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SUGAR BEET PEST DYNAMICS IN THE CONDITIONS OF CENTRAL MOLDOVA (ROMANIA)

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Abstract

The plant's development near the soil characterizes the sugar beet agrosystem. Soil pests are important in crop evolution, and less so the foliar ones. Research carried out at the Agricultural Research and Development Station Secuieni Neamț consisted of inventorying the species that attacked sugar beet plants from the emergence period to the formation of the leaf rosette. The results showed that eight species attacked the sugar beet crop, belonging to the Coleoptera, Lepidoptera, and Homoptera orders. The highest densities of pests specific to sugar beet crops were recorded for the species Chaetocnema spp. (30 specimens), Bothynoderes punctiventris L. (26 specimens) and Opatrum sabulosum L. (18 specimens). In sugar beet crops, attacks by Agriotes larvae at seed germination were 30%, and during the vegetation period, the plants were attacked by B. punctiventris L. and Tanymecus spp. (30%), Chaetocnema spp. (15%), A. gamma L. (9%) and Aphis fabae (23%).

Key words*: sugar beet, attack, entomofauna, climatic conditions.*

INTRODUCTION

Sugar beet is mainly used as a raw material in the sugar industry, and the molasses resulting from its processing is used in the food and alcohol industries. A wide range of pathogens and pests that affect plants throughout the growing season can quantitatively and qualitatively reduce sugar beet yield (Baicu and Săvescu, 1978).

In Romania, the area cultivated with sugar beet was 21,330 thousand ha in 2020 and decreased to 19,640 thousand ha in 2021, respectively, to 8,890 thousand ha in 2022 (FAO STAT, 2024).

The sugar beet agrosystem has as a particularity the development of the plant in and near the soil. Many pests, especially monophagous and oligophagous, have migrated from Chenopodiaceae weeds, part of the same family as sugar beet, forming a specific entomofauna. They were accompanied by entomophagous. Some species found an abundant source of food in sugar beet crops and began to prefer this crop (Baicu and Săvescu, 1986).

Ciochia et al. (1984) mention 13 pathogens that appear in sugar beet crops from germination to harvest. The harmful entomofauna comprises 37 specific and polyphagous pests that can attack plants either in the adult or larval stage or in both stages. Some are vectors that infect plants with pathogens.

However, the highest sensitivity of sugar beet is to attack by soil and plant pests during the period of seed germination - plant emergence - complete formation of the leaf rosette (Cantar, 1997; Cantar et al., 1997; Rășcănescu et al., 1997).

The scientific literature indicates that the most well-known species of pests of sugar beet are *B. punctiventris* and *Tanymecus* spp., whose populations have experienced an expansion that occurred due to the increase in average temperature and changes in the control methods of these insects (Drmic et al., 2018). From 1990 to 2018, pest populations and their attack were controlled with neonicotinoid insecticides used in chemical seed treatment, and foliar application of insecticides was made only when necessary to combat soil pests when their densities exceeded the Economic Damage Threshold (Bažok et al., 2012). Therefore,

neonicotinoids contributed to a significant reduction in the amount of insecticide used in sugar beet cultivation. Treating sugar beet seeds with imidacloprid has been confirmed to protect young plants against low to moderate infestation with wireworms, fleas, and aphids (Igrc et al., 2000). Viric Gasparic et al. (2020) showed that the treatment of sugar beet seeds with neonicotinoid insecticides leaves minimal traces in the plants due to complete degradation, but also that they reduced the attack of soil pests and provided good protection to beet plants (Viric Gasparic et al., 2021).

The withdrawal of neonicotinoids from the chemical treatment of beet seeds led to the rapid appearance and spread of aphids in the crop, the attack being at a rate of 100%. This attack recorded in 2020 in Western European countries occurred during a very mild winter that led to high overwinter survival of the primary vector, the aphid *Myzus persicae*, which migrated from the hosts where they overwintered to those that emerged in April, i.e., in beet crops (Dewar and Qi, 2021).

The paper presents results obtained between 2020-2024 regarding the inventory of harmful organisms and attacks on sugar beet crops in Central Moldova (Romania) without applying chemical treatments to control damaging insects.

MATERIALS AND METHODS

***Location*:** The research was conducted at the Agricultural Research and Development Station Secuieni - Neamț (Romania), located at 26°5' east longitude and 46°5' north latitude, in a hilly area where altitudes rise to 250 m above sea level (a.s.l.). The region's topography includes extensive interfluve plains, grasslands, and terraces (Trotuș et al., 2020). The area has a temperate continental climate, D.f.b. in the updated Koppen-Geiger climate classification, with short springs, cool summers, and harsh winters (Kottek et al., 2006).

The experiments with sugar beet were located in the experimental field of the Plant Protection Laboratory, on a typical cambic chernozem soil, with a pH in water of 6.29, a humus content of 2.3, a nitrogen index of 2.1, a mobile P_2O_5 content of 39 ppm and a K_2O content of 161 ppm.

Observation methodology: Monitoring pests' occurrence, spread, and evolution was carried out periodically through soil surveys with a 25/25 cm metric frame and collections using Barber traps installed in the field between plant emergence and crop harvest. During the vegetation period of the sugar beet crop, observations were made regarding the attack produced by specific harmful organisms. Determinations regarding the attack produced by pests were made through visual analysis of the plants (25 plants x 10 repetitions). The scores were made by giving grades according to the 0-6 scale (0 = no attack; 1 = 1-3% attack; 2 = 4-12% attack; 3 = 13-25%; 4 = over 26-50% attack; 5 = 51-75%; 6 = over 76%). Each species' frequency, intensity, and degree of attack were calculated based on the grades given (Pintilie et al., 2023).

The frequency of attack (F%) is the ratio between the number of attacked plants or organs of the attacked plant (n), related to the number of plants or vegetative organs observed (N): F% = (n x 100)/N.

Attack intensity (I%) represents, in fact, the percentage of attacked plants or organs of the plant destroyed by the pest: I% = (i x f)/n.

The degree of attack (DA%) is the product of these two indicators: DA% = (F% x I%)/100.

This paper used the attack frequency values for *Agriotes* spp. and *Aphis fabae*, respectively, for the remaining species and the degree of attack values.

No chemical treatments were applied to the sugar beet crops to control harmful insects.

Climatic conditions: Climatic data were recorded using a Wireless Vantage Pro 2 Plus weather station (SC Rom Tech SRL, Sibiu, Romania) near the experimental field. To characterize the years from a climatic point of view, we used data on the average air temperature (◦C) recorded at 2 m height and the amount of rainfall (mm).

RESULTS AND DISCUSSIONS

Climatic conditions

Monthly temperatures were much higher during the analyzed period than the multiannual average (Figure 1).

The spring months were characterized by atypical temperatures, with periods in which

recorded high temperatures alternated with intervals of low temperatures. The summer months were warm and very warm from a thermal point of view in the years in which the research was carried out (Figure 1). These conditions determined plants' faster growth and development, with temperatures recorded on average 4.3°C higher than the multiannual average.

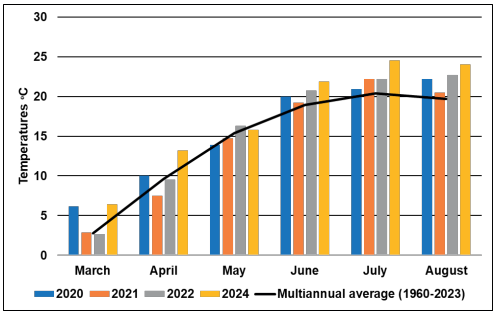


Figure 1. Average monthly temperatures recorded between March and August, Secuieni - Neamț

In terms of rainfall, the analyzed period recorded a rainfall deficit each year in which the research was carried out.

The spring months were deficient in rainfall, which raised problems in soil preparation and sowing of the sugar beet crop. This negatively influenced the emergence of plants, which occurred unevenly and staggered, and the growth and development of plants were slow (Figure 2).

The summer months, except June, when precipitation amounts close to the multiannual average were recorded, which helped the beet plants to develop, were deficient in rainfall, which negatively influenced the evolution of the crop and led to the qualitative and quantitative depreciation of the harvest (Figure 2).

Therefore, the climatic data recorded at the meteorological station of ARDS Secuieni presents an increase in average air temperatures and a decrease in rainfall during the spring and summer months (Isticioaia et al., 2020). An earlier spring-summer period is noted, which leads to the appearance, spread, and early attack of harmful organisms. Also, the lack of rainfall leads to uneven crop emergence, and extreme summer temperatures accelerate crop development. The plants reached maturity faster, and the yield was small and of poor quality.

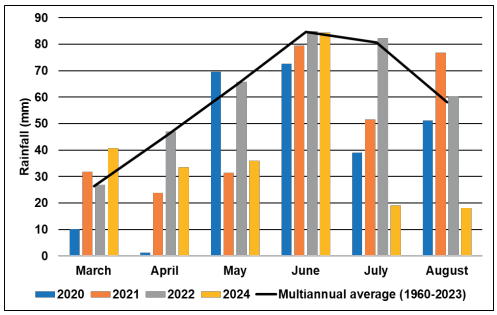


Figure 2. Monthly rainfall recorded between March and August, Secuieni - Neamț

Entomofauna in beet crops

From 2020 to 2024, the entomofauna inventoried in sugar beet crops consisted of eight insect species. The number of specimens collected varied from one year to another, with 80 specimens/m^2 identified in 2020 along with seven aphid colonies, 64 specimens/m^2 recorded in 2021, 64 specimens/m^2 recorded in 2022, 64 specimens/m^2 identified in 2022 along with five aphid colonies, and 196 specimens/m^2 and 11 colonies identified in 2024 (Table 1). By species, the most numerous specimens belonged to the *Chaectocnema* spp., with 30 specimens, followed by *B. punctiventris* with 26 specimens, and *O. sabulosum* with 18 specimens (Table 1).

Table 1. Harmful entomofauna to sugar beet crops inventoried in 2020 - 2024, Secuieni - Neamț

No.	Order/Species	Density specimens/m^2				Average
		2020	2021	2022	2024	
Coleoptera						
1	*Agriotes spp*	8	4	4	5	5
2	*Tanymecus spp.*	26	14	5	11	14
3	*Opatrum sabulosum* L.	0	4	0	66	18
4	*Gonocephalum pusillum* Fabricius	1	3	6	3	3
5	*Bothynoderes punctiventris* L.	11	9	16	67	26
6	*Chaectocnema spp*	29	26	33	33	30
Lepidoptera						
7	*Autographa gamma* L.	5	4	0	11	5
Homoptera						
8	*Aphis fabae* Scopoli	7 col	0	5 col	11 col	6 col
Total = three orders/eight species		80 + 7 *	64	64 + 5 *	196 + 11*	101 + 6 *

*colony

Calculating species share according to the number of specimens collected, we find that *Chaectocnema* spp. recorded the highest value, 28%, followed by *B. punctiventris*, with 24%, *O. sabulosum*, with 17%, *Tanymecus* spp., with 13%, *A. fabae, Agriotes* spp, and *A. gamma*, with 5% each, and *G. pusillum*, with 3% (Figure 3).

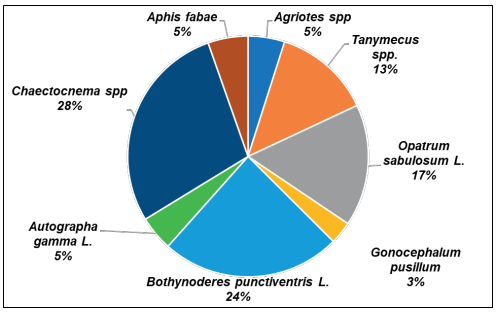


Figure 3. Species share according to the number of specimens collected, Secuieni – Neamț

Following the determinations carried out in the vegetation period, during the period 2020-2024, we found that *Agriotes* larvae were present and caused attacks in the sugar beet crop. The *Agriotes* larvae fed on the germinating seeds, which reduced plant density and gaps in the crop, and the yield potential was affected from the beginning of the plant emergence (Popov et al., 2001).

The frequency of attack by the larvae of the *Agriotes* species on grain was, on average, 30%. The highest attacks produced by the larvae on grain was recorded in 2020, at 37%, and the lowest attack was in 2021, at 19% (Figure 4).

Regarding the attack caused by the *Agriotes* larvae on the plant, the frequency of attacked plants was, on average, of 1%, and over the years, it varied between 0% (2024) and 3% (2021) (Figure 4).

The percentage of plants saved was, on average, 69%, recording values between 60% (2022) and 78% (2021) (Figure 4).

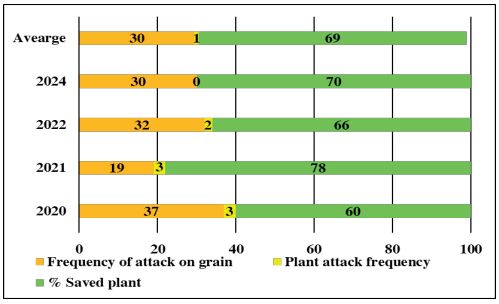


Figure 4. Frequency of attack by *Agriotes* spp., Secuieni - Neamț

In addition to the attack caused by the *Agriotes* species, the damage caused by the rest of the species is also added: *B. punctiventris* L., *Tanymecus* spp., *Chaetocnema* spp., *A. gamma* L. and *A. fabae*.

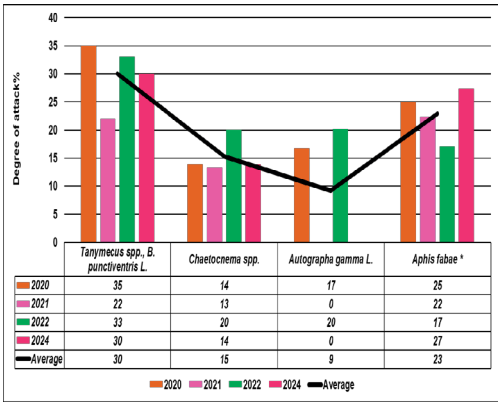
The fleas appeared as the plants emerged. They consumed the leaves' epidermis, the attack being recognized by the appearance of translucent holes. The weevils' adults and larvae consumed the young leaves, leaving only the petiole (Figure 5).

Figure 5. Attack caused by specific pests on beet: *Chaectocnema* spp. (left) and *B. punctiventris* (right) (original photo)

The attack of specific pests was recorded through determinations carried out in the vegetation, and we found that:

- in 2020, five species of harmful insects attacked the crop: the species *B. punctiventris* L. and *Tanymecus* spp. recorded the highest degree of attack rates, of 35%, followed by *A. fabae* with a frequency of attack of 23% (Figure 6);
- in 2021, the attack was lower because the spring conditions characterized the cool and dry period, the attack of *Autographa* larvae was no longer recorded, and the rest of the species recording degrees of attack values between 13% (*Chaectocnema* spp) and 22% (*B. punctiventris* L. and *Tanymecus* spp.) (Figure 6);
- in 2022, the conditions were favorable for the species attack, the degree of attack being between 20% (*A. gamma* L.) and 33% (*B. punctiventris* L. and *Tanymecus* spp.) (Figure 6);
- in 2024, the highest degree of attack was recorded by *B. punctiventris* L. and *Tanymecus* spp., at 30%, followed by *A. fabae,* which, following the determinations carried out, had values of the frequency of attacked plants of 27% (Figure 6);
- on average, *B. punctiventris* L. and *Tanymecus* spp. recorded the highest degree of attack values of 30%, followed by *A. fabae*, where the

frequency of attacked plants was 27%, and the lowest attack rate values of 9% were recorded at *A. gamma* (Figure 6).



	Tanymecus spp., B. punctiventris L.	Chaetocnema spp.	Autographa gamma L.	Aphis fabae *
2020	35	14	17	25
2021	22	13	0	22
2022	33	20	20	17
2024	30	14	0	27
Average	30	15	9	23

Figure 6. Degree of attack by specific pests, Secuieni – Neamț (*- values of frequency of attacked plants)

It was found that sugar beet plants were attacked by aphids at a high frequency each year, ranging between 17% and 27%, which requires the application of corrective treatments to control the spread of aphids (Figure 7).

Figure 7. *A. fabae* colonies on sugar beet

The species identified in sugar beet crops are the most widespread and produce the highest attacks if climatic conditions are favorable (Doncilă, 2006).

Our results were obtained without applying chemical seed treatment and systemic insecticides on vegetation. They showed that soil pests produced a high degree of attack and that the identified species had favorable conditions for emergence, spread, and attack.

CONCLUSIONS

The insect fauna that was harmful to the sugar beet crop from the emergence period until the formation of the leaf rosette was composed of eight species belonging to the orders Coleoptera, Lepidoptera, and Homoptera.

The highest densities of pests specific to the sugar beet crop were recorded at *Chaetocnema* spp. (30 specimens), *B. punctiventris* (26 specimens) and *O. sabulosum* (18 specimens).

In sugar beet crops, attacks were registered on the grain by *Agriotes* (30%) and on the plants during the vegetation period by *B. punctiventris* and *Tanymecus* spp. (30%), *Chaetocnema* spp. (15%), *A. gamma* (9%) and *A. fabae* (23%).

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REFERENCES

Baicu, T., Săvescu, A. (1978). *"Sfecla de zahăr" în "Combaterea integrată în protecția plantelor"*. Bucharest, RO: Ceres Publishing House, 251-253.

Baicu, T., Săvescu, A. (1986). *Sisteme de combatere integrată a bolilor și dăunătorilor pe culturi*. Bucharest, RO: Ceres Publishing House, 110-125.

Bažok, R.; Buketa, M.; Lopatko, D.; Ljikar, K. (2012). Suzbijanje štetnika še´cerne repe nekad i danas. *Glas. Biljn. Zašt*.,12, 414–428.

Cantar, C., Răşcănescu, M., Tărabuță, C. (1997). Cunoașterea evoluției și structurii entomofaunei din culturile de sfeclă de zahar din zona Roman – Neamț. *Cercetări agronomice în Moldova*, *4*(110), 152.

Cantar, C., (1977). Frecvența și dinamica populațiilor unor specii de Noctuide (Lepidoptera) la sfecla de zahar în zona Roman. *Cercetări agronomice în Moldova*, *4*(110), 159.

Ciochia, V., Codrescu, A., Rizescu, Gh. (1984). *Bolile si daunatorii sfeclei de zahar*, Bucharest, RO: Ceres Publishing House, 101 pg.

Doncilă, A. (2006). Retrospection concerning the sugar beet protection on Fundulea zone, district Calarasi, Romania. *Proc. Nat. Sci, Matica Srpska Novi Sad*, 110, 141–149.

Dewar, A. M., Qi A. (2021). The virus yellows epidemic in sugar beet in the UK in 2020 and the adverse effect of the EU ban on neonicotinoids on sugar beet production. *Outlooks on Pest Management*, *32*(2), 53–59, ISSN = 1743-1026, EISSN = 1743-1034, doi = doi:10.1564/v32_apr_02

Drmić, Z, Čačija M, Virić, Gašparić, H, Lemić, D, Bažok, R. (2019). Phenology of the sugar beet weevil, Bothynoderes punctiventris Germar (Coleoptera: Curculionidae), in Croatia. *Bulletin of Entomological Research*; *109*(*4*): 518-527. doi:10.1017/S000748531800086X

FAO STAT, 2024, (https://www.fao.org/faostat/en/#data/QCL)

Igrc, B., J.; Dobrin, R., Šarec, V., Kristek, A. (2000). Investigation of the Insecticide Seed Dressing on the Sugar Beet. *Agric. Conspec. Sci*., 65, 89–97.

Isticioaia, S.F, Trotuș, E., Amarghioalei, R.G., Pintilie, P.L., Leonte, A. (2020). Studiul privind evoluția regimului termic și pluviometric înregistrat la stația meteo a S.C.D.A. Secuieni, în perioada 2000-2019. *Analele INCDA Fundulea*, LXXXVIII, 129–145, Electronic ISSN 2067–7758. https://www.incda-fundulea.ro/anale/88/88.14.pdf

Kottek, M., Grieser, J., Beck, C., Rudolf, B., Rubel, F. (2006). World map of the Köppen-Geiger climate classification updated. *Meteorologische Zeitschrift 15*(3), 259-263. DOI:10.1127/0941-2948/2006/0130

Răşcănescu, M., Cantar, C. (1997). Atacul bolilor și dăunătorilor în culturile de sfeclă de zahar în zona Roman - Neamț. *Cercetări agronomice în Moldova*, *4*(110), 152.

Pintilie, P.L., Trotuș, E., Amarghioalei, R.G., Leonte, A., Enea, A., Pintilie, A.S. (2023). Research on the attack produced by *Tanymecus dilaticollis* Gyll. (Coleoptera: Curculionidae) in the conditions of Central Moldova, Romania. *Scientific Papers. Series A. Agronomy*, *LXVI*(2), 350–355.

Popov, C., Bărbulescu, A., Trotus, E., Vasilescu, S., Bucurean, E. (2001). Control of wireworms by seed treatment in Romania. *Romanian Agricultural Research,* 15, 69–75.

Trotuș E., Mîrzan O., Naie M., Leonte A., Buburuz A.A., Pochișcanu S.F., Popa L.D., Lupu C., Pintilie P.L., Pleșcan I.D. (2020). *Tehnologii de cultivare a unor plante de câmp pentru zona Centrală a Moldovei*. Iasi RO: "Ion Ionescu de la Brad" Publishing House, ISBN 978-973-147-367-3, 290 pg.

Viric Gasparic, H., Grubelic, M., Dragovic Uzelac, V., Bazok, R., Cacija, M., Drmic, Z., Lemic, D. (2020). Neonicotinoid Residues in Sugar Beet Plants and Soil under Different Agro-Climatic Conditions. *Agriculture*, 10, 484. https://doi.org/10.3390/agriculture10100484

Viric Gasparic, H., Lemic, D., Drmic, Z., Cacija, M., Bazok, R. (2021). The Efficacy of Seed Treatments on Major Sugar Beet Pests: Possible Consequences of the Recent Neonicotinoid Ban. *Agronomy*, 11, 1277. https://doi.org/10.3390/agronomy11071277