll Content Index).

Dynamic analysis of the studied varieties showed the highest content of chlorophyll (CCI) in Coarnă neagră variety, throughout the growing season (Fig. 3) with a maximum grain growth phenophases and maturation grape (18.3 or 18.2). In other phenophases (flowering and ripening) chlorophyll content was low, but higher in value compared with the other varieties analyzed.

Gelu, the earliest variety analyzed as follows by Coarnă neagră as chlorophyll content, with maximum grain growth phenophase and firstfruits (15.1 CCI) and lower values at flowering and ripening of grapes (Fig. 3).

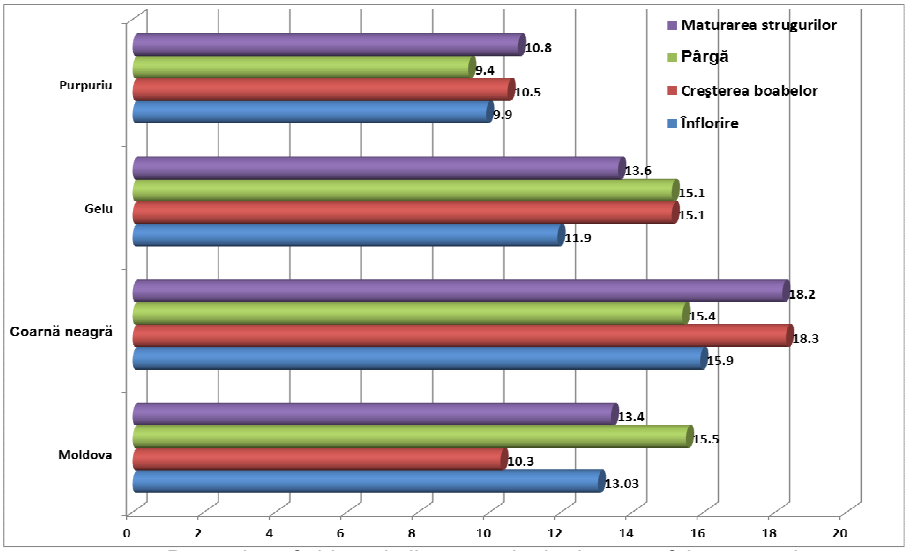

Fig. 3 - Dynamics of chlorophyll content in the leaves of the grapevine

At the variety Moldova the highest chlorophyll content was obtained in phenophase of firstfruits, similar values at flowering and ripening grapes and a much lower at the increase of the grains.

Of all the varieties analyzed, the lowest chlorophyll content was measured at Purpuriu in all phenophases analyzed. The climatic conditions of 2012 in terms of the variety Purpuriu chlorophyll content was found to be the most sensitive to water stress increased, behavior evidenced by decreased chlorophyll content.

In 2012, the content of chlorophyll in leaves of vine growing season varied for nearly the flowering phenophase a higher content of chlorophyll (CCI) had late period of ripening varieties: Moldova and Coarnă neagră.

A high content of chlorophyll was observed in the growth phenophase of grain varieties Gelu and Coarnă, which shows an intense photosynthetic activity of these varieties.

Totally different behaviors of varieties of vine were a result of the interaction between the characters of varieties ampelographic degree of precocity and climatic conditions of the growing season, characterized by soil and atmospheric drought stressed.

CONCLUSIONS

1. Temperature and water regime of 2012 was characterized by soil and air drought. From the thermal point of view it was found that 2012 was a warmer year than normal, average air temperatures were 0.6 to 5.1 °C higher than normal

climatological values. Rainfall was unevenly distributed, it notes in particular the summer months with a deficit of between 72.4 mm and 24.8 mm in June to August.

2. The leaf area at the analyzed varieties varied between phenophase, varietal characteristics and conditions of climatic stress. We noted in particular varieties of Moldova and Coarnă neagră by elevated surfaces on both shoot and per vine in all phenophases and lowest in Purpuriu.

3. Dynamic analysis of the studied varieties showed the highest content of chlorophyll (CCI) in Coarnă neagră variety, throughout the growing season, with a maximum growth phenophases grain and grape maturation (18.3 18.2) and lowest in Purpuriu, the totally different behaviors of the vine varieties were a result of the interaction between the characters of varieties ampelographic degree of precocity and climatic conditions of the growing season.

***Acknowledgments**: "This work was cofinanced from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/I.89/1.5/S62371 ,,Postdoctoral Schole in Agriculture and Veterinary Medicine area"*

REFERENCES

1. Burzo I. et al., 1999 – *Fiziologia plantelor de cultură. Fiziologia pomilor fructiferi şi ai viței de vie*. Edit. Ştiința Chişinău, ISBN 9975-67-147-0.

2. Dry P. R., Loveys B. R., **1999** – *Grapevine shoot growth and stomatal conductance are reduced when part of the root system in dried*. Vitis 38 (4), p. 151 – 156.

3. Ferrini F., G. B. Mattii, Nicese F. P., 1995 - *Effect of Temperature on Key Physiological Responses of Grapevine Leaf*. Am. J. Enol. Vitic.46, p. 375-379.

4. Irimia L., **2012** – *Biologia, ecologia şi fiziologia viței de vie*. Edit. Ion Ionescu de la Brad, Iaşi, ISBN 978-973-147-106-8.

5. Jităreanu Carmen Doina, Liana Doina Toma, Cristina Slabu, Alina Elena Marta, 2011 - *Studies about the dynamics of some physiological processes during the grape vine shoot growth*. JFAE Vol 9. (3&4), p.793-799.

6. Lebon E., Pellegrino Anne, Gaetan L., Lecoeur J., **2006** – *Branch Development Controls Leaf Area Dynamics in Grapevine (*Vitis vinifera*) Growing in Drying Soil*. Annals of Botany 98, p. 175–185.

7. Marta Alina Elena, 2012 - *Eco-physiological response of vine varieties during the growing season of 2011*, Lucrări ştiințifice, Seria Agronomie vol. 55, Iaşi,

8. Montero F.J., De Juan J.A., Cuesta A., Brasa A., 2000 - *Nondestructive methods to estimate leaf area in* Vitis vinifera L., HortScience 35, p. 696-698,

9. Țârdea C., Rotaru Liliana, 2003 - *Ampelografie* vol. II, Edit. Ion Ionescu de la Brad, Iaşi.

ANTIOXIDATIVE ENZYME ACTIVITY IN FIELD-GROWN RED RASPBERRY AND BLACKBERRY PLANTS DURING EXPOSURE TO WATER DEFICIT AND DIFFERENT LIGHT INTENSITIES

ACTIVITATEA ENZIMELOR ANTIOXIDATIVE ÎN PLANTE DE ZMEUR ŞI MUR CRESCUTE ÎN CÂMP ÎN TIMPUL EXPUNERII LA DEFICIT HIDRIC ŞI DIFERITE INTENSITĂȚI DE LUMINĂ

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Abstract. *To control the level of reactive oxygen species and to protect the cells, plants possess a number of low molecular mass antioxidants and enzymes scavenging ROS (reactive oxygen species). Under normal conditions, the production and scavenging of ROS are well regulated. However, under stressful conditions such as drought ROS formation might be in excess of antioxidant scavenging capacity, thus creating oxidative stress. This work investigated the effects of water deficit on the activity of foliar antioxidative enzymes—superoxide dismutase (SOD), catalase (CAT), guaiacol (POD) and ascorbate (APX) peroxidases in three raspberry (Cayuga, Opal and Ruvi) and two blackberry (Thornfree and Lochness) cultivars grown under full sunlight (100% solar light, HL) and low light (25% solar light, LL) conditions in the experimental field. Each category was divided into 2 groups. One group was used as control and maintained in optimal water conditions by supplementary irrigations; the second group was not irrigated and potentially exposed to water stress. Under HL and water deficit conditions CAT and POD activities increased in both berry species irrespective of the cultivar. In contrast, the APX activity was up-regulated in raspberry and down-regulated in blackberry while SOD response to water deficit was dependent on cultivar. Under LL and water deficit conditions the POD activity increased in all raspberry cultivars while it declined in blackberry. In general, the activities of antioxidative enzymes were higher in HL-grown plants than in LL-grown plants during exposure to water deficit. The cultivars Cayuga (raspberry) and Thornfree (blackberry) showed more efficient antioxidative characteristics which could provide better protection against oxidative stress in leaves under water limited conditions.*
Key words: *raspberry, blackberry, water deficit, antioxidative enzymes, light intensity.*

Rezumat. *Pentru a controla nivelul de specii reactive de oxigen (ROS) și pentru a proteja celulele, plantele posedă antioxidanti și enzime antioxidative. În condiții normale, producția și inactivarea speciilor active de oxigen sunt bine reglementate. Cu toate acestea, în condiții de stres, cum ar fi seceta, formarea de ROS ar putea fi în exces față de capacitate antioxidantă, creând astfel stresul oxidativ. Aceasta lucrare a investigat efectele deficitului de apă asupra*

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activității enzimelor antioxidative foliare-superoxid dismutaza (SOD), catalaza (CAT), guaiacol peroxidaza (POD) şi ascorbat peroxidaza (APX), în trei soiuri de zmeur (Cayuga, Opal si Ruvi) și două soiuri de mur (Thornfree si Lochness) cultivate în condiții de radiație solară de 100% (HL) și 25% (LL), în câmpul experimental. Fiecare categorie a fost împărțită în 2 grupe. Un grup a fost folosit ca şi control fiind mentinut în condiții optime de apă prin irigare suplimentară, al doilea grup nu a fost irigat și potențial expus la stresul hidric. In conditii de HL si deficit de apă activitățile CAT şi POD au crescut în ambele specii, indiferent de soi. În schimb, activitatea APX a fost stimulată în zmeur şi inhibată în mur, iar răspunsul enzimei SOD la deficitul de apă a fost dependent de genotip. În condiții de LL si deficit de apă activitatea POD a crescut în toate soiurile de zmeur, în timp ce a scăzut în cele de mur. În general, activitatea enzimelor antioxidante a fost mai mare în plantele cultivate la HL decât în cele crescute la LL în timpul expunerii la deficitul de apă. Soiurile Cayuga (zmeur) și Thornfree (mur) au avut caracteristici antioxidante mai eficiente, fapt care ar putea oferi o mai bună protecție împotriva stresului oxidativ instalat în frunze ca urmare a deficitului de apă din sol.
Cuvinte cheie: *zmeur, mur, deficit hidric, enzime antioxidative, intensitatea luminii*

INTRODUCTION

Drought can cause oxidative stress and lead to the formation of reactive oxygen species (ROS). To control the level of reactive oxygen species and to protect the cells, plants possess a number of low molecular mass antioxidants and antioxidative enzymes. The ability for rapid upregulation of these enzymes was closely correlated with drought tolerance in different species (Wang et al., 2009).

The areas in Northeastern Romania, where raspberries and blackberries can be extensively grown are falling under water stress condition. Thus, identification of highly productive cultivars with better tolerance to water limited regimes is extremely important. This work investigated the effects of water deficit on the activity of foliar antioxidative enzymes: superoxide dismutase (SOD), catalase (CAT), guaiacol peroxidase (POD) and ascorbate peroxidase (APX) in several raspberry and blackberry cultivars grown under two different light intensities in the experimental field in order to evaluate their tolerance to water deficit for future breeding programs.

MATERIAL AND METHOD

Three cultivars of raspberry (*Rubus idaeus* L.) Ruvi, Opal and Cayuga and two cultivars of blackberry (*Rubus fruticosus* L.) Thornfree and Lochness were cultured in June 2011 at the experimental station "V. Adamachi" from Iasi, Romania. The orchard was divided in two categories: HL, plants grown in full sunlight and LL, plants grown in shade conditions by covering them with a net which retained 75% sunlight (LL). Both HL and LL plants were grown under natural conditions of precipitations but each category was divided in two lots: one that was maintained in well watered conditions (85% FC) by supplementary irrigation (control, C) and the other one that was non-irrigated and thus exposed to water deficit. Samples (leaf tissues approximately from 5 plants/experimental variant) were taken after two months of plant growth under the above conditions.

Enzyme extracts were prepared using the method described by Vitória et al. (2001) with some modifications. The quantification of total soluble proteins was performed using the method of Bradford (1976). Superoxide dismutase (SOD) activity was assayed by measuring its ability to inhibit the photochemical reduction of nitroblue tetrazolium (NBT) (Rao and Sresty, 2000). Catalase (CAT) activity was determined using the method described by Aebi (1983). POD activity was estimated according to Putter (1983). Ascorbate peroxidase (APX) activity was determined using the method described by Nakano and Asada (1981). All spectrophotometric measurements were made using a T70 UV/VIS spectrophotometer (PG Instruments Ltd., London, UK).

Each analysis consisted of triplicate measurements of each sample and data were averaged over the three measurements. All data were subjected to t-test analysis at the $P<0.05$ probability level using SPSS 20.0 software package. The results are given as percentage of the corresponding well-watered controls.

RESULTS AND DISCUSSIONS

Changes in the activities of antioxidative enzymes in raspberry. Superoxide dismutases (SOD, EC 1.15.1.1) are enzymes that catalyze the dismutation of superoxide (O^{2-}) into oxygen and hydrogen peroxide. In this study we determined only the total SOD activity in leaf samples. The activity of SOD in non-irrigated raspberry plants declined in Opal and Ruvi. In Opal the light intensity did not influence this response. Here, SOD activity recorded values that were 50% lower than the corresponding control values, irrespective of the light treatment. However in Ruvi, the activity of SOD showed a larger decrease in HL (70%) than in LL conditions (50%). In contrast, SOD activity increased in Cayuga when plants were grown under HL conditions and did not change under LL conditions (Fig. 1).

Catalase (CAT, EC 1.11.1.6) is a common enzyme found in nearly all living organisms exposed to oxygen. It catalyzes the decomposition of hydrogen peroxide to water and oxygen. CAT activity increased in plants grown under HL conditions with Ruvi and Opal showing the largest increases. Under LL conditions it decreased slightly in Ruvi and Cayuga and approximately 50% in Opal (Fig. 1).

Ascorbate peroxidases (APX, EC 1.11.1.11) are enzymes that detoxify peroxides such as hydrogen peroxide using ascorbate as a substrate. Under HL conditions, APX increased by 50% in Opal and Cayuga and only 20% in Ruvi. In plants grown under LL conditions, APX activity in Ruvi and Cayuga showed values that were higher by 150% and 50%, respectively than those of well-watered controls. The values obtained for Opal were slightly lower than control (Fig. 1).

Guaiacol peroxidase (POD, EC 1.11.1.7) reduces H2O2 to water using various substrates as electron donors. It increased largely in all cultivars irrespective of the light treatment. The highest values were obtained in Opal+LL followed by Ruvi+HL.

*Changes in the activities of antioxidative enzymes in blackberry***.** The activity of SOD decreased in Lochness plants grown under HL conditions by 40%

while it did not change in plants grown under LL. In Thornfree, SOD activity increased under both light conditions mostly at HL (Fig. 2).

The alterations of CAT activity were influenced by light intensity rather than by genotype. It increased by 70% in plants grown under HL conditions and did not change in plants grown under LL. APX activity increased highly in Lochness+LL while it decreased in Thornfree and Lochness+HL. POD increased in both cultivars exposed to HL, mainly in Lochness while it decreased in Thornfree+LL or did not change in Lochness+LL (Fig. 2).

*Similarities and differences in the activities of antioxidative enzymes***.** Similarities and differences in the activities of the oxygen-scavenging enzymes, SOD, POD, APX, and CAT were detected among raspberry and blackberry cultivars exposed to soil water deficit. The differences were imposed by light conditions and genotype. In general, the activities of antioxidative enzymes were higher in HL-grown plants than in LL-grown plants suggesting that high light combined with water deficit resulted in enhanced production of ROS by the photosynthetic apparatus because these conditions limit the availability of CO2 for the dark reaction, leaving oxygen as one of the main reductive products of photosynthesis.

Under HL+water deficit conditions CAT and POD activities increased in both berry species irrespective of the cultivar. In contrast, the APX activity was up-regulated in raspberry and down-regulated in blackberry suggesting the presence of species-dependent regulatory mechanisms of APX. SOD response to water deficit was dependent on genotype.

Among berry cultivars, Cayuga and Thornfree showed increased activities of all categories of enzymes (SOD, CAT and POD) which may contribute to a higher degree of tolerance of these cultivars to the growth conditions. In Opal, Ruvi and Lochness SOD down-regulation could result in the overproduction of the H2O2 and O2.- whereas increased activities of catalase and peroxidases suggests high demands of H2O2 quenching.

Under LL+water deficit conditions the POD activity increased in all raspberry cultivars while it declined in blackberry. The fact that POD is up-regulated in raspberry irrespective of the light treatment and genotype suggests a response exclusively induced by water deficit. In contrast, the activity of POD in blackberry seems to be depended on light intensity, this enzyme being up-regulated at high light.

In conclusion, the above mentioned enzymes act as a system. Some of them seem to be under different regulatory mechanisms and/or they are compartmentalized in different organelles. To further elucidate the role of these enzymes in tolerance of raspberry and blackberry plants to water deficit, their cell localization needs to be determined.

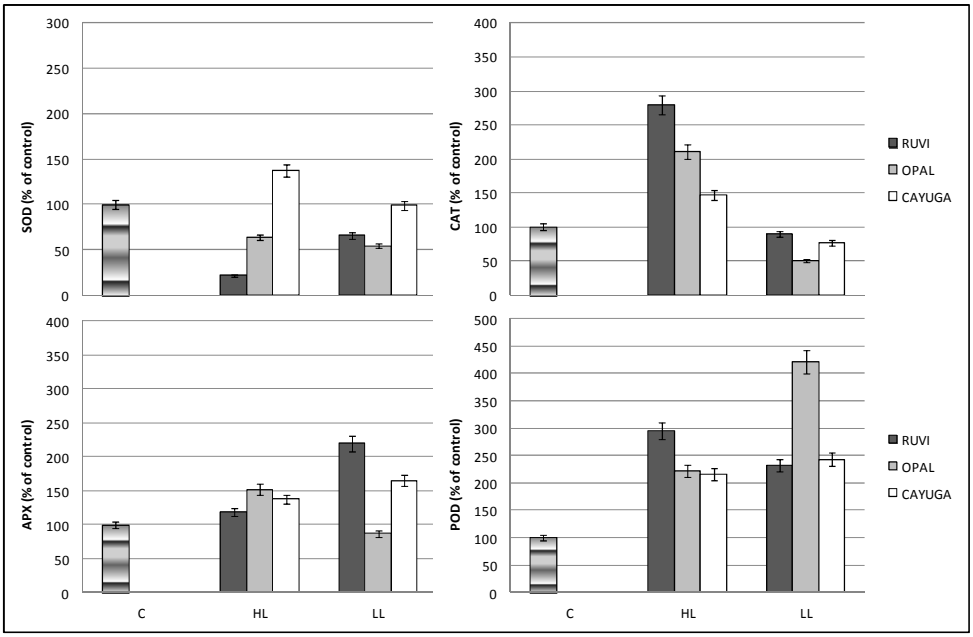

Fig. 1 - The activities of key antioxidative enzymes (SOD, CAT, APX and POD) in three red raspberry cultivars grown without irrigation under different light intensities. The values are expressed as percentage of irrigated control plants (C)

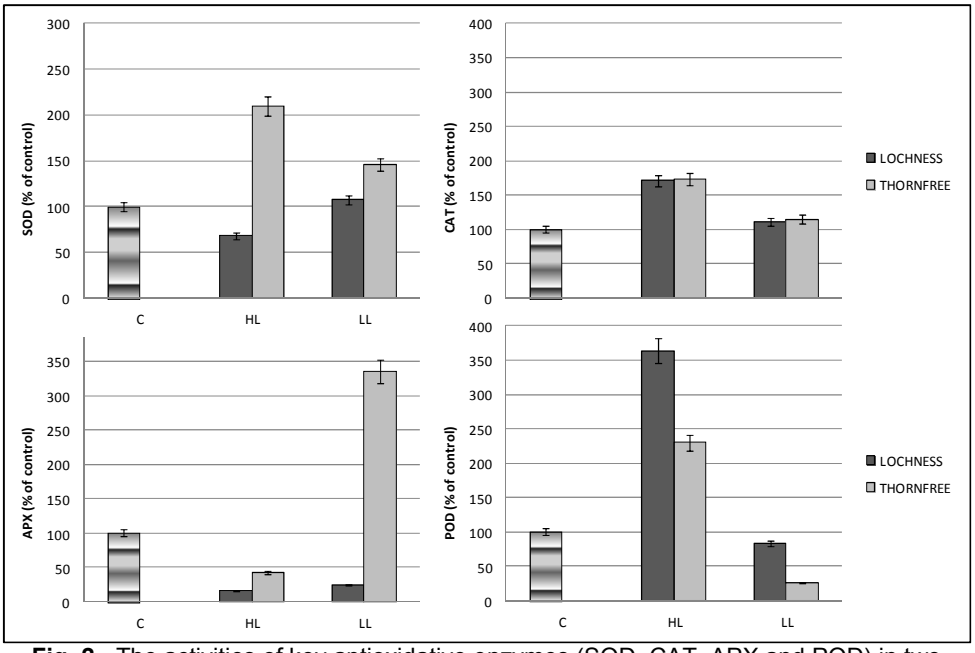

Fig. 2 - The activities of key antioxidative enzymes (SOD, CAT, APX and POD) in two blackberry cultivars grown without irrigation under different light intensities. The values are expressed as percentage of irrigated control plants (C)
(for details, see Materials and Methods)

CONCLUSIONS

1. The activities of antioxidative enzymes were higher in HL-grown plants than in LL-grown plants during exposure to water limited conditions.

2. Under water deficit conditions, HL increased CAT and POD activities in both berry species irrespective of the cultivar.

3. APX and SOD response to a combination of high light and water deficit is influenced by species and cultivar, respectively.

4. During water deficit POD is up-regulated in raspberry plants irrespective of the light treatment and genotype. In blackberry its activity is dependent on light intensity.

5. The cultivars Cayuga (raspberry) and Thornfree (blackberry) exhibited efficient antioxidative characteristics which could provide better protection against oxidative stress in leaves under water limited conditions.

***Acknowledgment**: The present work was supported by the EU-funding grant POSCCE-A2-O2.1.2-2009-2 ID.524, cod SMIS-CSNR 11986.*

REFERENCES

1. Aebi H., **1983** - *Catalase,* In: Bergmeyer, H. (Eds.), Methods of Enzymatic Analysis 3. Verlag Chemie, Weinheim, Adamse, p. 273-277.

2. Bradford M. M., **1976** - *A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding*, Anal. Biochem., 72, p. 248-254.

3. Nakano Y., Asada K., **1981** - *Hydrogen peroxide is scavenged by ascorbate specific peroxidase in spinach chloroplasts*, Plant Cell Physiol., 22, p. 867-880.

4. Putter J., Becker R., **1983** - *Peroxidase*, In: Bergmeyer, H.U., Bergmeyer. J., Grassl, M., (Eds.), Methods of Enzymatic Analysis. Verlag Chemie, Weinheim, p. 286-293.

5. Rao K.V.M., Sresty T.V.S., **2000** - *Antioxidant parameters in the seedlings of pigeon pea* (C*ajanus cajan* (L.) *Millspaugh*) *in response to Zn and Ni stresses*, Plant Sci., 157, p. 113-128.

6. Vitória A. P., Lea P. J., Azevedo R. A., **2001** - *Antioxidant enzymes responses to cadmium in radish tissues.* Phytochem. 57, p. 701-710.

7. Wang W.B., Kim Y.H., Lee H.S., Kim K.Y., Deng X.P., Kwak S.S., **2009** - *Analysis of antioxidant enzyme activity during germination of alfalfa under salt and drought stresses*, Plant Physiol. Biochem., 47, p. 570–577.

EFFECT OF NATURAL PRODUCTS ON SOME PHYSIOLOGICAL PROCESSES OF SOYBEAN PLANTS (*GLYCINE MAX* L.)

INFLUENȚA UNOR PRODUSE NATURALE ASUPRA UNOR PROCESE FIZIOLOGICE DIN PLANTELE DE SOIA (*GLYCINE MAX* L.)

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Abstract. *In this paper, are presented the results concerning the influence of deuterium depleted water (DDW) in combination with aqueous extract obtained from the spruce bark, on the growth and development of soybean plants. For this purpose, in the presence of distilled water (control), DDW, extract of spruce (SB) and spruce extract in combination with DDW, tests were performed for soybeans in vegetation pots. The influence of treatment was evaluated by gravimetric and biometric analysis, by quantifying photoassimilating pigments, photosynthetic activity, respiration intensity, transpiration intensity and substomatal carbon dioxide content. Results showed that in the presence of DDW and extract obtained from the spruce bark was a stimulation effect for biomass quantity and photoassimilating pigments synthesized. In the presence of spruce bark aqueos extract (26 mg GAE/100g) and spruce bark extract in combination with DDW photosynthetic and respiratory rate was high.*
Key words*: polyphenols, bioregulators, deuterium depleted water, photosynthesis, soybean.*

Rezumat. *În lucrare sunt prezentate rezultatele unui studiu in care s-a urmărit evidențierea rolului apei sărace în deuteriu (ASD) în combinație cu extractul apos obținut din coajă de molid în creşterea şi dezvoltarea plantelor de soia. În acest scop au fost realizate teste în vase de vegetație in care s-au însămânțat semințele de soia în prezența apei distilate (martor), ASD, a extractului de molid şi a extractului de molid în combinație cu ASD. Influența tratamentelor a fost apreciată prin efectuarea de analize biometrice şi gravimetrice privind evoluția plantelor, precum şi prin stabilirea conținutului în pigmenți fotoasimilatori, a activității fotosintetice, respiratorii, transpiratiei si continutului substomatal in dioxid de carbon. Rezultatele au evidențiat că în prezența ASD și extractului obținut din coajă de molid se înregistrează o stimulare a cantității de biomasă acumulată dar si a pigmenților fotoasimilatori sintetizați. Prin determinarea ratei fotosintetice și respiratorii s-a constatat o intensificare a acesteia în prezența extractului de molid cu concentrația 26 mg GAE/100g.*
Cuvinte cheie: *polifenoli, bioregulatori, apa săracă în deuteriu, fotosinteza, soia.*

INTRODUCTION

Natural compounds and other plant interactions are part of allelopathy, commonly defined as any plant's or microorganism's direct or indirect, stimulatory or inhibitory effect toward other plants through various chemical

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compounds released into the environment. Allelochemicals are released into the environment through various mechanisms: volatilization from plant leaves, rhizosphere formation, bark extraction and residue decomposition (Rice, 1984). Studies on the mechanism by which polyphenolic compounds affect the metabolic processes of plants allow current research reorientation to an ecological agriculture (Lichtenthaler and Wellburn, 1983).

Thus, assessing the action of polyphenolic products of spruce bark extracts on tomato seeds germinated was a positive influence on the rate and capacity germination, seedlings growth and the amount of biomass accumulated. The stimulatory effect of the primary root elongation and hypocotyles, found in the presence of polyphenolic extracts at concentrations of 40, 200 mg / L in the growth medium, can be compared with those of auxins or citokinins (Bălaş et al., 2005; Bălaş and Popa, 2007).

In the present study it was followed the physiological effect produced by polyphenolic extract from spruce bark in combination with deuterium depleted water on soybean plants that have developed in greenhouse conditions.

MATERIAL AND METHOD

The experiment was conducted over a period of 60 days. Its beginning was to prepare the necessary materials following steps:

a) Imbibitions – soybeans seeds, were carefully selected to be without any deterioration. Then they were immersed in the test solution for 15 hours at a constant temperature of 25°C.

b) Sowing by 3 seeds / pot and 10 pots for each experimental variant.

c) Application of test solutions for their test solutions absorption was performed at intervals of 5 days, from the first day after sowing. This was done at radicular level. Experimental variants analyzed were organized into 5 experimental variants: deuterium depleted water (DDW) DDW mixed with spruce bark polyphenolic extract, with concentration of 26 mg GAE/100g (DDW + SB2), spruce bark polyphenolic extract with concentration 5 g / L (26 mg GAE/100g - SB1) and 10 g / L (52 mg GAE/100g - SB2) and control where water was applied.

To determine the intensity of photosynthesis, respiration, transpiration and substomatal CO_2 was used Non Dispersive Infrared (NDI). To determine these physiological processes of plants was used LCI device photosynthesis system (ADC BioScientific's).

Quantification of assimilating pigments - 0.05 g fresh vegetal material was extracted in 80% acetone by grinding with a spatula tip of quartz sand. Chlorophyll extract was analyzed spectrophotometrically by reading absorbance at various specific wavelengths: 470, 646, and 663 nm. In order to determine the concentration of chlorophyll pigments (chlorophyll a and b) and carotenoid pigments were used formula proposed by Lichtenthaler and Welburn (1983):

Clorophyll a (µg/mL) = 12, 21 (A_{663}) – 2, 81 (A_{646})

Clorophyll b (µg/mL) = 20, 31 (A_{646}) 5, 03 (A_{663})

Carotenoids (µg/mL) = (100· A 470 – 3,27 [chl a] – 104 [chl b])/22

To determine the elongation and biomass accumulation ten plants/experimental version were separated into root, leaves and stems at 60 days after sowing. These parts of plants were oven dried at 65° C, and weighed. The results obtained as the average were reported (%) to the Control sample.

Our results are expressed as mean ± standard error where n = 3. Comparison of the means was performed by the Fisher least significant difference (LSD) test (PB ≤ 0.05) after ANOVA analysis using program PAST 2.14. Sampling and chemical analyses were examined in triplicate in order to decrease the experimental errors and to increase the experimental reproductibility.

RESULTS AND DISCUSSIONS

Vegetative organs elongation

To determine the length differences between experimental variants for each organ vegetative biometric technique was applied. This was done after 60 days from sowing. The following indices were established: root length, stem length, length and number of leaves. The stimulation/inhibition effect was calculated in percentage compared with the control (this was for the case when distilled water was applied). Soybean plant roots in the DDW + SB2 and SB1 variants, has developed very well, with an increase in length growth of over 30 %. Analyzing the increase in length of the stem, it was observed significant stimulation in the SB1 (63.27%), SB2 (37.65%) and ASD + SB2 (43.2%) variants. For other variants, stimulating percentages are lower. Analyzing length and number of leaves, the stimulating effect was higher in the case SB1 variant (leaf length - 96.61%, leaf number - 12.76%). A significant stimulation of growth in length of leaves was observed for the plants developed in variant DDW + SB2 and DDW (20.21%) (Fig. 1).

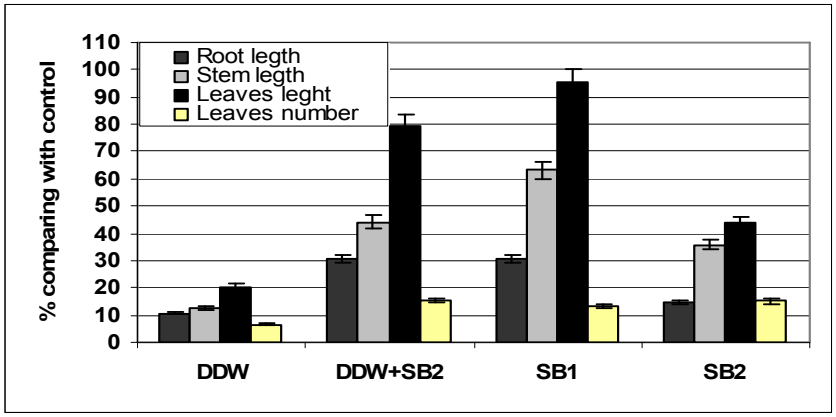

Fig. 1 - The influence of DDW (deuterium depleted water), SB1 and SB2 (spruce bark aqueous extract) and SB aqueous extract in combination with DDW on soybean plant length growth

Biomass accumulation in vegetative organs

Determination of fresh and dry weight plant biomass was performed by gravimetric method using analytical balance. These results underline once again allelophatic effect of deuterium depleted water and spruce bark aqueous extracts on soybean plants.

Analyzing Figure 2 we can observe a noticeable, increase in the amount of biomass from plants that have developed in the presence of spruce bark aqueos extract. The highest percentage of stimulation is obtained for the amount of biomass accumulated in roots of soybean plants for all experimental variants.

For the version with the lowest concentration in polyphenolic compounds (26 mg GAE/100g - SB1) were recorded the highest percentages of stimulation for accumulated amount of wet biomass (102.2% - root, 32.3% - strain, 33 12% - leaves) (fig. 2a). At a higher concentration of the extract (SB2), the percentage of stimulation is lower than SB1. The utilization of DDW + SB2 will increase the amount of biomass accumulated in all vegetative organs. The amount of dry biomass for this variant is higher than other alternatives (87.3% - root, 28.1% - stem, 20.1% - leaves) (Fig. 2b). The aplication of DDW increases the amount of biomass accumulated in all vegetative organs, but with lower percentages compared to variant DDW + SB2.

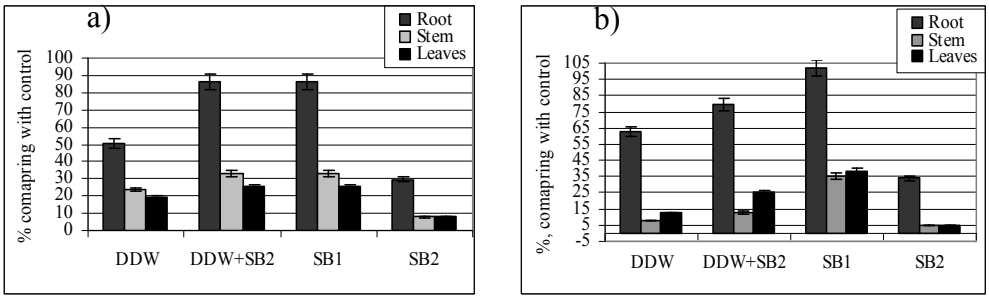

Fig. 2 - The influence of DDW (deuterium depleted water) SB1 and SB2 (spruce bark aqueous extract) and SB aqueous extract in combination with DDW on soybean dry biomass accumulation

Accumulation of photoassimilating pigments

Analyzing the figure 3 we can observed stimulating effect on the amount of photoassimilating pigments accumulation in soybean plants, developed in case of SB1 and DDW + SB2 variants. The amount of total chlorophyll compared with the control, is higher for DDW + SB2 (46%) and SB1 (29.2%) variants. Polyphenolic extract with a concentration of 52 mg GAE / 100g, has a lower impact on the amount of pigments accumulation, compared with the values obtained for DDW, DDW + SB2 and SB1 variants.

The intensity of photosynthesis, respiration, transpiration and CO_2 content

By determining photosynthetic rate (Fig. 4) in plants subjected to treatment with various solutions there was a slight increase in all experimental variants. It is noteworthy result obtained for SB1 variant, where the percentage of photosynthetic intensity is with 92% higher compared with the control. Values recorded in variant DDW + SB2 are close to those recorded in SB1 version.

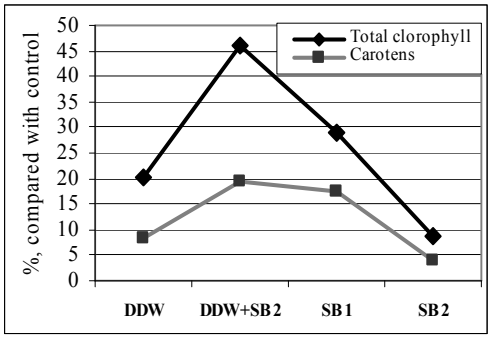

Fig. 3 - Photosynthetic pigments content (µg/g) for soybean plant grown under polyphenolic extracts and deuterium depleted water effect

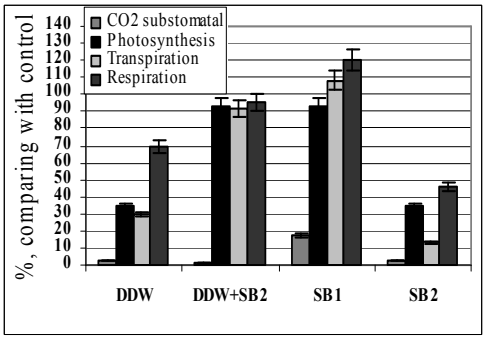

Fig. 4 - Physiological indices for soybean plant grown under polyphenolic extracts and deuterium depleted water effect

If the follow the obtained data, we can found an increase in the breathing process for soybean plants in all experimental variants with higher percentages for SB1, DDW + SB2 and DDW variants.

Noting the role of DDW and spruce bark aqueous extract on the intensity of transpiration, from the results, we find that the soybean plant to stimulate transpiration percentage for all experimental variants, especially for SB1 (120.1 %) and DDW + SB2 (94.2%) variants. We can see that the removal of carbon dioxide in the breath is correlated with the removal of water from the plant; these processes are more pronounced in plants treated with polyphenolic extracts obtained from spruce bark having 26 mg GAE/100g concentration. Regarding substomatal CO_2 content, there is a significant increase in soybean plants in case pf SB1 variant, compared with control.

CONCLUSIONS

1. The aqueous extract obtained from the spruce bark, caused an increase in the amount of biomass, the amount of photosynthetic pigments as following due to increased photosinthetical activity.

2. It is found that for soybean plants the percentage of stimulation transpiration intensity for all experimental variants is high, especially in the case of DDW + SB2 and SB1 variant.

3. It was observed that the intensity of respiration is higher in soybean plants that were treated with spruce bark aqueous extract with 26 mg GAE/100g concentration.

4. The information regarding the effects of polyphenolic compounds and deuterium depleted water on plant growth and development are important in determining their potential to be used in agriculture as natural growth bioregulators.

Acknowledgement: *This paper was realised with the support of POSDRU CUANTUMDOC "Doctoral studies for european performances in research and inovation" ID79407 project funded by the European Social Found and Romanian Government.*

REFERENCES

1. **Bălaş A., Dănăilă M., Popa V.I., Anghel N**., **2005** - *On the behavior of natural polyphenolic products as plant growth regulators*, Buletinul Institutului Politehnic Iaşi, Seria Chimie şi Inginerie Chimică, Tom LI (LV), 3-4, p. 121-125.
2. **Bălaş A., Popa V. I.**, **2007** - *The influence of natural aromatic compounds on the development of Lycopersicon esculentum Mill*", BioResource, 2 (3), p. 363-370.
3. **Lichtenthaler, H.K., Wellburn, A.R**., **1983** - *Determinations of total carotenoids and chlorophylls a and b of leaf extracts in different solvents*. Biochem. Soc. Trans. 11, p. 591–593.
4. **Rice E.L., 1984** - *Allelopathy*, Academic Press, New York, p. 1-7.

QUANTITATIVE DETECTION OF PLUM POX VIRUS (PPV) IN SEVERAL VARIETIES OF PEACH BY REAL-TIME RT-PCR

DETECTIA CANTITATIVA A VIRUSULUI *PLUM POX* (PPV) LA UNELE SOIURI DE PIERSIC FOLOSIND TEHNICA REAL TIME RT- PCR

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Rezumat: *TaqMan real-time reverse transcriptase (RT)-polymerase chain reaction (PCR) using plant extract spotted onto a membrane (3MM Whatman) to realise PPV targets procedures was developed to detect and quantify Plum pox virus (PPV) in sevaral varieties of peach. The sensitivity of conventional real time RT-PCR was 1,000 times higher than immunocapture (IC)-RT-nested PCR and 106 times higher than enzyme linked immunosorbent assay (ELISA). Reliable quantitation of PPV targets present in infected plant material immobilized on paper can be directly used as template without the need of RNA purification. In the present study, different approaches for sample preparation prior to real-time RT-PCR based on the TaqMan chemistry for a simple, rapid, sensitive and universal detection and quantification of PPV, have been developed. This paper presents data from the Ph. degree thesis in the frame POSDRU/107/1.5/S/76888, project financed from the European Social Fund through the Sectorial Operational Programme for Human Resources Development 2007-2013.*
Key words: *varieties, peach, detection, strains, resistance.*

Abstract: *TaqMan real time reverstranscriptazei (RT)-polimerazei reacție în lanț (PCR) folosind extract de plante imobilizat pe o membrană (Whatman 3MM) pentru a realiza țintele de PPV este o procedură ce a fost dezvoltată pentru a detecta şi cuantifica virusul Plum pox virus (PPV), la diferite soiuri de piersic. Sensibilitatea în timp real convențional RT-PCR a fost de 1.000 de ori mai mare decât immunocapture (IC)-RT-PCR şi 106 de ori mai mare decât enzima legate immunosorbent assay (ELISA). Cuantificarea percisă şi obiectivă a probelor de PPV prezent în materialul infectat ce apoi a fost imobilizat pe membrană 3MM Whatman pot fi utilizate direct ca şablon fară să fie nevoie de o purificare prealabilă a ARN-ului. În studiul de față, au fost dezvoltate abordări diferite pentru pregătirea probei înainte de Real Time -PCR bazat pe Kitul TaqMan pentru o detectare simplă, rapidă, sensibilă şi universală cât şi cuantificarea virusului PPV, prin real time RT PCR. Lucrareade față prezintă date din teza de doctorat in cadrul POSDRU/107/1.5/S/76888, proiect finanțat din Fondul Social European prin Programul Operațional Sectorial pentru Dezvoltarea Resurselor Umane 2007-2013.*
Cuvinte cheie: *soiuri, piersic, detecție, suşe, rezistență*

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INTRODUCTION

Plum pox (Sharka) is a serious disease caused by virus Plum pox virus (PPV) attacking species of the genus Prunus, and is considered the most important viral disease of fruit trees in Europe and the Mediterranean region (Royand Smith, 1994). How far can travel PPV-infection vectors and how much infectaþie retain the capacity are issues which remain unknown. In Europe, the aphids primary vectors that transmit PPV's were identified in Romania (Isaac et al., 1998), Spain (Llacer and Cambra, 1998), Hungary (Gaborjanyi and Basky, 1995), and France (Labonne et al. 1995). Many questions remain to be elucidated about the range of host plants. We now know that both in the case of the woody plants and herbaceous host susceptibility is dependent PPV strain used in studies (Schneider et al., 2004). One objectives of this study was to identify genotypes of peach able to sustain long-term systemic infection with PPV. He hypothesized that these genotypes could be effective in maintaining long-term infection with PPV being an important reservoir that could be a danger to any attempt eradication program, especially if the infected plants remain asymptomatic, the least part of the year. Different PCR techniques have been described above, with or without imunocapture (Wetzel et al., 1991). In all cases plant extracts are necessary, even if grinding operation is time consuming and involves the risk of contamination and release of PCR inhibitors. Several reports have demonstrated the potential of using different methods to immobilize the PCR viral particle by imunocapture.

MATERIAL AND METODS

A total of 88 different peach genotypes from the national collection (Miorița, Turist, Partizan, Miur, Gloria, Frumos de Baneasa, Roşie marmorată, Cluj, Ideea, De Voineşti, Superbă de Toamnă, De Cândeşti, Veteran, etc.) including witnesses and positive control, were tested for their ability to support infection with PPV infection in natural conditions in the field. Quantitative analysis of real-time RT-PCR was performed on RNA previously captured on the membrane (paper) Wathman 3MM putting it directly extracts and then to use specific primers designed to detect PPV's presence. Print fresh peach leaf tissue infected or healthy previously mortar and pipettes on to Whatman 3MM paper. This prepared material can be worked immediately or stored at room temperature for up to 1 month without negative effects on the process of amplification.

Plant extract is prepared with PBS buffer +2% PVP, 0.2% DIECA. Take 5 to 10 ml and placed on 3MM Wathman membrane spots. Spots Wathman cut paper with scissors and placed in sterile 1.5 ml eppendorf tubes to free PPV on paper Wathman spot plus 0.5% Triton X-100. You can use this form as a sample for real time RT-PCR without prior purification ARN. The Primers used are:

P241 primer: 5'-CGT TTA TTT GGC TTG GAT GGA A- 3', P316D primer : 5'-GAT TAA CAT CAC CAG CGG TGT G- 3', P316M primer : 5'-GAT TCA CGT CAC CAG CGG TGT G- 3', PPV-DM probe: 5'- FAM CGT CGG AAC ACA AGA AGA GGA CAC AGA – TAMBRA 3', 1 x TaqMan Universal PCR Master Mix (Applied

Biosistems);1 x MultiScribe şi RNase Inhibitor Mix (Applied Biosistems).For real time RT – PCR preparation were used: 1 µM P241 primer, 0,5 µM P316D primer, 0,5 µM P316M primer, 200 nM TaqMan probe şi 5 µl plants probe at the final volume 25 µl.

RESULTS AND DISCUSSIONS

The PCR amplification attempts by pipetting the vegetable juice directly onto Wathman paper spots, the Real Time-PCR resulted in specific amplification of some peach varieties. Attempts to amplify fragments that highlights PPV's presence in extracts released on to membrane Wathman or commercials without Triton X-100 proved to be unsuccessful, indicating the need to use Triton in order to release viral particles that must be amplified. Real time RT - PCR sensitivity is fast, secure, with low risk of contamination. An observation made during this study is that anti-PPV immunoglobulins specific primers are required for a successful capture RT-PCR. The results showed that among the 90 samples presented in figure 1, only the probe number 88, the variety "Michelin", prove that is positive and certainly the control probe materialised by un upward curve like in figure 2 or figure 4.

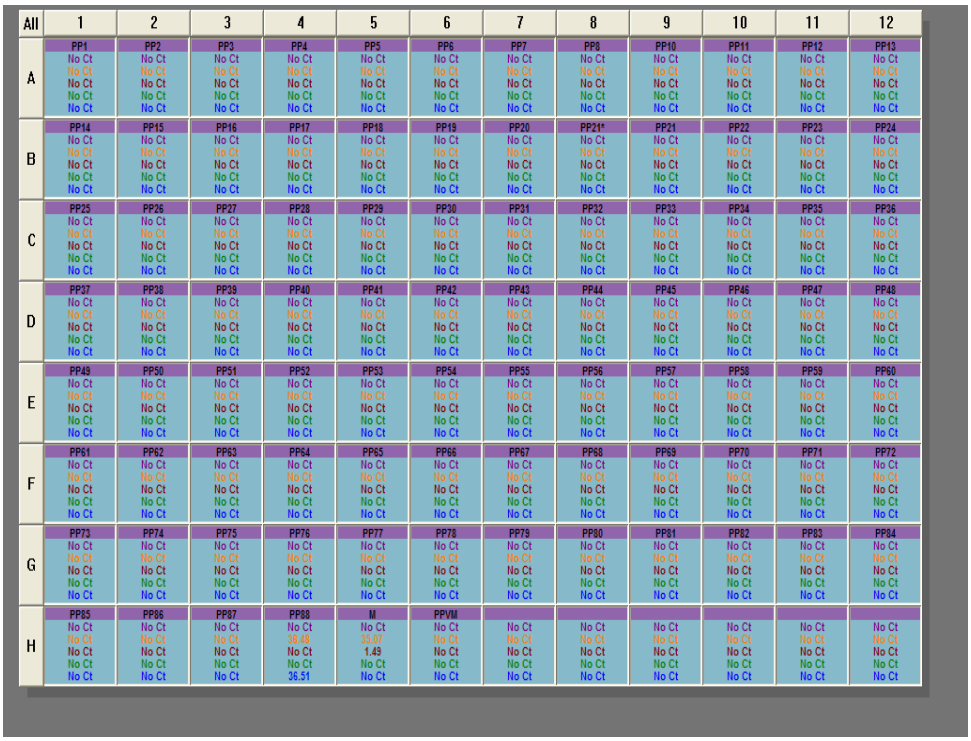

Fig.1 - Placing the peach samples in Real Time RT-PCR plate.

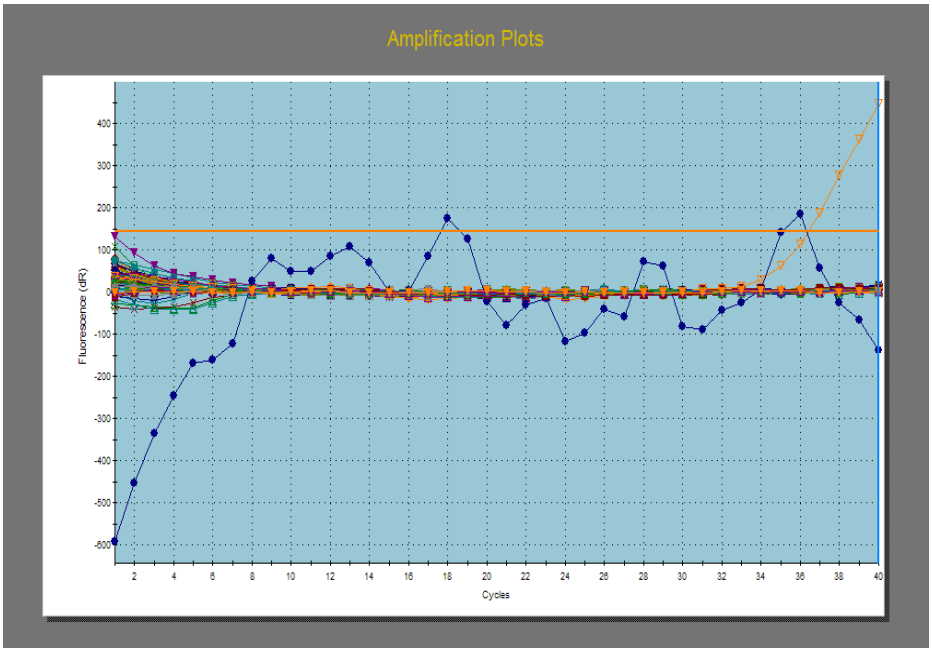

Fig.2 - The results of all tests "in cluster" reported to the control probs

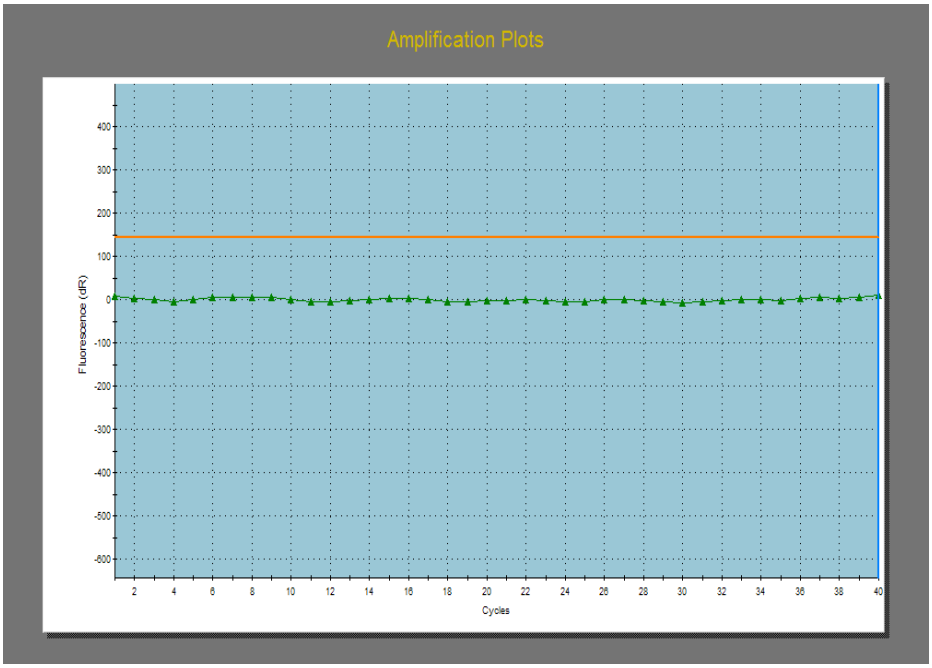

Fig.3 - Negative reaction to infection with PPV to peach variety "De Candesti"

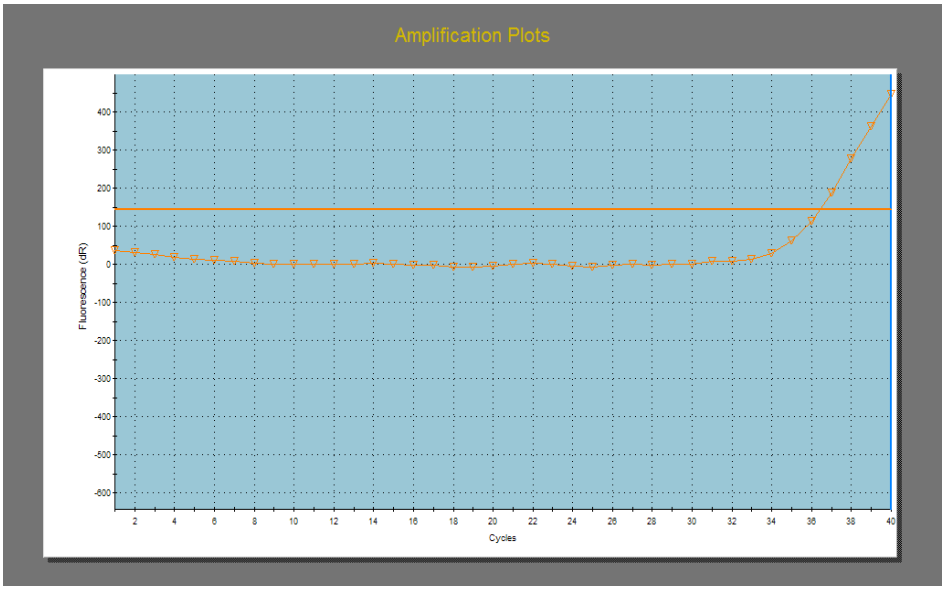

Fig.4 - Positive reaction in Real Time RT-PCR peach variety "Michelin"

Below are samples of peach last values that were revealed to be infected with PPV based on threshold values in relation to infection control. Shown in the last column as evidence that the variety 88 "Michelin" has been positive for different fluorescent 36.48 to 35.07 in rapport of the witness (so close in value).

H2	PP86	FAM	FAM	Unknown	"4,186,715"	No Ct
H3	PP87	CY5	CY5	Unknown	"3,367,025"	No Ct
H3	PP87	CY3	CY3	Unknown	"144,736"	No Ct
H3	PP87	ROX	ROX	Unknown	"317,820"	No Ct
H3	PP87	HEX	HEX	Unknown	"89,525"	No Ct
H3	PP87	FAM	FAM	Unknown	"4,186,715"	No Ct
H4	PP88	CY5	CY5	Unknown	"3,367,025"	No Ct
H4	PP88	CY3	CY3	Unknown	"144,736"	"36,48"
H4	PP88	ROX	ROX	Unknown	"317,820"	No Ct
H4	PP88	HEX	HEX	Unknown	"89,525"	No Ct
H4	PP88	FAM	FAM	Unknown	"4,186,715"	"36,51"
H5	M	CY5	CY5	Unknown	"3,367,025"	No Ct
H5	M	CY3	CY3	Unknown	"144,736"	"35,07"
H5	M	ROX	ROX	Unknown	"317,820"	"1,49"
H5	M	HEX	HEX	Unknown	"89,525"	No Ct
H5	M	FAM	FAM	Unknown	"4,186,715"	No Ct

CONCLUSIONS

Preparation of prints is simpler and faster than DNA extraction or isolation kits and can be used with quarantine viruses without risks. Another advantage is that, unlike plant extracts, membranes spots printed or vegetable juice can be stored at the room temperature for a long period of time before being used or can be sent by post, therefore allowing their training directly field, if necessary. Method of Real Time RT-PCR is simple, fast, inexpensive and very sensitive, and is thus very well suited for use in routine indexing programs. In addition, this technique should be easily adapted to detect plant viruses and other pathogens. Amplified by RT PCR fragments were expected size, confirming the reliability of this method.

***Acknowledgments**: This paper presents data from Phd thesis part of the project POSDRU/107/1.5/S/76888, funded by European Social Fund through the Sectoral Operational Programme Human Resources Development 2007-2013.*

REFERENCES

1. **Gaborjanyi R., Basky S., 1995 -** *Correlation between migration of aphid vector and natural spread of plum pox virus.* Acta Hortic. 386, p. 201-206.
2. **Isac M., Preda S., Marcu M., 1998 -** *Aphid species vectors of plum pox virus*. Acta Virol. 42, p. 233-234.
3. **Llacer G., Cambra M., 1998 -** *Thirteen years of sharka disease in Valencia, Spain*. Acta Hortic. 472, p. 379-384.
4. **Labonne G., Yvon M., Quiot J. B., Avinent L., Llacer G., 1995 -** *Aphids as potential vectors of plum pox virus: comparison of methods of testing and epidemiological consequences*. Acta Hortic. 386, p. 207-218.
5. **Roy A. S., Smith I. M., 1994** - *Plum pox situation in Europe*. EPPO Bull. 24, p. 515-523.
6. **Schneider W. L., Sherman D. J., Stone A. L., Damsteegt V. D., Frederick, R. D., 2004** - *Specific detection and quantification of Plum pox virus by real-time fluorescent reverse transcription- PCR*. J. Virol. Methods 120, p. 97-105.
7. **Wetzel T., Candresse T., Ravelonandro M., Dunez J., 1991** – *The PCR methods*.J. Virol. Methods 33, p. 355–365.

SUBSTRATE INFLUENCE ON FLAVONOID GENE EXPRESSIONS DURING EXPOSURE OF RED RASPBERRY PLANTS TO WATER DEFICIT

INFLUENȚA SUBSTRATULUI ASUPRA EXPRESIEI GENELOR SINTEZEI FLAVONOIZILOR IN TIMPUL EXPUNERII PLANTELOR DE ZMEUR LA DEFICITUL DE APA DIN SOL

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Abstract. *Red raspberry is an economically important crop worldwide and represents an invaluable source of health-related compounds. Drought stress is one of the factors that greatly affect plant growth and agricultural productivity. The aim of the present study was to gain insights into the transcription profile of flavonoid-related genes in response to water-deficit stress. For this purpose, the expression of PALs, 4CLs and CHS genes in red raspberry plants grown in soil and in a soil: peat mixture was investigated. Transcriptional profiling was performed on leaf tissues collected from plants grown in semi-controlled greenhouse conditions and exposed to different soil water levels such as full water supply (90% FC), moderate (50% FC), and severe water stress (35% FC). Furthermore, we investigated whether the changes in gene expression were reflected on the metabolite level. Our data showed that transcript accumulation was affected by both water stress and substrate conditions.*
Key words: *raspberry, qRT-PCR, PAL, 4CL, CHS, water deficit, flavonoids.*

Rezumat. *Zmeurul este o specie importanta la nivel mondial din punct de vedere economic intrucat reprezintă o sursă bogata de compusi importanti pentru sanatatea umana. Seceta este unul dintre factorii cu efecte negative asupra creşterii plantelor şi productivitatii agricole. Scopul studiului de faţă a fost acela de a obţine informatii cu privire la schimbarile survenite în profilul de transcriere a genelor responsabile de sinteza flavonoizilor ca răspuns la stresul indus de deficitul de apă din sol. În acest scop, expresia genelor PALs, 4CLs şi CHS în culturi de zmeur cultivate în sol şi într-un amesteec de sol: turba a fost investigata. Profilul transcriptelor a fost efectuat pe tesuturi de frunze colectate de la plantele cultivate în condiţii semi-controlate de seră şi expuse la diferite grade de hidratare a substratului de crestere si anume hidratare optima (90% FC), hidrare moderată (50% FC), şi deficit hidric sever (35% FC). Mai mult, am investigat daca schimbarile in expresia genelor s-au reflectat in profilul fenilpropanilor. Datele obtinute au aratat ca atat acumularea transcriptelor cat si a metabolitilor respectivi a fost afectata atat de deficitul hidric cat si de caracteristicile substratului de crestere.*
Cuvinte cheie: *zmeur, qRT-PCR, PAL, 4CL, CHS, deficit hidric, flavonoizi*

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INTRODUCTION

The phenylpropanoid pathway leads to the synthesis of many important secondary metabolites such as lignins, flavanols and anthocyanins. Former studies have reported the accumulation of flavanols under different stress situations such as drought (Gansh et al., 2009). Drought stress is one of the factors that greatly affect plant growth and agricultural productivity. It induces changes in water status, concentrations of compatible solutes and other osmoprotectants, cell membranes, oxidative conditions, and in antioxidative metabolism (Tahkokorpi et al., 2007).

Raspberries (*Rubus idaeus* L.) are very rich sources of bioactive compounds such as phenolics, anthocyanins, organic acids, minerals, and more. It has been confirmed that the antioxidant ability of raspberry fruit is derived from the contribution of phenolic compounds in raspberries (Liu et al., 2002). However, the composition in bioactive compounds depends on the environmental conditions and genotype. In this study we aimed to investigate the effects of water deficit on phenylpropanoid genes and the accumulation of anthocyanins, flavanols and total phenolics in raspberry plants (Ruvi cv) grown in soil and a mixture of soil: peat.

MATERIAL AND METHOD

Experimental conditions. *Rubus ideaus* plants (Ruvi cultivar) were divided in two lots and grown under greenhouse environment for 3 weeks. One lot (control) was maintained by irrigation at 90%FC. The other lot was exposed to water stress by withholding water until the field capacity decreased to 35%. The pots were kept at the above drought stress levels by weighting. Control plants were watered daily. Plant leaves were collected from three biological replicates ground to a fine powder in liquid nitrogen and stored at -80^{o}C to preserve full-length RNA.

RNA isolation and quantification. Total RNA extraction and purification was performed with Spectrum Plant Total RNA kit. RNA quality was verified by Agilent Bioanalyzer analysis using an RNA 6000 Nano Labchip kit. To remove any trace of genomic DNA contamination, RNA samples were treated with DNase (Promega).

cDNA synthesis and qRT-PCR analysis. Equal aliquots of RNA-DNAse treated samples were reverse transcribed with SuperScript II Reverse Transcriptase kit (Invitrogen). The resulted first-strand cDNA was amplified using gene-specific primers for *Rubus idaeus spp*. listed in Table 1 (Efrose et al.,2012), using Primer Express 1.5 software (Applied Biosystems, Darmstadt, DE). Quantitative real-time PCR analysis was performed on the Rotor-Gene 6000 (Corbette) using MyTaqTMRedMix (Bioline).The temperature cycle used comprised 40 cycles at 95°C for 15 sec and 60°C for 1 min. Relative transcript levels of the gene of interest (X) were calculated using a modification of the comparative threshold cycle method, as a ratio to the histone H3 gene transcripts (U), as $(1+E)^{-\Delta Ct}$, where ΔCt was calculated as $(Ct_X – Ct_U)$. PCR efficiency (E) for each amplicon was calculated employing the linear regression method (Ramakers et al. 2003).

Determination of Total Phenolics. The content of total phenolics was determined by Folin-Ciocalteu method using gallic acid as a standard compound (Singleton et al., 1999).

Determination of Total Anthocyanins. Anthocyanin quantitation was performed in leaf samples by the pH differential method of Giusti and Wrolstad (2003). Values were expressed in terms of mg anthocyanin/100 g FW.

Determination of Flavonols. The total flavanol content was estimated using the p-dimethylaminocinnamaldehyde (DMACA) method as described by Arnous et al. (2002). Results were expressed as catechin equivalents (mgCTE/100 g FW). At least three analyses were run for each experimental category. Each analysis consisted of triplicate measurements of each sample and data were averaged over the three measurements.

RESULTS AND DISSCUSIONS

Expression levels of phenylpropanoid genes in red raspberry cultivar during progressive drought. The expression of six phenylpropanoid pathway genes (*pal1, pal2, chs, 4cl1, 4cl2* and *4cl3*) was investigated in leaves collected from *Rubus* plants exposed to different water deficit conditions.

Table 1.

Primers used for qRT-PCR analysis

Target genes	Gene-specific primers	
Phenylalanine ammonia-lyase1 (pal1)	pal1F	5'-TCGACAATGCCAGGATCGA-3'
	pal1R	5'-CAACGGATAAGACCTGCATTCC-3'
Phenylalanine ammonia-lyase2 (pal2)	pal2F	5'-ACCTCTTCCGATCTGCTAGCC-3'
	pal2R	5'-CGAAGTGGAATGGAATGACACA-3'
4-coumarate:coA ligase1 (4cl1)	4cl1F	5'-TGCTCGTCACCCATCCTAACA-3'
	4cl1R	5'-TCACGACAAATGCAACCGG-3'
4-coumarate:coA ligase2 (4cl2)	4cl2F	5'-CGGCTACTTTCCCAAATCGATA-3'
	4cl2R	5'-TCACCCCGGCCATTATAGAA-3'
4-coumarate:coA ligase3 (4cl3)	4cl3F	5'-TCCGCAAAAAGATGATGCTG-3'
	4cl3R	5'-GCTCATTGCCGCCATTAGAT-3'
chalcone synthase (chs)	chsF	5'-TCACAGTGTGGCAGCTTCAAC-3'
	chsR	5'-ACTGATCAAGGAGATCACCCAA-3'
histoneH3 (his)	hisF	5'-TTCCAGAGCCATGCAGTTTTG-3'
	hisR	5'-TGGCATGAATGGCACAGAGA-3'

Transcription profiling of the above mentioned genes was performed using relative quantification of target gene transcripts in comparison to the appropriate reference gene. The expression levels of the control gene, was used as internal standards to normalize small variations in cDNA template amounts. The relative transcript levels of the gene of interest were calculated as a ratio to the histone H3 gene transcripts (Fig.1). At 50% FC the transcript levels of flavonoid genes decreased on both substrates. The only gene upregulated by moderate water deficit was *pal1* in plants grown in soil:peat. With the exception of *chs* and *4cl1* the plants cultured in soil showed lower transcript levels than those cultured in soil:peat. When FC decreased at 35% the genes were upregulated and the transcript levels increased on both substrates. Among all genes, the expression of *pal2* in plants

cultured in soil and *pal2*, *4cl2* and *4cl3* in plants cultured in soil:peat showed the highest rate of transcript accumulation. However, under 35% FC, the plants cultured in soil accumulated higher levels of *chs* transcripts than plants grown in soil:peat (Fig.1). These results show that phenylpropanoid genes are upregulated by severe drought stress mainly when plants are grown in soil:peat although this subsstrate has an inhibitory effect on the accumulation of *chs*.

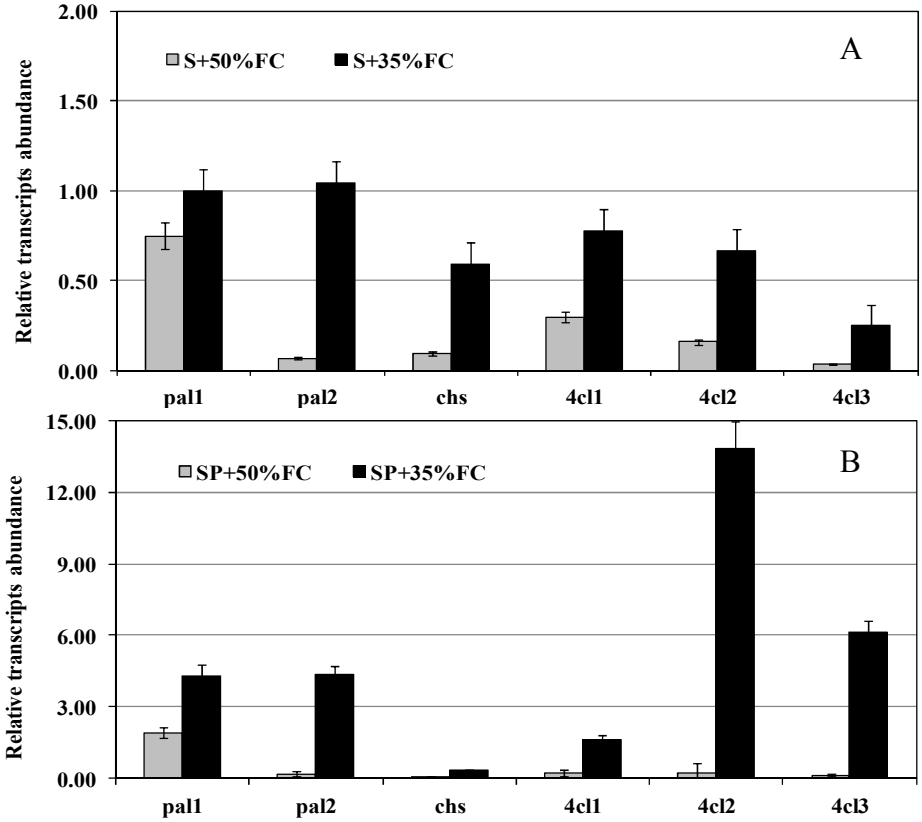

Fig. 1 - Expression levels of phenylpropanoid genes in red raspberry cultivar during progressive drought. Plants were grown in soil (A) or in a soil:peat mixture (B). Total RNA was isolated from leafs, treated with Dnase. reverse transcribed to cDNA, and subjected to real-time quantitative PCR. Transcript levels in the different samples were normalized to those of the reference gene, histone H3. Relative mRNA level was calculated with respect to the level of histone H3 transcripts. Values are given as the ratio between stress and control plants. Bars show means +SD (n = 3)

Changes in metabolites accumulation during progressive drought. Total phenolics accumulation was not influenced by growth substrate or moderate water stress. At 35% FC there was a decrease in the accumulation of total phenolics irrespective of substrate.

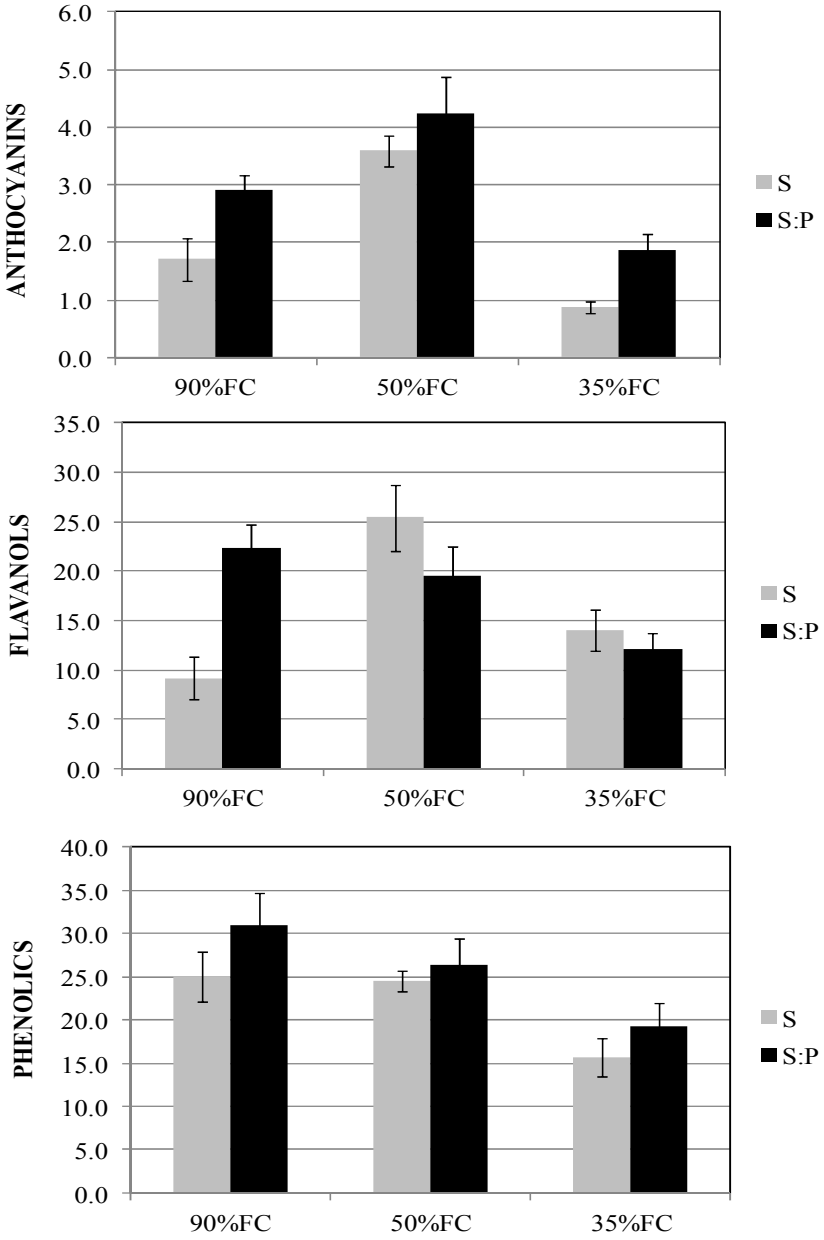

Fig. 2 - Changes in total phenolics, anthocyanins, and flavonols in red raspberry cultivar during progressive drought.

Anthocyanins increased under moderate drought but they decreased when FC reached 35%. In general, the amount of anthocyanins was higher in plants grown in soil: peat than in soil.The amount of flavanols increased at 50% FC only in plants cultured in soil. At 35% FC flavanol content decreased but in soil they

still were higher than at 90% FC. Interestingly, at 90% FC flavanol levels on soil:peat were higher than in soil (Fig. 2). The data obtained from the analysis of metabolite accumulation show that moderate drought stimulates the accumulation of anthocyanins and flavanols but severe water stress downregulates the production of phenylpropanoids even if the expression of phenylpropanoid pathway genes is upregulated.

CONCLUSIONS

Transcripts of phenilpropanoid genes were differentially expressed during progressive drought and were influenced by the growth substrate.

Moderate drought (50% FC) increased the transcription of *pal1*, whereas severe drought (35% FC) increased the transcription of pal2. *4cl* genes, mostly *4cl2* and *4cl3* were upregulated in plants grown in soil:peat mixture, under the influence of severe drought conditions while *chs* transcripts were more abundant in plants grown in soil.

The level of flavanols and anthocyanins increased at 50%FC but they decreased at 35% FC. Their accumulation was influenced by growth substrate being more abundant in plants grown in soil:peat.

***Acknowledgement**: The present contribution was supported by the EU-funding grant POSCCE-A2-O2.1.2-2009-2, I.D. 524, cod SMIS-CSNR 11986.*

REFERENCES

1. Arnous A., Makris D. P., Kefalas P., **2002** - *Correlation of pigment and flavanol content with antioxidant properties in selected aged regional wines from Greece*. J. Food Compos. Analysis, 15, p. 655-65.

2. Barrs H.D., Weatherley P.E., **1962** - *A re-examination of the relative turgidity technique for estimating water deficit in leaves.* Austr. J. Biol. Sci., 15, p. 413-428.

3. Efrose R., Ciobotari G., Morariu A., Pascu D., Brinza M., Sfichi-Duke L., **2012** - *The use of qRT-PCR approach for comparative phenylpropanoid gene expression studies in two Rubus spp.,* The "Ion Ionescu de la Brad" Publishing House, Scientific works, Series Horticulture, p. 57-62.

4. Gansch H., Weber C. A., Lee C. Y., **2009** - *Antioxidant capacity and phenolic phytochemicals in black raspberry.* NY Fruit Quarterly, 17, p. 20-23.

5. Giusti M.M., Wrolstad R.E., **2003** - *Acylated anthocyanins from edible sources and their applications in food systems.* Biochem. Eng. J., 14, p. 217-225.

6. Liu, M., Li X.Q., Weber C.A., Lee C.Y., Brown J., Liu R.H., 2002 - *Antioxidant and antiproliferative activities of raspberries.* J. Agric. Food Chem., 50, p. 2926-2930.

7. Ramakers C., Ruijter J.M., Deprez R.H., Moorman A.F., 2003 - *Assumption-free analysis of quantitative real-time polymerase chain reaction (PCR) data.* Neurosci. Lett. 339, p. 62–66.

8. Singleton V.L., Orthofer R., Lamuela-Raventos R.M., **1999** - *Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent.* Methods Enzym., 299, p. 152–178.

9. Tahkokorpi M., Taulavuori K., Laine K., Taulavuori E., **2007** - *After-effects of drought-related winter stress in previous and current year stems of Vaccinium myrtillus L.* Environ. Experim. Bot., 61, p. 85–93.

META-REFERENTIAL ASPECTS IN ARTISTIC COMMUNICATION

ASPECTE ALE METAREFERENȚIALITĂȚII ÎN COMUNICAREA ARTISTICĂ

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Abstract. *In his films, the Austrian director, born in Germany, Michael Haneke, suggests a new perspective towards artistic communication. His attempt joins the ample and modern current of meta-referentiality. The classical, linear characters are doubled by para-characters and the sequence of events is offset by the symbolic significance of many meta-referential elements. Several characters take charge of a non-conventional filmmaker who defies stereotypes and disestablish traditional norms. The ludic appearance predominates over the movie in which nothing is predictable and there is no happy-end. The elements having a tragic connotation and exemplifying fortuna labilis topos convey a more serious message and grievious significance about the meaning of life. The comic aspect is mostly exbited by unspecific personages and highlights these features. These comic dramas bind in a single game the loss of sufferings, joys and future. The meta-referential aspects abolish the border between fiction and reality.*
Key words: *artistic communication, meta-referentiality, para-character, fiction, symbol.*

Rezumat. *Regizorul austriac, de origine germană, Michael Haneke propune, în filmele sale, o viziune nouă asupra comunicării artistice. Încercarea sa se înscrie în curentul amplu şi modern al metareferenţialităţii. Personajele clasice, lineare sunt dublate de para-personaje, iar succesiunea evenimentelor este anihilată de semnificaţia simbolică a numeroaselor elemente metareferenţiale. Unele personaje preiau sarcina unui regizor atipic care sfidează stereotipiile şi normele tradiţionale. Aparenţa latură ludică domină filmele în care nimic nu este previzibil, iar happy-end nu există. Elementele, care ar fi avut o conotaţie tragică şi ar fi exemplificat topos-ul fortuna labilis, transmit o semnificaţie mai gravă despre sensul vieţii prin aspectul comic evidenţiat. Comicul uneşte dramele într-un singur joc al pierderii suferinţelor, bucuriilor şi a viitorului. Aspectele metareferenţiale determină dispariţia graniţei dintre ficţiune şi realitate.*
Cuvinte cheie: *comunicare artistică, metareferenţialitate, para-personaj, ficţiune, simbol.*

INTRODUCTION

Defining what is meant by meta-referentiality is essential, but a mere definition seems difficult to find out and the concept has been ascribed a plethora of meanings. Applied to cinema-art, the concept reveals any attempt to show or to offer a hint at the enunciative apparatus of the film itself. This may be found in

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film within a film and the reflexive devices suspend our disbelief in the autonomy of diegesis. For centuries the meta-referential phenomenon has been present in humanities in general. The research work regarding this interesting aspect began later. Over the decades of the 20th century, fruitful essays and discussions have revealed meta-referential practice and strategy in other fields of media. As cinematographic art is considered one of the latest, meta-reference appeared and became an explicit expression of self-consciousness during the '60s and afterwards. Besides the aspect of self-representation, it also involves dialectic forms (essence vs. appearance; truth vs. illusion; reality vs. image, thing vs. sign) and the ambiguity of the aesthetic border. Self-reflexivity in cinema may be seen, from the director's point of view, as a kind of device revealing the enunciation, but, from the point of view of the audience, it is a reminder that they are watching a movie. The present contribution aims to highlight several meta-referential features in Michael Haneke's films. Since there is a close connection with the works of other directors, we refer to the films of Woody Allen as well.

MATERIAL AND METHOD

The contribution is based on principles of visual semiotics, theory of narrativity and style. This is a trans-generic attempt because it transposes a few of the openings of meta-referential research in other artistic fields into this one. It also capitalizes the mythical and the symbolic significances of the chosen cinematographic elements, trying to offer a more complete understanding of these several innovative artistic endeavors. Reassessing the contemporary cinematographic *heresies*, the contribution underlines the opposition to the aesthetic norm and the paradigmatic value of these masterpieces.

RESULTS AND DISCUSSIONS

The visual arts allow a special undertone and an extremely spectacular feature and for this method to create a variety of connotations. The cinema-field confirms this remark. The directors and the fim production designers were captivated by the opportunity to achieve, through fantasy, bridges between the fiction-world and reality (Arhip, 2013). A simple chronological unfolding of more or less predictable events, the effort to come into notice due to various visual or sound effects were no longer enough to require more from the spectator's spirit of observation and interpretative ability. The masters of cinema wished new challenges and a different message of their creations.

Michael Haneke stated his *ars poetica*: "My films are intended as polemical statements against the American 'barrel down' cinema and its dis-empowerment of the spectator. They are an appeal for a cinema of insistent questions instead of false (because too quick) answers, for clarifying distance in place of violating closeness, for provocation and dialogue instead of consumption and consensus." On the other hand, Woody Allen has flirted with the idea of „film within film" almost since the beginning of his career. In an interview, he said that it was not Buster Keaton's attempt (*Sherlock Jr.*) the one which inspired him, but his own self-interest. „The idea to enter the screen was a thought that came much later."

(Björman, 2013). Thus, after 25 years he watched Keaton's film, Allen directs *The Purple Rose of Cairo* (1985). A double-crossing between fiction and reality takes place in this film. The female character, Cecilia, idealizes the fictional world and enters the screen following a character, the archeologist Tom Baxter, who also has descended into the real world. Both crossing of the aesthetic border occur under the pretext of a quasi-traditional love-story. Therefore, the viewer watches two films in which the main characters have dual membership to different fictional levels, and the meta-referential aspect becomes the principle theme of meditation for the director and for the audience. Woody Allen was fascinated by the possibility to blur the limit between fiction and reality. The proof can be found in his previous works. For example, in *Annie Hall* (1977), the main characters talk explicitly about this trans-medial aspect. Waiting in a movie-line, the male hero Avy brought Marshall McLuhun himself to support his opinions that contradict the emphatic speech of another character. This personality, apparently inaccessible to ordinary reality, appears metonimically behind a poster. He is an element of imagination which becomes reality. McLuhan is kind of *correctio*, an incarnate *anthorismos* (Dragomirescu, 1975) joining the world of ideas with the concrete world. In the same series of interviews, W. Allen admits that he tried to persuade Ingmar Bergman ori Fellini to appear in his film, but they refused, though appreciating the originality of his idea. Other monologues of Woody Allen may be observed in *Alice* and *Husbands and Wives*.

The aesthetic attraction to blur the border between fiction and reality may be better noticed in Michael Haneke's films. The Austrian director was born in Germany, but he has been living, directing and teaching in Vienna. We mainly refer to *Caché* (2005) and *Funny Games* (1997/remake in 2007). In the first one, a subtle exergue for self-reflection draws the viewers attention. The film begins with the image of a still-camera placed on the street which is called Iris. Iris is a visual diaphragm of the eye which controls the amount of light reaching the retina. The sight of the audience is presented metaphorically by video cassettes and drawings received by G. Laurent. From a mythological point of view, Iris was the messenger of the gods, a female correspondent for Hermes. Another exergue in the same film is the title *Brothers*. It is the title of a movie watched by G. Laurent one afternoon and it clearly appears on the light-signboard of the cinema. This exergue allegorically refers to the myth of the brothers Cain and Abel which is reinterpreted in Haneke's film by the stepbrothers Georges Laurent and Majid. In the other Haneke's movie, *Funny Games*, the strange killing doublet, Peter and Paul, looks straight to the camera several times and talks to the audience and to the director about their opinion regarding the usual course of action and the ordinary predictable happy-end which it is not the case of their murder-game. In addition, Paul literally rewinds the film with a television remote and he goes for a turn in reality. According to the biblical perspective, Paul and Peter are martyrs and symbols of revealing the true knowledge and faith. Haneke inverts the original meanings and the normal evolution of the events.

All these movies are very rich in symbolic elements implying also biblical or mythical significances. The combinative perspectives of the directors are a strong proof of their artistic intentions. They wish to modernize their art and to transform the audience into a more elevated and active communication-partner. The illusionist character of the representation constitutes the source of intellectual, aesthetic pleasure. There is a prominent, deliberate continuity between the representational level and the reality-level breaking the Hollywood-standards and classic norms.

A universal symbol is the rose (*The Purple Rose of Cairo*) and it connotes revival, love and accomplished perfection (Chevalier and Gheerbrant, 1995). All these meanings comply with Cecilia's wishes and dreams which do not become true. Eventually, the movie itself is the Rose, the perfect, magical cinematographic jewel. Cecilia remained in her dreary life and her only offering for Tom Baxter/Gil Shephard is a merry-go-round which stands for *simulacra* of the world. The purple colour of the rose represents the mystery of life and the nocturnal or feminine principle. It apprises for danger and for rule violation.

The Laurent family, presented in *Caché*, receive several video cassettes revealing their own slices of life and having a first deceiving designation of threatening. They are also used as symbols. In fact, this modern device stands for G. Laurent's recollections of his wrongdoing against his adoptive brother during their childhood. The cassettes and the drawings are projections of this guilt and his remorse. His present successful, fulfilling life and career as guest of a TV talk show cannot counter-balance the culpable past. His real sin is not his vanity, but his self-abandonment which is the main cause for not realizing the *gravitas* of his behaviour. George Laurent, the contemporary Cain, is guilty of violation of *xenia*. The Greek term *xenia* refers to the ritualized friendship and hospitality, both of them being not observed by George.

The drawings received by the Laurents have a bloody cock on them. The cock is another symbol standing for vanity and reckless anger (Chevalier and Gheerbrant, 1995). Laurent's envy and hatred as a child against his adoptive brother, Majid, render the mythical conflict between Cain and Abel. The drawn blood from Laurents' received papers figures Cain's sacrifice in front of divinity, but the tribute is not accepted. Georges Laurent carries up his sin and grief.

The egg is the main symbolic element in *Funny Games*. The egg is a universal symbol referring to genesis and the mystery of human existence. It is the primary reality which contains the plurality of human beings. The egg is the anaphoric element of the series of crime-games played by the doublet Paul and Peter in *Funny Games* by M. Haneke. One of the two strange young men comes to borrow eggs from their next victims. The egg also symbolizes order and the diversity of the origins. Although the egg is not essentially the first, it epitomizes the seed of diversity. Each crime starts with this basic principle, and the variety of possibilities to continue the events is impressive. Paul and Peter challenge the audience to this game of a new and unpredictable unfolding of events. They become the directors and a kind of para-characters evolving into a second parallel

fictional level. *Funny Games* proposes the reverse of a happy-ending for a thriller. The para-characters behave abnormally and have an unusual appearance. They are wearing white golf-clothes instead of the classical black helmets for negative personages. New rules of a strange game are announced by this dress-code. It is a paradox as the croquet-game from *Alice in Wonderland*. When Paul and Peter violently attack the family, the movie itself becomes a loaded gun and the onlookers are molested similar to the characters. The para-characters disobey all the normal rules of a serial killer; there are no miraculous escape routes or techniques, no survivors, no justice. The movie deconstructs the modality in which media present violence. Virtually, the doublet does not commit crimes. As directors of the new genre of film about violence which they have offered, they kill or eliminate a category of predictable, oversimplified characters that they no longer want to be present on the screen and in the scripts. An element of the cinema-heroes paradigm must disappear.

From a symbolic point of view, the double or the divided self (Peter and Paul) has a tragic and evil connotation. The double is our enemy who comes to fight against us and it forebodes death. Paul and Peter, the doublet from *Funny Games*, came to Anne and George Farber's vacation house and, after a prologue consisting of a bunch of lies, they took the family hostage. They represent the psychopathic enemy who proposes sadistic games during the next twelve hours. After the innocent guess-game of famous musical theme, a game played by the family before reaching their vacation retreat, the double Peter and Paul initiates them into sadistic games involving mental and physical violence. Another connotation of their arrival to the house and on the screen may be that specific to the author/director as a "visitor" into his own creation. He becomes a semiotic instrument and creates his self-portrait as a modern, iconoclast and contextualized film-director. This is a good opportunity to remember Montaigne's words: "So, my reader, I'm the very dough of my book" (de Monaigne, 2012).

In *Funny Games*, golf may be seen as a metaphor for life or for the course of life. The sport golf is the only one not requiring a standardized playing area, but it involves definite rules and a degree of hazard (unplayable situations). Paul and Peter play life-and-death golf on the greater field of the neighbourhood in which every family is a hole, but they also play golf with the Farber family, the death of each character being a hole. The final scene in which Anne fails to grab the knife and save her life being thrown from the boat is very figurative. The move resembles a skilled stroke of a golfer and her fall is like the roll of the white golf-ball into a hole. A lot of inter-textual syntagmatic combinations can be noticed while the game is taking place. The standard plot is reversed and disestablished; the general assembly is a completely different one. The common thriller and the intellectual-film constitute *in absentia* rapport. They are mutually exclusive. The director also uses a sophism *extra dictionem*. The relative elements are intermingled with the absolute ones as in "Alice in Wonderland". The cinematographic sophism highlights *technè*, the art itself as the real subject of any film.

In all these films, the screen acts as a modern mirror that highlights the relationship between truth and illusion, between reality and fiction. As well, the directors' camera in all these movies is the door for our fictional entering and the characters' reality disclosure. The relationship between cinematographic fiction and the reality of the onlookers has become a meta-artistic one. The movie itself is a parergon (Dragomirescu, 1975), a work undertaken in addition to that of nonconventional communication between the audience and the directors. The latter brings to light the stagy elements and challenge the onlookers who become the real partners of the artistic communication. The lens of the camera has become an aesthetic border. It plays the role of a window or that of a door or any other kind of specular surface in painting or in architecture. In fact, we have to deal with the awakening of self-consciousness of the new cinema. The emergent cinema rests upon three convergent features and artistic impulses: illusionist representation, the theme of the vanity of action/story and the meta-referential aspect of the artistic representation. The lens of the camera emphasizes the hiatus between two different spiritual attempts to deal with cinematographic art.

CONCLUSIONS

1. The novelty of the concept meta-film has required attention in the recent decades and many case studies or scientific papers are devoted to this topic.

2. Unlike the usual representation, meta-representation must take into account the different media, the message being a specific artistic work which lays itself into a particular cultural context, code and channel

3. The cinematographic image presents itself as being aware of its image-character expressing a desideratum – to accede to a new and superior existential level. The film-art struggles for its specific autonomy.

REFERENCES

1. **Arhip O., 2013 -** *Film, Life and Meta-referential Inferences.* Revista *Colocvii teatrale* (sub tipar).
2. **Chevalier J., Gheerbrant A., 1995** – *Dicționar de simboluri*. Editura Artemis, Bucuresti, p. 171, 176-177, 343, 390-395, 438.
3. **Dragomirescu M., 1975** – *Mică enciclopedie a figurilor de stil*. Editura ştiințifică şi enciclopedică, Bucuresti, p. 56, 67.
4. **Montaigne Michel de, 2012** - *De la vanité*, Gallimard, Paris.
5. **Petreu M., 2013** – *Jocurile manierismului logic.* Editia a II-a, Polirom, Iasi.
6. **Wolf W., 2009** - *Metareference across Media. Theory and Case Studies.* Rodopi, Amsterdam – New York.
7. *****, 2013** – *Woody Allen în dialog cu Stig Björkman*. Traducere de P. S. Grigoriu, Editura Publica, Bucuresti, p. 167.

LEARNING FOREIGN LANGUAGES THOUGH THE GLOTTODRAMA METHOD IN HIGHER EDUCATION

ÎNVĂȚAREA LIMBILOR STRĂINE PRIN METODA GLOTTODRAMA ÎN ÎNVĂȚĂMÂNTUL SUPERIOR

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Abstract. *The Glottodrama project is a project approved and financed by the Life Long Learning Programme of the European Union. The project is coordinated by the Laboratory of Linguistics of Culturiana Publishing Company. It aims to develop and test an innovative methodology for teaching foreign languages that will integrate communicative learning processes with techniques of Theatre Arts. The project plans to devise courses based on in-class workshops carried out by two teachers, one of languages and one of drama. The course programme relies on both linguistic and theatrical activities derived from in-depth explorations of mini-texts under the guidance of the teachers. The acting performance is not only the objective and but also the didactic content.*
Key words: *drama, role play, act, innovation, languages, didactic*

Rezumat. *Glottodrama este un proiect de cercetare multilaterală aprobat şi co-finanțat de Programul Lifelong Learning al Uniunii Europene. Proiectul este coordonat de Laboratorul de Cercetare Lingvistică al editurii Culturiana şi îşi propune să formuleze şi să experimenteze o metodologie inovatoare pentru predarea limbilor străine, care să integreze glotodidactica comunicativă cu dinamica şi tehnicile laboratorului teatral. Proiectul prevede organizarea de cursuri bazate pe conceptul de "clase-laborator" de artă dramatică într-o limbă străină, conduse de doi profesori - unul de limbă străină şi altul de artă dramatică. Programa cursurilor prevede, după faza de activitate în laborator, punerea în scenă a unui text dramatic sau a unui scenariu.*
Cuvinte cheie: *joc de rol, inovație, limbi, didactic, teatru*

INTRODUCTION

Dramatization and role-play are very common nowadays in foreign language teaching and learning. The Glottodrama project (project number-2012-1-IT1-LEO05-02861; CUP code: G82F12000190006) was born from the

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recognition of national and international experience in the application of theatre to language teaching.

The Glottodrama project tries to maximize experiences from the use of drama resources in the foreign language learning process. Its novelty lies in that it fully exploits the potential of the theatrical techniques frequently used in drama workshops. Unlike the traditional use of drama in language teaching the Glottodrama gives equal chances to both acting and language teaching techniques. Classes provide deep insights into theatrical and linguistic aspects.

The Glottodrama is a flexible methodology suitable for any level of knowledge and to any educational context: from beginners (familiarizing them with the language) to advanced learners (interested in mastering the language). Therefore, the Glottodrama can be used as a main language course but also as a parallel activity, which gives learners plenty of captivating practice and challenging opportunities to improve their speaking skills.

Objectives

The main objective of the Glottodrama method is to make foreign language learning more challenging and attractive to students. The school class changes into a theatre company, united by a common goal (project-work) which develops a strong sense of belonging. Communication flows naturally relying on verbal and non-verbal solutions; it is no longer an exchange of information but part of social interaction and negotiation in pursuit of a goal.

The intercultural objective should also be highlighted: the profound understanding of a dramatic text means to present a culture in action perceived both explicitly and implicitly.

Targets of the project

The first language targeted by the project has been Italian for foreigners. The core of the project has been the implementation of a methodology for foreign language teaching through theatrical resources. The successful results obtained with the learning of the Italian language through the Glottodrama have encouraged the coordinators to apply the methodology to the teaching of other European languages, among which Romanian.

MATERIAL AND METHOD

The methodology of the Glottodrama project functions according to ten pedagogical principles:

1. Supremacy of the student's personality. In the language learning process the entire student's personality is transferred to the second language. The learning pace and manner of the entire process are personal characteristics of each individual.

2. Language teaching is interdisciplinary by its nature.

3. The pleasure of "learning by doing" is the best motivation. Without the pleasure of learning and the satisfaction acquired through the achievement of the communicative goal, there is no satisfaction and motivational reinforcement.

4. Glottodrama is based on project work. The drama-based class is a specific project work (text project) based on tasks which lead to communicative performance.

5. The holistic principle: learning to communicate involves body and mind. Successful language learning is possible if the whole person, body and mind, is involved in the learning activity.

6. Priority of intercultural and social dimension. From the others' language to my language. The learners evolve from the perception of the second language as "a foreign- the others' language", to the perception as "our own language", as another personal tool to communicate in the context of a real or virtual community of speakers to which they belong.

7. Primacy of semantics in language pedagogy. Form is better learned when the student's attention is directed to meaning. Therefore the semantic and pragmatic dimension (the intensive understanding of its texts) should be a priority when compared with the extensive learning of its grammar and vocabulary (morphological-syntactic dimension).

8. Pragmatic principle of communication: language is a form of action aimed at the achievement of goals. Since every form of communication is directed towards a goal, language learning cannot be limited to grammar and vocabulary learning, but must be related to the pragmatic purposes and uses of the language, which involve the skills of decoding and encoding communicative purposes and super-purposes of a text.

9. Decisive function of paralinguistic aspects. Paralinguistic elements in communication have a decisive role in the efficiency of communication. The importance of non-verbal aspects of communication is widely underestimated in the language teaching practice although research studies have demonstrated that messages are strongly affected by para- and extra-linguistic elements that together form 83% of the whole vocal message.

10. Professional actors and social actors. In acting as a professional the goal is to interpret a character "different from oneself" in front of an audience. In the Glottodrama learning process the goal is to give the social audience an improved interpretation of oneself.

How a Glottodrama course works

The course aims at gradually developing both linguistic and acting skills by making use of a wide range of activities such as dramatization, role-play, story-telling, monologues, and improvisation.

The course is made up of two distinctive sections: the first section is the basic actor's training using micro-texts whereas the work in the second section focuses on a more complex text (a complete theatre play or a script), already available or produced by the class.

Essential elements

• The Glottodrama course requires two teachers, language and drama, who have to achieve a harmonious osmosis between theatre and language teaching. Their common goal is to train "social actors". They both work together towards the same goal, having different roles: one leads the acting activities and the other one focuses more on language exploration and learning.

•The course takes place in a workshop-classroom with a "stage" area; teachers and students sit in a circle. The classroom needs a stage, a slightly

raised platform, used for every staging activity. Therefore, there is a clear distinction between on stage and off stage activities and behaviours.

• A video-camera

• An equipped grammar corner: the classroom is equipped with grammar textbooks and dictionaries (one copy for each student; students can freely consult them during the stage of the grammar corner.

The programme

A GlottoDrama course needs about 90 hours. The programme has two distinctive sections. In the first section the course uses "micro-texts", letting the students get to know each other, work as a group, and familiarize with acting activities. Attention is focused on the connection gesture and word. Teachers encourage free experimentation; everything happens within the group; the audience is made up of other students; everybody is alternately actor and spectator, including the teachers. At this stage, when they are prepared, the students can start writing the play which will be used in the next stage.

In the second part of the course the students work on more complex texts based on the existing materials or written by the class. The course tales on a "project-work" character and the main goal is the "performance" before an audience (other school students, teachers, friends and acquaintances…). Everybody's attention concentrates on the success of performance (script, acting, costumes, gestures, lights, music).

The final performance is filmed, and a copy of the film is given to the students together with their certificates to remind them of the time spent with their group.

The course is divided into teaching units having the following structure:

• Presentation of the textual or situational input

• Performance

• Linguistic reflection (grammar corner)

• Actor Studio (rehearsal)

• Back to the performance

Each lesson has a pattern, which develops in line with the "learning by doing" philosophy.

RESULTS AND DISCUSSIONS

Iasi experience so far

We have implemented the method with foreign students from several countries studying Romanian as foreign language. They were first administered a test to assess their knowledge of Romanian and also to highlight their motivation and need to learn the language.

According to the test findings, spending up to six months in a Romanian university environment seems to raise interest in learning our language and even makes it possible but support is considered necessary. Moreover, the European Union policy encourages multilingualism, which has often proved to be a personal advantage under the circumstances of the economic crisis, which is why some are even interested in getting a certificate of linguistic competence.

The findings also showed a low level of the Romanian language as students did not benefit from any exposure to our language before coming to Romania. We selected those students who were interested in our Glottodrama project course and expressed their agreement to the experiment.

The materials and texts to be used during the course were selected taking into consideration the students' field of interest (medicine), linguistic difficulty and attractiveness of the story. The mini-texts of the first units focus on funny sketches carefully chosen to engage the group and to be appropriate in terms of linguistic and cultural aspects.

We have involved our students in a wide range of activities with a view to working on and improving both their acting and language skills. Throughout the whole course we have often filmed lesson sequences in order to allow the students and teachers to watch, reflect, and comment upon the performances.

We have noticed a higher degree of participation and involvement in the activities on behalf of the students; they also contribute more to the lessons and their fluency has improved; they are more spontaneous and are no longer inhibited by their mistakes as long as their message is understood. They have also learned to use the films as useful tools of reflection and error correction. They have started to work on writing and extending the mini-texts with a view to preparing the final event. We are planning to put on their final performance in May in front of an audience.

CONCLUSIONS

The Glottodrama project involves spheres which have been neglected so far and it is getting closer to achieving an efficient communication in another language.

First of all, Glottodrama's goals include decreasing the use of language in a metalinguistic function, and directing it towards the achievement of more genuine communicative purposes.

Secondly, Glottodrama draws attention to the language as we use daily, which is rich in rhetorical expressions, implicit meanings, gestures or intonation. If the target of a language course is "communicative competence in the foreign language", learning can neither neglect paralinguistic aspects nor isolate the linguistic code from the rest of the signs that form the communicative act.A linguistic act, as a communicative act, is complex based on the interaction of different sign codes: linguistic, paralinguistic (suprasegmental and intonational aspects), kinesic (expression and gestures), proxemic (posture and special position) and so on. Communicative efficiency depends on the ability to combine these codes in a proper way.

Thirdly, according to Glottodrama, linguistic competence becomes communicative competence as the learner uses the language in a wide range of fields, from the personal to the social, improving his abilities to interact with

the other people, and engaging social and cultural experiences beyond the classroom.

REFERENCES

1. **Krashen S.M. 1982 -** *Principles and Practice in Second Language Acquisition*, Prentice-Hall International, London
2. **Maley A., Duff A. 2005 -** *Drama Techniques*, Cambridge University Press, Cambridge
3. **Nofri Carlo, 2009 -** *Guide to Glottodrama method*, Novacultur, Rome

STATUS OF IMPLEMENTATION OF AGRICULTURE SATELLITE ACCOUNTS FOR ROMANIA

STADIUL IMPLEMENTĂRII CONTURILOR SATELIT DIN DOMENIUL AGRICULTURII PENTRU ROMÂNIA

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Abstract. *An example of a specific account for agriculture is represented by the European Accounts for Agriculture (EAA). Its purpose is to describe the evolution of agricultural production and income. Once, this information is used to analyze the economic situation of agriculture in an European country and, secondly, for monitoring and evaluation of the common agricultural policy in European Union. EAA focuses on the production and the income derived from it. In principle, a satellite account for agriculture should not fully comply with the EAA. For Romania, there isn't a clear intention to introduce in the near future a satellite account for agriculture.*
Key words: *system of national accounts, satellite accounts, agriculture, European Union, Romania.*

Rezumat. *Un exemplu de cont specific domeniului agriculturii este reprezentat de conturile europene pentru agricultură (CEA). Scopul acestuia este de a descrie producția agricolă și evoluția venitului din agricultură. Aceste informații sunt utilizate la analizarea situației economice a agriculturii dintr-o țară europeană dată și la monitorizarea și evaluarea politicii agricole comune în Europa. CEA se concentrează pe procesul de producție și pe venitul derivat din acesta. În principiu, un cont satelit în domeniul agriculturii nu trebuie să corespundă în totalitate cu CEA. Pentru România nu există o intenție clară de introducere în viitorul apropiat a unui cont satelit pentru agricultură.*
Cuvinte cheie: *sistemul conturilor naționale, conturile satelit, agricultură, Uniunea Europeană, România.*

INTRODUCTION

The main aggregate measures in national accounts are gross domestic product (GDP), gross value added, disposable income, saving and external trade. The typical national accounts tools include input-output tables (showing how industries interact with each other in the production process), and the national balance sheet (showing assets on one side and liabilities and wealth on the other). The accounts are derived from data sources, including surveys, administrative and census data and official records. They are structured in a sequence of accounts components that include current accounts (production, income and expenditure accounts), capital accounts, financial accounts and balance sheets. Each account has a balancing item, which is obtained by subtracting the total value of the entries on one side of an account (uses or assets) from the total value on the other

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side (resources or liabilities). This ensures that the accounts balance, and provides information such as value added, operating surplus, disposable income, saving, net lending/net borrowing and net worth (OECD et al., 2011).

The 1993 SNA incorporated the concept of satellite accounts, a major step in the direction of flexibility. Moving forward, satellite accounts are expected to continue to provide a useful way of working towards solutions that give the appropriate level of confidence in challenging measures, such as those for environmental accounting issues. Using satellite accounts as a means of expanding the relevance of the national accounts, but without affecting the comparability of the central framework used for economic policymaking, has become an accepted means of developing and testing new data sources and methods. Further, the 2008 SNA has introduced the item of "supplementary" items and tables. The term "supplementary" is used when the SNA recognizes that items may be of limited relevance in some countries or that while of analytical interest, a table cannot be prepared to the same standard of accuracy as the main set of accounts (European Commission et al., 2008)

MATERIAL AND METHOD

Personal research on satellite accounts of national accounts system (SNA) is a fundamental, conceptual and, partly, a development one, i.e. the empirical application of the concept of functional satellite accounts for agriculture in Romania (Costuleanu, 2013).

The concepts are generalizations. In economics, a concept is a "logical, mental construction of one or more connections". The concepts are inherently abstract and based on logic and reasoning. In economics, the concepts are typically focused on the relationships between variables. The main purpose of the fundamental conceptual framework is the development of hypotheses to be tested (Evensen, 2012).

The fundamental aim of the research was represented by the current state and prospects of international implementation of satellite accounts of national accounts system in EU and Romania, to meet specific needs for agriculture certain data, according to the requirements of the SNA 2008 and in particular, of the EU (SEC 95; SEC 2010) (European Commission et al., 2008; European Parliament, 2010).

RESULTS AND DISCUSSIONS

As the name indicates, the satellite account is both tied and distinct to the central system of national accounts. It is possible to develop several satellite accounts but, although each one is consistent with the central system, they may not always be consistent with each other. Satellite accounts can range from simple tables to an extended set of accounts. Satellite accounts can be compiled and published on an annual or quarterly basis. For other satellite accounts, production at more extended intervals such as once every five years is appropriate.

Satellite accounts can have various characteristics: a) links to functions, as in functional satellite accounts; b) links to industries or products, which is one type of special sector accounts); c) links to institutional sectors, a second type of special sector accounts; d) extension with physical or other non-monetary data; e)

extra detail; f) use of supplementary concepts; g) modification of some basic concepts; h) use of modeling or inclusion of experimental results. For a specific satellite account, one or more of the characteristics above can apply (European Parliament, 2010).

Functional satellite accounts focus on describing and analyzing the economy for a function, such as environment, health, and research and development. For each function they provide a systematic accounting framework. They do not provide an overview of the national economy, but focus on what is relevant for the function. To that end, they show detail not visible in the aggregated central framework, rearrange information, add information on non-monetary flows and stocks, ignore what is irrelevant for the chosen function and define functional aggregates as the key concepts (European Parliament, 2010).

There are several types of satellite accounts recommended to be developed and compiled at European level (European Parliament, 2010): a) agricultural accounts; b) environmental accounts; c) health accounts; d) household production accounts; e) labor accounts and social accounting matrices; f) productivity and growth accounts; g) R&D accounts; h) social protection accounts; i) tourism accounts.

Transforming a consistent satellite account into a product for data users may involve additional steps. An overview table with key indicators for a number of years may be introduced. These key indicators could focus on describing the size, components and developments of the specific issue involved, or may show the links to the national economy and its major components. Extra detail or classifications relevant for political and analytical purposes may be added. Detail with little value added or compiled at relatively high costs may be dropped. Efforts could also focus on reducing the complexity of the tables, increase simplicity and transparency for data users and include standard bookkeeping decompositions in a separate table (European Parliament, 2010). As example, I modified a physical supply and use table, compiled at SEEAland level (Table 1).

An example of an agricultural account is the European Accounts for Agriculture (EAA) (European Commission et al., 2008; European Parliament, 2010). Its purpose is to describe agricultural production and the development of agricultural income. This information is used for analyzing the economic situation of a European country's agriculture and for monitoring and evaluating the common agricultural policy in Europe.

The EAA focus on the production process and the income derived from it. However, in principle a satellite account on agriculture need not correspond fully to the EAA. Agricultural accounts could also include a supply and use table providing a systematic overview of the supply and use of agricultural products. This would provide information on the role of imports including the role of import duties, and developments in the demand for agricultural products such as exports and final consumption by households, and the role of related taxes and subsidies.

Table 1

Compiled example of physical supply and use table for agriculture, fishing and mining, modified stating on SEEAland source (European Parliament, 2010)

Physical supply table (Millions of tons)		
Products	P1 Animal and vegetable products	66.000
	P2 Stone, gravel and building materials	
	P3 Energy	112.000
	P4 Metals, machinery etc.	
	P5 Plastic and plastic products	65.000
	P6 Wood, paper etc.	
	P7 Other commodities	7.000
	All products	**250.000**
Residuals	To national territory	
	R1 CO_2	19.020
	R2 N_2O	0,007
	R3 CH_4	0,073
	R4 NO_X	0,061
	R5 SO_2	0,023
	R6 NH_3	0,020
	R7 Other to air	0,010
	R8 P	0,070
	R9 N	0,590
	R10 Other to water	0,030
	R11 Mining waste	7.233
	R12 Other solid waste	8.103
	Total to national territory	35.240
	To ROW territory	
	To air	
	R1 CO_2	
	R4 NO_X	
	R5 SO_2	
	Total to ROW territory	
	Total residuals	**35.240**
Total material supply		**285.240**
Physical use table (Millions of tons)		
Products	P1 Animal and vegetable products	23.000
	P2 Stone, gravel and building materials	12.000
	P3 Energy	
	P4 Metals, machinery etc	34.000
	P5 Plastic and plastic products	
	P6 Wood, paper etc.	
	P7 Other commodities	5.000
	All products	**74.000**

Natural resources	National natural resources	
	N1 Oil	38.000
	N2 Gas	27.000
	N3 Other	118.000
	N4 Wood	7.000
	N5 Fish	1.000
	N6 Other	
	N7 Water	1.000
	Total national natural resources	192.000
	ROW natural resources	
	N5 Fish	4.000
	N7 Water	
	Total ROW natural resources	4.000
	Total natural resources	**196.000**
Ecosystem inputs	National ecosystem inputs	15.000
	ROW ecosystem inputs	
	Total ecosystem inputs	**15.000**
Residuals	From national territory	
	R1 CO_2	
	R2 N_2O	
	R3 CH_4	
	R4 NO_X	
	R5 SO_2	
	R6 NH_3	
	R7 Other from air	
	R8 P	
	R9 N	
	R10 Other from water	
	R11 Mining waste	
	R12 Other solid waste	0,240
	Total from national territory	0,240
	From ROW territory	
	R1 CO_2	
	R4 NO_X	
	R5 SO_2	
	Total from ROW territory	
	Total	**0,240**
Total material use		**285.240**

The agricultural accounts could also be expanded by including secondary non-agricultural activities, such as those for leisure activity. This can reveal important trends and substitution mechanisms. The interaction with the government can be made explicit by adding a table showing all income and capital transfers by local, central, or European government to the agricultural industry; this may also include special treatments in the tax system. Agricultural accounts could also be designed like a special sector account and include a full sequence of accounts including balance sheets and financial accounts, for farmers and corporations engaged in agriculture (European Parliament, 2010).

CONCLUSIONS

1. EU legislation regarding satellite accounts in agriculture is far from being developed.

2. An example of a specific agricultural account is the European Accounts for Agriculture (EAA). However, in principle, a satellite account on agriculture need not correspond fully to the EAA.

3. For Romania there is not a clear intention to introduce in the near future a satellite account for agriculture.

***Acknowledgements**: This work was supported by the project "Post-Doctoral Studies in Economics: training program for elite researchers - SPODE" co-funded from the European Social Fund through the Development of Human Resources Operational Program 2007-2013, contract no. POSDRU/89/1.5/ S/61755.*

REFERENCES

1. Costuleanu Carmen Luiza, 2013 – *Satellite accounts of national accounts system.* In: Post-doctoral studies in economics. Post-doctoral dissertations, vol. 6. Romanian Academy Publishing House, Bucharest, ISBN 978-873-27-2296-1.

2. European Commission, FMI, OCDE, UN and BM, 2008 - *A System of National Accounts 2008*. New York: 2009. Available at: http://unstats.un.org/unsd/national account/ docs/SNA2008.pdf, p. XLIX.

3. **European Parliament, 2010** - *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the European System of national and regional accounts in the European Union*. Bruxelles, 20.12.2010, COM(2010) 774 final. Available at: http://www.europarl.europa.eu/RegData/docs_autres_institutions/ commission _europeenne/com/2010/0774/COM_COM(2010)0774(PAR23)_EN.pdf, p. 2, 4, 5-6, 23-26.

4. Evensen C., 2012 - *Research and Methodology Lectures*. Available at: http://manoa. hawaii.edu/ctahr/aheed/Carl/15/08/2012.

5. OECD, Eurostat and WHO, 2011 - *A System of Health Accounts 2011*. OECD Publishing. doi: 10.1787/9789264116016-en. Available at: http://www.oecd-ilibrary.org/social-issues-migration-health/a-system-of-health-accounts_9789264116016-en, p. 35.

CULTIVAR AND PLANT DENSITY INFLUENCE ON THE QUANTITY AND QUALITY OF THE SWEET PEPPER YIELD OBTAINED IN ECOLOGICAL FARMING POLLYTUNNELS CONDITIONS

INFLUENȚA CULTIVARULUI ȘI A DENSITĂȚILOR DE PLANTARE ASUPRA CANTITĂȚII ŞI CALITĂȚII RECOLTEI DE ARDEI GRAS OBȚINUTE ÎN SOLAR, ÎN CONDIȚII ECOLOGICE

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Abstract. *The aim of this paper is to establish the influence of the cultivar and plant densities on the quantity and quality of the yield (as an expresion of the following indicators: solids content, soluble dry substance, reducing sugars, total protein and vitamin C) on a sweet pepper crop grown in pollytunnels in organic farming conditions. Mainly, the results emphasize the influence of genotype on the yield quantity and of plant densities on the yield quality. The total yield varied between 37.07 t / ha (Bianca F1 x 45 cm) to 49.90 t / ha (F1 Brillante x 35 cm) and the dry matter content between 8.89% (Bianca F1 x 40 cm) to 16.67% (F1 Brillante x 45 cm). The others qualitative parameters recorded values comparable with those reported by the other authors.*
Keywords*: ecological sweet peppers, dry matter content, C vitamin content.*

Rezumat. *Scopul lucrării este de a stabili influența cultivarului și densității la cultura de ardei gras în solar, în condiții de agricultură ecologică, asupra cantității şi calității recoltei (exprimată prin conținutului în: substanță uscată totală, substanță solubilă, zaharuri reducătoare, proteine totale și vitamina C). Rezultatele obținute reliefează, cu preponderență, influența genotipului asupra cantității recoltei şi a densităților de plantare asupra calității acesteia. Producția totală a variat de la 37,07 t/ha (Bianca F1 x 45 cm) la 49,90 t/ha (Brillante F1 x 35 cm) iar conținutul în substanță uscată de la 8,89 % (Bianca F1 x 40 cm) la 16,67 % (Brillante F1 x 45 cm). Ceilalți indicatori calitativi au înregistrat valori în limitele raportate de literatura de specialitate.*
Cuvinte cheie*: ardei gras ecologic, conținutul de substanță uscată, conținutul de vitamina C.*

INTRODUCTION

Accounted for vegetable with the highest intake of vitamin C in the human diet, pepper fruit provides important extra vitamins and minerals giving it the status of "medicinal vegetable" (Stoian, 2005).

The aim of this study is to determine the influence of cultivar and plant density on an ecological pollytunnel sweet pepper crop on the quantity and quality of the crop (expressed as content of: solids, soluble dry substance, reducing sugars, total protein and vitamin C).

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MATERIAL AND METHOD

The researches were conducted during the 2012 year in the vegetable growing experimental field from "V. Adamachi" farm belonging to UASVM Iași, on a pollytunnel sweet pepper culture with seedling produced at alveolar pallets with subculturing procedure.

The bifactorial experience (table 1) was organized in a subdivided plots device with three repetitions, each plot containing ten plants.

Table 1

Tehnological factors graduation

A factor (Cultivar)	B factor (Distance between plants / row)
a1 = Brillante F1	**b1** = 33 cm (33.670 plants/ha)
a2 = Export	**b2** = 40 cm (27.778 plants/ha)
a3 = Bianca F1	**b3** = 50 cm (22.223 plants/ha)

Harvesting was conducted on the technological maturity of the fruit. For biochemical analyzes were taken three fruits / plant and were stored at-80^{o}C. Afterwards they were mortar and on the mixture obtained were carried out following determinations:

- Dry matter content was determined by oven drying at 105 °C to constant weight;
- Soluble solids content - determined by ABBE refractometer and expressed in Brix degrees;
- Reducing sugar content - by the Miller method (1972) using the 3,5 - dinitrosalicylic acid (DNSA) reagent;
- Total protein content - was determined by the Bradford method;
- Vitamin C content - was estimated by titration with 2,6 - dichlorphenol indophenol reagent (Sadasivam and Manicke, 1992).

RESULTS AND DISCUSSIONS

Analyzing the interaction of the two factors influence on total production highlights three very significant positive variants (Brillante F1 x 35 cm, Brillante F1 x 40 cm and Export x 35 cm), whose production increases compared to the control were: + 6.73 t/ha, + 3.42 t/ha, respectively + 3.19 t/ha and three very significant negative variants (Bianca F1 x 45 cm, Bianca F1 x 40 cm and Export x 45 cm) with a lack of production to the control of 6,1 t/ha, -3.6 t/ha, respectively -3.21 t/ha (see table 2).

At most species, the dry matter content increases with light intensity (Weston and Zandstra, 1989).

The dry matter is not significantly affected by planting distance, but increases progressively with culture maturation (Arteaga et al., 1999).

The cultivar x crop density interaction reveals two extreme variants within the ninth, respectivly Bianca F1 x 40 cm (8.89%) and Brillante F1 x 45 cm (16.67%) (figure 1).

Table 2

Interaction of cultivar and culture density on total production of pepper

Variant		Total production		Difference over the control (t/ha)	Significance
No.	Specification	t /ha	%		
1.	Brillante F1 x 35 cm	49,90	115,59	6,73	***
2.	Brillante F1 x 40 cm	46,59	107,92	3,42	***
3.	Brillante F1 x 45 cm	42,39	98,19	-0,78	-
4.	Export x 35 cm	46,36	107,39	3,19	***
5.	Export x 40 cm	41,75	96,71	-1,42	o
6.	Export x 45 cm	39,96	92,56	-3,21	ooo
7.	Bianca F1 x 35 cm	44,93	104,08	1,76	**
8.	Bianca F1 x 40 cm	39,57	91,66	-3,6	ooo
9.	Bianca F1 x 45 cm	37,07	85,87	-6,1	ooo
10.	Media experienței (Mt)	43,17	100		

DL 5% = 1,10 t/ha
DL 1% = 1,51 t/ha
DL 0,1% = 2,08 t/ha

A general idea can be highlighted on the influence of planting density on the dry matter content analysis. Therefore, at all hybrids, the maximum dry matter was recorded at 50 cm between plants/row variants and the lowest at 40 cm between plants/row variants.

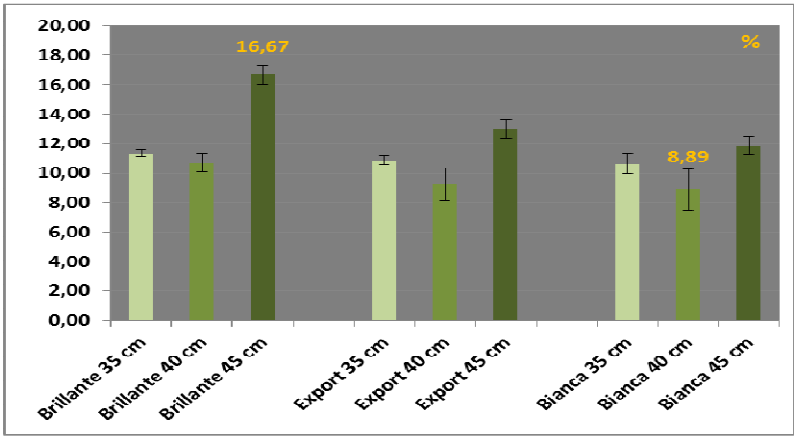

Fig. 1 - Dry matter content on sweet pepper

Production and fruit quality are in a directly proportional relation with all the fotoasimilants available during fruiting period. Photosynthesis efficiency is provided by the interaction of many factors, among which light is the most important. Studies have shown that there is a correlation between the amount of fotoasimilants and the number of light days during the growing period, resulting a decreased by 20% due to the climatic conditions in such countries (eg. England), with a similar decline of production (Cockshull et al. 1992).

Glucides content of fruit is most easily assessed by measuring soluble solids content, expressed in Brix degrees. Although fruits contain a whole range of soluble compounds, such as vitamins, minerals, organic acids and so on, the majority of them (80-85%) is represented by the soluble glucides.

Soluble solids content decreased with plant densities within Brillante F1 and Export cultivars. In contrast, at Bianca F1 , the highest value was recorded at 45 cm between plants/row variant (1.27 degrees Brix) (figure 2.).

Limit variants were Bianca F1 x 40 cm (one Brix degree) and Brillante F1 x 35 cm (2.02 Brix degrees).

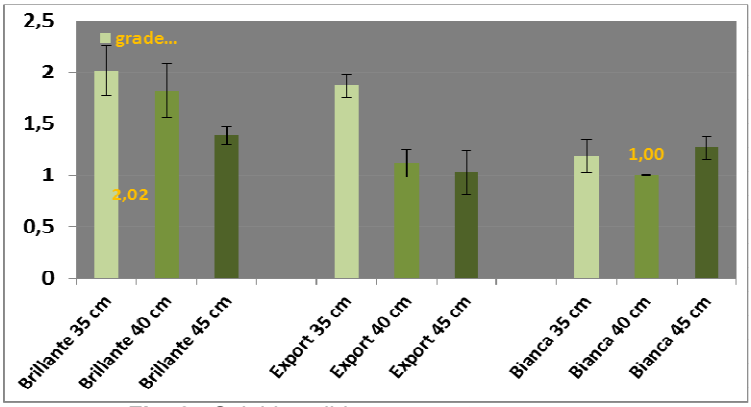

Fig. 2 - Soluble solids content at sweet pepper

The importance of cultivar on the reducing sugars content has been shown to be predominant, unlike the content of dry matter or total protein. Supporting this assertion are the reducing sugars levels achived by the deficient hybrid (Bianca F1 – 2,86 mg/100 g f.s.) and by superior hybrid (Brillante F1 – 4,48 mg/100 g f.s.) (figure 3.).

The cultivar x crop density interaction highlights Export x 40 cm (2.72 mg/100 g f.s.) as minimum variant and Brillante F1 x 35 cm (4.48 mg / 100 g f.s.) as upper variant.

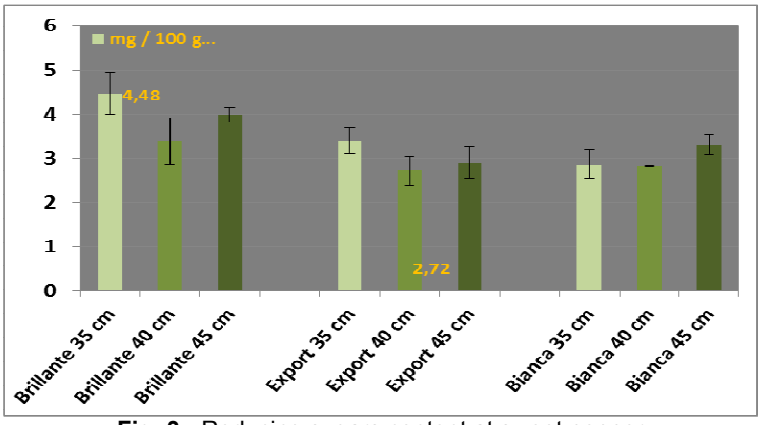

Fig. 3 - Reducing sugars content at sweet pepper

The analyzes concluded that the genotype influence on total protein content is insignificant, the average difference between the minimum variant (Bianca F1) and the maximum one (Brillante F1) being of only 0,73 mg/g f.s.

The influence of planting distances provides ambiguous information, even contradictory. Thus, at two of the three cultivars (Export and Bianca F1), the maximum total protein content was achieved at 40 cm between plants/row variants, while at the other hybrid the 40 cm variant reported the lowest concentration of total protein (figure 4.).

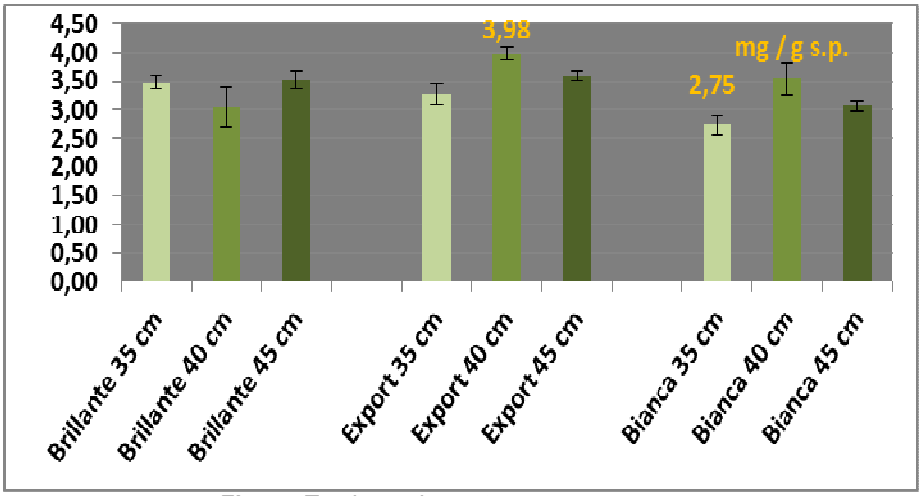

Fig. 4 - Total protein content at sweet pepper

L-ascorbic acid (C vitamin) is an essential compound to human health but has also a special role as an antioxidant and modulator of hormonal signaling pathways in plant tissues. Biosynthesis of this compound is closely related to the primary carbon metabolism: the main pathway ("Smirnoff-Wheeler") of ascorbic acid biosynthesis has the L-galactono-1,4-lactone (L-GL) as the immediate precursor and other intermediate phosphorylated and nephosphorylated monosaccharides (Obaet al., 1995 Gatzek et al., 2002).

Mahendran şi Bandara (2000), citaţi de R. Vijitha şi S. Mahendran (2010) relatează că stresul de umiditate reduce conţinutul de vitamina C din fructele de ardei.

Mahendran and Bandara (2000), cited by Vijitha and Mahendran (2010) reported that stress moisture reduces the C vitamin content of fruit pepper.

The cultivar x crop density interaction reveals two minimum variants Brilliant F1 x 40 cm and Bianca F1 x 45 cm) with 121 mg / 100 g f.s. and one variant with the most pronounced ascorbic acid content - Export x 40 cm (152.67 mg / 100 g f.s.) (figure 5.)

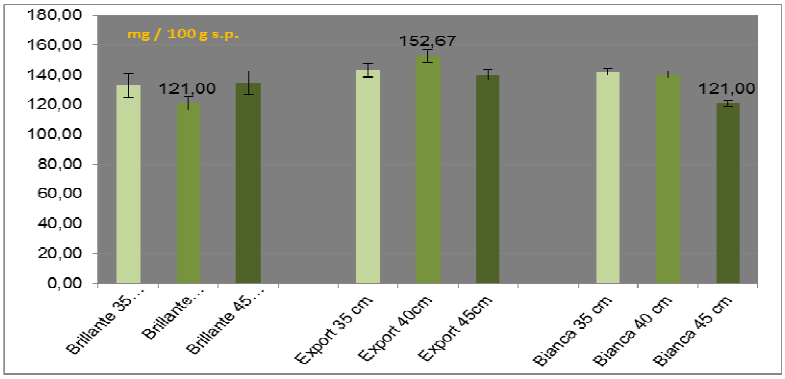

Fig. 5 - C vitamin content at sweet pepper

CONCLUSIONS

1. In general, the high content of protein is given by an increased activation of metabolic reactions and mechanisms for adaptation to different environmental conditions. From this perspective, we can consider that the distance of 40 cm is optimal for adaptation of pepper plant to pollytunnel culture conditions.

2. Primarly, C vitamin content depends on the genotype, the planting distances having an secondary effect. The only qualitative indicators that allow the shaping of plant densities influence are the dry matter content and soluble solids content.

Acknowledgements. *This work was cofinanced from the European Social Fundthrough Sectorial Operational Programme Human Resources Development 2007-2013 project number POSDRU –CPP107-DMI1/5/S/77222 "*

REFERENCES

1. **Arteaga de R. L. et al., 1999** - *Chronological response of physical variables for bell pepper (Capsicum annuum L.) fruit maturity determination in relation to planting distance.* Revista de la Facultad de Agronomía, Universidad del Zulia Vol. 16 No. 2 p. 152-159.
2. **Cockshull K.E., Graves C.J., Cave C.R.J., 1992** - *The infuence of shading on yield of glasshouse tomatoes.* Journal of Horticultural Science 67, p. 11-24.
3. **Gatzek S., Wheeler G.L., și Smirnoff N., 2002** - *Antisense suppression of l-galactose dehydrogenase in Arabidopsis thaliana provides evidence for its role in ascorbate synthesis and reveals light modulated l-galactose synthesis*. Plant J. 30, p. 541–553
4. **Oba K., Ishikawa S., Nishikawa M., Mizuno H., Yamamoto T., 1995** - *Purification and properties of l-galactono-c-lactone dehydrogenase,a key enzyme for ascorbic acid biosynthesis, from sweetpotato roots.* Journal of Biochemistry 117, p. 120-124.
5. **Stoian L., 2005** – *Ghid practic pentru cultura biologică a legumelor.* Editura Tipoactiv, Bacău.
6. **Vijitha R., Mahendran S., 2010** - *Effect of moisture stress at different growth stages of tomato plant (Lycopersicon esculentum Mill.) on yield and quality of fruits,* J Sci.Univ.Kelaniya 5, p. 1-11.
7. **Weston L.A., Zandstra B.H., 1989** - *Transplant age and N and P nutrition effects on growth and yield of tomatoes.* HortScience 24, p. 88–90.

INFLUENCE OF MINERAL FERTILIZATION ON DWARF BEAN SEED PRODUCTION, IN THE IASI AREA CONDITIONS

INFLUENȚA FERTILIZĂRII MINERALE ASUPRA PRODUCȚIEI DE SEMINȚE LA FASOLE DE GRĂDINĂ, ÎN CONDIȚIILE ZONEI IAȘI

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Abstract. *In this paper is presented the influence of the interaction between fertilization regime and seven new dwarf beans cultivars on seed production. Research has been organized an experimental plot at Didactic and Experimental Station "V. Adamachi "in Iasi, in order to promote new cultivars from official catalog of varieties of the EU in NE area from Romania. In the 2011-2012 period that were carried out observations and biometric measurements pods and seed production per hectare etc. The best results for seed production were obtain from cultivars Scylla (2469 kg / ha) and Minidor (2202 kg / ha), the results are considered distinct and very significant compared with the experience average. Regarding characterization in terms assortment of seed color, we can say that it is white all cultivars except Saxa variety and MMB range from 200 g (Bergold) to 390 g (Saxa).*
Keywords: *cultivar, fertilization scheme, dwarf french bean, seed production*

Rezumat. *În lucrarea de față este prezentată influența interacțiunii dintre regimul de fertilizare și șapte cultivaruri noi de fasole de grădină asupra producției de semințe la fasolea de grădină pitică. Cercetările au fost organizate la Stațiunea Didactică Experimentală "V. Adamachi" din județul Iași, cu scopul de a promova noi cultivaruri din Catalogul oficial al soiurilor de la UE, în condițiile de cultură din NE țării. În periada 2011-2012, s-au efectuat observații și determinări biometrice pentru păstăi și producția de semințe la hectar etc. Cele mai bune rezultate pentru producția de semințe au fost obținute de cultivarele Scylla (2469 kg/ha) și Minidor (2202 kg/ha), rezultatele obținute fiind considerate distinct și foarte semnificative comparativ cu media experienței. În ceea ce privește caracterizarea sortimentului din punct de vedere al culorii seminței, putem afirma că acesta este albă la toate cultivarele cu excepția soiului Saxa, iar MMB variază de la 200 g (Bergold) la 390 g (Saxa).*
Cuvinte cheie: *cultivar, regim de fertilizare, fasole de grădină, producție de semințe*

INTRODUCTION

Beans along with other legumes, is one of the essential foods that

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contribute to the diversification of the assortment of vegetables, which improves protein balance in the human diet is much appreciated and quite high due to the content in the other nutrients, sugars (carbohydrates 5-7 g/100g), vitamins (vit. C - 16 mg/100g, vit. PP – 0,5 mg/100g, vit. B1 – 0,6 mg/100g, vit. B2 – 0,5 mg/100g s.a) (Chaux, 1996, Ciofu, 2004)

Enriching the germoplasm fund of this crop of new sources of resistance to pathogens, high in nutrients, clustered layout of clusters in the upper third of the plants, higher yield potential to promote new varieties of garden beans, represent an objective basic research that are addressed by this paper (Fouillox, 1992, Patron, 1992, Munteanu, 2003).

In terms of climate change in recent years and the implementation of sustainable practices, variety is perhaps the most important biological factor of production, which is directly related to its adaptation to new environmental conditions. At the same time variety is an element of expression of crop biodiversity in terms of a permanent change assortment growing (Olaru, 1982, Munteanu, 2003).

The variety, by definition, is an experimental biological population including individuals characterized by distinctibility, uniformity and stability, and agronomic value. At the same time, characteristicsis seed is the carrier characters or characteristics of each variety. All biological characteristics give it agronomic value, defined briefly as a complex of characteristics that assures usefulness determined by productivity and crop quality, the suitability for certain environmental conditions, the ability to respond positively to anthropogenic inputs provided of a technology for cultivation (Poasca, 1986, Fouilloux, 1992, Ruști, 2007).

The importance of seed as the carrier material factor cultivar characteristics, leads to approach or knowledge of measures and means of cultivar quality is maintained or kept as standard, according to "official description" made by the owner cultivation or its author (Borosic, 2000, Munteanu, 2003).

The conservation of cultivars is of major importance in producing seed, knowing that environmental factors (the external factors), and some endogenous factors can cause degradation or degeneration cultivars. Romanian varieties registered in the official catalog to the European Commission (DG SANCO) for inclusion in the EU Common Catalogues, which can be marketed throughout the EU. These varieties are submitted for inclusion in the List of Varieties Eligible for Seed Certification, published by the Organization for Economic Cooperation and Development (OECD) (Dumitrescu, 1998, Catalogul, 2012).

MATERIAL AND METHOD

The research was carried out at D.E.S. "V. Adamachi "from Iasi place, during 2011-2012. It was studying an assortment of seven cultivars of dwarf French beans: a_1-Jutta, a_2-Scylla, a_3-Maxidor, a_4–Saxa, a_5-Minidor, a_6–Slenderette și a_7 –Bergold.

Regarding fertilization regime applied in the two experimental years, it is as graduation:

- d_1 – base fertilization with 50 kg s.a. P2O5 S and 50 kg s.a. K2O (autumn) and 40 kg s.a./ha N from ammonium nitrate (spring on land preparation);

- d_2 – base fertilization with 75 kg s.a. P2O5 and 75 kg s.a. K2O (autumn) and 40 kg s.a./ha N from ammonium nitrate (spring on land preparation) ;

- d_3 – base fertilization before seeding with 300 kg/ha complex III fertilizer (39 N ; 78 P2O5 ; 38 K2O) ;

The experiment was set in a experimental stationary after a tomato crop of for industrialization. Soil preparation works were carried out in accordance with appropriate technology of conventional crops.

Sowing was done around the time of 01.05, using his own seed produced in 2010 and 2011 from previous experiences. Setting up crop has been achieved with SUP 15 average distance of 37.5 cm between rows and 5-6 cm between plants in the row, at a depth of 3 cm, resulting in a density of 440000-530000. The quantity of seed used to establish a crop of MMB varied between 89-170 kg / ha.

Seeded area of each experimental plot was 40 m^2, so that the minimum size for harvesting is 30 m^2 (Săulescu, 1967).

During the years 2011 and 2012 were carried out observations and biometric measurements that ensure the achievement of a general characterization of the assortment. The seed production was analyzed at the end of the growing season (on July 30). Production data were processed by specific methods (Săulescu şi Săulescu, 1967, Jităreanu, 1994).

RESULTS AND DISCUSSIONS

In terms of the influence of fertilization and cultivars on seed production during 2011-2012, can be seen from Table 1, that production experiment varied between very wide limits, from 1356 kg / ha (Bergold x d3) in 2687 kg / ha (Scylla x d2) obtained from the average differences being statistically experience, 95%, 99% and 99.9%.

Table 1

The interaction influence of cultivar x fertilization dose on dwarf French bean seed production (kg/ha)

Specification	Fertilization scheme			Total yield (kg)	Average yield (kg/ha)
Cultivar	d_1	d_2	d_3		
Jutta	1950	2240	1790	5980	1993
Scylla	2480	2687	2240	7407	2469
Maxidor	1870	2289	1543	5702	1901
Saxa	1884	1950	1796	5630	1877
Minidor	2192	2376	2037	6605	2202
Slenderette	1970	2285	1793	6048	2016
Bergold	1654	1785	1356	4795	1598

The seed production of the dwarf French bean obtained at the 30.07 in the conventional system, varied from 1598 kg / ha for Bergold to 2469 kg / ha for Scylla variety; same results have been obtained by Borosic, 2000. The production

difference than the average experience in this case (461 kg / ha) is regarded as positive, very significant. Also, distinctive significant difference (Table 2) was also obtained and the Minidor variety (194 kg / ha). Bergold variety achieved the lowest seed production (1598 kg / ha), the difference from the average experience (-410 kg / ha) was negative very significantly. Negative differences than the average experience have obtained on Saxa (-131 kg / ha) and Maxidor (-131 kg / ha) cultivars.

Jutta and Slenderette cultivars have been close yields to the average experience and production increases obtained are considered unsignificant.

Table 2

The seed production of dwarf French bean and the significance of differences compared to the control

No.	Variant	Average yield (Kg/ha)	% than control	Diference than control (kg/ha)	Significance of differences
1	Jutta	1993	99,25	-15	-
2	Scylla	2469	122,96	461	***
3	Maxidor	1901	94,67	-107	-
4	Saxa	1877	93,48	-131	o
5	Minidor	2202	109,66	194	**
6	Slenderette	2016	100,40	8	-
7	Bergold	1598	79,58	-410	ooo
8	Control (experience average) X	2008	100,00	0	-

LSD 5% = 110 kg/ha; LSD 1% = 154 kg/ha; LSD 0,1% = 217 kg/ha.

Table 3

The influence of fertilization regime on seed production of dwarf French bean and significance of differences than control

Variant	Kg/ha	% than control	Difference than control	Significance of differences	LSD
d_1	2000	99,60	-8	-	LSD 5% = 110 kg/ha LSD 1% = 154 kg/ha LSD 0,1% = 217 kg/ha
d_2	2230	111,06	222	***	
d_3	1794	89,54	-214	oo	
Control (average of experience) X	2008	100,00	0	-	

Regarding the influence of fertilization on seed production in dwarf French bean (Table 3), we can say that it ranged from 1794 kg / ha in d3 fertilization scheme to 2230 kg / ha in d2 fertilization version, similar with results obtained by Alvino, 1988. Production difference obtained between this variant and control is statistically assured a percentage of 99.9%.

CONCLUSIONS

1. The studied assortment behaves in according to precocity of extra-early cultivars (Bergold) to early (Maxidor, Saxa) and the semi (Jutta, Scylla, Minidor and Slenderette), which causes enlargement of the growing dwarf French bean.

2. The seeds production determined by the influence of fertilization system and varieties varied between very wide limits, from 1356 kg / ha (Bergold x d3) at 2687 kg / ha (Scylla x d2).

3. Regards the influence of the fertilizer on seed yield, it can be said that the best results have been provide when was applied the basic fertilization 75 kg of P_2O_5 and 75 kg K_2O (autumn) and 40 kg / ha of N from ammonium nitrate (applied in the spring to ground prepare), which is 2230 kg / ha.

4. The seed production in the case of use of different cultivars of 1598 kg / ha for Bergold to 2469 kg / ha for Scylla variety. statistically Yields than average experience cultivars have been made Scylla and Minidor.

REFERENCES

1. **Alvino A., Tedeschi P., Zerbi G., 1988** - *Growth, flowering, setting and yield of kidney bean (Phaseolus vulgarisL.) as influenced by water regime, P fertilization and bnoa treatment*. Acta Hort. 228, p. 219–226.
2. **Borosic J., Romic D., Dolanjski D., 2000** - *Growth and yield components of dwarf French bean grown under irrigation conditions.* Acta Hort. 533, p. 451–459.
3. **Chaux Ch., Foury Cl., 1996** – *Productions legumiers*. Editura Agriculture D'aujourd'hui.
4. **Ciofu Ruxandra, Stan N. şi colab, 2004** – *Tratat de legumicultură*. Editura Ceres, București.
5. **Dumitrescu M., Scurtu I., Stoian L., Glăman Gh., Costache M., Dițu D., Roman Tr., Lăcătuş V., Rădoi V., Vlad C. Zăgrean V., 1998** – *Producerea legumelor*. Editura ArtPrint. Bucureşti
6. **Dumitrescu, M. şi colab., 1977** – *Tehnologia producerii semințelor şi a materialului săditor la plantele legumicole.* Editura Ceres, București.
7. **Fouillox, G., Bannerot, H., 1992** – *Le Haricot Amelioration des Especes vegetables cultivees.* Edit. INRA.
9. **Gavras M.F., 1989** -*The influence of mineral nutrition, stage of harvest and flower position on seed yield and quality of Phaseolus vulgaris L.* Dissertation Abstracts International. Biological Sciences and Engineering, 50, p. 1687–1698.
10. **Munteanu N., Stan N., Stan T., 2003** – *Legumicultură, vol.III*, Editura „Ion Ionescu de la Brad", Iaşi.
11. **Olaru, C., 1982** – *Fasolea*. Editura Scrisul românesc, Craiova.
12. **Patron, I., Petru, 1992** – *Legumicultura.* Editura Universitas, Chișinau.
13. **Poasca, C., 1986** – *Contribuții la îmbunătățirea tehnologiei de producere a semințelor de fasole de grădină.* Analele I.C.L.F. Vidra, vol. VIII.

14. **Ruşti Grigore, 2007 -** *Cercetări privind îmbunătățirea tehnologiei de cultură a fasolei de grădină urcătoare (Phaseolus vulgaris L. var. communis L.).* Teză de doctorat. USAMV Iași
15. **Catalogul comun al soiurilor de legume, 2012 -** *Jurnalul Oficial al Uniunii Europene,* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri =OJ:C:2012:015A:0001:0033: RO: PDF

STUDIES ON GENETIC STRUCTURE VARIABILITY AT "MARILENA", *LACTUCA SATIVA* L. VARIETY

STUDII PRIVIND VARIABILITATEA STRUCTURII GENETICE A SOIULUI DE SALATĂ (*LACTUCA SATIVA* L.) MARILENA

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Abstract *This paper presents a study on the variability of the main traits and significance for selection works at "MARILENA" variety of Lactuca sativa L., created and patented at Vegetable Research and Development Station, Bacau. Maintaining of quantitative and qualitative features of variety, annually within their variability in purpose to ensure the identity, uniformity and stability is achieved by the conservative selection works. Our undertaken studies show that studied variability of different traits, is: low at shape's index, head's height, medium at head diameter and head weight and high at weight of seed / plant (g). Data presented in this study reveal that the variety of lettuce – 'MARILENA' is properly maintained in conservative selection process, and the limits of variability are normal.*
Key words: *population, gene, genotype, coefficient of variability*

Abstract *Soiul de salată 'MARILENA' a fost creat la SCDL BACĂU. Lucrarea are ca scop prezentarea unui studiu asupra variabilităţii principalelor caractere şi semnificaţia pentru lucrările de selecţie. Menţinerea anuală a caracterelor cantitative şi calitative ale soiului în limitele proprii de variabilitate, respective asigurarea identităţii uniformităţii şi stabilităţii acestuia se realizează prin lucrări de selecţie conservativă. Studiile intreprinse relevă faptul că variabilitatea caracterelor studiate diferă: este mică la "indicele de formă" şi "înălţimea căpăţânii", s% ≤ 10, mijlocie la "diametrul şi greutatea căpăţânii" (s% cuprins între 10-20) şi mare la "greutatea semințelor/plantă" (s% ≥ 20). Datele prezentate în lucrare scot în evidenţă faptul că soiul de salată 'MARILENA', este corect menţinut în procesul selecţiei conservative, limitele de variabilitate fiind cele normale. Soiul este distinct şi uniform.*
Cuvinte cheie: *populatie, gene, genotip, coeficient de variabilitate*

INTRODUCTION

Lettuce (*Lactuca sativa*) is the most important crop in the group of leafy vegetables. It is characterized by considerable morphological and genetic variation. (Brezeanu, 2010). The crop comprises seven main groups of cultivars (including oilseed lettuce) differing phenotypically; they are usually described as morphotypes. Lettuce breeding is primarily focused on various morphological features and resistance against diseases and pests. (Křístková, 2008)

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The study of genetic structure and determination of population are crucial for estimating the value of population (type of genes and genotypes) from genetic and plant breeding view point, in order to investigate ways how genes and genotypes can be included in that population, as of how plant population can be kept within certain variability. Genetic analysis of quantitative characters (plant height, head diameter, shape index, the amount of seed produces by a plant) have importance in conservative selection of lettuce varieties. (Ambarus, 2010).

It is known the fact that any biological population is characterized by a frequency of genes and genotypes. A lots of evolution's factors (mutation, migration and selection) are acting on natural populations and tend to modify its structure. At artificial populations (varieties) of plants, in addition to evolutionary factors, genetic drift is acting and the original structure of the variety may be soon changed. (Mureşan, 1986)

Changing the frequency of genes and genotypes led to changes of the average population characteristics and therefore of variety characteristics. For this reason the variety's structure must be known, and after each cycle of selection, must be verified with the original structure. To reduce genetic drift action is necessary to work with large populations of plants.

MATERIAL AND METHOD

The experiments were conducted in condition of an alluvial soil, medium evaluated and sandy loam developed texture, pH value between 6.2 and 6.7 and humus content 2.5-2.7 %. Studies were accomplished on biological homogenized material form field of progenies study of *Lactuca sativa* L. variety, named "MARILENA". The mass selection was the selection method.

There were accomplished phenological observations and biometrical measurements: phenophases duration, rain and temperature regime, head's height (cm), head's diameter (cm), index's shape, head's weight (g), weight of seed / plant.

There were marked elites and we kept only the seeds from the plants whose values of studied characters were within the limits of variation of variety.

The limits of variation results from the calculation of statistical data from measurements made on a sample of 100 individuals (sample survey) taken at random on the diagonal field.

RESULTS AND DISCUSSIONS

The goal of our work is to develop adapted lettuce cultivars and associated germplasm with increased yield potential; while lowering production input and minimizing the impact on the surrounding environment. Conventional and modern breeding methods are providing new cultivars well tailored for the specific needs of producers and consumers.

Daily phenological observations were registered.

The regime of temperature (sum of degrees of temperature) and rainfall was settled for each phenophase (Table 1).

Table 1

Maine phenophase at - *Lactuca sativa* L. variety "MARILENA"

No	Phenophase	Period	Days /phenophase	Sum of (^{0}C) degree	Rainfall (mm)
1	sowing - springing	16.09-21.09	6	-	-
2	resume vegetation	20.03-21.03	-	-	-
3	resume vegetation - head issuing	22.03-22.05	30	385.20	72.10
4	formation of head – floriferous steam issuing	22.05-12.06	21	481.15	110.10
5	floriferous steam issuing - flowering	12.06-26.07	44	909.60	68,70
6	flowering – seeds maturation	26.07-29.08	33	758.90	10.60

Statistical and mathematical processing of data drawn from the measurements, showed the following ranges of variation of lettuce variety "MARILENA" (table 2).

Table 2

Variability study of some traits at "MARILENA" lettuce variety

No	Features	X	s	s%	Limits of variation	Signification %
1.	head's height (cm)	10,46	1,03	9,80	9.43-11.49	<10
2.	head's diameter (cm)	23,45	1,03	15,95	18.00 -28.90	10-20
3.	index shape	0,45	0,06	5,36	1.06-1.18	<10
4.	head's weight (g)	206,42	26,25	12,12	180.17-232.67	10-20
5.	weight of seed /plant (g)	10,37	2,12	20,44	8.25-12.49	>20

- <10 - low level of variability
- 10-20 - medium level of variability
- >20 - high level of variability

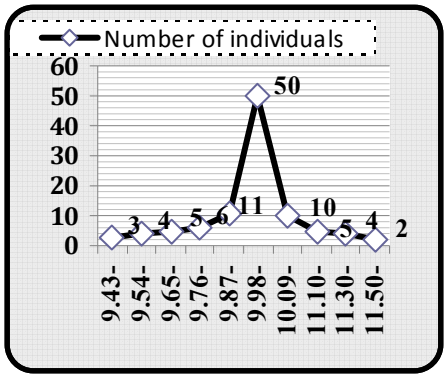

Fig. 1 - Histogram of head's height variation (cm)

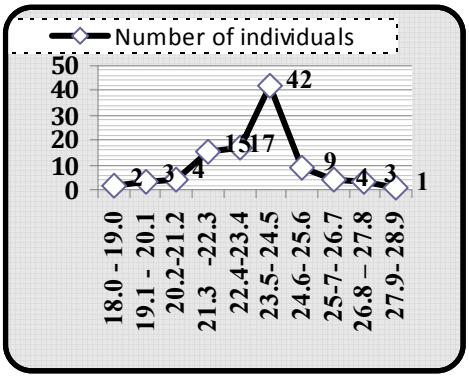

Fig. 2 - Histogram of head's diameter variation (c**m)**

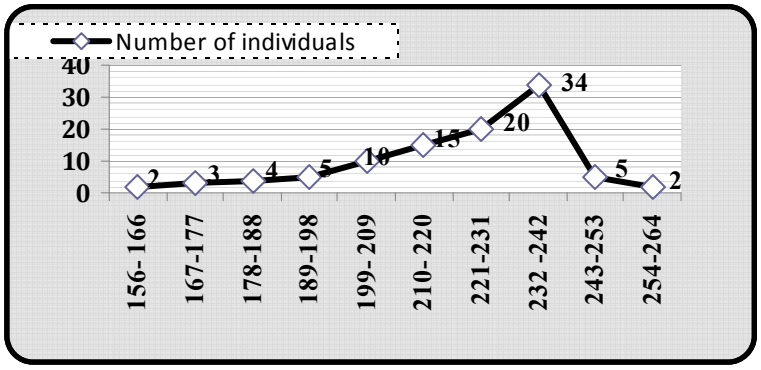

Fig. 3 - Histogram of head's weight variation (g**)**

CONCLUSIONS

"MARILENA" variety was within the normal range of variation. The variability of features like: index shape, head's height, weight of seed / plant, head's weight and head's diameter: low, at index shape, head's height, medium, at head's diameter and head's weight, high, at weight of seed / plant (g).

Acknowledgements: *This work was co financed from ADER 2020 Program, projects: ADER 1.1.10 and ADER 1.1.11*

REFERENCES

1. **Ambarus S., Brezeanu C, Brezeanu PM, 2010** *Producerea semințelor şi a materialului săditor la speciile legumicole*. Ed. Alma Mater, ISBN 978-606-527-094-7
2. **Brezeanu C., Ambarus S., Brezeanu PM, 2010** - *Resurse genetice legumicole cultivate in Romania* Ed. Alma Mater, ISBN 978-606-527-092-3
3. **Křístková E., Doležalová I., Lebeda A., Vinter V., Novotná A., 2008** - *Description of morphological characters of lettuce (Lactuca sativa L.) genetic resources* Hort. Sci. (Prague), *35*, (3), p. 113–129
4. **Mureşan, T., Pană, N.P., Cseresnyes, Z., 1986** - *Producerea şi controlul calității semințelor agricole*, Bucureşti

RESEARCHES ON THE BEHAVIOUR OF CERTAIN GENOTYPES OF CARROT (*DAUCUS CAROTA* L.) AT THE THERMIC AND HYDRIC STRESS CONDITIONS

CERCETĂRI PRIVIND TESTAREA UNOR GENOTIPURI DE MORCOV (*DAUCUS CAROTA* L.) ÎN CONDIȚII DE STRES TERMIC ȘI HIDRIC

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Abstract *Three genotypes of carrot were studied at RDIVFG Vidra, in 2012, for testing purposes under thermal and hydric stress conditions. The experiment was established by sowing in two different periods (April, June), and three different technological: V1- irrigated as per normal growth and development needs, V2- 50% of irrigation standard, V3- not irrigated. The weather conditions in 2012 determined the increase of the irrigation standard for variant V1. For variant V2, the yielding capacity was more than 50% lower than for variant V1. The plants from variant V3 (sown in the month of April) were very small, low quality and improper for consumption. As for variant V3 (sown in the month of June), the seeds did not germinate.*
Key words*: carrot, hydric stress, thermal stress.*

Rezumat. *Trei genotipuri de morcov au fost studiate, la ICDLF Vidra, în anul 2012, în vederea testării în condiții de stres termic și hidric. Experiența a fost înființată prin semănat în două epoci diferite (aprilie, iunie) și trei variante tehnologice: V1- irigat conform necesarului de creștere și dezvoltare, V2- 50% din norma irigare, V3- neirigat. Condițiile climatice din anul 2012 au determinat suplimentarea normei de irigare în varianta V1. La varianta V2 capacitatea de producție a fost cu peste 50% mai mic față de V1. Plantele din variantele V3 (înființată în luna aprilie), au fost foarte mici, de calitate inferioară, improprii consumului. La varianta V3 (înființată în luna iunie), semințele nu au germinat.*
Cuvinte cheie: *morcov, stres hidric, stres termic*

INTRODUCTION

The carrot root shape and size are genetically determined characteristics, (Fremmel and Lauche, 1983 – quoted by Shinohura, 1984), but strongly influenced by the environment and subject to modifications (Kappert and Rudorf, 1962; Korla and Rastogi 1980). In the carrot's vegetative development there are two main phases, that of the primary growth and that of maturation. The first phase is longer or shorter depending on the variety, either early or late, as well as on the environment conditions, especially temperature and humidity. The typical size and shape for the respective variety shall be obtained when a balance between growth and maturation is achieved. The cylindrical shape with rounded head is associated with the root's full development, being a criterion for assessing

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maturation and quality (Rosenfeld, 1998), being mostly preferred by breeders and also by consumers. The variety is unpretentious towards temperature (the seeds germinate starting from 4^0C), while optimal growth temperature is 18 - 25^0C. Above 30^0C, the production decreases and the root is low quality. As to water the biggest requirements are during the seeds' germination and deposition of reserve substances in the root. (Dumitrescu et al.,1998).

Within the context of the current weather changes, the selection of genotypes which are tolerant to thermal and hydric stress represents a major goal in the carrot's amelioration activity we carry out here at the Vegetable and Flower Breeding Research and Development Institute Vidra.

MATERIAL AND METHOD

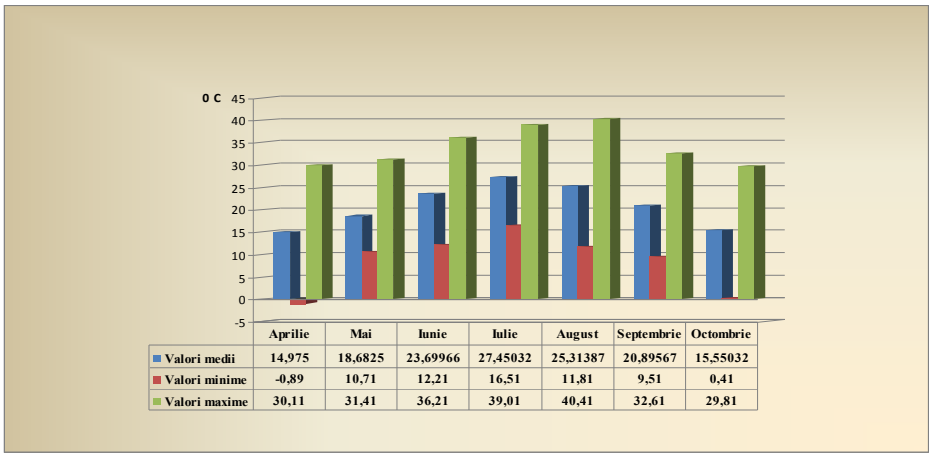
For achieving this goal, as part of ADER 1.1.10 project, three genotypes of carrot (L66, L29, Nabuco) were studied in 2012, at RDIVFG Vidra.

The experiment sample was planted by manual sowing, in two different periods (April and June) and in three technological variants: V1- irrigated as per normal growth and development needs, V2- 50% of irrigation standard, V3- not irrigated. Water administration to the plants was made by dripping.

For the culture in the first period, in V1 variant, the watering standard was 50 m^3/ha applied every five days, until emergence, and then of 200 m^3/ha, every seven days, in the months of: June, July, August and September (in the first two decades). In V2 variant, the watering standard was 50% lower, applied at the same interval and for the same period. In V3 variant, the culture was not irrigated, the watering needs being covered by the precipitations in the area. For the culture in the second period, in V1 variant, the watering standard was 50 m^3/ha, every 48 hours, until emergence (June), and after that of 200 m^3/ha, every seven days in the months of July, August, September and one in the first decade of October. In V2 variant the watering standard was 50% lower, applied at the same interval and for the same period. Plants from the first period were harvested on the 30th of September, while those from the second period were harvested on the 23rd of October. Determinations were made for 75 plants, and the significance of differences was determined by the multiple comparison method.

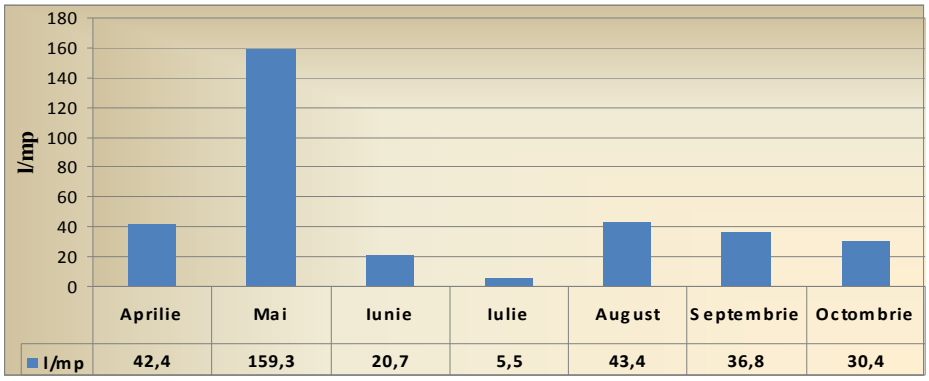
RESULTS AND DISCUSSIONS

In Vidra area, the year 2012 was characterized by extremely high temperatures, in the months of July, August and even September, with maximum temperatures above 30^0C, starting with May (Fig.1). These were correlated with extremely poor precipitations, in the period of June – September, much below the multiannual values (Fig. 2). All this triggered the increase of the irrigation standard to ensure the plants' growth and development, reaching 2800 m^3/ha in the first period and 3400 m^3/ha in the second period, as compared to normal years, when this was of maximum 2400 m^3/ha. This variety requires big quantities of water during the root's lengthwise growth and deposition of reserve substances, as well as small and constant quantities during germination and emergence.



	Aprilie	Mai	Iunie	Iulie	August	Septembrie	Octombrie
Valori medii	14,975	18,6825	23,69966	27,45032	25,31387	20,89567	15,55032
Valori minime	-0,89	10,71	12,21	16,51	11,81	9,51	0,41
Valori maxime	30,11	31,41	36,21	39,01	40,41	32,61	29,81

Fig.1 Evolution of temperatures recorded during the period of April-October 2012



	Aprilie	Mai	Iunie	Iulie	August	Septembrie	Octombrie
l/mp	42,4	159,3	20,7	5,5	43,4	36,8	30,4

Fig. 2 Evolution of precipitations recorded during the period of April-October 2012

In these circumstances, the three carrot genotypes were influenced both by the sowing period and technological variant.

In the first sowing period, in V1 and V2 variants, the seeds germinated based on the water from the soil and that provided by irrigation. There were no significant differences between the two variants until the beginning of June. The drought conditions and temperature increase, and also the reduction of the watering standard finally determined significant yielding capacity differences between V1 and V2. For all genotypes, the yielding capacity was reduced by more than 50% (Table 1). In V3 variant, the seeds germinated more slowly, after 14 days, and the plants' density was lower. The plants continued to develop due to precipitations in May. The high temperatures and drought from the period of June-August determined the plants' poor development, the stopping of the roots' primary lengthwise growth phase, the roots' deformation and ramification. There followed the growth's stopping and tissue premature lignification, the concentration of volatile oils, which determined the roots' bitter taste.

Table 1

The root´s characteristics and yielding capacity - sown in the month of April

Genotyp / technological variant		Length (cm)	Semnification *	Diameter (cm)	Semnification *	Weight (g)	Semnification *	Yielding capacity (t/ha)	Semnification *
L66	V1	14,8	a	3,4	a	150,5	a	46,6	a
	V2	12,8	b	2,2	b	121,0	b	19,7	b
	V3	10,2	c	1,2	c	48,5	c	9,8	c
L29	V1	12,9	a	3,9	a	138,2	a	40,8	a
	V2	10,5	b	2,3	b	106,0	b	17,2	b
	V3	8,8	c	1,8	c	40,8	c	7,2	c
NABUCO	V1	13,2	a	3,4	a	131,3	a	34,8	a
	V2	11,6	b	2,6	a	116,0	b	15,5	b
	V3	9,2	c	1,7	b	41,7	c	6,7	c

*Variants having the same letters do not differ significantly for the level of P=5%

These were improper for consumption. The yielding capacity was extremely low, the culture being economically inefficient since the production obtained could not be used.

For all root characteristics and yielding capacity the differences between the three technological variants are significant (Table 1).

In the second sowing period, the genotypes' behaviour was also determined by the technological variant and environment conditions. The high temperatures, correlated with the low precipitations and atmospheric drought, starting with June, influenced the plants' growth and development. In this period, the seeds' germination was different, for the three technological variants.

In V1 variant the seeds germinated after 6 days, while for V2 after 10 days, the plants' density being lower, as compared to V1. In V3 variant the seeds did not germinate for any genotype. In June, the daytime temperature was above 30^0C, there were no precipitations, and there was no water administered by irrigation.

For the root's characteristics and yielding capacity the differences between the two variants (V1 and V2) are significant, same as for the first sowing period (Table 2).

From the results obtained we can say that for the carrot, the summer culture can not be sown without providing the necessary water quantities for the seeds' germination, and the varieties show their genetic potential when the necessary water quantity is provided.

Table 2

The root´s characteristics and yielding capacity - sown in the month of June

Genotyp	Technological variant	Length (cm)	Diameter (cm)	Weight (g)	Yielding capacity (t/ha)
L66	V1	13,8	3,4	140,5	44,6
	V2	11,8	2,2	109,0	21,7
	V3	-	-	-	-
L29	V1	11,9	3,7	125,2	39,8
	V2	10,7	3,5	106,0	19,4
	V3	-	-	-	-
NABUCO	V1	12,8	2,8	115,3	31,8
	V2	11,0	2,2	98,0	14,5
	V3	-	-	-	-

CONCLUSIONS

The study of the three carrot genotypes (L29, L66, Nabuco), with respect to their behaviour to the thermal and hydric stress, leads to the following conclusions:

1. The extreme weather conditions of 2012 created the conditions for genotypes' testing towards the thermal and hydric stress.
2. The plants' growth and development was influenced by: the environment conditions, the sowing period and technological variant.
3. The extremely high temperatures and extended drought determined the increase of the irrigation standards, as compared to previous years, in both sowing periods, in V1 variant.
4. The yielding capacity in V2 variant, for both sowing periods, was more than 50% lower for all genotypes, being determined by a smaller number of plants per hectare and more reduced roots' weight
5. In V3 variant, sown in the first period (April), the production obtained was very small, low quality and improper for consumption, while sown in the second period (June), the seeds did not germinate for any genotype.

REFERENCES

1. **Dumitrescu M., Scurtu I., Stoian L., Glăman Gh., Costache M., Dițu D., Roman Tr., Lăcătuş V., Rădoi V., Vlad C., Zăgrean V., 1998** - *Producerea legumelor*, Editura ArtPrint, București, p. 297-298.
2. **Kappert H., Rudorf W.**,**1962** - Züchtung von Gemüse. Obst., Reben und Forstpflazen, Möhre. Ed. Paul Parey, Berlin und Hamburg, Vol. VI, p. 1-20.
3. **Korla B.N., Rastogi K.B**., **1980** - *A note phenotypic stability for root yield carrot* (*Daucus carota* L.) *Haryana J*., Horti. Sci., 9, p. 88-89
4. **Rosenfeld H.J**.,**1998** - *Maturity and development of the carrot root* (*Daucus carota* L.), Gartenbauwissenschaft 63 (2), p. 87-94.
5. **Shinohura S**.,**1984** - *Vegetable seed production technology of Japan elucidated with respective variety development*. Histories, particulars, carrot, vol. I.

RESULTS REGARDING BIOLOGICAL PARTICULARITIES STUDY OF JERUSALEM ARTICHOKE (*HELIANTHUS TUBEROSUS* L.)

REZULTATE PRIVIND STUDIUL PARTICULARITĂȚILOR BIOLOGICE LA TOPINAMBURUL LEGUMICOL (*HELIANTHUS TUBEROSUS* L.)

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Abstract: *This scientific study is based on a research regarding some biological characteristics of the Jerusalem artichoke (Helianthus tuberosus L.). The purpose of this research was to evaluate the possibilities to cultivate three of the Helianthus tuberosus L. clones (Topstar, Gute Gelbe and Violet de Rennes) in order to evaluate the opportunity to implement a specific cultivation method. The measurements and plant determinations have been taken during the experiment, keeping track of the plant height, the leaf's shape and color, tuber's growth dynamics, tuber's shape and flowering date.*
Key words: *topinambur, cultivation method, plant height, leaf shape and color, tuber growth dynamic, tuber shape, flowering date.*

Rezumat. *Lucrarea constă într-un studiu privind unele particularități biologice ale speciei legumicole topinambur (Helianthus tuberosus L.). Scopul cercetărilor a fost de a evalua posibilitățile de cultivare a topinamburului legumicol în vederea evaluării oportunităților de implementare unei tehnologii de cultivare. Materialul biologic a constat din trei clone- Topstar, Gute Gelbe și Violet de Rennes. Pe timpul experimentării au fost efectuate măsurători și determinări asupra principalelor caracteristici: înălțimea plantelor, forma și culoarea frunzelor, dinamica creșterii tuberculilor, forma tuberculilor și data apariției inflorescenței.*
Cuvinte cheie*: topinambur, tehnologii de cultivare, înălțimea plantelor, forma și culoarea frunzelor, dinamica creșterii tuberculilor, forma tuberculilor, data apariției inflorescenței.*

INTRODUCTION

The Jerusalem artichoke species belongs to the *Helianthus* genus, *Asteraceae* family, *Asterales o*rder, genomic formula 2n = 6x = 102 (Stanley, 2008). Under cultivation conditions the artichoke behaves as annual species, although in the places of origin and in spontaneous flora it acts as perennial species.

The plant is herbaceous, but in the second period of the yearly life cycle it becomes ligneous at the levels of the main stem and the lower branches (Stanley, 2008).

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The general morphology of the Jerusalem artichoke plant may have a critical impact on productivity. The rapid development and the general architecture of the epigeal part are important advantages for the species' hardiness (Pas'ko, 1973).

The plant morphology is genetically determined and major differences between clones can be distinguished. Two genetically identical plants grown in different conditions may morphologically develop in different ways (Pas'ko, 1973).

The Jerusalem artichoke is cultivated for its tubers, which can be consumed boiled (mostly in soups and other flavored dishes), baked, or even fresh, thanks to their very pleasant taste and nutritional value. The fresh tubers can be cut as thin slices for various types of simple or assorted salads, especially to give the plate a crunchy texture and a slightly nutty taste. It can also be used as canned food, as simple or assorted pickles (Stanley, 2008).

The Jerusalem artichoke species has certain distinctive biochemical properties. The tuber stores the inulin as a reserve substance, in comparison to other species that use the starch as the main source of carbohydrates. The inulin, along the high content of mineral salts, gives the Jerusalem artichoke tubers a high importance in the human diet, especially for people suffering from obesity and diabetes.

The aim of the present research is to conduct a study on the possibilities of cultivating three clones of *Helianthus tuberosus* L. in order to assess the opportunities to implement a base technology.

MATERIAL AND METHOD

The aim of the present research is to conduct a study on the possibilities of cultivating three clones of topinambur in order to assess the opportunities to implement a base technology.

In order to establish the cultivation technology of the *Helianthus tuberosus L.*, the following target was set: the study of three clones of the Jerusalem artichoke in comparative cultures.

The *Topstar* clone has German origin, available in the gene bank from *Leibniz Institut für Pflanzengenetik Kulturpflanzenforschung* (IPK) in Gatersleben, Germany. The average recorded yield is 8 tones of dry matter per hectare (Stolzenburg, 2004).

The *Gute Gelbe* clone has also German origin, available in the *Research center for special crops*, Austria (under the code WIES-D18). The recorded average yield is 10 tones of dry matter per hectare (Stolzenburg, 2004).

The *Violet de Rennes* clone is of French origin. The tubers are red-violet, pear-shaped. It matures late, the plant height can reach up to 2-3 m and the plant can form up to two shoots. It is available in the *Leibniz Institut für Pflanzengenetik Kulturpflanzenforschung* (IPK) in Gatersleben, Germany, and *L'Institut National de la Recherche Agronomique* (INRA), France. This variety has been used in numerous studies, mainly as a control crop to compare the new clones. The recorded average yield is 8.8 tones of dry matter per hectare (Fernandez, 1985).

The evaluation of the studied clones was conducted by analyzing the following morphological specifications: plant's height, leaf's shape and color, tuber's shape and the date of inflorescence emergence.

The experience of 2012 was only for guidance purposes because it was conducted at a preliminary stage of the detailed research. It was performed to verify

the previous studies on this species. Since the parcels contain a small number of plants and the variants are not arranged in multiple repetitions and they are not subject to a particular positioning mode, the data cannot be statistically used. The variations are compared between themselves to see whichever is the perspective ones, in order to be thoroughly investigated.

RESULTS AND DISCUSSION

The distribution of plant height

The growth dynamics of Jerusalem artichoke young shoots has been observed since planting (in the first decade of May) until mid-November. The shoots growth rate is different for each clone. While *Topstar* clone, for instance, has a rapid vegetative mass growth, the other two clones are slower. The vegetative mass growth of the early *Topstar* clone decreases from mid-June, when the flowering begins. The other clones, more late, reach the maximum rate of vegetative mass growth exactly in this period. The semi-late or late clones that produce vegetative mass up to October, reach heights that the early varieties achieve only partially.

Table 1

The plants height distribution in centimeters, for each clone

Date	Clone		
	Violet de Rennes	Topstar	Gute Gelbe
9th of May	28,8	19,3	24,5
18th of May	51,5	39,0	46,5
14th of June	171,5	143,3	145,8
19th of July	290,5	213,0	261,5
7th of September	398,5	218,0	393,3
16th of November	417,0	220,0	431,0

The phenotypic characteristics of the leaves

The clear description of Jerusalem artichoke clones can be very difficult due to limited cultivation and permanent replanting of the tubers derived from the crop, so a mix of varieties occurred and, consequently, heterogeneous populations. A sure classification can be usually made only for varieties with a typical appearance.

The propagating material of the present experiment comes from Mr. Georg Lindl from Bavaria, Germany. The tubers were received in small quantities, therefore the subsequent experiments will use the material produced by the first year of cultivation.

For a description of the Jerusalem artichokes varieties used in this experiment, we performed morphological assessments of the leaves. The shape,

size and color of the leaves of the leaves of Jerusalem artichoke clones under study are described as follows:

The *Violet de Rennes* clone

The upper part of young leaves is somewhat wrinkled, the shape is oblong, curved, not very narrow and pointed. The leaves are alternated positioned from the sixth to the eighth typical fully developed leaf.

The leaf's color is fresh strident spring green (light), the young leaves somewhat have a lighter color (almost yellowish green, bright).

The maximum length of the leaf is 17 cm, the maximum width is about 8 cm. The leaf length proportional ratio: leaf width (without petiole) = 1: 0.61.

The edge is serrated for the mature leaves, often forming 1 to 2 peaks in the last third of the leaf (1).

The mature leaf shape is almost round with a sharp end. They have a smooth surface, slightly curved only between the vascular bundles.

The leaf veins are highlighted, the leaf surface is covered with less visible hairs, and the leaf's veins on the inferior part are covered with trichomes.

Leaf tips are bent slightly downward; at the young leaves the laminae are slightly convex.

The large distances between the insertions on the gives a plant elongation impression.

The *Topstar* clone

The young leaf surface is wrinkled between conductive vascular bundles. The mature leaves have a smoother surface, but they partially buckle along the conductive vascular bundles. From the 9th fully growth leaf the arrangement is alternated.

The mature leaf shape is flat in the lower part of the plant, but pointed at the end. The leaves are large; at the top part of the plant the leaves are a little smaller, pointed, oblong, lanceolate.

The maximum length of the leaf is about 20 cm, a maximum width of about 11 cm The leaf length proportional ratio: leaf width (without petiole) = 1: 0.62.

The surface of the mature leaf is slightly hairy (trichomes). The veins on the inferior part of the plant are covered with hairs as well. The leaves are arranged horizontally on the twig.

From the base to the middle section of the plant the leaves are large. In the upper part of the plant, the leaves are smaller and fewer.

The angle between the petiole and young leaves lamina is about 100°-110° (round, downward protruding parts), and for the mature leaves is about 90°-110°.

The *Gute Gelbe* clone

The leaf's surface is much wrinkled, curled, almost silky. They are arranged on the stem from horizontally to vertically. The leaf edge is slightly curved forward. The layout is alternated from the 8th to the 10th leaf.

The mature leaves have a relatively smooth surface with slight convex sides along the conductive vascular bundles, which are however hairy. The leaves are arranged on the stem slightly bent.

The large leaves have a broad lamina, almost round with serrated edge. The leaf shape is similar to the *Topstar* clone, but a bit wider. The coloration is bright to medium green with pale yellow hues at the young stage.

In the lower half of the plant the leaves are especially large. At the top of the plant, they are small and sharp. The angle between the petiole and the lamina is about 90°, approx. right angles convex sides, almost heart-shaped.

The maximum length of the leaf is about 19 cm, a maximum width of about 12 cm. The leaf length proportional ratio: leaf width (without petiole) = 1: 0.69. The petiole is longer.

The date of inflorescence emergence

The studied clones differ widely at the flowering beginning. The Jerusalem artichoke generally falls into the category of short-day plant, so the inflorescence induction occurs after certain daylight duration as a result of phylogenetic adaptation. This is an advantage for the tubers crop and the nutrients content in the storage organs because the photosynthesis and the assimilation capacity is very high due to the high percentage of vegetative mass.

The *Topstar* clone blossoms between the first and the second decade of July, and the other two clones much later, in September.

Table 2

Date of flowering beginning for the studied Jerusalem artichoke clones

Clone	Flowering beginning 2012
Gute Gelbe	18th of September
Violet de Rennes	12th of September
Topstar	05th of July

Tubers' morphological particularities

The tubers of the artichoke varieties often exhibit typical shapes which at harvest can be round, oval, cylindrical, lanceolate or fusiform.

The tubers' number was different depending on the terrain and climate conditions, and in the case of Topstar clone side tubers appeared from ramifications at the armpit of the first cataphyll leafs.

Violet de Rennes

The tuber's shape is very inconsistent, oblong, oval, fusiform, cylindrical, round, completely different forms (as if it were more clones). The color of fusiform types of tubers is brown-beige, the oval types has light brown background, reddish-brown scales (strong, dark). The size is uneven; the most common is thick, large tubers.

Topstar

The tuber's shape is from partially to strongly oval branched. The background color is light beige, with light brown scales. The sizes are much differentiated, the length Is 4.0 to 8.0 cm, and the diameter is from 2.5 to 8.0 cm.

Gute Gelbe

The tuber's shape is round-oval, partly potato shaped, smooth. The background color is light brown (the buds), purple-red to dark brown for the scales, strong dark color. The length is approximately 4.0 to 15.0 cm and diameter is from 3.0 to 6,0 cm.

CONCLUSIONS

1. After the study conducted on the basis of information recorded in the specialty literature enough necessary data were structured to substantiate the nutritional value and the agronomic and economic importance of the Jerusalem artichoke.

2. The *Violet de Rennes* and *Gute Gelbe* late clones vegetate until October, reaching heights of four meters, while *Topstar* early clone grows up to a height of two meters.

3. A clear differentiation between the clones of Jerusalem artichoke can be difficult but the use of a detailed protocol for the leaves characterization can lead to the identification of strong recognition characters.

4. The inflorescence emergence date makes the obvious difference between the early *Topstar* clone which start blossoming from 5th of July and the late clones of *Violet de Rennes* and *Gute Gelbe* that bloom after 12th of September.

5. The studied Jerusalem artichoke clones have specific morphological shape, color and size of the tubers at the harvest moment.

REFERENCES

1. **Fernandez J., Curt M.D., Martinez M., 1988** – *Productivity of several Jerusalem artichoke (Helianthus tuberosus L.) clones in Soria (Spain) for two consecutive years (1987 and 1988), in Topinambour (Jerusalem Artichoke)*, Luxembourg, Commission of the European Communities (CEC), p. 61–66, Report EUR 13405.
2. **Pas'ko N.M., 1973**– *Basic morphological features for distinguishing varieties of Jerusalem artichoke*, p. 91-101, Publisher: Genetike i Selektsii, 50(2).
3. **Stan N., Munteanu N., 2003**– *Legumicultură specială, Vol. II,* Editura: "Ion Ionescu de la Brad", Iaşi.
4. **Stanley J.K., Nottingham S.F., 2008** – *Biology and Chemistry of Jerusalm artichoke Helianthus tuberosus*. Publisher: CRS, New York,.
5. **Stolzenburg K., 2004.** – *Rohproteingehalt und Aminosäuremuster von Topinambur*, LAP Forchheim, Germany, http://www.landwirtschaft-bw.info.

RESULTS CONCERNING THE GROWTH AND THE DEVELOPMENT OF THE TOMATOES GRAFTED SEEDLINGS

REZULTATE PRIVIND CREŞTEREA ŞI DEZVOLTAREA RĂSADURILOR ALTOITE DE TOMATE

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Abstract. *The research was realized in the Laboratory of Protected Crops of the ICDIMPH-Horting Bucharest, during the years 2008-2009. Were watched the growth and the development of the tomatoes grafted seedlings. The biological material used was composed from grafted seedlings, using two scions, tomatoes F_1 hybrids (Alambra and Cypriana) and rootstocks of Lycopersicon genus (Beaufort, Titron, Suketto and Konkurabe). The rootstocks have induced force at root and aerial part to grafted plants. Beaufort rootstock has obtained the best results, followed by Titron, then Suketto and Konkurabe. From registration of the growth and development indicators has resulted a superior quality of the grafted planting material, compared with the normal seedlings.*
Key words: *vegetable growing, planting material, quality indicators*

Rezumat. *Cercetarea s-a realizat în Laboratorul de Culturi Protejate al ICDIMPH-Horting Bucureşti, pe parcursul anilor 2008-2009. S-au urmărit creşterea doi şi răsadurilor de tomate altoite. Materialul biologic folosit a fost alcătuit din răsaduri altoite, folosind ca altoi doi hibrizi F_1 de tomate (Alambra şi Cypriana) şi portaltoi din genul Lycopersicon (Beaufort, Titron, Suketto şi Konkurabe). Portaltoii au imprimat plantelor altoite vigoare la nivel radicular şi la partea aeriana. Portaltoiul Beaufort a obţinut rezultatele cele mai bune, urmat de Titron, apoi Suketto şi Konkurabe. Din înregistrarea indicatorilor de creştere şi dezvoltare a rezultat o calitate superioară la materialul săditor altoit, comparativ cu răsadurile nealtoite.*
Cuvinte cheie: *legumicultură, material săditor, indicatori de calitate*

INTRODUCTION

Grafting the vegetables seedlings (solanaceous, cucurbits) is experienced in ICDIMPH-Horting from 2005 year.

The grafted tomatoes seedlings compared with normal seedlings have superior growth and development, are a valuable planting material, give quality of the crops and increased production. Also, the grafted plants are resistant to diseases (*Fusarium* spp., *Verticillium* spp.) and pests (nematodes) transmitted through the ground (Bogoescu et al., 2008).

The production technology of the grafted tomatoes has opened the prospect of a production in accordance with the standards required by the European

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market. The quality of the seedlings is critical to ensuring economic efficiency and environmental protection (Dobrin, 2005).

MATERIAL AND METHOD

In this experience, were investigated two F_1 hybrids of tomatoes (Alambra, Cyprian) used as scions and four F_1 hybrids of tomatoes (Titron, Beaufort, Suketto, Konkurabe) used as rootstocks..

Alambra - tomatoes F_1 hybrid with undetermined port, type "Long Shelf Life", suitable for cultivation in spaces protected and open field. It have tolerance to: *Tobacco mosaic tobamovirus* pathotype 0, *Cladosporium fulvum* race 5, *Fusarium oxysporum f.*sp. *lycopersici* race 2, *Verticillium albo-atrum* and *Meloidogyne* sp.

Cypriana - tomatoes F_1 hybrid with undetermined port, suitable for cultivation in spaces protected and open field. It have tolerance to: *Tobacco mosaic tobamovirus* pathotype 0, *F. oxysporum f.* sp. *lycopersici* race 1, 2, *V. albo-atrum, Meloidogyne* sp. and medium tolerance to *Tomato yellow leaf curl begomovirus*.

Titron is characterized by resistance to: *TMT* pathotype: 0,1,2, *V. albo-atrum*, *F.o. var. lycopersici* race 0,1, *F.o. lycopersici* race 0,1, *M. incognita*, *C. fulvum* a, b, c, d, e, V. dahliae. It is tolerant to *Pyrenochaeta lycopersici* and print to plants: rusticity and vigor. Is recommended especially on soils with strong attack of nematodes.

Beaufort is a rootstock that print the plant resistance to: *TMT* pathotype: 0,1,2, *V. albo-atrum*, *F.o. radicis-lycopersici* race 2, *M. incognita*, *M. javanica*, *C. fulvum, P. lycopersici , Clavibacter michiganensis* subsp. *michiganensis*. It is strongly recommended on terrains with strong attack by *P. lycopersici*. The plants are vigorous.

Konkurabe is a rootstock used for high resistance to: *TMT* pathotype: 0,2 *Ralstonia solanacearum*, *V. albo-atrum*, *F.o. lycopersici* race 0.1; *M. incognita*, *P. lycopersici, V. dahliae*. Gives plants a medium vigor, a shallow root system and is recommended for soils with high humidity.

Suketto is characterized by high resistance to: *TMT* pathype 0,2; *R. solanacearum, V. albo-atrum, F.o. lycopersici* race 0,1, *M. incognita*, *P. lycopersici*, *V. dahlia*. The grafted plants on this rootstock are vigorous. It is recommended at cultures with longer period of vegetation (Bogoescu et al., 2008).

Experience has included 10 work variants, each was obtained from 300 scion plants x 300 plants rootstock : V_1-Alambra F_1/Titron, V_2-Cypriana F_1/Titron; V_3-Alambra F_1/Beaufort V_4-Cypriana F_1/Beaufort; V_5-Alambra F_1/Konkurabe; V_6-Cypriana F_1/Konkurabe, V_7-Alambra F_1/Suketto; V_8-Cypriana F_1/Suketto, V_9-Alambra F_1 (control 1), V_{10}-Cypriana F_1 (control 2).

Observations and biometric measurements were made at the root system and the part aerial of the grafted seedlings and the normal seedlings (control).

The results were interpreted statistically (analysis of variance, Fisher test).

Variance analysis was performed concerning the total mass values, based of scion hybrid, for rootstocks experienced.

The statistical assurance of the differences between variants was determined using variance analysis (Iordăchescu, 1976).

RESULTS AND DISCUSSIONS

The results concerning the growth and the development of the normal and grafted tomatoes seedlings are shown in table 1.

Table 1

Indicators of growth of tomato seedlings at the time of planting

Variant	Combination (rootstock x scion)	Height of aerial part (cm)	Diameter of stalk (mm)	Roots length (cm)
V_1	Alambra F_1 /Titron	18,7	7,5	13,8
V_2	Cypriana F_1 /Titron	18,5	7	13,6
V_3	AlambraF_1 /Beaufort	17,8	8	14,5
V_4	Cypriana F_1 /Beaufort	17,6	8	14,2
V_5	Alambra F_1 /Konkurabe	19,5	7,5	12,6
V_6	Cypriana F_1 /Konkurabe	19,7	7	12,3
V_7	Alambra F_1 /Suketto	19,5	7,5	12,8
V_8	Cypriana F_1 /Suketto	20,0	7	12,5
V_9	Alambra F_1	20,3	6,5	11,5
V_{10}	Cypriana F_1	20,5	6	11,2

At all indicators of growth, are observed higher values in grafted variants compared with control variants, normals; less on the plant height (17,6-20 cm/grafted; 20,3-20,5/normals), elongation of plants was set on grafting (scions and rootstocks cut short).

For grafted plants, the highest values of the indicators determined (stalk diameter and root length) have obtained variants grafted on Beaufort rootstock (V_3, V_4).

Concerning the diameter of the stalk, followed grafted variants on others rootstocks (Titron, Konkurabe, Suketto). Is observed a higher growth in diameter at rootstocks grafted with Alambra scion (7,5 mm) compared with Cypriana scion (7mm). On normal plants, the stalk diameter values indicate a lower quality planting material (6 - 6,5 mm). At Root length, have followed variants grafted on Titron rootstock 13,6 - 13,8 cm (V_2, V_1), then Konkurabe rootstock 12,3 - 12,6 cm (V_6, V_5) and Suketto rootstock 12,5 - 12,8 cm (V_8, V_7), then normal plants 11,2 - 11,5 cm (V_{10}, V_9). Is observed a superior length at variants with Alambra scion.

The results concerning analysis of variance to total mass values, depending on the scion hybrid, for rootstocks experimented are shown in the table of the variances (table 2).

Table 2

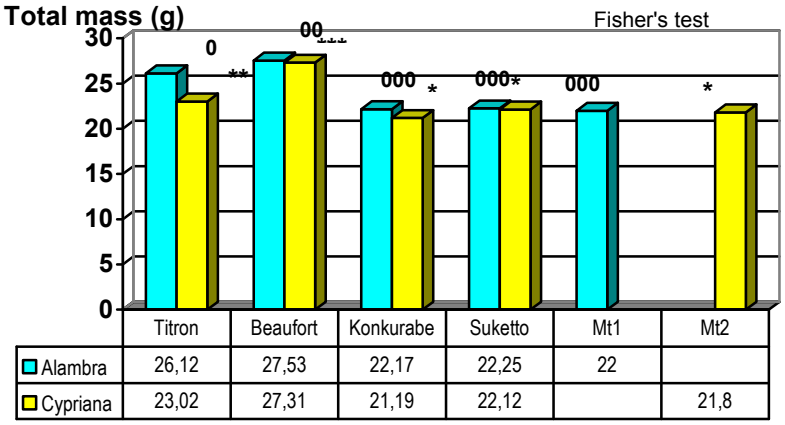
Analysis of variance for variants at total mass of tomatoes

Source of variance	SSD	DF	d^2	F
Between groups	0,32	1	0,32	2
Within the group	3,71	23	0,17	
Total		24		

By calculating the factor F of Fisher's exact test, were obtained the F function values: 4,28 and 7,88; it follows that it is less than the theoretical F factor for $\alpha = 5\%$ and $\alpha = 1\%$, so the difference between variances is insignificant.

Analyzing the results obtained on the variation of the total mass (g/pl.) - fig. 1, depending on the scion hybrid, for rootstocks experienced is observed that

lowest values were recorded at normal variants and large values at variants grafted on Beaufort rootstock; for all variants results are insignificant for both types of scion hybrids used in grafting (Alambra and Cypriana).



	Titron	Beaufort	Konkurabe	Suketto	Mt1	Mt2
Alambra	26,12	27,53	22,17	22,25	22	
Cypriana	23,02	27,31	21,19	22,12		21,8

Fig. 1 -Total mass variation depending on the scion hybrid, for the rootstocks investigated

At Alambra scion, the values were higher at grafted variants, at all rootstocks, but and at the control variants - normal Alambra was superior of the normal Cypriana variant.

CONCLUSIONS

1. At grafted seedlings studied, the growth indicators had superior values, quality comparative with the normal seedlings.

2. By cutting plants, at grafting was performed adjustment of the plant in height.

3. The rootstocks used in research has printed the plants vigor; the grafted tomatoes had the stalk diameter and roots length superior than the grafted tomatoes.

4.The total mass of the grafted seedlings was higher than that of the normal seedlings.

5. Alambra had determined a superior vigor to all combinations, compared with Cypriana.

REFERENCES

1. **Bogoescu M., Doltu M., Sora D., Iordache B., 2008** - *Results on establishing the technology for obtaining the tomatoes grafted seedlings designed for greenhouses.* Bulletin UASVM Horticulture Cluj-Napoca, vol. 65(1), p.147-152.
2. **Dobrin E., 2005** - *The setting up of the extra-early cultures from greenhouses by planting the seedlings.* Journal Horticulture no.4, Editura Agris Bucharest, p. 3.
3. **Iordăchescu O., 1976** - *The research methodology for vegetables valorisation technology*, M.AI.A., I.P. Official Bulletin.

RESEARCHES LOOKING THE INFLUENCE OF CULTURE AND THE NUTRITIOUS SOLUTIONS USED FOR GROWING AND DEVELOPMENT OF THE TOMATO TRANSPLANTAS (*LYCOPERSICON ESCULENTUM* MILL.)

CERCETĂRI PRIVIND INFLUENȚA SUBSTRATURILOR DE CULTURĂ ŞI A SOLUȚIILOR NUTRITIVE FOLOSITE ASUPRA CREŞTERII ŞI DEZVOLTĂRII RĂSADURILOR DE TOMATE (*LYCOPERSICON ESCULENTUM* MILL.)

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Abstract. *Seedling production is a very important technological sequence for achieving an early and mid-early production, superior in terms of quantity and quality. The main purpose of this paper is to introduce and made in our country an improved technology for producing seedlings that using small amounts of nutrient substrate and a relatively small production space to obtain quality seedlings, under total control of all factors technology with lower costs. Taking into account the main indicators of quality of seedlings was found that the best results were recorded in 3 variant which was used as a substrate a mixture of peat 85% + perlite 10% + 5% vermiculite.The plants were fertilized with FERTICARE foliar which contain both macro-and micro-elements. At the time of planting the seedlings had an average height of 19.9 cm, the diameter of the largest to the package (4.4 mm), the higher the number of leaves (10.1), the highest weight (23.8 g), the highest number of flowers and flower buds differentiate (4.3 or 6.5 inflorescences and flower buds).*
Key words*: tomato seedlings growing substrate****.***

Rezumat. *Producerea răsadurilor reprezintă o secvență tehnologică deosebit de importantă pentru realizarea unor producții timpurii, semitimpurii, superioare din punct de vedere cantitativ şi calitativ. Scopul principal al lucrării efectuate constă în introducerea şi în țara noastră a unei tehnologii îmbunătățite de producere a răsadurilor în care utilizând cantități reduse de substrat nutritiv şi un spațiu de producție relativ restrâns să se obțină răsaduri de calitate, în condiții de control total al tuturor factorilor tehnologici, cu costuri cât mai reduse. Ținând cont de principalii indicatori de calitate ai răsadurilor s-a constatat că cele mai bune rezultate s-au înregistrat în cazul variantei 3 la care s-a folosit ca substrat un amestec format din turbă 85% + perlit 10% + vermiculit 5%, iar plantele au fost fertilizate cu îngrăşământul foliar FERTICARE I care conține pe lângă macroelemente şi microelemente, la care în momentul plantării răsadurilor aveau o înălțime medie de 19,9 cm, diametrul cel mai mare la colet (4,4 mm), numărul cel mai mare de frunze (10,1), greutatea cea mai mare (23,8g), numărul cel mai mare de inflorescențe şi muguri florali diferențiați (4,3 inflorescențe şi respectiv 6,5 muguri florali).*
Cuvinte cheie: *tomate, răsaduri, substrat de cultură*

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INTRODUCTION

Seedling production is a very important technological sequence for achieving early production, mid early and total superior in terms of quantity and quality (Bartolini and Petruccelli, 1991).

Seedling production technologies practiced in our country until the beginning of this millennium,entails an intensive manual labor, energy and materials and as result the quality seedlings was often unsatisfactory (Ciofu et al., 2004; Stan and Stan, 2010).

New technology for the production of seedlings in cellular trays for fertilizing plants using nutrient solutions is already common in some European countries like the Netherlands, Spain, Greece, Italy etc. and North America, where, 92 % of vegetable crops are established by planting seedlings obtained by this technology (Atherton and Rudick, 1986). Should be noted that countries with advanced experience in using this technology widely Japan, Israel, Australia, South Korea, Taiwan, China, Colombia, South Africa etc. (Stan et al., 2003; Stan., 2005; Stand and Moraru, 2006).

The main purpose of this paper is to introduce in our country an improved technology for the production of seedlings in which small amounts of nutrient substrate using a relatively small production space to obtain quality seedlings, under the total control of all factors technology with a low price.

MATERIAL AND METHOD

The experiences have been carried out in the production spaces of S.C. Cox Farms Agriculture Romania S.R.L., located in Feteşti, Romania County.

As biological material we used tomato seeds (*Lycopersconesculentum* Mill.), variety Kristy 47, approved and placed in the Official Catalogue of varieties (hybrids) of crops in Romania, in 2001.

We used three substrates for culture and two foliar fertilizer solutions in the following experimental:

- V1- control (nutrient mixture consisting of 50 % manure + 30% + 20% ground celery sand by volume - called generic mixture 1) watering performed with water seeding was done in the substrate alveolar pallets;
- V2 - prepared mixture of 85 % peat forest moss (Sphagnum sp.) + 10 % + 5% vermiculite perlite by volume (mixture 2), marketed by the company HECOINC under the name HecoPlug Mix, imported from Canada, packed in plastic bags with a capacity of 110 dmc. This substrate was used fertilizer solution (solution 1), formula 13-4-20 +3Ca +4 Mg concentration as EC = 1.10 mS;
- V3 - prepared mixture of 85 % peat forest moss (Sphagnum sp.) + 10 % + 5% vermiculite perlite by volume (mixture 2), watered with fertilizer solution (solution 2) 15-30-15 formula (product I Ferticare made by company KEMIRA) EC concentration = 1.10 mS;
- V4 - nutrient mixture prepared from 60% forest peat moss (Sphagnum sp.) + 35% + 5% vermiculite perlite by volume (solution 3) in combination with fertilizer solution formula 13-4-20 + 3 Ca + 4 Mg with EC = 1.10 mS concentration (solution 1);

- V5 - nutrient mixture prepared from 60% forest peat moss (Sphagnum sp.) + 35% + 5% vermiculite perlite by volume (mixture 3) watering with fertilizer solution (solution 2) 15-30-15 formula (I Ferticare product of the company KEMIRA) EC = 1.10 mS concentration.

Summarizing the foregoing:

- **V1 (mt)** – mixture 1+watering;
- **V2** – mixture 2 + wateringwithsolution 1;
- **V3** – mixture2 + wateringwithsolution 2;
- **V4** – mixture 3 + wateringwithsolution 1;
- **V5** – mixture3 + wateringwithsolution 2.

The experience was just the plots subdivided for each variant had 3 repetitions of 15 pallets each alveolar.

Sowing was conducted from March 1 to 10, the blades alveolar black plastic, 54 cm x 27.5 cm with 288 cells (12 columns x 24 rows), with pockets in the form of a truncated pyramid with a square base, the largest side of 18 mm, the short side of 12 mm, the height is 36 mm.

They were filled with mixtures 1, 2 and 3 were experimental variants.

RESULTS AND DISCUSSIONS

Substrates and nutrient solutions used have influenced seedling growth expressed in their biometric parameters when planting, nutrients contents in the intensity of development of physiological indices and time to produce seedlings.

Of biometric measurements made at planting seedlings of tomato (Table 1-2.) shows that the variant (2-5) to which the mixtures are used as the substrate 2 (85 % peat + 10% + 5% perlite vermiculite) and 3 (60 % peat + 35 % + 5% vermiculite or perlite), the plants are fertilized with foliar solution 1 (14-4-20 + 3Ca +4Mg) and solution 2 (15-30-15), the seedlings were registered a growth rate and intense development, seedling height of these variants was higher compared to the control by 3.8 cm (V2) to 7.1 cm (V5), differences from control were statistically supported very significant.

Table 1

Characteristics of tomato seedlings (average data), Kristy -47 variety, the time of planting in the field.

Variant	High (cm)	Diameter (mm)	Leaf number			Inflorescences number	Floral buds number	Organogenesis stage of the first bud from the last inflorescence	Age (days)
			on the strain	in the apical bud	Total				
V1	15,7	3,9	4,1	3,2	7,3	3,2	4,7	IV	45
V2	19,5	4,2	4,3	4,2	8,5	4,1	5,2	IV	38
V3	19,9	4,4	4,5	5,6	10,1	4,3	6,5	Va	38
V4	19,7	4,1	4,2	4,1	8,3	4,3	6,2	III	40
V5	22,8	3,8	4,3	4,1	8,7	4,0	6,1	V_0	39

Increase in plant height was correlated with the number of leaves formed by the in variants 2-5 the time of planting was more than 1.2 to 2.8 compared to the control.

The following 2-5 under the influence of the substrate and of the solution used for fertilization, when measurements were carried out, were differentiated in addition to the blank version (V1) inflorescences 1-2 flower buds with all parts fully formed.

Table 2

Analysis of the culture substrate and fertilizers on growth, height and diameter of tomato seedlings

Variant	High (cm)		Differences (cm)	Signif.	Diameter		Difference	Signif.
	cm	%			mm	%	mm	
V1	15,7	100	-	-	3,9	100,0	-	-
V2	19,5	124,2	+3,8	xxx	4,2	107,7	+0,3	-
V3	19,9	126,7	+4,2	xxx	4,4	112,8	+0,5	x
V4	19,7	125,5	+4,0	xxx	4,1	105,1	+0,2	-
V5	22,8	145,2	+7,1	xxx	3,8	97,4	-0,1	-
			DL 5% = 1,52 DL 1% = 2,21 DL 0,1% = 3,32				DL 5% = 0,48 DL 1% = 0,70 DL 0,1%= 1,06	

By using growing media and fertilizers mentioned solutions in controlled environmental conditions in greenhouses has managed to obtain quality seedlings to shorten their production time by 5-7 days compared to the control (Fig.1).

Fig. 1 - Tomato transplants obtained in alveolar trays

The average weight of the vegetative mass of fresh seedlings had different valuesdepending on the variant and body parts of young plants. This ranged from 23.8 g to 14.3 g in the control and V3, which shows the difference between variants than force as a result of the influence of substrate and nutrient solutions used.

Differences between variants were seen in terms of the weight of the root system, the aerial and the mass ratios of aboveground part and root system (table 3).

Table 3.

The average weight of fresh vegetative mass (g) and total solids content (%) of tomato seedlings

Variant	Total weight (g)	Radicular part weight (g)	Aerian part weight (g)	Aerial part/ radicular part	Total dry matter (%)
V1	14,3	2,8	11,5	4,1	12,5
V2	19,4	4,1	15,3	3,7	15,8
V3	23,8	4,7	19,1	4,0	16,9
V4	20,8	4,4	16,4	3,7	15,2
V5	21,6	3,9	17,7	4,5	16,1

The percentage in the total solids of tomato seedlings, determined by drying in an oven at 105 ºC, is an attribute their quality of great importance, since this is the bigger seedlings are able to adapt more easily and better environmental conditions after planting in the field, plants make better and earlier productions, etc. The level of total solids content was different such maximum values were achieved in the variant V3, namely 16.9 %, the minimum being achieved in the case of V1 blank (Fig. 2).

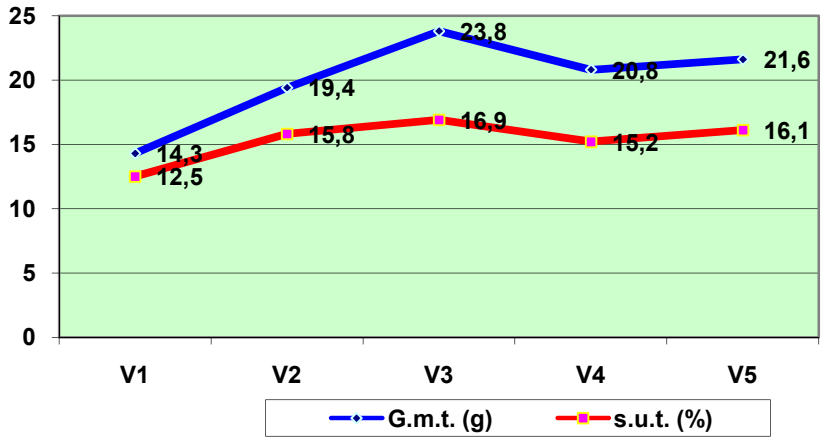

Fig. 2 - The average weight of vegetative fresh mass (g) and the content in total drayed substance (%)

CONCLUSIONS

1. Height growth of seedlings was influenced by the culture substrate and fertilizer solutions used in the sense that in all variants height growth of seedlings

was higher than that of the control, the differences which ranged from 3.8 cm (V2) to 7.1 cm (V5) were supported statistically very significant.

2. Height growth of seedlings was correlated with their diameter, the number of leaves formed, total weight, number of flowers and buds differentiated.

3. Taking into account the main indicators of quality of seedlings was found that the best results were recorded in 3 variant which was used as a substrate a mixture of peat 85 % + perlite 10% + 5% vermiculite and the plants were Ferticare foliar fertilization the fertilizer I which contain in addition to macro- and micro-elements, at the time of planting the seedlings had an average height of 19.9 cm, the diameter of the largest to the package (4.4 mm), the higher the number of leaves (10.1), the highest weight (23.8 g), the highest number of flowers and flower buds differentiate (4.3 or 6.5 inflorescences and flower buds).

4. For versions 2-5 and solution under the influence of substrate used in fertilizer when planting, seedlings were differentiated in addition to the control, 1-2 buds with all components fully formed.

5. Total dry matter content of tomato seedlings was influenced by two factors studied, ranging from 12.5% to 16.9 % in the control variant 3, it was generally superior version control 1.7 -4.4 %.

6. By using the substrate of culture and fertilizing solutions, the environmental conditions are controlled and guided to the optimum, in solarium has been able to obtain tomato seedlings quality and shorten production time for them by 5-7 days compared to the control and 15-20 days to the conventional technology.

REFERENCES

1. **Atherton J.G., Rudick J., 1986** – *The tomato crop a scientific basis for improvement.* Chapman and Hall, Londra.
2. **Bartolini G., Petruccelli R., 1991** - *Substrati utilizanti nell' allevamento delle piante in contenitore.*Colture protette, 7.
3. **Cioifu Ruxandra, Stan N., Popescu V. şi colab., 2004** – *Tratat de legumicultură.* Editura Ceres, Bucureşti.
4. **Indrea D. şi colab., 2007**- *Cultura legumelor* .Editura Ceres, Bucureşti.
5. **Stan N., Stan T., 2010** – *Legumicultură generală.* Editura Ion Ionescu de la Brad, Iaşi.
6. **Stan T., Moraru C., 2006**– *Istoricul producerii răsadurilor în România* .Lucrări şt., seria Horticultură, vol.49.
7. **Stan N., Munteanu N., Stan T., 2003** - *Legumicultură. Vol.III.*Editura Ion Ionescu de la Brad, Iaşi.
8. **Stan T., 2005** –*Tehnologia cultivării legumelor.* Editura Alfa, Iaşi.

CONSUMER PERCEPTION REGARDING THE DIFFERENCES BETWEEN ORGANIC AND CONVENTIONAL PRODUCTS, BY CATEGORY OF CHARACTERISTICS

PERCEPȚIA CONSUMATORILOR CU PRIVIRE LA DIFERENȚELE EXISTENTE ÎNTRE PRODUSELE ECOLOGICE ŞI CELE CONVENȚIONALE, PE CATEGORII DE CARACTERISTICI

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Abstract. *This study tried to get knowledge of consumer perception from Moldova area, towards differences between organic and conventional food products. It was performed on sample of 225 respondents and the data obtained from the survey were analyzed by SPSS version 20 program by chi-square test and correlation analysis. As a research method to quantitatively study used a questionnaire applied to their face to face by interviewers. The instrument used was a questionnaire consisting of 14 questions, including four sections: filter questions, consumer behavior, perception differences between organic and conventional foods (common) and demographic characteristics. The main points of purchase organic products are: domestic market, supermarket and health food stores. Thus, a higher percentage of women (87.13%) believe that ECO foods are healthier than usual while a higher percentage of men consider them as equally or less healthy than usual (23%). In the taste of organic products, 70.09% of women believe that organic food is more tasty than usual compared to only 52.53% of the men.*
Key words*: perception, survey, organic products, conventional products*

Rezumat. *Acest studiu a încercat să scoată în evidență percepția consumatorilor din zona Moldovei, cu privire la diferențele care există între produsele alimentare ecologice şi convenționale. Studiul a fost efectuat pe un eșantion de 225 de respondenți iar datele obținute din sondaj au fost analizate cu ajutorul unui program statistic, SPSS var. 20 pentru testul chi-pătrat și analiza corelației. Ca metodă de cercetare s-a folosit un chestionar, aplicat față în față pentru respondenți. Chestionarul a fost format din 14 întrebări, pe patru secțiuni: întrebări filtru, comportamentul consumatorului, diferențele de percepție între alimentele organice și convenționale (comune) și caracteristici demografice. Principalele puncte de produse ecologice de cumpărare sunt: piața internă, supermarket-uri si magazine alimentare de sănătate. Astfel, un procent mai mare de femei (87.13%) consideră că alimentele ECO sunt mai sanatoase decat cele convenționale, în timp ce un procent mai mare de bărbați consideră ca produsele ecologice sunt la fel sau mai puțin sănătose decât cele obişnuite (23%). În ceea ce priveşte gustul produselor ecologice, 70.09% dintre femei cred că alimentele ecologice sunt cu mult mai gustoase decât cele obişnuite, comparativ cu doar 52.53% dintre bărbați.*
Cuvinte cheie*: percepție, chestionar, produse ecologice, produse conveționale*

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INTRODUCTION

The concept of consumption must be presented and analyzed closely related with that of the need, the latter given regarding to the people needs, the economic units and institutions goods and services considered social scale.

Consumer behavior is a multidimensional concept designates that the overall approach, all acts decision made on an individual or group directly related to the collection and use of goods and services to meet current and future need, including decision-making processes that precede and determine these acts (Florescu, 2003).

Because the purchase is the result of interaction between the firm's activities and demographic characteristics, psychological and sociological consumer, it is essential for the company to understand their customers (Sasu, 2005).

Through consumption we will ensure the existence of people, satisfaction of the overall needs of the company and general development of the human personality. In a broader perspective, which includes consumption represents the needs of society, economic societies and institutions, as well as each individual.

We define consumption as an economic transaction consisting in the use of various goods and services - the damage, wear or incorporation into other products - to satisfy a need (Florescu, 2003).

Consumer behavior comprises all the actions involved in the selection, purchase, use and disposal of products or services. When people see an advertisement on TV, when you buy a pair of shoes, read a book or when you return and recycled glass packaging, they actually engage in consumer behavior.

Purchasing behavior and the less widely refer specifically to actions taken by consumers when deciding whether to buy or not to buy a product. Actual purchase decision is not adopted instant. It appears that the end result of a process sequence for a specific duration.

Behavior is always reported to a situation, a context, in this way situational influences occur as a result of factors beyond consumer or object (product) consumer behavior. Situational influences involving both subject (the consumer) and the object (product), being inherent in a given situation.

In analysis of consumer behavior marketers need to consider the following features: consumer behavior is dynamic, there are very few absolute rules of human behavior, consumer behavior determines interactions being necessary to know what consumers think (perception), I feel (feeling) and they do (behavior), and what are the factors that influence (environment) determines consumer behavior exchanges between participants in the sale, consumers are very different from each other, consumers act emotionally rather than rationally and act different distinct points in time consumer behavior can be influenced, it can learn and can change attitudes and behavior.

MATERIAL AND METHOD

Assumptions on which the present paper gone, has in view the following aspects:
a) Among people from Iasi there are many perceptual stimuli.

b) Investigation of consumer perceptions of organic products from Iasi.

c) The perception of people differ according to gender, age, education, income, occupation or socio-professional category.

d) Is there a connection between perception of people and age, income or socio-professional category.

To achieve the goal of this paper were fixed a series of objectives consistent with the assumptions stated above.

a) To find out the perception of people from Iasi regarding the consumption of ecological products.

b) To find out whether people's perception differs by gender, age, income, occupation or socio-professional category.

c) To find out if there is a link between the perception of people and age, income or their socio-professional category, and alternative lifestyles.

d) Assessing perceived by the population difference between organic and conventional vegetable production, in terms of evaluation criteria: taste, aroma, appearance, shelf life, health impacts and price.

e) Assessing the integration of ecological vegetable consumption of products.

Population and sampling. The total population of Iasi is 316 716, from which about 150 776 are men (48%) and 165 940 are women (52%) (Statistical Yearbook, 2007). The target market consists of people who have reached the age of 18 years (243 760 people) in urban areas, regardless of education, education, ethnicity, or religion.

To study the concept of perception from Iasi, it was chosen as the method data collection, quantitative research through investigation. The instrument used for this research is the questionnaire and it administration was based on an interviewer. The questionnaire will be applied on a sample of 225 individuals from Iasi.

The questionnaire includes 14 questions and is divided into two sections. Questions need to answer a series of well-defined features such as: easy to understand, that does not contain words that can not be understood by the respondents; are stimulants, that incite answer questions; to be precise, responses that lead to light and allow proper data processing.

The first section of 7 questions, concerns gender, age, education, income of family members, marital status and type of dwelling; to find out the gender and education were used nominal scales and for finding the age, the income, marital status and type of dwelling were used interval scales; questions on education and age were processed for under Romanian market characteristics; for finding the number of family members we used the open type question. Those two items concerning occupation and socio-professional category of people will demonstrate whether or not there is a connection between the concept of perceptual and occupation of persons and / or category to which they belong.

The second section, all 7 question concerns the perception and consumption of people, as it aims to find out respondents' perceptions about the consumption of ecological products.

Although it seems that the questionnaire is relatively small compared to what he wants to demonstrate, the questions are addressed in the way, that they can find important information on consumer perception of the organic vegetable products they use, and the reactions they have at the appearance of other new products.

The most mentioned differences between organic and conventional vegetables are artificial substances content, because they are healthier and tasty. Over 80% of respondents considered that organic vegetables are healthier than the usual ones. Over 60% believe that organic products are more tasty and goes bad faster than the usual ones.

The research was carried out as follows dates:

Table 1

The study period on the consumers perception towards the organic vegetable products

Stage Research	Period
Conceiving the questionnaire	4 – 8 March 2013
Pretesting the questionnaire	11 – 15 March 2013
Training the operators and multiplication questionnaires	March 20, 2013
Data Collection	March 25-April 19, 2013
Creating the database	22 – 26 April 2013
Data analysis	6 – 10 May 2013
Drafting the report	13 – 15 May 2013

The difference most frequently mentioned by respondents is the content of artificial substances (category which included responses with reference to artificial fertilizer, artificial coloring), representing 24.15% of the answers. That are healthier and better quality is the difference representing 22.64% of the responses and tastier 20.38% of the answers (figure 1).

Respondents percentage: 33.68% of the respondents said that the difference between organic and regular products vegetable is the artificial substances content, 31.58% mention the quality of organic vegetables and 28.42% mention that the organic products are healthier and tastier.

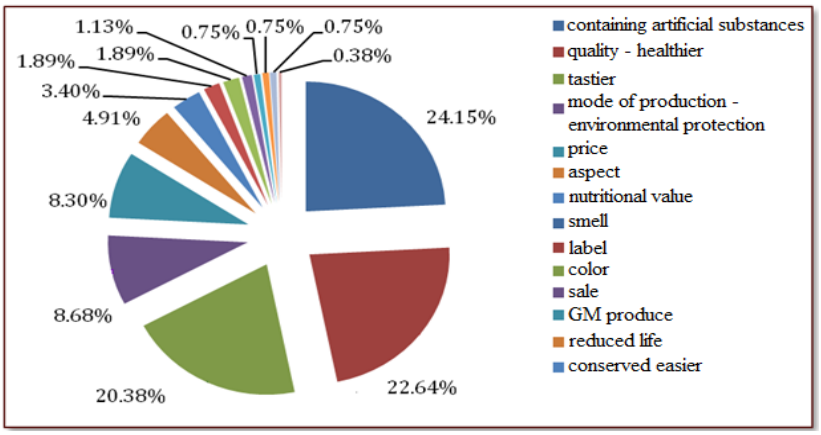

Fig. 1- Consumer perceptions between conventional and organic vegetable production

The results show that, from the point of view of the consumer appearance is not a clear difference between the organic vegetables and the normal ones. 45.74% of the respondents answered that the two categories of products have an equally pleasant aspect. 30.32% answered that organic vegetables have a more than pleasant aspect and 23.94% have a better look. The results are supported by those obtained previously analyzed question where appearance is referred to as the difference between the two product categories only 6.84% of respondents (figure 2).

The situation is quite different, however, when people are asked which of the two categories of foods are healthier, 82.09% believe that organic vegetables are healthier than the usual. A clear difference is observed in the case of the criterion of durability. Thus, 62.77% of the respondents consider that organic vegetables goes bad quickly than the normal, goes bad fast than the normal 21.28% and 15.96% goes bad harder than usual.

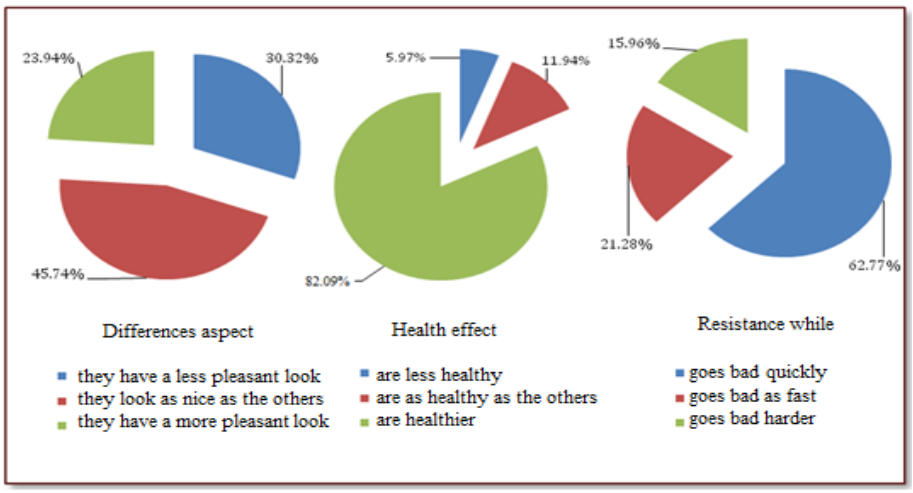

Fig. 2 - Perception of organic vegetables from the appearance, strength and nutritional value

Organic vegetables flavour is a feature that they are positive different from the usual 44.74% of the respondents said so. 34.21% believe that the two categories are as flavorful as the others and 21.05% that vegetables are less flavorful. In terms of taste, 61.65% of respondents believe that vegetables are tastier than usual, 22.82% consider them as tasty as the others and 15.53% consider them less tasty (figure 3).

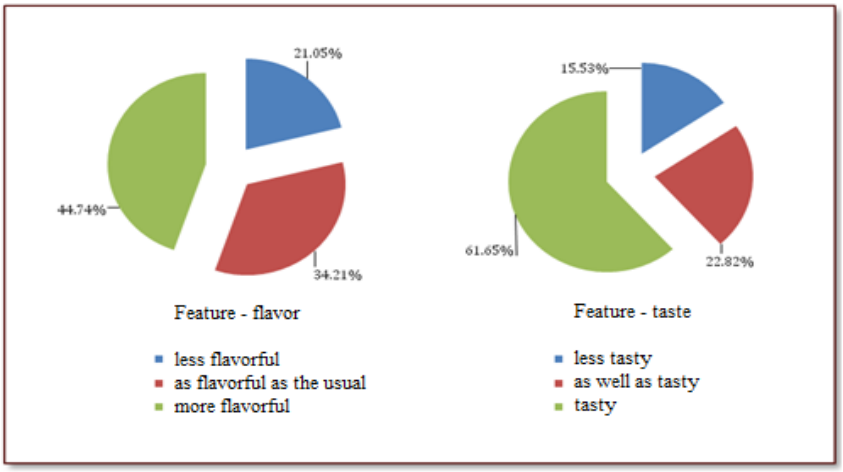

Fig. 3- Perception of organic vegetables by taste and aroma

CONCLUSIONS

1. The difference most frequently mentioned by respondents between organic and conventional vegetables is the content of artificial substances, representing 24.15% of the answers.

2. Regarding the aspect of the vegetables, 45.74% of the respondents answered that the two categories of products have an equally pleasant aspect, 30.32% answered that organic vegetables have a more than pleasant aspect and

23.94% answered that have a better look.

3. 82.09% believe that organic vegetables are healthier than the usual.

4. 44.74% of the respondents said that organic vegetables flavour is a feature that they are positive different from the usual.

5. In terms of taste, 61.65% of respondents believe that vegetables are tastier than usual, 22.82% consider them as tasty as the others and 15.53% consider them less tasty.

REFERENCES

1. **Florescu C., Mâlcomete P., Pop N. Al., 2003** - *Marketing: dicționar explicativ*, Editura Economică, Bucureşti, p. 153-166.
2. **Haghiri M., Hobbs J. E., McNamara M. L., 2009** - *Assessing consumer preferences for organically grown fresh fruit and vegetables in eastern New Brunswick*. International Food and Agribusiness Management Association, College Station, USA, International Food and Agribusiness Management Review, 12, 4, p 81-99.
3. **Harris M., Susan, 2007** - *Green Tick: an example of sustainability certification of goods and services*. Management of Environmental Quality: An International Journal, Vol. 18 No. 2, p. 167 – 178.
4. **Lea E., Worsley T., 2005** - *Australians' organic food beliefs, demographics and values*. British Food Journal, Vol.11 pp. 855-869.
5. **McEachern M.G., Willock J., 2004** - *Producers and consumers of organic meat: a focus on attitude and motivations*. British Food Journal, Vol. 7, p. 534-552
6. **Munteanu Neculai, Stoian Lucian, Stoleru Vasile, Fălticeanu Marcela, 2008** – *Baze tehnologice ale legumiculturii ecologice*, Editura Ion Ionescu de la Brad, Iaşi;
7. **Peattie Ken, Crane Andrew, 2005** - *Green marketing: legend, myth, farce or prophesy?, Qualitative Market Research:* An International Journal , Vol. 8 No.4, p. 357-370.
8. **Pieniak Z., Aertsens J., Verbeke W., 2010** - Subjective and objective knowledge as determinants of organic vegetables consumption. Elsevier Ltd, Oxford, UK, Food Quality and Preference, 21, 6, p. 581-588.
9. **Pratibha Goyal, Aditi Sharma, 2011** - *Consumer preferences for organized and unorganized food retail stores.*; Hind Agri-Horticultural Society, Muzaffarnagar, India, International Journal of Commerce and Business Management, 4, 1, p 65-68.
10. **Ramsey C.E., Rickson R.E., 1976** - *Environmental knowledge and attitudes*. Journal of Environmental Education, Vol. 8, p. 10 – 18.
11. **Roitner-Schobesberger B., Darnhofer I., Somsook S., Vogl C. R., Haas R., Canavari M., Slee, B., Tong, C., Anurugsa B., 2010** - *Consumer perceptions of organic foods in Bangkok, Thailand.* Wageningen Academic Publishers, Wageningen, Netherlands, Looking east looking west: organic and quality food marketing in Asia and Europe, p. 195-209.
12. **Sasu, C., 2005** - *Influența culturii asupra deciziilor privind marketingul mix în context decizional,* Ed. Universității „Al. I. Cuza", Iaşi, p. 12.
13. **Stan N., Stoleru V., Munteanu N., Stan T., 2005** - *The study of the attitude and preferences for organic vegetables depending on the education level of the respondents.* Lucrări Ştiinţifice, Universitatea de Ştiinţe Agricole si Medicină Veterinară "Ion Ionescu de la Brad" Iaşi, Seria Horticultură Vol. 48 p. 93-98.
14. **Tobler C., Visschers V. H. M., Siegrist M., 2011** - *Eating green. Consumers' willingness to adopt ecological food consumption behaviors*. Elsevier Ltd, Oxford, UK, Appetite, 57, 3, p. 674.

COMPARATIVE STUDIES ON THE BEHAVIOR OF HYBRID APPLE PROGENIES RESISTANTS TO *VENTURIA INAEQUALIS* UNDER FIELD AND "*IN VITRO*" CONDITIONS

STUDII COMPARATIVE PRIVIND COMPORTAMENTUL UNOR DESCENDENȚE HIBRIDE DE MĂR REZISTENTE LA *VENTURIA INAEQUALIS* ÎN CONDIȚII DE CÂMP ŞI ÎN CONDIȚII *"IN VITRO"*

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Abstract. *The priorityin the trees field is to reduce pesticide levels for environmentaly safe fruit production.In the short term, new varieties resistant to scab, tolerant to mildev and fire blight should be released at SCDP Voinesti in colaboration with . University of Agronomy Sciences and Veterinary Medicine Bucharest. Using the techniques in vitro multiplication of hybrid progenies of interest in further studies on genetic resistance to scab, with a low susceptibility to mildew and fire blight, quality of the fruit is also a top priority. The main objectives of this study is the implementation of a new program to improve the genetic resistance varieties of apple using different genotypes that were irradiated for the induction and stabilization of the resistance characters, and comparative study of these hybrid descendants under field conditions and conditions of culture "in vitro".Resistant varieties increase profits by reducing the number of treatments to 14 (number phenophases likely) plus the number of unwanted implications of climate events in the spread of disease. The paper presents data from the Ph. degree thesis in the frame POSDRU/107/1.5/S/76888, project financed from the European Social Fund through the Sectorial Operational Programme for Human Resources Development 2007-2013*
Key words: *Venturia inaequalis, apple, cultivars, in vitro, resistance.*

Rezumat: Prioritatea in pomicultura este de a reduce nivelurile de pesticide pentru producția de fructe sanatoase si în condiții de siguranță a mediului inconjurator.Pe termen scurt, noi soiuri rezistente la rapăn, tolerante la man ,fainare si foc bacterian au fost lansate la SCDP Voineşti, în colaborare cu Universitatea de Stiinte Agronomice si Medicina Veterinara Bucuresti. Ameliorarea genetică în cazul pomilor fructiferi este foarte lentă şi limitată; este nevoie de aproximativ 15 ani pentru a realiza un nou soi de măr cu valori genetice şi organoleptice mari. Folosind tehnici de multiplicare in vitro asupra unor descendențe hibride de mar F1 pot oferi o scurtare a acestei perioade clasice.O biectivele principale ale acestui studiu este punerea în aplicare a unui nou program de ameliorare a unor descendențe hibride de măr cu rezistență

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genetică la Venturia inaequalis folosind diferite genotipuri de măr care au fost iradiate pentru inducerea şi stabilizarea caracterelor de rezistenţă, şi de studiul comparativ al acestor descendenţe hibride, în condiţii „in vivo" şi condiţiile de cultura "in vitro". Răspândirea in cultură a soiurilor cu rezistența genetică este de perspectivă deoarece asigură profituri prin reducerea numărului de tratamente la 14 (corelate cu fenofazele de crestere), la care se adaugă scaderea implicațiilor nedorite a evenimentelor climatice în răspândirea bolii. Lucrarea prezintă date din teza de doctorat in cadrul POSDRU/107/1.5/S/76888, proiect finanțat din Fondul Social European prin Programul Operațional Sectorial pentru Dezvoltarea Resurselor Umane 2007-2013
Cuvinte cheie: *Venturia inaequalis, mar, soi, in vitro, rezistenta.*

INTRODUCTION

Breeding for disease resistance aims to develop varieties resistant to scab and molds. (B'enaouf and Parisi, 2004). Crosby et al. (1992) describes two basic types of resistance to apple scab, qualitative and quantitative. Segregating progenies in sensitive and resistant genotypes is guided by Mendel's laws. An important source Malus floribunda Sieb resistance is, clone 821. (Boone, 1971, Chevalier et al, 2004), "Prima" was the first variety resistant to scab, which was improved by gene Vf (Dayton et al. 1970). Along with development of resistance to apple scab, Venturia inaequalis new races were also identified (Parisi et al. 1993). In some varieties of apple genetic resistance is broked by the new races of the fungus Venturia inaequalis. The relationship "plant / pathogen" intreraction remained in a precarious balance. In addition to traditional approaches, DNA markers will be employed in the Romanian improvement programs. A majority of DNA markers for resistance to Venturia inaequalis is based on polymerase chain reaction (PCR). One of these markers detected mainly Vf gene Tartarini et al. (1999) are co-dominant markers specific PCR to detect homozygous dominant heterozygous and homozygous recessive.

MATERIAL AND METHOD

Biological material is obtained from maternal and paternal lines crossing used in the hybridization by sexual propagation through natural pollination varieties primarily with postmaturate seeds irradiated with doses of 5000 R (gamma), series hybrid, 1990, respectively H5/91- 90, H1/46-90, H3 / 123-90, H1/53-90, H2/44-90, and varieties with genetic resistance to diseases newly introduced in culture like: Redix, Remar, Iris, with different levels of resistance Vf gene or resistant varieties as General, Police, Florina with Vf resistance gene and Goldenspur - variety susceptible to scab, used as a control probs. (Figures 1)

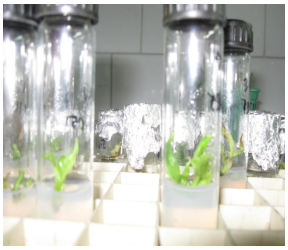


Fig.1 - Aspects of "in vitro" and "in vivo" cultures.

In 2011 sexual hybridization was performed following combinations:

1. Redix x H5/91-90
2. Redix x H1/46-90
3. Remar x Redix
4. H3/123-90 x Generos
5. Generos x H1/53-90
6. Goldenspur x H2/44-90

În 2012 sexual hybridization was performed following combinations:

7. Florina x Irisem
8. Goldenspur x H1/46-90.

Pathogen used consists of common Venturia inaequalis race.

RESULTS AND DISCUSSIONS

In the follow 8 combinations were pollinated the number of 3536 flowers, were harvested a number of 851 fruits which were extracted an number of 4624 hybrid seed. Some of these seeds were inoculated on culture medium "in vitro" and some were planted under field conditions for testing in field conditions.

These seeds were given 3787 hybrid plants that were transferred to strengthen field (Table 1)

Table 1

Results of hybrids under field conditions

No.	Combinations	Flowers polenateded	Hibrids obtained		No. of seeds	Ratio		No. of plants	
			No.	%		seeds/ fruts	seeds/ flower	No.	%
2011									
1	REDIX x H-5191-90	610	98	16,0	396	45	0,7	388	86,9
2	REDIX x H1/46-90	436	115	26,3	513	4,8	1,3	456	80,9
3	REMAR x REDIX	576	59	10,2	321	6,2	0,6	305	82,2
4	H-3/123-90 x GENEROS	835	78	9,3	381	5,5	0,5	391	90,7
5	GENEROS x H1/53-90	380	87	22,8	554	6,9	1,6	525	86,9

6	GOLDENSPUR x H2/44-90	390	280	71,7	1470	5,4	3,9	1220	86,3
2012									
1	FLORINA x IRISEM	182	71	39,0	303	4,9	1,9	288	
2	GOLDENSPUR x H1/46-90	127	63	49,6	286	5,3	2,6	214	
TOTAL		**3536**	**851**		**4224**			**3787**	

Results of hybrids under field conditions showed that the largest number of hybrid fruits are recorded in combination GOLDENSPUR x H2/44-90. Largest population in the number of seeds is the same combination GOLDENSPUR x H2/44-90 (Figure 2).

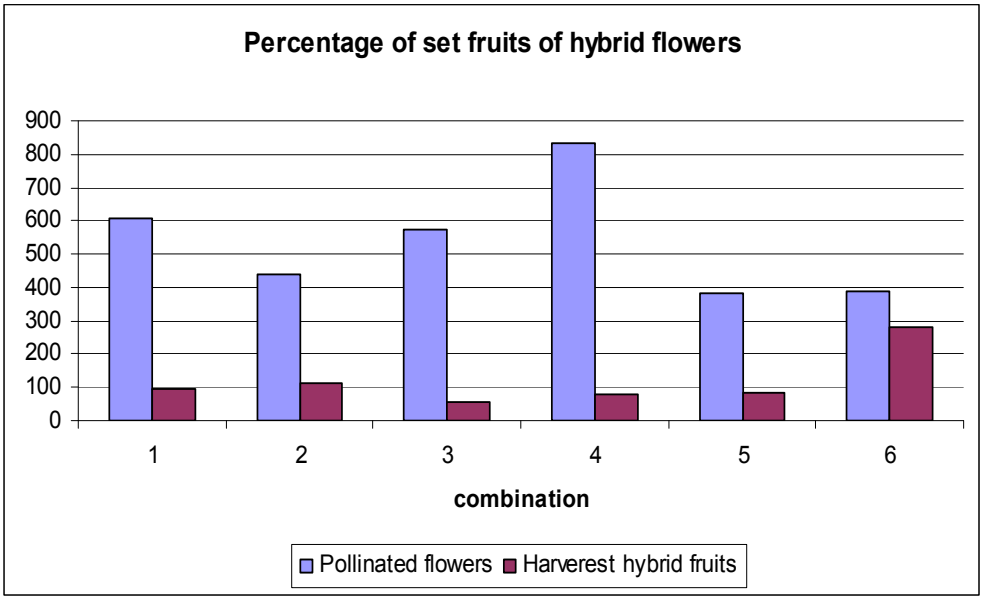

Fig. 2 - The percentage of flowers pollinated and hybrid number obtained (flowers pollinated / combination)

In Table 2, we can see that the same number of seeds, the best combination of multiplication with the highest percentage had Redix x H-5191-90 with 70%, followed by combinations REMAR x Redix 68% and x GOLDENSPUR x H2/44-90 56%. (Figure 3), Lowest in the multiplication behavior "in vitro" are combinations Generous x H1/53-90 24% (Table 2). Plants obtained are transferred to rooting medium will be inoculated with Venturia inaequalis common race and then followed to make reading visual symptoms on leaves and seedlings without symptoms will be tested by molecular techniques.

Table 2

The percentage of pollinated flowers and number of hybrid plants obtained

No.	Combinations	Polinated flowers	Hybrids seeds		No.of inoc.seeds. "in vitro"	No of plants	No. of shoots/ plants	%of multiplication
			Nr.	%				
1	REDIX x H-5191-90	610	98	16,0	50	35	3	70
2	REDIX x H1/46-90	436	115	26,3	50	23	2	46
3	REMAR x REDIX	576	59	10,2	50	34	2.5	68
4	H-3/123-90 x GENEROS	835	78	9,3	50	20	1.5	40
5	GENEROS x H1/53-90	380	87	22,8	50	12	1,6	24
6	GOLDENSPUR x H2/44-90	390	280	71,7	50	28	3	56
7	FLORINA x IRISEM	182	71	39,0	50	15	1.5	30
8	GOLDENSPUR x H1/46-90	127	63	49,6	50	13	0.9	26
TOTAL		**3536**	**851**		**400**	**180**		

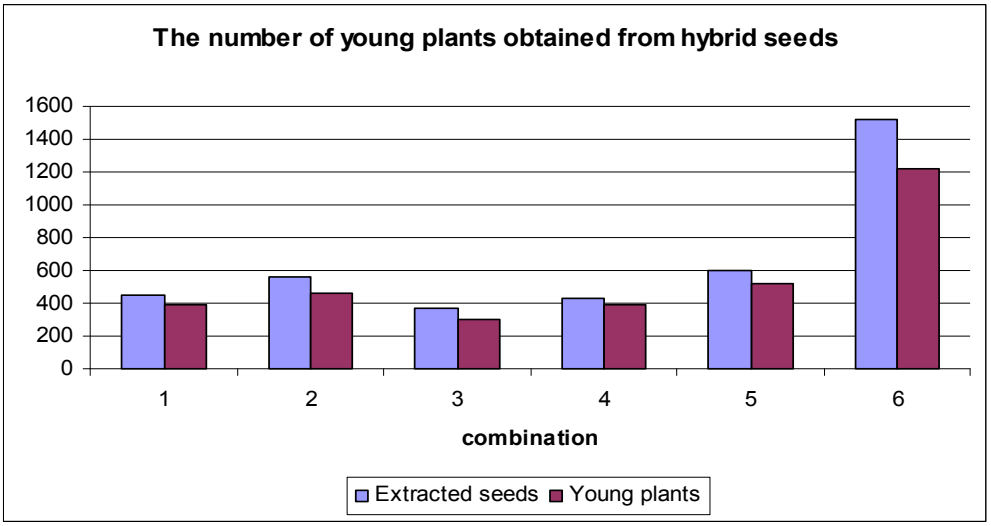

Fig .3 - Number of young plants produced from hybrid seed (young plants / combination)

CONCLUSIONS

Hybrids obtained at SCDP Voineşti in spring 2011 and 2012 were multiplied under "in vitro", most were suitable for this method, which allows a shorter period of this breeding programe with 2 years. Young plants obtained were artificially infected with scab in greenhouse conditions. The next step is to test this plant material phenotypic and molecular techniques.

***Acknowledgments**: This paper presents data from Phd thesis part of the project POSDRU/107/1.5/S/76888, funded by European Social Fund through the Sectoral Operational Programme Human Resources Development 2007-2013.*

REFERENCES

1. **Benaouf G., Parisi L., 2004** - *Genetics of host-pathogen relationships between Venturia inaequalis races 6 and 7 and Malus species*, -Phytopathology, vol. 90, no. 3, p. 236–242.
2. **Boone D.M.,1971 -** *Genetics of Venturia inaequalis,* Annual Review of Phytopathology, vol. 9, p. 297-318.
3. **Chevalier M., Bernard C., Tellier M. et al., 2004 -** *Host and non-host interaction of Venturia inaequalis and Venturia pirina on Pyrus communis and Malus x domestica*, ActaHorticulturae, vol. 663, p. 205–208.
4. **Dayton D.F., Mowry J.B., Hough L.F., Balley C.H., Williams E.B., Janick J., Emerson F.H., 1970** - *Prima – an early fall red apple with resistance to apple scab*. Fruit Var. Hort. Dig., 24, p. 20–22.
5. **Parisi L., Lespinasse Y., Guilaumes J., Kruger J. 1993** - *A new race of Venturia inaequalis virulent to apples with resistance to the Vf gene.* Phytopathology, 83, p. 533–537.
6. **Tartarini S., Gianfransceschi L., Sansavini S., Gessler C. 1999 -** *Development of reliable PCR markers for the selection of the Vf gene conferring scab resistance in apple*. Plant Breed., 118, p. 183–166.

STUDY ON THE INFLUENCE OF CLIMATIC CONDITIONS DURING THE REST PERIOD UPON APRICOT TREES FRUCTIFICATION IN THE N-E OF ROMANIA

STUDIUL INFLUENȚEI CONDIȚIILOR CLIMATICE DIN PERIOADA DE REPAUS A POMILOR ASUPRA FRUCTIFICĂRII CAISULUI ÎN ZONA DE N-E ROMÂNIEI

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Abstract: *The winter resistance of apricot is the limiting factor for the culture expansion of this specie. This feature is determined not only by the singular effect of temperature (as lowered), but also winter condition evolution and plant's ability to adapt to higher temperature amplitudes, combined with the presence or lack of snow. Winter resistance is influenced by heredity factor, trees degree of hardening for winter, trees age, fluctuations in temperature during the winter, the land exhibition and the technology applied last year. Environmental conditions in the N-E area of Romania compromise apricot trees fructification in some years, due to very low temperatures but especially temperature fluctuations during the rest period. In this paper we present the situation during 2006-2007 and 2011-2012, when the total production was affected even at Umberto and Goldrich varieties that are known to have good resistance to frost, as compared to other varieties*
Key words: *apricot, winter resistance, production affected.*

Rezumat: *Rezistența la iernare a soiurilor de cais, constituie factorul limitativ, pentru extinderea culturii acestei specii. Această însuşire este determinată nu numai de efectul singular al temperaturii (cât mai coborâte), ci şi de mersul vremii din cursul iernii şi de capacitatea plantei de a se adapta la amplitudini mai mari ale temperaturii, combinată şi cu existența sau lipsa zăpezii. Rezistența la iernare este influențată de: factorul ereditar, gradul de călire al pomilor pentru iarnă; vârsta pomilor; oscilațiile de temperatură din cursul iernii; expoziția terenului şi tehnologia aplicată în anul precedent. În condițiile ecologice din zona de N-E a României datorită temperaturilor foarte scăzute dar în special a oscilațiilor de temperatură din timpul perioadei de repaus, compromit fructificarea caisului în unii ani. În lucrarea de față se prezintă situația din anii 2006-2007 şi 2011-2012., când producția a fost total afectată chiar şi la soiurile Umberto şi Goldrich, care au o rezistență bună la ger în comparație cu celelalte soiuri.*
Cuvinte cheie: *cais, rezistență la iernare, producție afectată*

INTRODUCTION

Apricot varieties winter resistance it's a limitative factor for culture expansion (Istrate and Rominger, 1995).

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This feature is determined not only of singular fact of lower temperatures but also of weather forecast during winter and plant capacity to adapt to higher amplitudes combined with snow presence or absence (Cociu et al., 1993).

Winter resistance is a complex concept and consists of:

- trees resistance at first frosts from the beginning of winter;
- trees resistance at lowest and prolonged temperatures during winter time;
- trees behaviour at low temperatures that comes after warmer periods from January and February, fact that drove to loosing the hardening and further looses.

Winter resistance is influenced by: hereditary factor, hardening level for winter, trees age, temperature oscillations during winter, field exposition and the technology applied the previous year (Istrate et al., 1996).

MATERIAL AND METHOD

Biological material consists of 3 apricot varieties grafted on *Armeniaca vulgaris* Lam. rootstock The experimental orchard was established in 1987 with 3.5x4 m plantation distances. It was used the pyramid crown.

There were made observations of the minimum temperatures evolution from trees rest period during 1993-1994; 1995-1996; 2006-2007 and 2011-2012 when were registered obvious deviations from multi-annual average. There were also made some observations of the varieties ecological adaptation capacity.

RESULTS AND DISCUSSIONS

Apricot culture limitative factor, for North-East part of the country is the temperature oscillations during winter that make flower buds to lose the resistance capacity at low temperatures and even their total loss at lower temperatures. During winter apricot resists to -20…-27^{o}C if the applied agro technique assures a proper development and growing in the first part of the summer and a good wood maturation in the second part (Bodi and Dumitrescu, 1972).

The facts that amplifies frost effects are: trees important consumes after big harvests, tissues incomplete maturation, soil insufficient drainage, nutrients deficit or when some exceed, pests, late irrigations, trees vigour, inadequate pruning, temperature variations in a short interval, the stage when the frost comes (Bodi and Istrate, 1987).

Repose period is preceded by a nitrogen and phosphorous reserves migration from leaves to the other organs but also a hydro carbonate compounds migration. Trees suffer some changes at the end of the summer and during autumn in order to resist at winter frost. The hardening takes place under environment and internal factors influence, very similar in a way with those that determines the repose.

External factors are: the daily light decreases, the nights are colder, than follows temperatures below 0 until -5^{o}C. Internal factors consist of multiple changes of protein substances, lipids, carbon hydrates, organic acids, amino acids, nucleic acids and growth regulators.

Depending on specie, temperature and ecological zone, trees may start the repose at the end of October or beginning of November. In rest period at fruit

growing species physiological processes are not very intense, thus there take place starch, oils and tannin accumulations.

Analyzing buds level of resistance we find that during October and November when temperatures are not too low, flower buds can resist up to -14°C. -20°C temperatures are lethal for buds. On the contrary, at the end of November and during December flower buds resist very well at -22….-25°C. At the end of this stage flower buds usually register the maximum winter frost resistance.

If in years with extremely mild winters, during November and December could be observed that floral primordial grow. In years with severe winter frosts that begins in December or even in November, there could be the risk that trees not to be ready to pass the winter so the buds and even the offshoots to be frozen.

This situation was noticed during trees rest period (1993-1994), when in November were pretty low temperatures (-18°C on 27th of November), apricot trees that were in profound repose were not affected by the frost (Fig. 1).

First bud burnishes were could be noticed after leaves fall down, especially when sudden frosts come, at the end of October and at the beginning of November, exactly how happened in Iasi in some years.

An exception from climatic point of view is winter 1995-1996, when were frequently registered negative temperatures for a period of six months. Minim absolute temperatures were -9°C (November, 1995), -16.3°C (December, 1995), -16°C (January, 1996), -19.4°C (February 1996). This drove to good trees hardening and implicit to a better winter resistance of the apricot varieties.

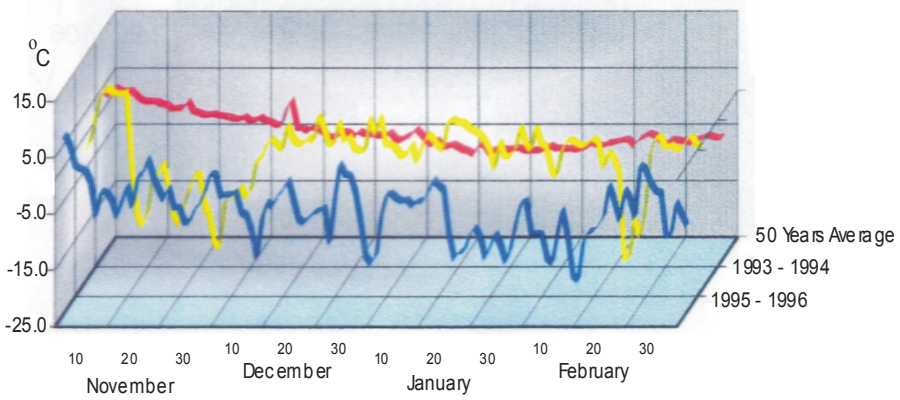

Fig. 1 - The evolution of minimum absolute temperatures during rest period in Iasi region

A better fruit tree plantations placement, depending on the favourability zone but also on temperature regime, choosing varieties resistant to the frost may diminish damages effects caused by winter frost. When environment temperature raises buds frost resistance lowers.

Big temperature oscillations during winter and especially at the end of winter, specific to our country (Iasi region particularly), lowers apricot winter resistance. In this way flower buds that passed through the winter and started vegetation may be affected by temperature of -13….-14°C (table 1).

Important damages were counted in February when after periods with positive temperatures from December and January came lower temperatures (-20,8°C) that destroyed completely the flower buds at all varieties.

Lower temperatures that come in February and March (when buds start their growing) affects flower buds or may provoke plagues on the tissues level of the branches. This period is characterized mainly by an intense increase of water content, fact that confirms buds transition from an obvious growing, more exactly cells elongation that is correlated with a bigger water inflow comparing with embryonic growth.

Buds total frosting registers specially in years when December, January and February are unusual warm, followed by sudden low temperatures at the end of February and the beginning of March. This situation was registered in Iasi, winter 2006-2007 (Fig. 2).

A similar situation was also recorded during the rest period 2011-2012, except that the period 25 January to 18 February minimum temperatures exceeded -13°C, with a maximum of -26.7°C (12 II). Buds loss due to the frost has a very characteristic aspect (Fig. 3). There could be noticed tissue burnish or only at the pistil base or of total floral parts.

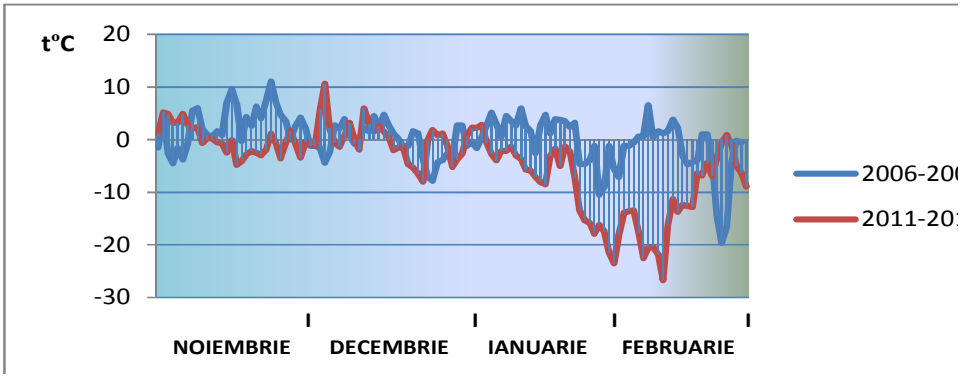

Fig. 2.- Minimum temperatures evolution during November - February 2006 – 2007 and 2011-2012.

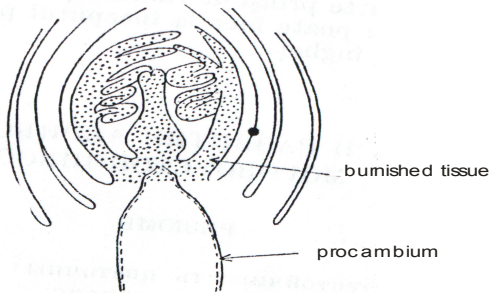

Fig. 3 - Apricot flower bud affected by -22°C temperature, in January

Table 1

Limits of low temperature resistance at apricot

Phenologic stage	Temperature °C		Predictable effects	
	Limits	Minimum registered	Minimum	Maximum
Deep winter rest period	Negative temperatures -25…-23°C	- 20…-23.9°C more than 2-3 days	6-90% frozen buds depending on the variety	Buds compete frozen and the loss of the harvest
Facultative winter rest	Temperature fluctuations +6…13.5°C	+16, -8…-16°C During a whole week	64-98% damaged buds	Flower buds and harvest total loss
		-21.6 block frost and 8 days ice	37-100% damaged buds	Flower buds and harvest total loss
The start of buds swelling	-13…-14°C	-7°C	40-60% frozen buds (good harvest)	80-90% damaged buds and harvest total loss
Buds swelling	-8…-9°C	-8°C	40-60% destroyed buds (economical harvest)	80-90% damaged buds, important harvest losses
Buds appearance	-7°C	-5.5°C	60-80% frozen buds	Buds and harvest total loss
The start of buds development	-3.9°C	-5°C	70-80% brown pistils, harvest decrease	100% of pistils are dark; harvest loss
Flowering	-2.2°C	-0.6…-3.2°C -3.5 …-5.5°C	90% of flowers are destroyed	100% of flowers are destroyed; harvest total loss
Petals fall	-3.2°C	-3.5…-5.5°C	70-80% of gynaecium are destroyed	Gynaecium is 100% dark; harvest loss
Young fruits development	-0.5°C 0.0…-1.5°C	1.0°C	Peduncles are frozen and 60% of fruits fall down	Fruits massive fall; harvest loss
Growing fruits	-1.0°C		fruits fall down 70% harvest decrease	Fruits massive fall; harvest loss
Trunk rest period	-28…-30°C			Tissue, bark and wood frozen

Buds sensibility, especially apricot, is bigger when they are in an advanced stage of development and also depends on their position on the crown tree. Thus, buts located on thick branches are much resistant than those placed on thin branches and the ones situated in the lower part of the crown are more affected by low temperatures comparing with ones from the top of the crown.

Short branches tissues and the bouquets are affected starting from down. More affected are the libber and cambium. Plagues provoked by winter frost at long branches are more reduced, mainly because the fact that the flower buds from these branches are late in development.

Apricot flower buds winter frost resistance is correlated with growing and development stages. At apricot buds with early differentiation during summer "grow old a little bit faster", being the fundamental cause of lower winter frost resistance in steppe conditions.

CONCLUSIONS

The North East region of Moldavia is suitable for apricot culture. The specie is drought resistant but it's located at the Nordic limit of culture for our country.

There are exceptions (once at 8-10 years), when because of temperature oscillations during winter as result of very low temperatures (-32.5^{o}C, winter 1962-1963), the production was compromised.

Unfavourable years for apricot culture in Iasi region were: 1962-1963, 1984-1985; 1993-1994; 2006-2007 and 2011-2012(3).

From all rootstocks used for apricot, peach give a reduced vigour and a better winter resistance comparing with *Armeniaca vulgaris* Lam. (2).

REFERENCES

1. **Bodi I., Dumitrescu Gh., 1972** – *Comportarea unor soiuri de cais în zona colinară a Moldovei,* Cercetări agronomice în Moldova, vol. 3, Iaşi.
2. **Bodi I., Istrate M., 1987** – *Comportarea în livada superintensivă a unor soiuri de cais altoite per zarzăr şi piersic*. Cercetări agronomice în Moldova, vol. 3, Iaşi
3. **Cociu V. şi colab., 1993** - *Caisul*, Ed Ceres, Bucureşti.
4. **Istrate M., Rominger M., 1995** – C*ontribuții la îmbunătățirea sortimentului de cais pentru zona de N-E Moldovei*. Cercet. agr. în Moldova, vol. 1-2, Iaşi. p. 161-166
5. **Istrate M., Grădinariu G., Dascălu M., 1996** - *Observații privind rezistența la iernare a unor soiuri de cais, în condițiile ecologice din zona colinară a Moldovei.* Lucr. şt. U. A. M. V. Iaşi, seria Horticultura vol. 39,. p. 71-76.

FERTILITY, VIABILITY AND THE GERMINATION CAPACITY OF POLLEN TO SOME SWEET CHERRY CULTIVARS

DETERMINAREA FERTILITĂȚII, A VIABILITĂȚII ŞI CAPACITATEA DE GERMINARE A POLENULUI LA UNELE SOIURI DE CIREŞ

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Abstract: *This paper's aim is the study of fertility, viability and germination capacity of pollen to some sweet cherry cultivars ('Andrei', 'Cociu', 'Margo', 'Iosif', 'Alex', 'Ludovic', 'Anda', 'Paul' and 'Mihai') created at Fruit Growing Research Station Iasi, Romania to establish the posibility of use them as suitable pollinators in breeding programs. The natural fertility was determined on control branches by counting of 200 flowers on each cultivar (by 50 in all cardinal points), by labeling the respective branches and by counting the fruits resulted after binding. The pollen germination was made on solid nutritive medium. The pollen viability was determined by the method carmine-acetic. The most of the studied cultivars had a high degree of pollen germination (of over 43%), percent considered as satisfying for a normal fructification to the sweet cherry species. From this point of view they can be recomended as potential genitors in the future breeding papers.*
Key words: *cultivars, sweet cherry, fertility, pollen, viability, germination.*

Rezumat: *Scopul acestei lucrări este evaluarea fertilității, viabilității şi a capacității de germinare a polenului la unele soiuri de cireş (Andrei, Cociu, Margo, Alex, Mihai, Ludovic, Anda, Paul şi Mihai) create la SCDP Iaşi, în vederea stabilirii posibilității utilizării acestora ca polenizatori în programele de ameliorare. Fertilitatea naturală s-a determinat pe ramuri de control prin numărarea a 200 de flori la fiecare soi (câte 50 în cele 4 puncte cardinale), etichetarea ramurilor respective şi numărarea fructelor rezultate după legare. Germinarea polenului s-a realizat pe mediu nutritiv solid. Viabilitatea polenului a fost determinată prin metoda carmin-acetică. Majoritatea soiurilor luate în studiu au avut un grad ridicat de germinare a polenului (peste 43%), procent considerat ca fiind satisfăcător pentru o fructificare normală la specia cireş. Din acest punct de vedere pot fi recomandate ca potențiali genitori în viitoarele lucrări de ameliorare.*
Cuvinte cheie: *soiuri, cireş, fertilitate, polen, viabilitate, germinare.*

INTRODUCTION

The researches concerning fertility and germination capacity of pollen have a great practical importance, being directly related with fruit's harvest quantity and

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quality and also a great theoretical importance, especially in knowledge of the value of a cultivar as pollinator and in reference as potential genitors in the works of new cultivars breeding (Cociu and Oprea, 1989; Budan and Grădinariu, 2000; Butac, 2006).

To be assured that the pollination results will be positive, it is necessary that the inherent value of pollen to be known (Cociu and Oprea, 1989; Koyuncu and Tosun, 2008). Evaluation of pollen quality is made often by tests 'in vitro' from where it's determined the viability, germination capacity of pollen and the rate of pollenic tube growing (Cociu and Oprea, 1989).

The aim of this paper were the study of viability and germination capacity of the pollen to some sweet cherry cultivars (nine cultivars) obtained at Research and Development Station for Fruit Growing, Iaşi - Romania for establishing the value of each cultivar as pollinator.

MATERIAL AND METHOD

The study was made on a number of nine sweet cherry cultivars (*Andrei, Cociu, Margo, Alex, Mihai, Ludovic, Anda, Paul* and *Mihai*) obtained at Research and Development Station for Fruit Growing, Iaşi – Romania.

The natural fertility was determined on control branches by counting a minimum of 200 flowers per cultivar (minimum 50 in the four cardinal points), the labeling of the branches and the counting of the fruits resulted after onset fruiting (Cociu and Oprea, 1989; Botu and Botu, 1997).For determining the viability and the germination of the pollen, the flowers were harvested in the stage of bud before flowering, in the spring of 2012. The anthers were excised and kept in Petri dishes for 24 hours at room temperature to release the pollen. Pollen germination was carried out on solid medium consisting of 15% sucrose, 1.5% agar and 2% boric acid (Pirlak and Bolat, 1999). For pollen germination, the Petri dishes were kept at 20^{o}C and humidity of 70-90% in dark room for four hours and after that the growth of the pollenic tube was stopped with chloroform. The examination was made with the optical microscope Motic with an objective of 4x and 10x. The length of the pollenic tube was evaluated with the camera soft and it was expressed in µm. To estimate the viability of the pollen, it has been fixed in Carnoy fixative for 12 hours and then was stored in a refrigerator in alcohol 70% solution.

The fixed pollen was colored with acetic carmine and visualized with the Motic optical microscope. The viable pollen is colored in carmine red and the sterile pollen gets colored in pink or it remains colorless (Cociu and Oprea,1989; Botu and Botu,1997).

The statistical interpretation of data was calculated with the variation coeficient (s%) for which are allowed arbitrary the next values:

- 0 – 10% - low variation coeficient;
- 10 – 20% - average variation coeficient;
- 20 – 30% - high variation coeficient.

RESULTS AND DISCUSSIONS

The climatic conditions from flowering period (14.04-3.05), were termic favorable, so the average temperatures in this period were between 7.9°C – 23.4°C, the maximum absolute temperature was 31.3°C (in 3rd of May) and the minimum absolute temperature was 6.1°C (in 18th of April)(fig.1). The relative air humidity in the same period had values between 40% - 98% (fig.2). There

was rainfall in the 8 days consecutive (all the day long) between 14th-21st of April, the values beeing between 1.2 - 13.2 mm (fig. 2). Rainfall in this period were unfavorable for pollination or fecundation with negative influence for pollen germination and for flying pollinators agents.

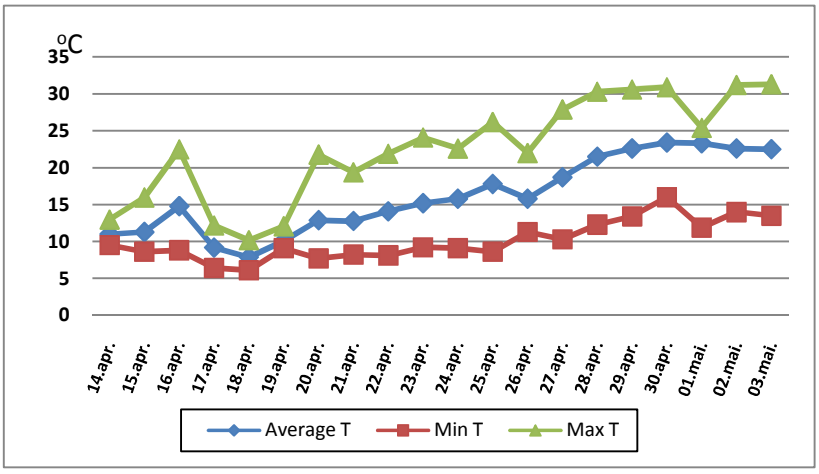

Fig. 1 – The temperature evolution in flowering period (April – May 2012)

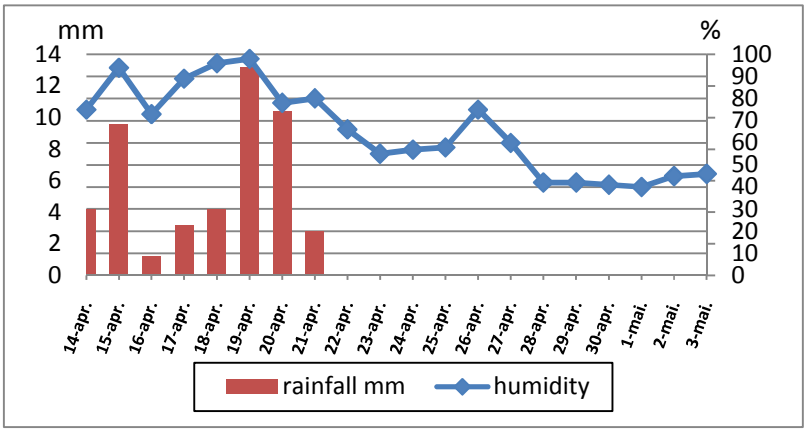

Fig. 2 – The rainfall and relative air humidity evolution in the flowering period (April – May 2012)

Coefficient of fertility by open pollination is a key element in appreciation of the pollinators value. The values of this coeficient are influenced by the flowering degree of the cultivars, the number of flowers affected by frost, the branches position in crown, the climatic conditions from the flowering period or the presence of bees for pollination etc. (Istrate, 1998).

Observations have shown that at sweet cherry tree species is considered as the highly productive cultivars of which the fertility index (i.e. the percentage of fruits results determined at 25-30 days after petal fall) recorded values of

minimum 30-35% (Cociu and Oprea, 1989). Analyzing the obtained results for the natural fertility coeficient to the nine sweet cherry cultivars, it seems that the values were between 8.8% (at *Iosif* and *Andrei*) and 70.3% (at *Paul*). For the most of the cultivars (*Cociu, Margo, Alex, Anda, Mihai* and *Paul*) the fertility index registered values over 30% (fig. 3).

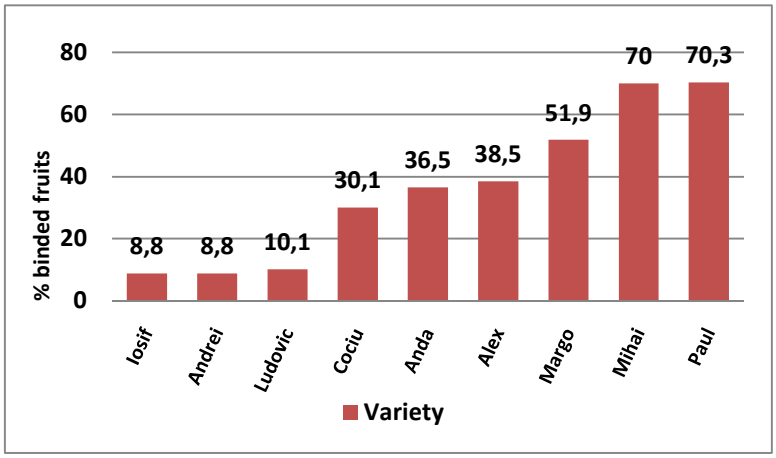

Fig. 3 – The sweet cherry cultivars behaviour in the free pollination conditions (Iasi, 2012)

The pollen must have a good viability, it must hev a good quality and it must to have high values of germination. The pollen viability was greater percentage then the capacity of germination for all the studied cultivars, result that beeing similar with the other results from literature (Ganeshan, 1989).

The values of this indicator varied between 75.33% (at *Mihai)* and 88.96% (at *Andrei*), registering a low variation coeficient (5.78%)(tab.1),(fig.4).

For fruit tree species, the capacity of germination and the growing rate of the pollinic tube are the most important features for the evaluation of the pollen quality, because for an eficient fertilization it is required a high germination capacity for pollen and a high growing rate for the pollinic tube. This fact was found by many researches that showed that most times, the pollen germination capacity and the environment conditions from the flowering period determined the binding degree of the fruits (Beppu et al., 2005).

The pollen germination capacity had values between 18.38% (at *Iosif*) and 76.02% (at *Margo*) with a variation coeficient of 34.46%, that indicates a big variability for this feature (tab. 1).

The low values registered to *Iosif* (18.38), *Cociu* (33.15) and *Anda* (36.73) can be determined by the influence of the abiotic factors (the continue rainfall from the flowering period and the minimum absolute temperature of -24.3°C in air and -32°C at soil (12th of February, 2012) from the vegetative repose period (Kolesnikov, 1959) on the pollen germination capacity (fig. 2).

The most studied cultivars (*Margo, Paul, Mihai, Andrei, Ludovic* and *Alex*) had a high pollen germination degree, over 43%, percent considered by other authors (Sharafi & Bahmani, 2010) being satisfactory for a normal fructification for sweet cherry tree, so, from this point of view, these cultivars can be recommended as potential genitors in the future breeding programs (tab.1),(fig.4).

Table 1

Pollen's viability, germination capacity and pollenic tube's length

Cultivar	Pollen viability%	Germination capacity %	Pollenic tube length – µm-	
			Average	Standard deviation
Iosif	80,66	18,38	57,53	± 17,30
Paul	76,74	64,79	76,83	± 17,19
Andrei	88,96	56,19	112,35	± 12,52
Cociu	81,46	33,15	89,45	± 11,14
Margo	78,62	76,02	76,02	± 10,12
Alex	88,11	43,54	66,34	± 13,24
Mihai	75,33	56,98	102,54	± 14,23
Ludovic	84,09	46,24	59,24	± 12,14
Anda	76,67	36,73	115,45	± 12,42
Media	81,18	48,00	83,11	
Variation coeficient %	5,78	34,46	25,63	

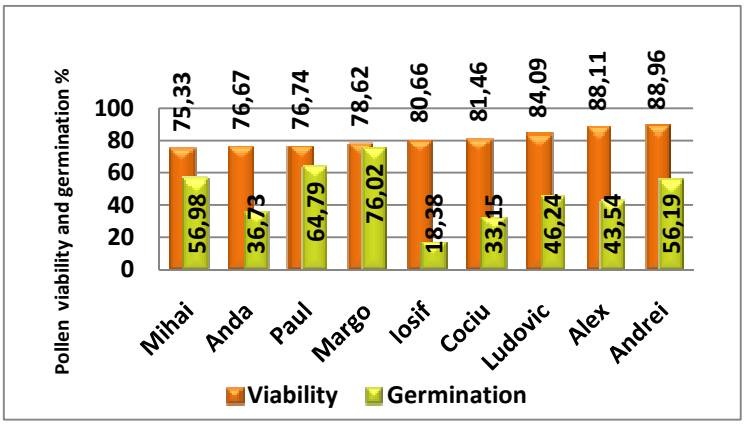

Fig. 4 – The dynamic of pollen viability and the germination capacity to nine sweet cherry cultivars

For the cultivars with high germination capacity there was not seen mandatory a big rate of growing for the pollenic tube. The greatest length of the pollenic tube was at *Anda* (115.45 µm), *Andrei* (112.35 µm) and *Mihai* (102.54 µm) (tab.1).

CONCLUSIONS

1. The obtained results show that the sweet cherry cultivars *Margo, Paul, Mihai* and *Alex* can be used as potential genitors – from the point of view of fertility, viability and pollen germination capacity – in the breeding work papers.

2. The high variability of the germination capacity '*in vitro'* of the pollen is generated both by the differences of genetic order between the studied cultivars and the negative effect of the very low temperatures, registered in the period January-February 2012. Because of this, it can be said that the cultivars *Margo, Paul, Mihai* and *Alex* manifested an increased resitence to frost – a very important feature for created of new sweet cherry cultivars adapted to climatic condition from this area..

REFERENCES

1. **Beppu K., Komatsu N., Yamane H., Yaegaki H., Yamaguchi M., Tao R., Kataoka I., 2005 -** *Se-haplotype confers selfcompatibility in Japanese plum (Prunus salicina Lindl).* J. Hortic. Sci. Biotech., 80, p. 760–764.
2. **Botu I.**, **Botu M., 1997 -** *Metode şi tehnici de cercetare în pomicultură*, Editura Conphys, Rm. Vâlcea, 327 pag.
3. **Butac Mădălina, Militaru Mădălina, Branişte N., Budan S., 2006 –** *Fertilitatea şi capacitatea de germinare a polenului la unele genotipuri de măr, păr, prun, cireş şi vişin utilizate ca genitori potențiali în lucrările de ameliorare,* în Lucrările ştiințifice ale ICDPP Piteşti-Mărăcineni, vol. XXII, Editura Pământul, Piteşti.
4. **Budan S., Grădinariu G., 2000 –** *Cireşul,* Editura Ion Ionescu de la Brad, Iaşi, 262 pag.
5. **Cociu V., Oprea Şt., 1989** – *Metode de cercetare în ameliorarea plantelor pomicole*, Editura Dacia, Cluj-Napoca, 172 pag.
6. **Kolesnikov M.A., 1959 –** *Cereşnia*. Gos. Iyd. Seliscohoziaistvenoi Literaturâ, Moscova.
7. **Koyuncu F., Tosun F., 2008 -** *Evaluation of pollen viability and germination capacity of some sweet cherry cultivars grown in Isparta, Turkey;* Proc. 5th I.C. on Cherry, Eds.: A. Eris end M. BuraK, Acta Hort., nr. 795, vol. 1, ISHS, p. 71-74.
8. **Istrate M.**, **1998 –** *Contribuții la stabilirea sortimentului de vişin pentru zona de N-E a Moldovei,* Teză de doctorat, ASAS Bucureşt, pp. 137.
9. **Parfitt D.E. and Ganeshan S., 1989 -** *Comparison of procedures for estimating viability of Prunus pollen*. HortScience, 24 (2), p. 354–356.
10. **Pirlak L., Bolat I., 1999 -** *An investigation on pollen viability, germination and tube growth in some stone fruits*. Turk. J. Agric. For., 23, p. 383-388.
11. **Sharafi Y., Bahmani A., 2010 -** *Study of pollen germination and tube growth in some Iranian Loquat cultivars and genotypes.* 3th International Symposium on Loquat May. Antakya. Turkey, pp. 3-6.

STUDIES ON BIOLOGICAL PECULIARITIES OF GROWTH AND DEVELOPMENT ROOTSTOCK AT DIFFERENT GRAFTING METHODS

STUDII PRIVIND PARTICULARITĂȚILE BIOLOGICE ALE CREŞTERII ŞI DEZVOLTĂRII PORTALTOIULUI LA DIFERITE METODE DE ALTOIRE

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Abstract. *Modernization (improvement) propagation technologies by grafting fruit trees species at the table constitute and is an ongoing concern in the research field, both nationally and internationally. Thus, it requires further research and experiments and after approval of new varieties / rootstocks high value in terms agrobiological to establish the most efficientmethods to increase efficiency work. In this study we proposed modernization of technological sequences on the table and containerization grafting, fruit tree seedlings grafted on different rootstocks and follow the behavior combinations variety / rootstock in the nursery.*
Key words*: table grafting, grafting in "Ω", grafting in "V".*

Rezumat. *Modernizarea (perfecționarea) tehnologiilor de înmulțire a speciilor pomicole prin altoire la masă a constituit şi constituie o preocupare permanentă în domeniul cercetărilor, atât pe plan național, cât şi internațional. Astfel, se impune continuarea cercetărilor şi experimentărilor şi după omologarea unor noi soiuri/portaltoi cu valoare ridicată din punct de vedere agrobiologic pentru a stabili cele mai eficiente metode de lucru pentru creaşterea randamentului la înmulțire. În prezentul studiu ne-am propus modernizarea unor secvențe tehnologice privind altoirea la masă şi containerizare, a materialului săditor pomicol altoit pe diferiți portaltoi şi urmărirea comportării combinațiilor soi/portaltoi în pepinieră.*
Cuvinte cheie: *altoirea la masă, altoirea în "Ω", altoirea în "V".*

INTRODUCTION

Grafting at the table has the advantage that shortens with one year the dates of grafted trees production, allows mechanization for the grafting process reducing the consumption of labor and eliminates the need for specialization for long time (Baciu, 2005). In the production units of grafted trees can be achieved using a continuous flow sheet in which rootstocks and scion branches occur during the growing season, harvested in autumn, is

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maintained and is grafted to the table throughout the rest period (Teodorescu and Neculae, 1998).

A few years ago, worldwide grafting at the table in protected areas are used mainly in walnut, but in recent years, this method was extended to other tree species, considering that it can run in dormant period, ensuring continuous flow of work a limited number of permanent workers (Elfving and Schecter, 1993).

MATERIAL AND METHOD

Like study material were used the varieties: Romus 3, Monica, Stanley and Stella, each one grafted on two rootstocks by three different methods(grafting in "T", "Ω" and "V").

The studies focused the influence of grafting methods on fruit tree seedlings obtained at different tree species.

The experiment was placed in a plot from Raducaneni nursery where was planted rootstocks from apple, pear, plum and cherry at a distance of 0,2 × 0,9 m for grafting method ("T"grafting) and the material grafted at table by two types of joint, first they were perforced (contained, callused and rooted). For each one of species was used two rootstocks which was grafted in August (for"T"grafting) and in March (for table grafting in"Ω"and "V"). In all cases was applied specific technology for nursery, specific agronomic works, phytosanitary treatments, irrigation and in June, fertilization.

The experiment, organized in randomized blocks, with three repetitions, ten tres for each repetition is polyfactorial with three experimental factors studied(4×2×3) resulting 24 variants.

The experimental factors were:

Factor A – species	**Factor B– roothstock**	**Factor C – Grating method**
a1: apple – varietyRomus 3	b1 – high vigor roothstock	c1 – grafting in „T"
a2: pearr – variety Monica	b2 – low vigor roothstock	c2 – grafting in „Ω"
a3: plum – variety Stanley		c3 –grafting in „V"
a4: cherry – varietyStella		

RESULTS AND DISCUSSIONS

1.1 Aspects about tree diameter in different methods of grafting

The mutual interaction between the two symbionts causes changes in the anatomy of hipobiontului but especially the epibiont. For this reason to have a complex image in which the clamping force of the tree grafted and the graft were determined diameter of the tree measured above and below the graft (graft or rootstock diameter) and determining the relationship between the two (Santos, 2004).

At higher values of apple species tree diameter (measured both the scion and the rootstock) were grafted on MM 106 variations recorded in the two methods of grafting at the table to grafting in occultation ("T") (table 1).

Comparing the trees diameter bellow the grafting is found that in use of rootstock with higher vigor (MM 106) as well as small vigor (M 9) together with combination change of both symbionts was an increase in thet hickness

of the rootstock and the scion higher percentagec ompared to the situation in which was grafted inoccultation with latente bud. Regarding the tree above the graft diameter, differences recorded between the two rootstocks grafted variants were statistically significant only at the table grafting variants in"Ω".

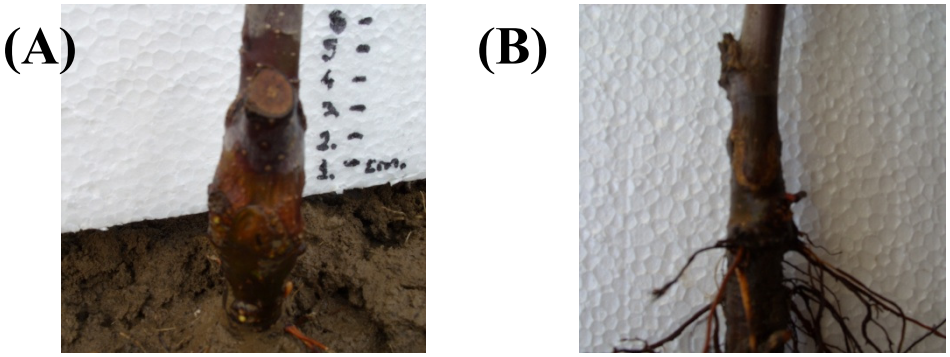

Fig.1 -Apple variety “Romus 3” on roothstock MM106, grafting in “Ω”-(A); grafting in “V” (original)

On pear as in apple species was observed the same trend of increasing diameter trees with using grafting in the table.

Also, there was a clear difference between variants grafted on different rootstocks, values recorded in the case of grafting on rootstocks franc Harbuzesti surpassing ones due to variants grafted on quince (table 1).

Grafting on quince resulted in a decrease of up to 11%, of the diameter of the rootstock grafted version "V" from the control in the case of a reduction of 10.5% graft of this indicator values.Positive differences were reported for grafting in the "Ω" to control and to the grafting of the "V" both above and below the graft (table 1).

In plum, higher values of trunk diameter variations were recorded in grafted on *Prunus cerasifera,* which may be due to the higher vigor of this rootstocks (table 1).

The variants grafted on *Prunus domestica* rootstock grafting methods on the table did not affect significantly the diameter trees under or above the graft, causing a significant decrease of this indicator most of all above the grafting, respectively 1.07 mm (grafting in”Ω”) and 1.62 mm (grafting in "V"). In contrast, the variants grafted on *Prunus cerasifera* values of these indicators were significantly decreased both scion and rootstock diameter just grafting in "V" that was performed grafting (tab.1.1).

It was also observed that grafted on *Prunus domestica* variants have a higher degree of uniformity in respect of the diameter trees (both the scion and the rootstock) to variants grafted on *Prunus cerasifera*.

Table 1

The average diameter of the trunk at speciesa pple, pear, plum and cherry

Variety/ Roothstock	Roothstockdiameter (mm)						Graftdiameter (mm)					
	V1 = „T”	V2 = „Ω”	V3 = „V”	DL 5% (mm)	DL 1% (mm)	DL 0,1% (mm)	V1 = „T”	V2 = „Ω”	V3 = „V”	DL 5% (mm)	DL 1% (mm)	DL 0,1% (mm)
Romus 3/ MM 106	25,72$^{(Mt)}$	28,99 ^{xxx}	26,32	0,82	1,33	2,55	17,21$^{(Mt)}$	24,64^{xxx}	18,36	1,52	2,44	4,51
Romus 3/ M9	22,44$^{(Mt)}$	27,43 ^{xxx}	25,62 ^{xxx}	0,83	1,44	2,64	16,36$^{(Mt)}$	22,15^{xxx}	17,53	1,11	1,81	3,42
Monica/ Harbuzesti	17,36$^{(Mt)}$	18,44	17,67	1,12	1,94	3,53	14,57$^{(M)}$	16,36 ^{xx}	15,40 ^{x}	0,64	1,03	1,95
Monica/ Quincetype A	15,34$^{(Mt)}$	16,45	14,75	1,07	1,87	3,48	12,89$^{(Mt)}$	13,10	12,27	1,79	3,12	5,73
Stanley/ P. Franc	14,28$^{(Mt)}$	13,37	13,12	1,33	2,12	3,87	12,40$^{(Mt)}$	11,33 ^{0}	10,78 ^{00}	0,88	1,46	2,84
Stanley/ P.cerasifera	18,55$^{(Mt)}$	19,23 ^{x}	17,51 ^{00}	0,39	0,67	1,29	16,55$^{(Mt)}$	17,54 ^{x}	15,23 ^{00}	0,85	1,25	2,50
Stella/ IPC1	16,49$^{(Mt)}$	18,31^{xxx}	19,17 ^{xxx}	0,54	0,94	1,65	14,21$^{(Mt)}$	15,81	15,24	1,40	2,38	4,42
Stella/ Mahaleb	19,47$^{(Mt)}$	20,63 ^{xx}	19,70	0,74	1,08	2,04	17,37$^{(Mt)}$	16,53 ^{0}	14,87 ^{00}	0,77	1,17	2,33

In contrast to other species, the species cherry trees values larger diameter (measured at the level of the scion and rootstock) were determined at the variants grafted on the *Prunus mahaleb*, while trees grafted on the IPC1were recorded lowest values of this indicator (table 1).

Analyzing the variation of this indicator in this species was a trend for reduction of its values to the values scion on rootstock grafting rootstock from *Prunus mahaleb*. Although the variants grafted on IPC1, diameter below the graft showed lower values compared to those determined for the variants grafted on *Prunus mahaleb*, it is found that if vegetative rootstock grafted to mass variations recorded significant differences compared to control.

Regarding graft diameter, where grafting was performed on generative rootstock was a decrease in this indicator values were used when grafting on the table instead the trees grafted on rootstocks vegetative state was diametrically opposed, values of this indicator reduced by 10.5% (from grafted variant Ω) and 11.68% (the variant grafted in "V") (table 1).

1.2 Ratio between the diameter graft and the rootstock

The ratio of the diameter of the scion and rootstock is used in literature as an important indicator in evaluating the success of grafting.A report diameter graft / rootstock diameter with values as close to one, indicates a welding and optimal vascularization of the two partners, ensuring normal growth and development subsequently grafted tree.

Regarding the ratio of the diameter of the scion and the rootstock (both measured at 2 cm from the area of grafting) can say that it varied according to species and grafting methods applied (Figure 1).

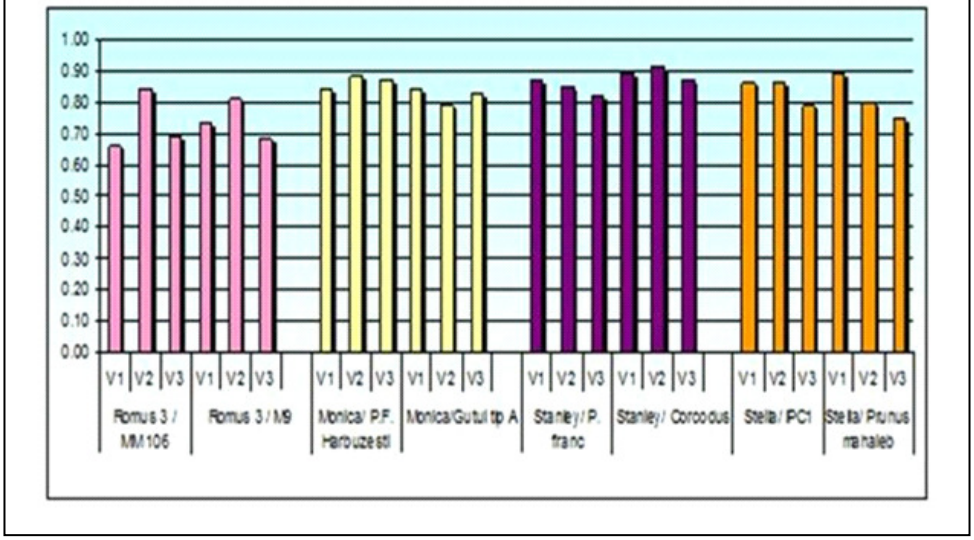

Fig. 1- Ratio between diameter graft/diameter rootstock at some tree species using different grafting methods(V1=”T”; V2=”Ω”; V3=”V”)

Increasing the thickness of the rootstock at a rate faster than the scion subunit caused a report to all variants. Pear species (Monica / Quince), plum (Stanley / PF) and cherry grafted on the table, caused a slight decrease in the ratio from field grafted variants (control). It is also possible that in the area of the graft to be some malfunction that prevents assimilate transport to graft thereby limiting growth.

The values of the ratio between the graft and the rootstock diameter increased with the use of "Ω" grafting method, which is up to version Stanley / *Prunus cerasifera*, Monica / PF Harbuzesti, Romus 3 / MM106 and Romus 3 / M9 (Figure 1).

A comparative analysis of the four species can be seen that the influence of grafting methods on the value ratio diameter graft / rootstock diameter is proportional to the vigor rootstock.

CONCLUSIONS

Tree diameter varies with the use of different methods of grafting.This is considered normal, because combining the two symbionts in various forms, causes callus grafting better or less good.

Grafting at the table welding and lead to a better vascularization in variants grafted on rootstocks higher than those at which grafting was performed on smaller rootstocks.

REFERENCES

1. **Baciu A., 2005-** *Technologies for effective and rapid seedling tree growing in the container,* Journal of Policy Science and Scientometrics - Special Number ISSN 1582-1218.
2. **Elfving D. C, Schecter I., 1993** – *Fruit count, fruit weight, and yield relationships in Delicious apple trees on nine rootstocks,* HortScience vol.28, p.793-795.
3. **Santos A., 2004 -** *Sweet cherry (Prunus avium) growth is mostly affected by rootstock and much less by budding height*, New Zeeland Journal Of Crop And Horticultural*Science,* vol. *32*, p. 309–318.
4. **Teodorescu A., Neculae L., 1998 -** *New items in breeding technologies trees, fruit trees, strawberry plants and deontological,* Scientific Studyes of ICPP Mărăcineni Pitesti, Volume XIX, Ministry of Agriculture, Academy of Agricultural and Forestry Sciences "Gheorghe Ionescu Siseşti" Sc. Gooseberry Editorial office Agricole SA, Bucharest, p. 65-71.

MORPHOGENESIS OF WALNUT (*JUGLANS REGIA* L.) FLOWERS AND POLLEN QUALITY DEPENDING OF ROOTSTOOCK AND WATER CONTENT OF SOIL

MORFOGENEZA FLORILOR FEMININE ŞI CALITATEA POLENULUI LA NUC (*JUGLANS REGIA* L.) ÎN DEPENDENŢĂ DE PORTALTOI ŞI CONŢINUTUL DE APĂ DIN SOL

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Abstract. *There are presented data concerning the influence of rootstock species (Juglans regia L. and Juglans nigra L.) and water level of saturation of soil (70% of whole content) on the of organogenesis process and the development of embryological structures of female flowers and pollen within dichogamous walnut varieties. In spite of more prolonged terms of initiation there is detected favorable influence of irrigation on the development of flower structures during the first stage of organogenesis: July-August within all dichogamous types. The most accelerated processes of morphogenesis were established for protoginous genotype on rootstock Juglans regia L. Obtained results shows that the end of female flower structures differentiation (in spring period), pollen diameter and viability there not connected with the hidrophisical soil parameters as well as rootstock Juglans regia L. and Juglans nigra L.*
Key words: *walnut, flower morphogenesis, rootstoock, irrigation*

Rezumat. *Sunt prezentate cercetări privind influenţa portaltoilor (Juglans regia L. şi Juglans nigra L.) şi a nivelului de asigurare a solului cu apă (70% din capacitatea totală) asupra proceselor de organogeneză şi de dezvoltare a structurilor embrionare a florilor femele şi a polenului în cadrul soiurilor dichogamice de nuc. La primele faze de iniţiere a structurilor florale (iulie-august) s-au depistat termene mai prelungite de organogeneză în cazul irigării la toate tipurile dihogamice. Cel mai accelerat ritm de morfogeneză s-a evidenţiat pentru genotipurile protogine, altoite pe portaltoiul Juglans regia L. Rezultatele obţinute demonstrează că primăvara, sfîrşitul diferenţierii structurilor florii femele, diametrul polenului şi viabilitatea lui nu depind de parametrii hidrofizici ai solului precum şi de portaltoii Juglans regia L. sau Juglans nigra L.*
Cuvinte cheie: *nucul, morfogeneza florilor, portaltoi, irigare*

INTRODUCTION

The problems of initiation and development of flower buds represent a major interest within fruit production of fruit trees. In the same time those are coherent aspects of genetics and breeding strategies of long and short terms creation of news varieties regarding adequate requirements of market, biodiversity conservation, etc. For apple, *Malus domestica* the most representative species of

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temperate zone, there are already published a lot of data regarding the above noted problem (Hanke et al., 2007). a special interest actually in the republic of Moldova is accorded to walnut culture. There are established a lot of new orchards. Some European varieties, created for different conditions of European country.

There are registered for promotion local varieties, well adapted to pedological and climatic condition of the country, as well as some European introduced varieties, created for different zones of walnut cultivation. Is it well known that walnut represent a south fruit tree species with high requirements to light, heat and water. In this context it is necessary to considering specific roots peculiarity (system of roots) of walnut trees, which could growing during almost all year: namely when the soil temperature is above $+5^0$ C (Mihăiescu, 1998), without obligatory rest period (for example like aerial part).

Therefore, water deficit of the period of flower buds initiation during July month, concomitantly with fruit development, and general programming of the yield for the next year play a special role for walnut. In the scope of diminish negative effects within walnut tree development, optimal tree loading for fructification, normal fruit set and its next development with the guarantee of quality formation, initiation of fruiting for the next year and generally insurance of stability in fruit production.

Establish of optimal irrigation scheduling is related with annual phenological stage of tree, with determination of period when water is more important for optimal development and fructification of walnut tree (Germain, 1999; Pîntea, 2004).

MATERIAL AND METHOD

Experimental investigations were effectuated in the fields of Experimental Station of Research Institute for Horticulture. Soil-ordinary chernoziom water level of saturation of soil (70% of whole content), irrigation - on furrow. Local registered walnut varieties Chişinevschi, Schinoschi, şi Costiujenschi, including all dichogamous types: protandrous, protoginous, homogamous were grafted on two rootstocks (*Juglans regia* and *Juglans nigra* L. Microscopical analysis were effectuated according standard methods (Cociu and Oprea, 1989; Mănescu et al., 1989).

RESULTS AND DISCUSSIONS

Investigations regarding the influence of rootstock and water insurant of soil under morphogenesis of flower buds there are very important for fruit trees species and particularly for walnut. In general until now there not formatted an unique conception regarding the influence of humidity of soil and air under the flower initiation at fruit tree species, especially for walnut. We could mentioned Mauget J.S. (Maughet, 1977), who during the experimentations of walnut variety Pedro with different degrees of water insurant of container soil, concluded that for the development of flower buds a high water insurance of soil is favorable.

Ours investigations are consecrated to attend during all annual cycle the influence of water insurant of soil upon the stages of flowers differentiation

depending on rootstock *Juglans regia* and *Juglans nigra* L. and type of dichogamy at varieties: Chişinevschi (homogamous), Schinoschi (protoginous), and Costiujenschi (protandrous).Two conditions of soil humidity maintenance in different period (experimental irrigation of orchard on furrow during the months June – September and its absence) there are experimented the following ones: 70% of total water insurant of soil and 30-40% of total water insurant of soi – without irrigation. There by ours researches demonstrate that initiation and differentiation of main female flowers are proceed during more than nine months.

According our general scheme, elaborated on the basis of cytological, histochemical and integral embryologic approaches (fig. 1) it is necessary to distinguish 9 stages, 3 of them are related to the summer-autumn period of bud development. Average obtained data, concerned the dynamic of all initial meristematic formations demonstrate that in summer-autumn period irrigation slow down rhythm of organogenesis at all dichogamous varieties in comparison with the absence of irrigation (tab.1). In the same time we notice that all differentiated structures are 2 times bigger. There are evident favorable influence of irrigation on formation of the respective structures.

Table 1

The influence of flowering type and soil WTE at the level of 70% on differentiation of female flowering buds during summer-automn seasons.

Variety/rootstock	**Chişineovschi**		**Costiujenschi**		**Schinoschi**	
Experimental variants: „**+**"-with irrigation; „ **–**" without irrigation, Developmental stages of flowers structures	+	-	+	-	+	-
Initiation of generativ primordium	12.06	17.06	20.06	22.06	05.06	10.06
Formation of floral bracteal primordium	13.07	01.07	05.07	05.07	20.06	25.06
Elongation of bracteal primordium	29.07	15.08	10.09	30.07	26.06	30.06
Apparition of perigonal primordium	29.08	10.09	07.09	19.09	18.07	03.09
Initiation of primary ovarian tissues	In spring			20.09	28.09	20.09

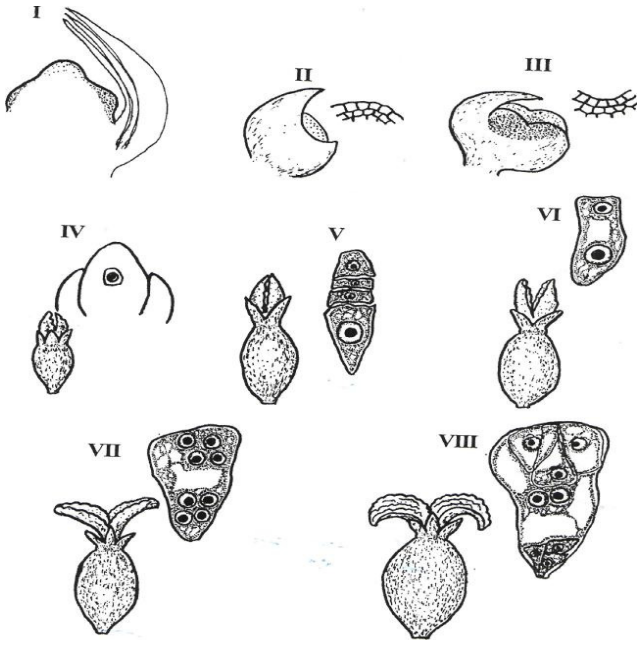

Fig. 1 - Schematic aspect of stages of female flower development. I-initiation of generativ primordium; II-formation of floral bracteal primordium (f.p.); III- elongation of f. p. and initiation of perianth foliols; IV-apparition ovule primordium, stigmates, ahesporium; V-meiosis; VI-binucleat embryo sac (e.s.); VII-8-nucleat e. s; VII- mature e. s.

CONCLUSIONS

1. There is detected favorable influence of irrigation on the development of flower structures during the first stage of organogenesis (July-August).

2. The most accelerated processes of morphogenesis were established for protoginous genotype on rootstock Juglans *regia* L.

3. The end of female flower structures differentiation (in spring period), as well as pollen diameter and viability there not connected with the hidrophisical soil parameters within rootstock *Juglans regia* L. and *Juglans nigra* L.

REFERENCES

1. **Cociu V., Oprea Şt., 1989 -** *Metode de cercetare în ameliorarea plantelor pomicole.* Ed. Dacia, Cluj, p. 29, 124-129.
2. **Hanke M.V., Flachovski H., Peil A., Hattasch C., 2007 -** *No flower no –fruit-genetic potentials to trigger flowering in fruit trees.* Genes, Genomes and Genomics 1(1), p. 1-20.
3. **Germain E., -1999 -** *Le noyer***.** INRA (France). 274 p.
4. **Maughet J. S., 1977** - *Dormans de bourgeons vegetative de noyers (Juglans regia L.), cultivees sous differents conditions climatiques***.** Comptes rendus Acad. .Ser. D**.-** Vol. 284, p. 2351-2354. ;
5. **Mănescu C., Georgescu M., Dejeu L., 1989.-***Controlul biologic al producției în pomicultură şi viticultură.* Ed. Ceres, Bucureşti, 244 p.
6. **Pîntea M., 2004** – *Nucul. Biologia reproductivă***.** Chişinău. 366 p.

ASPECTS REGARDING THE ORNAMENTAL VALUE OF SOME ROSE NURSEY SPONTANEOUS FROM „TUDOR NECULAI" NURSERY COLLECTION - IAŞI COUNTY

OBSERVAȚII PRIVIND VALOAREA ORNAMENTALĂ A UNOR SPECII SPONTANE DE TRANDAFIRI ÎNTÂLNIȚI ÎN PEPINIERA „TUDOR NECULAI" IAŞI

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***Abstract**: Wild species of the genus Rosa L. have importance for: creating green spaces, getting roses nobles and their use as rootstock for cultivated varieties. The purpose of this paper is to highlight the possibilities of identifying potential ornamental species in the genus Rosa sp. Observations were made at 6 species of wild rose "Rosa californica", "Rosa caudata", "Rosa centifolia", "Rosa damascena", "Rosa multiflora" and "Rosa rugosa". To achieve that goal were made observations and measurements on the main morphological characters, growth of stems, number of buds and abundance of flowers.*
***Key words:** roses, stems, buds, flower*

***Rezumat**: Speciile spontane ale genului Rosa L. au importanță deosebită pentru: amenajarea spațiilor verzi, obținerea trandafirilor nobili şi utilizarea lor ca portaltoi pentru soiurile cultivate. Scopul lucrării este de a pune în evidență potențialul ornamental şi posibilitățile de identificare ale speciilor spontane de Rosa în cadrul genului. Observațiile au fost făcute la 6 specii spontane de trandafiri: „Rosa californica", „Rosa caudata", „Rosa centifolia", „Rosa damascena", „Rosa multiflora" şi „Rosa rugosa". În vederea realizării obiectivului propus s-au efectuat observații şi determinări privind principalele caractere morfologice; ritmul de creştere al lujerilor; numărul de muguri şi abundența florilor.*
***Cuvinte cheie:** trandafiri, lujeri, muguri, flori*

INTRODUCTION

One of the basic components of green spaces which assure the esthetical aspect of localities and contributes to the welfare and good mood of people, which also assure a favourable working and living climate is represented by floral and roses landscapes designs (Wagner, 2002).

Rose was considered from ancient times "Queen of flowers", due to its multiple qualities and particularly great wealth and beauty flowers, scented and with various colours and shapes (Haenchen, 2003).

In the multitude of dendrological species which contains ornamental shrubs, spontaneous species of *Rosa L*. have a real importance for design of green spaces, obtaining of noble roses, and many of them are utilised as parent stocks

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for cultivated sorts (Rudolf, 1978; Popescu, 1986).

The conditions from Romania are generally favourable for this specie. Necessity for diversifying the assortments is a priority, having in view the diversity of biological material and the results obtained in the world. Literature shows, which in this genus are known over 200 species with more than 20,000 sorts (Rusu, 1973, Luban, 1973).

Being known the diversity importance of *Rosa L*. spontaneous species, in the research method was proposed to be realised phenological observations on: stems, leaf, flowers and fruits.

MATERIAL AND METHOD

Observations on roses were carried out at "Tudor Neculai" – Iaşi nursery. Nursery is placed outside Iaşi City, into a field belonging to Miroslava village, being destined for production of planting dendrological and floral material for decoration and beautification of Iaşi City green spaces.

Nursery have also a rich assortment of spontaneous rose species from which we mention: *"Rosa californica"*, *"Rosa canina", "Rosa carolina", "Rosa caudata", "Rosa centifolia", "Rosa corymbifera", "Rosa damascena", "Rosa davidii", "Rosa davurica", "Rosa foetida", "Rosa gallica", "Rosa multiflora", "Rosa rugosa"*, *"Rosa virginiana".*

Observations were made on 6 spontaneous rose species:

- *"Rosa californica"* (Fig. 1);
- *"Rosa caudata"* (Fig. 2);
- *"Rosa centifolia"* (Fig. 3);
- *"Rosa damascena"* (Fig. 4);
- *"Rosa multiflora"* (Fig. 5);
- *"Rosa rugosa"* (Fig. 6).

The aim of the current paper is to highlight the ornamental potential and identification possibilities of *Rosa* spontaneous species in the genus.

Were realised observations and determinations regarding:

- Growing rhythm of stems;
- Number of buds;
- Abundance of flowers.

Observations and determinations regarding phenological particularities were realised for 6 *Rosa L*. spontaneous species, in three repetitions and in five different days, as follows: (28.04, 7.05, 9.06, 11.07 and 10.08). Observations were carried out during 2011-2012 and were studied the growing rhythm of stems, number of buds and abundance of flowers.

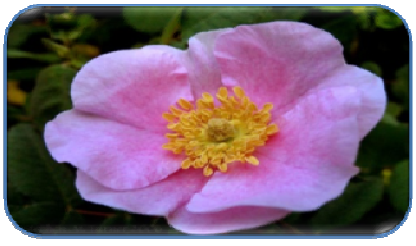

Fig. 1 *"Rosa californica"*

Fig. 2 *"Rosa caudata"*

Fig. 3 *"Rosa centifolia"*

Fig. 4 *"Rosa damascena"*

Fig.5 *"Rosa multiflora"*

Fig.6 *"Rosa rugosa"*

RESULTS AND DISCUSSIONS

From measurements made at the end of observation period (10.08) at analysed species regarding height of stems were recorded low growing rates of 11.33 cm at *Rosa californica*, 14 cm at *Rosa rugosa*, and the greatest growing rates were recorded at *Rosa damascena* with a stem growing of 19.66 cm and 16.33 at *Rosa caudata* (Tab. 1).

Table 1

Mean of stem height (cm) during 28.04.2011 – 10.08.2011

No.	Species	28.04	7.05	9.06	11.07	10.08
1	*Rosa californica*	5.33	32	11.66	9.03	11.33
2	*Rosa caudata*	6	7.33	13.66	10.66	16.33
3	*Rosa centifolia*	6	7.66	21.66	1.8	15.33
4	*Rosa damascena*	5	12.66	13.66	14	19.66
5	*Rosa multiflora*	12	12	15	9.66	15.66
6	*Rosa rugosa*	11.66	5.33	14.33	13.66	14

Analysing the number of buds, the lowest values were recorded at specie *Rosa californica* (4.66), and the greatest values were recorded at species *Rosa multiflora* (8.66) and at *Rosa damascena* (10.66) (Tab. 2).

Table 2

Mean of buds number during 28.04.2011 – 10.08.2011

No.	Species	28.04	7.05	9.06	11.07	10.08
1	*Rosa californica*	1	1	4.33	6.66	4.66
2	*Rosa caudata*	-	3.33	1	-	-
3	*Rosa centifolia*	1	2	3.33	-	-
4	*Rosa damascena*	-	1.33	3.33	6	10.66
5	*Rosa multiflora*	-	3.33	11.33	6.66	8.66
6	*Rosa rugosa*	1	1	3	5.33	7

Study realised regarding recorded abundance of flowers at the end of observation period appreciate that the lowest values were recorded by *Rosa californica* (1.33) and the highest values were recorded at *Rosa damascena* (8.66) and *Rosa multiflora* (4) (Tab. 3).

Table nr. 3

Mean of flowers abundance during 28.04.2011 – 10.08.2011

No.	Species	28.04	7.05	9.06	11.07	10.08
1	*Rosa californica*	-	-	1.66	3.33	1.33
2	*Rosa caudata*	-	-	2.33	-	-
3	*Rosa centifolia*	-	-	3.66	-	-
4	*Rosa damascena*	-	-	2	2.33	8.66
5	*Rosa multiflora*	-	-	8	3	4
6	*Rosa rugosa*	-	-	1.33	2.33	3

Also was realised a total mean regarding stems height, buds number and flowers abundance in period 28.04.2011 and 10.08.2011 (Tab. 4) and average for period 09.06.2011 - 09.06.2012 (Tab. 5), and based on them were designed 6 graphs for year 2011 (Fig. 7; Fig. 8; Fig. 9; Fig. 10; Fig. 11; Fig. 12) and 6 graphs for year 2012 (Fig. 13; Fig. 14; Fig. 15; Fig. 16; Fig. 17; Fig. 18).

Table 4

Total mean during 28.04.2011 – 10.08.2011

Nr.	Specie	Height of stems (cm)	Number of buds	Abundance of flowers
1	*Rosa californica*	13.93	3.53	1.26
2	*Rosa caudata*	10.79	0.86	0.46
3	*Rosa centifolia*	13.66	1.26	0.73
4	*Rosa damascena*	13	4.26	2.60
5	*Rosa multiflora*	21.44	6	3
6	*Rosa rugosa*	11.79	3.46	1.33

Table 5

Mean during 9.06.2011 – 9.06.2012

N0.	Species	Mean at 9.06.2011			Mean at 9.06.2012		
		Stems height (cm)	*Buds number*	*Flowers abundance*	*Stems height (cm)*	*Buds number*	*Flowers abundance*
1	*Rosa californica*	11.66	4.33	1.66	13.33	6.33	2.33
2	*Rosa caudata*	13.66	1	2.33	15	2	4
3	*Rosa centifolia*	21.66	3.33	3.66	24	5.33	5.33
4	*Rosa damascena*	13.66	3.33	2	15.66	5	3.33
5	*Rosa multiflora*	15	11.33	8	16.66	13	10.33
6	*Rosa rugosa*	14.33	3	1.33	15.66	4.33	3

Graphs regarding mean from 9.06.2011

Fig. 7

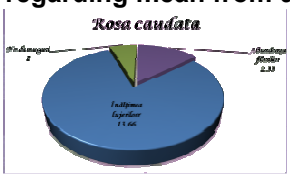

Fig. 8

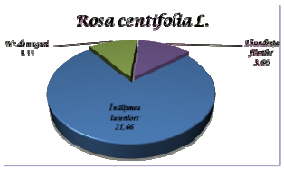

Fig. 9

Fig. 10

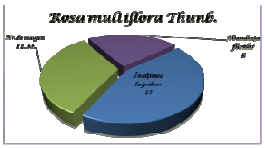

Fig. 11

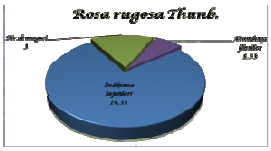

Fig. 12

Graphs regarding mean from 9.06.2012

Fig. 13

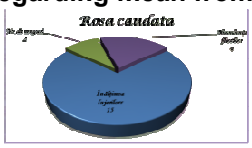

Fig. 14

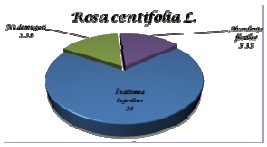

Fig. 15

Fig. 16

Fig. 17

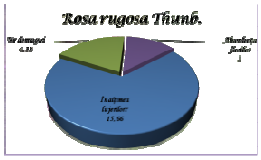

Fig. 18

CONCLUSIONS

Based on the effectuated determinations, observations and analyse of the obtained results we could draw the following conclusions:

1. Regarding the stems growing rhythm:

- spontaneous species of *Rosa* have a different growing rhythm;
- the highest growing rate: *Rosa multiflora* with an annual mean of 21.4 cm, and the lowest one at *Rosa caudata* 10.79 cm.

2. Regarding number of buds:

- buds number is different function of their appearance period on stems and function of specie;
- at *Rosa californica*, *Rosa centifolia* and *Rosa rugosa,* buds appear in the second decade of April and have a mean of 1 bud. At *Rosa multiflora* and *Rosa caudata* buds appear on stems in the first decade of May with a mean of 3.33 buds.

3. Regarding abundance of flowers:

- flowers differs through abundance and decoration period;
- *Rosa centifolia*, decoration period is in June with a flowers abundance mean of 3.66, and *Rosa damascena* have a decoration period between June-July-August with an average of 2.60.

4. Regarding development of *Rosa* spontaneous species between 9.06.2011 and 9.06.2012 we could appreciate that:

- growing rhythm of stems is between 1.33 cm (*Rosa rugosa*) to 2,34 (*Rosa centifolia*);
- buds number in these period increase in average from 1 (*Rosa caudata*) to 2 (*Rosa centifolia* and *Rosa californica*);
- flowers abundance at majority of studied *Rosa* species increases with a mean value around 1.67.

Having in view the tradition of rose cultivation, their biological potential and high decorative value, it is recommended utilisation of *Rosa* genus spontaneous species for:

- parent stock for noble sorts;
- decorative purposes in the majority of landscape designs.

REFERENCES

1. Eckart H., 2003 – *Cultura trandafirilor*. Editura M.A.S.T., Bucureşti.
2. Haenchen E., 2003 – *Cultura trandafirului*. Editura M.A.S.T., Bucureşti.
3. Luban E., 1967 – *Cultura trandafirului*. Editura Agro-silvică, Bucureşti.
4. Popescu Şt., 1986 – *Trandafirul*. Editura Ceres, Bucureşti.
6. Rudolf C., 1978 – *The Rose in three Kultur*. Stuttgart.
7. Rusu V., 1973 – *Cultura trandafirilor*. Editura Ceres, Bucureşti.
8. Wagner Şt., 2002 – *Trandafirul de la mit la mileniul trei*. Editura Echard et Co. SNC, Cluj-Napoca.

THE HEMEIUȘI ARBORETUM - „A LIVING LABORATORY”

ARBORETUMUL HEMEIUȘI – „UN LABORATOR VIU”

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Abstract. *Dendrological Park ,,Hemeiuşi" Bacău, created in 1880, with an area of 49,5ha, is situated on the right bank of the river Bistrița. The multifunctionality of conservation, environmental protectin, recreation, education and scientific research, derived from many indigenous and exotic species, represented by solitary species, biogrups, orchands and compararive cultures, assigned to park a real character of,, living laboratory". The encounter with the arboretum communicates to the visitor, in an live manor data and knowledge concerning the species in the patrimony collection, brought here from all the corners of the world, an impressive explosion of shapes, sizes and colours.*
Key words: *arboretum, dendrological, park, Hemeiusi, collection*

Rezumat. *Parcul Dendrologic ,,Hemeiuşi" Bacău , creat în anul 1880, cu o suprafață de 49,5ha este așezat pe malul drept al râului Bistrița. Prin multi-funcționalitatea de conservare, protecția mediului, recreație, educativă și a cercetărilor științifice, derivate din multitudinea speciilor indigene și exotice, reprezentate prin exemplare solitare, biogrupe, plantaje și culturi comparative, atribuie parcului dendrologic un adevărat caracter de ,, laborator viu". Întâlnirea cu arboretumul comunică vizitatorului, într-o manieră vie date şi cunoştințe în legătură cu speciile aflate în patrimoniul colecției, aduse aici din mai toate colțurile lumii, o explozie impresionantă de forme, dimensiuni, culori.*
Cuvinte cheie: *arboretum, dendrologic, parc, Hemeiuși specii, colecți.*

INTRODUCTION

Arboretums are collections of wood plants represented by solitary species, biogroups or small experimental stands, located in the teritory by echological, systematical or fitogeographical criteria. They show themselves under the form of original vegetal structure, created by man in strong collaboration with nature, in different landscape architectural styles (Mihalache, 1982).

Romania was a country poor in tree species and shrubs, things observed from the first Romanian forestry. This time, there were concerns of bringing wood species from different parts of the world, to try them acclimated on this occasion giving birth dendrolgice parks and gardens.

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Such a vegetal collection includes the Hemeiusi Arboretum also known as the "Dendrological park of Hemeiusi" located at the periphery of the UP Lilieci village, at a 10 km distance from Bacău.

MATERIAL AND METHOD

The Hemeiusi Arboretum is covered in the ecological subregion B3-Bistrita Tarcau, being located at the west limit of the Moldavian Plateau, at the interface with Moldavia lower Carpathians, on the straight shore terasse of the Bistrita river.

Arboretum was created by arranging a meadow openly structured in terms amenajistic in 12 plots.

The climate is continental, hilly plateau characteristic attire with large hollows summer registering periods of drought and winter cold currents localized on Bistrita valley, which creates a specific microclimate, drier. The fog is a common climatic phenomenon that associated with low winter temperatures negatively influence Lemon exotic vegetation species, causing partial or total plant frostbite.

The landscape is very diversified, featuring 2 - 4m bumps characteristic meadows, including a mosaic of soils belonging to several classes and types, most of the area occupying a class undeveloped land. Of the other soils meet the cambisoil class and the hydromorphic.

Most of the exotic species in its area are received from Europe and America, and very little from Japan and China. The timber group represents 18% of the total of existing species, and the deciduous group that dominates the collection represents 82%. Observations, measurings, studies and specialised complex work realised this whole time on the arboretum are the sources used in this short presentation.

RESULTS AND DISCUSSIONS

The Hemeiusi Arboretum was founded at the end of the XIXth century, in 1880. Incorporation Basics Arboretum Hemeiusi were made by German specialist Cristian Adolf of Essen Forest Academy graduate, who entered the park in a rich and varied range of exotic and indigenous species by planting saplings from seeds brought from home seeds of Darmstadt, Germany (Mihalache, 1988).

Its initial functionality was limited only to satisfy the need to create around the private residence an original, spectaculous and as exotic as possible by planting some trees with unique ornamental qualities brought from far lands that contrasted with the local vegetation.

After 50 years in the administration arboretum Forest Research and Management Institute Hemeiusi under the guidance engineer A. Mihalache, who had a great contribution in enriching dendrologic collection, all over the park, with exotic species, placed in isolation, in biogroups, orchards and comparative cultures that formed over the years to source genuine scientific research.

In this period a great importance had it set up in the park arboretum nursery in order to obtain seedlings and ornamental belonging to various indigenous and exotic species that were used in creating or enriching dendrologic parks or recreational, collection for gardens botanical (Iasi, Bucuresti) to green areas in cities etc.

Its multifunctionality amplified considerably through time obtaining scientifical, botanical (360 sistematic units from the herbaceous flora and over 1060 sistematic units from the wood flora), forestry (old climatisation centre and forestry experiments), ornamental purposes and also recreational sanogene and learning purposes.

Experiments and research studies had as theme the Hemeiusi Arboretum since 1956, and played an important role in the development of the dendrological collection and also in implementing the results in the silvic production. Thus, with the passing of time, there were orchards *(Larix decidua, Pinus silvestris si Pinus strobus, Picea abies)*, comparative cultures and many biogroups with exotic species of forestry interest realised in the arboretum with foreign and local sources and also indigenous species and this proved to be an important experimental base for selection and improvement works of the exotic species, being a precious source for seeds, an important production and distribution centre for the exotic and decorative seedlings.

Numerous studies and research over the last 5 decades were recovered through scientifical work (books, essays, parts of thesis or articles in specialised publications), but this rich experiment field leaves place for approaching new scientifical aspects.

A supported activities took place in the international trade conducted over 60 similar units or botanical gardens especially in the northern hemisphere of the globe (Mihalache, 1976).

Arboretum was a research base for various topics such as:

- acclimatization of exotic wood species forestry interest by introducing new exotic species, obtained by culture of different samples or batches of seeds received, special orders, collecting their own seeds;
- about genetic improvement spruce orchards by installing a number of 28 clones of spruce (Picea abies) of different origins in our country and in Europe and 13 clones of various exotic and indigenous origin spruce in North America ;
- comparative culture with various exotic forestry interest
- the production of vegetative material by grafting for creating comparative cultures with various exotic pines;
- improvement of forest species of economic interest and production forestry genetically improved seeds;
- determination of the vegetation of major forest species based on phenological phases;
- biology of flowering and fructification, methods of providing a quantitative assessment of fruiting species of oak.

Originality Hemeiuşi Arboretum is on landscape style. The style in which it is done is the English with walkways curves and surfaces alternating with meadows surrounded stand in an irregular shape of the stand. Network paths plots the boundaries marked by hedges, collections of woody and shrub species and valuable collection Roza, comprising around 280 species of roses.

The large diversity that is the arboretum made possible the development throughout time of a rich ecosystem in fauna elements (vertebrate and invertebrate), who these were subjects over time in the development of valuable works scientifically, the specialists in forestry and biology.

CONCLUSIONS

1.The large number of systematic units contained dendrological Arboretum is a valuable collection for the east of the country – Moldavia.- a living testimony to the next generation, for which it is necessary to continue to give special attention and care to maintain them.

2.The Hemeiusi Arboretum, besides its wealth in systemtical units it is also a form of "ex situ" preservation and protection of the genetic forest resources of Terra, highlighting their multiplication methods with special reference to the endangered species being at the same a living laboratory that indicates us the their value as superior forestry essences and also as ornamental species.

REFERENCES

1. Mihalache A., 1976 – *Cercetări asupra fezabilității bioecologice și economice privind introducerea speciilor exotice de interes forestier in România,* Ceres, București

2. Mihalache A., 1982 - *Aspecte privind aclimatizarea și îmbogățirea colecțiilor de specii lemnoase în arboretumurile Hemeiuși și Dofteana,* Culegere de studii și articole de biologie, Iași.

3.. **Mihalache A., 1988 -** *Monografia arboretumului Hemeiuși,* Ceres, București.

STUDIES ON THE GROWTH AND DEVELOPMENT OF SOME *HIPPEASTRUM* VARIETIES

STUDII PRIVIND CREŞTEREA ŞI DEZVOLTAREA UNOR SOIURI DE *HIPPEASTRUM*

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Abstract. *Genus of Hippeastrum is compound by 90 bulbous species which are originated from the tropical regions of Mexico, Argentina and the Caribbean. Nowadays are cultivated more then 600 cultivars. In this research work have been studied several varieties of Hippeastrum vittatum. During the experiments were made some observations, measurements and determinations on the most important decorative and morphological features of plant in the period of December 2011 - May 2012. The aim of the research is to identity some species valuable for indoor design and for cut flowers. The results obtained showed overall value varieties such as Carnival and Philadelphia, which due to remarkable decorative characters, such as color and flower size, flower stem length, can be recommended for breeding and cultivation.*
Key words: *cultivars, morphological characteristics, indoor plant*

Rezumat. *Genul Hippeastrum cuprinde 90 de specii bulboase care provin din regiunile tropicale ale Mexicului, Argentinei şi din Caraibe. Se cunosc astăzi peste 600 de soiuri şi hibrizi. În cadrul acestei lucrări ştiinţifice au fost studiate câteva soiuri de Hippeastrum vittatum. Pe parcursul desfăşurării experimentelor s-au efectuat observaţii, măsurători şi determinări asupra celor mai importante caracteristici morfo-decorative ale plantelor, în perioada decembrie 2011 – mai 2012. Activitatea de cercetare s-a desfăşurat şi cu scopul de a identifica unele soiuri valoroase, în vederea utilizării lor pentru decorul interioarelor, dar şi pentru flori tăiate. Rezultatele obţinute au evidenţiat valoarea în ansamblu a unor soiuri, precum Carnival şi Philadelphia, care datorită caracterelor decorative remarcabile, cum sunt: culoarea şi dimensiunile florii, lungimea tijei florale, pot fi recomandate pentru înmulţire şi cultivare.*
Cuvinte cheie*: soiuri, caractere morfologice, plantă de interior*

INTRODUCTION

Amaryllis (*Hippeastrum*) is an ornamental bulbous flowering plant belongs to the family Amaryllidaceae (Agavaceae) (Sara, 2013; El-Naggar, 2009).

Hippeastrum genus grouped 90 species from South America. Name is derived from Greek *hippe* ("horse") and *aster* ("star"), but the allusion is obscure (Bryan, 2002; Toma, 2009). Formerly classified as *Amaryllis* and best known by this name. This genus includes three important categories of cultivars: large-flowered singles, large-flowered doubles, and miniatures. The flowers are funnel shaped and borne in an umbel on a stout, cylindrical, hollow, leafless stem which may be

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coated with a waxy bloom. The bulb of most species is large and globe-shaped. Large bulbs may produce more than one flowering stem (Bryan, 2005).

Breeders have developed many lovely *Hippeastrum* hybrids which are popular as an indoor plant, brought into flower in December at Christmastime. The exact parentage of the modern hybrids is uncertain. Can be grown outside where night temperatures during the growing season do not drop below about 4ºC (Bryan, 2002; Cantor, 2008).

The very large bulbs should be planted in a soil mix consisting of equal parts of good topsoil, peat moss or leafmold, and sharp sand, with about 1/3 of the bulb above the soil level. Bulbs that have been exposed to warmth before planting take about 55 days from planting time to flowering. It is an advantage to give the pots a little bottom heat while the roots are forming, a period of about 21 days. During this time, a temperature of about 13°C at night should be maintained (Bryan, 2002; Cantor, 2008).

When the stem is several cm high, the plants can be move into full sun. It can be delay the buds opening by lowering the temperature. After flowering, the flower can cut off, but the stem since its photosynthetic activity helps nourish the bulb so it's not necessary to cut. The foliage now makes its growth, and during this time a weekly feeding of organic liquid fertilizer can be given for 6-8 weeks. The plants should show signs of the foliage maturing in late July and should then receive less water. By the beginning of August, stop watering completely and allow the bulbs to ripen in full sun for a minimum of 6 weeks (Bryan, 2002).

Propagation can be done by seed, offset bulblets and twin scaling (Sara, 2013). Seeds germinate quickly in temperatures of 15°-18°C at night. When the seedlings have leaves 10-15 cm long, transplant them into 10 cm pots. Keep them watered and growing; only if the foliage yellows should water be withheld. The bulbs can be brought into flower in these pots, but it will probably be necessary to repot them in their 2nd season and allow them a period of dormancy before being brought into flower (Bryan, 2002; Draghia and Chelariu, 2011).

Offsets are produced by mature bulbs and can be separated after the foliage dies and grown on. When separating them, be careful not to damage the persistent roots. Vegetative propagation is the only way to obtain flowers identical to those of the parent (Bryan, 2002).

The purpose of current paper was to identify valuable cultivars, for use for indoor design, but also for cut flowers.

MATERIAL AND METHOD

Experiences regarding the studies on growth and development of some *Hippeastrum* varieties were placed in the greenhouse belonging to the Floriculture Department of UASVM - Cluj-Napoca. The studied cultivars were: Philadelphia, Jewel, Blossom Peacock and Carnival (Fig. 1).

Biological material was provide from Dutch. The experiment was carried out during 2011-2012.

For the experiments were used 32 bulbs (two/repetitions) with superior quality, and until planting were kept in special conditions.

Phenological observations were made concerning the date of planting, date of emergence, appearance of floral stem and end of flowering. During the experiments were established the morphologic characteristics of cultivars: the length and number of leaves, the length and width of petals and flower stem length.

Fig. 1 – The studied *Hippeastrum* cultivars
(Philadelphia, Jewel, Blossom Peacock, Carnival)

Measurements were made in the middle of flowering, when plants have reached the maximum decoration period. All measurements were performed with ruler, using four replicates of each cultivar.

RESULTS AND DISCUSSIONS

Following the observations and the results from Table 1, can see that all variants have risen between 17 and 22 January 2012.

According to Table 2 varieties Blossom Peacock and Carnival needs only six days to rise. Jewel cultivar emerged in nine days. Generally, emergence of plants was realized very quickly after planting, between six and nine days.

The percentage of bulbs rise was 100%, so the bulbs used in the experiments had with superior quality and health in addition and soil mixt was free of pests and diseases.

Concerning the leaves length, in the case of four studied cultivars, this character varied between 46.35 cm at Philadelphia cultivar and 54.21 cm at Carnival. Cultivars like: Jewel with 50.12 cm and Carnival with 54.21 cm registered higher values than the average of experiment (Table 3).

Table 1

Phenological observations of *Hippeastrum* cultivars

Cultivars	Data of planting	Data of emergence	Data of flowering		
			beginning	maximum	end
Philadelphia	10.01.2012	17.01.2012	06.03.2012	30.03.2012	14.04.2012
Jewel	10.01.2012	19.01.2012	16.03.2012	12.04.2012	20.04.2012
Blossom Peacock	16.01.2012	22.01.2012	09.03.2012	04.04.2012	15.05.2012
Carnival	14.01.2012	20.01.2012	14.03.2012	08.04.2012	01.05.2012

Table 2

The growing and flowering dynamics at the studied *Hippeastrum* cultivars

Cultivars	Number of days from planting to emergence	Number of days from beginning and end of flowering	Decoration period (days)
Philadelphia	7	24	38
Jewel	9	27	35
Blossom Peacock	6	25	36
Carnival	6	24	46

In terms of statistical interpretation, significant positive differences were recorded at Carnival. All other cultivars show insignificant differences concerning the leaf length (Table 3).

Table 3

The leaves length at *Hippeastrum* cultivars

Cultivars	Leaves length		Difference (+/- cm)	Significance of difference
	Absolute (cm)	Relative (%)		
Philadelphia	46.35	92.71	-3.64	o
Jewel	50.12	100.26	0.13	-
Blossom Peacock	49.21	98.43	-0.78	-
Carnival	54.21	108.44	4.22	*
Average of experiment (C)	49.99	100.00		

LSD 5% = 3.3, LSD 1% = 4.5, LSD 0.1% = 6.2

Data regarding the number of leaves are summarized in Table 4, which was performed statistically using analysis of variance. Cultivars with a higher number of leaves than the average are: Blossom Peacock 6.3 and Carnival with 7.2 leaves. Statistically, it can be noted that two cultivars realized positive differences, but not statistically assured (Table 4).

Table 4

The number of leaves at *Hippeastrum* cultivars

Cultivars	Number of leaves		Difference (+/- cm)	Significance of difference
	Absolute	Relative (%)		
Philadelphia	5.9	96.72	-0.2	-
Jewel	5.4	88.52	-0.7	-
Blossom Peacock	6.3	103.27	0.2	-
Carnival	7.2	118.03	0.7	-
Average of experiment (C)	6.2	100.00		

LSD 5% = 1.2; LSD 1% = 1.8; LSD 0.1%= 2.4

The results concerning the floral stem length are shown in Table 5. The analyzed character varied between 41.75 cm at Blossom Peacock to 54.25 cm at

Philadelphia cultivar. The cultivars which exceeds the average of this character are the following: Jewel with 47.53 cm, Carnival with 48.24 cm and Philadelphia with 54.25 cm. Statistically one cultivar registered very significant positive differences: Philadelphia.

Table 5

The floral stem length of Hippeastrum cultivars

Cultivar	Floral stem length		Difference (+/- cm)	Significance of difference
	Absolute (cm)	Relative (%)		
Philadelphia	54.25	117.73	6.31	***
Jewel	47.53	103.14	-0.11	-
Blossom Peacock	41.75	87.08	-6.19	ooo
Carnival	48.24	104.68	0.3	-
Average of experiment (C)	47.94	100.00		

LSD 5% = 2.3; LSD 1% = 2.9; LSD 0.1% = 4

In the Table 6 are summarized the results concerning the length of petals interpreted using analysis of variance. Considering the average of character being as 5.08 cm, can note that some cultivars have lower values than average, such as: Carnival with 4.86 cm and Philadelphia with 4.93 cm. The other two cultivars have higher values than the average, 5.18 cm at Blossom Peacock and 5.37 cm for Jewel. However, Jewel and Blossom Peacock present positive differences; these are not statistically assured (Table 6).

Table 6

The petal length of Hippeastrum cultivars

Cultivar	Petal length		Difference (+/- cm)	Significance of difference
	Absolute (cm)	Relative (%)		
Philadelphia	4,93	97,04	-0,15	-
Jewel	5,37	105,7	0,29	-
Blossom Peacock	5,18	101,96	0,1	-
Carnival	4,86	95,66	-0,22	-
Average of experiment (C)	5,08	100,00		

LSD 5% = 0.8; LSD 1% = 1.4; LSD 0.1% = 2.3

According with the results presented in the Table 7, width of petals varied from 3 cm at Philadelphia to 4.66 cm at Blossom Peacock. The following cultivars show lower values concerning the width of petal: Philadelphia with 3 cm and Carnival with 3.39 cm. The table shows that two cultivars had higher values than the average width of petal, such as: Jewel with 3.92 cm and Blossom Peacock with 4.66 cm. Statistically, regarding the width of petals the cultivars Philadelphia and Blossom Peacock provide very significant positive differences, while Carnival cultivar achieves significant positive difference.

Table 7

The petal width of Hippeastrum cultivars

Cultivar	Petal width		Difference (+/- cm)	Significance of difference
	Absolute (cm)	Relative (%)		
Philadelphia	3,0	80,21	-0,74	***
Jewel	3,92	104,81	0,18	-
Blossom Peacock	4,66	124,59	0,92	***
Carnival	3,39	90,64	-0,35	*
Average of experiment (C)	3,74	100,00		

LSD 5% = 0.2; LSD 1% = 0.3; LSD 0.1% = 0.8

CONCLUSIONS

Analyzing the results concerning the main morphological characters of four varieties of *Hippeastrum vittatum*, the following conclusions can be noted:

1. The emergence period was between 6 days at Blossom Peacock and Carnival, and 9 days at Jewel cultivar.

2. Regarding the decoration period, the most appreciated cultivar was Carnival with 46 days.

3. In the case of leaf length Carnival cultivar remarks with long leaves 54.21 cm, while Philadelphia shows the shortest leaf, with 46.35 cm.

4. Concerning the number of leaves, on the first place is Carnival cultivar with 7.2 leaves. The cultivar with the lowest number of leaves is Jewel (5.4 leaves).

5. Measurement of the length of flower stems has shown that Philadelphia has the longest stem of 54.25 cm.

6. The cultivar with the longest petals was Jewel (5.37 cm), and the shortest petals were measured at Carnival cultivar.

REFERENCES

1. Bryan J. E., 2002 - *Bulbs* (rev. ed.). Timber Press, Portland, OR.

2. Bryan J. E., 2005 - *Bulbs*. Timber Press, Portland, OR.

3. Cantor Maria, 2008 - *Plante ornamentale de interior*, Ed Todesco, Cluj Napoca.

4. Draghia Lucia, Elena Liliana Chelariu, 2011 - *Floricultură*. Ed. Ion Ionescu de la Brad Iaşi.

5. **El-Naggar A.H., El-Nasharty A.B., 2009** - *Effect of Growing Media and Mineral Fertilization on Growth, Flowering, Bulbs Productivity and Chemical Constituents of Hippeastrum vittatum*, Herb. American-Eurasian J. Agric. & Environ. Sci., 6 (3), p. 360-371.

6. Toma F., 2009 - *Floricultură şi Artă florală, Specii utilizate ca plante în ghivece pentru decorul interioarelor*, Vol. 3, Editura Invel Multimedia, Bucureşti.

7. Zakizadeh S., Behzad K., Rasoul O., 2013 - *Role of photoperiod on some growth characters of Amaryllis (Hippeastrum johnsonii), a Bulbous plant*, European Journal of Experimental Biology, 3(1), p. 289-291.

VASE LIFE BEHAVIOUR OF CUT GLADIOLUS FLOWERS IN DIFFERENT STORAGE SOLUTIONS

COMPORTAREA FLORILOR TĂIATE DE GLADIOLE IN DIFERITE SOLUȚII DE PĂSTRARE

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Abstract. *Gladiolus cultivars were evaluated during the summer season of 2012 at USAMV Cluj-Napoca, Horticultural Storage Laboratory, for their vase life behaviour of the cut spikes with different concentrations solutions under normal room temperature. Eight commercial varieties of gladiolus, namely 'Corula', 'Candida Ali', 'Cipriana', 'Nova Lux', 'Priscilla', 'Jester' , 'Peter Pears' and 'White Prosperity' were treated with the next four solutions: Bell Fleur, Chrysal, Native and sucrose 3% + citric acid 0,015% to determine the best solution for preservation and the vase life of cut flowers. Control flowers were stored in tap water. Furthermore was tested the unilateral influence of cultivars concerning the vase life. Results of laboratory experiment on the effect of different concentrations of solutions in the vase life behaviour of Gladiolus cut spikes under normal room temperature (25°C) demonstrated that Bell Fleur solution was the most effective substrate in prolonging the vase life (14.1 days). 'White Prosperity' and 'Priscilla' cultivars show positive significant compare with control cultivar ('Cordula'), in all the preservative solutions including tap water.*
Key words: *cut flower gladiolus, preservation, vase life*

Rezumat. *Soiuri de gladiole au fost evaluate în perioada de vară 2012 privind comportarea lor ca flori tăiate în diferite soluții conservante în condiții de cameră la USAMV Cluj-Napoca, laboratorul de Păstrare a Produselor Horticole. Opt soiuri comerciale de gladiole 'Corula', 'Candida Ali', 'Cipriana', 'Nova Lux', 'Priscilla', 'Jester', 'Peter Pears' and 'White Prosperity' au fost testate în următoarele patru soluții conservante: Bell Fleur, Chrysal, Native şi zahăr 3% + citric acid 0,015%, pentru a determina cea mai bună soluție de conservare şi durata de păstrare a florilor tăiate. Compararea s-a făcut cu flori păstrate în apă de robinet. De asemenea, s-a testat şi influența unilaterală a soiurilor, comparativ, privind durata de păstrare. Rezultatele experiențelor de laborator asupra efectului diferitelor concentrații de soluții conservante privind comportarea spicelor de gladiole la temperatura camerei (25°C) au demonstrat că soluția Bell Fleur a fost cea mai bună pentru a prelungi durata de păstrare (14.1 zile). Soiurile White Prosperity' şi 'Priscilla' au prezentat semnificații pozitive comparativ cu soiul martor ('Cordula'), în toate soluțiile conservante, inclusiv apa de robinet.*
Cuvinte cheie*: flori tăiate gladiole, păstrare, soluții conservante*

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INTRODUCTION

Cut flowers of Gladiolus occupy a major share in floriculture industry. For a viable cut flower business it is very important to maintain high quality of the produce. The qualitative and quantitative post harvest losses of gladiolus can be reduced by adopting improved technologies like harvesting at proper stage, use of floral preservatives and bud opening solution, pulsing, precooking, improved storage techniques such as low temperature storage, proper packaging methods etc. (Yoram et al., 1981).

The effects of 6 pretreatment on the freshness index of cut Gladiolus showered an increased of the Gladiolus vase life (Reid and Award 1980). Lazăr (2006) shows that the concentration of sucrose from solutions for the impulsion of Gladiolus flowers is 20%.

The longevity of gladiolus cut flowers is very short and for the florists and consumers one of the most important factors is to try to prolong the vase life of cut flowers. The typical vase life of individual florets is just 4 to 6 days and senescent florets remain at the bottom of the spikes after the opening of the upper florets (Yamada et al., 2003).

Rasul Jalili Marandi et al., 2011 showed that Salicylic acid (SA) and essential oils alone cannot provide very good preservative to increase of vase life of cut gladiolus flowers and for best efficacy this substances should be combined with chemical components such as STS (silver thiosulphate). Experiments of Ezhilmathi et al., 2007 suggest that 5-SSA (5-sulfosalicylic acid) increases vase life by rising the reactive oxygen species (ROS) scavenging activity of the *Gladiolus* cut flowers.

Preservative solutions are widely used in all major countries producing flowers, to help maintain quality and prolong the life of cut flowers. The components of preservative solutions differ from one species to another, depending on the sensitivity to certain substances flowers. Also, the concentration of sugars and other substances that make up solutions for a particular species of flower is different, depending on the intended solution (Draghia and Chelariu, 2011).

Preservative solutions can be used to fortify or strengthen flowers after they have suffered from lack of water to boost or loading rods with sugars and antimicrobials before transporting or storing refrigerated for opening buds and for preserving in stores or to the consumer.

MATERIAL AND METHOD

The experiment has been carried out in 2012 at the Horticultural Storage Laboratory, USAMV Cluj-Napoca; the aim of the research was to screen out the suitable fresh-keeping agent of eight gladiolus cultivars. There were observed the following factors (table 1):

Biological material, which has been studied, was obtained from the teaching collection of Floriculture department, were harvested in the morning, when the turgid flowers was highest. The cutting moment of flower sticks interfere with the optimal harvesting moment (1-2 bud opened), stored in preservation solutions in habitual conditions of light and temperature specific for an apartment (Lazăr, 2006). During

vase life of cut flowers were done observations regarding the general aspect of inflorescent according with: floral stems, flowers blossom, turgid and the decorative value of cut flowers.

Table 1

Experimental Factors

Factor		
Cultivar	**Color**	**Fresh-keeping agent**
Cordula (Control)	Red-cream	Sink water (Control)
Priscilla	Pink-cream	Bell Fleur
Cipriana	Yellowed green	Chrysal
Nova Lux	Yellow with purple striations	Native
Jester	Yellow – red	sucrose 3% + citric acid
Peter s Pears	Orange	0.015%
Candida Ali	Pink-mauve	
White Prosperity	White	

Biological materials were represented by Gladiolus cultivars obtained from commerce and Romanian cultivars obtained at USAMV Cluj (Fig. 1).

All flowers were introduced in solutions and kept at about 25°C, in room conditions.

Data obtained concerning the days of vase life were synthesized by LSD test analysis to illustrate the differences between these varieties (Ardelean et al., 2007).

Fig. 1 – *Gladiolus* biological materials

RESULTS AND DISCUSSIONS

According with the results presented in the table 2, about unilateral influence of cultivar on vase life, it can be showed that all the eight *Gladiolus* cultivars studied have a different development preserved in vase comparing with the control cultivar with an average of vase life about 11.7 days, three cultivars recorded positively deviations, two cultivars had negatively deviations, while the other two with positive deviations recorded statistical not proved.

Table 2

The influence of the cultivar on vase life

Cultivar	Vase life (days)	± Difference in comparison with control	Significance of difference
Cordula (Control)	11.7	-	-
Priscilla	13.9	2.2	**
Cipriana	9.6	-4.3	ooo
Nova Lux	9.9	0.3	-
Jester	12.3	2.4	**
Peter s Pears	13.1	0.8	-
Candida Ali	10.6	-2.5	oo
White Prosperity	16.7	6.1	***

LSD 5% 1.38, LSD 1% 1.84, LSD 0.1% 2.65

Analyzing unilateral influence of the cultivar on vase life, results that 'White Prosperity' cultivar showed a positively difference of 6.1 days, difference which is very significant. Positively results statistical registered, showed 'Jester' cultivar (2.4 days) and 'Priscilla' cultivar (2.2 days), with distinct significant positive deviation. 'Nova Lux' and 'Peter's Pears' cultivars, although showed positive deviations, the differences in comparison with control are very low, statistical not proved. At the opposite, is situated 'Candida Ali' with negative deviations distinct significant negative and 'Cipriana' very significant negative. The results presented in table 3 show that all the five preservative solutions used influenced different vase life period for *Gladiolus* cultivars.

Table 3

The influence of preservation solution on vase life period

Fresh-keeping agent	Vase life (days)	± Difference in comparison with control (days)	Significance of difference
Sink water (Control)	10.7	-	-
Bell Fleur	14.1	3.4	***
Chrysal	13.2	2.5	***
Native	11.8	1.1	**
sucrose 3% + citric acid 0.015%	11.4	0.7	(*)

LSD 5% 0.72, LSD 1% 0.96, LSD 0.1% 1.25

Vase life of cut flowers preserved in commercial solutions (Bell Fleur, Chrysal, Native) showed deviation statistical proved and in sucrose 3% + citric acid 0.015% solution the deviation is positive and near by limited difference of 5% (LSD 5%). The combined effect of preserve solutions with the influence of cultivar on vase life (table 4) highlight 'White Prosperity' cultivar, which shows positive deviations very significant compare with control ('Cordula'), in all the preservative solutions in which was stored, including sink water. Positive deviations statistical registered, showed 'Priscilla' cultivar for which the difference is distinct significant for Bell Fleur solution (3.4 days), also significant for Chrysal solution (2.4 days) and Sucrose 3% +

citric acid 0.015% (2.3 zile). The lowest results regarding preservation of gladiolus were statistical registered with negative deviation for 'Cipriana' and 'Nova Lux' cultivars for all three commercial solutions recommended for cut flowers.

Table 4

The influence of preservation solution and cultivar on vase life

Variant		Vase life (day)	± Difference in comparison with control	Significance of difference
Fresh-keeping agent	**Cultivar**			
Tap water (Control)	Cordula (Mt.)	9.7	-	-
	Priscilla	11.7	2.0	-
	Cipriana	9.0	-0.7	-
	Nova Lux	8.7	-1.0	-
	Jester	10.7	1.0	-
	Peter s Pears	11.7	2.0	-
	Candida Ali	8.7	-1.0	-
Bell Fleur	White Prosperity	15.7	6.0	***
	Cordula (Mt.)	13.3	-	-
	Priscilla	16.7	3.4	**
	Cipriana	11.0	-2.3	o
	Nova Lux	11.7	-1.6	-
	Jester	13.7	0.4	-
	Peter s Pears	15.0	1.7	-
Chrysal	Candida Ali	12.3	1.0	-
	White Prosperity	18.7	5.4	***
	Cordula (Mt.)	13.3	-	-
	Priscilla	15.7	2.4	*
	Cipriana	9.3	-4.0	oo
	Nova Lux	10.7	-2.6	o
	Jester	13.3	-	-
	Peter s Pears	14.3	1.0	-
	Candida Ali	11.3	-2.0	-
	White Prosperity	17.7	4.4	***
Native	Cordula (Mt.)	11.7	-	-
	Priscilla	12.3	0.6	-
	Cipriana	9.3	-2.4	o
	Nova Lux	9.3	-2.4	o
	Jester	12.7	1.0	-
	Peter s Pears	12.7	1.0	-
Sucrose 3% + citric acid 0.015%	Candida Ali	10.7	-1.0	-
	White Prosperity	16.0	4.3	***
	Cordula (Mt.)	10.7	-	-
	Priscilla	13.0	2.3	*
	Cipriana	9.3	-1.4	-
	Nova Lux	9.0	-1.7	-
	Jester	11.3	0.9	-
	Peter s Pears	12.0	1.3	-
	Candida Ali	10.0	-0.7	-
	White Prosperity	15.7	5	***

LSD 5% 2.28, LSD 1% 3.03, LSD 0.1% 4.08

CONCLUSIONS

The scientific results obtained regarding the behavior of some *Gladiolus* cultivars at preservation in preservative solutions conduct to the next conclusions:

The observed cultivars behaved different at preservation in preservative solutions. The best results were obtained at ‚White Prosperity' cultivar for which the difference of 6.1 days compared with control is very significant;

Regarding with the unilateral influence of preservative solution on vase life it can be observed compared with control (sink water) that solutions recommended by traders, also self recipe shoed significant positive differences between 0.7 – 3.4 days.

The interaction of the two factors analyzed pointed out the 'White Prosperity' presented a very significant positive deviations in all preservative solution and 'Priscilla' cultivar which statistical registered show positive deviations for three preservative solutions of five, used.

REFERENCES

1. **Ardelean M., Sestraş R., Cordea Mirela**, **2007** - *Tehnică experimentală horticolă*. Ed. AcademicPres Cluj-Napoca.
2. **Draghia Lucia, Elena Liliana Chelariu, 2011 –** *Floricultură*. Ed. Ion Ionescu de la Brad Iaşi.
3. **Ezhilmathi K., Singh V. P., Arora A., Sairam R. K., 2007** - *Effect of 5-sulfosalicylic acid on antioxidant activity in relation to vase life of* Gladiolus *cut flowers*. Plant Growth Regulation February 2007, Volume 51, Issue 2, p. 99-108.
4. **Lazăr V., 2006 –** *Tehnologia păstrării şi industrializării produselor horticole***.** Ed. AcademicPres Cluj-Napoca.
5. **Marandi RJ, Hassani A., Abdollahi A., Hanafi S., 2011** - *Improvement of the vase life of cut gladiolus flowers by essential oils, salicylic acid and silver thiosulfate*. Journal of Medicinal Plants Research Vol. 5(20), p. 5039-5043.
6. **Reid S., Award R.E., 1980** - *Pulsing Gladiolus hybrida with silver or quaternary ammonium compunds before low teperature storage*. Acta Hort. 109, p. 253-258.
7. **Yamada T., Takatsu Y., Manabe T., Kasumi M., Marubashi W., 2003** - *Suppressive effect of trehalose on apoptotic cell death leading to petal senescence in ethylene - insensitive flowers of gladiolus*. Plant Sci., 164, p. 213-221.
8. **Yoram M., Herdemburg R.E., Anton M., 1981** - *Effect of silver-thiosulfate pretreatment on vase life of cut standard Carnation, spray Carnations and Gladiolus after a transcontinental truck shipment.* HortScience 16 (6), p. 766-768.

PENNISETUM VILLOSUM R. Br. ex Fresen. – EXOTIC SPECIE ADDAPTED TO CROPPING CONDITIONS FROM N-E AREA OF ROMANIA

PENNISETUM VILLOSUM R. Br. ex Fresen. – SPECIE EXOTICĂ ADAPTATĂ LA CONDIȚIILE DE CULTURĂ DIN N-E ROMÂNIEI

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Abstract. *In the current paper are presented aspects regarding cultivation for ornamental purposes of specie Pennisetum villosum, in pedo-climatic conditions from Iaşi County, Romania. Research aimed to establish a suitable substrate for obtaining planting material from seeds and the behaviour in cropping conditions of the obtained biological material. Were utilised for substrate the following variants (V1 – garden soil, V2 - peat, V3 – 1 part garden soil + 2 parts peat + 0.5 parts sand, V4 - jiffy-pots). The best results regarding seedlings production were obtained at variant V3. In crop at variants V3, V2 and V1 were obtained the most representative results, which are very close as value.*
Key words*: Pennisetum villosum, ornamental grasses, Iaşi*

Rezumat. *În această lucrare sunt prezentate aspecte privind cultivarea în scop ornamental a speciei Pennisetum villosum, în condițiile pedoclimatice din județul Iaşi, România. Cercetările au avut ca scop stabilirea unui substrat corespunzător pentru producerea materialului săditor din semințe şi comportarea în cultură a materialului biologic obținut. S-au utilizat patru variante de substrat (V1 - pământ de grădină, V2 - turbă, V3 – 1 parte pământ de grădină + 2 părți turbă + 0,5 părți nisip, V4 - jiffy-pots). Rezultatele cele mai bune privind producerea răsadurilor s-au obținut la variantă V3. În cultură la variantele V3, V2 şi V1 s-au obținut cele mai reprezentative rezultate, fiind apropiate ca valoare.*
Cuvinte cheie: *Pennisetum villosum, ierburi ornamentale, Iaşi*

INTRODUCTION

Genus *Pennisetum* L. C. Rich. is part of *Poaceae* botanic family and includes around 80 tropical and subtropical perennial species (http://botany.csdl.tamu.edu/FLORA/taes/tracy/610/pennisetum.html).

Specie *Pennisetum villosum* R. Br. ex Fresen. is a specie with origin in North-East of Africa and Arabic Peninsula, naturalized in United States of America and Australia, in semiarid and arid subtropical areas (http://www.fao.org/ag/agp/AGPC/doc/Gbase/data/pf000307.htm). In Europe specie is frequently meet in the West of Mediterranean area and in Portugal, being naturalized in Italy and Azores Islands (Damanakis M, Yannitsaros A., 1986). Is cultivated in ornamental purposes in Greece (Damanakis M, Yannitsaros A., 1986),

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Ethiopia, South Africa and in United States of America (http://www.fao.org/ag/agp/AGPC/doc/Gbase/data/pf000307.htm), China, especially as annual plant (Wu Ju-Ying et al., 2009).

Specie has the shape of a compact bush, with a height of 40-75 cm and a diameter of 30-50 cm. Leave are linear, thin and with an intense green colour. Flowers are white-yellow, grouped in panicles. It blooms from June-July till late in autumn. Prefer sunny or semi-shadowed lands, sandy soils and well drained. It tolerates the drought periods and air pollution. It doesn't support the excess of moisture (Ardle J., 2007).

Species of genus *Pennisetum* could multiply through seeds or in a vegetative way by division of bushes (Wu Ju-Ying et al., 2009).

The current paper aimed to enlighten some aspects regarding multiplication and cultivation of *Pennisetum villosum* (feathertop) for ornamental purposes, in the pedo-climatic conditions Iaşi County, Romania.

MATERIAL AND METHOD

The studied material was represented by specie *Pennisetum villosum* (fig. 1a). The utilised seeds for establishing the crops were gathered at Botanical Garden from Barcelona, Spain.

Research was carried out in 2012, in didactic collection of Floriculture discipline from UASVM Iaşi, Romania. Experience was organized in four variants with four different substrate types (table 1). Sowing was realised on 10th of February 2012 and establishment of crops was realized on 10th of May 2012. The effectuated observations were focused on aspects regarding obtaining of seedlings (germination rate of seeds, the necessary period from sowing to the end of plants' emergence, growing dynamics of seedlings), and the behaviour in crop, in pedo-climatic conditions of Iaşi County, of *Pennisetum villosum* specie. The obtained results were statistically processed and compared.

Table 1

Experimental design

Specie	Biologic material	Variant	Substrate for sowing
Pennisetum villosum	seeds	V1	garden soil
		V2	peat
		V3	garden soil + peat + sand (1:2:0,5)
		V4	jiffy-pots

a) Mother plant (original)

b) seeds (original)

Fig. 1 - *Pennisetum villosum*

RESULTS AND DISCUSSIONS

At the end of the research it could be observed that at specie *Pennisetum villosum* the rate of germinated seeds varied between 50% and 100%, the best results being recorded at variant V3 (1 part garden soil + 2 parts peat + 0.5 sand), and the weak ones at variant V4 (jiffy-pots). In the case of variants V1 (garden soil) and V2 (peat) were recorded intermediary values, 75% respectively 85% (fig. 2).

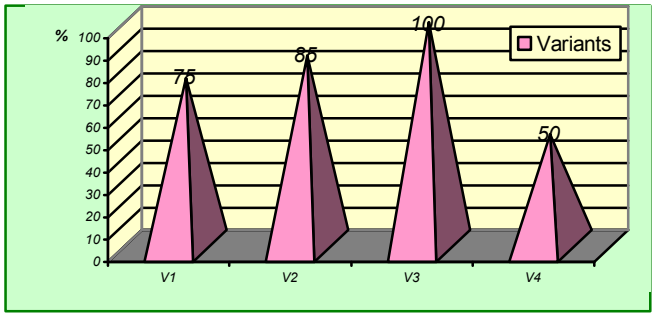

Fig. 2 - Germination percentage (%)

Also was observed that between variants appeared differences regarding the necessary period of time for emergence. So, at variants V1, V2 and V3 emergence occurred after 7 days from sowing and at variant V4 after 14 days (fig. 3). Necessary time for complete emergence, calculated from sowing, was of 31 days at variant V3, 32 days at variant V2 and 34 days at variant V1. In the case of variant V4 were necessary 42 days from sowing till emergence ends (fig. 3).

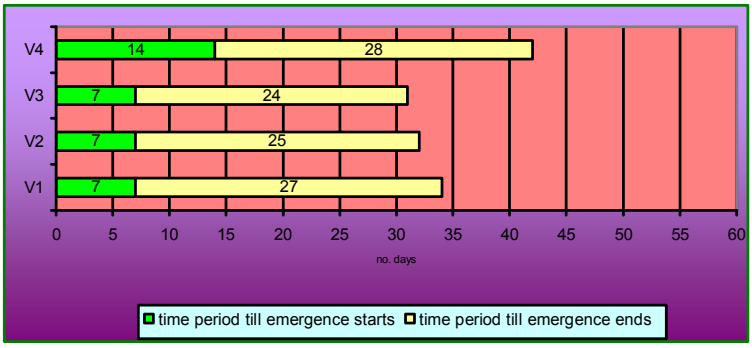

Fig. 3 - Time period for emergence start and complete emergence (nr. of days from sowing)

Table 2

Morphological features of seedlings planted in experimental field

Variant	Mean number of roots/pl	Mean length of roots (cm)	Plant mean height (cm)	Mean nr. of leaf/plant
V1	7,5	16,9	50,8	8.1
V2	8,0	16,8	51,1	8.3
V3	8,0	17,4	52,4	8.5
V4	4,2	9,3	21,3	6.3

The utilised seedlings for establishing the crops had different characteristics function of experimental variant (table 2, fig. 4).

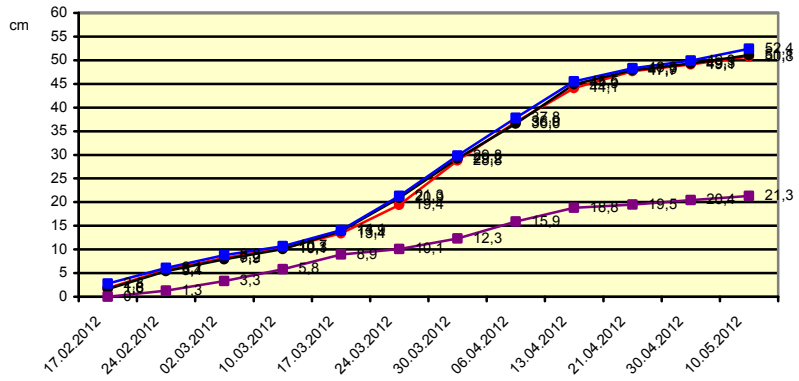

Fig. 4 - Growing dynamics of seedlings at *Pennisetum villosum*

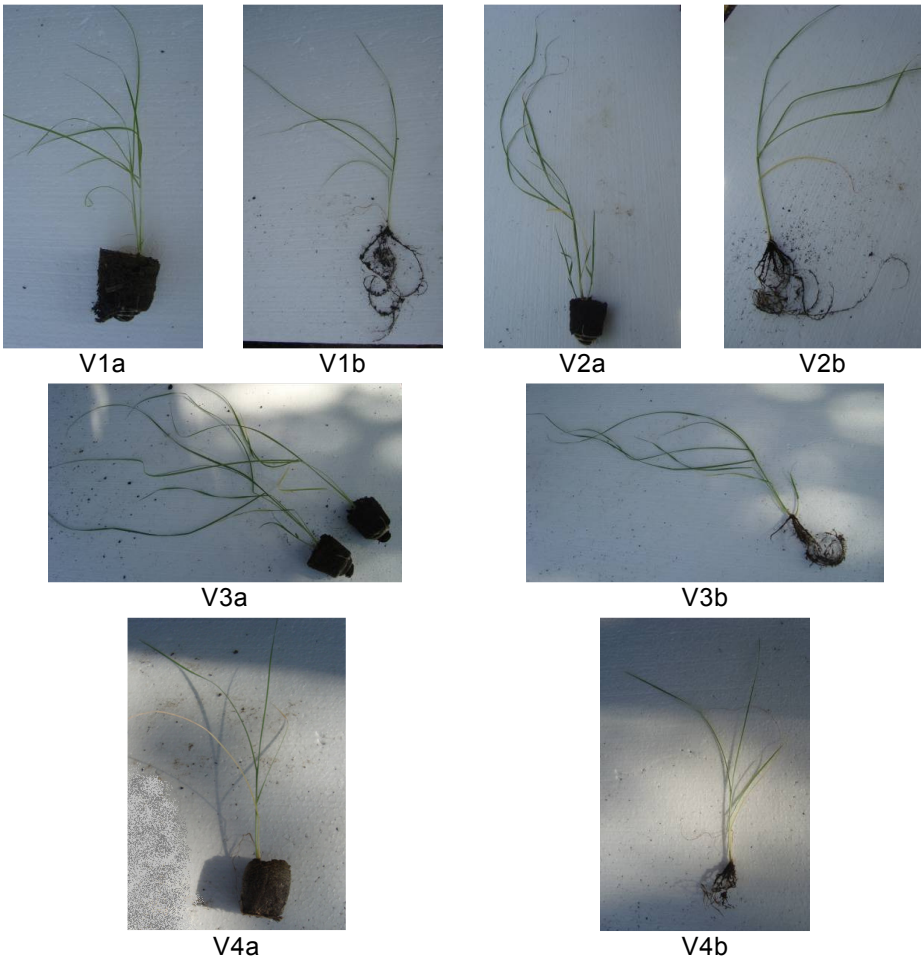

Fig. 5 - Seedlings at 10.05.2013; a – with soil bolus; b – without soil bolus (original)

The data regarding growing of seedlings (recorded at the last observations from May) were statistically processed. From statistically point of view, differences between variant V1 (control) and variant V4 is very negative significant, the other variants having values close to control variant (table 3).

Table 3

Results regarding seedlings' growing

Variant	Mean height of plant	% face to control	Differences	Signification
V1	50.8	100.00	0.00	control
V2	51.1	100.59	0.30	
V3	52.4	103.15	1.60	
V4	21.3	41.93	-29.50	000
LSD 5% = 2.5 cm, LSD 1% = 3.8 cm, LSD 0.1%= 6.1 cm				

In the experimental field, seedlings which were planted on 10th of May 2012, had a medium growing rhythm, blooming starting from the first decade (V1, V2, V3) or third decade (V4) of July, and fructification starting with the second decade (V1, V2, V3) or third decade (V4) of August. Ending of vegetation period took place I the first decade of November due to the climatic conditions (table 4).

Table 4

Phenology of *Pennisetum villosum* in cropping conditions from Iaşi County

Variant	Date of planting 2012	Growing rhythm	Blooming (decade/month)	Fructification (decade/month)	Ending of vegetation period
V1	10.05	medium	I/07	II/08	I/11
V2	10.05	medium	I/07	II/08	I/11
V3	10.05	medium	I/07	II/08	I/11
V4	10.05	medium	III/07	III/08	I/11

Morphological characterization of plants, realised at 31st of October 2012, is presented in table 5.

Table 5

Morphological characterization of *Pennisetum villosum* plants

Variant	Mean height of plant -cm-	Diameter of bush -cm-	Mean length of leave -cm-	Mean width of leave -cm-	Mean length of inflorescences -cm-	Mean number of inflorescence / plant -pieces-
V1	62.4	48.7	26.2	0.5	8.9	56.3
V2	62.8	48.9	26.3	0.5	8.9	56.5
V3	63.3	49.3	26.3	0.6	9.0	57.5
V4	59.5	46.5	26.1	0.4	8.5	54.6

Pennisetum villosum R. Br. ex Fresen (fig. 6) decorates through port from establishing the crop in spring till late in autumn, and through inflorescence from June to October. Specie could be utilised in different vegetal compositions, in landscape designs like rounds, rabats, plat-bands, rocky designs, decorative pots or as cut flowers in fresh or dry state.

Fig. 6 - *Pennisetum villosum* (autumn 2012) (original)

CONCLUSIONS

1. Specie *Pennisetum villosum* R. Br. ex Fresen is easily multiplied through seeds, and for crop establishing is recommended utilisation of seedlings.

2. Substrate formed by 1 part garden soil, 2 parts peat and 0.5 parts sand determine the obtaining of a 100% germination percent and seedlings with suitable morphological features.

3. In crop conditions from Iaşi County, Romania, *Pennisetum villosum* R. Br. ex Fresen behaves like an annual plant which have a medium growing rhythm, and which presents remarkable ornamental features, decorating through port and inflorescence.

Acknowledgments. "*This work was co-funded from the European Social Fund through Sectorial Operational Programme Human Resources Development 2007-2013, project number POSDRU/I.89/1.5/S62371 ,,Postdoctoral School in Agriculture and Veterinary Medicine area*"

REFERENCES

1. Ardle J., 2007 – *Bamboos and Grasses*, Royal Horticultural Society, Ed. Dorling Kindersley Ltd. Londra, U.K., ISBN 978-1-4053-1683-5.

2. Damanakis M, Yannitsaros A., 1986 – *The genus Pennisetum (Poaceae) in Greece*. Willdnowia 15, p. 401-406, ISSN 0511-9618, http://www.jstor.org/discover/10.2307/3996454?uid=3738920&uid=2&uid=4&sid=21102433388091

3. WU Ju-Ying,TENG Wen-Jun,YUAN Xiao-Huan,YANG Xue-Jun, 2009 - *Evaluation of Five Ornamental Grasses from Pennisetum Rich. Grown in Beijing.* Journal of Wuhan Botanical Research, 27(6), p. 661-666, http://en.cnki.com.cn/Article_en/CJFDTotal-WZXY200906014.htm and http://www.cabdirect.org/abstracts/20103109520.html;jsessionid=6CFDB826C0451AA93E0D18F1DC664B44

4. http://botany.csdl.tamu.edu/FLORA/taes/tracy/610/pennisetum.html

5. http://www.fao.org/ag/agp/AGPC/doc/Gbase/data/pf000307.htm

RESEARCHES REGARDING THE FLOWERS COLOR TRANSMISSION TO DESCENDENTS AT *GLADIOLUS HYBRIDUS* L.

CERCETĂRI PRIVIND TRANSMITEREA ÎN DESCENDENȚĂ A CULORII FLORILOR LA *GLADIOLUS HYBRIDUS* L.

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Abstract. *Nowadays, gladioli are most often used as cut flowers for vases in various floral arrangements, bouquets, using only cultivars of the Gladiolus genus, or in combination with other flower species. In order to observe how the color of the gladioli was hereditary transmitted, were performed direct intraspecific crosses between 15 varieties having different colors, existing in the UASVM Cluj-Napoca collection, from which resulted 10 hybrid combinations. In 2012, was performed a comparative analysis of F_1 hybrids and their parental forms in terms of flower's color. At the first generation, F_1 hybrids showed phenotypic several intermediate colors between genitors or inherited from one parent the color, in all combinations that were performed. Flower's color has shown greater variability in F_1 hybrids than parental forms, with a tendency to exceed significantly with more or less the mean of this character.*
Key words: *hereditary, hybrid, genitor, phenotypic*

Rezumat. *În momentul de față, gladiolele sunt cel mai des utilizate ca şi flori tăiate în diferite aranjamente florale pentru vaze, buchete, fie folosind doar soiuri ale genului Gladiolus, fie în asociere cu alte specii floricole. În vederea observării modului de transmitere ereditară a culorii la gladiole s-au efectuat încrucişări intraspecifice directe între 15 soiuri de diferite culori, existente în colecția USAMV Cluj-Napoca, rezultând 10 combinații hibride. În anul 2012, s-a efectuat o analiză comparativă a hibrizilor F_1 şi a formelor parentale ale acestora din punct de vedere a culorii florilor. În prima generație F_1, hibrizii obținuți au manifestat fenotipic, la toate combinațiile efectuate, mai multe culori intermediare între genitorii utilizați, sau au moştenit culoarea de la unul din părinti. Culoarea florilor manifestă o variabilitate mai mare la hibrizii F_1 decât la formele parentale, cu tendința de a depăsi semnificativ în plus sau în minus valorile medii ale caracterului respectiv.*
Cuvinte cheie*: ereditar, hibrid, genitor, fenotipic*

INTRODUCTION

The modern *Gladiolus* cultivars offer a diversity of colors, shapes, and sizes available in few other flowering plants. It is cultivated in almost all countries of the world where spring and summer conditions are favorable (Cantor and Tolety, 2011). Today, *Gladiolus*, the queen of the bulbous ornamentals, is the leading

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geophytes grown worldwide for cut flower trade and garden displays. It occupies a pristine place in the garden for its magnificent inflorescence, wide array of colors, and fascinating varieties of shapes and sizes (Pragya, 2010).

Most of the economically important ornamental plants are cut flowers, which are produced by vegetative propagation. For many years, new varieties of ornamental plants have been produced by cross-hybridization and mutation breeding techniques, separately or in combination (Shibata, 2008).

Gladioli are popular plants, cultivated in Europe for more than 250 years and renewed for their striking, colorful flowers. In the last period, in many countries the production value of *Gladiolus* cut flower was increased. Nowadays, in Romania, few persons grow gladioli and the assortment is limited at some cultivars obtained from commerce (Cantor et al., 2010).

Hybridization, the crossing of one cultivar with another, will probably continue as the most reliable source of new cultivars (Hartline, 1996). Flower color is one of the fundamental characteristics in terms of decorative value of all flowering species and more. *Gladiolus* species meets a variety of colors, from white to red, burgundy, yellow or purple. The varieties with various stripped or different colors on lip petals or midribs are completing the range of colors (Cantor et al., 2006).

It is also important to study the performance of existing cultivars for their superior desirable characters (Swaroop, 2010).

MATERIAL AND METHODS

The investigation took place at UASVM Cluj-Napoca, using plant material from the didactical collection of *Gladiolus*. For the study, in 2010 were used 15 cultivars to perform direct intraspecific crosses from which in 2012 were selected 10 elites $F_{1.}$ The hybrids and their genitors were analyzed in terms of the color of the flowers.

Table 1

Colors of genitors and hybrid combinations

Genitors ♀ x ♂	Color of the flowers at genitors	
	maternal	paternal
White Prosperity x Cipriana	white with purple to pink	lemon green
Nova Lux x Fidelio	yellow	intense pink
Nova Lux x Madonna	yellow	blue
White Prosperity x Plum Tart	white with purple to pink	burgundy
Trader Horn x Mon Amour	coral red	light yellow
Princess Marg. Rose x Plum Tart	range with yellow	burgundy
Black Jack x Alice	burgundy to claret	orange
Peter Pears x Blue Isle	orange	indigo
Trader Horn x Wine and Rose	coral red	pink
Peter Pears x Expresso	orange	dark red, deep velvety

The cross hybridization protocol implementation and the steps taken to obtain the F_1 elites were described by Horț et al., 2012 in Bulletin UASVM. A detailed observation was made on the selected genitors and the F1 elites regarding the uniformity of the color, the presence or absence of other color (spots, strips, dots etc.). The data are presented in the table below (table 1) and the plants were photographed using a digital camera. The data were processed and statistically interpreted using Microsoft Excel 2007 version.

In table 2 are presented the number of seeds that were planted in the field from, which 100 plans were selected from each hybrid combination.

Table 2

***Gladiolus* hybrid combinations and the number of seeds obtained, 2010 Cluj-Napoca**

Hybrid comb.	Female Genitor ♀	Male Genitor ♂	No. of pollinated flowers	No. of ripen flowers	No. of seeds
H5	White Prosperity	Cipriana	11	9	201
H6	Nova Lux	Fidelio	21	17	583
H7	Nova Lux	Madonna	20	18	612
H9	White Prosperity	Plum Tart	38	29	908
H13	Trader Horn	Mon Amour	12	6	224
H16	Princess M. Rose	Plum Tart	36	10	543
H22	Black Jack	Alice	30	25	305
H25	Peter Pears	Blue Isle	30	9	387
H34	Trader Horn	Wine and Rose	30	21	347
H35	Peter Pears	Expresso	30	28	446
Total			258	172	4556

RESULTS AND DISCUSSIONS

In table 3 is presented the distribution of the color of the flower to descendents obtained from ten hybrid combinations.

Analyzing table 3 can conclude that 17.2 % from descendents inherit the color from the maternal genitor, 17.5% from the paternal genitor and 40.9% have intermediary colors. From the total of 1000 analyzed plants, only 24.4% of descendents have other colors. From the ten hybrid combination studied, only at H6 combination the highest number of descendents resemble to the maternal genitor (75 plants) and in the case of H16 combination, 78% of descendents resembled to the paternal genitor.

Comparing figure 1.a. with figure 1.b. it can be observed that in a combination of a yellow flower with a white one, the yellow color is dominant and was transmitted downward maternal and paternal.

If the yellow flower is combined with a blue one (fig. 1.c.) or red one (fig. 1.f.), then the yellow color became recessive and the number of hybrids obtained with this color is smaller than those that had other colors.

In the case of H9 (fig. 1.d.) and H13 (fig. 1.e.) combination the white color is dominating the burgundy or coral red color.

Table 3

Hybrid plants repartition by color

Hybrid comb.	Color of the flower at genitors		Hybrid plants repartition			
	maternal	paternal	Resembling to maternal genitor	Resembling to paternal genitor	Interme-diary color	Other colors
H 5	white with purple	yellow lemon to green	1	27	59	13
H6	yellow	intense pink	75	4	16	5
H7	yellow	blue	-	18	5	77
H9	white with purple	burgundy	21	5	72	2
H13	coral red	light yellow	3	6	21	70
H16	yellow	burgundy	4	78	4	14
H22	burgundy to claret	orange	8	15	74	3
H25	orange	indigo	23	-	35	42
H34	coral red	pink	20	9	66	5
H35	orange	dark red with velvety	17	13	57	13
Total			172	175	409	244
Average			17.2	17.5	40.9	24.4

In the combination of orange color with burgundy (fig. 1.g.) or indigo (fig. 1.h.), the dominating color is orange knowing that the number of hybrids having this color is almost double comparing with those who inherit the color of the paternal genitor. 23% of H25 combination inherited the orange color from the maternal genitor, while the indigo color of the paternal genitor was not transmitted to descendents.

The figure 1.j shows that the difference between the number of descendents that inherit the maternal genitor's color and those who inherit the paternal genitor's has a value of 4%, the majority of plants obtained from cross hybridization had intermediary colors (57%).

In the case of a combination between two colors of the range: coral red with pink (fig. 1.i.), the greatest percent was registered by the intermediary colors (66%), but the red color was transmitted also to a considerable number of descendents (20%).

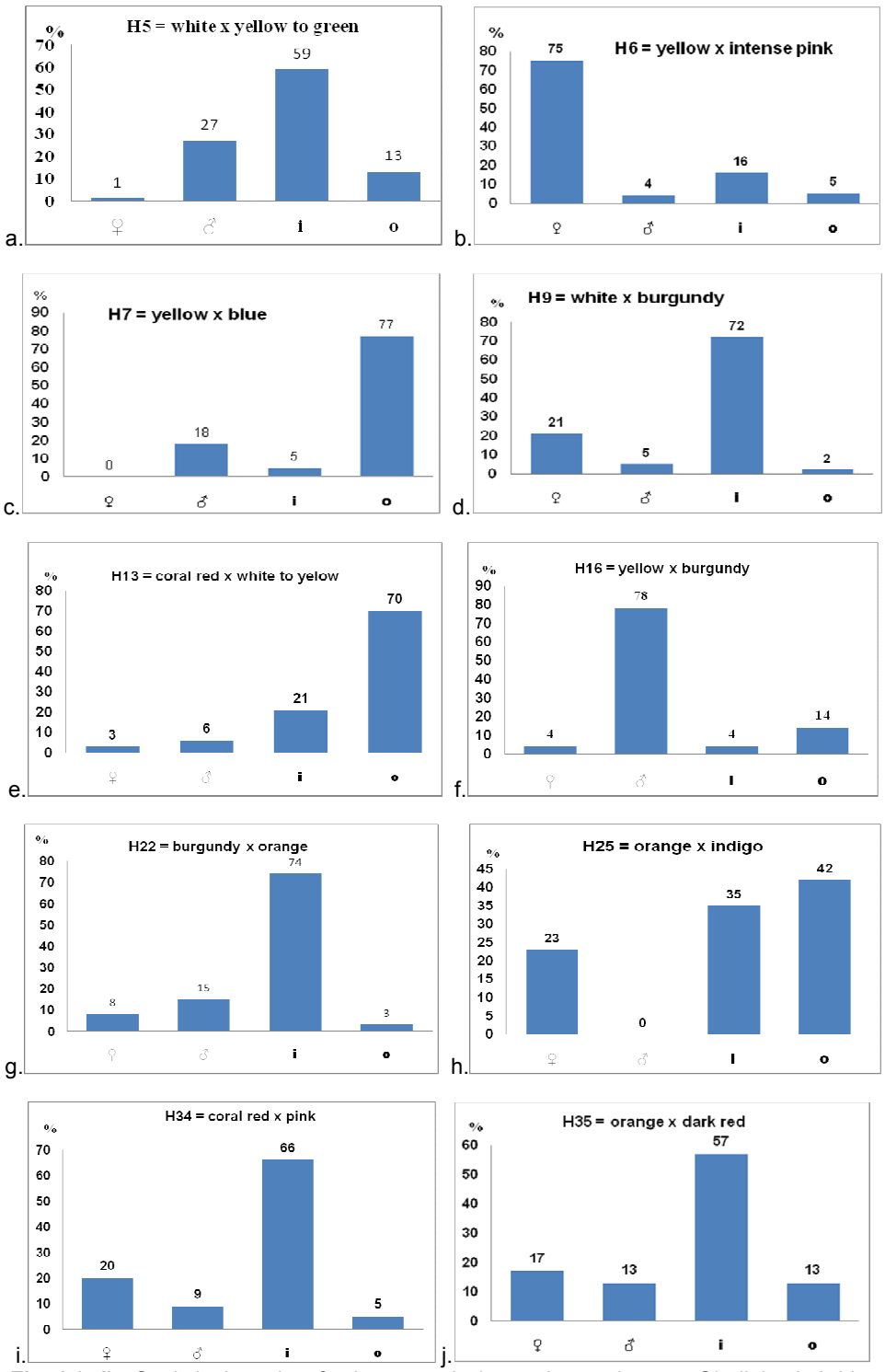

Fig. 1 (a-j) - Statistical results of color transmission to descendents at *Gladiolus hybridus*

CONCLUSIONS

1. The transmission of the color from the maternal and the paternal genitor to descendents was achieved in approximately 17% of the cases.

2. In the case of the ten analyzed combination, there is a chance of almost 25% to obtain other colors than the parents in the hybridization process.

3. The higher percentage of hybrids with intermediary and other colors than the genitor's, is assuring the material for selecting valuable clones, and so, 65.3% of descendents, elites can be selected.

REFERENCES

1. **Cantor Maria, Pop Ioana, Zaharia A., Pop Rodica, 2006 -** *Studies concerning a new assortment of gladiolus hybridus in USAMV Cluj-Napoca Collection*. Lucrări ştiinţifice USAMV Iasi, seria Horticultură, V. 1(49), p. 609-612.
2. **Cantor Maria, Buta Erzsebet, Cristea G., Chis Lenuta Mirela, 2010 -** *Improvement of Gladiolus varietal collection in order to use as genitors in breeding work*. Bulletin UASVM Horticulture Cluj-Napoca, V. 67(1), p.1-7.
3. **Cantor Maria, Tolety J., 2011 -** *Wild Crop Relatives: Genomic and Breeding Resources. Plantation and Ornamental Crops*. Ed. Springer, Heidelberg, p. 133, 142.
4. **Hartline C., 1996 -** *How to grow glorious Gladiolus*. The North American Gladiolus Council, USA. p. 79.
5. **Horţ Denisa, Cantor Maria, Buta Erzsebet, Andriescu Ioana, 2012** – *Researches regarding intraspecific hybridization of Gladiolus L. species in order to obtain novel ornamental varieties*. Bulletin UASVM Cluj-Napoca, Horticulture 69(1), p. 172-177.
5. **Pragya, Bhat K. V., Misra R. L., Ranjan J. K., 2010 -** *Analysis of diversity and relationships among Gladiolus cultivars using morphological and RADP markers*. Indian Journal of Agricultural Sciences 80(9), p. 766-72.
6. **Shibata M., 2008 -** *Importance of genetic transformation in ornamental plant breeding*. Plant Biotechnology V. 25, p. 3-8.
7. **Swaroop Kishan, 2010 -** *Morphological variation and evaluation of Gladiolus germplasm*. Indian Journal of agricultural Sciences 80(8), p. 742-745.

RESEARCH REGARDING FLOWERING OF SOME *CANNA INDICA* L. CULTIVARS OBTAINED FROM SEEDS, UNDER THE INFLUENCE OF SUBSTRATE IN CONTAINER CULTURE

CERCETĂRI PRIVIND ÎNFLORIREA UNOR CULTIVARE DE *CANNA INDICA* L. OBȚINUTE DIN SEMINȚE, SUB INFLUENȚA SUBSTRATULUI LA CULTURA ÎN VASE

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Abstract. *This paper aims to analyze the influence of the culture substrate on flowering of three Canna indica L. cultivars. Plants were obtained from seeds, they were grown in pots and placed in the field, using three types of substrate: rotten manure, sludge from wastewater treatment plant in Bistrița+ sand (1:1) and for the third type of substrate was fitted an aquatic culture: the flower pots were placed in containers with water, where they remained throughout the entire growing season. Observations were made on the number and size of inflorescences, statistically significant differences being observed at the number of flower stems and the number of inflorescences per plant, on aquatic culture at the 'Tropical Yellow' cultivar.*
Key words: *Canna indica L., flowering,rotten manure, sludge, aquatic culture*

Rezumat. *Lucrarea urmăreşte analiza influenței pe care o are substratul de cultură asupra înfloririi a trei cultivare de Canna indica L. Plantele au fost obținute din semințe şi au fost cultivate în vase aşezate în câmp, utilizându-se trei tipuri de substrat: mraniță, nămol provenit de la stația de epurare a apelor uzate din municipiul Bistrița + nisip (1:1), iar pentru al treilea tip de substrat a fost montată o cultură acvatică, în care ghivecele cu plante au fost introduse în vase cu apă, unde au rămas pe tot parcursul perioadei de vegetație. Au fost făcute observații asupra numărului şi dimensiunilor inflorescențelor, diferențe semnificative statistic observându-se în privința numărului tijelor florale şi al inflorescențelor pe plantă, în cazul culturii acvatice, la cultivarul 'Tropical Yellow'.*
Cuvinte cheie: *Canna indica L., înflorire,mraniță, nămol, cultura acvatică*

INTRODUCTION

As landscaping components, *Canna* plants are an impressive presence, often considered harsh by size, shape and color. In public green spaces they are successfully used along thoroughfares, in squares and parks.

Canna flowers highlight extroverted nature of these plants,by different colors, both vivid and pastel tones. They are grouped in spike inflorescences, the color being given mostly by staminodes (sterile metamorphosed stamens), style

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and stamens rather than petals. In inflorescence, flowers open one at a time, starting at its baseand the flowering period varies depending on the habitat. Thus, in areas of originthey may flourish 11 months per year, while in temperate climates Cannasflourish 5-6 months per year (Kamer and Maas, 2008).

The purpose of this paperaims to establish the influence of the culture substrateon flowering of three *Canna indica* L. cultivars.

MATERIAL AND METHOD

The experiments were conducted in the Public Services Department's production base of Bistrița City Hall, in 2011. The biological material used in experiments, was represented by planting material belonging to three *Canna indica* L. cultivars, grown from seeds: 'Tropical Rose, 'Tropical Bronze Scarlet' and 'Tropical Yellow'.

Seedlings were produced in the greenhouse, where they were kept until May 18, when they were transplanted in to pots with a volume of 7,7L and then they were placed in the field.

Three types of substrate were used: rotten manure, sludge from waste water treatment local plant (Shugeng et al., 2009) mixed with sand (1:1) and for the third type of substrate an aquatic culture was fitted: the pots with plants were introduced in rubber containers with water, having a volume of 39,5L.

Plants remained in these containers throughout the whole growing season, and the water level in the recipients was maintained at the substrate level in the pots, respectively 20 cm height. Plant maintenance was ensured by weed removing and daily watering the variants cultivated onrotten manure and sludge + sand (1:1) substrates, not using pesticidesor fertilizer products.

Observations and measurements of this study focused primarily the number of inflorescence per plant, number of flowers per inflorescence, length of floral stems and the length of spikes.

Statistical analysis of data was based on the variance calculation on a bifactorial experiment that allowed the significance of differences interpretation between experimental variants (Ardeleanu, 2008). Each variant was found in the experiments in three repetitions.Organizing the experiment, 12 plants were used for each variant, and for results comparing, it was calculated the average of nine experimental variants, considering it the control.

RESULTS AND DISCUSSIONS

There were made observations on the number and size of the inflorescences, in table 1 being presented the average absolute results regarding plant flowering under the influence of culture substrate and cultivar.

Regarding the number of inflorescences per plant (table 2), the differences statistically as very significant negative from control are registered in variant V1, and the differences very significant positive compared to control, in variant V9. The data in table 3 show that the type of culture substrate influenced the number of inflorescences per plant, distinctly significant negative at the culture on rotten manure and distinctly significant positive from control ataquatic culture.

Depending on the cultivar (table 4), the results show a distinctly significant positive difference at 'Tropical Yellow' and a very significant negative difference at 'Tropical Rose'.

Table1

Experimental results on flowering of *Cannaindica* L. plants obtained from seeds, under the influence of substrate and cultivar in container culture

Variant		No. of inflor. /plant	No. of flowers /inflor.	Floral stem length (cm)	Spike length (cm)
No.	Factor combination				
V1	Rotten manure x*TropicalRose*	7,0	15,1	49,9	19,1
V2	Rotten manure x *Tropical Bronze Scarlet*	8,9	15,1	58,0	14,2
V3	Rotten manure x *TropicalYellow*	9,5	13,3	43,1	15,1
V4	Sludge+sand(1:1) x *Tropical Rose*	9,7	17,1	49,4	17,0
V5	Sludge+sand (1:1) x *Tropical Bronze Scarlet*	14,1	16,3	57,0	13,2
V6	Sludge+sand (1:1) x *Tropical Yellow*	13,4	15,6	49,1	14,2
V7	Aquatic cult. x *Tropical Rose*	12,2	16,9	49,8	17,3
V8	Aquatic cult. x *Tropical Bronze Scarlet*	14,6	15,9	52,0	14,2
V9	Aquatic cult. x *Tropical Yellow*	16,7	14,3	42,7	14,1
	Average V1-V9, Control	11,8	15,5	50,1	15,4

Table2

Number of inflorescences at*Canna indica* L. plants obtained from seeds, under the influence of substrate and cultivar, in container culture

Variant		No. of inflorescences /plant		±d	Signif. of difference
No.	Factor combination	Absolute (pieces)	Relative (%)		
V1	Rotten manure x *Tropical Rose*	7,0	59,3	-4,8	000
V2	Rotten manure x *Tr.Bronze Scarlet*	8,9	75,4	-2,9	00
V3	Rotten manure x *Tropical Yellow*	9,5	80,5	-2,3	0
V4	Sludge +sand (1:1) x *Tropical Rose*	9,7	82,2	-2,1	0
V5	Sludge +sand (1:1) x *Tr. Bronze Scarlet*	14,1	119,5	2,3	*
V6	Sludge +sand (1:1) x *Tr. Yellow*	13,4	113,6	1,6	–
V7	Aquatic cult. x *Tropical Rose*	12,2	103,4	0,4	–
V8	Aquatic cult. x *Tropical Bronze Scarlet*	14,6	123,7	2,8	**
V9	Aquatic cult. x *Tropical Yellow*	16,7	141,5	4,9	***
	Average V1-V9, Control	11,8	100,0	-	-

LSD 5% = 1,66 pieces LSD 1% = 2,33pieces LSD 0,1% = 3,29pieces

Table 3

The influence of substrate on the number of inflorescences at *Canna indica* L. plants obtained from seeds, in container culture

Factor A graduations (substrate)	No. of inflorescences /plant		± d	Signif.of difference
	Absolute (pcs.)	Relative (%)		
Rotten manure	8,5	72,0	-3,3	00
Sludge +sand (1:1)	12,4	105,1	0,6	–
Aquatic culture	14,5	122,9	2,7	**
Average V1-V9, Control	11,8	100,0	-	-

LSD 5% = 1,56pieces LSD 1% = 2,56pieces LSD 0,1% = 4,79pieces

Table 4

The influence of cultivar on the number of inflorescences at *Canna indica* L. plants obtained from seeds, in container culture

Factor B graduations (cultivar)	No. of inflorescences /plant		± d	Signif. of difference
	Absolute (pcs.)	Relative (%)		
Tropical Rose	9,6	81,4	-2,2	000
Tropical Bronze Scarlet	12,5	105,9	0,7	–
Tropical Yellow	13,2	111,9	1,4	**
Average V1-V9, Control	11,8	100,0	-	-

LSD 5% = 0,96pieces LSD 1% = 1,34pieces LSD 0,1% = 1,90pieces

Regarding the number of flowers per inflorescence, in fig. 1 can be observed that its lightly differs from control (15,5 pieces). Thus, the lowest number of flowers per inflorescence is registered in'Tropical Yellow'grown on rotten manure substrate (13,3 pieces), and the highest number of flowers per inflorescence (17,1 pieces), is registered in 'Tropical Rose'grown on sludge + sand(1:1). In each of the three cultivars, the maximum number of flowers per inflorescence was found in plants grown on sludge + sand (1:1), and the minimumin plants grown on rotten manure.

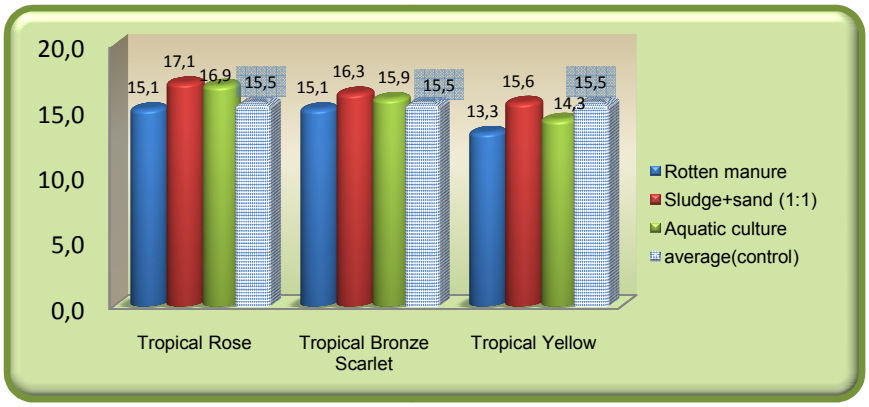

Fig.1 - Numberof flowers per inflorescence, depending on culture substrateandcultivar

The length of floral stems, which in fact represents the plant high, is analyzed in table 5. Statistically differences provided as verysignificant negative from control are registered in variants V3 and V9, and those verysignificantpositivefrom control, in variant V2.

Table 5

The length of floral stems at*Canna indica* L. plants under the influence of substrate and cultivar, in container culture

Variant		Floral stems length		± d	Signif. of difference
No.	Factor combination	Absolute (cm)	Relative (%)		
V1	Rotten manure x *Tropical Rose*	49,9	99,6	-0,2	–
V2	Rotten manure x *Tr.Bronze Scarlet*	58,0	115,8	7,9	***
V3	Rotten manure x *Tropical Yellow*	43,1	86,0	-7,0	000
V4	Sludge +sand (1:1) x *Tropical Rose*	49,4	98,6	-0,7	–
V5	Sludge +sand (1:1) x *Tr. Bronze Scarlet*	57,0	113,8	6,9	**
V6	Sludge +sand (1:1) x *Tr. Yellow*	49,1	98,0	-1,0	–
V7	Aquatic cult. x *Tropica lRose*	49,8	99,4	-0,3	–
V8	Aquatic cult. x *Tr. Bronze Scarlet*	52,0	103,8	1,9	–
V9	Aquatic cult. x *Tropical Yellow*	42,7	85,2	-7,4	000
	Average V1-V9, Control	50,1	100,0	-	-

LSD 5% = 3,56cm LSD 1% = 4,99cm LSD 0,1% = 7,05cm

Tabl e6

The influence of substrateon floral stems length at*Canna indica* L. plants obtained from seeds, in container culture

Factor A graduations (substrate)	Floral stems length		± d	Signif. of difference
	Absolute (cm)	Relative (%)		
Rotten manure	50,3	100,4	0,2	–
Sludge +sand (1:1)	51,8	103,4	1,7	–
Aquatic culture	48,2	96,2	-1,9	–
Average V1-V9, Control	50,1	100,0	-	-

LSD 5% = 2,88cm LSD 1% = 4,76 cm LSD 0,1% = 8,91 cm

Table 7

The influence of cultivar on floral stems length at*Cannaindica* L. plants obtained from seeds, in container culture

Factor B graduations (cultivar)	Floral stems length		± d	Signif. of difference
	Absolute (cm)	Relative (%)		
Tropical Rose	49,7	99,2	-0,4	–
Tropical Bronze Scarlet	55,7	111,2	5,6	***
Tropical Yellow	45,0	89,8	-5,1	000
Average V1-V9, Control	50,1	100,0	-	-

LSD 5% = 2,05 cm LSD 1% = 2,88 cm LSD 0,1% = 4,07 cm

Table 6 shows that the length of flower stems and the default plant height is not significantly influenced by substrate type, instead it varies depending on the cultivar (table 7). Differences statistically significant at very negative compared to control are registered in 'Tropical Yellow' and the very significant positive differences in 'Tropical Bronze Scarlet' cultivar.

Spike length is shown in fig. 2. The smallest inflorescences were registered at 'Tropical Bronze Scarlet' (13.2 cm) grown onsludge + sand (1:1) substrate, and the longest in 'Tropical Rose' grown on rotten manure substrate (19.1 cm).

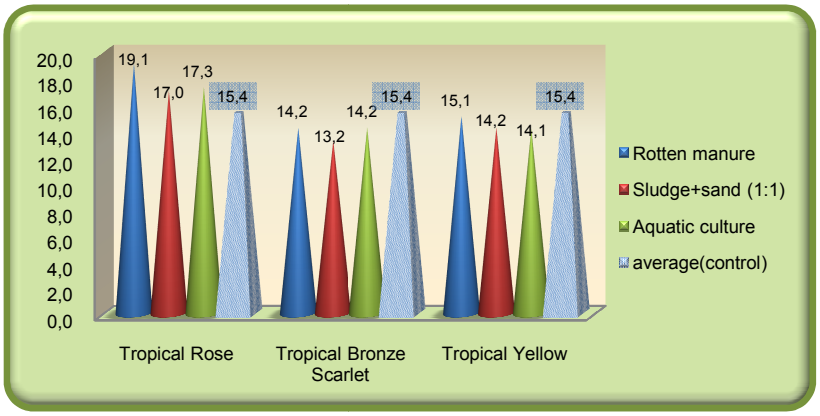

Fig.2 -Spike length (cm) depending on culture substrate and cultivar

CONCLUSIONS

1. *Canna indica* L. plants can be successfully grown as water plants, in this study the largest number of inflorescences per plant being registeredat 'Tropical Yellow' cultivar in aquatic culture.

2. At all three studied cultivars the maximum number of flowers per inflorescence was registeredat plants grown onsludge + sand (1:1) substrate, and the minimum number at plants cultivated on rotten manure.

3. Both, length of flower stems (plant height) and spikes length were not significantly influenced by any of the three used substrates, the differences being observed between cultivars.

REFERENCES

1.Ardelean M., 2008- *Principii ale metodologiei cercetării agronomice şi medical veterinare.*Ed. AcademicPres Cluj – Napoca.

2. Maas-Vande Kamer, H., P. J. M. Maas, 2008 - *The Cannaceae of theworld.*Blumea, 53: 247–318

3. Shugeng Li, Kefang Zhang, Shaoqi Zhou, Liqiu Zhang, Qiuli Chen, 2009 - *Use of dewatered municipal sludge on Cannagrowth in pot experimentswith a barrenclaysoil*. Waste Management, nr. 29: 1870–1876

RESEARCHES REGARDING THE PHENOLOGY AND THE PRODUCTION OF SEED BULBS TO SIX TULIP CULTIVARS

CERCETĂRI PRIVIND FENOLOGIA ŞI PRODUCEREA DE BULBI SEMINCERI LA ŞASE CULTIVARURI DE LALELE

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Abstract. *The research refers to the study of six cultivars of tulips on how to scroll the phenophases of growth and development, from planting to emergence and formation of buds, leaves and bulbs obtained from seeds. Observations have determined the degree of rooting, the plant leaf surfaces, the percentage flowering bulbs of the total bulbs produced per unit of area and morphological characteristics of bulbs. The statistical calculation applied to experimental results determined whether the different results between cultivars and media of the experience (considered as control cultivar) are real or not, and whether it has statistically values. Finally, conclusions and recommendations were conceived.*
Key words: *cultivar, phenophase, morphological characers, control.*

Rezumat. *Cercetările inteprinse se referă la studiul a şase cultivaruri de lalele privind modul de parcurgere al fenofazelor de creştere şi dezvoltare, de la plantare la răsărire şi formarea bobocului, formarea frunzelor şi a bulbilor seminceri. Observaţiile au stabilit şi gradul de înrădăcinare al plantelor, suprafeţele foliare, procentul de bulbi floriferi din totalul de bulbi produşi la unitatea de suprafaţă, precum şi caracteristicile morfologice ale bulbilor. Calculele statistice aplicate rezultatelor experimentale au stabilit dacă diferitele rezultate între cultivaruri şi media experienţei considerată martor sunt sau nu reale, şi dacă sunt asigurate statistic sau nu. În final s-au format concluzii şi recomandări.*
Cuvinte cheie*: cultivar, fenofază, caractere morfologice, martor.*

INTRODUCTION

Tulips are among the most admired and wanted flowers in green spaces. The elegance of flowers accompanied by a vast variety of shapes and colors make these plants to delight many admirers (Zaharia, 1994, Cantor, 2007, Şelaru, 2007). Due to the biological characters, tulips can be found whether in spontaneous forms or cultivated almost in all geographic areas of the world. This explains the numerous studies of the scientists, botanists, technologists, breeders, physiologists and whose results have led, among others, by discovering more diverse assortment of many species and the creation of many varieties.

Today the number exceeds one hundred species and thousands cultivars and continues to grow from year to year as a result of the work of creation and

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selection of new forms (Preda, 1989). A significant landscape effect is achieved by the colours of tulip flowers. The diversity of this character is scientifically determined by the knowledge of each colour pigments which is achieved through a combination in the hybridization work (Shibata, 1960; Van Eijk, 1987; Halevy, 1959; Nieuwhof, 1989; Torskangeroll, 1999). Also, successful hybridization aims to obtain new shapes and is based on the knowledge estabished by research papers regarding the degree of polyploidy of *Tulipa*'s species and cultivars (Zeilinga, 1968; Hall, 1931; Upco, 1936). The introduction of newly created varietys in the range geographical area is the result of studies that determine their behavior under the influence of environmental factors of a specific area. In this regard, during 2011 - 2012 were organized experiences to establish the behavior of six cultivars of tulips in the climatic conditions of Cluj-Napoca. The results allow the characterization of decorative values of these cultivars for making relevant recommendations for how to use them.

MATERIAL AND METHOD

Studies undertaken targeted six cultivars of tulip belonging to four species. Among these cultivars only one, 'Unicum', forms more flowers on the stem, while the others are having a single flower.

Table 1

Morphological characteristics of studyed cultivars

Variant			No. of flowers/ plant	Colour		Plant height (cm)
No	Cultivar	Species or group		Flowers	Leaves	
1	‚*Chaperon rouge*'	*Tulipa greigii*	singleflower	Red	Green	20-30
2	‚*Mary Ann*'	*Tulipa greigii*	singleflower	Red with yellow	Streeped green	20-35
3	‚*Candela*'	*Tulipa fosteriana*	singleflower	Yellow	Verzi	30-35
4	‚*Golden apeldoorn*'	*Darwin hybrid*	singleflower	Yellow	Green with blue	30-40
5	‚*Unicum*'	*Tulipa praestans*	More flowers	Red	Green with yellow	40-60
6	‚*Judith Leyster*'	*Tulipa triumph*	singleflower	Pink	Green	30-45

The starting material was represented by the bulbs purchased from Holland. The soil in which bulbs were planted was prepared in advance, respecting the specific technological recommendations. The texture was sandy-loam, well supplied with mineral and organic nutrients. Planting was made in late October 2011. The planting depth was 10 cm, and the distance between the plants was 15 to 20 cm. Morphological and decorative characteristics of the studied cultivars, are represented in Table 1.

RESULTS AND DISCUSSIONS

The first observations were made when the growth cones occur on the surface of the terrain, and this phenological phase represented the emergence. The timing could not be reduced to a specific day, because even plants of the same cultivar reached this phenophase at different moments. These statements are confirmed by the results presented in Table 2. The earliest, in terms of the rising, 'Candela' cultivar formed in early February growth cone (5-8 II). The most delayed of the cultivars, from the point of view of the appearance of the growth cone is 'Judith Lyster'(26 II-5 III). Other cultivars emerged between those two data. The emergence period of the plants of a cultivar is between 3 ('Candela') and 8 days ('Unicum'). The number of days depends on the cultivar and on the influence of the conditions of each bulb separately. When the plants have emerged was established their rooting degree and were counted the formed roots. It is found that the lowest average number of roots formed the cultivar 'Unicum' (97.8 roots /plant), and greater average number of roots formed was found at cultivar 'Candela' (149.3 roots / plant). Other cultivars have values between those listed and can say that the degree of rooting is good and very good, which means that the plants are firmly fixed in the ground and will be well supplied with water and nutrients.

The data from Table 2 shows that the number of days from emergence to the initiation of bud is at least 27 to 29 days ('Judith Leyster') and the maximum period is 42-43 days ('Candela'). It can be seen that the number of days from emergence to the phenophase of the bud initiation is specific to each cultivar, and the order of the emergence was not the same when the buds appeared. Regarding the average size of the leaves, can say that the length is between 11.9 cm ('Unicum') and 15.1 cm ('Golden Apeldoorn'), and the width range between 4.2 cm and 5.1 cm values recorded at the same cultivars. The ratio between the length and width of leaves (called coefficient of shape) have values exceeding the number 2.05 ('Candela') and 2.83 ('Unicum'). Note that leaves formed on plants studied had very different sizes depending on the cultivar, and within the cultivar, depending on the position on the plant. The largest leaves are basal ones and the dimensions are decreasing on the leaves of the flower stem (Table 3).

Observations were made on leaves considering as important character the leaf area of the tulip seed bulbs. For more preciseness of the measurements were considered only active leaves that are involved in photosynthesis. The leaf area of each plant was calculated and by summing, the leaf area per plant was established. The values of these determinations are variable within the 155.6 cm^2 ('Unicum') and 360 cm^2 ('Golden Apeldoorn'). Statistical analysis were made using the significance of differences method (Table 4) and it shows that the compared with the average value of experience, three cultivars were very significantly positive in leaf area values, two were very significantly negative and the cultivar 'Chaperon rouge' was distinct significantly negative.

Table 2

Experimental results obtained from measurements and observations on seed bulbs tulips studied in 2011

Variant	Roots/plant (no.)		Date of the appearance of		Days from emergence to stem appearance	Medium size of leaves (cm)		Shape coefficients of leaf (L/w)
Cultivar	Emergence	Appearance of stem	Growth cone	Bud		Length	Width	
Chaperon rouge	125,4	190,6	17-21 II	28 III - 2 IV	40-41	14,2	5,4	2,63
Mary Ann	142,2	203,4	15-20 II	26 - 28 III	40	13,7	5,1	2,69
Candela	149,3	205,8	5-8 II	18 - 22 III	42-43	15,0	7,3	2,05
Golden apeldoorn	130,6	187,3	22-28 II	28 III - 2 IV	35-34	15,1	7,2	2,30
Unicum	97,8	123,7	18-26 II	26 - 30 III	37-32	11,9	4,2	2,83
Judith Leyster	108,3	164,5	26II-5 III	27 III - 3 IV	27-29	14,8	7,1	2,08
Average	125,6	179,2				14,1	6,1	2,31

Table 3

Experimental results regarding the characteristics of leaves and leaf area at tulip cultivars studied in 2011

Variant		Frunza												Leaf area (cm^2)
No.	Cultivar	1			2			3			4			
		L (cm)	w (cm)	area (cm^2)	L (cm)	w (cm)	area (cm^2)	L (cm)	w (cm)	area (cm^2)	L (cm)	w (cm)	area (cm^2)	
1	*Chaperon rouge*	18,3	8,1	111,2	16,6	5,5	68,5	13,3	4,0	39,9	8,4	3,7	23,3	242,9
2	*Mary Ann*	17,6	7,6	100,3	16,2	5,5	66,8	12,3	3,9	36,0	8,7	3,4	22,2	225,3
3	*Candela*	20,1	11,9	179,4	18,1	8,3	113,9	14,3	6,3	67,6	7,3	2,8	15,3	376,2
4	*Golden apeldoorn*	19,7	12,0	177,4	17,3	7,1	92,1	15,9	5,8	69,2	7,3	4,0	21,9	360,6
5	*Unicum*	15,3	5,7	65,4	14,1	4,5	47,6	10,4	3,2	24,7	7,7	3,0	17,9	155,6
6	*Judith Leyster*	21,5	11,7	188,7	17,5	6,8	89,3	13,4	5,8	58,3	6,9	4,0	20,2	356,5
	Average	18,8	9,5	137,1	16,6	6,3	79,7	13,3	4,8	49,3	7,7	3,5	20,1	286,2

Table 4

Summary of experimental results on leaf area under the influence of cultivar (2011)

No.	Cultivar	Leaf area		±d	Significance of the difference
		cm^2	%		
1	*Chaperon rouge*	242,9	84,9	-43,3	00
2	*Mary Ann*	225,3	78,7	-60,9	000
3	*Candela*	376,2	131,5	90,0	***
4	*Golden apeldoorn*	360,6	126,0	74,4	***
5	*Unicum*	155,6	54,4	-130,6	000
6	*Judith Leyster*	356,5	124,6	70,3	***
	Average	286,2	100	-	
	LSD 5%			29,6	
	LSD 1%			42,9	
	LSD 0,1%			57,2	

Another category of determinations was made on bulbs. To be able to be selected as flowering or non flowering bulbs, two measurements were made on the bulb diameter, height and weight. Bulbs that had both determinations of diameter over 2.5 cm were selected as flowering. The average values of these are given in Table 5. The average weight of a flowering bulb is within 14.3 g (‘Chaperon rouge’) and 24.0 g (‘Candela’). For 1 m^2 (considered the unit area) was obtained a medium quantity of 784.9 g, while the 1046.4 g represent the maximum and 564.1 g is the minimum value. The seed bulb’s weight per m^2 is an average value of 80.5% of the total weight of the obtained bulbs per m^2. Analyzing this aspect within each cultivar, it is found that the lowest percentage of flowering bulbs was obtained at 'Mary Ann' (76.8) and the highest (88.6) at ‘Candela’.

Table 5

Experimental results on the production of seed bulbs and their characteristics of the tulip cultivars studied in 2011

Variant	Characteristics of seed bulbs					Seed bulbs/m^2		
Cultivar	H (cm)	Ø (cm)	Ø (cm)	Øm (cm)	g	pieces	g	% of t
Chaperon rouge	4,6	2,6	3,0	2,80	14,3	40,2	574,9	78,5
Mary Ann	4,9	2,8	3,1	2,95	14,5	38,9	564,1	76,8
Candela	4,9	3,0	3,8	3,40	24,0	43,6	1046,4	88,6
Golden apeldoorn	4,1	3,0	3,7	3,35	21,5	44,2	950,3	80,3
Unicum	3,1	2,6	3,2	2,90	17,8	37,8	372,8	77,3
Judith Leyster	4,2	3,7	3,0	3,35	21,7	41,5	900,6	81,2
Average	4,3	2,9	3,3	3,13	19,0	41,0	784,9	80,5

Statistical analysis of the quantity of flowering bulbs (Table 6) show that the two cultivars (‘Champeron rouge’ and 'Mary Ann'), have significant negative differences, other two cultivars ('Candela' and ‘Gloden Apeldoorn’) are having significant positive values, ‚Judith Leyster’ has significantly positive values and (‘Unicum’) has significantly negative values. It can be observed that in this respect, the cultivars studied are different from each other.

Table 6

Summary of experimental results on the production of flowering bulbs/m^2 on studied tulip cultivars (2011)

No.	Variant	Flowering bulbs/m^2		± d	Significance of the difference
	Cultivar	weight	% of the average	G	
1	*Chaperon rouge*	574,9	73,2	-210,0	000
2	*Mary Ann*	564,1	71,9	-22,0	000
3	*Candela*	1046,4	133,3	261,5	***
4	*Golden apeldoorn*	1950,3	121,1	165,4	***
5	*Unicum*	672,8	85,7	-112,1	0
6	*Judith Leyster*	900,6	114,7	115,7	*
	Average	784,9	100,0		

CONCLUSIONS

1. Cultivars studied have very good capacity of rooting, which provides good nutrition and fixing soil.

2. The shortest period of 27-29 days from emergence to floral bud initiation is achieved at cultivar 'Judith Leyster', and the longest period of 42-43 days is the cultivar ‚Candela'. These differences make the studied varieties to stagger the flowering period.

3. Cultivars 'Golden Apeldoorn' and 'Candela' are having the leaf area 360.6 cm^2 and 376.2 cm^2 which also have the largest quantities of mother flowering bulbs.

4. To produce flowering bulbs the recommended cultivars are: 'Candela' 'Golden Apeldoorn' and 'Judith Leyster'.

REFERENCES

1. **Cantor Maria, Dumitraş Adelina, Zaharia D., 2007** – *Plante bulboase utilizate în amenajări peisagistice*. Ed. Todesco, Cluj-Napoca.
2. **Halevy A.H., Asen S., 1959** - *Identification of the anthocyanins in petals of tulip varieties Smiling Queen and Pride of Haarlem*. Plant Physiol., 34, p. 494–499.
3. **Hall Sir A. Daniel, 1931** - *Polyploidy in Tulipa*. The Gardener's Chronicle, 90 (III), p. 30.
4. **Nieuwhof M., van Eijk J.P., Eikelboom W., 1989** - *Relation between flower colour and pigment composition of tulip (Tulipa L.)*. Neth. J. Agric. Sci. 37, p. 365–370.
5. **Preda M.,1989** – *Dicționar dendrofloricol*. Ed. Științifică și eucidopedică. București
6. **Shibata M., Ishikura N.,1960** – *Paper chromatographic survey of anthocyanin in tulip-flowers*. I. Jpn. J.Bot., 17, p. 230-238.
7. **Șelaru Elena, 2007** - *Cultura florilor de grădină*. Editura Ceres. Bucureşti.
8. **Torskangerpoll K., Fossen T., Andersen M., 1999** - *Anthocyanin pigments of tulips*. Phytochemistry 2, p. 1687–1692.
9. **Van Eijk J.P., Nieuwhof M., Van Keulen H.A., Keijzer, P., 1987** - *Flower colour analyses in tulip (Tulipa L.). The occurrence of carotenoids and flavonoids in tulip tepals*. Euphytica 36, p. 855–862.
10. **Upcott M., LaCour L., 1936** – *The genetic structure of Tulipa I.A. chromoseome survey.* J. Genetics, 33, p. 237-254.
11. **Zaharia D., 1994** – *Floricultură*. Ed. Agronomia. Cluj-Napoca
12. **Zeilinga A. E., Schouten H.P., 1968** – *Polyploidy in garden tulips I A survey of Tulipa varietes for polyploids*. Euphytica 17, p. 252-264.

CONTRIBUTIONS TO THE KNOWLEDGE OF THE BEHAVIOR OF NEW VARIETIES OF VINE PAULA AND GELU TO BAD WEATHER CONDITIONS

CONTRIBUȚII LA CUNOAȘTEREA COMPORTĂRII SOIURILOR NOI DE VIȚĂ DE VIE PAULA ȘI GELU LA CONDIȚII CLIMATICE NEFAVORABILE

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Abstract. *In the vineyard ecosystem Copou-Iasi, in 2012, were recorded absolute minimum temperatures far below the freezing limit of the vine, -26.7°C and -33.0°C in air and ground surface. In the summer and early autumn of 2012 it was very hot, with average daily temperatures higher by 1°C to 4°C above normal, and the absolute maximum temperature above 35°C, persistent, sometimes reaching 40°C and the rainfalls totalised 89,6 mm. These values have influenced the phenophases of vegetation growth processes, the productivity and quality characteristics of the vines in the variety. New varieties, Paula and Gelu, were affected by the frosts in winter, when the buds losses ranged from 60-70% and by the prolonged drought in 2011 which has increased in 2012 that has resulted in yields under the potential of the variety of grape, limitation of the size of the grapes and grains and thus reducing their commercial value.*
Key words: *new varieties, resistance, climatic factors, production, quality*

Rezumat. *În ecosistemul viticol Copou-Iaşi, în anul 2012 au fost prezente temperaturi minime absolute, cu mult sub limita de îngheț a viței de vie, respectiv de -26,7°C în aer şi de -33,0°C la suprafața solului. Vara anului 2012 şi începutul toamnei, a fost foarte caldă, caniculară şi secetoasă, cu temperaturi medii zilnice mai mari cu 1°C până la 4°C față de cele normale, şi temperaturi maxime absolute de peste 35°C, persistente, atingând uneori 40°C, iar precipitațiile au însumat 89,6 mm. Aceste valori şi-au pus amprenta asupra fenofazelor de vegetație, proceselor de creştere, însuşirilor de productivitate şi calitate ale soiurilor de viță de vie din sortiment. Soiurile Paula şi Gelu au fost afectate de îngheț, înregistrând pierderi de muguri de 60-70% cât şi de seceta prelungită din 2011 care s-a accentuat în anul 2012 şi care a condus la realizarea unor producții de struguri sub potențialul soiurilor afectând şi calitatea acestora.*
Cuvinte cheie*: soiuri noi, rezistență, factori climatici, producție, calitate*

INTRODUCTION

Viticultural conveer that constructs the assortment of table grape varieties, was improved by creating new varieties with early maturing age, with better

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adaptability to the ecosystem in which they were created, with superior characteristics of production and quality due berry and grapes size, core consistency and diversified skin coloration shaded in different colors, making them attractive to consumers. Studies regarding the knowledge of these species behavior in their originary areas, were performed by their authors in certain environmental conditions (Calistru et. al., 1997, 1998, 1999, Doina Damian 1992, 2006). Climate changes that have occurred in recent years, showed a national average warming of 0.3°C, more pronounced in the eastern half of the country and a lower rainfall regime. From this point of view, in Copou-Iaşi vineyard ecosystem, we see a decrease of precipitation regime, an alternation of rainy and excessively rainy years (1-2 years) with excessively dry and very dry years and with normal years. At these conditions are added an increased frequency of severe frosts in winter, with absolute minimum temperatures below freezing level of the vine. The climatic conditions in 2012, allowed performing the research on new table grapes varieties behavior, Paula and Gelu, on the cumulative effect of stressful environmental factors, in terms of production resistance and its quality compared with another new variety created at SCDVV Iaşi, Aromat de Iaşi, with close age of maturation and mixed functions.

MATERIAL ŞI METHOD

The research was conducted in the experimental plantations filled with new varieties, Paula and Gelu, established in 2002. They are located on a chernozem soil in which were practiced planting distance of 2.2 m between rows and 1.2 m on row, providing an average density of 3787 vines / ha. Was performed the culture system on stems of 70 cm height, the vine trunk beeing driven as bilateral cordon and the cutting system was the short cane with 2-3 buds ensuring a load of fruit of 25 - 35 buds / vine and with safety buds at the basis of vine that were protected by a mound in winter in order to regenerate the vine trunk vegetative potential in case of cane buds freezing.

The culture technology used was that recommended by vine agrotechnics for table grapes culture. The observations made on the studied varieties included the following aspects: monitoring the climatic factors by weather station AGROEXPERT and calculation of their level, recording the vegetation phenophases, grapes production and quality and especially resistance to wintering, prolonged drought and extreme temperatures.

RESULTS AND DISCUSSIONS

Climatic conditions of the year 2012 were less favorable for viticulture, negatively influencing the physiological and metabolic processes, conditioning the increasing, the fructification and grapes production and its quality.

From thermal point of view, the winter of 2012 was a frosty one with absolute minimum temperatures much below the strength of the vine, which occurred periodically with values of -26.7°C in air and -33.0°C at the soil surface that was covered by a thick layer of snow (50 cm) which ensured by melting 60 mm of precipitation (table 1). Note that in February,diurnal maximum temperatures were low, with values between -10.5°C and -14.9°C, and the

average daily temperatures between 2°C and -19.2°C, the average of this month being -9.3°C against the multi-annual value of -1.9°C.

Table 1

Values of the main climatic elements registered in 2012 in Iaşi-Copou Vineyard Center

Month	Temperature ^{0}C, aer			Temperature ^{0}C, sol			Amount degrees of temperature, ^{0}C			Hygroscopicity %	Precipitation m	Heat stroke, hours
	med	max	min	med	max	min	global	activ	useful			
I	-2,8	11,8	-17,9	-3,2	10,7	-21,8				81	12,3	99,8
II	-9,3	7,2	-26,7	-11,1	1,5	-33,0				80	61,0	150,1
III	3,8	20,4	-9,5	3,4	33,8	-8,6				65	15,8	157,6
IV	12,9	30,0	-1,5	14,2	51,5	-1,9	387,3	340,1	120,1	62	66,2	187,2
V	17,7	31,0	6,3	22,5	56,4	6,1	548,4	548,4	238,4	63	85,0	217,9
VI	22,3	36,0	11,6	29,5	66,8	7,5	670,2	670,2	370,2	56	26,2	314,7
VII	25,4	38,0	14,0	33,3	68,0	10,5	788,7	788,7	478,7	49	29,5	334,4
VIII	22,6	40,1	10,6	26,3	61,2	6,8	700,8	700,8	390,8	53	33,9	227,3
IX	18,6	30,5	8,4	21,3	49,7	4,2	557,4	548,1	258,1	57	46,4	217.6
X	11,7	28,0	0,4	12,1	39,5	-1,8				75	55,2	121,7
XI	6,0	18,6	-2,5	5,8	25,5	-3,8				84	26,8	76,1
XII	-3,8	9,4	-13,7	-4,6	8,9	-21,0				88	77,6	65,1
Total	**10,4**			**11,6**			**3652,8**	**3596,3**	**1856,3**	**68**	**535,9**	**2169,8**

Spring began with negative average temperatures which gradually increased reaching to 23-24°C in late April. The absolute maximum temperatures reached 30°C in air and 51.5°C at the soil surface. Accumulated rainfall in April-May was 151.2 mm. The summer of 2012 was estimated to be very warm; extreme hot and very dry with daily average temperatures between of 22.3-25.4°C, with 3-4°C over specific thermal normal of this season. Absolute maximum temperatures were very high reaching values over 35°C (13 days in July) and 40.1°C in August. Along with hot weather was installed the atmospheric and pedologic drought, the soil accessible moisture value for vine being below the wilting coefficient. The rainfalls accumulated in the summer months were only 89.6 mm, representing only 44% of normal of this period. The amount of sunshine hours recorded high values between 217.9 and 334.4 hours. Warm weather has been maintained in the autumn months, in September the value of daily average temperature was 18.6°C, with 2°C above multiannual average and the absolute maximum was 30.5°C, October and November while maintaining the same characteristic of warm weather. Referring to the period of active growth, it appears that global thermal balance, active and useful, showed high values, respectively 3652.8°C, 3592.3°C and 1856.3°C, rainfalls were reduced, only 287.6 mm, and the length of sunshine hours of 1499.1. By going through unfavorable conditions of climate, the knowledge of Paula and Gelu varieties behavior has been complemented with new elements necessary for the practice of production. Studied in terms of resistance to frost, it was found that they were affected in a large proportion, as a specific characteristic for table grape varieties. By winter buds viability analysis determined in dormant period by longitudinal

sections of buds complex and visualization at binocular magnifier, it was found that on the length of a cane of 10-12 buds the viability was variable, being corelated to temperature differences recorded at different heights (table 2).

Table 2

Winter buds viability of studied genotypes, in Iaşi-Copou Vineyard Center

No.	Variety	% viable buds – pozition on the cane								
		1 - 3			1 - 6			1 - 12		
		P	S	P + S	P	S	P + S	P	S	P + S
1	Paula	44	83	83	36	86	86	32	88	88
2	Gelu	31	94	94	18	94	94	19	94	94
3	Aromat de Iaşi (control)	21	56	56	26	69	69	24	70	70

A better resistance showed Paula variety, the percentage of viable primary buds was 44% (position 1-3), decreasing to the peak at 32% (position 1-12), and the viability of the whole buds complex was smaller at the basis of the cane (83%), up to 88% on top of the cane. Gelu variety showed a lower resistance, only 31% of the main buds on chord position 1-3 were viable, and on the whole buds complex was 94%. Both varieties were superior for this feature to compared variety Aromat de Iaşi, where the proportion of viable buds was growing from the base (21% primary buds) to the top of the chord (24%). At the begining of the vegetation, these varieties have recovered their vegetative system through protected buds on the safety cords or through secondary buds from the cords.

The started shoots had a high force of growth mostly being fertile. At Paula variety, the shoots had a good fertility thus ensuring the production of this year by a lower quality. Research on the phenophases sequence and physiological perfection completed by the studied varieties in relation to ecological factors characteristic for 2012, shows that the phenophases of vegetation were conditioned by the level and cumulative action of climatic factors and by the hereditary specific of the variety. The budbursting occurred for Paula variety on April 25th 2012, followed by Gelu variety, on 26th April 2012, both after Aromat de Iaşi, on 23th April 2012 (table 3), being influenced by high temperatures in late April.

Table 3

Phenological cycle of the grapevines – 2012, in Iaşi-Copou Vineyard Center

Variety	Budburst	Flowering	Veraison	Grape maturity	Leaves fall	Vegetation periode, no. days
Paula	25.04	30.05	09.07	08.08	03.11	190
Gelu	26.04	02.06	15.07	15.08	03.11	189
Aromat de Iaşi (control)	23.04	26.05	11.07	25.08	03.11	192

Flowering took place between 30th May to 2th June, Paula and Gelu varieties being brought forward with 4-7 days towards witness variety and with about two weeks towards normal years. Cold weather and high atmospheric humidity during flowering led to an uneven and closed flowering, and the processes of pollination, fertilizaton and binding berries have been affected,

aspects that will be reflected in the quantity and especially the quality of production. Grapes veraison was marked by Paula variety (9th July), followed by Gelu variety (15th July), and the grapes could be consumed since 8th August (Paula variety) and after 15th August the Gelu variety, while the witness after 25th August. Cycle of active vegetation period at studied varieties totaled 189-192 days, the end of vegetation taking place on 3 th November due to occurrence of frost. The fertility and the productivity as elements that define the ability of a variety for fructification and production, have been strongly influenced by climatic conditions of the year 2012 (table 4).

Table 4

Fertility and productivity of studied varieties, in Iaşi-Copou Vineyard Center

Variety	Fertile shoots %	Fertility coefficient		Productivity index	
		FCA	FCR	PAI	PRI
Paula	33	1,0	0,45	205	92
Gelu	47	1,15	0,55	230	110
Aromat de Iaşi (control)	52	1,25	0,73	200	116

FCA – fertility coefficient absolutely, FCR – fertility coefficient relative
PAI – productivity absolutely index, PRI –productivity relative index

The percentage of fertile shoots had values below the potential of each variety, as well the coefficients of fertility and indices of productivity. Compared to the reference variety, Aromat de Iaşi, Paula and Gelu varieties had lower fertility, with values of the fertility coefficient absolutely above unit 1,0 or 1.15, and with the relative one of 0.45 and 0.55. The absolute and relative productivity was also small. Cumulative action effect of the climatic factors of stress can be found in grapes production and its quality.

Thus, buds losses due to frosts in winter, cold and wet weather during flowering and berries binding as well as strong drought and hot weather during grapes growth and ripening, have led to lower grapes production, which not reached to the known quality parameters (table 5).

Table 5

Grapes production and its quality during year 2012 in Iaşi-Copou Vineyard Center

Variety	Grapes production			Quality of production			
	Effective Kg/vine	Calculated t/ha	Wares %	Average weight grape, g	Average weight of 100 berries, g	Sugars g/l	Total acidity g/l H_2SO_4
Paula	0,75	2,85	76	205	328	170	2,9
Gelu	2,4	9,1	80	200	318	168	2,1
Aromat de Iaşi (control)	1,71	6,0	65	160	22,0	175	3,5

The new varieties of table grapes Paula and Gelu, realized very small productions, far below from normal years values, being strongly affected by winter frost, when a large part of the fruit buds were destroyed. And crop quality

was affected mainly by unfavorable conditions during the growing season, the grapes obtained being smaller, by 200 g at Gelu variety and 205 g at Paula variety, with smaller berries. The sugar accumulations were helped by the very hot weather during grapes ripening. The results obtained in 2012 regarding the culture of new varieties for table grapes in Iaşi Vineyard, impose mandatory measures to protect the vines in winter by burying the safety canes from the base, ensuring the recovery possibility of vegetative and production potential.

CONCLUSIONS

1. Viticultural year 2012 was characterized by absolute minimum temperatures below freezing limit for vine (-27.6°C), a cold and rainy spring, a hot summer and dry with daily average temperatures higher with 1-4°C compared to normal ones, with accumulated rainfall during June-July-August of only 89.6 mm.

2. Studied varieties were affected by frost, the fruit buds viability being of 20-32%.

3. Vegetation phenophases were brought forward almost with two weeks, compared to years with normal weather conditions.

4. Fertility of studied varieties has been below their genetic potential; between 33 and 47 % of the started shoots from the vine trunk being fertile.

5. Under the influence of mentioned climatic factors, the studied varieties, Paula and Gelu did not complete their known potential for quantitaty and qualitaty .

REFERENCES

1. **Calistru Gh., Doina Damian, 1997 –** *Rezultate privind crearea unor soiuri de struguri de masă pentru zonele cu resurse termice reduse.* Cercet. agron. în Moldova, vol. 3, Iaşi
2. **Calistru Gh., Doina Damian, 1998 –** *Paula – un soi nou de viță de vie pentru struguri de masă cu maturare timpurie.* Revista Hortinform nr. 2 – 66, Bucureşti.
3. **Calistru Gh., Doina Damian, 1999 –** *Gelu – un soi nou valoros pentru struguri de masă.* Lucr. şt., vol 1, seria Horticultură, Univ. Agron. Iaşi. şi Revista Fermierul – iulie Bucureşti
4. **Damian Doina, Gh. Calistru, 1992 –** *Posibilitatea lărgirii conveierului varietal din podgoria Iaşi cu noi soiuri de struguri pentru masă.* Cercet. agron. în Moldova, vol. 3, Iaşi
5. **Damian Doina, Gh. Calistru, C. Savin, Ancuța Vasile, Gabi Zaldea,** 2006 – *Valoarea agrobiologică şi tehnologică a unor soiuri noi şi clone de viță de vie create la SCDVV Iaşi.* Lucr. şt. seria Horticultură, vol 46,, Univ. Agron. Iaşi.

EFFECTS OF CLIMATE CHANGE ON GRAPE YIELD AND QUALITY ON A LONG-TERME EXPERIENCE

INFLUENȚA SCHIMBĂRILOR CLIMATICE ASUPRA PRODUCȚIEI ȘI CALITĂȚII STRUGURILOR, PE BAZA UNEI EXPERIENȚE DE LUNGĂ DURATĂ

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Abstract*. Starting with the fundamental influence of climatic factors on the territorial repartition, on the quantity and quality of viniviticultural products, there were studied the effects of global warming on grapevine, in the last decade. The research concerned the variety Fetească regală, clon 21 Bl, grafted on Kober 5 BB rootstock, on the experimental plantation of the University of Agronomical Sciences and Veterinary Medicine Bucharest, in 2001-2012. Following the evolution of climatic indicators in this period, as compared to the annual average, we can notice the frequence of the years with high temperature at maturation, which led to increased sugar accumulation in the grapes, lowering the acidity of the must, together with the speed-up of the fenophasis and the extension of favourable areas for viticulture.*
Key words: *climate change, vine, grape quality*

Rezumat. Începând cu influența fundamentală a factorilor climatici asupra repartizării teritoriale, a cantității și calității produselor vitivinicole, au fost studiate influențele încălzirii globale asupra viței-de-vie, în ultima decadă. Cercetările au fost efectuate la soiul Fetească regală, clona 21 Bl, altoită pe portaltoiul Kober 5 BB, în plantația experimentală a Universității de Ştiințe Agronomice şi Medicină Veterinară Bucureşti în perioada 2001-2012. Urmărind evoluția indicatorilor climatici în această perioadă, comparativ cu media multianuală, s-a constatat o frecvență mai mare a anilor cu temperaturi ridicate în perioada de maturare a strugurilor, fapt ce a condus la acumulări sporite de zaharuri în boabe, reducerea acidității mustului, alături de o desfăşurare mai rapidă a fenofazelor şi extinderea zonelor favorabile pentru viticultură.
Cuvinte cheie: *schimbări climatice, vița-de-vie, calitate struguri*

INTRODUCTION

The influence of climate changes on grapevine, obvious recent decades is the concern of many researchers, in order to establish strategies to adapt to this phenomenon (Burzo and Dobrescu, 2011; Bock et al., 2011; Retallack, 2012; Salazar-Parra et al., 2012). The impact of these changes was studied on both grapevine (phenology, yield quality, diseases, erosion) and wine (typicity, microbiology, color, flavors) etc (Cotea et al., 2008; Dejeu et al., 2008; Bucur et al., 2012).

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This works aims at evaluating the main climate changes occurred during the last 52 years (1961-2012), as well as their influence on grapevine, in a long term experience (2001-2012).

MATERIAL AND METHOD

The experience was conducted in the experimental plantation of the Horticulture Faculty within USAMV Bucharest, during 2001-2012. Plantation was established in 1994, with the variety of Fetească regală, clone 21 BI, grafted on Kober 5 BB, planted at distances of 2.2/1.2 m (3787 vines/ha), with spur – pruning cordon and loading of 10 eyes/m^2.

The following parameters were taken into consideration for a period of 52 years (1961-2012): the average annual temperature; the average temperature during the growing season (IV-X); average temperature of the hottest month (July or August) and on seasons (spring III-V, summer VI-VIII, autumn IX-XI and winter XII-II); annual precipitations, during the growing season and on seasons.

Using the information from a long term experience (2001-2012), a series of correlations were established between: precipitations and the wood eliminated annually after pruning; average temperature during growing season (IV-X) and sugars accumulated in grapes; average temperature during summer (VI-VIII) and sugar concentration; average temperature during the hottest month (VII or VIII) and titratable acidity; rainfall in summer (VI-VIII) and sugars; annual rainfall and titratable acidity.

RESULTS AND DISCUSSIONS

On climatic conditions. Following the evolution of average annual temperature during the 52 years (fig. 1) there is a significantly distinct heating especially during the last decade with approximately 0.8ºC from the beginning of the study period.

An obvious warming can be noticed also concerning the average temperature during growing season, the difference being that, for the same interval, of 1.0-1.1ºC (fig. 2).

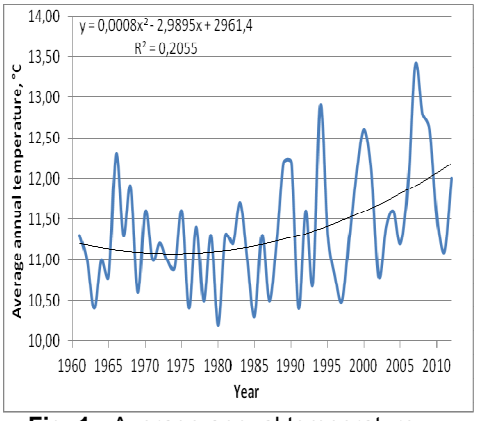

Fig. 1 - Average annual temperature evolution, ºC (1961-2012)

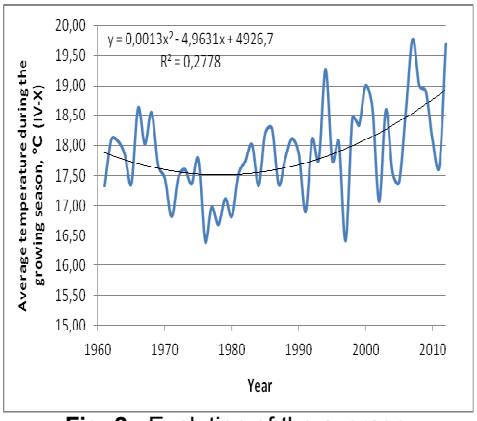

Fig. 2 - Evolution of the average temperature during the growing season (IV-X)

The warming is even more accentuated during summer (VI-VIII), highlighted by a difference of almost 2ºC and the highest degree of significance (fig. 3). It is known that climate changes manifest also by an increased frequency of extreme phenomena (accentuated winter frosts, severe summer drought, storms etc.). In our case we noticed an increased frequency during the last decade of minimum harmful temperatures for grapevine (< -20ºC), but also by lower values (fig. 4).

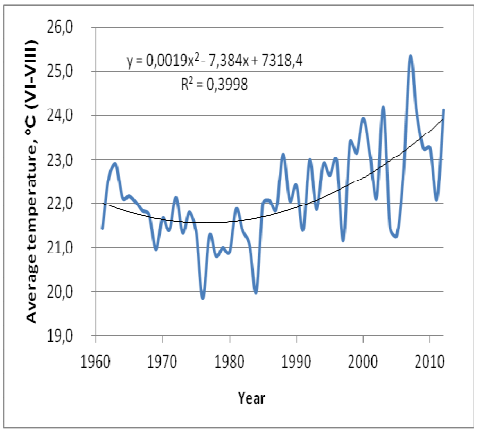

Fig. 3 - Evolution of the average temperature in summer season, ºC (VI-VIII, 1961-2012)

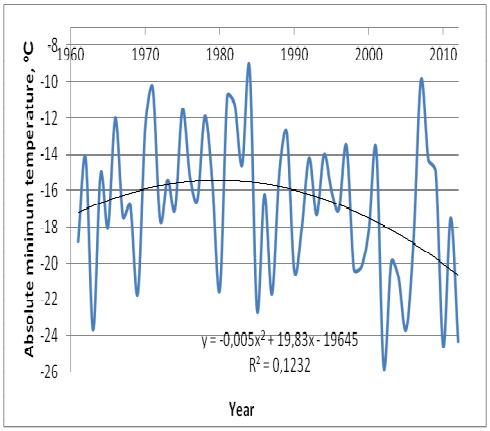

Fig. 4 - The absolute minimum temperature evolution, ºC (1961-2012)

Related to the annual rainfall during growing and the season of summer, there are no significant changes, except for higher variations from one year to another (fig. 5, 6 and 7).

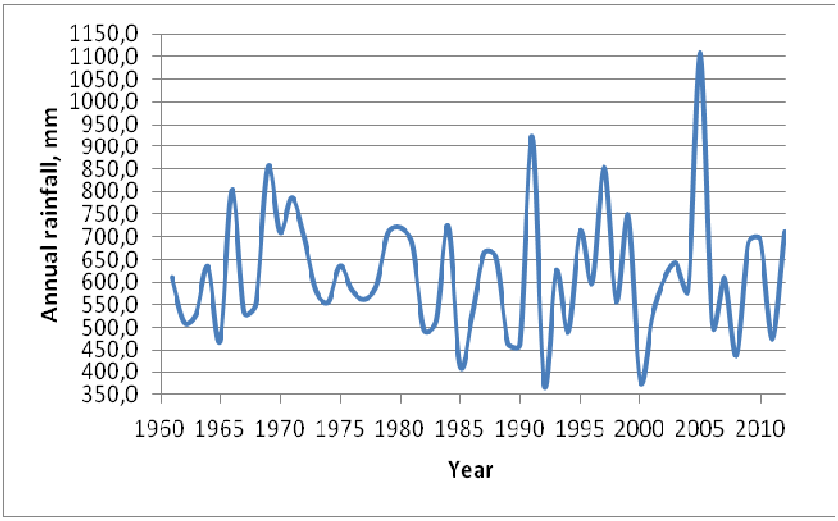

Fig. 5 - Evolution of annual rainfall (mm)

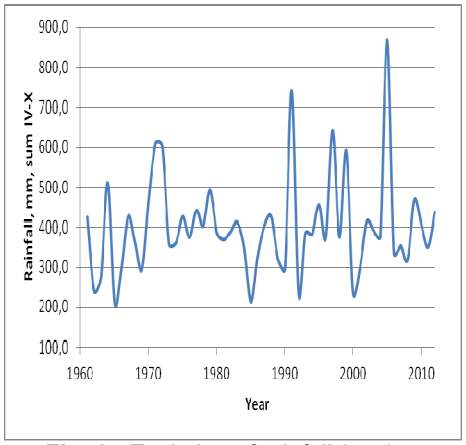

Fig. 6 - Evolution of rainfall (mm) in the growing season (IV-X)

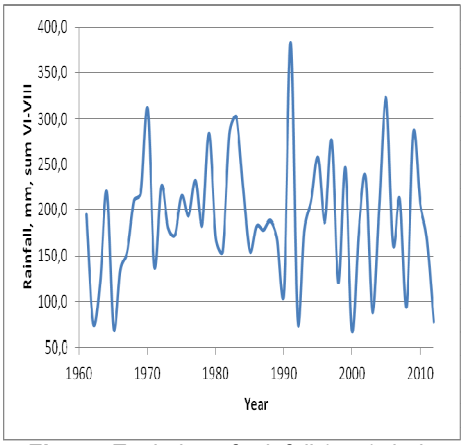

Fig. 7 - Evolution of rainfall (mm) during the summer (VI-VIII)

Related to the influence of climate changes on grapevine. A distinctly significant correlation was established between spring rainfall (III-V) and the quantity of annual wood eliminated at pruning (fig. 8).

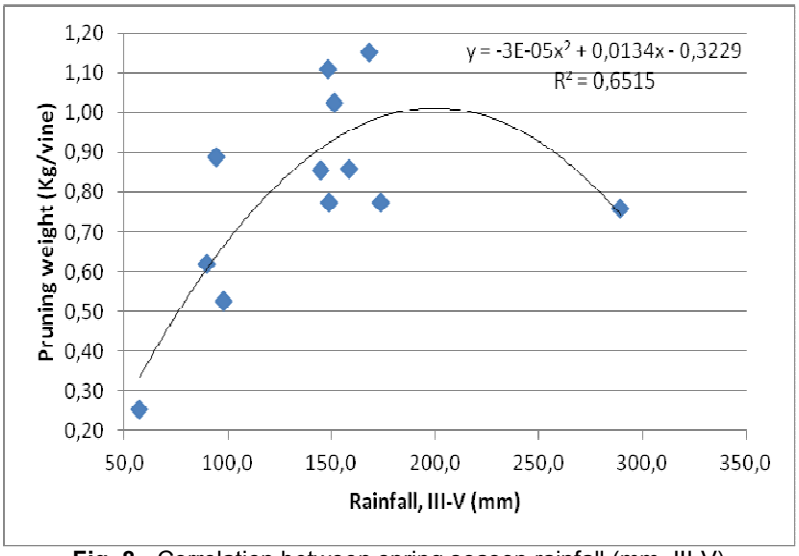

Fig. 8 - Correlation between spring season rainfall (mm, III-V) and pruning weight (kg/vine)

Higher temperatures during growing season, but especially during summer are positively correlated with the accumulation of sugars in grapes (fig. 9, 10).

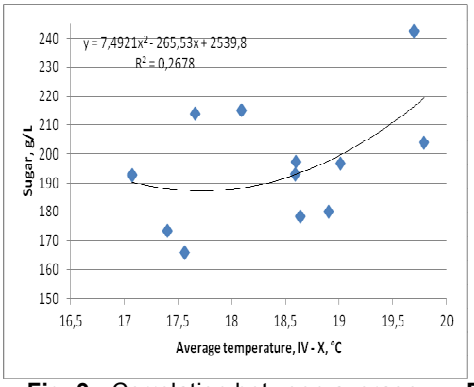

Fig. 9 - Correlation between average growing season temperature (ºC, IV-X) and sugar accumulation in grape berries (g/L)

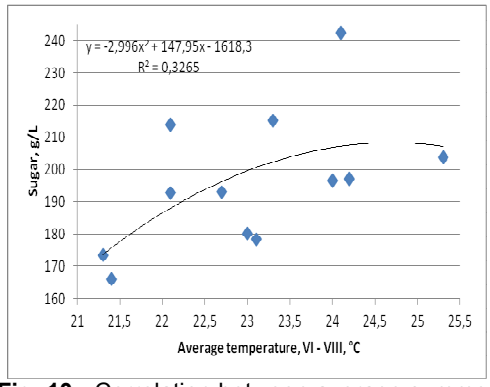

Fig. 10 - Correlation between average summer temperature (ºC, VI-VIII) and sugar accumulation in grape berries (g/L)

A significant parabolic correlation was determined between the average temperature in the warmest month (July or August) and the titratable acidity of the must (fig. 11).

Increasing the amount of rainfall from 30 to 110 mm, has determined a lower accumulation of sugar with approximately 30 g/L (fig. 12).

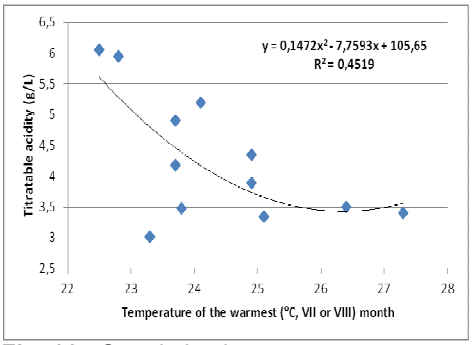

Fig. 11 - Correlation between temperature of the warmest month (VII or VIII) and titratable acidity (g/L)

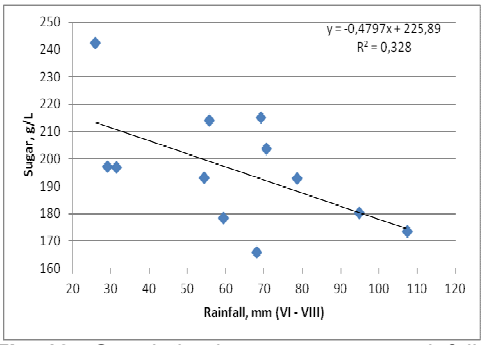

Fig. 12 - Correlation between summer rainfall (mm, VI-VIII) and sugar accumulation in grape berries (g/L)

CONCLUSIONS

1. Study of the evolution of climate elements during a long period of time (1961-2012), has highlighted an increase of the average annual temperature with approximately 0.8ºC, of that during growing season with 1.0-1.1ºC and with almost 2ºC of that during the summer season (VI-VIII).

2. Also, a higher frequency was observed during the last decade of the minimum harmful temperatures for grapevines (under -20ºC).

3. Analyzing the evolution of rainfalls, no significant changes are found, except for bigger oscillations, related to both the annual quantum, and to that of the growing period (IV-X) and from the season of summer (VI-VIII).

4. The existence of a distinctively significant correlation was established between the quantum of rainfalls during the season of spring (III-V) and the quantity of annual wood eliminated at pruning.

5. Accumulation of sugars in grapes increases as the average temperature grows during April-October, but especially with that of the summer season (June-August).

6. Increasing the temperature during the warmest month (July and August), obvious in the last decade, has determined an accentuated reducing of the titratable acidity.

7. Increasing rainfalls during summer season (June-August), from 30 to 110 mm, has determined more reduced accumulations of sugars (from 210 g/L to 180 g/L).

REFERENCES

1. **Burzo I., Dobrescu Aurelia, 2011 –** *Stresul termohidric la plante. Temperaturi ridicate şi secetă.* Editura Ceres, Bucureşti.
2. **Bucur Georgeta Mihaela**, **Dejeu L., Cazan G., Tănase Ana, 2012** - *Researches concerning the influences of climate changes on grapevine*. Scientifical Papers U.S.A.M.V. Bucharest, seria B, vol. LVI, p. 43-47.
3. **Bock Anna, Sjarks T., Estrella N., Menzel Annette, 2011** – *Changes in the phenology and composition of wine from Franconia*, *Germany.* Climate Research, vol. 50, p. 69-81.
4. **Cotea V.V., Rotaru Liliana, Irimia L.M., Colibalea C., Tudose Sandu- Ville S., 2008 –** *The grean house effect on the viticultural ecoclimat in Northern Moldavia, Romania.* 31st World Congress of vine and wine, 15-20 June, 2008, Verona, Italy.
5. **Dejeu L., Patic M., Mereanu Diana, Savu (Bucur) Georgeta Mihaela, Gutue C., 2008 –** *Impact of climat change on grapevine culture durability*. 31st World Congress of Vine and Wine, 15-20 June, Verona, Italia.
6. **Retallack Mary, 2012** – *What can be done in the vineyard to manage risk in difficult seasons?* Grapegrower & Winemaker, Novembre 2012, issues 5861.
7. **Salazar- Parra C., Aguirreol J., Sanchez- Diaz M., Irigoen J.J., Morales F., 2012** – *Photosynthetic response of Tempranillo grapevine to climate change scenarios.* Annals of Applied Biology, vol. 61, Issue 3, p. 277–292.

STUDIES OF THE INFLUENCE OF CLIMATIC CHANGES ON SOME GRAPE VARIETIES FOR WHITE WINES IN MOLDAVIAN VINEYARDS

CERCETĂRI PRIVIND INFLUENȚA MODIFICĂRILOR CLIMATICE ASUPRA UNOR SOIURI PENTRU VINURI ALBE CULTIVATE ÎN PODGORIILE MOLDOVEI

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Abstract: *Global warming has multiple effects and represents an important stress on the vine plant. Small amounts of rain, extreme negative and positive temperatures at a too short time intervals, all increase the bad influence of the ever-changing climate, leading to shortening the phenophses period, hastening grape maturation, with positive and negative implications. This article presents, in a comparative manner, the compositional characteristics of wines obtained from grapes harvested from Moldovian vineyards (Iasi, Contari and Targu Bujor) from three consecutive years 2010, 2011 and 2012.*
Key words*: climatic changes, white wines, viticultural regions*

Rezumat: *Incălzirea globală, din ce în ce mai vizibilă datorită efectelor sale multiple, reprezintă un stress important asupra viței de vie. Precipitațiile reduse, temperaturile negative şi pozitive extreme ce se succed la intervale reduse de timp, toate sporesc influenta nefastă a climatului în continuă schimbare şi conduc la scurtarea fenofazelor de vegetatie, precipitând maturarea strugurilor, cu implicații semnificative, în sens pozitiv, dar şi negativ. În lucrare sunt prezentate comparativ caracteristicile de compozitie ale vinurilor obtinute din struguri recoltati din podgoriile Moldovei (Iasi, Cotnari, Dealurile Bujorului), sub influența modificărilor climatice din ultimii trei ani, 2010, 2011 si 2012.*
Cuvinte cheie *: modificari climatice, vinuri albe, regiuni viticole*

INTRODUCTION

Climate generally constrains a given variety's optimum ripening conditions to a narrow geographic zone, putting the grapevines at a greater potential risk from climatic variations and change than crops with a broader geographic range (Jones, 2005). Furthermore, wine has developed as a key economic sector with broad historical, social, and cultural identity (Tate, 2001) derived from grape growing and production (e.g., the Moldavian Hills region, Romania). Based on the cultural and economic importance of viticulture, extensive evidence of historical responsiveness to climate change and the

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potential impacts that may come from future climate change, this research studies the nature and trends of climate (Rotaru et al., 2013) and wine quality for the three most important vineyards in the North-Eastern part of Romania.

MATERIAL AND METHOD

Three North-Moldavian vineyards (Iasi, Cotnari and Targu Bujor) and wines obtained from four grape varieties (Frâncuşă, Fetească regală, Grasă de Cotnari and Tamaioasa romaneasca) were taken into study during 2010-2012 viticultural years.

RESULTS AND DISCUSSIONS

A comparative evaluation of the wines obtained during the three study years was done in order to underline the influence of the *terroir* on the final viticultural product: wine.

The Feteasca regala wines (table 1) have high alcoholic concentrations, ranging between 11,02% (Feteasca regala Tg. Bujor 2012) and 14,98% vol. (Feteasca regala Tg. Bujor 2011), thus classifying as quality wines. The values of reductive substances are as follows: 1,05 g/L Feteasca regala Tg. Bujor 2012 – 46,59 g/L Feteasca regala Iasi 2010; except the wines obtained from Feteasca regala in Iasi vineyard, harvest of 2010 and 2011, all other wines are dry. The values of the non-reductive extract vary between 11,31 g/L (Feteasca regala Iasi 2010) and 20,92 (Feteasca regala Tg. Bujor 2012); all, except Feteasca regala Iasi 2010 wines, are wines of superior quality.

Table 2 presents the values of the compositional characteristics of Francusa wines from Iasi and Cotnari vineyards, during 2010-2012. The total acidity of Francusa wines is equilibrated, with values between 6,03 (Francusa Cotnari 2012) and 10,56 g/L $C_4H_6O_6$ (Francusa Cotnari 2011).

The alcoholic concentration has values ranging from 9,71% (Francusa Cotnari 2012) and 12,92 (Francusa Iasi 2011); the lower alcoholic concentrations than those of the previous samples are a results of the early harvesting because of unfavourable climatic conditions. Francusa wines are also dry, ranging between 0,72 (Francusa Iasi 2011) – 1,26 g/L (Francusa Iasi 2012) reductive substances, except the sample Francusa Iasi 2010, with 18,21 g/L fermentiscible sugars. The values of the non-reductive extract of Francusa wines has values between 18,79 (Francusa Iasi 2010) and 23,79 g/L (Francusa Cotnari 2010); this serves as proof for classifying the variants as quality wines, according to the Romanian legislation.

Table 3 presents the main compositional characteristics of the wines obtained from Grasa de Cotnari variety during 2010 -2012 in Iasi and Cotnari vineyards.

Table 4 registers the values of the main physical-chemical characteristics of Tamaioasa romaneasca wines during 2010 -2012 in Iasi and Cotnari vineyards.

The values of the alcoholic concentration are specific to this type of wines, describing the oenological potential of this grape variety, ranging between

10,96% (Grasa de Cotnari, Cotnari 2010) and 14,44% vol. alcohol (Grasa de Cotnari, Iasi 2011).The Grasa de Cotnari wines have concentrations of the reductive substances lower than 4 g/L, except the ones obtained in Iasi vineyard in 2010 and 2011; in these two years, demidry wines were obtained with values of remanent sugars between 4,23 and 8,34 g/L. The values of the non-reductive extract is similar to the other wines, ranging between 18,67 (Grasa de Cotnari, Iasi 2011) – 28,73 g/L (Grasa de Cotnari, Cotnari 2012), while the other results are close to 22 g/L, the normal values for this type of wine.

Table 1

Main compositional parameters of Fetească regala wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,33	7,39	11,08	1,0076	46,59	11,31	57,9	23,69	94,12
Tg. Bujor 2010	0,53	7,1	12,7	0,9913	1,42	19,18	20,6	61,27	129,18
Iasi 2011	0,23	7,77	13,79	0,99185	7,02	18,23	25,30	22,24	61,24
Tg. Bujor 2011	0,18	7,05	14,98	0,98925	1,68	20,22	21,90	21,02	65,81
Iasi 2012	0,27	5,78	12,29	0,99293	2,58	20,92	23,50	26,41	195,29
Tg. Bujor 2012	0,31	5,81	11,02	0,99394	1,05	21,15	22,20	24,58	155,32

Table 2

Main compositional parameters of Francusa wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,28	7,97	11,21	0,9993	18,21	18,79	37	19,58	85,59
Cotnari 2010	0,25	10,56	8,43	0,998	1,01	23,79	24,8	74,85	129,49
Iasi 2011	0,19	9,34	12,92	0,99148	0,72	20,88	21,60	24,07	57,58
Cotnari 2011	0,19	7,58	11,43	0,99303	0,74	20,36	21,10	27,11	55,14
Iasi 2012	0,22	6,72	11,14	0,99316	1,26	19,46	20,90	25,06	153,18
Cotnari 2012	0,19	6,03	9,71	0,99454	0,94	18,86	19,80	40,68	147,29

Table 3

Main compositional parameters of Grasa de Cotnari wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,33	9,17	12,33	0,9958	8,37	22,93	31,3	16,11	96,33
Cotnari 2010	0,4	9,6	10,96	0,9947	2,08	22,12	24,2	38,22	134,23
Iasi 2011	0,25	7,24	14,44	0,99029	4,23	18,67	22,90	7,92	42,04
Cotnari 2011	0,26	8,73	12,57	0,99236	0,77	22,13	22,90	34,73	73,42
Iasi 2012	0,31	5,75	13,45	0,99301	3,96	23,14	27,10	14,49	183,22
Cotnari 2012	0,27	7,23	12,47	0,99513	0,97	28,73	29,70	33,58	163,38

Analysing the data in table 4, the total acidity of Tamaioasa romaneasca wine samples registers values between 5,72 (Tamaioasa romaneasca Cotnari 2012) and 10,32 g/L $C_4H_6O_6$ (Tamaioasa romaneasca Iasi 2010). 2010 was

characterised by colder climatic parameters, so the wines obtained have higher total acidities. Except the Tamaioasa romaneasca sample from 2010 from Cotnari vineyard, with only 9,13% vol., all the other wines with over 12,5% vol. The Tamaioasa romaneasca Iasi 2012 sample has 14,12% vol. alcohol, close to liqueur wines. As with the other wine samples from this study, the Tamaioasa romaneasca variants are mostly dry [0,69 (Tamaioasa romaneasca Cotnari 2011) – 3,91 g/L reductive sugars (Tamaioasa romaneasca Iasi 2012)] except one wine obtained in Iasi in 2010, with 5,14 g/L non-fermented sugars. The values for the non-reductive extract are higher compared to the other analysed samples, ranging between 20,61 (Tamaioasa romaneasca Cotnari 2010) – 26,86 g/L (Tamaioasa romaneasca Iasi 2010).

Table 4

Main compositional parameters of Tamaioasa romaneasca wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,41	10,32	12,67	0,9958	5,14	26,86	32	30,64	129,18
Cotnari 2010	0,47	10,08	9,13	0,9963	2,09	20,61	22,7	107,7	255,51
Iasi 2011	0,23	7,81	12,97	0,99180	1,96	20,74	22,7	14,93	73,42
Cotnari 2011	0,42	8,81	12,75	0,99248	0,69	23,16	23,85	41,02	78,15
Iasi 2012	0,31	5,95	14,12	0,99294	3,91	24,99	28,90	8,36	189,57
Cotnari 2012	0,40	5,72	13,27	0,99389	2,52	26,38	28,90	28,70	175,84

CONCLUSIONS

High-quality wine regions create unique physical and cultural landscapes that, through production, processing, trade, and tourism industries, are a vibrant component of local economies. While the exact magnitude and rate of future climate change is uncertain, any change can greatly impact the narrow geographical limits of high-quality production viability and will likely bring about related changes in suitable grape varieties, regional wine styles, and regional cultures. To prepare for the future, the wine industry should integrate planning and adaptation strategies to adjust accordingly.

Acknowledgements: *This study was realized with the help of the USAMV Iasi internal research grant 5526/25.052013 and the research project POSCCE-A2-O2.1.2-2009-2 ID.653, code SMIS-CSNR 12596.*

REFERENCES

1. Gregory V. Jones, Michael A. White, Owen R. Cooper, Karl Storchmann, **2005** - *Climate change and global wine quality*, Oregon, USA.

2. Rotaru L., Colibaba C., Amăriucăi M., Machidon O., 2013 - *The influence of 2012 meteorological peculiarities on the grape varieties from the North- East of Romania*, 36th OIV Congress, Bucharest, Romania.

3. Tate A. B., 2001 - *Global warming's impact on wine*. J. Wine Res. 12, p. 95–109.

ANTHOCYANIN CONTENT VARIATION UNDER THE INFLUENCE OF TREATMENTS WITH GIBBERELLIC ACID (GA_3) AT SOME TABLE GRAPE VARIETIES (*VITIS VINIFERA* L.) GROWN IN IASI VINEYARD AREA

VARIAȚIA CONȚINUTULUI DE ANTOCIANI SUB INFLUENȚA TRATAMENTELOR CU ACID GIBERELIC (AG_3) LA UNELE SOIURI DE VIȚĂ DE VIE (*VITIS VINIFERA* L.) PENTRU STRUGURI DE MASĂ CULTIVATE ÎN AREALUL PODGORIEI IAȘI

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Abstract. *The aim of the study is to evaluate anthocyanins content of hydroalcoholic extracts obtained from berry skins of some table grape varieties (Vitis vinifera L.) grown in the areal of Iasi vineyard, after the treatment with gibberellic acid (GA_3). At the analyzed varieties, total anthocyanins content varied under the influence of genetic factor, concentration of gibberellic acid applied and the year of harvest. It was registered an upward trend in anthocyanins at the varieties Coarnă Neagră and Coarnă Neagră Selecționată once with increasing of GA_3 concentration. According to the results, anthocyanin content values of Gelu and Moldova treated variants are lower then control sample. The data obtained represents a reference point in establishing the optimal dosage of gibberellic acid applied in the cultivation technology of the table grape varieties, to increase productivity, quality and their commercial aspect.*
Key words: *anthocyanins, gibberellins, biostimulating substances, Vitis vinifera L.*

Rezumat. *Scopul studiului este evaluarea conținutului în antociani din extractele hidroalcoolice obținute din pielița bacelor unor soiuri de viță de vie (Vitis vinifera L.) pentru struguri de masă, cultivate în arealul podgoriei Iași, după tratarea cu acid giberelic (AG_3). Conținutul total de antociani la soiurile analizate, a variat sub influența factorului genetic, a concentrației de acid giberelic aplicat, precum și a anului de recoltă. A fost înregistrată o tendință ascendentă a conținutului în antociani la soiurile Coarnă Neagră și Coarnă Neagră Selecționată odată cu creșterea concentrației de AG_3. Conform rezultatelor obținute, valorile conținutului de antociani la soiurile Gelu și Moldova tratate cu giberelină sunt inferioare variantei martor. Datele obținute reprezintă un punct de reper în stabilirea dozelor optime de acid giberelic aplicate în cadrul tehnologiilor de cultură a viței de vie pentru struguri de masă la soiurile analizate, în vederea creșterii productivității, calității și aspectului comercial al acestora.*
Cuvinte cheie*: antociani, gibereline, substanțe biostimulatoare, Vitis vinifera L.*

INTRODUCTION

Anthocyanins (gr. *anthos* - flower and *kyanos* - blue) are natural pigments, secundary products of vegetal metabolism, belonging to the class of flavonoids

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responsible for the red-blue-violet colour of fruits, flowers and some vegetables, being the most important group of hydrosoluble vegetal pigments visible to the human eye (Kähkönen et al., 2003; Davies, 2004; Horbowicz et al., 2008).

Anthocyanins of grapes represents approximately 38% of total phenolic compounds, this percentage varies by variety (Ţârdea, 2007). In black grapes varieties of *Vitis vinifera* L. amount of anthocyanins varies in the range 30-1100 mg cy-3-gl/100 g f.w. (Mazza and Miniati, 1993; Rein, 2005). Plant hormones (phytohormones) are a class of organic substances which in low concentrations influence the physiological processes of growth, differentiation and development of plants. Phytohormones are multifunctional substances that participate in the adjustment of many physiological processes (Davies, 2004).

The introduction of hormonal treatments in the cultivation technology of vine aims to achieving high quality viticultural products in sufficient quantities, and at affordable prices for consumers.

MATERIAL AND METHOD

Were selected five varieties of table grapes (*Vitis vinifera* L.) in order to cover the variety of forms existing within the specie, as follows: two romanian new creations, Gelu and Coarna neagra selectionata, variety Coarna neagra, cosmopolitan variety Muscat de Hamburg and resistant variety Moldova, all grown in Iasi vineyard area, in the Ampelographic Collection of Faculty of Horticulture, belonging to the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" Iasi, Romania. Rootstock used was Berlandieri × Riparia Kober 5 BB. Planting distances were 2.2/1.2 m, half-high leading form, bilateral cord with cutting in fructification rings. Soil maintenance was “black field” and maintenance operations of vines were specific to industrial vineyard ecosystem.

The observations were conducted in 2011 and 2012. Scheme of experience was the following: control sample V_m - H_2O, V_1 - 25 ppm gibberellic acid (GA_3), V_2 - 50 ppm GA_3, V_3 - 100 ppm GA_3. The experience was organized in three repetitions, with five stocks in each plot. Applying of GA_3 was performed by spraying the inflorescences in the flowering phenophase, when 70% of corollas were fallen.

After grape harvesting, were achieved ethanolic extracts. Plant material/ solvent ratio was 1:30 (2 g skins/60 mL extraction solution). The containers were stored in the dark at room temperature (20±2°C), overnight (14 hours). Extraction solution was EtOH-HCl-H2O (96:1:3) (pH 1.5). The three extraction fractions were pooled and stored at low temperatures (6±1°C) in the dark. For determining the total amount of anthocyanins was used pH differential method, which is based on the following principle: in an acidic environment is a balance between the colorless and colored forms of anthocyanins (Wrolstad R.E., 2001). This balance is a function of pH (Lee J. *et al*., 2008). A (absorbance) = $(A_{520nm} – A_{700nm})$pH 0.68–$(A_{520nm} – A_{700nm})$pH 3.5. Variation of extract color between the two pH values is proportional to the total amount of anthocyanins in the sample (mg antocyanins/100 g skins).

Measurements were made using a UV-vis spectrophotometer Shimadzu 1700 series Pharmaspec. Statistical analisys (ANOVA) of the experimental data was performed with Microsoft Excel ™ software, Data Analisys.

RESULTS AND DISCUSSIONS

Anthocyanin content values of grape varieties analyzed revealed a similar evolution of this parameter in the two years of study. In 2012 there was an

increase of anthocyanin content at all variants of the experience, under the influence of the climatic factors specific to the harvest year.

In the case of Gelu variety, total anthocyanin content determined spectrophotometrically has evolved once with the increasing of gibberellic acid dose. The highest quantity of anthocyanins was recorded in variant V_3-100 ppm (538.45 mg/100 g skins). At this variety, the values obtained at all three variants treated with gibberellins were lower compared with the control variant (Fig. 1). Although may appear the necessity of the application of some higher concentrations of gibberellic acid to stimulate the accumulation of anthocyanin pigments, this fact may be contradictory with the influence that these higher doses have on marketed production and grape quality indicators.

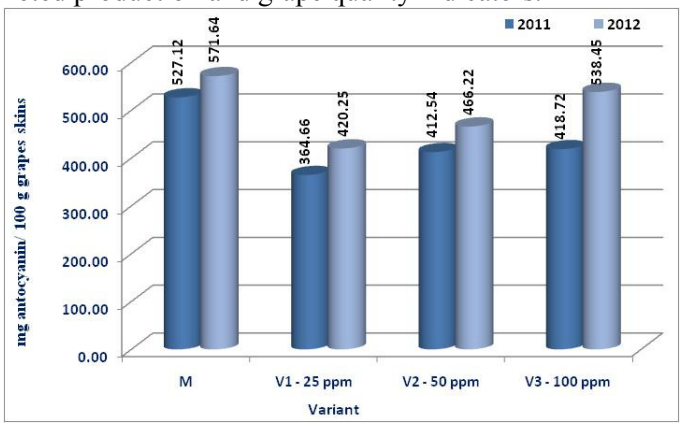

Fig.1 - Anthocyanin content of Gelu variety under the influence of gibberellic acid

Anthocyanin content at grape variety Muscat de Hamburg has evolved inversely proportional to the dose of stimulator applied, the trend being the same in both years of study (Fig. 2). Thus reduced concentrations of gibberellic acid (25 ppm) have led to an intense accumulation of anthocyanins at this variety.

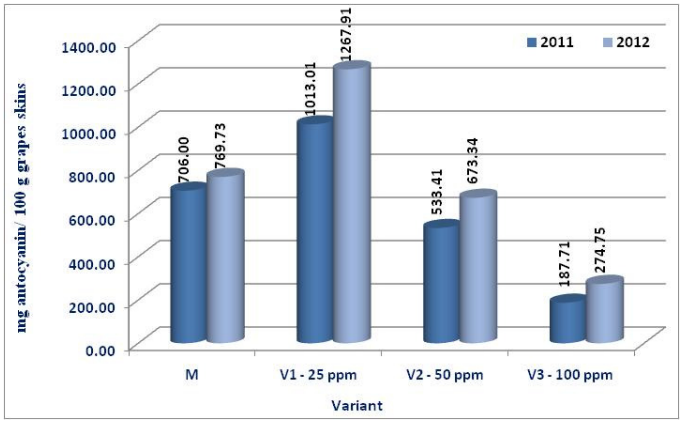

Fig. 2 - Anthocyanin content of Muscat de Hamburg variety under the influence of gibberellic acid

Increasing the concentration of GA_3 applied on inflorescences resulting in a reduction of the content of anthocyanins in grape skins and reaches the variant V_3- 100 ppm to 274.75 mg/100 g skins, respectively an content of anthocyanins reduced by about 40% compared to the control variant.

Anthocyanin content of table grape variety Coarna neagra has registered values statistically insignificant influenced (p-value>p=0.05) by applying of bio-stimulating treatments with gibberellic acid. Variant V_2-50 ppm presented the most significant value of anthocyanin concentration compared to the control variant, with a yield of about 29%, in 2012 (Fig. 3).

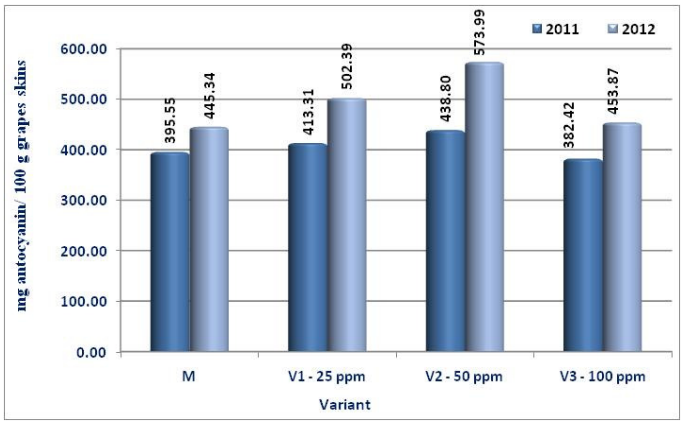

Fig. 3 - Anthocyanin content of Coarna neagra variety under the influence of gibberellic acid

The subsequent increase of GA_3 doses led to a discolouring in berry skins and consequently the quantities of anthocyanins determined.

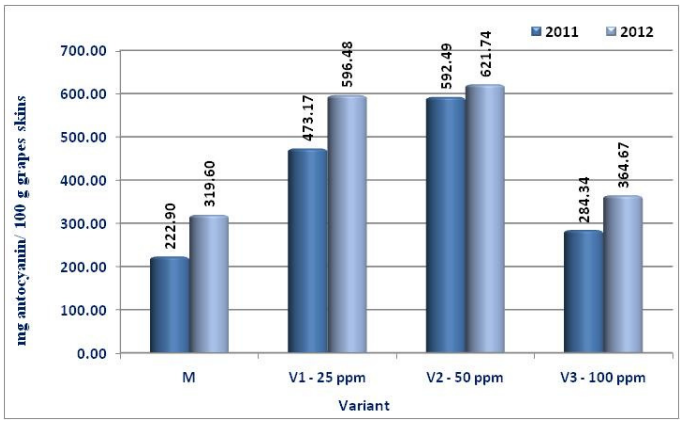

Fig. 4 - Anthocyanin content of Coarna neagra selecționata variety under the influence of gibberellic acid

According to the recorded spectra, anthocyanin concentration of Coarna neagra selectionata grape skins has reached maximum values at the variant treated

with average concentrations of GA_3 (V_2-50 ppm), as in the case of Coarna neagra variety, evolution of anthocyanin pigment content being similar (Fig. 4).

It may be noted that the increasing of GA_3 concentration to 50 ppm at the variety Coarna neagra selectionata, resulted in a major diminution in anthocyanin content of extracts, however, the values were upper to control variant.

In the case of variety Moldova, the use of gibberellic acid led to a decrease in the anthocyanin content of grapes. Thus, the concentration levels of berry anthocyanins of the variants treated with GA_3 were lower than control in all studied cases (Fig. 5).

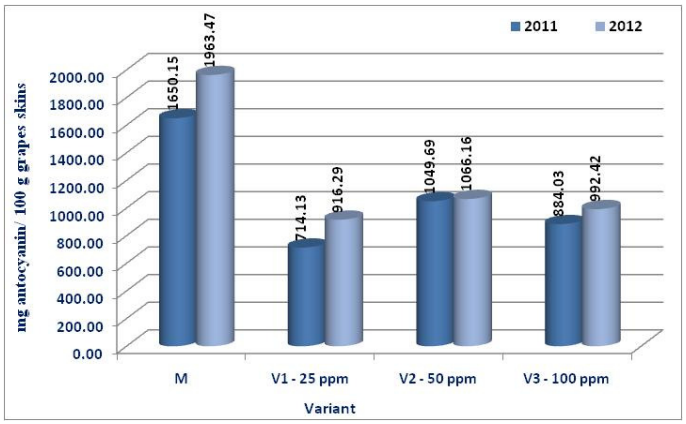

Fig. 5 - Anthocyanin content of Moldova variety under the influence of gibberellic acid

The concentration of 50 ppm GA_3 (V_2) resulted in the accumulation of higher amounts of anthocyanins of over 1000 mg/100 g skins, both decreasing and increasing of gibberellins doses leading to a decrease in the content of anthocyanins in berries in the detriment of the commercial aspect of grapes.

CONCLUSIONS

1. Accumulation of anthocyanins in grapes under the influence of gibberellic acid presented a series of specific characteristics for each variety, average concentrations of gibberellic acid (50 ppm) leading generally to an increase in the total amount of pigment.

2. In the case of Gelu and Moldova varieties there has been a reduction in the concentration of anthocyanins simultaneous with the application of biostimulating treatments with gibberellic acid, values recorded being in all cases lower than those of untreated variant.

3. Muscat de Hamburg variety had the best response at gibberellic acid treatments in terms of the berries pigmentation. Low concentrations of gibberellins (25 ppm) lead to an increased accumulation of anthocyanins in the epicarp cells.

4. Anthocyanin content of Coarna neagra grapes has registered values insignificantly influenced by the application of the gibberellins treatments. The use of GA_3 at the related variety Coarna neagra selectionata, led to an accumulation of significant amounts of anthocyanins compared to untreated variant and thus to a more intense and uniform berries color, regardless of the applied dose.

Acknowledgments: *This work was co financed by the Social Fund through Sectoral Operational Programme Human Resources Developement 2010-2013, number POSDRU/CPP107-DMI1/5/S/77222.*

REFERENCES

1. Davies K., 2004 - *Plant pigments and their manipulation*. Annual plant reviews. Vol. 14, CRC Press, Boca Raton, Florida, USA
2. Davies P.J., 2004 - *Plant hormones: Biosynthesis, signal transduction, action*. Edit. Kluwer Academic Publishers, Netherland
3. Horbowicz M. şi colab., 2008 - *Anthocyanins of fruits and vegetables - their occurrence, analysis and role in human nutrition*. Veg. Crops Research Bulletin, vol. 68, p. 5-22.
4. Kahkonen P. Marja, Heinamaki Johanna, Ollilainen V., Heinonen Marina, 2003 - *Berry anthocyanins: isolation, identification and antioxidant activities.* J. Sci. Food. Agric., vol.83, p. 1403-1411
5. Lee J., Rennaker C., Wrolstad R.E., 2008 - *Correlation of two anthocyanin quantification methods: HPLC and spectrophotometric methods*. Food Chem. vol. 110, p. 782-786.
6. Mazza G., Miniati E., 1993 - *Anthocyanins in Fruits, Vegetables, and Grains*. Edit. CRC Press, Boca Raton, USA.
7. Rein Maarit, 2005 - *Copigmentation reactions and color stability of berry anthocyanins*. Academic Dissertation, University of Helsinki. http://ethesis.helsinki.fi/julkaisut/maa/skemi/vk/rein/copigmen.pdf.
8. Ţârdea C., 2007 - *Chimia şi analiza vinului*. Ed. Ion Ionescu de la Brad, Iaşi.
9. Wrolstad R. E. (editor)**, 2001** - *Current Protocols in Food Analytical Chemistry.* Unit F1.1.1-F1.1.11., Unit I1.1.1-I1.1.8. Ed. John Wiley & Sons, New Jersey, USA.

RESEARCH ON THE BEHAVIOR OF SOME VARIETIES OF VINES IN THE VINEYARD AREA OF DEALU BUJORULUI

CERCETARI PRIVIND COMPORTAREA UNOR SOIURI DE VIȚĂ DE VIE ÎN CONDIȚIILE PODGORIEI DEALU BUJORULUI

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Abstract. *Morphological and physiological changes which it carries the vine are closely correlated with climatic conditions. Triggering phenologic of vegetation is affected by atmospheric humidity and temperature – ecological. To characterize genotypes identified in tolerance key a biotic and biotic stress were made observations and determinations regarding the registration and processing of meteorological data and phenological, consistent with the requirements of the biological characteristics of the vine. The meteorological factors important to characterize the climate temperature have been studied, sunstroke, rainfall and relative humidity of the air. The main phases of vegetation (ripening, the maturation of the grapes and the fall leaves) have made comments on some biological and thresholds have been recorded and additional weather data to characterize the climate of critical phenomena (Frost, hail). In the climatic conditions of the year 2012 the studied genotypes showed a different tolerance to biotic and biotic factors, and have assimilated in the climatic conditions of the ecosystem, a fact reflected in the data on the phenologic completion of vegetation, productivity, yield and quality of grape.*
Key words: *vine, grape, production, quality, vineyard*

Rezumat. *Schimbările morfologice şi fiziologice pe care le desfăşoară viţa de vie sunt în strânsă corelaţie cu condiţiile climatice. Declanşarea fenofazelor de vegetaţie sunt influenţate de temperatură –umiditate atmosferică şi pedologică.Pentru caracterizarea toleranţei genotipurilor identificate la principalii factori de stres abiotici şi biotici s-au efectuat observaţii şi determinări cu privire la înregistrarea şi prelucrarea datelor meteorologice şi a unor observaţii fenologice, în concordanţă cu cerinţele biologice ale viţei de vie. Ca factori meteorologici importanţi pentru caracterizarea climatică s-au studiat temperatura, insolaţia, precipitaţiile şi umiditatea relativă a aerului.La principalele faze de vegetaţie (pârga, maturarea strugurilor şi căderea frunzelor) s-au făcut observaţii privind unele praguri biologice şi s-au înregistrat şi date meteorologice suplimentare pentru caracterizarea unor fenomene climatice critice (îngheţ, grindină). In condiţiile climatice ale anului 2012 genotipurile studiate, au manifestat o toleranţă diferită la factorii abiotici şi biotici, şi au asimilat în mod diferit condiţiile climatice din ecosistem, fapt reflectat în datele privind parcurgerea fenofazelor de vegetaţie, productivitatea, producţia de struguri şi calitatea acesteia.*
Cuvinte cheie: *vita de vie, struguri, producţie, calitate, podgorie*

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INTRODUCTION

Knowledge of multiple existing connections within wine-growing ecosystem between the subsystems of the components thereof is of particular importance in modern viticulture. Marketing ecosystem is directly influenced by global climate change. Climatic factors influence or determine certain processes, acting directly or indirectly on the cultivation of the vine (Damian and Calistru, 1992). Also, her action and in the complex on everybody of species and of all bodies in the biocenoses. Regional ecological factors cause changes that lead to delaying or accelerating the development of populations of pests and predators (multiplying and spreading, adaptation to new environmental conditions), to increase or decrease the numerical density of insect populations, to change the structure and dynamics of the ecosystem (Tardea and Rotaru, 2003). Knowing the evolution of climatic factors is crucial in forecasting the occurrence of pathogens and control measures.

MATERIAL AND METHOD

The research has been taken into the study. The variety was grafted on rootstock Selection Oppenheim 4 (SO 4) Transylvania, the variety has been obtained from The Fruit, research by annealing of sexual plant variety right Baby rose x Cardinal and approved in 1984. Author: St. Oprea. Grapes are conical, medium-sized or cylinder. Transylvania variety was introduced in Ampelographic to SCDVV Bujoru Collection in 2008, planted at distances of 2.1 cm between rows and 1.2 cm between plants on the row. The shape was bilateral Cordon and practiced cutting system was mixed, the spur 2 and cane 4. The technology applied is culture in the classical system.

Observations were carried out and the time of the commencement of the various determinations phenophase vigor and growth of tree stumps, winter grape production and its quality. He also conducted a sensory profile of the variety.

Meteorological data used were extracted from the database of the resort, collected during the 2011-2012. The climate in the year 2012 was considered an atypical for South East area of Moldova; climatic factors have adversely affected the growth and development of the vine. Phenophase of vegetation were taken about 10 days versus the normal from the point of view of NAS climate grapes taking place on 15 July, and coincided with the maturation time of harvest grapes on 5th September. First fruits a grape is considered early maturing this year had a character, false "because the beans have been in first fruits a grape just by changing the color of epicarp but not from the biochemical point of view, when they increase in weight and volume. Due to hydric deficit, has not achieved the balance of berries which causes osmotic elongation of the cells, and increased weight and grain volume has been reduced. Maturation of the grapes was slow in terms of growth in the volume of grains and intense in terms of the accumulation of sugars. In 2012, the grape production were small, the potential of each.

RESULTS AND DISCUSSION

The period studied was assessed as being very hot and dry with average values over normal daily environment of heat July (25.4 ° C), august (22.6 ° C)

and September (18.6 ° C) and with the absolute maximum of over 30 ° C (25 days in July, from which 13 days over 35 ° C) (tab1). The accumulated rainfall in these months has been few, 109 mm, and air higroscopicity has remained at a low level of 49 – 53% (tab. 2).

Table 1

Air temperature 2011-2012

Moon	T average (°C)		T minim (°C)		T maxim (°C)		No. days of T>30°C	
	2011	2012	2011	2012	2011	2012	2011	2012
XI	2.0	8,2	-10.1	-2,0	16.1	20,0	0	0
XII	3,2	-1,7	-11.0	-17,9	17,0	13,0	0	0
I	-2.9	-2.3	-19.1	-15.1	9.9	10.6	0	0
II	-2.9	-8.0	-13.6	-23.6	10.4	10.7	0	0
III	3.7	4.4	-11.6	-11.2	22.4	21.5	0	0
IV	9.5	12.9	-0.8	-2,0	22.3	30.5	0	3
V	16.1	18.0	2.1	8.6	30.4	35.7	1	6
VI	20.1	22.5	9.9	10.1	31.3	36.8	7	17
VII	24.2	28.1	10.8	14.0	35.4	38.0	20	27
VIII	23.3	26,1	10.0	10.5	32.5	41,5	16	18

Table 2

Rainfall distribution (November 2011-August 2012)

Moon	P (mm)		
	2011	2012	multianual average
XI	0.2	4,3	30.7
XII	8.8	102,3	28.6
I	15.2	39.3	19.8
II	26.8	25.4	20.3
III	5.4	9.2	25.2
IV	53.6	18.6	36.6
V	32.2	115.8	46.5
VI	45.2	13.8	71.0
VII	93.4	27.1	57.4
VIII	29,3	23,1	48.0
IX	5,2	24,6	38,0
Amount (Jan-Sept)	**306,3**	**296,9**	**362,8**
period April-September	**258,9**	**223,0**	**297,5**

The fig. 1-8, pulled out in the highlights significant differences between the two years ' experience compared to the witness who was made up of the standard variety of the data. The results reveal that in 2011, the production level was higher compared to the year 2012. The County has developed well in the climatic conditions of the year 2011 (dry year), and has overcome her witness in terms of

average weight have a grape with + 82 g (fig 1). The results of the 2012 highlight the fact that shed productive qualities were influenced by climatic conditions. In terms of the size of grapes as measured by average meal, neither of the two varieties of biological parameters specific to this realization.

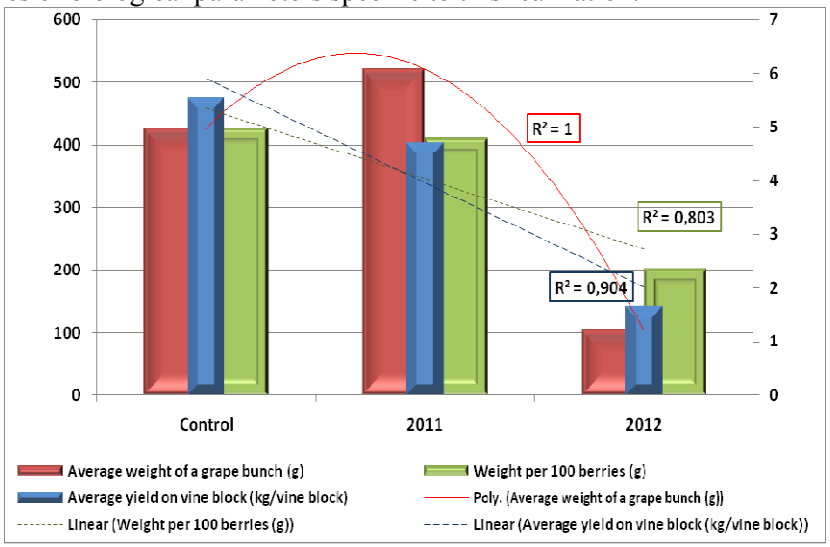

Fig. 1 - Characteristics of the variety to be cv. Transylvania agro productive under Dealu Bujorului vineyard

At maturity, the grapes have accumulated between 145-165 g/l sugars, differentiated on years and between the two varieties. Due to maturing forced the County has the lowest amount of sugar and 147g/l mash (2012). In terms of total acidity expressed in H2SO4, whatever is found, the acidity is low at least two varieties namely 2, 6-2, 8 g/l H_2SO_4 (Fig. 2).

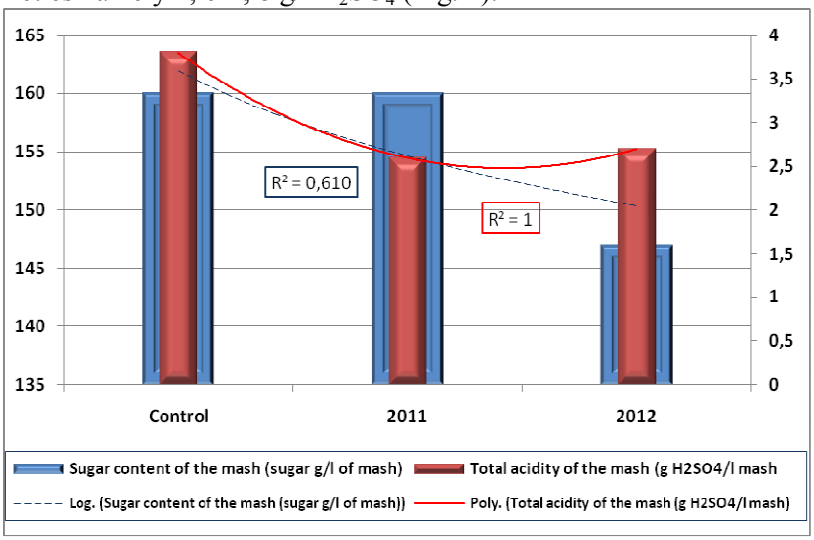

Fig. 2 - The quality of the cv. Transylvania production

In terms of percentage, represented the fertility had a low fertility compared to the witness. Fertility was influenced by the degree of impairment of the mugural in the winter. The production has had lower values with witness-15-40% (Figure 3).

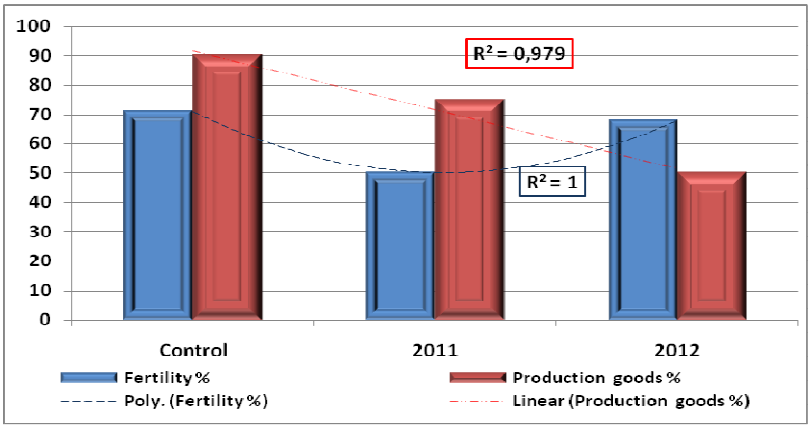

Fig. 3 - Technological features of the cv. Transylvania

Of sensory profile of grapes for their two years of study evaluation being performed at a scale of 1-10 points (Figure 4). It was found that in 2012 the quality was significantly reduced in terms of commercial appearance and in terms of quality buds. In 2011, though it was a dry year, the variety has performed well in terms of the quality of the grapes from the sensory point of view.

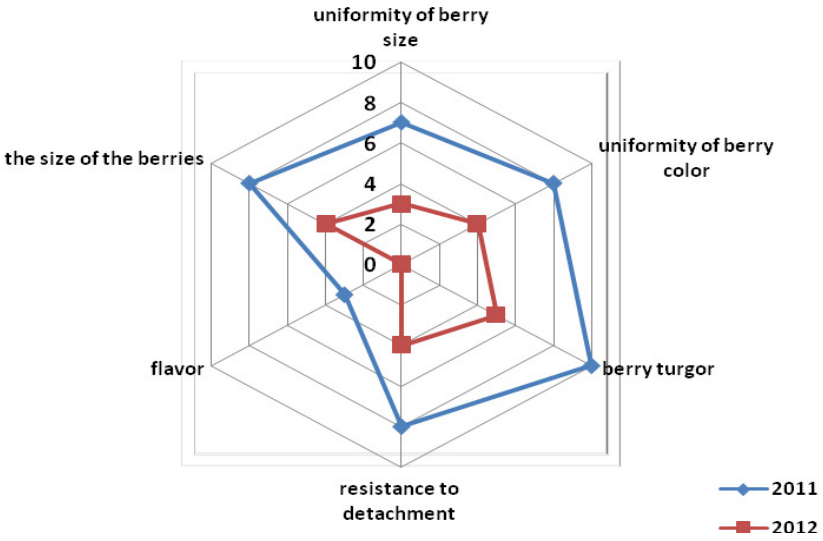

Fig. 4 - Sensory profile of Transylvania grape

CONCLUSIONS

1. Due to the climatic conditions in the year 2012, the parameters are much inferior to analyze both the witness and the face compared to 2011.

2. The County has developed well in the climatic conditions of the year 2011 (dry year), and has overcome her witness in terms of average weight have a grape with + 80 g.

3. The County performed well in climatic conditions of Dealu Bujorului vineyard.

Acknowledgments: *The work was developed within the framework of the Sectorial Project ADER 2020, PS 1.1.7 entitled "Identification and evaluation of local viticulturale germplasm sources in order of their promotion under regional climate change conditions."*

REFERENCES

1. Damian Doina, Gh. Calistru, 1992 – *Posibilitatea lărgirii conveierului varietal din podgoria Iaşi cu noi soiuri de struguri pentru masă.* Cercet. agron. în Moldova, vol. 3, Iaşi

2. Târdea Constantin, Rotaru Liliana, 2003 – *Ampelografie*, vol. II. Ed. Ion Ionescu de la Brad, Iaşi

3. *, 2005 -** *Soiuri de viță de vie roditoare realizate de cercetarea viticola romanească* Ed. Ceres, Bucuresti

DYNAMIC EVOLUTION OF QUALITY COMPONENT IN GRAPE JUICE, UNDER INFLUENCE OF CHEMICAL FERTILIZER DOSES TO FETEASCĂ NEAGRĂ VARIETY TOHANI AND TOPOLOVENI CENTERS

EVOLUȚIA DINAMICĂ A COMPONENTELOR DE CALITATE A MUSTULUI, SUB INFLUENȚA DOZELOR DE ÎNGRĂȘĂMINTE CHIMICE LA SOIUL FETEASCĂ NEAGRĂ ÎN CENTRELE VITICOLE TOHANI ŞI TOPOLOVENI

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Abstract. *The chemical fertilizers have influenced different the quality of grape to the Feteasca neagră variety by applied dosage, and wine-growing centre, changing in terms of quantity and quality the composition characteristics of row-material.To highlight the impact of fertilizer doses, and of the ecosystem concerning the quality, have been curried out studies regarding accumulation of sugar and grape juice total acidity, phenolic compounds and the alcoholic potential to the Feteasca neagră variety in the wine-growing centres Topoloveni and Tohani. It was studied the influence of chemical fertilizers and relations between chemical composition and quality of raw materials obtained.*
Key words: *variety, dose, fertilizer, quality*

Rezumat: *Îngrăşămintele chimice şi-au pus amprenta diferit asupra calităţii strugurilor la soiul Feteasca neagră prin mărimea dozelor, anul de recoltă, dar şi centru viticol, modificând cantitativ şi calitativ, caracteristicile de compoziţie ale materiei prime.Pentru a evidenţia impactul dozelor de îngrăşăminte, dar şi a ecosistemului cercetat asupra calităţii mustului , s-au impus determinări privind acumulările de zaharuri şi aciditatea din bob, compuşi fenolici şi potenţialul alcoolic al soiului Feteasca neagră în centrele viticole Topoloveni şi Tohani. S-a cercetat influenţa îngrăşămintelor chimice şi relaţiile dintre acestea şi compoziţia chimică şi calitatea materiei prime obţinute .*
Cuvinte cheie*: soi, doză, fertiliyare, calitate*

INTRODUCTION

Fertilizer application must be done by taking care of the following factors such as, soil moisture, soil type, supply level of soil with nutrients, planed yield etc. (Țârdea and Dejeu, 1995). Applied chemical fertilizer dose rates have influenced differently the quality of juice grape, resulting that we have to optimize the fertilisation (Davidescu et al., 1981). It was proved that increasing of fertilizer dose rate doesn't lead to higher accumulation of sugar content in juice grape. Good quality of juice grape obtained at Tohani it is due to the other

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factors then the nutrition one (favorable microclimate). Ripening grapes depends on the variety genetics, climate factors and nutritional factors during vegetation season (Budan, 1966).

MATERIAL AND METHOD

The first trial has been placed in Tohani Centre localized in Central part of Dealu Mare vineyard, where it was tested the variety Feteasca neagra grafted on Berlandieri Riparia x Selectare Oppenheim 4 rootstock. The vineyard it was 20 years old. Planting distance where 2,20/1,20 m. The surface is situated at 417 m altitude, the rows was oriented North-South. The soil type it was preluvosol, reach in ferro-humic components. Analysed soil texture was loamy and the humus content very low (1.21 – 1, 03%) and the pH betweent 5,6-6,5.

Second trial it was placed in Topoloveni center, localised in Central-West part of the vineyard Stefanesti-Arges. Biotic factor it was the Feteasca neagră variety grafted on Berlandieri Riparia x Kober 5 BB rootstock. Vineyard was 25 years old. Planting distance was between 2,20 x 1,00 m, surface slope 0% and rows orientation North-South

Trials have been established in 2002-2004. Utilized fertilizer: NH_4NO_3 -34,55%, crystallized single superphosphate with 18% P_2O_5, potassium salt with 48-50% K_2O. The fertilizers have been applied in unic dose rate at the beginning of trials, in the autumn the phosphorus and potassium one and the nitrogen one in springtime at disbudding. The trials where done with two variants: V_1 (N_{100} P_{150} K_{200}) and V_2 (N_{150} P_{200} K_{200}). Physicochemical analyses have been made to the grapes and to the juice quality parameters (sugar content, total acidity, phenolic compounds and alcoholic potential).

RESULTS AND DISCUSSION

Before ripening and technological maturity Feteasca neagră variety has accumulated an average of 236,0 g/l sugar content in Tohani Center, comparative with 225,3 g/l sugar content in Topoloveni Centre to the first V_1 (N_{100} P_{150} K_{200}). Even the fertilizer dose rates has increased with the second variant V_2 (N_{150} P_{200} K_{200}), the sugar content it was higher in Tohani, exceeding the accumulation potential of Feteasca albă variety from Topoloveni (fig. 1).

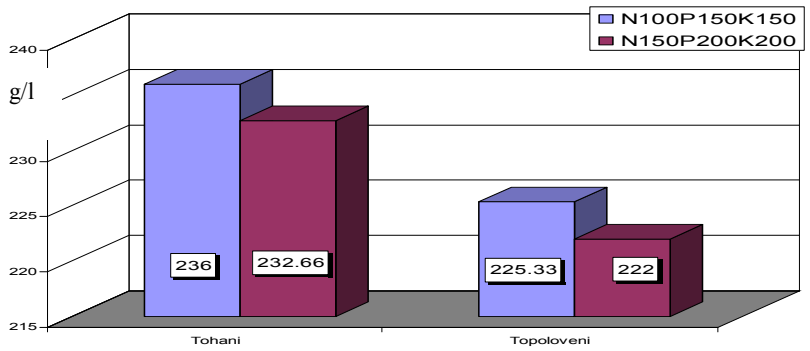

Fig. 1 - Sugar content of juice grape (g/l) according to the chemical fertilizer dose rate and Vineyard Center for Fetească neagră variety in 2002-2004

Feteasca neagră variety cultivated in Topoloveni it had a total acidity of juice grape much higher. The average acidity of juice grape was 5,1 g/l H_2SO_4 , in Topoloveni due to the dose rate increase at the second variant V_2(N_{150} P_{200} K_{200}), (fig. 2).

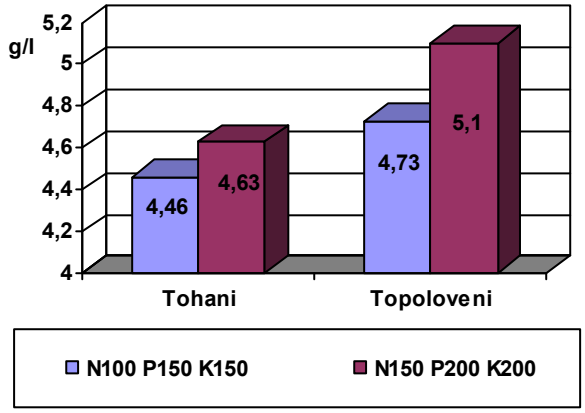

Fig. 2 - Acidity content of juice grape (g/l) in accordance with chemical fertilizer dose rate and vineyard Center for Fetească neagră variety in 2002-2004

The average alcoholic potential 13,0% vol., from Tohani Centre it is ahead Topoloveni Centre (12,4 % vol.), due to variety. (fig. 3).

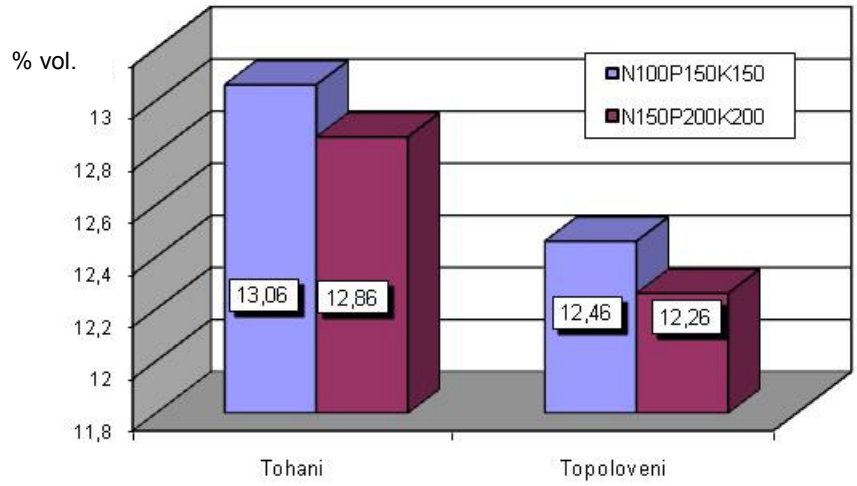

Fig. 3 - Alcoholic potential of juice grape in accordance with chemical fertilizer dose rate and vineyard Center for Fetească neagră variety in 2002-2004

Other analysed quality parameter at Feteasca albă variety was the juice grape content in phenolic compounds. After optioned results from

colorimetric determinations the average of studied years was 1038,3 mg/l in Tohani Centre and 875,0 mg/l in Topoloveni (fig.4).

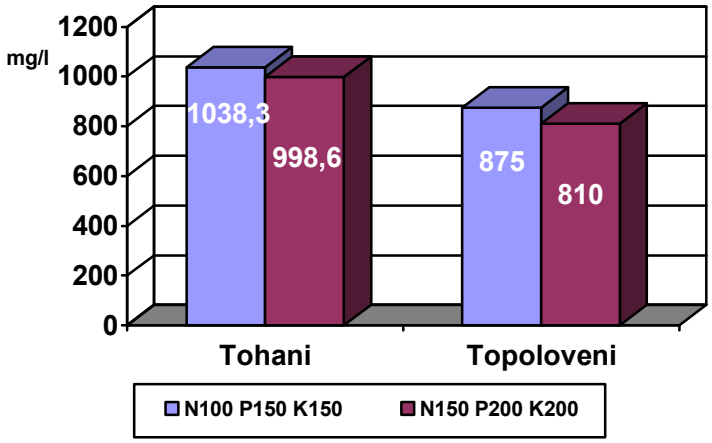

Fig. 4 - The content in phenolic compounds of juice grape in accordance with chemical fertilizer dose rate and vineyard Center for Fetească neagră variety in 2002-2004

CONCLUSIONS

1. Fetească neagră variety has proven to have a higher sugar content accumulation capacity in Tohani.

2. Dose rates of variant V_2 (N_{150} P_{200} K_{200}) have determined an increase of total acidity from juice grape in Topoloveni (5,1 mg/l H_2SO_4).

3. Fetească neagră variety behaviour analysed in the 2 vineyards centres, has proven that even a good quality vine can be obtain in both centres, however in the Tohani centre the vine quality it is slightly better.

4. Increased dose rates on variant V_2 (N_{150} P_{200} K_{200}) have influenced negatively the anthocyanin in Fetească neagră variety at both centres.

REFERENCES

1. Budan Alexandra, 1966 – *Maturarea strugurilor la principalele soiuri din podgoria Ştefăneşti, Topoloveni, Ioneşti-Costeşti şi Jiblea-Călimăneşti,* Lucrări ştiințifice ICHV, vol. 7, p. 827-844.

2. Davidescu D. şi colab., 1981 – *Agrochimie,* Editura Didactică şi Pedagogică Bucureşti

3. Țârdea C., Dejeu L. C., 1995– *Viticultura.* Editura Ceres, Bucureşti.

INFLUENCE OF IN GREEN COMPLEX WORKS ON FERTILITY AND PRODUCTIVITY AT FETEASCĂ NEAGRĂ CULTIVATED IN COTNARI VINEYARD

INFLUENȚA UNUI COMPLEX DE LUCRĂRI ÎN VERDE ASUPRA FERTILITĂȚII ŞI PRODUCȚIVITĂȚII SOIULUI FETEASCĂ NEAGRĂ CULTIVAT ÎN PODGORIA COTNARI

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Abstract*. Grapes, recorded in their constitution, all natural factors and influences that they exert on the agrotechnical vine. Optimization of technology for a new variety introduced in range of a vineyard requires study various technological links so that the chosen solution to be viable in terms of quality and economy. The paper presents a influences of green complex works and operations on fertility and productivity of Feteasca neagră in Cotnari vineyard grown over the years 2011-2012. It appears that the fertility and productivity elements analyzed were affected differently, which ultimately lead to the achievement of diverse quality finished products.*
Key words: *vine, Feteasca neagră, vineyard, Cotnari*

Rezumat. *Strugurii, înregistrează în constituția lor, toate influențele pe care factorii naturali şi cei agrotehnici îi exercită asupra viței de vie. Optimizarea unei tehnologii pentru un soi nou introdus în sortimentul unei podgorii impune studiul diverselor verigi tehnologice astfel încât soluția aleasă să fie viabilă din punct de vedere calitativ şi economic. In lucrare sunt prezentate influențele exercitate de un complex de lucrări şi operațiuni în verde asupra fertilității şi producțivității soiului Feteasca neagră cultivat în podgoria Cotnari, pe parcursul anilor 2011-2012. Se constată că elementele de fertilitate şi productivitate analizate, au fost influențate diferit, fapt ce duc în final la obținerea unor produse finite de calitate diversă.*
Cuvinte cheie*: viță de vie, Feteasca neagră, podgorie, Cotnari*

INTRODUCTION

The technological choices for red wine from our vineyards are limited enough because they are based on a small number of varieties (local and foreign), comparative with other vineyard countries (Rotaru, 2009). Therefore, the enlargement of vine areas is the specialist main concern, especially in the context of lately climate changes.

Concerning the agro-technical vine measurements the green complex works and operations take the leading part(Dumitriu, 2008). By the side of these, disease and pests combat represents one of the main techniques in order to increase the quality grapes production (Dobrei et al., 2005).

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The paper presents the influences of green complex works and operations on fertility and productivity of Feteasca Neagra in Cotnari vineyard, in order to obtain a superior red wine quality.

MATERIAL AND METHOD

Studies have been made in number 4 vineyards of SC Cotnari S.A., on a Feteasca Neagra vine plantation grafted on Oppenheim 4 selection.

Putting into practice took place on 24 strings in 8 variants including blank version, placed in 3 rehearsals (Fig.1). Each variant includes 25 vine stumps being established according to cutting type and vine fruitage, aiming to the cutting in short elements variant, variants “a”, but also the Guyot cutting on the half stem vine, “b” variants, in parallel.

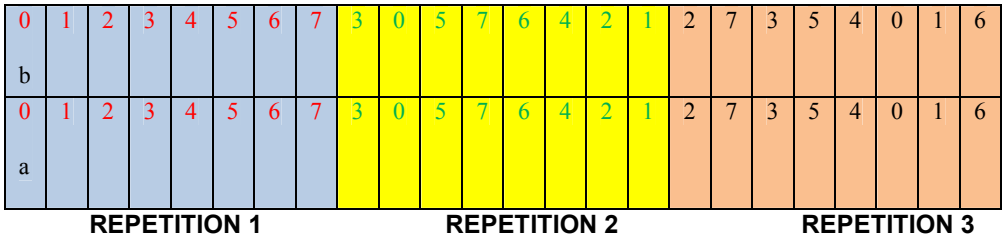

Fig.1 - Putting into practice in field

V0 variants are blank versions. Apart from the fruitage cuttings, no operations have been made during the vegetation period.

No operations have been made on **V1** variants except 30% shoots` weeding vines, intervening only with pinching woks vine shoots and leafless operations on **V2** and **V3**.

On **V4**, **V5** and **V6** the operations were combined: weeding and pinching vines, weeding and leafless, pinching and leafless vines.

On **V7**, last variant, were applied to all work, apart from fruitage cuttings, meaning: weeding, pinching and leafless vines operations.

The productivity and fertility elements have been studied for 2011 – 2012 and expressed such as: percentage of fertile shoots, number of inflorescences per vine, fertility coefficient and relative, productivity index and relative and average weight of grapes.

RESULTS AND DISCUSSIONS

Fertility represents the ability to form, each year, fruiting bodies as initial baseline for achieving grape harvest and this fact can be appreciated under two aspects: potential fertility and actual fertility. In order to asses the degree of fertility of a variety we calculate the coefficient of fertility: absolute and relative.

Vine fruition is going through several phases physiological represented by floral induction, the inflorescences formation at the cellular level within the bud (invisible) and bud development and the formation of inflorescences (visible) on vine shoots, inflorescence growth, flowering, pollination and fertilization, early ripening and normal ripening grapes.

Normal development of these processes depends on the percentage of shoots that appear on vine tub. Percentage of fertile shoots represents one of the most important indicators for assessing the actual fertility of a vine variety. Thus, more fertile shoots indicate a higher fertility, so a higher production, while less fertile shoots indicate a lower fertility, thus leading to a lower grapes production.

Productivity means acquiring plant to form grapes and to keep the hub and vine in normal enviroment conditions until full maturity (Dumitriu, 2008). Vine productivity is expressed by productivity index, which can be absolute productivity index (Ipa) and relative productivity index (Ipr).

In table 1 is shown fertility and productivity for cutting shorts production elements. It shows that the percentage of shoots was highest in **V1** variant (64% fertile shoots). Weeding was applied to sterile shoots in 30 % proportion, followed by V7 variant and V2 variant. The lowest percentage of fertile shoots was in V3 variant (49% fertile shoots), very close in value to the control V3 varian (48% fertile shoots).

Table 1

Fertility and productivity elements for Feteasca Neagra wine variety with short cutting wine fruit elements, year 2011

Variant	Percentage of fertile shoots	Number of inflorescences per vine vine	Absolute fertility coefficient	Relative fertility coefficient	Average weight of a grape	Absolute productivity index	Relative productivity index
V0	48	27	1,01	0,49	112	113,12	54,88
V1	64	27	1,12	0,71	134	150,08	95,14
V2	59	29	1,07	0,63	145	155,15	91,35
V3	49	26	1,04	0,51	125	130,00	63,75
V4	55	29	1,23	0,67	144	177,12	96,48
V5	52	26	1,09	0,56	129	140,61	72,24
V6	51	33	1,15	0,59	119	136,85	70,21
V7	61	37	1,29	0,77	126	162,54	97,02

The highest inflorescences number formed on grape vine was in the case of V7 (37 inflorescences) and after that in the case of V6 (33 inflorescences). The lowest inflorescences number formed on grape vine was in the case of V1 the same as for the version control (27 inflorescences). The absolute fertility coefficient values shows that an average is formed between 1,01 and 1,29 inflorescences on a fertile shoots (V1).

The lowest average weight of a grape was the version control, 112 grams, and the highest average weight of a grape was in the case of V2 (145 grams) followed closely by V4 (144 grams), in which case the weeding and pinching vines were applied.

Concerning the productivity indexes, the best productive performance is in the case of V7 with 97,02 grams medium formed on a shoot production, than V4

(weeding and pinching procedure) with 96,48 grams medium formed on a shoot production and than V1 (30% weeding procedure) with 95,14 grams/shoot. The lowest performance was in the version control case, 54,88 grams.

Table 2

Fertility and productivity elements for Feteasca Neagra wine variety with long cutting wine fruit elements, year 2011

Variant	Percentage of fertile shoots	Number of inflorescences per vine vine	Absolute fertility coefficient	Relative fertility coefficient	Average weight of a grape	Absolute productivity index	Relative productivity index
V0	45	27	1,00	0,45	116	116,00	52,20
V1	58	29	1,10	0,64	129	141,90	82,56
V2	55	29	1,04	0,57	144	149,76	82,08
V3	52	26	1,01	0,52	108	109,08	56,12
V4	52	29	1,17	0,60	138	161,46	82,80
V5	49	24	1,04	0,51	115	119,60	58,65
V6	54	32	1,15	0,62	123	141,45	76,26
V7	58	36	1,25	0,72	116	145,00	83,52

When cutting the long wine fruit elements (table 2) shows that the percentage of fertile shoots was lower than in variants who underwent short cutting elements, maximum recorded values to the V1 and V7 variants (58% fertile shoots), and the lowest was in the control variant 45% fertile shoots.

The inflorescences number ranged between 36 inflorescences in V7 and 24 inflorescences in V% (weeding + leafless). An average number of inflorescences are formed on a fertile shoots was reduced in cutting in shorts elements, ranged between 1.00 in the control variant and 1.25 in V7.

The average weight of a grape was highest in V4 (weeding and pinching procedure), 138 grams and the lowest was in V3 (leafless) variant, 108 grams.

Productive efficiency was maximum in V7 (weeding + pinching + leafless procedure), 83,52 grams/shoot, similar values were recorded at V4, V2 and V1, too. The lowest productive efficiency was in V0 variant, 52,20 grams/shoot.

Soil fertility behavior analysis (fig. 1 and 2) shows that in the year 2012 the trend was the same with the above. All variants that had the highest values in 2011, have the same highest values in 2012, too.

Soil productivity in 2012 was lower than last year because of the unfavorable eco-climatic conditions recorded during the summer and autumn, when excessive drought and high thermal regime caused the values concerning the average weight of a grape, the average weight of a 100 grains grape to be much lower. But the overall trend of each variant was the same as in 2011.

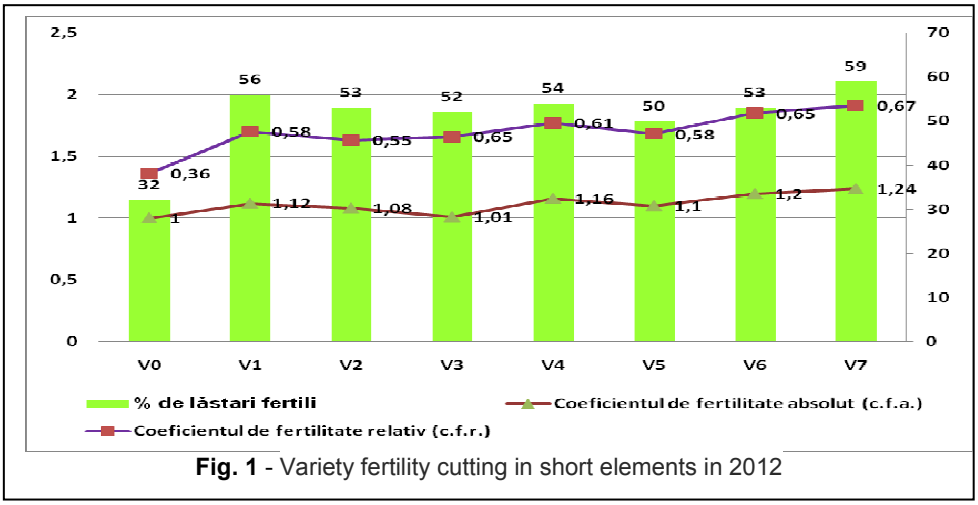

Fig. 1 - Variety fertility cutting in short elements in 2012

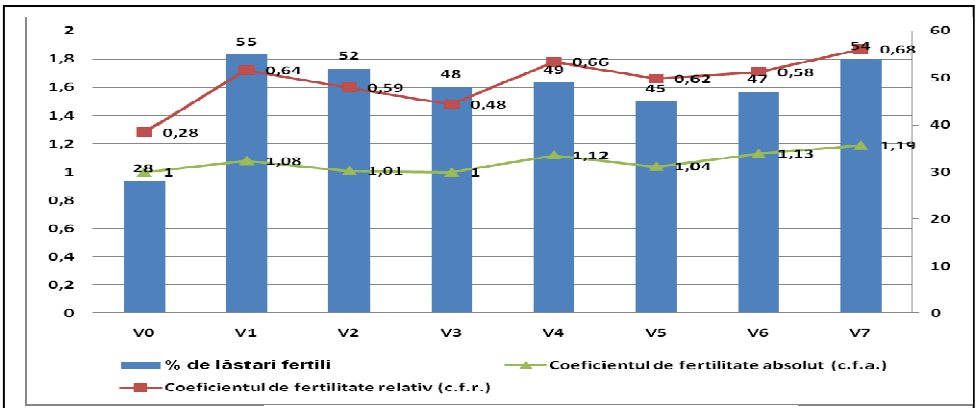

Fig. 2 - Variety fertility cutting string vine elements in 2012

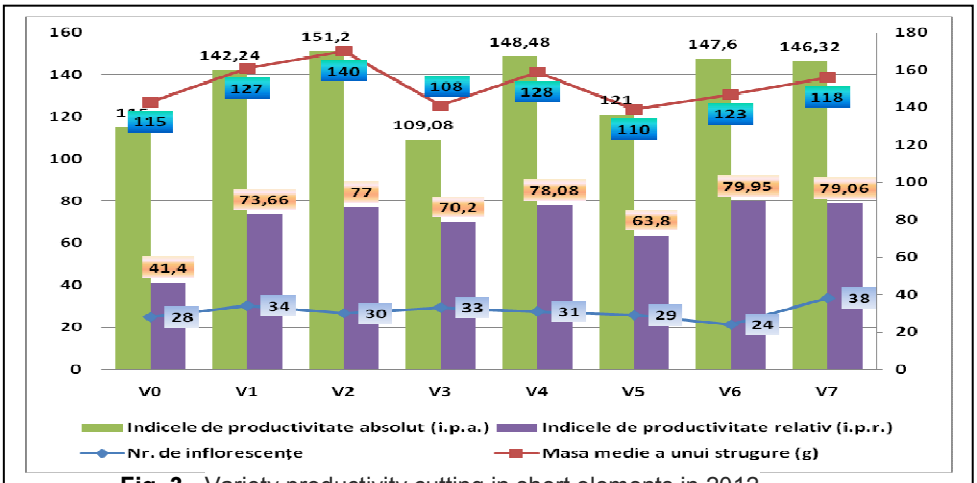

Fig. 3 - Variety productivity cutting in short elements in 2012

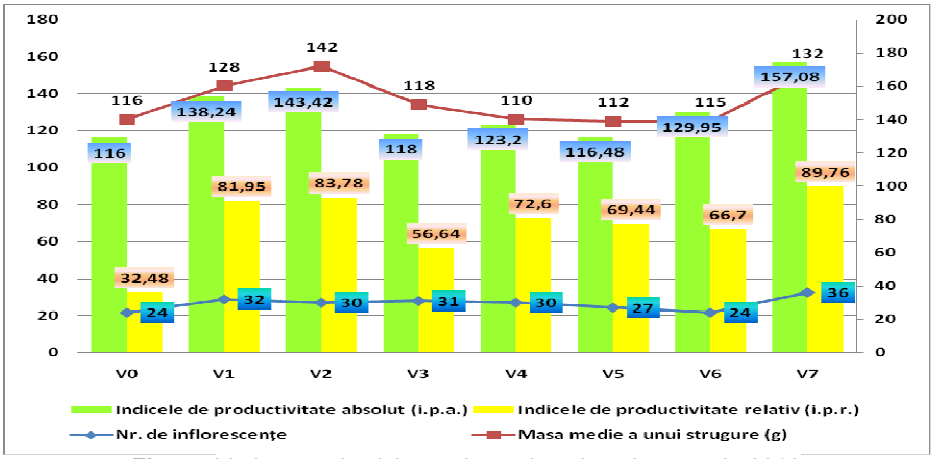

Fig. 4 - Variety productivity cutting string vine elements in 2012

CONCLUSIONS

1. Concerning fertility elements it appears that they were a little higher cutting in short elements, than cutting long fruitage elements, which can be attributed to the existence of a large quantity of multiannual wood on vine log increasing soil fertility.

2. Productive efficiency was maximumm in V7 variant (weeding + pinching + leafless procedure), reducing the vegetative leading finally to a larger production on each vine shoot formed on a vine log.

3. The average weight of a grape was highest in V2 (pinching procedure), highlighting the importance of the operations acceasta grape supply growth by limiting competition with intense growth of shoots.

4. The weight of a 100 grains grape was highest in V2 (pinching procedure) and green operation has been applied earlier entry into ripening grapes, comparative the variant in which green operation applies only to entry into ripening grapes V3 (leafless).

Acknowledgments. *This work was co financed from the Social Fund through Sectoral Operational Programme Human Resources Developement 2010-2013, number POSDRU/CPP107-DMI1/5/S/77222.*

REFERENCES

1. Dobrei Alin, Rotaru Liliana, Mustea Mihai, 2005 – *Cultura viței de vie*. Editura "Solness", Timişoara.
2. Dumitriu I.C., 2008 - *Viticultură*. Edit. Ceres, Bucureşti.
3. Rotaru Liliana, 2009 - *Soiuri de viță de vie pentru struguri de vin.* Editura "Ion Ionescu de la Brad", Iaşi.

THE MATURATION OF THE GRAPES IN THE CONDITIONS OF EXCESSIVE DROUGHT OF 2012 IN THE VINEYARD DEALU BUJORULUI

MATURAREA STRUGURILOR ÎN CONDIȚIILE SECETEI EXCESIVE ALE ANULUI 2012 ÎN PODGORIA DEALU BUJORULUI

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Abstract. *The quality of raw material plays an important role in producing of the quality wines. For this purpose we aimed ripening grapes in the dry climatic conditions of the year 2012. Due to excessive drought during the growing season, the grapes had a limited increase in the biological variety, the index of grapes and weight of grapes was around at the half of the specific weight. The phenophases of growth and maturation of grapes decreased, so the harvesting of grapes was done from the third decade of august. The complete maturity of the grapes in the conditions of 2012 was made prematurely and forced under the impact of excessive temperatures which produced the strong dehydration of grape berrys and a concentration of the sugars more through evapotranspiration than by synthesis. The dry climate during the maturation period of the grapes favoured the high quantitative accumulation in compounds by colour, due to their synthesis and also the change of quantity ration between the skin and the pulp of the grape.*
Key words*: maturation, sugar, grapes, acidity, phenolic compounds*

Rezumat. *Calitatea materiei prime ocupă un loc important în producea vinurilor de calitate. In acest scop s-a urmărit maturarea strugurilor în condițiile climatice deosebit de secetoase ale anului 2012. Datorită secetei excesive din perioada de vegetație, strugurii au avut o creştere limitată sub nivelul biologic de soi, indicele de boabe şi greutate a strugurilor s-a situat la aproximativ jumătatea greutății specifice. Fenofazele de creştere şi de maturare a boabelor s-au redus, astfel că recoltarea strugurilor s-a efectuat începând cu a treia decadă a lunii august. Maturitatea deplină a strugurilor în condițiile anului 2012 s-a efectuat prematur şi forțată sub impactul temperaturilor excesive producând deshitratarea puternică a boabelor şi o concentrare a zaharurilor mai mult prin evapotranspirație decât prin acumulare. Climatul secetos din timpul perioadei de maturare a strugurilor a favorizat acumulări cantitative ridicate în compuşii de culoare, fapt datorat sintezei lor dar şi de schimbarea raportului cantitativ dintre pielița şi pulpa strugurelui.*
Cuvinte cheie*: maturare, zahar,struguri, aciditate, compuşi fenolici.*

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INTRODUCTION

The maturation of the grapes was monitored every year to SCDVV Bujoru but were obtained different results in almost all years of harvest. 2012 was an exceptional year. Thanks to the excessive drought, was a forced maturation through the dehydration of the grapes (fading) followed by a concentration of the sugars. The proces of maturation of the grapes was done in other vineyards of Romania (Odobeşti and Murfatlar) establishing the full maturity and technological of the grapes in the pedoclimatic conditions of these areas (Braga et al., 1962; Mujdaba et al., 1962).

The full maturity of the grapes in the vineyard Dealu Bujorului over a period of 10 years was accomplished from 15 September (Ciubucă et al., 1999), compared with the 2012 harvest year, when the maturity of the grapes was achieved earlier 20-25 days. In the surrounding vineyards Nicoresti and Iveşti the maturation of the grapes on the same 10-year period was conducted from 20 September (Ciubucă et al., 2000). After 2002 assist at this phenomenon of early maturation of the grapes, but 2012 was the exception.

MATERIAL AND METHOD

In 2012 is watched the dynamic of maturation of the grapes at white and red varieties in the vineyard Dealu Bujorului. These determinations were made: sugar, acidity, weight of 100 seeds and at the harvesting of grapes was determined: the weight of a grape, the volume of a grape, the weight of the beans, the number of the beans, the weight of the clusters, the index of composition of the grape (skins, seeds, pulp), the polyphenols and anthocyanins. The varieties that were analyzed:, Fetească albă, Fetească regală, Aligote, Băbească gri, Riesling italian,Sauvignon, Burgund mare, Băbească neagră, Fetească neagra Merlot, Cabernet Sauvignon and Muscat Ottonel. The culture conditions of plantation are: the planting distance of 2.0 m x 1.2 m, middle leading, type of cutting, rings bilateral in rings of fruit.

RESULTS AND DISCUSSION

The annual climate of viticulture is reproduced in the table 1. The precipitations in this period were very low, placed to 412 mm from above 448 mm, the annual average for the vineyard Dealu Bujorului. The unprecedented excessive drought during the growing season was due to the rainfall distribution during this time that is only 5 days of May fell on 102 mm, and the rest of 143.3 mm were distributed in other months. The drought have emphasized and because of duplication evapotranspiration effects due to average of maximum temperatures in summer months were very high, ranging from 30.3°C in June, 32.4°C in August and 34.3°C in July. The average temperature during the ripening of the grapes fall in July from 28 º C to 20.7 º C in September (Table 1).

Table 1

The annual viticultural climate in the viticultural center Dealul Bujorului

Month	T average (°C)	T minimum average (°C)	T maximum average (°C)	Precipitations (mm)
January	-1.3	-4.7	2.2	32.7
February	-7	-11.9	-2.9	21.1
March	6.0	0.5	10.8	6.1
April	14.9	7.7	20.8	14.6
May	19.7	13.4	25.1	102.2
June	24.3	17.0	30.3	11.9
July	28.1	19.9	34.3	27.1
August	26.1	18.3	32.4	23.1
September	20.7	12.5	27.5	24.6
October	14.6	8.8	20.3	42.0
November	8.2	5.0	11.1	4.3
December	-1.7	-5.2	1.4	102.3

The rate of daily accumulation in sugars of the grapes is good for most varieties except Fetească regală variety which had a rate of sugar accumulation very low because the damage of foliar appliance by wilting that therefore has reduced the photosynthesis process and to the decrease in sugar accumulation. The Fetească albă variety had a low rate of sugars accumulation because of the alert rate in the grape berry growth in weight, which is favored by young plantation potential (Table 2).

The rate of daily diminishing of acidity is normal at most varieties except the above mentioned varieties, which records the lowest rate of acidity, with the same causal (Table 2). The rate of quantitative accumulations is higher at Fetească albă and Băbească gri and very low in variety Riesling italian which otherwise is the particularity of the Fetească regală variety, where photosynthesis was strongly inhibited (Table 2).

The harvest date of grapes varied depending on the state of maturation of the crop but also the degree of damage to crops, grapes more or less fades (Table 3). The maturation and harvesting of the grapes in this year were made prematurely, is as an unprecedented situation, of excessive drought, and harvesting was done in August, as follows: Fetească neagră harvested on 27.08. followed by Fetească regală at 29.08. (strong fade grapes). At supramaturare, was harvested on 18.09.2012 Riesling italian to obtain the sweet wine that is specific our area. The weight of a grape at harvesting was located a little over half of variety potential, because to lower growth of grapes followed by fading.

Table 2

The dynamic of maturations grapes in the viticultural center Dealu Bujorului

The variety	The daily accumulation rate of sugars, g/day	The daily accumulations rate of acidity, g/L sulfuric acid /day	The quantitative daily accumulations rate of 100 grape berrys. g/day
Fetească albă	1,41	1,10	1,10
Fetească regală	1,18	1,00	0,50
Aligote	2,65	2,34	0,96
Băbească gri	3,38	1,48	1,79
Riesling italian	2,00	1,14	0,38
Sauvignon	2,72	1,35	0,92
Burgund mare	3,30	1,27	0,46
Băbească neagră	3,00	1,43	2,00
Fetească neagră	2,70	2,13	0,32
Merlot	2,57	1,76	0,00
Cabernet Sauvignon	2,62	1,43	0,41
Muscat Ottonel	2,60	1.72	0,80

Table 3

The quality of the grape at harvesting in the viticultural center Dealu Bujorului

The variety	The harvest date	The weight of the grape(g)	The volume of the grape(ml)	The weight of the grape berrys(g)	Number of grape berrys	The weight of the bunch (g)
Fetească albă	31.08.2012	79.7	74.3	74	118.3	5.7
Fetească regală	29.08.2012	99.3	83.3	93	101.3	6.3
Aligote	09.09.2012	79.6	79.3	76.6	81.7	3
Băbească gri	31.08.2012	132.7	113.7	127.7	90.7	5
Riesling Italian	18.09.2012	70.3	70	67	86	3.3
Sauvignon	13.09.2012	118.3	110	113	120	5.3
Burgund mare	11.09.2012	75.7	66.7	72.3	90.3	3.3
Băbească neagră	15.09.2012	123.7	110	119.3	93.7	4.3
Fetească neagră	27.08.2012	91.3	86.7	86	120.3	5.3
Merlot	12.09.2012	95.3	80	90	149.7	5.3
Cabernet Sauvignon	17.09.2012	64	58.3	61	85.3	3.3
Muscat Ottonel	01.09.2012	90	83	86.6	61	3.3

The mechanical analysis of the grapes at harvest highlights a lightweight at a half of a grape, with a identical volumetric reporting, a reduced weight of the grape berrys and weight of the rachis located at the upper limit

(Table 3). Analyzing the structure of grape berry itself, is found a large proportion of grape peel and seeds in detrimental of the pulp. This had negative effects on grape berry composition, which recorded low levels in most varieties, varying between 1.3 at variety Riesling italian and 3.3 at variety Băbească gri. Compared to the annual average recorded with values between 5-8, the values obtained at analyzed varieties are very small which shows that the ratio core weight / weight of peel + weight of seeds is very low (Fig. 1). The Index of grape berrys, indicating the small size of the grapes, represented by the number of grape berrys per 100 g grapes attest high values, over 100, reaching the maximum at variety Fetească regală (148.5), the variety which has been most affected by drought and freezing in winter. The average weight of a grape was located at reduced parameters, which is below 100 g in all varieties, which show damage to all varieties of this unprecedented drought. The polyphenolic potential of black grapes at harvesting was high, approaching to the upper limit that is 85 at the Băbească neagră variety and 98 at Merlot variety.

The anthocyanin content of grapes was high, ranging from 540 mg / l at Băbească neagră variety and 901mg / l at Merlot variety. The dry climate during the maturation period of the grapes favored high quantitative accumulations in compounds of color. This was doubled by the high ratio between the skin and the grape berry weight (Table 3, Fig. 2).

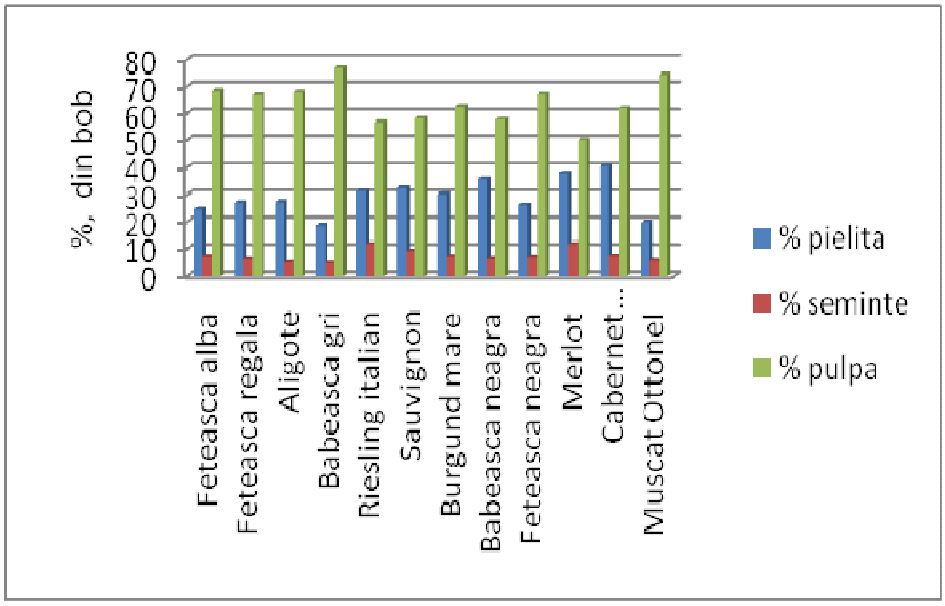

Fig. 1 - The index of composition of the grape berry in the viticultural center Dealu Bujorului

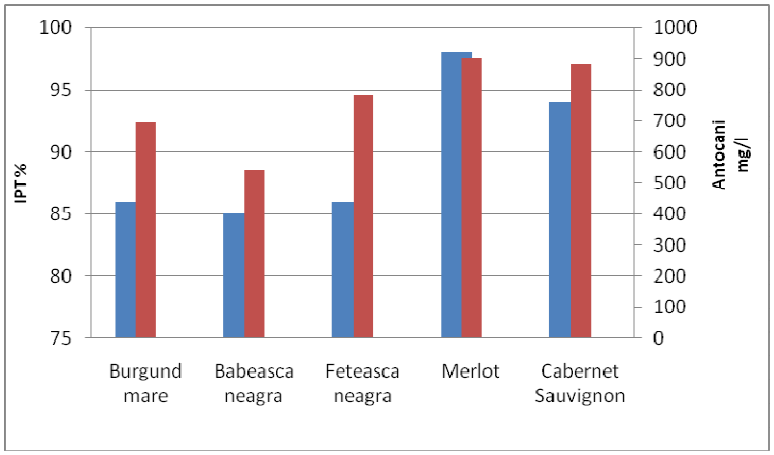

Fig. 2 - The polyphenolic profile of grape at hervesting in thr viticultural center Dealu Bujorului

CONCLUSIONS

1. The climate during maturation period of grapes was excessively dry, a fact underscored by the absolute maximum temperatures of July and August which ranged from 38 to 41.5 C and by the large number of days with temperatures above 30°C.

2. The technological indices of the grapes at harvesting highlight the decisive influence of climatic factor, of excessive drought of 2012, atypical year in this regard, influencing the quantitative growth of grapes, of grape berrys and their composition.

3. Analyzing the structure of grape berry itself, there is a large proportion of grape peel and seed in the expense of pulp. This had negative effects on the production, on the accumulation of grapes as well as the composition of grape berry, which showed low levels in most varieties.

4. The harvest of grapes have surpassed with 2-3 weeks toward other years.

REFERENCES

1. **Brăguță Gr., Istrate N., Jurubită J., Ecaterina Simion, 1962** - *Maturarea strugurilor la principalele soiuri de viță roditoare din podgoria Odobeşti, în anii 1950-1960.* Lucrări ştiințifice ICHV , 1960-1961. Editura Agro-Silvică, Bucureşti, 1962, p. 435-447.
2. **Ciubucă A., Birliga N., Elena Postolache,. Indreica E., 1999-** *Evolution of grape maturity in the Dealurile Bujorului vineyard.* Lucrări ştiințifice vol. 1(42), Seria Horticultură, Universitatea Agronomică şi Medicină Veterinară,, Ion Ionescu de la Brad" Iaşi, p. 154-160.
3. **Ciubucă A., Birliga N., Elena Postolache, 2000** – *The study of the grape maturity in the Nicoreşti and Iveşti vineyards.* Lucrări ştiințifice vol. 1(43) Seria Horticultură, Universitatea Agronomică şi Medicină Veterinară ,, Ion Ionescu de la Brad" Iaşi.p. 333-339.
4. **Mujdaba F., Vodarici C., 1962 -** *Studiul maturării strugurilor la principalele soiuri din pogoria Murfatlar.* Lucrări ştiințifice ICHV, 1960-1961. Editura Agro-Silvică, Bucureşti, p. 424-435.

PHENOLOGICAL CHANGES IN SOME GRAPE VARIETIES FOR WHITE WINES IN THE NORTH-EAST AREA OF MOLDOVA

MODIFICĂRI FENOLOGICE LA UNELE SOIURI PENTRU VINURI ALBE CULTIVATE ÎN ZONA DE NORD EST A MOLDOVEI

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Abstract. *In the last years, the changes of the environmental factors have become more and more visible. The repercussions are registered in the vineyard system as well; the grape varieties alter their annual life cycle. In the northern area of Romania, an increase of the thermal regime and a decrease of rains led to a thermic and hydric stress of plants. The present article presents the behaviour of some grape varieties for white wines, during 2011 and 2012, grown in the Cotnari and Iaşi vineyards. The vegetation phenophases start much earlier than before, leading to a hastened grape maturity, 2-3 weeks prior to normal years and with a negative influence on the quality of the obtained products.*
Key words: *vine, vegetation phenophases, global warming*

Rezumat. *În ultima vreme asistam tot mai mult la modificarea unor factori de mediu, ca fapt concret al schimbărilor climatice. Repercusiunea acestora în ecosistemele viticole nu s-a lăsat asteptată, astfel încât soiurile de viță de vie îşi schimbă ciclul de viață anual. În ultimii ani, în zona de nord a României s-a înregistrat o creştere a regimului termic şi un deficit al precipațiilor, ceea ce a dus la un stres termic şi hidric al plantelor. În lucrarea de față este prezentată comportarea unor soiuri pentru vinuri albe, pe parcursul anilor 2011-2012, cultivate în podgoriile Iaşi şi Cotnari. Se constată o devansare a fenofazelor de vegetație, ceea ce duce la o grăbire a maturării strugurilor, cu circa 2-3 saptămâni față de anii normali viticoli şi cu implicații negative asupra calității produselor viti-vinicole obținute.*
Cuvinte cheie: *viță de vie, fenofaze de vegetație, încălzire globală*

INTRODUCTION

Starting with the '80s until the present time, global warming has become an issue. Expected changes in temperature and rainfall are likely to lead to changes in the vegetation periods, zoning of grape varieties and many other changes that, at present, are not visible but can escalate over time. Predictions based on global climate models show we can expect a more frequent occurrence of extreme weather events and related risks and damages can be significant (Legave et al., 2008). A qualitative and quantitative decrease in the yield of grapes and damages vines in vineyards due to weather events (early autumn frosts, spring frosts,

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excessive negative temperatures, rainfall, etc..) lead to significant losses for the national vineyards area (Rotaru et al., 2012).

Climatic changes have a high impact on vine culture and implicitly on the phenological spectra. Climate change has a direct impact and lead to disruption of the normal physiological and biochemical processes with implications for the quality and specificity of vine products. Varieties behavior analysis confirms the dependence of the vine on the climate resources over a time period, the relationship is substantiated by studies on a series of unitary and multi criterion climatic indices, duration and intensity of various climatic determinants along phenophases of vegetation (Chmielewski and Rötzer, 2002).

MATERIAL AND METHOD

Three grape varieties were taken into study: Fetească albă, cultivated in all the three studied vineyards, Fetească regală, cultivated in Iaşi and Dealu Bujorului vineyards, as well as Tămâioasă românească, from Iaşi and Cotnari vineyard.

The values of the main climatic elements were recorded from the meteorological stations of the above mentioned areas, during 2011 and 2012. The values of some specific viticultural indices were calculated: real heliothermal index, hydrothermal coefficient, viticultural bioclimatic index, oenoclimatic aptitude index and aridity index.

The analysis of the plants aimed at the development of the active biological cycle, registering onset dates of different phenophases as well as calculating number of days from one phenophase to another.

RESULTS AND DISCUSSIONS

Table 1 presents the main climatic elements and specific indicators used for evaluating favourability of vine culture in some areas from Dealu Bujorului, Iaşi and Cotnari, for 2011-2012.

Table 1

Main climatic indices used for evaluating the vine culture favourability in Dealu Bujorului, Iaşi and Cotnari vineyards during 2011-2012

Climatic elements	Dealu Bujorului		Iaşi		Cotnari	
	2011	2012	2011	2012	2011	2012
Global thermal balance, (^{o}t°g)	4287,9	4402,3	3855,2	4287,9	3706,4	4403,6
Active thermal balance, (^{o}t°a)	3093,9	3797,8	3112,5	3567,9	3073,8	3787,5
Useful thermal balance, (^{o}t°u)	1784,2	2037,8	1663,5	2012,6	1603,9	1995,8
Σ annual rainfalls, mm	360,1	445,5	372,0	507,7	368,2	526,1
Σ rainfalls during vegetation period, mm	254,2	223,0	287,2	275,1	287,6	274,1
Σ insolation hours during vegetation period, hours	1487,2	1552,8	1472,5	1499,1	1426,9	1410,2
Mean annual temperature °C	10,1	11,9	10,3	10,8	10,4	10,6
Mean temperature in – July °C	22,6	26,2	22,9	26,3	22,0	25,2
- August °C	21,8	23,7	21,6	23,1	21,2	22,7
- September °C	19,2	19,8	18,1	18,9	18,7	18,6
Absolute minimal temperature °C	-16,2	-19,7	-16,5	-26,6	-19,9	-28,4
Date	31.I	9.II	5.I	12.II	5.I	2.II
Absolute maximal temperature °C	35,9	41,5	37,0	41,3	35,7	38,8

Mean temperature of first and second decades of June	19,9	23,2	20,3	22,1	19,2	22,1
Mean speed of wind (km/hour)	3,4	3,2	2,8	3,5	3,5	3,7
Relative air humidity (%)	72	66,6	71,4	67,9	72	68
Cloudiness	5	5	6	5	6	6
No. days with maximal temp. > 30 °C	38	65	31	66	27	52
Bioactive period span, days	193	212	190	206	188	204
Real heliothermal index	2,65	3,16	2,44	3,01	2,28	2,81
Hydrothermal coefficient	0,82	0,58	0,92	0,77	0,93	0,72
Bioclimatic index of vine plants	9,38	12,47	8,39	9,44	8,11	9,55
Oenoclimatic aptitude index	4576,9	5377,6	4547,8	5041,9	4463,1	5173,6
Annual aridity index	17,9	20,3	18,3	24,4	18,04	25,53

From a climatic point of view, the year 2011 can be considered a normal year from the point of view of climatic conditions. 2012 was an exceptional year, from the point of view of winter thermal values that were under the resistance limit of vine as well as a very droughty summer and autumn with thermal values of over 40 ^{o}C. Vines were affected by climatic conditions in the viticultural area of Moldovian hills.

In the case of Fetească albă grape variety, cultivated in all of the three vineyards, table 2 registers the manner on which phenophases develop.

Table 2

Phenophases development at Fetească albă grape variety

Vineyard / year	bleeding	Bud break	Flowering	Veraison	Full maturity	Leaf fall
Iasi-2011	08.04.2011	13.04.2011	03.06.2011	04.08.2011	18.09.2011	20.10.2011
Iasi-2012	15.04.2012	22.04.2012	06.06.2012	24.07.2012	23.08.2012	11.11.2012
Cotnari-2011	08.04.2011	17.04.2011	09.06.2011	14.08.2011	15.09.2011	21.10.2011
Cotnari-2012	15.04.2012	18.04.2012	07.06.2012	28.07.2012	28.08.2012	01.11.2012
D. Buj.-2011	23.03.2011	12.04.2011	31.05.2011	07.08.2011	18.09.2011	23.10.2011
D.Buj.-2012	03.04.2012	10.04.2012	30.05.2012	17.07.2012	20.08.2012	14.11.2012

Analysing the biological cycle of Fetească albă grape variety (fig. 1), one registers that the time period between bleeding and full maturity is, in the case of a normal viticultural year, of 157-176 days, while, in the case of a year characterised by thermal and hydric stress, grape maturation was hastened, the time span shortening up to 128-137 days. A prolongation of the vegetation process is registered, until late autumn, the time span between full maturity and leaf fall being of de 63-84 days, compared to 32-36 days in a normal year.

In the case of Fetească regală from Iaşi and Bujoru vineyards, phenophases development is as seen in table 3.

Table 3

Phenophases development at Fetească regală grape variety

Vineyard / year	Bleeding	Bud break	Flowering	Veraison	Full maturity	Leaf fall
Iasi-2011	05.04.2011	15.04.2011	07.06.2011	12.08.2011	24.09.2011	21.10.2011
Iasi-2012	18.04.2012	25.04.2012	06.06.2012	24.07.2012	25.08.2012	15.11.2012
D. Buj.-2011	24.03.2011	14.04.2011	02.06.2011	12.08.2011	21.09.2011	23.10.2011
D.Buj.-2012	04.04.2012	12.04.2012	07.06.2012	24.07.2012	28.08.2012	17.11.2012

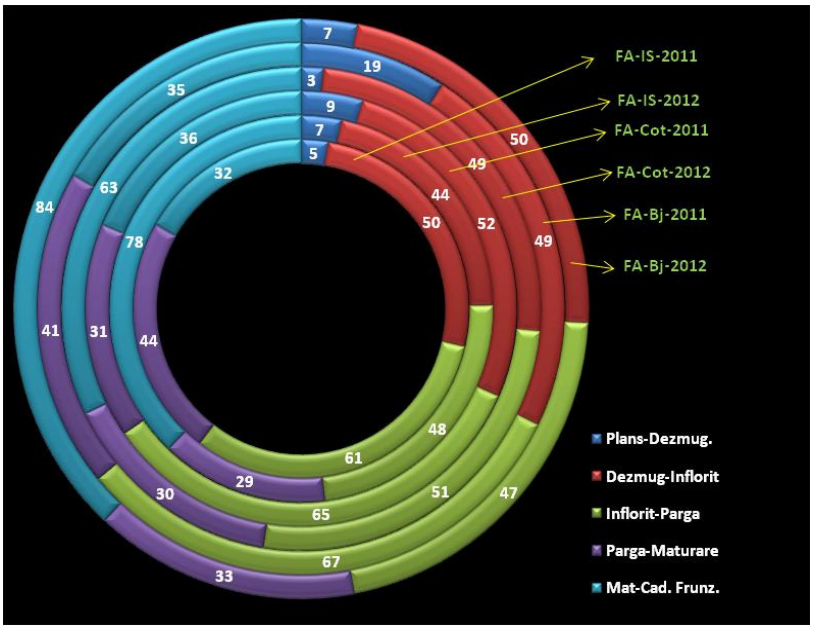

Fig. 1 - Biologic cycle of the active vegetation period for Feteasca alba grape variety in Iaşi, Cotnari and Dealu Bujorului vineyards during 2011-2012 (no. of days)

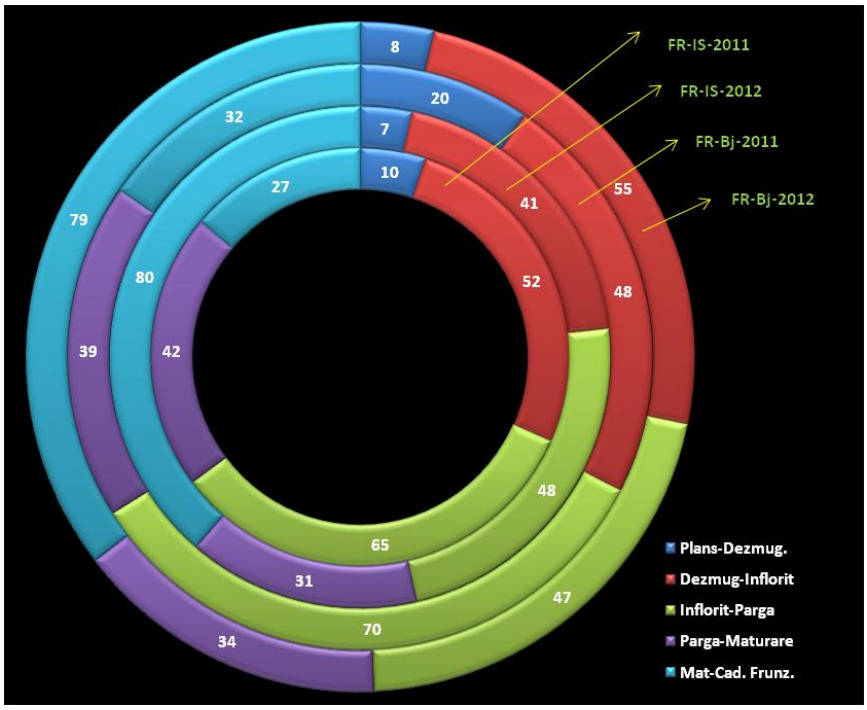

Fig. 2 – Biologic cycle of the active vegetation period for Feteasca regală grape variety in Iaşi and Dealu Bujorului vineyards, during 2011-2012 (no. of days)

Analysing the biological cycle of Fetească regală grape variety (fig. 2) one registers that the time period between bleeding and full maturity is, in the case of a normal viticultural year of 169-177 days, while, in the case of a year characterised by thermal and hydric stress, grape maturation was hastened, the time span from bleeding to bud break shortening up to 127-144 days. A prolongation of the vegetation process is registered, until late autumn, the time span between full maturity and leaf fall being of 79-80 days, compared to 27-32 days in a normal viticultural year.

In the case of Tămâioasă românească grape variety in Iaşi and Cotnari vineyards, table 4 registers the phenophases development.

Table 4

Phenophases development at Tămâioasă românească grape variety

Vineyard / year	bleeding	Bud break	Flowering	Veraison	Full maturity	Leaf fall
Iasi-2011	07.04.2011	24.04.2011	14.06.2011	12.08.2011	27.09.2011	27.10.2011
Iasi-2012	21.04.2012	28.04.2012	07.06.2012	27.07.2012	29.08.2012	12.11.2012
Cot.-2011	11.04.2011	21.04.2011	14.06.2011	15.08.2011	25.09.2011	25.10.2011
Cot.-2012	22.04.2012	29.04.2012	14.06.2012	26.07.2012	29.08.2012	03.11.2012

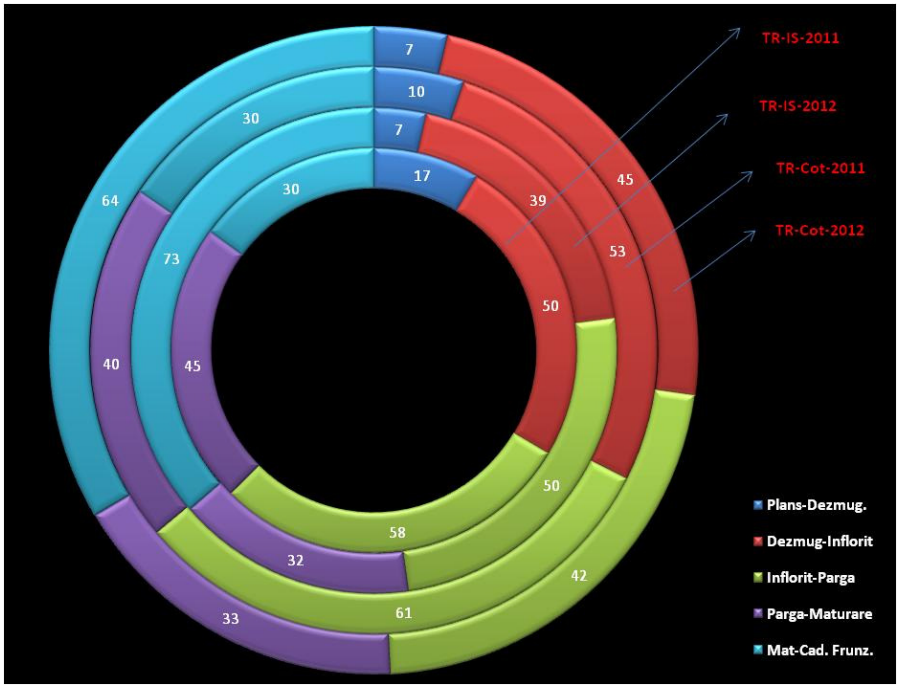

Fig. 3 - Biologic cycle of the active vegetation period for Tămâioasă românească in Iaşi and Cotnari vineyards during 2011-2012 (no. of days)

The biological cycle of Tămâioasă românească (fig. 3) has changed accordingly, as well: the time period between bleeding and full maturity is, in the case of a normal viticultural year of 164-170 days, while during a thermal and hydric stressed year, grape maturity was forced, the biological cycle registered between bleeding from bud break was of 127-128 days. A prolongation of the

vegetation process is registered, until late autumn, the time span between full maturity and leaf fall being of 63-64 days compared to 30 days in a normal viticultural year.

CONCLUSIONS

1. Regarding the development of the vegetation cycle, the shortest time segment from vine bleeding to bud break was found in Fetească albă variety, from Cotnari in 2012, of only 3 days, while the longest period was identified in Fetească regală, from Dealu Bujorului, of 20 days.

2. The shortest period of time (39 days) from bud break to flowering was recorded in the case of Tămâioasă românească, in Iaşi in 2012, while the longest (55 days) was identified in the case of Fetească regală in Bujoru in 2012.

3. The duration logged between flowering and veraison was shortest in the case of Tămîioasă românească (42 days) cultivated in Cotnari vineyard in 2011, while the longest was found to be in Fetească regală variety from Bujoru vineyard, in 2011.

4. The time period between veraison and full maturity of grapes was shortest in Fetească albă, grown in Iaşi vineyard, in 2012 registering a number of only 29 days, while the slowest grape maturation was registered in Tămâioasă românească grape variety, from the same vineyard, in 2011, of 45 days.

5. The interval from full maturity of grapes to leaf fall ranged from 27 days in the case of Fetească regală, in Iaşi, in 2011 and 84 days in Fetească albă from Dealu Bujorului, in 2012.

6. The long and draughty autumn, with a high thermal regimen, influenced the development of longer intervals from full maturity to leaf fall, the phenomenon being more accentuated in the south part of the region, respectively Dealurile Bujorului vineyard, where vegetation stopped in the last decade of November, with over 35-40 days later than usual.

Acknowledgments*.This study was realised and published within the research project POSCCE-A2-O2.1.2-2009-2 ID.653, code SMIS-CSNR 12596.*

REFERENCES

1. Chmielewski F.M, Rötzer T., 2002 - *Annual and spatial variability of the beginning of growing season in Europe in relation to air temperature changes*. Clim. Res., vol. 19, nr. 1, p. 257-264.

2. Legave J.M., Farrera I., Alméras T., Calleja M., 2008 - *Selecting models of apple flowering time and understanding how global warming has had an impact on this trait.* Journal of Horticultural Science & Biotechnology, nr. 83:, p. 76-84.

3. Rotaru Liliana, Amăriucăi M., Colibaba Cintia, Machidon O., 2012 - *The evolution of the main meteorological parameters (year 2011) in the eastern part of wine region Moldova hills.* Lucrări Ştiințifice U.S.A.M.V. Iaşi, seria Horticultură, vol. 55, nr. 1, p. 341-346.

AMELIORATION OF GRAPEVINE ASSORTMENT TO BIOLOGICAL RESISTANCE IN REPUBLIC OF MOLDOVA

AMELIORAREA SORTIMENTULUI VITICOL LA REZISTENȚĂ BIOLOGICĂ ÎN REPUBLICA MOLDOVA

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Abstract. *Creation of new varieties which biological resistance is ensured by genetic constitution of plant was selected as solution in order to diminish the impact of stress factors of environment on grapevine. In the results of studies of P and F_1 were established the principles, formulated the conception for realization of breeding programs: absence of genetic barrier between hereditary factors determinative for the resistance to winter conditions, powdery mildew and for quality of production, inclusive seedlessness, productivity, early maturity offers the possibility to create and select a genotypes with advanced resistance and quality. As a result in republic were created about 80 new varieties with various direction of use of grapes, most of them with advanced biological resistance, 30 varieties were included in actual assortment.*
Key words: *grapevine, breeding, biological resistance, assortment,*

Rezumat. *Crearea soiurilor noi, rezistența biologică a cărora este asigurată de constituția genetică a plantei, s-a ales în calitate de soluție în diminuarea impactului factorilor stresanți ai mediului ambiant asupra viței de vie. În rezultatul studiilor P, F_1 au fost stabilite principiile, formulată concepția de realizare a programelor de ameliorare: lipsa barierei genetice între factorii ereditari determinanți ai rezistenței la iernare, la mană şi calitatea strugurilor, inclusiv grad diferit de apirenie, productivitate, maturare timpurie atestă elocvent posibilitatea combinării libere într-un singur genotip a caracterelor studiate şi a creării şi selectării genotipurilor cu rezistență sporită şi calitate înaltă. Ca rezultat, în republică au fost create cca. 80 de soiuri noi de utilizare diversă, majoritatea cu rezistență biologică sporită, 30 din ele au devenit componente ale actualului sortiment.*
Cuvinte cheie: *viță de vie, ameliorare genetică, rezistență biologică, sortiment*

INTRODUCTION

In Republic of Moldova grapevine (*Vitis* L.) is one of the crops with significant economic weight, with an important potential in diversification of market with products of high nutritional and curative value.

Location of the territory of republic (45.5° - 48.5° N latitude) at the northern border of the industrial viticulture presents for the culture climate risks during the winter: diverse and unstable thermal regime with the absolute minimum of -27...-34°C and heating the air, considered as a provocation of

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physiological dormancy. The territory of republic is not sufficiently provided with humidity. Situation is periodically aggravated by increased temperatures (up to +38°C…+41°C) and prolonged droughts during the summer as well during the winter.

Interdiction of HPD and expansion of cultivated areas with noble varieties had as a result sharp increases in costs related to the protection of plantations. Vulnerability to winter conditions of *V.vinifera* L. assortment increased with the transition to the unprotected cultivation of vines on high stem. Annually multiple chemical treatments were applied against *Plasmopara viticola* Schw., but completely protection not always been possible. Frequently, in the epiphytotic years, in conditions of the Republic of Moldova, harvest is compromised at a rate of 50-70%. Add that annual shoots affected by downy mildew, with insufficiently lignifications, become more vulnerable to severe wintering conditions.

Cardinal solving of problem of vine protection against stress factors can be achieved by creating new varieties, whose resistance is provided by genetic constitution of the plant. The study and establishment of the law of inheritance of resistance to abiotic and biotic stress factors of environment is the way to create such genotypes (Negrul, 1936).

MATERIAL AND METHOD

Were studied P, F_1 populations including 22 parental forms and 2475 seedlings obtained as a result of 38 hybrid combinations.

Frost resistance of the seedlings and parental forms was determined by the percentage of total alive and affected buds in the field conditions and testing in the freezing room at temperatures of -19 …-20°C. Experimental material was classified into 4 classes of resistance to frosts: from class I - relative resistance (percentage of alive + affected buds > 70) to class IV - susceptible (29-0%) (Savin, 1970). Resistance of the seedlings and parental forms to *Plasmopara viticola* was determined in sever artificial environments, according the methodology developed by Prof. Verderevskii et all. (1965): from 1 point - high resistance to downy mildew to 5 points - highest sensitivity

Statistical processing was performed according to the methods applied in selection (breeding) (Plohinschii, 1966).

RESULTS AND DISCUSSIONS

In comparison with the previously researches, where as maternal components were involved relatively resistant to frost *V. vinifera* varieties, we focus on using *V.vinifera* varieties with high quality, but susceptible to frost and to downy mildew. Such as maternal components were taken (Savin, 1970) crop varieties (*V.vinifera* L.): Djura uzium, Guzali Kara, Pobeda, Coarna neagra et al. Paternal components included complex hybrids of III-rd generation, which are characterized by resistance to frost and fungal diseases, have a better quality grapes compared with HPD: Pierrelle, Villard Blanc, Muscat de Saint Vallier, Datier de Saint Vallier, Perle noir et al.

In warm winter conditions characteristic for the years of study, seedlings have not shown diversity of resistance to winter hardiness. In order to increase the efficiency and accelerate the process of selection of valuable forms, the resistance to the seedlings and parental forms was evaluated by determining the total percentage of alive and affected buds in artificial conditions at a temperature of -19...-20°C. The analysis of experimental data denotes that indices of heredity concerning the resistance to frosts of maternal, paternal components and their interaction are relatively small, but significant, therefore it is possible to choose in F_1 offspring with desired traits. It was also found that an improvement of frost resistance in F_1 can be made by individual selection of specific maternal and paternal forms (Savin, 1970, 1971).

Resistance to downy mildew of the seedlings was assessed in sever infected environment, artificially created in field conditions (Juraveli, Savin, 1976). Influence of genotypic diversity of parental components and of conditions of the years of study on general variability of resistance of grapevine hybrids to mildew was evaluated using analysis of variance. Was established the significant influence of maternal components in transmission of resistance to mildew. There was no influence of years of study that explain the uniformity of severity of infected environment. Therefore, for some specific combinations we can select descendants with advanced resistance to mildew in the first year of study (Juraveli, Savin, 1972, 1976).

The character of correlation between grape quality and resistance to frost, pests and diseases is a crucial issue. The works for genetic improvement and practice of exploration of F_1 generations of interspecific hybrid at the first attempts to solve this problem (end of 19^{th} c. – beginning of 20^{th} c,) did not bring the expected results, so the opinions that there is a linkage between low quality and increased resistance were quite common. But the next stages of research of populations of improved hybrids established that resistance to downy mildew and European type of leaf is inherited separately (Sorial, 1965).

The values of coefficients of linear correlation between berries quality and winter hardiness, between winter hardiness and resistance to mildew (Table 1) for seedlings are small and insignificant, which suggests that descendants have inherited these traits independently.

Table 1

Correlation between valuable characteristics in F_1

Carachter	By individual indices				By mean data	
	quality of berries, GAI		resistance to mildew, points		resistance to mildew, points	
	r	t_r	r	t_r	r	t_r
Resistance to frosts	0,14	0,82	-0,024	-0,14	0,19	0,88

This shows absence of linkage between genes or gene complex that causes the studied characters or even if genes are present in the same chromosome, their

location is far from one another, so linkage is not manifested. Therefore, there are not the genetic barriers for transmission by heredity of quality and resistance, for combination in a single organism of resistance to mildew and frost with high quality of berries.

Practical confirmation of this hypothesis results in the creation, highlighting and selecting within this population of descendants, elites with table grapes, later becoming the components of the actual assortment, also appreciated in other countries, especially varieties Moldova, Codreanca and those with the potential for completion of assortment: Pamiati Negrulea, Struguras, Decabrischii, Urojainâi et al.

In the republic were created and homologated seedless varieties Kişmiş lucistâi and Kişmiş Moldovenesc (author M. Juraveli) with standard quality, but sensitive to frost and fungal diseases. In order to create a seedless varieties adapted to local conditions, as initial material were used existing genetic resources: seedless varieties from the "old" collection, seedless hybrid forms and varieties of M. Juravel created in previous research, hybrids obtained with the participation of Seyve Villard, main purpose was to create the initial population for selection of seedless forms resistant to wintering at mildew. First pollination were conducted in 1970, in 1971 was founded the nursery of descendants and in 1972 - the hybrid field.

As maternal components in 19 hybrid crosses were taken forms resistant to frost and mildew, derived from crosses with the complex resistant hybrids of third generation, including descendants obtained in the initial breeding program and paternal components included seedless varieties and elite from crossbreeding of Proles *orientalis* Negr. varieties. In this population were identified 38 plants with different levels of seedlessness.

Evaluation of hereditary links in F_1 between quality of berries and winter hardiness and mildew was performed for 4 combinations randomly chosen. The distribution of the number of descendants by organoleptic evaluation and resistance is presented in Table 2.

Table 2

Distribution of descendants by organoleptic note and level of resistance

Level of resistance	Organoleptic evaluation, mark (on the scale of 10 points)						
	1,0-6,0	6,1-7,0	7,1-7,5	7,6-8,0	8,1-8,5	8,6-9,0	>9
Resistance to mildew, points							
1							
2	67	49	17	2	4		
3	12	20	7	13	1		
4	24	74	27	8		3	
5	6	27		4			
Resistance to frosts, class							
I	12	23	9	11	2	2	
II	36	74	15	9	5		
III	45	63	23	14	6		
IV	3	5	3	5			

The values of coefficients of linear correlation between berries quality and winter hardiness, between winter hardiness and resistance to mildew (Table 3) are small and insignificant, which suggests independently inheritance of these traits.

Table 3

Correlation between valuable characteristics in F_1

Caracter	By individual indices				By mean data	
	quality of berries, GAI		resistance to mildew, points		resistance to mildew, points	
	r	t_r	r	t_r	r	t_r
Resistance to frosts	0,04	0,94	-0,08	-0,14	0,12	0,94

In the studied biological material high quality of berries, resistance to mildew and frost are found in various combinations and are a practical confirmation of the hypothesis about the possibility of free combination of these characters. We note, in this case, the presence of a qualitatively new character compared to previous breeding program - seedlessness. Therefore, the above hypothesis was confirmed, and developed on a biological material with more complex characteristics: quality, including seedlessness, productivity, early maturity, and divers' directions of use, resistance to unfavorable abiotic and biotic factors.

Practical confirmation resulted in highlighted perspective forms. By 1980 were highlighted the first elites. As a result of the studies, were revealed a series of forms with different levels of seedlessness. Were homologated three varieties - Apiren alb, Apiren roz and Apiren negru de Grozeşti and varieties Apiren roz timpuriu and Apiren Basarabean and are in the process of homologation (Registrul soiurilor, 2012; Savin, 2011, 2012). All these varieties are patented.

Obtained results refuted the skepticism circulated about the possibility of creation of seedless assortment adapted to the specific of our climatic conditions. For the first time was established the possibility of creating of such assortment for Carpathian-Danubian-Pontic geographical region. Thus, in order to create the varieties with high quality, including different degrees of seedlessness, productivity and increased biological resistance was established to be of fundamental importance and with advanced potential crossover of resistant elites and seedless varieties and elites with Proles *orientalis* Negr. origin.

As a result of applying in breeding programs of the marked out principles in republic have been created about 80 new grapevine varieties with divers using, most of them with increased biological resistance, and 30 of them have become part of the current assortment (Register, 2012). For the first time were created and included in assortment seedless varieties. Thus was created the new assortment basis that includes biological resistance to unfavorable environmental factors, quality and with the creation of economic conditions will allow increase area occupied by them.

CONCLUSIONS

1. As a result of studies of P, F_1 on hereditary transmission of resistance to winter frosts, downy mildew and the quality of the grapes, including different levels of seedless, productivity was determined the absence of genetic barrier between determinants hereditary factors and, therefore, the possibility of combining in a single genotype of studied characters.

2. Application in the genetic improvement of formulated theoretical principles allowed the creation of varieties Moldova, Pamiati Negrulea, Urojainâi, Struguras, Decabrischii et al. with increased resistance to wintering, mildew and high quality/productivity and of new varieties with different degree of seedlessness, resistant to wintering, with quality, productivity, early maturation: Apiren alb, Apiren roz, Apiren negru de Grozeşti - already homologated and Apiren roz timpuriu and Apiren Basarabean, other elite – in process of documentation.

REFERENCES

1. **Juraveli M.S., Savin G.A., 1972 –** *Vzaimosviazi morozoustoicivosti, mildiu-ustoicivosti i kacestva vinograda.* Sadovodstvo, vinogradarstvo i vinodelie Moldavii, № 12, p. 16-18.
2. **Juraveli M.S., Savin G.A., 1976 –** *Nasledovanie mildiuustoicivosti F_1 seianțev vinograda.* Ustocivosti vinograda i plodovâh culitur k zabolevaniam i vrediteliam. Kişinev: Ştiința, p. 17-36.
3. **Negruli A.M., 1936 –** G*eneticeskie osnovâ selekții vinograda.* Trudâ po prikladnoi botanike, genetike i selekții VASHNIL, Seria VIII, Nr. 6. Plodovâe i iagodnâe kulturâ. 150 p.
4. **Plohinskii N.A., 1966 -** *Pokazateli silâ vliiania.* Genetika, № 5, p. 161-172.
5. **Savin G.A., 1970 -** *Nasledovanie morozoustoicivosti i mildiuustoicivosti v F_1 ot skreşcivania sortov V.vinifera L. so slojnâmi mejvidovâmi ghibridami:* avtoref. diss. na soisk. uc. stepeni kand. s./h. nauk. K. 20 p.
6. **Savin G.A., 1971 -** *Nasledovanie morozoustoicivosti vinograda v seianțah pervogo pokolenia.* Sadovodstvo, vinogradarstvo i vinodelie Moldavii, № 1, p. 21-24.
7. **Savin Gh., 2011 -** *Perfecționarea sortimentului de struguri pentru masă şi racordarea acestuia la cerințele piețelor de desfacere.* Viticultura şi Vinificația în Moldova, nr. 1[31], p. 12-13, nr. 2[31], p. 7-8.
8. **Savin Gh., 2012 -** *Ameliorarea sortimentului viticol al Republicii Moldova.* Ch. : S.n., (Tipogr. AŞM). 260 p.
9. **Sorial G.F., 1965 –** *O nasledstvennosti, izmencivosti i prirode mildiustoicivosti vinograda:* avtoref. diss. na soisk. uc. stepeni kand. biolog. nauk. M. 18 p.
10. **Verderevskii D.D., Voitovici K.A., Naidenova I.N., 1965 –** *Metodika vâiavlenia i otbora ustoicivâh k mildiu biotipov v sostave evropeiskogo vida (V.vinifera L.)*. Tez. dokl. IV Vsesoiuz. soveş. po immunitetu s.-h. rastenii. p. 5.
11. *****, 2012 -** *Registrul soiurilor de plante pentru anul 2012*. Ch.: 2012. 133 p.

THE HIDRIC AND THERMIC STRESS IN THE AGRICULTURAL YEAR 2011-2012 AND THIS INFLUENCE ON SCDVV IASI VINEYARDS

STRESUL HIDRIC ŞI TERMIC DIN ANUL AGRICOL 2011 – 2012 ŞI INFLUENŢA ACESTUIA ASUPRA PLANTAŢIILOR VITICOLE DE LA SCDVV IAŞI

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Abstract. *In the conditions of Copou-Iasi viticultural center, the annual average of rainfall is 517.8 mm and, during the vegetation, 335.8 mm. In the years when the drought caused serious damage, precipitation deficit began the year before (summer or fall), continuing during the winter, and in spring and summer next year (Zaldea, 2004, 2008). The drought period that began in august 2011 continued in the winter and summer of 2012 and has led to a increased soil water deficit into the deeper layers (100-150 cm). The lack of moisture in the soil and the recorded maximum temperatures up to 40.1°C (August) in air and 68°C at the soil surface (July) have led to reducing the growth, the premature wilting and yellowing of the leaves and to the drying of the vines. Also, the grape yields obtained were below the biological potential of the varieties grown.*
Key words: *rainfall, drought, maximum temperatures, vines.*

Rezumat. *În condiţiile centrului viticol Copou Iaşi, media multianuală a precipitaţiilor este de 517,8 mm iar în perioada de vegetaţie de 335,8 mm. În anii când seceta a produs pagube importante, deficitul de precipitaţii a început din anul precedent (vara sau toamna), a continuat pe parcursul anotimpului rece, precum şi în primăvara şi vara anului următor (Zaldea, 2004, 2008). Perioada de secetă care a început din luna august 2011, a continuat în iarna şi vara anului 2012 şi a dus la creşterea deficitului de apă din sol până în straturile profunde (100–150 cm). Lipsa umidităţii din sol şi înregistrarea unor temperaturi maxime de până la 40,1ºC (august) în aer şi de 68ºC la suprafaţa solului (iulie), au dus la diminuarea creşterilor, la ofilirea şi îngălbenirea prematură a frunzelor şi chiar la uscarea butucilor. De asemenea, producţiile de struguri obţinute au fost sub potenţialul biologic al soiurilor cultivate.*
Cuvinte cheie: *precipitaţii, secetă, temperaturi maxime, viţă de vie.*

INTRODUCTION

In the temperate zone vines require annual rainfall regime between 400 and 700 mm, of which 250-300 mm supposed to be evenly distributed throughout the vegetation period, as useful rain, more than 10 mm (Oşlobeanu et. al., 1980). Vine plantations bearing fruit are quite drought tolerant due to deep root system that

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explores in depth the soil for water supply, especially if the soil has accumulated during autumn and winter sufficient moisture from rain and snow coming (Alexandrescu, et al., 1998).

In Copou viticultural center of Iasi, in recent years we are witnessing a decrease of precipitation amount and their uneven distribution throughout the year. It was also found that after rainy periods of 1-2 years, follows 1-2 years of drought or excessively drought interspersed with normal years (Zaldea et. al., 2008).

MATERIAL AND METHOD

For the analysis of rainfall and temperatures were used the data recorded by automatic station Agroexpert of Research - Development Station for Viticulture and Vinification Iaşi and from Moldova Regional Meteorological Center. To determine soil moisture, the samples were taken in layers from 10 to 10 cm up to 150 cm depth for each month during the growing season.

Results were expressed first in percentage compared to dry soil weight, then into percent by volume. With hydrophysical indices values were calculated the accessible moisture existing in soil at a time (Uacc) expressed in mm and the deficit in mc/ha and %. To establish the insurance degree with available water supply for plants was reported the momentary humidity (Uacc) to useful water capacity (AUC), previously calculated for Iaşi Copou viticultural center .

RESULTS AND DISCUSSIONS

Agricultural year 2011-2012, in terms of climate, was less favorable for vine culture, with absolute minimum temperatures below freezing limit (-26.7°C in air and -33.0°C to ground surface) with little precipitation and unevenly distributed, with monthly mean temperatures higher than normally and maximum temperatures up to 40.1°C into air and 68.0°C on the surface. Number of days with maximum temperatures values greater than 30^{o}C was 55 of which 10 days in June, 25 days in July, 16 days in august and 4 days in September. In this paper we present the distribution of rainfall, humidity and soil water deficit, average and maximum temperatures recorded, and their influence on the vineyards. Period of drought began in August and September 2011, continued with the winter months, November, December and January 2012 when there was a deficit of precipitation (-33.2 mm in November, -19.3 mm in December and -16.6 mm in January) and summer months, June, July and august of 2012 with a deficit of -48.9 mm, -39.7 mm and -23.8 mm from multiannual values (figure 1).

The amount of rainfall during the growing season of 2012 was only 287.2 mm compared to 403.0 mm multiannual average in Iasi Copou viticulture centre. From the presented results and from the analyzes carried previously at SCDVV Iasi, we can say that into agricultural year 2011-2012 was registered the longest period of drought in the last 30 years namely between: august 2011 - august 2012, the last period considered the greatest, was between: May 2006 - July 2007 (Zaldea et al., 2008).

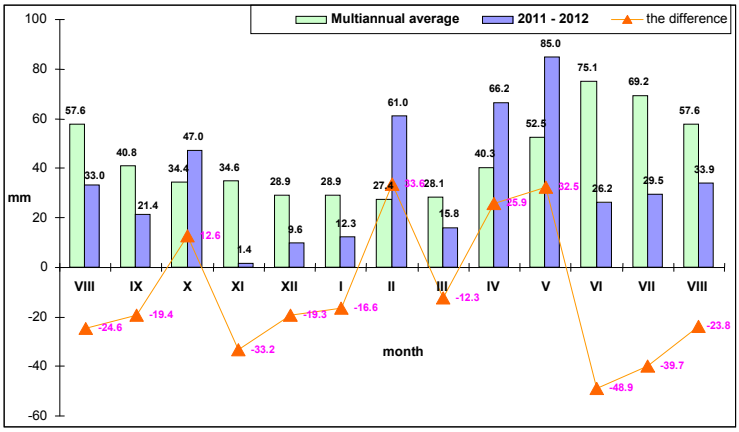

Fig.1 - Rainfall registered in Iasi Copou Viticultural Center during august 2011 - august 2012.

In these conditions, the soil hydric deficit increased from one month to another, reaching the end of august 2012 to 80% in a depth of 0-100 cm (table 1). Available moisture values ranging between 15-20% (Table 2) were situated in the water interval very hardly accessible onto profile 0-100 cm, being known that easily accessible water range of vines are between 50 to 80% of useful water capacity (Moțoc, 1968).

Table 1

Water deficit of soil during vegetation period of 2012

Depth cm	Month											
	IV		V		VI		VII		VIII		IX	
	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha	%	m^3/ha	%
0 – 20	272	57	192	40	410	86	424	89	390	82	361	76
20 – 50	135	18	335	45	599	81	638	86	627	85	580	78
50 - 100	69	6	204	19	611	57	828	77	855	80	814	76
100 - 150	80	12	-	-	167	26	377	59	353	55	349	54

Table 2

Soil accessible moisture during vegetation period of 2012

Depth cm	Month											
	IV		V		VI		VII		VIII		IX	
	mm	%	mm	%	mm	%	mm	%	mm	%	mm	%
0 – 20	20,36	43	28,32	60	6,59	14	5,18	11	8,55	18	11,46	24
20 – 50	60,44	82	40,47	55	14,13	19	10,14	14	11,32	15	16,01	22
50 - 100	100,27	94	86,80	81	46,05	43	24,41	23	21,65	20	25,81	24
100 - 150	56,43	88	80,43	125	47,79	74	26,71	41	29,16	45	29,60	46

The analysis of average temperatures during the vegetation season of 2012 shows that in this period were recorded monthly average temperatures whose values were greater than the multiannual values, rising from 12.9°C in April to 25.4°C in June. June, July and August were the warmest. The averages of maximum temperatures in air were 28.3°C in June, 32.8°C in July and 29.3°C in

august. Multiannual average of maximum temperatures registered in same months between 1981-2010, were 25.0°C in June, 27.2°C in July and 26.9°C into august (table 3).

Table 3

Temperature values during vegetation season of 2012

Thermal values	Month					
	IV	V	VI	VII	VIII	IX
Average temperature, mult. values, °C	10,1	16,1	19,4	21,0	20,3	15,6
Average temperature, °C, 2012	12,9	17,7	22,3	25,4	22,6	18,6
Max. Temp. average, mult. values,°C	15,9	22,4	25,0	27,2	26,9	21,5
Max. Temp. average, °C, 2012	18,1	23,6	28,3	32,8	29,3	25,3

The amount degrees of global temperature, active and useful during the vegetation season showed higher values than the multiannual. Thus, the global thermal balance was 3652.8°C compared to 3138.6°C, active thermal balance was 3596.3°C compared to 3009.6°C and useful thermal balance was 1856.3°C as against 1359.7°C (table 4).

Table 4

The values of climatic elements of 2012 compared with multi annual averages.

Climatic elements studied	Multiannual average	Year 2012
Global thermal balance, (Σt°g)	3138,6 (1972-2011)	3652,8
Active thermal balance, Σt°a)	3009,6 (1972-2011)	3596,3
Useful thermal balance, (Σt°u)	1359,7 (1972-2011)	1856,3
Mean temperature of July , °C **August,°C** **September,°C**	21,0 (1972-2011) 20,3 (1972-2011) 15,6 (1972-2011)	25,4 22,6 18,6
Absolute min. temp. in air,°C	-27,2/28.12.1996	-26,7/12.02.2012
Absolute min. temp. at the soil surface,°C	-35,0/26.01.2010	-33,0/08.02.2012
Annual average temperature T°C	9,7 (1972-2011)	10,4
Σ annual rainfall, mm	572,3 (1972-2011)	539,9
Σ season vegetation rainfall, mm	403,0 (1972-2011)	287,2
Σ hours of heatstroke during vegetation season, hours	1448,0(1972-2011)	1499,1
Maximum average temperatures of August,°C	26,9 (1972-2011)	29,3
Average temperatures of decades: I and II June	19,1 (1972-2011)	22,2
Number of days with maximum temperatures > 30 °C	17,3 (1972-2011)	55
the duration of bioactive vegetation season, no. days	169,0 (1972-2011)	175
Real heliothermic index	1,96 (1972-2011)	2,8
Hydrothermal coefficient	1,34 (1972-2011)	0,8
Bioclimatic index	7,08 (1972-2011)	10,7
Oenoclimatic index	4106,1 (1972-2011)	5058,2

The high temperatures corroborated with soil water deficit led to a accentuated atmospheric and pedological drought with adverse effects on

vegetation state of vine by advancing the growth and fruiting phenophases. Shoots growth was slow (reduced), occurred frequently the withering phenomenon of vine trunk, premature yellowing of leaves, especially around the grapes, taking the appearance of natural defoliation, grapes remained small, with small and faded berries compared to normal years in terms of climate (figure 2).

Fig. 2 - Appearance of vine with dry leaves and shrunken grapes

Maximum air temperatures at the end of April and the first decade of May, which ranged from 27 to 31°C forced the early vegetation, growth of shoots and inflorescences appearance in a very short time, practically surpassing these phenophases with about two weeks. Thus,the budbursting, phenophase which mark the start of the vegetation period was held from 26th April, was carried out unevenly, due to minimum temperatures recorded in winter and due the damage of the main buds from bud complex. Flowering, the phenophase which defines the fructification and influence the grapes production in 2012 started on 25th May, the grapes veraison started at the end of July, and grapes ripening in the first decade of September. However, cold weather and high atmospheric humidity during flowering led to an uneven and closed flowering, and the processes of pollination, fertilization and berries binding were affected. As a result of climatic conditions, the grapes productions in the fall of 2012 were below the biological potential of varieties cultivated in Iasi SCDVV (table 5).

Table 5

Grapes production and the quality of varieties cultivated at SCDVV Iaşi

Variety	Production kg/ha	Sugars g/L	Total acidity g/L H_2SO_4	Average weight of a grape, g
Aligoté	4000	188	5,0	102
Fetească regală	4100	187	4,9	132
Fetească albă	3800	192	4,6	127
Muscat Ottonel	3247	191	6,7	95
Sauvignon blanc	4200	191	4,6	100
Chardonnay	4150	200	6,6	118

The smallest productions were obtained from varieties Muscat Ottonel 3247 kg/ha, Fetească alba 3800 kg/ha and Aligoté 4000 kg/ha. Sugar content in must ranged from 187 g/L at Fetească regală variety and 200 g/L at Chardonnay variety.

CONCLUSIONS

1. In terms of climate the agricultural year 2011-2012 is characterized as being very difficult, with a very cold winter below the frost resistance of the vine, with a warmer spring than normal and with a dry summer with absolute maximum temperatures that frequently exceeded 35°C.

2. Amounts of precipitation were small, only 287.2 mm during the vegetation period compared to 403.0 mm multiannual average in Iasi Copou viticultural center and very uniformly distributed. Period of drought began in August and September 2011, continued with the winter months, November, December and January and summer months of June, July and august 2012.

3. Monthly average temperatures recorded higher values than multiannual. June, July and August were very warm, with average monthly temperature of 22.3°C, 25.4°C or 22.6°C. The highest temperature in air was recorded in August,of 40.1°C and on the ground in July, of 68.0°C.

4. Due to the small amounts of rainfall and high temperatures recorded, has occurred an accentuated decrease of soil moisture values and an increase of deficit. In late August accessible humidity values were, on the depth of 0-100 cm, well below the optimal humidity values for vines.

5. Has occurred frequently the withering phenomenon of vine trunk, premature yellowing of leaves, especially around the grapes, taking the appearance of natural defoliation, grapes remained small, with small and faded berries compared to normal years in terms of climate

6. Quantitative and qualitative production has been influenced by climatic conditions of this year, respectively very low temperatures in February that led to the loss of buds and drought during the vegetation period.

***Acknowledgments**: The work was developed within the framework of the Sectoral Project ADER 2020, PS 2.2.5. entitled "Technological links of vine culture and processing of raw materials to ensure the commercial farm income, while respecting the criteria of cross-compliance".*

REFERENCES

1. **Alexandrescu I., Pițuc P., Băbuşanu V., Chivu D., 1998 –** *Viticultura practică sezonieră*, vol. I., Editura Danaster Iaşi.
2. **Moțoc M., 1968** – *Estimarea deficitului de umiditate a solului în plantațiile viticole*. Centrul de documentare agricolă, Bucureşti.
3. **Oşlobeanu M., Oprean M., Alexandrescu I., Georgescu Magdalena, Baniță P., Jianu L., 1980** – *Viticultura generală şi specială*. Editura Didactică şi Pedagogică Bucureşti.
4. **Zaldea Gabi, Apostol V., Stoica Carmen, Măriuță P., 200**4 – *Regimul hidric al solului în plantațiile viticole din centrul viticol Copou Iaşi*. Anale I.C.V.V. Valea Călugărească volumul XVII, p. 159-165;
5. **Zaldea Gabi, Vasile Ancuța, Damian Doina, Savin C., 2008** – *Stresul hidric şi termic din anul agricol 2006-2007 şi influența acestuia asupra plantațiilor viticole.* Lucrări ştiințifice Seria Horticultura, vol. 51, USAMV Iaşi, p. 841-846.

THE EFFECT OF SOME ENZYMATIC TREATMENTS ON ALIGOTÉ WINE COMPOSITION

EFECTUL UNOR TRATAMENTE ENZIMATICE ASUPRA COMPOZIȚIEI VINURILOR OBȚINUTE DIN SOIUL ALIGOTÉ

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Abstract: *In this study, the must obtained in 2011 from Aligoté variety was subjected to a number of 3prefermentative treatments with enzymatic products (Alphalase® NP (V_1), Belpan® Bi (V_2) şi Papain® (V3). It was found that after applying Alphalase ® NP treatment, the content of Na, K, Ca and Fe in wine increased compared with untreated sample. The amount of total polyphenolic compounds and with reducing properties decreased in samples treated with Alphalase ® NP and Belpan ® Bi.*
Key words: *Aligoté, phenolic compounds, enzyme, papain*

Rezumat. *În acest studiu mustul obținut din soiul Aligoté în campania din 2011 a fost supus unui numar de 3 tratamente prefermentative cu preparate enzimatice (Alphalase® NP, Belpan® Bi şi Papain®). S-a constatat că în urma aplicării tratamentului cu Alphalase® NP, nivelul conținutului de Na, K, Ca şi Fe din vin a crescut comparativ cu proba netratată. Cantitatea de compuşi polifenolici totali şi cu proprietăți reducătoare s-au diminuat la probele tratate cu Alphalase® NP şi Belpan® Bi.*
Cuvinte cheie: *Aligoté, compuşi fenolici, enzime, papaină*

INTRODUCTION

Enzymes are biological catalysers very much used in the food industry and particularly in the oenological sector. Fundamentally, they are used to clarify and filter the must and wine, increasing their physicalechemical stability and strengthening the aromatic profile or colour of wines produced from certain varieties of grape (Lourdes et.al., 2010; Pomohaci, 2005).

It was also found that the enzymes used in winemaking technology have an impact on the polyphenolic content and composition. (Alev Akpinar Borazan et al., 2012; Romero Cascale et al., 2012). The objective of this study is to investigate the influence of enzymatic treatment on the composition of Aligoté wines, especially on metal content of wine.

MATERIAL AND METHOD

The analysed wines were obtained from the Aligoté variety, processed through the general white wines technology. Before the fermentation, 3 treatments were

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applied to the must: Alphalase® NP - 0.05 g/L (V_1), Belpan® Bi - 0.05 g/L (V_2), Papain® - 0.05 g/L (V_3)

The major physical-chemical parameters were analysed for the obtained wines: total and volatile acidtity, pH, alcoholic concentration, total dry extract and non-reductive extract. The used analytical methods for the above mentioned parameters are in conformity with European standards and those by OIV. In order to characterise the phenolic compounds a series of photometrical determinations were done with the Shimadzu UV-1800 spectrophotometer.

The total poliphenolic index or D280 – represents a global photometric determination of all the phenolic compounds present in wine.The Folin-Ciocâlteu index is determined by the method described by Waterhouse in 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, Ribéreau-Gayon, 2006).

Measuring of the antioxidant capacity of wines was effectuated using the reductive power method, as in the protocol established at the Vine and Wine Institute, Dijon. For his two solutions were prepared:Solution A – in a 50 mL vial, 150 mg feroamoniacal sulphate 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'–bipyridil were dissolved in 40 mL 0.1N 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, pippetting 3 mL of the AB mix and 37.5 µL of the wine sample.

The absorbency was read at 510 nm. Solutions of feroamoniacal sulphate of 0.25, 0.5, 0.75, 1.00, 1.25, 1.50, 2.00 mg/L concentrations were used for the etalon curve, and the obtained data were expressed in mg/L feroamoniacal sulphate.

MINOLTA CT-210 spectrophotometer was used to determine the chromatic characteristics according to CIE Lab 76 (Ţârdea, 2007). The content of sodium, potasium, calcium, iron, zinc, copper in Aligoté wines was determind using the atomic absorbtion spectrophotometer Shimadzu AA6300 according to OIV Codex. (Cotea V.D. et al., 2009)

RESULTS AND DISCUSSIONS

After determining th epsuysical-chemical parameters of the wines (tab. 1), one can state that the dry wines can be classified as superior quality (VS).

Table 1

Physical-chemical characteristics of Aligoté wine

Variant	Volatile ac. g acetic acid /L	Total ac. g tartaric acid /L	pH	Alcholic conc. % v/v	Reducing substances g/L	E.S.T g/L	E.N. g/L
V	0,37	7.39	3.137	10.48	2.8	21.4	18.6
V_1	0.34	7.35	3.148	10.36	2.87	20.8	18.04
V_2	0.37	7.73	3.128	10.41	2.21	21.1	18.89
V_3	0.35	7.5	3.138	10.49	1.3008	20.1	18.8

The volatile acidity of Aligoté wines registers values between 0.34 g/L in the sample with Alphalase® NP treatment and 0.37 g/L in the control sample and Belpan® Bi. Total acidity decreased due the prefermentative treatments.

The values of the alcoholic concentration are very close regardless the sample analyzed. Papain treatmet (V_3) decreased the quantity of reductive substances (1,3 g/L) compared to control sample (2,8 g/L).

For evaluating the total dry extract the lower values are found in the samples treated with papain and for the non-reductive extract, Alphalase® NP registered the smallest value. The obtained wines are dry, the reductive substances' content being low

Following spectrophotometry was found that the total phenolic compounds and phenolic compounds with reducing properties decreased due to application Alphalase ® NP and Belpan ® Bi treatments.

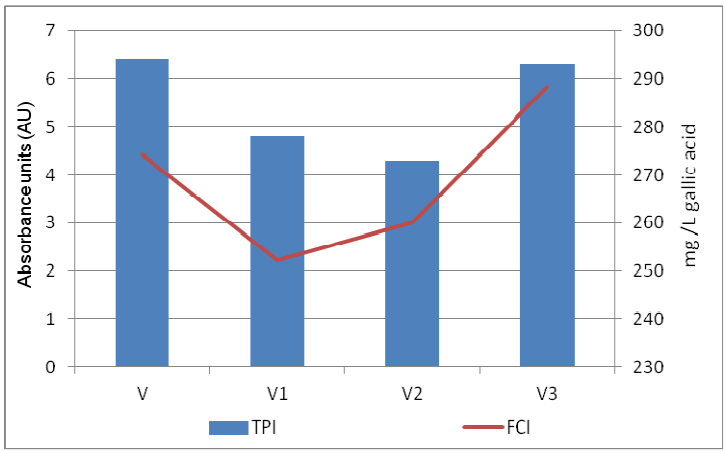

Fig.1. - TPI and FCI evolution

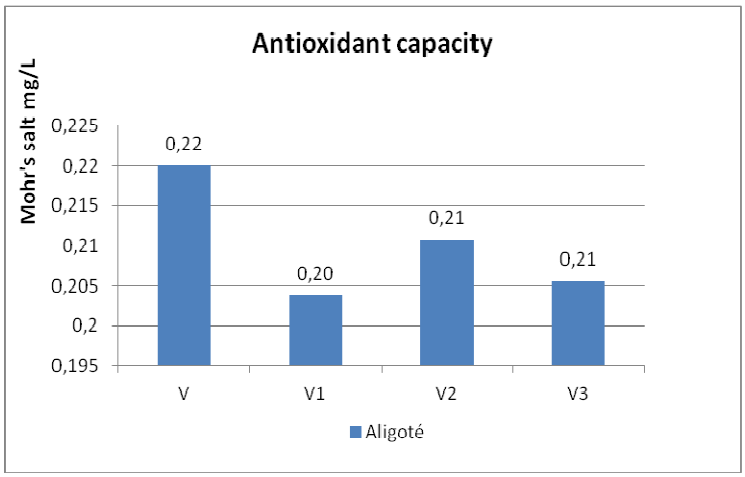

Fig.2 - Antioxidant capacity of Aligoté wines

Antioxidant capacity determined by reducing power method presents low values at samples treated with enzymatic preparations compared with the control.

Chromatic parameters were calculated according to CIE Lab 76, regarding the absoprtion spectrum registered for each wine sample (Țârdea, 2007). The results of L parameter show that the obtained wines are very clear. In general, the wines have a yellow-greenish color (tab. 3).

Major hue differences and colorimetric differences is observed in the wine sample treated with Alphalase® NP (tab.3).

Table 2

Chromatic parameters in Aligoté wines where different treatments were applied

Sample	Clarity L	Chromaticity		Saturation or Chroma L
		a	b	
V	99,64	-0,48	2,45	2,50
V1	99,50	-0,40	2,95	2,98
V2	99,58	-0,65	2,52	2,60
V3	99,10	-0,58	2,70	2,76

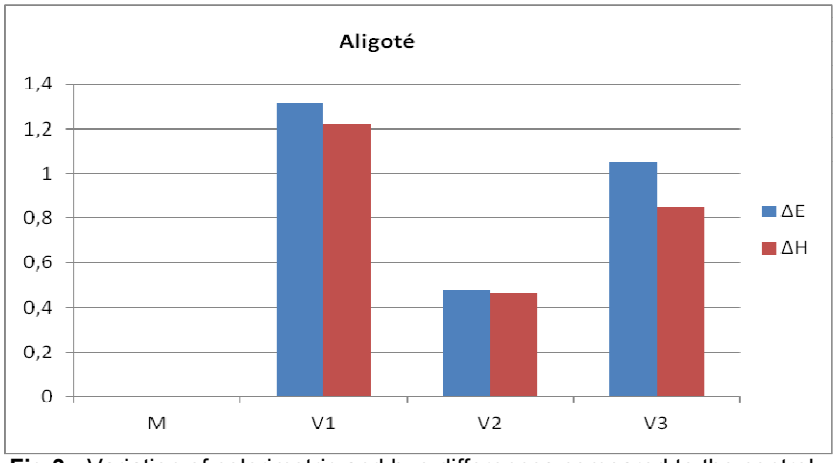

Fig.3 - Variation of colorimetric and hue differences compared to the control

In assessing the sodium content of wine was observed that the addition of papain decreased the level of this content (8.87 mg / L) compared with the control (33.95 mg / L), but other treatments have resulted in a slight increase of sodium content in the wine. Regarding the content of potassium, its level increased after performing the enzymatic treatments before fermentation. Treatments with Belpan ® Bi and papain contributed to diminishing the calcium content of wines. By applying thetreatment with papain, the iron content was reducedcb compared with the control, and the level of zinc content decreased slightly regardless of

treatment. Copper content was below the limit of detection (SLD <0.01mg / L) in all samples analyzed.

Table 3

Sodium, potassium and calcium content of Aligoté analyzed wines

Sample	Sodium		Potassiu		Calcium	
	Conc. (mg/L)	SD (mg/L)	Conc. (mg/L)	SD (mg/L)	Conc. (mg/L)	SD (mg/L)
V	33,95	0,0015	627,02	0,0031	135,72	0,0025
V1	39,72	0,0008	670,01	0,0016	148,37	0,002
V2	40,85	0,0006	710,67	0,0029	116,35	0,0005
V3	8,87	0,0008	676,22	0,002	120,86	0,0022

Table 4

Iron and zinc content of Aligoté analyzed wines

Sample	Iron		Zinc	
	Conc. (mg/L)	SD (mg/L)	Conc. (mg/L)	SD (mg/L)
V	4,22	2,395741358	1,62	0,155308306
V1	4,82	0,800240291	1,21	0,221038404
V2	4,32	1,109424193	1,28	0,345023676
V3	3,48	0,726291239	1,17	0,168105344

CONCLUSIONS

Antioxidant capacity presents low values at samples treated with enzymatic preparations compared with the control. The level of total phenolic compounds and phenolic compounds with reducing properties decreased due to application Alphalase ® NP and Belpan ® Bi treatments.

The content of potassium increased after performing the enzymatic treatments. Belpan® Bi and papain contributed to diminishing the calcium content of wines. Papain reduced the amount of iron in wine. Zinc content decreased slightly regardless of treatment. . Copper content was below the limit of detection (SLD <0.01mg / L) in all samples analyzed.

Acknowledgments: *This study is part of the national research program POSDRU – CPP107 DMI1/5/S/77222 for PhD. support.*

REFERENCES

1. Alev Akpinar Borazan A., Berrin Bozan, 2012 - *The influence of pectolytic enzyme addition and prefermentative mash heating during the winemaking process on the phenolic composition of Okuzgozu red wine,* Food Chemistry 138, p. 389–395.

2 .Cotea D V., Zănoagă V. C., Cotea V. V., 2009 - *Tratat de Oenochimie.vol. 1.* Editura Academiei Române, Bucureşti.

3.Lourdes Armada, Esperanza Fernández Elena, 2010 - *Influence of several enzymatic treatments on aromatic composition of white wines*, LWT - Food Science and Technology 43, p. 1517-1525

4. Pomohaci N., 2005 – *Prelucrarea strugurilor şi producerea vinurilor.* Editura Ceres, Bucureşti.

5. Ribéreau-Gayon P.,2006 – *Handbook of Enology Volume II – The Chemistry of* Wine. Stabilization and Treatments, 2nd Edition, Editura John Wiley & Sons, West Sussex, England;

6. Romero-Cascales I., Ros-Garcia J. M., Lopez-Roca J. M., 2012 - .*The effect of a commercial pectolytic enzyme on grape skin cell wall degradation and colour evolution during the maceration process*. Food Chemistry, 130, p. 626–631.

7. Ţârdea C., 2007 – *Chimia şi analiza vinului.* Editura "Ion Ionescu de la Brad", Iaşi.

8. **Waterhouse A.L., 2002.** - *Polyphenolics: Determination of Total Phenolics. In: Current Protocols in Food Analytical Chemistry***,** Wrolstad, R.E (Ed.). JohnWiley and Sons, Inc., New York, ISBN: 0471325651, p. 1-4.

9. * OIV 2011** - *International Code of Oenological Practices,2011 edition,* Organisation International de la Vigne et du Vin, Paris.

IMPACT STUDY OF SOME MICRO AND MESOPOROUS MATERIALS ON THE CHEMICAL COMPOSITION OF TĂMÂIOASA ROMÂNEASCĂ WHITE WINE

INFLUENȚA UNOR MATERIALE NANOPOROASE ASUPRA COMPOZIȚIEI CHIMICE A VINULUI TĂMÂIOASĂ ROMÂNEASCĂ

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Abstract. *The exploration of compositions and structures for micro and mesoporous materials in view of specific applications in the oenological area as sorption and separation support, has led to considerable results, reported in literature. The synthesis of nanoporous materials is an active segment of research. The nanomaterials: AlMCM-41, SBA-15, MCM-41 and KIT-6 were synthesized according to the literature and were characterized using the following methods: FTIR, SEM and nitrogen sorption. The aim of this research is to investigate the impact of some nanomaterials on the concentration of volatile compounds from Romanian Tămâioasă Românească white wine, harvested in 2011. The used method for determining the concentration of volatile compounds is in accordance with OIV specifications, method OIV-ME-AS312-01A. The obtained results, following the wine treatment with nanomaterials, demonstrate that KIT-6 mesoporous material decrease the concentration of alcohol in investigated wines.*
Key words: *wine, alcohol concentration, nanomaterials, adsorption*

Rezumat. *Cercetările asupra compoziției şi structurii materialelor micro şi mezoporoase în vederea obținerii de aplicații specifice în adsorbția şi separarea unor compuşi bioactivi din vin, a condus la rezultate considerabile, raportate în literatura de specialitate. Studiul sintezei, structurii şi a domeniilor de utilizare a acestor materiale, cu dimensiunea porilor între 2 si 50 nm este un segment activ în cercetare. Următoarele materiale: AlMCM-41, SBA-15, MCM-41 si KIT-6 au fost sintetizate conform literaturii de specialitate şi caracterizate prin următoarele metode: FTIR, SEM şi adsorbția azotului. Scopul acestei cercetări este de a investiga impactul nanomaterialelor sintetizate cu privire la variația conținutului de compuşi volatili a vinului alb Tămâioasă Românească din producția anului 2011. Metoda utilizată pentru determinarea concentrației compuşilor volatili este în conformitate cu specificațiile OIV. Rezultatele obținute în urma tratamentului demonstrează că materialul mezoporos KIT-6 scade concentrația alcoolică a vinurilor investigate.*
Cuvinte cheie: *vin, concentrația alcoolică, nanomateriale, adsorbție*

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INTRODUCTION

Wine aroma depends on the balance of several hundred volatile compounds, whose individual concentrations vary between 10^{-1} and 10^{-10} g/L. Some volatile compounds are formed during alcoholic fermentation by the yeasts. These compounds constitute the fermentation bouquet of wine and they have a large influence on the final aroma of the product (Lambrechts et al., 2000).

Microporous and mesoporous materials are among the best known and most widely used porous materials. Their uniform pore sizes with molecular dimensions, good stability, selectivity and activity due to their crystalline structure, make these materials unique for several processes (sorption, membrane separations etc.).

The exploration of compositions and structures for micro and mesoporous materials in view of specific applications in the oenological area as sorption and separation support, has led to considerable results, reported in literature (Cotea et al., 2011).

The synthesis of nanoporous materials, defined by IUPAC as materials with pore sizes between 2 and 50 nm, is an active segment of research. The nanomaterials: **AlMCM-41, SBA-15, MCM-41 and KIT-6** were synthesized according to the literature and were characterized using the following methods: FTIR and SEM.

The aim of this research is to investigate the impact of some nanomaterials on the concentration of volatile compounds of Tămâioasă Românească wine, 2011 vintage. The method used for determining the alcoholic strength in volume percent (% vol) at 20 °C is in accordance with OIV specifications, method OIV-ME-AS312-01A (*** OIV, 2011) .

MATERIAL AND METHOD

Clinoptilolite was collected from Mârşid Romania subsoil assets (obtained from volcanic eruptions). It was crushed and sieved to obtain the fractions of 0.1 and 1.0 mm.

The commercial H-mordenite comes from Tosoh Corporation Tokyo, Japan.

The nanomaterials: **AlMCM-41** (Corma et al., 1994)**, SBA-15** (Zhao et al.,1998), **MCM-41** (Beck et al., 1992) **and KIT-6** (Kleitz et al., 2003) were synthesized according to the literature and were characterized using the following methods: FTIR and SEM. Molar composition of the synthesis gel for used nanomaterials is described in Table 1:

Table 1

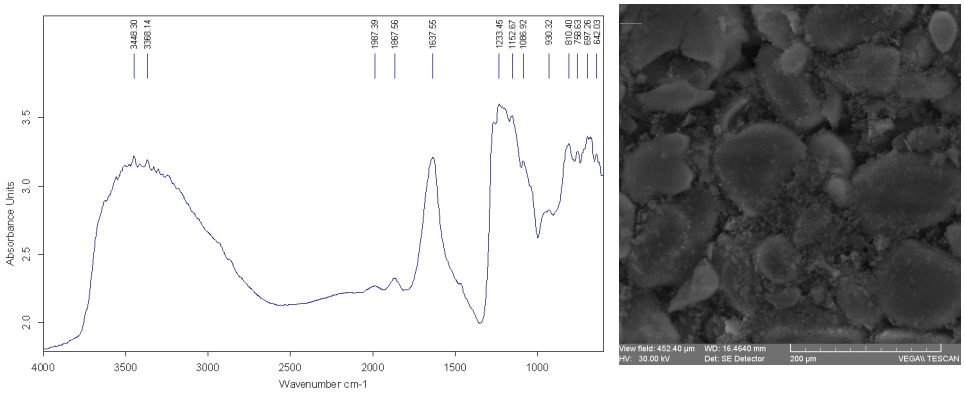
Molar composition of the synthesis gel

AlMCM-41	$1SiO_2$: $0.033Al_2O_3$: 0.2C16TMABr: $100H_2O$
MCM-41	$1SiO_2$: $0.2C_{16}$TMAB: $5.7NH_3$: 113 H_2O
SBA-15	$1SiO_2$: 0.017 P123: 5.87 HCl: 194 H_2O.
KIT-6	0.017 P123: 1.3 TEOS: 1.31 BuOH: 1.83 HCl : 195 H_2O

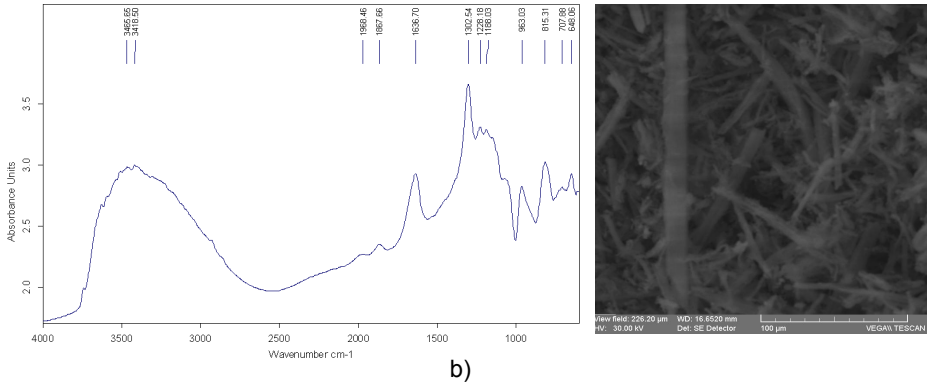
Scanning Electron Microscopy (SEM) analysis of sample were carried out on a SEM VEGA II LSH (TESCAN) with EDX detector tip Quantax QX2 (Bruker/ Roentex).

FTIR spectra were performed in the range of the wave numbers 600 - 4000 cm-1, using a TENSOR 27 unit, Brucker FTIR.

Fig. 1 presents the FT-IR spectra and SEM micrograph of calcined AlMCM-41 (a), SBA-15 (b), MCM-41(c) and KIT-6(d) samples.



a)



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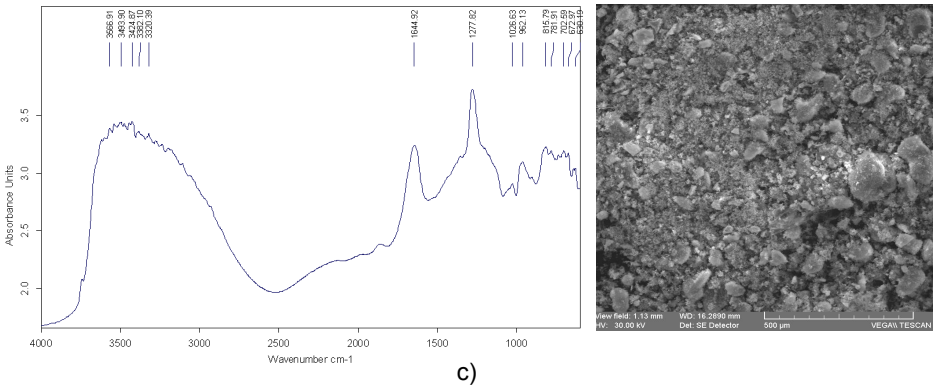
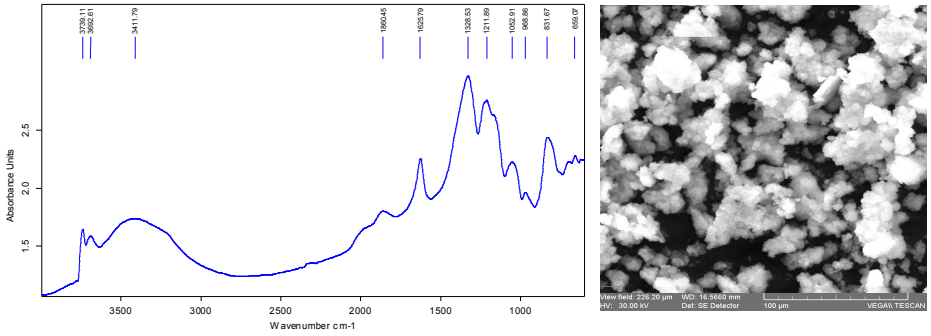


c)



d)

Fig. 1 - FT-IR spectra and SEM micrograph of calcined AlMCM-41 (**a**), SBA-15 (**b**), MCM-41(**c**) and KIT-6(**d**) samples

Table 2

Standard chemical analysis of Tămâioasă Românească wite wine

Parameter	Value
pH	3.68
Total acidity	6,8 g/L (as tartaric acid)
Volatile acidity	0.27 (as acetic acid)
Free SO_2	22.75 mg/L
Total SO_2	137.28 mg/L
Sugars	2.78 g/L
Alcool	11.80% v/V

Total acidity, volatile acidity, pH, total and free SO_2, sugars and alcool of the used wine were analyzed according to the methods proposed by O.I.V. (2011) (Table 2).

Wine volatile compounds analysis. The wine volatile compounds composition was carried out with Shimadzu GC-MS QP2010 Plus with Headspace Autosampler AOC 5000.

GS-MS Parameters:
– Shimadzu GC-MS QP2010 Plus with Headspace Autosampler AOC 5000
– Column: Thermo SLB 5 MS, 30 m, 0.1mmX0.1µm.
– Ion sourse temperature: 250 ºC,
– Detector voltage: 1 kV

Headspace parameters:
– Incubation temperature: 75 ºC
– Syringe temperature: 110 ºC
– Incubation time: 15 min
– Agitator speed: 500 rpm
– Injection speed: 1000 µL/s

RESULTS AND DISCUSSIONS

The adsorption experiments and preparation of wine samples distillates. The adsorption experiments were conducted at 20ºC for 24 hours adding amounts of nanomaterial powder into 250 mL wine (Table 3). After filtration, 100 mL of sample was distilled by steam stripping at 120ºC according to the OIV method OIV-ME-AS312-01A (OIV, 2011). From a distillate volume of 100 ml sample the alcoholic concentration is determined by standard methods (OIV, 2011) and then the amount of volatile compounds is measured using a GS-MS system.

Table 3

Volatile compounds concentrations from alcoholic extracts (µL volatile compounds/L wine)

Volatile compounds	***3-methyl-butan-1-ol***	***2-methyl-butan-1-ol***	***3-methyl-butan-1-ol acetate (Isoamyl acetate)***	***hexanoic acid ethyl ester***	***octanoic acid ethyl ester***	***decanoic acid ethyl ester***
Wine	454.93	-	174.77	597.10	390.74	99.78
Al-MCM-41 0.49532(g/L)	453.35	508.12	175.12	598.28	390.60	-
MCM-41 0.50454(g/L)	402.43	954.15	174.67	599.80	390.68	99.79
Clinoptilolite 0.52617(g/L)	408.83	897.68	174.50	595.71	390.21	99.78
Mordenite 0.50148(g/L)	468.52	375.41	175.67	598.36	390.58	99.80
SBA-15 0.53048(g/L)	467.00	388.65	174.63	600.83	390.54	99.80
KIT-6 0.52902(g/L)	451.47	524.65	176.63	595.13	389.97	99.76

Table 4

Alcohol concentration of wine treated with different adsorbents

Sample	Adsorbent, g/L	Alcohol, % v/V
Wite Wine	0	11.80
AlMCM-41	0.49532	11.73
MCM-41	0.50454	11.78
Clinoptilolite	0.52617	11.68
Mordenite	0.50148	11.77
SBA-15	0.53048	11.78
KIT-6	0.52902	11.65

CONCLUSIONS

1. The experimental results, following the wine treatment with nanomaterials, demonstrate that Clinoptilolite and KIT-6 reduce the concentration of alcohol in wine (Table 4).

2. Aluminum siliceous material Al-MCM-41 has a lower influence on the amount of alcohol from red wine Tămâioasă Românească.

3. The GS-MS collected data demonstrate that 2-methyl-butan-1-ol compound is found in blank sample, below the detection limit. In distillates of wine samples treated with nanomaterials this compound is present in a variable amount between 375.41 and 954.15 μL /L wine depending on the material (Table 3).

Acknowledgments.*This study was realised and published within the research project POSCCE-A2-O2.1.2-2009-2 ID.653, code SMIS-CSNR 12596.*

REFERENCES

1. **Beck J.S., Vartuli J.C., Roth W.J., Leonowicz M.E., Kresg C.T., Schmitt K.D., Chu C.T.W., Olson D.H., Sheppard E.W., Mccullen S.B., Higgiens J B., Schlenker J.L., 1992 -** *A new family of mesoporous molecular sieves prepared with liquid crystal templates.* J. Am. Chem. Soc., 114(27), p.10834-10843.
2. **Corma A., Fornés V., Navarro M.T., Perez-Pariente J., 1994** - *Acidity and stability of MCM-41 crystalline aluminosilicates*. J. Catal., 148, p. 569-574.
3. **Cotea V.V., Luchian C., Bilba N., Niculaua M., 2011 -** *Mesoporous silica SBA-15, a new adsorbent for bioactive polyphenols from red wine*. Analytica Chimica Acta, 732, p.180-185.
4. **Kleitz F., HeiChoi S., Ryoo R., 2003 -** *Cubic Ia3d large mesoporous silica: synthesis and replication to platinum nanowires, carbon nanorods and carbon nanotubes.* Chem. Commun., p. 2136-2137.
5. **Lambrechts M.G., Pretorious I.S.**, **2000** - *Yeast and its importance to wine aroma-a review*. South African Journal of Enology and Viticulture, 21, p. 97-129.
6. **Zhao D., Huo Q., Feng L., Chmelka B.F., Stucky G.D., 1998 -** *Nonionic triblock and star diblock copolymer and oligomeric surfactant syntheses of highly ordered, hydrothermally stable, mesoporous silica structures.* J. Am. Chem. Soc., 120(24), p. 6024-6036.
7. ***** OIV, 2011** - *Recueil des methodes internationales d'analyse des vins et des mouts.* Office International de la Vigne et du Vin, Editura O.I.V., Edition Officielle, Paris.

STUDY OF SOME POLYPHENOLIC EXTRACTS OBTAINED FROM LEES OF WINE

STUDIUL UNOR EXTRACTE POLIFENOLICE OBȚINUTE DIN DROJDIA DE VIN

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Abstract. *The identification of active principles derived from the polyphenolic extracts obtained from lees of wine can help create an alternative use and recovery of by-products of wine, fact which increases their economic value. The research in this paper aim to characterise the extracts obtained from lees of wine by identifying and quantifying the major polyphenolic compounds in their composition. The results of the preliminary characterization showed quite similar values in the content of total polyphenols and tannoid matters index. The maceration variants did not affect the amount of hydroxybenzoic and hydroxycinnamic acids. The other polyphenolic compounds that were identified varied depending on the grape variety and maceration technology used. The obtained data justifies the use of lees of wine as raw material to obtain polyphenolic extracts, recommending further research on its biologically active properties.*
Key words: *lees of wine, maceration, polyphenols.*

Rezumat. *Identificarea principiilor active ale extractelor polifenolice obținute din drojdia de vin poate contribui la crearea unei alternative de utilizare şi valorificare a subproduselor din vinificație, fapt ce măreşte valoarea lor economică. Cercetările din prezenta lucrare urmăresc să realizeze caracterizarea unor extracte obținute din drojdia de vin prin identificarea şi cuantificarea celor mai importanți compuşi polifenolici din compoziția acestora. Rezultatele procesului de caracterizare preliminară au evidențiat valori relativ apropiate ale conținutului de polifenoli totali şi al indicelui de materii tanoide. Variantele de macerare nu au influențat cantitatea de acizi hidroxibenzoici şi hidroxicinamici. Ceilalți compuşi polifenolici identificați au variat atât în funcție de soi cât şi de varianta de macerare. Datele obținute justifică utilizarea drojdiei de vin ca materie primă pentru obținerea unor extracte polifenolice, recomandându-se continuarea cercetărilor cu privire la proprietățile lor biologic active.*
Cuvinte cheie*: drojdie de vin, maceratie, polifenoli.*

INTRODUCTION

The grapes store complex mixes of polyphenolic compounds, mostly found in seeds and skins of the berry, from where they are transferred in to must and then wine through maceration (Țardea et. al., 2010; Ribereau-Gayon et. al., 2006).

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Among the by-products of the winemaking process, the lees of wine is considered an important source of polyphenolic compounds due to its physical-chemical composition (Pérez-Serradilla et. al., 2011; Yi Chun et. al., 2009; Cheng et. al., 2011). It can be used as raw and cheap matter for producing natural chemical compounds (Braga et. al., 2002; Bustamante et. al., 2008; Naziri et. al., 2012) as well as from an environmental point of view, in dealing with management of waste.

The present study aims at creating an alternative for the use of the lees of wine resulted in the winemaking process as polyphenolic extracts.

MATERIAL AND METHOD

The polyphenolic extracts were obtained from the lees of wine of Fetească neagră, Băbească neagră, Cabernet Sauvignon Merlot and Arcaş wine-making process. In order to study the influence of the maceration technology on the content of polyphenolic compounds, the grapes were processed using classic maceration, thermo-maceration, microwave maceration and rotating tanks maceration.

After drying and crushing, the obtained lees of wine was degreased with ethylic alcohol in the following ratio 1 g plant material: 20 mL solvent for removing lipophilic substances. The extraction process was done in a continuous manner with the Soxhlet device, using ethylic alcohol in a ration of 1/10 (plant material (g)/solvent (mL). The time span of the extraction varied according to depletion time of plant material (48 – 72 hours), with a constant temperature of 78°C.

For a preliminary characterisation of polyphenolic extracts, total polyphenols were determined, using the spectrophotometric method Singleton V. And tannoid matter indices (I.M.T), method established by Bourzeix et al., 1986.

A HPLC analysis (high performance liquid chromatography) identified and quantified a series of phenolic acids, stilbens (trans-resveratrol), non-hydrolysable tannins (catechin and epicatechin), as well as flavons (rutin and quercitin).

RESULTS AND DISCUSSIONS

The data obtained in the preliminary characterisation process of the analysed polyphenolic extracts are presented in table 1. Analysing the results, one can observe similar values regarding the content of total polyphenolic compounds and tannoid matter index, disregarding the grape variety used.

Within the same grape variety, a reduced influence of used technology on the polyphenolic content is noticed. Therefore, the wine variants obtained through classic maceration and rotating tanks maceration have a lower concentration of polyphenolic compounds, the lees of wine being richer in polyhenolic compounds.

The extracts obtained from lees of wine of Cabernet Sauvignon have mean values of anthocyanin content of 25.219 mg/L. No matter of the maceration technique, extracts from the lees of wine of Băbească neagră wine has small values of anthocyans. An explanation could be the fact that the used grapes have a small content of anthocyans.

Table1

Preliminary characterisation of polyphenolic extracts obtained from the lees of wine

Grape variety/ maceration variant	Total polyphenols, g equiv. gallic acid /L	Anthocyans, mg/L	Tannoid matter index
Fetească neagră /thermo-maceration	0.1312	14.875	5.92
Fetească neagră / microwaves	0.1712	14.875	5.72
Fetească neagră / classical maceration	0.2706	18.125	7.00
Fetească neagră /roto-tanks maceration	0.2728	20.125	6.48
Merlot / thermo-maceration	0.1552	22.750	6.36
Merlot / microwaves	0.2312	16.625	6.44
Merlot / classical maceration	0.1756	6.875	6.04
Merlot / roto-tanks maceration	0.1704	7.875	5.88
Cabernet Sauvignon/ thermo-maceration	0.2420	20.125	5.92
Cabernet Sauvignon / microwaves	0.2880	31.500	6.04
Cabernet Sauvignon / classical maceration	0.3066	23.875	6.48
Cabernet Sauvignon/roto-tanks maceration	0.3132	25.375	6.56
Băbească neagră / thermo-maceration	0.1936	6.125	5.60
Băbească neagră / microwaves	0.1092	3.500	5.60
Băbească neagră / classical maceration	0.1212	1.250	6.60
Băbească neagră / roto-tanks maceration	0.1204	1.750	6.04
Arcaş / classical maceration	0.1776	17.500	6.40

Through HPLC, a series of phenolic acids, respectively hydroxybenzoic and hydroxycinnamic acids were identified. Among the hydroxybenzoic acids, the vanillic and p-hydroxybenzoic acids are majorly represented, in relatively similar quantities (figure 1).

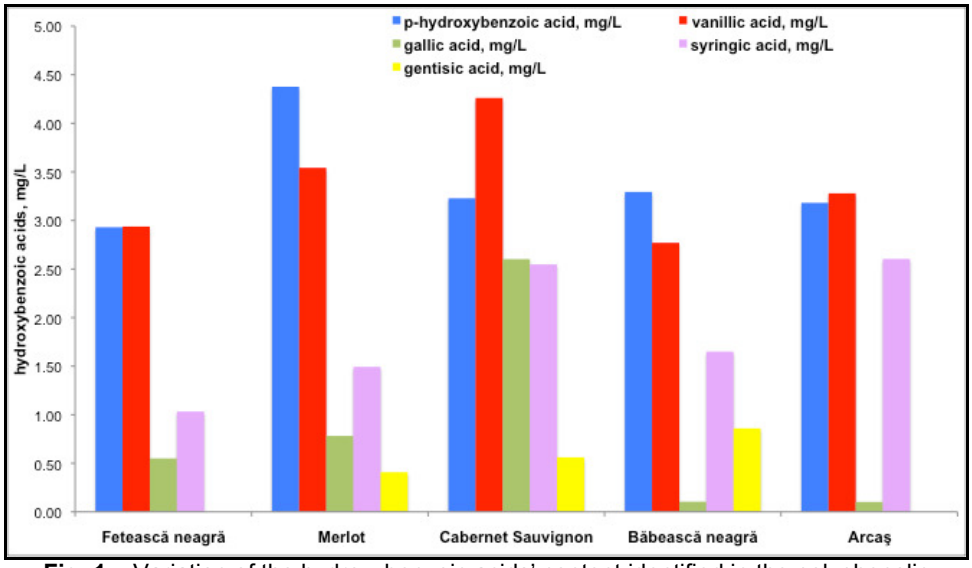

Fig. 1 – Variation of the hydroxybenzoic acids' content identified in the polyphenolic extracts obtained from the lees of wine

Gallic acid, the most frequent hydroxybenzoic acid, was identified in highest quantity in the lees of wine of Cabernet Sauvignon wine (2.602 mg/L).

Syringic acid has higher values that gallic acid. This can be justified by the creation process of syringic acid, moreover by the anthocyanidins (malvidin, oenidine) degradation during alcoholic fermentation.

Compared to the extracts obtained from seeds and skins, the extracts obtained from the lees of wine, n-hydroxybenzoic acid was not identified, having probably degraded during the maceration process.

At the same time, salicylic acid could not be well identified because of tannin interference. Gentisic acid is formed during the fermentation process and was identified only in the extracts obtained from the lees of wine of Merlot, Cabernet Sauvignon and Băbească neagră wines.

HPLC analysis identified some hydroxycinnamic acids in the alcoholic polyphenolic extracts, respectively caffeic, p-coumaric, ferullic, sinapic and clorogenic acids (table 2).

The registered data in table 2 show subunit values for all the identified hydroxycinnamic acids, regardless of the maceration variant.

Table 2

Hydroxycinnamic acids identified in the polyphenolic extracts obtained from the lees of wine

Grape variety / maceration variant	caffeic acid, mg/L	p-coumaric acid, mg/L	ferullic acid, mg/L	sinapic acid, mg/L	clorogenic acid, mg/L
Fetească neagră /thermo-maceration	-	0.272	0.078	0.015	0.037
Fetească neagră / microwaves	0.171	0.403	0.017	0.012	0.052
Fetească neagră / classical maceration	0.222	0.433	0.061	0.015	0.064
Fetească neagră /roto-tanks maceration	0.495	0.624	0.089	0.018	0.103
Merlot / thermo-maceration	0.230	0.682	0.163	0.009	0.423
Merlot / microwaves	0.134	0.178	0.026	0.008	0.440
Merlot / classical maceration	0.252	0.434	0.030	0.046	0.334
Merlot / roto-tanks maceration	0.370	0.691	0.033	0.084	0.228
Cabernet Sauvignon/ thermo-maceration	0.080	0.414	0.013	0.112	0.283
Cabernet Sauvignon / microwaves	0.065	0.982	0.095	0.086	0.173
Cabernet Sauvignon / classical maceration	0.139	0.503	0.043	0.071	0.218
Cabernet Sauvignon/roto-tanks maceration	0.272	0.113	0.020	0.015	0.197
Băbească neagră / thermo-maceration	0.053	0.632	0.047	0.016	0.050
Băbească neagră / microwaves	0.042	0.276	0.072	-	0.030
Băbească neagră / classical maceration	0.085	0.563	0.049	0.008	0.140
Băbească neagră / roto-tanks maceration	0.117	0.495	0.050	-	0.230
Arcaş / classical maceration	0.197	0.692	0.161	0.036	0.910

Beside phenolic acids, in the analysed polyphenolic extracts trans-resveratrol was identified (figure 2). It is one of the most important active principles and determines the bioactive values of the extracts.

The trans-resveratrol content varied from 0.06 mg/L at Merlot wine obtained by thermo-maceration to 0.45 mg/L in Cabernet Sauvignon obtained through the same process.

Analysing the data in figure 2, a correlation between the maceration variants and the trans-resveratrol content can be drawn.

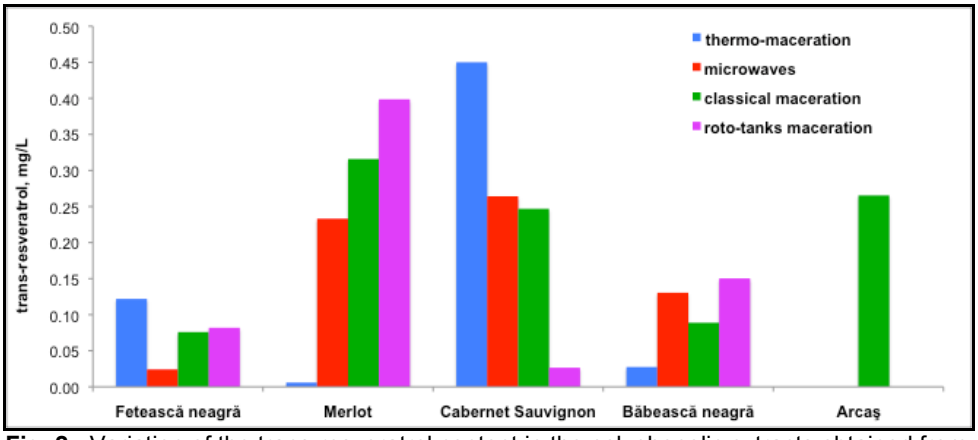

Fig. 2 - Variation of the trans-resveratrol content in the polyphenolic extracts obtained from the lees of wine according to the maceration variant

A HPLC analysis of the polyphenolic extracts obtained from the lees of wine identifies non-hydrolysable tannins: catechin and epicatechin, as well as some flavons, like rutin and quercitin (table 3). They have similar values to those of catechin and epicatechin content. In the extracts obtained from the lees of wine of Cabernet Sauvignon, the catechin and epicatechin mean values are 4.84 mg/L, respectively 3.76 mg/L.

Table 3

Non-hydrolysable tannins and flavones identified in the polyphenolic extracts obtained from the lees of wine

Grape variety / maceration variant	catechin, mg/L	epicatechin, mg/L	rutin, mg/L	quercitin, mg/L
Fetească neagră /thermo-maceration	0.915	-	0.712	1.082
Fetească neagră / microwaves	5.076	0.951	1.317	2.314
Fetească neagră / classical maceration	5.602	1.614	1.389	2.216
Fetească neagră /roto-tanks maceration	10.816	3.890	2.139	3.252
Merlot / thermo-maceration	2.255	1.548	1.733	3.315
Merlot / microwaves	2.321	1.108	2.570	5.585
Merlot / classical maceration	1.952	1.178	3.007	7.901
Merlot / roto-tanks maceration	1.582	1.248	3.444	10.218
Cabernet Sauvignon/ thermo-maceration	4.517	5.446	2.597	4.643
Cabernet Sauvignon / microwaves	4.089	4.682	2.201	13.783
Cabernet Sauvignon / classical maceration	4.840	3.763	2.267	11.223
Cabernet Sauvignon/roto-tanks maceration	5.914	1.160	2.003	15.244
Băbească neagră / thermo-maceration	2.704	2.240	1.047	1.645
Băbească neagră / microwaves	0.502	0.048	0.159	1.361
Băbească neagră / classical maceration	1.692	1.251	0.645	2.267
Băbească neagră / roto-tanks maceration	0.679	0.263	0.243	2.890
Arcaş / classical maceration	0.689	0.063	0.849	12.305

Concerning flavones, stands extracts obtained from the lees of wine of variety Merlot with an average of 2.69 mg/L rutin and 6.75 mg/L quercetin and extract of Cabernet Sauvignon with 2.27 mg/L rutin and 11.22 mg/L quercetin.

CONCLUSIONS

1. The study of the extracts obtained from lees of wine underlined the presence in high quantities of non-hydrolysable tannins (catechin, epicatechin) and flavons (rutin and quercitin). Phenolic acids and trans-resveratrol were identified in smaller quantities with subunit values, except some hydroxybenzoic acids (vanillic, p-hydroxybenzoic and syringic acids).

2. The maceration variants (classic maceration, thermo-maceration, microwave maceration and rotating tanks maceration) do not significantly influence the polyphenolic content of the lees of wine.

3. The identified active principles are proof for the possibility of lees of wine for obtaining polyphenolic extracts. Therefore, an economically efficient alternative for the role of winemaking by-products is created.

***Acknowledgments**: This study was supported from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/I.89/1.5/S62371 "Postdoctoral School in Agriculture and Veterinary Medicine area".*

REFERENCES

1. Bourzeix M, Heredia N, Kovac V, 1986 – *Les procyanidols de la grappe de raisin et du vin*. Journales Internatinal D'etude du Groupe Polifenoliques et Assemblée Generale, vol 13, p. 403 – 411.

2. Braga G. Fernando, Lencart e Silva A. Fernando, Alves Arminda, 2002 - *Recovery of Winery By-products in the Douro Demarcated Region: Production of Calcium Tartrate and Grape Pigments*. Am. J. Enol. Vitic. vol 53., p. 41-45.

3. Bustamante M.A., Moral R, Paredes C, Perez-Espinosa A, Moreno-Caselles J, Perez-Murcia MD, 2008 - *Agrochemical characterisation of the solid by-products and residues from the winery and distillery industry*. Waste Manag, vol. 28, p. 372-380.

4. Cheng V. J., Bekhit A. E. D., McConnell M., Mros S., Zhao J. H., 2011 - *Effect of extraction solvent, waste fraction and grape variety on the antimicrobial and antioxidant activities of extracts from wine residue from cool climate*. Food Chemistry vol. 134, p. 474 – 482.

5. Naziri Eleni, Mantzouridou Fani, Tsimidou Z. Maria, 2012 - *Recovery of squalene from wine lees using ultrasound assisted extraction - a feasibility study*. Journal of agricultural and food chemistry vol. 60 issue 36, p. 9195 - 9201.

6. Pérez-Serradilla J.A., Luque de Castro M.D., 2011 - *Microwave-assisted extraction of phenolic compounds from wine lees and spray-drying of the extract*. Food Chemistry vol. 124 issue 4, p. 1652 - 1659.

7. Ribéreau-Gayon P., Dubourdieu D., Donèche B., Lonvaud A., 2006 - *Phenolic Compounds, 2nd Edition*. Handbook of Enology, The Chemistry of Wine, Vol. 2. John Wiley & Sons Ltd, Chichester, West. Sussex (England), p. 141–205.

8. Singleton V.L., Rossi J.A. jr, 1965 – *Colorimetry of total phenolics with phosphomolybdic – phosphotungsticacid reagents*. Amer J. Enol. Viticult. vol. 16., p. 144-158.

9. Ţardea C, Sârbu Gh., Ţârdea Angela, 2010 - *Tratat de vinificaţie*, Editura "Ion Ionescu de la Brad", Iaşi, 766 p.

10. Yi Chun, Shi John, Kramer John, Xue Sophia, Jiang Yueming, Zhang Mingwei, Ma Ying, Pohorly Joseph, 2009 - *Fatty acid composition and phenolic antioxidants of winemaking pomace powder*. Food Chemistry vol. 114 issue 2, p. 570-576.

POTENTIAL OF PHENOLIC COMPOUNDS IN RED WINES FROM LOCAL VARIETIES

POTENȚIALUL COMPUŞILOR FENOLICI AL VINURILOR ROŞII DIN SOIURI AUTOHTONE

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Abstract. *For widening assortment of red wines,on study the possibility of using local red varieties. Significant for red wines is content in phenolic compounds - antocyans and phenolic substances. In this context to the study were subjected wines made of 11 local varieties (Fetească Neagră, Rară Neagră, Codrinschi etc.) and cosmopolitan Merlot varieties under classic technology. The wines subject to investigations determined content of phenolic substances and antocyans initially and over 6 and 11 months of storage. Research has shown that the initial content of phenolic substances depending on the variety ranges from 936 up to 3159 mg / l, and antocyans - from 90 up to 793mg / l. In all samples investigated, including the wine - Merlot witness, loss of phenolic substances predominate in the first 6 months of storage and then decreased intensity of this essential process. Unlike phenolic substances, decrease of anthocyans in investigated wines, and in wine witness - Merlot has a higher intensity during storage at 6-11 months.*
Key words: *local varieties, phenolic compounds, antocyans, phenolic substances.*

Rezumat. *Pentru lărgirea sortimentului de vinuri roşii se studiază posibilitatea utilizării soiurilor negre autohtone. Important pentru vinurile roşii este conținutul în compuşi fenolici – substanțe fenolice şi antociani. În acest context au fost supuse studiului vinurile obținute din 11 soiuri autohtone (Fetească Neagră, Rară Neagră, Codrinschi ş.a.) şi soiul cosmopolit Merlot conform tehnologiei clasice. În vinurile supuse investigărilor a fost determinat conținutul în substanțe fenolice şi antociani inițial şi pe parcursul a 6 şi 11 luni de păstrare. Cercetările au demonstrat că conținutul inițial în substanțe fenolice în funcție de soi variază de la 936 pînă la 3159 mg/L, iar în antociani – de la 90 pînă la 793mg/L. În toate mostrele investigate, inclusiv şi în vinul – martor Merlot, pierderile de substanțe fenolice predomină în primele 6 luni de păstrare, iar ulterior intensitatea acestui proces scade esențial. Spre deosebire de substanțele fenolice, diminuarea antocianilor în vinurile investigate , cît şi în vinul – martor Merlot, este mai intensă în perioada de păstrare de la 6 la 11 luni.*
Cuvinte cheie: *soiuri autohtone, compuşi fenolici, antociani, substanțe fenolice.*

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INTRODUCTION

Currently research is to broaden the assortment of red wines using indigenous varieties (Rusu E. et al., 2011). At the moment in Moldova assortment of varieties with black bean for wine is dominated by classic French varieties - Cabernet Sauvignon, Merlot, Pinot noir. However, our country has some local varieties, which in vision of researchers should present a strong interest for wine consumers (Apruda and Bereznicov, 2002). Their widespread use in wine-making would contribute to expanding the assortment of red wines and create identity of Moldovan red wines. From local black varieties can be useful for this purpose next varieties: Fetească neagră, Rară neagră and Codrinschi (Țuțuc et al., 1998).

Important for red wines is the color, which participates in the formation of grape phenolic compounds extracted by maceration-fermentation process. Quality of red wines, along with habitat and technological factors, depends largely on the used variety. Also highlights the black varieties each with a different content of phenolic compounds and are divided into varieties with potential biological and phenolic advanced coloring, with an average and poorly colored varieties (Rusu, 2006).

The present study aims to investigate the potential of phenolic compounds of red wines made from local varieties Fetească neagră, Rară neagră, Codrinschi, Negru de Căuşeni, Kopceak, Negru de Akkerman, Seină, Brează, Bătută neagră, Ciorcuță neagră, Busuioacă de Bohotin and variety Merlot – control.

MATERIAL AND METHOD

Were subjected to experimental researches dry red wines made from local grape varieties harvested in the central region of the country, and the wines from variety Codrinschi from South (Pleseni) wine season of 2011. Samples were prepared in the section micro vinification of Practical Scientific Institute for Horticulture and Food Technology. Merlot wine served as a witness (control). The experimental wine samples were obtained according to the classical technology pulp maceration-fermentation at a temperature of 25-28 ° C for 5-8 days.

Phenolic substances were determined according to OIV method - with the Folin-Ciocalteu and anthocyanins with method of color stabilization of wine with acidified alcohol and colorimetric determination of optical characteristics (Gherjicova, 2002).

RESULTS AND DISCUSSION

Research results showed that dry red wines made from local varieties are distinguished from each other by different contents of phenolic substances and anthocyanins. Figure 1 shows graphically the initially content of these compounds in dry red wines undergo investigations.

It should be noted that wine from Codrinschi variety harvested in the South is characterized by the highest potential of phenolic substances - 3159 mg / L, followed by varieties Kopceak (2340 mg / L), Codrinschi of the Center and Negru de Căuşeni (2048mg / L). The highest content of anthocyanins in mentioned wine varieties are recorded in the variety Negru de Căuşeni - 793 mg /

L. In wines from variety Codrinschi, South and Kopceak, this index is 634 mg / L, and the wine from Codrinschi variety Center - 507 mg / L.

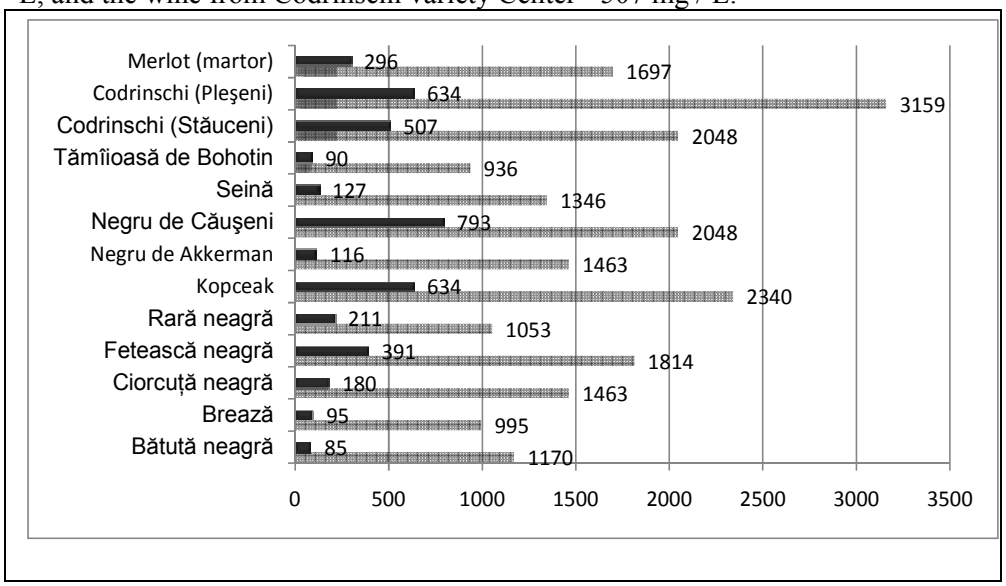

Fig. 1 - Phenolic substances and anthocyanin content of dry red wines from local varieties, harvest 2011

■ - anthocyanins, mg/L ■ - phenolic substances, mg/L

Wine Fetească neagră has an average potential of phenolic compounds from 1814 mg / L- phenol substances and 391 mg / L anthocyanins, being placed closer to the control wine Merlot - 1697 and 296 mg / L - accordingly. Regarding wine from variety Rară neagră can be seen that it has a lower content of phenolic substances (1053 mg / L) and anthocyanins (211 mg / L) and is presented as a lighter red wine. And wine variety Busuioacă de Bohotin has poorest potential of phenolic compounds 936 mg / L- phenolic substances and 90 mg / L - anthocyanins. The lowest recorded potential of phenolic compounds in wines Bătută neagră, Brează, Seină and Negru de Akkerman.

Dynamics of phenolic compounds was studied during 6 to 11 months of storage of the investigated wines. Figure 2 reflected the dynamics of phenolic substances. Research has shown that after 6 months of storage the reduction of the phenolic substances ranging from 32.5 up to 48.7% compared with the initial. This index decreased by over 45% in wines Negru de Akkerman, Seină and Bătută neagră and in the control wine Merlot reduction of phenolic substances is average and is 39.5%. Phenolic substances diminishes less during 6 months of storage in wines Codrinschi (Stăuceni), Kopceac -32.5% and Negru de Căuşeni - 34.4%. In wines Fetească neagră and Rară neagră this index is about 40%, ranking the control wine.

The obtained results show that the 6-month to 11-month period, the reduction intensity of the content of phenolic substances is slower and does not exceed 9.6% of their initial amount. In Merlot variety this index is 7%.

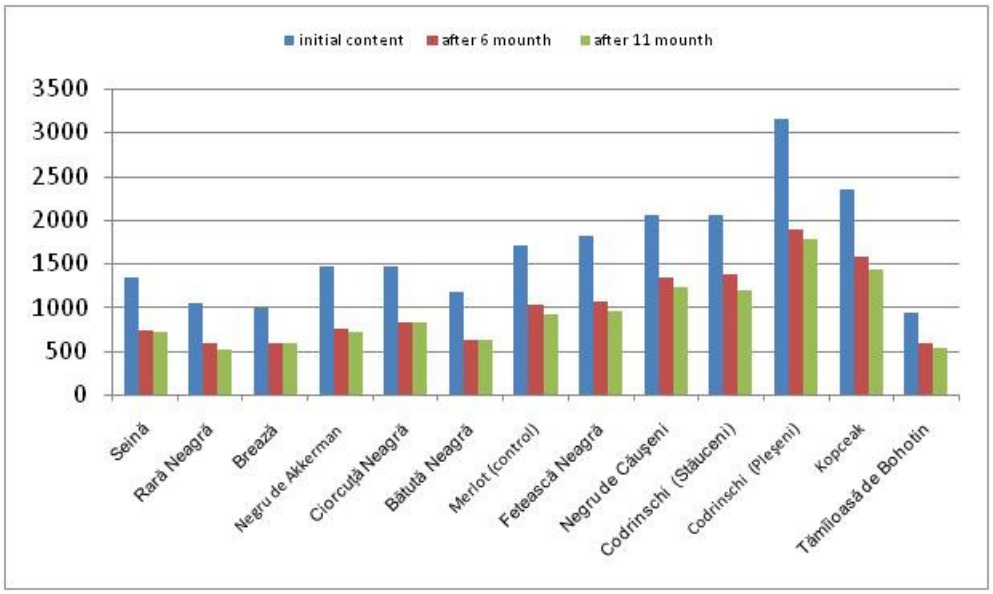

Fig. 2.- Dynamics of phenolic substances (mg / L) in red wines from local varieties over a 11 month period, the harvest of 2011.

In Figure 3 graphically are presented research results on the dynamics of anthocyanin content during a 11 month period.

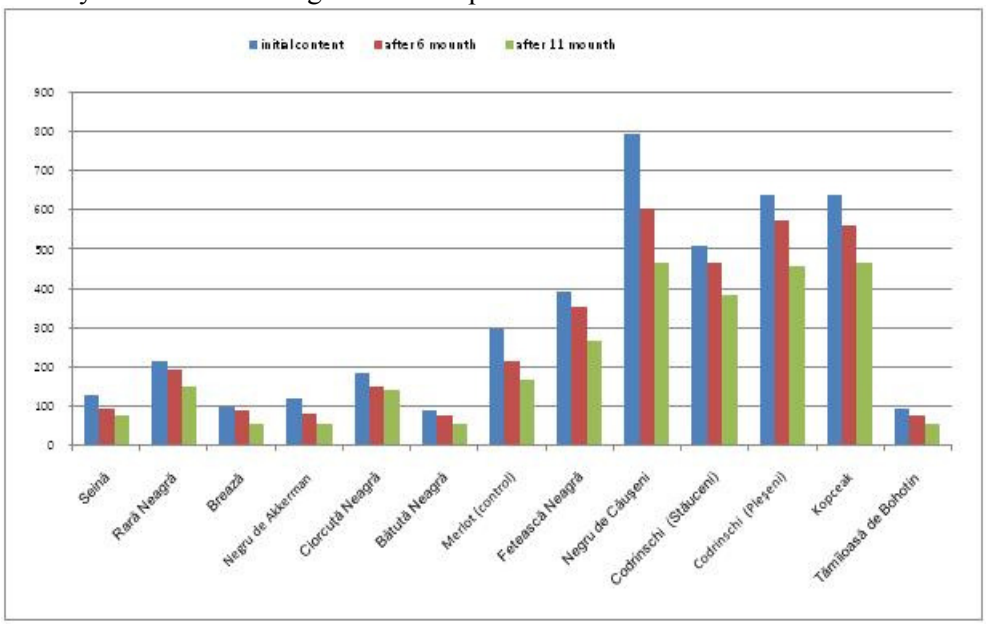

Fig. 3 - Dynamics of the colorants (mg / L) in red wines from local varieties over a 11 month period, the harvest of 2011

Data demonstrate that anthocyanin content decreases during the 6-11 month period, but the intensity decrease is different depending on the variety. After 6 months of storage the decrease of anthocyanins is distinguished by lower intensity and tends to reduce the maximum of the colorants in wines subject of research. The wines Codrinschi (Pleșeni) Kopceak, Fetească neagră, Rară neagră and Brează anthocyanins decreases by only 10.0 to 12.0% compared to the initial content. An important decrease of anthocyanins is recorded in wines Negru de Akkerman (31.9%), Seină (29.1%) and Negru de Căușeni (24.1%).

The results obtained show that the retention period of 6-11 months in investigated wines anthocyanin content continues to decrease with a higher intensity than in the case of phenolic substances - from 6.1% to 33.7%. Thus in wine from variety Brează anthocyanins decreased rate of 33.7% in the second period to keep the wine Bătută neagră - 24.7%, Fetească neagră - 21.8% and Busuioaca de Bohotin-23, 3%.

In variety Merlot in this period, the percentage decrease in anthocyanins was 15.9%. Research has shown that more instances are anthocyanins in wines wich had the lowest initial containing in these compounds - Brează, Bătută neagră, Seină. Those wines are distinguished by a low content of phenolic substances.

Wines Fetească neagră, Codrinschi, Rară neagră and Kopceak characterized by greater stability of colorants, their total reducing being about 30.0% within 11 months of storage, while Merlot index is high and is 44.6%.

Based on research results it can be seen that the loss of phenolic substances and anthocyanins after 11 months of storage is an inevitable process that occurs both in red wines from local varieties, and in the control wine Merlot. The data correlate with the literature on loss of phenolic compounds in young red wines made from European varieties (Pomohaci et al., 2001; Valuico, 2011).

CONCLUSIONS

1. The investigated wine obtained from local varieties the phenolic compounds varies widely: phenolic substances - from 936 up to 3159 mg / L, and anthocyanins - from 90 up to 793 mg / L.

2. With a high content of phenolic substances and coloring are distinguished red wines from local varieties Codrinschi Pleşeni, Kopceak and Fetească neagră.

3. Variety Rară neagră is characterized by an average containing of phenolic compounds which can be obtained lighter red wines.

4. Bătută neagră, Brează, Ciorcuță neagră, Seină and Negru de Akkerman have a low potential of phenolic compounds and can not be recommended for red wines.

5. Decrease over time of the content in phenolic compounds is an inevitable process that takes place both in wines from local varieties, and in the control wine Merlot.

REFERENCES

1. **Rusu E., Covalciuc Olga, Obadă Leonora, Scorbanov Elena, Tampei Olga, 2011, -** *Vinul în mileniul III –probleme actuale în vinificație.* Lucrările Conferinței științifico-practice cu participare internațională, 24-26 noiembrie, Chișinău. p. 53-58
2. **Apruda P.I., Bereznicov M.D., 2002** - *Vinogradnaia loza, raionirovannîe sorta moldavscoi selecții.* Chishiniov.
3. **Țuțuc V., Cuharschii M., Olari F., 1998 –** *Sortiment vinograda Respublichi Moldova*. Chishinău. 84 s.
4. **Rusu E., 2006** - *Oenologia moldavă: realitatea şi perspectivele*. Ed. Academiei de Ştiințe a Moldovei, Chişinău, 267 p.
5. **Gherjicova V.G., 2002 –** *Metodî tehnohimicescogo controlia v vinodelii*. Simferopoli "Tavrida". 259 s.
6. **Pomohaci N., Cotea V.V., Stoian V., Năməloşanu I., Popa A., Sîrghi C., Antoce Arina, 2001** – *Oenologie, vol. II, Îngrijirea, stabilizarea şi îmbutelierea vinurilor. Construcții şi echipamente vinicol.* Editura Ceres, Bucureşti. 399 p.
7. **Valuico G. G., 2011** – *Tehnologhia vinogradnîh vin.* Simferopoli „Tavrida". 623 s.

PECULIARITIES OF AROMATIC COMPOSITION OF WINES MADE FROM WHITE VARIETIES OF MOLDOVIAN SELECTION LEGENDA AND RITON

PARTICULARITĂȚILE COMPOZIȚIEI AROMATICE ALE VINURILOR OBȚINUTE DIN SOIURILE ALBE DE SELECȚIE MOLDOVENEASCĂ LEGENDA ŞI RITON

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Abstract. *An important role in the formation of white wines quality it has aroma compounds. In this context, white wines produced from Moldavian selection varieties Legenda and Riton have been submitted to research on aromatic composition. The determination of aromatic compounds was performed on the gas chromatograph coupled with mass spectrometer Clarus 600T. Research has proved that Legenda and Riton wine are distinguished by the structure of aromatic compounds. Thus, the proportion of higher alcohols in wine from the Legenda variety is about two times higher compared to wine produced from Riton variety. Also in the Legenda wine terpenic compounds share is lower than the Riton variety. Characteristic to aromatic complex of Riton wine is the large share of lactones in comparison with Legenda wine (over 1.000% and respectively 0.219%) and of furans (0,366% and 0.138%). The share of odorant oxides in the Riton wine is 0.107% and pyrans 0.034%, while in the Legenda wine respective compounds were not identified.*
Key words: *wine, aromatic complex, higher alcohols, terpenic compounds, lactones, furans, odorant oxides, pyrans.*

Rezumat. *Un rol important la formarea calității vinurilor albe îl au compuşii de aroma. În acest context au fost supuse cercetărilor referitor la compoziția aromatică vinurile albe obținute din soiurile de selecție moldovenească Legenda şi Riton. Determinarea compuşilor aromatici s-a realizat la cromatograful de gaze cuplat cu spectrometru de masă Clarus 600T. Cercetările au demonstrat că vinurile Legenda şi Riton se disting prin structura compuşilor de aromă. Astfel, ponderea procentuală a alcoolilor superiori în vinul obținut din soiul Legenda este de circa două ori mai mare în raport cu vinul produs din soiul Riton. Totodată în vinul Legenda ponderea compuşilor terpenici este mai mică față de soiul Riton. Caracteristic pentru complexul aromatic al vinului Riton este ponderea mare a lactonelor în raport cu vinul Legenda (peste 1,000% şi respectiv 0,219%) şi a furanilor (0,366 şi 0,138%). Ponderea oxizilor odoranți în vinul Riton constituie 0,107% şi a piranilor 0,034%, atunci cînd în vinul Legenda compuşii respectivi nu au fost identificați*
Cuvinte cheie: *vin, complex aromatic, alcooli superiori, compuşi terpenici, lactone, furani, oxizi odoranți, pirani.*

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INTRODUCTION

Besides the non-volatile compounds that mainly influence the taste of white dry wines, an important role in formation of their quality is owed to aromatic complex. Recent studies concerning consumer preferences for quality of wines proved that the aroma is considered an important attribute which is taken into consideration when purchasing (Lamberchts and Pretorius, 2000). Therefore, the wines with intense aroma, such as: Muscat, Traminer, Busuioacă etc have lately become very popular among consumers.

As noted Bartowsky et al. (2004) the wine aroma represents a harmonious blend of several chemicals of different nature and origin. Among the wine compounds, the aromatic substances have been more studied. It worths mentioning the fundamental works of Cordonnier R. and Bayonovo C. (1981), Dubois (1994), Rapp (1994), Delcroix et al. (1994), Bayonove et al. (1984).

In Romania, the researches related to the development of certain aroma constituents during grapes ripening and wine elaboration were committed by Heroiu et al. (1994).

Extensive reviews concerning aromatic compounds of the wines obtained from noble varieties are presented in the works: "*Tratat de oenologie*", vol. I by Cotea, 1985; "*Chimia şi analiza vinului*" by Ţârdea, 2007; "*Tratat de oenochimie*" by. Cotea et al., vol. I, II, 2009; french monograph "*Le vin. Composition et transformation chimiques*" by Taillandier and Bonne, 2005, as well as in the monograph "*Oenologie. Chimia şi analiza senzorială*" by Antoce Oana Arina et al., 2007.

In the Republic of Moldova, the Sherry-type wines were submitted to fundamental researches related to aroma composition, the works being performed in the 80's of last century at the Institute of Technologies and Engineering SPA "Ialoveni".

Through gas chromatographic method there were identified 34 volatile compounds – aroma constituents of Sherry-type wines. The obtained results were used to determine regression equations concerning the correlation of volatile compounds with the quality of Sherry-type wines.

Once the improvement of the analytical equipment and especially with the advent of mass spectrometers was essentially increased the number of odorous compounds detected in wine aroma.

According to Cotea et al. (2009), odorous compounds mean those components of the grapes, must and wine that excite the sense of smell, as volatile substances or after their formation from bound forms.

So far there have been discovered over 500 odorant substances which individually or in association within a large and complex variety of blends, can give 10.000 odor variations to wine relatively to a maximum of five taste sensations (sweet, bitter, salty, sour, alkaline) formed by other components of the wine.

It should be mentioned that the wines submitted for research on aroma composition were obtained from mainly European varieties and especially those that are distinguished by accentuated aromas.

To this end, it presents interest the research of aromatic substances in white wines produced from local varieties of new selection Riton and Legenda.

MATERIAL AND METHOD

As objects of research were used wine samples obtained from white varieties Legenda and Riton of harvest year 2010. The grapes of concerned varieties were processed under microvinification conditions with pomace maceration for 8 hours for Legenda and 10 hours for Riton.

The extraction of wine aromatic compounds was achieved by passing it through a DIAPAK type cartridge with the adsorption layer composed of hydrophobic polystyrene of high quality, which was subsequently activated with methyl chloride. The elution of aromatic substance was carried out with a mixture of ethyl acetate and methyl chloride in a ratio of 1:1 (by volume).

The analysis of the concentrated eluent in the air stream up to 0.5 mL was carried out on the gas chromatograph with a PE – WAX RETR column (having a length of 50 meters and an internal diameter of 0.32 mm) and coupled with the mass spectrometer Clarus 600T. The analysis conditions were the following: the carrier gas – helium, evaporator temperature 220 °C, column temperature 75 °C (0 min) – heating with 4 °C/min up to a final temperature of 225 °C. The total duration of the analysis was 60 min. The identification of the separated chromatographic peaks was performed according to the general library of NIST mass spectrometer and to the published data about the fragmentation of individual compounds.

The percentage share of detected compounds was achieved by calculating the peak area of that substance against the sum of all the compounds of the eluent. A compound peak area is directly proportional to its concentration in the aromatic extract.

RESULTS AND DISCUSSIONS

The researches have proved that the aromatic composition of the investigated wines is quite complex due to detection of a large number of chemical compounds classes: alcohols, organic acids, esters, terpenic compounds, aldehydes, ketones, lactones, furans, odorant oxides, volatile phenols, pyrans, etc. It was also found that the percentage share of aromatic compounds classes is different according to grape variety.

Figure 1 presents the percentage share of volatile compounds classes obtained as a result of summing the share of each compound from the respective category, detected in the aromatic extract of Legenda wine.

Typically for Legenda wine aroma is the large share of higher alcohols that is over 63%, as well as organic acids – 14.62%. Relatively to other categories of volatile compounds, researches have proved a low rate in the varietal aroma structure of some of them. Thereby, in comparison with the Riton variety, the share of esters is only 6.7%, terpenic compounds 0.147%, lactones 0.218%, aldehydes 0.021% and furans 0.138%.

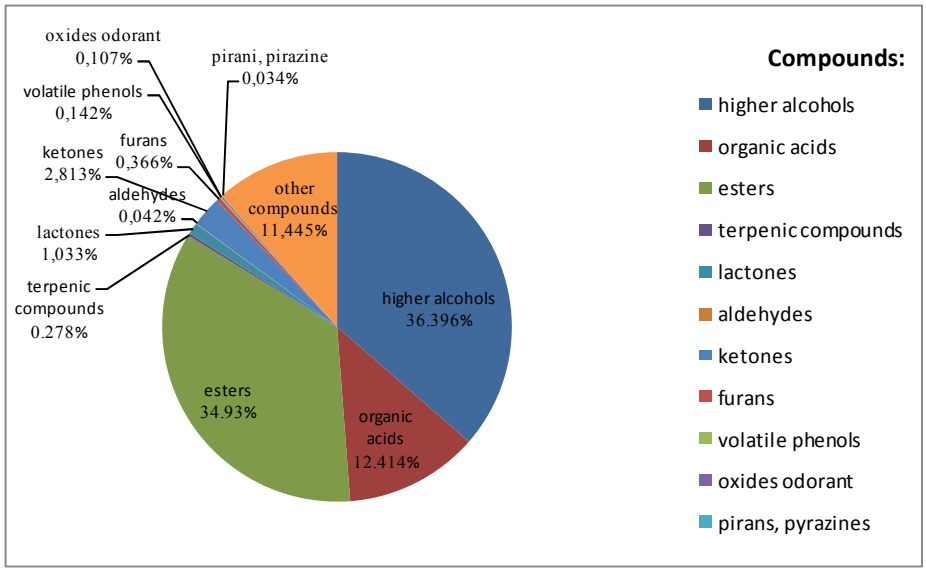

Fig. 1 - Percentage share of compound classes determined in the aromatic extract of Legenda wine.

In the structure of aromatic compounds of Legenda wine have not been identified odorant oxides, pyrans and pyrazines, and the share of sulfur compunds and volatile phenols is the lowest in comparison with Riton wine – 0.010% and respectively – 0.038%.

Between the investigated wines, the Riton sample is characterized by a very specific aroma composition structure (fig. 2.). This is reflected through the fact that in the aromatic structure is highlighted the lowest share of higher alcohols and organic acids of 36.396% and respectively 12.414%, and also the higher share of esters of approximately 35%.

It should be mentioned that higher alcohols and esters in the aroma structure of Riton wine is 1:1, while in the Legenda wine is about 9:1.

In the composition of the aromatic extract of this wine it has been detected a large amount of terpenic compounds and their summary share is 0.271%, that is almost two times more in comparison with Legenda wine.

To be noted that in the aromatic structure of the Riton wine lactones are about 1.0% and this is the highest value among the investigated wines.

Also, worth noting that in the structure of this wine, as opposed to the other samples, it was detected the presence of a large amount of furans with a summary share of 0,366 %, of odorant oxides – 0.107% and also pyrans and pyrazines – 0.039 %.

At the same time, in the composition of the aromatic extract of the wine were not identified sulfur compounds and the volatile phenols share is 0.142%.

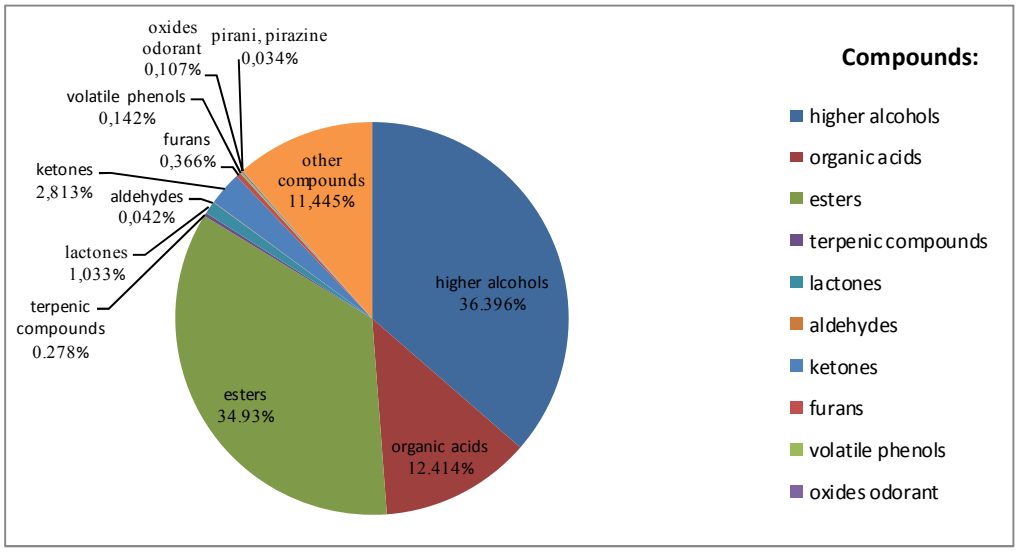

Fig. 2 - Percentage share of compound classes determined in the aromatic extract of Riton wine.

CONCLUSIONS

As a result of research it was found that white dry wines obtained from Moldavian selection varieties, Legenda and Riton, are distinguished by the aromatic compounds structure. The aroma of Legenda wine is dominated by higher alcohols, whose share represents more than 63%, by volatile acids - about 15% and ketones - 2.75%. The share of esters is much lower in comparison with Riton wine, likewise lactones, aldehydes, furans and volatile phenols.

In the structure of Riton wine aroma in equal measure prevail higher alcohols (over 36%) and esters (about 35%). Besides these categories in the concerned wine aroma is highlighted the presence of lactones, terpenic compounds, furans, odorant oxides, pyrans and pyrazines.

REFERENCES

1. **Bartowsky E.J., Henschke P.A., Hoj P.B., Pretorius I.S., 2004** – *Chasing wine aroma – Does Oenococcus oeni have the potential to release aroma compounds from authentic grape precursors?,* Wine Industry Journal, vol. 19, Nr. 2, march-april, p 24.
2. **Bayonove C, Gunata Z., Cordonnier R., 1984** – *Mise en évidence de l'intervention des enzymes dans le développement de l'arôme du jus de Muscat avant fermentation: la production de terpénols.* Bull. OIV, 57
3. **Cordonnier R., Bayonove C., 1981** – *Etude de la phase prefermentaire dela vinication: extraction et formation des certains composés del'arome: cas des terpenols, des aldéhydes et des alcohols en C6*. Conn. Vigne et Vin, no. 13, p. 15.
4. **Cotea V.D., Zănoagă C.V., Cotea V.V., 2009** – *Tratat de oenochimie*, Editura Academiei Române, vol.I, Bucureşti,
5. **Cotea V.D., Zănoagă C.V., Cotea V.V., 2009** – *Tratat de oenochimie*, Editura Academiei Române, vol.II, Bucureşti.

6. Delcroix A., Gunata Z., Sapis J.C., Salmon J.M., Bayonove C., 1994 – *Glycosidase activities of three enological yeast strains during winemaking: Effect on the terpenol content of muscat wine.* American Journal of Enology and Viticulture, no. 45.
7. Dubois P., 1994 – *Les arômes des vins et leurs défauts.* Revue Française d'Oenologie, nr. 145
8. Heroiu E., Giosanu T., Popescu T., Vartolaş E., 1994 – *Conținutul în compuşi de aromă ai strugurilor la unele soiuri pentru vinuri albe cultivate în podgoria Ştefăneşti Argeş,* An. I.C.V.V., XIV
9. Lamberchts M.G., Pretorius I.S., 2000 – *Yeast and its importance to wine aroma. A review.* South African Journal of Enology and Viticulture, Nr. 21, p. 97-129.
10. Rapp A., 1994 – *Unerwünschte aromaten im Wein*, Der Deutsche Weinbau, no. .2.

STUDY OF VOLATILE COMPOUNDS IDENTIFIED BY HEAD-SPACE METHOD IN BĂBEASCĂ NEAGRĂ ROSE WINES OBTAINED BY DIFFERENT PREFERMENTATIVE MACERATION PERIODS

STUDII PRIVIND COMPUȘII VOLATILI IDENTIFICAȚI PRIN METODA HEAD-SPACE ÎN VINURILE ROZE DIN SOIUL BĂBEASCĂ NEAGRĂ OBȚINUTE PRIN DIFERITE PERIOADE DE MACERAȚIE PREFERMENTATIVĂ

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Abstract. *This study reveals the content in volatile compounds of rosé wines obtained by different prefermentative maceration periods of Băbească neagră (Vitis Vinifera L.) native grape varieties in Romania, using GC-MS SHIMADZU 2010 through Head-Space method. Prefermentative maceration process was conducted in eight styles of Băbească neagră grape variety; first one without maceration representing the control sample and the others was subjected to the maceration process for the following seven periods of time: 3 and a half hours, 7 hours, 10 and a half hours, 14 hours, 17 and a half hours, 21 hours and 24 and a half hours. Prefermentative maceration process exerts a significant influence on the amount of volatile compounds. We observed a decrease of volatile compounds content along with using longer prefermentative maceration periods. This study represents a beginning in the influence assessment of the prefermentative maceration process to the volatile compounds content in Băbească neagră rosé wine.*
Key words*: volatile compounds, prefermentative maceration, Băbească neagră, rose wine.*

Rezumat: *Studiul de față relevă conținutul în compuși volatili a vinurilor rose obținute prin diferite perioade de macerație prefermentativă din soiul tradițional românesc, Băbească neagră (Vitis Vinifera L.), utilizând GC-MS SHIMADZU 2010 prin metoda Head-Space. La soiul Băbească neagră s-au realizat opt variante de macerare prefermentativă, prima varianta reprezentând martorul, căreia nu i s-a aplicat procedeul de macerație prefermentativă, iar celelalte șapte variante au fost supuse acestui proces pentru următoarele perioade de timp: 3 ore și jumătate, 7 ore, 10 ore și jumătate, 14 ore, 17 ore și jumătate, 21 ore și 24 ore și jumătate. Procesul de maceratie prefermentativă exercită o influență semnificativă asupra cantității de compuși volatili. Se observă o diminuare a cantității de compuși volatili odată cu folosirea unor perioade mai mari de macerație prefermentativă. Acest studiu reprezintă un început în ceea ce privește evaluarea influenței procesului de macerație prefermentativă asupra conținutului în compuși volatili din vinurile roze de Băbească neagră.*

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***Cuvinte cheie**: compuşi volatili, maceraţie prefermentativă, Băbească neagră, vin roze.*

INTRODUCTION

Băbească neagră is a Romanian local red variety of *Vitis silvestris*, which acquires its superior quality in the Moldavian vineyards where wines with a protected geographic origin are produced. This grape variety is very important for production of high-quality rosé and red wines.

The volatile profile of wines is determined by the combined effects of hundreds of chemical compounds (Cabaroglu, 1997; Cotea, 1985; Cotea, 1988). The formation of the aroma bouquet depends on many factors that are dependent on the cultural conditions of the vineyard but also on the production technologies, fermentation conditions and aging of the wine (Marais, 1988; Günata, 1993).

This study is focused especially on the firts part of the wine-making process – prefermentative maceration. The conditions of prefermentative maceration process to the grape varieties influence the content of volatile compounds, because the total concentration and composition of volatile compounds exerts significant influences to the senzorial profile of the wines.

MATERIAL AND METHOD

The experiments were done during September 2012 – November 2012, at the Oenology Laboratory of the University of Agricultural Studies and Veterinary Medicine "Ion Ionescu de la Brad" Iasi.

In view of the study has been used a quantity of 1200 kg of grapes from Băbească neagră (*Vitis vinifera* L.) autochthonous grape varieties, harvested on September 29, 2012 from Iaşi vineyard, Bucium wine center. After conducting qualitative and quantitative receipt of grapes, they were desteeming not crushing, and then the whole mass of the resulting mark was divided into eight experimental variants that are identical in terms of quantity and quality, without adding oenological extraction enzymes or sulfur dioxide.

Băbească neagră 0 h (BN-0 h). In this variant, the must was pulled from the mass of the mark through the gravitational drainage without pressing pulp, immediately after getting it. The must obtained was passed quantitatively in glass containers (demijohns 50 L) and it was added activators for fermentation Nutristart type at a measure of 30 g/hL, selected yeasts species Saccharomyces cerevisiae RX 60 from Laffort® at a measure of 25 g/hL according to the protocols prescribed by the manufacturer.

Băbească neagră - the other seven variants (BN-3½ h; BN-7 h; BN-10½ h; BN-14 h; BN-17½ h; BN-21 h and BN-24½ h). All these seven variants run a prefermentative maceration process for the following periods of time: 3 and a half hours, 7 hours, 10 and a half hours, 14 hours, 17 and a half hours, 21 hours and 24 and a half hours, each time interval corresponding to a variant. The must was subsequently subjected to the same technological wine-making methods that were applied to variant 1 (BN-0.0 h).

To each variant, the mark was been vigorously homogenized for five minutes every hour throughout the prefermentative maceration process. After the finished of the alcoholic fermentation wines were pulled from yeast deposit, were not sulphited

only filtered with 0.45 µm sterile membrane filters and bottled in 0.75 L wine glass bottle. The prefermentative maceration process and alcoholic fermentation took place at 10°C temperature in a room with controlled temperature. Wine bottles were stored in a cellar at a 12°C constant temperature.

After the alcoholic fermentation wines were analyzed in terms of physico-chemical characteristics: alcoholic strenght (% vol.), relative density at 20°C, pH, χ (mS/cm), total acidity (g/L $C_4H_6O_6$), reducing sugars (g/L), non reducing extract (g/L), total dry extract (g/L).

After two weeks, in November the volatile compounds were determined with a Shimadzu GC-MS QP 2010Plus using HeadSpace method. 1000 µL extract are injected into a Supelco SLB 5 ms GC column, of 15 m length, column oven temperature 30 ^oC, in splitless mode, initial temperature 30 ^oC for 5.75 minute, then it grows at a rate of 6^oC until 80 ^oC where it stays for 0,5 minutes; then it grows at a rate of 10 ^oC until 200 ^oC where it stays for 0,2 minutes; then it grows at a rate of 14 ^oC until 245 ^oC where it stays for 1 minute. The program lasts for 31 minutes.

RESULTS AND DISCUSSIONS

After GC–MS analyses were identified the following volatile compounds (Fig.1):

- 2 methyl 1 propanol (isobutanol) is produced in wine during alcoholic fermentation ($(CH3)_2CHCH_2OH$) and gives wines their specific character;

- 3-methyl-1butanol (isoamilic alcohol – $C_5H_{12}O$) is a clear liquid, colorless and appears during the alcoholic fermentation;

- 3-methyl-1-butanol acetate (isoamyl acetate – $C_7H_{14}O_2$) is an ester, very inflammable and insoluble in water. It is produced in wine during alcoholic fermentation and it gives fermentation bouquet to the young wines. It gradually disappears during the aging period of wine;

- butanoic acid is produced during the alcoholic fermentation and, sometimes, under the action of microorganisms from *Acetobacter sp.;*

- **butiric acid** ($C_6H_{12}O_2$) is un oily liquid, colorless, slightly soluble in water, ethanol, ether. The smell of this acid is similar to rancid butter. (Cotea, 2009);

- **hexanoic acid** ($CH_3(CH_2)_3CH(C_2H_5)CO_2H$), is produced during the alcoholic fermentation;

- **octanoic acid** is produced during the alcoholic fermentation, is slightly soluble in water, with a smell and taste unpleasant of rancid;

- decanoic acid is produced during the alcoholic fermentation. It has a wax-like smell;

- propanoic acid ($C_5H_{10}O_2$) is a clear liquid, colorless, with a sweetish smell. It's soluble in water and alcohol; melts at -21°C, boils at 141° C. It has a acid fruits-like taste;

- **hydroxyacetic acid** hase a signal with a high area at variant 3 (B.N. 7.0 h) witch suggests its presence in the highest amount compared to other options. Hydroxyacetic acid is colorless and odorless;

- **ethyl propionate** (C_2H_5 (C_2H_5COO)) is the ethylic ester of propionic acid. It has a pineapple-like aroma;

- **formic acid** (HCOOH or HCO_2H) called as metanoic acid, is the most simple carboxylic acid. In wine is formed by non-enzymatic oxidation of glyoxylic acid (HOOC-CHO). Bottled wines revealed a higher content of formic acid. It has a pungent odor. Participation of formic acid in volatile acidity of wine is poor, only 59% of existing formic acid in the wine is driven by distilled water vapors (Țârdea, 2007). Formic acid is a colorless liquid with a penetrating smell, very pungent at room temperature. It is miscible in water and polar organic solvents and is somewhat soluble in hydrocarbons;

- **heptane-2, 3-dione** (valeryle acetyl – $C_7H_{12}O_2$) is a clear liquid with a buttery smell, of fatty cheese;

- **izobutil acetate** is un ester of the acetic acid. It is produced following the esterfication of acetic acid and isobutanol. Like other esters it has a floral or fruit-like smell. In high concentrations isobutyl acetate has an unpleasant odor and can be harmful to health;

- **aspartic acid** is an amino acid ($HOOCCH(NH_2)CH_2COOH$). Aspartic acid plays a key role in the metabolism of other amino acids and biochemicals in the citric acid cycle. Among the biochemicals that are synthesized by aspartic acid are asparagine, arginine, lysine, methionine, threonine, isoleucine, and more. Aspartic acid also plays a vital role in energy production. Aspartic acid is similar to the taste of lemon. Figure 1 present the overlay of chromatograms of volatile compounds profile detected in Băbească neagră rosé wine.

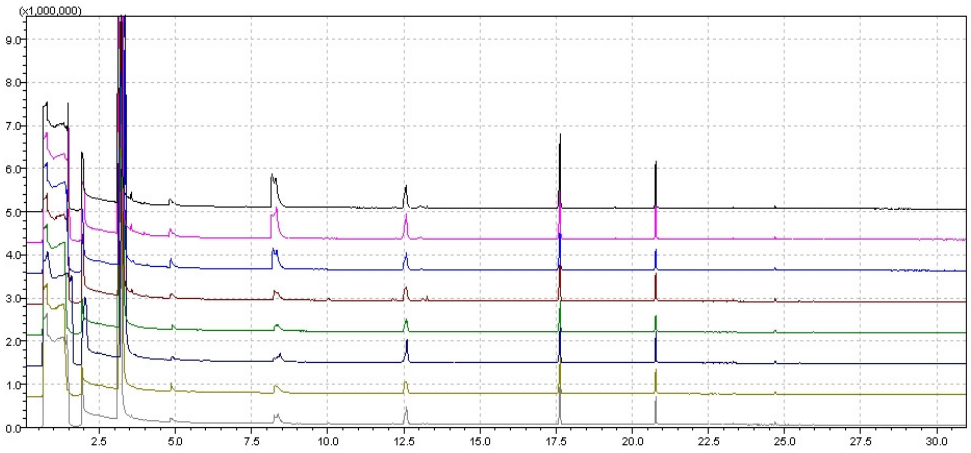

Fig. 1 - Chromatograms of volatile compounds profile detected in the studied wines.

It can be seen from table 1 a decrease in the content of volatile compounds on the extent of applying the prefermentative maceration operation. Therefore, isoamyl acetate, hexanoic acid, octanoic acid and decanoic acid are highest in the control sample, values that decrease with the prefermentative maceration application.

Table 1

Volatile compounds identified to all studied variants

Volatile compounds	BN 0.0 h		BN 3.5 h		BN 7.0 h		BN 10.5 h	
	Ret. time	Peak area	Ret. time	Peak area	Ret. time	Peak area	Ret. time	Peak area
2 methyl 1 propanol	1.95	11069	1.99	11720	1.92	15268	1.92	17904
3-methyl-1butanoll	3.20	51787	3.23	68756	3.28	57460	3.25	60712
3-methyl-1-butanol acetate	8.30	8001	8.32	5561	8.33	4024	8.25	1447
butanoic acid	4.81	2038	4.83	992	4.85	1231	4.88	677
hexanoic acid	12.58	4358	12.58	3572	12.58	2580	12.58	1422
octanoic acid	17.63	9191	17.63	5594	17.63	3376	17.63	3099
decanoic acid	20.77	3939	20.77	2222	20.78	1454	20.77	1440
	BN 14.0 h		BN 17.5 h		BN 21.0 h		BN 24.5 h	
	Ret. time	Peak area	Ret. time	Peak area	Ret. time	Peak area	Ret. time	Peak area
2 methyl 1 propanol	1.92	11282	2.03	22063	1.91	10171	1.94	6878
3-methyl-1butanoll	3.26	48458	3.35	74412	3.25	49706	3.21	57199
3-methyl-1-butanol acetate	8.37	1013	8.43	1002	8.26	1000	8.37	995
butanoic acid	4.89	630	4.90	443	4.85	832	4.88	343
hexanoic acid	12.55	973	12.60	921	12.57	899	12.59	867
octanoic acid	17.63	2486	17.64	2343	17.63	2180	17.63	1998
decanoic acid	20.77	1117	20.78	1090	20.78	1003	20.78	973

Ret. – retention time in minutes; Peak area – in thousands of mAU units.

CONCLUSIONS

1. This study is a step forward made in characterizing volatile profile of wines obtain from indigenous varieties of Babeasc㠠neagr㠠. Prefermentative maceration technology application and studying its effect on the volatile compounds of wines are new elements, both on the national and international plan.

2. The different technologies used to obtain this category if rose wines are able to provide assortment diversification and to ensuring constancy of quality.

3. Winemaking technology applied to obtain the 8 variants, has a influence on the major volatile compounds identified in the wines studied.

4. It is shown that Head-Space method, used in this study reveals less volatile componds than other methods used in gas chromatography.

5. Is observed a decrease in the content of volatile compounds by appling the prefermentative maceration treatment. Thus, most of the volatile compounds

found in wine present the highest values in the control sample, values that decrease with the prefermentative maceration application.

Acknowledgments: *This work was co financed from the European Social Fund through Sectoral Operational Programme Human Resource Development 2007-2013, project number POSDRU/I.89/1.5/S62371 "Postdoctoral School in Agriculture and Veterinary Medicine area".*

REFERENCES

1. Cotea V.D., Sauciuc J., 1988 - *Tratat de oenologie*, vol. 2. Ed. Ceres, Bucureşti.
2. Cotea V.D., 1985 - *Tratat de oenologie*, vol. 1. Ed. Ceres, Bucureşti.
3. Cabaroglu T., Canbas A., Baumes R., Bayonnove C., Lepoutre J.P., Günata Z., 1997 - *Aroma composition of a white wine of Vitis vinifera L. cv. Emir as affected by skin contact*. Journal of Food Science, no. 14.
4. Günata Y.Z., Dugelay I., Sapis J.C., Baumes R., Bayonove C., 1993 - *Role of enzyme in the use of the flavour potential from grape glycosides in wine making*. In: P. Schreier and P. Wintehhalter, Editors, Progress in flavour precursors studies, Allured Publishing Corporation, USA.
5. Marais J., Rapp A., 1988 - *Effects of skin-contact time and temperature on juice and wine composition and wine quality*. South African Journal of Enology and Viticulture.
6. Ţârdea C., 2007 – *Chimia şi analiza vinului,* Editura "Ion Ionescu de la Brad", Iaşi.

EFFECT OF INDUSTRIAL PROCESSING ON THE LEVEL OF PYRETHROIDS RESIDUES IN GREEN PEAS

EFECTUL PRELUCRĂRII INDUSTRIALE ASUPRA NIVELULUI UNOR REZIDUURI DE PIRETROIZI DIN MAZĂREA VERDE

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Abstract. *The main objective of this study was to quantify the effect of industrial processing, including washing, blanching, sorting, and sterilization, the level of pesticide residues in samples of green peas, which were analyzed for the content of cypermethrin (1, 2, 3 and 4), permethrin (1 and 2), cyfluthrin (1, 3 and 4), fenvalerate, esfenvalerat, lambda cyhalothrin and bifenthrin. Pesticide residues were quantified by gas-chromatographic method (GC - TSD). The results indicated that pyrethroids quantify the green peas bean were substantially reduced to canned green peas bean in brine (finished product). However, the residual cyfluthrin 1, did not change from the industrial processing of green peas bean. Pesticide concentrations detected in samples of green peas were below the MRL's.*
Keywords*: pyrethroids pesticides, industrial processing, green peas*

Rezumat. *Obiectivul principal al acestui studiu a fost de a cuantifica efectul de prelucrare industrială, incluzând, spălarea, blanșarea, sortarea și sterilizarea, privind nivelul de reziduuri de pesticide din eșantioanele de mazăre verde, ce au fost analizate pentru conținutul de cipermetrin (1, 2, 3 și 4), permetrin (1 și 2), ciflutrin (1, 3 și 4), fenvalerat, esfenvalerat, lambda cihalotrin și bifentrin. Reziduurile de pesticide au fost cuantificate cu ajutorul metodei gaz-cromatografice (GC - TSD). Rezultatele au indicat că, piretroizii evaluați cantitativ în mazărea verde boabe s-au redus substanțial până la conserva de mazăre verde boabe în saramură (produs finit). Cu toate acestea, nivelul rezidual de ciflutrin 1, nu s-a modificat în urma prelucrării industriale a mazării verzi boabe. Concentrațiile de pesticide detectate în eșantioanele de mazăre verde au fost sub LMR.*
Cuvinte cheie: *pesticide piretroide, prelucrare industrială, mazăre verde*

INTRODUCTION

In Romania, the most widely used pesticides are fungicides followed by herbicides and insecticides.

Pyrethroid pesticides comprise an important group of insecticides, used as internal insecticides because of their toxicity is relatively low and the effect on insects is high, and are also used in agriculture, since the advantageous properties

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through short residence time in soil and the environment. In recent years, research has been directed towards obtaining synthetic pyrethroids, which are cheaper and more convenient than natural, and which are widely used to protect various crops (Beltran et al. 2003).

Among the most commonly used pyrethroid insecticides are cyhalothrin, cyfluthrin, cypermethrin, fenvalerate, esfenvalerate and bifenthrin. These six pyrethroids are moderately toxic to humans. Esfenvalerate can be mixed up with a wide variety of other types of pesticides, such as carbamates and organophosphates compounds.

Based on this information and given that there are few data on pyrethroid residues in vegetables, the aim of the present study was to determine the concentration of pyrethroids in green peas which was analyzed to quantify the effects of the washing, blanching, final sorting and sterilization of the technological process flow of canned green peas beans in brine.

Effects of industrial processing of vegetables and fruits on pyrethroids were analyzed by researchers such as Lin H. et al., (2005) and Rasmussen R.R. et al. (2003). These authors concluded that there was a reduction in the level of pesticide residues, due to techniques for processing, for the most part. It has been suggested that the effects of processing on the levels of cypermethrin residues may cause hydrolysis degradation during processing, thus reducing consumer exposure.

Maximum residue limits established by the European Union (Reg. (EC) No. 396/2005) for residues of peas (without pods) (Garden pea, green pea, chickpea) were 0.7 mg/kg for cypermethrin (cypermethrin including other mixtures of constituent isomers (sum of isomers)), 0.05 mg/kg cyfluthrin (cyfluthrin including other mixtures of constituent isomers (sum of isomers)) and bifenthrin, fenvalerate and esfenvalerate to 0.02 mg/kg and 0,2 mg/kg for λ cyhalothrin. Thus, the methods multireziduu used to determine the pyrethroid samples of green peas must be sensitive enough to reach the level of quantification.

MATERIAL AND METHOD

In general, production procedures canned green peas bean include four steps, washing, blanching, sorting and final sterilization. In the current study, green peas was analyzed in five stages (green peas - unprocessed, washing, blanching, sorting and final sterilization) and taken to determine and investigate the variation in the content of pesticide residues during processing.

Each processing step (see below) was considered a point of sampling for residue analysis.

(i) Washing: Green peas was subjected to washing steps (four washes) with sorting has been done in pre-sorted and hydraulic conveyor.

(ii) Blanching: Stage of scalding (blanching) was carried out in continuous scalding machine at a temperature of 98°C for 3 minutes.

(iii) Final sort: After blanching was carried out in a rapid cooling to a temperature of 30°C for 1 minute; at the same time there was a further washing. After cooling was achieved a final sorting conveyor belts.

(iv) Sterilization has been carried out in an autoclave at a temperature of 120°C for 15-35 minutes, followed by cooling of the vessels (jar) on the outside, cooling is provided at 40 minutes, during which time the product is brought to a temperature of 40°C.

Immediately after removal of the unit of processing fruit and vegetables, samples were placed in plastic bags and stored at -20°C until analysis, and analyzed as such.

Determination of pesticide residues was carried out according to standards: EN 12393-1, 2, 3:2009 - Foods of plant origin. Multireziduu methods for determining pesticide residues GC.

For the quantitative determination of residues of POcl performed in this study was used as the gas chromatography apparatus of Varian 450 coupled to the detector TDS, where the samples were injected automatically separated and purified by a pre-processing thereof by solvent extraction organic (acetonitrile, petroleum ether).

To report levels of pesticide residues were using two parameters: mean value and standard deviation (s) from three identical samples for each sampling point, expressed in mg/kg. Data were subjected to analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Study results concerning pyrethroid pesticide residues analyzed along four processing steps are shown in table 1.

The average concentration of cypermethrin 1 of the unprocessed green peas was 0.0047 mg/kg. The washing steps were led to increased of concentration up to the 0.0050 mg/kg, content what subsequently decreased after step of blanching by up to 46% to a value of 0.0027 mg/kg. Also, the reductions of the content in this isomer were recorded and after step of sorting up to 52%, from 0.0027 mg/kg to 0.0013 mg/kg. In samples of green peas collected to canned achieve an increase in the average level of cypermethrin 1 as against the peas which was sorted, by 31%, from 0.0013 mg/kg to 0.0017 mg/kg.

The analytical data obtained for cypermethrin 2, is characterized by a decrease in all the samples analyzed on the flow as follows: at unprocessed green peas, the concentration of cypermethrin 2 decreased by 27.8% after the washing; the decrease in the concentration of cypermethrin 2 were recorded and after blanching stage, with 21%; in samples of peas sorted by 38% from peas that was blanched; and by 53% after sterilization of canned green peas beans.

It notes that the average level of concentration of cypermethrin 3 was different from that of cypermethrin isomers 1, 2 and 4 by the content oscillations under the action of heat treatments. After the blanching step the average level of concentration of cypermethrin 3 increased by 13%, from 0.0213 mg/kg (value obtained after the washing step) to 0.0240 mg/kg. After the sorting stage, the content of the isomer has slightly decreased by 4.16% from 0.0240 mg/kg to 0.0230 mg/kg and after the sterilization phase, with 3%.

Own investigations on the behavior isomer, cypermethrin 4 the technological flow, showed an increase after stages of washing and blanching. Were decreased by 11.25% of the concentration of cypermethrin 4, after the step of sorting comparative with the values recorded after the blanching step, from 0.0240 mg/kg at 0.0213 mg/kg.

Tabel 1

Residue levels during processing in mg/kg of green peas (mean ± SD) (n=3)

Pesticide	Unprocessed peas	Whasing	Blanching	Final sorting	Sterilization
Cypermethrin 1	0,0047±0,002	0,0050±0,002	0,0027±0,002	0,0013±0,001	0,0017±0,001
Cypermethrin 2	0,0110±0,001	0,0080±0,002	0,0063±0,002	0,0043±0,002	0,0020±0,001
Cypermethrin 3	0,0267±0,003	0,0213±0,001	0,0240±0,001	0,0230±0,001	0,0223±0,002
Cypermethrin 4	0,0227±0,002	0,0250±0,003	0,0240±0,004	0,0213±0,002	0,0173±0,002
Cyfluthrin 1	0,0013±0,001	0,0013±0,001	0,0017±0,001	0,0013±0,001	0,0013±0,001
Cyfluthrin 3	0,0180±0,001	0,0133±0,003	0,0090±0,002	0,0045±0,002	0,0050±0,001
Cyfluthrin 4	0,0030±0,001	0,002±0,002	0,0023±0,001	0,0033±0,002	0,0020±0,001
Fenvalerate	0,0040±0,001	0,0027±0,002	0,0010±0,001	0,0010±0,001	0,0013±0,001
Esfenvalerate	0,0020±0,001	0,0007±0,001	0,0010±0,001	0,0013±0,001	0,0013±0,001
λ cyhalothrin	0,0040±0,001	0,0030±0,001	0,0013±0,001	0,0013±0,001	0,0013±0,001
Bifenthrin	0,0190±0,002	0,0190±0,001	0,0180±0,002	0,0160±0,004	0,0137±0,004

Effect of industrial processing on the pyrethroid cyfluthrin was marked by fluctuations within each isomer studied (Table 2). The concentration by cyfluthrin 1 of 0.0013 mg/kg was recorded in samples of unprocessed green peas, and peas taken after the washing steps, value that which has increased to 31% after blanching step. Removal of vegetal remnants resulted from phase blanching, and sterilization ultimately leading at decreased concentrations of cyfluthrin 1 to the initial value by 0.0013 mg/kg.

The results obtained for cyfluthrin 3 are shown a concentration of 0.018 mg/kg for unprocessed green peas. The washing steps have reduced the level of residual cyfluthrin 3 to an average value of 0.0133 mg/kg. Blanching resulted in a decrease in the concentration of cyfluthrin 3 to 32%, from 0.0133 mg/kg at 0.0090 mg/kg. The sorting operations significantly influence the concentration of this isomer leading to reduced thereof by 50%.

The concentrations obtained for cyfluthrin 4, increased in the early stages of processing of green peas, 15%, after the step of blanching from 0.002 mg/kg (the washing step) at 0.0023 mg/kg and 43% from 0.0023 mg/kg (blanched green peas) at 0.0033 mg/kg, a level which corresponds to the samples of green peas collected by sorting step. Sterilization of canned green peas beans as compared to sorting phase, resulted in a reduction of 39% of the content in cyfluthrin 4 in the samples of green peas studied.

The analytical results of quantitative evaluation of the concentration of fenvalerate from green peas have indicated above average values before the

processing of 0.004 mg/kg, comparative with samples of the technological stages studied. The average concentration of fenvalerate has reduced after the steps of washing with 32.5%, up to a level of 0.0027 mg/kg. After the blanching step the content of fenvalerate was reduced by 63%, a percentage value which corresponds to 0.0010 mg/kg. After sterilization step, green peas taken canned green peas beans has registered a level of 0.0013 mg/kg.

The washing steps reduced the content of esfenvalerate, with 65%, from 0.0020 mg/kg to 0.0007 mg/kg. The data obtained for the level of esfenvalerate after the step of blanching showed a high level of concentration of peas compared to samples taken after the washing steps, on average by 43%; sorting process has resulted to increased by 30% to 0.0013 mg/kg, a value that was recorded to samples taken after the sterilization phase.

Analytical results of the quantitative evaluation of λ cyhalothrin concentration of green peas have indicated the highest average value for green peas before processing of 0.0040 mg/kg. The washing steps followed by blanching step reduced content of the chemical compound with 25% and 57%. After stages of blanching, sorting and sterilization green peas has registered a content by 0.0013 mg/kg.

Influence of technological process on the content of bifenthrin decreased the concentration of green peas to the finished product. Decreases were recorded after blanching stage, by 6.8% from 0.0190 mg/kg to 0.0180 mg/kg; sorting stage for the removal of vegetal remnants results after blanching at 98°C, reduced content of 11%, from 0.0180 mg/kg to 0.0160 mg/kg. The stage sterilization reduced the average concentration of bifenthrin, with 14.3% from 0.0160 mg/kg to 0.0137 mg/kg.

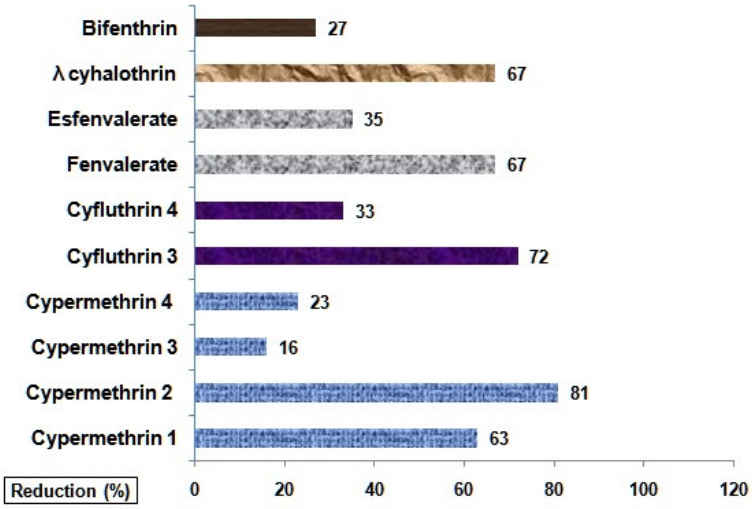

Fig. 1 - Decreased percentage (%) of pyrethroid residues of canned green peas beans in brine

The total amount of pesticides removed through processing steps for each pyrethroid compound (with the exception of isomer cyfluthrin 1, to effect processing did not change the content of green peas) is shown in Fig. 1.

In general, removal of residues was more effective (<70%) in the case of cypermethrin 2 and cyfluthrin 3.

Canned green peas and beans were reduced by up to 67% of the residue of λ cyhalothrin and fenvalerate, while bifenthrin, esfenvalerate, cyfluthrin 4, cypermethrin 4 and cypermethrin 3 showed a lower reduction of about 30% by processing green peas.

CONCLUSIONS

1. Samples of green peas taken from canned green peas beans in brine and analyzed to the average content of pyrethroids, have resulted through in values significantly decreased after processing.

2. The isomer cyfluthrin 1 did not change concentration after processing green peas.

3. The research results confirms the presence of pesticides in green peas, quantity these being well below maximum limits admissible (MRL's) (EC, 2005).

Acknowledgements. *This work was carried out with the financial support of the Sectoral Operational Programme Human Resources Development 2007 - 2013 under the project, POSDRU/CPP107/DMI1.5/S/77222, „Improvement and Development of Human Resources for Research and Innovation in Graduate School"*

REFERENCES

1. **Beltran J., Peruga A., Pitarch E., Lopez F. J., Hernandez F., 2003** - *Application of solid-phase microextraction for the determination of pyrethroid residues in vegetable samples by GC-MS*, Anal Bioanal Chem 376, p. 502–511;
2. **Rasmusssen R.R., Poulsen M.E., Hansen H.C.B., 2003** - *Distribution of multiple pesticide residues in apple segments after home processing*. Food Additives and Contaminants, p. 1044–1063;
3. **Lin H.M., Gerrard J.A., Shaw I.C., 2005** - *Stability of the insecticide cypermethrin during tomato processing and implications for the endocrine activity*. Food Additives and Contaminants 22 (1), p. 15 – 22.
4. **XXX** - Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum levels for pesticide residues in and/on food of plant and animal avaible online at. http://eurlex.europa.eu/LexUriServ/LexUriServ.do ?uri=OJ:L:2005:070:0001:0016:en:PDf.

RESEARCH ON BLACKBERRY FRUIT PROCESSING

CERCETĂRI PRIVIND PRELUCRAREA FRUCTELOR DE MUR

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Abstract. *This paper reflects the results of scientific investigations on biometric and organoleptic indices of fresh blackberry fruits and processed products. Blackberry culture is one of perspective for Republic of Moldova, which can give an output of 6.0 - 12.0 t/ha of high quality fruits, and the processed blackberry products are highly appreciated. As results of research have been established the biometric indices and organoleptic quality of fresh fruit blackberry variety Thornfree Cl., and products made from them. From the investigated agricultural raw material were prepared following samples: compote of blackberries, blackberry nectar with sugar, mashed blackberries with sugar, blackberry jam, frozen berries and dried berries. It was found that the samples of the blackberry canned products are distinguished by original taste, aroma characteristic, intense color and pleasing appearance, which were valued at tasting with high notes. Blackberry jam won the 4.47 mark, blackberry compote was rated at 4.67. Nectar of blackberries with sugar scored a 4.68. Mashed blackberries with sugar were assessed with the highest grade of 4.73. Blackberry industrialization in order to obtain frozen and lyophilized represents a future direction for use.*
Key words: *blackberry, berries, biometric and organoleptic indices, processed products.*

Rezumat. *În lucrare sunt reflectate rezultatele cercetărilor ştiinţifice efectuate referitor la indicii biometrici şi organoleptici ai fructelor proaspete de mur şi ai produselor prelucrării. Cultura murului este una de perspectivă pentru Republica Moldova, care poate da o producţie de 6,0 - 12,0 t/ha de fructe de calitate înaltă, iar produsele obţinute în urma prelucrării bacelor de mur sunt înalt apreciate. În rezultatul cercetărilor s-au stabilit indicii biometrici şi organoleptici de calitate a fructelor proaspete ale soiului de mur Thornfree Cl., precum şi a produselor preparate din acestea. Din materia primă agricolă cercetată s-au preparat următoarele mostre: compot din mure, nectar din mure cu zahăr, mure pasate cu zahăr, dulceaţă din mure, mure congelate şi mure liofilizate. S-a constat că mostrele din produse conservate din mure se deosebesc printr-un gust original, aromă caracteristică, culoare intensă şi aspect exterior plăcut, care au fost apreciate la degustare cu note înalte. Dulceaţa din mure a obţinut nota de 4,47, compotul din mure - nota 4,67, nectarul din mure cu zahăr a obţinut nota de 4,68. Murele pasate cu zahăr au fost apreciate cu cea mai înaltă notă de 4,73. Industrializarea murelor în vederea obţinerii produselor congelate şi liofilizate reprezintă o direcţie de utilizare de perspectivă.*
Cuvinte cheie: *mur, bace, indicii biometrici şi organoleptici, produse prelucrate.*

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INTRODUCTION

Blackberry bush, prized berries in the diet for its high nutritional value with herbal properties, is successfully used as melliferous and decorative culture. Currently in the world there are known over 300 varieties of blackberry in culture strains which grow vertically and are equipped with barbs or semi-creeping up to 3m long and without barbs (Kondratenco et al., 2002). Blackberry bush fruiting period is between the months of July to September, the fruits are large, dark, protected by a layer of bloom, and the fruit harvest obtained exceeds 5-10 t / ha (Hapova, 2003). The duration of fruit ripening at different blackberry varieties is almost 3 months, which is of great importance for providing fresh fruit, raw material for the canning factories and employment over a long year (Mladin et al., 1990).

The importance of the blackberry bush is conditioned by a number of advantages it possesses over other fruit crops. One of these advantages is that the blackberry bush easily and quickly multiplies. He enters bearing early and give quite big harvests. Rich harvests are obtained from blackberry in the 3 to 4 th year after planting. Due to late flowering, the blackberry flowers are not injured by the late spring frosts (Julea,1973). Blackberries are berries of perspective with high potential for the food industry of Moldova.

They contain a wide range of nutrients and pharmacological substances, including: sucrose, glucose, fructose (up to 5%), citric acid, tartaric, malic, salicylic acid and other organic acids, vitamins B, C, E, K, P, PP, provitamin A, minerals (potassium, copper and manganese), phenolic and aromatic substances, pectic substances, fibers and various macro-and micronutrients (Şahin et al., 2010; Patraş et al., 2009; Turkben et al., 2010). In traditional medicine are used fresh blackberries for prophylactic purposes. Blackberries contain a significant amount of phenolic substances, which act to strengthen the capillaries, antiatherosclerotic and antiinflammatory (anthocyanins, leucoantociane, flavonols and catechins) (Crețu et al., 1989).

MATERIAL AND METHOD

The research was conducted at the stage "Testing of new varieties and the technology of horticultural crops perspective by establishing their manufacturing divisions," which were used fresh and frozen fruits of blackberry, variety Thornfree Cl., harvest fruit 2011, obtained as a result of the shrubs research laboratory of the Scientific and Practical Institute for Horticulture and Food Technologies. Organoleptic tests were performed on frozen blackberry, which were kept for 8 months at minus 18ºC, and on products made from fresh fruit of this variety of berries.

RESULTS AND DISCUSSIONS

Blackberry bush is a culture that begins to quickly fructify and enter the bearing fully in the fourth year after planting, does not support shading and water shortages during critical periods of plant development adversely affects fruit production (Chira, 2000). Culture blackberry bush is one of perspective, being of high productivity and high quality fruit, but however is still less

cultivated on large surfaces. Moldova's climate conditions are difficult because the critical periods of development of plants frequently are set high temperatures, rainfall is insufficient or absent, and air humidity is low, which negatively influence fruit harvest if irrigation is applied. Amount of precipitation that has accumulated during the growing season of 2011 reached 351.5 mm in total and average temperature compared air reached 17.01°C.

According to the bushes and strawberry research laboratory of IP IŞPHTA, the harvest per hectare of blackberries, cultivated in Central Moldova, depending on the variety and pedo-climatic conditions for several years was 6.0 -12.0t / ha, which gives a good perspective for creating the raw material for berry crops in the country. In our country, the use of blackberry is limited for processing due to the small number of industrial plantations. Blackberry variety Thornfree Cl. (Original - IP IŞPHTA) was included in the Register of Plant Varieties in 2012, which presents a premise for spreading it. The fruits obtained from the shrubs experimental laboratory were subjected to laboratory research in fruit processing.

The results obtained allowed to establish technical characteristics, biometric indices of blackberry fruit harvested in 2011, variety of Thornfree Cl., which are presented in Table 1. In fresh blackberries, variety Thornfree Cl., are contained 8.6 to 10.2% soluble solids, 1.74% - malic acid recalculate on the titratable acids, 21-22 mg/100g of vitamin C. The Blackberry active acidity measures 2.9 (pH). From the processed blackberry fruits were prepared jam, sugary nectar, compote of blackberries and mashed blackberries with sugar, which were presented at the tasting to be judged according to their quality. Appearance of fresh blackberry fruits is shown in Figure 1 (A) and the blackberry in a frozen state in Figure 1 (B).

Table 1

Fruits biometric characteristic of blackberry variety Thornfree Cl.*

Features	Index
weight of 1000 berries, g	9091,0
weight of berry, g	9,0
Length of berry (average / min-max), mm	27,0/20-30
diameter of berry (average / min-max), mm	20,2/18-22
shape index	1,3
Description of variety	Berries are beautiful, large, straight conical shape, shiny, without dried grains, with consistent pulp. The berries have dark purple colour, uniform, 30% of the berries have claret stripes. Their taste is sweet-sour, the flavour is less pronounced. Each grape seeds correspond to the large size of berries. These berries are considered mature when fully complete each hole in the center of pearls.

*Note: area of harvesting blackberry variety Thornfree Cl. is the experimental field of Small fruits laboratory (Center of Republic of Moldova).

Figure 2 illustrates four samples of products made from berries: jam, sugary nectar, compote of blackberries and mashed blackberries with sugar. Blackberry compote is great, it has a pleasant taste and the color is slightly different compared to the raw material. Blackberry nectar has a pleasant aspect and specific intense taste. It is recommended to use these high quality berry compotes or nectar only in combination with other fruits (assortment) with neutral flavor to alleviate astringency.

Mashed blackberries with sugar have a pleasant taste and the required consistency, but requires alleviate sweet. This product requires the addition of acid or the blending of raw materials that are more acidic. Blackberries mashed with sugar may be used in confectionery or ice cream recipes, cocktails or in combination with apple puree. They may be recommended for industrial processing.

A B

Fig. 1- Appearance of blackberry variety Thornfree Cl. Fresh (A) and frozen (B).

Having a specific taste that sweet has a limited use, depending on the customer's preferences. It recommends a less severe heat treatment for it. It is also recommended to improve the manufacturing technology of blackberry jam to maintain stable colour raw material. Blackberry varieties tested can be used for freezing and sublimation.

Figure 3 presents the assessment blackberry taste samples suggested the tasting dishes: jam, sugary nectar, blackberry compote and blackberry mashed with sugar.

In the blackberry jam fruits are too hard and too sweet, and the syrup has a brown tint, which reduces the value of its external appearance, the seeds are too noticeable.

A B C D

Fig. 2 - Samples made from mulberry (Cl Thornfree variety.): A - nectar of blackberries, B - compote of blackberries, C - dried berries, D - blackberry jam.

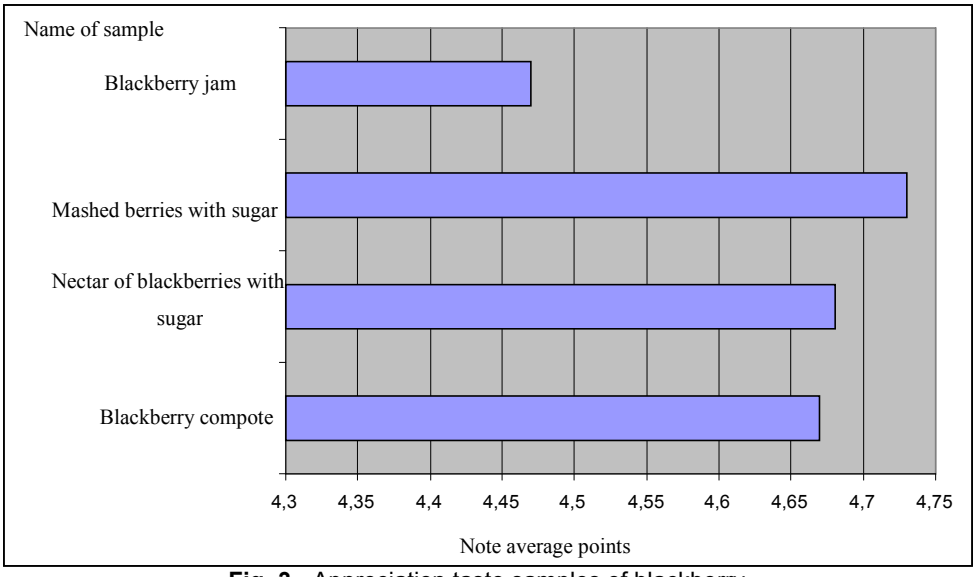

Fig. 3 - Appreciation taste samples of blackberry

According to data included in Figure 3 the products made from blackberries and presented at the tasting were assessed with high notes. Blackberry jam scored a 4.47. Blackberry compote was rated at 4.67. Nectar of blackberries with sugar scored 4.68.

Mashed blackberries with sugar were assessed with the highest grade - 4.73. Thus, for blackberry industrialization is rational for them to be used in the form of puree or mashed fruit. Industrialization of blackberries in order to obtain frozen and lyophilized products represents a future direction for use. Blackberry products, given the cost of raw material represent elite products.

CONCLUSIONS

1. The culture of blackberry bush is one of perspective for Moldova, which can give an output of 6.0 to 12.0 t / ha of high quality fruits, and the products processed from blackberry berries are highly appreciated.

2. Were established the biometric and organoleptic indices of quality of fresh blackberry fruits, variety of Thornfree Cl., as well as the processed products thereof.

3. The following samples were prepared from agricultural raw materials investigated: compote of blackberries, blackberry nectar with sugar, mashed blackberries with sugar, blackberry jam, frozen berries and dried berries. Samples of the blackberry canned products, the variety Thornfree Cl., are distinguished by original taste, characteristic aroma, intense color and pleasing appearance.

4. High efficiency, nutritional value and enhanced biological value of blackberries determine the importance and prospects of using this type of material in the food industry for making compotes, jams, jelly, fruit mashed with sugar, nectars, juices, dietary and prophylactic products. For the industrialization of blackberries is more rational for them to be used in the form of puree or mashed fruit. Their industrialization in order to obtain frozen and freeze-dried products is a direction for future use.

REFERENCES

1. **Chira Lenuța, 2000** - *Cultura arbuştilor fructiferi,* Editura M.A.S.T, Bucureşti p. 102-105.
2. **Crețu L., Domaşenco L., Socolov M., 1989** - *Mir pişcevîh rastenii.* Timpul, Chişinau
3. **Hapova S., 2003 -** *Все о ягодных культурах: лучшие сорта, новые растения. Атлас-справочник садовода.* Изд-во ООО Академия развития, Академия холдинг, Ярославль, s.12-15.
4. **Julea V., 1973** - *Cultura arbuştilor fructiferi*, Editura Cartea Moldovei, Chişinău, p.106-111.
5. **Kondratenco P., Nadtocii I., 2002 -** *Калина, малина, ожина та обліпиха. Сорти розмножения, вирощування та використания.* Київ, s.40-54.
6. **Mladin Paulina., Mladin Gh**., **1990 -** *Elemente tehnologice noi în cultura agrişului.* Horticultura. Bucureşti, p. 39-44.
7. **Patras A., Brunton N. P., Da Pieve S.,. Butler F**., **2009 -** *Impact of high pressure processing on total antioxidant activity, phenolic, ascorbic acid, anthocyanin content and colour of strawberry and blackberry purées.* Innovative Food Science & Emerging Technologies, Volume 10, Issue 3, p. 308–313.
8. **Şahin S., C. Demir, C. Türkben, V. Uylaşer. 2010** - *Phenolic Content and Antioxidant Activity of Raspberry and Blackberry Cultivars.* Journal of Food Science. Volume 75, issue 4, p. 328–335.
9. **Türkben C., Sarıburun E., Demir C., Uylaşer V.**, **2010 -** *Effect of freezing and frozen storage on phenolic compounds of raspberry and blackberry cultivars.* Food Analytical Methods, vol. 3, nr. 10, p. 144-153.
10. ***** 2012**- **Registrul soiurilor de plante pentru anul 2012 al Republicii Moldova**. Ediție oficială. Chişinău

HPLC CHARACTERIZATION OF COMMERCIAL AVAILABLE JUICES FROM ROMANIA

CARACTERIZAREA CROMATOGRAFICĂ A UNOR SUCURI DE PE PIAȚA ROMANEASCĂ

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Abstract. *Commercial available juices of beetroot (Beta vulgaris), elderberry (Sambucus nigra) and chokeberry (Aronia melanocarpa), were purified using C18 SPE cartridges in order to obtain anthocyanin-rich fraction. However obtained extracts were analyzed by high-performance liquid chromatography coupled with photodiode array detection and also electrospray ionization-mass spectrometry (LC/PDA/ESI-MS). Chokeberry and elderberry purified extract contained 7 kinds of glycosilated anthocyanins. The major ones were cyanidin-3-O-sambubioside and cyanidin-3-O-galactoside in elderberry, chokeberry respectively. Beetroot juice was found to contain another type of plant pigments, betalains which were recently studied for their antioxidant potential. Total polyphenol (TP) content was analyzed by using Folin-Ciocalteu method.*
Keywords*: Berry juices, anthocyanins, betacyanins, HPLC*

Rezumat. *Sucurile comerciale de sfeclă roșie (Beta vulgaris), soc (Sambucus nigra) și aronia (Aronia melanocarpa), au fost purificate prin tehnica SPE folosind coloanele C18 Sep Pack, în scopul de a obține fracții bogate de antociani. Prin urmare extractele obținute au fost analizate prin Cromatografia de lichide de înaltă performanță cuplată cu dioda şi de asemenea, spectrometrie de masă (LC/PDA/ESI-MS). Extractele purificate de aronia şi soc conțin 7 tipuri de antociani glicozilați. Antocianii majoritari au fost cianidin-3-O-sambubiozid și cianidin-3-O-galactozid în soc, aronia respectiv. Sucul de sfecla rosie conține un alt tip de pigmenți naturali, betalanine, studiate recent pentru potențialul lor antioxidant. Evaluarea polifenolilor totali a fost realizată prin utilizarea metodei Folin-Ciocalteu.*
Cuvinte cheie: *sucuri, fructe, antociani, batalanine, HPLC*

INTRODUCTION

A number of different fruits and vegetables beverage shows to have antioxidant potential due to their high content of polyphenols especially anthocyanins. Blueberry, elderberry and chokeberry are the most common *berries* consume in Romania, have strong antioxidant activity and related health benefits.

Anthocyanins are water soluble pigments belonging to the class of plant secondary metabolites named flavonoids. They are present in different

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plant organs, such as fruits, flowers, stems, leaves and roots (Brouillard, 1982). The main sources of anthocyanin are red fruits, mainly berries and red grapes, cereals, principally purple maize, vegetables, red wine among drinks, also anthocyanins can be found in roots, bulbs, grasses and many other sources (Giusti and Wrolstad, 2003, Markham et al., 2000). The large variety of anthocyanins sources found in nature makes them the most complex and interesting group of plant pigments. When this class of compounds is missing from the plant sometimes they are replaced with betalanins. Anthocyanins and betalains have never been reported in the same plant till now (Henriette M.C.Azeredo, 2006). Betalains are water-soluble nitrogen-containing pigments, synthesized from the amino acid tyrosine into two structural groups: betacyanins, having red-violet color and betaxanthins which is yellow-orange (Henriette M.C.Azeredo, 2006). The main sources of betalains are red and yellow beetroot (*Beta vulgaris* L. ssp. *vulgaris*), seeds or amaranth leaf (*Amaranthus* sp.) (Cai et al., 1998). In order to their isolation and purification different kinds of chromatographic methods have been developed such as paper chromatography, thin-layer chromatography, column chromatography high speed countercurrent chromatography and high-performance liquid chromatography. The most convenient method is solid-phase extraction (SPE) because is the simplest, most effective and do not imply any sophisticate equipment low cost (He and Giusti 2011). The objectives of the current study were (1) isolation of anthocyanin rich fraction from commercial juices using C18 SPE cartridges (2) HPLC characterization of obtained fraction, (3) determination of total polyphenol.

MATERIAL AND METHOD

Anthocyanin Sources. Commercially available bio chokeberry, beetroot and elderberry juices were purchased from available local market.

Chemicals All HPLC reagents, anthocyanin standards were purchased from Sigma Aldrich (Germany). Gallic acid (GAE) (purity 97.5%), 2, 2-diphenyl-1-picrylhydrazyl (DPPH) 95% purity, were obtained also from Sigma-Aldrich (Darmstadt, Germany).

Anthocyanins semipurification was done according to the protocol described by Giusti and Wrolstad, 2008.

HPLC-PDA identification and quantification of anthocyanin. Analyses were performed on a Shimadzu HPLC system equipped with a binary pump delivery system LC-20 AT (Prominence), a degasser DGU-20 A3 (Prominence), diode-array SPDM20 A UV-VIS detector (DAD) and a Luna Phenomenex C-18 column (5µm, 25 cm x 4.6 mm). The mobile phase consisted in: solvent A - formic acid (4.5%) in bidistilled water and solvent B - acetonitrile. The gradient elution system was: 10% B, 0-9 min; 12% B, 9-17 min; 25% B 17-30 min; 90% B, 30-50 min; 10% B, 50-55 min. The flow rate was 0.8 ml/min and the analyses were performed at 35°C. The chromatograms were monitored at 520 nm. The anthocyanin quantification was performed using cyanidin-3-*O*-sambubioside.

HPLC–MS Analysis were performed with a Quadrupole 6110 mass spectrometer (Agilent Technologies, Chelmsford, MA) equipped with an ESI probe equipped with an electrospray ion source. Mass spectra were recorded between 260 and 1000 m/z.

Total phenolic content. The total concentration of polyphenol in the purified juices was determined using Folin-Ciocalteu colorimetric method with minor modifications

(Singleton et al., 1999. The results were expressed as milligram of gallic acid per 100 grams.

RESULTS AND DISCUSSION

Prior to chromatographic analysis the purified anthocyanin rich-fraction was dissolved in acidified water and filtered through 0.45μm.The quantification was done using cyanidin 3-*O*-sambubioside standard curve. Anthocyanin identification of purified juices was done using were identified based on their retention time, UV-VIS spectra compared with pure standards and also were compared with anthocyanin profiles of fruit juice found in literature. (Heinonen et al., 2002). As a confirmation LC/PDA/ESI-MS analysis was done. Peaks identification is summarized din Table 1. Both chokeberry and elderberry juices content only cyanidin based pigment.

Chokeberry juice contained a mixture of four different cyanidin-glycosides. Cyanidin-3-galactoside and cyanidin-3-arabinoside were found to be the majors compounds, these anthocyanins represented together about 60% from total anthocyanin content. Cyanidin-3-xyloside (57.3 mg Cy-3-sam /100ml FJ) and cyanidin-3-glucoside (68.5 mg Cy-3-sam /ml FJ) were found in low concentration. Published data are in accordance with the results obtained in this study for chokeberry juice (Nakajima J., et al., 2004, Lidija Jakobek et al., 2007). Total anthocyanin content obtained for elderberry juice was 416.9 mg cy-3-same/100 ml FJ. The majors anthocyanins identified were cyanidin-3-*O*-sambubioside-5-glucosid and cyanidin-3-*O*-sambubioside representing 40% and 21% respectively from total anthocyanin content. The obtained results are in good correlation with data reported previously (Lidija Jakobek et al., 2007).

Beetroot juice was characterized by the presence of betalanins, another class of water-soluble plant pigments. In this case the major compound was Betanin, representing about 42%. The obtained data was similar whit those found in literature (Czapski, 1990, , Florian et al., 2006, Peter et al., 2011). Concentrations of anthocyanins in analyzed juices (mg/100ml), calculated using HPLC method and percentage distribution of anthocyanin are presented in Table 2. The recorded PDA chromatograms of purified juices (520nm absorption) are shows in Figure 1.

Table 1

Compounds, UV-Vis and mass spectral data of analyzed juices.

Sample name	Peak no	Identified compound	λ_{max}	[M + H]+ ion, fragments)
Beetroot	1	Betanin	245, 536	551/549/389
	2	Isobetanin	290, 536	551/549/389
	3	Betanidin	244, 534	551/398
	4	Neobetd 5-glc	245, 469	549.1/387
	1	Cyanidin-3-*O*-sam-5-glucoside	279, 528	743, 611, 287
	2	Cyanidin-3,5 -diglucoside	278, 518	611, 449, 287

Elderberry	3	ND	280, 518	
	4	Cyanidin-3-*O*-sambubioside	279, 518	581/287
	5	Cyanidin-3-*O*-glucoside	279, 517	449 /287
Chokeberry	1	Cyanidin-3-*O*-galactoside	279, 517	449 /287
	2	Cyanidin-3-*O*-glucoside	280, 517	449/ 287
	3	Cyanidin-3-O-arabinoside	279, 517	419 /287
	4	Cyanidin-3-O-xiloside	279, 517	454/ 287

Total polyphenol (TP) values in purified analyzed juices as gallic acid equivalents were in the range of 82.9-110 mg GAE/100 ml. Among all the samples analyzed, beetroot juice shows to have the highest total phenolics content (110mg GAE/100ml) follow by elderberry (54.3 mg GAE/100ml) and chokeberry (28.9 mg GAE/100ml). In a previous study, Lidija Jakobek et al., 2007, reported values comparable with those obtained in this study (91.5 mg GAE/100ml for chokeberry juice and 63.6 mg GAE/100ml for elderberry juice. The results are presented in Table 2.

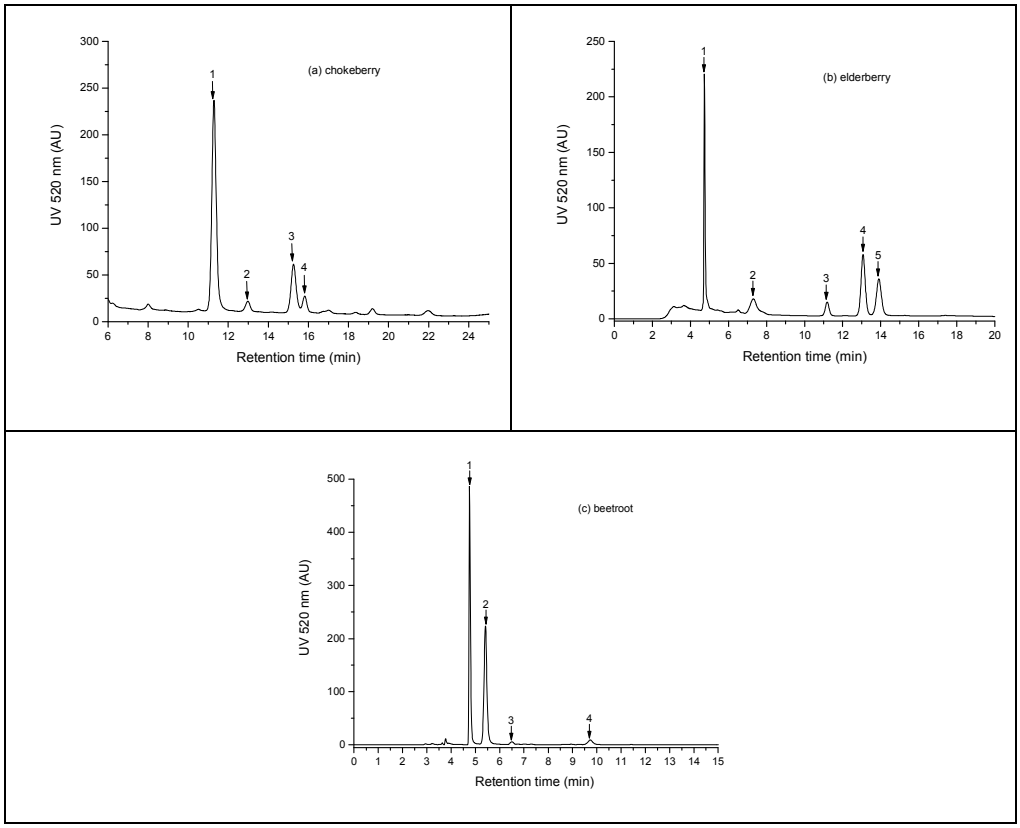

Fig. 1 - HPLC-PDA chromatograms of purified juices (a) Chokeberry; (b) Elderberry; beetroot (c). Peaks identification is shown in Table 1.

Table 2

Concentration of anthocyanins and polyphenol in commercial juices analyzed

Juice/Compound	Concentration Cy-3-sam mg/100ml	Total anthocyanins %	Total polyphenol content mgGAE/100ml
Beetroot			
Betanin	381.4	42.5	110
Isobetanin	374,4	41.7	
Betanidin	63.4	7.08	
Neobetd 5-glc	77.23	8.6	
Total	**895.5**	100	
Elderberry			
Cyanidin-3-*O*-sambubioside-5-glucosid	184.7	40	54.3
Cyanidin-3,5 -diglucoside	57.1	12.4	
unknown	42.3	9.2	
Cyanidin-3-*O*-sambubioside	98.6	21.4	
Cyanidin-3-*O*-glucoside	79	17.1	
Total	**416.9**	100	
Chokeberry			
Cyanidin-3-*O*-galactoside	79.8	37.4	82.9
Cyanidin-3-*O*-glucoside	68.5	19.3	
Cyanidin-3-O-arabinoside	152.9	23.4	
Cyanidin-3-O-xiloside	57.3	19.8	
Total	**358.69**	100	

CONCLUSIONS

1. Cyanidin glycosides are the predominant anthocyanins in chokeberry and elderberry purified extract

2. Beetroot purified juice was found to be rich in another class of plant pigment, betalains.

3. Moreover this study demonstrates that phytochemical composition of commercial available juices is complex and complete and it makes these juices to be recommended as daily consumption.

4. This is the first paper to report anthocyanin, betalanin and polyphenol composition of commercial available juices in Romania.

Acknowledgments. *This research was supported by CNCSIS-UEFISCSU; project PNII-TE-168, code 109/2010.*

REFERENCES

1. **Brouillard R**., **1982** - *Chemical Structure of Anthocyanins. In: Anthocyanins as Food Colors,* Markakis, P. (Ed.). Academic Press, New York, London, Paris, pp. 1-40.
2. **Cai Y.Z., Sun, M., Corke H**., 2005 - *Characterization and application of betalain pigments from plants of the Amaranthaceae*. Trends in Food Science & Technology, 16, p. 370–376
3. **Czapski J**., **1990** - *Heat stability of betacyanins in red beet juice and in betanin solutions*. European Food Research and Technology, 191, p. 275–278
4. **Florian C. Stintzing, Jan Trichterborn, Reinhold Carle, 2006** - *Characterisation of anthocyanin–betalain mixtures for food colouring by chromatic and HPLC-DAD-MS analyses, Food Chemistry*, 94(2), p. 296-309
5. **Giusti M.M., Wrolstad R.E., 2003** - *Acylated anthocyanins from edible sources and their applications in food systems.* Biochemical Engineering Journal 14: p. 217-225
6. **He J., M.M. Giusti**, **2011**- *High-purity isolation of anthocyanin mixtures from fruits and vegetables – a novel solid-phase extraction method using mixed mode cation-exchange chromatography*.Journal of Chromatography, A 1218, p. 7914-7922
7. **Heinonen, L. M., Meyer A. S., 2002 -** *Antioxidants in fruits, berries and vegetables*, In Jongen, Izl (ed.): *Fruit and vegetable processing*, p. 23-51, Woodhead Publishing Limited, Cambridge
8. **Henriette M.C. Azeredo, 2009 -** *Betalains: properties, sources, applications, and stability – a review*, International Journal of Food Science and Technology, 44, p. 2365–2376
9. **Lidija Jakobek, Marijan Šeruga, Martina Medvidović-Kosanović, Ivana Novak, 2007**- *Antioxidant Activity and Polyphenols of Aronia in Comparison to other Berry Species,* Agriculturae Conspectus Scientificus, 72, 4, p. 301-306
10. **Markham K.R., Gould K.S., Winefield C.S., Mitchell K.A., Bloor S.J., Boase M.R., 2000** - *Anthocyanic vacuolar inclusions - their nature and significance in flower colouration*. Phytochemistry, 55, p. 327-336.
11. **Peter C. Wootton-Beard, Lisa Ryan, 2011** - *A beetroot juice shot is a significant and convenient source of bioaccessible antioxidants*, Journal of Functional Foods 9, p. 332 –334
12. **Singleton V. L., Orthofer R., Lamuela-Raventos R. M., 1999** - *Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent.*Methods Enzymol, 299, p. 152-178

THE EFFECT OF DIFFERENT CONCENTRATIONS OF BIOSTIMULATORS ON THE NUMBER AND WEIGHT IN THE EAR CARYOPSES AT VARIETIES OF WHEAT BOHEME, CRINA AND ARIESAN - A RESEARCH STUDY CARRIED OUT AT EZARENI STATION, IAŞI

EFECTUL UNOR BIOSTIMULATORI ÎN CONCENTRAŢII DIFERITE ASUPRA NUMĂRULUI ŞI GREUTĂŢII CARIOPSELOR ÎN SPIC LA SOIURILE DE GRÂU BOEMA, CRINA ŞI ARIEŞAN, ÎN CONDIŢIILE FERMEI EZĂRENI-IAŞI

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Abstract.*We studied in agricultural year 2010 - 2011 at farm Ezareni Iasi the effect of three biostimulators (BCO 4DMA; BCO 4K; BCO 4K + Zn acetate) in concentrations of 50, 25 and 12,5 ppm on numbers and caryopsis weight in spike at varieties of wheat Boema, Crina and Ariesan. BCO 4K biostimulators determined the largest weight of caryopsis / spike of 1,735 g with 0,06 more than control variant, and the largest number of caryopses / spike (38.8) was achieved in applying growth regulators BCO 4DMA. At biostimulators concentrations of 50 ppm was obtained the lowest number of caryopsis in spike of 36,8, but with higher their spike weight of 1,717 g. Interaction between BCO 4 ppm DMA x 50 x variety Boema made the highest number caryopses / spike of 48, with weighing of 2,072 g/spike*
Key words: *biostimulators, concentration, wheat, caryopses.*

Rezumat.*În anul agricol 2010-2011 la ferma Ezăreni Iaşi s-a urmărit efectul a trei biostimulatori (BCO 4DMA; BCO 4K; BCO 4K + acetat de Zn) în concentraţii de 50, 25, 12,5 ppm asupra numărului şi greutăţii cariopselor de grâu la soiurile Boema, Crina şi Arieşan. Biostiumulatorul BCO 4K a determinat cea mai mare valore, de 1,735 g a greutăţii cariopselor/spic, cu 0,06 g mai mult decât martorul, iar cel mai mare număr de cariopse/spic (38,8) s-a realizat la aplicarea biostimulatorului BCO 4 DMA. La o concetraţie a biostimulatorilor de 50 ppm s-a obţinutcelmaimicnumăr de cariopsepe spic, de 36,8dar cu ceamai mare valoare a greutăţiiacestorape spic, de 1,717 g. Interacţiuneadintre BCO 4 DMA x 50 ppm x soiulBoema a realizatcelmai mare număr de cariopse/spic, de 48, având o greutate de 2,072 g/spic*
Cuvinte cheie: *biostimulatori, concentraţii, grâu, cariopse, cultivare*

INTRODUCTION

Wheat has enjoyed over the years a lot of attention from local and foreign researchers because of the importance it has in human and animal nutrition.

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The research made in recent years showed that in plants life an important role plays some organic compounds that regulate various physiological processes. Call today growth stimulators, plant hormones or phytohormones they act on stimulating or inhibiting the processes of their action (Ghițău Carmen, 2011).

Over eight decades ago were discovered the first endogenous plant hormones (auxins and gibberellins), and soon began to appear successively different synthetic compounds having properties similar to the natural hormones. They in very small amounts can stimulate, inhibit or modify the qualitative growth or development of plants (Jităreanu Doina Carmen, 2002).

BCO generic name, the new class of stimulators was discovered by Cornelius Oniscu and coworkers (1975, 1978, 1979) through synthesis of sulfonamide derivatives of carboxylic acids fenofialchil.

In 2010, Ghițău Carmen and collaborators studied under laboratory conditions, the influence of stimulators in different concentrations on the germination process (energy and germination), roots and coleoptile length in wheat variety Bohemia.

In Analyses concluded that the highest percentage of germination was recorded in the following stimulators: BCO 4K with 91.12% germination, BCO 2K + Zn acetate with 94.50% germination, BCO - 4DMA with 95.5% germination, BCO 2DMA + Zn acetate with 93.87% germination.

MATERIAL AND METHOD

The experience has been established at the Ezareni station, Iasi in subdivided plots with three repetitions.

The experimental factors are:

A factor – The biostimulators:

a_1 → BCO – 4DMA;

a_2 → BCO 4K;

a_3 → BCO 4K + acetat de Zn.

B factor – Biostimulator concentrations:

b_1 → 50 ppm;

b_2 → 25 ppm;

b_3 → 12,5 ppm.

C factor – Varieties of wheat:

c_1 → Arieşan;

c_2 → Crina;

c_3 → Boema.

The biostimulators usedin the experiment were obtained from Prof. dr. Corneliu Oniscu, „Gheorghe Asachi" Tehnical University of Iasi.

Biostimulators have a low toxicity and is also biodegradable, making them part of fenofialchil carboxylic acid sulfonamide group.

In agriculture year when the experience occurred the climatic conditions were favorable to wheat crop.

RESULTS AND DISCUSSION

The number and weight caryopses perea rare important components of wheat productivity. They can be influenced by climatic conditions during the growing season as well as the particular biological material used, and by the fertilizers applied.

The application of the three stimulators in wheat crop in agriculture year 2010 - 2011 did not significantly different the number and weight caryopses perspike (Table1).

BCO-4 K biostimulator achieved the highest value of weight caryopses/ spike of 1,735 g, 0.06 g more than the control (BCO 4DMA). The highest number of caryopses/ spike, 38.8 was obtained inthe control.

Table 1

The influence of fertilizationon some aspectsof winter wheatproductivity

Biostimulator	The weight caryopses/spike			The number of caryopses/spike		
	g	% Compared to the stander-by	The difference (%)	no.	% Compared to the stander-by	The difference (%)
BCO 4DMA	1,677	100,00	mt.	38,8	100,00	mt.
BCO-4K	1,735	103,45	0,06	36,9	95,04	-1,9
BCO 4K+ Ac. de Zn	1,595	95,15	-0,08	36,3	93,61	-2,5
DL 5%	0,2 g			5,3		
DL 1%	0,3 g			7,3		
DL 0,1%	0,5 g			9,9		

The weight of caryopses per ear increased with increasing concentration of growth regulators, obtained from 1,637 g at 12.5 ppm up to 1,717 g at concentration of 50 ppm (table 2). The lowest number of caryopses / spike of 36.8 was achieved at the concentration of 50 ppm, and the largest of 37.7 bostimulatorilor application at a concentration of 25 ppm.

The influence of biological material used on the weight of caryopses per spike was noted that the stander-by Boema variety, achieved the highest value of 1,713 g(table 3).

As regards the number of caryopses/spike, Crina variety made their highest value, 40.5, being significant difference compared to control, while the Ariesan variety obtained the lowest number of caryopses / spike, the 32.8, the difference from the control, -6.0, being very significantly negative.

The interaction between stimulators with concentrations and varieties of wheat (table 4) highlighted the interaction BCO 4DMA x 50 ppm x Boema variety who obtained a total of 48 caryopses per pike,12 caryopses more than control variables, the difference from the control being very significant. Very significant differences were obtained at the interaction of zinc acetate BCO +

4K x 12.5 ppm x Crina variety with a number of caryopses per spike of 46.3. At interactions between , BCO 4DMA x 12,5 ppm x Arieşan and BCO 4K + zinc acetate x 12,5 ppm x Arieşan differences were obtained negatives.

Table 2

The influence of growth regulators concentration on aspects of productivity of winter wheat

The concen-tration ppm	The weight caryopses/spike			The number of caryopses/spike		
	g	% Compared to the stander-by	The differen-ce (%)	no.	% Compared to the stander-by	The differen-ce
12,5	1,637	100,00	mt.	37,5	100,00	mt.
25	1,653	100,95	0,02	37,7	100,69	0,2
50	1,717	104,86	0,08	36,8	98,22	-0,7
DL 5%			0,2 g			1,7
DL 0,1%			0,3 g			2,4
DL 1%			0,4 g			3,4

Table 3

The influence of of variety on some elements of productivity of winter wheat

Variety	The weight caryopses/spike			The number of caryopses/spike		
	g	% Compared to the	The difference (%)	no.	% Compared to the	The difference (%)
Boema	1,713	100,00	mt.	38,8	100,00	mt.
Crina	1,661	96,94	-0,05	40,5	104,49	1,7*
Arieşan	1,633	95,32	-0,08	32,7	84,43	-6,0ooo
DL 5%			0,20 g			1,5
DL 1%			0,25 g			1,9
DL 0,1%			0,30 g			2,6

The influence of the interaction between the three factors did not cause significant weight of caryopses per spike. From 27 interactions at 18 of these have been obtained values of caryopses / spike weight less than control. The highest value caryopses weight of 2,072 g was obtained from the interaction BCO 4 ppm DMA x 50 x Boema variety.

Table 4

The influence of interaction between stimulators x concentration x varieties on aspects of productivity of winter wheat

Biosti-mulators	Con pp m	Variety	The weight caryopses/spike			The number of caryopses/spike		
			g	% Compared to the stander-by	The difference (%)	no.	% Compared to the stander-by	The difference (%)
BCO – 4 DMA	50	Boema	2,072	117,61	0,310	48	133,33	12***
		Crina	1,626	92,30	-0,136	39,7	110,19	3,7
		Arieşan	1,474	83,64	-0,288	30,3	84,26	-5,7o
	25	Boema	1,589	90,20	-0,173	41,7	115,74	5,7*
		Crina	1,810	102,72	0,048	43,7	121,30	7,7**
		Arieşan	1,886	107,04	0,124	38	105,56	2,0
	12,5	Boema	1,762	100,02	Mt,	36	100,00	mt,
		Crina	1,425	80,89	-0,337	42,3	117,59	6,3*
		Arieşan	1,445	81,99	-0,317	29,7	82,41	-6,3o
BCO 4 K	50	Boema	1,939	110,06	0,177	41,3	114,81	5,3*
		Crina	1,520	86,25	-0,242	38,3	106,48	2,3
		Arieşan	1,884	106,94	0,122	32,7	90,74	-3,3
	25	Boema	1,588	90,11	-0,174	36	100,00	0
		Crina	1,775	100,76	0,013	36,3	100,93	0,3
		Arieşan	1,552	88,08	-0,210	32,3	89,81	-3,7
	12,5	Boema	1,898	107,72	0,136	39	108,33	3,0
		Crina	1,836	104,18	0,074	43	119,44	7,0*
		Arieşan	1,619	91,88	-0,143	33	91,67	-3,0
BCO 4 K + acetat de Zn	50	Boema	1,517	86,08	-0,245	33,7	93,52	-2,3
		Crina	1,680	95,33	-0,082	32,3	89,81	-3,7
		Arieşan	1,739	98,68	-0,023	35	97,22	-1,0
	25	Boema	1,460	82,86	-0,302	35	97,22	-1,0
		Crina	1,518	86,17	-0,244	42,7	118,52	6,7*
		Arieşan	1,696	96,25	-0,066	34	94,44	-2,0
	12,5	Boema	1,592	90,33	-0,170	38,3	106,48	2,3
		Crina	1,756	99,64	-0,006	46,3	128,70	10,3***
		Arieşan	1,402	79,55	-0,360	29,7	82,41	-6,3o
DI 5%			0,6 g		5,3			
DI 1%			0,8 g		7,3			
DI 0,1%			1,1 g		9,9			

CONCLUSIONS

1. Biostimulators separate studies did not significantly influence the weight and number of caryopses / spike. The lowest values of weight and number of caryopses per spike, 1,595 g and 36.3 were obtained at BCO 4K + zinc acetate biostimulator.

2. The highest weight of the caryopses per spike, of 1.717 g was achieved at growth regulators concentration of 50 ppm, and the highest number of caryopses / ear, 37.7, concentration of 25 ppm.

3. Crina variety achieved the highest number of caryopses / spike, 40.5, difference from the control, 1.7, being significant. Ariesan variety recorded the lowest values of both weight (1,633 g) and the number of caryopses / spike, 32.7.

4. The interaction of the BCO 4DMA x 50 ppm x variety Boema have achieved the highest value of the weight (2,072 g), and the number of caryopses / spike (48).

REFERENCES

1. **Ghiţău Carmen,** 2011, - *Efectul unor fertilizanţi şi biostimulatori la realizarea cantitativă şi calitativă a producţiei grâului de toamnă în condiţiile ecologice din Câmpia Moldovei,* Teză de doctorat, Iaşi.
2. **Ghiţău Carmen, Donţu Geanina Diana,** 2010, - *Efectul biostimulatorilor asupra unor însuşiri biologice ale grâului de toamnă,* Lucrări ştiinţifice USAMV Iaşi, seria Horticultură, vol. 53, nr. 1, p. 557-562.
3. **Jităreanu Doina Carmenica,** 2002, - *Fiziologie vegetală,* Editura Ion Ionescu de la Brad, Iaşi.
4. **Oniscu C., Botez G.,** 1975, - *Brevet Rom.,* 61526.
5. **Oniscu C., Botez G.,** 1978, - *Brevet Rom.,* 69149.
6. **Oniscu C., Botez G.,** 1979, - *Brevet Rom.,* 77869.
7. **Oniscu C., Botez G., Nitelea I.,** 1975, - *Brevet Rom.,* 61526.

RESULTS REGARDING THE INFLUENCE OF VARIETY, SOIL TYPE AND CROP YEAR FACTORS ON THE PROTEIN CONTENT IN SPRING BARLEY GROWN IN NORTH-EAST BĂRĂGAN

REZULTATE PRIVIND INFLUENȚA FACTORILOR SOI, TIP DE SOL ȘI AN DE CULTURĂ ASUPRA CONȚINUTULUI DE PROTEINĂ LA ORZOAICA DE PRIMĂVARĂ CULTIVATĂ ÎN BĂRĂGANUL DE NORD-EST

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Abstract. *The contents of protein substances, expressed as a percentage of the dry matter, is a characteristic of varity but, at the same time, it is strongly influenced by the pedoclimatic conditions and cultivation techniques, ranging widely within the same variety, from one year to another and from one place to another. The main aim of the research was to study the influence of the observed factors and of the interactions between those factors on the production of spring barley in Vădeni area, Brăila County.*
Keywords *barley varieties, production, soil*

Rezumat. *Conținutul de substanțe proteice, exprimat în procente din substanța uscată este o caracteristică de soi, dar în același timp este puternic influențat de condițiile pedoclimatice și modul de cultură, variind în limite largi în cadrul aceluiași soi, de la un an la altul și de la o localitate la alta. Scopul principal al cercetărilor a fost acela de a urmări influența factorilor studiați și a interacțiunillor dintre aceștia asupra producției de orzoaică de primăvară cultivată în zona Vădeni, județul Brăila.*
Cuvinte cheie *soiuri de orz, producție, sol*

INTRODUCTION

The contents of protein substances in barley varies widely from 8 to 13.5% of dry matter. It is recommended that the barley used for making beer should have a content of protein substances between 9 and 11.5% (Berzescu et al., 1981).

Protein substance content, expressed as a percentage of dry matter, is a characteristic of variety, but it is also strongly influenced by pedo-climatic conditions and how the culture is grown (Bîlteanu, 2003), varying widely in one and the same variety, from one year to another and from one place to another.

MATERIAL AND METHOD

The research was conducted in 2008-2010, in Vădeni area, Brăila county, on two different types of soil, typical chernozem (with the following physical and chemical

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properties: bulk density (DA): 1.15 g/cm^3, pH (water): 7.60, humus content (H): 3.5%, phosphorus (P_{AL}): 45 ppm, Potassium (K_{AL}): 222 ppm and indicate N (IN): 3.55) and calcaric aluviosoil (with the following physical and chemical properties: bulk density (DA): 1,35 g/cm^3, pH (water): 7.75, humus content (H): 2.93%, Phosphorus (P_{AL}):47 ppm Potassium (K_{AL}):111 ppm and indicate N (IN): 2.93). Four varieties of spring barley were studied - Annabell, Thuringia, Cristalia and Tunika.

The precedent plant was corn. The sowing was done in all the years of research, at the optimum age for this area (the first decade of March) at a density of 400 b.g./m^2.

Climatic conditions during the period in which the experiments took place were different from year to year (Table 1). Analysing the annual amount of rainfall compared to the multi-annual average (447 mm), it appears that the agricultural year 2007-2008 was a normal year (481 mm), 2008-2009 was dry (363 mm), 2009-2010 was a year with more precipitation (714 mm) irregularly distributed throughout the year.

Table1

The main climatic elements for the agricultural years 2007-2008, 2008-2009 and 2009-2010 compared to the normal

Elemente climatice		Valori lunare												Total/media an agricol
		X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
Precipitatii (mm)	Normala	31	36	33	27	27	29	36	52	63	47	42	29	447
	2007/2008	81	53	77	7	2	15	44	86	40	7	0	60	481
	Abatere	+50	+17	+44	-20	-25	-14	+18	+34	-23	-40	-42	+31	+34
	2008-2009	21	18	24	64	27	29	11	32	25	43	16	15	363
	Abatere	-10	-18	-9	+37	0	0	-25	-20	-38	-4	-26	-14	-84
	2009-2010	37	22	114	89	70	28	10	54	165	88	19	21	717
	Abatere	+6	-14	+81	+62	+43	-1	-26	+2	+102	+41	-23	-8	+270
Temperaturi in aer (°C)	Normala	11,7	5,6	0,4	-2,5	-0,3	4,6	10,9	16,9	20,7	22,8	22,1	17,5	10,9
	2007/2008	11,8	3,9	0,1	-1,3	2,6	8,3	12,3	16,3	21,6	22,9	24,3	16,3	11,6
	Abatere	+0,1	-1,7	-0,3	+1,2	+2,9	+3,7	+1,4	-0,3	+0,9	+0,1	+2,2	-1,2	+0,7
	2008-2009	12,1	6,6	3,3	0,3	2,5	5,6	11,5	17,5	21,4	24,5	22,6	17,6	12,1
	Abatere	+0,4	+1,0	+2,9	+2,8	+2,8	+1,0	+0,6	+0,6	+0,7	+1,7	+0,5	+0,1	+1,2
	2009-2010	12,8	7,2	0,2	-3,3	0,2	5,1	11,6	17,8	21,2	23,5	25,0	17,5	11,6
	Abatere	+1,1	+1,6	-0,2	-0,8	+0,5	+0,5	+0,7	+0,9	+0,5	+0,7	+2,9	0	+0,7

The researched observed the influence of the soil factor, the variety factor and crop year factor and also of the interactions between those factors on grain production in spring barley.

The experimental results were statistically processed by analysis of variance, the F test and limit differences (Săulescu and Săulescu, 1967). The production data capitalizing was done in a series, following the trifactorial model (2x4x3), as an experiment with two different soil types and four varieties grown in three years.

RESULTS AND DISCUSSION

From the analysis of the variance table for the protein content in the varieties of spring barley (Table 2) the following conclusions emerge:

- the varieties/error F test shows that there are distinctly significant differences between varieties grown on the two soil types in different experimental years.

- the soils/error F test shows there are distinctly significant differences between the two types of soil.

- the AxB combined varieties/action F test and the BxC combined varieties/action F test show that the varieties have distinctly significant differences, with different responses to soil type and respectively crop-year, which shows the superiority or inferiority of certain varieties regardless of soil type or crop year.

Table 2

Analysis of variance and the F test

Cause of variance	GL	SP	s^2	F test		
				Compared to error	Compared to AB	Compared to BC
Total	23	5,38				
Soil type (A)	1	0,28	0,280	33,6 ** *(5.99; 13.74)*	7,64 (10,13; 13,74)	
Varieties(B)	3	4,55	1,517	182** (*4.76; 9.78*)	41,36** (*9,28; 29,46*)	30,33** (4,76; 9,78)
Crop years (C)	2	0,07	0,035	4,4 *(5.14; 10,92)*		
Interaction AxB	3	0,11	0,040	5,0* (*4.76; 9.78*)		
Interaction AxC	2	0,3	0,050	6,0* *(4.28; 8.47)*		
Interaction BxC	6	0,02	0,007			
Interactions AxBxC (error)	6	0,05	0,008			

From the data presented in Table 3 it is found that the lowest value of protein content is obtained on aluviosoil, with a difference of 0,22% from chernozem, which is very significant statistically. Regarding the difference from the average content of protein, this is of 0,11%, being statistically significant.

Table 3

The influence of soil on the protein content of spring barley

Soil	protein (% d.m.)	Dev. from mt.		Signif.	Dev from the average		Signif.
		% d.m.	%		% d.m.	%	
Typical chernozem (**mt**)	10,44	0	100		0,12	101,2	*
Calcaric aluviosoil	10,21	-0,22	97,9	000	-0,11	98,9	0
Average	10,32				mt	100	
DL 5% =0,89% s.u., DL1% =0,13% s.u., DL 0,1% =0,22% s.u.							

Table 4

The influence of variety on the protein content of spring barley

Variety	protein (% d.m.)	Dev. from mt.		Signif.	Dev from the average		Signif.
		% d.m.	%		% d.m.	%	
Thuringia (**mt**)	9.75	mt	100		-0,58	94,4	0
Annabell	10.60	0,85	108,7	**	0,27	102,6	-
Cristalia	10,87	1,12	111,5	***	0,54	105,2	*
Tunika	10,09	0,34	103,5	-	-0,24	97,7	-
Average	10,33				mt	100	
DL 5%=0,39% s.u. DL1%=0,59% s.u. DL 0,1%=0,95% s.u.							

The range of protein content of spring barley grain is between 9,75% d.m. for the Thuringia variety and 10,87% for the Cristalia variety. Compared to the control variety, Thuringia, for the Annabell and Cristalia varieties there have been distinctly significant differences and very significant statistical differences of +0,85% and +1,12% (Table 4).

Table 5

The influence of the crop year on the protein content of spring barley

Crop year	protein (% d.m.)	Dev. from mt.		Signif.	Dev from the average		Signif.
		% d.m.	**%**		% d.m.	**%**	
2008 -(**mt**)	10,31	mt	100		-0,02	99,8	-
2009	10,39	+0,08	100,8	-	+0,06	100,6	-
2010	10,28	-0,03	99,7	-	-0,04	99,5	-
Average	10,33				mt	100	
DL 5%=0,34% s.u. DL1%=0,52% s.u. DL 0,1%=0,83% s.u.							

The data in Table 5 shows that, compared to the average content of protein obtained in 2008, took as a reference year, the climatic conditions in the other two research years were different, and so in 2009 a protein increase of 0.08% was obtained and in 2010, a deficit of 0,03%, without statistical coverage. Compared to the average protein content of the research, it can be seen that the year of 2009 has favoured the achievement of a higher content of protein, with a difference of 0,06% from the average, without statistical coverage.

Table 6

The influence of the variety/crop-year interaction on the protein content of spring barley

Variety		protein (% d.m.)	Dev. from mt.		Signif.	Dev from the average		Signif.
			%d.m	%		%d.m	%	
Thuringia (mt)	2008	10,50	mt	100		+0,17	101,6	-
	2009	10,66	mt	100	-	+0,33	103,2	-
	2010	10,66	mt	100	-	+0,33	103,2	-
Annabell	2008	9,65	-0,85	91,90	0	-0,68	93,4	*
	2009	9,85	-0,81	92,40	0	-0,48	95,3	-
	2010	9,75	-0,91	91,46	0	-0,58	94,4	-

Cristalia	2008	11,05	+0,55	105,23	-	+0,72	106,9	*
	2009	10,73	+0,07	100,65	-	-0,40	103,8	-
	2010	10,84	+0,18	101,68	-	+0,51	104,9	-
Tunika	2008	10,05	-0,45	95,71	-	-0,28	97,3	-
	2009	10,35	-0,31	96,71	-	-0,02	100,1	-
	2010	9,89	-0,77	92,77	0	-0,44	95,7	-
Average		10,33				mt	100	
DL 5%=0,68% s.u. DL1%=1,03% s.u. DL 0,1%=1,66% s.u.								

According to data presented in Table 6 the following facts emerge: compared to the control variety, Thuringia, significant negative differences of 0,85% were recorded for the Annabell variety in 2008, of 0,81% in 2009 and of 0,91% in 2010 while for the variety Tunika a significant negative difference of 0,77% was recorded in 2010. Compared to the research average (10,33%) there were significant positive differences of 0,68% for the Annabell variety and 0,72% for the Cristalia variety in 2008.

An analysis of the data in Table 7 shows that: the Annabell variety recorded very significant negative differences compared to the control variety, Thuringia, on both chernozem and aluviosoil in all three crop years; the Tunika variety had distinctly significant negative differences on chernozem in 2008 and 2010 and on aluviosoil in 2008 and very significant negative differences in 2009 and 2010; the Cristalia variety showed significant positive differences in 2008 both on chernozem and aluviosoil and distinctly significant differences in 2010.

Compared to the average of the research, there were very significant negative differences for the Annabell variety on chernozem in 2008 and 2010 and on aluviosoil in all three experimental years, and the Tunika variety on aluviosoil in 2010; distinctly significant negative differences for the Annabell variety grown on chernozem in 2009 and the Tunika variety grown on aluviosoil in 2008; a significantly negative difference for the Tunika variety on chernozem in 2009; very significant positive differences for the Cristalia variety grown on chernozem in all three research years and on aluviosoil in 2008; distinctly significant positive differences for the Thuringia variety on chernozem and aluviosoil in 2009 and 2010 and for the Cristalia variety grown on aluviosoil in 2010; significant positive differences on chernozem for the Thuringia variety in 2008 and on aluviosoil for the Cristalia variety in 2009.

Table 7

The influence of the soil type/variety/crop-year interaction on the protein content of spring barley

SSoil	Variety	Crop year	protein (%d.m.)	Dev. from mt.		Signif.	Dev from the average		Signif.
				%d.m	%		%d.m	%	
Typical	Thuringia (mt)	2008	10,55	0,00	100,0		+0,23	102,2	*
		2009	10,70	0,00	100,0		+0,38	103,6	**
		2010	10,67	0,00	100,0		+0,35	103,3	**
	Annabell	2008	9,70	-0,85	91,94	000	-0,62	93,9	000

		2009	9,92	-0,78	92,70	000	-0,40	96,1	00
		2010	9,85	-0,82	92,31	000	-0,47	95,4	000
	Cristalia	2008	11,15	+0,60	105,68	***	+0,83	108,0	***
		2009	10,87	+0,17	101,58	-	+0,55	105,3	***
		2010	10,97	+0,30	102,81	**	+0,65	106,2	***
	Tunika	2008	10,15	-0,40	96,20	00	-0,17	98,3	-
		2009	10,55	-0,15	98,59	-	-0,23	98,3	0
		2010	10,27	-0,40	96,25	00	-0,05	99,5	-
Calcaric Aluviosoil	Thuringia	2008	10,27	0,00	100,0		-0,05	99,5	-
		2009	10,62	0,00	100,0		+0,30	102,9	**
		2010	10,65	0,00	100,0		+0,33	103,1	**
	Annabell	2008	9,60	-0,67	93,47	000	-0,72	93,0	000
		2009	9,77	-0,85	91,99	000	-0,55	94,6	000
		2010	9,65	-1,00	90,61	000	-0,67	93,5	000
	Cristalia	2008	10,95	+0,68	106,62	***	+0,63	106,1	***
		2009	10,60	-0,02	99,81	-	+0,28	102,7	*
		2010	10,72	+0,07	106,62	-	+0,40	103,8	**
	Tunika	2008	9,95	-0,32	96,88	00	-0,37	96,4	00
		2009	10,15	-0,47	95,57	000	-0,17	98,3	-
		2010	9,52	-1,13	89,38	000	-0,80	92,2	000
Average			10,32				mt	100,0	
DL 5%=0,19% s.u. DL1%=0,29% s.u. DL 0,1%=0,47% s.u.									

CONCLUSIONS

1. All four varieties analysed both on chernozem and aluviosoil in the three years of research obtained a protein content (between 9,52 -11,15%) which complies with the standards of beer producers (9 – 11,5%).

2. The most stable variety in terms of protein content is Annabell which was the least affected by the studied factors.

3. The soil type influences the protein content of barley grain, a higher value of protein content being obtained on chernozem than on aluviosoil for the same varieties grown under the same environmental conditions.

REFERENCES

1. **Berzescu P. şi colab., 1981** - *Tehnologia berii şi a malțului*, Editura Ceres, Bucureşti, p. 18-24.
2. **Bîlteanu Gh., 2003** - *Fitotehnie, vol. I*, Editura Ceres, Bucuresti, p.183-210.
3. **Săulescu N.A., Săulescu N.N., 1967** - *Câmpul de experiență- ediția a II a*, Edit. Agro-Silvică de Stat, Bucureşti.

RESEARCH ON THE IMPORTANCE OF SOILS ECOLOGICAL RECONSTRUCTION FOR THE OPTIMAL DEVELOPMENT OF FIELD CROPS ROOT SYSTEM IN THE BURNAS PLAIN

CERCETĂRI PRIVIND IMPORTANȚA RECONSTRUCȚIEI ECOLOGICE A SOLURILOR PENTRU DEZVOLTAREA OPTIMĂ A SISTEMULUI RADICULAR LA CULTURILE DE CÂMP DIN CÂMPIA BURNASULUI

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Abstract. *The purpose of this paper is to present the results of ecological research made on the soils from Southern Romania, in the Burnas Plain, and their effects on the field crops evolution. During the 3 agricultural years taken into study (2010-2012), due to registered variations among the abiotic factors (temperature, rainfall, humidity, evapotranspiration), we analyzed the evolution of plant roots, making comparisons from one stage of growth to another, from one year to another. Is going to be emphasized that the different tillage technologies, the crop rotations, the plant treatments, but also the variety have a bearing on how the plant develops, on its resistance to pathogens, but also on the production obtained. All these will rely on the data obtained from experiments carried out in plots, while for exemplification it will be used tables, graphs and photos made by the authors.*
Key words: *roots, ecological techniques, Burnas Plain, stage of growth*

Rezumat. *Scopul acestei lucrări este acela de a prezenta rezultatele cercetărilor de ecologizare realizate pe solurile din partea de sud a României, în Câmpia Burnasului, şi efectele acestora asupra evoluției culturilor de câmp. În cei 3 ani luați în studiu (2010-2012), pe fondul variațiilor înregistrate în rândul factorilor abiotici (temperatură, precipitații, umiditate, evapotranspirație), s-a urmărit evoluția rădăcinilor plantelor şi s-au realizat comparații de la o etapă de creştere la alta, de la un an la altul. Se va observa că diversele tehnologii ale pregătirii terenului, asolamentele, tratamentele efectuate, dar şi soiul îşi pun amprenta pe modul în care se dezvoltă planta, pe rezistența acesteia la agenții patogeni, dar şi pe producțiile obținute. Cele propuse se vor realiza pe baza datelor obținute în urma experimentelor făcute în parcele, iar pentru exemplificare se vor folosi tabele, grafice şi fotografii realizate de către autori.*
Cuvinte cheie: *rădăcini, tehnici de ecologizare, Câmpia Burnasului, etapă de creştere*

INTRODUCTION

Food, this amount of nutrients which is so necessary for every organism in order to live, has entered into the researchers' attention for years now, each one

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trying to find new solutions for agriculture. According to the analyzes made for the last two centuries, at the beginning of the XIXth century, for example, the registered yields on wheat and barley were around 1000 kg/ha (Farack, 2010). Thereby, it is noticed that so far the threshold of 8000 kg/ha in wheat has been reached and even exceeded, respectively 5000 kg/ha in barley, both at European level, which means an increase of 500-600%. The proportions are also similar for other crops (rice, maize, sunflower, soya, rapeseed, potato etc.).

The results obtained so far are due to the collaboration between several elements, among which we mention genetics (by varieties improving), inputs (fertilizers, pesticides, tillage), as well as abiotic factors that should be permanently taken into account (water, heat).

A performant ecologization management involves the limitation, as far as possible, of soil's losses through the conservation of nutrients level in organic form and of the one of microorganisms, by avoiding soil compactation and of the reduced capacity for water through cancellation measures of landslides and desertification (Berca, 2011) etc. For plants this requires a good development from sowing until harvesting and the first test is the one of roots formation, they offering them the opportunity to nourish, stability against winds or heavy rains, a larger capacity of water and nutrients storage, and therefore resistance to drought.

MATERIAL AND METHOD

Starting from these objectives and applying them to the pedoclimatic conditions that are characteristic for the Burnas Plain, could be demonstrated, using concrete examples, how the plants on these lands were influenced by the climatic conditions of the years 2010-2012, this aspect also being reflected by the yields obtained here in comparison with the ones from the conventionally worked soils.

The database that has been used includes photographs taken even by the authors during their visits made in the field in order to pursue the plants' development stage and the pathogens' incidence. Other scientific papers are going to be used in order to make some comparisons. In the same time will be provided information on soil conservation techniques, which were applied to each particular case: tillage, preceding plant, type of culture, treatments etc.

Another part of the paper will briefly review the yields obtained and how they evolved over the analyzed period.

It is mentioned that the experiments were conducted within the Teleorman Country area, in conditions of a cambic chernozem soil type, having as basic characteristics the values:

- humus: 3,0 – 3,6%;
- clay (in 0-45 cm profile): 45 – 48%;
- nitrogen (N): 224 ppm;
- phosphorus (P): 684 ppm;
- potassium (K): 388 ppm;
- pH: 6,3.

RESULTS AND DISCUSSIONS

In this paper there will be made references only regarding the winter crops, since the spring ones are much less common in Romania. It has been observed that the roots of winter wheat have reached even the depth of 2,2 m, while for the spring wheat the maximum depth was of 1,1 m (Thorup-Kristensen et al., 2009). The main condition is for the soils to be well maintained. Therefore, the deeper goes the root system, the better it will be able to use the reserves of water and nutrients that have been washed from soil's top layer.

Rapeseed is a good culture to be used before cereals, its roots having a beneficial effect on soil structure, that leaves it rich in nitrogen (Norton R. et al., 1999), out of here resulting the better harvests obtained in the following year. Another advantage is that it reduces the weed degree in the next autumn after the rapeseed harvesting.

In a study performed on wheat in Spain during 2003-2007 (Muñoz-Romero et al., 2010) better results of roots development have been achieved in no-tillage system, as compared to the conventional one, this being attributed to the soil's compaction reverse, but also to the rainfalls and to their distribution. The conclusions were, however, quite evasive, the authors seeming rather reserved in their enunciation.

On our own soils from the Burnas Plain, in the first year was done a raising work with the scarifier at the depth of 60 cm, its purpose being to remove the hardpan profile which was formed in the 30-45 cm layer. This work will be repeated in every third year. Until then only works with a hard disk for stubble-turning and some superficial works before sowing (with gruber, tiger or cultivator, at 10-20 cm) would be done. The traditional plowing was completely eliminated.

In Fig. 1 are presented the differences in roots plants architecture as a result of soils' reconstruction process and of hardpan layer destruction. Roots can penetrate into deep, not being forced to stagnate or to return to the surface. In most cases the growth differences at soil surface are not very visible, especially in the first vegetation stages, when plants have similar pedological conditions.

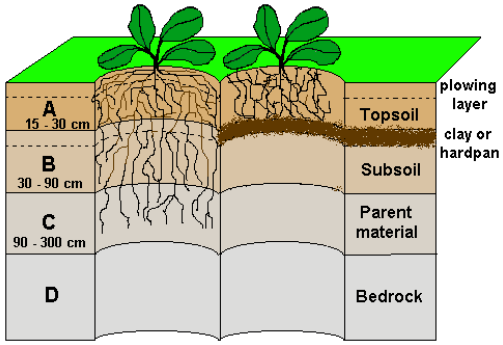

Fig. 1 - Roots development on the whole soil profile - conservation soil (left) compared to the non-ecologically soil (right) – original

For what happens underground there is no equipment able to show exactly how far the root system of each plant extends and to what resources it has access to that point.

The separation occurs throughout periods of growth, especially when the abiotic factors intervention (temperature, water) makes its presence felt. The results obtained on wheat and barley are shown in Fig. 2 and are conclusive to support the previous assertions.

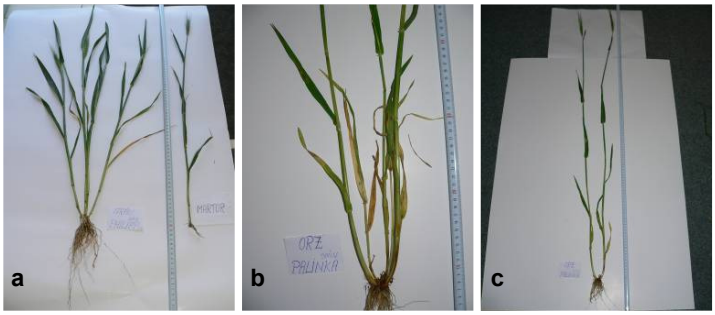

Fig. 2 - Differences in plants growth depending on soil tillage – Burnas Plain, May 2011 (photos of the authors)
a – Philipp wheat variety, parralel between ecologically (left) and conventional (right)
b, c – Palinka barley variety in ecological (b) and conventional (c) variant

In Table 1 are listed the main characteristics of the soil profile on which the research was conducted. Soil ecologization aims to improve the pedological features that are major influencing the productions, especially by slowing or even stopping the extent of plants root system up to the optimum depths.

Table 1

Soil conditions of the experimental plots from Burnas Plain

Crt.	Indicator	Depth	Range / Value
1.	Clay content	0-40 cm	42,8%
2.	Apparent density	0-40 cm	1,26 g/cm^3
		40-100 cm	1,41 g/cm^3
3.	Total porosity	0-40 cm	53,3%
4.	Soil aeration	0-170 cm	9,6 – 17,1 %
5.	Hydraulic conductivity	0-40 cm	11,1 – 15,7 mm/h
		> 40 cm	2,6 – 6,9 mm/h
6.	Penetration resistance	0-20 cm	19 kgf/cm^2
		20-50 cm	33 kgf/cm^2
		50-100 cm	48 kgf/cm^2

Drawing up a graph of roots depth is difficult to accomplish given that we can not take photos or make measurements at above 1 m into the ground. For wheat, according to the vegetative stages, variety and sowing depth, the pictures from Fig. 3 have been selected.

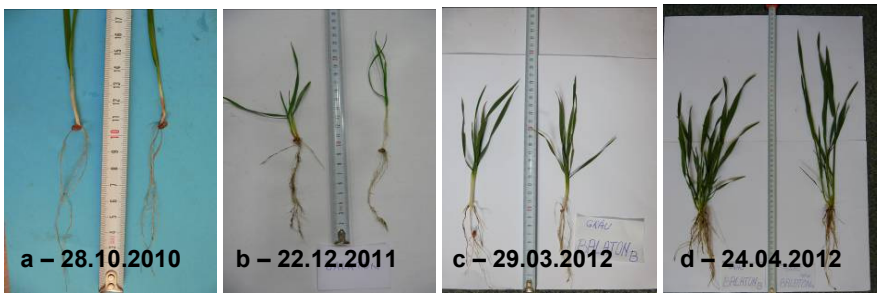

Fig. 3 - The Balaton wheat variety evolution along the biological phases – conservation plot by using the mentioned above methods (photos of the authors)
a – ecologically/non-ecologically parallel ⇒ similar increase in the first stage
b – sowing at optimum depth (left) and at 6 cm (right) ⇒ visible differences
c – sowing at 6 cm (left) and optimum (right) ⇒ different root system
d – Balaton Basis and Balaton C1, both in conservation system

It can be noticed that the differences are becoming more visible on roots. In the conditions of aridity recorded in 2012, the plants from ecological soil didn't suffered (Fig. 3d), managing to successfully pass over a hard winter and store the excess rainfall.

In a similar way it can be analyzed the behavior of studied barley varieties.

Fig. 4 - The evolution of Hanzi barley variety over the biological phases (authors photos)
a – sowing at optimum depth (left) and at 6 cm (right) ⇒ visible differences
b – sowing at 6 cm (left) and optimum (right) ⇒ different root system

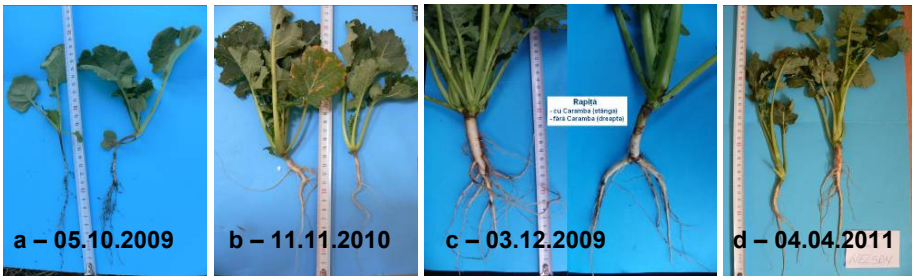

Fig. 5 - The evolutionary cycle of rapeseed crop (photos of the authors)
a – ecologically (left)/non-ecologically (right) parallel right after emergence
b – comparison between optimum (left) and with 2 weeks delay (right) sowing
c – roots to the plants treated with Caramba (left) and to the untreated ones (right)
d – non-ecologically (left)/ecologically (right) before flowering

Rapeseed has a special status, it is sown earlier and it must have 7-8 leaves until the onset of winter in order to survive to the cold period. The roots are going especially in depth, occupying a lateral area of only 20-30 cm.

Differences occur, as seen from the pictures that are composing Fig. 5, depending on the sowing period, on variety, on soil ecologization etc.

Finally, a comparison between the yields obtained from ecologically soils and the ones from conventionally worked soils has been made (Table 2). It can be seen that yields of the conservation soils are getting at least 30-120% more than the others, which leads us to believe that we are on the right track.

Table 2

Wheat, barley and rapeseed productions (kg/ha) in Burnas Plain, 2010-2012

Crop	Conventional (C)			Ecological (E)			Differences E – C %		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
Wheat	3350	3150	2960	4900	6880	6582	+46	+118	+122
Barley	3660	3720	3240	5010	6910	6830	+37	+85	+111
Rapeseed	1790	2020	1650	2590	3120	2200	+45	+54	+33

CONCLUSIONS

1. The roots have a very important role in the development of plants during the entire growing cycle.

2. Maintaining the soils in optimum parameters can increase the production and, most importantly, can ensure a continuous flow of its, the action of abiotic factors being proportionally reduced.

3. By soil conservation the natural soil inputs can be exploited at maximum, especially those that were previously inaccessible, being stored to a higher depth than the one to which the roots could reach.

***Acknowledgments**: The present paper is financed through the POSDRU/107/1.5/S/76888 program.*

REFERENCES

1. Berca M., 2011 - *Agrotehnica, transformarea modernă a agriculturii*. Ed. Ceres, Bucureşti

2. Farack E., 2010 - *Nachhaltige Sicherung der Bodenfruchtbarkeit unter Beachtung des Klimawandels*. Simpozion Düngungstagung Sachsen, 26.02.2010

3. Muñoz-Romero V. şi colab., 2010 - *Monitoring wheat root development in a rainfed vertisol: Tillage effect*. European Journal of Agronomy nr. 33 (2010), p. 182-187

4. Norton R. şi colab., 1999 - *Canola in rotations, Chapter 5, Canola in Australia: The first thirty years*. PA Salisbury

5. Thorup-Kristensen K. şi colab., 2009 - *Winter wheat roots grow twice as deep as spring wheat roots, is this important for N uptake and N leaching losses?*. Plant Soil (2009) 322, p. 101-114, DOI 10.1007/s11104-009-9898-z

ANALYSIS OF FINNISH CADASTRAL SYSTEM

ANALIZA SISTEMULUI CADASTRAL FINLANDEZ

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Abstract. *On a global scale, the cadastral systems must furnish actual balance sheets regarding the properties. This tendency represents a base condition in order to achieve an unitary development in territorial administration. Taking into account of the worldwide development and computerization of the cadastre domain and also knowing the importance of cadastre and real estate registration in Romania. In this context were analyzed the main features of the cadastral system in Finland.*
Key words: *cadastral system, INSPIRE, JAKO.*

Rezumat: *Pe o scară globală, sistemele cadastrale trebuie să furnizeze bilanţuri actuale cu privire la imobile. Această tendinţă reprezintă o condiţie de bază, în scopul de a realiza o dezvoltare unitară în administrarea teritoriului. Dezvoltarea şi informatizarea actuală a cadastrului la nivel mondial, trebuie să fie cunoscută şi aplicată şi în condiţiile realizării cadastrului şi publicităţii imobiliare din România. În acest context au fost analizate principalele caracteristici ale sistemului cadastral din Finlanda.*
Cuvinte cheie: *sistem cadastral, INSPIRE, JAKO.*

INTRODUCTION

In the European Union there are attempts to develop a common international cadastral system by international integration of the systems which answer the best to the requirements of potential users. This can only be accomplished based on the national systems, together with the software conceivers and developers. This approach leads to a growth in the eficiency and the performance of the informational systems, reperesenting important steps towards standardization (Petcu-Lovin, 2011).

International Federation of Surveyors published statement on the cadastre (FIG, 1995) defines the cadastre as: "*A Cadastre is normally a parcel based and up-to-date land information system containing a record of interests in the land (e.g. rights, restriction and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, and often the value of the parcel and its improvements*."

In Finland all cadastral information - both map data and attribute data - are registered in one integral database, started in 1998 and renewed in 2005, managed by the National Land Survey of Finland. Surveyors working at the National Land Survey and in certain municipalities are responsible for carrying out legal surveys, measuring data and registering it in the database. The system has been renewed

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and expanded in 2005 and during that time, it was modeled thoroughly with UML figures, and XML/GML schemas for data transfer were introduced (Myllymäki and Pykälä T., 2011).

MATERIAL AND METHOD

Taking into account of the worldwide development and computerization of the cadastre domain and also knowing the importance of cadastre and real estate registration in Romania, in this article I intend to show the main characteristics of the cadastral systems from Finland. On a global scale, the cadastral systems must furnish balance sheets regarding the real estates. This tendency represents a base condition in order to achieve an unitary development in territorial administration. The cadastral systems have to be flexible because the users demand an up to date record of the legal, technological and new registration methods modifications. Present paper aims to answer some questions like:

Which are the particularities of the Finnish Cadastral System?
Which are the bases institutions serving cadastre and land register?
What software use Finland for cadastral work?
Which problems occurred in the evolution of Finnish Cadastral System?

RESULTS AND DISCUSSIONS

In Finland, national the whole country was covered with the base maps in 1977. At the same time cadastral index maps were generated. Since then, the maps have continuously updated, both on the rural areas, scale 1:10.000, and urban areas, larger than 1:10.000.

The National Land Survey (NLS) started the digitalization of the cadastre in the 1970´s. The objectives were to improve the efficiency of the activities and to promote the joint use of registers. The land register was digitalized in the 1980´s by the Ministry of Justice (http://www.cadastraltemplate. org/countrydata/fi.html). *The National Land Survey (*NLS) developed JAKO cadastre, a new GIS-based cadastral information system, in 1995-1998. This object-orientated system stores attribute data and map data in the same database (Uimonen, 2002).

The new Law on the Land Information System and its Information Service came into force January 1, 2003. The law stipulates the data contents of the system, responsibilities of the parties involved and the administration of the system as well as the conditions of data delivery.

An amendment of the Cadastre Act has been issued changed and it will come into force on June 1, 2005. Then there will no more exist distributed Cadastres but the cadastral part of the Land Information System will be the only official Cadastre in Finland.

The basic property units that are the register units in the Cadastre are surveyed and registered in the nationwide Land Information System that includes also a cadastral index map and information about titles and mortgages. The Land Information System consists of (Viitanen, 2003):

- the Land Register includes the Register of Ownership, Mortgages and special rights;

- the Cadastre (Real Estate Register) includes information of the real property units, how the land is divided, what the process has been, and also information on easements and special rights; the register also includes maps and other official cadastral survey documents.

The whole country is covered with one uniform cadastral index map. The database is centralized and seamless. These object-orientated databases consist of the map and attribute data. The cadastral index map consists of boundary points, boundary lines and parcels (http://www.cadastraltemplate.org/countrydata/fi.html).

The main objects in the Cadastre include basic property units, parcels, boundaries and right-of use units. Transactions are also recorded in the register. Also information on ceased units is preserved. The Official Purchase Price Register is integrated into the cadastre. Since the beginning of 2010 The National Land Survey has been responsible for registering titles and mortgages but this particular database is separated from other registers and will be renewed (Myllymäki and Pykälä T., 2011).

Nowadays, the quality of Cadastral Systems data is quite good and numerical system is useful. NLS is responsible for administration and developing of Cadastral System and mostly for updating of cadastre. Starting from 2010, NLS is also responsable for updating of Land Register. Municipalities and other producers of cadastral data are responsible for updating their own data (Rummukainen, 2009).

1. Institution of cadastre and organizational matters

National Land Survey of Finland (NLS) is a governmental authority which is responsible for the administration of the cadastre and carrying out cadastral surveys; is subordinated the Finnish Ministry of Agriculture and Forestry.

National Land Survey of Finland (NLS) is also responsible for topographic mapping and the topographic database. From the beginning of 2010 there are 12 survey offices in the country, 79 cities take care of the cadastral surveys and mapping in their urban areas. On May 1, 2012 the National Land Survey opened its topographic datasets for free use (http://www.cadastraltemplate.org/countrydata/fi.html).

National Land Survey of Finland (NLS) is responsible for practical mapping work, data gathering, production of general maps, product distribution and general promotion of the shared use of mapping material and other geographic information.

Another significant institution is the **Population Register Centre**, which is responsible of the Building Register; under the Ministry of Interior.

The Finnish Geodetic Institute (FGI) is responsible for coordinate systems, the measuring and updating the highest-level permanent control point network, and sectoral research in the field of public mapping.

2. Programul JAKO, utilizat pentru evidența cadastrală

National Land Survey of Finland (NLS) introduced a new GIS-based cadastral information system (*JAKO Cadastre*) in 1998. The JAKO Cadastre is a multi-purpose cadastral system in which the attribute and map data on the cadastral unit are stored in the same database. Development was carried out using Smallworld GIS as the development tool. The JAKO cadastre consists of applications for providing a cadastral information service and conducting legal land surveys.

Experience with JAKO cadastre has been very good. Following the introduction of JAKO cadastre, the NLS developed new applications using the same platform – giving birth to the JAKO FAMILY.

The first new member of this family was JAKO Topographic Data System (JAKO/TDS) which which was introduced in 2000. It was followed by JAKO Market Price Register on Cadastral Units (JAKO/KHR), introduced in spring 2001. Next member was JAKO Valuation and Land Consolidation (JAKO/VLC) and finally, JAKO Map Site, which will replaced NLS Map Site and serve internet users by distributing topographic and cadastral data (Uimonen, 2002).

The JAKO Topographic Data System of *National Land Survey of Finland* (NLS) is used to produce and maintain a topographic map covering the whole country. The TDS database contains both real-world and cartographic features. The real-world features include, for instance, shore lines, road lines and buildings; the cartographic features include, for instance, tree symbols indicating forest vegetation and legend texts (Vitikainen, 2003).

Cadastral Information System structure which was conducted through the JAKO-Hardware Architecture (National Land Survey of Finland) is shown in Figure 1 (Vitikainen, 2003).

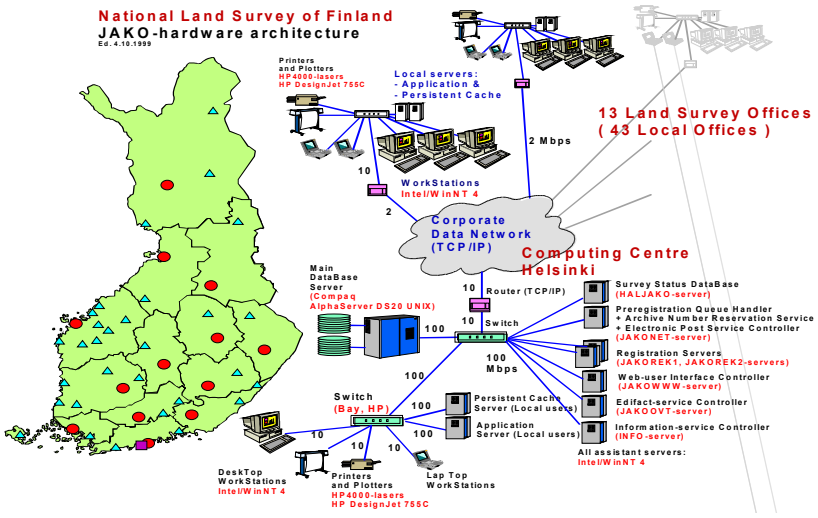

Fig. 1 - JAKO Cadastru (Vitikainen, 2003)

3. Deficiencies and problems with the old system

Basic units of the Land Information System are of real estates, common holds, public roads and transfers of parts. A basic unit is identified by its identifier (city district number/village number, block number/building group number, basic unit number etc.).

The contents of Finnish Cadastral System have developed into wide and versatile data, but it is disjointed and disconnected too. In Finland the rights to the land come into existence by judicial deed, by administrative decision or by law. Only easements and other rights which have prescribed by legal cadastral survey come into existence by registering the data to the Cadastral System.

The main failings with data of real estates are:

- There is data of real estates in multiple registers of diverse authorities in Finland. The registers are partly overlapping and there are no links between these registers, while some of them are only on paper (Rummukainen, 2009).

Therefore, Finland's basic information systems, each with its own register are: the Personal Information System, various information systems covering enterprises, corporations and foundations, the Building Information System, and the Land Information System.

- Because of excessively detailed legislation the data can lie scattered in many registers. Part of the data may be in the Cadastral System and part of it is in another registers.

- Not all the rights to land which are established by judicial deeds can be registered to the Cadastral System.

- There is no obligation to register all the rights that could be registered to the Cadastral System. Regardless of non-registering, these rights can be binding to outsiders, too (Rummukainen, 2009).

CONCLUSIONS

1. Because of excessively detailed Finnish legislation the data can lie scattered in many registers, and there is no obligation to register all the rights that could be registered to the Cadastral System; only easements and other rights which have prescribed by legal cadastral survey come into existence by registering the data to the Cadastral System.

2. In Finland all land is divided into basic property units that are the register units in the Cadastre. All the basic property units are surveyed and registered in the nationwide Land Information System that includes also a cadastral index map and information about titles and mortgages. The Land Information System consists of: *the Cadastre and the Land Register.*

3. In Finland, the whole country was covered with the base maps in 1977 which were continuously updated, while in Romania, until now, maps were only partially realized and were not updated.

4. Digital maps and relational database, updating of changes relating to the real estate, the property and the owners are a few aspects that Romania should borrow from Finland.

5. With all disfunctionalities mentioned above, it can be said that Finland cadastral system can be a model for countries that want to improve their own cadastral system.

Acknowledgments: *This paper was realised with the support of POSDRU CUANTUMDOC "Doctoral Studies for European Performances in Research and Innovation" ID79407 project funded by the European Social Found and Romanian Government.*

REFERENCES

1. FIG (International Federation of Surveyors), 1995 - *The Statement on the Cadastre*, FIG Publication No. 11, Canberra, Australia.
2. Myllymäki T., Pykälä T., 2011 - *The Challenge to Implement International Cadastral Models- Case Finland,* International Federation of Surveyors, Sydney, Australia.
3. Petcu-Lovin D.R., 2011 - *Contribuții la realizarea bazei de date a cadastrului urban şi cărții funciare*, PhD Thesis, "Gheorghe Asachi" Technical University of Iasi, Romania.
4. Rummukainen A., 2009 - *Contents of Finnish Cadastral System,* FIG Working Week 2009, Surveyors Key Role in Accelerated Development, Eilat, Israel.
5. Uimonen M., 2002 - *New Tools and Processes for Land Consolidation,* FIG XXII International Congress Washington, D.C. USA.
6. Viitanen K., 2003 - *Real Estate in Finland*, Helsinki University of Technology, Instituteof Real Estate Studies, Espoo, Finland.
7. Vitikainen A., 2003 - *Land Consolidation and the Guidelines on Land Administration*, WPLA-Workshop, Athens, Greece.
8. *** *http://www.cadastraltemplate.org/countrydata/fi.html*

STATISTIC ANALYSIS OF THE SPATIAL DATABASE OF AN ORTHOPHOTOPLAN AND OF THE SOIL CARTOGRAPHIC UNITS

ANALIZA STATISTICĂ A BAZEI DE DATE SPAȚIALE A UNUI ORTOFOTOPLAN ŞI A UNITĂȚILOR CARTOGRAFICE DE SOL

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Abstract. *Drawing up the geo-spatial database of the agricultural lands from the Romanian territorial administrative units using the digital orthophotoplan, allowed the realization of multiple statistic analyses of the cadastral lots in accordance with the soil cartographic units. For correlating the spatial data base of the physical agricultural blocks with the data corresponding to the soil cartographic units it has been used the existent cartographic and pedological documentation for the administrative territory of Drăguşeni commune, Suceava County. For this purpose, the area taken into consideration was that corresponding to the agricultural land from the unincorporated area of Drăguşeni, with the surface of 2168.71 ha. On this agricultural land there have been delimited a 173 the physical blocks. On the digital support of the orthophotoplan, the soil cartographic units have been overlaid, with a spatial distribution of 89 graphic entities. The case study performed includes a statistic analysis of the surfaces occupied by the physical blocks, in correlation with the soil units, on the geodetic trapezium control area, scale 1 : 5 000.*
Key words: *orthophotoplan, spatial database, agricultural, physical block, soil cartographic units, control area of geodetic trapezium*

Rezumat. *Realizarea la nivelul unităților administrativ teritoriale din România a bazei de date geo-spațiale a terenurilor agricole sub forma digitală a ortofotoplanului, a permis efectuarea unor multiple analize statistice asupra parcelelor cadastrale, în strânsă corelație cu unitățile cartografice de sol. Pentru integrarea bazei de date spațiale a blocurilor fizice agricole cu datele corespunzătoare ale unităților cartografice de sol, s-a folosit documentația cartografică şi pedologică existentă în cazul teritoriului administrativ al comunei Drăguşeni, din județul Suceava. În acest scop, s-a luat în studiu suprafața aferentă terenului agricol din extravilanul teritoriului Drăguşeni, care ocupă 2168,71 ha. Pe această suprafață de teren agricol s-a procedat la delimitarea unui număr de 173 blocuri fizice agricole. Pe suportul digital al ortofotoplanului, s-a realizat, suprapunerea unităților cartografice de sol, cu o distribuție spațială de 89 entități grafice. În studiul de caz realizat, s-a realizat, analiza statistică a suprafețelor ocupate de blocurile fizice, în corelație cu unitățile de soluri, pe aria de control a trapezului geodezic, la scara 1 : 5 000.*
Cuvinte cheie: *ortofotoplan, bază de date spațiale, bloc fizic agricol, unități cartografice de sol, aria de control a trapezului geodezic*

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INTRODUCTION

The basic cadastral entities realized at the level of all territorial administrative units of Romania are defined by the construction/building and the owner. For drawing up the spatial database of the cadastral plants content, the constructions/buildings have to be identified, measured and described. Cadastre and cadastral register represent, at the present time, the unitary and compulsory economic, legal and technical evidence system for all the buildings from the entire territory of Romania (Law no.7/1996, republished, 2013). The proper measurements are performed using graphic, numeric, photogrammetric and combined methods.

Among the types of measurements used for cadastral works, the photogrammetric method turned out to be the most used; in time, it has experienced three different stages of evolution: analogue, analytical and digital (David, 2007). Nowadays, the LiDAR technology has started being implemented; it represents a modern, complementary measuring technique which replaces the traditional aerial mapping method. The implementation of this technology allowed the realization of different photogrammetric products, using the 3D system (Voiculescu and Banciu, 2011). Between 1951-1990, period which represented the first phase of the process, the photogrammetric measuring technology was used to create the basic topographic plan for almost 85% of the entire surface of Romania, scales 1:2 000, 1:5 000 and 1:10 000 (Moca et al., 2012). The second phase, between 2001 and 2010, consisted in drawing up the digital orthophotoplan, for all the territorial administrative units of the country, scale 1:10000. These orthophotograms have previously passed through photogrammetric operations: stereo-restitution, ortho-rectifying, but by digital processing (Băluț and Blidaru, 2006).

Based on the studies dealing with the pedological mapping of the soils in Romania, operation which lasted more than 100 years (1906-2012), soil maps have been created, at low, medium and large scales. Among the major accomplishments, we can mention the Romanian soil map, scale 1:200 000, which was drawn up on 20 sheets, at first in analogic format and later on in a digital formal as well (Florea, 2002).

Practically speaking, the digital orthophotoplan includes both the demarcation of the boundaries of the territorial administrative units as well as the limits of the physical agricultural blocks, along with the alpha-numeric attributes. This is what stood at the base of the correlation between the technical and the economic function of cadastre, which is represented by the graphic entities of the land-soil cartographic units. Based on this correlation, it was integrated the spatial database of the physical agricultural blocks represented on the digital support of the orthophotoplan by the territorial distribution of the graphic entities of the soil cartographic units, which were identified on the surface of the agricultural fields.

On this agricultural surface there have been identified 173 agricultural physical blocks, on which have been overlaid 26 soil units, with a distribution of 89 graphic entities.

MATERIAL AND METHOD

The implementation of sustainable development projects for agricultural exploitations implies the existence of a rigorous inventory of the agricultural land fund and of the physical blocks, as well as knowing and promoting monitoring and management systems of soil resources. Administratively speaking, the territory of Drăgușeni commune, is part of Suceava County, which, if we consider that the total surface occupied is of 855 350 ha, is considered to be the second county in Romania. Considering the manner in which the land fund in Suceava county is used, it results that the agricultural area represents 41% of the total surface, and the non-agricultural area represents 59 % (Moca et al.,2010).

The territory of Drăgușeni commune is situated in the South-West limit of Suceava County, being delimited in the North-East and South-West by the borders of Iași County, in the South-West it is situated Neamț County, and in the North – is the border of Forăști commune. Geomorphologically speaking, the territory of Drăgușeni commune is considered part of the Fălticeni Plateau (geomorphological subunit of Suceava Plateau), being situated, geographically, in the Moldova-Siret interfluve, at the interference with the major river bed of Moldova river.

The aerophotogrammetric elevation of the Drăgușeni territory was performed based on the flight from July 2nd, 2009, conducted by Estereofoto Geoegenharia S.A., the main beneficiary of this action being the Agency of Payments and Intervention for Agriculture in Romania. In the first phase, technical data of the graphic entities of the physical blocks were collected, being then identified on the digital orthophotoplan of Drăgușeni commune (SIRSUP code 148382).

On the raster images of the digital orthophotoplan there have been overlaid ”the thematic layers” provided by both soil map drawn at scale 1:10000 as well as by the existent correlative maps. From the thematic maps used for the case study, the ones mentioned are those referring to the soil cover and the quality and/or favorability classes; they were drawn up based on the pedological mapping process and the quality assessment process of the agricultural fields in natural conditions. The soil units have been mapped according to the technical requirements pointed out at the level of the ecologic homogenous territorial surfaces for the use categories of the agricultural fields. The general structure of the relational model included collecting the primary technical data of the digital orthophotoplan and obtaining the scanned/digitalized spatial data of the soil maps from the territory of Drăgușeni commune. The conversion to the digital format of the graphic support of the soil map and/or cadastral quality assessment was made within the precision limits determined by the graphic error reference function of ± 0.2, at scale 1 : 10 000.

On the digital graphic support of the agricultural field covered by the 173 physical agricultural blocks, was overlaid the thematic plan of the soil cover map which, in the conditions in which it was analyzed, it was identified due to a total number of 26 soil cartographic units with the surface of 2168.71 ha.

The statistical analysis of the correlation between the qualitative and technical data of the agricultural cadastre was performed for the control surface of the geodetic trapezium with nomenclature L-35-30-A-a-1-III (Drăgușeni), scale 1 : 5 000.

This case study includes the calculations for the rectangular plane Stereographic 1970 coordinates, based on the ellipsoidal geographic coordinates of the trapezium’s corners considered, using the constant coefficients formulae, with a precision of ± 0.001m.

The graphic entities of the physical agricultural blocks and the soil-land cartographic units, respectively, from the lower part of the trapezium, scale 1 > 5 000, were delimited, calculated and compensated on its control area.

RESULTS AND DISCUSSIONS

The administrative territory of Drăguşeni commune, Suceava county was cartographically represented between the South latitude of 47°16'15", and the North latitude of 47°21'15", and West longitude 26°26'15" and East longitude 26°35'37".5 (Fig. 1).

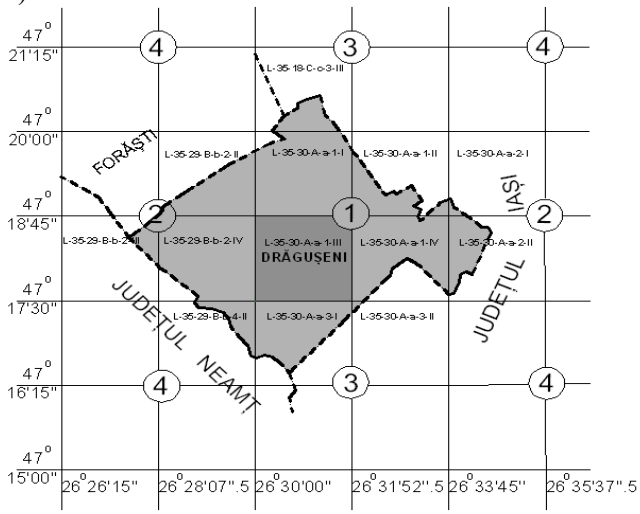

Fig. 1 - Cartographic representation of the territory of Drăguşeni

From the general scheme of the connection of geodesic trapeziums, resulted the following cartographic framing of the Drăguşeni territory: 3 map sheets at scale 1 : 50 000, 3 map sheets at scale 1 : 25 000, 6 map sheets at scale 1 : 10 000 and 13 plan sheets for the scale 1 : 5 000.

a. Calculation of the cartographic base for plan sheets

The case study was performed based on the graphic fond of the basic cadastral plan, scale 1:5 000 **nomenclature L-35-30-A-a-1-III**, which included 100% the territory of Drăguşeni commune. The calculation algorithm included, first of all, the process of determining the Stereographic coordinates from the "*tangent plan*", parallel with the unique secant plan – 1970, based on the following general relations:

$$X_{tg} = (a_{00} + a_{10}f + a_{20}f^2 + a_{30}f^3 + a_{40}f^4 + a_{50}f^5 + a_{60}f^6)\ 1.000 + (a_{02} + a_{12}f + a_{22}f^2 + a_{32}f^3 + a_{42}f^4)\ l^2 + (a_{04} + a_{14}f + a_{24}f^2)\ l^4 + (a_{06} + \ldots)\ l^6 + \ldots. \quad [m]$$

$$Y_{tg} = (b_{01} + b_{11}f + b_{21}f^2 + b_{31}f^3 + b_{41}f^4 + b_{51}f^5)\ l + (b_{03} + b_{13}f + b_{23}f^2 + b_{33}f^3)\ l^3 + (b_{05} + b_{15}f + \ldots)\ l^5 + \ldots \quad [m]$$

where: $\mathbf{f = 10^{-4}(\varphi_i - \varphi_0)''}$ - the latitude difference between the given point $P_i(\varphi_i, \lambda_i)$ and the projection pole Q_0 (φ_0, λ_0);

$\mathbf{l = 10^{-4}(\lambda_i - \lambda_0)''}$- the longitude difference between the given point Pi(φi, λi) and the projection pole Q_0 (φ_0, λ_0).

The numeric values of the geographic coordinates from the Krasovschi – 1940 ellipsoid and Stereographic – 1970 of the trapezium's corners with nomenclature L-35-30-A-a-1-III and the **control surface**, respectively, are presented in Table 1.

Table 1

Coordinates of L-35-30-A-a-1-III trapezium corners and the area on the Krasovski - 1940 reference ellipsoid and in Stereo-1970 projection plane

No.	Point position	Geographic coordinates		Stereo -70 coordinates	
		φ (° ' ")	λ (° ' ")	X (m)	Y (m)
1	North - West	47 18 45	26 30 00	613401.689	646954.986
2	North - East	47 18 45	26 31 52.5	646954.986	647000.443
3	South - West	47 17 30	26 30 00	613445.784	644639.278
4	South - East	47 17 30	26 31 52.5	615809.075	644684.744
Trapezium area (ha)		**547.4066 ha**		**547.3600 ha**	

Non-spatial database (areas occupied by the cadastral parcels, agricultural physical blocks, land-soil map units) was calculated and compensated by the **control area** of **547.3600 ha** of the considered trapezium at scale 1: 5 000.

b. Delimitation of soil cartographic units on plan sheets, scale 1: 5000, and calculation of areas

Pedological mapping carried out in the area corresponding to the agricultural, outlined the classification of soils in **26 land-soil units**. On the plan sheet considered in the case study were identified a number of **9 land-soil units** with an area of **492.30 ha**, (Table 2).

Table 2

Spatial distribution of soil cartographic units from the geodetic trapezium L-35-30-A-a-1-III – Drăguşeni

Code of the cartographic soil unit	Name of the soil cartographic unit from the geodetic trapezium	Surface of the soil unit from the geodetic trapezium	
		ha	%
US 5/1	Stagnic Phaeozems	2.93	0.5
US 8/2	Haplic Luvisols	70.41	12.9
US 8/4	Haplic Luvisols	20.15	3.7
US 10/4	Luvic Phaeozems	6.58	1.2
US 10/5	Luvic Phaeozems	5.63	1.0
US 14/1	Stagnic-Luvic Phaeozems	193.37	35.3
US 16/1	Stagnic-Luvic Phaeozems	36.18	6.6
US 17/1	Stagnic-Luvic Phaeozems	27.57	5.0
US 20/4	Haplic Luvosol	11.73	2.1
US 24/1	Mollic-Calcaric Gleysols	31.94	5.8
US 24/7	Mollic-Calcaric Gleysols	1.43	0.3
US 501/1	Calcaric Regosol	84.39	15.4
Incorporated area Drăguşeni		55.06	10.1
Trapezium area	-	547.36	100.0

In the study we conducted there have been identified **12 areas of soil cartographic units**, differentiated in the surfaces from 1.43 ha (US 24/7) until 193.37 ha (US 14/1), (Fig. 2).

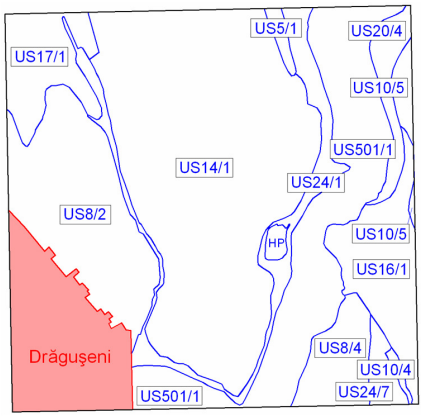

Fig. 2 - Graphic database of soil units from the trapezium L-35-30-A-a-1-III

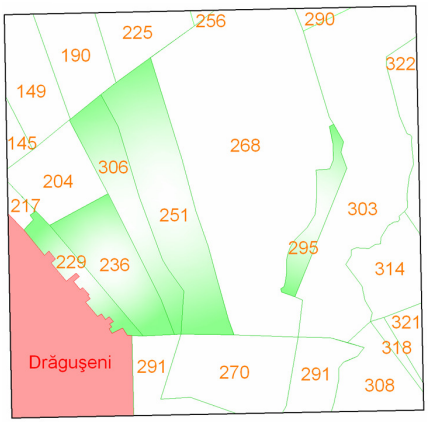

Fig. 3 - Graphic database of agricultural blocks from the trapezium L-35-30-A-a-1-III

c. Cadastral delimitation of territorial units on the plan sheets at scale 1 : 5 000, and area calculations

In accordance with the *technical norms for introducing the general cadastre*, the elaboration of the main cadastral plan in analog form has to be made on map sheets (trapeziums) in the Stereo-70 Projection System.

In order to verify the calculation method for the areas of the territorial cadastral units from the plan sheets, the known area of the trapezium is used. In the case of the digital orthophotomap, with nomenclature L-35-30-A-a-1-III, corresponding to the cadastral territory of Drăguşeni village, two separate cadastral units, namely, the residential and the unincorporated rural area, respectively, were bounded according with the current legislation. Areas calculated and compensated on the **control surface** of the trapezium of **547.36 ha** were **492.30 ha** for the unincorporated rural and **55.06 ha** for the residential.

In the inner frame of the plan sheet were bounded a number of **22 physical blocks**. The distribution of agricultural land in rural area covered **8 physical blocks** with limits of the areas between **0.50 ha** and **10.0 ha**, **12 physical blocks**, with limits from **10.01 ha** up to **30.0 ha** and **2 physical blocks**, with limits from **30.01 ha** up to **130.0 ha** (Fig. 3 and Table 3).

d. Storage of spatial data for the land-soil cartographic units on the orthophotomap digital medium

By integrating the spatial database of the land-soil maps with specific data for agricultural physical blocks from the ortophotomaps content, has resulted the database information medium. The experimental model achieved for the plan sheet L-35-30-A-a-1-III ensures the access to the database at the level of all 22 physical blocks. **For instance**, by accessing the physical block with the **cadastral number 251**, results the following types of spatial and non-spatial data: physical block area = **39.47 ha**; use: **agricultural land**; average slope = **6.40%**; land-soil units and types: (**US 14/1** and **US 24/1**); topographic elements of land; parcel owners; agricultural crops (Fig. 4).

Table 3

Delimitation of soil units on the agricultural physical blocks from the geodetic trapezium L-35-30-A-a-1-III – Drăguşeni

Code of the agricultural physical block	Surface of the agricultural physical block from the geodetic trapezium		Spatial distribution of soil unit on the surface of the agricultural physical blocks
	ha	%	
148382-145	3.11	0.6	US 8/2; US 17/1
148382-149	19.27	3.5	US 8/2; US 17/1
148382-190	18.34	3.3	US 8/2; US 14/1; US 17/1; US 24/1
148382-225	14.37	2.6	US 14/1
148382-256	0.63	0.1	US 14/1
148382-290	2.17	0.4	US 24/1; US 501/1
148382-322	10.70	2.0	US 10/5; US 16/1; US 20/4
148382-314	16.77	3.1	US 16/1
148382-303	96.52	17.6	US 8/4; US 16/1; US 20/4; US 24/1; US 501/1
148382-295	8.20	1.5	US 24/1; US 501/1
148382-268	121.77	22.2	US 5/1; US 14/1; US 24/1; US 501/1
148382-251	39.47	7.2	US 14/1; US 24/1
148382-306	21.73	4.0	US 8/2; US 14/1; US 17/1; US 24/1
148382-204	17.40	3.2	US 8/2
148382-217	2.32	0.4	US 8/2
148382-236	4.45	0.8	US 8/2; US 14/1
148382-229	21.70	4.0	US 8/2
148382-291	24.50	4.5	US 8/2; US 14/1; US 24/1; US 501/1
148382-270	25.84	4.7	US 14/1; US 24/1; US 501/1
148382-308	16.54	3.0	US 8/4; US 10/4; US 16/1; US 24/7
148382-318	1.51	0.3	US 16/1; US 24/7
148382-321	4.99	0.9	US 16/1
Drăguşeni	55.06	10.1	Incorporated area Drăguşeni
Trapezium area	547.36	100.0	-

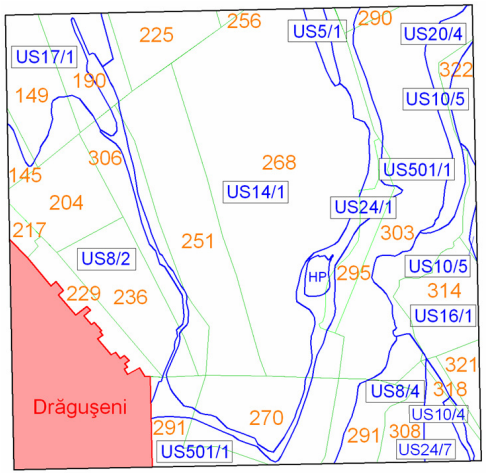

Fig. 4 - Integration of the spatial database of the soil units with the agricultural physical blocks, from the geodetic trapezium L-35-30-A-a-1-III

CONCLUSIONS

1. The integration of the graphic database of the soil units and of those taken from the digital orthophotoplan was performed on the **control area of 547.36 ha** of a geodetic trapezium, scale 1:5 000, from the territory of Drăguşeni.

2. The discrepancy between the vectored surfaces of the soil map and the digital surfaces of the orthophotoplan was compensated, at first, on the areas of the agricultural physical blocks, after which they were constrained and compensated on the **control area of 547.36 ha** of the trapezium used.

3. The experimental model of integrating the spatial database of soil cartographic units with that of agricultural physical blocks represents, from the user's point of view, knowing the data necessary for efficiently exploiting the agricultural land and taking the proper decisions, at the level of the administrative territorial units.

REFERENCES

1. **Băduț M., Blidaru G., 2006 –** *A Model of Exploiting the Ortho - Photograms for checking and Receiving the sporadic Cadastre Works and for graphical Database Completing.* RevCAD Journal of Geodesy and Cadastre, no. 6, p. 71-76, Alternates Publishing House; ISSN 1583-2279, Alba Iulia, România.
2. **David Viorica, 2007 –** *Importanța fotogrammetriei în generarea bazei de date SIG.* Revista de Geodezie, Cartografie şi Cadastru, volumul 16, nr.1-2, p. 34-42, Uniunea Geodezilor din România, ISSN 1454-7914, Iaşi, România.
3. **Florea N., 2002 –** *Hărțile de soluri la scară mică şi mijlocie.* Revista Ştiința Solului, seria a III-a, nr.2, volumul XXXVI, p. 111-123, Editura Signata, ISSN 1224-0303, Bucureşti, România.
4. **Moca V., Ilioi D., Radu O., Huțanu Cr., 2009** – *The use of digital orthophotoplans at the realization of spatial database for the cartographic soil units*. Lucrări ştiințifice, seria Agronomie, vol. 52, nr. 1, p. 383-390, Editura "Ion Ionescu de la Brad", ISSN 1457-7414, Iaşi, România.
5. **Moca V., Bucur D., Ilioi D., Curaleț Adr., Huțanu Cr., 2010** – *Soil resources and hydro - ameliorative improvements in the agricultural area of Suceava country*. Lucrări ştiințifice, seria Agronomie, vol. 53, nr. 3, p. 75-86, Editura "Ion Ionescu de la Brad", ISSN 1457-7414, Iaşi, România.
6. **Moca V., Cârdei Mihaela, Radu O., Huțanu Cr., Savu C., 2012** – *Evolution of surfaces calculation precision from the digital base of the orthophotograms and from field measurements using control areas of geodetic trapezium*. RevCAD Journal of Geodesy and Cadastre, no. 12, p. 71-76, Alternates Publishing House; ISSN 1583-2279 (www.uab.ro/reviste_recunoscute/revcad/), Alba Iulia, România.
7. **Voiculescu Florica, Banciu Ana Roxana, 2011** – *Tehnici LiDAR folosite la prelucrarea datelor şi realizarea produselor fotogrammetrice 3D*. Simpozionul "Geodezie Prezent şi Viitor", p. 243-254, Editura Conspress, ISSN 978-973-100-162-3, Bucureşti, România.
8. *****, 2013** – *Legea cadastrului şi a publicității imobiliare nr. 7/1996, cu modificările ulterioare.* Monitorul Oficial al României, partea I, nr. 83/07.02.2013, p. 3-16, 181 (XXV), Bucureşti, România.

RESEARCH ON CFD SIMULATION OF A NEW TYPE OF HIDROCLON USED IN THE WINEMAKING INDUSTRY

CERCETĂRI PRIVIND SIMULAREA CFD A UNUI NOU TIP DE HIDROCLON FOLOSIT ÎN INDUSTRIA VINIFICAȚIEI

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Abstract. *Currently, in winemaking industry, is seeking solutions for a separation of solid particles, whether organic or anorganic origin, both in must and in the final stage of the wines clarifycation. The advantages of using separation through hydrocyclones is given by the short time of separation, separation quality and not least, by the continued operation of the facility. New constructive forms for hydrocyclones have been possible as a result of the possibilities offered by CFD simulations (Computational Fluid Dynamics). In this work were made more CFD simulations for the optimization of a new hydrocyclone model, in terms of geometric and functional, with a view to increasing the efficiency of separation. The optimized hydrocyclone, proposed in the paper, has undergone experimental study and the CFD simulation coupling the Reynolds turbulence model for fluid flow with the discrete phase model for tracking the particles trajectory that will be separated inside.*
Key words: *winemaking, hydrocyclone, CFD simulations*

Rezumat. *În prezent, în industria vinificației, se caută soluții pentru o separare a particulelor solide, fie ele de origine organică sau anorganică, atât din must cât și în etapa finală de clarificare a vinurilor. Avantajele utilizării separării prin hidrocicloane este dată de timpul scurt al separării, calitatea separării și nu în ultimul rând de funcționarea continuă a instalației. Noi forme constructive pentru hidrocicloane au fost posibile ca urmare a posibilităților oferite de simulările CFD (Computational Fluid Dynamic). În această lucrare au fost realizate mai multe simulări CFD pentru optimizarea a unui nou model de hidrociclon, din punct de vedere geometric și funcțional, în vederea creșterii eficienței separării. Hidrociclonul optimizat, propus în lucrare, a fost supus studiului experimental, iar simularea prin CFD cuplează modelul de turbulență a lui Reynolds pentru curgerea lichidului cu modelul fazelor discrete pentru urmărirea traiectoriei particulelor ce urmează a fi separate în interiorul acestuia.*
Cuvinte cheie: *vinificație, hidrociclon, simulare CFD*

INTRODUCTION

The need to introduce a hydrocyclone in the technological flow of production of wines, is to separate a large amount of anorganic and organic particles, up to the dimensions of 8–10 μm (the size of a cell yeast).

New constructive forms for hydrocyclones were possible as a result of the possibilities offered by CFD simulations (**C**omputational **F**luid **D**ynamic).

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Ultimately, many experiments were carried out to determine the flow within a hydrocyclone. Knowles et. al.(1973) carried footage at high speed to track anisol drops moving in a hydrocyclone and to determine rates of the liquid flow. More recently, a number of researchers have carried out a series of measurements with laser (Laser Doppler Velocimetry - LDV) and by electrical impedance tomography (Dai, 1999; Hsieh and Rajamani, 1991).

Experimental methods proposed are expensive and difficult to implement from a technical perspective, being limited to a dispersed liquid phase. Along with experimental efforts, various analytical models have been established, in order to control and determine the flow characteristics of a hydrocyclone (Chen et. al., 2000; Nageswararao et. al., 2004; Plitt. et. al., 1976).

Most of the works have addressed the CFD simulation for determining flow and particle trajectory in conventional geometry hidrocicloane in various sizes.

As a result of experiments conducted by Băetu et. al. (2012), using a hydrocyclone whose geometry is shown in figure 1a, the authors demonstrated that the best speed, to obtain a must with a lower turbidity, is 1800 rpm.

Under the same experimental conditions and the particle trajectory simulation analysis of the must, it was observed that the separation efficiency for particles of 100 μm diameter is insignificant (4.28%).

The paper presents a new three-dimensional geometric model of hydrocyclone, which was constructive optimized by numerical modeling of the must flow and particle trajectories which initially are foundin the must. The CFD simulation of the hydrocyclone shows the particles separation degree

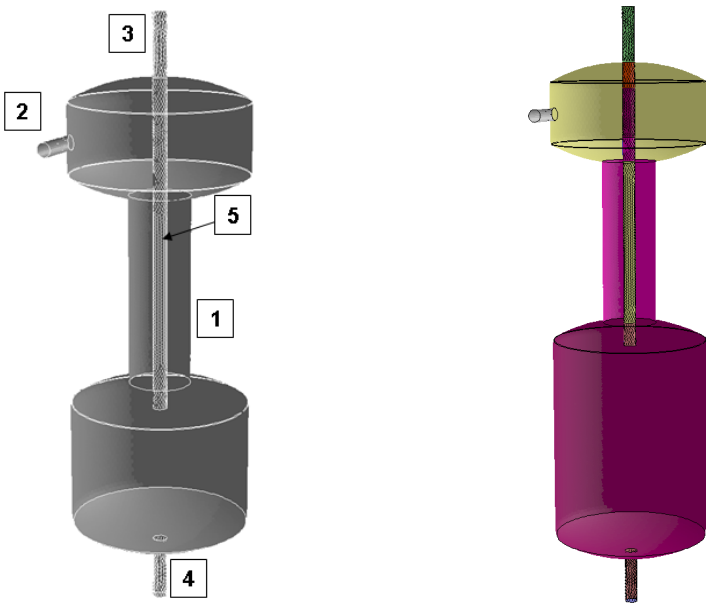
MATERIAL AND METHOD

The hydrocyclone, whose geometry is shown in figure 1a, used in experimental research, has two exits on the vertical axis: an outlet at the bottom, which typically is collected solid fraction (4), and an outlet at the top where it is discharged the clarified liquid or with a small amount of solid fraction (3). The entrance of the solid - liquid mixture passes through the top of the hydrocyclone and is positioned tangentially (2). As a result of the tangential entry, the suspension is partially agglomerated on the walls of the hydrocyclone, due to the effect of the centrifugal force, and the fluid flow and the form construction part pull the solid particles to the bottom of the hydrocyclone.

In order to increase the probability, that the most of the particles with a diameter of 100 μm to be separated, it recourse to lengthen the separation chamber of the hydrocyclone, by doubling the capacity, as shown in figure 1b.

The ultimate goal is to identify the optimal flow for a efficiently separation of the particles with a diameter of 100 μm and the evolution of these particles in conjunction with the must turbulence when flicking the hydrocyclone from entrance to the exit.

Physical parameters of the must and particles, introduced into the hydrocyclone, have the following values: must viscosity η = 0.0018 Pa/s, must density ρ_l = 1085 kg/m^3, particles density ρ_P = 1130 kg/m^3. The particle flow introduced in hydrocyclone trough the inlet connection shall be 10% of the must flow-rate. This flow of particulates must not exceed 10 – 12% and it fits in the recommendation of the FLUENT textbook (Ansys-Fluent – User Guide, 2010).



a b

Fig. 1 – The geometry of the originally hydrocyclone (a) and the geometry of the modified hydrocyclone (b):
1 – cylindrical body; 2 – input connection for must; 3 – output connection for the partially cleared must; 4 – connection for sediment purging; 5 - inner pipe collection for partially cleared must.

Experimental tests were performed more by varying the pump speed *n* of the hydrocyclone resulting different flow rates and different inlet speeds (table 1).

Table 1

Outline experimental conditions

Pump revolution n (rot/min)	**Speed**		**Flow rate**	
	u (m/s)	**u_P** (m/s)	**Q_l** (kg/s)	**Q_P** kg/s)
1200	2.62	2.62	0.358	0.0372
1500	3.10	3.10	0.423	0.0441
1800	3.63	3.63	0.488	0.0508
2100	3.93	3.93	0,531	0.0553

(u- must speed, u_p- particles speed, Q_l – inlet flow rate of the must, Q_p – inlet flow rate of the particles)

The separation of particles from the must, assume a knowledge of the nature of existing particles from the physical point of view, the particle diameter, geometric shape and the particles concentration in the must volume. The particles introduced in hydrocyclone separation simulation are considered to have a spherical shape and the size was 100 μm.

In order to characterize the turbulent flow occurring as a result of must rotation within the hydrocyclone, it is necessary to apply an appropriate turbulence model. RSM turbulence model (**R**eynolds **S**tress **M**odel) describes with a good precision the anisotropic turbulence (Wang et al., 2008; Xu et al. 2009).

The processing of the system of partial differential equations composed of continuity equation, moment equation, Reynolds tensions equation (**RSM**) and the equation of turbulent energy dissipation rate ε was performed using a segregated solver (equations are calculated so that the continuity equation is satisfied and local) with the program ANSYS - FLUENT V 3.6.26.

Simulated solids hydrocyclone movement is carried out by selecting the Lagrange model probabilistic (stochastic) tracking particle trajectory, model called DPM (**D**iscrete **P**article **M**odel) and was also performed with the program ANSYS - FLUENT V 6.3.26.

The simulation of the must flow and particle movement in hydrocyclone, in a reasonable time, was conducted with TYAN workstation (2XCPU-Intel Xeon 3.33 GHz RAM - 16 GB DDR3).

The results of processing are given in the speed fields form, the Reynolds (Re) turbulence form, the current lines form and particle trajectory form, for several sizes.

RESULTS AND DISCUSSIONS

Following the CFD simulation of the experimental data, it was found that the best results are obtained at a inlet rate flow of 0.531 kg/s. This was achieved by changing the flow speed to 2100 rpm.

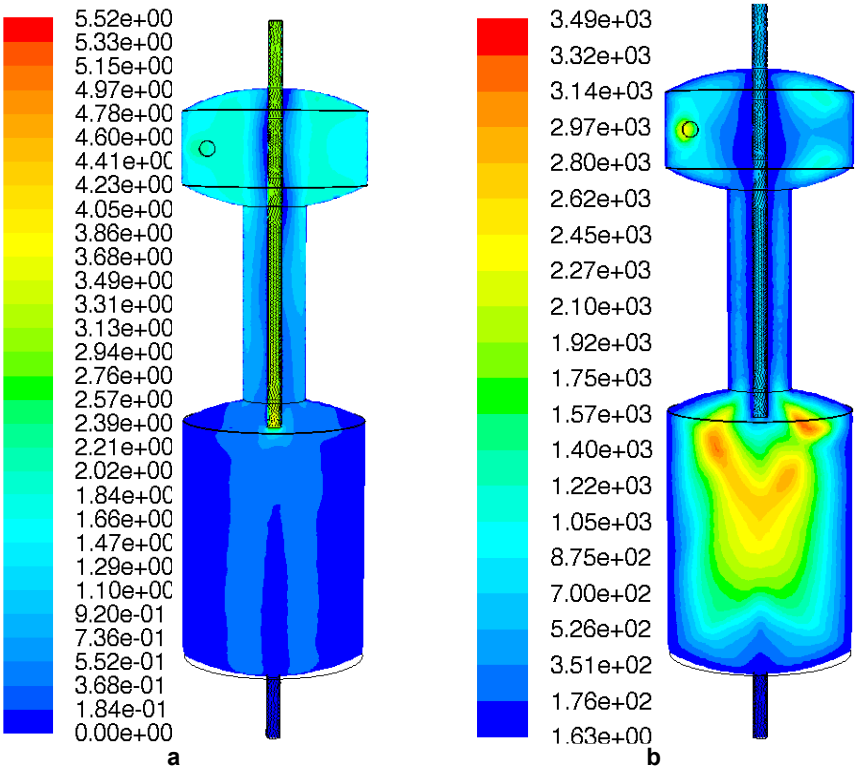
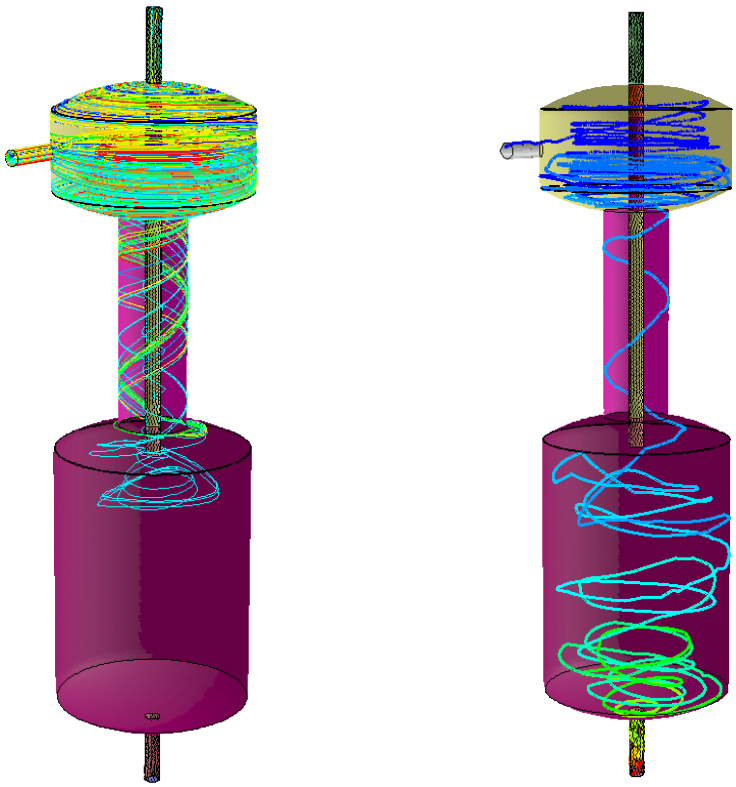


Fig. 2 - Representation of the must speed profile **(a)** and the Re number profile in the hydrocyclone **(b)** at a inlet flow rate of 0.531 kg/s

At the input maximum flow of the must in the hydrocyclone, the distribution of the field of speed (fig. 2a) show a different speed of 0 in the sedimentary body, on the vertical sedimentation pipe direction.

Moreover, it can be seen that, through the representation of the speed field, it shows an increase of must speed in upper body where the centrifugal forces prevail, and as the fluid forward towards the bottom, the field speed intensity drops by allowing the particles to settle.

The turbulence field given by the Reynolds number (fig. 2b) is higher in the upper body of the hydrocyclone, where centrifugal force predominates. Here, it can be observe an increase of the turbulence in the upper part of the separation chamber and its decrease in the particles deposit on the drain pipe.



a **b**

Fig. 3 - Representation of the current lines (**a**) and the trajectory of a particle with dp = 100 μm in the hydrocyclone (**b**) at a inlet rate of 0.531 kg/s

The current lines obtained by CFD simulation (fig. 3a), after the stabilization of the must flow, at a maximum must rate entry, don't have trajectories to reach the bottom wall of the sedimentation bod. Thus, it can be say that, the most many particles with de diameter of 100 μm will settle on the drain pipe.

In figure 3b it can be seen that the representation of a sinuous trajectory of a particle in the hydrocyclone, due to high turbulence, it is finally deposited on the drain pipe.

CONCLUSIONS

1. The mathematical modeling and the CFD simulation (Computational Fluid Dynamic) of the mixture flowing in the proposed hydrocyclone, show us the flow regime from inside as well as the trajectories of the fluid current lines and of the solid particles.

2. The advantages of using CFD simulation on a hydrocyclone are saving time and material resources, when using performance programs and hardware (FLUENT, TYAN workstation).

3. By using the CFD simulation, which are based on experimental data, we can design new types of hydrocyclone, in order to obtain optimal variants to increase the efficiency of separation

REFERENCES

1. **Băetu M.M., Țenu I., Cârlescu P., Pahoni C., Barcan (Băetu) Alina Loredana, 2012** - *Research on experiment the hydrocyclon SLV02 for the partial separation of the must,* Lucrări științifice, USAMV Iasi, Seria Horticultura, vol. 55, nr.1, p. 537-540.
2. **Chen W., Zydek N., Parma F., 2000 -** *Evaluation of hydrocyclone models for practical applications*, Chem. Eng. J., 80, , p. 295-303.
3. **Dai G.Q., Chen W.M., Li J.M., Chu L.Y., 1999** – *Experimental study of solid-liquid two-phase flow in a hydrocyclone.* Chem. Eng. J., 74, p. 211-216.
4. **Hsieh K.T., Rajamani R.K., 1991** – *Mathematical-model of the hydrocyclone based on physics of fluid-flow,* AIChE J., 37, p. 735-746.
5. **Knowles S.R., Woods D.R., Feuerste I.A. 1973** – *Velocity distribution within a hydrocyclone operating without an air core,* Can. J. Chem. Eng., 51, p. 263-271.
6. **Nageswararao K., Wiseman D.M., Napier-Munn T.J., 2004** – *Two empirical hydrocyclone models revisited,* Miner. Eng., 17, p. 671-687.
7. **Plitt L.R., 1976** – *A mathematical model of the hydrocyclone classifier*, CIM Bull., 69, p. 114-123.
8. **Wang B., Yu A.B., 2008** – *Numerical Study of the Gas-Liquid-Solid Flow in Hydrocyclones with Different Configuration of Vortex Finder*, Chem Eng J.,vol. 135, p. 33-42.
9. **Xu P., Wu Z., Mujumdar A.S., Yu A.B., 2009** - *Innovative Hydrocyclone Inlet Designs to Reduce Erosion-InducedWear in Mineral Dewatering Processes*, Drying Tech., Vol. 27, p. 201-211.
10. *****,** 2010 – *Ansys-Fluent – User Guide*

RESEARCH CONCERNING SCARIFICATION INFLUENCE ON SOIL FERTILITY AND AGRICULTURAL PRODUCTION ON SLOPES

CERCETĂRI PRIVIND INFLUENȚA SCARIFICĂRII ASUPRA FERTILITĂȚII SOLULUI ȘI PRODUCȚIEI AGRICOLE PE TERENURI ÎN PANTĂ

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Abstract. *Soil compaction on slopes leads to worsening of aeration regime, reducing water capacity and permeability of the soil and also to increased loss of water from surface runoff. As an effective method of soil loosening can be scarification. In the literature there are no arguments for parameters that vary depending on soil texture, landscape and crop. This paper provides farmers experimentally reasoned knowledge about the frequency of scarification, the distance between cracks and its depth.*
Key words: *crop yield, scarification, soil fertility, water conservation.*

Rezumat. *Tasarea solului pe pante conduce la înrăutățirea regimului de aerație, micșorarea capacității și permeabilității pentru apă a solului și totodată conduce la majorarea pierderilor de apă din precipitații și scurgerile de suprafață. Ca procedeu eficient de afânare a solului poate servi scarificarea. Actualmente în literatura de specialitate nu sunt argumentați parametrii ce variază în dependență de textura solului, relief și cultură. Prezenta lucrare pune la dispoziție agricultorilor cunoștințe argumentate experimental despre periodicitatea de scarificare, distanța între fisuri și adâncimea ultimei.*
Cuvinte cheie: *fertilitate, recolta, scarificarea, umiditatea solului.*

INTRODUCTION

Erosion is the main factor of soil degradation on slopes (Krupenikov, 2004). The harmful effects of the erosion are: decrease of soil fertility and crop production, worsening of hydric regime, increase of drought effect etc. An important role for runoff decrease and erosion reduction on agricultural lands has soil scarification. It contributes to water conservation in soil, maintaining of a good physical soil state and, at the same time, reduces fuel consumption. The main purpose of our research was elaboration of optimal technologic parameters for scarification of eroded arable soils. The next objectives were achieved: 1. Assessment of the effectiveness of different periodicity of scarification; 2. Determination of necessary scarification depth; 3. Argumentation of optimal distance between the fissures. The article describes modifications of properties of moderately eroded ordinary chernozem from the South part of Republic of Moldova after the scarification.

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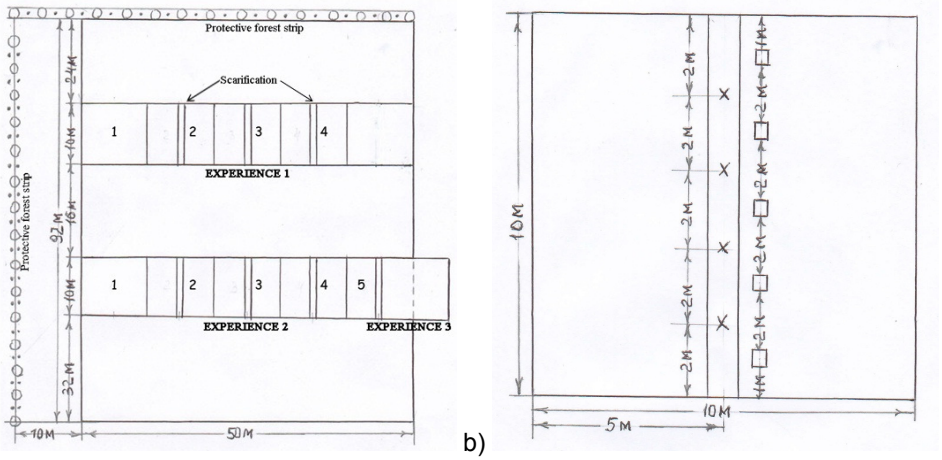
MATERIAL AND METHOD

It is well known that scarification is an efficient method of soil loosening (Dumitrescu, 1979; Stancu, 2005; Douglas, 2006; Alincăi, 2007). But in literature there are no experimentally based arguments for such parameters as optimal periodicity, depth and distance between the fissures for scarification, that will evidently vary depending on soil texture, relief and temperature. According to that, in autumn 2001 at the experimental station of Institute of Pedology, Agrochemistry and Soil Protection "Nicolae Dimo", Ursoaia village, Cahul district, three experiments were founded (figure 1 A). The experiments were set up on moderately eroded ordinary chernozems on a slope 5-7° with northeast exposition.



a) b)

Fig. 1 - A) Experiences location scheme; B) Experience scheme: x - soil sample points; □ – crop yield sample points

Each experimental variant contains two fissures at a depth of 40 cm oriented across the slope (figure 1 B). The experimental plots are 10 m long. Between the pairs of fissures four soil sample points are set up. Among this sample points and 1 m downhill the fissures, in five points was made crop accounting (experience 1).

Assessment of the effect of scarification periodicity was made through determination of water reserves in soil annually in March, bulk density, total porosity, humus content, mobile forms of phosphorus and potassium and crop yields. Annually chemical fertilizers ($N_{60}P_{30}$) were applied. Scheme of the second experience, length of experimental plots and distance between them, soil and crop yield sample points are similar to the first experiment (figure 1 A). In the second experiment scarification was made once during the foundation. In the next years (year 2, 3, 4) it was determined the length of post action of scarification at different depth. Estimation of scarification optimal depth was made through determination of the same indices as from the first experiment. Annually in spring chemical fertilizers ($N_{60}P_{30}$) were applied. Estimation of the optimal distance between the fissures was made through determination of water reserves accumulated in 0-100 cm of soil at different distances downhill the fissures.

RESULTS AND DISCUSSIONS

The research results revealed that scarification of moderately eroded ordinary chernozems had a benefic influence on soil total water reserves (table 1)

Table 1

Influence of scarification on total water reserves (m^3/ha) in 0-100 cm layer depending on different parameters

Variant / Crop, year	Winter barley	Maize	Sunflower	Winter wheat
Experience 1. Determination of scarification optimal periodicity of eroded soils				
1) Control plot (20 cm tillage)	2153	2124	2186	2167
2) Annual scarification	2344	2327	2402	2388
3) Scarification once in 2 years	2336	2318	2378	2382
4) Scarification once in 3 years	2227	2210	2279	2243
5) Scarification once in 4 years	2221	2196	2270	2238
Experience 2. Determination of scarification optimal depth of eroded soils				
1) Control plot (20 cm tillage)	2354	2291	2443	2172
2) Scarification at 20 cm	2473	2373	2552	2266
3) Scarification at 40 cm	2578	2495	2666	2381
4) Scarification at 60 cm	2597	2510	2680	2400
Experience 2. Determination of optimal distance between the pairs of fissures				
1) Control plot (20 cm tillage)	2339	2178	2277	2196
2) 1 m from the scarification line	2573	2419	2504	2400
3) 2 m from the scarification line	2556	2411	2488	2393
4) 3 m from the scarification line	2434	2282	2360	2290
5) 4 m from the scarification line	2427	2269	2355	2271

In comparison with the control plot, periodic scarification contributed to additional water accumulation in 0-100 cm layer. The reserves were higher by 68-191 m^3/ha at winter barley, 72-203 m^3/ha at maize, 84-216 m^3/ha at sunflower and 72-221 m^3/ha at winter wheat. The best results were obtained on variants with annual scarification and once in two years at all crops with similar results. The best effect of water accumulation was obtained on variants with scarification made at a depth 40 cm and 60 cm. The values of water reserves here are approximately identical. The highest values of water reserves in 0-100 cm layer were obtained at scarification with distance between the fissures 1-2 m that was considered optimal. Laboratory analysis revealed some changes of physical and chemical properties in tilled layer as well as in the underlying layers after periodic scarification (table 2).

Soil bulk density varies between 1,18 and 1,26 g/cm^3. The lowest values were obtained at the scarification once in two years where a sharp increase was established (1,18 g/cm^3). At the same time total porosity increased to 55,1% in comparison with control plot (52,6%). It was established an increase of humus content and nutritive elements in soil in conditions of scarification with best results at annual scarification and once in two years.

Table 2

Influence of periodic scarification on physical and chemical properties of moderately eroded ordinary chernozems, 2002-2005

Depth, cm	Bulk density, g/cm^3	Porosity, %	Humus content, %	P_2O_5	K_2O
				mg/100 g soil	
Control plot (20 cm tillage)					
0-20	1,26	52,6	2,29	1,44	16,1
20-40	1,34	49,4	1,47	0,99	14,3
40-60	1,35	49,6	0,89	0,47	13,2
Annual scarification					
0-20	1,22	53,8	2,52	2,47	20,4
20-40	1,26	52,6	1,64	1,71	18,3
40-60	1,29	50,4	1,12	1,02	15,1
Scarification once in 2 years					
0-20	1,18	55,1	2,51	2,43	21,7
20-40	1,22	53,8	1,62	1,69	17,8
40-60	1,27	51,0	1,10	0,81	14,2
Scarification once in 3 years					
0-20	1,25	52,3	2,41	1,98	18,3
20-40	1,33	49,6	1,53	1,36	15,4
40-60	1,34	49,4	0,93	0,75	14,8
Scarification once in 4 years					
0-20	1,26	52,4	2,39	1,81	17,9
20-40	1,35	49,6	1,51	1,30	15,9
40-60	1,35	50,0	0,91	0,66	14,4

Some significant changes were established in moderately eroded ordinary chernozems in dependence of scarification depth (table 3).

Table 3

Influence of scarification depth on physical and chemical properties of moderately eroded ordinary chernozems, 2002-2005

Depth, cm	Bulk density, g/cm^3	Porosity, %	Humus content, %	P_2O_5	K_2O
				mg/100 g soil	
Control plot (20 cm tillage)					
0-20	1,29	50,4	2,27	1,42	15,9
20-40	1,34	49,4	1,49	0,98	14,1
40-60	1,37	46,7	0,93	0,51	12,8
Scarification at 20 cm					
0-20	1,30	49,6	2,37	1,84	17,2
20-40	1,34	49,4	2,56	1,35	15,0
40-60	1,36	47,2	1,02	0,69	13,2
Scarification at 40 cm					
0-20	1,19	54,4	2,61	2,49	20,8
20-40	1,23	53,0	1,68	1,76	18,1
40-60	1,29	50,4	1,20	1,07	15,9
Scarification at 60 cm					
0-20	1,22	53,8	2,64	2,51	21,1
20-40	1,26	52,6	1,73	1,84	18,4
40-60	1,27	51,0	1,21	1,12	16,1

The lowest values of bulk density were registered in arable layer at scarification depth 40 cm and 60 cm (1,19 and 1,22 g/cm^3). Total porosity increased up to 53,8 and 54,4%. In this conditions it was established an increase of humus content and nutritive elements respectively: 0,33 and 0,37%, 1,07 and 1,09 mg/100 g soil, 5,2 and 5,9 mg/100 g soil. In both layer this values are almost identical.

The influence of deep scarification on crop production was determined. It was established that periodic scarification increased crop yield of winter barley by 242-449 kg/ha (17-32%) in comparison with control plot (table 4).

Table 4

Influence of periodic scarification on crop production on moderately eroded ordinary chernozems, 2002-2005

Variant	Crop production		
	kg/ha	%	Crop increase
Winter barley, 2002			
1) Control plot (20 cm tillage)	1412	100	-
2) Annual scarification	1861	132	449
3) Scarification once in 2 years	1843	131	431
4) Scarification once in 3 years	1701	121	289
5) Scarification once in 4 years	1654	117	242
LSD (The Least Significant Difference) 0,5% - 317			
Maize, 2003			
1) Control plot (20 cm tillage)	3312	100	-
2) Annual scarification	3700	112	388
3) Scarification once in 2 years	3669	111	357
4) Scarification once in 3 years	3569	108	257
5) Scarification once in 4 years	3487	105	175
LSD 0,5%	273		
Sunflower, 2004			
1) Control plot (20 cm tillage)	1214	100	-
2) Annual scarification	1546	127	332
3) Scarification once in 2 years	1528	126	314
4) Scarification once in 3 years	1397	115	183
5) Scarification once in 4 years	1355	112	141
LSD 0,5%	204		
Winter wheat, 2005			
1) Control plot (20 cm tillage)	1324	100	-
2) Annual scarification	1713	129	389
3) Scarification once in 2 years	1681	127	357
4) Scarification once in 3 years	1440	109	116
5) Scarification once in 4 years	1415	108	91
LSD 0,5%	152		

The research results revealed that the highest crop yields were achieved at scarification at a depth of 40 cm and 60 cm (table 5). Crop increase of winter barley was 400 and 425 kg/ha, maize 342 and 374 kg/ha, sunflower 314 and 329 kg/ha, winter wheat 391 and 469 kg/ha.

Table 5

Average crop yields at different scarification depth on moderately eroded ordinary chernozems, 2002-2005

Variant	Crop production		
	kg/ha	%	Crop increase
Winter barley, 2002			
1) Control plot (20 cm tillage)	1397	100	-
2) Scarification at 20 cm	1507	108	110
3) Scarification at 40 cm	1798	129	401
4) Scarification at 60 cm	1822	130	425
LSD 0,5%	203		
Maize, 2003			
1) Control plot (20 cm tillage)	3289	100	-
2) Scarification at 20 cm	3428	104	139
3) Scarification at 40 cm	3631	110	342
4) Scarification at 60 cm	3663	111	374
LSD 0,5%	178		
Sunflower, 2004			
1) Control plot (20 cm tillage)	1199	100	-
2) Scarification at 20 cm	1318	110	119
3) Scarification at 40 cm	1513	126	314
4) Scarification at 60 cm	1528	127	329
LSD 0,5%	238		
Winter wheat, 2005			
1) Control plot (20 cm tillage)	1301	100	-
2) Scarification at 20 cm	1398	107	97
3) Scarification at 40 cm	1692	130	391
4) Scarification at 60 cm	1770	136	469
LSD 0,5%	259		

CONCLUSIONS

1. Scarification influences the majority of soil properties located on slopes increasing its fertility and crop productivity.

2. We recommend performing scarification of soil on slopes once in two years at a depth of 40-50 cm with distance between the fissures 1-2 m.

REFERENCES

1. **Alincăi C., 2007 –** *Agrotehnica terenurilor arabile.* Ed. Ion Ionescu de la Brad, Iași, p. 119-187.
2. **Douglas L., et. al., 2006** – *Assessing soil quality at a watershed scale in North central Iowa, USA*. International soil tillage research conference, Kiel, Germany, p. 1255-1267.
3. **Dumitrescu N., Popa A., 1979 -** *Agrotehnica terenurilor arabile în pantă.* Ed. Cereș, București, p. 23.
4. **Krupenikov I., 2004** – *Consecințele biosfero-ecologice ale proceselor erozionale. Evoluarea fertilității solurilor erodate.* Eroziunea solului. Ed. Pontos, Chișinău, p. 72-97.
5. **Stancu I., 2005** – *Cercetări privind influența nivelării și fertilizării minerale asupra nivelului și calității producției de porumb pentru boabe*. Revista de politica științei și scientometrie nr. sp. 2005-ISSN-1582-1218, p. 15.

THE EVALUATION OF SOME WHEAT VARIETIES RESISTANCE TO INFECTION WITH PATHOGEN *TILLETIA CARIES* (D.C.) TUL.

EVALUAREA REZISTENȚEI UNOR SOIURI DE GRÂU LA INFECȚIA CU AGENTUL PATOGEN *TILLETIA CARIES* (D.C.) TUL.

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Abstract. *The necessity to establish the presence and distribution of the pathogens in some area has a major impact on wheat plants because they have a high food share. Although, in the conventional culture, the disease can be relatively easily controlled by chemical seed treatments, in ecological agriculture this treatments is restricted, therefore cultivation of resistant wheat varieties have importance for agriculture. This study contains data about bunt resistance of 24 wheat varieties artificially infected with Tilletia caries (D.C.) Tul., sin. T. tritici. The experiment was organized at the Ezăreni farm from University of Agricultural Sciences and Veterinary Medicine in 2011-2012 year. Based on the observations made regarding the evolution of pathogen the Tilletia caries (DC) Tul., on the studied varieties, we recorded a high variation of the attack. Some varieties have been shown to be resistant and others are registered in the attack maximum value of 12.78%.*
Key words: *bunt, wheat varieties, resistance*

Rezumat. *Necesitatea stabilirii prezenței şi distribuției agenților patogeni într-o anumită zonă prezintă o importanță majoră mai ales pentru plantele de grâu deoarece acestea au o pondere alimentară mare. Deşi, în cultura clasică boala poate fi combătută uşor prin tratamente chimice la semințe, în cultura ecologică aceste tratamente sunt interzise, astfel cultivarea de soiuri rezistente prezintă o importanță majoră. Lucrarea conține date referitoare la rezistența a 24 de soiuri de grâu la infecția artificială cu agentul patogen Tilletia caries (D.C.) Tul., sin. T. tritici. Experiența a fost organizată la Ferma Didactică Ezăreni din cadrul Stațiunii Didactice a Universității de Ştiințe Agricole şi Medicină Veterinară Iaşi, în anul agricol 2011-2012. Evoluția agentului patogen Tilletia caries (D.C.) Tul., urmărită la soiurile luate în studiu a condus la înregistrarea unor variații mari ale gradului de atac. Unele soiuri s-au dovedit a fi rezistente iar altele au înregistrat valori maxime ale gradului de atac de 12,78%.*
Cuvinte cheie*: mălură, soiuri de grâu, rezistență*

INTRODUCTION

Bunt is one of the most common diseases of wheat crop and in the organic wheat culture it produces high yield losses (Wilcoxson and Saari, 1996). In conventional culture the control of this disease can be relatively easy made by

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chemical treatments on seed. However, in organic farming, these treatments are restricted therefore an effective control of the disease can be achieved through the cultivation of resistant varieties. In recent years, the interest for this type of agriculture began to increase more, this why it is important to pay special attention to this disease. The main objective of this study was to test some wheat cultivars in terms of their response to artificial infection with *Tilletia caries* (DC) Tul. and to observe their behavior in the field.

MATERIAL AND METHOD

The biological studied material is represented by a number of 24 wheat varieties, 5 of them indigenous and the rest of them imported from other UE countries. The wheat caryopses were artificially infected with *Tilletia caries* the (DC) Tul. teliospores. After the artificial infection, they were sown in a randomized block type experiences in 4 repetitions at the Ezăreni Farm from the University of Agricultural Sciences and Veterinary Medicine Iasi. During the growing season there have been made observations and measurements to determine infection with *Tilletia caries* (DC) Tul. Quantification of infection in the studied varieties was achieved by determining the frequency of infected ears from the total number of spikes contained in the metrics frame (Severin and Cornea, 2009). For the artificial infection of the studied wheat varieties we used infected caryopses provided by The Phytosanitary Directions of Covasna, Valcea and Vaslui Countys. After the identification of *Tilletia caries* species (DC) Tul. from the caryopses, the infection inoculum was obtained by crushing infected wheat caryopses. Thus for the artificial infection of 24 wheat varieties we used 0.1 g spores *Tilletia caries* (DC) Tul. for 250 healthy caryopses of wheat. The samples were mixed continuously for 1 minute in a Erlenmeyer glass (Dumalasová Veronika and Bartos, 2010) and then sown under wheat cultivation technology.

RESULTS AND DISCUSSIONS

The young ears infected with *Tilletia caries* (DC) Tul. have generally darker aspect and remain green longer, compared with healthy ears. The specific blight symptoms appear generally after wheat earing when the infected ears are thin, green-blue to normal color, yellowish green and ruffled aristele of the infected spikes occur at an angle greater major axis of the ear.

The specific simptom of bunt can be observed at the flag leaf sheath opening stage when it can be seen that the infected ears have a higher number of kernels, all spikelets are fertile and ear position is upright until harvest. The first symptoms of bunt attack on the studied material were observed after the earring stage of wheat plants. The plants which were attacked by *Tilletia caries* (D.C.) Tul. showed spikes with ruffled awns, lemma and paleas easily removed due to the shape kernels infected.

Based on observations made during the vegetation period there was a large variability of resistance of the 24 wheat varieties to *Tilletia caries* (DC) Tul. pathogen attack. The mean frequency of the infected ears had not ovecome 13% although in some repetitions, varieties such as Accor and S0 07 had values of the infection rate of 30.23% and 24 16% (fig. 1). In terms of the agricultural year 2011-2012 most studied varieties recorded a good resistance to infection with

Tilletia caries (DC) Tul. In some variants showed no infected ears but in other varieties, the mean frequency of infected ears registered a maximum value of 12.33%, the variety Kiksun Gold.

The lower values of the frequency attack with *Tilletia caries* (DC) Tul had been observed at Antonius Ariesan Boema GK Kalász, Primmo, Andalou, Kiksun Serina, Gruia, Joseph, Dropia, Crina varieties, which registered values of infected ears between 1% and 5%. Based on these results and according to the evaluation scale of wheat resistance to *Tilletia* sp. (Ajula et al., 1989), these cultivars can be considered resistant to *Tilletia caries* (DC) Tul. attack.

In order to have a better evaluation regarding the resistance of the studied varieties at *Tilletia caries* (DC) Tul., we also made observations about the influence of the disease on the main morphological characters of wheat: the plant height, the number of tillers and the number of kernels per ear.

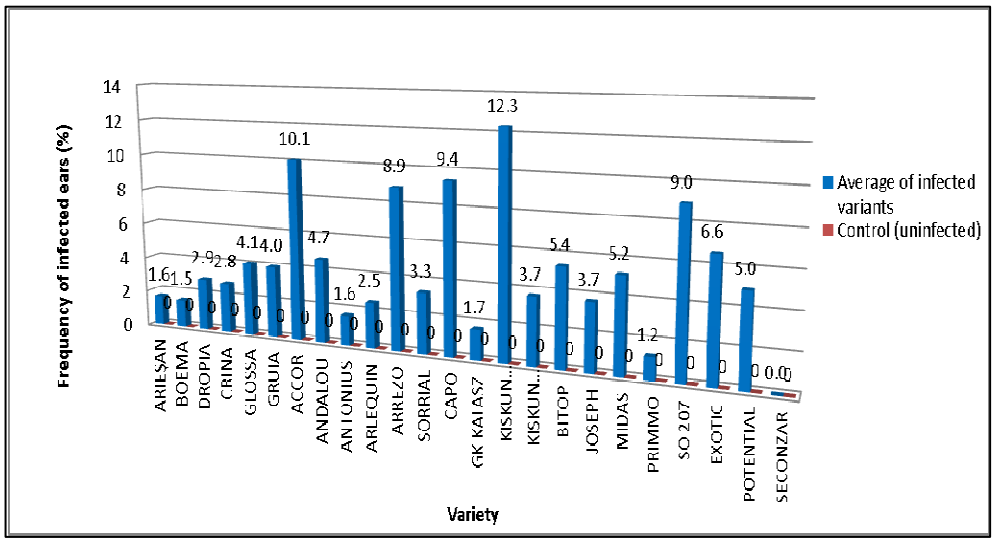

Fig. 1 – Frequency of the infected ears with Tilletia caries (DC.) Tul., in 2011-2012

The mean plant height varied in the control variant between 44.6 cm in Exotic variety to 76.7 cm in Seconzar variety. At the infected variants, the lower value of the plant height was 40.8 cm at Exotic variety and maximum value was 70.2 cm at Seconzar variety (fig. 2). The variability of the plant height both in the the control and the infected variants was determined based on morphological characteristics of the variety and infection with *Tilletia caries* (DC) Tul. Other authors mentioned that the plants which are attacked by *Tilletia caries* (DC) Tul. have a significantly lower height (Rodenhiser, 1931). Based on the measurements made at the 24 wheat studied varieties we observed that at the infected variants, the plant height was lower than at the control variants.

The decrease of the plant the plant height at the infected wheat with *T. caries* had been also observed in other studies. For example, in a study made in the Czech Republic, after the artificial infection of some wheat varieties with *Tilletia caries* (DC) Tul., the plant height of the infected plants was decreased

with 23.2%, 28.2% and 54% (Huszar, 1993). Other authors have reported reductions of up to 22% of the wheat plants infected with *Tilletia spp.* (Agrios, 2005). In our case, the plant height differences from the control variants and the infected variants were smaller, recording values between 0.1% and 17%.

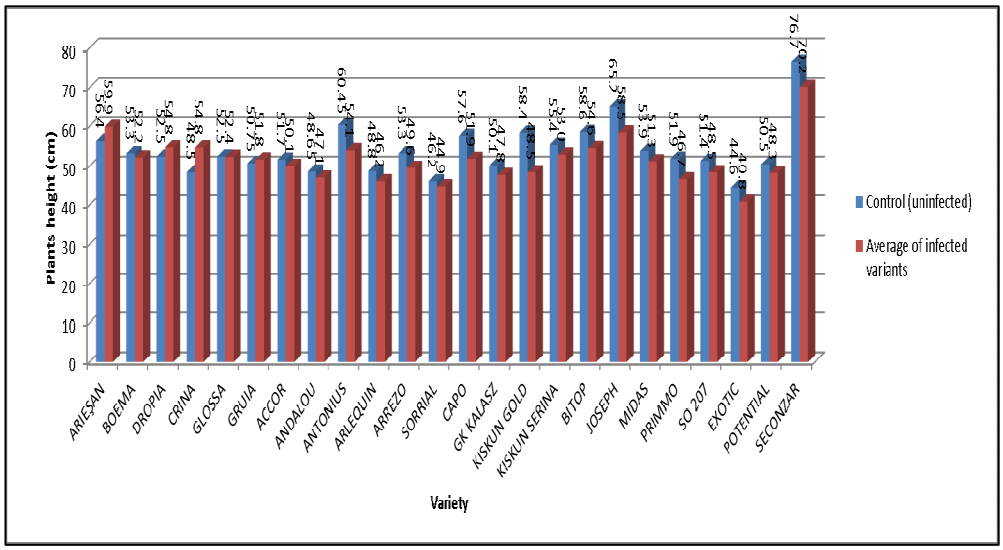

Fig. 2 - Height of wheat plants in 2011-2012

In previous studies regarding the effect of the *Tilletia* attack upon the tillering degree, some authors concluded that at the infected plants, the phenomenon of tillering is higher (Săvulescu, 1957). Dumalasová Veronika and Bart (2007) in some experiments with artificial infection of some wheat cultivars with *Tilletia caries* (DC.) Tul., conducted in 2005-2007 period, observed that at the infected plants the numbers of tillers is bigger with by 2.0% to 24.0%.

Regarding the mean number of tillers on the studied varieties, at the control variants, the mean values which were observed ranged between 2.8 tillers/plant at Arezzo variety and 5.2 tillers/plant at the Arlequin variety.

According to the literature, the number of tillers at some studied wheat varieties have increased in case of the infected variants. An example in this case is the Arezzo variety which had in the infected case a mean number of 2 tillers/plant. The varieties Kiskun Gold Kiskun Serina, Midas, Capo and Gk Kalász had also shown a higher mean number of tillers in the infected variant than in the control variant (fig. 3).

The smallest mean value for the number of tillers was 2.5 tillers/plant at Glossa variety in the infected variant and was 3.9 tillers/plant in the control variant.

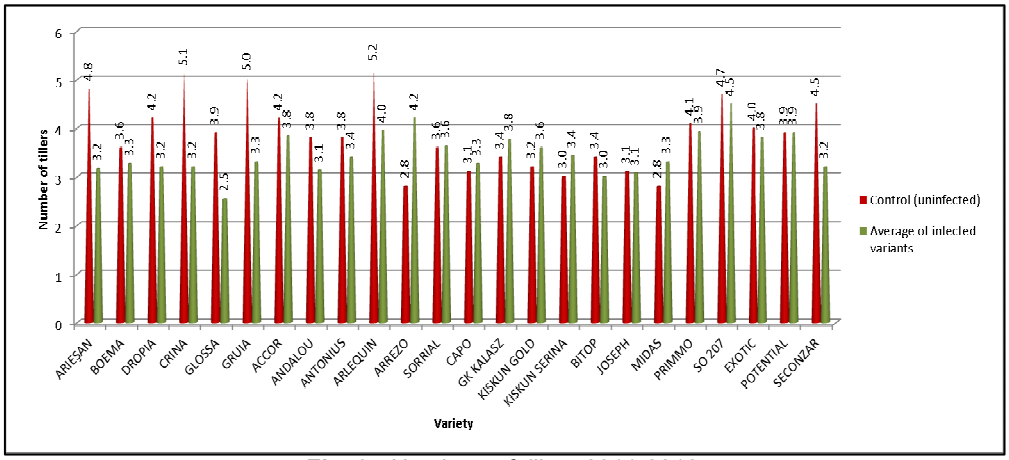

Fig. 3 - Numbers of tillers 2011-2012

The number of tillers recorded at the 24 wheat varieties was generally higher in the control variant than the infected variant, except Arrezo and Capo cultivars which are susceptible to *Tilletia caries* (DC) Tul. and Midas which is tolerant to the disease who recorded a higher values of the number of tillers in the infected variant than in the control.

The number of kernels per ear, in the control variants was different than in the infected variants, depending on the characteristics of each variety, the mean values ranging between 18.6 at Ariesan variety and 41.4 at Accor variety (fig. 4).

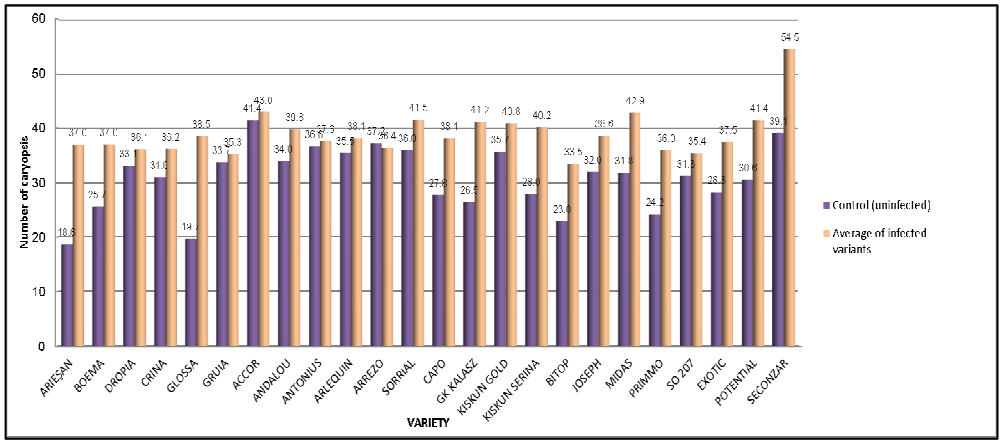

Fig. 4 – Number of caryopsis per ear in 2011-2012

The mean number of kernels from the control variants was lower than the mean number of kernels from the infected variant. Varieties such as Antonius, Accor and Arezzo showed small differences of the mean number of kernels per ear compared with the control. The variety with the highest number of kernels per ear were Seconzar, Accor and Midas, which registered a mean of kernels between 54.5, 43 and 42.9.

CONCLUSIONS

After the artificial infection of the 24 wheat varieties, it was identified 13 resistant varieties with values of the attack spikes smaller than 5%, 6 tolerant varieties with a disease frequency between 5-10% and two susceptible varieties with frequency of attacked ears between 10-20%.

The number of tillers was influenced by the *Tilletia caries* (D.C.) Tul attack. So, the higher value of the number of tillers was recorded in the control variant.

The most resistant variety was Arlequin, wich recorded a mean value of of 5.2 tillers / plant in control variant and a number of 4 brothers / plant in the infected variant.

The mean number of kernels was bigger in the infected variants. A notable difference from the control was observed at Seconzar variety which recorded a mean number of 39 kernels/spike at the control variant and 54.5 kernels/spike at the infected variant.

The plant height was influenced by the attack of *Tilletia caries.* For example, the plant height of the Exotic variety was smaller in the infected variant with a mean value of 44.6 cm and 76,7 cm in the control variant.

Acknowledgments*: This study is part of a project co-financed by European Social Fund through the Sectoral Operational Programme Human Resources Development 2007-2013, POSDRU/CPP107/DMI1.5/S/77222*

REFERENCES

1. Agrios G. N., 2005 - *Plant pathology*, fifth edition, Elsevier Academic Press.

2. **Aujla S. S., Sharma I., Singh B. B., 1989**- *Rating scale for identifying wheat varieties resistant to Neovossia indica.* Indian Phytopathology 42, p. 161–162.

3. Dumalasová Veronika, Bartoš P., 2007 - *Reaction of winter wheat cultivars to common bunt Tilletia tritici (Bjerk.) Wint. and T. laevis Kühn,* Plant Protection Science., nr. 43, p. 138–141.

4. Dumalasová Veronika, Bartoš P., 2010 - *Reaction of wheat, alternative wheat and triticale cultivars to common bunt*, Czech Journal of Genetics and Plant Breeding, 46, p. 14–20.

5. Huszar, 1993 - *Wheat reaction to Tilletia species and biological efficiency of chemical seed dressing to control T. laevis Kühn and Blumeria graminis (DC.) Speer.* Ochrana Rostlin, 29, p. 61–68. (in Slovak).

6. Rodenhiser H. A., 1931 - *Stunting of wheat caused by Tilletia levis and T. tritici*, Paper No. 1004 of the Journal Series of the Minnesota Agricultural Experiment Station.

7. Săvulescu Tr., 1957 - *Monography of Ustulaginales from R.P.R Romania*., Academy Publishing House, Bucharest.

8. Severin V., Cornea Călina-Petruța, 2009 - *Ghid pentru diagnoza bolilor plantelor, (Guidelines for diagnosis of plant)*, Ed. Ceres, Bucharest.

9. Wilcoxson R.D., Saari E.E., 1996 - *Diseases of Wheat: Concepts and Methods of Disease Management.* eds. Bunt and Smut, D.F.: CIMMYT, Mexico

PARTIAL RESULTS REGADING THE EVALUATION OF THE RESISTANCE OF SOME OILSEED RAPE CULTIVARS AT *VERTICILLIUM LONGISPORUM* PATHOGEN

REZULTATE PARTIALE PRIVIND EVALUAREA REZISTENTEI UNOR CULTIVARE DE RAPITA (*BRASSICA NAPUS*) LA AGENTUL PATOGEN *VERTICILLIUM LONGISPORUM*

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Abstract. *Oilseed rape (Brassica napus L) is a relative young species species which appeared a few hundred years ago through a spontaneous interspecific hybridization between cabbage (Brassica oleracea L.) and turnip rape (Brassica rapa L.) (Snowdon, 2007). Among the main diseases that can affect the oilseed rape culture we can find also verticillium wilt caused by the pathogen Verticillium longisporum. The mycelium is colonizing the vascular system of the plant and cause his obstruction, so due to the water stress the plant can die. The aim of this study was to evaluate the resistance of 39 oilseed rape cultivars at V. longisporum through artificial infection in laboratory. After the artificial infection, we identified 7 oilseed rape cultivar with resistance at V. longisporum.*
Key words:*Verticillium longisporum, resistance, rapeseed*

Rezumat. *Rapița (Brassica napus L.) este o specie relativ nouă care a apărut în urmă cu câteva sute de ani în urma unei hibridări interspecifice spontane între varză (Brassica oleracea L.) şi nap (Brassica rapa L.) (Snowdon, 2007). Una dintre bolile ce se află în ascensiune în cultura de rapiță este şi veştejirea plantelor produsă de agentul patogen Verticillium longisporum. Agentul patogen invadează sistemul vascular al plantei, obstrucționând fluxul sevei şi în consecință induce o stare de stres afectând productivitatea şi chiar viabiliatatea plantei. Scopul acestui studiu a fost evaluarea rezistentei a 39 cultivare de rapita la agentul patogen Verticillium longisporum prin infectia artificiala in laborator. In urma infectiei artificiale s-au identificat 7 de cultivare rezistente la atacul patogenului.*
Cuvinte cheie:*Verticillium longisporum, rezistență, rapiță*

INTRODUCTION

Verticillium wilt produced by the pathogen *Verticillium longisporum* is considered to be nowadays one of the main diseases of oilseed rape, besides blackleg and stem canker caused by *Phoma lingam* and stem rot caused by *Sclerotinia sclerotiorum* (Enyck, 2007).

After the germination of microsclerotia from the soil, which is induced by root exudates (Mol et al., 1995), the fungus enter in the main root of the plant. From here, the fungus spreads systemically in the vascular system by means of

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mycelium and conidia released into the transpiration stream (Zhou et al., 2006). When senescence of the plant begins, the fungus leaves its vascular environment and produces ample masses of microsclerotia in the dying plant tissue.

The control of the disease is difficult to make because the microsclerotia can survive in the soil for several years (Schnathorst, 1981; Heale & Karapapa, 1999). Due to the fact that until now there are no available chemicals to prevent this disease, resistant cultivars are required. But, until now, breeding for resistance for both winter and spring type oilseed rape has been severely hampered by the absence of sufficient resistance in commercially available breeding material, however, recently, some promising genotypes of cabbage (*B. oleracea*) and turnip rape *(B. rapa*) with enhanced resistance were identified (Happstadius et al., 2003; Dixelius et al., 2005).

The aim of this study was to test some winter oilseed rape cultivars to the infection with the pathogen *Verticillium longisporum* in order identify some new sources of resistance at *Brassica napus*.

MATERIAL AND METHOD

The resistance tests were performed with *V. longisporum* isolates VL 43 which was provided by the division of Plant Pathology and Plant Protection, Gottingen, Germany. The isolate was chose on the basis were chosen on the basis of results of preliminary virulence tests of several *Verticillium* strains from *B. napus* described by Zeise & von Tiedemann (2002a). Long-term storage of fungi was performed as conidial suspensions in a concentration of 1-3 x 10^6 conidia mL^{-1} in Czapek-Dox medium supplemented with 25% glycerol. The inoculums for the infection were produced by 500 µL of spore stock solutions to 250 mL potato dextrose broth. The cultures were subsequently incubated for 7 days at 23°C on a rotary shaker (100 RPM). After the incubation period, the resulting suspension was filtered through sterile gauze and using a haemocytometer was diluted to 1 x 10^6 spores mL^{-1}.

In order to identify some new sources of resistance, a number of 39 winter oilseed rape cultivars originating from Centre for Genetic Resources Netherlands – CGN were tested by artificial infection with the pathogen *Verticillium longisporum*. Details about the studied material are presented in table1.

As reference control in our experiments, we used Express (less susceptible) and Falcon (highly susceptible). The seeds were two times surface sterilized by immersion in 70% ethanol for 2 minutes. After the sterilization, the seeds were washed with tap water and then sowed in silica sand. After 10 days, the roots of the plans were carefully washed from the sand. Inoculations were performed by cutting 2 cm from the roots and hold them for 30 min in the spore suspension. Plants from the controls were also cut and hold 30 min in tap water. For each cultivar we used 10 plants inoculated and 10 controls.

Table1

Detalils about the studied oilseed cultivars

Nr. Crt.	*Name of accession*	*Country of origin*
1.	Libritta	Germany
2.	Skriverskii	Lithuania
3.	B. napus	Ukraine
	group 1	
4.	Kievskii 216	Ukraine
5.	Kievskii 18	Ukraine
6.	Kombi	Ukraine

7.	SKR. II Kormovoi	Lithuania
8.	Uspekh	Ukraine
9.	Blagodatnyi	Ukraine
10.	Fedorovskii	Ukraine
11.	Snityskii	Ukraine
12.	Diana	Germany
13.	Ksaverovskii	Ukraine
14.	Kodakskii	Ukraine
15.	Lictor	Germany
16.	Liglandor	Germany
17.	Ligora	Germany
18.	Lindora	Germany
19.	Lingot	France
20.	Link	-
21.	Liquanta	Germany
22.	Lirabon	Germany
23.	Lirajet	Germany
24.	Lirakotta	Germany
25.	Lirama	Germany
26.	Lirastern	Germany
27.	Lirektor	Germany
28.	Liropa	Germany
29.	Madora	Germany
30.	Maras	Poland
31.	Marens	France
32.	Marex	Germany
33.	Matador	Sweden
34.	Mirander	Germany
35.	Niederarnbacher	Germany
36.	Norli	Germany
37.	Octavia	-
38.	Olimpiade	Italy
39.	Olymp	Germany

Plantlets were transferred after inoculation in pots into a mixture of sand, peat and compost (1: 1:2) and grown in a climatic chamber at 23^0C with a light/dark cycle of 1/10. Every week we take the disease scores using an assessment key with nine classes as described by Eynck et al 2007 (table 2).

Table.2

Assessment key for scoring disease severity

Score	Symptom development
1	No symptoms
2	Slight symptoms on the oldest leaves (yellowing, bleck veins)
3	Slight symptoms on the next younger leaves
4	About 50% of the leaves show symptoms
5	More than 50% of the leaves show symptoms
6	Up to 50%of the leaves are dead
7	More than 50% of the leaves are dead
8	Only apical meristem is still alive
9	The plant is dead

Because the disease produced by *Verticillium longisporum* reduces the plant growth, the plant height was measured at 28 days after inoculation.

For each accession, area under disease progress curve (AUDPC) was calculated from the disease severity values.

RESULTS AND DISCUSSIONS

After the artificial infection with *Verticillium longisporum* pathogen, the observed symptoms were typical asymmetric yellowing of leaves and the occurrence of black veins (measured as AUDPC value) as well as stunted growth.

The plants from the control variant were also scored in order to take into account the unspecific symptoms occurring during the natural ageing process which varied between accessions.

During the experiment it was observed a large variation of resistance to *V. longisporum* among the tested cultivars. Resistance responses of the tested cultivars along with the oilseed rape controls "Express" and "Falcon" measured by AUDPC values are shown in figure1.

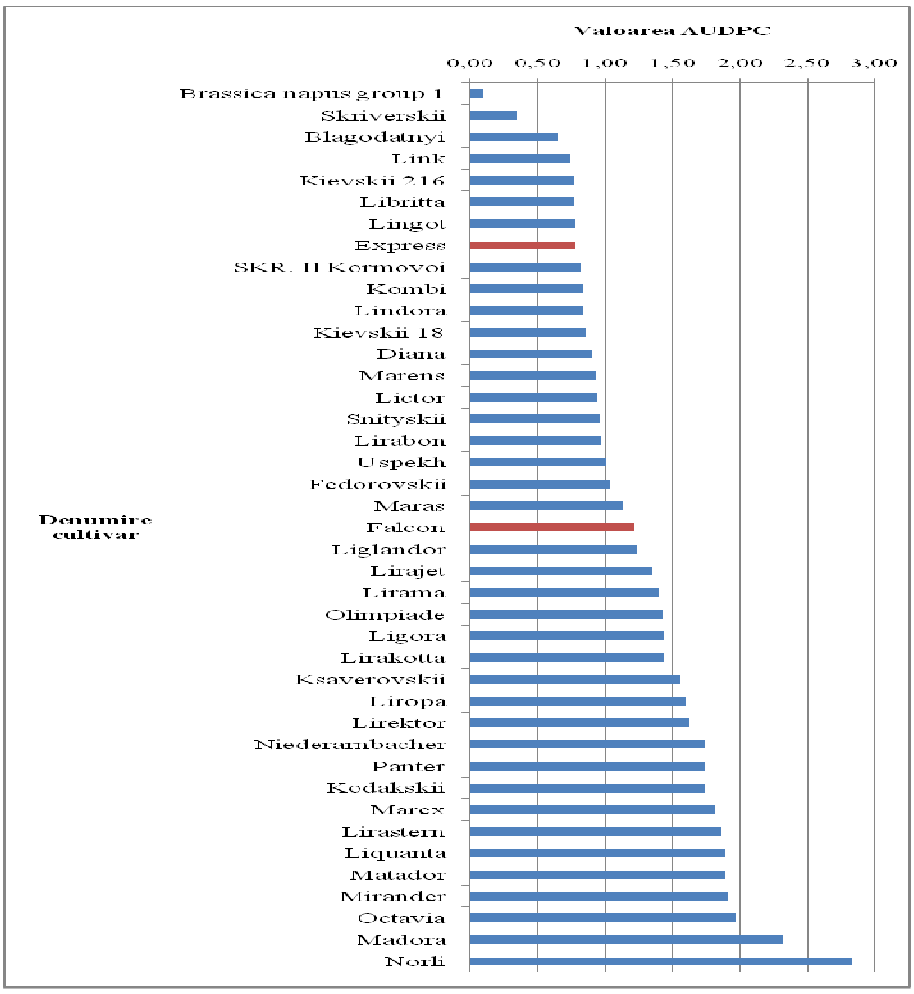

Fig. 1 - The resistance response of the tested oilseed rape cultivars to *Verticillium longisporum*

After the artificial infection of the 39 tested cultivars at *Verticillium longisporum* the AUDPC recorded values between 0,10 („*Brassica napus* Group 1") and 2,83 („Norli"). The most resistant cultivars proved to be „Brassica napus Group 1", „Skriveskii", „Blagodatny", „Link"," Kievskii 216", „Libritta" și „Lingot", with AUDP values smaller than "Express"cultivar. A medium resistance showed 12 cultivars with AUDPC values situated between „Express" and „Falcon".

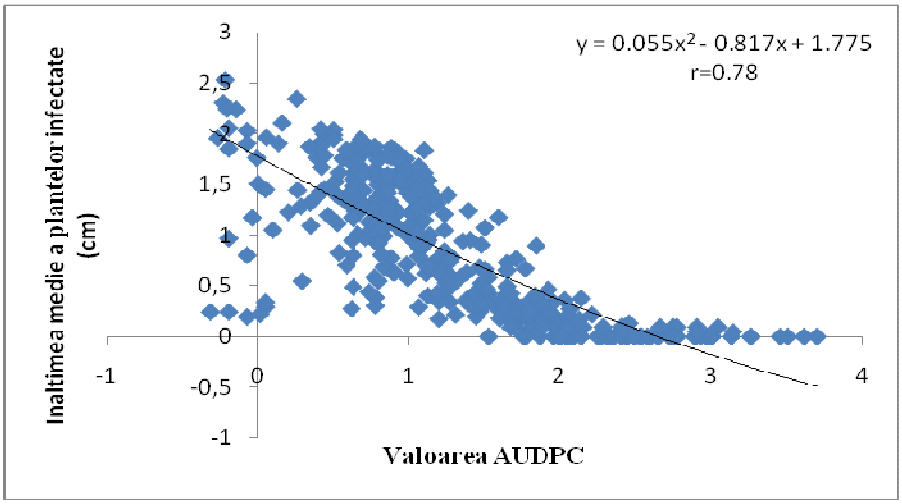

Fig. 2 - Correlation between the AUDPC values and the plant height for the 1-39 rape cultivars

Because one of the symptoms that occur in the case of the infection of with *V. longisporum* is the plant stunting (Enyck, 2007), for each infected plant, at 28 dpi, it was measured the plant height.

In order to show the influence of the attack of the pathogen upon the morphological traits of the plant, it was calculated the correlation between the AUDPC values and plant height (figure 2). The correlation coefficient was positive with a value of 0,78 indicating that the plant height is smaller when the infection is strong.

CONCLUSIONS

The present spread of *V. longisporum* in European oilseed rape production areas with a long history of cultivation of this crop requires great efforts to develop cultivars with total or at least partial resistance to this pathogen (Enyck, 2007).

For this reason a large numbers of plant accessions and breeding progenies need to be screened for resistance. The aim of this study was to test a number of 39 oilseed rape cultivars to the pathogen *Verticillium longisporum* in order to identify some new sources of resistance in *Brassica napus*.

The *Brassica napus* cultivars tested in this study showed a large variation of resistance to the pathogen *V. longisporum*. In this case, we identified seven cultivars with greater resistance to the pathogen than the Express cultivar. These genotypes can be a valuable source of resistance for the future studies for in the breeding process for obtaining some resistant commercial oilseed cultivars.

***Acknowledgments**: The financial support for our work is from the project POSCCE ID714/1268 funded by EU.*

REFERENCES

1. **Cociu V., Oprea Şt., 1989 -** *Metode de cercetare în ameliorarea plantelor pomicole.* Ed. Dacia, Cluj, p. 29, 124-129.
2. **Dixelius, C., Happstadius, I., Berg, G., 2005 -** *Verticillium wilt on Brassica oil crops – a swedish perspective*, Journal of the Swedish Seed Association, nr.115, p. 36-48.
3. **Eynck, C, Koopmann B, Grunewaldt-Stöcker G, Karlovsky P, von Tiedemann A., 2007 -** *Differential interactions of Verticillium longisporum and Verticillium dahliae with Brassica napus detected with molecular and histological techniques,* European Journal of Plant Pathology, nr.118, p. 259-274**.**
4. **Happstadius, I., Ljungberg, A., Kristiansson, B., Dixelius, C., 2003** - *Identification of Brassica oleracea germplasm with improved resistance to Verticillium wilt*. Plant Breeding nr.122, p. 30–34**.**
5. **Heale, J.B., Karapapa, V.K., 1999 -** *The Verticillium threat to Canada`s major oilseed crop:* Canola, Canadian Journal of Plant Pathology, nr.21, pag. 1-7.
6. **Mol, L., Scholte, K., 1995 -** *Formation of microsclerotia of Verticillium dahliae Kleb. On various plant parts of two potato cultivars,* Potato Research, nr.38, p. 143-150**.**
7. **Schnathorst, W.C., 1981 -** *Life cycle and epidemiology of Verticillium*. In: Mace, M.E., Bell, A.A., Beckmann, CH (editor) Fungal Wilt Diseases of Plants, ed. Academic Press, New York, p. 81-111.
8. **Zeise, K., von Tiedemann, A., 2002a -** *Host specialization among vegetative compatibility groups of Verticillium dahliae in relation to Verticillium longisporum*, Journal of Phytopathology, vol.150, p. 112-119.
9. **Zhou, L., Hu, Q., Johansson, A., and Dixelius, C., 2006 -** *Verticillium longisporum and V. dahliae: infection and disease in Brassica napus*, Plant Pathology, nr. 55, p. 137–144.

RESEARCHES REGARDING THE ATTACK OF *SCLEROTINIA SCLEROTIORUM* (LIB.) DE BARY ON RAPESEED USING THE COTYLEDON ASSAY

CERCETĂRI PRIVIND ATACUL DE *SCLEROTINIA SCLEROTIORUM* (LIB.) DE BARY LA RAPIȚĂ UTILIZÂND METODA DE INFECȚIE PE COTILEDOANE

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Abstract. *Sclerotinia sclerotiorum (Lib.) de Bary is a major pathogen for the rapeseed crop (Brassica napus L.). The aim of the study was the assessment of 130 rapeseed cultivars regarding the response to the attack of white rot, using a cotyledon assay, in controlled enviromental conditions. In order to evaluate the response of the cultivars, we have artificially inoculated the cotyledons, with a solution of macerated mycelium (10^4 mycelial fragments / ml), in liquid PDB media, following the protocol described by Garg et al.(2008). After three days, the diameter of the lesions was measured. From the 130 cultivars, 39 had smaller lesions than the control. The cotyledon assay proved to be a rapid method to identify the reaction of the rapeseed cultivars to the attack of Sclerotinia sclerotiorum (Lib.) de Bary.*
Key words: *Sclerotinia sclerotiorum, rapeseed, lesions, attack*

Rezumat. *Sclerotinia sclerotiorum (Lib.) de Bary este un patogen important al culturii de rapiță (Brassica napus L.).scopul acestui studiu a fost testarea a 130 de cultivare de rapiță în ceea ce privește atacul de putregai alb, utilizând metoda de infecție artificială pe cotiledoane, în condiții de mediu controlat. Pentru a evalua răspunsul cultivarelor, cotiledoanele au fost inoculate artificial, cu o solutie de miceliu macerat (104 fragmente de miceliu / ml), în mediu lchid PDB, după protocolul descris de Garg și colab. (2008). După trei zile, a fost măsurat diametrul leziunilor apărute. Din cele 130 de cultivare, 39 au înregistrat leziuni mai mici decât cele ale martorului. Metoda de infecție pe cotiledoane s-a dovedit a fi o emtodă rapidă de identificare a reacției cultivarelor de rapiță la atacul de Sclerotinia sclerotiorum (Lib.) de Bary.*
Cuvinte cheie: *Sclerotinia sclerotiorum, rapiță, leziuni, atac*

INTRODUCTION

Sclerotinia sclerotiorum (Lib.) de Bary, is one of the most important pathogens of rapeseed, and can cause significant losses of yield worldwide (Zhao et al., 2004).

There have been used various controlled environment screening methods, in order to evaluate the resistance of *Brassica napus* to white rot: petiole inoculation (Zhao et al., 2004, Bradley et al., 2006), detached leaf inoculation

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(Bradley et al., 2006), oxalic acid assay (Bradley et al., 2006), but they don't positively correlate with the field results.

Due to its economic importance, it's crucial to find genotypes with improved tolerance to *Sclerotinia sclerotiorum* (Lib.) de Bary,

MATERIAL AND METHOD

Test conditions. The *Brassica* genotypes used for screening were grown in 38 x 24 x 5 trays, each having 40 cells and containing a compost mixture. Three seeds of each genotype were sown in each cell and thinned to a single seedling per cell after emergence. A complete randomized block design was used with three replications and two plants per genotype per replication. All experiments were conducted in the growth room, under controlled environmental conditions (18 ±1^{o} C during the day and 14 ±1^{o} C during the night, with a light intensity of 150 μE/m^{2}.s (Garg et al., 2008). Seedlings were grown until cotyledons were fully expanded (growth stage 1.00, on the scale given by Sylvester-Bradley and Makepeace, 1984).

Genotypes tested. The 130 genotypes tested were provided by the Centre of Genetic Resources of Netherlands.

Inoculum production. A single sclerotium of *Sclerotinia sclerotiorum* was surface sterilized 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). *S.sclerotiorum* was subcultured and maintained in an incubator at 20^{o} Con PDA. Seven agar plug discs (each 5 mm in diameter) were cut from the actively growing margin of a 3-day-old colony and transferred to a 25m ml flask containing 75 ml of a sterilized liquid medium of PDB (potato dextrose broth 24 g, peptone 10 g, H_2O 1 l). Flasks were rotated on a platform shaker, at 120 rpm / min. After 3 days, colonies were harvested and washed twice with sterilized water (fig. 1). The fungal mats obtained were transferred to 125 ml of the same liquid medium and the mycelia macerated in a food grinder for 3 min. The mycelial suspension was then filtered through four layers of cheese cloth and the concentration was adjusted to 10^4 fragments /ml using a haemocytoemeter with the same liquid medium (Garg et al, 2008).

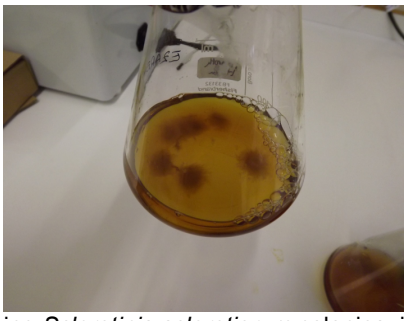

Fig. 1 - Flask containing *Sclerotinia sclerotiorum* colonies, in liquid PDB medium

Inoculations. The inoculation was made when cotyledons were 10 days old. A total of four droplets of mycelial suspension of 10 μl were deposited on every seedling using a micropipette, with a single drop on each cotyledon lobe (fig. 2). While inoculating, the mycelial suspension must be shaken regularly to maintain the homogeneity of the mixture. A very fine mist of water was sprayed both over

cotyledons and on the inside of the lids, with the purpose of maintaining a relative humidity level of □100 %. After the inoculations, the trays covered by lids were placed for 2 days at a low light intensity of □13 μE / m^2 and then returned to the original light intensity (Garg et al, 2008).

Fig. 2 - Rapeseed seedling, artificially inoculated

Disease assessment. Typical hypersensitive and or / necrotic lesions were apparent by 1-2 days post-inoculation. At 4 days post-inoculation, the lids were removed and the diameter of the lesions (mm) was measured with a linear ruler (fig. 3).

Fig. 3 - Lesions measured on the infected cotyledons

RESULTS AND DISCUSSIONS

Typical necrotic lessions appeared on cotyledons of susceptible genotypes infected. The size of the lessions varied between the tested genotypes, from 0,37 mm for the *Libritta* cultivar to 10,04 mm for the *Liberator* cultivar (fig. 4, fig. 5), with an average considered as control of 4,73 mm. From all the tested genotypes, 39 had smaller lessions than the control.

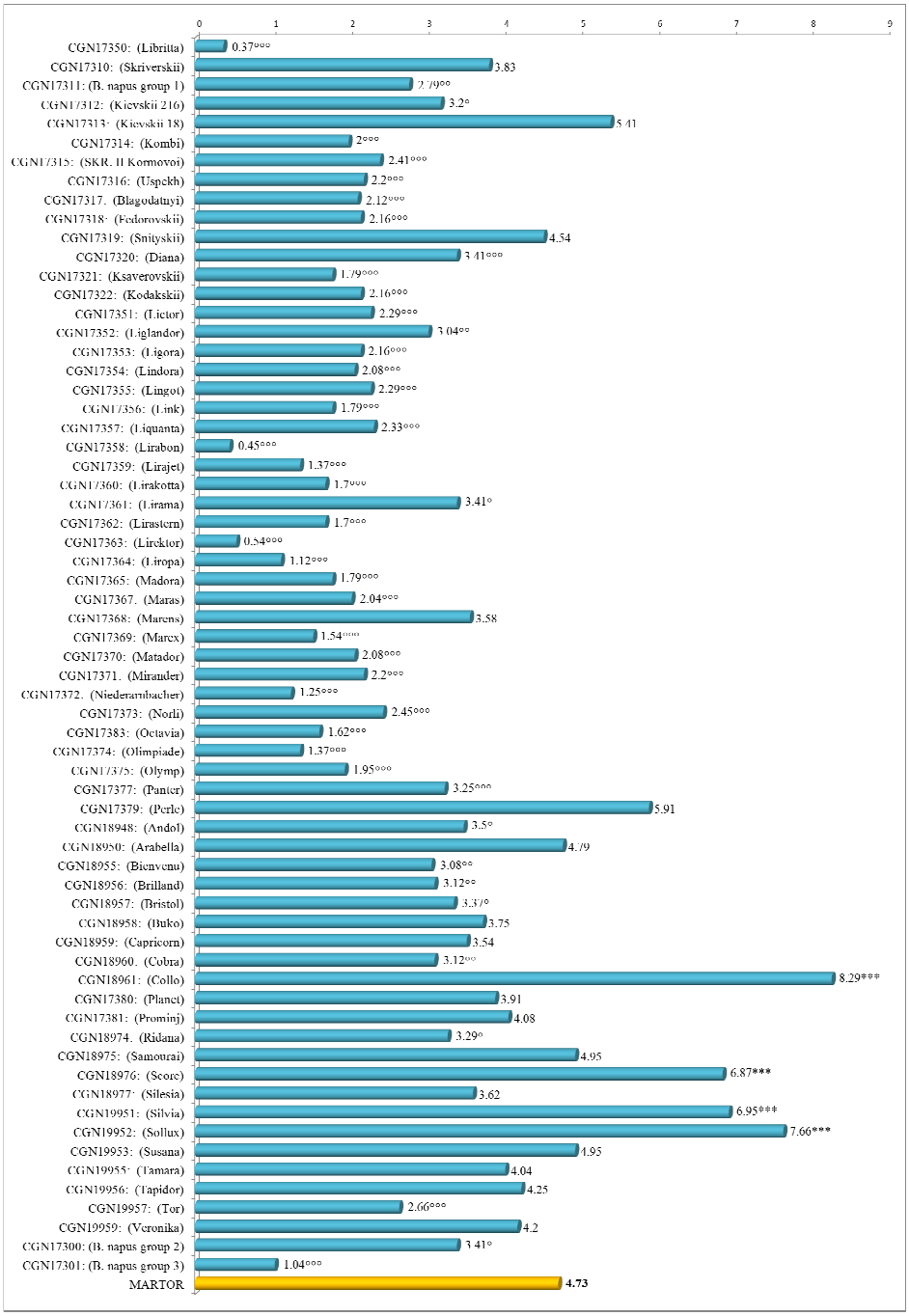

Fig. 4 - Diameter of the lession measured on the cotyledons for the cultivars1-65

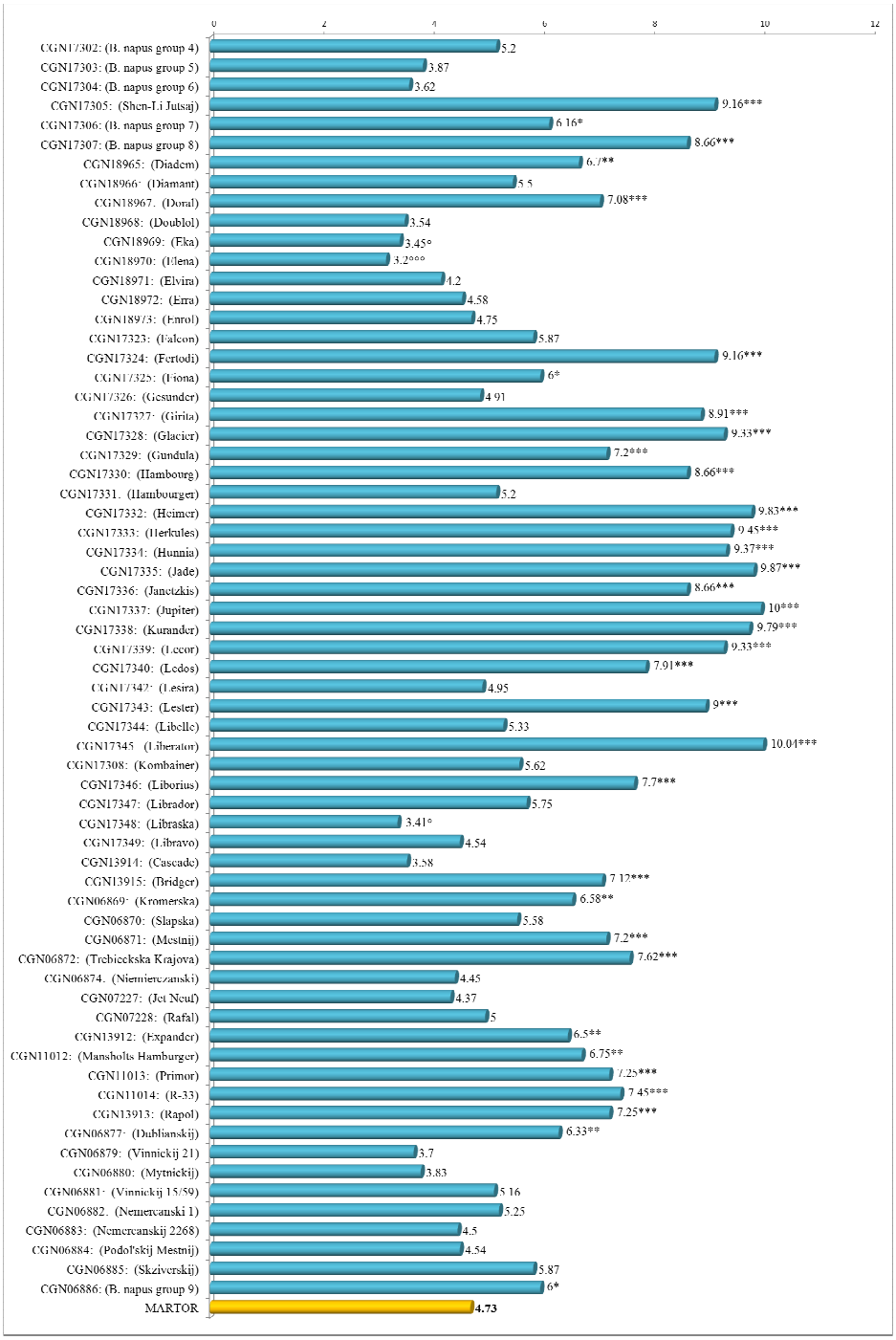

Fig. 5 - Diameter of the lession measured on the cotyledons for the cultivars 65-130

CONCLUSIONS

From the 130 genotypes tested, 39 presented a better resistance to the pathogen, compared to the control. Those cultivars can be used by plant breeders in order to identify resistance genes to the attack of *Sclerotinia sclerotiorum* (Lib.) de Bary.

***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*

REFERENCES

1. **Bradley C.A., Henson R.A., Porter P. M., LeGare D.G., del Rio L.E., Khot S.D., 2006** – *Response of canola cultivars to Sclerotinia sclerotiorum in controlled and field conditions*, Plant Disease 90, p. 215- 219
2. **Clarkson J. P., Staveley J., Phelps K., Young C. S., Whipps J. M., 2003** – *Ascospore release and survival in Sclerotinia sclerotiorum*, Mycological Research 107, p. 213 - 222
3. **Garg H., Sivasithamparam K., Banga S. S., Barbetti M.J., 2008** – *Cotyledon assay as a rapid and reliable method of screening for resistance against Sclerotinia sclerotiorum in Brassica napus genotypes*, Australasian Plant Pathology, 37, p. 106 – 111
4. **Kull L. S., Vuong T. D., Power K.S. Eskridge E.M., Steadman J.R., Hartman G. L., 2003** – *Evaluation for resistance screening methods for Sclerotinia stem rot of soybean and dry bean*, Plant Disease 87, p. 1471 – 1476
5. **Pratt R.G., Rowe D. E., 1998** – *Evaluation of simplified leaf inoculation procedures for identification of quantitative resistance to Sclerotinia trifoliorum in alfalfa seedlings*, Plant Disease, 82, p. 1161 - 1164
6. **Sarahan G. S, Naresh Mehta, 2008** – *Sclerotinia Diseases of Crop Plants: Biology, Ecology and Disease Management*, Springer, 2008, p. 42 – 44
7. **Sylvester – Bradley R., Makepeace R.J., 1984** – *A code for stages of development in oilseed rape (Brassica napus L.)*, Aspects of Applied Biology 6, p. 399 – 419
8. **Zhao J., Peltier A.J., Meng J., Osborn T.C., Grau C. R., 2004** – *Evaluation of Sclerotinia stem rot resistance in oilseed Brassica napus using a petiole inoculation technique under greenhouse conditions*, Plant disease, 88, p. 1033 – 1039

RESULTS ON COMBATING THE MAIN DISEASES AND PESTS OF GRAPES IN THE VINEYARD AGRO-CLIMATIC CONDITIONS DEALU BUJORULUI

REZULTATE PRIVIND COMBATEREA PRINCIPALELOR BOLI ȘI DAUNATORI AI VIȚEI DE VIE IN CONDIȚIILE AGROCLIMATICE DIN PODGORIA DEALU BUJORULUI

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Abstract. *The research was conducted in 2012 at SCDVV Bujoru where a program has been tested against the main diseases and pests of vines. The program introduced last generation pesticides such as Mikal Flash, Profiler 71 WG, Flint Max, Melody Compact 49 WG, Mega Decis EW 50 etc. These plant protection products applied in a limited number of treatments provided a great effectiveness in combating the main pathogens and pests in the vineyard.*
Key words: *grapevine, pathogens, vineyard*

Rezumat. *Cercetările s-au desfășurat în anul 2012 la S.C.D.V.V. Bujoru unde a fost experimentat un program de combatere a principalelor boli și dăunători ai viței de vie în care au fost introduse pesticide de ultimă generație cum ar fi: Mikal Flash, Profiler 71 WG, Flint Max, Melody Compact 49 WG, Decis Mega 50 EW etc. Aceste produse fitosanitare aplicate într-un număr redus de tratamente au asigurat o eficacitate deosebită în combaterea principalilor agenți patogeni și dăunători din plantațiile viticole.*
Cuvinte cheie: *vița de vie, agenți patogeni, podgorie*

INTRODUCTION

After certain pathogens and pests from the American continent penetrated the vine growing countries in Europe, the growers, both practitioners and researchers, have equally sought ways and means to prevent and effectively fight them. In the vine growing technology, the fight against pathogens and pests is one of the crucial technological links for obtaining high yields of grape and high quality wine (Teodorescu et al., 2003, Ulea, 2005).

The emergence and evolution of the main pathogens and pests of wine grapes in the Dealu Bujorului vineyard area is influenced by direct and indirect effects of technological and ecological factors specific to this area, affecting the quality and quantity of grape production (Tabaranu and Simion, 2005).

[1] Research and Development Station for Viticulture and Vinification Bujoru, Romania

MATERIAL AND METHOD

The research was conducted at the Bujoru Research and Development Station for Viticulture and Winemaking in a vineyard cultivated with Feteasca Regala and Aligoté aged 32 years.

The experiment was conducted on a land surface with a slope of 3-5%, chernozem soil type, with a humus content between 1.14 to 1.86% in the A horizon with a weak alkaline reaction (pH 7.44 to 8.30) and a sandy loam texture; with the land surface facing east and about 170-200 m altitude. The rows' orientation was north to south, with a planting distance of 2.1 m x 1.2 m, and a provided density of 3968 vines / hectare. The rootstock used was Berlandieri x Riparia rootstock, Teleky 8 B and Openheim SO4-4 selection.

The experiment involved the following varieties:

- Fetească regală
- Aligoté
- The Witness/ The Untreated Lot

To determine the gravity of the attack produced by the main vine diseases such as manna, powdery mildew, and gray rot, observations have been conducted on the intensity (I) the frequency (F) and the degree of the attack (AD/GA%) upon the leaves and grapevine (Mirica and Mirica, 1976).

RESULTS AND DISCUSSION

Under the climatic conditions of the growing season of 2012, six phytosanitary treatments for combating pathogens and pests of vine have been administered.

Scheme for combating pests and diseases of the grapevine products from Bayer CropScience company *:

I. After debudding, shoots 10-15 cm: powdery mildew (Sulfavit 80 PU - 4,0 kg/ha)

II. Shoots of 30-50 cm: manna (Mikal Flash* - 3,0 kg/ha) and powdery mildew (Sulfavit 95 PP - 10 kg/ha);

III. Before flowering (treatment of safety): manna (Profiler 71 WG* - 2,25 kg/ha), powdery mildew (Flint Max* – 0,16 kg/ha) and the grapes moth (Decis Mega 50 EW* - 0,2l/ha);

IV. After blooming (treatment of safety): manna (Verita - 2,0 kg/ha), powdery mildew (Folicur Solo 250 EW - 0,4 l/ha) and gray rot (Teldor 500 SC* - 1,0 l/ha);

V. The grape growth (berries the normal size): manna (Eclair 49 WG* - 0,5 kg/ha) and powdery mildew (Sulfavit 80 PU - 4,0 kg/ha);

VI. Compaction of grape bunches : manna (Melody Compact 49 WG* -1,5 kg/ha), powdery mildew (Falcon 460 EC - 0,3 l/ha) and powdery mildew (Rovral 500 SC* - 1,0 l/ha);

VII. Entering the first fruits period: due to the adverse climatic conditions (prolonged drought, high temperatures, etc.) the treatment was canceled because it was not economically justified.

The treatments were performed at warning using MPSP machine 3-300 and the products were complex depending on the pathogens that have been targeted.

The quantity of 400 l/ha of solution has been used for the first two treatments while the following treatments used a quantity of 900-1000 l/ha of the same solution.

To describe the specific microclimate conditions of the Dealu Bujorului vineyard, the weather data recorded at the Bujoru SCDVV meteorological station have been used. During the vegetative rest period, the absolute minimum temperatures have dropped below the frost resistance threshold of the vine (-18,0°C). On 11.02.2012 the recorded temperature dropped to – 22, 0°C, which means that the temperature has affected the viability of the vine buds in the experimental lots. The spring season climate conditions were unusual for that period of time as the average temperatures were higher than the normal ones and, overall, the average of the monthly temperatures was higher by 5, 3°C than the normal temperature of that period. During June and July frequently elevated temperatures of over 35,0°C have been recorded as follows: 37,6°C on 22.06.2012 and 38,0°C recorded for four consecutive days (26,28,29,30.08.2012). The absolute maximum temperature was 41,7 °C recorded during the summer, more precisely on 07.08.2012. In the recent years, the most obvious weather phenomenon was drought which has become most common. Monitoring this phenomenon implies the knowledge of the total annual precipitations, of the specific periods of the year when the lack of precipitation was as its peak or when the precipitation was insufficient and to compare these values to the multiannual average.

The year of 2012 was an extremely droughty year, in which vines experienced a decrease in the precipitation amount with an uneven distribution of precipitation, with long dry periods. The active vegetation period started with elevated precipitations but unevenly distributed over time. Also during this period, the precipitations exceeded the monthly average rainfall, thus the records showed a surplus of 27, 1 mm from March to May. Regarding the evolution of rainfalls, it can be noticed an uneven distribution of these throughout the vegetation period, with a surplus in May (71,0 mm to 31,2 mm annual average), and in June, July and August with a pronounced deficiency of 106,2 mm. Table 1 presents data about the relative humidity, insolation etc.. The average air hygroscopicity has registered low values compared to the monthly average ones, and annual insolation was 1889, 5 h compared to the multiannual one which was 1661, 9 h.
The pluviometric deficiency started as early as March when were registered 9,2 mm compared to 25,5 mm, the annual average, except for the month of May when precipitations were in excess. Combined with insufficient precipitations, excessive temperatures, higher than the multiannual one, have led to the installation both, the atmospheric and pedological drought. Throughout the vegetation period, the air temperature was higher than its multiannual average. The extreme temperature values had a huge contribution to the atmospheric drought. Ever since the end of April, air temperatures higher than 30°C have been recorded. Thus, in April were recorded 3 such days, in May 6 such days, in June 17 such days and in July 27 such days. The high temperatures, combined with the lack of precipitations, have

led to low air humidity that impacted the experimental batches. Under these climatic conditions, the vine varieties from the experimental lots have suffered from the lack of rain, and so the grapes have withered, the leaves have partially or totally dried and fell, and, therefore, the grape production decreased considerably.

The vines manna (*Plasmopara viticola* - Berk. Et Curt.): The climatic conditions of 2012 were unfavorable to the emergence and the evolution of vines manna. Thus, during the vegetation period, the manna evolution was insignificant (table 2).

The vines mildew (*Uncinula necator* - Schw. Burr.): During the growing season, the pathogens registered a number of 15 generations, with a lifetime period of 11 days in April, May, and June and 13-21 days in July and August. Among weather conditions favorable for the emergence and evolution of vines powdery mildew, air temperature held a decisive role. The limits are large, basically from 10°C, the biological threshold of vines, to 30°C, while the optimal range is to about 22-26 °C. The extension of the evolution of a generation to 21 days was due to the surpassing of the common biological threshold of 30 °C in July-August. During the growing season, the pathogen was weak, due to the application of phytosanitary treatments at the optimum moment, with specific products. In late blooming, varieties included in the study registered a degree of attack (GA %) on leaves between 0,04 to 0,07% and in the berries' growth phenophase, between 0.05 to 0.10%. In the **Witness - untreated** lot, the attack degree of leaves was 0.21% at the end of flowering and 0.24% during the berries growth (table 3).

Table 1

Weather data from the period of 01.XI.2011 – 31.10.2012

Month of year	Monthly average (t ºC)		Precipitations (mm)		Hygroscopicity humidity (%)		Insolation (h)	
	Average of the month							
	the normal	2011 2012	the normal	2011 2012	the normal	2011 2012	the normal	2011 2012
XI.2011	4,8	3,4	34,9	0,0	83	62	52,3	49,8
XII.2011	1,7	3,2	28,6	8,8	88	68	30,7	20,0
I.2012	-1,7	-1,3	13,8	34,6	87	63	41,2	68,9
II.2012	2,0	-7,0	13,6	21,1	79	63	80,4	72,2
III. 2012	5,5	6,0	24,2	6,1	75	52	106,5	176,6
IV.2012	11,2	14,9	40,4	14,6	70	49	142,2	209,1
V.2012	18,6	19,7	31,2	102,2	62	53	237,1	181,6
VI.2012	22,6	24,3	53,2	11,9	62	46	236,8	312,6
VII.2012	24,9	28,1	54,9	27,1	63	41	251,3	337,5
VIII.202	23,2	26,1	61,7	23,1	66	43	226,4	286,0
IX.2012	17,2	20,7	47,2	24,6	73	50	150,9	226,0
X.2012	11,6	14,6	34,9	42,0	78	59	106,1	134,0
Sum	**141,6**	**152,7**	**438,6**	**316,1**	**886**	**649**	**1661,9**	**2074,3**
Averge	**11,8**	**12,7**	**-**	**-**	**73**	**54**	**-**	**-**

Table 2

The situation concerning the vines manna attack *Plasmopara viticola* (Berk. et Curt.) at S.C.D.V.V Bujoru 2012

Variety	After blooming		Berries growth		Firstfruits grapes		Technological maturity	
	leaves	Grapes	leaves	Grapes	leaves	Grapes	leaves	Grapes
	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %
Fetească regală	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Aligoté	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Witness - untreated	**0,0**	**0,0**	**0,30**	**0,04**	**0,0**	**0,0**	**0,0**	**0,0**

Table 3

The situation of the grapevine mildew attack *Uncinula necator* (Schw. Burr) at S.C.D.V.V Bujoru in 2012

Variety	After blooming		Berries growth		Firstfruits grapes		Technological maturity	
	leaves	Grapes	leaves	Grapes	leaves	Grapes	leaves	Grapes
	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %
Fetească regală	0,04	0,0	0,10	0,0	0,0	0,0	0,0	0,0
Aligoté	0,07	0,0	0,05	0,0	0,0	0,0	0,0	0,0
Witness - untreated	**0,21**	**0,0**	**0,24**	**0,18**	**0,0**	**0,0**	**0,0**	**0,0**

Table 4

Situation concerning the grapes gray rot attack (*Botrytis cinerea* - Pers.) at S.C.D.V.V Bujoru 2012

Variety	After blooming		Berries growth		Firstfruits grapes		Technological maturity	
	leaves	Grapes	leaves	Grapes	leaves	Grapes	leaves	Grapes
	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %	G.A %
Fetească regală	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Aligoté	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Witness - untreated	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**

Gray rot of grapes (*Botrytis cinerea* - Pers.)**:** Due to adverse climatic conditions in 2012 (precipitations low during the summer period, low atmospheric humidity) symptoms of pathogen attacks have not been signaled in the experimental groups (Table 4).

The Grape Moth or eudemis - (*Lobesia botrana* - Den. et Schiff.) Under the conditions of 2012, amid high biological reserves from the previous year, the grapes moth has fared weak in all three generations without surpassing the economic damage threshold (PED) of 100 - moth / trap / week.

CONCLUSIONS

1. The atypical climatic conditions of 2012 were unfavorable to the attack of cryptogamic diseases (manna and gray rot) that led to a lack of symptoms in the experimental lots.

2. The vine powdery mildew in 2012 had favorable conditions for evolution in the first part of the vegetation period; its attack manifesting weak on leaves. The pathogen was kept under control by applying phytosanitary treatments of six specific products. During the period June-July, very high temperatures have been registered, thus creating unfavorable conditions for the development of the fungus.

3. The grape moth was monitored using synthetic sex pheromone traps - type ATRABOT. These pointed to the fact that although the biological reserve of the previous year was great, the emergence and evolution of the pest in 2012 was weak and did not exceed the PED (100 catches / trap / week) in any generation.

REFERENCES

1. **Mirică I., Mirică Afrodita**, **1976** – *Combaterea bolilor şi dăunătorilor la vița de vie,* Editura Ceres, p. 25 - 55.
2. **Teodorescu Georgeta, Roman T., Mirică Sumedrea Mihaela**, **2003** - *Entomologie Horticolă*, Editura Ceres,Bucureşti p 330 - 343.
3. **Ulea E., 2003** - *Fitopatologie,* Ed."Ion Ionescu de la Brad", Iaşi, p. 205 - 229.
4. **Tabaranu G., Simion Cristina, 2005** - *Întrebări şi răspunsuri privind recunoaşterea şi combaterea dăunătorilor precum şi a celor mai frecvente boli în plantațiile viticole din S-E Moldovei*, Editura Pax Aura Mundi, Galați.

*** **Ministerul Agriculturii şi Industriei Alimentare**, **1980** - *Metodici de prognoză şi avertizare a tratamentelor împotriva bolilor şi dăunătorilor plantelor de cultură,* Ed. Tehnica, Bucureşti.

ASPECTS OF BIODIVERSITY AND DYNAMICS ON EARTHWORM SPECIES (*OLIGOCHAETA-LUMBRICIDAE*) COLLECTED FROM A DECIDUOUS FOREST (NEAMȚ COUNTY) FROM 2010-2012

ASPECTE PRIVIND BIODIVERSITATEA ŞI DINAMICA SPECIILOR DE LUMBRICIDE (*OLIGOCHAETA - LUMBRICIDAE*) COLECTATE DINTR-O PĂDURE DE FOIOASE (NEAMȚ) ÎN INTERVALUL 2010- 2012

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Abstract. *The presence of earthworms in soil represents a major benefit to the health of the soil as well as an important indicator of the extent of their pollution. For three years (2010-2012 period) were carried out investigations and biological sampling of the more distant points in a forest of deciduous species were determined by present and former earthworms, monitored their biological activity, following the establishment of biodiversity ,within the question under present environmental conditions by comparison with previous determinations, most with more than three decades ago.*
Key words: *Earthworms, environment, biodiversity, Tree, faunal investigation.*

Rezumat. *Prezența lumbricidelor în soluri reprezintă atât un beneficiu major pentru sănătatea acestor soluri cât şi un indicator important al gradului lor de poluare. Timp de 3 ani (în intervalul 2010- 2012) au fost efectuate investigații şi prelevări de probe biologice din mai multe puncte de lucru aflate într-o padure de foioase, au fost determinate speciile de lumbricide prezente şi a fost monitorizată activitatea lor biologic, urmărind stabilirea biodiversității în perimetrul respective, în condițiile ecologice actuale prin comparație cu determinările anterioare, efectuate cu mai bine de trei decenii în urmă.*
Cuvinte cheie*: râme, mediu, biodiversitate, copac, investigarea faunei*

INTRODUCTION

Earthworms are soil species and their development is conditioned by soil moisture, temperature and obviously by the quality of food. They represent the major component of soil fauna, dominating terrestrial biomass.

In Romania (Pop, 2005) are known 82 species, grouped into three categories, depending on the depth at which they are active: epigeal, endogee and anec.

This work represents the beginning of faunal investigations to assess the situation earthworm species (*Oligochaeta, Lumbricidae*) in the region of Moldavia , in different ecosystems.

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MATERIAL AND METHOD

Biological material was collected from a deciduous forest in Suceava, the main tree species that dominate are beech, ash, hornbeam, but local forms mixtures with up to 12 species of trees. The leaves of these species of trees are the main source of food for earthworms in that area and they with herbaceous vegetation covering the ground. Multi-annual average temperature of 8.8 ° C, and the amount of annual rainfall exceeds 600 l / m.

In the spring of 2010 were down 4 locations (marked synthetic L1, L2, L3 and L4) spaced on a circular area with a diameter of 1km, each having its own structure of wood and herbaceous plant species. The four locations were moved in 2011 and the same in 2012 to more accurate results and more complete information.

Sampling of biological material was carried out in four stages, each corresponding to a respective season: March, April, June and August of each year studied. Samples were sorted manually separate categories of species (species epigenous, endogee and ANEC) and identified in the laboratory.(Csudy and Pop, 2011; Pop, 2007).

RESULTS AND DISCUSSIONS

In 2010, six species were collected, with a total number of individuals of 186 individuals, as can be seen in the table below:

Table 1

Records and abundance of species collected in 2010

No.	Species	April	June	August	November	Total ind.
1	*Eisenia foetida*	48	12	2	2	**64**
2	*Eisenia submontana*	-	2	-	-	2
3	*Lumbricus castaneus f. typica*	23	11	1	-	35
4	*Lumbricus rubellus*	15	9	2	22	48
5	*Dendrobaena rubida*	-	1	-	-	1
6	*Eiseniella tetraedra typica*	12	7	-	17	36
	Total individuals	**98**	**42**	**5**	**41**	**186**

The dominant species was *Eisenia foetida* with 64 individuals collected, respectively 34.46% of total individuals, and the month with the highest number of individuals was collected is April, when they were harvested 98 individuals of 4 species, 52.68 % of all individuals collected during the year.

In 2011 there were a total of 12 species collected a total of 1,077 individuals (table 2).

Table 2

Records and abundance of species collected in 2011

No.	Species	April	June	August	November	Total ind.
1	*Allolobophora caliginosa*	28	14	-	-	42
2	*Allolobophora rosea*	23	6	-	12	41

3	*Octolasium lissaense*	-	4	-	-	4
4	*Eisenia foetida*	50	47	49	47	193
5	*Eisenia submontana*	43	32	50	24	129
6	*Lumbricus terrestris*	18	8	4	-	30
7	*Lumbricus castaneus*	45	56	40	36	177
8	*Lumbricus rubellus*	51	47	58	57	213
9	*Dendrobaena typica*	15	1	-	2	18
10	*Dendrobaena octaedra*	5	-	1	-	6
11	*Dendrobaena rubida*	21	21	29	36	107
12	*Eiseniella tetraedra f. typica*	46	60	25	27	158
	Total individuals	**345**	**296**	**256**	**244**	**1077**

The dominant species was *Lumbricus rubellus* with 213 individuals, or 19.20% of the total, followed *by Eisenia fetida* by 193 individuals, and the species was accidentally present *Octolasium lissaense* 4 individuals. Most individuals were collected in April, but the difference between the number of individuals collected in the 4 seasons was not significant.

2012 15 species were collected and a total of 680 individuals (table 3).

Table 3.

Records and abundance of species collected in 2012

No.	Species	April	June	August	November	Total ind.
1	*Allolobophora caliginosa*	26	8	-	22	56
2	*Allolobophora rosea*	21	4	-	19	44
3	*Allolobophora dugesi var. Dacica*	12	-	-	-	12
4	*Dendrobaena octaedra var. Typica*	21	2	1	7	31
5	*Dendrobaena alpina var. typica*	2	-	-	-	**2**
6	*Dendrobaena rubida*	25	11	1	8	45
7	*Eisenia fetida*	45	29	3	26	**103**
8	*Eisenia submontana*	27	15	1	19	62

9	*Eisenia lucens*	3	1	-	1	5
10	*Eiseniella tetraedra typica*	17	2	-	8	27
11	*Lumbricus terrestris*	23	4	1	19	47
12	*Lumbricus rubellus*	44	27	2	43	**116**
13	*Lumbricus castaneus*	6	-	-	-	6
14	*Octolassium lissaense*	18	6	-	4	28
15	*Octolassium lacteum*	41	12	2	41	96
	Total individuals	**331**	**121**	**11**	**217**	**680**

In 2012, the same species that were dominant in the previous year ,*Lumbricus rubellus* and *Eisenia fetida*, the month with most individuals being collected April.

2012 was a particular year even Carpathian areas, characterized by persistent drought, high temperatures for long periods alternating with heavy rain, so there were significant differences between collection, August being the poorest, and individuals collected were very few in number.

CONCLUSIONS

After analyzing and interpreting information obtained after 3 successive years in the same complex collections I have seen the following:

- In the study area there are 15 species, but they have shown differently in the first year of collection is determined only 6 in the 2nd 12 and in the third year 15.

- Species present in all 3 years of research were: *Eisenia fetida*, *Lumbricus rubellus*, *Eisenia submontana*, *Lumbricus castaneus, Dendrobaena rubida*.(Pop V.Victor,2005).

- Completely accidentally occurring species (only in a certain year) were *Octolasium lacteum*, *Eisenia lucens*, and *Allolobophora dugesi Allolobophora caliginosa var. Dacica*.

REFERENCES

1. **Csuzdi C., Pop Antonia, 2011** - *The Earthworm fauna of the Carpatian Basin with records and description of three new species*, Zoologischer Anzeiger.
2. **Pop Antonia et al., 2007** - *Application of 16 S, 18 S and rDND and COI sequences in the Molecular Systematics of the Earthworm family Lumbricidae*, European Journal of Soil Biology.
3. **Pop V., 1949** - *Lumbricidele in Romania*, Annals Academy RPR, RPR Academy Publishing House, Bucharest
4. **Pop V.V., 2005** - *The Pop's collection earthworm (Annelida, Oligochaeta) from the Zoological Museum of the Babes-Bolyai University in Cluj-Napoca*, *Romania*. In: Advances in Earthworm Taxonomy II (Annelida: Oligochaeta). Cluj University Press, p. 211-22

CONTROL OF THE MAJOR APPLE PESTS

COMBATEREA PRINCIPALILOR DĂUNĂTORI LA MĂR

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Abstract. *In the period 2011-2012, at SCDP Iaşi, were carried out research to combat the most important pests in apple orchards. The experiment was conducted on a plantation of apple with Idared, Golden delicious and Florina varieties, and mites, codling moth and San Jose Scale, was pests on which the observations have been made. The combating complex it was realized with plant protection products of latest generation which recorded a very good efficiency.*
Key words*:* control, pests, effectiveness, insecticides, biology

Rezumat*. În perioada 2011-2012, la SCDP Iaşi s-au desfăşurat cercetări cu privire la combaterea celor mai importanţi dăunători întâlniţi în plantaţiile de măr. Experienţa s-a desfăşurat pe o plantaţie de măr la soiurile Idared, Golden delicious şi Florina, iar dăunătorii asupra cărora s-au efectuat observaţii au fost: acarienii, viermele merelor şi păduchele ţestos din San Jose. Complexele de combatere cuprind produse de protecţia plantelor cu eficacitate ridicată.*
Cuvinte cheie: combatere, dăunători, eficacitate, insecticide, biologie;

INTRODUCTION

Combating apple pest is one of the most difficult problems in plant protection of orchards. The large variety of the complex of pests specific to fruit-growing plantations imposes the application of a great number of control treatments during a calendar year (Beşleagă et al., 2012; Howell et. al.,1992).

Among the pests that cause significant damage in apple orchards are specified: mites (*Panonychus spp*), codling moth (*Cydia pomonella L.)* and San Jose scale (*Quadraspidiotus perniciosus Comst*). (Beşleagă et al. 2011; Cârdei et al., 2007).

During the period 2009 – 2011, at S.C.D.P. Iaşi there have been developed a several experimentations regarding the control of the major pests, above-mentioned, by using plant protection products which were recently introduced in the phytosanitary treatments.

MATERIAL AND METHOD

Researches on control of major pests of apple were conducted during 2011-2012, in an apple plantation, located in the SCDP Iaşi, and the varieties that were studied had included Idared, Golden Delicious and Florina, with trees planted at 4x3m distance.

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As part of this experience was also tested the effectiveness for combating mites, codling moth and San Jose scale, with plant protection products in the following diagram:

- for *Cydia pomonella L*
  - year 2011: generation I — treatment I : Coragen 0,0075%, treatment II : Proteus 0,04%
  - generation II — treatment I : Coragen 0,0075% treatment II :Decis Mega 0,011%
  - year 2012: generation I — treatment I : Coragen 0,0075%, treatment II : Proteus 0,04%
  - generation II — treatment I :Coragen 0,0075% treatment II : Laser 0,03%
- for *Quadraspidiotus perniciosus Comst*.
  - year 2011: generation I — treatment I:Calypso 0,02% treatment II : Pyrinex Quick 0,1%
  - generation II — treatment I :Calypso 0,02% treatment II : Pyrinex 48EC 0,2%
  - year 2012: generation I — treatment I : Calypso 0,02% treatment II : Reldan 0,15%
  - generation II — treatment I : Pyrinex Quick 0,1% treatment II : Novadim 0,15%
- for San Jose scale (winter generation) and hibernated eggs of mites - Confidor Oil – 1,5%

Phytosanitary treatments were applied to the warning, depending on the climate changing, pest biology and plant phenology.

In the period 2011-2012, climatic conditions, were also very favorable for attack and pests evolution. Under these conditions, there were several deviations from normal values of the main climatic factors, although these changes are quite common in this area (table 1).

Thus, in terms of climate, the annual average temperature was lower with $0,6^0$C in 2011 and $1,6^0$C in 2012 compared to the annual average. Maximum temperatures during May - August above $30,1^0$C ($41,3^0$C in August 2012) combined with 81,2 - 98,4mm of precipitation from April and June have drastically favored the evolution and pest attack. It should be noted that in 2011, rainfall had the same value of 432,4mm just like the normal one (432,4mm), although in the period September to December, there was an acute shortage of precipitation (below 50% of this time normal) table 1. In 2012, the total amount of rainfall recorded was about 446.6 mm, much larger than normal (432.4 mm).

RESULTS AND DISCUSSION

The results regarding efficacy of insecticides used to control the main pests of apple are presented in tables 2 and 3. The success for combating of these pests is guaranteed, only if, phytosanitary treatments are performed at warning.

At the beginning of the vegetation period (lug-mouse), it was conducted a treatment against mites on their hibernating eggs, with Confidor Oil product in concentration of 1.5%. It has a long lasting effect for more than 30 days, ensuring the optimal penetration of plant systemic component and his protection effect against mites is for 5 to 6 months.

Table 1

Main climatic elements during 2011-2012

Month	Normal average T ^{0}C	Temperature ^{0}C						Precipitation		Normal average precipitations (mm)
		2011			2012			2011	2012	
		mean	high	low	mean	high	low			
I	-2,6	-2,2	-16,2	10,4	-2,7	-18,3	11,9	15,8	8,4	32,7
II	-0,2	-2,6	-5,8	0,9	-9,2	-24,3	8,4	6,0	18,2	25,6
III	4,3	3,5	-1,3	8,7	4,1	-11,0	21,7	13,2	19,6	35,0
IV	11,5	10,0	4,8	15,1	12,7	-1,4	30,9	81,2	62,0	44,0
V	16,6	15,8	2,3	30,1	17,3	5,8	31,3	39,0	84,2	51,3
VI	20,2	19,6	8,7	33,5	21,2	10,7	37,0	98,4	32,0	65,4
VII	22,1	21,8	9,6	34,1	25,3	12,8	38,5	72,4	24,8	91,0
VIII	21,4	20,4	8,9	30,9	22,3	8,6	41,3	38,8	22,4	45,8
IX	15,7	17,7	5,5	30,4	18,2	7,9	31,4	18,4	53,0	46,7
X	11,2	8,5	-3,3	26,7	11,3	-0,6	27,7	39,4	41,2	51,9
XI	5,2	2,5	-5,5	13,1	5,9	-3,7	19,0	1,8	21,6	35,9
XII	-1,0	2,4	-9,3	14,5	-3,7	-14,0	6,9	8,0	59,2	23,5
Total	**10,4**	**9,6**	**-16,2**	**34,1**	**9,2**	**-18,3**	**41,3**	**432,4**	**446,6**	**432,4**

Table 2

Efficiency of phytosanitary treatments for combating of *Cydia pomonella L*

Used products	Dose l/ha	2011-% attacked fruits			Used products	Dose l/ha	2012-% attacked fruits		
		Idared	Golden	Florina			Idared	Golden	Florina
GIT1 – Coragen GIT2 – Proteus	0,15 0,8	1,0	1,5	1,1	GIT1 – Coragen GIT2 – Proteus	0,15 0,8	0,7	1,1	1,0
GIIT1 – Coragen GIIT2 – Decis Mega	0,15 0,225	0,8	1,2	0,9	GIIT1 – Coragen GIIT2 – Laser	0,15 0,6	0,6	0,8	0,7
Untreated control - Golden delicious	68,4%				65,2%				

Table 3

Efficiency of phytosanitary treatments for combating of *Quadraspidiotus perniciosus Comst.*

Used products	Dose	2011-% attacked fruits			Used products	Dose	2012-% attacked fruits		
		Idared	Golden	Florina			Idared	Golden	Florina
GIT1 – Calypso GIT2 – Pyrinex Quick	0,4 2,0	1,1	1,4	1,2	GIT1 – Calypso GIT2 – Reldan	0,4 3,0	0,8	1,3	1,0
GIIT1 – Calypso GIIT2 – Pyrinex 48EC	0,4 4,0	0,9	1,3		GIIT1 – Pyrinex Quick GIIT2 – Novadim	2,0 3,0	0,6	0,9	0,8
Untreated control - Golden delicious	64,2%				60,1%				

Efficacy against hibernating eggs of mites was 98%, for all 3 varieties.

During the growing season, to control both, Codling Moth and San Jose Scale, were performed two chemical treatments for each generation. Most attacked fruits by these pests were recorded on Golden Delicious variety, where the untreated control values were as follows: at the species *Cydia pomonella* has been recorded 68.4% of attacked fruits in 2011 and 65,2% in 2012 and also for the species *Quadraspidiotus perniciosus* the results were about of 64,2% in 2011 and 60,1% in 2012.

Products applied to combat the species *Cydia pomonella* (Coragen 0,0075%, Proteus 0,04% şi Decis Mega 0,01%), have reduced the insect attack to values of 0.8%, in 2011, for Idared variety (compared to untreated control where we recorded values up to 64.2% of attacked fruits). The following year, at the same used products, Laser insecticide was added, in concentration of 0.03%, thereby it was observed a decreasing of the percentage of attacked fruits at 0.06% (compared to untreated control where we recorded values up to 65,2% of attacked fruits).

Regarding to the San Jose scale, between the substances used in plant protection treatments, very efficient was Pyrinex Quick 0,1% and Novadim 0,15%, with a percentage of attacked fruits only by 0.6% in 2012, (compared to untreated control where we recorded values up to 60,1% of attacked fruits).

Application of combating scheme ensured a good pest control and the products used have proven to be a very effective suport, although climatic conditions during 2011 and 2012 period, have favored the evolution and the attack of this pests.

CONCLUSIONS

1. Climatic conditions were very favorable during 2011-2012 period, both development and attack on apple orchards;

2. Confidor Oil product applied at the beginning of the growing season proved to be very effective in combating the hibernating eggs of mites and other insects (aphids, ladybugs, etc.) recording an efficiency of over 98%;

3. Among a lot of the products used to control Cydia pomonella species, Coragen insecticide proved to be very effective, by applying it have recorded the lowest percentage of attacked fruits to the Idared variety (0.6% in 2011 and 0.8% in 2012);

4. Very effective insecticides were also: Coragen, Decis Mega and Laser to combating the Codling moth and products like Calypso, Pyrine Quick, Pyrinex 48EC and Novadim to combating of San Jose scale;

5. Insecticides used to control the main apple pests have showed a very high efficiency and can be used, successfully, in orchards protection.

REFERENCES

1. **Beşleagă Ramona, Cârdei E., Tălmaciu M., 2012** – *Reserach on the biology and control of San Jose to test scale SCDP Iaşi*. Lucr. şt. USAMV Iaşi, seria Horticultură, vol 55, nr. 2, p. 541-545.
2. **Beşleagă Ramona, Cârdei E., Tălmaciu M., 2011** – *Rezultate privind eficacitatea unor insecticide în combaterea principalilor dăunători ai mărului*. Lucr. şt. USAMV Iaşi, seria Horticultură, vol 54, nr. 2, p. 603-607
3. **Cârdei E., Corneanu G., Ramona Humă, 2007** – *Rezultate tehnologice şi economice în cultura mărului*. Lucr. şt. USAMV Iaşi, seria Horticultură, vol 50, nr. 1, p.
4. **Howell, J.F., Knight, A.L., Unruh, T.R., Brown, D.F., Krysan, J.L., Sell, C.R. and Kirsch, P.A. 1992** - *Control of codling moth in apple and pear with sex pheromone-mediated mating disruption*. J.ournal of *Ecoomic. Entomology* 85, p. 918-925.

PRINCIPAL SPECIES OF TORTRICIDES (CARNATION LEAF-ROLLERS) FROM APPLE ORCHARDS REPORTED IN THE SCDP FALTICENI IN 2011

PRINCIPALELE SPECII DE TORTRICIDE SEMNALATE ÎN PLANTAȚIILE POMICOLE DE MĂR DIN CADRUL S.C.D.P. FĂLTICENI ÎN ANUL 2011

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Abstract: *Defoliator butterfly are frequent pests in apple orchard. Observations were made in 2011 in apple orchard of SCDP Falticeni into two groups: a group chemically treated and untreated group. In this paper we present the comparative results on the dynamics of defoliator butterfly attack reported in plantations undergo conventional treatments and the untreated control. From chemical group the results obtained, three species were reported as follows: Adoxophyes orana (225 samples collected), Pandemis heparan (10 samples collected), Archips podana (54 samples collected).Most samples were collected larval stage of various ages, but were also samples collected and pupa stage.In the group treated due to the complex of parasites and predators that have significantly reduced populations of the same species were reported the tortricides(carnation leaf-rollers) with a smaller number of samples (23 samples), the predominant species being Adoxophyes orana (18samples).*
Keywords: *tortricides, apple orchards, pests*

Rezumat: *Lepidopterele defoliatoare sunt dăunători frecvenți în plantațiile de măr. Observațiile au fost efectuate în anul 2011 în plantațiile de măr ale S.C.D.P. Fălticeni în două loturi: un lot tratat chimic şi un lot netratat. În lucrare prezentăm rezultate comparative privind dinamica atacului lepidopterelor defoliatoare semnalate în plantațiile supuse tratamentelor convenționale de combatere şi în cele netratate. În lotul chimic în urma datelor obținute, au fost semnalate trei specii şi anume: Adoxophyes orana (225 exemplare colectate), Pandemis heparana (10 exemplare colectate), Archips podana (54 exemplare colectate). Majoritatea exemplarelor au fost colectate în stadiul de larvă, de diferite vârste, însă au fost şi exemplare colectate şi în stadiul de pupă. În lotul netratat datorită complexului mare de paraziți şi prădători care au diminuat semnificativ populațiile de tortricide au fost semnalate aceleaşi specii cu un număr mai redus de exemplare (23 exemplare), specia predominantă fiind Adoxophyes orana (18 exemplare).*
Cuvinte cheie: *tortricide, plantații pomicole, dăunători*

INTRODUCTION

Currently, culture is the most important crop apple orchards in our country are common in the mountains to the plain but large areas with intensive orchards

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superintensive found in the foothills and plateau areas where pools are made real fruit (Fălticeni Iasi, Pitesti, Voineşti etc.). This culture has a great complex of pests affecting both qualitative and quantitative value of the fruit, which is why it requires the implementation of measures to combat severe. It is known that most species that bring significant damage in orchards belong to the order Lepidoptera, this being due to the diet of the larvae, which can be filofag or xylophagous, thus destroying various organs of plants (Alexinschi and Peiu, 1966 Rakosy et al. 2003). A special group of lepidopteran defoliators consists of some species of the family *Tortricidae*, whose larvae build their silk threads using a feeding shelter made of leaves or parts of buds and shoots (Peiu, 1955). *Tortricidae* family is one of the largest families microlepidopterans with over 5,000 species recorded mainly from temperate and tropical regions, their number is much higher because the tropical equatorial region are poorly studied (Horak et al., 1991). Rollers have an average reproductive capacity of 50-200 eggs / female depending on the species, food, generation, inter-and intraspecific, climatic factors, etc.. During the period 1992-1999 the research were obtained by some authors (Diaconu, 1997; Diaconu, 2007) in apple orchards in many parts of our country more than 50 species of *Lepidoptera* belonging to the families *Argyresthiidae*, *Choreutidae*, *Gelechiidae*, *Oecophoridae*, *Plutellidae*, *Tortricidae*, *Yponomeutidae*, *Dilobidae*, *Geometridae*, *Lymantriidae*, *Lasiocampidae*, *Lycaenidae*, *Noctuidae* and *Papilionidae*. Among these families is remarkable because Tortricidae family representatives recorded the highest values of the number and frequency of specimens collected and also highlighting through a number of species such as *Hedya nubiferana* Haw., *Spilonota ocellana* Den.& Schiff., *Rhopobota naevana* Hb., *Adoxophyes orana* F.R., *Pandemis heparana* Den.& Schiff., *Pandemis cerasana* Hb., *Archips rosana* L., *Archips podana* Scop.

MATERIAL AND METHOD

Observations were carried out in the S.C.D.P. Fălticeni in 2011, the two groups studied that is:

A group that chemical treatments were applied according to warnings issued by the Plant Protection Centre, represented by the apple orchard on the farm "Center Dumbrava" orchard established in 1990 with an area of 53 ha. Jonatan predominant varieties, Golden and Starkimson to 90% and the remaining 10% are Ionared varieties, Florina, Rădăşeni and Fălticeni.

And a control group that were removed with a chemical treatment area of 0.5 ha being represented all the three varieties (Jonatan, Golden and Starkimson).

To carry out this research were collected in a non-selective samples of larvae and pupae of Lepidoptera foliofage the tree crown, less those species whose larvae live in nests or undermine limbo of leaves. Sampling was carried out with care to not crush or lose copies of the housing feeding larvae being collected are co with it and pupae with pupae shelter, taking care to be with exuvie last larval.

The collection of material in order to identify the species of tortricides was performed throughout the growing season of a calendar year, but most often

repeated in March-June, when most foliofag-rollers are active in the larval stage or the pupa.

Harvested material was gathered in the thick nylon cloth bags, and they were placed in metal baskets that ensured ventilation, not to be destroyed during transport.

Specimens at harvest are parasitoids or show signs of having parasites were isolated in small pipes / tubes.

After harvest, samples were brought to the laboratory where each sample collected was identified were grouped by species and larval age and adults may be achieved by increasing the effective parasites being kept under continuous observation (Fig. 1 a).

After recording the data on the label and isolation caterpillars feed is introduced within it, food that consists of 2-3 leaves from your access fresh fruit tree species where collections occurred (in this case 2-3 leaves of apple) then the tube is closed with a plug of cotton wool for the caterpillars to have air and are placed in boxes, usually made of cardboard, where time and place of collection to be easier to follow and also should avoid exposure to heat or sunlight direction (Fig. 1 b).

a **b**

Fig. 1 - Identification and growth of carnation leaf-rollers species in laboratory

Change excrement tube feeding and cleaning or replacing the tube with another clean is 2-3 days or even daily if food is consumed entirely, at which point is marked morphological changes occurring while data recorded on transition from one age to another, body size and cephalic capsule, the overall color of the body and especially the parties chitin, some elements of chetotaxie etc. The individuals who die from various causes, are removed from the tube and kept as dry material or 70% alcohol. If there are no morphological changes essential pupae have just watched their transformation into adults identifying sex.

RESULTS AND DISCUSSIONS

In 2011, the S.C.D.P. Fălticeni were carried out a total of 10 harvest the entire period of growth, especially in the months of April to July when most foliofage-rollers, is in the larval active stage or pupa. Of the 10 harvest, six harvests were performed in batch chemical from 22.04, 09.05, 26.05, 10.06, 04.08

and 29.07 respectively of 4 harvests in the untreated sample to 22.04, 09.05, 26.05, last harvest taking place on 10.06.

Carnation leaf-rollers species collected and analyzed (identified) in a plantation of apple orchards in the SCDP Fălticeni - chemical group.

The chemical group were performed at 6 selective harvesting on different dates depending on the mode of attack of different species-rollers are reported as (Tab. 1):

First harvest was place on 22.04, when they were collected a number of 4 samples belonging *Adoxophyes orana*, specimens were collected in the larval stage.

- II of harvesting took place on 09.05 being collected a total of 54 samples of which 53 belong *Adoxophyes orana* samples and a samples *Pandemis heparana* the species, all sampples were collected in the larval stage;

- The harvesting of III, which took place on 26.05, they collected a total of 114 samples of which 54 samples belonging *Adoxophyes orana* (49 ex. Collected in the larval stage and 5 EX. pupa stage), 54 samples belonging to the species *Archips podana* (51 ex. collected in the larval stage, and 3 EX. the pupa) and a number of 6 ex. species belonging *Pandemis heparan* (5 ex. collected larval stage and 1EX. pupa stage)

- The collection of IV dated 10.06, 12 samples were collected belonging *Adoxophyes orana*, all specimens were collected in the larval stage;

- The harvesting time of 29.07 V, was collected a total of 105 ex. in which: 102 ex. belong *Adoxophyes orana* (99 ex. collected in the larval stage and 3EX. pupa stage), and 3 ex. species belonging *Pandemis heparana* (1 ex. collected in the larval stage and 2EX. collected pupa).

- The last harvest of 04.08 on any item not collected.

Table 1

Carnation leaf-rollers species collected plantation of apple orchards in the SCDP Fălticeni - chemical group

No	Date of harv	Total	Adoxophyes orana Fisch.V.Rosl.			Pandemis heparana Den. & Schiff.			Archips podana Scopoli		
			No.	stage	A%	No.	stagel	A%	No	sta	A%
1.	22.04	4	4	Larvae	100	-	-	-	-	-	-
2.	09.05	54	53	Larvae		1	Larvae		-	-	-
3.	26.05	114	54	Larvae 49 Pupa 5	47,37	6	Larvae 5 Pupa 1	5,26	54	Larvae 51 Pupa 3	47,37
4.	10.06	12	12	Larvae		-	-	-	-	-	-
5.	29.07	105	102	Larvae 99 Pupa 3	97,14	3	Larvae 1 Pupa 2	2,86	-	-	-
6.	04.08	-	-	-	-	-	-	-	-	-	-

Carnation leaf-rollers species collected and analyzed (identified) in a plantation of apple orchards in the SCDP Fălticeni - untreated group.

In the untreated group, there were a total of four harvests, the situation thus:

- The harvest I, III and IV of data 22.04, 26.05, 10.06 not collect any copy;
- At the second harvest was collected in 23 samples, 18 samples belong *Adoxophyes orana*, 3 ex. *Hedy nubiferana* and two species belonging to ex. species belonging *Archips podana*, all 23 samples were collected in the larval stage (Tab. 2).

Table 2

Carnation leaf-rollers species collected plantation of apple orchards in the SCDP Fălticeni – untreated lot

No	Date of harv	Total	Adoxophyes orana Fisch.V.Rosl.			Hedya nubiferana Haworth			Archips podana Scopoli		
			No.	stage	A %	No.	stage	A %	No	stage	A %
1.	22.04	-	-	-	-	-	-	-	-	-	-
2.	09.05	23	18	Larvae	78,26	3	Larvae	13,04	2	Larvae	8,7
3.	26.05	-	-	-	-	-	-	-	-	-	-
4.	10.06	-	-	-	-	-	-	-	-	-	-

The chemical group the data obtained have been reported a number of three species namely *Adoxophyes orana* FR, *Pandemis heparan* Denis & Schiff., *Archips podana* L. with a total of 289 samples collected, the predominant species being *Adoxophyes orana* FR with a number of 225 samples collected, followed by *Archips podana* L 54 of a number of samples collected and *Pandemis heparana* Denis & Schiff. having the lowest number of samples collected ie 10 samples. Most species were collected in the larval stage, of different ages, but there were species collected in the pupa stage.

In the untreated group were reported all three species, however, a number of large complex due to parasites and predators that have significantly reduced populations of carnation leaf-rollers were collected a few samples (23 samples), the predominant species being more *Adoxophyes orana* FR with a total of 18 species, *Hedy nubiferana* Haworth 3 samples and *Archips podana* Scopoli. 2 samples.

CONCLUSIONS

1. In 2011, the S.C.D.P. Fălticeni were carried out a total of 10 harvest the entire period of growth, especially in the months of April to July when most foliofag-rollers, is in the larval stage of processing or pupa.

2. The chemical group were made of 6 harvests a total of 289 samples collected, the predominant species being *Adoxophyes orana* FR with a number of 225 samples collected, followed by *Archips podana* 54 L of a number of samples collected and *Pandemis heparana* Denis & Schiff. 10 samples collected.

3. In the group treated due to high complexity of parasites and predators that have significantly reduced populations of carnation leaf-rollers were collected a total of 23 species predominant species being *Adoxophyes orana* FR with a total of 18 samples, *Hedy nubiferana* Haworth 3 samples and 2 samples *Archips podana* Scopoli.

REFERENCES

1. **Alexinschi A., Peiu M. 1966** - *Contribuţii la cunoaşterea lepidopterelor din Moldova şi Regiune Iaşi* (partea a VIII-a). Analele Şt. ale Univ. "Al.I.Cuza"- Iaşi (Biologie), 12(2), p. 365 - 368.
2. **Diaconu A., 1997 –** *Noi contribuţii la cunoaşterea tortricidelor foliofage (Lep.: Tortricidae) ale arborilor fructiferi.* Bul. şt., seria Biol., Univ. Piteşti, 1(1) , p. 161 – 167.
3. **Diaconu A., 2007** – *Tortricide foliofage (Lepidoptera:Tortricidae) ale pomilor fructiferi din România.* Editura ,,Ion Ionescu de la Brad" Iaşi.
4. **Horak Marianne, Brown R., 1991 –** *Tortricid pests Their biology, natural enemies and control Ed. Elsevier Amsterdam.*
5. **Peiu M., 1955** - *Contribuţii sistematice şi biogeografice asupra tortricidelor din Moldova.* Bul.Şt. (Şt. Biol., Agr., Geol., Geogr.), 7 (4),p. 1282 – 1293.
6. **Rakosy L., Goia M., Kovacs Z. 2003 -** *Catalogul Lepidopterelor României* / Verzeichnis der Schmetterlinge Rumaniens. Soc. Lepid. Rom. Cluj-Napoca. 446 pp.

CROP PROTECTION ASPECTS OF WINTER RAPE THE *BREVICORYNE BRASSICAE* IN CONDITION OF BRĂILA PLAIN

ASPECTE PRIVIND PROTECȚIA CULTURILOR DE RAPIȚĂ DE TOAMNA DE *BREVICORYNE BRASSICAE* ÎN CONDIȚIILE CÃMPIEI BRĂILEI

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Abstract. *Rapeseed crop success is conditioned by respected technology links all plant protection against attack by pests ferecvent reduce production by 33%, leading to compromised in some years. Brevicoryne brassicae conditions in Câmpia Brăilei is one of the widespread and damaging species in some years its mass attack taking place. Because of this from 2008-2012 were organized experiences with a range of insecticides to control this pest, which in the period of buds - the maturity of the crop produce damage.*
Key words *: winter raps, Brevicoryne brassicae, corp protection*

Rezumat *.Reuşita culturilor de rapiță este condiționată de respectatea tuturor verigilor tehnologice de protecția plantelor împotriva atacurilor produse de dăunătorii care ferecvent diminuează producția până la 33%, ajungându-se în unii ani la compromiterea acesteia. În condițiile Câmpiei Brăilei Brevicoryne brassicae este una dintre speciile cele mai răspândite şi păgubitoare , în unii ani având loc atacul acestuia în masă. Din această cauză în perioada 2008-2012 au fost organizate experiențe cu o gamă de insecticide pentru controlul acestui dăunător, care în perioda de îmbobocore - maturitatea a culturii, produce mari pagube.*
Cuvinte cheie *: rapită de toamnă, Brevicoryne brassicae, frecvența, eficacitate.*

INTRODUCTION

Because harmful entomofauna rape crops in the country's includes a large number of species, pest control and combating must be dynamic and well developed (Buzdugan, 2011; Rîşnoveanu, 2010 ; Trotuş, 2009). *Brevicoryne brassicae* is one of the most damaging pests during adulthood (Popov and Barbulescu, 2007; Trotuş, 2009 Rîşnoveanu, 2010 Buzdugan, 2011).

MATERIAL AND METHOD

Research was conducted in Câmpia Brăilei in the period 2008-2012 , they conducted a series of observations and measurements on the collection and identification of harmful entomofauna winter rape crops, especially *Brevicoryne brassicae*.

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To prevent attack by *Brevicoryne brassicae* has experienced a wide range of insecticides: Dackillin 0.2 l / ha, Mavrik 2F 0.2 l / ha, Karate Zeon 0.2 l / ha, Biscay OD 240 0.3 l / ha

The research was installed after randomized block method in five repetitions. Observations and measurements were made on the frequency of this pest, both untreated variant and the variants that were applied insecticides mentioned above. Efficacy of insecticides was determined using Abott's formula

Scientific data obtained were calculated and statistically analyzed using analysis of variance, compare mutiplã, regesiile and correlations (statistical package SAS / SAT, PASW).

RESULTS AND DISCUSSIONS

Brevicoryne brassicae part of the order *Homoptera*, suborder *Aphidina* family *Aphididae,* accounting for 8.4% of all insect species identified in Câmpia Brială includes 3 species : *Brevicoryne brassicae L., Smynthurodes betae Wstw.* and *Myzodes persicae Sulz*., each with a different impact on the culture of rape. Bet on this farm complex (*Brevicoryne brassicae*), accounting for 85% of the systematic order is the main representative. This species has economic importance and potential harm of rape plants which can lead to the compromise of chains, when you do not take appropriate protective measures. (fig.. 1).

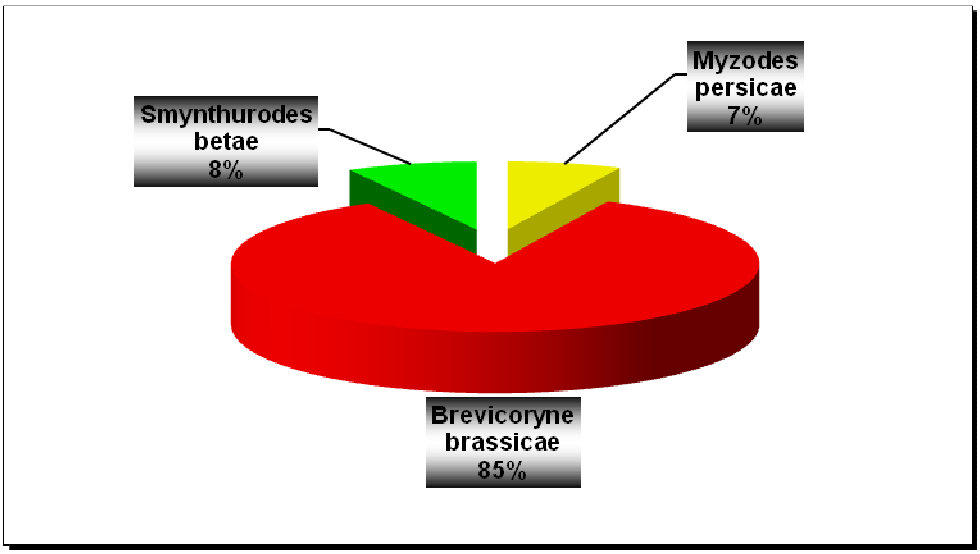

Fig.1 - Structure of rape in order *Homoptera* in Brăila Plain

In figure 2 can be seen that the application of protective substances in the control population *Brevicorine brassicae* in Câmpia Brăilei causes a significant decrease in frequency of this pest (R = 0.9415 **) 72.4%, indifferent of insecticide experienced

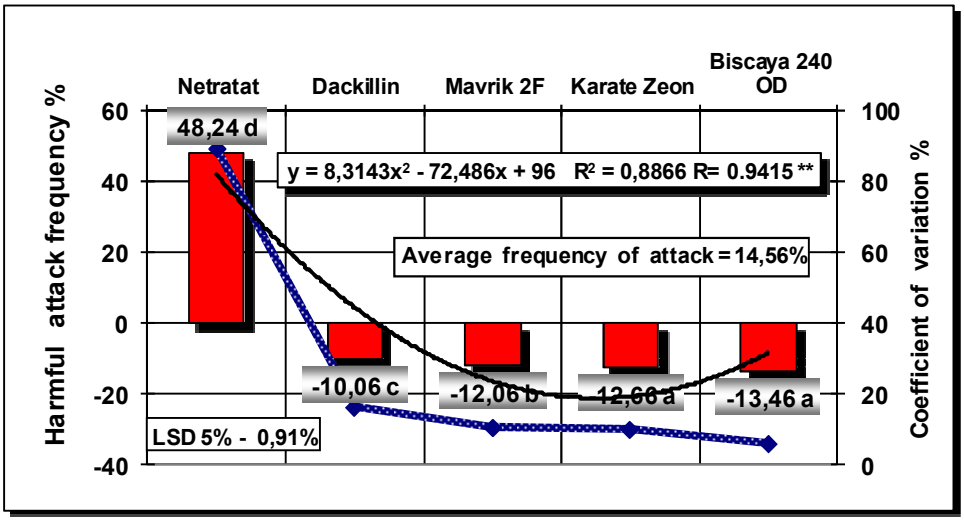

Fig 2 - Frequency of attack by *Brevicoryne brassicae* in winter rape culture

Lowest frequency of pest ones is determined by Biscaya OD 240 and Karate Zeon, which is on the first level of significance with a decrease of 13.46% and 12.66% to 14.56% average rate experiment

Efficacy of insecticides applied to combat rape culture *Brevicoryne brassicae* was significant with the application of protection substances tested, being at the level of 97.1% (R = 0.9462 **) (fig. 3).

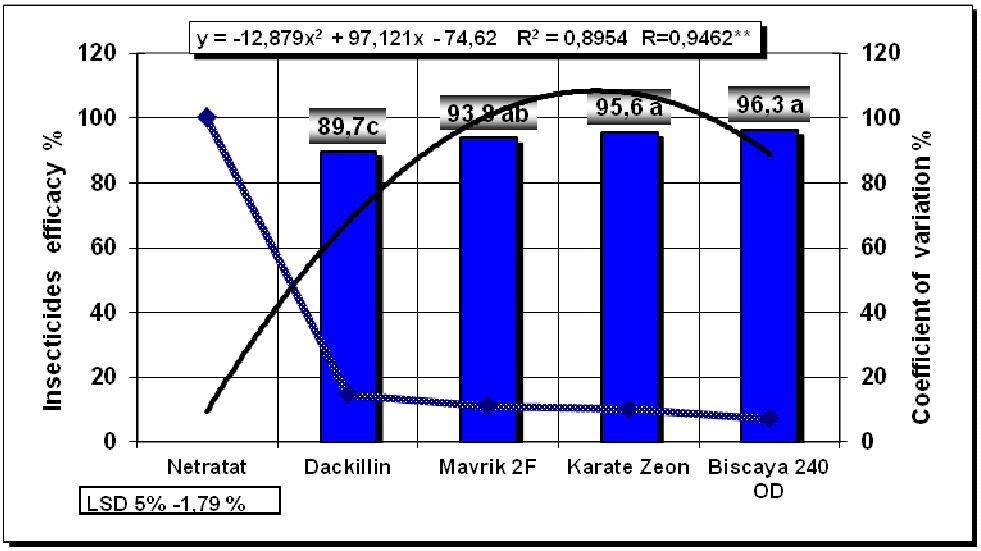

Fig.3 - Efficacy of insecticides applied pest *Brevicoryne brassicae* in winter rape culture

Biscaya OD 240 of 96.3% and 95.6% of Karate Zeon determine the most effective insecticides placing the first level of significance.

Not be neglected Mavrik 2 F which determine in conditions Câmpia Brăilei winter rape culture in pest control efficacy of 93.8%

At the same time there is a special stability of the effectiveness of these insecticides during recording spreads in the 5 years of experimentation insignificant between 7.2 to 10.2%.

CONCLUSIONS

1. To control pest population in winter rape in this case *Brevicoryne brassicae* is in this case permanent determination of the structure and its weight at some point during the growing season

2 Determination of *Brevicoryne brassicae* attack frequency is essential in achieving an efficient and dynamic structure in choosing protective substances that determine the best efficacy

3. Insecticides Biscaya 240 OD, Karate Zeon, Mavrik 2 F proved to be the most effective in combating this pest particularly damaging

REFERENCES

1.Buzdugan L. Gh., **2011**- *Tehnologia culturii de rapită de toamnă în Insula Mare a Brăilei*. Teza de Doctorat, USAMV Bucureşti

2.Popov. C., Bărbulescu, 2007- *50 de ani de activitate ştiinţifică în domeniul protecţiei culturilor de camp, împotriva bolilor şi dăunătorilor*. An. INCDA Fundulea , volum jubiliar LXXV

3.Rîşnoveanu Luxiţa 2010 – *Influenţa unor factori fitotehnici asupra populaţiei de dăunători la rapită de toamnă în zona Bărăganului de Nord-Est.* Teză de Doctorat USAMV Bucureşti

4.Trotuş Elena, Popov,C., Rîşnoveanu Luxiţa, Stoica V., Mureşan Felicia, Naie Margareta, 2009 – *Managementul protecţiei culturilor de rapiţă fată de atacul insectelor dăunătoare*. An. INCDA Fundulea, Vol.LXXVII

BENEFICIAL ENTOMOFAUNA FROM THE CABBAGE CROP FROM THE BANU MĂRĂCINE, CRAIOVA AREA

ENTOMOFAUNA UTILA DIN CULTURA DE VARZĂ DIN ZONA BANU MĂRĂCINE, CRAIOVA

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Abstract. *Knowledge of beneficial species, their density and behavior is essential to the integrate pest control. Following our research, conducted at SD Banu Maracine, Craiova cabbage crop, we identified 37 species of beneficial insects which has intervening in the cabbage pest density. Beneficial fauna identified in SD Banu Maracine consists of predators, parasites and few pantofagi. Parasites and predators feed on eggs, larvae and adult insects present in cabbage crops. The beneficial fauna comprised species framed in two classes: Insecta, Arachnida; six orders: Neuroptera, Heteroptera, Coleoptera, Hymenoptera, Diptera, Araneae.*
Key words: *beneficial entomofauna, cabbage, Banu maracine*

Rezumat. *Cunoaşterea speciilor utile, a densității şi comportării lor este o condiție esențială în integrarea pe baze ştiințifice a mijloacelor de combatere. În urma cercetărilor noastre, efectuate la SD Banu Maracine în cultura de varză Craiova, am identificat 35 specii de insecte utile care au intervenit în reglarea densității dăunătorilor verzei. Fauna utilă identificată la SD Banu Maracine este formată din prădători, paraziți şi foarte puțini pantofagi. Paraziții şi prădătorii se hrănesc cu ouă, larve de insecte şi adulți ai insectelor dăunătoare prezente în culturile de varză. Entomofauna utila a cuprins specii incadrate in doua clase: Insecta, Arachnida; sase ordine: Neuroptera, Heteroptera, Coleoptera, Hymenoptera, Diptera, Araneae.*
Cuvinte cheie: *entomofauna utila, varza, Banu Maracine*

INTRODUCTION

In our country cabbage has a high prevalence area and found favorable growing conditions in all counties, especially on meadows, excepting mountains and arid area (Mitrea, 2005). The largest area cultivated in irrigated system are found in the Danube Plain, West Plain, Southeast and the Transylvanian Plateau.

Lately there has been a strong multiplication of the pest species and there has increased the damage produced by the cabbage moth (*Mamestra brassicae* L.), turnip flea beetle (*Phyllotreta undulata* Kutsch.), cabbage aphid (*Brevicoryne brassicae* L) and cabbage fly (*Delia brassicae* L.) (Andow et al., 1986).

In order to reduce the damage caused by these pests were undertaken studies and research regarding the integrated control of them. For this an

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important link is the knowledge of the useful fauna that can help restore the biocenotic balance (Root, 1973).

MATERIAL AND METHOD

The research has been made at the S.D. Banu Maracine, on an area of 2000 m^2, cultivated with autumn cabbage, Buzau variety. The crop has been set up in the first decade of July, preceded by a crop of peas.

Regarding the collection and identification of beneficial entomofauna from the cabbage crop.

Determinations consists in:

- ground surveys, using the metrical frame 25/25 cm;
- collecting with entomological net;
- collecting with traps installed from the begining to harvesting crops.

Collecting of biological material was made weekly. Biological material collected was analyzed and determined using the binocular magnifier glass using the Panin Identification Manual (Panin, 1951).

RESULTS AND DISCUSSIONS

Following our research, conducted in the cabbage crops of the Banu Maracine Craiova, we identified 35 species of beneficial species, which were intervening in the regulation of the cabbage pest density (table 1).

Useful fauna identified in S.D. Banu Maracine consists of predators, parasites and few pantophagi.

Parasites and predators feed on eggs, insects larvae and adults of the harmful species present in cabbage crops (Thompson, 1984) .

Species of Coleoptera order are most numerous (61%), followed by representatives of the orders Hymenoptera (21%) and Neuroptera (9 %).

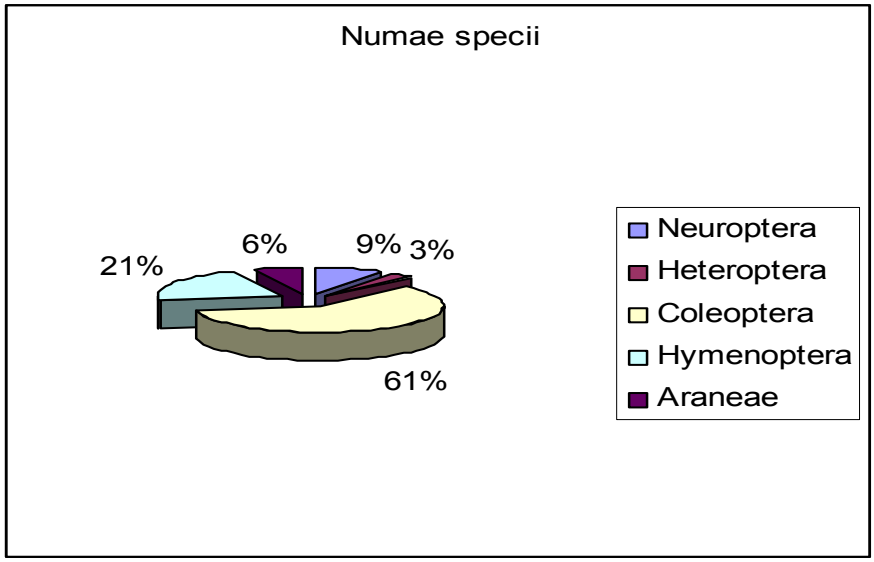

Fig. 1 – Beneficial entomofauna, order classification

Table 1

Beneficial species identified in the cabbage crop from SD Banu Maracine, 2011

Class	Orderl	Family	Species	Trophic relations
Insecta	*Neuroptera*	*Chrysomidae*	*Chrysopa carnea* Steph.	predator
			Chrysopa perla L.	predator
			Chrysopa septempunctata Wes.	predator
	Heteroptera	*Nabidae*	Nabis rugosus L.	predator
	Coleoptera	*Carabidae*	*Bembidion lampros* Hrbst.	predator
			Bembidion quadrimaculatum L.	predator
			Brachynus elegans Chand.	predator
			Anisodactylus signatus Panz.	predator
			Abax ater Vill.	predator
			Agonum dorsale Pont.	predator
			Poecilus cupreus L.	predator
			Poecilus sericeus Fw.	predator
			Pseudophonus rufipes Deg.	predator
			Pterostichus melanarius Ill.	predator
			Pterostichus vernalis Panz.	predator
			Calathus halensis Sch.	predator
			Clivina fossor L.	predator
			Carabus cancellatus Ill.	predator
		Cicindelidae	*Cicindela germanica* L.	predator
		Staphylinidae	*Lethrobium fulvipene* Grav.	predator
			Aleochara bilineata Gvll.	predator
			Oxytelus rugosus F.	predator
		Coccinellidae	*Coccinella septempunctata* L.	predator
			Adalia bipunctata L.	predator
	Hymenoptera	*Ichneumonidae*	Diadegma armilata Grav.	parasite
			Thyraella colaris Grav.	parasite
		Braconidae	*Apanteles glomeratus* L.	parasite
		Aphdiidae	*Praon volucre* Hal.	parasite
		Trichogrammatidae	*Trichogramma evanescens* W.	parasite
		Pteromalidae	*Hyposoter ebeninus* Grav.	parasite
		Formicidae	*Formica rufa* L.	pantophagous
	Diptera	*Larvivoridae*	*Tachina larvarum* L.	parasite
		Syrphidae	*Spaerophoia scripta* L.	predator
Arachnida	*Araneae*	*Lycosidae*	*Pardosa agrestis* W.	predator
			Pardosa agricola Th.	predator

CONCLUSIONS

According to the obtained results, we can say that at S.D. Banu Maracine, within the vegetable area, cabbage crop, were identified 35 beneficial species.

Among them the weight has been represented by the insect species, namely the ones belonging to Coleoptera order 20 species, grouped into 4 families.

At the opposite pole has been placed the order Heteroptera with one species *Nabis rugosus* L.

REFERENCES

1. **Andow,D.A., Nicholson,A.G., Wien H.C., Willson,H.R., 1986 -** *Insect populations on cabbage grown with living mulches.* Environ. Entomol. 15, p. 293–299.
2. **Panin I., 1951** - *Determinatorul Coleopterelor dăunătoare şi folositoare din R.P.R.* Editura de Stat, Bucureşti.
3. **Mitrea I., 2005** - *Entomologie agricolă*. Editura Universitaria, Craiova.
4. **Root R.B., 1973 -** *Organization of a plant-arthropod association in simple and diverse habitats, the fauna of collards (Brassica oleracea)*. Ecol. Monogr. 43, p. 95–120.
5. **Thompson J.N., 1984 -** *Insect diversity and the trophic structure of communities*. In: Huffaker, C.B., Rabb, R.L. (Eds.), Ecological Entomology. Wiley, New York, p. 591–606.

INFLUENCE OF SOME EXOGENOUS FACTORS ON γ AMYLASE ACTIVITY IN FUNGUS *RHIZOPUS STOLONIFER*

INFLUENȚA UNOR FACTORI EXOGENI ASUPRA ACTIVITĂȚII γ AMILAZEI LA CIUPERCA *RHIZOPUS STOLONIFER*

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Abstract. *Microbial amylases are present among bacteria, protozoa, algae and fungi, and fungal amylases are found especially in species of Aspergillus and Rhizopus. The use of these microorganisms in industrial scale production has obvious advantages, including rapid multiplication rate, diversity of present enzymes and genetic manipulation. Synthetic media are costly and therefore the use of cheap and available raw materials such as grain caryopses with a high starch content is required. The objective of this paper is to monitor the influence of nutritive substrate represented by grinded cereal caryopses, the pH, trace elements and amino acids on the γ amylase activity from fungus Rhizopus stolonifer. Enzymatic measurements were performed at three time intervals: 3, 6 and 9 days. A stimulatory action exerted amino acids: histidine, methionine, glutamic acid and trace elements: manganese, copper and trace elements mixture, and the optimum pH of the enzyme activity was 7 for media with corn, 6 for media with wheat and 4 for media with barley.*
Key words: *Rhizopus stolonifer, γ amylase, pH, amino acids, trace elements, cereal caryopses.*

Rezumat*. Amilazele microbiene sunt prezente la bacterii, protozoare, alge și ciuperci, iar cele fungice se găsesc mai ales la speciile de Aspergillus și Rhizopus. Utilizarea acestor microorganisme în producția la scară industrială are avantaje evidente, ce includ rata rapidă de multiplicare, diversitatea enzimelor prezente și posibilitatea de manipulare genetică. Mediile de cultură sintetice sunt costisitore de aceea se impune folosirea unor materii prime ieftine și ușor accesibile cum sunt cariopsele de cereale cu un conținut ridicat de amidon. Obiectivul acestei lucrări reprezintă monitorizarea influenței substratului nutritiv reprezentat de cariopse măcinate de cereale, al pH-lui și al aminoacizilor asupra activității γ amilazei la ciuperca Rhizopus stolonifer. Măsurătorile enzimatice au fost efectuate la 3 intervale de timp: 3, 6 și 9 zile. O acțiune stimulatoare au exercitat aminoacizii: histidina, metionina, acidul glutamic și oligoelementele: manganul, cuprul și mixtura de oligoelemente, iar pH-ul optim de acțiune al enzimei a fost 7 în cazul mediilor cu porumb, 6 în cazul celor cu grâu și 4 în cazul mediilor cu orz.*
Cuvinte cheie*: Rhizopus stolonifer, γ amilaza, pH, aminoacizi, oligoelemente, cariopse măcinate*

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INTRODUCTION

Microbial amylases are present among bacteria, protozoa, algae and fungi, and fungal amylases are found mainly in species of *Aspergillus* and *Rhizopus* (Fisher and Stein, 1960). The use of these microorganisms in production an industrial scale has obvious advantages, including the rapid rate of multiplication, the diversity of present enzymes and possibility of genetic manipulation. Usually fungal amylase production was achieved with well defined chemical culture media by submerged fermentation or solid state fermentation (Ayogu and Amadi, 2010). However, these culture media are costly and therefore it requires the use of cheap and readily available row materials such as cereal caryopses with high starch content, which makes them excellent growth nutritive substrates for amylase producing microorganisms.

The glucoamylase is a hydrolyzing enzyme that can degrade both the amylose and amylopectin true hydrolyzing α-1,4 and α-1,6 glycosidic bonds of starch to produce glucose. Since can completely convert starch to glucose, glucoamyalase is currently one of the most important enzyme in the food industry (Ono et al., 1964; Beauchat 1987; Soccol et al., 1992), being used for the production of glucose and fructose syrup from liquefied starch. It also is used in baking and many food industries based on fermentation for commercial production and in some cases in skin and detergents industries (Hesseltine, 1965; Reed and Rhim, 1987; Whistler et al., 1984). This enzyme is produced by a variety of fungal species (Tsujisaka et al., 1958; Sen and Chakarabarty, 1984), although commercial supplies are primarily obtained from *Aspergillus* and *Rhizopus* sp. as a result of their low trans glycosylation activity and the ability to obtain near 100% yields of glucose from starch (Mertens and Skory, 2007). Due to its increasing demand, the production technique of glucoamylase has been studied in detail (Nahar et al., 2008).

This study aimed to investigate the influence of nutritive substrate represented by grinded cereal caryopses, the pH, trace elements and amino acids on the activity of γ amylase from *Rhizopus stolonifer* grown on liquid medium.

MATERIAL AND METHOD

Studied species – *Rhizopus stolonifer* was isolated from germinated cereal caryopses. In order to monitor the effect of pH on γ amylase activity was used liquid Leonian medium ($K_2HPO4.7H_2O$ 1.25 g, $MgSO_4$ 0.625 g, peptone 1 g, glucose 20 g, distilled water 1000ml) (Constantinescu O., 1974), from whose composition carbon source – glucose was substituted with wheat, corn and barley caryopses (20 g/l). The medium was distributed in 100 ml quantities in Erlenmeyer flasks. The flasks inoculated with *Rhizopus stolonifer* were incubated at 28° C. We have obtained 7 working variants for each type of cereal caryopses with a pH scale ranging between 2 and 8, the medium pH being adjusted using NaOH and H_3PO_4 solutions.

To follow the influence of some amino acids on the activity of glucoamylase from saprophytic fungus *Rhizopus stolonifer* the nitrogen source represented by peptone was replaced with the following amino acids: α alanine, valine, methionine, glutamic acid, serine, histidine, asparagine and a control variant deprived of any nitrogen source.

In order to determine the influence of some trace elements the medium was supplemented with the following trace elements: B – 10 mg, Cu – 100 mg, Mn – 20 mg, Mo – 20 mg, Fe – 20 mg, Zn – 200 mg, Pb – 20 mg. These quantities were calculated from the following compounds: H_3BO_3, $CuSO_4$ x $5H_2O$, $MnCl_2$ x $4H_2O$, $NaMoO_4$ x $2H_2O$, $FeSO_4$ x $7H_2O$, $ZnSO_4$ x $7H_2O$, $Pb(CH_3COO)_2$ x $3H_2O$. The control was deprived of trace elements. Finally we obtained 8 medium variants for each cereal species, and also a variant supplemented with a solution of trace elements listed above.

Enzyme assays and determination of soluble proteins amount were performed at 3 time intervals from fungus inoculation: at 3, 6 and 9 days, being carried out from fungus culture liquid. The γ amylase measurement was performed using dinitrosalicylic reagent method (Cojocaru, 2009). The enzyme activity was reported to the amount of total protein estimated by Bradford method (Artenie et al., 2008). Experiments were performed in triplicate for the accuracy of obtained data.

RESULTS AND DISCUSSIONS

Optimum pH range of glucoamylase varies between 4.5 and 5, with stability at pH 7 (Taylor P.M., et al., 1978), and according to James J.A. and Lee B.H. (1997) the optimum pH of glucoamylase varies between 3.7 and 7.4. *Rhizopus oligosporus* and *Rhizopus*-RFF strain showed maximum γ amylase activity when they were grown at initial pH 4.5 (Jin B., et al., 1999; Nahar S., et al., 2008).

The influence of pH on glucoamylase activity determined at three time intervals from *Rhizopus stolonifer* culture liquid is depicted in figure 1. Thus, in the first time period (3 days) from fungus inoculation enzyme activity is maintained at low levels in all medium variants, regardless of nutritive substrate used. Maximum values of enzyme activity were obtained at pH=5 for media with wheat (16.259 U/ml/mg protein), at pH 7 for those with corn (36.331 U/ml/mg protein) and at pH 8 for those with barley (23.991 U/ml/mg protein). In the next time interval a significant increase in enzyme activity takes place in most experimental variants. The highest enzyme activity has been recorded at pH 6 for media with wheat (19.945 U/ml/mg protein), at pH 7 for those with corn (48.348 U/ml/mg protein) and at pH 4 for those with barley (38.412 U/ml/mg protein). In the last interval of the experiment a sharp decrease occurs in the γ amylase activity in all work variants. The highest values were observed at pH 8 for media with wheat (9.547 U/ml/mg protein), at pH 7 for those with corn (16.139 U/ml/mg protein) and at pH 4 for those with barley (17.158 U/ml/mg protein).

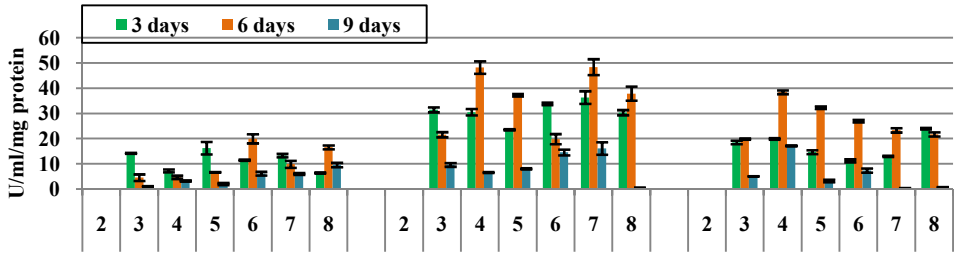

Fig. 1 - Influence of pH on γ amylase activity in fungus *Rhizopus stolonifer*

The influence of nitrogen source represented by a series of organic acids on γ amylase activity is shown in figure 2. After three days of incubation the enzyme activity was stimulated by the presence in the culture medium of glutamic acid (7.967 U/ml/mg protein), asparagine (10.628 U/ml/mg protein) and histidine (9.531 U/ml/mg protein) in media containing wheat caryopses, by the presence of histidine (15.095 U/ml/mg protein) and valine (18.623 U/ml/mg protein) in media with corn and by the presence of histidine (23.831 U/ml/mg protein) in the case of media with barley caryopses. At 6 days after fungus inoculation γ amylase was positively affected by all amino acids used in medium variants with wheat, the highest values being observed in variants with histidine (18.409 U/ml/mg protein) and methionine (15.78 U/ml/mg protein). α Alanine (9.489 U/ml/mg protein), asparagine (11.012 U/ml/mg protein) and valine (8.688 U/ml/mg protein) have a positive effect on the enzymatic activity in media with corn and regarding media with barley enzyme activity was stimulated by all amino acids, and the highest values were observed in the variants with α alanine (10.051 U/ml/mg protein) and methionine (9.489 U/ml/mg protein). In the last time interval glucoamylase activity was enhanced by the presence of all amino acids in media with wheat and barley, except for variant with valine (11.79 U/ml/mg protein) from wheat media and variant with methionine (4.442 U/ml/mg protein) from barley media. Also, the presence of asparagine (19.83 U/ml/mg protein) stimulated enzyme activity in the case of corn media. The highest values of γ amylase activity were observed in variants whit histidine (29.351 U/ml/mg protein) and methionine (31.874 U/ml/mg protein) for medium variants with wheat and in variants with histidine (14.87 U/ml/mg protein) and serine (18.543 U/ml/mg protein) for media with barley.

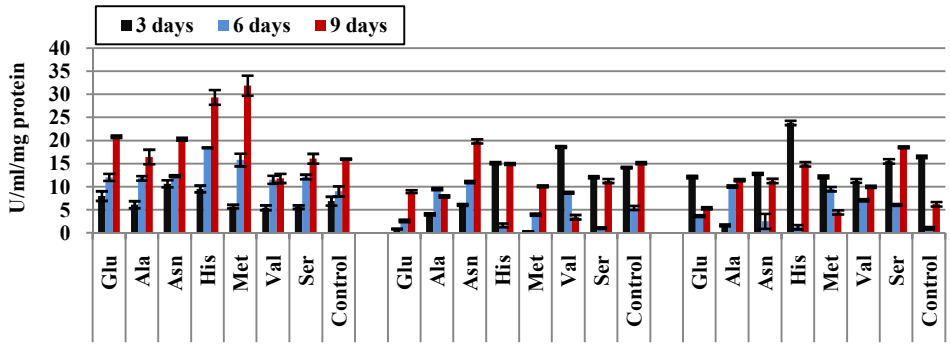

Fig.2 - Influence of amino acids on γ amylase activity in fungus *Rhizopus stolonifer*

To observe the influence of mineral elements on the glucoamylase activity, salts of these elements were added to the culture medium of fungus *Rhizopus stolonifer*. γ Amylase activity (figure 3) recorded, after 3 days of incubation, very high values in most work variants with grinded cereal caryopses. In medium variants with wheat caryopses a positive effect on the enzyme activity have had copper (30.144 U/ml/mg protein), manganese (57.482 U/ml/mg protein),

molybdenum (28.991 U/ml/mg protein), lead (26.491 U/ml/mg protein) and trace elements solution (66.491 U/ml/mg protein) and regarding medium variants with grinded corn caryopses most trace elements stimulated enzyme activity, except for the variant with iron (0,4292 U/ml/mg protein). Boron (9.811 U/ml/mg protein), copper (4.842 U/ml/mg protein), molybdenum (11.491 U/ml/mg protein), iron (13.575 U/ml/mg protein), lead (17.742 U/ml/mg protein) and the mixture of trace elements (13.736 U/ml/mg protein) have increased glucoamylase activity in medium set with barley. In the next time period there is a decrease in γ amylase activity in most work variants. In culture media that contained wheat amylase activity was stimulated by the presence of copper (28.027 U/ml/mg protein) and the trace elements mixture (22.161 U/ml/mg protein), while in the media supplemented with corn only molybdenum (22.067 U/ml/mg protein) stimulated enzyme activity. In the medium samples with barley enzyme activity was stimulated by manganese (17.582 U/ml/mg protein), zinc (15.495 U/ml/mg protein) and lead (23.187 U/ml/mg protein). In the last time interval γ amylase activity is increasing in most experimental variants. The enzyme activity was stimulated by the presence in the culture liquid of boron (33.798 U/ml/mg protein), copper (32.644 U/ml/mg protein), molybdenum (32.644 U/ml/mg protein), lead (40.047 U/ml/mg protein) in media with wheat; of all trace elements, except iron (10.532 U/ml/mg protein) regarding those with corn; of molybdenum (12.934 U/ml/mg protein) and the trace elements mixture (38.704 U/ml/mg protein) in the case of media with barley.

Manganese has a stimulating action on the glucoamylase activity synthesized by microorganisms (Pandey A., et al., 2000), as in the case of liquid cultures of *Rhizopus stolonifer*, medium variants supplemented with manganese showed quite high values.

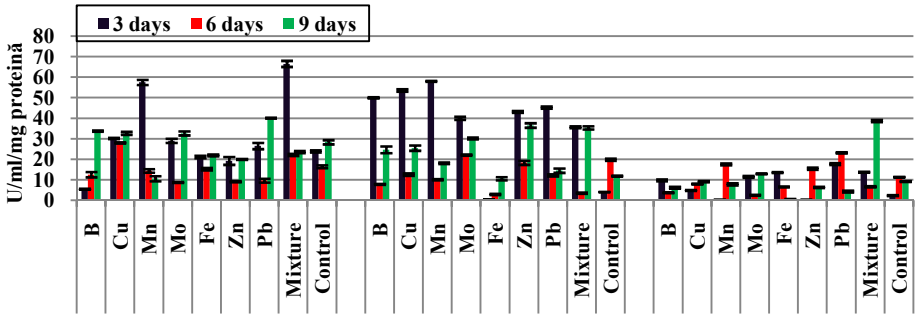

Fig. 3 -Influence of trace elements on γ amylase activity in fungus *Rhizopus stolonifer*

CONCLUSIONS

The maximum value of glucoamylase activity was recorded after 6 days of incubation at pH 6 for media with wheat, at pH 7 after for those with corn and at pH 4 for medium variants with barley caryopses. At the extreme value of pH 2 the fungus mycelium was completely inhibited during entire experiment. A number of amino acids have increased amylase activity: asparagines, histidine,

methionine, valine. Also, some trace elements that supplemented *Rhizopus stolonifer* culture medium had a positive effect on enzyme activity: boron, copper, manganese, zinc and trace elements solution.

REFERENCES

1. **Artenie Vl., Ungureanu E., Negura A.M**., **2008 –** *Metode de investigare a metabolismului glucidic şi lipidic – manual de lucrări practice*, Editura Pim, Iaşi, p. 97-99.
2. **Ayogu T.E., Amadi E.S., 2010** – *Amylase production by Rhizopus nigricans using mashed maize*, The Inter. Journal of Microbiology, Vol. 8, Nr. 1.
3. **Beuchat L.R., 1987** - *Food and Beverage Mycology*, 2nd Ed. Van Nostrand Reinhold, New York.
4. **Cojocaru,D.C., 2009** – *Enzimologie practică*. Editura Tehnopress, p. 141-143.
5. **Constantinescu O., 1974** - *Metode şi tehnici în micologie*, Editura Ceres, Bucureşti, p. 105-106.
6. **Fisher E.W., Stein E.A., 1960** - *Alpha-amylase*,*The enzyme*, Boyer PD, Lardy, H (Ed), Academic Press, New York.
7. **Hesseltine, C.W., 1965** - *A millennium of fungi, food and fermentation*, Mycologia, 57:149-197
8. **James J.A., Lee B.H., 1997** - *Glucoamylases: microbial sources, industrial applications and molecular biology – A review*, J. Food Biochem. Vol. 1, p. 1-52.
9. **Jin B., Huang, Leeuwen, H.J., Patel, B., Doelle, H.W., Yu, O., 1999 –** *Production of fungal protein and glucoamylase by Rhizopus oligosporus from starch processing wastewater*, Process Biochemestry, Vol. 34, p. 59-65.
10. **Mertens J.A., Skory C.D., 2007** – *Isolation and characterization of a second glucoamylase gene without a starch binding domain from Rhizopus oryzae,* Enzyme and Microbial Technology, Vol. 40, p. 874–880.
11. **Nahar S., Hossain F., Feroza B., Halim,M.A., 2008** – *Production of glucoamylase by Rhizopus sp. in liquid culture*, Pak. J. Bot., Vol. 40(4), p. 1693-1698.
12. **Ono S., Hiromi K., Zinbo M., 1964** - *Kinetic studies of glucoamylase, I. The influence of chain length of linear substrates on the rate parameter*, J. Biochem., (Tokyo) 55, p. 315-320.
13. **Pandey A., Nigam P., Soccol C.R., Soccol,V.T., Sihg,D., Mohan R., 2000** – *Advances in microbial amylases*, Biotehnol. Appl. Biochem., Vol.31, p. 135-152.
14. **Reed H.J., Rhem J., 1987** - *Enzymes in Food and Feed Processing,* Biotechnology, 7a, p. 547-603.
15. **Sen S., Chakarabarty S.L., 1984** - *Amylase from Lactobacillus cellobiosus isolated from vegetable wastage*, J. Ferment. Technol., Vol. 62 No. 5, p. 407-413.
16. **Soccol C.R., Cabrero M.A., Roussos S., Raimbault M., 1992** - *Selection of Rhizopus for growing on raw cassava*, In: Guerrero R (ed.) Proceedings of the VI International Symposium on Microbial Ecology, Barcelona, 6.
17. **Taylor P.M., Napier E.J., Fleming I.D., 1978** – *Some propreties of glucoamylase produced by the thermophilic fungus Humicola lanuginosa*, Carbohydrate Research, Vol. 61, p. 301-308.
18. **Tsujisaka Y., Fukumoto J., Yamamoto T., 1958** - *Specificity of crystalline saccharogenic amylase of moulds*, Nature, Vol. 181, p. 770-771.
19. **Whistler R.L., Bemiller J.N., Paschall E.F., 1984** - *Starch: Chemistry and Technology*, 2nd Ed. Academic Press. Orlando.

THE INFLUENCE OF THE NITROGEN SOURCE ON SOME DEHYDROGENASES INVOLVED IN THE ENERGY METABOLISM OF THE FUNGUS *TRICHODERMA REESEI* QM9414

INFLUENȚA SURSEI DE AZOT ASUPRA ACTIVITĂȚII UNOR DEHIDROGENAZE IMPLICATE ÎN METABOLISMUL ENERGETIC CE CARACTERIZEAZĂ FUNGUL *TRICHODERMA REESEI* QM9414

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Abstract: *Fungi are a very diverse group of organisms which share a rather similar morphology and a significant metabolic diversity. This diversity is reflected in the variaty of substrates fungi can use as carbon sources. Trichoderma reesei is an industrial fungus largely exploited for its ability to produce valuable enzymes. For enzyme production, cheap substrates, usually cellulose rich are prefered. The objective of this study was to investigate the influence of carbon sources represented by bio residues resulting from different agricultural practices, namely wheat straws, barley straws and maize stalks on the activity of Krebs cycle dehydrogenases and on glucose dehydrogenase . Also, we analysed how the nitrogen source, represented by different amino acids affect the activity of the aforementioned enzymes. Our results indicate that enzymes involved in Krebs cycle are influenced by the nutritional substrate used, by the addition of certain amino acids and last but not least by the age of the fungal culture.*
Keywords: *Trichoderma reesei, Krebs cycle, agricultural residues*

Rezumat: *Fungii reprezintă un grup divers de organisme care împărtășesc o morfologie destul de similar și o mare diversitate metabolică. Această diversitate se reflectă în gama variata de substraturi pe care ciupercile le pot folosi ca surse de carbon. Trichoderma reesei este o ciuperca industrială, puternic exploatată pentru capacitatea sa de a produce enzime valoroase. Substraturile ieftine, bogate în celuloză sunt preferate pentru a produce enzime industiale. Obiectivul acestui studiu a fost de a investiga influența surselor de carbon, reprezentate de resturi provenite din diferite practici agricole, și anume paie de grâu, paie de orz și tulpini de porumb asupra activității dehidrogenazelor ciclul Krebs și asupra glucozo-dehidrogenazei. De asemenea, am analizat modul în care sursa de azot, reprezentată de diferiți aminoacizi afectează activitatea enzimelor menționate anterior. Rezultatele noastre, indică faptul că enzimele implicate în ciclul Krebs sunt influențate de substrat nutritiv folosit, de adiția anumitor aminoacizi și nu în ultimul rând de vârsta culturii fungice.*
Cuvinte cheie: *Trichoderma reesei, ciclul Krebs, deşeuri agricole*

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INTRODUCION

The species belonging to the genus *Trichoderma* are well known for their ability to degrade a variety of polysaccharides (cellulose, hemicellulose), and related polymers such as chitin (Harman and Kubicek, 1998). Throughout their evolution microorganims have adopted various metabolic pathways and regulation mechanisms to deal with different environments and different nutritional requirements. Through the process of respiration (aerobic) and fermentation (anaerobic) organisms get their energy from various substrates in the form of ATP. These processes allow the microorganims to produce ATP at rates and with different degrees of efficiency (Chambergo et. al., 2003). Respiratory process in fungi is similar to other aerobic organisms, and it consists of three interrelated processes, citric acid cycle, oxidative phosphorylation and electronic transport.

Trichoderma reesei is a metabolically versatile microorganisms able to use both simple and complex sources of carbon and nitrogen. Cellulosic waste from different agricultaral practices (e.g. sugar cane, corn cobs, barley and wheat straws), and the forest industry (sawdust), are promising substrates for cheap enzymatic hydrolysis. Nitrogen sources such as peptone are often used to reduce the lag phase of growth when using polymer substrates like cellulose. (Mandels and Andreotti, 1978). However, peptone is used both as a source of nitrogen and as carbon source by *Trichoderma reesei* when it is grown simultaneously with polysaccharides. Trichoderma reesie is able to use some amino acids as substrates for energy production, of which alanine, aspartic acid and glutamic acid (Danielson and Davey, 1973c; Jackson et. al., 1991). Thus, in this study we aimed to analyze how certain amino acids stimulate metabolic activity of the fungus *Trichoderma reesei* QM9414, especially the dehydrogenases involved in the Krebs cycle.

MATERIAL AND METHOD

The fungus *Trichoderma reesei* was grown on PDA medium at 28°C, for 7 days. Enzymatic determinations were performed by inoculating the microorganism in Mandels liquid medium (Ferreira et. al., 2009). The nitrogen sources represented by ureea, peptone and ammonium sulfate were replaced by various amino acids: alanine, asparagine, glutamic acid, histidine, methionine, valine and serine at a concentration of 1g/L. A control variant was made in which the nitrogen source was absent. The carbon source-glucose was replaced by 30 g/L wheat straws, barley straws and corn stalks. Prior to the addition in the medium, these substrated were chopped with a power grinder. The liquid cultures were incubated for 14 days at a constant temperature of 28°C. Enzymatic determinations were performed at 7 and 14 days. The enzymatic activity was assayed using the metod described by Cojocaru (2008).

RESULTS AND DICUSSIONS

Isocitrate dehydrogenase (IDH, E.C 1.1.1.42) is an enzyme that catalysed the oxidative decarboxylation of isocitrate, leding to the formation of α-ketoglutarate and CO_2. Three isomorphic genes are currently know for this enzyme: IDH3 catalyzes the third step of the Krebs cycle, converting NAD^+ to

NADH in the mitochondria, while IDH1 and IDH2 are located both in the cytosol and in the mitochondria and peroxisome. The influence of amino acids on the activity of isocitrate-dehydrogenase is illustrated in Figure 1. Its activity was stimulated by valine (2,6682 µg formazan/g biomass) and glutamic acid (1,6498 µg formazan/g biomass), in the media with wheat straws, by glutamic acid (2,0584 µg formazan/g biomass), alanine (1,4731 µg formazan/g biomass) and asparagine (1,2597 µg formazan/g biomass), in the variants with barley straws and finally by glutamic acid (3,731 µg formazan/g biomass), valine (3,2845 µg formazan/g biomass) and serine (2,2557 µg formazan/g biomass) in media with corn stalks. The activity of isocitrat-dehydrogenase is inhibitate by the addition of methionine.

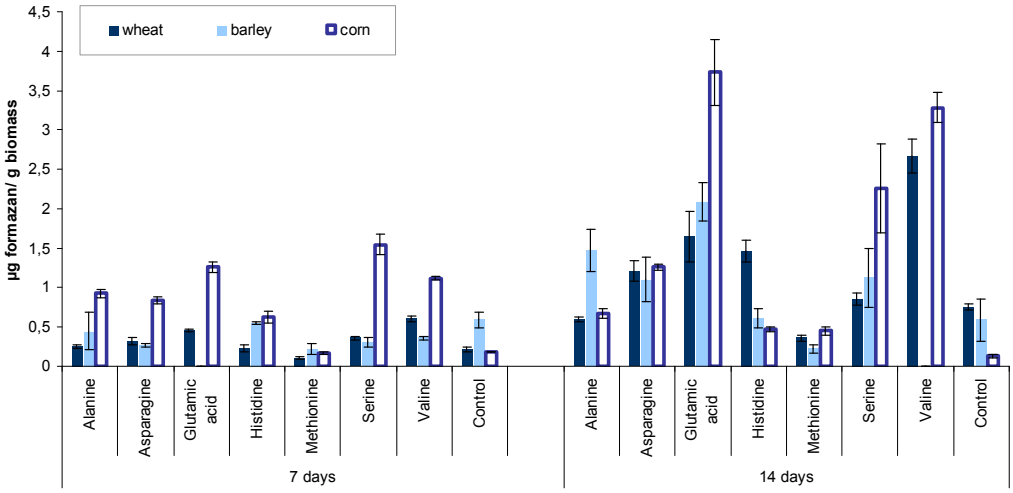

Fig. 1 - The influence of amino acids on isocitrate dehydrogenase in *Trichoderma reesei* grown on media with wheat straws, barley straws and corn stalks.

Malate dehydrogenase (MDH, L-malat: NAD oxidoreductase, EC 1.1.1.37) catalyzes the reaction NAD/NADH-dependent, of interconversion of malate and oxaloacetate. In eukaryotic cells are at least two forms of MDH, an isomorphic is located in the mitochondria, the other in the cytosol (Minárik et. al., 2002). A third form was found in yeasts, and is involved in the conversion of malate product of glyoxal in the cicle of glyoxylate (Minard and McAlister-Henn, 1991). Some amino acids introduced into the culture medium as a source of nitrogen can stimulate the activity of this enzyme. The increse in MDH activity is dependant on the complex poysaccharide used as a carbon source (figure 2). Thus, in media with wheat straws, the activity is stimulated by histidine (0,554 µg formazan/g biomass) and alanine (0,2181 µg formazan/g biomass), in media with barley straws by alanine (1,1749 µg formazan/g biomass) and serine (1,04 µg formazan/g biomass), and in variants with corn stalks by glutamic acid (3,2331 µg

formazan/g biomass), serine (2,2074 µg formazan/g biomass) and valine (2,316 µg formazan/g biomass).

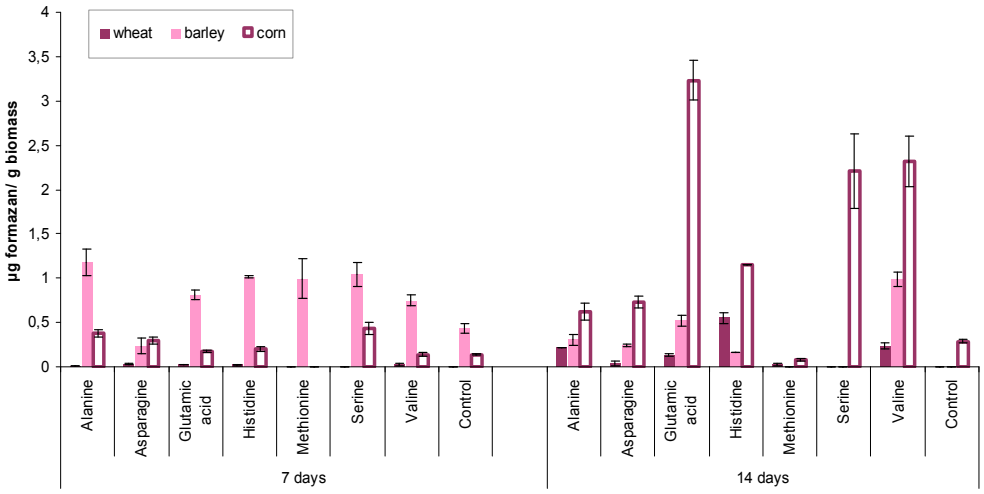

Fig. 2 - The influence of amino acids on malate dehydrogenase in *Trichoderma reesei* grown on media with wheat straws, barley straws and corn stalks.

Succinate dehydrogenase (SDH, E.C.1.3.99.1, succinate-oxidoreductase, Complex II), is a dehydrogenase present in all aerobic organisms and is involved in donating electrons from succinate oxidation to the respiratory chain. Succinate dehydrogenase activity is modulated by specific activators and inhibitors (Hederstedt L. & Rutberg L., 1981). Amino acids stimulate the activity of SDH as follows (Figure 3): in the variants with wheat straws activity is stimulated by valine (2,6682 µg formazan/g biomass), glutamic acid (1,6498 µg formazan/g biomass) and histidine (1,4674 µg formazan/g biomass), in variants with barley straws by alanine (0,4471 µg formazan/ g biomasă) and histidine (0,5546 µg formazan/g biomass), and in variants with corn stalks SDH is stimulated in the presence og glutamic acid (3,731 µg formazan/g biomass), valine (3,2845 µg formazan/g biomass) and serine (2,2557 µg formazan/g biomass). Low levels of SDH activity have been reported especially in media with methionine compared to control, regardless of the agricultural waste introduced into the media.

Alpha-ketoglutarate dehydrogenase (alpha-KGDH, E.C 1.2.4.2) is an enzyme that catalyzes the oxidation of α-ketoglutarate to succinyl-CoA, producing NADH and CO_2, supplying electrons to the respiratory chain. By cultivating the fungus *Trichoderma reesei* on media with different amino acids, this enzyme was stimulated by the addition of histidine (0,8903 µg formazan/g biomass) and glutamic acid (0,4394 µg formazan/g biomass), in media with wheat straws, by serine (1,5737 µg formazan/g biomass) and glutamic acid (1,289 µg formazan/g biomass), in media with barley straws and by glutamic acid (0,4648

µg formazan/g biomass) and asparagine (0,3738 µg formazan/g biomass), in media with corn stalks (Figure 4). Low values in activity were recorded in the variants with methione compared to control.

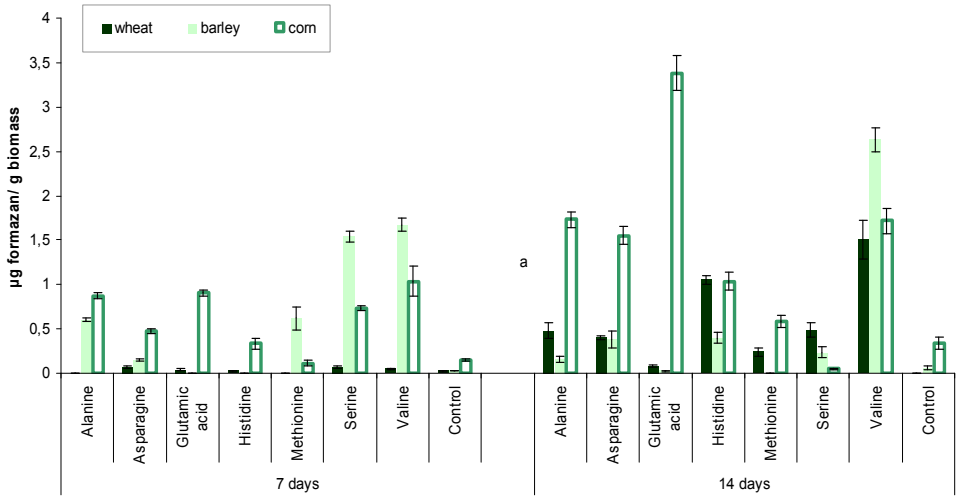

Fig. 3 - The influence of amino acids on succinate dehydrogenase in *Trichoderma reesei* grown on media with wheat straws, barley straws and corn stalks.

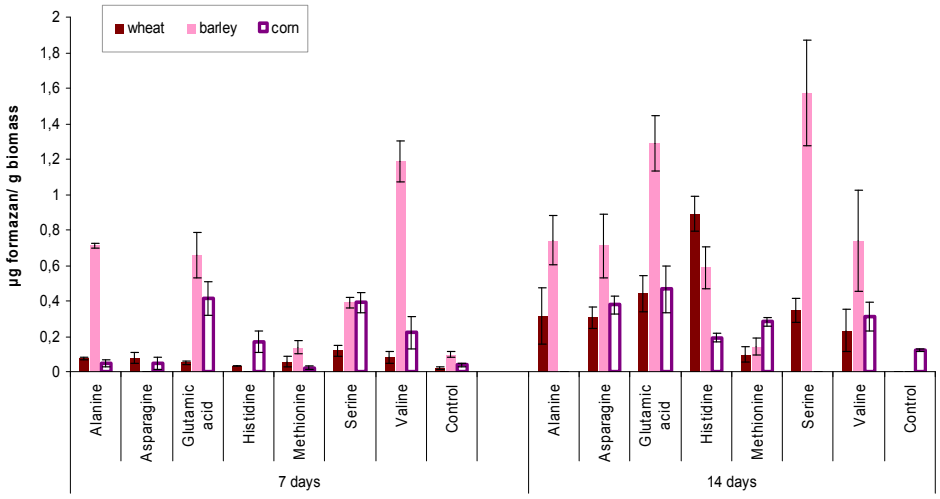

Fig. 4 - The influence of amino acids on α-ketoglutarate dehydrogenase in *Trichoderma reesei* grown on media with wheat straws, barley straws and corn stalks.

CONCLUSIONS

1. The energy metabolism of *Trichoderma r*eesei is modulated by a number of nutritional factors, such as the carbon and the nitrogen source of the culture medium. Thus, the use of cellulosic material derived from different agricultural practices can stimulate the activity of Krebs cycle dehydrogenases. Corn stalks proved to be more appropriate nutrtional substrate for the activity of dehydrogenases.

2. The addition of amino acids such as glutamic acid, valine and serine in the growth medium improves the activity of dehydrogenases, while adding methionine causes the opposite effect.

3. The age culture is also an important factor that shapes the metabolism of Trichoderma reesei species. Thus, at 7 days, the activity of dehydrogenases is lower, while at 14 days there is a significant increase in activity.

***Acknowledgments**: This work was supported by the the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/107/1.5/S/78342]*

REFERENCES

1. **Chambergo F.S., Bonaccorsi E.D., Ferreira A.J.S., Ramos A.S.P., Junior J.R.F., Abrahao-Neto J., Simon Farah J.P., El-Dorry H.**, **2002** - *Elucidation of the metabolic fate of glucose in the filamentous fungus Trichoderma reesei using expressed sequence tag (EST) analysis and cDNA microarrays*, Journal of Biochemical Chemistry, 277, p. 13983-13988.
2. **Cojocaru D. C., 2009** - *Enzimologie practica*. Editura Tehnopress.
3. **Danielson R.M., Davey C.B., 1973** - *Carbon and nitrogen nutrition of Trichoderma*. Soil Biol.Biochem., 5, p. 505-515.
4. **Fereirra S.M.P, Duarte A.P., Queiroz J.A., Domingues F.C., 2009** - *Influence of buffer system on Trichoderma reesei RUT C-30 morphology and cellulase production*. Electronic Journal of Biotechnology. 12(3), p. 1-9.
5. **Harman G.E., Kubicek C.P., 1998** - *Trichoderma* and *Gliocladium*, Taylor & Francis, London.
6. **Hederstedt L., Rutberg L., 1981** - *Succinate-dehydrogenase-a comparative review*. Microbiol.Rev., 45(4), p. 542-555.
7. **Jackson A.M., Whipps J.M., Lynch J.M., 1991** - *Effects of temperature, pH and water potential on growth of four fungi and disease biocontrol potential*. World J. Microbiol.Biotechnol., 7, p. 494-501.
8. **Mandels M, Andreotti R,E., 1978** - *Problems and challenges in the cellulose to cellulase fermentation*. Proc.Biochem., 13, p. 6-13.
9. **Minárik P., Tomáśková N., Kollárova M., Antilik M., 2002** - *Malate-dehydrogenases-Structure and function*. Gen.Physiol.Biophys*.,* 21, p. 257-265.
10. **Minard K. I., McAlister-Henn L., 1991** - *Isolation, nucleotide sequence analysis, and disruption of the MDH2 gene from Saccharomyces cerevisiae: evidence for three isozymes of yeast malate dehydrogenase*. Mol. Cell. Biol*.,* 11, p. 370-380.

INFLUENCE OF THE NUTRITIVE SUBSTRATES ON THE QUALITY OF THE *BEAUVERIA BASSIANA* SPORES

INFLUENTA SUBSTRATURILOR NUTRITIVE ASUPRA CALITĂȚII SPORILOR DE *BEAUVERIA BASSIANA*

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Abstract. *In order to select an efficient culture medium for the multiplication of the fungal suspension with insecticidal activity was performed the analysis of the Beauveria bassiana spores in relation with the nutritive substrate. Six different carbon sources: sucrose, glucose, maltose, fructose, lactose, cellulose and three nitrogen sources: yeast extract, peptone and corn extract were tested. A conditioning liquid form, Beauveria bassiana (Bb01) with fungitoxic effect on phylloxera radicicola, which was obtained by The Research and Development Institute for Plant Protection, Bucharest. Among the six carbon sources tested, lactose was the best carbon source for the fungus multiplication and sporulation. Combinations of lactose with yeast extract and peptone resulted in a higher production of spores. The use of cellulose as a carbon source in combination with all three sources of nitrogen conducted to the worst results, both in terms of vegetative growth and the amount of spores produced.*
Key words: *viticulture, phylloxera, substrate*

Rezumat *În scopul selecției unui mediu de cultură eficient pentru multiplicarea suspensiei fungice cu activitate insecticidă a fost realizată analiza calității sporilor de Beauveria bassiana, în funcție de substratul nutritiv. Au fost testate 6 surse de carbon: zaharoza, glucoza, maltoza, fructoza, lactoza, celuloza şi 3 surse de azot: extract de drojdie, peptona şi extract de porumb. În experiment a fost utilizat un produs condiționat sub formă lichidă de Beauveria bassiana (Bb01) cu efect fungitoxic asupra filoxerei radicicola, obținută de Institutul de Cercetare-Dezvoltare pentru Protecția Plantelor, Bucureşti. Dintre cele şase surse de carbon testate, lactoza a fost cea mai bună sursă pentru multiplicare şi sporulare. Extractul de drojdie şi peptonă au determinat o producție mare de spori viabili numai în combinație cu lactoza. Cele mai slabe rezultate, atât din punct de vedere al creşterii vegetative cât şi al cantității de spori viabili produse, au fost obținute în condițiile utilizării celulozei ca sursă de carbon pentru toate cele trei surse de azot.*
Cuvinte cheie: *viticultură, filoxera, substrat*

INTRODUCTION

The intensification of the vegetative production during the last decades is associated with the existence on the market of the effective and efficient plant protection products. These are synthetic inorganic and organic chemical

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substances which have a negative impact on the human healts, animals and environment. Among them, the chemical insecticides are less used as pest control agents due to the high cost of production and their high toxicity, persistence and accumulation in the environment.

The application of the biological methods for the pest control represent an alternative to the chemical control (Mc Coy et al.,1988). The using of the entomopathogenic fungus *Beauveria bassiana*, the „active substance" of the bio-fungi preparations in the biological control of the insect populations is one of the most effective ways of the pest control applied in the last time (Liuel Bauer, 2006; Dara et al., 2007).

In order to achieve the bio-fungi preparations it was necessary previously to determine the medium culture conditions which enshure the multiplication and sporulation of the *Beauveria bassiana* fungus while maintaining its insecticide properties.

This study aimed to analyse the quality of the *Beauveria bassiana* spores in relation with the nutritive substrate and the selection of the most efficient culture medium for the multiplication of the fungal suspension with insecticidal activity.

MATERIAL AND METHOD

A conditioning liquid product of *Beauveria bassiana* (Bb01) with fungitoxic effect was used in the experiment. This product was obtained by The Research and Development Institute for Plant Protection, Bucharest and was maintained by repeated subculturing every three months in the germplasm collection of The Reserch and Development Institute for Viticulture and Enology, Valea Calugareasca, on the Potato Dextrose Agar medium, at 4°C.

In order to establish the composition of the culture medium which determine a high rate of multiplication of the fungal suspension with the preservation of the biological parameters of the strain, some different culture media were analysed.

The parameters ranging during experimentation were: carbon source (20g/l) and nitrogen source (20g/l).

A source of protein represented by the crumbled insect *Tenebrio molitor* in a concentration of 0.5 g/l was added to all the medium variants. Six different carbon sources: sucrose (a_1), glucose (a_2), maltose (a_3), fructose (a_4), lactose (a_5), cellulose (a_6) and three nitrogen sources: yeast extract (b_1), peptone (b_2) and corn extract (b_3) were tested.

250 ml of culture medium were distributed in sterile culture vessels and sterilised by autoclavation at 121°C and 1 atm. Each culture variant was than added with 2.5 ml of *Beauveria bassiana* fungal suspension at a concentration of 1×10^6 conidia/ml. In order to stimulate the production of the spores, the cultures were shaken at 150 rpm, for 72 hours at the room temperature, and then incubated at 25°C (as described by Jenkins et al., 1998, slightly modified).

The folowing observations and determinations were made: capacity of the vegetative multiplication, conidiogenesis, viability (germination %), tolerance to the nutrient substrate.

The capacity of the vegetative multiplication was determine by the culturing of the spores suspension on Potato Dextrose Agar medium and the incubation of the cultures at 25°C for 8 days. The measurements regarding the growth of the

fungal colony were performed periodically (after 2, 5 and 8 days). 10 randomly chosen colonies were analysed.

The microbial load was performed by using the succesive serial dilutions method. The spores were counted with Thoma chamber.

The conidia germination percentage was determined by the method developed by Inglis si col., 1993. 50 µl of fungal suspension were inoculated in 150 µl Sabouraud Dextrose Broth (SDB) liquid medium (neopeptone: 10 g/l; glucose: 20 g/l; pH at 25°C: 5, 6). The cultures were shaken for 2 hours at 120 rpm and incubated for 72 hours at 24°C. The observations were made in triplicate, after 24 hours. Conidia germination percentage was assessed by the analysis of 200 conidia for each variant.

The experimental data were statistically processed by using principal component analysis based on the XLSTAT programme.

RESULTS AND DISCUSSIONS

In the first stage, the parameters used for the selection were the folowing: the diameter of the fungal colony after 8 days of culturing on the culture medium, the number of conidia x 10^8 in 1 ml of fungal suspension and the germination of conidia after 24 and 72 hours (Table 1).

Table 1

Analytical table

Variant	Diameter of fungal colony (cm)	Number of conidia x 10^8/ 1 ml	Conidia germination (%)	
			24 hours	72 hours
a1b1	2,93	6.93	64	74
a1b2	2,70	7.04	61	72
a1b3	1,90	4.90	66	76
a2b1	2,48	3.89	50	62
a2b2	2,24	4.01	61	72
a2b3	1,82	1.87	58	69
a3b1	2,22	3.83	60	72
a3b2	1,88	5.17	68	80
a3b3	1,54	3.23	61	72
a4b1	2,40	4.46	33	45
a4b2	2,34	3.73	61	73
a4b3	1,44	2.80	58	71
a5b1	3,50	9.44	80	93
a5b2	3,68	9.06	83	94
a5b3	2,80	8.03	81	92
a6b1	1,72	1.76	28	50
a6b2	1,50	1.77	30	42
a6b3	1.24	1.30	63	44

The first specific information for the factorial analysis was provided by the total explained variance, which is presented in table 2. The main components formed as a linear combination between the variables were characterized by a value and a variance. The variance explained by each factor

was distributed as follows: the first extracted component was equal to 2.570 and was the linear combination which took the maximum possible from the initial data, 85.66% respectively. The second principal component took much less of the variance (12.04%), was equal to 0.361 and the third variant took 2.3% from the variance of the data heaving the value of 0.069. The first two extracted components acquired 97.7% of the total variance of data. The reduction dimensionality of the data was achieved (Table 2).

Table 2

The explanation of the variance

Value	PC 1	PC 2	PC 3
Eigenvalues	2,570	0,361	0,069
Variability (%)	85,664	12,039	2,296
Cumulative (%)	85,664	97,704	100,000

The first principal component was positively correlated with all three variables. The second component was positively correlated only with the variable "Conidia germination after 72 hours (%)", (0.484) and negatively with the other two, and the third component was positively correlated only with the variable "number of conidia x 10^8", (0.203). Since the variables are correlated with at least one of the main components, the variables can be considered responsible for the variance of the data (Table 3).

Table 3

The correlations between the initial variables and the principal components

Variabiles	PC 1	PC 2	PC 3
Diameter of the fungal colony	0,928	-0,338	-0,155
Number of conidia x 10^8	0,973	-0,111	0,203
Conidia germination after 72 hours (%)	0,873	0,484	-0,062

For each variable was given a score based on the projection of the variables on the two main axes. The score provided information concerning the coefficients of each variable involved in the component description.

The score obtained for each relation was graphically represented in figure 1.

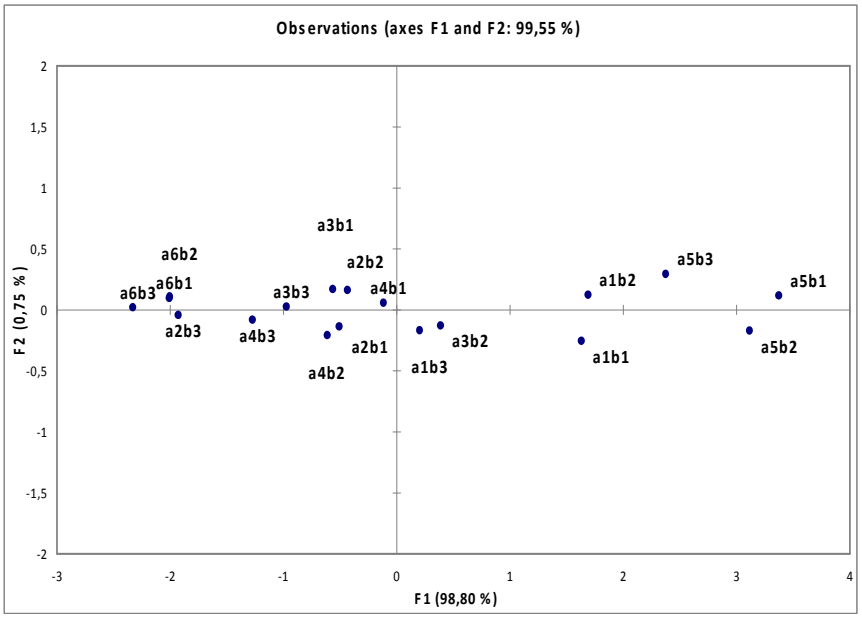


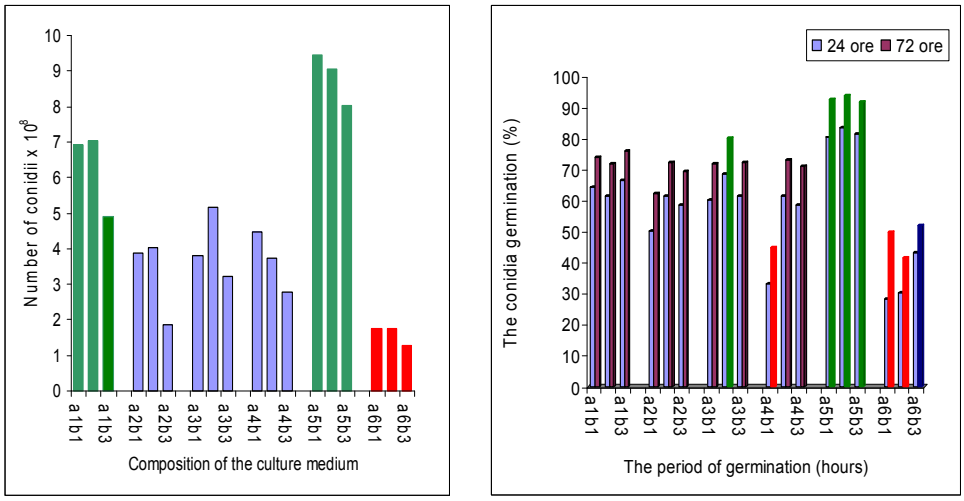
Fig. 1 - Graphically representation of the PCA1 and PCA2 points

Statistical, the experimental variants were grouped as follows: the variants a_5b_1 and a_5b_2 were clearly different from the other variants, in a positive way, for all the variables taken in the study; the variants a_6b_3, a_6b_1 and a_6b_2 presented the lowest values for the studied variables; the other variants showed lower values and uneven in comparison with the first group; among the six carbon sources tested, lactose (a_6) was the best carbon source for the multiplication and sporulation of the fungus; the combinations of lactose with yeast extract and peptone resulted in a higher production of spores; the use of cellulose as a carbon source in combination with all three sources of nitrogen conducted to the worst results, both in terms of vegetative growth and the amount of spores produced.

The largest amount of conidia/1 ml was obtained on the media with lactose ($8.0 – 9.4 \times 10^8$) and sucrose ($4.9 – 7.0 \times 10^8$). The smallest amount ($1.3 – 1.8 \times 10^8$) was registered in case of variants with cellulose (Figure 2 a).

The analysis of the viability of conidia showed an average percent of germination of 60% after 24 hours and 70% after 72 hours. Maximum values were obtained for the combination lactose and yeast extract and minimum values for cellulose and yeast extract (Figure 2b).

Folowing the obtaining results, the best variant of the medium for the multiplication of the fungal suspension was selected. This was a_5b_2 variant with the following composition: lactose 20g/l, peptone 20g/l, and the crumbled insect *Tenebrio molitor* 0.5g/l.



a) Number of conidia b) Germination of conidia

Fig. 2 - The conidiogenesis depending on the composition of the culture medium

CONCLUSIONS

1. The nutritive substrate influenced the multiplication and the sporulation capacity of the *Beauveria bassiana* spores.

2. The best results, both in terms of vegetative growth and the amount of spores produced were obtained when the lactose was used as the carbon source. The worst results were obtained on the medium added with cellulose for all the three nitrogen sources used in the experiment.

3. The medium which was selected for the multiplication of the fungal suspension have in composition the lactose as source carbon and peptone as nitrogen source.

Acknowledgments: *This study was conducted during the program of doctoral studies, financed through the POSDRU/107/1.5/S/76888 project.*

REFERENCES

1. **Dara S.K., Mcguire M.R., Kaya H.K. 2007** - *Isolation and evaluation of beauveria bassiana (deuteromycotina: hyphomycetes) for the suppression of glassy-winged sharpshooter, homalodisca coagula ta (homoptera: cicadellidae*). Journal of Entomological Science. 42, p. 56-65.
2. **Jenkins N.E., Heviefo G., Langewald J., Cherry A. J., Lomer C.J., 1998** - *Development of mass production technology for aerial conidia for use as mycopesticides*. Biocontrol News Inf. 19, 21N-31N.
3. **Liu H, Bauer L.S., 2006** - *Susceptibility of Agrilus planipennis (Coleoptera: Buprestidae) to Beauveria bassiana and Metarhizium anisopliae*. J. Econo. Entomol. 99: 1096-1103.
4. **Mc Coy C.W., Samson R.A., Boucias D.G**., **1988** - *Entomogenous fungi, CRC Handbook of Natural Pesticides.*

CAROL I AVENUE – A WALK THROUGH GARDENS AND HISTORY

BULEVARDUL CAROL I – UN PARCURS PRINTRE GRĂDINI ŞI ISTORIE

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Abstract: *Carol I Avenue in Iaşi is one of the most popular promenade areas of the city. Although it was developed aspart of a nineteenth century neighborhood, as the axis of a new aristocratic residential district, it is one of the areas which preserved its heritage. Beyond its undoubted historical value, Carol I Avenue is a place where the city blends with nature. The entire pathway represents a genuine garden with slow and quick rhythms, with different visual layers in which historical buildings are found. A journey in history through the old maps of Iaşi uncovers the anatomy of this green axis, of this genuine landscape pathway of the city.*
Key-words*: Carol I Avenue, green axis, history of city planning, landscape design, public gardens*

Rezumat: *Bulevardul Carol I din Iaşi este unul din cele mai apreciate locuri de promenadă din oraşul Iaşi. Deşi face parte din străzile zonei istorice structurate abia în secolul al XIX-lea, construită ca axă urbană a unui nou cartier boieresc, este una din zonele care au păstrat patrimoniul iniţial. Pe lângă indiscutabila valoare istorică, Bulevardul Carol I este o zonă în care oraşul se desfăşoară în strânsă legătură cu natura. Întregul parcurs este o adevărată grădină cu o mare varietate de configuraţii, cu ritmuri alerte sau potolite, cu diverse registre de profunzime în care sunt amplasate clădirile, în cea mai mare parte monumente istorice.O călătorie în istorie pe hărţile vechi ale oraşului Iaşi relevă mecanismul formării axei verzi a acestui autentic parcurs peisajer al oraşului.*
Cuvinte cheie: *Bulevardul Carol I, axă verde, istoria urbanismului, peisagistică, grădini publice*

INTRODUCTION

Carol I Avenue, an important axis of Iasi, raises particular interest not only from the historical, town-planning and architectural point of view, but it is also a remarkable example of landscape design. The study of the area is of major importance in the urban history research of Iasi, being essential in understanding the position of the city in the larger context of the civilization of the period.

MATERIAL AND METHOD

The purpose of the present paper is to analyse the Carol I Avenue area, focusing mainly on the research of historical plans and the written documents,

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highlighting the unique character of **the avenue as a green axis of the city** in the historical context**.** The area has a complex structure with several important components.

RESULTS AND DISCUSSIONS

1. Position of Carol I Avenue in the city-planning of Iasi

Carol I Avenue is amajor traffic axis with urban and historical value.

Historically, it appeared as a continuation on the same direction of the main development axis of the city of Iasi, called the GreatStreet (Ulița Mare), which started from the initial core of the city – the princely court.

A comparative study of the historical plans shows that, until the 20th century, the development of the street network of the town was almost entirely spontaneous, resulting in anorganic reticular configuration.

From written documents until the 19th century, we canreconfigure an approximate image of the old town. In history, the trades and crafts nucleus, which by nature required concentration, synchronicity and simultaneity, was characterised by urban density.It is also obvious that most of the historical part of Iasi preserved the old medieval street network, with a major axis that determines an exemplary linear development, standing out as the backboneof the citythrough all its historical stages.This axis is the old Great Street, in constant development to the present day,always keeping an orthogonal perspective on the princely court. At first it appeared spontaneously, and it was later continued during the 19th century by ”cutting” the so-called “Green Bridge” in the Copou area: ”in the autumn of 1834, the Department of Internal Affairs started the building of ′a road that passes through the Green Bridge area′ ”(Mitican, 2009).

The structuring force of this axis can be perceived in the grid pattern town plan project from 1943, made by architect Von Bedeus, who proposed to extend the avenuebeyond the Palace of Culture towards the southern limit of the town. The new street becomes an important promenade area of the town, so that the Department of Public Works, initiatesplanting tree rows along the whole avenue, after the model of the great European capital cities. These tree rows remain the most prominent feature of the avenue.

2. The configuration and specific characteristics of the properties boarding the avenue

The Copou area started to develop from the end of the 17th century as a residential area adjacent to the medieval town. In the 18th century, it included former villages known as Highlands / Muntenimi (Lower, Middle, Upper). Its northernmost area developed as a town only later, from the 19th century to the beginning of the 20th century.

In the absence of historical maps, historians suppose that Carol I Avenue, in its present form, started to take shape around the 17th-18th century, as a passage area between the cemeteries of the churches Lady Prapa and St Nicholas the Poor, as it provided easier access from the city centre to the northern Upper

Highlands, as the other access road, Sărărie (”the road of the salt”), was situated more periferically.

The mild,sunny slope of Copou hill, with a wide perspective on the town and the spectacular southern hills, appealed to the city boyards (noblemen). Documents from the 17th – 19th centuries include information related to the purchase of lands in the area.

After the great fire from 1827, the Upper Highlands and newly built road called ”the Green Bridge” witnessed the creation of an elite residential district, as most of the boyards left the houses traditionally situated around the princelycourt in a high-density area which was permanently threatened by fire.

Towards the end of the 19th century, the whole axis of the Green Bridge, starting from the present Eminescu Square up to the Copou Gardens,was bordered on both sides by a spectacular line of boyard houses.

On the right, at the foot of the hill, lay the imposing the Palace of Elena Cuza (before 1812), later known as the Jockey Club, then demolished for the roundabout construction in Eminescu Square and the building of the Youth House; the Cantacuzino – Paşcanu House (1840), today’s The Children’s Palace; Luca House (before 1811) situated at the crossing between Coroi Street (Pogor Street) and the Green Bridge, demolished in 1968 to widen the avenue; Costache Sturza House (before 1811) situatedin the yard of the present Military Hospital, and later demolished. At the intersection between the avenue and 40 Saints Street there was the house on the Sturza property, next to the Mârzescu house, which is nowadays property of the ”Al. I. Cuza” University. In the same neighbourhood, to the north, there was architect Iulius Reinicke’s house. In the area of the park in front of the Politechnics building, the Prăjescu familyhouses were situated; these were later destroyed by the bombings from the Second World War. Along the Gh. Asachi Street, there remains the Costin Catargiu House, which now also belongs to the ”Al. I. Cuza” University, and Sigurov House, today in the property of the National Insurance County Office. Next is Racovita House, today hosting the French Institute. The old houses in the area between Racovita House and Oastei Streetwere mostly destroyed by the bombings at the end of the Second World War: Panait Bals House, Vasile Adamachi House, Pavli, M.D. Sturza, Matei Cantacuzino Houses. The only ones remaining are theBogdan Houseandthe Frey House (Bădărău and Caproşu, 1974).

Further up on the left side we findthe M. Mavrogheni House which currently hosts the Institute of Hygiene, with its newly added upper floor dating from the 20th century.Upper northare the housesbelonging to the Carp family, spread over large area between the avenue, the G. Ibrăileanu street andthe Pacurari Street. Some of the buildings were pulled down in order to build the Rail Road Company Hospital.Next to it there was the Alecu Sturza House, now company headquarters, the Cimara House, later turned into The Army House, andthe Canta House – The University House of today. The site of the ”Al. I. Cuza” Universitywas also initially occupied by boyard houses, starting with the house of Ana and Constantin Bals, situated at the cross roads between the avenue

and the Toma Cozma street, and demolished after the war. Right on the site of the University, there used to be the Copou Theatre, formerly a house built by Ionita Sturza and laterowned by Teodor Bals, and the Teodor Ghica House, later turned into the Fine Arts School and Painting Museum. Between the university and the Titu Maiorescu street of today there were the Krupenschi houses, later organised as the Tzaicu Rest Home, and the Cazimir House - both disappeared, then theSteege House, also known as the Antiquity Museum of Professor Orest Trafalli, a one-storey building later turned into the German Centre of today;the Vălescu-Juvara House, which was actually the first German Cultural Centre;the Jora House, still existent, at the crossing with Titu Maiorescu Street. Between the Jora House and the Copou Gardens there were later built a series of houses of which the Diaconescu House and Pavli House still remain; the latter went through radical changes when turned into the Commerce Chamber.

As historical maps and written documents show, in the 19th century, the Green Bridge Street was bordered by properties and boyard houses. In the romantic fashion of the 19th century, the boyards used to buy large pieces of land where they built houses and designed parks with various tree species. As a result, the architectural facade plane was doubled by a continuous line of private gardens. Those who still remember this part of Iasi speak about the picturesque or exquisite gardens surrounding the houses at the time.

The Cantacuzino-Pascanu House had ”in front of it a flower garden with secular trees” (Mitican, 2009), on the large Carp property there was ”a forest of walnut trees, apple trees and oaks” (Mitican, 2009); the great park on Costache Sturza’s property was well-known by the people in Iasi – ”a forest of secular trees in a garden crossed by paths in dense shadewhich was open to the public on Thursdays and Sundays” (Mitican, 2009). The CimaraHouse”had a beautiful garden with a marble fountain facing the Green Bridge” (Mitican, 2009)

At the end of the 19th century, the district witnesses theemergence of several higher education schools. The first university in the United Principalities, in the early stages of modern-time Romania, was built on the Carol I Avenue, formerly known as the Green Bridge Street.The expansivedomains of the Sturza family were turned into the premises of the School for the Sons of Military Officers (the Military Hospital of today). During the 1950s, on the locationdevastated by bombings right opposite the University, the Politechnical Institute was built. All these institutions followed the initial line of the avenue, and were provided with large green areas, real picturesque gardens.

3. Placement of the most important public gardens in Iasi on the side axis of the avenue

The area was the site of the first attempts of modern town planning, focused on the way in which the ”Green Bridge” Street and the areas in the neighbourhood were organised and on the placement of public gardens.

The Copou Park was founded in 1834 by Prince Grigore Sturza and was later developed by Prince Mihail Sturza. In 1834 the Obelisk of the Lions,

designed by Gh. Asachi, was errected. This has been the most renowned park in Iasi, famous especially for Eminescu'slinden tree (Cantacuzino, 1977).

Designed in 1852 near the northern end of the Green Bridge, Ghica Voda Alleys represented a walking area with 50m wide green areas on both sides, with roundabouts for carriages, widened parts and paths. The green areas were preserved to the present day, though much simplified, left without any special design details.

The Botanical Garden was founded in 1921, on a site situated in the north of the"Al. I. Cuza' University. Rare plant species were brought here from the former botanical gardens in Iasi. In 1965 a great part of these were transferred to the new Botanical Garden and part of the site was occupied by the student campus.

The Exhibition Park was founded in 1922 in the northern part of the Copou district, with the purpose to host agricultural exhibitions. It was designed by the landscape design architect F. Rebhun, just as the Copou Park.

The Botanical Garden, in its current form, was founded in 1965, on a considerably large site on the western side of Copou hill. It is one of the largest in the country, impressive not only throughsize, but also through the variety of plant species and landscape design details, as well as through the beauty of theperspective opening from the hills towards the north-west part of the town.

The Copou area is thus especially rich in gardens, remarkablenot only for their beauty, but also for their memorial and cultural heritage.

4. The visual relationship between the avenue and the rest of the town; the position of the area in the town landscape

Unlike the central area, situated on a perfectly flat plateau, the Copou area is situated on a hill and it takes benefit from the favourable effect of the ascending views.Designed against the green of the rich vegetation of the hill, the buildings in the area offer a complex view, of great richness and beauty.

The buildings which visually stand out are the larger,monumental ones: the imposing building of the University, the Negruzzi High School, the Copou Military School, the Central University Library. Apart from these, there are still to be seen the newer buildings of the Politechnical Institute, the Institute of Economy and the Iasi branch of theRomanian Academy,.

The town offers panoramic views towards the Copou hill, opening it to the viewers from Bahlui valley, particularly from the Stone Bridge area, from the car drive in Alexandru cel Bun, from Pacurari Street, from Princes' Square and Dacia District. A climb uphill alongthe Carol I Avenue offers short, gradual views on the monuments placed on both sides of the street.

When facing the town center direction, the viewers's eye can hardly perceive the other areas behind the buildings and the trees. Nevertheless, we can mention a few places in the background which can be seen along the whole walk down Carol I Avenue towards the Palace of Culture, which stands against the silhouetteof the Repedea Hill. The original and spectacular views towards the

town are visible from the town buildings on Copou Hill (The Institute ofDesign, The Academy, the Parhon Hospitaland the University).The views from the hill are suitable for designing viewing terraces on the roofs of tall buildings.

This status of green axis of the citymakes the Carol I Avenue an attractive area, with positive features as the ones discussed above, which define one of the oldest and most appealing areas of ”loisir”: the whole walk along the avenue, the series of gardens, the Copou Park, the Exhibition Park, the Botanical Garden.The old boyard houses – many turned into public institutions, next to which the old parks still remain, now open to the public– all these special featuresattract a great number of visitors from Iasi and away.

CONCLUSIONS

The analysis uncovers a series of aspects which define the specific character of the area around the Carol I Avenue. These aspects have been analysed and ranked into four categories, important in defining the distinctiveness of the area. An aspect of particular interest is the fact that, parallel to the changes in the existence of this place, the defining particular features have been preserved and developed. This fact makes us further respect these values, keeping the same responsible attitude of preserving and promoting historical tradition.

REFERENCES

1. Bădărău D., Caproşu I., 1974 - *Iaşii vechilor zidiri. Pînă la 1821*, Editura Junimea
2. Cantacuzino G. M.,1977 - *Izvoare şi popasuri*, Editura Eminescu
3. Mitican I., 2009 - *Urcând Copoul cu gândul la Podul Verde* Editura Tehnopres

NATURAL ELEMENTS AS INSTRUMENTS IN INDUSTRIAL BUILDING CONVERSION

ELEMENTELE NATURALE CA INNSTRUMENTE ÎN CONVERSIA CLĂDIRILOR INDUSTRIALE

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Abstract.*The continuous growth of technology and the process of migration of industries left behind a vast built environment consisting of unused production spaces. For cultural, affective, ecological or economic reasons, many of these buildings are subject to architectural conversion towards civil functions. Architects must face the challenge of interpreting these highly utilitarian objects and adapting them to the needs and aspirations of the new users. Through their intrinsic value and their psychological effects, natural elements used in conversion increase the diversity and the quality of architectural composition and enrich the aesthetics of architectural space. Our paper analyses the expressive and informational potential of the natural component, emphasizing its formal and psycho-emotional effects*
Key words*: industrial architecture, architectural conversion, aesthetics, psycho-emotional effects.*

Rezumat. *Evoluția continuă a tehnologiei, însoțită de fenomenul migrației industriilor, a lăsat în urmă o uriașă masă construită de spații de producție neutilizate. Din motive culturale, afective, ecologice sau economice, din ce în ce mai frecvent acestea fac obiectul conversiei arhitecturale la funcțiuni civile. Provocarea la care este supus arhitectul constă în interpretarea unor obiecte concepute pe principii preponderent pragmatice și adaptarea lor la cerințele și aspirațiile noului utilizator. Prin valoarea intrinsecă și prin efectele psihologice, elementele naturale utilizate în conversia industrială cresc diversitatea și calitatea compoziției arhitecturale și potențează estetica spațiului arhitectural. Lucrarea analizează potențialul expresiv și informativ al componentei naturale, subliniind efectele sale formale și psiho-emoționale*
Cuvinte cheie: *arhitectură industrială, conversie arhitecturală, estetică, efecte psiho-emoționale.*

INTRODUCTION

More than two centuries of industrialization, marked by rapid technical progress, resulted in the moral depreciation of production halls, leaving behinda considerable built heritage, often damaged or deserted.

The experience gathered so far in the field of architectural conversion shows that industrial buildings and equipment raise a special interest due to the unusual forms, proportions and scale of these volumes and spaces, formerlyinaccessible to the public.

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The initial shape, based on practical principles, was designed to strike an efficient balance between profit and cost, and was thereforeorganised in modular form, convenient both in terms of prefabricationand for the possibility of later extensions.

As a downside, the composition obtained by repeatingseveral identical modules often generates monotonous rhythms which may have negative effects on the human psyche.

While the building exterior often illustrates the representative function of facade volumes, for the same economical reasons, the interior is most of the times simple, using modest materials and finishing.

From the point of view of the relationship with the exterior, most production spaces use an introvert composition, a rather inadequate solution for the civil functions which usually require an open space and a continuous communication with the exterior, be that functional or visual.

MATERIAL AND METHOD

This paper analyses examples of architectural conversion of industrial buildings which use natural elements – vegetation, water, air – as a composition tool.

The selected cases cover the basic spatial types of industrial architecture (both single floor andmulti-storey), considering both the interior and the exterior of the buildings.

In the final synthesis, we highlight the complex qualities oflandscape compositions and their positive effects on aesthetic and psycho-emotional level.

RESULTS AND DISCUSSIONS

The use of natural elements in the industrial architecture conversion

In industrial architecture conversion, natural elements are often the ones which suggest the most suitable solutions in reconsidering the relationship between interior and exterior space, in a new family of shapes, formal or chromatic dynamics resulted from the changing of the seasons. Thus, natural elements can increase the architectural quality of the industrial building, either in terms oflandscape design, combined with formal operations of opening the industrial space, or by including natural elements in the interior space, both cases establishing continuitybetween the interiorand exterior (Andrei, 2012).

The Paganini Auditorium in Parma, former a sugar factory, remarkably accomplishes this continuity by removing the brick facades on the short side of the hall. This operation has a double effect, that of diminishing the presence of the building in the site and that of opening the concert hall'sspace and integrating it in the parkoutside it. The naturally dynamic landscape becomes the stage background, highlighted by the illumination system.(Fig. 1, Fig. 2) The contrast between the natural element and the building is, on a formal level, given by the juxtaposition of the cartesian network of window frames placed in the heavy full walls and the free, lace-like shape of the trees.

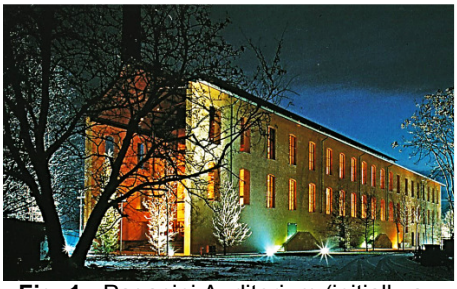

Fig. 1 - Paganini Auditorium (initially a sugar factory), Parma – exterior view

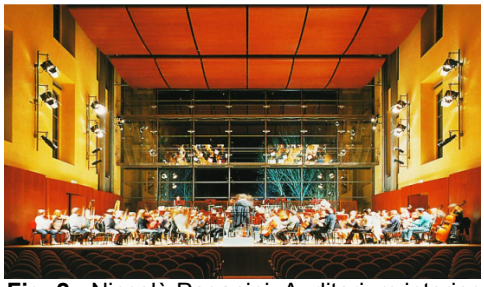

Fig. 2 - Niccolò Paganini Auditorium interior view

Another type of attitude was adopted in the conversion of the former Fiat car factory in Torino. Built between1916-1923 and designed byarchitect MattéTrucco, it represents an important landmark for the town citizens. While in use, the number of employees reached the impressive number of 12,000. Apart fromits emotional importance for the community, it is internationallyfamous for its architectural value, confirmed by the positive feedback of modern architects and adepts of the futuristic trend who considered it a key moment for the avant-garde of the period.

Thegreen areas in the patios and inside the building contribute to the compositional unity through colour and formal register (Fig. 3). Thus, the orderly form of the facade is repeated in the layout of the natural elements.

Fig. 3 - Exterior view

Fig. 4 - Opening the space towards the patios

Extending landscape design into the interior space, beyond the perimeter structureof certain parts of the building's envelope, led to the creation of intermediary spaces which increase the permeability of the building towards the public space and the landscape design of the patios (Fig. 4). These operations reduce the introvert aspect of the building andcreate a new scale hierarchy, emphasising the structural elements and the integrity of volumes.

The conversion of industrial warehouses in Los Angeles in a community centre ended in a regeneration of the whole area by changing spaces of negative connotation for the population into an ensemble which created a new community pole.

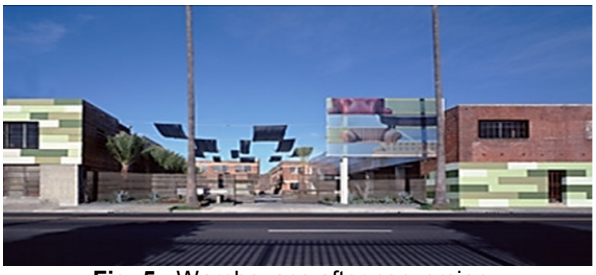

Fig. 5 - Warehouses after conversion

Fig. 6 - Image from the patio of the ensemble

In the new design, the exterior space becomes the element that brings together the volumes otherwise treated differently in aesthetic expression. The design of the patio, specific to the region, uses the same trees types as the ones in the nearby streets, creating a formal continuity between public and private areas. Liniar green registers add a human touch to the industrial image of the ensemble and come in harmony with the other interfering volumes due to their prolonged shape (Fig. 5, Fig. 6**Error! Reference source not found.**). The textile elements used in the patio for solar protection are disposed so as to form a texture which is projected to the other parts of the complexin the transparent drawing of shadows. The result is similar to that of a modern art installation which uses air currents to create a dynamic effect.

The chromatic register used for the facade panels is in harmony with that of the green compositions, a detail which confers unity to the whole work.

Creative art meanings and effects of the landscape design works

Creative art values

The water mirrors created in the interior or exterior produce the effect of a game of images which overlap the fixed image of the building, in the form of vibrating reflexions (Fig. 8). Inside, the water mirrors bring more light to the space but also complexity and dynamics (Fig. 7).

Fig. 7 - Jigsaw Studio (initially a warehouse), Los Angeles

Fig. 8 - Stone Museum (initially warehouses), Nasu, Japonia

Vegetationused inside as well as outside, plays an ambience role in the conversion of industrial architecture. With their free shapes, green elements are in contrast with the rigorous geometry of industrial architecture, the landscape

design clearly contributing to the aesthetic quality and bringing a human touchto the converted ensemble(Andrei R., 2012).

Environment integration. Creating a bond with the exterior

One of the characteristics which define the relationship between the former production halls to the exterior is the introvert character imposed by the specific conditions of the production process. When the industrial building changes its function, especially when turned into public space, its introvert character canclash with the requirements of the new functional program. The bond with the exterior can be created either by integrating natural elements into the industrial space, or by formal operations on the building which could give a functional or visual continuity with the exterior space.The landscape design works undertaken inside the industrial buildings to be conversed help create a direct connection between the closed space and natural sequences, following the idea of reconciling architecture with the environment (Fig. 9).

Another solution is creating planted facades which revitalize the image of the industrial buildings and at the same time suggest a spontaneous reintegration into nature (Fig. 10).

Fig. 9 - Conversion of industrial halls into office space, Koln, BRS Architecture

Fig. 10 - Caixa Forum, Madrid, arch. Herzog & de Meuron

The time component can be expressed in conversion by preserving the aspect of ruin and decay or by using plants to create the image of a deserted place (Fig. 11, Fig. 12). This method, used in romantic style gardens to express the irreversible passing of time, in a time when sustainability is in focus, also suggestsan image of nature regaining a lost territory, restoring a natural orderthat had been destroyed (Andrei R., 2012).

Fig. 11 - Dwelling, (initially a cement factory), Barcelona

Fig. 12 - The Paradise Lost in Time (initially a paper factory), Taipei

CONCLUSIONS

Due to their intrinsic values as well as to the potential psychological effects, natural elements used in conversion increase the diversity and the quality of the architectural work and highlight the poetic feature of architectural space. Bringing a human touch into the industrial architecture can be accomplished in the process of adapting to the requirements of the individual or to those of the community in reference to a common code of values. Natural elements are thepotentialbond between parts, and the mechanism of emotionally and aesthetically appreciatingnatureis rooted into the archetype of our being. Through the creative qualities they enhance, through the new meanings they bring, as well as through thepositive influence they have on the human spirit and psyche, natural elements can be a key instrument in the architectural conversion of industrial architecture.

REFERENCES

1. Andrei R., 2012 – *Spațiul industrial ca resursă arhitecturală* – Unpublished PhD Thesis
2. Powell, K., 1999–*ArchitectureReborn*, Laurence King Publishing
3. Van Uffelen, C., 2010 – *Re-Use Architecture*, Braun Publishing

ABOUT LANDSCAPE ARCHITECTURE IN THE PERSPECTIVE OF THE THIRD MILLENIUM: HALF A CENTURY JOURNEY TOWARDS A CENTRAL STAGE POSITION

DESPRE ARHITECTURA PEISAGERĂ DIN PERSPECTIVA MILENIULUI TREI: O CĂLĂTORIE DE O JUMĂTATE DE SECOL PENTRU O POZIȚIE CENTRALĂ ÎN PROIECTAREA MEDIULUI

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Abstract. *The paper follows the path Landscape Architecture has travelled during the last decades. The field has gradually emerged from the shadow where it had fallen due to the lack of concordance with the ideas of Modern Architecture. Remarkable designers, through their innovation, new ecological and sustainable approaches and attractive functions, brought Landscape Architecture in the centre of the environmental planning.*
Key words: *landscape architecture, modern movement, new tendencies*

Rezumat. *Articolul urmăreşte drumul parcurs de arhitectura peisageră în ultimele decenii. Creatori de excepție au scos treptat domeniul din zona de penumbră în care căzuse datorită nepotrivirii cu ideile arhitecturii moderniste. Inovațiile aduse şi direcțiile noi deschise de aceste personalități remarcabile au condus proiectarea peisajului către o abordare ecologică, către o gîndire bizuită pe sustenabilitate, către introducerea de funcțiuni atractive şi au poziționat această disciplină în centru preocupărilor proiectării ambientelor antropizate.*
Cuvinte cheie: *arhitectura peisageră, mişcarea modernistă, noi tendințe*

INTRODUCTION

At the middle of the 20th century, when the Modern Movement had the most relentless attitude in architecture, landscape designers failed to match the new ideas. The main preoccupation of Modern Movement architects were:

- Progress and function
- Geometry and order
- Technology and prefabrication
- New materials and techniques
- Mashine image etc.

Landscape architecture, romantic, focused on historical examples and on the descriptions of subjective feelings when contemplating a natural scenery or a man made garden, knew a period of crisis.

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"Landscape's organic character was inherently difficult to incorporate into that (the Modern) frame of reference"

"Landscape designers (...) offered no convincing Modernist schema (...). Their practice was (...) too intimately associated with the architecture of the previous (19th) century, against which the Modernists had so radically reacted." (Lyall, 1991).

The need for poetry always exists, and there were cracks in the hard shell of the new architectural tendencies. Memorable examples of landscape architecture appeared, in spite of the subordinate position landscape architecture had. These paved the way towards a new approach in landscape design and opened new paths. The new conceptions allowed the appearance of remarkable achievements beginning with the last decades of the 20th century.

MATERIAL AND METHOD

No special materials were necessary for the present study.

The methods used were:

- Gathering of documentary evidence
- Observation "in situ" of remarkable examples of green urban areas, street and squares layout
- Application of new tendencies to specific sites in Romanian towns, especially Timişoara
- Launching and guiding of students projects on the topics of this paper.

RESULTS AND DISCUSSIONS

THE FORERUNNERS: THE COURAGIOUS EXCEPTIONS

The profound understanding of the tranquil beauty of a northern landscape was masterly shown by Gunnar Asplund and Sigurd Lewerenz at the Woodland Cemetery near Stockholm. The design added significance and a sense of reconciliation to the bare, mildly waved local relief (Fig.1.).

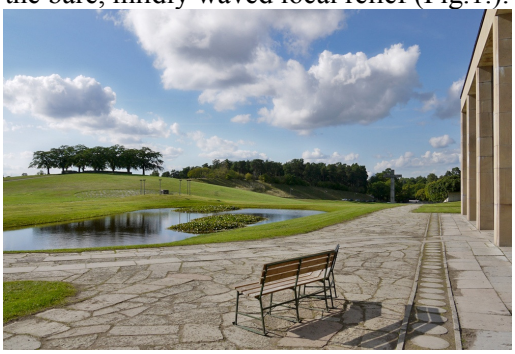

Fig. 1 - WOODLAND CEMETERY, 1917-1920

Roberto Burle Marx, the Brazilian landscape architect, was at the same time painter, print maker, ecologist, naturalist, artist and musician. His works

reflected his complex personality and, using the vivid colours and the powerful expressivity of tropical plants silhouettes, he created abstract painting with the diverse and always changing vegetal material. He used his artistic skill in producing ornamental drawings to be seen from above, from high buildings. He is considered one of the first designers to have introduced Modernist tendencies in landscape architecture (Fig.2.).

Fig. 2 - EDMUNDO CAVANELLAS RESIDENCE, PETROPOLIS, BRAZIL 1954

Thomas Dolliver Church was an American landscape architect known as having created the "California Style". By dividing the landscaped areas, he introduced the concept of outdoor living space or "outdoor rooms" (Fig.3.).

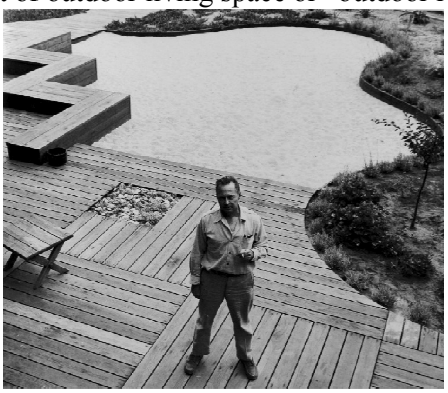

Fig. 3 - MARTIN RESIDENCE BEACH GARDEN, APTOS, CALIFORNIA, 1948

Environmental artists brought poetry in the landscape design and enriched it with significance, meaning and symbolism. They brought a new dimension to the landscape, the unexpected and the bizarre. Two of the best known environmental artists by the scale of their interventions and the magnitude of the requested material means were Cristo and Jeanne-Claude (Fig.4.).

Ian L. McHarg professor at the University of Pennsylvania advocated in his theoretical works an ecological approach in planning and landscape design. In his 1969 book, *Design with Nature,* he set forth the concepts that were to develop later in Geographic Information Systems.

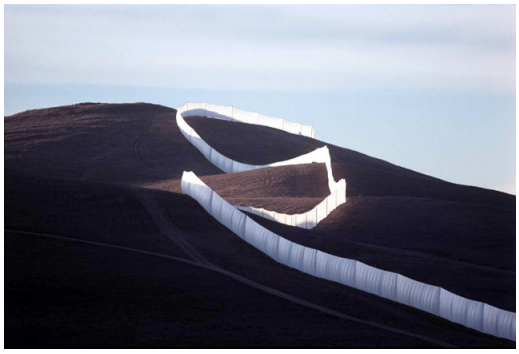

Fig. 4 - RUNNING FENCE, CALIFORNIA, 1976

Ian L. McHarg professor at the University of Pennsylvania advocated in his theoretical works an ecological approach in planning and landscape design. In his 1969 book, *Design with Nature,* he set forth the concepts that were to develop later in Geographic Information Systems.

CONTEMPORARY TENDENCIES IN LANDSCAPE ARCHITECTURE

1. A new life is given to historic parks. Not only did they change their beneficiaries in the 20th century, from a limited number of exclusivist nobles to a democratic use, but they house vivid contemporary activities.

Fig. 5 - Jardin du Luxembourg, Paris

In the traditional geometric Jardin du Luxembourg in Paris for instance (Fig. 5.), one can find attractions for every age category: children have playing grounds under the old trees; ponies await the young visitors; tennis courts are organized in the clearings; young people rest on the lawn, in the sun; on the

chairs, employees enjoy their lunch under the trees; older men play “petanque”. Everybody finds a suitable activity in the old park.

2. One can trace the same profound understanding of the landscape Asplund and Lewerenz displayed in Woodland Cemetery, the same subtle use of natural features, the same harmonious integration of architecture in the site, the same understanding of the “genius loci” in the works of Tadao Ando. In his 1985 Chapel on the Water, the building not only is in complete harmony with its surroundings, but the worship space opens widely towards the serene waters of a lake, rendered symbolic by the presence of a Latin cross (Fig.6.).

Fig. 6 - Chapel on the Water, Tomamu, island of Hokkaido

3. The ecological approach did bear fruit. In contrast with the usual concept for urban green areas, which are open ecosystems, needing maintenance, material and energy input, today design of closed ecosystems is encouraged, using local species and allowing a natural succession to occur. The first wild parks appeared in Holland, aiming to recreate local vegetal communities, almost extinct in wilderness. The Amsterdamse Bos was begun already in the ‘30ties, but it reached its full maturity at the end of the 20th century and became a model for many other parks, like the Time Landscape in New York.

In historic centers and residential areas, the concept of “traffic calming” and “mixed use” of the streets surface dethroned the car from its ruling position in the design of urban space. Already widely spread all over the world, the new ideas are essentially a way by which the pedestrian reclaims the streets and squares of his neighbourhood (Fig. 7.).

Fig. 7 - Joint usage streets for pedestrians & vehicles in the United Kingdom

4. Instead of imposing a building onto the landscape, today the landscape plays an essential role in determining the form of a building. Architecture becomes landscape as the greenery conquers and colonizes the buildings. Green roofs (also called vegetated roofs, living roofs and eco-roofs), rooftop ponds and living walls (genuine works of art, as it was designed in Defense, Paris) are encouraged by local and national administrations.

The School of Art, Design & Media of Singapore was located in a wooded valley which was supposed to be left as a green lung in the master plan of the university campus. The artificial relief created by the designer (CPG Consultants), covered by greenery became a powerful statement for the "landscaped architecture" (Fig. 8.).

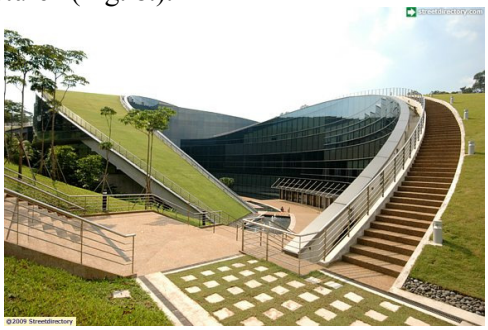

Fig. 8 - School of Art, Design & Media, Singapore, 2007

Contemporary cities need sustainable and ecological solutions, while their population increases, the rhythm of building activities is alert and a constant rise of life quality is a main goal. The increase of green areas, the creation of pedestrian friendly urban spaces and the harmony between architecture and landscape are a must today.

Landscape Architecture has a central role in future urban environment!

CONCLUSIONS

LANDSCAPE DESIGN IN THE FUTURE

1. New, vivid functions
2. Sensitivity for the character of natural landscape
3. Ecological attitude

REFERENCES

1. Lyall S., 1991 – *Designing the New Landscape.* Ed. Thames and Hudson Ltd., London, p. 10-14, 123-128.

2. Whiston Spirn A., 1984 - *The Granite Garden.* Ed. Harper Collins publishers, New York, p. 67-70.

3. Bayerische Staatsministerium des Innern, 1982 - *Verkehberuhigung,* Verlag Jehle, Munchen, p. 9-35.

TYPES OF AGRICULTURAL LANDSCAPE IN BOTOSANI

TIPURI DE PEISAJ AGRICOL ÎN JUDEȚUL BOTOȘANI

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Abstract. *The landscape is very important globally, achieving numerous studies to determine the types of landscape. Adjustable single d epeisaj types identified were made for the development or rehabilitation policy landscape is included in the territorial development and rural. Botosani county agricultural activities predominate, countryside, agriculture is dominant, so it is necessary agricultural landscape typology identify localities. Agricultural landscape presents some specific features, so that [for the study will be analyzed demographic and agricultural indicators to determine its typology.*
Key words: *countryside, agricultural landscape, agro-zootechnical indicators, rural development.*

Rezumat. *Peisajul are o importanta deosebita la nivel mondial, realizandu-se numeroase cercetări pentru a stabili tipurile de peisaj. În funcție de tipurile de peisaj identificate s-au realizat politici pentru dezvoltarea sau reabilitarea peisajului, fiind inclus în dezvoltarea teritorială sau cea rurală. În județul Botoșani predomină activitățile agricole, peisajul rural-agricol fiind dominant, de aceea este necesar idetificarea tipologia peisajelor agricole a localităților. Peisajul agricol prezintă câteva trăsături specifice, astfel că pentru realizarea studiului vor fi analizați indicatori demografici și agro-zootehnici pentru a stabili tipologia sa.*
Cuvinte cheie: *peisaj rural, peisaj agricol, indicatori agro-zootehnici, dezvoltare rurală.*

INTRODUCTION

Agricultural landscape overlaps particular countryside, although countryside includes many features and a rural landscape classification serve to highlight how living or operating the countryside. Countryside are complex method to characterize rural areas being classified natural landscapes with low human impact (includes vegetation types: polar, subpolar, arid and subaride, and forest landscapes) and agricultural landscape which highlights the geographical specificity of the countryside in terms of livestock, crop plants, landscapes transformed by human impact (Nicului, 1990).

Agricultural or rural landscape - agriculture because it is a category of countryside outlines the types of crops and animals that are bred in a region. This can be seen by using the statistical methods used type of agriculture, subsistence and modern, and the predominance of preferences in respect of a type of animal or growing a plant (Vijulie, 2010).

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The importance of rural landscapes has led many experts from different fields to study the characteristics and Poignancy agricultural landscapes. Dominant research areas are: geography, landscape, philosophy, economics, agriculture, addressing different aspects of the agricultural landscape. Interdisciplinary study highlighting the importance of landscape determines amenjarae agricultural landscape planning and the need to develop policies to create a competitive agricultural landscape at regional / national level both in terms of landscape and economic, geographic, social (Socol and Radulescu, 2006).

MATERIAL AND METHOD

The study used quantitative statistical data from the Statistical Institute Botosani County owned Agricultural Census (2003 and Population and Housing Census (2002). Statistical methods were used to synthesize statistical data, which were then carografiate Philcarto and processed in the program Adobe Illustrator CS 6 Trial.

Indicators used to identify rural landscapes are land planted with crops (wheat and rye, corn, potato, vegetable, sunflower) and number of animals in a village (cattle, sheep, poultry and pigs). Such automatic linking indicators used prinintermediul ascending hierarchical analysis program Philcarto emerge above the average county municipalities that have a certain culture, a certain type of animal or type of animal culture and predominant. After identifying the typology of rural landscapes, landscape analysis will be correlated with the types of existing landscapes to support changes of natural peisjaul impact agricultural landscape landscape built in the area in respect arhictecturale tradition and landscape.

Statistical methods are designed to create local typologies and highlight classification-agricultural rural landscapes by emphasizing the presence indicators in rural areas. Dominance of a culture or an animal growth-agricultural countryside denotes the respective agricultural specialization, so in this study is thorough classification of rural-agricultural landscapes. Data were excluded cities and towns (Botoșani, Dorohoi, Darabani, Bucecea, Săveni, Flămânzi, Ştefăneşti) to observe rural landscapes in terms of rural statistics.

RESULTS AND DISCUSSIONS

Cartograms made will be analyzed in the following order: rural-agricultural landscapes typology of cultures, landscapes typology of rural-agricultural farming and rural landscapes-final typology of agricultural crop plants and livestock. This will see the ranking of agricultural landscapes, prodominance in a certain area of a rural landscape type, possible causes, positioning within the urban rural landscapes etc., visual aesthetics of landscape costruit integrated agricultural landscape.

Rural-agricultural landscapes with growth animals (Fig.1) made by analyzing zootechnical indicators show the following types of rural landscapes: rural landscape with sheep dominant (Hudeşti, Conceşti, Coțuşca, Rădăuți-Prut, the central area of the county), the dominant rural landscapes with cattle and poultry (Suharău, Cristineşti, Vorona, Tudora, Dângeni), dominant rural landscapes with cattle (Mihăileni, Vlăsineşti, Unțeni, Avrămeni, Pomârla) and rural landscapes dominant in poultry (Frumuşica, Santa Mare, Mihai Eminescu,

Păltiniş, Viişoara). It can be seen that the rural-agricultural landscapes dominate sheeps growth, which suggests that there are large areas of grassland and meadows that allow growth of these animals.

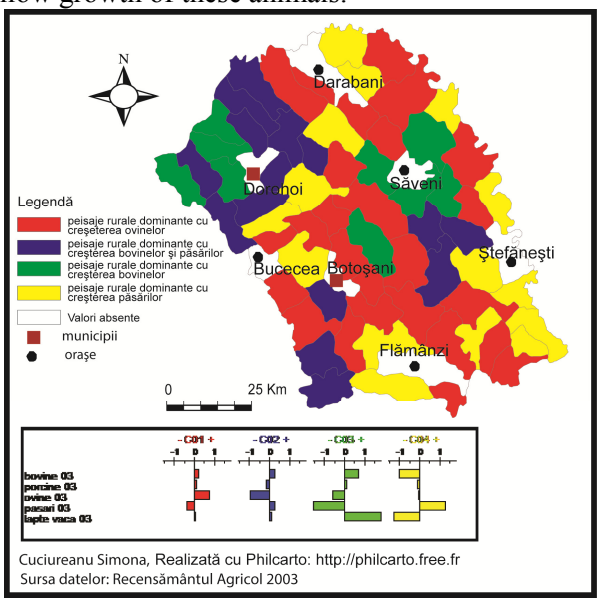

Fig. 1 - Rural landscapes livestock farming in Botoșani County

Cartogram in fig. 2, shows agricultural landscapes in terms of cultivating plants in Botosani and identified several types of landscape.

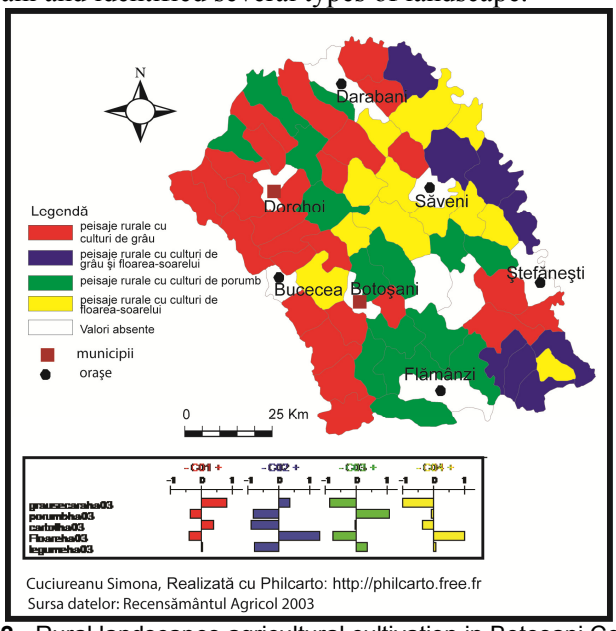

Fig. 2 - Rural landscapes agricultural cultivation in Botoșani County

Agricultural landscapes highlighted no.2 cartogram are rural landscapes dominant wheat crops (western county, Păltiniş, Viişoara, Drăguşeni, Durneşti), rural landscapes with the dominant culture withn wheat and sunflower (Avrameni, Adăşeni, Manoleasa Rădăuţi-Prut, Răuseni, Santa Mare), rural landscapes dominant crops of maize (south-central part of the county, Corlăteni, Răchiţi) and rural landscapes dominant crops sunflower (central part of the county: Ungureni, Vlăsineşti, Ştiubeni). It can be seen that in terms of culture prevails plant wheat because of a fertile soil for this type of plant.

Cartogram Fig. 3 highlights the complex agricultural landscapes, which summarizes all the indicators analyzed in agro-zootechnical cartograms Figure 1 and Fig. 2 were added and demographic indicators (population 2003) and agricultural areas. Such rural-agricultural landscapes in Botoşani County are rural agricultural landscapes complex (have a high share of livestock and crop plants), rural landscapes populated (population is large, while crops and livestock are the very low), rural landscapes dominant with increasing bovinelo and poultry, rural landscapes with cattle and dominant culture and rural landscapes sunflower dominant in poultry and all kinds of crops.

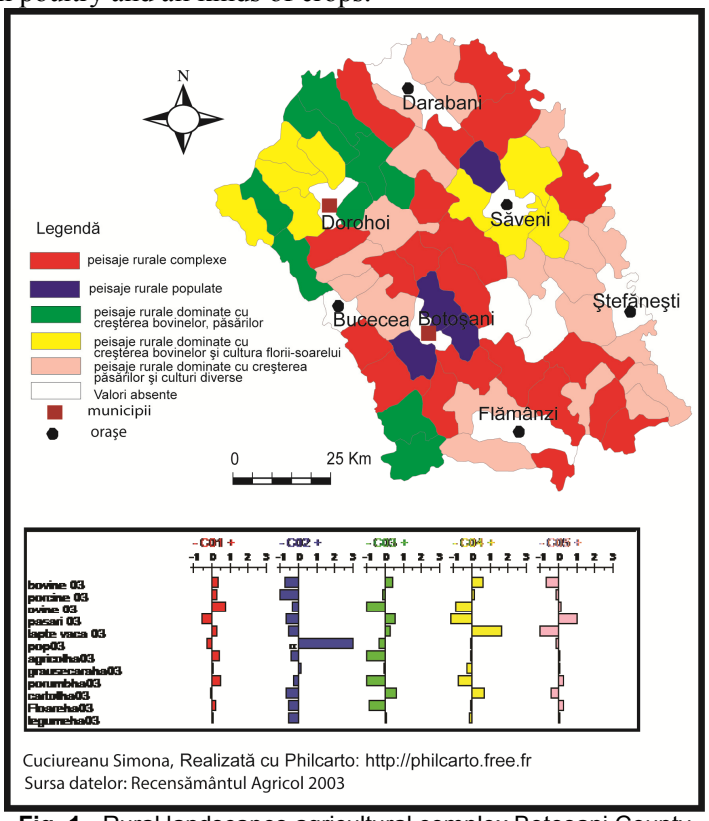

Fig. 1 - Rural landscapes agricultural complex Botoșani County

Predominant two types of agricultural landscape: complex, in which animals are bred and cultured animals of all classes, without specializing in a

particular type (central-south and north-east: Rădăuți-Prut, Manoleasa, Corni, Sulița, Albeşti) and poultry and cultures (the eastern, southern and central-western county: Păltiniş Viişoara, Frumuşica, Santa Mare, Durneşti).

Classification of agricultural landscape highlights the type of agriculture practiced and the analysis shows that using subsistence agriculture in which plants are grown for their own household consumption and increase animaelelor is only for their own consumption. It highlights poultry or cattle farms and slaughterhouses because they are specialized for some distillation meats or dairy products (Răchiși, Mihai Eminescu, Băluşeni, Vlăsineşti).

Botoșani County is characterized by a specific agricultural landscape, where subsistence agriculture gives a touch of complexity, crop and livestock are completed. However, this agricultural landscape has a negative combined, in a landscape as it determines concomitant destruction of soils and landscapes.

Fig. 4 - Pictures of the agricultural landscape in Botoșani County

Steppe vegetation due to grazing and accelerate geomorphological processes, supports gullying and mass movement resulting landscape change through aggression. Specific for subsistence is micro farms, which means that there is an excessive agricultural surface, confirming that agricultural landscape is a complex one, in which an area of 10 hectares can be planted at least 5 different cultures.

Fig. 5 - Images of built and landscape modeling agricultural landscape; Source: Cuguat-TIGRIS, 2003

Agricultural landscape has undergone changes in terms of visual impact by destroying buildings serving until 1990 agricultural mechanization resort premises (SMA) and state agricultural enterprise (IAS), which ensure agricultural mechanization, land or property management. This resulted in a bleak landscape in which buildings are harmoniously integrated into the landscape, birds and are currently ongoing to tear down because they are no longer functional.

Restoring agricultural landscape, economically and aesthetically, it is possible by setting up associations and societies that allow recurrence of mechanized agrarian morphology and recompose, and then reshapes the landscape, reducing fragmentation.

CONCLUSIONS

1. Agricultural landscape in Botoşani County highlights the precariousness of the countryside and shows necisitatea implement policies for the development and exploitation of land for potentiation and preserving agricultural landscape values of this area.

2. This farms and slaughterhouses emphasizes specialization defining several villages and rural landscape.

3. The influence of urban areas by defining and shaping agricultural landscapes, agricultural specialization countryside settlements in their vicinity.

4. The need for policy development and customization of the countryside and rural development in order to identify agricultural specificities of localities.

5. Applying the legal framework across Botoşani County (Lease Law, Law Association, Law legal circulation of land) for the establishment of farms in the process of combination, sale, lease, that will positively change the agricultural landscape and the local economy.

REFERENCES

1. Nicului C., 1990 - *Satul românesc în perspectiva dezvoltării teritoriale - contribuție la o metodologie de cercetare,* Editura Tipografia Ploiești-Prahova.

2. Socol Gh., Rădulescu D. C., 2006 - *Civilizația rurală din România în perspectiva Integrării în Uniunea Europeană,* Editura Centrul de informare și Documentare Economică, București.

3. Vijulie I., 2010 - *Dinamica peisajului rural în Câmpia Boianului*, Editura Universității din București.

4. *** Carta europeană a amenajării teritoriului.

5. *** Cartea Verde pentru Dezvoltarea Rurala in Romania.

6. *** Convenția europeană a peisajului.

7. *** Planul de Amenajare a Teritoriului Județean Botoşani.

THE HISTORICAL, URBAN AND LANDSCAPE EVOLUTION OF IAŞI UNION PIAZZA

EVOLUȚIA ISTORICĂ, URBANĂ ŞI PEISAGISTICĂ A PIEȚEI UNIRII DIN IAŞI

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Abstract. *This study analyses the historical evolution of the urban and landscape systematization of Iaşi Union Piazza. The mistakes, both old and new, done in the piazza historical evolution and in its modern rehabilitation, have affected its urban and architectural importance and value. Over time, negligence and errors have created visible physical consequences and subtle psycho-emotional effects.*
Key words: *urban evolution, landscape evolution, historical effects.*

Rezumat. *Acest studiu analizează evoluția istorică a amenajărilor urbane şi peisagistice din Piața Unirii Iaşi. Greşelile, atât cele vechi, cât şi cele noi, făcute de-a lungul evoluției istorice, dar şi în reabilitarea modernă a pieței, i-au afectat importanța şi valoarea urbană şi arhitecturală. De-a lungul timpului, neglijențele şi erorile au creat consecințe fizice vizibile şi subtile efecte psiho-emoționale.*
Cuvinte cheie: *evoluție urbană, evoluție peisagistică, efecte istorice.*

INTRODUCTION

Due to their multi-functionality, public sqares have become urban centers of great interest. Many of the functions accumulated over time are available today also. The squares can be urban spaces of public gathering, socializing, meeting, business, or daily circulation and promenade. In terms of ambiance, these spaces should have high class aesthetics, charged with magnetism, generating social cohesion and having an outstanding contribution in the field of leisure and daily comfort (Dascălu, 2006).

MATERIAL AND METHOD

Currently, in most of our cities, not just historical public spaces, but also those created a few decades ago, have been degraded, damaged, contaminated by parasitic buildings, becoming favourite utilities, or suffocated by the needs of excessive car traffic. In this serious situation, due to the disinterest of public authorities, we add the quite recent, negligent planning and rehabilitation of public spaces. Rehabilitations were done with many mistakes, with negative consequences, on physical and psycho-emotional level over the inhabitants. As a result, these areas have gradually lost real contact with residents. In this context, this study examines the historical development of urban facilities and landscape from Union Piazza of Iasi.

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RESULTS AND DISCUSSIONS

Union Piazza, an important public space of Iaşi, is considered the heart of the city even today, although the new civic center, created in seven post-war decades, inside the old historic heart of Iasi, tried to move the center of gravity of the urban area. Deciphering the old Iasi plans, drawn up by engineers Bayardi in 1819, Rascheck in 1844 and Peytavin in 1857, we see that in the urban tissue of the area of Union Square there was an intersection of five streets, without a corresponding spatial expansion (Dascălu, 2012). Union Piazza appears later, crystallized as shape in the plan of engineer Bejan in 1897.

Even before the advent of the square, the mentioned intersection of five streets was gaining fame because of both the commercial venue, created by shops where they sold products of high class European ranking, and the presence of some hotels with spacious multifunction rooms, where restaurant halls housed theater performances, or major public gatherings. One of the leading venues, important meeting point for Iasi progressive intellectuals, was the Petre Bacalu Inn. The building is mentioned in the Peytavin plan, located at the intersection of Academy street with street Săulescu, across from future hotel building of Traian Hotel. Not incidentally, a famous event, that sits an important foundation stone to Union Square, takes place in front of this inn. Protesters gather to celebrate the union in 1859, dancing Hora Unirii (Union Dance) for the first time in front of the inn (Şutu, 1923).

The place where Hotel Traian and Union Square are located today, previously hosted the stalls of the lawyer Scarlat Pastia, mayor of Iaşi between 1877 to 1879. Although trade was profitable, Pastia decided to demolish the stalls and build a theater. The theater project was refused by local autorities and he raised Hotel Traian, instead of the cultural edifice. The hotel was finished in 1882. Pastia entrusted Effel, the famous franch engineer, designing and building the hotel. Actual birth of Union Square takes place in 1897, when city officials decide to buy and demolish several buildings in front of the hotel Traian to open a public piazza. On the occasion of the completion of the plan of Iasi in 1897 by engineer Gr. Bejan, Union Square area is designed. This plan also set the path and alignment of the main streets of Iasi (Bogdan, 1997). The square was necessary both in the context of urban prestige already owned by the area and in context of the modernization of the city, by introducing electric lighting and electric trams. Between 1897 and 1900, the market area was disrupted by the setting of the first eletric tram line. In an old photograph (fig. 1) we notice that the market fronts had sidewalks for pedestrian traffic, the remaining space being treated as a large common area, which intersected pedestrians and vehicles - carriages, trams and cars emerging. Functions of pdestrian circulation and parking of vehicles was the main activities in the piazza environment. The vehicles circulation were a danger for pedestrians.

The new emerged space of piazza attracted more people, becoming the favorite promenade of the social elite that, in the evenings, on the route from the Royal Court to Copou hill, stopped here to chat and do shopping. The square is

already becoming a multi-functional space: social meeting place, front parking for the carriages, a relaxation place in the summer at the restaurant terraces and cafés in the area. In a postcard before 1912 we notice, as a central point of interest in the middle of piazza, the presence of a decorative street lighting pole, sitting on a broad base, creating a pedestrian refuge (fig. 1). The area was still disturbed by the movement and parking of carriages. Despite the dysfunctions, the area was used extensively for both meetings, promenades and relaxation, but also for public gatherings.

Fig. 1 - Union Square before 1912. Postcard collection of antiquarian D. Grumăzescu

Fig. 2 - Union Square in 1930. Postcard collection of antiquarian D. Grumăzescu

In 1912, in the Union Square, was erected a statue in memory of Alexandru Ioan Cuza, the creator of the Union, by the italian sculptor Raffaello Romanelli. From this moment on, the Union Square of Iasi overshadows all other squares, maintaining over time, until today, the position of "*heart of the city"*. The Union Monument is an important landmark of the city space, giving the market a spatial, symbolic and emblematic significance, that no other public space in Iasi will have. Photos after 1912 shows the square having more magnetism (fig. 2). We see obvious animation, residents who spend time chatting, having meetings and shopping, standing in the space because they had no public furniture for rest and recreation. Until 1944, the piazza is performing the same function space, perpetuated in time: pedestrian traffic, movement of vehicles (carriages, electric

trams and cars) vehicle parking area, space for events, festivals - cultural and socio-political, socializing place, business and friendly meetings, promenade, recreation area in the adjacent terraces, catering market, trading activities area.

Bombing in 1944 severely affected the piazza, destroying group of buildings in front of the hotel Trajan and in front of the Mayor Hall (the former palace Cantacuzino-Paşcanu) to Cuza Voda street.

After the war, city officials tried to restore the destroyed area, left vacant on the eastern side of the square. Postcards from 1949 and 1950 show the pleasant ambience of the area landscaped with vegetation and resting places. We notice from the images the care for aesthetic design of benches and of vegetation interspersed between resting places and the steps located in front of the green slope of the City Hall plateau. We emphasize that this is the first initiative, in Union Square history, dedicated to the creation of a harmonious ambient spaces for relaxation and rest, since, until now, this had been a completely neglected urban function.

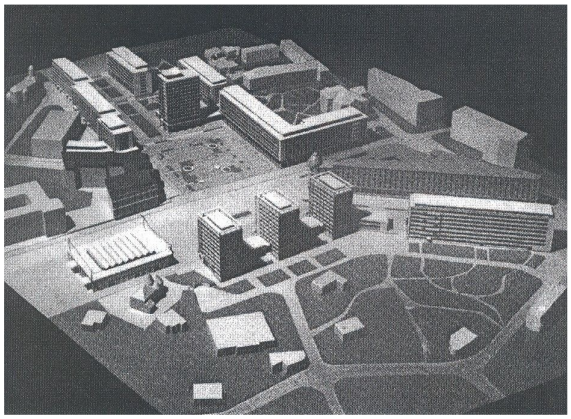

Fig. 3 - Renovation of Union Square. Image of Arhitectura R.P.R.,1963, nr. 4, p. 10-16

Fig. 4 - Union Square in 1970. Postcard collection of antiquarian D. Grumăzescu

In 1960 architects in Bucharest are called to renovate, to systematize the central Iasi (fig. 3). A modern ensemble is created, rather austere, of housing and social-cultural facilities (like the Union Hotel and Victoria Cinema Hall), all

combined with ample green lawn, without trees. The creation of this new urban center generated many demolitions of old historic setting buildings that resisted 1944 bombing. In the pictures of 1965 and 1970, we can see a fairly broad deserted modern piazza (fig. 4). Of course, this ample space was specially created just for public communist events. The inhabitants are not tempted to gather, to stand in the square to socialize. No reason for that, because the urban space does not offer resting space with appropriate furniture, does not provide any space for refuge from the pedestrian traffic, no gray areas for socializing. Although the urban composition of the market is coherent and also has a certain elegance. But the main function of the piazza remains pedestrian traffic. Unfortunately this service is not safe, because the area of maximum interest, the decorative mosaic, telling the legend of Dragos Voda, was made of large slabs of highly polished marble, so highly dangerous in pedestrian traffic in the rain and snow. The rest of the square functions existed only theoretically as they were not supported practically by concrete urban furniture or landscape arrangements.

In 2006, the Municipality initiated a project to rehabilitate the piazza. Primarily they wanted to eliminate car traffic and parking in front of the hotels Traian and Unirea, aggressively implemented over the time. This could be done by creating a system for both underground auto traffic and parking spaces. The intentions were not materialized due to lack of funds, so parking and auto circulation remained intact and even expanded (fig. 5).

Fig. 5 - Union Square in 2011. Photo D.M. Dascalu

What was done was just the repavement, creation of rainwater gutters, restoration of the monument and of decorative ponds, restoring of green spaces, furnishing the area with benches and adding public lighting poles. Unfortunately, before the execution was not done a judicious analysis of the existing situation in terms of comfort and quality of daily life, reparing the old mistakes. In the context of piazza gaps made in 1960, the rehabilitation should have covered the more pressing needs. The following are some of the most important issues that should have been addressed:

• for the safe pedestrian circulation the recreation of the „legendary mosaic" should have been done with anti-slippery material, but in fact the restauration added new areas of glossy large surfaces; in order to facilitate the movement in time of the rain and snow, plastic sleepers are placed together with damns created out of benches; it was also necessary the elimination of traffic and parking areas, but parking and auto circulation remained intact and even expanded.
• resting spaces have not been created created with appropriate furniture, harmoniously integrated as shape, material and color; the urban aesthetics of the square is altereted by the presence of styles, shapes and materials, all dissonant;
• there has been no judicious placement of street furniture, so as to provide an intimate relaxation; some banches were placed linearly, following only area of green spaces without creating pockets of rest, other banches were placed around the monument, preventing its admiring and photographing;
• plant compositions were not aesthetically arranged creating shady places for rest, therefore the sunlight is excessive in the square;
• the unity of urban composition created in 1960 was destroyed by eliminating the green space around the Union Statue; only a small strange green surface was preserved nearby the monument;
• slopes and drainage channels for rainwater were performed negligently, causing extensive paddles after rains hampering the circulation.

CONCLUSIONS

1. Mistakes, both old and new, made along the historical development, but also in modern rehabilitation of the square affected the urban and architectural importance and value of Union Piazza in Iasi.

2. Over time, omissions and errors created physical and subtle psycho-emotional effects and consequences.

3. However, the inhabitants are sentimental, they love and use this public space with joy, passing over the dicomfortable details.

REFERENCES

1. **Bogdan N. A., 1997** - *Oraşul Iaşi Monografie istorică şi socială, ilustrată*, Editura Tehnopress, Iaşi, p. 375, 381.
2. **Dascălu Doina Mira, 2006** - *Peisagistica: o posibilă terapie pentru problemele mileniului al III-lea*, Editura Societății Academice „Matei - Teiu Botez", Iaşi, p. 25.
3. **Dascălu Doina Mira, 2012** - *Aspects of daily life reflected in Iaşi Union Piazza evolution- Aspecte ale vieții cotidiene oglindite în evoluția Pieței Unirii din Iaşi*, Historia Urbana, tom. XX, Ed. Academiei Romane, Bucuresti, pag. 116-124.
4. **Şuțu Rudolf, 1923** - *Iaşii de odinioară*, vol. I şi II, Tipografia Lumina Moldovei, Iaşi, vol. I, p. 34, 314.

THE TECHNICAL AND ARTISTIC DRAWING - A TOOL IN TRAINING AND INTERDISCIPLINARY COMMUNICATION FOR LANDSCAPE ARCHITECTURE DESIGNERS

DESENUL TEHNIC ŞI ARTISTIC – UN INSTRUMENT ÎN INSTRUIREA ŞI COMUNICAREA PROIECTANȚILOR DE ARHITECTURĂ PEISAGERĂ

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***Abstract**: Among subjects who completed training curricula of first year landscape students are Descriptive Geometry and perspective, Representations and Composition. All this is a mandatory first step in training future landscape specialists, given that admission to college does not require prior training of students in this field. Profession of landscape, as the architect, involves a combination of several skills and competencies, among them the power to imagine, design and correctly represent the spatial composition of Landscape Architecture, playing the role of intermediary between project design and execution. Therefore the question arises which are the best subjects suited to develop these qualities. The paper presents and discusses briefly the shortest path from idea to action - technical drawing and perspective one.*
***Key words:** technic drawing, art drawing, architectural representation, design of built landscape*

***Rezumat.** Printre disciplinele care completează curricula de pregătire a studenților peisagişti de anul I sunt Geometria Descriptivă şi Perspectivă, Reprezentări, dar şi Compoziție. Toate acestea reprezintă o primă etapă obligatorie în instruirea viitorilor specialişti peisagişti, având în vedere faptul că admiterea la facultate nu cere o pregătire prealabilă a studenților în acest domeniu. Meseria de peisagist, ca şi cea de arhitect, presupune întrunirea mai multor abilități dar şi competențe, între acestea fiind puterea de a imagina, concepe şi reprezenta corect o compoziție spațială de arhitectură peisageră, jucând şi rolul de intermediar dintre schița de proiect şi executant. Prin urmare se pune întrebarea care sunt disciplinele cele mai indicate să dezvolte toate aceste calități. Articolul prezintă succint şi dezbate cea mai scurtă cale de la idee la faptă – desenul tehnic dar şi cel în perspectivă.*
***Cuvinte cheie:** desen tehnic, desen artistic, reprezentarea arhitecturală, designul peisajului construit*

INTRODUCTION

In the technical universities, Technical drawing and Descriptive geometry disciplines is compulsory for students to take from the first year of

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study, because of the specific applicative and technical character, but also because of the need to representate of abstract processes, technologies or other objects and structures design for each of the specialties.

In the Faculty of Horticulture from Iaşi, Department of Landscape Architecture, in the curricula of study, exist a range of disciplines ment to develop space view, artistic sense and students imagination, and also the ability to draw spatial objects in plan and three-dimensional representation.

MATERIAL AND METHOD

It became apparent to us that architecture Is generally assumed to be a highly specialized system with a set of prescribed technical goals rather than a sensual social art responsive to real human desires and feelings. This limitation is most frighteningly manifested in the reliance on two-dimensional diagrams that lay more stress on the quantifiable features of building organization than on the polychromatic and thridimensional qualities of the whole architectural experience. - Kent Btoomer & Charles Moore

The only way you can build, the only way you can get the building into being. Is through the measurable. You must follow the laws of nature and use quantities of brick, methods of construction, and engineering. But in the end, when the building becomes part of living,it evokes unmeasurable qualities, and the spirit of its existence takes over. - Louis Kahn

Given these statements of some practitioners and philosophers of architectural thinking, emphasize that every creative thought witch will be built and put into practice by a worker or by the author himself, need a measurable representation more or less abstract, on paper or electronic support. The classical system of 2 sizes representation is scrubber technical drawing (fig. 1), and the 3-dimensional representation is axonometric and perspective drawing (fig. 1, 2) (Ciolacu and Şerban, 2013; Enache and Ionescu,1983).

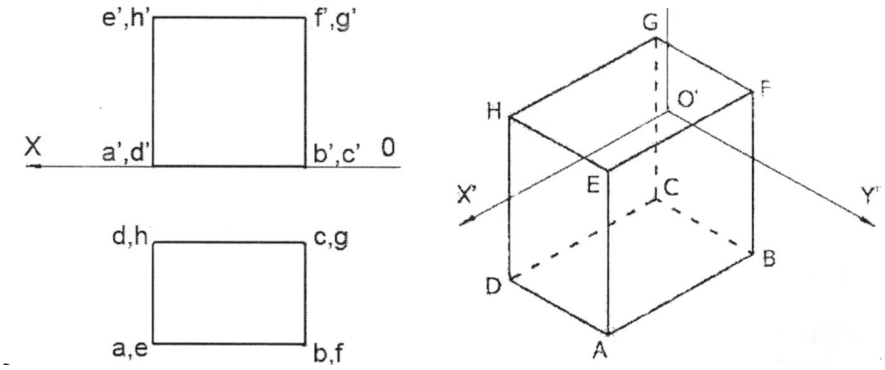

Fig. 1 – 2D scrubber representation (left) and 3D axonometric representation (right) (Ciolacu and Şerban, 2013)

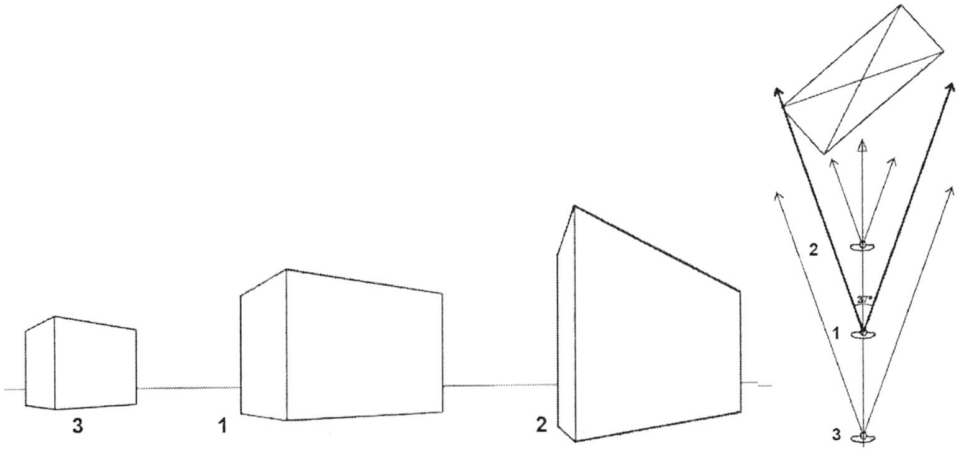

Fig. 2. – Representation in perspective: 1 - normal, 2 - close, 3 – far
(Enache and Ionescu I.,1983)

RESULTS AND DISCUSSIONS

The following are some examples of exercises designed to develop students' space vision and the ability to accurately represent certain volumetric objects in 2 and 3 dimensions (fig. 3, 4, 5).

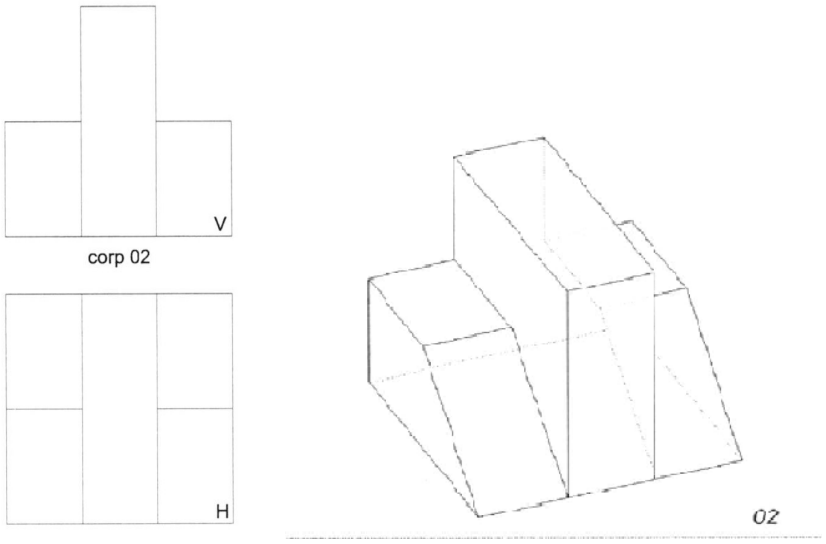

Fig. 3. – Scrubber and downward axonometric representation of a volume
(Ciolacu and Şerban, 2013)

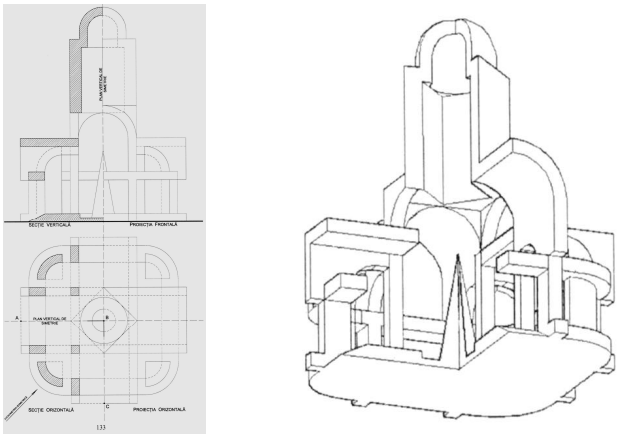

Fig. 4 – Scrubber and bottom axonometric representation of a volume (Ciolacu and Şerban, 2013)

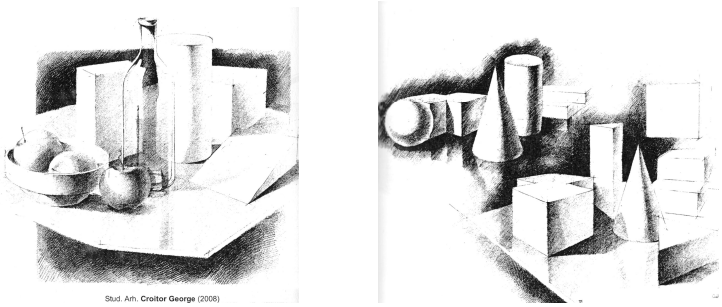

Fig. 5 – Grafic perspective representation of geometric objects and groups (Ciolacu and Şerban, 2013)

In the students landscape projects are pursuing a number of theoretical and practical objectives about spatial composition concepts, or details of steps, stairs, fountains, pergolas and decorative walls. Figure 6 illustrates the images of examples.

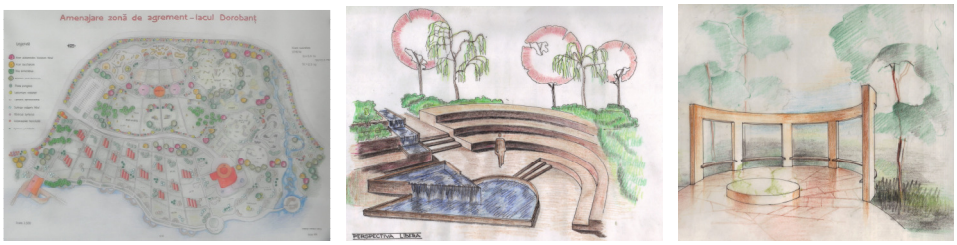

Fig. 6 – Plan and grafic perspective representation of Landscape planning projects of student from 2, 3, 4 year of study (projects conducted under the guidance of Prof. Dr. Arch Dascalu Doina Mira)

When referring to the training requirements of students architects, will find concern for developing spatial artistic sense, through the study of architectural composition of buildings and harmonize the functional needs with aesthetic and volumetric proportions of the facade and overall.

"Practic Architectural Surveying" discipline aims for architecture students to acquire techniques of survey, representation and evaluation of construction. Learning results are expresed in knowledge, technical or professional competency:

- Develop students' ability to observe the composition of a building;
- Observation of construction techniques and materials used in different eras;
- Learning the techniques of preparation of a project - surveying;
- Follow the accuracy of measurements and assuming the role of the architect restaurator.
- Awareness of the role of the architect in the preservation of identity and cultural values, in case of interventions on ancient architectural objects.

These skills and abilities can be followed and measured with this type of completion project stages, which is based primarily on preparing students for technical and artistic drawing, in the first year of study in the disciplines of Descriptive Geometry and Form Study. The catalogue compiled by tutors through summing up the best works of the second year students, realised in the Practice-Surveying on the end of the 2007-2008 school year, is testament to the skills acquired by students during the two years of study (fig . 7) (Nica and Purcaru A., 2009) .

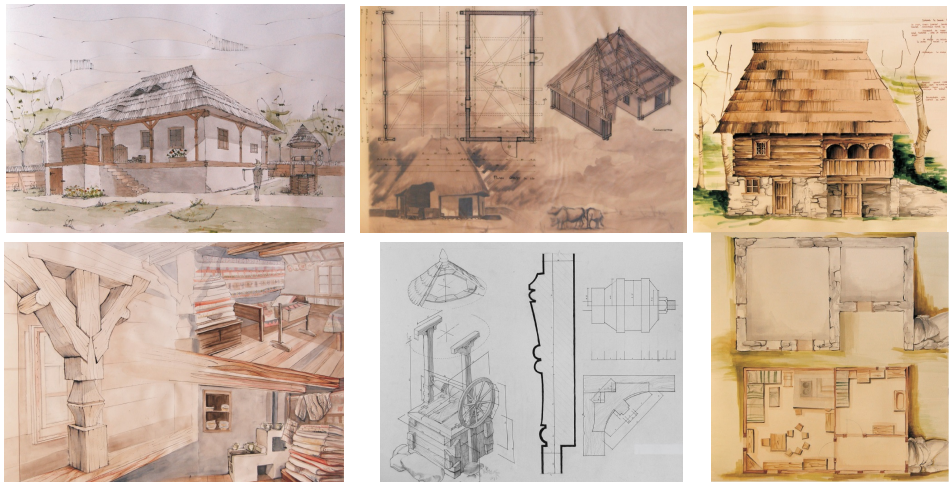

Fig. 7 – Representations plan, facade, axonometric and perspective of objects of traditional architecture specific to different areas of Romania, in the "ASTRA" Museum Sibiu (Nica and Purcaru A., 2009)

If landscape students will devote propensity for plants study and harmoniously bringing them into an existing or future built environment, , architecture students will have particular regard to the technical-utilitarian issues of architectural object, but they will not forget the aesthetic and harmonious integration in the environment (fig. 8).

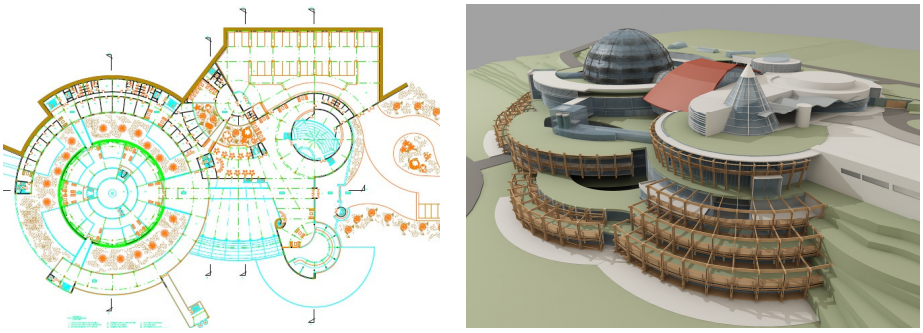

Fig. 8 – Computerised plan and perspective representation of an architect student Diploma project (Purcaru, 2004)

CONCLUSIONS

In conclusion, the requirements for landscape architecture projects are clearly reflected in the practicaly – forming caracter of disciplines Descriptive geometry and perspective representation, Composition, Landscape Design and Teritorial planning.

REFERENCES

1. **Ciolacu Dragoş, Şerban Sorin, 2013 –** *Admitere Arhitectura: Propuneri şi Subiecte*, Ed. Matei Teiu-Botez
2. **Ching Francis D.K., 1979 -** *Architecture: Form, Space & Order*, Published by Van Nostrand Reinhold, New York
3. **Ching Francis D.K., 1995** – *Avizual Dictionary of Architecture*, John Wiley &Sons, New York
4. **Enache Mircea, Ionescu Iulius, 1983** – *Geometrie descriptivă şi perspectivă*, Institutul de Arhitectură Ion Mincu Bucureşti
5. **Nica Răzvan M., Purcaru Andrei (coord.), 2009 –** *Practica Releveu Muzeul Civilizației Populare Tradiționale "Astra" Sibiu 2007-2008,* Univ. Tehnică "Gh. Asachi" din Iaşi, Facultatea de Arhitectură "G.M. Cantacuzino", Princeps Edit, Iaşi
6. **Purcaru Codrina, 2004** – Proiect de Diplomă „*Centru de cercetare şi terapie în Medicina tradițională indiană Ayurveda*", Universitatea Tehnică „Gh. Asachi" din Iaşi, Facultatea de Arhitectură şi Construcții, Iaşi

LANDSCAPING MULTIFUNCTIONAL RECYCLING CENTERS

PEISAGISTICĂ MULTIFUNCȚIONALĂ A CENTRELOR DE RECICLARE

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Abstract. *The low social involvement in delivering reusable materials to recycling is a shameful feature of transition societies – such as post-communist Romania. Beyond its environmental impact, this attitude is the symptom of the social cohesion and civic spirit loss. Urban landscape design provides ways to increase the efficiency of the reusable waste collection, starting with the causes up to the process management. This paper analyses the possibility of introducing multifunctional usage of recycling centers – such as for community queries support. Using modular landscape design there are created recycling center units suitable for easy urban integration. In this case, choosing a specific container transmits a message to the query organizer. Connecting the center to nearby playgrounds also ensures energy collection. The designs are assigned to real urban sites and their impact is anticipated in terms of landscape quality, management efficiency, social cohesion and community culture benefit.*
Key words: *environmental culture, integrated urban landscape, recycling centers, transdisciplinary design, urban wastes*

Rezumat. *Implicarea redusă a populației în aprovizionarea centrelor de reciclare cu materiale reutilizabile este o trăsătură negativă a societăților în tranziție – cum este cazul României post-comuniste. Dincolo de impactul de mediu, această atitudine constituie un simptom al degradării coeziunii sociale și a spiritului civic. Peisagistica urbană asigură modalități de sporire a eficienței colectării deșeurilor reciclabile, pornind de la abordarea cauzelor până la managementul procesului. Această lucrare analizează posibilitatea utilizării multifuncționale a centrelor de reciclare – cum ar fi cazul introducerii funcțiunii de infrastructură pentru sondarea opiniei publice. Prin utilizarea design-ului peisagistic modular sunt astfel constituite unități de colectare a deșeurilor, ușor adaptabile integrării în context urban. În acest caz, alegerea unui anumit container transmite un mesaj organizatorului sondajului. Proiectele sunt integrate unor situri urbane reale și impactul acestora este anticipat după criteriul calității peisajului, a eficienței managementului, a coeziunii sociale și al aportului cultura comunității locale.*
Cuvinte cheie: *Centre de reciclare, cultura de mediu, design transdisciplinar, deșeuri urbane, peisaj urban integrat*

INTRODUCTION

The gap that emerging societies need to fill in comparison with the old western civilizations raises growing costs and risks on the long run for

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environmental protection – mainly in matters of environmental culture. As a newcomer, Romania still needs to cover the EU's *communautaire acquis*, which involves integrating new features in the politic, administrative and popular culture.

The reuse of objects and wastes is connected to the peasant culture of efficiency, unfortunately losing ground to consumerism these days. The thing that is left relevant to contemporary society is that environmental protection was never an end in itself but a collateral result of the fight for survival, as recycling is associated to moderate living and large scale environmental protection (cultural landscapes) was achieved following painful historic experiences (floods, famine, pests or invasions).

MATERIAL AND METHOD

The paper approaches the role of landscape design in urban waste collecting, aiming to improve process efficiency. There is analyzed the possibility that increasing urban waste selective collection point (WCP) functionality would determine an improvement of their basic function. To test this hypothesis, the research uses a pool heterogeneous from urban, civic culture and management efficiency of the reusable waste collection – three sites in Bucharest (Romania): 1- Drumul Taberei district – proletariat residences from the 60's; 2 – Domenii Market – inter-war villas; 3 – Răzoare district, with blocks of flats built for the soviet army in the 50's, similar to Cotroceni district through accessibility, real estate value, life quality and crime rate (fig. 1). A WCP design is derived from the three site's analysis, through transdisciplinary (Cutler, 2009) and adaptive research.

Fig. 1 - Urban framing and site limits: 1- Drumul Taberei; 2- Domenii; 3- Răzoare

RESULTS AND DISCUSSIONS

There is started with the general assumption that in contemporary culture, reward is the basis of any sustainable social action. As a source of social and personal services, landscape could reward the effort for selective waste disposal.

Analysis:

Table 1 reflects the representativeness of the study sites for Bucharest opposing the recordings for each site to the minimum and maximum for the entire city. Considering its diversity, results can be extrapolated for most of the urban Romanian landscapes. The data has been obtained through empiric research and from independent researches (table 1).

Table 1

Site analysis

Cartier/WCP					
Site	**Accessibility**	Bucharest	Sit 1	Sit 2	Sit 3
	Real estate value	1<10	1	8	6
	Life quality	5<8	7	8	4.3
	Delinquency	4,1>10	3,5	10	6.9
	Fear	-1,7<1,18	0,36	0,27	1.04
1	**WCP accessibility**	Width [m]	1	1	7
2	**Use period**	%	60	85	70
3	**WCP ergonomics**	%	40	60	30
4	**Conflicts**	%	0	30	50
5	**Max. limit distance**	[min.]	10	2	5
6	**Beneficiaries (emp.)**	n X 10^3	20	5	5
7	**Social POS**	%	10	40	80
8	**Green spaces**	%	35	2	35
9	**Community sp. Erg.**	%	30	50	70
10	**WCP visibility**	%	70	85	35
11	**Landscape attract.**	%	10	30	70
12	**Landscape identity**	%	10	30	60
13	**POS security**	%	- 80	-30	+100
14	**POS appropriation**	%	15	10	70
15	**Civic activism**	%	5	15	30
16	**POS Accessibility**	%	40	30	50
17	**Soc. cohesion**	%	35	35	75
18	**Diversitatea soc.**	%	80	70	10
19	**Soc. diversity**	%	30	10	90
20	**Winter comfort**	%	50	70	80
21	**Traffic impact**	%	90	100	0
22	**Green space serv.**	%	30	5	50
23	**Environm. Connect.**	%	20	15	20
24	**WCPambient impact**	%	80	70	50

WCP environmental efficiency (de Leeuw, 2012) was approached as urban integration and environmental culture impact. Thus, site analysis targeted the following indicators:

- General neighborhood accessibility (Asociația Urban 2020, 2011) – through psycho-social impact, it affects the people's perception toward the landscape identity of their own neighborhoods; at the same time, the inhabitants of accessible areas have superior levels of urban culture – they are more likely to explore the city; this also reveals the administration's level of concern for landscape's quality (Lazăr-Bâra A. P., 2011);
- The real estate value (ibid.) – affects the landscape appropriation level, thus influencing through civic responsibility the behaviors regarding the environment (Caves R. W., 2005) – the environmental protection concern;
- The subjective neighborhood life quality – the resident's satisfaction is proportional to the appropriated landscape's quality (Asociația Urban 2020, 2011) and therefore to the proper use of the urban facilities; this also indicates the perception towards public services' quality;
- Delinquency (ibid.) – was interpreted as public space vandalization risk;

- The public safety subjective level – *the fear map* (Ciobanu, 2011) – is interpreted as public facilities' abuse risk, considering that in an unsafe neighborhood the citizen's response to the disobedience regarding the rules of living together is low; the average fear index for each neighborhood were taken from the same author's study, in 2012 (ibid.);
- WCP functionality: pedestrian accessibility – the minimum access width to the nearest crossroads (1), the yearly effective usage time – on the basis of the maximum gathering efficiency (2), the WCP ergonomics impact on waste gathering (3), conflicting juxtaposings to other urban structure features – internal impact (4), maximum distances – in minutes – to the borders of the served areas are determined on the basis of the adjoining WCP, on the isochrone halfway between the target nucleus and each adjacent center, within the 5 minutes limit;
- Public open spaces (POS) in the served area: the social spaces' capacity (7), the total green space area (8), the community space quality (9), the landscape impact of the WCP (10), the site's landscape attractivity (11), the landscape identity (12), the POS security in the served area as compared to the neighborhood average (13);
- Social life: public space appropriation level (14), civic activism (15), social accessibility – possible exclusion of certain social categories from the served area (16), social cohesion (17), diversity (18);
- Environment – surroundings' impact: summer ambient comfort (19) and in the winter (20), traffic aggressiveness (21), green space services (22), green infrastructure integration – the environmental services transfer (23), the environmental aggressiveness of the WCP (24);
- Landscape – the psychological and instructive impact: landscape identity (mental landmark – Lynch K., 1960), perceptive impact (the distance at which it draws pedestrian's attention, the landmark value, the conflict juxtaposing perception, the mental impact of the natural elements (Cauquelin A, 2002), the perception of the surrounding's contribution, the semantic coherence of image and function, the urban and local representation.

Following the analysis there were found connections between environment's quality – according to the Urban Ecological Integrity Index – UEII (McDonnell et. al., 2009) and the landscape parameters as following:

- Vegetation – as a habitat structural feature – suffers diversity and structure decline as a consequence of the poor public space appropriation, inducing the surrounding's environment and aesthetic decay.
- The urban charismatic fauna – landscape quality feature – is poor in the analyzed areas; possible causes are the ecologic connectivity deficiencies within the green infrastructure, the absence of nearby suitable habitats (inappropriate vegetation architecture, urban predators – cats mostly, the pedestrian and road traffic aggressivity).

In their present shape, the WCP's inflict negative environmental impact on the surroundings; owing their negative attractivity they do not make efficient landscape landmarks.

Urban features' multifunctionality is the originator concept of the design. Aiming to build up a kit of modular elements for site reorganization (fig. 2) there is approached the transdisciplinarity concept, which integrates urban functionality, the social, the environmental and the landscape issues.

Proposals:

There are targeted modules complying with the following functional requirements: local landmark, urban rank – volume, chromatics, texture; sound reward (bell) for waste dropping in the appropriate container; canopy, shrubs, seating devices; the possibility to fit the CPTED – crime prevention through environmental design – requirements (Smith, 2012); bird micro-habitat creation – traffic proof green-blue shielding (plants, water); pedestrian environment enhancement; the selection and primal arrangement of the modules to comply the urban development strategies.

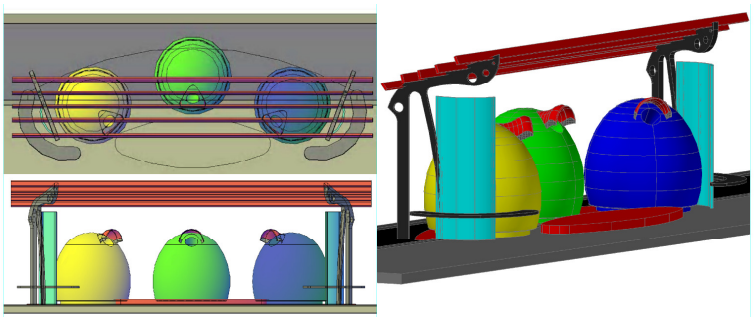

Fig. 2 - Proposals

Environmental impact design – EID (Turner, 1996) was considered in the site modulation, for landscape to point at one of the four cases: *identity, resemblance, differentiation* or *coalition*, on the basis of the environmental, urban and social set-up context.

The integration within the same structure of benches and community poster boards are meant to ensure social opening of the WCP; the surroundings' environmental impact is managed with the use of vines and juxtaposing green space strips – maintained as continuous structure in such way that containers' replacement would be ensured from the pedestrian side, eliminating the wastage of placing their disposal holes toward the road side. The WCP structure aims creating a screen against the aggressive zones – as car traffic is most frequent source of pedestrian discommode. The aesthetics are only suggested – design principles were the WCP signaling, the scaling of the general design volume and the creation of a repeatable structure – except for minor adjustments. According to the context, benches can be replaced with planters to increase planting area.

CONCLUSIONS

Including landscape quality among the standard objectives of urban management can drive the enhancement of the selective waste gathering efficiency, while answering environmental, social, cultural and economic quests.

1. WCP are an urban landscape feature, contributing to its diversity and identity. This way, through landscape, the WCP can support environmental culture.

2. Through their short-term potential – recovering energy from the wastes – mid-term – enhance public-space quality – and their long-term services – environmental culture support – the urban wastes selective gathering system raises contractors' interest (valorizing the waste energy) and the interest of the local and central administrations (responsible for the socio-ecologic system's sustainability).

3. The environmental impact of the urban imbalances – be they of social (economic or cultural segregation, criminality, community/neighborhood identity loss, low appropriation of the public open spaces), economic (real estate value), functional (in the specific case of the WCP and general at the POS scale) and cultural (urban and zonal identity, environmental culture) can be enhanced through WCP landscape integration – adaptive and participative – within the city's public open spaces.

REFERENCES

1. **Asociația Urban 2020, 2011** – *Revitalizarea urbană orientată spre comunitate: noi instrumente pentru revalorificarea spațiilor publice ale cartierelor bucureștene*. Documentary report summary
2. **Caves Roger W. (ed.), 2005** – *Encyclopedia of the City*. Editura Routledge, London and New York, p. 224.
4. **Cauquelin A., 2002** - *Le site et le paysage.* PUF Quadrige, p. 191
5. **Ciobanu C., 2011** – *Studiu de geografie mentală în Municipiul Bucharest*. PhD paper – Bucharest University, The Geography Faculty, "Simion Mehedinți" PhD school, coord. Ion Nicolae, PhD
6. **Ciobanu C., 2012** – *Harta fricii în Bucharest*. Personal blog. http://mentalgeo.wordpress.com/2012/01/07/harta-fricii-in-bucuresti/, table 1
7. **Cutler T. (ed.), 2009** – Designing Solutions to Wicked Problems – A Manifesto for Transdisciplinary Research and Design. Editura Design Research Institute, RMIT University
8. **de Leeuw B. (ed.), 2012** – *Urban Eco-Efficiency and Biodiversity*. World Resources Forum. http://www.worldresourcesforum.org
9. **Lazăr-Bâra,A. P., 2011** – *Round-about by Cașin Church*. Bulletin USAVM Horticulture 68(1), p. 392-399. Cluj Napoca
10. **Lynch K., 1960** – *The Image of the City*. MIT Press
11. **McDonnell M. J., Hahs A. K., Breuste J. H. (ed.), 2009 –** *Ecology of Cities and Towns: a comparative approach.* Cambridge University Press, New York, p. 108
12. **Smith S. (ed.), 2012 –** *International Encyclopedia of Housing and Home*, Elsevier, Cambridge, UK, p.280-284
13. **Turner T., 1996** – *City as Landscape: a Post-Postmodern View of Design and Planning*. Editura Taylor & Francis, Londra, p. 196

THE ”PROMENADE ARCHITECTURALE” FROM A LANSCAPING PERSPECTIVE

PROMENADA ARHITECTURALĂ DIN PERSPECTIVĂ PEISAGISTICĂ

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Abstract. *This paper aims to address, from a landscaping perspective, an idea that has crossed the history of ideas - from ancient Rome, through Renaissance, and to Le Corbusier: the idea of ' promenade architecturale ', of axes, predetermined perceptions, and carefully elaborated dramatic scenographies. The research is based on historical evolution and uses as examples ancient Roman structures, like the sanctuary of Fortuna Primigenia in Palestrina, a temple complex whose overall compositional structure supports and demonstrates the influence theory of ancient models on the Renaissance, Mannerist and Baroque garden design in Western Europe.*
Key words: *promenade architecturale, scenography, axiality, baroque.*

Rezumat. *Lucrarea de față își propune abordarea din punct de vedere peisagistic a unei idei care a traversat istoria, începând cu Roma antică, trecând prin Renaștere și poposind glorios în arhitectura lui Le Corbusier: ideea de ”promenadă arhitecturală”, de axe, parcursuri și perspective predeterminate, de spectacol prestabilit și scenografie atent elaborată. Cercetarea se bazează pe un parcurs istoric general și este susținută apoi prin analiza unor structuri antice romane, precum sanctuarul Fortunei Primigenia din Palestrina, a cărui structură compozițională generală susține și demonstrează ideea influențelor, în parcursul istoric, asupra organizării grădinilor renascentiste, manieriste și baroce din Europa de Vest.*
Cuvinte cheie: *promenadă arhitecturală, scenografie, axialitate, baroc.*

INTRODUCTION

The ancient Sanctuary of Fortuna Primigenia in Palestrina, near Rome, one of the largest religious complexes built by the Romans, is composed of a series of seven terraces connected by stairs and ramps, a two-dimensional pyramid made of concrete, perfectly adapted to the natural ground slopes, and complying to a rigorous symmetry and axiality, while emphasizing the ascensional character of what we shall call, in this paper, a “promenade architecturale”, borrowing the term from the twentieth century French architect Le Corbusier. The justification of the term stems from the scenographic quality of the sanctuary. Ancient Romans had a predilections for spectacular vistas and fabulous locations, and left nothing to the accidental, not even the spatial perceptions, thus organizing, predetermining and modulating spatial experiences, a model later taken on by Renaissance,

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Mannerist and Baroque architects and artists, the terraces and the ramps becoming extensions of the villas and palaces into the adjacent gardens.

When Le Corbusier introduced the concept of "architectural promenade", it was considered that the idea of movement in space was to become the guiding principle of a new and different architecture – not just movement in and through space, but an alternation between moving and resting, predetermined, controlled perspectives, experiencing a narrative construct whose architectural conclusion, the major architectural element of the complex, opens up towards the broadest perspective, reconnecting the dots and recomposing in one image the journey and the spectacular natural setting.

MATERIAL AND METHOD

When reserching the art of gardening in Europe, mainly Italy, the ancient documents are of inestimable value, as well as ancient Roman ruins, because they explicitely show the tradition embraced by Renaissance architects, lately to be transformed into more complex shapes by Baroque artists.Once the premise is established, research uses literature and archeological reviews, a historical method using primary sources, collecting data and interpreting it, and providing an empirical conclusion.

RESULTS AND DISCUSSIONS

After the Roman Empire fell, Europe went through times of cultural stagnation which spared neither agriculture, nor the art of gardens. The memories of ancient Roman gardens vanished, and the tradition was lost. It was only during the 9th century that the interest in the aesthetic qualities of nature witnessed a rebirth. Monks were among the first ones to rediscover the culture and art of horticulture, drawn from the ancient treaties preserved in the monastic libraries, an activity that will remain bound to their interior gardens like a well-kept secret, and used for their own benefit or for that of a powerful ruler (Mosser and Teyssot G., 1991).

Towards the middle of the fifteenth century, the suburban villa with garden, designed in accordance with the indications contained in the ancient Roman treaties, became the predominant type. The treaty *De re aedificatoria* (Leon Battista Alberti, 1485), which was resuming the canons of the ancient classical architecture (Pliny the Younger, 1858- ed; Vitruvius, 1914- ed.), was to become one of the fundamental texts for the development of Renaissance architecture and town planning. Alberti emphasized the importance of choosing the correct location for a new residence, preferring hilly areas with spectacular views, an optimal orientation towards the cardinal points, and exposed to the sun and to the salubrious action of the eight winds. Regarding gardens, he was recommending the ars topiaria. The enclosed and compact character of medieval architecture was decomposed through the use of loggias, terraces and stairs featuring spectacular vistas. Gardens were thus becoming the materialization of an art, the art of transitioning from the built environment to the surrounding landscape.

The profound religious schism caused by the Reformation, as well as the process of power reunification and the recomposing of feudal territorial fragmentation already begun in the fifteenth century, had created favorable conditions for the sixteenth century to become a time of European cultural and political renewal. This century will witness a new revival of classical art and architecture, and Rome shall be the converging point of such activities, especially during the first two decades. A new language will evolve, sprang from the reevaluation of the ancient orders and from the complex spatial organizations based on axial symmetries, in a reinterpretation of the typological models of Greek and Roman classicism. The garden becomes the ideal place to celebrate ancient culture, embracing the values of a glorious and intellectualized civilization whose memory was present in the form of ruins scattered across the entire Italian landscape. It is an ulterior development of humanistic thinking, strongly expressed through human controls over nature, in the shape of landscape design. The garden becomes the expression of the creative and organizing energy of the lord of the land, expressed through axial perspectives and panoramic views over the landscape, open transitional spaces in which the inside and the outside become a unified whole.

Although the Roman and Florentine regions are the richest in landscape art manifestations, in the sixteenth century villas and gardens are built throughout the entire Italian territory. In the second half of the century, the Genoese Republic, under the leadership of Andrea Doria, enjoyed a period of great economic prosperity manifested especially by the advent of many villas surrounded by beautiful gardens, molded on the typical, rugged Ligurian landscape, offering great views and panoramas. In 1543, Andrea Doria commissions Antonio Montorsoli for the Palazzo Doria garden project. The gardens, located on a gently sloping area overlooking the sea, are composed of many overlapping terraces. The composition is developed on a central axis with a series of fountains, pergolas and flower beds framed by green hedges. The terraces are so well-suited to the rugged terrain, that they became a constant all over Genoa. The Villa, a compact element, opens to the sea through the loggias on the ground floor, and towards the mountain through those of the piano nobile, and is surrounded by extensive gardens in both directions, the result being a scenography with strong visual impact, dictated by the landscape conditions (Mader and Neuber-Mader,1987). A strict geometry organizes the succession of terraces and ramps of stairs linking them, highlighting and emphasizing axiality and the emergence of the Villa from the garden. The garden adopts less rigid and schematic shapes, while keeping Renaissance's straight lines, but adding to them elliptical, circular and diagonal ones, introducing a variety of new perspectives. Dramatic effect becomes predominant; the entire complex of the Villa and the garden is designed and built in close connection to the natural environment, integrating a part of the surrounding landscape and highlighting the dramatic elements – the play of terraces at different heights, fountains, and vegetation.

The fragmentation of the small states of Italy, a phenomenon also encountered in Germany, impeded the adoption of the ample French garden designs. Throughout the century, the gardens that are being designed are still fairly reduced in dimensions, following Mannerist compositions, even though in the North, the French model will increasingly impose itself in the second half of the century. The specific geomorphologic conformation of Italy, as well as the reduced availability of water, resulted in a clear predominance of the architectural element.

Perhaps the most significant example of Italian Baroque landscaping splendor is represented by the gardens of Isola Bella on Laggo Maggiore (fig. 2-3), a lacustrine structure transformed into a garden at the request of Count Carlo III Borromeo (Grimal, 1987, Fariello, 1967). Completed in 1670, the island is a completely artificial structure developed on several levels, a floating garden composed of architectural elements, terraces, statues, railings and stairs with precise shapes and strong theatrical connotations, a pyramid structure composed of ten terraces descending towards the lake, overcrowded with niches, statues and trees, a composition whose sole purpose was to inspire awe and admiration.

Fig. 2 - Isola Bella, aerial view and detail of the parterre
http://ades.dicar.units.it/01_progetti/proj_103/img/giaridno_barocco.pdf

Fig. 3 - View towards the stairs inside the garden
http://ades.dicar.units.it/01_progetti/proj_103/img/giaridno_baroc

In Tuscany, in the case of the Villa Garzoni in Collodi (fig. 4 - 5), the Baroque garden are developed vertically, adjusting to the conformation of the

ground and creating an impressive scenographic composition, but in this case off centre with the architectural object. At the entry level there is a parterre decorated with green embroideries and two fountains. The slope is cut in an orderly succession of terraces that visually enhance the ascensional quality of the composition (Vannucchi, 2003).

Fig. 4 - View over the Garzoni gardens. Perspective towards the entrance.
http://ades.dicar.units.it/01_progetti/proj_103/img/giaridno_barocco.pdf

Fig. 5 - The ramps and stairs composition inside the garden with emphasis on symmetry and axiality
(http://ades.dicar.units.it/01_progetti/proj_103/img/giaridno_barocco.pd)

CONCLUSIONS

The "architectural promenade", key-term of the modernist architecture language, is superior to the one of "movement", of a passing through space, because it provides different sensorial experiences, unexpected and spectacular. Stricto senso, it is a journey, but both the Corbusian understanding of the term, as well as in its ancient architectural expression, the "promenade" reflects the initiation character of architecture. The successive terraces connected by ramps give an illusion of infinity, a universe designed according to a rigorous geometry, and having an inherent ontological structure. The experience of the space depends on the interdependence of the built and natural environments - in the case of the Renaissance and Baroque gardens, and the relations between the structure of the villa and the succession of terraces opening it towards the landscape.

The architectural promenade is an itinerary to be followed, a "travel" investing the architectural object with a seemingly infinite variety of perceptions. Thus, the promenade is the synergic manifestation of a spatially dynamic experience whose value is more significant than the sum of the effects the separate elements of the ensemble might have. The ramps become a spectacle of pure form and space, a design in space-time.

REFERENCES

1. Alberti L.B, 1485 - De re aedificatoria, Florence, N. di Lorenzo.
2. Fariello F., 1967 - *Architettura dei giardini*, Edizioni dell'Ateneo, Roma, p. 114-118.
3. Grimal P., 1987 - *L'arte dei giardini – Una breve storia*, Edizioni Ripostes, Roma, p. 24.
4. Mader G., Neuber-Mader L.,1987 - *Jardins italiens*, Fribourg, p. 34-40.
5. Mosser M., Teyssot G.(dir.), 1991 - *Histoire des jardins de la Renaissance à nos jours*, Paris, Flammarion, p.227-230.
6. Pliny the Younger, 1858 - ed., *Epistulae,* Westcott, John Howell.
7. Tagliolini A., 1994 - *Storia del giardino italiano*, Ponte alle Grazie S.p.A., Firenze, p. 278.
8. Vannucchi, M., 2003, *Giardini e parchi – Storia, morfologia, ambiente,* Alinea editrice, Firenze, p. 172-177
9. Vitruvius 1914 – ed., *De Architectura*, Oxford University Press.
10. http://ades.dicar.units.it/01_progetti/proj_103/img/giaridno_barocco.pdf

STRUCTURE AND ORGANIZATION OF TRADITIONAL GARDEN FROM BOTOȘANI

STRUCTURA ȘI MODUL DE ORGANIZARE A GRĂDINII TRADIȚIONALE BOTOȘĂNENE

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Abstract*. At the basis of the traditional Romanian homestead configuration were, primarily, the functional principles of satisfying the human needs, but on the structure and its evolution have left their mark over time, many factors that led to the emergence of notable differences between Romanian households: from one region to another and even from one village to another within the same region. Geo-climatic factors, the occupation of the residents, social economic status, ethnic appearance and local tradition, the technical expertise of craftsmen, quality and quantity of materials used for construction, etc. decisively influenced the organization of homesteads on the Romanian territory. This paper presents the issues that concern traditional homestead structure from Botoşani, its mode of organization and makes an analysis of its evolution.*
Key words*: traditional homestead, utilitarian garden, typology*

Rezumat. *La baza configurării gospodăriei tradiționale românești au stat, în primul rând, principii funcționale de satisfacere a nevoilor umane însă asupra structurii și evoluției sale și-au pus amprenta, de-a lungul timpului, o multitudine de factori ce au condus la apariția unor diferențe notabile între gospodăriile românești de la o regiune la alta și chiar de la un sat la altul, în cadrul aceleiași regiuni. Factorii geo-climatici, ocupațiile locuitorilor, starea social-economică, aspectul etnic, tradiția locală, nivelul de cunoștințe tehnice ale meșterilor populari, calitatea și cantitatea materialelor utilizate pentru construcție etc. au influențat decisiv modul de organizare al gospodăriilor pe teritoriul românesc. Lucrarea de față prezintă aceste aspecte ce vizează gospodăria tradițională botoșăneană, structura și modul său de organizare și face o analiză asupra evoluției sale.*
Cuvinte cheie: *gospodăria tradițională, gradina utilitară, tipologie*

INTRODUCTION

The structure and manner of organization of the traditional homestead of Botoşani region have been influenced, like those on the entire Romanian territory, by the geographical location, climate factors, occupations of the residents and their social-economic status. The mild relief that predominates in the area offers the viewer large perspectives in which the undisturbed nature reveals its absolute beauty (fig. 1 a, b, c).

Even from the ancient times, the main occupations of the residents of Botoşani area have been in agriculture and animal breeding. Fishing and

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beekeeping have been additional sources for the food and raw materials needed by the people in the area (Paveliuc-Olariu, 1983).

The traditional buildings destined for sheltering people and animals, from the studied area, are limited both as size and proportion, mainly as a consequence of the fact that wood is present in low quantities.

a) b) c)

Fig. 1 - Natural background of the studied area (original):
a) Hudești area; b - c) Mlenăuți area

The purpose of this paper is the presentation of the main types of traditional Botoşani homesteads, with the analysis of some characteristic elements (structure and manner of organization of the homestead, assortment of flowering plants and their positioning etc.)

MATERIAL AND METHOD

In order to draw up this paper, a study has been made on some homesteads from the Botoşani area. The aspects targeted in the analysis carried out refer to: the shape of the lot and the positioning of buildings on the lot; the number, position, destination and size of the existent buildings; the manner the lot is divided; the particularity, shape, size and positioning of the garden within the lot.

The following research methods have been used: theoretic documentation, systematic observation, case study method, analysis and synthesis of the obtained data.

RESULTS AND DISCUSSIONS

The traditional homestead from the Botoşani area falls into the larger organization framework of Moldavian homesteads, which in turn presents common traits with those from the entire country.

Basically, the lot corresponding to the traditional homestead is divided into farmstead (barn or pound) and utilitarian garden behind the house.

The farmstead (barn or pound) is located in front of the estate, with an opening to the access road, including the actual yard, the buildings (house and homestead enclosures) and lay-outs with various destinations (such as the flower garden and mixed garden – flowers, vegetables, trees, aromatic plants etc.).

The utilitarian garden, located in the back of the lot, includes various cultures on surfaces larger than that in the farmstead: an area with potatoes, corn

and alfalfa; the vegetable garden – tomatoes, beans, cucumbers, cabbage and others, and a small orchard.

In the mentioned area there are several types of traditional peasant homesteads, the most common of which is that where the house is located in the middle of the yard, with its main entrance towards the road (fig. 2 a). In this case, the homestead enclosures (barn, chicken coop etc.) are located behind the house, parallel or perpendicular to it.

The land in front of the house is covered by a simple garden, only with flowers and vegetables, surrounded or not by a fence. The farmstead area is smaller, the area for the storage of hey or cobs being smaller. Behind the house, depending on the case, are located the outbuildings, the area for the storage of hey or cobs etc. The trees are planted around the house, the orchard being reduced in order to make more room for the other cultures (fig. 2 c).

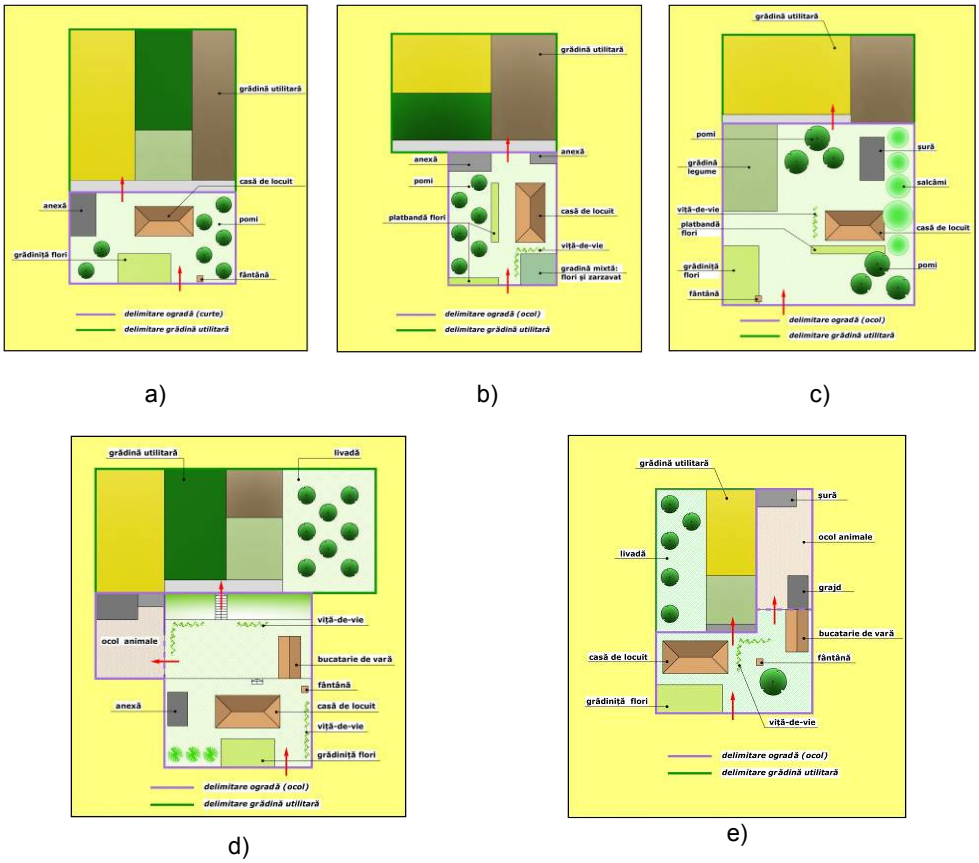

Fig. 2 - Organization layout for Botoşani homesteads: a - b) Cornești neighbourhood, Darabani city; c) George Coșbuc village, Gorbănești commune; d - e) Ivancăuți village, Păltiniș commune

Another type of homestead plan, less common, is that where the house is located perpendicular to the road, the enclosures being positioned either parallel to the plan of the house, or in line with it (fig. 2 b).

The plan of the newer homesteads has the house at its forefront, positioned with the front to the road, quite close to it, the area in front of it being destined for planting flowers. The enclosures are located behind the house, most often parallel to them. We note the presence of the summer kitchen (fig. 2 d). Also at the newer homesteads we notice the tendency to free the yard of buildings, keeping only the house and summer kitchen, the rest being grouped in the second plan of the property (fig. 2 e).

We also have cases where in the same yard there are two houses, for two generations. Usually, the older house, smaller, is located in the second plan of the allotment, and the newer, more spacious one, is located in front, closer to the road (Paveliuc-Olariu, 1983).

Of small size, the *flower garden* is ever present in traditional gardens from the Botoşani area.

The flower species assortment that provides the basic scenery of traditional gardens is made up of a series of rustic "classical" perennial and semi-perennial plants such as: daffodils, tulip, columbine, poppy, peony, lily, phlox, sunflower, chrysanthemum, aster, dahlia, gladiolus, and several annual species such as: basil, Jasmine tobacco, calendulas, moon flower, etc. Besides these, shrubs such as jasmine, lilac, rose or lianas (clematis) come to complete the ornamental flower assortment used for the decoration of traditional gardens.

a) b)

Fig. 3 (a, b) - Mixed garden – Cornești neighbourhood, Darabani city (original)

In the garden in front of the house (an area reserved for "beauty") vine and trees are always present. Some vine stalks and one or two trees give the traditional garden, besides its immediate usefulness, vertical accents or curtains that gain additional usefulness (shade, visual delimitation, creation of interest points etc. (fig. 4 a-b) and at the same time contribute to the defining of this type of garden. The combination of the above mentioned vegetal species in the rural

garden in a somewhat chance mixture, gives it a special appeal and at the same time, it can be considered as a defining characteristic of the traditional Romanian garden (Glăman and Mircea, 2003).

a) b)

Fig. 4 - Other vegetal species in the traditional garden: a) Vârfu Câmpului village; b) Cornești neighbourhood Darabani city (original)

The positioning manner of the ornamental species in the ground is not based on a preset plan or on certain compositional principles, this positioning being random, depending on the wish and skills of the housewife. Nevertheless we notice two tendencies in the way the flower species are positioned in the area of the garden, namely:

- *linear positioning* – manner of positioning that is often met in the studied area, as continuous border and small groups or isolated individuals from the same species, planted in line, either parallel to a side of the house, or the fence (towards the road or the access path), or perpendicular on it.

a) b)

Fig. 5 (a, b) - Mixed gardens – linear positioning of flower plants Cornești neighbourhood, Darabani city (original)

- *free positioning* – seen especially in case of the isolated specimens, located in the "free" areas in the garden.

a) b)

Fig. 6 (a, b) - Mixed gardens – free positioning of flower species Cornești neighbourhood, Darabani city (original)

CONCLUSIONS

1. The relief, environment conditions and occupation of the residents have had a decisive role in the way the peasant homestead is organized.

2. In the areas where these factors are comparable, the homesteads basically present the same typology.

3. The flower garden, simple or mixed, is a distinct area within the homestead in the plane or hill regions and usually covers the forefront, having both a representation and embellishment purpose for the property.

REFERENCES

1. Glăman Ghe., Mircea N.Vlăduţ, 2003 - *Floricultura şi arta grădinăritului la români*. Ed. Ceres, Bucureşti

2. Paveliuc-Olariu Angela, **1983** - *Zona etnografică Botoșani*. Ed. Sport Turism, București

3. Vlăduțiu I., **1973** - *Etnografie Românească*. Ed. Științifică, București

LANDSCAPE ARCHITECTURE CASE STUDY FOR IMPROVNG ABANDONED NAVAL TRANSPORTING EQUIPMENT INTO FLOATING GARDENS

STUDIU DE AMENAJARE PEISAGERĂ ÎN VEDEREA REABILITĂRII UNOR UTILAJE NAVALE ABANDONATE SUB FORMA UNOR GRĂDINI PLUTITOARE-MOBILE

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Abstract. *According to an inventory conducted by the Ministry of Environmental and National Water Administration, a number of 632 barges were found with several deficiencies of which 21 are inoperable barges, 63 barges were abandoned, 5 barges are proposed to be listed in the abandoned procedure and the remaining of 543 have major damages. The present paper aims the recycle or conversion of such abandoned marine equipment through the Ecodesign concept. Thus, barges can be put back into operation with a new purpose, such as floating gardens with functional and decorative form. In terms of actual planning, the platforms would be transformed into decorative gardens with pavilions and „green roofs". Such investment is beneficial both for the environment by turning waste into green spaces that help the reduction of pollution but it would help improving the Romania tourism by offering a new concept towards public opinion.*
Key words: *floating gardens, barges, ecodesign, green roofs.*

Rezumat. *Conform Ministerul Mediului şi Gospodăririi Apelor şi Administraţiei Naţionale ,,Apele Române", la un număr de 632 de barje s-au constatat o serie de deficienţe din care 21 barje sunt nefuncţionale, 63 barje sunt abandonate, 5 barje sunt propuse pentru a fi trecute in procedură de abandonare iar restul de 543 prezintă defecţiuni majore. Lucrarea propune reciclarea unor astfel de echipamente navale abandonate cu ajutorul conceptului Ecodesign sub forma unor grădini plutitoare. Spaţiile unde pot fi instalate aceste platforme sunt ape stătătoare de dimensiuni medii sau mari, înconjurate de spaţii terestre. Plantarea în sine ar folosii tehnicile „acoperişurilor verzi", irigarea putând fi proprie printr-un sistem de filtrare a apei înconjurătoare iar curentul electric putând fi prezent prin energie solară. O astfel de investiţie este benefică atât pentru mediu, deşeurile fiind transformate în spaţii verzi ce ajută la reducerea poluării cât şi pentru turismul României, proiectul oferind un concept nou publicului.*
Cuvinte cheie: *grădini plutitoare, barje, ecodesign, acoperişuri verzi.*

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INTRODUCTION

A barge is considered a ship with plain bottom with or without propulsion, used for transporting heavy materials on river runs or secondary usage for different marine interventions. Barges are moved with the help of a pusher ship, emplaced at the back of the convoy (http://www.navrom.ro). Due to its constructive flat bottom, on the Danube river the barges traffic its permanent all year around, constrained by the minimum water depth level of 2.8 meters. The standard dimensions of a Danube river barge are: 89 m length, 15.3 m width 3.3 m draft and a weight capacity transport of 3000 t.

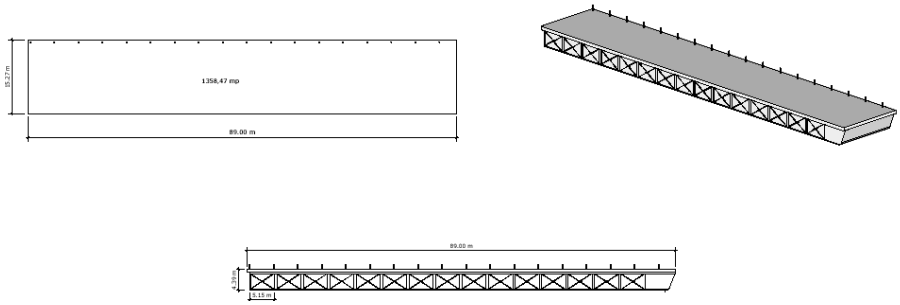


Fig. 1 - Technical aspects of the studied barge (original)

The beneficiary profile is related to people that are keen on environmental protection and its durable development, dynamic persons, that tend to spend their relaxing activities in open air. Also the beneficiary profile consist in people keen on different open air cultural activities, that will try the new offered perspectives of a - „recycled island". Freely landscaped designed, the floating garden is keen on functional purpose for cultural exhibition and workshop establishment. The final implementation of the propose floating gardens could be made on static water or floating water, the barges being attached by a pusher ship offering an dynamic landscape generating new perspectives.

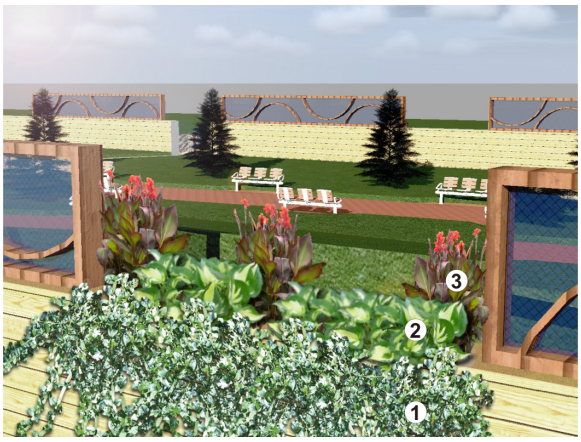
The active surface of a barge was established at 1358,47 m^2 offering an maximum amount of visitors established at the value of 100 people/barge, resulting a surface green area of 13,58 m^2/visitor. The general principles taken into study for designing the floating gardens where keen on „Eco Design" and „Land Art" concepts (Chet Van Duzer, 2006).

MATERIAL AND METHOD

The present paper wishes to resolve the problem of abandoned naval construction by transforming them into long-lasting recycled floating gardens. The case study reflected the standard dimensions of a average barge that transits the Danube river with the following dimensions: 89 m length, width 15.3 m, depth 3.3 m and a transport capacity of 3000 to. The general principles taken into study for designing the floating gardens where keen on „Eco Design" and „Land Art" concepts, generating a floating garden for different human activities as art exhibition and workshops.

RESULTS AND DISCUSSION

The floating garden designed for cultural activities and workshops, is delimited by an ornamental concrete fence with beech wood insertion, treated wit mat varnish. The height of the surrounding reaches 80 cm with an width of 30 cm, where we propose mono-block flower pots. In alternance with the propose delimitation we propose secured ornamental glass with wood frames. For plant usage in the mono-block flower pots (fig. 2) we adopted the general term of perma-culture using perennial species as: *Cana indica, Hedera helix, Hosta plantaginea.*



1	*Hedera helix*
2	*Hosta plantaginea*
3	*Cana indica*

Fig. 2 - Planting detail (original)

The barge involves the creation of a covered stage, coated by secured glass and impermeable textile material by its sides. The surface of the stage is 136 m^2 offering sufficient space for different cultural activities.

During the CAD construction of the design where obtained the following area calculations (table 1).

Table 1

Surface calculation by usage category (m^2)

No.	usage category	area (m^2)	% from total
1.	total area	1358	100
2.	pathways	150	11,04
3.	small plaza	290	21,35
4.	green area	760	55,96
5.	event stage	136	10,01

The proposed landscape design implemented location for 30 benches constructed by usage of durable aluminum and oak wood insertions treated with varnish. The proposed benches are designed for a common usage of 3 persons/bench, offering a total sitting capacity of 90 persons (fig. 3).

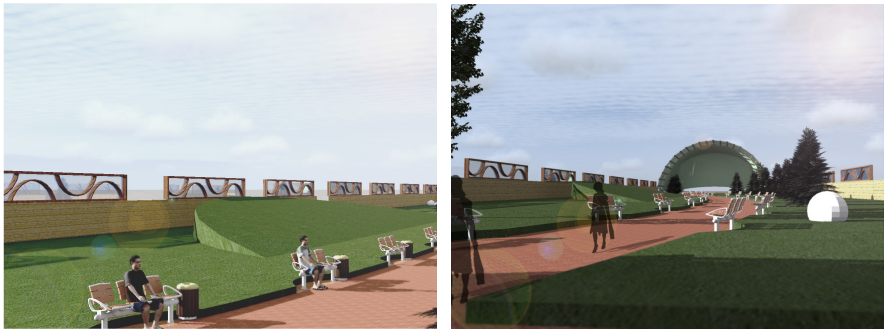


Fig. 3 - Surrounding perspective (original)

The two topographic positive modification upon the soil offered sufficient space for art exhibition, vertically arranging the art exponents available for everyone's point of perspective (http://www.mogat-werke.de). Area calculation for the sloped terrain consisted in 92.3 m^2 (left side) and 137.3 m^2 (right side) with maximum heights of 0.5 and 0.8 m generating a uniform slope for visitors acces (http://www.mogat-werke.de). The landscape design consisted in usage of different tree gender composed by 13 species of *Picea pungens* var. baby blue and 2 species of *Betula pendula*. As planting techniques we take into consideration the height of the barge and its transport capacity, obtaining and optimum soil volume drained with a layer composed by sand + gravel. Regarding the turf seeding we adopted a standard geotextile system (fig. 4) used for green roof design (http://www.greenroofs.org; http://www.liveroof.com).

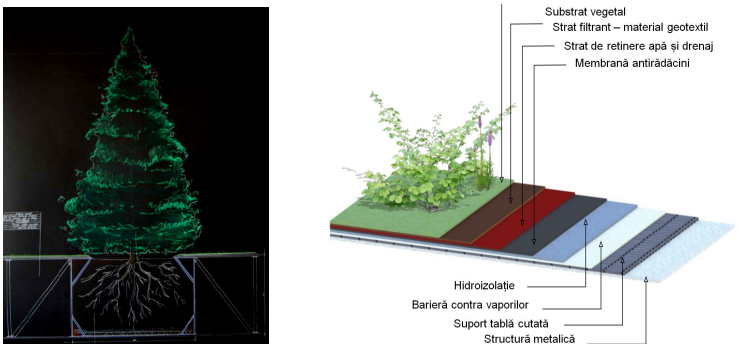


Fig. 4 - Hydro isolating materials and geo-textiles used for planting technology (original)

The proposed building at the N side of the barge (fig. 5), was conceived as a one level building, functionally regarded as art exhibition center when meteorological conditions are improper or sightseeing info point.

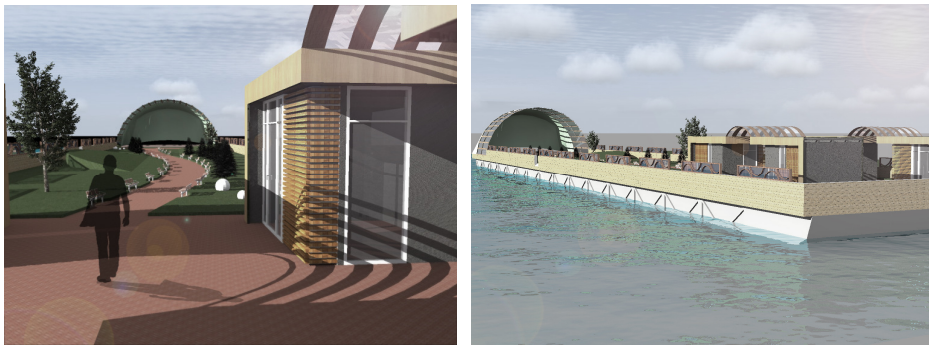


Fig. 5 - Proposed art center perspectives (original)

In the vicinity of the exhibition center we proposed spherical lightning spots (fig. 6) lightened with sodium light bulbs, assuring an optimum relation with the minimalist design adopted.

Fig. 6 - Spherical lightning posts (original)

CONCLUSIONS

During the project implementation, special consideration will regard the maintenance of the proposed landscape design divided in two stages:

- maintenance operations after planting, witch can last minimum 2 years, where are considered slopes consolidation. During this period of time special consideration will regard the fertirigation system, obtaining a moist and fertile substratum. For a better conservation of water an nutrients we propose organic mulching system (http://www.optigreen.co.uk/index.html;http://www.optigruen.de/index.html);
- during the service period of the floating garden, special consideration will be keen on weed suppressing (http://www.mulehide.com).

The constructive barge type was a maximum weight transport capacity of 3000 to., sufficient for generating a fertile planting substratum, assuring optimum root development for plants, shrubs and trees.

The standard height of a barge differs from 2.60 m till 4.40 m assuring optimum root development. The proper root development was obtained by a rigorous structure compartment, constructed with vertical steel walls protected by an impermeable layer. The vertical walls are consolidated with metallic braces for maintaining the substratum structure.

The lifespan of the floating gardens is considered the period of time where the properties of the barge are kept in optimum condition related to its design purpose. The lifespan period is established under a rational usage, considering all the maintenance cost during the entire lifespan (Life Cycle Cost):

- renovation costs for the damaged barges;
- projection, execution and exploitation costs;
- costs resulting from exclusive situations, such as improper meteorological events;
- costs regarding partial restoration;
- inspection, maintenance and repairing elements costs;
- recycling and decommissioning costs;
- environment protection costs.

REFERENCES

1. Chet Van Duzer, 2006 - *Floating Islands A Global Bibliography*, Cantor Press California

2. Neufert 2004 - *Manualul arhitectului - Elemente de proiectare şi de construcție,* Editura Alutus Bucureşti.

3. Olsson Per, Folke Carl, Thomas Hahn, 2004 - *Social-Ecological Transformation for Ecosystem Management: the Development of Adaptive Co-management of a Wetland Landscape in Southern Sweden,* Ecology and Society 9 (4), p.2.

4. Petre Derer, 1974 - *Mobilier urban,* Editura tehnică - Bucureşti.

5. Sidle Roy C., Ziegler Alan D., Vogler John B., 2007 - *Contemporary changes in open water surface area of Lake Inle, Myanmar,* Sustain Science 2, p. 55-65.

6. *** http://www.greenroofs.org

7. *** http://www.liveroof.com/

8. *** http://www.mogat-werke.de/

9. *** http://www.mulehide.com/

10. *** http://www.optigreen.co.uk/index.html

11. *** http://www.optigruen.de/index.html

12. *** http://www.navrom.ro/

ANALYSIS OF AIR POLLUTANTS IN IASI TOWN

ANALIZA POLUĂRII AERULUI DIN MUNICIPIULUI IAŞI

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Abstract. *Immissions of carbon monoxide (CO), sulphur dioxide (SO_2) and nitrogen oxides (NOx) were measured in five points (automatic air quality monitoring station) of Iasi municipality, since January 2006 until December 2011. The aim of this study is to present the air quality and the connection between concentrations and tendencies of gaseous pollutants in the climatic conditions and in anthropic activities specific of the Iasi City. Yearly averages of carbon monoxide (CO), sulphur dioxide (SO_2) and nitrogen oxides (NOx) for the period 2006 to 2011 varied between: 0.194 µg/mc and 0.458 µg/mc; 4.95 µg/mc and 6.85 µg/mc, respectively 36.99 µg/mc and 43.75 µg/mc, with maximum values registered at station Iasi 1, and the lowest at station Iasi 4. The maximum monthly averages of the pollutants immissions are registered in the cold semester of the year, and the minimum monthly averages of the immissions, in the warm semester.*
Key words: *pollutants, carbon monoxide, nitrogen oxides, sulphur dioxide, air quality, Iasi town*

Rezumat. *Emisiile de monoxid de carbon, dioxid de sulf şi oxizi de azot au fost măsurate în cinci puncte (staţiile de monitorizare a calităţii aerului) din municipiu Iasi, în perioada 2006-2011. Scopul prezentului stadiu este să prezinte calitatea aerului şi corelaţiile dintre concentraţiile şi tendinţele de evoluţie ale poluanţilor gazoşi în contextul condiţiilor climatice şi a activităţile antropice specifice oraşului Iaşi. Concentraţiile medii anuale de monoxid de carbon, dioxid de sulf şi oxizi de azot în perioada 2006 – 2011 au variat între 0.194 µg/mc şi 0.458 µg/mc; 4.95 µg/mc and 6.85 µg/mc, respectiv 36.99 µg/mc si 43.75 µg/mc, valorile maxime fiind înregistrate la staţia Iaşi 1, iar cele minime la staţia Iaşi 4. Valorile lunare maxime ale emisiilor sunt înregistrate în semestrul rece al anului şi cele minime în semestrul rece.*
Cuvinte cheie: *poluanţi, monoxid de carbon,oxizi de azot, dioxid de sulf, calitatea aerului, oraşul Iaşi*

INTRODUCTION

The quality of the air experiences significant diurnal, weekly and yearly variations depending on various factors (Apostol, 2007) which can be: natural (the atmospheric calm, the thermal convection, thermal inversions, the vegetation – the process of photosynthesis, the topography, the soil, aerosols, etc.) and anthropogenic (the nature of the activities in the town, the variation in the number of cars, urban factors – the topography of the buildings and the air flow change, the colours that alter the natural albedo, the heat coming from the heating

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systems, the transport, industrial units, the shading caused by buildings, thermal conditions and dust particle charging etc.).

For the classification of the concentration levels according to the limit values and to the critical levels of concentration of the main categories of pollutants analyzed in the ambient air, we used the reference legislation, Law no. 104 of 15 June 2011 and OM. 592/2002.

The air quality monitoring network in Iasi has five automatic stations located in areas which are representative of the types of stations existing in the national network for monitoring the air quality; it was premade in the PHARE RO 2002 project comprising five automatic monitoring stations which have been functional since 18.11. 2005, and the recorded data are made available to the public by two information panels, i.e. an exterior one, located outside Tudor Vladimirescu Boulevard – the parking lot of the Supermarket IULIS Mall, as well as an interior one located inside the Town Hall in Iasi. IASI 1 Station – Podu de Piatră – traffic station located on road crossing N.Iorga Boulevard and Nicolina Avenue, on the site of the old food market in Podu de Piatră, in a residential area; IASI 2 Station – Decebal – Cantemir – urban background station, located inside the Department of Nurseries – Nursery No.6, across from D. Cantemir High School monitor the level of pollution in urban areas, the influence of "human settlements" without being directly influenced by traffic or industry; IASI 3 Station - Oancea – Tătăraşi - industrial station, located on the Oancea-Tătăraşi Esplanade, IASI 4 Station – Copou – Sadoveanu – regional background station, located in the area of the Research and Development Station for Viticulture and Winemaking located away from sources of pollution, IASI 5 Station – Tomeşti – suburban station, located inside D. D. Pătrăşcanu school.

MATERIAL AND METHOD

The database was elaborated from the annual reports for the environmental status issued by APM Iasi, for the monthly and annual average values, as well as the daily average values for the three pollutants under analysis. The database was analyzed and processed statistically and the annual and monthly average values were determined, and correlations (Chersan et al., 2012) were made for the daily average values (Pearson correlation coefficient was calculated, and the graphs with linear regressions were realized).

RESULTS AND DISCUSSIONS

Because of their implications on the health of humans, plants and animals, a series of limit values for air pollutants was set (table 1).

The main sources of SO_2 in the town of Iasi are the fossil fuel in the energy industry – the production of electricity and heat in SC CET Iasi – operator in the town of Iasi with a contribution of 94.8%. The SO_2 emissions in 2011, as reported by SC CET Iasi SA, increased by 63% as compared to 2010, from 1255 t to 1993.9 t (Annual report of EPA Iasi, 2011).

The activities of burning solid fuel (wood) in low power stationary sources – residential heating / cooking – represent 2.8% of the total SO_2 emissions, followed by the manufacturing of bricks, tiles and ceramics, with a contribution of 2.25%.

Table 1

Limit values for CO, SO_2 and NOx concentrations in the air of urban agglomeration, according to the 141/2011 Law for air quality

Specification	CO (µg/m³)	SO_2 (µg/m³)	NO_x (µg/m³)
Critical Level	-	20	30 ***
Daily limit value for the protection of human health	10 *	125	-
Hourly limit value for the protection of human health	-	350	-
Alert threshold		500 **	400 **

* maximum daily average – every 8 hours
** measured for 3 consecutive hours at locations representative of air quality over an area of at least 100 km2 or of an entire zone or agglomeration, whichever alert is smaller.
*** critical level for vegetation protection, calendar year

Thus, the annual average concentrations for the period 2006 – 2011 recorded the highest annual average for Iasi 1 Station, representing the urban traffic station with a concentration of 6.2µg/m³; this was followed by Iasi 5 Station located in the suburbs, in Tomeşti, with elevated values due to the spreading of fixed sources of pollution, the multi-annual average being of 6 µg/m³. There is a downward trend from 2007 until now, due to the regulations for traffic pollution reduction (introduction of catalysts, fuels with smaller quantities of sulfur, etc.). The lowest annual average concentrations were recorded at Iasi 4 station, a regional background station.

The monthly average concentrations recorded the highest values during the cold season, i.e. in January and February, when there are immissions caused by heating sources operating at full capacity due to low temperatures, and high frequency thermal inversions which do not favour the dispersion of pollutants; the lowest concentrations were recorded in May due to the increased activity of plants. All the concentrations recorded do not exceed any critical level, nor that of the limit values.

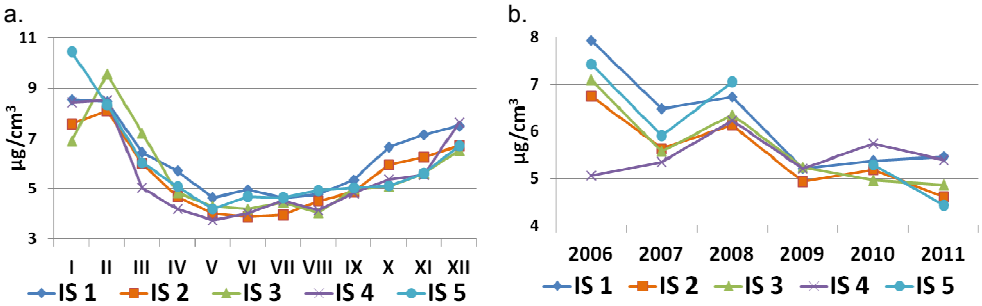

Fig. 1 - a. Monthly medium concentrations of SO_2 (µg/m3), b. Yearly medium concentrations of SO_2 in period 2006 - 2011 (µg/m³) in Iasi

Nitrogen oxides (NOx) are a group of highly reactive gases containing nitrogen and oxygen in varying amounts as follows: nitrous protoxide, nitrogen monoxide, nitrogen dioxide, dinitrogen trioxide, etc., but only NO and NO2 are easier to monitor in the air pollution and are represented by the formula NOx (Apostol et al, 2012).

For 2011, of the major sources of NOx, the highest percentage - 89.8% (11658.05 t) – comes from road transport, an activity which is associated with exhaust emissions due to fuel combustion in heat engines that equip vehicles and were calculated by the ANPM by means of Cover 4 program and with data provided by the Romanian Auto Registry; this percentage is followed by another one of 6.35% (824.7 t NOx) from fossil fuel combustion in the energy industry – the production of electricity and heat in SC CET Iasi SA, followed by 2.26% (293.736 t) of the total NOx emissions from solid fuel combustion activities (wood) in low power stationary sources – residential heating / cooking (Annual report of EPA Iasi, 2011).

The annual average concentrations for the period comprised between 2006 and 2011 for air quality monitoring stations reveal exceeding of critical levels for the protection of the vegetation and reaching the annual maximum limit value for the human health protection in stations Iaşi 1 and Iaşi 2, with the highest values for the station located in Podu de Piatră, with an average value of 91.6 µg/m for the period under discussion, traffic station, which confirms that road traffic is the main source of NOx pollution in the city. For Iasi 5 station, which is a suburban station, only the critical level is exceeded due to the proximity of the unity CET II Holboca.

The monthly average concentrations for 2006-2011 once again shows Iaşi 1 station as being the station with the highest concentrations that exceed both the critical threshold and the limit value. For the other stations, the evolution of monthly concentrations and the exceeding of the limit values show clear correlations with the air temperature, so that for the months of May to August the limit threshold is exceeded, while for the period from March to September, the annual limit value for the protection of the public health is exceeded, the highest values being recorded in winter.

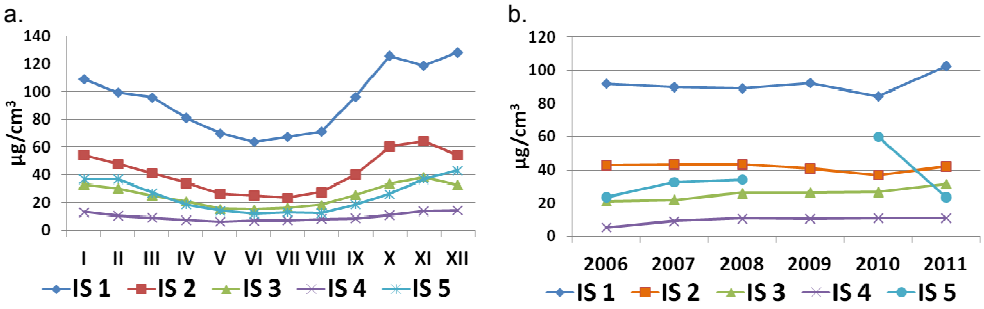

Fig. 2 - a. Monthly medium concentrations of NO_x (µg/m3), b. Yearly medium concentrations of NO_x in period 2006 - 2011 (µg/m³) in Iasi

Carbon monoxide is responsible for generating the greenhouse effect, its formation being caused by incomplete combustion of fossil fuels, the main sources being industrial activities and traffic by road, railways and air.

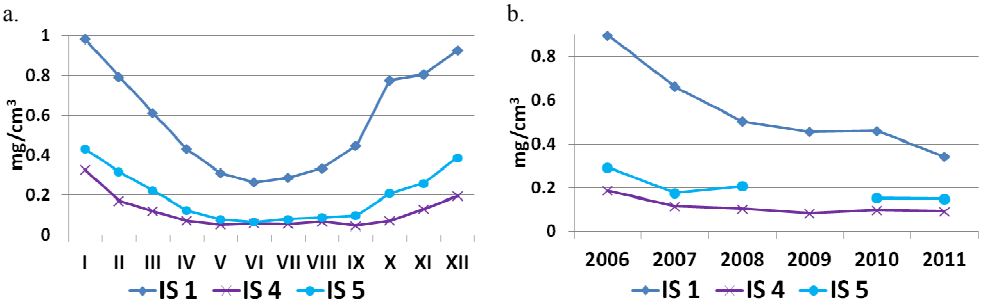

Fig. 3 - a. Monthly medium concentrations of CO (µg/m3), b. Yearly medium concentrations of CO in period 2006 - 2011 (µg/m³) in Iasi

Monitoring of this parameter is done only for three stations, and the annual average concentrations emphasize again the highest values for the urban traffic station Podu de Piatră (0,6 µg/m³), compared to the other stations with annual average values of 0,2 µg/m³. The monthly average concentrations show higher values in winter and spring, when the use of fossil fuels is widespread and the atmospheric calm (Erhan, 1979) as well as the low temperatures favour the appearance of high CO concentrations.

The linear regression was performed in order to determine the correlations among the analyzed pollutants and how close they are, by calculating the Pearson correlation coefficient (1).

$$r_{xy} = \frac{\frac{1}{n}\sum_i (x_i - \bar{x})(y_i - \bar{y})}{S_x S_y} \quad (1)$$

Where:

- n is the size of the sample formed of pair measurements (xy);
- x_i represents the individual measurements of x variable (SO_2, NOx – independent values set)
- y_i represents the individual measurements of y variable (CO –dependent values set)
- x represents the arithmetic average of x variables;
- y represents the arithmetic average of y variables;
- s_x represents the standard deviation for x values;
- s_y represents the standard deviation for y values;

Standard deviations corresponding to the two variables is calculated with the help of the relation:

$$S_x = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}}; \; S_y = \sqrt{\frac{\sum_{i=1}^{n}(y_i - \bar{y})^2}{n}}; \quad (2)$$

CO =19,331 SO_2 + 3,2379, R^2=0.5785

$CO = 41{,}802\ NO_x + 18{,}43$, $R^2 = 0.5206$,

The values the Pearson correlation coefficient are: r SO2,CO = 0.760, respectively r NOx, CO = 0.721, indicating a positive correlation between the three parameters under analysis.

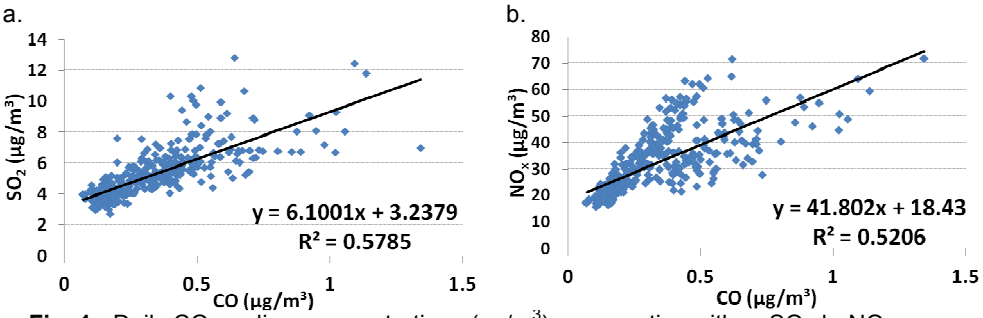

Fig. 1 - Daily CO medium concentrations (µg/m^3) comparative with a. SO_2 b. NOx ones (µg/m^3) in 2006-2011

CONCLUSIONS

The study of the main air pollutants shows the following aspects:

1. Exceeding the limit values provided by law for nitrogen oxides for which action must be taken, as they are the main component in the formation of the secondary ozone pollutant.

2. Strong positive correlations are established among the three pollutants under analysis, the Pearson coefficients having values higher than 0.7.

Acknowledgments: *This work was supported by the the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/CPP 107/DMI 1.5/S/78342].*

REFERENCES

1. **Apostol L., Vieru Nicoleta Delia, Vieru P.N., 2012 -** *Analysis of gaseous pollutants in the atmosphere of Botosani town.* Present Environment and Sustainable Development, Vol. 6, no. 1, p. 195-204.
2. **Apostol L, 2007** - *The role of the meteo-climatic factors in the dispersion of atmospheric polluants,* Present Environment and Sustenable Development, vol. 1, Editura Universității ,,Al. I. Cuza", Iaşi, p. 17-26,
3. **Chersan Corina-Ionela, Mironiuc Marilena, Robu I.B., 2012** - *The Influence of the Client's Financial Performance on the Audit Fees*, Audit financiar, no 94, p. 3 - 12
4. **Erhan Elena, 1979 -** *Clima şi microclimatele din zona oraşului Iaşi,* Editura Junimea, Iaşi.
5. ***, **2011** - Legea privind calitatea aerului înconjurător, n^o. 104/2011
6. ***, **2006 – 2011** - Annual report of environment state in Iasi county

STUDIES ABOUT DIRECTIONS OF RECOVERY THE WASTES FROM APPLE PROCESSING

STUDII PRIVIND DIRECȚIILE DE VALORIFICARE A DEȘEURILOR DE LA PROCESAREA MĂRULUI

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Abstract. *Agro-food processing industry provides appreciable amounts of waste, mostly biodegradable. Some of these are used effectively in obtaining various products for human or animal consumption, while others are used to extract various biological active components. Thus, waste material can be processed in anaerobic digestion for producing biogas, can be subjected to composting or worm composting processes in aerobic digestion or can be utilized as adsorptive material.*
Key words: *agro-industrial solid wastes, apple processing, direction of recovery*

Rezumat. *Industria de procesare a produselor agroalimentare este un furnizor de cantități apreciabile de deșeuri, în marea lor majoritate biodegradabile. O parte dintre acestea se utilizează eficient în obținerea de diferite produse destinate consumului uman sau animal, pentru extragerea diferitelor principii biologic active, ca material în procese de digestie anaerobă pentru obținerea de biogaz sau aerobă în procese de compostare sau viermi-compostare.*
Cuvinte cheie: *deșeuri agroalimentare solide, procesarea merelor, direcții de valorificare*

INTRODUCTION

Development of human society resulted not only in super-industrialization, but also in urban demographic explosion and, consequently, in generation of massive amounts of waste, mainly solid. Wastes, along with other sources of environmental pollution led to disruption of ecological balance of the environment. The specialists in environmental quality control have noted that even development of potential non-polluting economic sectors began to raise certain environmental pollution problems. Thus, the growth of agriculture and agro-food industry contributes to environmental pollution through waste generated by specific activities, as well as through the varied chemicals used in different amounts in order to improve the nutritional capacity of soil. To these, the effect of other chemical pollutants found in effluents that are discharged into the environment should also be considered (Suteu et al., 2009; Zaharia, 2010). Since the concept of sustainable development was introduced, solid waste issues became even more evident, considering that one cannot achieve sustainable development

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in economic, social and environmental protection without implementing a sustainable waste management (Zaharia and Suteu, 2011). Sustainable waste management include: (i) waste minimization, (ii) use of waste as secondary raw material, (iii) non-recoverable waste burial in landfills without affecting the environment and (iv) use of waste as alternative fuel (Suteu et al., 2009). After processing of agricultural raw materials can resulting sometimes large amounts of secondary products that unused properly can turn into waste. Large amounts of secondary products often result by processing of agricultural raw materials, which can turn into waste if are improperly used. In this context, scientists focus on the development of advanced processing technologies capable to reduce these by-products, but also of technologies that recover and convert them into useful products for human or animal consumption. A possibility to capitalize the agricultural by-products may consist in extraction of their active components that can be further used in cosmetics, pharmacy and nutrition (Horoba et al., 2001). It is also considered the possibility to integrate the waste resulted from different manufacturing stages into different biodegradation processes, such as anaerobic digestion (in order to produce biogas) or/and aerobic processes as composting or worm composting (Suteu et al., 2012a,b; Suteu et al., 2011). Agro-industrial wastes generated in different technological phases were tested as materials with adsorptive properties toward some chemical pollutants (metal ions, organic compounds) present in industrial effluents and domestic sewage, as a result of their composition in lignocellulosic compounds (Suteu et al., 2010; Suteu et.al., 2012a,b; Egila et al., 2011; Mahmoud et al.,2012).

This paper presents the results of a preliminary study concerning several possible directions of reusing the waste derived from apples processing.

MATERIAL AND METHOD

Materials. Preliminary experimental studies were carried out using biodegradable waste consisting in lignocellulosic material generated by industrial processing of several varieties of apples from Romania (Florina, Idared, Ionathan, Golden, Ionagold). Solutions of organic solvents (n-hexane and methanol), but also other common chemicals necessary for different purposes within the experimental studies were used as auxiliary materials. Stock solutions of dyes (Methylene Blue, Brilliant Red HE-3B, Rodhamine B) with concentrations of, respectively, 320 mg/L, 500 mg/L, and 479.2 mg/L, have been prepared by using bi-distilled water. The working solutions were obtained by appropriate dilution.

Methods. he components of apple wastes have been processed differently. A part of apple wastes was added to the mixture used in anaerobic and aerobic digestion processes (worms composting). The seeds have undergone extraction with solvent in a Soxhlet device type in order to obtain bioactive compounds or were tested in the view of their adsorptive potential for retention of textile dyes from aqueous media. Physico-chemical characterization of various materials was done by different techniques. These include (1) FT-IR spectroscopy involving a FT-IR BioRad spectrometer FTS2000 with 4 cm^{-1} resolution for 32 scans, using KBr pellets, and operating in wavelength range between 4000 to 400 cm^{-1}, (2) UV-Vis spectroscopy using a Jasco V550 UV-Vis spectrophotometer and (3) fluorescence spectroscopy through a PERKIN-ELMER fluorescence spectrometer. Adsorption studies were

performed by batch method. An amount equal to 0.05 g of solid adsorbent was equilibrated with a volume of 25 mL of dye solutions by certain concentrations. Different pH values of initial solutions and also different temperatures have been employed within the study. After the equilibrium was reached, the dyes content in supernatant was determined spectrophotometrically. The adsorption efficiency of the solid waste was evaluated by determining the percentage of dye removal, R (%):

$$R=\frac{c_0-c}{c_0}.100 \quad (\%) \qquad (1)$$

where: c_0 and c are initial and, respectively, the equilibrium concentration of dye in solution (mg/ L).

RESULTS AND DISCUTIONS

Apples (*Malus domestica Rosaceae* family) are the fruits with the highest use due to their complex composition (Fig. 1), consisting in a big number of nutrients that meet almost all the needs of human body.

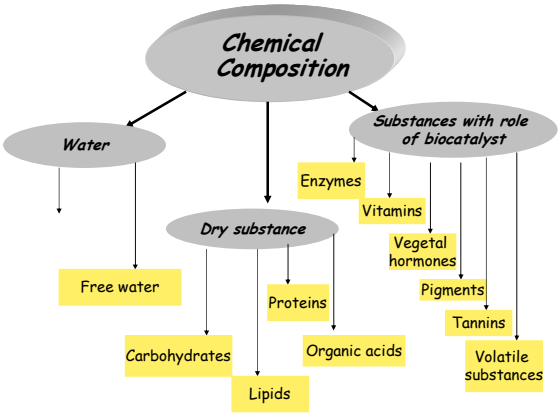


Fig.1 - Chemical composition of apples

The overall chemical composition of a fruit (with slight differences depending on variety) are : 84.5% water, 14.1% sugars, 0.2% pectic substances, 0.6% fats, 90 UI A vitamin, 0.02 mg % B2 vitamin, 0.1mg % B1 vitamin, 7mg% C vitamin, 7 mg% Ca, 10 mg% K, and small amounts of Al, Mn, S, Co, Fe, Zn, vitamins of group B (B5, B3, B6, B9), flavonoids and phenols (Maurice et al.1976). Apple seeds stand out by the presence of amygdalin (B17 vitamin), linoleic acid (48-64%), oleic acid (24-42%) and palmitic acid (48-71%). For this reason, apples are an important source of chemical compounds essential for a proper nutrition and processing of their waste can be a valuable source of biologically active substances. Apples waste, that include peels, seeds and spine may be fed in the mass of biodegradable waste in order to subject them to anaerobic digestion or to aerobic digestion (worm composting). In the first case, the apple waste are converted to biogas, while in the second, it become a source of nutrients and fibers essential for the development of micro- and macro-organisms involved in

these biological processes (Suteu et al., 2012a,b; Suteu et al., 2011). Prior to processing, the apple seeds were dried and chopped. The material thus prepared was kept in closed containers. Extraction of bioactive compounds from apple seeds was achieved by the classical method of liquid-solid extraction using two solvents, n-hexane and methanol, both accepted by pharmaceutical, cosmetics and food industries. The results obtained from processing of spent material evidenced different selectivity for the two solvents used (fig.2).

Table 1

Conditions for extraction of bioactive compounds from apple seeds

Type of extraction solvent	n-hexane	methanol
Solid material for extraction (seeds) (g)	13.150	14.836
Volume of solvent extraction (mL)	160	160
Time of extraction (minute)	190 minutes	120 minutes

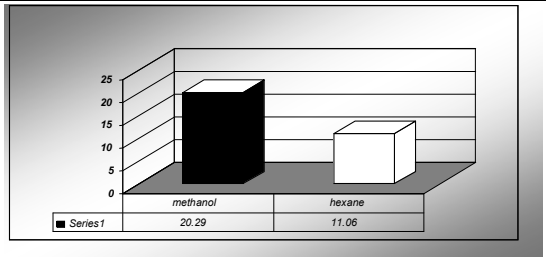


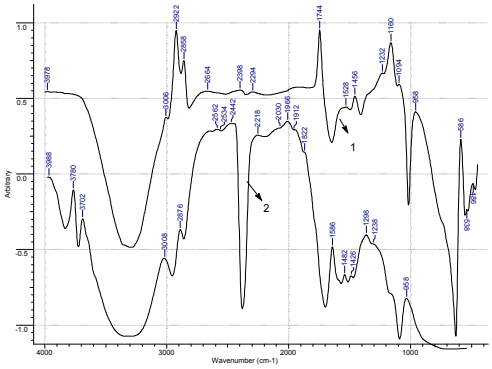
Fig. 2 - Percentage content of extracted substances

FTIR (fig.3a) *and UV-Vis* (fig.3b) *spectra* analysis shows the complex composition of both obtained extracted. Apart of evidencing the different selectivity of the two extraction solvents, the FTIR spectra (fig.3a) showed that besides various lipid fractions (represented by polycyclic unsaturated fatty acids, phospholipids, glycolipid etc., identified by the presence of characteristic groups - PO_2^- and R-O-P-O-R` [1200-1060 cm^{-1}], C=O [1500-1800 cm^{-1}], CH_2 [2700-300 cm^{-1}]) , there are also a number of other organic components (phytosterols, tocopherols, carotenoids, etc.), especially in the case of alcoholic extract. *UV-Vis spectra* (fig.3b) confirm the presence of phenolic and lipidic compounds, absorption limit being situated in the ranges 212-214 nm (lipidic compounds) and 275-290 nm respectively, attributed to phenolic compounds. Analysis of *fluorescence spectra* (fig.3c) confirms the different behavior of the two solvents used in extraction, one polar (methanol) and one non-polar (hexane). As demonstrated above have been extracted two categories of substances:

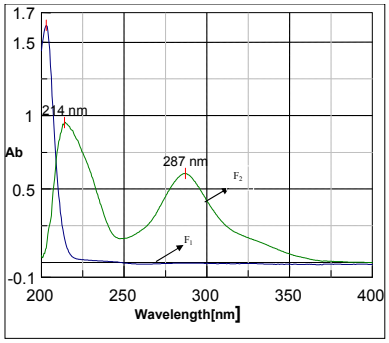
- in *methanol* phenolic compounds, characterized by absorption in UV-Vis at 287 nm wavelength (band characteristic to conjugated aromatic ring) and at 214 nm wavelength. This fact is revealed by fluorescence spectra (fig.3c) through characteristic fluorescence emission of aromatic structures (407.5 nm);
- in *hexane* the extraction of superior fat and aliphatic alcohols was achieved. One may observe only one adsorption band at 203 nm wavelength, without the involvement of double bonds or aromatic rings in the structure of separated compounds. This is revealed by the fluorescence spectrum (fig.3c) through

characteristic fluorescence emission of fatty acids and low molecular weight alcoholic structures (389 nm).

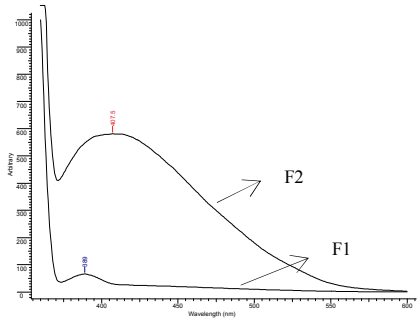
The results of the qualitative analysis of the two extracts is in agreement with some literature data (Lu and Foo, 1998), confirming the complex composition of apple and the possibility of using waste from their industrial processing as sources of biologically active compounds useful in pharmaceutical industry, food and cosmetics industries. Seeds, dried and chopped were used in adsorption experiments to retain some textile dyes present in aqueous and potentially present in industrial effluents.



(a)



(b)



(c)

Fig. 3 - (a) FTIR spectra of the extracted obtained in n-hexane (1) and methanol (2); (b) UV-Vis spectra of the extracted obtained in n-hexane (F1) and methanol (F2); (c) Fluorescence spectra (F1 - hexane si F2 - methanol)

Table 2

Characteristics and results of the dyes adsorption on apple seeds as adsorbent

Dye	Methylene Blue	Brilliant Red HE-3B	Rodhamine B
Operational characteristics			
Concentration of dye stock solution, mg/L	320	500	479,2
Concentration of dye working solution, mg/L	51,2	80	47,92
Molecular weight of dye, g/mol	320	1463	479
Solution pH	6	3	4
Temperature, ^{0}C	25	25	25
Work time, h	24	24	24
Adsorbent amount, g	0,05	0,05	0,05
Results of adsorption experimental works:			
Dye retention, %	64,4	86,75	14,98

Using aqueous solutions of three textile dyes and static adsorption method of separation were obtained results (Table 2) which certifies that this material can be a good and efficient adsorbent for this class of organic pollutant compounds.

Results were expressed as percentage retentions of textile dyes belonging to different structural classes (Brilliant Red HE-3B – reactive dye; Methylene Blue – phenotiazine dye; Rodhamine B – xantenic dye) and exhibited values ranged between 14.98 and 86.75 %. Along with the calculated adsorption capacities (about 3.3865- 26.73 mg/g), the values of percentage removal led to suggestion that the apple seeds can be used for removal of textile dyes from aqueous medium with good results (except Rhodamine), in the case of low flows.

CONCLUSIONS

1. The extract with bioactive compounds obtained from apple seeds using as solvent n-hexane and methanol were characterized with respect to their FTIR, UV-VIS and fluorescence spectra that led to identification of some lipid and phenolic fractions.

2. The adsorption studies of textile dyes on dry and chopped apple seeds highlighted a good adsorption capacity, with retentions of up to 26.73 mg/L and 86.75%, respectively.

REFERENCES

1. **Egila J.L., Dauda B. E. N., Iyaka Y. A., Jimoh T.,** 2011 - *Agricultural waste as a low cost adsorbent for heavy metal removal from wastewater*. International Journal of the Physical Sciences, 6(8), p. 2152-2157
2. **Horoba E., Cristian Gh., Horoba L., 2001 –** *Tehnologii de valorificare a produselor naturale.* Ed. Corson, Iasi
3. **Lu Y., Foo L.Y., 1998 -** *Constitution of some chemical components of apple seed*. Food Chemistry, 61(1/2), p. 29-33
4. **Mahmoud D.K., Salleh M.A.M., Karin A.A.W.A., 2012 -** *Characterization and evaluation agricultural solid wastes as adsorbents: A review.* Journal of Purity, Utility Reaction and Environment, 1(9), p 451-459.
5. **Maurice I.M., Shorland F.B., Williams E., 1976** - *Seed oil of apples (Malus pumila).* Journal of Science of Food and Agriculture, 22(4), p. 186-188
6. **Suteu D., Zaharia C., Badeanu M., 2009 -** *The impact of solid waste against the principal environment components*. Lucrari Stiintifice USAMV, Seria Horticultura, 52, p.1168-1172
7. **Suteu D., Zaharia C., Badeanu M., 2010** - *Agriculture wastes used as sorbents for dye removal from aqueous environments*. Lucrari Stiintifice USAMV IASI Seria Agricultura, 53(1), p.140-145
8. **Suteu D., Blaga A.C., Badeanu M., 2011** - *Preliminary Study Concerning the Anaerobic Digestion of Food Industrial Wastes.* Bul.Polyt.Inst.Iasi,s. Chem Chem Eng, 57(1), p. 79-85
9. **Suteu D., Zaharia C., Badeanu M., 2012a** - *Biohumus production by worm`s composting of some food wastes*. Scientific Study & Research, 13(2), p.169 -176
10. **Suteu D., Zaharia C., Malutan T., 2012b** - *Equilibrium, kinetic, and thermodynamic studies of Basic Blue 9 dye sorption on agro-industrial lignocellulosic materials.* Cent Eur J Chem, 10(6), p. 913-926
11. **Zaharia C., 2010 -** *The sustainable agricultural development – concepts, principles, eco-efficiency, eco-equity*. Cercetari agronomice in Moldova, XLIII (143) (3), p. 91-99
12. **Zaharia C., Suteu D., 2011 -** *The natural resources and sustainable development*. Cercetari agronomice in Moldova, XLIV (145) (1), p. 93-101

DESIGN METHODS OF GEOTEXTILE MATERIALS USED IN THE RECOVERY OF WEATHERED SOILS

METODE DE PROIECTARE A MATERIALELOR GEOTEXTILE UTILIZATE ÎN REFACEREA SOLURILOR ERODATE

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Abstract. *The paper emphasizes the functions and design methods of geotextile materials needed for the recovery of weathered soils by erosion from agrarian fields. Also there are presented a few properties of biodegradable textile materials made of natural polymers used in the recovery of soils.*
Key words: *design parameters, geotextile, biodegradability;*

Rezumat. *Lucrarea evidentiaza functiile si metodele de proiectare a materialelor geotextile necesare in refacerea solurilor degradate prin eroziune din terenuri agricole. De asemenea sunt prezentate si anumite proprietati ale materialelor textile biodegradabile din polimeri naturali uitilizate in refacerea solurilor.*
Cuvinte cheie: *parametrii de proiectare, geotextil, biodegradabilitate;*

INTRODUCTION

The water clears away gradually the superior layer of soil from declivous fields that results even into the total removal of fertile soil. This form of manifestation is called surface erosion. The continuous degradation of the fertile soil layer leads gradually to the worsening of soil's chemical properties like the loss of fertile elements from humus soil and K_2O. The erosion made by water affects not only the chemical properties, but also the physical ones like pH and the porosity of soil.(Dumitrescu,1987; Titus, 1996).

MATERIAL AND METHOD

1. The interaction between soil and geotextile material

A lot of textile materials are available for a large scale of geotechnical applications. An understanding of dynamic interactions between the textile structures and the geotechnical environment is essential for the design and selection of textile materials for geotechnical applications for agrarian cultures.

The geotextiles are part of the industrial or technical textiles category. The textile materials from this category can be classified in: composite textile materials made by sheeting, impregnation, lamination or other procedures, industrial textile materials – that are used as components in a fabrication process and industrial textile materials for direct use or embedded in the final products.

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The characteristics of geotextile materials are a result of the interaction between the yarn, the material's geometry and the finishing process, and can be characterized by the geometric and performance criteria.

The geometric parameters are described by: a) the porosity of materials as being the total of free spaces from a volume-unit of materials. Proportional with the growth of the yarn diameter, the structure is prone to become more porous. A porous material is lighter and more permeable. b) the volume of materials that represents the body on area unit. A material is prone to be bulkier if the fiber or yarn diameter and the mobility freedom of the fiber in the repetitive geometric unit is higher. c) the material thickness. Similarly to voluminousness the thickness of the material is related to the fiber or yarn diameter. The higher the diameter of fiber or yarn is, the more the thickness of material grows. (Koerner et al., 2011; Koerner et al., 1995 ; Narejo et al., 1992 ; Weimar, 1983)

The performance parameters are described by: a) the permeability if represented by the flow or pass capacity of the liquid or serum through material. The permeability of a material gets higher if the material porosity grows. The porosity is influenced by the fiber's nature and diameter, geometry of the fiber's cross section and the structure of material and its finishing methods. The permeability is a function of the fiber's or yarn's diameter for a given architecture of fiber (direction of fibers), the size of abruptions in the material's inside is variable depending in a large measure of the fibers' properties. b) the compressibility represents a main mechanical force of textile materials evaluated by: compressibility, hardness and resilience to compression. c)the behavior of materials to the pull evaluated by expansibility and the material's resistance. The expansibility and the material's resistance are correlated to the nature and structure of raw material and also to the technological process of crafting and finishing it. (Koerner et al., 2011; Weimar, 1983).

2. Elements of geotextile materials design for weathered soils by erosion

There are 3 functions of geotextile materials: drainage, filtering and separation. For every function there was established a design procedure using basic concepts of mechanics, hydraulics and geotechnics. For the geotextile materials used in the recovery of agrarian soils, the most important function is the filtering one.

A geotextile filter, as any other filter, must accomplish two criteria:

a) the retention criteria. A geotextile filter must have small enough holes so that it can block the movement of soil particle;

b) The permeability criteria: A geotextile filter must be permeable enough so that it won't slow down the flow of water (for a given porosity). (Koerner et al., 2011; Koerner et al., 1995 ;)

a) Two types of parameters are implied in the retention of soil by a filter:

- the mechanical parameters represented by: hydraulic forces of pull that are prone to move particles; the resistance of soil that depends of the pressure strains between soil and filter and the cohesion of soil that is prone to block the movement of particles and the acceleration of gravity that is prone to provoke or block the movement of particles according to the flow direction;
- the geometric parameters: the sizes of holes from the geotextile material; the size of soil particles and their distribution and the soil consistency.

b) As we have said previously, the permeability criteria is one of the two filters' criteria. The permeability of a geotextile filter must be high enough so that it

won't slow down the flow of water. This criterion is emphasized also by the relation between the distribution of blanks (the size of holes and porosity) and the permeability of geotextiles.

The biodegradable textile materials used in agriculture for the recovery of weathered soils are designed according to the following criteria: biodegradability and permeability. The materials are composed of biodegradable polymeric compounds, represented by polymeric mixtures that contain biopolymers type starch, cellulose, chitosan. The organic substance in soil is created because of the plants' activity plus microorganism and natural organisms from different species. The most important constituents of vegetals that have a role in the synthesis of humus are celluloses, proteins and phenolic compounds. Celluloses is transformed by microorganisms into CO2 ensuring the energy needs and the creation of living matter. (Briassoulis, 2006; Nair et al., 2007; Chandra,. 1998 ; Jakubowicz, 2003).

The biodegradable polymers are used in a very high number of applications and processes such as: fibers, yarns, chemical finishing of textile materials. The lactic acid is a monomer obtained from renewable resources: corn starch, potato starch and other products with high concentration of starch. The polylactic acid is a biodegradable polymer obtained by the direct polycondensation of lactic acid. The applications of biodegradable polymers in agriculture represents an ever-growing domain. (Chandra, 1998; Jakubowicz, 2003).

Biopolymers are defined as substances obtained through biological processes or chemical reactions of natural monomers. Because it is found in high quantities, amidine is the most used raw materials for polymere obtaining on base of alloy. There have been obtained polymere alloys through extrusion with 50% amidine with a synthetic polymere and with a compatibility agent. The hydrophylic copolymere used as compatibility agent encourages the interaction amidine – synthetic polymere. The extrusion of raw material ensures a mixture at molecular level of synthethic polymere and amidine chains. (Nair et al., 2007 ; Okada, 2002).

Biodegradable polymers on base of amidine can be used as fertilizers with controlled release in a slow or controlled lapse. As a result, the loss of fertilizers and environment pollution can be avoided or reduced.

RESULTS AND DISCUSSIONS

The role of the geotextile material in a constructive assembly, is defined as its function. In relation with functions ascribable to these materials in accomplishment of composed structures, these must posses certain physical and mechanical characteristics for which are established, according to case, adequate quality performances.

The main characteristics are represented by their good permeability to liquids and air, a controlled permeability that retains soil particles, and can accomplish simultaneously other functions, not only filter-drain, such as the controlled biodegradation process.

For soils recovery that require works on mid and long term, an important parameter is represented by the physical-chemical durability and dimensional stability of the designed material for a certain structure.

CONCLUSIONS

The geotextile materials are designed according to the physical-chemical properties of soil using the retention and permeability criterion. Also the development of biodegradable textile materials from natural polymers on a celluloses or starch base can solve some of the problems of organic fertilization of soils.

***Acknowledgments**: This work was cofinanced from the European Social Fund through Sectorial Operational Programme Human Resources Development 2007-2013, project number POSDRU/I.89/1.5/S62371 ,,Postdoctoral School in Agriculture and Veterinary Medicine area"*

REFERENCES

1. **Briassoulis, 2006** - *Mechanical behaviour of biodegradable agricultural films under real field conditions*. Polymer Degradation Stability, p. 1256-1272.
2. **Chandra, R., Rustgi R., 1998** - *Biodegradable polymers*. Progr. Polym. Sci. 1998, 23, p. 1273-1335.
3. **Dumitrescu N. si colab., 1987** - *Prevenirea si combaterea eroziunii solului in perimetrul etalon Popesti-Podu Iloaie, Jud. Iasi*. Prod.veg.cereale si plante tehnice;
4. **Jakubowicz I., 2003** - *Evaluation of degradability of biodegradable polyethylene PE*. Polymer Degradation Stability, p. 39-43.
5. **Koerner G. R., Koerner R. M., 1995** - *Survivability Considerations for Geotextile Filters*, IGS Case Histories Volume 1995 .
6. **Koerner R. M., Koerner G. R., 2011** - *Geotextile Filter Failures: Examples and Lessons Learned*, Proc. 25th Central PA Geotechnical Conference, Hershey;.
7. **Lawton J.T., 1996** - *Effect of starch type on the properties of starch containing films*. Carbohydrat Polymer, p. 203-208.
8. **Narejo D. B., Koerner R. M.,1992** -*A Dynamic Filtration Test for Geotextile Filters*,Tech. Note, Proc. Jour. Geotex. and Geomemb., Vol. 11, No. 4-6, p. 395-400;
9. **Okada M., 2002** - *Chemical synthesis of biodegradable polymers*. Progress in Polymer Science, p. 87-133.
10. **Weimar R. D., 1983** - *Mechanism of the Geotextile Performanc in Soil-Fabric Systems for Drainage and Erosion Control*, Transportation Research Record No. 916, p. 37-40.

RARE, THREATENED OR ENDANGERED ECOSYSTEMS THAT HAVE BECOME HIGH CONSERVATION VALUE FORESTS 3 (HCVF 3) MANAGED BY NATIONAL FOREST ADMINISTRATION – ROMSILVA

ECOSISTEME RARE, AMENINȚATE SAU PERICLITATE CARE AU DEVENIT PĂDURI CU VALOARE RIDICATĂ DE CONSERVARE 3 (PVRC 3), GOSPODĂRITE DE REGIA NAȚIONALĂ A PĂDURILOR - ROMSILVA

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Abstract. *Forests have both environmental and social values, such as uniqueness of biodiversity, watershed protection, soil stabilization or certain archaeological sites. When these values are considered to be of high significance or critical importance, the forest can be defined as a High Conservation Value Forest. The HCVF concept was first introduced by the Forest Stewardship Council (FSC) in 1999. There are six categories of HCVs covering both environmental and social values of forests. In the process of forest certification in Romania, in twenty-three County Forest Administrations and one hundred fifty-five Forest Districts from the national forest fund, an area of approximately 6,521.64 ha HCVF 3(Forest areas that are in or contain rare, threatened or endangered ecosystems), representing 3% of the total area of HCVFs, was identified. Thus, there have been identified thirteen (13) types of rare, threatened or endangered ecosystems, the largest area being represented by virgin forests (2,085.8 ha), followed by Picea abies Bog woodland (1119,5 ha), Forest ecosystems with high structural and functional complexity (1089,7 ha) and Alluvial forests with Alnus glutinosa and Fraxinus excelsior (694,7 ha), the remaining nine ecosystems having much smaller surfaces.*
Key words: *Conservation, identified, forest certification, ecosystems.*

Rezumat. *Pădurile au atât valori de mediu cât şi valori sociale, cum ar fi unicitatea biodiversității, protecția apelor, stabilizarea solurilor sau anumite situri arheologice. Când importanța acestor valori este deosebită sau critică, putem spune că avem o pădure cu valoare ridicată de conservare. Conceptul de PVRC a fost introdus pentru prima dată de Forest Stewardship Council (FSC), în 1999. Există şase categorii de valori ridicate de conservare, care acoperă atât valorile de mediu cât şi cele sociale ale pădurilor. În procesul de certificare a pădurilor din România, în fondul forestier național de pe suprafața celor 23 de Direcții Silvice(DS) şi 155 de Ocoale Silvice (OS) s-a identificat o suprafață de 6.521,64 ha de PVRC 3 (Suprafețe forestiere care sunt în sau conțin ecosisteme rare periclitate sau amenințate), ceea ce reprezintă un procent de 3% din suprafață totală de păduri cu valoare ridicată de conservare. Astfel, au fost identificate treisprezece (13) tipuri de ecosisteme rare, periclitate*

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sau amenințate, cea mai mare suprafață fiind reprezentată de pădurile virgine (2,085.8 ha), urmată de ecosistemele de Picea abies şi tinoave (1119,5 ha), ecosisteme forestiere cu o mare complexitate structurală şi funcţională (1089,7 ha) şi ecosistemele naturale de zone umede de anin (694,7 ha), restul de nouă ecosisteme având suprafeţe mult mai mici.
Cuvinte cheie: *conservare, identificate, certificare forestieră, ecosisteme*

INTRODUCTION

Every forest has multiple environmental and social values. It may contain rare species, recreational sites or resources harvested by local residents. If these values are considered to be of outstanding significance or critical importance, the forest can be defined as a High Conservation Value Forest (HCVF). The HCVF concept was first introduced by the Forest Stewardship Council (FSC) in 1999 when it included HCVFs in one of its requirements for timber companies seeking forest certification. According to Principle 9 of FSC, „management activities in HCVF shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach"(Mc Cracken et al, 2007). There are six categories of high conservation values (Rayden T., 2008). The studied ecosystems belong to the third category (HCV 3) - areas that are in or contain rare, threatened or endangered ecosystems. Application of the concept HCVF 3 can address environmental issues such as conservation of an area's most valuable species, ecosystems and landscapes.

Research objectives were to identify forest areas with rare, threatened or endangered ecosystems or rare associations of species, even when the constituent species may be widespread and secure. These ecosystems must be managed with a precautionary approach in order to maintain or enhance their surfaces (Hayes and Finegan, 2003).

MATERIAL AND METHOD

The study was conducted in 23 County Forest Administrations (CFA) from the national forest fund, of the range of one hundred fifty-five Forest Districts (FD) managed by National Forest Administration – ROMSILVA: Alba (AB), Argeş (AG), Bacău (BC), Bihor (BH), Bistrița Năsăud (BN), Braşov (BV), Buzău (BZ), Caraş Severin (CS), Covasna (CV), Dolj (DJ), Gorj (GJ), Harghita (HG), Hunedoara (HD), Ialomița (IL), Ilfov (IF), Mureş (MS), Prahova (PH), Satu Mare (SM), Sibiu (SB), Tulcea (TL), Vâlcea (VL), Vaslui (VS), Vrancea (VN). For HCVF 3 identification there were used: Plannings and forest districts maps; Biological studies; Annex 6, Annex 5 of the Toolkit (Jennings S., et al, 2003) and Meetings with the interested stakeholders: administrators, educational and research institutions, NGO, Environmental Protection Agency etc. The methodology involves three stages:

a) The first stage: **the planning of the process**: put up an evaluation team with experts from different fields: Biologists, ornithologists, sociologists, etc.

b) The second stage: **preliminary assesment** was carried out at the office. After consulting the management plan, it can be seen which forest types are present within the Forest Management Unit (FMU) (Rayden T., 2008). This information is now

analysed to identify potential forest regions in the FMU that are in or contain threatened or endangered ecosystems according to *Annex 5 and 6*;

c) The third stage: **full assesment**, on field, applied to forests identified in the second stage, as being potentially rare ecosystems, was carried out in order to establish if these ecosystems are effectively present in forest area.

RESULTS AND DISCUSSIONS

After the full assesment, an area of 6,521.64 ha HCVF 3 were identified, which represents 3 % of the total area with HCVF of the twenty-three CFA inventoried (fig.1). The 6,521.64 ha area with rare, threatened or endangered ecosystems, has 13 types of ecosystems. The largest area (2,085.8 ha) which represents 31% of the total area with HCVF 3, is the area with near-virgin forest ecocystems, followed by two ecosystems with approximately equal areas: Bog woodland (91D0) (1,119.5 ha) -17% and Natural forest ecosystems with a high compositional and structural complexity (1,089.7 ha) -17%. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Pandion, Alnion incanae, Salicion albae) (91E0) has an area of 694.78 ha and represents 11% of the total area with HCVF 3. The rest of ecosystems have smaller areas, between 400 ha to 2.5 ha, representing between 6% and 0.03% of the total. The area covered by near-virgin forests (31%) was identified only in one CFA, CFA Argeş – here were delineated two forest areas: Near-virgin forest Munţii Frunţii – 287.2 ha and near-virgin forest Capra – 1,799.5 ha.

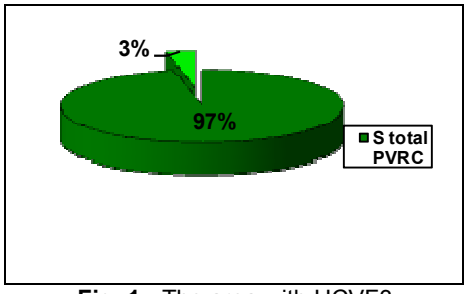

Fig. 1 - The area with HCVF3

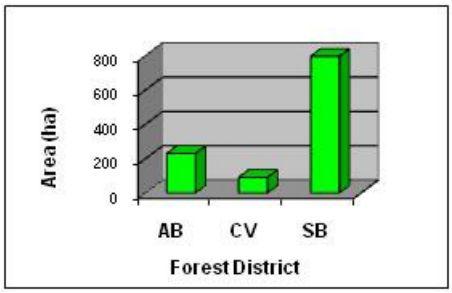

Fig. 2 - Bog woodland (91D0)

Bog woodland (91D0) (17 %) are present on the range of three CFA (fig. 2). The largest area with these ecosystems was identified in CFA Sibiu (796.9 ha). In CFA Alba was determined an area of 231 ha, and a smaller area of 91.6 ha is located in CFA Covasna. These ecosystems, has forest type (FT)1172 (Open wood spruce forest with *Sphagnum* and *Vaccinium myrtillus*) at the altitudes between 900 and 1600 m, in depressions, plateaus, rarely on the slightly slanted slopes (Lazăr and Stăncioiu, 2007).

Natural forest ecosystems with a high compositional and structural complexity (Silver fir, pine, beech, oak, ash, elm) (17%), which have an area very close to Bog woodland (1,089.7 ha) were identified in three CFA, as observed in figure 3. The largest area of these ecosystems is located in CFA Gorj (698.7 ha).

In CFA Vâlcea there was identified an area of 363.1 ha and the smallest area is in CFA Argeş (27.9 ha).

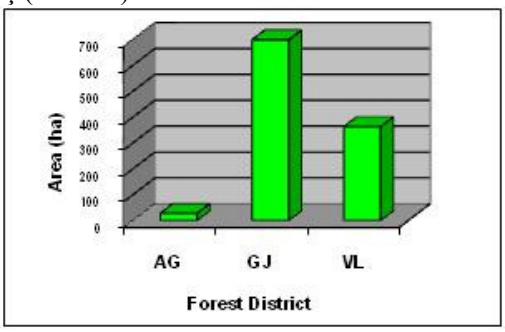

Fig. **3** - Natural forest ecosystems with a high compositional and structural complexity

Alluvial forests with *Alnus glutinosa*, having an area of 694.78 ha were identified in 16 CFA (fig. 4). The largest area with Alluvial forests is in CFA Vâlcea (165.5 ha), followed by CFA Argeş (109.4 ha) and by CFA Prahova (93.3 ha). In the other CFA, the areas are between 51 ha (CFA Vrancea) and 2.6 ha (CFA Gorj). Alluvial forests are characterized by FT: 9721, 9821, 9713 (Grey alder on sandy alluvium and gravels, Black alder riverside coppice), in narrow mountain meadows, wet slopes and alluvial terrace, river banks (Lazăr and Stăncioiu, 2007).

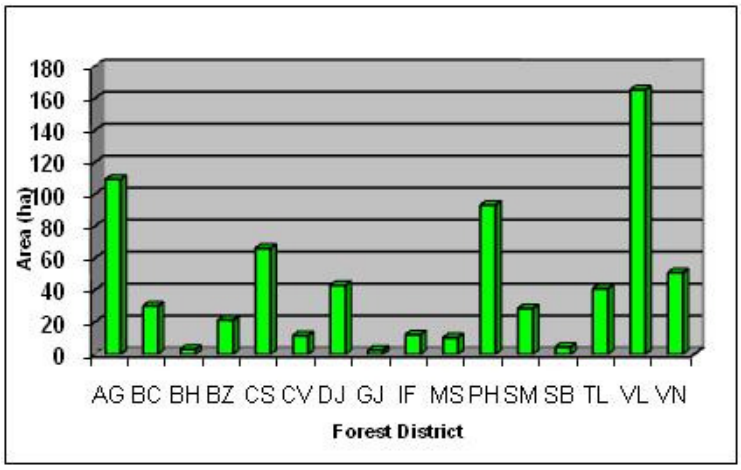

Fig. **4** - Alluvial forests with *Alnus glutinosa*

Acidophilous *Picea* forests of the montane to alpine levels, with an area of 404 ha, were identified only in CFA Sibiu with forest type (FT) 1611 (Carpathian spruce forest) at altitudes between 1200–1600 m. (Doniță N., Biriş I.A., 2005).

Eutrophic wetlands ecosystems were found on an area of 307.96 ha, spread in nine CFA (fig.5). The largest area is located across CFA Dolj – 93.7 ha, followed by CFA Gorj with a surface of 64.9 ha eutrophic wetlands ecosystems.

In the other CFA, these ecosystems have the areas between 37.62 ha (CFA Prahova) and 0.7 ha (CFA Vâlcea).

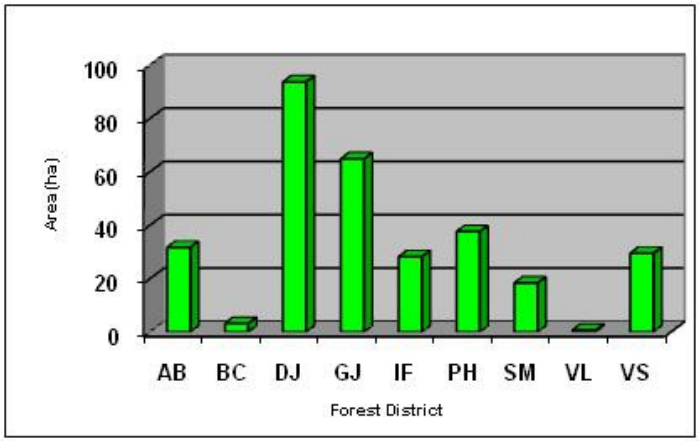

Fig. 5 - Eutrophic wetlands ecosystems

The Old growth forest areas which are not declared protected areas and thus are not HCVF 1.1. (Forest areas from protected areas), are declared HCVF 3.

These forest were identified in four CFA: Alba Iulia, Bacău, Dolj and Vrancea (fig.6). The largest area with Old growth forests are in CFA Dolj (91.6 ha): Old growth forests of *Quercus pedunculiflora* from Ciuperceni – 11.3 ha, Cioace – 5.8 ha and Bratovoieşti 74.5 ha. In CFA Alba (83.5 ha) there are two Old growth forests: The Beech forest from Groza of 51.2 ha and the Silver fir-Beech forest from Gotu of 32.3 ha. CFA Vrancea has an 52.4 ha Old growth forest area of *Quercus pedunculiflora* in Focşani and the smallest area in CFA Bacău– The Beech forest from Cambur with an area of 23.8 ha.

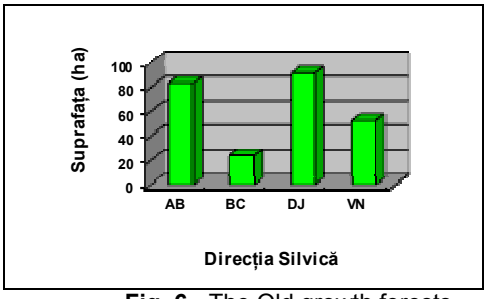

Fig. 6 - The Old growth forests

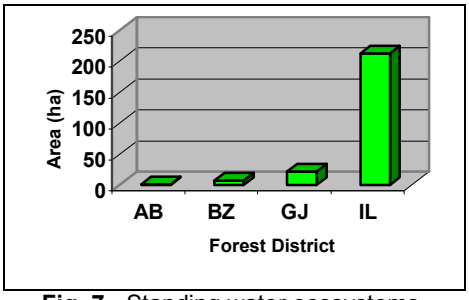

Fig. 7 - Standing water ecosystems

Standing water ecosystems were identified on an area of 243.6 ha, in four County Forest Administration (fig.7). The most important area is contained in CFA Ilfov: 212.6 ha. In the other CFA, the areas are much smaller, respectively 22.3 ha in CFA Gorj, 7.8 ha in CFA Buzău and 0.9 ha in CFA Argeş.

Pannonian woods with *Quercus pubescens* are present only in two CFA of the twenty three CFA investigated, on the area of 185.8 ha (fig. 8.). The largest

area is contained in CFA Sibiu, 132.5 ha, with forest type: *Quercus pubescens* open woods and gaps of steppe, and in CFA Tulcea on the 53.3 ha area, with forest type: *Quercus pubescens* open woods and gaps of steppe from Defileul Dunării.

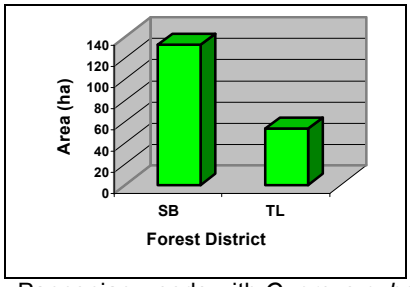

Fig. 8 - Pannonian woods with *Quercus pubescens*

CONCLUSIONS

1. The researches from the twenty three County Forest Administrations led to the identification of an area of 6,521.64 ha HCVF 3, with 13 types of rare, threatened or endangered ecosystems.

2. Virgin forest ecosystems have the largest area (2,085.8 ha), and can be found in a single CFA (CFA Argeş).

3. The smallest areas with HCVF 3 were identified in those CFA where it was found only one type of ecosystem, respectively in CFA Mureş (10.4 ha) and CFA Bihor (3.2 ha) – Alluvial forests with *Alnus glutinosa* and CFA Harghita (6.7 ha) – Opwen woods and alpine shrubs.

4. These ecosystems are a small part of rare, threatened or endangered ecosystems, because the largest area is included in HCVF 1.1. in Protected Areas, Natural Reservations, National and Natural Parks .

5. The HCVF 3 management will be done in the context of a precautionary approach, and monitoring will be done by a careful analysis of ecosystems and periodic observations on field.

REFERENCES

1. **Doniță N., Biriş I.A., ş.a. 2005 –** *Habitats from Romania*. Ed. Tehnico Silvică, Bucureşti.
2. **Hayes J., Finegan B., Delgado D., & Gretzinger S., 2003 -** *Biological monitoring for forest management in High Conservation Value Forests*.
3. **Jennings S., Nussbaum R., Judd N., Evans T., 2003 -** *HCVF Toolkit*
4. **Lazăr G., Stăncioiu P.T., ş.a. 2007 –** *Forest habitats of community importance included in the Life Nature Project LIFE05 NAT/RO/000176 „Priority forest, sub-alpine and alpine habitats in Romania”*. Ed. Universității „Transilvania” din Braşov.
5. **Mc. Cracken J., Steindlegger G., Koon C., 2007** - *HCVF - the concept in theory and practice.* Ropress, Switzerland.
6. **Rayden T., 2008** - *Assessment, management and monitoring of High Conservation Value Forest (HCVF) A practical guide for forest managers.* Proforest, Oxford.

ENVIRONMENTAL IMPACT ESTIMATION OF SOME DISINFECTION TREATMENTS APPLIED FOR A FINAL ZOO-TECHNICAL EFFLUENT USING THE GLOBAL POLLUTION INDEX

ESTIMAREA IMPACTULUI DE MEDIU AL UNOR TRATAMENTE DE DEZINFECȚIE APLICATE UNUI EFLUENT FINAL ZOOTEHNIC FOLOSIND INDICELE DE POLUARE GLOBALĂ

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Abstract. *This paper discusses some disinfection treatments (i.e. chlorination with sodium hypochlorite, advanced oxidation with hydrogen peroxide and ferrous ions, and UV irradiation) applied in the case of a real zoo-technical effluent in terms of legal and approved quality of final effluent discharged directly in a watercourse nearby. The environmental impact of these disinfection treatments against the local natural aquatic environment (natural receptor – watercourse) estimated by the global pollution index (I^*_{GP}) is within or over admissible limits but with potential effect of discomfort or even stress against organisms (application of different disinfection treatments) in comparison with the direct discharge of un-treated zoo-technical effluent that produced an 'aquatic environment highly affected, dangerous for organisms'.*
Key words: *zoo-technical effluent, chemical treatment, disinfection, environmental impact assessment, global pollution index*

Rezumat. *Această lucrare discută câteva tratamente de dezinfecție (i.e. clorinarea cu hipoclorit de sodiu, oxidarea avansată cu apă oxigenată şi ioni feroşi, iradierea cu radiație UV) aplicate în cazul unui efluent real dintr-o fermă zootehnică în termeni de calitate certă şi legală a efluentului final evacuat direct într-un curs de apă din apropiere. Impactul acestor tratamente de dezinfecție asupra mediului acvatic natural (receptor natural local – curs de apă) exprimat prin indicele de poluare globală (I^*_{PG}) este în sau depăşeşte limitele admisibile (aplicarea tratamentelor de dezinfecție) dar cu efect pronunțat de disconfort sau chiar stres asupra organismelor, în comparație cu evacuarea directă în emisar a efluentul final neepurat care generează un 'mediu acvatic puternic afectat, dăunător pentru organismele existente'.*
Cuvinte cheie: *efluent zootehnic, epurare chimică, dezinfecție, evaluare impact de mediu, indice global de poluare*

INTRODUCTION

Disinfection is known as a procedure of removal or killing of viruses and organisms present in water (final individual or mixed effluent). In general, more than 96-99% of the organisms in water are mostly removed by coagulation, flocculation, oxidation, sedimentation and filtration (complex wastewater technol-

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ogical process), but the quality norms for natural water resources and treated wastewater require that in case of them used for drinking or bathing/swimming proposes to be lacking of coliform organisms and to meet the conditions of microbiological quality for human, sportive and social consumption (Yen, 2007). The important removals in the physico-chemical treatment steps are useful, but these are not complete. That is why, the supplementary chemical and non-chemical disinfection is necessary in order to fulfil these demands.

The organisms (procaryotic and eucaryotic organisms, simple invertebrates), and also different viruses from drinkable water and wastewater, were at the origin of some diseases with mass transmission (*i.e.* typhoid fever, cholera, infectious hepatitis, dysentery, etc.) namely pathogenic agents (Zaharia, 2011a). The bacteriological analysis being long-time consuming, the preventive water disinfection actions for human, industrial, sportive consumption are imposed with priority. Thus, disinfection becomes an important step in treatment of water resources because is a threat for public health or causes tastes, smells and unwanted increasings of organisms and pollutants concentration in conduits and basins.

The disinfection mechanism depends of desinfectant type (*i.e.* halogens, chloroamines, ozone, oxidizing agents, UV radiation, etc.) but also of organism type. The disinfectant based on halogen acts by penetration in cell and disactivation of essential enzime (produced by cell as spores, fungi, etc.) important being the oxidation potential directly correlated with disinfecting capacity. Numerous disinfection procedures are available: (*i*) *chemical disinfection* – with chemicals as: halogens – chlorine and derivates containing chlorine, chloroamine, bromine, iodine, ozone, other oxidizing agents (H_2O_2, H_2O_2/Fe^{2+}, Fe^{3+}, $KMnO_4$,etc.) and (*ii*) *non-chemical disinfection* – with heat (stream, hot air) and UV, ionizing radiation, which have also an important role.

The disinfecting mechanism (killing of pathogenic agents) is not very well known being expressed by empirical equations determined by kinetic models of diffusion and chemical transformations (*e.g.*, Chick law). Also, the disinfecting mechanism depends of contact time, temperature, pH, concentration of disinfectant, concentration of microorganisms (especially, total coliforms-TC, E-coli, total fecal coliforms) and presence of any interferring substances.

The diagnosis of environmental impact due to effluent treatment is one of the first stages in complete evaluation of sustainability of a technological treatment process of individual or mixed effluents. This is the reason for why the environmental impact assessment caused by final effluent treatment is always necessary, considering mainly the impact against natural aquatic environment (*i.e.* direct discharges in natural receptor of improper treated or even untreated final effluent). This is the principal target of this paper which evaluates the disinfection treatments applied to a final effluent from a zoo-technical farm in order to follow the development strategy for environmental protection adoptable/easily adopted by the farmer. Moreover, the study proposes the emphasizing of a practice tool for cumulative impact (CIA) based on application of alternative methodology of

global pollution index (I^*_{GP}), considered as a revision or initial evaluation of cumulative effects and local impact (Zaharia, 2011b, 2012).

MATERIAL AND METHOD

1. Data collection and analysis of different effluent quality indicators

Data collection, sampling and analysis of potential pollution produced by different effluent disinfection treatments from the studied zoo-technical farm against the natural aquatic environment (watercourse nearby) were performed, and achieved in the environmental analysis laboratory. The principal specific quality indicators of untreated and treated analyzed effluent are: pH, color, suspended solids - SS, chemical oxygen demand - COD_{Cr}, biochemical oxygen demand - BOD_5, chlorides, sulfates, ammonia, total nitrogen, total phosphorus, phenol index, fixed residues, total coliforms (TC), total fecal coliforms (TFC), etc. For analysis were used different individual analyzers or multifunctional apparatus (*i.e.* HACH One-Laboratory pH-meter; DRELL DR/2000 spectrophotometer - HACH Company, SP-830 Plus spectrophotometer - Metertech Inc., autoclave, microscope etc.) and, also, different volumetric (titrimetric) and gravimetric analysis methods internationally approved (analytical and microbiological methods) in accordance with the standards in force.

The application of preventive treatment of zoo-technical effluent (disinfection) is always indicated in each farm for ensuring a proper quality of all discharges in aquatic environment, based mainly on different mixed treatments (disinfection treatments), such as (Zaharia and Suteu, 2007; Zaharia and Surpateanu, 2009):

- *treatment **I**: coagulation (*bentonite - 3 g/L, ferric sulfate - 57.50 mol/L or aluminium sulfate - 5.85 mmol/L, 2 min of rapid agitation, 10 min of lent agitation, 50 rpm) – *sedimentation* (30 min of sedimentation or settlement),
- *treatment **II**: coagulation* (the same as the treatment I) – *sedimentation – simple oxidation (H_2O_2)* (36.76 mmol/L H_2O_2, min 3 h, or 24 h of oxidation) – *adsorption* (contact filter with active carbon - AC, for residual H_2O_2 removal),
- *treatment **III**: coagulation* (the same as treatments I-II) – *sedimentation – advanced oxidation* (H_2O_2 / Fe^{2+}, VIS radiation) (pH 3-4.5, 0.176 M H_2O_2, 1.44 M Fe^{2+}, 120 min of advanced oxidation) – *adsorption* (contact filter with AC),
- *treatment **IV**: coagulation*(as treatments I-III)– *sedimentation– chlorination* (pH=7.50, 1h, room temperature, 17.60 mg/L Cl-NaOCl, residual chlorine < 0.11 mg Cl_2/L),
- *treatment **V**: coagulation* (as treatments I-IV) – *sedimentation – UV Disinfection* pH=7.50, time of 1h, UV mercury lamp of medium pressure – length of 0.12 m, diameter of 0.020 m and tubular reactor of 0.3 L capacity, height of 0.45 m).

2.2. Environmental impact evaluation – Alternative methodology of I^*_{GP} index

Some analyzed quality indicators of the investigated zoo-technical effluent were used for calculation of an effluent quality index, EQ_i (Eq.1), and also of an evaluation score, ES_i, expressed by a mark between *1* and *10* attributed based on evaluation scale (Zaharia C., 2011b, 2012).

$$EQ_i = C_{i,measured} / CMA_i \quad (1)$$

in which, *i* – identification of the specific quality indicator; $C_{i,measured}$ – measured/analyzed value of the quality indicator and MAC_i – maximum admissible concentration of the quality indicator in accordance with the imposed limits of local environmental authority.

The cumulative effect of different potential polluting components is expressed by the average arithmetic value (EQ_{water} *or* ES_{water}) of all quality indicators (EQ_i) or evaluation scores (ES_i). For quantification of the environmental impact is calculated

the global pollution index (I^*_{GP}). The correlation between the global pollution index (I^*_{GP}), real state of aquatic environment and impact of effluent disinfection treatments is characterized in table 1 (Zaharia, 2011b, 2012).

Table 1

Correlation (I^*_{GP}) – local pollution status of aquatic environment in the alternative methodology of global pollution index

I^*_{GP} values	Real pollution status of natural aquatic environment
$I^*_{GP}=1$	Natural aquatic environment, unaffected by the effluent disinfecting treatment
$1 < I^*_{GP} < 2$	Aquatic environment modified by disinfecting treatment in admissible limits
$2 \le I^*_{GP} < 3$	Aquatic environment modified by disinfecting treatment, with generation of discomfort effects
$3 \le I^*_{GP} < 4$	Aquatic environment modified by disinfecting treatment, with stress generation against organisms
$4 \le I^*_{GP} < 6$	Aquatic environment modified by disinfecting treatment, dangerous for organisms
$I^*_{GP} \ge 6$	Polluted aquatic environment (degraded), improper for organisms

RESULTS AND DISCUSSIONS

The disinfection performances and removals of different polluting components from zoo-technical effluent are good and sustain the necessity of its treatment (Zaharia and Suteu, 2007; Zaharia and Surpateanu, 2009). But, the principal quality indicators of untreated and disinfected zoo-technical effluent (table 2) require permanent control, environmental impact and risk assessment.

Table 2

Principal quality indicators of untreated and treated zoo-technical effluent

Quality indicator		Untreated effl.	I (C/S)	II (C/S, Ox.)	III (C/S, Adv.Ox.)	IV (C/S, chlorin.)	V (C/S, UV)	C.M.A.* (II quality category)	C.M.A.** (discharge in natural receptor)
Colour, HU		2442	1302	580	437	534	124	200	500
Suspended solids, mg/L		1385	476	108	73	92	86	150	60
Turbidity, FTU		1315	415	191	142	156	125	-	-
COD_{Cr}, mg O_2/L		549.2	133.5	81.14	65.3	85.6	25.2	25	125
BOD_5, mg O_2/L		102.3	82.2	75.4	29.6	78.9	23.4	5	25
Phenol index, mg/L		2.9	2.3	1.4	0.9	0.4	0.2	0.001	0.3
Total phosphorus, mg P/L		12.5	10.5	11.20	9.2	4.8	7.3	0.2	2.0
Fixed residues, mg/L		4736	3845	3452	2124	1732	1690	500	2000
Ammonia, mg/L		332	134	65.2	32.2	20.3	18.2	0.3	3.0
Total coliforms, no./L	Min	150	120	90	10	0	0	10000	5000
	Average	4500	2900	2600	300	60	10	10000	5000
	Max	12000	11000	9500	640	130	20	10000	5000
Total fecal coliforms, no./L	Min	80	70	60	10	0	0	500	50
	Average	3600	2200	2000	220	50	6	500	50
	Max	10500	8800	8200	4500	60	10	500	50

* Ministerial Order (MMDD) No.161/2006 (quality categories for water bodies); **Government Directive No. 352/2005 (NTPA 001) (Zaharia, 2008)

The quality indexes and evaluation scores of final treated effluent vary function of disinfection type, selected operational parameters, efficiency of each

treatment type and, also, working regime (continuous or discontinuous) (table 3). The maximum admisible limits of discharges in natural aquatic receptor are locally imposed, respecting Government Directive No.352/2005 approving the technical norms for discharges in natural aquatic receptors (NTPA001) (Zaharia, 2008).

Table 3

Quality indexes (EQ_i) and evaluation scores (ES_i) for different disinfection treatments of untreated and/or treated zoo-technical effluent

Quality indicator	Untreated efluent		I (C/S)		II (C/S, Oxidation)		III (C/S, Adv.Ox.)		IV (C/S, Chlorinaton)		V (C/S, UV)	
	EQ_i	ES_i	EQ_i	ES_i	EQ_i	ES_i	EQ_i	ES_i	EQ_i	ES_i	EQ_i	ES_i
Colour, HU	4.9	4	2.6	5	1.2	6	0.9	7	1.1	6	0.25	8
Suspended solids, mg/L	23.1	1	7.9	4	1.8	6	1.2	6	1.5	6	1.43	6
COD_{Cr}, mg O_2/L	4.7	4	1.1	6	0.5	8	0.5	8	0.07	9	0.2	9
BOD_5, mg O_2/L	4.1	4	3.3	5	3.0	5	1.2	6	3.2	5	0.94	7
Phenol Index, mg/L	9.7	3	7.7	4	4.7	4	3	5	1.3	6	0.67	8
Total phosphorus, mg P/L	6.3	4	5.3	4	5.6	4	4.6	4	2.4	5	3.65	5
Fixed residues, mg/L	2.3	5	1.9	6	1.7	6	1.1	6	0.9	7	0.85	7
Total coliforms, no./L	0.9	7	0.6	8	0.5	8	0.06	9	0.012	9	0.002	9
Average value:	**7.00**	**4.0**	**3.80**	**5.25**	**3.60**	**5.875**	**1.57**	**6.375**	**1.31**	**6.625**	**0.999**	**7.375**

Analyzing the values of quality indexes (EQ_i) and evaluation scores (ES_i) is evident that the natural aquatic environment is affected, but in admissible limits - level 2, with potential effects (treatment V), or over the maximum admissible limits – level 1, with pronounced effects (treatments – III, IV), or level 2, with dangerous effects (treatments – I, II) or can be considered degraded - level 2, with lethal effects at short times of exposure (untreated effluent).

The discharges of final zoo-technical effluents from the studied disinfection area must be periodically controlled for some quality indicators such as: total suspended solids, COD_{Cr}, BOD_5, ammonia, total N and total P, phenol index, fixed residues, but also for microbiological indicators (TC, TFC), among others.

The quality indexes vary between 0.99-7.00, and the evaluation scores are of 4.00-7.375. The final results of impact evaluation by the global pollution index are presented in table 5 for all five disinfection treatments and compared with the untreated effluent (pH 7.50) discharged directly in the local watercourse.

The values of global pollution index (I^*_{GP}) are of 1.782 - 3.419 (table 4) and correspond to some real situations of different local pollution as: a '*natural aquatic environment modified by the disinfection treatment of zoo-technical effluent*' in admissible limits (treatment V), or over these limits with generation of discomfort effects (treatments II-IV) or stress against organisms (treatment I).

These results sustain the necessity of zoo-technical effluent disinfection treatments in terms of good quality and environmental protection, with respecting the imposed quality of final effluent discharging, but also the application of preventive protection strategy and periodic control of discharges in natural receptors.

Table 5

Values of evaluation scores (ES_{water}), global pollution indexes (I^*_{GP}) and estimation of the real pollution state of natural aquatic environment (watercourse)

Effluent disinfection treatment	$\overline{ES}_i^2$	ES_{water}	I^*_{GP}	Real status of local pollution of the natural aquatic environment
Untreated effluent / No disinfection treatment	18.50	4.301	5.405	'Aquatic environment modified by the treatment, dangerous for organisms'
I (C/S)	29.25	5.408	3.419	'Aquatic environment modified by the effluent disinfection treatment, with generation of stress against organisms'
II (C/S, Ox, Ads))	36.625	6.052	2.730	'Aquatic environment modified by the effluent disinfection treatment, with generation of discomfort effects'
III (C/S, Adv.Ox,Ads)	42.875	6.548	2.332	
IV (C/S, Chlorination)	46.125	6.792	2.168	
V (C/S, UV)	56.125	7.492	1.782	'Aquatic environment modified by the treatment in admissible limits'

CONCLUSIONS

1. The results of cumulative impact evaluation due to some different disinfections of a final zoo-technical effluent by the global pollution index (I^*_{GP}) indicate a local pollution of natural aquatic environment in comparison with the natural state (ES_{water}=10) (*i.e.* real evaluation scores of 4.301-7.492 (ES_{water}) for aquatic environment of discharging zone).

2. The values of I^*_{GP} (1.782-3.419) correspond to a 'natural aquatic environment modified by the effluent disinfecting treatment' in different ways such as: 'in admissible limits' (treatment V) or 'over the admissi-ble limits', with potential of generation discomfort effects (treatments II-IV) or stress against organisms (treatment I).

3. The direct discharging of untreated zoo-technical effluent in the watercourse is estimated to be generating an 'aquatic environment modified, dangerous for organisms'.

REFERENCES

1. **Yen T.F., 2007** – *Chemical Processes for Environmental Engineering*. Imperial College Press, London, p. 259-312
2. **Zaharia C., Suteu D., 2007** - *Analysis and treatment of effluents from a zootechnical farm*. Scientific Annals of "Al.I. Cuza" University, series Chemistry, XV(1), p. 89-96
3. **Zaharia C., 2008 –** *Protecția juridică a mediului.* Ed. Ecozone, Iasi, p. 234-235
4. **Zaharia C., Surpățeanu M., 2009** - *Preliminary study of simple and Fenton oxidation with hydrogen peroxide applied on final effluents from a zootechnical farm,* Environmental Engineering and Management Journal, 8(3), p. 409-415
5. **Zaharia C., 2011a –** *Elemente de chimia mediului acvatic*. Ed. Performantica, Iaşi, p. 24
6. **Zaharia C., 2011b** - *A comparative overview of the environmental impact assessment produced by different economic activities using the global pollution index*. Proceeding of the 15th International Conference – ModTech – New Face of T.M.C.R., May 25-27, Vadul lui Voda, Republic of Moldova, Vol.2, p. 1185-1188
7. **Zaharia C., 2012 -** *Evaluation of environmental impact produced by different economic activities with the global pollution index.* Environmental Science and Pollution Research, 19(6), p. 2448-2455

ASPECTS REGARDING THE BEHAVIOR IN CULTURE OF DIFFERENT VARIETIES OF CALLA GROWN IN GREENHOUSE SOIL

ASPECTE PRIVIND COMPORTAREA ÎN CULTURĂ A DIFERITELOR SOIURI DE CALA CULTIVATE ÎN SOLUL SEREI

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Abstract. *More commonly known as Calla, Zantedeschia is one of the most popular cut flowers and it is included in the so-called group of aristocratic flowers. Calla is part of the least demanding plants, with a quite easy culture and to the reach of many farmers. This paperwork presents four hybrids of Zantedeschia (‚Picasso', ‚Cameo', ‚Black Eyed Beauty' and ‚Black Star') grown in greenhouse soil. Determinations and observations were performed regarding the vegetation of the plant and flower stem emergence, plant height, number of leaves / plant, number of flowers / plant, flower stem length. The results revealed the following: the early growth of 'Picasso' cultivar ('Cameo' the most belated); highest production of flowers/plant and flower stems shorter in 'Black Star' cultivar; the lower flower production 'Black Eyed Beauty' cultivar, but the longest flower stems; rich vegetation mass in 'Picasso' and 'Cameo' cultivars.*
Key words: *Zantedeschia cultivars, grown in greenhouse soil, morphological characteristics*

Rezumat. *Cunoscută mai frecvent sub numele de cala, Zantedeschia este una dintre cele mai apreciate flori tăiate, fiind inclusă în așa numita grupă a florilor aristocrate. Cala face parte din categoria plantelor puțin pretențioase, cu o cultură destul de ușoară și la îndemâna unui număr mare de cultivatori. În această lucrare sunt prezentați patru hibrizi de Zantedeschia (‚Picasso', ‚Cameo', ‚Black Eyed Beauty' și ‚Black Star'), cultivați în solul serei. S-au efectuat determinări și observații privind pornirea în vegetație a plantelor și apariția tijelor florale, înălțimea plantelor, numărul de frunze/plantă, numărul de flori/planta, lungimea tijelor florale. Rezultatele obținute au scos în evidență următoarele aspecte: timpurietatea cv. ‚Picasso' (‚Cameo' fiind cel mai tardiv); producția cea mai mare de flori/plantă şi tijele florale mai scurte la cv. ‚Black Star'; producția de flori cea mai mică la cv. ‚Black Eyed Beauty', dar tijele florale cele mai lungi; masa vegetativă bogată la cv. ‚Picasso', ‚Cameo'.*
Cuvinte cheie: *cultivaruri de Zantedeschia, cultură în solul serei, caractere morfologice.*

INTRODUCTION

Zantedeschia genus unites approx. 8 species of geophytes plants (with rhizomes and tubers), found on moist soils, in swamps or lakes shores of

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southern and eastern regions of South Africa (van Dijk and Kurpershoek, 2001). The genus name comes from the Italian botanist and physiologist, Giovanni Zanthedeschi (1773-1846). Known more commonly under the name of Calla or Calla Lily, *Zantedeschia* has no connection with true lilies (genus *Lilium*) or with their family. It is one of the most popular cut flowers and it is included in the so-called group of aristocratic flowers (Toma, 2009).

Callas draw attention by their original inflorescences consisting of spadix (inflorescence itself) and spathe (bracts) that protects bloom. *Zantedeschia* species and their hybrids have different colored spathes (white, from red or purple to pink or lilac, from deep yellow to pale yellow or orange etc.). No one knows exactly when and how Calla was introduced in Europe, but it appeared illustrated in royal gardens in Paris in 1664 and in the second half of the nineteenth century, exotic South African plant was introduced in the United States of America and began to appear as a subject in American art.

The species that are commonly found in culture: *Zantedeschia aethiopica* Spreng. (syn. *Calla aethiopica* L., *Richardia africana* Kth.) *Zantedeschia albimaculata* Baill., *Zantedeschia elliotiana* Engl. (syn. *Calla elliotiana* Knight., *Richardia elliotiana* W. Watson) and *Zantedeschia rehmanii* Engl. (syn. *Richardia rehmanii* N.E. Br.) (Cantor and Pop, 2008; Toma, 2009).

Zantedeschia aethiopica Spreng. is the most widespread species. Its underground organs are vigorous rhizomes, its leaves are large, shiny dark green colored and inflorescences are accompanied by white spathes. *Zantedeschia albimaculata* Baill. has a tuber in the ground, spear-shaped-sagittal leaves numerous white macules, white flowers, slightly greenish at the base and smaller than *Zantedeschia aethiopica. Zantedeschia elliotiana* Engl. has tubers, the oval-heart-shaped leaves have white macules yellow spathes. Many hybrids of *Zantedeschia* are based on *Z. elliotiana. Zantedeschia rehmanii* has also tubers, spear-shaped dark green leaves, smaller than the previous species. Spathe, pink, purple, white or yellow protects the spadix (Cantor and Pop, 2008; Şelaru, 2002).

MATERIAL AND METHOD

The research was conducted in the discipline of Floriculture at the University of Agricultural Sciences and Veterinary Medicine Iasi, Romania. The *Zantedeschia* cultivars that were used in the experiments:

- 'Picasso' (fig. 1 a) is obtained from *Zantedeschia albimaculata* Baill. (leaves with white macules and gradient spathe from white to dark purple);
- 'Black-Eyed Beauty' (fig. 1 b) is obtained from *Zantedeschia elliotiana* Engl. (leaves with many white macules, spathe with various shades of yellow-green and a black base "collar");
- 'Cameo' (fig. 1 c) is obtained from *Zantedeschia albomaculata* Hook./Baill. (Janowska Beata, Roman A., 2010), with special color of the spathe, a combination of yellow and red, sometimes gradient and other times the colors merge;
- 'Black Star' (fig. 1 d) is obtained from *Zantedeschia rehmanii* (leaves have white macules and spathe gives the impression that is black, actually it is dark red-purplish).

a) 'Picasso' **b)** 'Black- Eyed- Beauty' **c) '**Cameo' **d)** 'Black Star'

Fig. 1 (a-d) - Hybrids of *Zantedeschia* used in the experiment (original)

The experiments were set up in the greenhouse soil by planting tubers at distances of 25/25 cm. Before planting, tubers were treated with a solution of 0.3% Topsin, by bathing them for 30 minutes. Establishment and maintenance works applied to the experimental cultures respected the technology recommended in the literature for this culture system. During the experiment, measurements were made regarding the vegetation of the plant and flower stem emergence, plant height, number of leaves/plant, number of flowers/plant, flower stem length.

RESULTS AND DISCUSSIONS

Table 1 presents the main technological and phenological data recorded at the experimental crops of Calla. The vegetation began after 40 days of crop establishment, and for the four varieties this was done during 11 days. The first who started vegetation was 'Picasso ', and the last one, 'Cameo'.

Table 1

Technological and phenological data

Cultivar	Crop establishment	Starting vegetation period	Appearance of steams	End of vegetation period
'Cameo'	21st of April	10th of June	17th of July	3rd of October
'Picasso'	21st of April	30th of May	11th of June	13th of September
'Black- Eyed- Beauty'	21st of April	3rd of June	29th of June	18th of September
'Black Star'	21st of April	5th of June	30th of June	20th of September

Large differences between varieties are noted between the length of time required from the start of the vegetation and the appearance of flower stems (tables 1 and 2). The 'Cameo' cultivar, which required 37 days (12 days more compared to average) was found to be the belatedly, registering very significant

positive differences. However, 'Picasso' cultivar was the earliest, requiring only 12 days until floral stem appearance, the differences from the average being very significant negative. Cultivars 'Black-Eyed Beauty' and 'Black Star' showed values close or equal to the average and the differences were insignificant.

Table 2

The period from starting vegetation period until appearance of the steams

Cultivar	No. of days until appearance of steams	% compared to the average	Differences	Signification
'Cameo'	37	148.0	+12	**xxx**
'Picasso'	12	48.0	-13	**000**
'Black- Eyed-Beauty'	26	104.0	+1	**-**
'Black Star'	25	100.0	0	**-**
Average	**25**	**100.0**	**control**	**control**

LSD 5% = 2.4
LSD 1% = 3.6
LSD 0, 1% = 5.8

As for the number of flowers per plant (table 3), it is noted that the variety 'Black Star' is the most productive, the average number of flowers/plant is 4.7. In descending order, follows 'Picasso' with 3.7 flowers/plant, 'Cameo' with 1.5 flowers/plant and 'Black-Eyed Beauty' with 1.3 flowers/plant. From the statistical interpretation of the results on flower production, in relation to the average, we obtained positive differences in cultivars 'Black Star' (very significant deviation) and 'Picasso' (distinct significant deviation). The cultivars 'Cameo' and 'Black-Eyed Beauty', the differences were very significant negative.

Table 3

Production of flowers/plant

Cultivar	No. of flowers/plant	% compared to the average	Differences	Signification
'Cameo'	1.5	53.57	-1,3	**000**
'Picasso'	3.7	132.14	+0.9	**XX**
'Black- Eyed-Beauty'	1.3	46.43	-1.5	**000**
'Black Star'	4.7	167.86	+1.9	**XXX**
Average	**2.8**	**100.0**	**control**	**control**

LSD 5% = 0.4
LSD 1% = 0.7
LSD 0, 1% = 1.1

Measurements were also made on the increase dynamics of plant height, starting from 75 days after planting (5th of July) and up to 110 days after

planting, when the maximum height was reached. At the last measurements (8th of August) it was observed that the 'Black-Eyed Beauty' cultivar is the highest, the plants reached an average height of 66.5 cm. The other three cultivars were characterized by a smaller size, but with similar values ranging between 54.42 cm and 55.55 cm (figure 2).

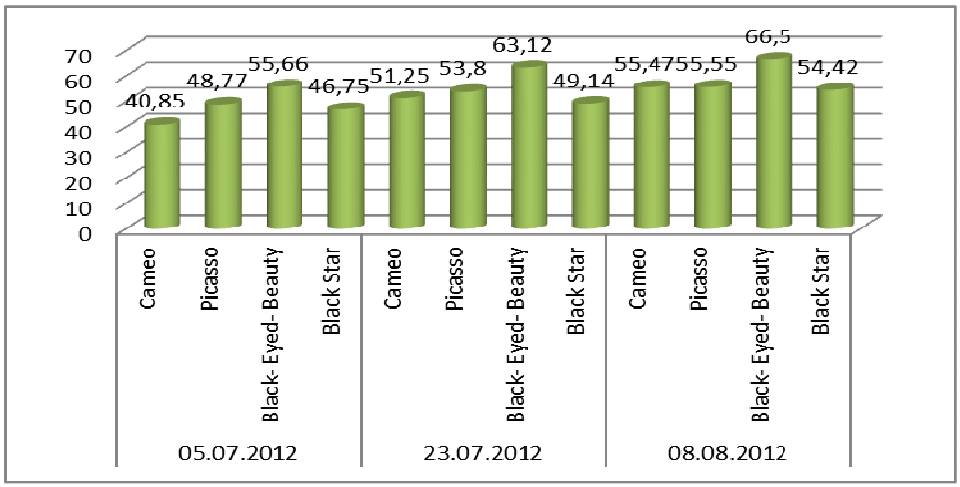

Fig. 2 - Dynamics of growth in plants height

Regarding the number of leaves per plant (figure 3), it highlights cultivars 'Cameo' and 'Picasso', with 13 and 11 leaves per plant. Cultivars, 'Black-Eyed Beauty' and 'Black Star' have a reduced vegetative mass, registering an average of 4-6 leaves per plant.

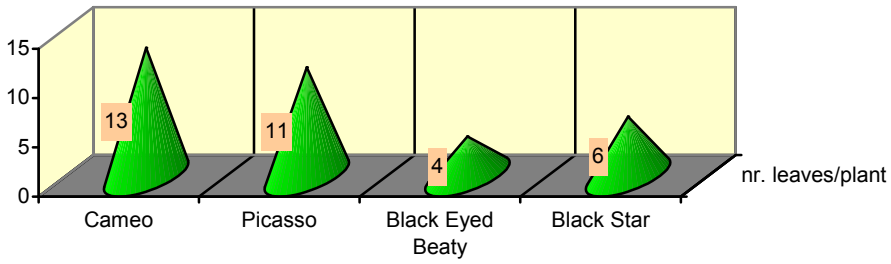

Fig. 3 - Number of leaves/plant

Flower stems length (figure 4) varies between 44.9 and 56.5 cm, the longest flower stems are at 'Black-Eyed Beauty' cultivar, and the shortest are at 'Black Star' cultivar.

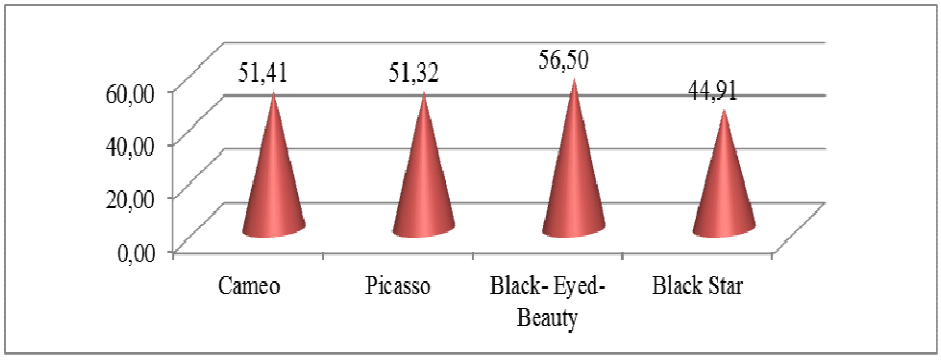

Fig. 4 - Flower stems length (cm)

CONCLUSIONS

1. The starting of the vegetation for the four cultivars of Calla was triggered after approx. 40 days after planting tubers, the first who started vegetation was ‘Picasso’ cultivar and the last one was ‘Cameo' cultivar.

2. The emergence of floriferous stem and beginning of flowering between cultivars kept the same order: the earliest cultivar was ‘Picasso', with 12 days until the appearance of the floriferous stems and the belatedly was ‘Cameo', which required 37 days until the appearance of flower stems. Towards average, cultivars ‘Black-Eyed Beauty' and 'Black Star' showed insignificant differences.

3. ‘Black Star' cultivar was the most productive (4.7 flowers/plant) followed by ‘Picasso’ (3.7 flowers/plant), ‘Cameo' (1.5 flowers/plant) and ‘Black-Eyed Beauty' (1.3 flowers/plant).

4. Floral stem length varies between 44.9 and 56.5 cm, the longest flower stems being at ‘Black-Eyed Beauty' cultivar and the shortest at Black Star' cultivar.

5. ‘Cameo' and 'Picasso’ cultivars form a rich vegetation mass (13 and 11 leaves/plant) compared with cultivars ‘Black-Eyed Beauty’ and 'Black Star' which were recorded with 4-6 leaves/plant.

REFERENCES

1. **Cantor Maria, Pop Ioana, 2008 –** *Floricultură. Baze de date.* Editura Todesco, Cluj-Napoca.
2. **Hanneke van Dijk, Kurpershoek M., 2001 –** *The complete encyclopedia of bulbs and tubers*. REBO Publishers, Lisse, The Netherlands.
3. **Janowska Beata, Roman A., 2010** - Effect of gibberellic acid spraying and soaking of rhizomes on the growth and flowering of calla lily (*Zantedeschia* Spreng.). Acta Agrobotanica, vol. 63 (2), pp. 155–160.
4. **Șelaru Elena, 2002 –** *Culturi pentru flori tăiate*. Editura Ceres, București.
5. **Toma F., 2009 –** *Floricultură și artă floral, vol. 2 - Specii utilizate pentru producerea florilor tăiate*. INVEL- Editura Multimedia, Bucuresti.

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Gică GRĂDINARIU

Bun de tipar: **28.06.2013**
Apărut: **2013**
Format: **61x86/16**
Editura: **„Ion Ionescu de la Brad" Iaşi**
Aleea M. Sadoveanu, 3
Tel.: 0232-218300
e-mail: editura@uaiasi.ro

ISSN–L=1454-7376
(Print)-ISSN 1454-7376
(Online)=ISSN 2069-8275
(CD-ROM) = ISSN 2069 – 847X

PRINTED IN ROMANIA

Editorial Consultant: **Vasile VÎNTU**

Technical Editors: **Liliana ROTARU**
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Liliana ROTARU
Gică GRĂDINARIU

Imprimatur: **28.06.2013**
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