BIOLOGICAL CONTROL TRIALS OF INVASIVE SPECIES FROM MAIZE AGROECOSYSTEMS BY EXPLOITATION OF INDIGENOUS NATURAL ENEMIES

ÎNCERCĂRI DE COMBATERE BIOLOGICĂ A SPECIILOR INVAZIVE DIN AGROECOSISTEMELE DE PORUMB PRIN EXPLOATAREA DUŞMANILOR NATURALI AUTOHTONI

Ioana GROZEA, A. CĂRĂBEŢ, Ramona CHIRIŢĂ, Ana Maria BADEA, F. PRUNAR, Floarea ADAM

Agricultural and Veterinary University of the Banat, Timisoara, Romania
Corresponding author:Ioana GROZEA, e-mail: ioanagrozea@yahoo.com

Abstract. *Current trends in control regard this method because high efficiency and non-pollutants effects of course. In this way, it follows protection of useful scale from agroecosystems and their exploitation in control of invasive population. Incidence of western corn rootworm, Diabrotica virgifera in Europe and Romania attract the specialist's attention and European organisms regarding substantial changes, which save the yield. For distinguish the frequency zones of invasive species accomplished a statistics for establish research locations from abundant zones of Diabrotica species dependent on last years monitoring. The results distinguish the follow zones: Timişoara (783 – 900 adults), Jimbolia (603 – 4030 adults), Deta (712 – 1901 adults), Lovrin (656 – 1975 adults), Peciul Nou (898 – 1481 adults), and Şag – Arad (903 - 2000 adults). It were take the soil and surface samples for establish the presence of control biological agents. The maximum appearance period of invasive species is very important in establishing the analogy with appearance of predator's species. From natural enemies of Diabrotica v. can be notice spiders: Theridion impressum (Araneae: Theriidae), Agriope bruennichi (Araneae: Araneidae) Speira diademata (Araneae: Araneidae), Pseudophomus rufipes (Coleoptera: Carabidae). In specialty literature from our country there not information or research results regarding the biological control of pests, so we intend to make known to all interested persons in health plants some ecological alternatives by pest reduction and damage level, too.*

Rezumat*. Tendinţa actuala a orientărilor in combatere vizează această metodă datorită eficienţei ridicate, dar si a efectelor non poluante. Prin acestea se urmăreşte protejarea gamei utile din agroecosisteme si chiar exploatarea lor in controlul populaţional invaziv. Incidenţa viermelui vestic al rădăcinilor de porumb, Diabrotica virgifera in Europa şi România a atras atenţia specialiştilor si a organismelor europene în vederea schimbărilor substanţiale care sa protejeze producţia. Pentru a evidenţia zonele cu frecvenţă a speciei invazive s-a realizat o statistică în vederea stabilirii locaţiilor de cercetare din zonele de abundenţă ale speciei Diabrotica în urma monitorizării din ultimii ani. Rezultatele evidenţiază zonele: Timişoara (783 – 900 exemplare), Jimbolia (603 – 4030 exemplare), Deta (712 – 1901 exemplare), Lovrin (656 – 1975 expl.), Peciul Nou (898 – 1481 expl.), Şag – Arad (903 - 2000 exemplare). S-au luat probe de sol şi de suprafaţă pentru a determina prezenţa agenţilor biologici de control. Perioada de apariţie maximă a speciei invazive prezintă o deosebită importanţă în stabilirea analogiilor cu perioada de apariţie a speciilor prădătoare. Dintre potenţialii duşmani naturali ai speciei invazive Diabrotica v. se pot menţiona arachnidele: Theridion impressum (Araneae: Theriidae), Agriope bruennichi (Araneae: Araneidae), Speira diademata (Araneae: Araneidae), Pseudophomus rufipes (Coleoptera: Carabidae). In literatura de specialitate din tara noastra nu exista informatiiastfel că dorim sa punem la dispozitia tuturor celor interesati de sănătatea plantelor câteva alternative ecologice care să determine o reducere numerica a exemplarelor daunatoare si implicit a gradului de daunare.*

Key words*: biological control, natural enemies, Diabrotica v.*
Cuvinte cheie*: control biologic, duşmani naturali, Diabrotica v.*

INTRODUCTION

One of the most important invasive species from maize agroecosystems is the western corn rootworm (*Diabrotica virgifera virgifera Le Conte*).

Some natural enemies, like the spiders were frequently in some agroecosystems, especially there when was used organics manure. These create a decline in western corn rootworm larval population. There are few referring to insects- predators, but Stowen et al. (1981) showed that these consumed eggs of Diabrotica virgifera virgifera. They founded a great number of natural enemies especially insects: *Hypoaspis aculeife* Canestrini *(Laelapidae)*; *Lasius neoniger* Emery (*Formicidae*) which consume eggs; *Androlelaps sp*. and *Stratiolelaps sp. (Laelapidae)* what consume eggs and larvae.

From genus *Celatoria* are three species known in control of *Diabrotica* adults (Zhang et al., 2003).

Recently researches made in maize field in irrigation and non-irrigation conditions emphases that nematodes *Steinernema carpocapsae* and *Heterorhabditis bacteriophora* are efficient in diminution of emergence adults. After comparison of nematodes and insecticides efficiency, the performance varied according to nematode effectives and insecticides type (Wright et al., 1993; Journey and Ostlie, 2000).

MATERIAL AND METHODS

For distinguish the frequency zones was made a statistic of monitoring from last years for establish the researches location where *Diabrotica* was most frequent. It was take in consideration the data from 2002 - 2004 periods. In this way were pointed the most frequently zones following the pests and useful species. Some of observations were made in collaboration with Phytosanitary Direction from the Timis County.

An important place in knowledge of recently achievements in this direction can be attributing to bibliography studies.

It were take the soil and surface samples for establish the presence of control biological agents. The maximum appearance period of invasive species is very important in establishing the analogy with appearance of predator's species.

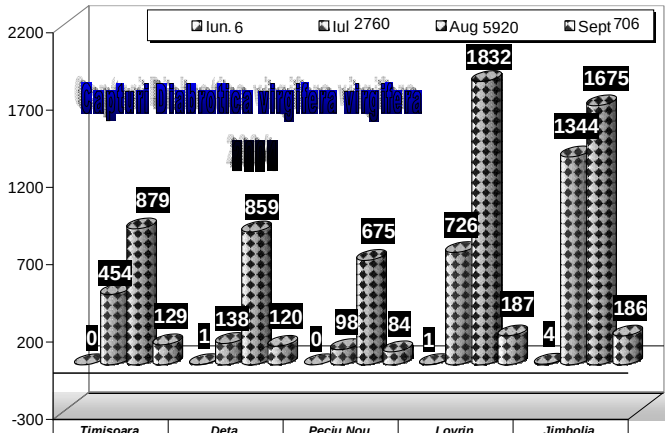
RESULTS AND DISCUSSIONS / PARTIALLY OBSERVATIONS

It was distinguishing the follow *Diabrotica* frequently zones: Timişoara (783 – 900 adults), Jimbolia (603 – 4030 adults), Deta (712 – 1901 adults), Lovrin (656 – 1975 adults), Peciul Nou (898 – 1481 adults), and Şag – Arad (903 - 2000 adults) (figure 1). These data emphasize a great number of adults in zones Şag – Arad and Jimbolia. In zones Lovrin, Peciul Nou, Deta, and Timisoara the number of captures was significant, so we can considered it like researches locations beginning 2007.

From natural enemies of *Diabrotica v.* can be notice spiders: *Theridion impressum (Araneae: Theriidae), Agriope bruennichi (Araneae: Araneidae) Speira diademata (Araneae: Araneidae), Pseudophomus rufipes (Coleoptera: Carabidae)* (figure 2). These species are signalled in maize fields from east Europe and from our country (Urack, 2005), so can be considered important agents in biological control.

Theridion impressum is considered an important species especially in appearance of maize silk. In this stage, the number of invasive species adults is greatest (Toth. et al., 2001).

Concerning the species *Argiope bruennichi* does not know information about useful in biological control of *Diabrotica* adults or other stages. From our observations in this first phase was remarked a high frequency of spiders in maize crop. Of course, the aggressiveness against pest insect was higher, especially in silk emergence period.



	Timişoara	Deta	Peciu Nou	Lovrin	Jimbolia
Iun.	0	1	0	1	4
Iul	454	138	98	726	1344
Aug	879	859	675	1832	1675
Sept	129	120	84	187	186

Figure 1. Graphical representation of numerical values to *Diabrotica v.* adults in the main monitoring zones (in 2004)

Theridion impressum - frequently in Europe, the length is 6 mm.

Agriope bruennichi - frequently in Mediterranean Sea zone, has an accented sexual dimorphism, the male has 7 – 8 cm length, and the female has 2.2 cm.

Speira diademata – frequent in Europe 1.0 – 2.5 cm.

In maize crops from western part of country are frequent the follow carabids: - genus Harpalus: *Pseudophomus rufipes* (about 70 – 80%).

The following species are present in lower percentage (20 – 25 %):

- genus Dolichus: *Dolichus malensis*
- genus Brachinus: *Brachinus crepitans*
- genus Pterostichus: *Pterostichus cylindricus*
- genus Calathus: *Calathus fuscipes*
- genus Carabus: *Carabus ullrich* (frequent in Timis Plain)
  C. coriaceus
  C. carcellatus (frequent in the Lugoj area)

The other aspect monitored in carabids is food. It known that these predator insects are feed with eggs, larvae, and pupae of different insect pests. In fact, the soil stage of *Diabrotica* can be a good food for carabids.

Some examples of natural enemies who feed on different insect stages from the family *Chrysomelidae* (*Leptinotarsa decemlineata*) are the following: *Poecilus cupreus*, *Pterostichus cylindricus L.*, *Calosoma auropunctatum L.* – consume eggs and larvae of *Leptinotarsa decemlineata Say*. (Tălmaciu, 1998) So, in control of eggs and larvae of *Diabrotica* its may be useful, too. The main raison is the same characteristics of family *Chrysomelidae*.

CONCLUSIONS

Western corn rootworm is the most important invasive species in maize agroecosystems from Banat.

From natural enemies of Diabrotica v. can be notice spiders: Theridion impressum (Araneae: Theriidae), Agriope bruennichi (Araneae: Araneidae) Speira diademata (Araneae: Araneidae), Pseudophomus rufipes (Coleoptera: Carabidae).

Some species (*Agriope bruennichi*, *Speira diademata*) were observed in our experimental fields.

Adults of
Diabrotica virgifera
on maize silk
(original)

Theridion impressum
Heimer and Nentwing, 1991
www.spiderling.de/Theridion

Agriope bruennichi
(original)

Speira diademata
(original)

Figure 2. Potential natural enemies (presents in maize fields) of *Diabrotica virgifera*

LITERATURE

JOURNEY A.M, OSTLIE K.R., *Biological control of western corn rootworm using entomopathogenic nematode Sternernema carpocapse*, Biological control, Minnesota, Environ. Entomol. 29 (4), 822 – 831, (2000).

ZHANG F., TOEPFER S., KUHLMANN U., *Basic biology and small-scale rearing of Celatoria compressa(Diptera:Tachinidae), a parasitoid of Diabrotica virgifera virgifera* (Coleoptera:Chrysomelidae), Bull.Entomol.Ress.93(6),569–75 (2003).

WRIGHT R.J., WITKOWSKI J.E., ECHENKAMP G., GEORGIS R., *Efficacy and persistence of Steinernema carpocapsae applied through a center-pivot irrigation system against larval corn rootworm*, J. Econ. Entomol., 86, 1348-1354 (1993).

TĂLMACIU M., Georgescu T., *Importanța economică a carabidelor (Coleoptera-Carabidae) în combaterea biologică a dăunătorilor*, Ed. Ion Ionescu de la Brad, Iași, 134, (1998).

TÓTH F., TUSKA T., KISS J., *Effect of Theridion impressum (Aranae: Theridiidae) on the silk clipping of Diabrotica virgifera virgifera adults in hybrid seed corn in Hungary*, XXI IWGO Conference, VIII Diabrotica Subgroup Meeting, Legnaro-Padua-Venice-Italy, Oct.27., 89 (2001).

URACK ISVAN, A study of the spiders (Aracneidae:Araneae) in the upper basin of the Olt rivers, teză de doctorat, abstract , Cluj Napoca, 2005.