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SEASONAL DYNAMICS OF THE *DIABROTICA VIRGIFERA VIRGIFERA* LECONTE (COLEOPTERA: CHRYSOMELIDAE) IN ZEMUN POLJE (SERBIA)

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ABSTRACT: The abundance of imagoes of the species *Diabrotica virgifera virgifera* Le Conte 1858 was monitored by the application of yellow sticky traps in a three-factorial trial with long-term continuous cropping of maize in Zemun Polje in 2004. The present study shows the dynamics of eclosion of this species during the July-October period and abundance of imagoes on the field in correlation with application of manure, application of NPK mineral fertilizers, and the amount of crop residues in the soil.

KEY WORDS: *Diabrotica virgifera virgifera*, imago, yellow traps, maize, continuous cropping

INTRODUCTION

The species *Diabrotica virgifera virgifera* Le Conte, 1858 originates from Central America, where it has been a serious maize pest since 1909, when it was first described by LeConte. It belongs to the genus *Diabrotica*, subfamily Galerucine, family Chrysomelidae, order Coleoptera. The range and harmfulness of the given species were limited to Mexico, the USA, and Canada until the 1990s, when it was introduced by chance to our country (BAČA, 1993, 1994). Soon after its introduction, the insect successfully adapted and spread into neighboring countries (SIVČEV *et al.*, 1994; ČAMPRAG AND BAČA, 1995). It has also been introduced in the majority of other European countries (FURLAN *et al.*, 1998; BERTOSSA *et al.*, 2002; REYNAUD, 2002; RUŽIČKA, 2002; LAMMERS *et al.*, 2004; CHEEK *et al.*, 2004). The average rate of range extension amounted to 20-25 km year $^{-1}$ in Serbia.

The imago is a poliphage that feeds on maize leaves before flowering, then on pollen, silk, and kernels at the top of the ear in the milk stage. When there is no more fresh silk in maize, it

migrates and feeds on pollen of other plants, including ones of the families *Poacae*, *Compositae*, *Leguminosae,* and *Cucurbitacae.* Losses caused by feeding imagoes are usually not of economic importance. However, the damage caused by larvae – which feed on maize roots, where females deposit eggs and cause plant lodging – is of economic importance. This species reaches an economically important level only in the case of maize in continuous cropping. A visually determined number of imagoes greater than one per plant is considered to lay eggs at an economically damaging level for the next year.

MATERIAL AND METHODS

A long-term maize continuous cropping trial has been carried out for some time in Zemun Polje. Weather conditions during the summer of 2004 were as follows: the precipitation sum of 66.4 mm in July was at the level of the long-term mean, while the sum of 39.4 mm in August was far below the long-term mean of 50.8 mm; mean daily air temperatures for both months were a bit above the long-term mean. Precipitation deficiency and high temperature during August resulted in soil drying, and faster silk maturing, which caused earlier migration, shortening of imago life, and earlier ending of eclosion.

A three-factorial trial with 54 variants encompassing three combinations of manure, six rates of NPK mineral fertilizers, and three methods of crop residue utilization was established in 1972.

Pherocon AM yellow sticky traps were set up in 12 selected variants. They were selected because the color of the traps attracts the imagoes. Reading was done twice a week during the whole period of abundance monitoring, i.e., a total of 18 readings were performed.

Table 1. Twelve selected variants with different ratios of manure, mineral fertilizers, and crop residues.

Variants	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
Manure - M	0*	0	2*	2	0	2	0	2	0	2	0	2
NPK – MF	0	0	0	0	1+U*	1+U	1	1	1+U	1+U	2+U	2+U
Crop residues-CR	0	1	0	1	0	0	1	1	1	1	1	1

Manure (M):
M (0*) – without manure,
M (2*) – 60 000 kg ha^{-1} of manure added every third year.

Mineral fertilizers (MF):
MF (0) – without added mineral substances,
MF (1) = 332 kg ha^{-1} NPK; 135 kg ha^{-1} , 123 kg ha^{-1} P_2O_5, 74 kg ha^{-1} K_2O,
MF (1+U*) = 332 kg ha^{-1} NPK, 135 kg ha^{-1} N, 123 kg ha^{-1} P_2O_5, 74 kg ha^{-1} , K_2O + 96 kg ha^{-1} of UREA,
MF (2+U*) = 664 kg ha^{-1} NPK, 27 kg ha^{-1} N, 246 kg ha^{-1} P_2O_5, 148 kg ha^{-1} K_2O + 96 kg ha^{-1} of UREA.
U* – urea

Crop residues (CR):
CR (0) – complete removal of crop residues,
CR (1) – removal of 1/2 of crop residues,

V1 = M - 0, MF - 0, CR – 0,
V2 = M – 0, MF – 0, CR – 1,
V3 = M – 2, MF – 0, CR – 0,
V4 = M – 2, MF – 0, CR – 1,
V5 = M – 0, MF - 1+U, CR – 0,
V6 = M – 2, MF - 1+U, CR – 0,
V7 = M – 0, MF – 1, CR – 1,
V8 = M – 2, MF – 1, CR – 1,
V9 = M – 0, MF - 1+U, CR – 1,
V10 = M – 2, MF - 1+U, CR – 1,
V11 = M – 0, MF - 2+U, CR – 1,
V12 = M – 2, MF - 2+U, CR – 1.

Abundance was monitored in the period from July 7, just after the beginning of eclosion, to September 10, 2004. The number of trapped imagoes was registered twice a week, while traps were replaced once in two weeks.

RESULTS AND DISCUSSION

The first increase in the number of imagoes was recorded on July 13, which coincides with the beginning of the oviposition period under the conditions of Zemun Polje (Fig. 1). The highest number of imagoes (231 individuals in all 12 variants) was recorded in the period of mass oviposition (BAČA *et al.*, 1995), i.e., from July 30 to August 12. August 6 was the day with the maximum number of recorded trapped imagoes (76). After this period, the number of imagoes was significantly lower, which can be attributed to their migration to neighboring fields for additional feeding. Not a single imago was registered in traps in the period from August 27 to September 10. Figure 1 shows the change in abundance of western corn root worm imago over the monitored period.

The number of trapped imagoes depended on the variant in which the trap was placed. The

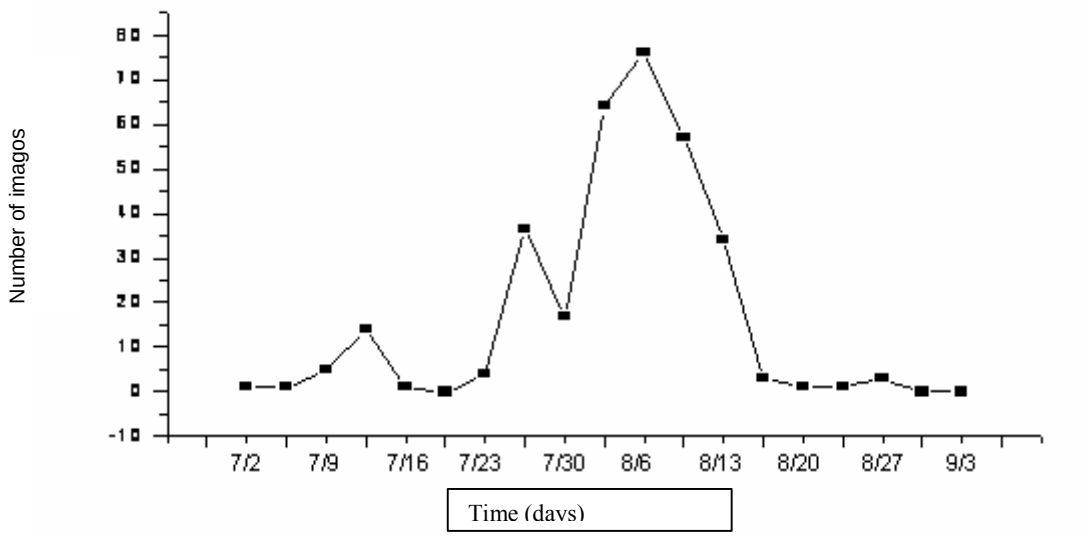

Fig. 1. Imago population dynamics in the period from July 7 to September 10, 2004.

highest number of trapped imagoes was recorded in variant V11 (M – 0, MF - 2+U, CR – 1), which had the greatest quantity of mineral fertilizers and 50% of crop residues plowed down. On the other hand, the lowest number of trapped imagoes was recorded in variant V1, which had no manure, no crop residues and no mineral fertilizers. A somewhat higher number of imagoes was detected in the variants V8 (M – 2, MF – 1, CR – 1) and V12 (M – 2, MF - 2+U, CR – 1) with 50% of crop residues, maximum amounts of manure, and application of mineral fertilizers. The obtained results indicate that conditions favoring maize also favor this species feeding on maize.

Table 2. Number of imagoes in relation to the time of monitoring and conditions of nutrition.

Monitoring interval	Variants												
	V 1	V 2	V 3	V 4	V 5	V 6	V 7	V 8	V 9	V 10	V 11	V 12	Sum
2 .07-15. 07	0	3	0	0	3	5	5	1	1	0	1	2	21
16. 07-29. 07	2	2	3	5	2	2	3	13	3	7	5	10	57
30.07- 12. 08	6	6	5	10	24	27	27	30	9	10	44	33	231
13. 08-26. 08	0	0	1	0	0	0	1	3	0	1	2	0	8
27. 08-10. 09	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	8	11	9	15	29	34	36	47	13	18	52	45	317

It can seen from Table 2 that size of the population of western corn root worm imagoes depends on the amounts of nutrients administered to the soil, while the abundance dynamics depends on weather conditions. Unfavorable weather conditions (precipitation deficiency and high temperatures during August, soil drying, and faster silk maturing) in 2004 caused faster and earlier migration of imagos, which further resulted in an earlier drop of abundance (recorded already in August).

Monitoring of the flight dynamics and abundance of imagoes has been performed in Zemun Polje since 1997 (BAČA *et al.*, 2002). Results obtained using yellow traps are in accordance with results gained in previous years. During the investigation, the total number of imagoes registered on the yellow traps amounted to as many as 1512 in 1999, while their abundance decreased significantly thereafter and amounted to only 16 in 2001. The total number of imagoes caught on yellow traps in the study carried out in 2004 was 317, which supports the opinion as to a general decrease of attack intensity.

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СЕЗОНСКА ДИНАМИКА *DIABROTICA VIRGIFERA VIRGIFERA* LECONTE (COLEOPTERA: CHRYSOMELIDAE) У ЗЕМУН ПОЉУ (СРБИЈА)

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Врста *Diabrotica virgifera virgifera* LeConte, олигофагна штеточина, доспела је на наше просторе случајном интродукцијом деведесетих година прошлог века. За ову врсту својствено је да формира економски ниво популације само у монокултури кукуруза. Оглед у којем је праћена бројност кукурузне златице је трофакторијелни заснован на експерименталној парцели Института за кукуруз у Земун Пољу 1972. године. Обухватао је 54 варијанте, шест комбинација минералних ђубрива, три начина поступања са жетвеним остацима и три дозе примене стајњака. Одабрано је 12 варијанти, праћена је бројност имага на жутим лепљивим клопкама марке Pherocon AM.

Прва појава имага у нашим условима почиње крајем јуна, пораст бројности догађа се у јулу, максимум у јулу и августу месецу.

Бројност популације анализирана је по варијантама на основу времена праћења и повољности временских услова за гајење кукуруза. Током тромесечног периода (јули, август, септембатр 2004.) укупно је ухваћено 317 јединки, бројност се кретала од нуле на почетку јула до максималних 76, регистрованих 6. августа. Након овог периода бројност се знатно смањила и од почетка септембра није више регистрован ни једаан примерак. Пад бројности у другој половини августа може се тумачити миграцијом јединки на суседна поља са свежом свилом или поленом у циљу допунске исхране. По варијантама огледа износила је од свега осам у варијанти са најмање хранива, до 52, у варијанти са највише хранива.

Можемо констатовати да је недостатак влаге у августу условио брже сазревање свиле, сушење земљишта, масовнију миграцију и скраћење дужине живота имага, што се одразило на пад бројности и мањег броја положених јаја, што се потврдило у 2005. години.

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