PROPOSALS OF TECHNOLOGICAL SEQUENCES IN THE INTEGRATED MANAGEMENT OF THE SPECIES DIABROTICA VIRGIFERA VIRGIFERA LE CONTE IN SIBIU COUNTY

PROPUNERI DE SECVENTE TEHNOLOGICE IN MANAGEMENTUL INTEGRAT AL SPECIEI DIABROTICA VIRGIFERA VIRGIFERA LE CONTE ÎN JUDEȚUL SIBIU

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Abstract: *Diabrotica virgifera virgifera is originary from U.S.A. and a pest for Europe from 1997. In Romania it was noticed for the first time in 1996 in the Nadlag-Arad area; in 1998 it has penetrated in the territory for 250 km. In Sibiu County the pest was noticed first in 2001. During 2001-2010 the coleopteron was monitoring by traps with sexual attractant pheromones. The monitoring was done in 54 collecting points having as its goal the knowledge of the spreading of the species in the county, establishing its density, the evaluation of the damages done in the stadium of an adult as well as in the stadium of a larva and the application of the most efficient measures of the integrated management.*

Key words: *Diabrotica virgifera, integrated management*

INTRODUCTION

In the agro ecosystems there is an accent on the protection of the biocoenosis, of the cultivated plants, against the pests, all having as a goal the stabilization of the crops, the security of the cultures and the profitableness of the agricultural exploitation (Mănescu & Ştefan, 2005). The prevention of the pest attack and mainly the control of their populations in the agro ecosystems is a complex, difficult and laborious action which requires a performing management comprising programs, coherent environment policies, organizing measures, rapid information in the territory, methods of immediate fight, warning and prognosis, monitoring

and last but not least the specialists in the protection of the plants that can make a performing management of the attacked culture. Among the pests of the agro ecosystems the insects play a major role in the biocoenosis invading larger and larger territories. This was the case of the western worm of the ground roots, *Diabrotica virgifera virgifera* Le Conte, which once penetrating our areas has extended very quickly, occupying larger territories. *Diabrotica virgifera virgifera* Le Conte belonging to *Coleopteron* order, *Chrysomelidae* family is a pest characteristic for the North America fauna, being noticed for the first time in Europe in July 1992, in corn field near the International Airport in Belgrade.

Since the noticing of its presence in Europe as well as in our country, the published materials emphasized the strong harmful potential of the species, drawing the attention of the scientific word and the farmers upon this factor of reducing the productions of corn cultures. The researches tried to clarify the main aspects regarding the biology and the ecologic factors which favor the development and mass multiplication and which made it a key pest of the corn culture.

The pest is considered in the U.S.A. as one of most important 4 pests of the corn culture. It is estimated that the losses done in this country by *Diabrotica virgifera virgifera* are comprised from 60 to 85 million USD/year. If to these there are added the costs for the control of the pest then the sum of the costs is over 100USD/year (Rosca, 1999). This is why this species was called "a milliard dollars insect" (Popov & coworkers, 2008).

Till now this coleopteron hasn't produced major damages in our country but there are great chances that in the following years, in the absence of prevention measures against the attack of this pest, *Diabrotica virgifera virgifera* to be the main pest of the corn in our country, too. (Roşca, 1999).

MATERIAL AND METHOD

The investigations took place during 2001 – 2010.

The agro ecosystem where the pest was monitoring was the corn.

For the evaluation of the efficiency of the measures of integrated management applied in Sibiu County there were established fix points of monitoring for the producers of seed corn and food corn. The number of fix

points was established function of the cultivate area with corn, so Sibiu County, in the research period were established 54 fix points of monitoring, from which we remind:Agnita, Apoldul de Jos, Arpaşul de Jos, Arpaşul de Sus, Avrig, Bazna, Bratei, Brădeni, Bruiu, Cârța, Cârțişoara, Chirpăr, Dârlos, Dealul Frumos, Dumbrăveni, Iacobeni, Laslea, Loamneş, Mediaş, Merghindeal, Micăsasa, Miercurea Sibiului, Movile, Noiştad, Nou Român, Ocna Sibiului, Porumbacul de Jos.
The first captures were registered in Sibiu County in 2001 the Miercurea Sibiului area (Antonie & coworkers, 2010).

The monitoring was done with the help of the traps with sexual attractant pheromone, which attract the males and accidentally the females. The traps were installed in the corn monocultures which occupied surfaces larger than 2 ha. The monitoring period was comprised from 15th June till 31st September, so a total of 15 weeks each year. The reading of the traps was done weekly, being registered the numbered of captured males. At an interval of a month the pheromones were changed.

There were collected a number of 2,565 adults;

The identification and the proposal of the most efficient technological sequences in the management of the studied species

RESULTS AND DISCUSSIONS

Sibiu County has a surface of 5432km^2 from which the total agricultural surface represents 305,351. From this surface only 115,973ha are arable soils. The surface cultivated in Sibiu County with seed corn and food corn is indicated in table 1.

Table 1

The cultivated surface in Sibiu County with food and seed corn during 2001 – 2010

The year	Total surface with corn, from which:	Food corn (ha)	Seed corn (ha)
2001	33.019	33.019	0
2002	33.152	33.152	0
2003	34.152	34.152	0
2004	34.422	34.422	0
2005	33.526	33.526	0
2006	31.365	31.365	0
2007	26595	26.585	10

2008	25.531	25.516	15
2009	24.966	24.854	112
2010	24.403	23.259	1144

1.THE MONITORING OF THE ADULTS OF *DIABROTICA VIRGIFERA VIRGIFERA* DURING 2001 – 2010 IN SIBIU COUNTY

Diabrotica virgifera virgifera appeared in Sibiu County in 2001, coming from west, at the border of Alba County where this species had been monitoring from previous years. The first collecting was done in the locality Miercurea Sibiului. During the researched period the numbers of monitoring points were up to 54.

The monitoring of the adults during 2001 – 2010 took place from the half of June, when the first adults emerge take place, till the end of September, using the pheromone traps "Atravirg". The installation of the traps were done mainly in the corn field, in points established by the Phyto Sanitary Unit in Sibiu (Table 2)

Table 2

The monitoring of the species *Diabrotica virgifera virgifera* during 2001 – 2010

Number	Locality/town	Monitoring point	Captured adults/year	The year	Total
1	Agnita	Agnita	72	2009	139
		After the vet dispensary	67	2010	
2	Apoldul de Jos	Apoldul de Jos	70	2003	147
		La şosea	41	2009	
		La şosea	36	2010	
3	Arpaşul de Jos	Arpaşul de Sus	3	2006	38
		Arpaşul de Jos	2	2004	
		Arpaşul de Jos	3	2006	
		Arpaşul de Jos	17	2007	
		Arpaşul de Sus	8	2007	
		Nou Român	5	2007	
4	Avrig	Bradu	13	2003	100
		Avrig	1	2002	
		Avrig	49	2003	
		La calea ferată	37	2010	
5	Bazna	Bazna	34	2004	34
6	Brădeni	Brădeni	0	2004	82
		Retiş	0	2006	
		Retiş	82	2007	
7	Brateiu	Brateiu	7	2003	68
		Lângă fermă	61	2009	
8	Bruiu	Bruiu	50	2006	176
		Şomartin	16	2006	
		Bruiu	65	2007	

		Şomartin	45	2007	
9	Cârța	La grajduri	15	2009	15
10	Cârțișoara	Cârțișoara	5	2007	5
11		Veseud	1	2006	
	Chirpăr	Vârd	47	2006	131
		Veseud	83	2007	
12	Cristian	Cristian	13	2003	13
13	Dârlos	Dârlos	21	2004	21
14		Dumbrăveni	0	2003	
	Dumbrăveni	Dumbrăveni	30	2004	61
		Către trei drumuri	31	2009	
15		Stejăriș	20	2003	
	Iacobeni	Netuș	0	2004	23
		Noiștat	0	2006	
		Movile	13	2007	
16	Laslea	La betoane	30	2009	30
17	Loamneș	Loamneș	128	2004	128
18	Mălăncrav	Lângă vale	49	2010	49
19	Mediaș	Noivis	61	2009	141
		Noivis	80	2010	
20		Dealul Frumos	3	2006	
	Merghindeal	Merghindeal	1	2006	65
		Merghindeal	61	2007	
21		Micăsasa	72	2001	
	Micăsasa	Micăsasa	73	2002	182
		Micăsasa	37	2003	
22		Miercurea Sibiului	129	2001	
	Miercurea Sibiului	Miercurea Sibiului	19	2002	200
		Apoldul de Sus	52	2003	
23	Mihăileni	Mihăileni	102	2004	102
24	Nocrich	Nocrich	0	2003	0
25		Ocna Sibiului	1	2004	
	Ocna Sibiului	După grădini	124	2009	169
		Lângă cartierul nou	4	2010	
		După grădini	40	2010	
26	Porumbacul de Jos	Scoreiu	0	2003	5
		Porumbacul de Jos	5	2004	
27		Şeica Mare	103	2003	
	Şeica Mare	Lângă sediu ISA Agro	29	2010	204
		Pe şes	72	2010	
28		Veştem	0	2001	
	Şelimbăr	Veştem	10	2002	61
		Veştem	51	2003	
29	Sibiu	Sibiu	1	2003	1
30	Slimnic	La grajduri	22	2010	22
31	Tălmaciu	Tălmaciu	0	2001	49
		Tălmaciu	41	2002	
					Table 2
		Tălmaciu	8	2003	
32	Țapu	Sub rozor	53	2009	53
33	Târnava	Târnava	36	2002	36
34	Topârcea	Dealul Luduşului	15	2009	15
	Total				2.565

Watching the data in table 1, it comes out that:

During 2001 – 2010 there were collected 2,565 adults. The biggest number of samples came from Miercurea Sibiu area – 200 samples.

The years 2009, 2010 are the years with the biggest number of captures.

During these years were monitoring 10 localities, the number of the captured adults being of 503 respectively 583 individuals.

On base of the monthly average variation of the air in Sibiu, during 2001-2009 and the sum of the precipitations was established that during 2007 – 2009 there were optimum conditions for the raising of the number of individuals of *Diabrotica virgifera virgifera.* We want to notify that the precipitations cumulated in excess quantities in 2007 and 2008 and slightly deficit in 2009, but on the background of previous satisfactory wetness and of a raise of temperature at the level of the entire year, there were favorable condition for a real explosion of the number of the adults of *Diabrotica virgifera virgifera* , from 384 as they were in 2007 to 503 in 2009 and respectively 583 in 2010.

The years with fewest captures were 2001 (202 adults), 2002 (180 adults) and 2006 (124 adults).

According to the monitoring plan for *Diabrotica virgifera virgifera* for the year 2008 Sibiu County was included among the infested counties, A zone, but the species wasn't monitoring that year.

2. PROPOSALS OF TECHNOLOGICAL SEQUENCES IN THE CONTROL OF THE SPECIES DIABROTICA VIRGIFERA VIRGIFERA LE CONTE IN SIBIU COUNTY

In these actions a very important role has the managerial actions which are referring to the preventing control of the pest insect, as follows

2.1 The prognosis

The prognosis on a long term: the prognosis of the apparition of the pest is based on the knowledge of the number of adults, eggs and larvae, on large surfaces, taking into consideration the density of the pest as well as the climate conditions and especially, the cultivation system existing in the area. It is very important to exist a system of monitoring of the pest and of cooperation from the interested farmers (Rosca, 1999)

Prognosis on short term (the warning): the monitoring of the pest is done watching or the adults or the larva.

For the adults, the corn fields must be monitoring little before the appearance of the silk, numbering the existent adults. In this respect there were **successfully used active biological substances** as sexual pheromones of synthesis, known as "the third generation of pesticide". So in the corn culture were installed pheromones traps Atravirg for monitoring the apparition and establishing the level of pest population.

For larva, the registration of the number is done during June in order to determine the number of larva/plant.

2.2 The directing of the agro technical methods for the pest control

The rotation of the cultures assures an excellent control because the eggs being laid almost exclusively in the corn cultures and the larva must find and feed on the corn roots in a short period of 3 days after hatching, this meaning that in the lack of this culture the larva die. Due to the large number of collected adults in 2009 (503 adults samples) and 2010 (583 adults samples) and taking into consideration the biologic reserve in these years there is forbidden the cultivation of corn in mono culture, so that in a period of 2 years consecutively on the field, the corn must be cultivated only once.

The soil works contributes to reducing the pest population by bringing to the air and dry zones of the eggs and larva and determining in this why a higher mortality.

Destroying the corn self sown.

The fertilization contributes to the development of the radicle system and the regeneration of the attacked one, so the pest can't produce so great losses.

The administration of nitrous fertilizers causes the death of the root corn worm.

The data of sowing influences the manifestation of the pest attack. The corn cultures that were sown earlier having a developed radicle system are attacked more than those sown later that presents a less developed radicle system. Reducing the available degree of the roots grows the mortality of the larva that hatch early.

The density of the plants. A big number of plants on a hectare favor the development of the pest but in the same time by lowering the pressure done by the pest upon on plant (lows the density larva/plant), grows the percentage of surviving plants.

Setting up the trap plots with corn sown belated. The pest, as an adult, after feeding with pollen or corn silk after its browning or after fecundation, can migrate. Most of the females (cca 90%) lay the eggs in the same field were they have fed and fecundated, but quite often, the females, after the browning of the corn silk migrate in large in the corn field with green silk where they continue their feeding and lay the eggs. After laying the eggs there come the destroying of the plot.

The installation in the culture of the pheromones traps Artavirg for monitoring the appearance and establishing the level of the population of the goal species.

2.3 The method of using the resistant and tolerant kinds and hybrids of corn. There is known the resistance phenomenon to the attack of this pest and there are cultivated hybrids or resisting lines, these referring to the abundance of the radicle system or to its capacity to recover. There are known as resisting ones a number of varieties (Haya Golden, Golden Republic, Midland yellow Dent, and so on), synthetic populations (Iowa Stick Stalk Synthetic, Pi-co Synthetic, and so on) or con sanguine lines (SD10, B69, Mo22, Ob05, B14, A231, W202, and so on).

2.4 Chemical methods. Referring to this method during the time there were two strategies of the pest control by application of insecticides for the larva control or for the adults (Popov & coworkers, 2008).

The first strategy watches the control of the pest mainly by the application of the insecticides in soil in the sowing moment or when is done the first weeding hoeing is done, as well as the treatment of the seeds for destroying the larva.

The second strategy is regarding the adult control by the application of the insecticides for reducing the number of adults and in the same time of laying the eggs that determines the diminution of the level of the population under the economic limit of harmfulness.

There is recommended to apply the granulated insecticides after sowing in the same time with fertilizing works.

Lately there were homologated by the National Committee of Homologation products for the control of the larva and adults of *Diabrotica virgifera virgifera* (Table 3).

The application of the chemical treatments against the adults is compulsory if there is reached the economic limit of harmfulness (PED) of 5-10 adults/plant in the case of food beans corn and 5 adults on a plant for the seed corn.

Table 3

Homologated products for the western worm of the corn root in the country

Stadium	Period	Recommended product for the protection of the plants		
		Active substance	Commercial product	
			Name	Doze l, kg/ha
Adult	In the phase of apparition of the panicle and the silk	Zeta cipermetrin 10%	Fury 10 CE	0,2 l/ha
		Clorpirifos 250 g/l	Pyrinex 25ME	1,5 l/ha
	In the mass flying period of the insects	Bifentrin 150 g/l	Seizer 10 EC	0,2 l/ha
Larva	At sowing, at a depth to 15 cm	Terbufos 5 %	Counter 5G	25 kg/ha

CONCLUSIONS

Diabrotica virgifera virgifera Le Conte has spread its area in Sibiu County;

Monitoring the adults during 2001 – 2010 was done during 15th June – 31st September, the maximum of captures being registered in July;

Monitoring was done in different areas for the seed corn, as follows: Bratei, Laslea, Mediaş, Topârcea and for feed corn: Agnita, Apoldul de Sus, Cârța, Dumbrăveni, Țapu; Ocna Sibiu in the biomass corn culture;

The factors that influenced the multiplying and spreading of the pest in Sibiu County are: large surfaces cultivated with corn, the mono culture of the corn, a quite large density of the plants.

This dangerous pest of the corn should be monitoring continuously in order of preventing, limiting its spreading and application of an efficient, integrated control;

The integrated control of the populations of *Diabrotica virgifera virgifera* Le Conte in Sibiu County can be done using the agro technical methods (the rotation of the cultures, establishing the moment of sowing,

harvesting in time and cultural hygiene, early cultivation of some trap strip, the cultivation of hybrids with well developed radicle system) as well as chemical methods both for larva and adults.

Adopting the efficient strategies that aim the control of the pest, as follows: the application of the insecticides in the soil at sowing, weeding hoeing and at the treatment of the seeds; the application of insecticides in order to reduce the number of adults; the application of the granulated insecticides in the same time with the fertilizing works; the chemical treatments become compulsory immediately as the density of the pest reaches the economic limit of harmfulness.

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