DYNAMICS OF ORGANISMS HARMING THE POTATO CROP IN THE YEAR 2024 IN THE CONDITIONS OF CENTRAL MOLDOVA, ROMANIA

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Abstract

Potato yield is diminished by a wide range of pathogens and pests that affect plants throughout the growing season. The research was carried out at ARDS Secuieni, where, in 2024, a potato experience was established that included monitoring pests and diseases in this crop. The climatic conditions from March to August characterized the analyzed period as extremely hot and dry. The species *Leptinotarsa decemlineata* and the pathogen *Phytophthora infestans* affected the potato crops. The *L. decemlineata* population density was from 4 adults/m^2 to 47.5 adults/m^2, and the number of larvae varied between 25 and 50 larvae/m^2. The *L. decemlineata* attack produced by adults and larvae on potato plants was between 0.7% (first part of June) and 22.3% (mid-July). The pathogen *P. infestans* produced attacks between 7.9% and 27.6% of potato crops.

Key words: adults, attack, larvae, *Leptinotarsa decemlineata, Phytophthora infestans*

The potato crop is an important food, and fodder plant and is highly suitable for industrialization (Mogârzan A., 2012). Potato tubers are rich in protein, calcium, and vitamin C and have a balanced amino acid content (CIP, 2024 https://cipotato.org/). Potato tubers produce the highest amount of energy per unit area and have the highest dry matter yield, 74.5% compared to wheat and 58% to rice (Ahmed B. *et al*, 2017).

Potato yield potential can be affected by several pests such as *Leptinotarsa decemlineata, Aphis sp., Myzus sp. Meloidogyne incognita, Ditylenchus destructor, Agriotes spp., Melolontha melolontha, Macrosiphon euphorbiae, Epitrix cucumeris, Phthorimaea operculella, Gryllotalpa Gryllotalpa, Agrotis segetum* or various pathogens: *Potato X virus, Potato Y virus, Erwinia carotovora pv. atroseptica, Synchytrium endobioticum, Phytophthora infestans, Fusarium solani, Alternaria solani* (Hatman M. *et al*, 1986).

Among the pests, adults, and larvae of the species *Leptinotarsa decemlineata* that consume the potato leaf, defoliating the plants produces the highest attacks (Tălmaciu M., 2017). The insect has other host plants such as tomatoes and eggplants, but it prefers potatoes for development (CABI, 2024). Among the many diseases that occur and spread in the potato crop, *Phytophthora infestans* is responsible for yield losses of 16% of world potato production (Haverkort A. *et al*, 2009). The high frequency of hot summers in Romania created favorable conditions for the appearance and spread of other pathogens such as *Alternaria* spp. whose incidence has increased in recent years, due to climate change, the cultivation of varieties with reduced tolerance to this pathogen, and the reduction in the number of products with fungal action that were used to prevent and combat the pathogen *Phytophthora infestans* (Adavi Z. *et al*, 2018; Hermeziu M. and Negușeri N., 2024).

The present paper includes data related to the inventory of the organisms harming the potato crop that have been registered and produced attacks in the conditions of Central Moldova in the year 2024.

MATERIAL AND METHOD

The research was carried out at ARDS Secuieni (Neamt - Romania), where, in 2024, an experience was established that included the monitoring of pests and diseases that appear in potato crops.

In the experimental field of the Plant Protection Laboratory, an experiment was conducted with potatoes that were planted manually, at a distance of 70 cm between rows, in the first part of April 2024 (04.02.2024), using the Darilena variety. The plants emerged on 07.05.2024.

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The plant protection technology consisted of:
- weed control that was carried out pre-emergence with Sencor 0.9 l/ha (09.05.2024), and post-emergence with Sencor 0.6 l/ha (05.09.2024), and hand weeding (25.05.2024, 10.06.2024).
- pest control was carried out with Gazelle 0.150 kg/ha (27.05.2024), Imazuma 0.2 kg/ha (10.06.2024), and Mospilan 0.2 kg/ha (16.06.2024, 02.07.2024).
- disease control was achieved with Alcupral 3.5 kg/ha (17.05.2024) and Bordeaux juice 3.75 kg/ha (10.06.2024, 16.06.23024, 02.07.2024).

The appearance and evolution of pests were monitored periodically through ground surveys with a metric frame of 25/25 cm and with the Barber traps during the period between the emergence of the plants and the harvesting of the tubers.

During the potato vegetation period, observations and determinations were made regarding the attack produced by the specific harmful organisms, the adults and larvae of the species *L. decemlineata* respectively, by *P. infenstans*.

Pest and disease attack determinations were made by visual plant analysis (20 plants x 10 replicates). The ratings were made by assigning grades according to the scale 0-6, where 0 represents lack of attack, and 6 attacks greater than 75% of the plant; based on the grades given, the attack grade was calculated for each harmful organism (Baicu T. and Săvescu A., 1986).

RESULTS AND DISCUSSIONS

Climatic conditions

In the analyzed period, March - August, it was found that the monthly temperatures were much higher compared to the multiannual average (*figure 1*).

The spring months were characterized as warm, with average temperatures being higher by +3.6°C in March and April, except for May, which had a deviation of 0.4°C, being characterized as normal thermally.

The summer months were hot from a thermal point of view, which led to rapid plant growth and development in June, but very high temperatures in July led to premature drying of the leaves.

Average monthly temperatures increased by +3°C in June and +4°C in July above the multi-year average, a fact that negatively affected the development of plants, as they quickly went through the phenophases of development and ended the vegetative cycle faster (*figure 1*).

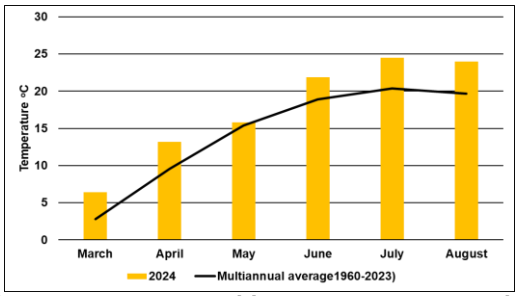

Figure 1 **Average monthly temperatures recorded during March-August, 2024, Secuieni – Neamț**

In terms of rainfall, a deficit was recorded in April, May, July, and August, and the months of March and June recorded rainfall close to the multiannual average (*figure 2*). The amount of rainfall below the multiannual average in April led to the uneven emergence of the potato plants. In May, half of the multi-annual amount of rainfall accumulated, negatively influencing the development of plants. The rainfall in June, which totaled 84.4 mm, helped the plants to develop rich foliage, but the water deficit in July (-61.6 mm) led to premature wilting and drying of the leaves (*figure 2*).

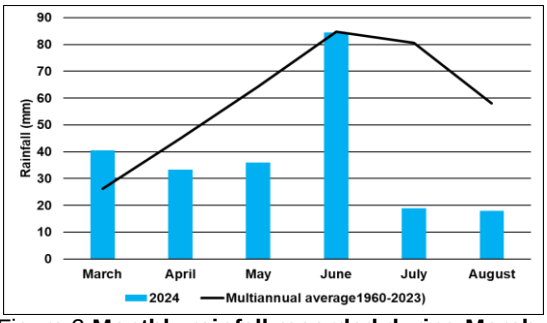

Figure 2 **Monthly rainfall recorded during March - August 2024, Secuieni - Neamț**

The entomofauna identified was made up of three pest species that totaled 207 specimens (*table 1*). The most specimens were recorded for *L. decemlineata*, with 107 specimens, followed by *Harpalus* spp., with 96 specimens, and *Agriotes* spp. with 4 specimens. The inventoried species are part of the Coleoptera order.

Analyzing the registered entomofauna, we found that the number of specimens collected was high, being between 2 specimens/m^2 as many as were registered in the first part of May, respectively 39 specimens/m^2, as many as were registered in the last part of June. The *Harpalus* species is spread throughout the territory of the unit, which is why it is captured in Barber traps, but also at the light trap (Trotuș E. *et al*, 2017). These species are described in local and foreign scientific literature as being predatory through their larvae, and the adults, being phytophagous, cause damage, especially to cereals with the grains they feed on.

Table 1

Harmful entomofauna to potato crops inventoried in 2024, Secuieni – Neamț (specimens/m²)

Species	Order	V			VI			VII			VII	Σ
		I	II	III	I	II	III	I	II	III	I	
Agriotes spp	Coleoptera	0	0	0	0	4	0	0	0	0	0	4
Leptinotarsa decemlineata	Coleoptera	2	5	6	15	17	21	13	12	6	10	107
Harpalus spp.	Coleoptera	0	0	4	8	10	18	18	16	15	7	96
Σ = three species	1 order	2	5	10	23	31	39	31	28	21	17	207

Calculating the share of species according to the number of specimens collected, we find that *L. decemlineata* had the share of 52% of the total catches, followed by *Harpalus* spp., with 46% and *Agriotes* spp. with 2% (*figure 3*).

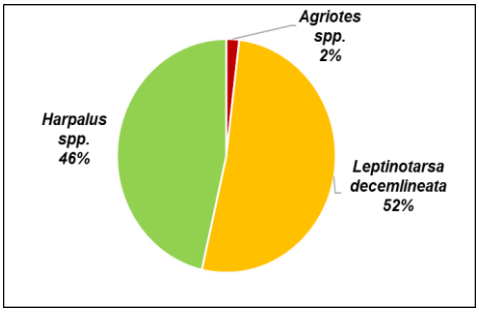

Figure 3 **The share of species according to the number of specimens collected, 2024, Secuieni – Neamț**

Observations and determinations regarding the appearance, spread, and attack of the species *L. decemlineata* were carried out weekly and it was found that the first adults were recorded in mid - May (5 adults/m^2), together with the identification of the first eggs laid by the insect (6 groups eggs/m^2) (*figure 4*). At the end of May, the first larvae were recorded, which required the application of a phytosanitary treatment to control and reduce the population density of larvae and adults. We find that the number of egg groups identified was between 4.5 and 9 egg groups/m^2, this stage being recorded throughout the vegetation period of the potato crop. The number of adults/m^2 was between 4 and 47.5 adults/m^2, their presence being signaled at each weekly determination. Regarding the number of larvae/m^2, it varied between 25 and 50 larvae/m^2.

The scientific literature mentions that the economic damage threshold is 1-2 adults/m^2 and 3-4 larvae/m^2 for potato crops (Tălmaciu M., 2017). In the case of potato crops from Secuieni, we can see that the EDT was exceeded during the entire monitoring period and it shows us the constant and high presence of the two stages that produce attacks in potato crops, the adult and the larva.

Hatman M. *et al.* (1986) mention that treatments against adults should be carried out when the numerical density exceeds 0.5 insects/m^2, i.e. one adult per 8-10 potato bushes. As we can see, the number of adults/m^2 recorded in the potato crops from Secuieni was close to the data from the scientific literature, a fact that indicates the maintenance of the high adult population density throughout the vegetation period. As for larvae, their density was high due to continuous egg-laying by adults and rapid hatching of larvae due to high temperatures.

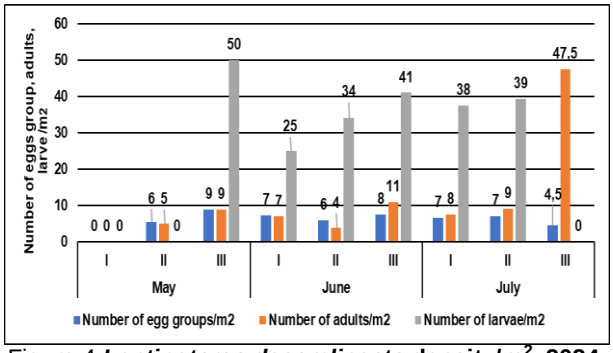

Figure 4 ***Leptinotarsa decemlineata*** **density/m^2, 2024, Secuieni – Neamț**

Along with the appearance and spread of the adults and larvae in the potato crops, the attack produced by the insect was also noted, which was between 0.7% as recorded in the first part of June and 22.3% as registered in mid - July (*figure 5*).

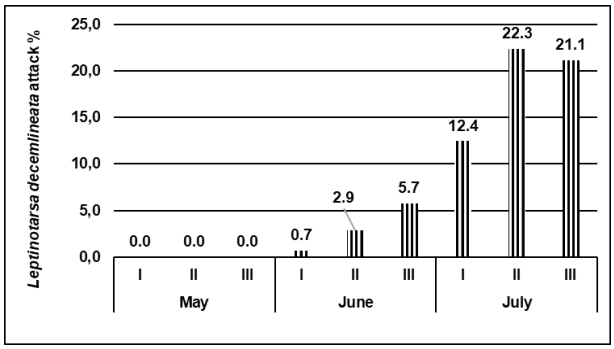

Figure 5 ***Leptinotarsa decemlineata*** **attack on potato crops, 2024, Secuieni – Neamț**

Among the pathogens, the appearance and spread of *P. infestans* were recorded, which depended on weather conditions, infection pressure, and potato development at the time of the disease attack (Razukas A. *et. al*, 2008). Potato late blight presents a complex evolution, which in current climate conditions is accentuated by extreme phenomena (torrential, short-term rains,

large amounts of water in a short period) and continues to raise serious problems for farmers (Hermeziu M. *et al*, 2019; Hermeziu M., 2021).

The pathogen has been registered since the beginning of June, the attack being between 7.9% and 27.6% (*figure 6*). The disease had a constant evolution and was present in potato crops until the maturity of the plants and tubers.

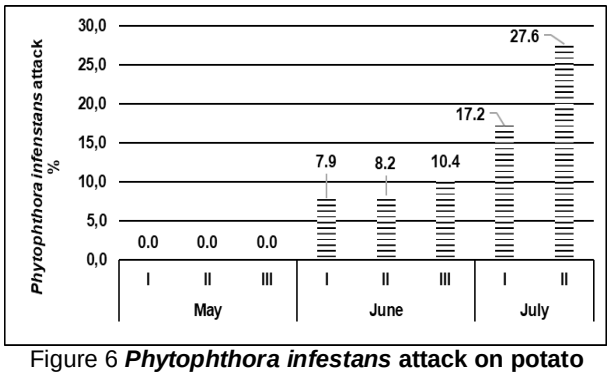

Figure 6 ***Phytophthora infestans* attack on potato crops, 2024, Secuieni – Neamț**

At harvest, potato tubers were analyzed to register the *Agriotes* frequency of attack and *P. infestans*. It was found that the frequency of tubers affected by the larvae of the *Agriotes* species was between 0% and 24%, with an average of 13.6%. The frequency of attack produced by *P. infestans* on tubers varied between 0 and 44%, with an average of 27.2% (*table 2*).

Table 2

Attack of harmful organisms on tubers

R	*Agriotes* spp. frequency of attack %	*P. infestans* frequency of attack %
R1	24	0
R2	12	20
R3	0	44
R4	12	36
R5	20	36
Average	13.6	27.2

CONCLUSIONS

The period March - August was characterized as being hot and dry, being unfavorable for the growth and development of the potato. In 2024, the climatic conditions in Secuieni - Neamț were favorable for the appearance, spread, and attack of *L. decemlineata* and the pathogen *P. infestans*. The *L. decemlineata* population density of adults was from 4 adults/m^2 to 47.5 adults/m^2, and of larvae, it varied between 25 and 50 larvae/m^2. The *L. decemlineata* attack of adults and larvae was between 0.7% (first part of June) and 22.3% (mid-July). The pathogen *P. infestans* produced attacks at plants with values between 7.9% and 27.6%. At harvest, it was found that the tubers were affected by *Agriotes* spp. (13.6%) and the pathogen *P. infestans* (27.2%).

ACKNOWLEGMENTS

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