

BIOPESTICIDES A NEW CHALLENGE IN ASSURING FOOD QUALITY AND SUSTAINABLE AGRICULTURE

BIOPESTICIDELE - O NOUĂ PROVOCARE PENTRU ASIGURAREA CALITĂȚII ALIMENTELOR ȘI PENTRU O AGRICULTURĂ SUSTENABILĂ

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Abstract. *The pesticides represent one of the most toxic compounds that affect the human health, these compounds having mutagenic and carcinogenic effects. One of the way by these compounds can get into the human body are the food. The use of biopesticides in the plants growth is part of the concept of "sustainable agriculture". Various biologically active compounds from plant sources have been shown to exhibit high efficacy, multiple mechanism of action, low toxicity to mammals, which has led to increased the interest in using them as biopesticides in a stabilized form and easy to handle. The aim of this paper is the study of some vegetal extracts with potential repellent effect, from the spontaneous flora of Moldavia/Bucovina in combating the pests.*

Key words: biopesticides, cold extraction, vegetal extract, insecticide effect

Rezumat. *Pesticidele reprezintă compuși toxici care afectează sănătatea umană, având efecte mutagene și carcinogene. Una dintre căile prin care acestea pot ajunge în corpul uman o reprezintă alimentele. Utilizarea biopesticidelor în cultivarea și creșterea plantelor se înscrie și conceptului de "agricultură durabilă". Este cunoscut faptul că o serie de compuși biologic activi din surse vegetale prezintă eficacitate ridicată, mecanism multiplu de acțiune, toxicitate scăzută la mamifere, ceea ce a determinat un interes crescut pentru testarea/utilizarea lor ca și biopesticide într-o formă stabilizată și ușor de manevrat. Scopul lucrării este studiul unor extracte vegetale cu potențial efect repulsiv, din flora spontană a Moldovei/Bucovinei, în combaterea dăunătorilor.*

Cuvinte cheie: biopesticide, extracție la rece, extract vegetal, efect insecticid

INTRODUCTION

With a rapidly growing technology, humanity is still at a crossroads generated by the food crisis, climate issues, and resource depletion. In this context, the concept of "sustainable development" is more appropriate than ever.

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People want to live a quality life, which means living conditions ensured by a friendly environment and a proper diet that contributes to preserving health. In this context, attention is paid not only to the technologies of processing vegetable and animal matter in the food industry, but also to the production of these materials, respectively to the practice of agriculture as a whole (Roman and Benelli, 2010; Béjaoui *et al.*, 2013). Ensuring the quality of food intended for consumption is possible if a rigorous control of the quality of all stages involved is carried out along the food chain (Suteu *et al.*, 2010). A defining stage in ensuring the quality of food is the conditions of the production of raw material, whether vegetal or animal. Also, people have become self-aware with their own bodies, especially ensuring and maintaining the health and the quality of their lives. In this context, there is this increasing tendency towards the consumption of safety products (without emerging chemicals).

The pesticides represent one of the most toxic compounds that affect the human health, these compounds having mutagenic and carcinogenic effects. One of the way by these compounds can get into the human body are the food.

The use of *biopesticides* in the cultivation and growth of plants is part of the concept of "sustainable agriculture". So, more and more research data show that a growing number of essential oils have been tested against a wide range of arthropod pests with promising results (Zoubiri and Baalouamer, 2014; Bett *et al.*, 2017; Singh and Kaur, 2018; Upasani *et al.*, 2003; Morar *et al.* 2008; Brudea and Ciucă, 2007). Various biologically active compounds from plant sources have been shown to exhibit high efficacy, multiple mechanism of action, low toxicity to mammals, which has increased the interest in using them as biopesticides in a stabilized form and easy to handle.

There are a number of products of vegetable origin, mainly used in vegetable growing, obtained from tobacco leaves but also from other plants. The most representative are: Nicotine, obtained from (*Nicotiana rustica*) Anabasină from (*Anabasis aphylla*), quasină from (*Quasina amara*), rotenone from (*Derris elliptica*) and pyrethrin obtained from *Pyrethrum coccineum*, (Morar *et al.* 2008).

Obtaining some metabolites from local plant sources can be made by various extraction techniques solid - liquid (Cascaval D. *et al.*, 2004; Chua, 2013), depending on the nature of the vegetal material, the direction of use of the extract, process cost, availability of equipment.

The Colorado potato beetle (*Leptinotarsa decemlineata* Say.) is a devastating pest in vegetable crops *Solanaceae* class. Currently, it is being combated exclusively by chemical products, which have a reasonable efficacy on the pests but have the side effect on the fauna and flora in that geographic area, being rather aggressive. Also, the repeated use of chemical treatment leads to the emergence of resistance in time. In order to reduce the amount of chemical pesticides administered to control the Colorado beetle (*Leptinotarsa decemlineata* say), as an alternative solution, various vegetal extracts can be used, because they proved effective at least as well as synthetic pesticides (Morar *et al.* 2008).

Some plants from spontaneous flora can be used as ecological remedies for combating harmful coleoptera, without requiring cultivation or growth costs, on the one hand, and on the other, without endanger the equilibrium of the ecosystem because these plants are native.

The aim of this paper is the study the behaviour of some vegetal extracts with potential repellent effect, predominantly from the spontaneous flora of Moldavia and Bucovina and the investigation of their effectiveness in combating the pests. The plants that have been targeted in this study are: *Salvia officinalis*, *Ocimum basilicum*, *Satureja hortensis*, *Origanum vulgare*, *Primula veris*, *Equisetum arvense*, *Urtica dioica*, *Allium sativum*, *Pimpinella anisum*, *Matricaria chamomilla*, *Calendula officinalis*, *Achillea millefolium*, *Hypericum perforatum*, *Rumex patientia*. The extracts obtained will be tested on Colorado beetle (*Leptinotarsa decemlineata* Say) an insect of the coleopteran order, from the *Chrysomelidae* family, widely spread worldwide, associated with the potato culture on which it acts as a pest .

MATERIAL AND METHOD

Materials

It were used several lots of adults of *Leptinotarsa decemlineata* say and their larvae in various stages of development harvested from potato crops in Suceava County.

The plants selected in this study come from the spontaneous flora characteristic of Moldavia, the Bucovina area : *Salvia officinalis*, *Ocimum basilicum*, *Satureja hortensis*, *Origanum vulgare*, *Primula veris*, *Equisetum arvense*, *Urtica dioica*, *Allium sativum*, *Pimpinella anisum*, *Matricaria chamomilla*, *Calendula officinalis*, *Achillea millefolium*, *Hypericum perforatum*, *Rumex patientia*.

As solvent for solid-liquid extraction was used ethylic alcohol 96 % concentration with analytical grade purity.

Method: extraction methodology

A very simple and used solid-liquid extraction technique is the maceration. It was practically achieved by suspending the solid in 96% alcohol, considering a 1:10 solid: alcohol ratio. It were used 10 g of dry plant (inflorescence and / or strains), chopped or milled, which were placed in an experimental installation with 100 mL of ethylic alcohol. The mixture was kept under intermittent stirred at room temperature (15-20°C). After reaching the established time, it was made the extracts phase separation and storage the liquid phases in a tight containers in a cool place.

Preliminary test insect

The solutions that were used in the experiments were prepared with a concentration of 100% from the prepared extracts and were sprayed a populations consist of 10 adults and 10 larvae of *Leptinotarsa decemlineata* Say. placed in enclosures with different volumes (0.5L or 5L, respectively) and fed with green plants. Monitoring was done periodically after a set timetable: at 2h, 12h, 24, 48, and 72h, following the mortality index, behavior, the occurrence of pits. The experiments with the 14 extracts were done in duplicate, with a blank test (simple alcohol spraying).

Also, in the case of extracts with notable effects, experiments on new individuals were resumed, experiments that were repeated twice.

RESULTS AND DISCUSSIONS

The obtained alcoholic extracts presented flavors specific to the plant from which they came, and different colours from green to yellow very light. The color and consistency of the liquid phases depend on the part of the plant introduced in the process of the extraction.

The results of the monitoring of *Leptinotarsa decemlineata* Say. behaviour are systematized in table 1.

Table 1

The effects of vegetal extracts on evolution and behavior of *Leptinotarsa decemlineata* Say.

Type of extracts	The percent (%) of deaths recorded by the number of hours since the first spraying including adults (A) and larvae (L)									
	2h		12h		24h		48h		72h	
	A	L	A	L	A	L	A	L	A	L
<i>Satureja hortensis</i>	0	0	0	0	0	0	10	0	10	20
<i>Ocimum basilicum</i>	0	0	0	0	20	0	0	0	0	0
<i>Origanum vulgare</i>	0	0	0	0	0	0	10	30	10	10
<i>Hypericum perforatum</i>	0	0	0	0	10	10	10	30	0	0
<i>Rumex patientia</i>	0	0	0	0	0	0	0	0	0	0
<i>Achillea millefolium</i>	0	0	0	0	0	25	0	0	10	10
<i>Calendula officinalis</i>	0	0	0	0	0	0	0	0	0	0
<i>Matricaria chamomilla</i>	0	0	0	0	0	0	0	0	0	0
<i>Salvia officinalis</i>	0	0	0	0	10	0	20	0	0	0
<i>Pimpinella anisum</i>	0	0	0	0	10	10	0	0	10	10
<i>Equisetum arvense</i>	0	0	0	0	0	0	0	0	0	10
<i>Allium sativum</i>	0	0	0	0	0	0	10	0	20	0
<i>Urtica dioica</i>	0	0	0	0	10	10	0	0	10	0
<i>Primula veris</i>	90	80	10	10	-	10	-	-	-	-
Blank sample	0	0	0	0	0	0	0	0	10	0

Analyzing the data from table 1 it can conclude that the manifestations recorded in the range of 0-2 h are normal, adaptive because the insects are installed in other living conditions than the natural ones. After two hours of application of the treatments, a series of clear neuroleptic manifestations of different intensity, depending on the plant from which the extract was performed, appear. These are: hyperexcitability, lack of coordination in space, partial paralysis with spasms of the appendages (wings, limbs, antennae, etc.) and end up to total paralysis and then death of individuals.

The study and analysis the data in Table 1 emphasizes that the *Primula veris* L. extract induced a mortality of 100% after 48-72h. The *Equisetum arvense*

L. extract causes late neuroleptic manifestations, and anise, chamomile, marigolds and rocks induce dynamism, so they are not important for the present study.

CONCLUSIONS

The use of plant extracts from native plants may be an alternative to obtaining organic crops. The obtaining the extracts by the maceration technique, using ethylic alcohol as solvents accepted by the agriculture and food industry, is a simple and relatively cheap option and ensures interesting results with potential for practical application.

A range of spontaneous flora plants can be effective in combating harmful coleopterans and can be used in biological control of the Colorado beetle - *Leptinotarsa decemlineata* Say (*Coleoptera*, *Chrysomelida*).

The best results for controlling *Leptinotarsa decemlineata* Say. were obtained using *Primmula veris* extract with an efficacy of 80% after the first 24 hours after spraying and 100% after the 48 hours after administration.

The use of plants extract with insecticid properties in pest control could be a useful method firstly for small farmers who apply the principles of bio-dynamics agriculture.

Biopesticides may represent a opportunity for farmers which gives attention to environmental protection (especially the soil protection) and want to obtain cultures with a low degree of chemical contamination.

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