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MONITORING OF *Rhagoletis cerasi* WITH THE HELP OF DECIS TRAP TRAPS AND MONILIOSIS IN THE CHERRY ORCHARD FROM USAMV OF BUCHAREST

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Abstract

In the conditions of our country, the cherry fly (Rhagoletis cerasi L.) is the most important pest of cherry orchards. At the same time, species of the pathogen Monilinia laxa, which cause moniliosis and brown rot, produce severe damage with high economic relevance. In the present work, we aimed to present the moment of appearance of adults and their evolution in the crown of cherry trees, based on Decis Trap traps, and how the climatic conditions influenced the activity of the cherry fly. In order to establish the dynamics of cherry fly populations, Decis Trap traps were used, installed in the crown of the trees. It is known that the attack produced by this species significantly affects fruit, production, depreciating the quality of the fruit and can be a way of installing the Monilinia laxa pathogen in the fruit. The incidence of fruit attack was between 6.78% and 32.25%.

Key words*: Rhagoletis cersi, traps, dynamics, Monilinia laxa.*

INTRODUCTION

The study proposed in this work consists of the evolution of the cherry fly (*Rhagoletis cerasi* L.) and how the climatic conditions influenced the activity of this species. It is known that the cherry fly is the most important pest in the cherry orchard, significantly affecting fruit production and quality. The larvae of the cherry fly are the most important pest of the cherry tree, especially in the semi-late and late varieties (Florian et al., 2018). They feed on the pulp of the fruit around the stone, which becomes soft and darker in color.

The yellow traps with glue present a high power of attraction for dipteran species, being useful in establishing the population level of the species *Rhagoletis cerasi* L. and its dynamics, leading to the application of warning treatments at the optimal times (Istrate and Manole, 2019).

The different species of the *Monilinia* pathogen are common pathogens of the stone fruit species (Hrustí´c, J. Et al.,2012, Popa et al., 2012, 2013, Moldovan et al., 2022), producing effects regardless of the culture system and applied treatments. Attacked fruits are often infected by species of the genus *Monilinia* (*Monilinia laxa*, *M. fructigena* and *M. fructicola*) known as a pest often found in Europe (EPPO, 2007, 2020; Usall et al., 2015).

In addition to fruit, the pathogen also infects the aerial parts of host plants with a variety of symptoms, including flower burn, wounding on woody tissues, and fruit rot during the growing season, but also in the post-harvest phase (Florian et al., 2018; Paraschivu et al., 2020).

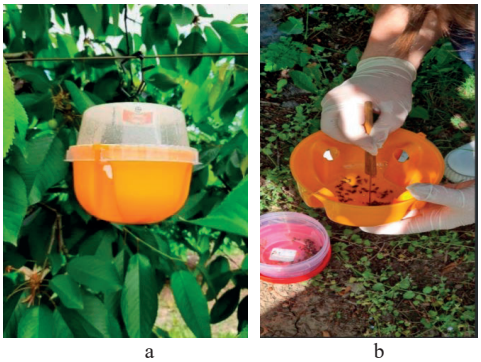
Brown rot of cherry fruits is one of the most important diseases. Injured, dying, or dead tissues of the trees can be infects by *Leucostoma* canker (Cotuna et al., 2020).

In chemically untreated cherry orchards, the frequency of attack can reach up to 100%, and the fruits lose their commercial value (Istrate and Roșca, 2009; Abang et al., 2014). The study of the pathogen *Monilinia laxa* included research on the degree of attack on leaves, shoots, and fruits, which was calculated based on the indicators, frequency (F%) and intensity of attack (I%), while the inspection was initiated in May with continuation in June, with the monitoring of the pest *Rhagoletis cerasi* L. The severity of the disease is largely determined by the weather; the symptoms vary from year to year (Gheorghieș and Geamăn, 2003). Disease severity is expected to increase during wet or rainy weather with mild daytime

temperatures (20-25°C) and cool nights (EPPO, 2020; Chițulescu et al., 2019).
The results of the research were put in line with the microclimate recorded during the determination period. In recent years, due attention has not been paid to the health of the plantations, recording large harvest losses due to the deterioration of the quality of the fruits.

MATERIALS AND METHODS

Research on the appearance and evolution of *Rhagoletis cerasi* L. adults was carried out in the cherry orchard of the University of Agronomic Sciences and Veterinary Medicine of Bucharest, during 2024, made up of a mixture of varieties: Regina, Skeena, Giorgia, Kordia, Ferrovia, Lapins, New Star, Van, Giant Red, Early Red, Rubin, Severin, Istrita, Katalin, Stefan, Ulster, Paul, Sam, Bigareau Burlat, Boambe de Cotnari, Vega, Margo, Germersdorf, Katalin, Rivan, Nimba, Royal Tioga, Pacific Red, Roket, Fisco, Alex, Margonia, Andante, Musatin, Amaris.
In order to monitor the species, before the cherries come into fruition (the second decade of May), yellow Decis Trap traps were placed in the crown of the trees, at a height of 1.5 m and a distance of approximately 10 m between them. The Decis Trap traps were installed on 23.04.2024, 5 traps per row (Figure 1a), a number of 25 traps, in 5 rows.



a b
Figure 1.a) Installation of traps Decis Trap; b) collection of captured insects (foto: Rada Istrate, 2024)

Observations were made daily until the first specimens appeared, then weekly, noting each reading (Figure 1b). On the basis of the obtained data, the graph of the evolution of the pest was drawn up (the beginning of the appearance of the adults and the maximum flight).
The Decis trap, is a trap designed to attract and combat the species *Rhagoletis cerasi* L. It is a trap consisting of a plastic container made up of two parts: the upper part is colorless and transparent, impregnated on the inner surface with the active substance, deltamethrin 0.015 g/trap, and the lower part of the trap is orange and serves to store flies caught and contains a sachet consisting of a strong attractant (ammonium carbonate), specific for *Rhagoletis cerasi* L. The sachet with attractant is dosed so that its elimination is done gradually, providing a duration of protection of 5 months. The assembled trap forms a closed system with 2 cm diameter side holes through which the flies enter. The method of identifying the pathogen *Monilinia laxa* was realized visually by observing the manifestation of symptoms on the plants under the conditions of the year 2024. To the varieties that showed symptoms, the methodology used in plant protection was applied: three branches arranged in different directions and floors, and on each branch, 100 shoots were examined.
For the examination of the fruits, 300 fruits per branch were analyzed, and finally the average was obtained for each variety. The evaluation technique consisted in noting the frequency of the attacked organs (attack incidence, %) and the intensity (attack severity, %) in which the symptoms were manifested. These phytosanitary indicators were used in the evaluation of the behavior of the varieties: A.D. (%) = F (%) x I (%)/100. For the intensity of the diseases, marks were granted on a scale from 0 to 4.
The research results were correlated with the regional temperatures and precipitation recorded during the determination period. (Rungjindamai et al., 2014), so that the attack of the pathogen and the pest can be controlled by combining several cultural practices (cultural hygiene by removing debris, winter treatments applied in winter windows, and performing chemical treatments). During 2024, three chemical treatments were carried out on: 01.02.2024 with Oleomin 80 EW, 1.3% + Faster 10 CE - 0.02% + Oviperon Top - 1.5% + Flipper 497.8 EW - 1.5%; 18.03.2024 with Decis Expert 100 EC - 0.05% + Score 250 EC -

0.02%; 12.04.2024 with Fastac 10 EC - 0.02% + Folicur Solo - 0.1% (Table 1).

Table 1. Treatments carried out in the cherry orchard

Date	The active substance	Products
01.02.2024	Ulei mineral horticol 80%	Oleomin 80 EW - 1.3%
	Cipermetrin 100 g/l	Faster 10 CE - 0.02%
	Ulei de parafină 800 g/l	Oviperon Top - 1.5 %
	Săruri de potasiu ai acizilor graşi C7-C18 79.8 g/l	Flipper 497.8 EW - 1.5%
18.03.2024	Deltametrin 100 g/l	Decis Expert 100 EC - 0.05%
	Difenoconazol 250 g/l	Score 250 EC - 0.02%
12.04.2024	Alfa-cipermetrin 50 g/l	Fastac 10 EC - 0.02%
	Tebuconazol 250 g/l	Folicur Solo 250 EW - 0.1%

RESULTS AND DISCUSSIONS

In order to obtain healthy fruits, it is necessary to know the *Rhagolesti cerasi* L., species population and the dynamics of its appearance as well as its evolution in the crown of the trees during the months of April, May and June of 2024. To monitor the cherry fly, we aimed to analyze the activity of the cherry fly under the influence of climatic factors and chemical treatments.

During 2024, the first appearance in the cherry orchard was in the first decade of May (06.05.2024), where between 0 and 8 captures/trap were recorded at a temperature of 19°C and an atmospheric humidity of 56%. The appearance of the first specimens in the first decade of May was also reported in the Iași region by Chelaru et al. (2021).

The first captures of adults in the Decis Trap traps were recorded in the first decade of May with an average of 1.6 adults/trap. The activity of adults increased significantly, so that in the second decade of May, 110 specimens/25 traps were captured in traps with an average of 4.4 adults/trap (Table 2). On May 12th-13th, the air temperature dropped to almost 14°C due to light precipitation, and the humidity was 78% (Figure 2).

The maximum level regarding the activity of the species *Rhagoletis cerasi* L, was reached in the first decade of June (03.06.2024) with a catch of 61 adults/trap recorded on row 8, located in the middle of the orchard, at a temperature of 25°C and a humidity of 60% (Figure 3).

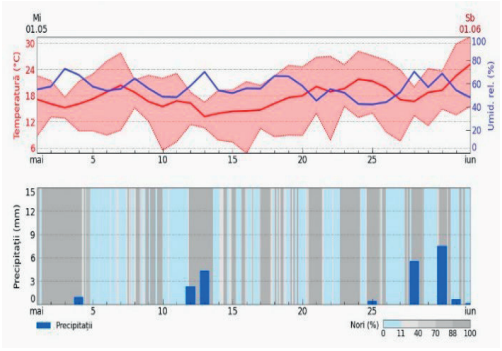


Figura 2. Graph: top) temperatures (red) and relative air humidity (light blue); down) precipitation (mm). May, 2024. Source: https://www.meteoblue.com/ro

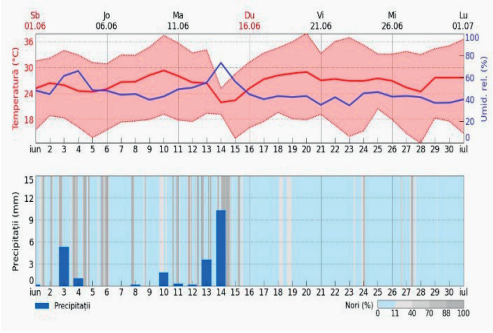


Figura 3. Graph: top) temperatures (red) and relative air humidity (light blue); down) precipitation (mm). June, 2024. Source: https://www.meteoblue.com/ro

In the third decade of May (17.05.2024), due to a colder climate, the activity of adults is lower with an average of 3.98 adults/trap. In some traps no adults were recorded in the Decis Trap traps. As the air temperature increased (22°C), more adults were captured, with a total of 185 specimens/25 traps and an average of 7.4 specimens/trap. The most intensive flight period was recorded on row 8, with an activity of 43 adults/trap, being also located in the middle of the cherry plantation. During the month of May, a total of 433 specimens were captured in the Decis Trap traps.

In June, the flight of the species *Rhagoletis cerasi* L. took place during the period 03-18.06, with a high frequency in the first decade of the month, with a total of 367 captures/25 traps and an average of 14.68 adults/trap (Table 3).

Consistent and significant presence observed in almost all Decis Traps.

Table 2. Evolution of the species *Rhagoletis cerasi* L., during May, 2024

Variants	Trap	6.05.2024	13.05.2024	17.05.2024	24.05.2024	Total catches
R27	C1	0	2	6	5	**13**
	C2	2	5	2	0	**9**
	C3	0	3	0	1	**4**
	C4	1	5	7	6	**19**
	C5	2	6	3	1	**12**
R29	C1	0	0	1	5	**6**
	C2	4	6	2	1	**13**
	C3	0	2	3	3	**8**
	C4	0	3	4	1	**8**
	C5	5	6	13	0	**24**
R31	C1	0	1	1	4	**6**
	C2	0	1	0	3	**4**
	C3	1	5	4	5	**15**
	C4	0	4	5	6	**15**
	C5	5	10	3	9	**27**
R33	C1	3	11	8	24	**46**
	C2	6	12	7	25	**50**
	C3	8	11	14	20	**53**
	C4	2	8	6	43	**59**
	C5	0	3	4	7	**14**
R35	C1	0	0	1	2	**3**
	C2	1	4	0	1	**6**
	C3	0	1	0	2	**3**
	C4	0	1	2	7	**10**
	C5	0	0	2	4	**6**
Total		**40**	**110**	**98**	**185**	**433**

Table 3. Evolution of the species *Rhagoletis cerasi* during June, 2024

Variants	Trap	03.06.2024	12.06.2024	18.06.2024	26.06.2024	Total
R27	C1	6	8	1	0	**15**
	C2	4	1	0	0	**5**
	C3	6	9	0	0	**15**
	C4	43	1	0	0	**44**
	C5	11	0	0	0	**11**
R29	C1	11	8	1	0	**20**
	C2	5	5	0	0	**10**
	C3	6	3	0	0	**9**
	C4	5	1	1	0	**7**
	C5	13	3	1	0	**17**
R31	C1	10	11	0	0	**21**
	C2	7	16	6	0	**29**
	C3	11	0	0	0	**11**
	C4	11	0	2	0	**13**
	C5	17	1	0	0	**18**
R33	C1	12	7	2	0	**21**
	C2	21	5	0	0	**26**
	C3	44	12	0	0	**56**
	C4	61	20	1	0	**82**
	C5	50	12	0	0	**62**
R35	C1	2	1	0	0	**3**
	C2	0	0	0	0	**0**
	C3	0	0	0	0	**0**
	C4	4	1	0	0	**5**
	C5	7	1	0	0	**8**
Total		**367**	**126**	**15**	**0**	**508**

Starting from the second decade, lower temperatures and a humidity of 73% were recorded, which led to a decrease in the activity of the cherry fly in the crown of the trees

(Figure 3). Towards the end of June, a decrease in the number of adults in the traps is observed, so that starting from 26.06.2024, no adults appear in the analyzed samples.

During the year 2024, the species *Rhagoletis cerasi* appeared in the Decis Trap traps starting from the first decade of May, with a number of 8 adults/trap, after which the number of the population increases to 46 adults/trap on 13.05. Amid low temperatures and rainfall, the population drops to 23 adults/trap, then increases towards the end of May to 43 adults/trap. The maximum flight was recorded in the first decade of June with a peak of 61 adults/trap. As the fruits are harvested, the population begins to drop significantly to 20 adults/trap on 12.06, then to 6 adults/trap on 18.06, and after 26.06, no adults appear in Decis Trap traps. It can be seen in figure 4 that as the air temperature is higher, the number of adults caught in the Decis Trap traps also increases (Figure 4).

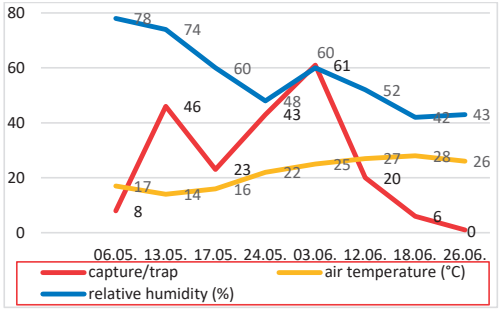


Figure 4. Population dynamics of *Rhagoletis cerasi*, 2024

The relatively small number of adults of *Rhagoletis cerasi* caught in traps was also due to the chemical treatment carried out when the species appeared in the crown of the trees, starting from the second decade of May (12.04.2024), with Fastac 10 EC - 0.02%. The cherry fly population was also kept under control by capturing the insect in Decis Traps. The largest population captured in the Decis Trap traps was recorded in the first decade of June, after which the density of the *Rhagoletis cerasi* species begins to decrease, so that towards the end of the month it is non-existent in the crown of the trees.

The fruits attacked by *Rhagoletis cerasi*, show deeper and darker areas on the outside, with time they become soft, turn brown and rot due to infections with the fungus *Monilinia* laxa (https://www.anfdf.ro/). *Monilinia laxa* is favored by the attack of these insects (Zală et al., 2007).

Among the cherry varieties analyzed, aspects of *Monilinia laxa* attack on inflorescences and shoots were highlighted in the Regina, Giorgia, Van, Boambe de Cotnari, Vega, and Rivan varieties. The first infections appeared at the beginning of May, in the varieties Boambe de Cotnari and Amaris. The attack on young shoots led to wilting, bending of the tip down, and their withering, and the frequency of attack was 10% on shoots in Boambe de Cotnari variety and 15% in Amaris variety. The attack of the pathogen was manifested in these varieties also on the flowers, showing browning and withering, remaining hanging on the shoots. During May, the temperatures recorded, correlated with the relative air humidity between 60-80%, allowed the pathogen *Monilinia laxa* to develop in good conditions on the attacked shoots, ultimately leading to their drying.

The high temperatures in June allowed the infections to spread to the fruits, where the appearance of round brown spots was initially observed. The infection on the fruit bunches settled from their center, expanding outwards. Finally, the fruits showed a soft rot, the flesh browned, and the appearance of specific fruiting was evident (Figure 5).

In June, the varieties where symptoms produced by the pathogen *Monilinia laxa*, anamorph stage *Monilia laxa* (Figure 6) were identified had an incidence of shoot attack between 3.54% in the Van variety and 30.25% in the Rivan variety (Figure 7).

At the fruit level, the attack incidence was a minimum of 6.78% in Regina and a maximum recorded in the Boambe de Cotnari variety, 32.25% (Figure 8).

The intensity of the shoot attack had a minimum in the Vega variety (9.51%) and a maximum of 45.25% in the Rivan variety. The intensity of the fruit attack had values of 10.31% in the Van variety and 53.1% in the Giorgia variety (Figure 9). Manifestations of moniliosis in these varieties during previous years were also highlighted by Zală et al. (2022).

Figure 5. *Monilinia laxa*- fruit attack
(foto: Zala Cristinel Relu, 2024)

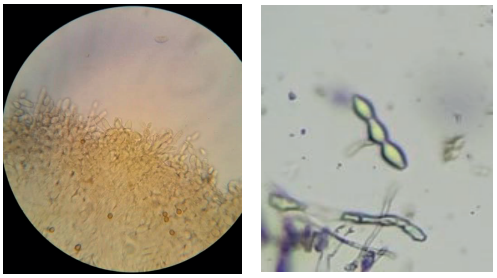


Figure 6. *Monilia laxa* - anamorph stage
of *Monilinia laxa* (foto: M.S. Manole, 2024)

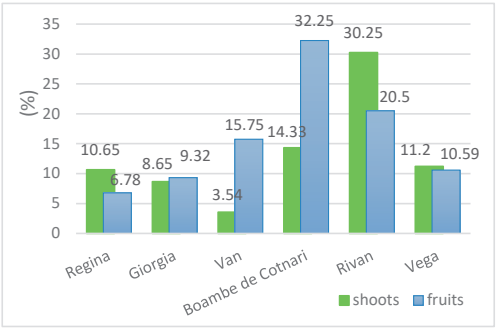


Figure 7. The incidence of attack
by *Monilinia laxa* to shoots and fruits

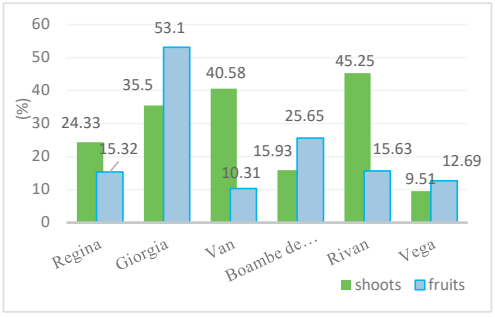


Figure 8. Intensity of attack by *Monilinia laxa*
on shoots and fruits

The values of the phytosanitary indicators led to the calculation of a degree of attack at the shoot level of 1.06% in the Vega variety and 13.68% in the Rivan variety. In fruits, the highest degree of attack was recorded in the Boambe de Cotnari variety, at 8.27% (Figure 9).

Everhart et al. 2011 consider that the locations of attacks on shoots from the previous year may play an important role in the manifestation of attacks in the current year.

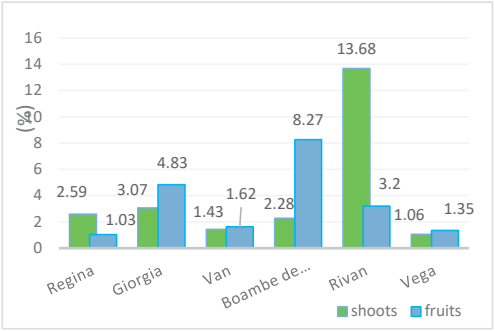


Figure 9. Degree of attack on shoots and fruits,
Monilinia laxa

CONCLUSIONS

In the year 2024, the population of the species *Rhagoletis cerasi* L. appeared in the crown of the trees in the first decade of May, followed by a significant increase in the second decade of May, after which the population decreases against the background of some precipitations recorded on May 12th and 13th.

Decis Traps have proven useful in tree crowns, both for monitoring and controlling *Rhagoletis cerasi*. Depending on the demographics of the population, the optimal time to apply chemical treatments can be determined.

The dynamics of *Rhagoletis cerasi* L. populations in the cherry orchard within the didactic experimental field of USAMV Bucharest highlighted the fact that the appearance of adults took place in the first decade of May, with a maximum flight in the first decade of June, followed by a gradual decrease as follows so that at the end of June there was a lack of adults in the Decis Trap traps.

In the context of climate change, a significant increase in the cherry fly population was found,

being present in the crown of the trees right from the beginning of May.
The observed pathogen appeared on flowers and young shoots at the beginning of May, and in June, the pathogen *Monilinia laxa* was noted in the crown of the trees on ripe cherry fruit.
During the monitoring of the disease attack, we observed an increase in *Monilinia laxa* infections with fruit ripening.
It was also found that where there was a large number of adults captured in traps, the manifestation of rot on cherry fruits was also more intense, knowing that the presence of the cherry fly produces pathways for the pathogen to enter the fruit.

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