

THE OCCURRENCE DYNAMICS AND SEX RATIO OF *DIABROTICA VIRGIFERA VIRGIFERA* ADULTS ON DIFFERENT CORN HYBRIDS IN WESTERN ROMANIA

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Abstract

Species which are the subject of study for this paper is an invasive insect for corn in Europe and thus in Romania. It is a coleopteran insect from genus *Diabrotica*, respectively *Diabrotica virgifera virgifera* Le Conte, known as "western corn rootworm". Adults' species cause significant loss of production, especially during the appearance of silk and are active in the period from June to September. The objective of this study was to specify the occurrence dynamic of adults on different type of corn hybrids in order to establish the influence of these on development of insects. In addition, their sexual structure (sex-ratio) were specified. Studies were conducted in Timis county, locality Narau, in period of 2015-2016. Corn hybrids which were made observations have belonged to different maturity groups (FAO), such as follows: DKC 3811 (extra-early type), SY Respect and SY Zephyr (semi-early type) P8523, SY Arioso, SY Irridium (early type) and DKC 5276 (semi-late type). Each plot consisted of 16 rows of corn /hybrid having 4 repetitions. The adults were captured with pheromone traps (Csalomon® type). The observations revealed significant differences between those seven groups of corn hybrids. The most numerous individuals were quantified in lots of semi-early hybrid and semi-late type with average values of 120.22 respectively 283.00/trap. During the flight of adults, the greatest number was registered early August. Females predominated in all versions of hybrids, regardless of group maturity. Their percentage in the total number of captures stood from 63.7 to 86.5. Large presence of adults in the experimental plots was somehow associated with the appearance and maintenance of silk and pollen.

Key words: *Diabrotica virgifera*, adult, dynamic, sex-ratio, corn

Diabrotica virgifera virgifera LeConte (Coleoptera: Chrysomelidae: Galerucinae) is an invasive species affecting the corn crops in Europe (Sivcev I. *et al*, 1994). Coleopteran insects with other groups are prevalent in cereal crops (Zhekova E.D., 2102).

In Romania, for a long time, respectively 21 years, the species was considered during installation, subject to research and monitoring observations collectively or own of some specialists. Most of these observations have been mainly focused on the monitoring, biology, damage and control (Grozea I., 2003; Grozea I. *et al*, 2017).

Currently the insect is present in the Americas (North and Central) and European. Warns expansion scenarios species and other continents (Asian, Australian and African). Models made Yonow T. and Kriticos D.J. (2014) shows a development of the species in the south, in South Africa.

In their environment, *Diabrotica* adults are commonly observed on plants, flying, searching

for food, when copulation or when feeding. Most often they are observed during day light. Adults of *Diabrotica virgifera virgifera* Le Conte are active in the early morning after sunrise and before sunset tonight (Van Woerkom *et al*, 1980). And the flight can be identified and the plant or the soil.

European Commission recommendation 2006/565/ EC on programs containing the spread of the harmful organism *Diabrotica virgifera Le Conte* in Community areas where this pest is confirmed in some reports (Report MADR, 2009).

MATERIAL AND METHOD

The experimental fields that were made observations was defined/marked in a corn culture in the locality Nerau, Timis County. This village is located near the border with Serbia, with the coordinates 45° 58.1' Nord, 20° 33.5'.

The experimental field was divided into 28 plots which corresponded to a different hybrid of corn. These have belonged to different maturity groups (FAO), such as follows: DKC 3811 (extra-early type), SY Respect and SY Zephyr (semi-early

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type) P8523, SY Arioso, SY Irridium (early type) and DKC 5276 (semi-late type) (table 1). Main producer belonged Syngenta, Dekalb and DuPont Pioneer Companies.

Each plot consisted of 16 rows with a length of 10 m /hybrid (variant) having 4 repetition. Each variant were placed by 3 pheromone traps. The adults were captured with pheromone traps (Csalomon® type) having double attractiveness for both females and males (figure 1).

To determine sex ratios was made identify morphological of beetles collected from traps.

Main characteristics: Female: 4-6 mm, bloated body; 3 sheath brown yellow longitudinal stripes; sharp abdomen. Male: 4-5 mm, elongated body; brown elytra with the terminal part of yellow; rounded abdomen.

RESULTS AND DISCUSSIONS

The results of the experimental field observations (Nerau, Timis) showed that invasive species (*Diabrotica virgifera*) is still present in large numbers being significant differences between those seven type of corn hybrids.

The most numerous individuals registered in 2015 were quantified in lots of semi-early hybrid and semi-late type. The average values varied from 36.55 to 283.00 individuals/ $T_1+T_2+T_3$ (table 2). Maximum value was observed in hybrid DKC 5276 (type semi-late) with 321.0 individuals/ T_1 (figure 2). Minimum value was observed in SY ZEPHYR hybrid which is extra-early type.

In 2016 the average levels of the traps were lower compared to 2015. Average values recorded

on the three traps peaked at 109.73 individuals for the some hybrid DKC 5276 (type semi-late) (table 3). Maximum number (136.3 individuals) was observed throughout the trap T_1 and also variant with hybrid DKC 5276.

During the flight of adults the greatest number was registered late July and early August. Large presence of adults in the experimental plots was somehow associated with the appearance and maintenance of silk and pollen.

On all traps placed in the experimental field were present but both males and females.

The ratio of the females and males of *Diabrotica virgifera* in experimental variants with different hybrids of corn was about 2:1 (F:M) (figure 3). This ratio was observed in all plots concerns of seven hybrids under studies. Their percentage in the total number of captures stood from 63.7 to 86.5. The maximum values were 169.85 females on variant of DKC 5276 hybrids, followed at a distance than hybrids DKC 3811, P8523 and SY IRRIDIUM (68.23 /68.16 and 63.06 females).

One possible explanation for the predominance of females would be that they are cumbersome and fly shorter distances and always looking for a place to deposit eggs. Also females are caught more easily on glue due to increased abdominal that once caught in the trap off hard. Some of the males caught in glue were able to break away (figure 2).

Their reading was done weekly in the period from June to September.

Table 1

Types of hybrids used in the experimental group

No.	Hybrids	No. rows	Maturity groups	FAO	Producer
1	DKC 3811	16	extra-early	280	DEKALB
2	DKC 5276	16	semi-late	470	DEKALB
3	SY ZEPHYR	8	extra-early	390	Syngenta
4	SY IRRIDIUM	8	early	380	Syngenta
5	SY ARIOSO	16	early	300	Syngenta
6	P8523	16	early	270	DuPont Pioneer
7	SY RESPECT	16	extra-early	170	Syngenta



Figure 1 Methodological aspects: a) experimental plots (left); pheromone traps (Csalomon® type) (center); identification of sex-ratio/male and female of *Diabrotica virgifera* (right)

Table 2

Average number of individuals per traps (T_1 , T_2 , T_3) in variants with different corn hybrids

from experimental field, in 2015

No.	Hybrids	Maturity groups	Number of individuals per traps/R			Average /Variant
			T ₁	T ₂	T ₃	
1	DKC 3811	extra-early	142.0	98.6	120.0	120.22
2	DKC 5276	semi-late	321.0	229.0	299.0	283.00
3	SY ZEPHYR	extra-early	57.33	22.33	30.0	36.55
4	SY IRRIDIUM	early	109.33	70.0	67.66	82.33
5	SY ARIOSO	early	80.7	52.3	57	63.33
6	P8523	early	129.4	67.7	89.5	95.5
7	SY RESPECT	extra-early	70.6	24.7	41.2	45.5

T₁ T₂ T₃, pheromone traps (Csalomon® type)



Figure 2 Adults *Diabrotica* captures on traps in different hybrids of corn: beetles caught on pheromone trap (Csalomon® type) (left); males and females collected from a trap (center); beetles on detail (right)

Table 2

Average number of individuals per traps (T₁, T₂, T₃) in variants with different hybrids from experimental field, in 2016

No.	Hibridul	Maturity groups	Number of individuals per traps/R			Average /Variant
			T ₁	T ₂	T ₃	
1	DKC 3811	extra-early	99.5	69.0	91.2	86.57
2	DKC 5276	semi-late	136.3	88.5	104.4	109.73
3	SY ZEPHYR	extra-early	43.07	15.5	21.0	26.52
4	SY IRRIDIUM	early	65.5	75.6	46.6	62.56
5	SY ARIOSO	early	65.0	45.7	30.0	46.9
6	P8523	early	101.5	64.3	58.9	74.9
7	SY RESPECT	extra-early	50.0	43.2	31.5	41.56

T₁ T₂ T₃, pheromone traps (Csalomon® type)

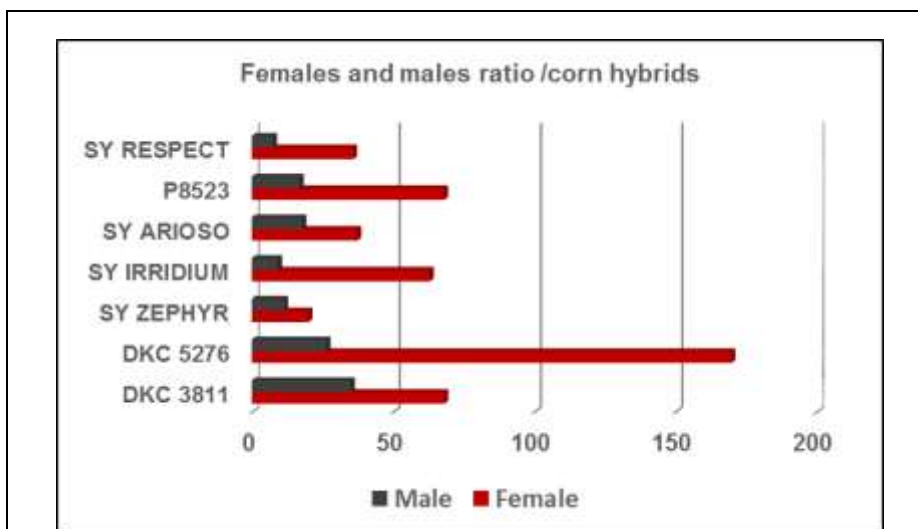


Figure 3 The ratio of the females and males of *Diabrotica virgifera* in experimental variants with different hybrids of corn

CONCLUSIONS

After 21 years since the first report, invasive species is present in the corn in our country. In the

west of Romania this is still a dangerous insects, especially in the adult because consume silks and pollen, essential organs in plant reproduction.

Diabrotica virgifera adults were present in all experimental variants, respectively in all seven hybrids. By far the hybrid DKC 5276 (type semi-late) evidenced by the large number of caught (average value of 283.00 individuals/all traps). Females were predominant on all corn hybrids without differentiating groups of maturity with ratio of 2:1 in against males.

Vegetation period in adults have excelled in maize was from July to August when most hybrids had silk and pollen present.

Year of 2015 was conducive for flight adults, as evidenced by the number markedly higher than in 2016. The reason is the higher temperatures with limited rainfall recorded during the flight peak of the adults. For comparison, in 2016 there have been numerous rain.

Presence of caught on each trap shows that these traps are highly efficient requiring only change to 3 weeks. Thus, we recommend these type of pheromone traps in monitoring *Diabrotica* adults.

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REFERENCES

- Grozea I., 2003.** *Cercetări privind biologia, ecologia și combaterea viermelui vestic al rădăcinilor de porumb (Diabrotica virgifera virgifera Le Conte) în condițiile Câmpiei de vest.* Teză de doctorat.
- Grozea I., Chis C., Carabet A., Varteiu A.M., Grozea A., Ștef R., Corcionivoschi N., 2017.** *Mathematical model to analyze the population changes of Diabrotica virgifera in terms of geographical coordinates and climatic factors.* Romanian Biotechnological Letters, 22 (3): 12630-12642.
- Raport MADR, 2009.** *Planul de monitorizare pentru organismul daunator Diabrotica virgifera Le conte (viermele vestic al rădăcinilor de porumb)* on-line (plan-de-monitorizare-diabrotica-virgifera.pdf).
- Sivcev I., Manojlovic, B., Krojajic, S., Dimic, N., Draganic, M., 1994.** *Rasprostranjenost i stetnost Diabrotica virgifera LeConte (Coleoptera: Chrysomelidae), nove stetocine kukuruza u Jugoslaviji,* Zastita bilja, 45 (1): 19-26.
- VanWoerkom G.J., Turpin F. T., Barrett J. R. Jr., 1980.** *Influence of constant and changing temperatures on locomotor activity of adult western corn rootworms (Diabrotica virgifera) in the laboratory.* Environmental Entomology, 9 (1): 32-34.
- Yonow T., Kriticos D.J., 2014.** *Diabrotica virgifera virgifera (Western Corn Rootworm).* Pest Geography, on-line (http://ageconsearch.umn.edu/bitstream/249750/2/Yonow).
- Zhekova E.D., 2012.** *Monitoring of the entomofauna in ecological crop rotation.* Banat's Journal of Biotechnology, III (6): 104, doi: 10.7904/2068 – 4738 – III(6):104-110.