

---

## PRELIMINARY STUDIES ON *RHAGOLETIS CERASI* L. ECOLOGICAL CONTROL

Constantina Chireceanu\*, Viorel Fatu

Research-Development Institute for Plant Protection, ROMANIA

\* correspondance address:

Research-Development Institute for Plant Protection

Bd. Ion Ionescu de la Brad nr. 8, CP 013813, S 1,

Bucharest, ROMANIA

Tel.: 004-021-2693231 (32, 34)

Fax.: 004-021-2693239

e-mail: [cchireceanu@yahoo.com](mailto:cchireceanu@yahoo.com)

**Abstract:** Preliminary experiments carried out under laboratory to evaluate the effect of four Romanian isolates of the entomopathogenic fungus *Beauveria bassiana* upon adults of European Cherry fruit fly *Rhagoletis cerasi* L. (Diptera: Tephritidae) at R&D Institute for Plant Protection, Bucharest in 2007. A maxim level of 76% mortality of the flies was obtained in case of the BbOb 1\95 strain isolated from *Operophtera brumata* species on *Acacia* sp. As well as, two initial field experiments were conducted in connection with the efficiency of the covering the soil under canopy cherry trees area to prevent *R. cerasi* emerging adults. Percentages of 5,5 and 8,6% infested cherries by the cherry fly were obtained in plots where the ground around the cherry three were covered with mowed grass and polyethylene, respectively, comparatively with the insecticide application in commercial orchard (18,50%) and untreated control plots (24,70%).

**Keywords:** *Rhagoletis cerasi*, biological method, *Beauveria bassiana*, cultural methods

### INTRODUCTION

European Cherry fruit fly *Rhagoletis cerasi* L. (Diptera: Tephritidae) is the most economically important pest that can affect cherries in Romania. Current control method of the pest is mainly based on synthetic pirethroids against adult populations, applied during the maturing stages of the cherries at a moment very closed to harvest. The optimal timing of insecticide applications base on the inspection of fruit maturity stage in combination with the first captured flies on the yellow sticky traps *Atraceras* and/or the effective temperatures sum. Nowadays, the number of available chemical insecticides for cherry fruit fly control continues to decrease due to the multitude negative effects on cherry ecosystem safety or regulatory restriction requirements imposed by the EU Council Directive 91/414.

New control tactics that use biological control agents (entomopathogenic fungi, nematodes, parasites, predators), agrotechnical and cultural control methods (covering trees with nets, ground cover and mulches under canopy area of trees) have become available in last years to take the place of synthetic insecticides, especially in the family and organic cherry farming. Extensive studies on the use of entomopathogenic nematodes and fungi for the control of the cherry fruit fly were done in such countries as Swiss (Daniel & Wyss, 2008), Germany (Herz *et.al.* 2006, 2008), Italy (Ladumer *et al.*, 2008), Russia (Vasilyeva & Hummel, 2008).

The paper aim was to assess the susceptibility of cherry fruit fly adults to *Beauveria bassiana* infection and the efficiency of some cultural methods to prevent *R. cerasi* emerging adults.

### MATERIAL AND METHOD

The trials were conducted in laboratory and growing area of R&D Institute for Plant Protection, Bucharest in 2007. The first experimental test focuses on identifying the susceptibility of cherry fruit fly adults to infection by *Beauveria bassiana* isolates was carried out under laboratory conditions (22 °C and 65% RH). Four Romanian isolates of *B. bassiana* were used in bioassay. The test flies were obtained from the pupae of the local populations resulted from field collected infested cherries in previous year. The pupae were stored in refrigerator as recommended Vallo *et al* (1976) before they were used in the laboratory tests. The emerged flies were transferred, each 50 adults in a cage (20x30cm), using 2 replicates/fungal isolate. They were provided with hydrolyzed yeast and

sugar (1:3) and water. After 4 days, the adults were directly sprayed with *B. bassiana* aerial conidia suspended in water (0, 01% Tween 80). The pathogenicity of *B. bassiana* strains was conducted with  $25 \times 10^7$  conidia/ml.

The mortality was recorded daily until the last fly died. In order to determine whether the flies died because of the fungal infection, the dead flies were placed in a moist room to stimulate the growth and sporulation of the mycelia.

The field experimental trials comprised two clusters of 4-5 sweet cherry trees each with large canopy (5-8m height) where the grounds under canopy area of trees were covered with 20-25 cm dry mowed grass (V1) and polyethylene sheet (V2) for to prevent the emerged *R. cerasi* adults from the overwintering puparia in soil to get up to cherries. The efficacy results related to the cultural methods for the control of cheery fruit fly were compared with those that obtained in the sweet cherry orchard where one insecticide treatment was applied against adults (V3) and untreated control plot (V4). In the cherry orchard, the different perennial grasses covered the ground. The cultivars were middle and late ripening (*Van* and *Germersdorf*) and the pirethroid insecticide was applied at five days after the first flies captured on sticky yellow traps. The flight of *R. cerasi* adults was monitored by three sticky yellow traps (Atraceras)/variant, placed in sunny side of trees and the evaluations were fulfilled. Placement of the traps in the canopy and covering of soil took take place on May 11<sup>th</sup> before the catching of adults on sticky yellow traps when the cherries were green yet. The percentages of damaged cherries were evaluated on 300 fruits randomly collected from the each of the plots. Climatic conditions (the rainfalls, air temperatures) were provided by Metrilog's M2M system placed at RDIPP Bucharest.

## RESULTS

The preliminary evaluation of *B. bassiana* isolates for virulence against *R. cerasi* adults (Baneasa population) presented in table 1 suggests that the Romanian *B. bassiana* isolates - BbHc 1\89, BbHc 1\87, BbHr 1\94, BbOb 1\95 are pathogenic to *R. cerasi* adults. The *B. bassiana* strain isolated from *Operophtera brumata* larvae (BbOb 1\95) was more virulent, causing the high mortality of adult's flies.

For the field trials, data about local variation of climate were necessary, especially that the oviposition and flight activity of *R. cerasi* adults have been affected by temperatures and precipitation in spring (Suta, 1969). Daily mean temperatures of 18<sup>0</sup>C during adult's emergence period induce the oviposition activity at 2-7 days and the precipitation amounts fallen over 140 mm destroyed adults immediately after their emergence from the soil (Suta, 1969). The weather conditions in Baneasa area during period of observation in spring of 2007 year are given in the figure 1.

Capture dynamics of cherry fruit adults on yellow sticky traps in each experimental plot are shown in figure 2. The yellow sticky traps were set up on 11<sup>th</sup> May. The first records of *R. crease* adults were on 14<sup>th</sup> May in insecticide application in orchard and control plots, on 18<sup>th</sup> May in covered ground with 20-25 cm of mowed grass and 23<sup>rd</sup> in covered ground with polyethylene plots. In all plots the captures on yellow sticky traps increased in abundance 4 - 5 days after emergence. The longest adult's flight period was observed in control plot. The flight period was much shorter in the orchard and in the covered ground with mowed grass and with polyethylene plots.

Results regard to the degree of damaged cherries depending of experimental plots is presented in table 2. Much better results were obtained where the ground was covered with mowed grass and polyethylene plots, the percentage of infested cherries caused by the cherry fly was between 5,5 and 8,6%, comparatively with the insecticide application in commercial orchard and untreated control plots which reduced the number of wormy cherries to 18.5-24.7%.

## CONCLUSIONS

- All *B. bassiana* isolate bioassayed were capable of infecting *R. cerasi* adults;
- There were differences in *R. cerasi* mortality, according to the isolate. The strain isolated from *Operophtera brumata* species on *Acacia sp.* was the most virulent (76% mortality of flies).
- Initial field results suggested that the covering the soil under canopy cherry trees area with mowed grass and polyethylene laid to an percentage of 5,5 and 8,6%, infested cherries caused

by the cherry fly. This control away of cherry fruit fly can be used in the fruit garden or small family organic farms.

#### **Acknowledgements:**

We are grateful to dr. Ana-Maria Andrei providing the *B. bassiana* isolates for experimentation. The work was funded by Romanian Ministry of Education and Research (Biotech Program, Project No. 133/2006).

#### **REFERENCES**

- DANIEL, C. and WYSS, E. (2008) Field applications of entomopathogenic fungi against *Rhagoletis cerasi*. Published in Boos, Markus, Eds. *Ecofruit - 13th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing: Proceedings to the Conference from 18th February to 20th February 2008 at Weinsberg/Germany*, pp. 87-92. Available from [www.ecofruit.net](http://www.ecofruit.net).
- HERZ, A., KÖPPLER, K., VOGT, H., ELIAS, E., KATZ, P., PETERS, A. (2006). Field application of entomopathogenic nematodes to control the cherry fruit fly, *Rhagoletis cerasi* L. (Diptera, Tephritidae): the "how and when" as key to success?. *Proceedings of the International Workshop "Implementation of Biocontrol in Practice in Temperate Regions – Present and Near Future"*. Research Centre Flakkebjerg, Denmark, November 1-3, 2005. *DIAS Report No. 119* (2006), 283-289.
- HERZ, A., KÖPPLER, K., VOGT, H., ELIAS, E., KATZ, P., PETERS, A. (2008). Practical experience in using entomopathogenic nematodes to control the European Cherry Fruit Fly, *Rhagoletis cerasi* L. (Diptera, Tephritidae). *First Meeting of TEAM. Palma of Mallorca. 7-8<sup>th</sup> April 2008*.
- LADUMER, E., BENUZZI, M., FIORENTINI, F., FRANCESCHINI, S. (2008). *Beauveria bassiana* strain ATCC 74040 (Naturalis ®), a valuable tool for the control of the cherry fruit fly (*Rhagoletis cerasi*). Published in Boos, Markus, Eds. *Ecofruit - 13th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing: Proceedings to the Conference from 18th February to 20th February 2008 at Weinsberg/Germany*, page pp. 93-97. Available from [www.ecofruit.net](http://www.ecofruit.net).
- SUTA VICTORIA, (1969). Contributii la studiul biologiei, ecologiei si combaterii mustei cireselor, (*Rhagoletis cerasi* L.) *Analele ICPP*, vol. V, 347-370.
- VALLO, V. REMUND, U. BOLLER, E.F. (1976). Storage conditions of stockpiled diapausing pupae of *Rhagoletis cerasi* for obtaining high emergence rates. *Entomophaga*, 21(3) 251-256.
- VASILYEVA, L.A., HUMMEL, E. (2008). First experiences in the application of biopreparations against the cherry fruit fly in Southern Russia in 2007. Published in Boos, Markus, Eds. *Ecofruit - 13th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing: Proceedings to the Conference from 18th February to 20th February 2008 at Weinsberg/Germany*, page pp. 98-101. Available from [www.ecofruit.net](http://www.ecofruit.net).

Table 1. Origin of fungal isolates and susceptibility of *R. cerasi* adults to infection of the Romanian *Beauveria bassiana* isolates under laboratory conditions (22 °C and 65% RH), 2007

Isolates of <i>B.bassiana</i> (Code)	Host		Location and date of collecting	Mortality of <i>R. cerasi</i> adults (the means no for 2 replicates of 50 flies). (%)
	Insect species	Plant species		
BbHe 1\89	<i>Hyphantria cunea</i>	<i>Morus sp.</i>	Medgidia, Constanta (Apr. 1989y)	28
BbHe 1\87	<i>Hyphantria cunea</i>	<i>Acer sp.</i>	Simnic, Dolj (Aug. 1987y)	40
BbHr 1\94	<i>Hyponomeuta rorella</i>	<i>Salix sp.</i>	Rusca-Uslina, Tulcea (May 1994y)	46
BbOb 1\95	<i>Operophtera brumata</i>	<i>Acacia sp.</i>	Dridu, Ialomita (July 1995y)	76
Untreated control (sterile distillate water)	-	-	-	4

Table 2. Percentage of infested cherries caused by the cherry fly *R. cerasi* detected in experimental plots, Baneasa area, 2007

Experimental plots	Infested cherries (%)
Covered ground with 20-25 cm mowed grass	8,60
Covered ground with polyethylene sheet	5,50
Insecticide application in commercial orchard	18,50
Untreated control, uncovered ground	24,70

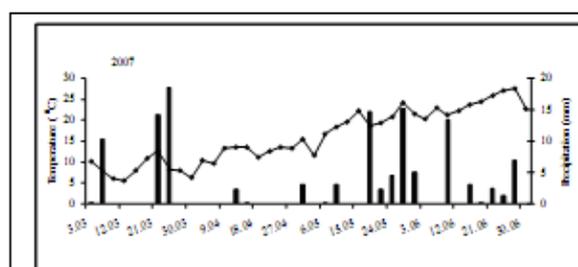
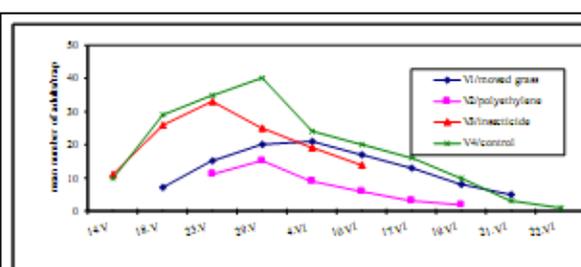


Figure 1. Daily means temperatures and the precipitation amounts fallen in February-June period 2007, Băneasa, Bucharest.

Figure 2. Capture dynamics of *R. cerasi* adults on yellow sticky traps in experimental plots in 2007, Baneasa, Bucharest