

MIJLOACE BIOLOGICE DE COMBATERE A PRINCIPALILOR DĂUNĂTORI LA CIREȘ BIOLOGICAL TOOLS FOR CONTROLLING THE MAIN PESTS OF SWEET CHERRY

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Abstract

The paper presents the data collected from an ecological plot of sweet cherries with an area of 0.5 ha, where different methods of monitoring and combating the main pests were tested: European cherry fruit fly - *Rhagoletis cerasi* L. and black cherry aphid - *Myzus cerasi* F. The study took place during the years 2019-2020. European cherry fruit fly monitoring - *Rhagoletis cerasi* L. was performed with both atraCERAS optical panels and Decis Trap devices, with both a warning and control role, the results obtained highlighting a similar flight dynamics. The control of the European cherry fruit fly, carried out by direct control with the help of Decis Trap devices, the dose of 100 traps / ha, proved to be effective, the Abbott effectiveness indicator registering values between 83.4 - 90.5% in 2019, respectively 81.6 - 87.8% in 2020, depending on the studied variety. To control the black cherry aphid - *Myzus cerasi* F., the product Prev-Am was mainly used, based on orange oil, which was used with good results for the first attacks observed.

Cuvinte cheie: musca cireșelor, afidul negru, combatere biologică

Key words: cherry fruit fly, black cherry aphid, biological control

1. Introduction

Over the last decade, public opinion has proven to be very sensitive to environmental and human health issues. If until 1990, the objectives of agriculture were to increase production, in order to meet food requirements, today the aim is to find new solutions in order to protect the environment and natural resources (Sallai P., et al., 2000; Geier B., 2000; Friedrich Polesny, 2000; Teodorescu Georgeta et al., 2003; Sumedrea Mihaela et al., 2010, 2015).

Taking into account these premises, multinational companies, once producing only synthetic chemicals, have integrated into the typical mechanisms for obtaining and marketing products dedicated to organic farming. Thus, the multitude of new products requires permanent, detailed research, in terms of establishing the best products combinations, correctly positioned in an optimized technology, which also includes non-polluting biotechnical methods (Blomfield, T.L., et al., 2000; Baptista A. and Clemente, J., 2000; Knight A., et al., 2013).

In the context of the increasing demand of the society for a sustainable agriculture, there was a tendency of dizzying growth of the agricultural surfaces cultivated in ecological system. This is also the case of the sweet cherry, a species with encounter good soil and climatic conditions in Romania, being one of the main species requested to be planted through PNDR 2014-2020, Fruit Subprogram - Submeasure 4.1a - 'Investments in fruit growing'. By implementing the mentioned program, approximately 800 ha of cherries will be planted, of which more than half in ecological system.

One of the most important challenges in organic orchards is to find an ecological way to limit the action of the pests, to reduce the risk of contamination with pesticides and other elements which can affect the health of final consumer and the environment (Bujdei Andrea, et al., 2016).

Biological pest control is a key component of IPM strategies for both conventional and organic farmers.

Rhagoletis cerasi L. is considered an important and extremely destructive pest of the genus *Prunus* spp. (Daniel and Baker, 2013; Daniel and Grunder, 2012). Its larvae grow inside cherries and, without effective control methods, 100% of the fruit can be infested (Daniel and Baker, 2013; Fimiani, 1983).

Myzus cerasi F. is another dangerous pest of the genus *Prunus* spp., which can cause serious economic damage, especially to young trees and nurseries, if populations are not properly controlled. (<http://treefruit.wsu.edu/crop-protection/opm/black-cherry-aphid>).

2. Material and methods

The experiment was located on an area of 0.5 ha, in a plot with 6 cultivars ('Daria', 'Severin', 'Stella', 'Van', 'Superb' and 'Rubin') grafted on 2 vegetative Romanian rootstocks ('IP-C4' and 'IP-C7'),

year of planting was 2011, planting distance 5.0/5.0 m, with an average biological reserve for the two pests studied (Fig. 7). Along the rows, the soil was maintained by hand plows, and on the interval between rows was mowed mechanically.

The appearance and staggering of the flight of the European cherry fruit fly - *Rhagoletis cerasi* L., was followed with the help of atraCERAS optical panels (Fig. 8), the readings being performed twice/week. Pest monitoring was performed in parallel with the Decis Trap devices (Fig. 9-10), which have the role of both combating and warning of its presence.

Control of European cherry fruit fly - *Rhagoletis cerasi* L. was performed by direct control using Decis Trap devices, dose 100 traps/ha, evenly distributed. These were installed at the beginning of the pest's flight, a time determined by the atraCERAS optical panels.

The Decis Trap devices were placed manually, at about half the height of the tree crown, on southern exposure, slightly protected from the sun's rays, the verification being performed weekly. They are provided with food attractants based on protein substances and impregnated with insecticide (0.015 g deltamethrin / trap) on the inside of the lid, with the role of destroying the harmful flies caught. The active substance *deltamethrin* belongs to the chemical group of synthetic pyrethroids and acts by contact and ingestion on harmful insects. The principle behind which Decis Trap works is to attract and kill as many adult flies (both females and males) in order to reduce the number of larvae below the economic threshold of damage, during the period when the crop is highly susceptible.

In order to establish the frequency of damage, before harvesting, 300-500 fruits / variant were analysed, in 4 repetitions. The fruits, harvested at random, from different levels, were cut in half and analysed according to the rules of EPPO PP 1/35 (2), recording the number of larvae present.

For the control of black cherry aphids - *Myzus cerasi* F., in the ecological variants was used the products Ovipron Top (highly refined paraffin oil 800 g/l), Prev-Am (natural orange oil 60g/l), Deffort (plant extract from the *Fabaceae* family 4.0%, manganese and zinc 1%) and Garex B (garlic extract 80.73% and boron 2.0%). The treatments were applied foliar, using mechanical equipment: Goldoni Star tractor + Osella 1000 pump, volume of solution per unit area of 1,000 l/ha. The first treatment was performed in February, at the end of the dormant period, with the Ovipron Top product (conc. 1.0%), in order to reduce the hibernating reserve of the pest. During the vegetation period, when were observed the first aphid colonies (17.04.2019; 10.04.2020), Prev-Am (conc. 0.5%) was applied, in association with Deffort, respectively Garex B, the last ones having repellent effect, with repetition at an average interval of 7 days.

The evaluation of the effectiveness was performed according to the EPPO norms PP1 / 21 (2), assessment being done with binocular magnifier (Zeiss Stemi 508), on 40 shoots / variant, previously marked, in 4 repetitions, counting the living specimens. The results obtained are presented as a percentage, as frequency of attack (F%), respectively as effectiveness. The efficacy was calculated according to the Abbott formula: $E\% = (1 - d / D) \times 100$, where: d = no. of attacked fruits / attacked shoots in the treated version; D = no. of attacked fruits / attacked shoots in the untreated control variant.

3. Results and discussion

Examining tables 2 and 3 it is observed that during the study period, the microclimate conditions were favourable to pest attack, European cherry fruit fly - *Rhagoletis cerasi* L. and black cherry aphid - *Myzus cerasi* F.

The recorded captures of *Rhagoletis cerasi* L. using atraCERAS optical panels, formed the basis of the pest flight curve. In 2019, the first capture of *Rhagoletis cerasi* L. was registered on May 17, 2019, with a maximum flight in the week June 10-14, 2019. In the conditions of 2020, the first capture was registered on May 20, 2020, and the maximum of the flight curve during June 15-19, 2020 (Fig. 1, a-b). Captures recorded with Decis Trap (Table 1, a-b) showed a flight dynamics similar to that recorded with atraCERAS panels (Fig. 2, a-b). The amount of catches / Decis Trap is shown graphically in Figure 3, a-b.

During the two years of the study, the Decis Trap traps ensured an effective control of the pest *Rhagoletis cerasi* L. Among the 6 varieties in the ecological group, the lowest frequency of attack was recorded at 'Superb' cv. (F = 2.6% / 2019; F = 4.0% / 2020), followed by 'Severin' cv. (F = 3.3% / 2019; F = 4.2% / 2020), and the highest, at the 'Rubin' cultivar (F = 4.6% / 2019; F = 6.0% / 2020) (Fig. 4). In the standard chemical version, the frequency of attack (F) was between 1.6% in 2019 and 2.8% in 2020. By comparison, in the untreated control there was a frequency of attack (F) of 28.0% in 2019, respectively 32.6% in 2020.

The effectiveness of Decis Trap devices in the control of European cherry fruit fly (EAbbott) was between 83.4-90.5% (2019) and 81.6-87.8% (2020), respectively, depending on the variety (Fig. 5). Thus, in both years of study, the highest efficacy was recorded for the 'Superb' cultivar (E = 90.5% / 2019; E = 87.8% / 2020), followed by 'Severin' cv. (E = 88.1 % / 2019; E = 87.2% / 2020), and the lowest for the 'Rubin' cultivar (E = 83.4% / 2019; E = 81.6% / 2020). Comparatively, in the standard chemical variant, the efficacy had values ranging between 94.1% in 2019 and 91.5% in 2020. Figure 11 shows images with

fruits from the ecological group of cherries vs. fruit infested with the larvae of the pest in the untreated control.

Applied during the growing season to control the attack of black cherry aphids - *Myzus cerasi* F., the product Prev-Am, ensured good control of them (Fig. 6; 12). Thus, 3 days after the application of the treatment, an efficacy (EAbbott) between 68.6-72.4% in 2019 and 70.0-72.5% in 2020, depending on the cultivar was provided.

Aspects from the untreated control are highlighted in Figure 13. Being a contact product, for the most effective pest control, Prev-Am, should be applied as soon as the first aphid colonies are observed. As the infestation spread, the leaves distort as a result of the attack, reducing the aphids contact with the products applied to control them. (http://oregonstate.edu/dept/nurspest/black_cherry_aphid.html).

In this situation, the effectiveness of treatment is greatly diminished.

With only contact action and low persistence, repeated treatments are required at intervals of about 7-10 days according to the level of infestation, to control the pest during the growing season and prevent reinfestation. So it can be used with good results for the first attacks observed.

During April, in the ecological group of sweet cherries there were also pests such as: winter moth - *Operophtera brumata* respectively mottled umber moth - *Hibernia defoliaria*. Deffort and Garex B products, applied in repeated treatments, limited both the frequency and intensity of the attack of these pests, which remained below the economic damage threshold.

4. Conclusions

Monitoring of European cherry fruits fly - *Rhagoletis cerasi* L. can be done with both atraCERAS optical panels and Decis Trap devices, the latter having both a warning and a control role. The flight curves of the pest, based on the captures recorded in the two types of traps, showed a similar flight dynamic.

To control of the European cherry fruit fly using direct control with the help of Decis Trap devices, the rate of 100 traps / ha proved to be effective. These, were located at the beginning of the flight and provided efficiency (EAbbott) of 83.4-90.5% in 2019, respectively 81.6-87.8% in 2020, depending on the studied cultivar.

Decis Trap devices can be used in both organic and conventional agriculture, with the advantage that they do not generate residues, do not present any risk of incompatibility and do not require a treatments break before harvest.

In the fight against black cherry aphid - *Myzus cerasi* F., good results were obtained with the product Prev-Am, based on a mixture of cold-pressed orange oil. At 3 days after the application of the treatment, an efficacy (EAbbott) was provided, ranging between 68.6-72.4% in 2019 and 70.0-72.5% in 2020, depending on the studied cultivar. Prev-Am, can be used with good results for the first observed attacks. As the infestation spread out, the leaves distort as a result of the attack, reducing the aphids contact with the control products. In this situation, the effectiveness of treatment is greatly diminished.

Because Prev-Am has only a contact action and low persistence, repeated treatments are required every 7-10 days, depending on the infestation level, in order to control the pest during the growing season and prevent reinfestation.

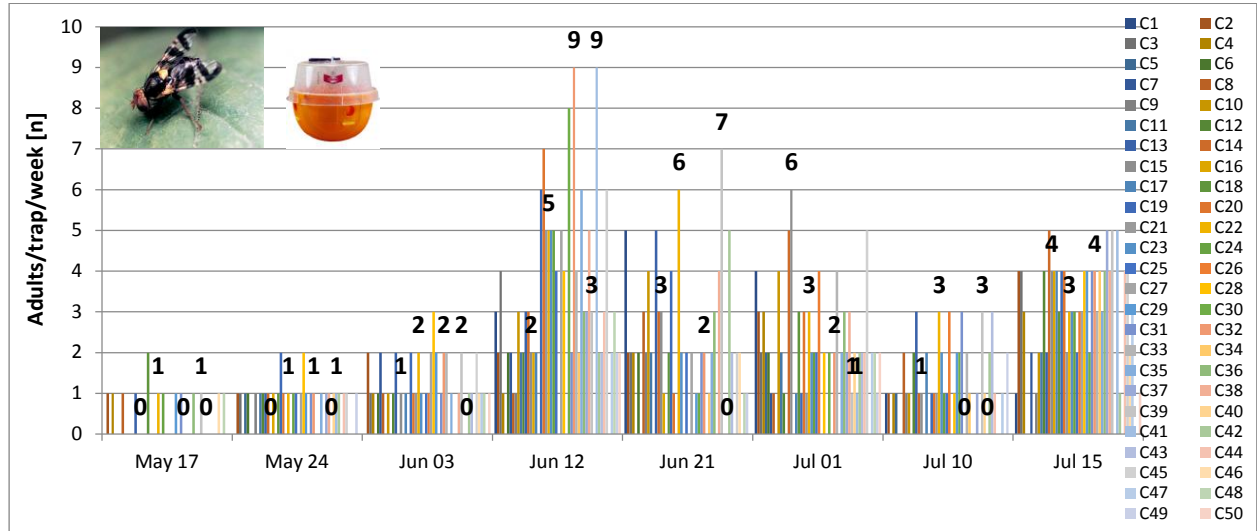
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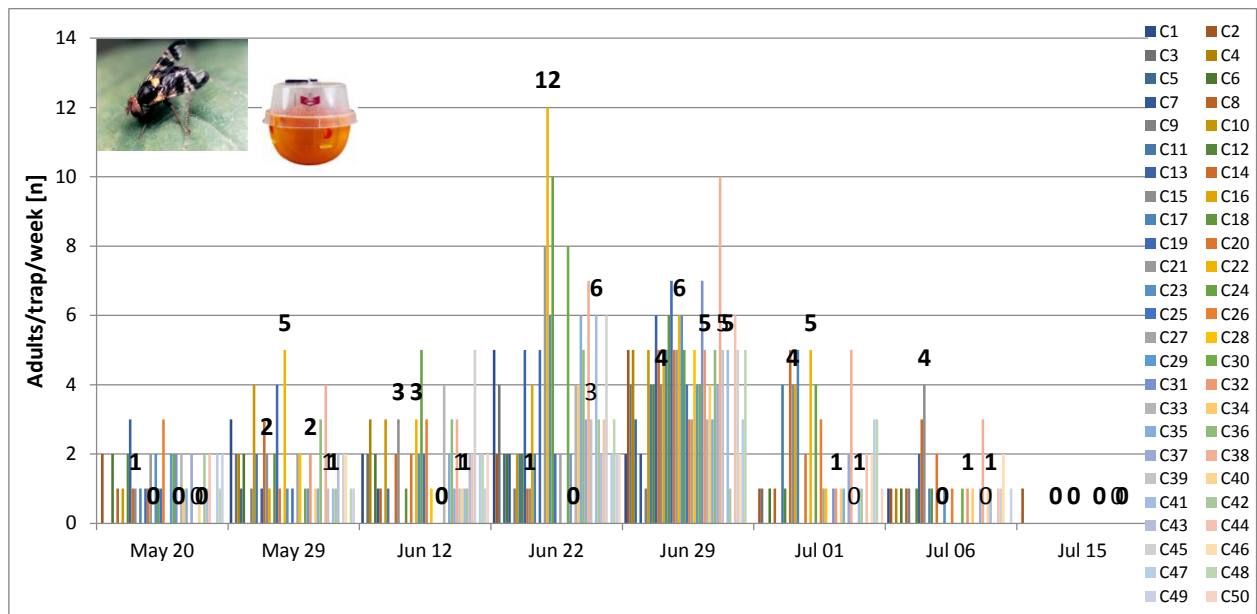
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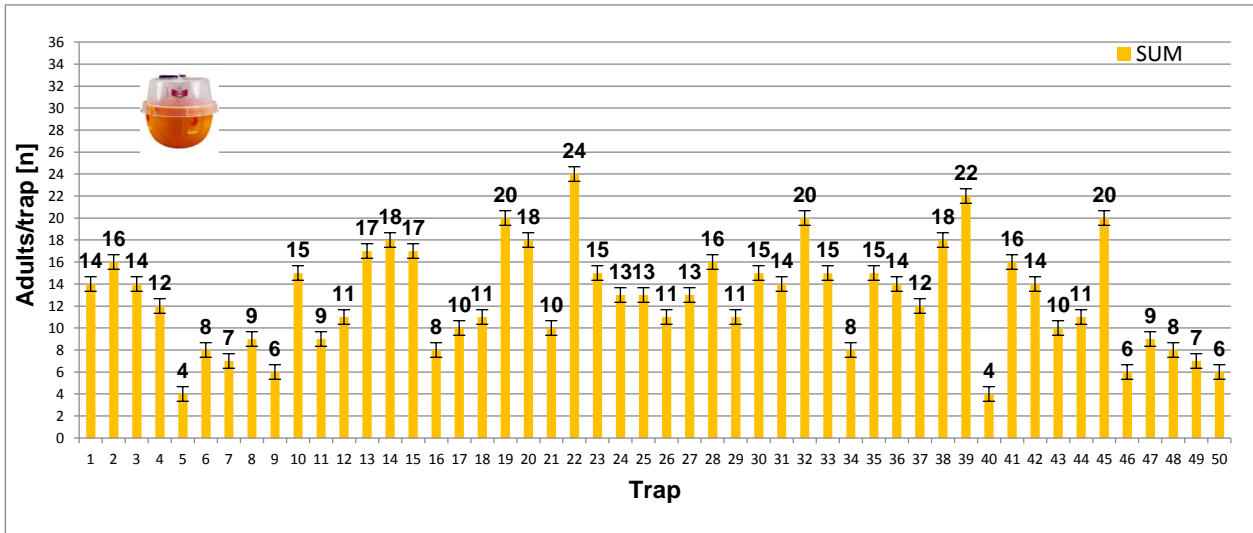


a)

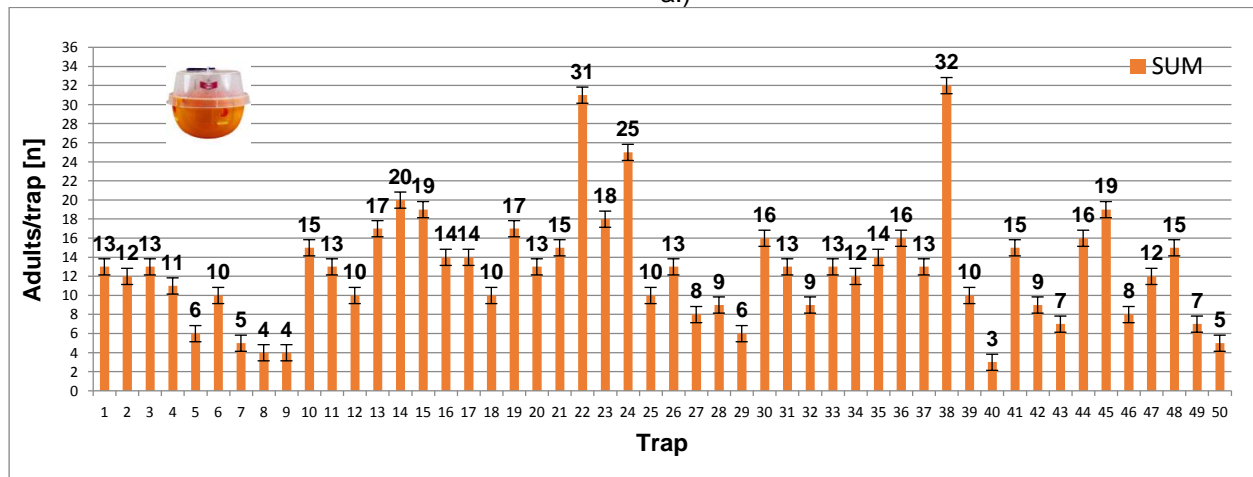


b.)

Fig. 2. Monitoring of European cherry fruit fly - *Rhagoletis cerasi* L. using Decis Trap RIFG Pitesti, Romania Lat. 44.513°N; Long. 24.52°E; Alt. 287 m., a) - 2019; b) – 2020



a.)



b.)

Fig. 3. Captures sum of European cherry fruit fly - *Rhagoletis cerasi* L. / Decis Trap RIFG Pitesti, Romania Lat. 44.513°N; Long. 24.52°E; Alt. 287 m, a) - 2019; b) - 2020

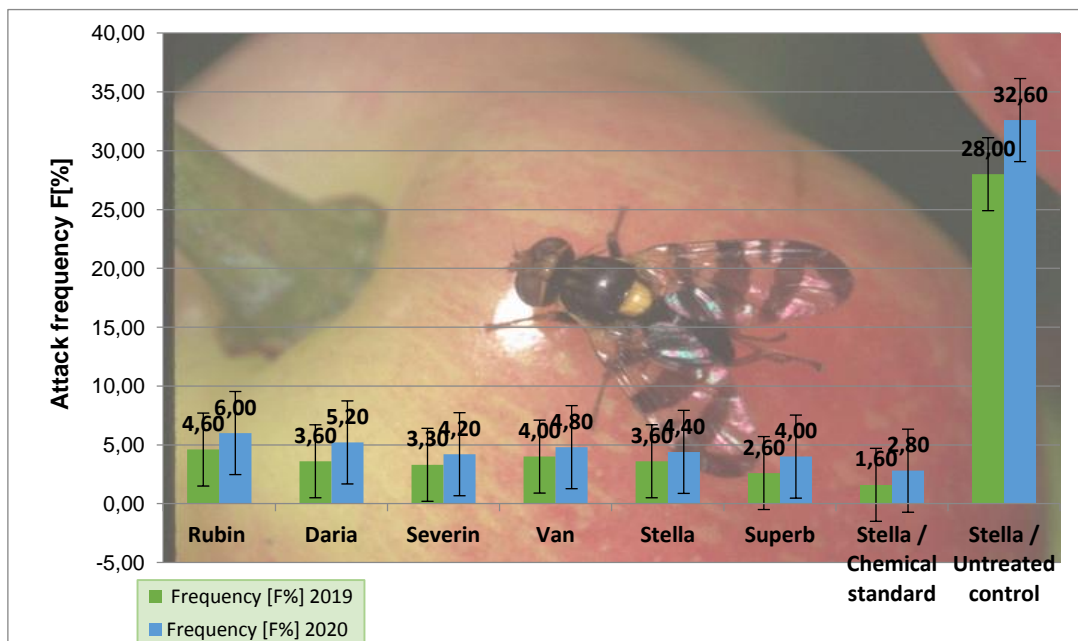


Fig. 4. Frequency of damages produced by European cherry fruit fly - *Rhagoletis cerasi* L. RIFG Pitesti, Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m, 2019-2020

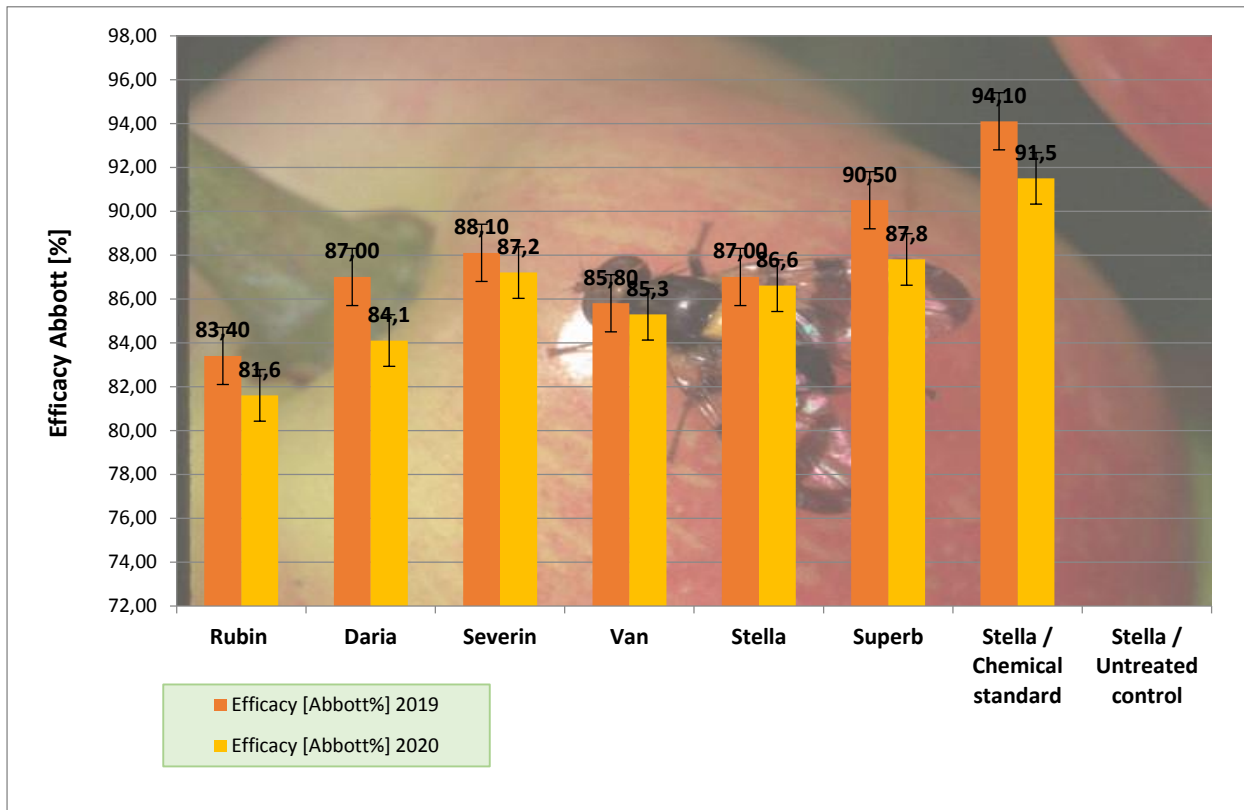


Fig. 5. Efficacy of Decis Trap devices in control of European cherry fruit fly - *Rhagoletis cerasi* L. RIFG Pitesti, Romania, Lat. 44,513°N; Long. E 24,52°E; Alt. 287 m, 2019-2020

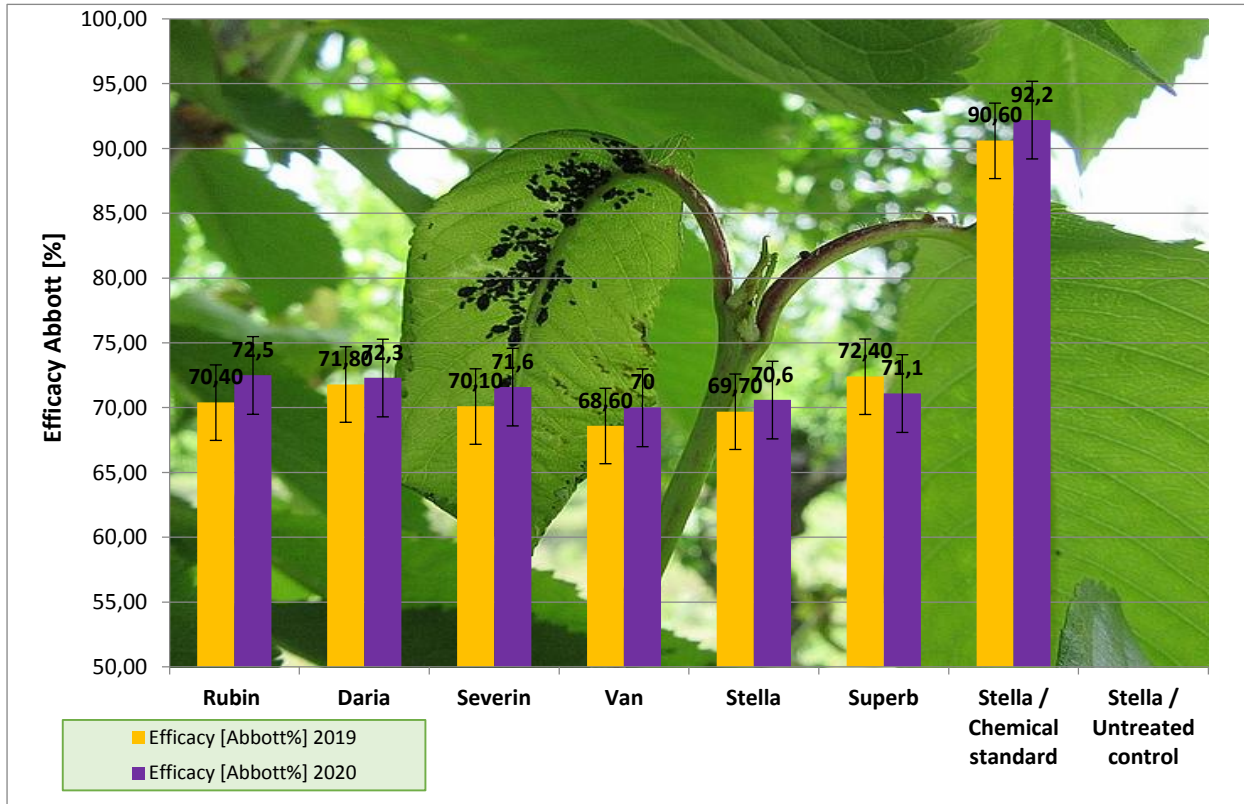


Fig. 6. Efficacy of the biological products used to control black cherry aphid - *Myzus cerasi* F., RIFG Pitesti, Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m, 2019-2020



**Fig. 7. Ecological plot of cherry (0.5 ha)
RIFG Pitesti Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m**



**Fig. 8. First capture of *Rhagoletis cerasi* L. observed in the monitoring traps type atraCERAS,
RIFG Pitesti, Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m**



**Fig. 9. Decis Trap devices installed in biologic variants, to control European cherry fruit fly -
Rhagoletis cerasi L., RIFG Pitesti, Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m**



a)



b.)

Fig. 10. European cherry fruit fly captured with Decis Trap: a.) at the flight start; b.) at the maximum flight curve, RIFG Pitesti Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m



**Fig. 11. Cherries from the ecologic plot vs. fruits damaged by European cherry fruit fly - *Rhagoletis cerasi* L. in untreated control, RIFG Pitesti, Romania
Lat. 44.513°N; Long. 24.52°E; Alt. 287 m**



Fig. 12. Effect of Prev-Am product against black cherry aphid *Myzus cerasi* F. 3 days after treatment RIFG Pitesti, Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m



Fig. 13. Aphid attack - *Myzus cerasi* F. in the untreated control RIFG Pitesti, Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m

Table 2. Dynamics of some weather parameters in the vegetation period 2019 RIFG Pitesti, Romania, Lat. N 44,513; Long. E 24,52; Alt 287m

Year 2019 / Month	Maximum temperature (*C)	Minimum temperature (*C)	Average Temperature (*C)	Leaf wetness (h)	Days with wetness (n)	Precipitations (l/m2)	Days with precipitations (n)	Wind speed (km/h)	Wind gust (km/h)
April	26.3	-0.1	10.8	54.8	22	35.6	11	2.5	22.5
May	28.2	2.4	15.7	107.0	27	46.3	19	1.9	20.1
June	32.2	11.2	21.2	188.3	30	197.1	19	1.0	20.9
July	34.9	7.9	21.1	135.8	26	93.4	10	1.0	17.2
August	35.1	10.2	22.8	32.8	12	9.7	3	1.0	17.7
Average	31,34	6,32	18,32	103,74	23,4	76,42	12,4	1,48	31,34
Std. deviation	3,9627	4,9484	4,9877	62,4829	6,9857	73,9544	6,7676	0,6907	3,9627
Variance	12,6442	78,2980	27,2254	60,2303	29,8534	96,7737	54,5772	46,6657	12,6442

Table 3. Dynamics of some weather parameters in the vegetation period 2020 RIFG Pitesti, Romania, Lat. 44.513°N; Long. 24.52°E; Alt. 287 m

Year 2020 / Month	Maximum temperature (*C)	Minimum temperature (*C)	Average Temperature (*C)	Leaf wetness (h)	Days with wetness (n)	Precipitations (l/m2)	Days with precipitations (n)	Wind speed (km/h)	Wind gust (km/h)
April	25.3	-3.9	10.9	11.3	6	21.1	6	2.3	20.8
May	30.13	4.3	15.0	79.0	21	104.1	14	2.6	18.6
June	32.8	4.3	19.6	168.8	27	166.2	14	4.0	18.8
July	35.3	11.6	22.0	98.3	21	52.0	11	2.5	15.0
August	33.9	11.0	22.0	94.0	17	29.0	10	3.8	18.4
Average	26,43	6,24	15,72	88,02	17,20	70,26	9,80	2,58	14,16
Std. deviation	2,1888	4,0489	3,3000	40,0472	4,1231	60,9681	2,0616	0,7848	1,8074
Variance	8,2828	64,8857	20,9924	45,4978	23,9715	86,7750	21,0363	30,4167	12,7641