

**FLIGHT DYNAMICS OF THE SPECIES
Diabrotica virgifera virgifera Le Conte IN MAIZE CROPS
IN CENTRAL MOLDOVA, IN THE PERIOD 2021-2023**

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Abstract

The species Diabrotica virgifera virgifera Le Conte is known as a dangerous pest of maize. The insect was monitored at ARDS Secuieni in the period 2021-2023, with the help of yellow traps with glue, but also pheromonal ones placed in maize crops. During the three years of monitoring, the presence of this species was observed in the maize crops in the Central area of Moldova, totaling an average number of 663 specimens. The flight of the species started in the first decade of July in all monitored years, and continued until the end of September in 2021 and 2022, respectively until the first decade of October in 2023. The maximum flight peak of was different each year, registering in the third decade of July in 2021, in the first decade of August in 2022 and in the third decade of August in 2023. On average, the flight of the species started in the first decade of July and continued throughout the maize vegetation period, the maximum flight peak being recorded in the first decade of August.

Key words: *Diabrotica, flight, maize, pest, traps.*

INTRODUCTION

The species *Diabrotica virgifera virgifera* Le Conte (corn rootworm) belongs to the order Coleoptera, family Chrysomelidae. It originates from North America and entered in Europe in 1992, in Yugoslavia. It entered in Romania in 1996, when three specimens were recorded in Nădlac (Arad county), and since then the range of the pest has continuously expanded.

By 2011, the pest was already reported in 22 countries in Europe. The speed of spread is approximately 25-50 km/year, but with the help of the wind it can move up to 300 km/year (Bacal, 2020).

Between 1997 and 2009, pheromonal traps were installed at A.R.D.S. Secuieni to monitor the appearance of the pest in maize crops in the Central area of Moldova, but it was not reported during this period. The pest was identified in maize crops in the Central area of Moldova starting in 2015, the flight intensifying from one year to the next (Trotuș et al., 2020).

Therefore, the western corn rootworm (*Diabrotica virgifera virgifera* Le Conte) is

present almost all over the country. Until recently, it was considered that this pest was found in the western half of the country, significant damage being reported in the west and northwest of the country. In the meantime, the range of this species has expanded, step by step, towards the east, currently also being found in the large maize-producing areas, such as those in the south-east of Romania (Georgescu, 2020). After many years of investigation in the natural habitat of North America, it seems that the species, in addition to the chemical attraction it has to the volatile substances emitted by maize, is also influenced by the relative humidity existing in the field. Dry conditions are not favorable for larval or adult feeding and development (Manole, 2017).

Also, the growth of *Diabrotica virgifera virgifera* populations is greatly favored by the practice of monoculture. The most important method of keeping this pest under control is crop rotation. It is recommended that maize return to the same soil after four years (Cotuna, 2020)

The insect attacks both in the larval and adult stages. Larval feeding reduces the ability of

plants to absorb water and nutrients by disrupting the structure and function of the root system, leading to significant yield losses (Ferracini, 2021).

The adults feed on leaves, silk, pollen, but also on the grains from the top of the cobs which are in the milk phase. They generally occur from July to mid-September, with peak flight from late July to August (Toth, 2020). Adults can be observed during the day, being more active in the morning after sunrise and in the evening before sunset (Horgoş, 2017).

Adult males begin to emerge before females, and the cumulative male emergence peak occurs earlier than the female cumulative emergence peak. The time of emergence of adults can be different due to several factors: late sowing of maize, presence of weeds that can serve as host plants for adults, lower soil temperatures (Meinke, 2009).

The preferred plant is maize, but it can also feed on other species in the *Poaceae*, *Asteraceae*, *Fabaceae* and *Curcubitaceae* families. When they can no longer find pollen or fresh silk, the adults fly to crops sown later. The maximum flight of adults usually occurs during the flowering period of maize (Tălmăciu, 2017).

Before flowering, adults are found on maize leaves, and during flowering they are found on maize panicles, cobs, and silk. After the flowering period, the adults are found in the axils of the leaves, where is collected the pollen they consume (Cotuna, 2020).

The present paper presents results regarding the flight of the species *Diabrotica virgifera virgifera* Le Conte in the period 2021-2023, in the conditions of the Central area of Moldova.

MATERIALS AND METHODS

Starting from 1997, at A.R.D.S. Secuieni - Neamţ, the appearance of the pest in maize crops was monitored, with the help of pheromonal traps, from the "Raluca Rîpan" Chemistry Institute in Cluj-Napoca. Since 2018, the flight has also been tracked using yellow glue traps (Figure 1).

The experiences were located in the experimental field of the Plant Protection Laboratory, on a typical cambic chernozem type soil, with a pH in water of 6.29, a humus content of 2.3, a nitrogen index of 2.1, contained in mobile P₂O₅ 39 ppm, and in K₂O 161 ppm.

Soil work, fertilization, seedbed preparation and crop maintenance were carried out according to the maize cultivation technology for the specific conditions in Central Moldova (Trotuş et al., 2020).



Figure 1. Yellow glue trap and pheromonal trap placed in the maize field

Maize was sown in the second decade of April in the year 2021 and 2022 and emerged in the first decade of May. In the year 2023, due to the weather conditions, namely the fall of the snow cover at the beginning of April, which made it difficult to prepare the seed bed, the sowing was done in the first decade of May, and the plants emerged in the second decade of May. The hybrid used was Turda Star.

The traps were installed in the experimental maize field of the Plant Protection laboratory, starting in June. Readings were taken decadally, recording the total number of adults captured on each trap. The pheromone change in the pheromone traps was performed monthly, and the yellow glue traps were replaced decadally or whenever necessary, if they were clogged with other species, dust or plant debris.

Based on the readings, were determined the emergence, evolution and end of the flight of *Diabrotica virgifera virgifera* adults, as well as the flight curve and its maximum peak.

With regard to the temperatures recorded during the maize growing season, in 2021 there were monthly deviations from the multi-year average between -2.0°C (April) and 1.8°C (July). The spring was cool and the summer months were normal (June and August) and hot (July). In 2022, the maize growing season was warm, with monthly deviations from the multi-year average ranging from 0°C (April) to 3.2°C (August). In

the year 2023, there were deviations between -1.4°C (April) and 3.9°C (October) (Figure 2). In terms of precipitation during the maize growing season, in 2021 there were monthly deviations from the multi-annual monthly amount between -36.5 mm (September) and 16.6 mm (August). The maize growing season in 2022 was characterized as dry.

The recorded precipitation had deviations from the multiannual average between -47.1 mm (July) and -8.5 mm (April). The precipitation that fell in 2023 characterized the maize growing season as dry. Deviations between -55.2 mm (July) and 22 mm (April) were recorded (Figure 3).

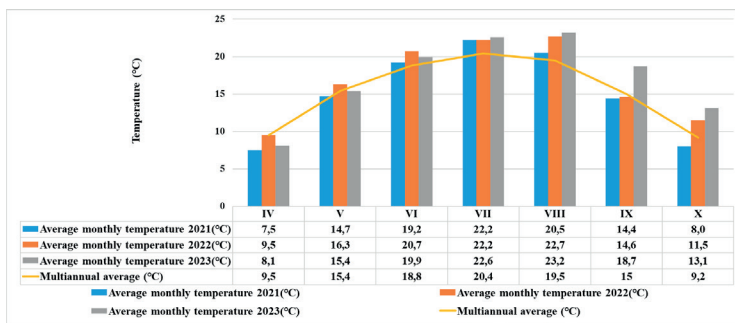


Figure 2. Temperatures recorded during the maize growing season in the period 2021-2023

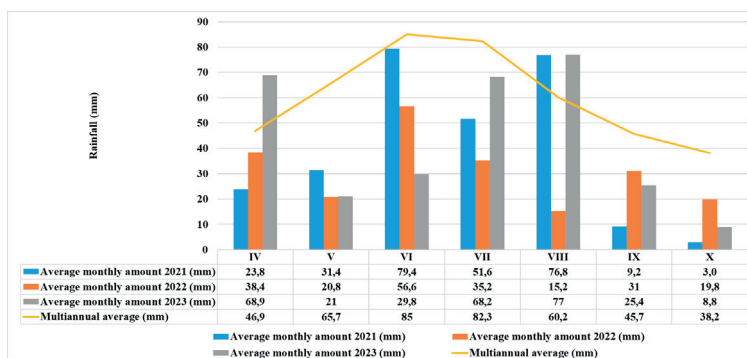


Figure 3. Precipitation recorded during the maize growing season in the period 2021-2023

Meteorological data comes from the unit's own weather station, located in the experimental field, this being automated with data recording and storage in the computer.

RESULTS AND DISCUSSIONS

Following the observations and determinations made in the period 2021-2023, both in the yellow glue traps and in the pheromonal ones, it was found that the average number of adults collected was 663.

The highest number of adults collected was recorded in 2021, being 810 specimens, and the lowest number was recorded in 2023, being 569 specimens (Table 1).

Table 1. Average number of adults collected using traps

Date of collection		Average number of specimens collected per traps			Average 2021- 2023
Month	Decade	2021	2022	2023	
July	I	2	42	12	19
	II	66	81	43	63
	III	180	48	64	97
August	I	135	182	64	127
	II	118	94	54	89
	III	120	87	135	114
September	I	99	44	89	77
	II	43	26	64	44
	III	47	6	35	29
October	I	-	-	9	9
Total collected		810	610	569	663

Based on the readings, the flight curve and the maximum flight peak of the species *Diabrotica virgifera virgifera* Le Conte were established, so that:

In 2021, the flight of the species began in the first decade of July, when 2 adults were captured, and continued without interruption until the end of September. The maximum flight peak was recorded in the third decade of July, with 180 specimens/trap being captured. After recording the maximum peak, the flight began to decline (Figure 4).

In 2022, the beginning of the flight of the species was recorded in the first decade of July, collecting an average number of 42 specimens/trap, and continued until the third decade of September, when the maize was harvested. This year, the maximum flight peak was recorded in the first decade of August, when an average number of 182 specimens/trap was captured, then the number of adults per trap was reduced to 6 specimens at the last reading (Figure 5).

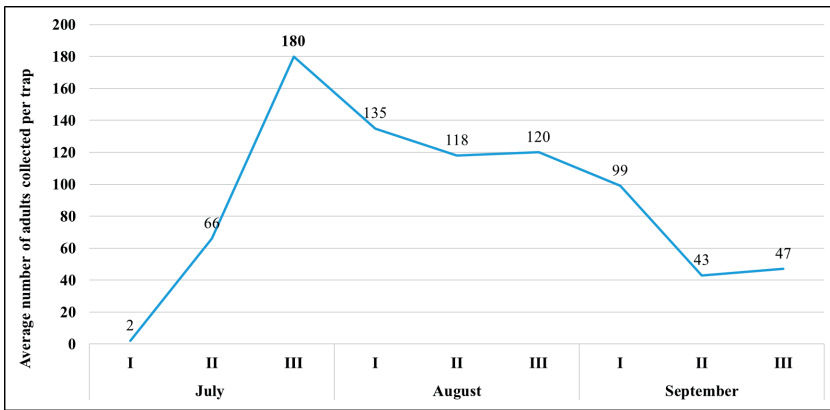


Figure 4. Flight curve of the species *Diabrotica virgifera virgifera* Le Conte in 2021

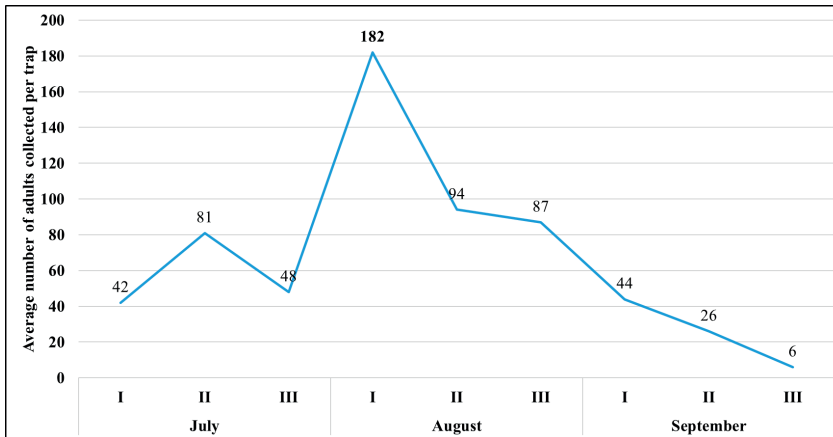


Figure 5. Flight curve of the species *Diabrotica virgifera virgifera* Le Conte in 2022

In the third year of monitoring, the year 2023, the flight of *Diabrotica virgifera virgifera* adults was recorded starting from the first decade of July, when 12 specimens were captured, and continued without interruption until the first

decade of October, when were captured 9 specimens per trap. The maximum flight peak of the species was recorded in the third decade of August, being 135 specimens/trap (Figure 6).

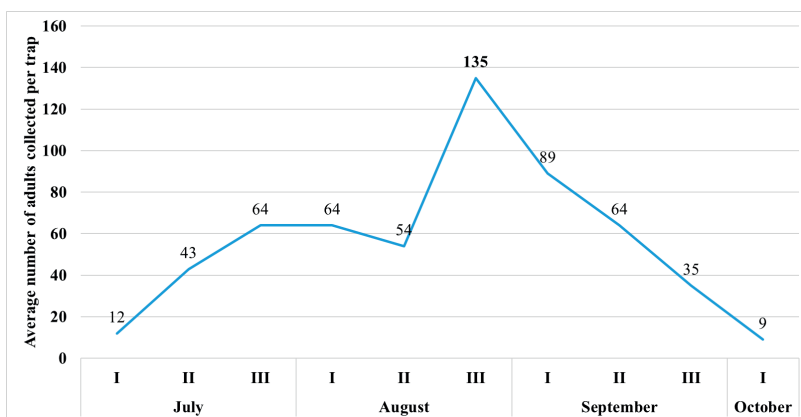


Figure 6. Flight curve of the species *Diabrotica virgifera virgifera* Le Conte in 2023

On average over the three years of monitoring, 2021-2023, the flight of the species *Diabrotica virgifera virgifera* Le Conte began in the first decade of July and continued throughout the

maize growing season. The maximum flight peak was recorded in the first decade of August, when an average number of 127 specimens/trap was totalled (Figure 7).

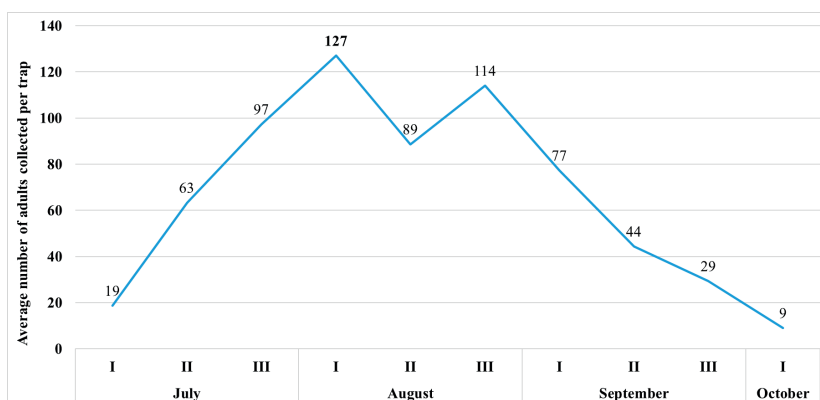


Figure 7. Average flight curve of the species *Diabrotica virgifera virgifera* Le Conte in the period 2021-2023

Following the results obtained at A.R.D.S. Turda, Malschi et al. (2013) stated that the flight of *Diabrotica virgifera virgifera* adults starts from the third decade of June, the maximum flight peak being recorded in the third decade of July and the beginning of August, after which the adults are found in the culture until September-October, but in smaller numbers. The results obtained by Horgoş (2018) in the western part of the country, show that the appearance of adults in maize crops is registered at the beginning of July and they are active until the beginning of October. Most adults registered from July to August, from September their

number began to decrease. Similar results were obtained at A.R.D.S. Secuieni following the observations made during the three years of monitoring.

Pop (2018) conducted research on the pest *Diabrotica virgifera virgifera* in the north-west part of the country, in two localities, and observed that the adult stage appeared at the end of June (Carei), respectively in the first decade of July (Livada). This stage lasted until October. And at A.R.D.S. Secuieni, the emergence of adults and the duration of the adult stage were similar.

CONCLUSIONS

The species *Diabrotica virgifera virgifera* Le Conte (western corn rootworm) is considered to be one of the most important pests of maize, causing significant damage to the crop.

The species attacks both in the larval and adult stages, with the larvae doing the most damage.

The pest has been identified in the maize crops of A.R.D.S. Secuieni since 2015.

Between 2021 and 2023, an average of 663 specimens were collected, the highest number being collected in 2021, 810 specimens, and the lowest number collected in 2023, being 569 specimens.

In all monitoring years, the flight of the species *Diabrotica virgifera virgifera* Le Conte began in the first decade of July and continued without interruption throughout the maize growing season.

The maximum flight peak of the species was different from year to year, as follows: in 2021 it was recorded in the third decade of July; in 2022 it was registered in the first decade of August, and in 2023 it was registered in the third decade of August.

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