

PRELIMINARY RESULTS REGARDING THE ATTACK PRODUCED BY THE SPECIES *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE ON MAIZE, DEPENDING ON THE CHEMICAL TREATMENT APPLIED TO THE SOIL, IN THE CONDITIONS OF CENTRAL MOLDOVA

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Abstract

The species *Diabrotica virgifera virgifera* Le Conte (western 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 (Manole, 2017). To reduce the spread of this pest, it is recommended to avoid monoculture and practice rotation. It can reduce the root attack to a minimum level, the larvae not being able to survive in soils cultivated with other plants (Ciobanu, 2009). The most common strategies used to protect maize roots against the pest *Diabrotica virgifera virgifera* are the application of an insecticide to the soil at seeding and the use of an insecticide in the seed treatment (Sutter et al., 1990). The average number of larvae per plant varied from 1 to 5, the fewest larvae being recorded in the variant where the granular insecticide Force G was applied to the soil at a dose of 15 kg/ha. The frequency of swan neck ranged from 0% to 58%. The attack produced by adults on the leaf recorded frequencies between 32% and 66%, and on maize silk, the attack was 100%. The average number of adults per plant was between 9 and 10.

Key words: maize, soil treatment, larvae, *Diabrotica*, attack

The species *Diabrotica virgifera virgifera* Le Conte (western 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 (Manole T., 2017). 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 S. et al, 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. 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 E. et al, 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 C. et al, 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.

It was observed that large areas cultivated with maize in monoculture for several years in a row contributed to the huge multiplication and spread of the species *Diabrotica virgifera virgifera* Le Conte.

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In the last few years, the use of maize seeds treated with neonicotinoid insecticides has been banned in several European countries, for this reason insecticides applied to the soil are increasingly being used (Blandino M. *et al*, 2017).

In the present work, preliminary results are presented regarding the reduction of the attack of the species *Diabrotica virgifera virgifera* Le Conte in the year 2023, in the conditions of the Central area of Moldova, through the chemical treatment applied to the soil.

MATERIAL AND METHOD

In the spring of 2023, a maize experience was placed in the experimental field of the Plant Protection laboratory within A.R.D.S. Secuieni, consisting in a number of four variants, placed according to the method of randomized blocks, in three repetitions, where was followed the influence of the applied chemical treatment on the soil on reducing the attack produced by the species *Diabrotica virgifera virgifera* Le Conte.

In parallel, was also monitored the influence of insecticides on the attack produced by *Tanymecus dilaticollis*.

The Agricultural Research - Development Station Secuieni is located in the SE part of Neamț county, being located on the geographical coordinates of 26051'00" east longitude and 46051'15" north latitude. The placement of the experience was carried out on a typical cambic phaeosium type soil, with pH in water 6.29, nitrogen index 2.1, mobile P2O5 39 ppm, mobile K2O 161 ppm.

The predecessor plant was maize. Soil work, fertilization, seedbed preparation and crop maintenance were carried out according to the maize cultivation technology for the specific conditions in Central Moldova (Trotuș E. *et al*, 2020).

Sowing was done on 05.05.2023, the hybrid used was Turda Star. The emergence of the plants was recorded on 22.05.2023.

Were tested three granular products with insecticidal action, applied to the soil at the same time as sowing: Force G (tefluthrin 15 g/kg) – 15 kg/ha, Picador (cypermethrin 1.6 g/kg) – 12 kg/ha and Trika expert (lambda cyhalothrin 4 g/kg) – 15 kg/ha. The area of each experimental variant was 22.4 square meters.

To determine the attack produced by the *Tanymecus dilaticollis* species, were made observations on 25 plants, in three repetitions, giving marks on a scale of 0-6. Based on the marks given, the frequency, intensity and degree of attack was established. Pest density was determined using the 25/25 frame.

To identify the larvae of *Diabrotica virgifera virgifera* in the soil, were made determinations consisting of the analysis of 10 maize plants in

three repetitions and the counting of the larvae on the root.

To determine the attack of adults of *Diabrotica virgifera virgifera* on leaves and silk, were made observations on 25 plants, in three repetitions, and was determined the frequency of attack. The determination of the number of adults per plant was achieved by visual assessment of 25 plants in three repetitions.

The experimental data obtained were analyzed by appropriate statistical methods using the difference test (DL) (DL < 0.01 % – ***/OOO – highly significant positive/highly significant negative; DL < 1% – **/ – ** / OO – distinctly significant positive/distinctly significant negative; DL < 5 % – */ – */O – significant positive/significant negative).

Climatic conditions: The temperatures recorded during the maize vegetation period characterized it as warm.

As for spring, the month of March was characterized by high average temperatures, the deviation being 3.2°C above the multiannual average of 2.8°C. The average temperature in April (8.1°C) was below the multiannual average (9.5°C), the month being characterized as cool. At the beginning of April, there was snow and blizzard. And the first decade of May was cooler, the other decades being close to the multi-year average. These conditions delayed the sowing of maize which was carried out in early May, with the plants emerging in the second half of May (figure 1). The summer months are hot (June) and very hot (July and August) with average monthly temperatures between 1°C and 3.5°C above the multiannual average.

In terms of precipitation, the monthly deviations from the multiannual amount were between -54.9 mm (June) and 24 mm (April). An atypical phenomenon recorded in April was the layer of snow that fell in the first decade, which made it difficult to prepare the land for sowing and sowing, the moment being shifted to the beginning of May. The precipitation in April, in the form of snow and rain, exceeded the multiannual average by 24 mm, thus reducing the water deficit. The last spring month, May, was dry, recording 21 mm of the 64.3 mm, the highest amount of precipitation being recorded in the first decade of the month. The month of June was very dry, the deviation from the multiannual amount being -54.9 mm. The month of July was characterized as being less dry, the deviation being -12.4 mm, and the storms recorded highlighted the attack produced by the larvae of the species *Diabrotica virgifera virgifera* (swan neck symptom). The precipitation that fell at the beginning and end of August led to the reduction of the water deficit, the monthly amount of precipitation (77 mm) exceeding the multiannual average by 19 mm (Figure 2).

Meteorological data comes from the unit's own VANTAGE PRO 2 weather station located in

the experimental field, the station being automated with data recording and computer storage.

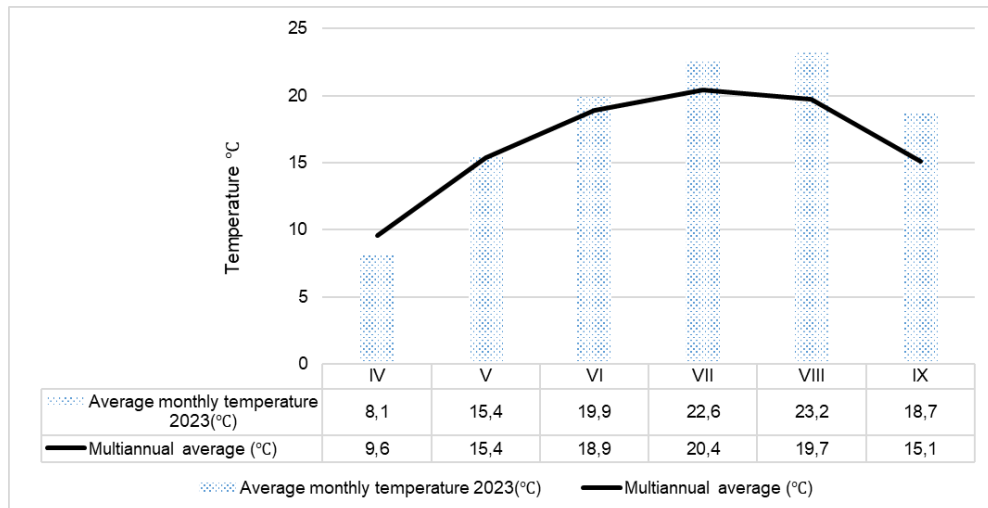


Figure 1 Temperatures recorded during the maize vegetation period, 2023

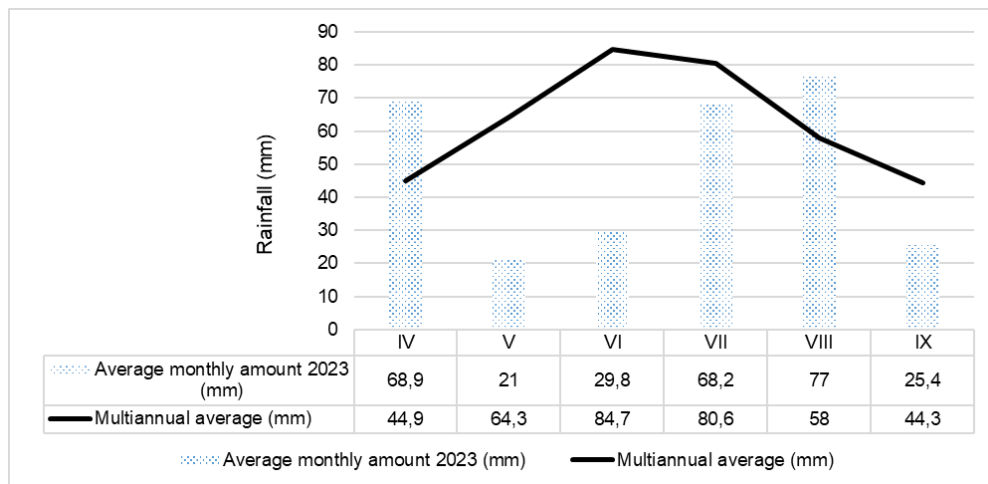


Figure 2 Precipitation recorded during the maize vegetation period, 2023

RESULTS AND DISCUSSIONS

Due to the low temperatures and precipitation in the form of snow recorded in April, the sowing of maize was possible in the first decade of May. In the first phases of vegetation, maize suffers attacks from the complex of soil pests, made up of the species *Tanymericus dilaticollis* and *Agriotes* spp. (Troțuș E. *et al*, 2021). In the conditions of the spring of 2023, the emergence, spread and attack of adults of *Tanymericus dilaticollis* in the maize crop were found. This fact led to the uneven emergence of plants, the density at emergence being on average 46205 plants/hectare. In the absence of chemical treatment of the seed against soil pests, the frequency of the attack produced by the *Tanymericus dilaticollis* species was 100%, and the degree of attack was between 85.3% (V2 – Force G) and 96% (V1 - control) (Figure 3). The density of the *Tanymericus dilaticollis* pest was between 6

exp/m² and 15 exp/m² (Figure 4). The first larvae of the species *Diabrotica virgifera virgifera* were identified in maize crops in the first decade of June.

During the dynamic determinations, it was found that the average number of larvae per plant varied from 1 to 3 (20.06.2023), respectively from 2 to 5 (26.06.2023), with the fewest larvae recorded in the variant where the Force G granulated insecticide was applied to the soil in a dose of 15 kg/ha (Figure 5).

At a first determination of the swan neck frequency, it recorded values between 0 and 10%. But after a strong wind in the first decade of July, the swan neck symptom in the attacked plants was much more pronounced, the frequency of the attack registering values between 0% (V2 – Force G) and 58% (V1 – control) (Figure 6).

Also, was followed the attack produced by the adults of the species *Diabrotica virgifera virgifera* Le Conte on leaves and silks and it was

found that they were present in the crop and attacked the maize plants.

The attack produced by adults on the leaf recorded frequencies between 32%, as recorded in the variant where was applied to the soil the granular insecticide Force G (tefluthrin), and

66%, as recorded in the control variant. On maize silk, the attack was 100%, in some plants consuming the silk entirely (Figure 7). The average number of adults per plant was between 9 and 10.

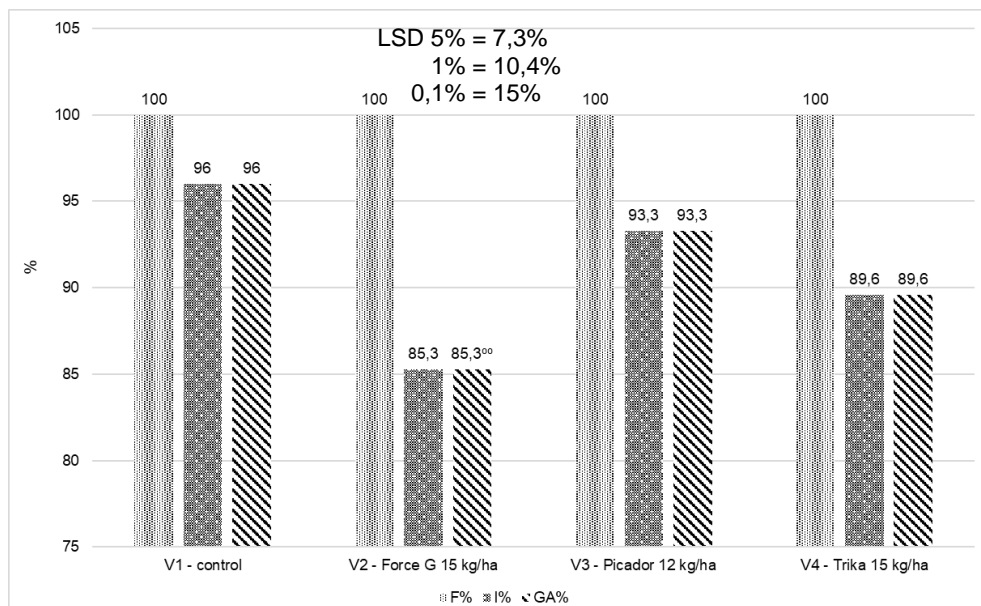


Figure 3 The attack produced by the species *Tanymecus dilaticollis* on maize plants, 2023

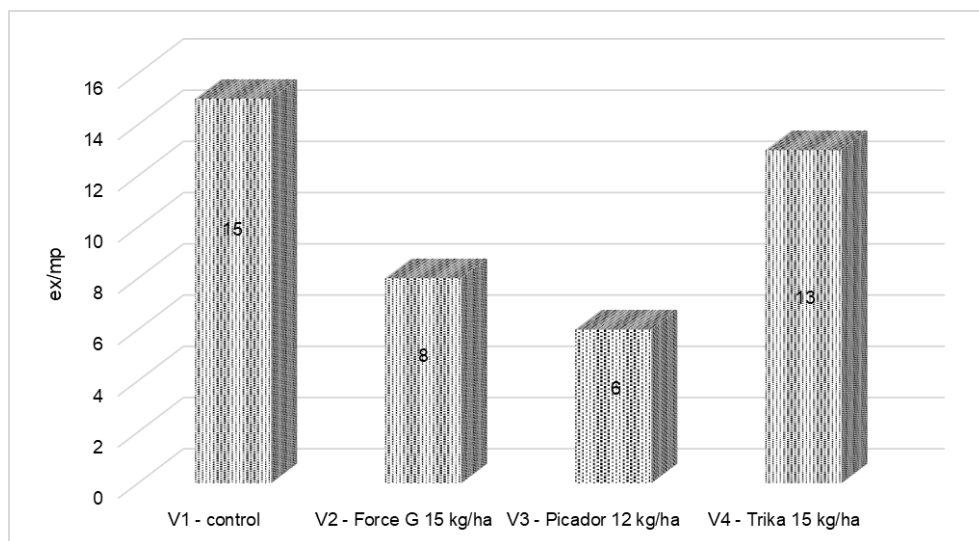


Figure 4 The density of the *Tanymecus dilaticollis* species/m², 2023

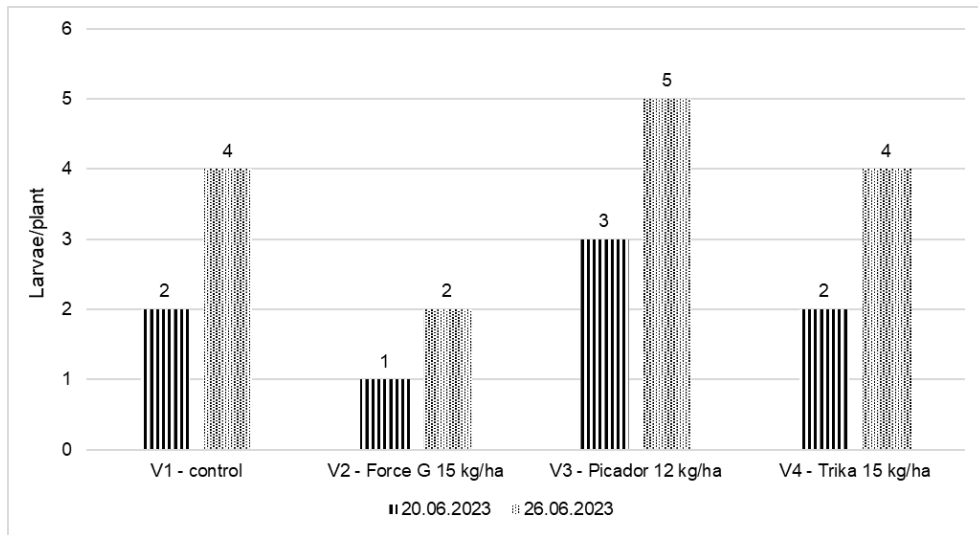


Figure 5 Number of larvae of *Diabrotica virgifera virgifera* Le Conte per plant, 2023

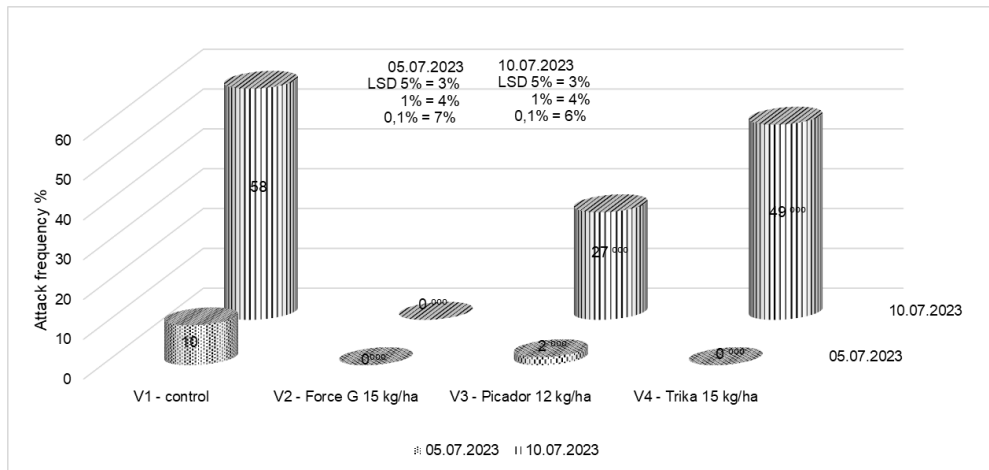


Figure 6 Frequency of plants with "swan neck" symptom, 2023

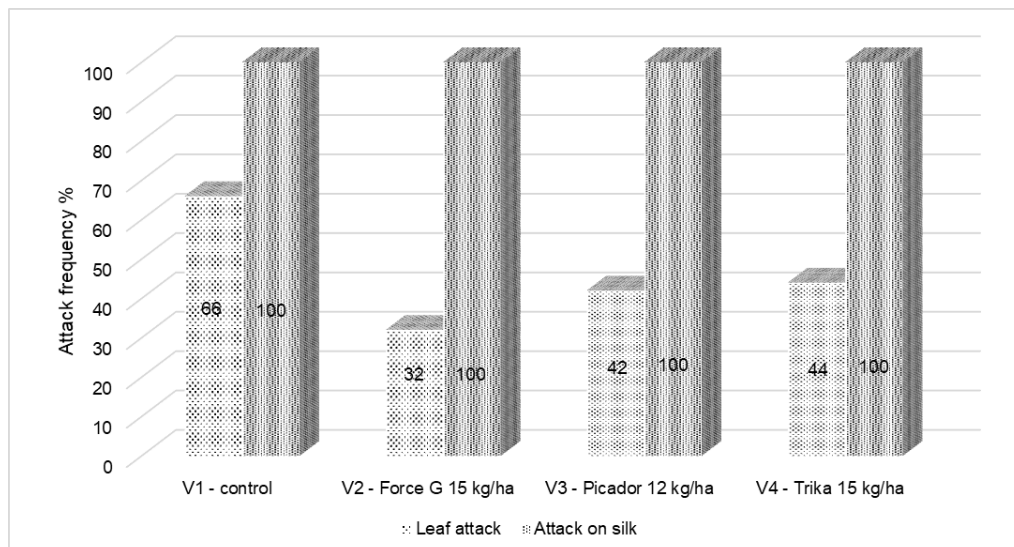


Figure 7 Frequency of attack by adults of the species *Diabrotica virgifera virgifera* Le Conte on leaf and silk, 2023

CONCLUSIONS

In 2023, the species *Diabrotica virgifera virgifera* produced attack in both the larval and adult stages. The larvae attacked the roots of the maize plants, causing stem bending, and the adults attacked the leaves, silk and pollen.

The average number of larvae per plant was between 1 and 5, with the lowest number of larvae recorded in the variant where Force G insecticide was applied to the soil.

Attack by adults on leaf was as high as 66%, while attack on maize silk recorded a frequency of 100%. The average number of adults per plant was between 9 and 10.

From the observations made in 2023, the best results were obtained in the variant where the granular insecticide Force G (tefluthrin 15 g/kg) was applied to the soil in a dose of 15 kg/ha.

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