First experiences in the application of biopreparations against the cherry fruit fly in Southern Russia in 2007

L. A. Vasilyeva[1], E. Hummel[2]

Abstract

On the Russian market there are no currently registered biological preparations for the control of Rhagoletis cerasi *(cherry fruit fly, CFF), and therefore the effects of natural products against this pest were studied. In laboratory, semi-field and field experiments a range of botanicals (NeemAzal-T/S and Quassia-MD) were tested alone and in combination with comparison product Phytoverm and chemical standard insecticides for their effectiveness against* R. cerasi *in commercial orchards. These products showed a high biological effectiveness against* R. cerasi *comparable with chemical insecticides.*

Keywords

Rhagoletis cerasi, European cherry fruit fly, bioproducts, *Rebell*- type traps

Introduction

Taking into the account the equipment and facilities available on large sweet cherry farms in Russia, the most reasonable way to control the cherry fruit fly *R. cerasi* L. in an environmentally safe manner is the replacement of chemical insecticides by biological products. However, on the Russian market there are no currently registered biological agents against this pest (Hummel, 2006). Instead, recent research projects have attempted to optimise an integrated management strategy using combinations of insecticide applications and physical methods. Research on the biology and ecology of *R. cerasi* has been started at the All-Russian Research Institute in 2001. Since then, numerous different chemical and biological control agents and formulations have been tested under laboratory and field conditions.

Material and Methods

In 2007, research into biological products included three stages. The first step consisted of a laboratory study of the effects of biologically active compounds against *Drosophila* sp. (Diptera), using the methodology of Anon. (2002). Selected preparations showed >70% mortality. The second stage involved tests of these selected products against adults of *R. cerasi* in “branch cages” (BC) on the sweet cherry varieties ‘Daibera Schwarze’ and ‘Franz Josef’. Leaves and fruits were sprayed with 0,5% aqueous NeemAzal-T/S; alternatively about 10% of the leaves were sprayed with a bait of 5% NeemAzal-T/S (Koeppler *et al.*, 2006). After drying of the spray solution, 50 *R. cerasi* adults were placed inside each cage.

Due to a lack of animals, no controls were carried out and the 2006 data were used. The effect of NeemAzal-T/S on the number of *R. cerasi* adults and fertility of females, infestation rate of fruits and phytotoxicity of leaves were conducted (Dorofeeva, 1998).

[1] All-Russian Research Institute of Biological Plant Protection, Krasnodar, Russia, e-mail: vasilevaludmila@yandex.ru

[2] Trifolio-M GmbH, Lahnau, Germany, e-mail: edmund.hummel@trifolio-m.de

At the third stage the botanicals NeemAzal-T/S (a.i. Azadirachtin A) and Quassia-MD (a.i. Quassin) from Trifolio-M GmbH, Germany and comparison product Phitoverm (active ingredient Aversectin C) from Pharmbiomed, Russia, were tested in comparison with the chemical standard insecticide Carbophos (a.i. Malathion) from Russia, Sumithion (a.i. Fenitrothion) from Sumitomo, Japan, Kung Fu (a.i. Lambda-cyhalothrin) and Actellic (a.i. Pirimiphos-methyl) from Syngenta. The trial was carried out in a commercial sweet cherry orchard during the mass flight of the pest (mid- May until end of June).

The field experimental design is shown in Table 1. During this experiment the *R. cerasi* population was monitored by catching adult flies in yellow *Rebell*-traps (Andermatt Biocontrol, Switzerland) (Katsoyannos *et al.*, 2000). The degree of egg maturity in trapped females and infestation rate of fruits were also evaluated. Larvae in the infested fruits were measured and their age was estimated, permitting the determination of fruit infestation time, *i.e.* the time at which the protective action of the tested products had broken down.

Because control variant 5 in commercial orchards showed excessively high catches of *R. cerasi* adults, this area was treated twice with insecticides. As a zero control (control 6), sweet cherry trees in a garden near site 1 were used.

Table 1: The field experimental design for 2007.

Variants	Date of application	Preparations (l/l water/ha)	Date of application	Preparations (l/l water/ha)	Date of application	Preparations (l/l water/ha)
1 (1 ha)	23 May	NeemAzal-T/S 2.5 / 1600	-	-	1 June	NeemAzal-T/S 2.5 / 1600
2 (1 ha)	23 May	Carbophos 1.5 / 1600	26 May	Actellic 1.0 / 1600	1 June	Sumithion 1.5 / 1600; Kung Fu 0.2 / 1600
3 (1 ha)	23 May	Phitoverm 1.0 / 1600	-	-	1 June	Phitoverm 1.0 / 1600
4 (1 ha)	23 May	Quassia-MD 1.5 / 1600	-	-	1 June	Phitoverm 1.0 / 1600
5 (0.5 ha)	-	Control 1	26 May	Actellic 1.0 / 1600	1 June	Phitoverm 1.0 / 1600
6 (0.5 ha)	-	Control 2	-	-	-	-

Results and Discussion

According to the literature, Phitoverm shows good efficacy against *R. cerasi* in sweet cherry commercial orchards (Cherbakov, 2004), and the NeemAzal-T/S treatment can also control this pest (Koeppler *et al.*, 2006). The results of our experiments confirmed a high effectiveness of NeemAzal-T/S; no fruits were infested CFF larvae at the end of the trials with either baits or aqueous solution (Tab. 2). In this trial no phytotoxicity effect of aqueous NeemAzal-T/S was observed on sweet cherry leaves, although leaves sprayed with the bait showed changes in the leaf blade form.

Table 2: The results of experiments in BC in 2007.

Variants	Number of CFF placed in cage on 18 May 2007	Damaged fruits at end of experiment	Comments
Bait with NeemAzal-T/S	47 adults	0 of 193	22 females dead, 3 with immature eggs, one with fertile eggs. Many flies had sunken into the bait
0,5% NeemAzal-T/S water solution	50 adults	0 of 92	All female with immature eggs
Control (in 2006)	50 adults (13 May 2006)	132 of 145	

The very high infection pressure by *R. cerasi* observed in the field experiment may be explained by the fact that in the previous year fruits were not fully harvested, showed a high degree of infection (60%) and were allowed to fall onto the soil. A mass flight of *R. cerasi* in 2007 was observed from mid-May until mid-June with two peaks on 23 and 31 May where the average trap catch was 25 insects/day. The first females with matured eggs were recorded on 23 May, but thereafter no oviposition-ready females were available until 31 May. This may be explained by the protective activity of the control strategy. The effect of this strategy is shown in Table 3.

Table 3. Infestation of sweet cherry fruits with larvae of CFF in 2007

Variants	Date	Fruit infestation on tree	Fruit infestation on soil	Date	Fruit infestation on tree	Fruit infestation on soil
1	7 June	0%	2%	19 June	0.6%	0.5%
2	7 June	0%	0%	19 June	0%	0%
3	7 June	0%	1%	19 June	0%	0%
4	7 June	0%	0%	19 June	0%	14%
5 (Control 1)	7 June	0%	8%	19 June	1.4%	19.2%
6 (Control 2)	7 June	10%	25%	20 June	30%	60%

In all treated variants the degree of fruit infestation was very low in the tree and on the soil on both sampling dates (7 and 19 June). A slightly elevated fruit infestation (14%) was observed with Quassia-MD and Phitoverm. In the untreated control (Variant 6) the fruit damage in the tree and in the soil showed steep increases from 7 to 19 July. Based on these results, further trials will be carried out in 2008.

References

Katsoyannos B.I., Papadopoulos N.T. & Stavridis D. (2000). Evaluation of trap types and food attractants for *Rhagoletis cerasi* (Diptera: Tephritidae). *Journal of Economic Entomology* **93**: 1005-1010.

Koeppler, K., Storch, V. & Vogt, H. (2006). Bait sprays – an alternative to control the European cherry fruit fly *Rhagoletis cerasi?* In *Proceedings of the 12th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing* (ed. Boos, M.), 61-66. Weinsberg: FÖKO.

Dorofeeva, T.B. (1998). The method of evaluation of fungicides and chemical preparations of their biological activity against powder mildew *Erysiphe orontii* on tomatoes. In *Proceedings of methodology recommendations for plant protection: 268-271. St. Petersburg: VIZR, Russia* [in Russian].

Anon. (2002). The methodology recommendation for the monitoring of sensivity of phyto- and entomophags compared to insecticides: 32. VNIIBZR, Krasnodar, Russsia [in Russian]

Hummel, E. (2006). Botanicals – one of the ways of reduce of pollution of the environment. Strategy and tactic of plant protection. *Materials of the scientific conference dedicated of 35 jubilee of organization of RUP "Institut of Plant Protection" of NAN Belarus (Minsk, 28 Feb.-2 March 2006): 439-440* [in Russian].

Cherbakov, N.A. (2004). Biological effect of Phitoferm against Cherry Fruit Fly on sweet cherry. Biological plant protection - the base of stability of agro-ecological systems. *Materials of the scientific and practical conference of 100 jubilee of the births of E. Stepanov (1902-2002), 8-9 October 2002. Krasnodar, Russia 2004: 311 [in Russian].*