

THE RESULTS OF PHEROMONE MONITORING OF INVASIVE PEST *Diabrotica virgifera virgifera* LeConte IN TRANSCARPATHIAN REGION OF UKRAINE

Vasile VOINEAC¹, Dina ELISOVETCAIA¹, Diana Cristman¹,
Mihail BABIDORICI¹, Eugenia TULGARA²,

e-mail: vvoineac41@mail.ru

Abstract

The sex pheromone testing of maize pest - *Diabrotica virgifera* (8-methyl-2-decanilpropionate) synthesized in IGFP by Dr. hab KOVALIOV B. G. (2008) was carried out during the years 2008 - 2012 on maize plantations, Velyka Bakta village, Beregovo district, and Onokovtsy village, Uzhgorod district (Ukraine). The testing was subject to different doses in the sections of rubber tube (1, 2, 3 mg), and different forms of sticky traps ("Delta" type, "Cardboard tube", "Open-type" - pieces of laminated cardboard "Tetrapac" of different sizes). The most attractive dose of the pheromone was of 1 mg, which attracted on the average 2163 males on a trap during the flight (June 24, 2008 – October 03, 2008). While the doses with 2 and 3 mg have attracted 697 and 533 individuals respectively. The most attractive tested traps were "Open-type 44 cm x 29 cm", which attracted 70% of caught males. The attraction of males at traps was between 6 a.m. up to 6 p.m. hours, with a peak from 9 up to 12 a.m. Mass copulation takes place from 12 a.m. up to 4 p.m. and then occurs egg laying till 10 p.m.. Based on the obtained results, is proposed using of pheromone traps for monitoring and regulation the density population of *D. virgifera* by method of mass catching of male.

Key words: synthetic sex pheromones, *Diabrotica virgifera*, traps, invasive pest, maize

Maize is one of the most important grain crops for food industry and forage reserves. Annually, this crop occupies in the Republic of Moldova a considerable area and constitutes the 5th part of area of arable land. The appearance of one of the most harmful pest at maize crop in Romania, Ukraine, as neighboring countries of the Republic of Moldova, may create a great harm for the economy of Moldova.

Diabrotica virgifera virgifera Le Conte from *Coleoptera* order, called popularly western corn rootworm, with a complex biology; adults of the pest and larvae are oligophagous (in larval phase, besides maize, which gives the possibility to mass reproduction, the larvae may develop else on 22 species of plants from families (*Poaceae*, *Asteraceae*, *Fabaceae* și *Cucurbitaceae*) and needs the organization of precaution and control measures at both stages apart. *Diabrotica virgifera virgifera* Le Conte by origin is from American continent, where beginning from 40-s years (period of passing from rotation to maize monoculture), in a short period have been spread on the area of 24

states of USA (all area of cultivated lands of maize) and prejudices the annual damages of one milliard dollars. One of the cases of fast spread of pest in USA (from 20-25 km/year to 110-120 km/year) is an intensive application of organophosphorous products which provoked a fast formation of pest resistance and implementation of maize hybrids of a high productivity, absent of pest resistance (Berger, 1998; Babidorichi et al., 2005; Bultemeier B., Nicola La Porta, 2008; Hancu M. et al., 2002; Muresan Felicia, 2004; Trepashko L.I., et al., 2010).

Taking into consideration the abovementioned, we decided that for experience accumulation in regulation of this pest, it should be necessary to study the biological-ecological peculiarities of its development in a new invasion zone, as was the Transcarpathian Ukraine (on maize seedlings of one point of test basis of our institute).

¹ Institute of Genetics, Physiology and Plant Protection ASM, Chisinau

² National Food Safety Agency (NFSA), Chisinau

MATERIAL AND METHOD

On maize seedlings of Velyka Bakta village, Beregovo district, and Onokovtsy village, Uzhgorod district (Ukraine), during year 2008-2009 were carried out the tests of pheromone materials: sex pheromone of species *D. virgifera* (8-methyl-2-decanilpropionate) synthesized in IGFPP, in different doses of 1, 2 and 3 mg, in preparative form (sections of rubber tube – 1.5 cm); different forms of sticky traps (“Delta” type, “cardboard tube”, “Open-type” – pieces of laminated cardboard “Tetrapac” of different sizes). The tests of pheromone materials, as well as monitoring of adults and larvae was made according to methods confirmed and applied in study of the pest in different European countries (Babidorici M., et al., 2005; Voineac V., et al., 2008; Oleson J. D. et al., 2005).

RESULTS AND DISCUSSIONS

Testing of efficacy of synthetic sex pheromones in doses of 1, 2, 3 mg/dispenser during years 2008-2009, demonstrated that in 2008 on maize seedlings in Velyka Bakta village, Beregovo district were caught 3393 males, among which at traps with pheromone in dose of 1 mg were attracted 2163 (63.7%) males, with dose of 2 mg – 697 (20.5%) and with dose of 3 mg – 533 (15.7%) males. As we can see, the dose of

synthetic pheromone of 1 mg was the most attractive which was confirmed in the tests carried out in the following years. So, in year 2009 were caught 4021 males in locality V. Bakta and 4485 males in locality Onokovtsy, which on the average per one trap/week constitutes 11.3 – 178.7 and 12.7 – 207.7 males. As compared with year 2008, it increased at 4.5 times. In year 2010 the population density already increased significantly, so on seedlings of V. Bakta village were caught 6882 individuals of beetles, but in Onokovtsy village – 6650 individuals, which on the average constitutes 52.3-448 and 17.3-535.7 respectively of males/trap/week. The comparison of trap captures with dose of 1 mg and 3 mg demonstrated that in V. Bakta village at 1 mg were caught 6882 males, but at 3 mg – 6652 males, in Onokovtsy village – 6650 and 6694 males. The difference of efficacy between the doses constitutes 230 and 314 pieces. So, from economic point of view, the dose of 1 mg is more convenient.

In the tests where was studied the influence of form and size of traps to number of captures of beetle males, was demonstrated that the traps of Delta type have caught 72 (4.3%), open-type 24x31 cm – 294 (17.6%) and open-type 39x44 cm – 1032 (78.1%) from a number of caught individuals. The open-type trap tied around the body is the most attractive – 97.3%.

Table 1

Dynamics of male caught *Diabrotica virgifera virgifera* at pheromone traps, V. Bakta, Transcarpathian region, 2011.

Date of record	Pheromone dose of 1 mg					Pheromone dose of 3 mg					STE
	1	2	3	Amount	Average	1	2	3	Amount	Average	
27.06	Traps installation										1022,8
28.06	0	0	0	0		0	0	0			1036,1
29.06	0	0	0	0		0	0	0			1042,6
30.06	1	1	2	4	1,3	0	0	0			1054,4
04.07	6	4	6	16	5,3	2	3	4	9	3,0	1079,8
11.07	56	42	35	133	44,3	49	37	51	137	45,7	1168,8
18.07	196	231	238	665	221,7	147	164	187	498	166,0	1266,4
25.07	114	121	117	352	117,3	111	114	113	338	112,7	1341,8
01.08	266	254	67	587	195,7	658	526	189	1373	457,7	1405,0
08.08	214	196	222	632	210,7	243	276	257	776	258,7	1479,8
15.08	637	511	329	1477	492,3	301	154	378	833	277,7	1552,7
22.08	232	186	164	532	177,3	241	162	157	560	186,7	1630,7
29.08	126	259	287	672	224,0	217	497	588	1302	434,0	1737,9
05.09	56	185	147	388	129,3	98	112	119	329	109,7	1813,3
12.09	42	21	21	84	28,0	49	14	14	77	25,7	
19.09	14	21	28	63	21,0	7	21	14	42	14,0	
26.09	7	14	14	35	11,7	7	14	21	42	14,0	
Amount	1967	2046	1627	5640		2130	2094	2092	6316		



Figure 1 Attractive efficacy of pheromone traps, lodge of plants at larvae density 22-29 larvae/plant

Examination of dynamics of adult captures at pheromone traps during 24 hours demonstrated that during the mass flight the first captures were registered at 6 a.m. and then are increased till 12 a.m., with a peak between 8 a.m. and 12 a.m., then falls slowly at 6 p.m., in some days till 10 p.m. From 12 a.m. till 4 p.m. is registered an intensive coupling, but then begins egg laying till 10 p.m.

The beginning of flight of adults *Diabrotica virgifera* in this region of Ukraine depends on meteorological particularities of year, on accumulation of sum of positive temperature (table 1) and varies from June 22 (2012) till July 06 (2010), is prolonged till September 26-30 (2011). In Onokovtsy village the mass flight of adults begins in the second decade of July and lasts till the first decade of September. So, in 2011 the mass captures of males were from July 18 till September 05 with three peaks – on July 18, July 29 and September 05, when were caught 221.7 males; 492.3 and 224.0 on the average per trap. It explains that the population density of beetle on seedlings in monoculture, especially at proprietaries where the maize is seeded 3-5 years in succession on maize.

In year 2011 the mass flight of males in V. Bakta village is marked during the period July 19 – September 30, with three peaks – August 02 (545 males/trap, STE-980,5), August 16 (312 males/trap, STE-1168), September 13 (224 males/trap, STE-1376,5).

The study of report between the number of caught males demonstrates us that at population density when are caught on the average 2.0-52.3 males/trap/week at roots of a plant are 10.5-17.1 larvae, percentage of lodged plants reaches 10-20%. It is established that at number of larvae 16-22/plant, the root system is completely destroyed, except of lodge of plants impede the formation and development of ears.

CONCLUSIONS

Synthetic analogue of sex pheromone of the pest *Diabrotica virgifera virgifera* Le Conte may be recommended for study of season dynamics of development and spread of pest population in dose of 1 mg, in preparative form “rubber tube”.

The most effective form of sticky trap among examined constructions, is the “open-type” form of size 39 x 44 cm.

The flight of adults of invasive pest *Diabrotica virgifera virgifera* Le Conte, in Uzhgorod region (Ukraine) takes place from the second decade of June and till the end of September, with three peaks of mass flight.

The comparison between the number of beetles caught at trap in a week with the number of larvae/plant may be used as indices for PED determination.

ACKNOWLEDGMENTS

The authors express our gratitude to the staff of the “Ion Ionescu de la Brad” University of Agricultural Sciences and Veterinary Medicine, Iasi, Romania, for organizing the International Congress - *Soil and food, resources for a healthy life*, and to the reviewers that work together with the Editorial Board of the “Scientific Papers” Journal, Agronomy series.

REFERENCES

- Babidorici M.M., Omelyuta V.P., Filatova N.K., 2005, *Viyavlennya i viznachennya zahidnogo kukurudzyanogo juka diabrotika ta zahodi zahistu posiviv kukurudzi*. Uzhgorod. 28 p.
- Berger H.K., 1998, *Distribution of Diabrotica virgifera virgifera in Europe in 1997*. IWG O Newsletter, 18(1): 5-6.
- Voineac V., et al., 2008, *Viermele vestic al rădăcinelor de porumb Diabrotica virgifera virgifera* Le Conte. C h.: Î.M.CEP “Chișinău-Prim”, 24 p.
- Bultemeier B., Nicola La Porta, 2008, *Integrated Pest Management for Western Corn Rootworm (WCR)*

in Central and Eastern Europe (GTFS/RER/017/ITA). Roma, FAO. 58p.

Hancu M. et al., 2002, *Monitoring of the western corn rootworm (Diabrotica virgifera virgifera LeConte) in Timis county, from 1997 to 2002*. Plant Protection Society of Serbia, 9th IWGO Diabrotica Subgroup Meeting and 8th EPPO ad hoc Panel, Book of abstracts, Belgrade, p. 18.

Muresan Felicia, 2004, *The pests from maize crops, the asses met of losses and the possibilities of their*

control (Transylvania-Romania). 10 IWGO, 9 EPPO, Diabrotica Meeting, Engelberg, Switerland, p. 35.

Oleson J. D. et al., 2005, *Node-injury scale to evaluate root injury by corn rootworms (Coleoptera: Chrysomelidae)*. J. Econ. Entomol. 98 (1): 1-8.

Trepashko L.I., et al., 2010, *Western corn rootworm found in Belarus*. Plant protection and quarantine. 3(97): 17-18.