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# NON-CHEMICAL CONTROL OF SOME IMPORTANT PESTS OF SWEET CHERRY

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**Abstract:** Some non-chemical insecticides were tested for efficacy of control of fall webworm, *Hyphantria cunea* (Drury), and of cherry weevil, *Rhynchites auratus* (Scop.) in the laboratory and black cherry aphid, *Myzus cerasi* (Fabr.) under field conditions. Hendreson & Tilton formula was applied for evaluation of efficacy. NeemAzal T/S (azadirahtin) at the concentration 0.5% and Naturalis (*Beauveria bassiana*) used at 0.2% or 0.3% have shown the best results against black cherry aphid. Good results were also obtained with Pyrethrum FS (pyrethrin + sesame oil + soft potassium soap) used at 0.05% or 0.1%, with NeemAzal T/S at 0.3%, PreFeRal WG (*Paecilomyces fumosoroseus*) at 0.2% and with Naturalis at 0.1%. The effect of PreFeRal WG, applied at 0.1% was unsatisfactory. Against the fourth instar larvae of fall webworm, excellent results were noted for Pyrethrum (0.05% and 0.1%) and Naturalis (0.1% and 0.2%). Very good effects were also obtained with the BMP 123WP (*Bacillus thuringiensis*), used in concentration of 0.1%. NeemAzal T/S – 0.5% had still good, albeit lower, efficacy. Against the cherry weevil only Pyrethrum FS was tested. This insecticide resulted in a very good efficacy, when used at the concentration 0.1% and still satisfactory – at 0.05%.

**Key words:** sweet-cherry, organic-farming, botanical-insecticides, microbial-insecticides, black-cherry-aphid, fall-webworm, cherry-weevil, non-chemical-pest-control

## INTRODUCTION

Organic farming system started to develop in Bulgaria since 1990, albeit with considerable difficulties. The main challenge is control of pests without agro-chemicals. Sweet cherry is grown in Bulgaria on about 4800 ha. It is suitable for organic farming because its period to harvest is shorter compared with other fruit crops and number of pesticide treatments is smaller

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Control of the key pest on sweet cherry – cherry fly *Rhagoletis cerasi* (L.) in organic orchards may be solved successfully by usage of yellow traps (Karov and Andreev 2000; Lecheva *et al.* 2001; Sredkov 2000; Karov *et al.* 2006), different products containing spinosad (California 2007; Smith 2007), rotenone or by covering trees with nets (Caruso and Cera 2004). However, other important pests of this crop are still difficult to control. These are black cherry aphid *Myzus cerasi* Fabr. (*Hemiptera: Aphididae*) that causes heavy damage to shoots every year as well as species periodically appearing in high density as cherry weevil *Rhynchites auratus* Scop. (*Coleoptera: Attelabidae*), chaffer *Epicometis hirta* Poda (*Coleoptera: Scarabaeidae*) or some leaf-eating caterpillars (*Lepidoptera*) as fall webworm *Hyphantria cunea* Drury (Arctidae), geometrid moths (*Geometridae*), gipsy moth *Lymantria dispar* L. (*Lymantriidae*), brown-tail moth *Euproctis chrysorrhoea* L. (*Lymantriidae*), European lackey moth *Malacosoma neustria* L. (*Lasiocampidae*) and leaf-rolling sawfly *Neurotoma nemoralis* L. (*Hymenoptera: Pamphilidae*) – Grigorow 1976; Kutinkova and Andreev 2004; Andreev 2006.

The objective of this study was to evaluate the efficacy of some non-chemical (based on plant products or microbial) insecticides against three important pests of sweet cherry – cherry aphid, *M. cerasi*; cherry weevil, *R. auratus* and fall webworm, *H. cunea*, aimed at improving plant protection systems for organic cherry production.

## MATERIALS AND METHODS

The experiments were carried out in the orchard of the Agro-Ecological Centre and laboratories of the Department of Entomology at Agricultural University of Plovdiv, Central-South Bulgaria, in the years 2005–2007. The tests included three insect pests of sweet cherry and five insecticides based on plant products or on micro-organisms (bacteria or fungi).

Against nymphs and alate adults of black cherry aphid, *Myzus cerasi* L., the following insecticides derived from plants were applied: NeemAzal T/S (azadirahtin) at the concentration 0.3 or 0.5% and Pyrethrum FS (pyrethrin + sesame oil + soft potassium soap) at 0.05 or 0.1%. Microbial insecticides against *M. cerasi* included Naturalis (*Beauveria bassiana*), used at 0.1, 0.2 or 0.3%, and PreFeRal WG (*Paecilomyces fumosoroseus*), applied at 0.1 or 0.2%. Against the fourth instar larvae of fall webworm, *H. cunea*, NeemAzal T/S was used at 0.5%, Pyrethrum FS at 0.05 or 0.1%, Naturalis at 0.1 or 0.2% and the microbial insecticide BMP 123WP (*Bacillus thuringiensis*) at 0.1%. Against adults of cherry weevil, *R. auratus*, only Pyrethrum FS was employed, at the concentrations 0.05% and 0.1%.

The experiments with *H. cunea* and *R. auratus* were carried out under laboratory conditions and those with *M. cerasi* under field conditions. Ten weevils or caterpillars were treated with respective pesticides in every replication of laboratory tests, using a small sprayer. The insects were placed in 250-$cm^3$ glass vessels. Fresh leaves and fruitless were then put into these vessels, when an insecticide had dried up. The food was renewed daily. Natural colonies of black cherry aphid in the non-treated orchard were used for the field experiments. Five shoots with minimum 150 aphids were examined in every treatment, including control. The number of surviving insects was recorded – one, three, five and seven days after treatment. The efficacy of the pesticides tested was evaluated by Henderson and Tilton (1955) formula.

## RESULTS AND DISCUSSION

Both insecticides based on plant products, tested against black cherry aphid, resulted in a good efficacy already one day after treatment, when used at the higher concentrations – NeemAzal T/S at 0.5% and Pyrethrum FS at 0.1% (Fig. 1). Number of aphids in the treated colonies continued to decrease in the following days and maximum efficacy was noted five days after treatment. NeemAzal T/S, applied at 0.5% reached then the 97.8% efficacy. This is an excellent result for a non-chemical insecticide. In the lower concentration (0.3%) the product showed a satisfactory efficacy (88.9%).

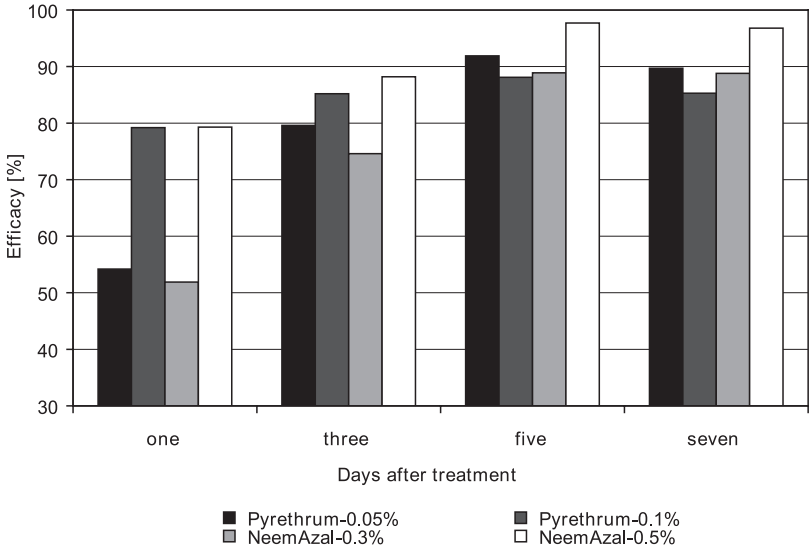


Fig. 1. Efficacy of insecticides based on plant products against nymphs and adults of black cherry aphid under field conditions

Surprisingly, Pyrethrum FS gave better results when applied at a lower concentration (0.05%). In this treatment efficacy reached 91.9%, whereas the efficacy of the same product used at the concentration of 0.1% was slightly lower – 88.1% (Fig. 1). Apparently the insecticide showed a similar action against black cherry aphid in both concentrations; the difference in efficacy was below 3%, so could be due to incidental factors. Seven days after treatment the new-born nymphs in a colony appeared in a greater number and no more dead individuals were recorded then. Population density of the aphid increased and efficacy of the insecticides decreased. This tendency was observed in all treated shoots. Apparently this was a critical, final moment of a satisfactory action of these two insecticides against the black cherry aphid.

The insecticide PreFeRal WG had a definitely poor action (Fig. 2). Applied at 0.1% it showed unsatisfactory effect, with efficacy 66.4% three days after treatment. Later the efficacy was even lower, decreasing to 46%. PreFeRal WG applied at 0.2% showed a satisfactory effect with 79.7% efficacy three days after treatment and 83% in the following days. Further increase of its concentration probably could result in an improvement of efficacy of this insecticide against black cherry aphid.

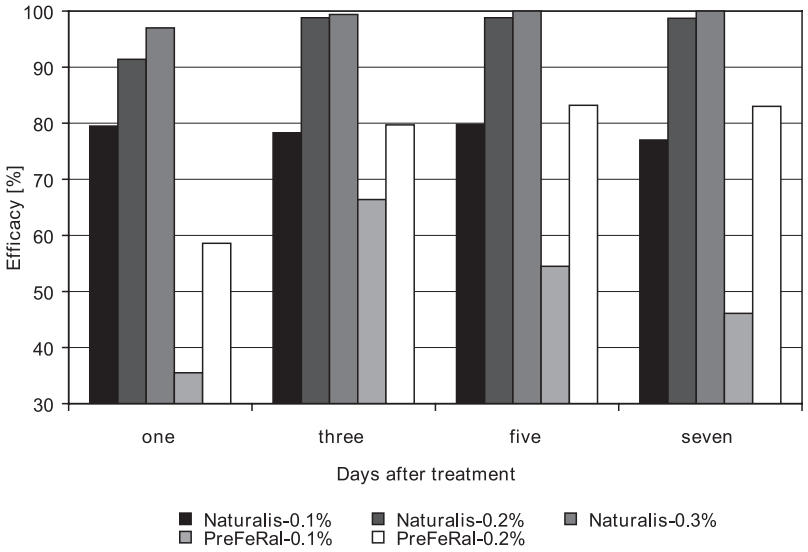


Fig. 2. Efficacy of microbial insecticides against nymphs and adults of black cherry aphid under field conditions

Six different treatments were tested against the fourth instar larvae of fall webworm (Fig. 3). Excellent results, with 100% efficacy were noted one day after treatment for Pyrethrum in both concentrations (0.05% and 0.1%) and for Naturalis applied at the concentration of 0.2%. Naturalis, applied at the concentration of 0.1%, showed 100% efficacy five days after treatment. Very good results (efficacy up to 96.4%) were also obtained with the microbial insecticide BMP 123WP, used at 0.1%. NeemAzal T/S, applied at 0.5% demonstrated still good, albeit a slightly lower efficacy – 82.1%.

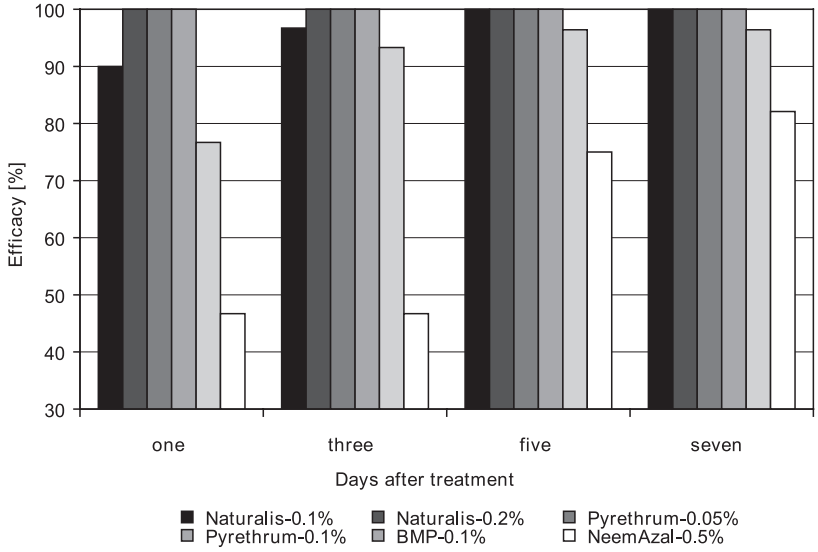


Fig. 3. Efficacy of insecticides based on plant products and of some microbial insecticides against the fourth instar larvae of fall webworm, tested in laboratory conditions

Pyrethrum FS tested against adults of cherry weevil showed a very high efficacy when used at the concentration of 0.1% (Fig. 4). The product had a very fast action, its efficacy on three days after treatment exceeded 90% and reached a maximum value of 96.6% after five days. At the concentration 0.05% the efficacy was lower but still satisfactory, reaching 89.3% after seven days.

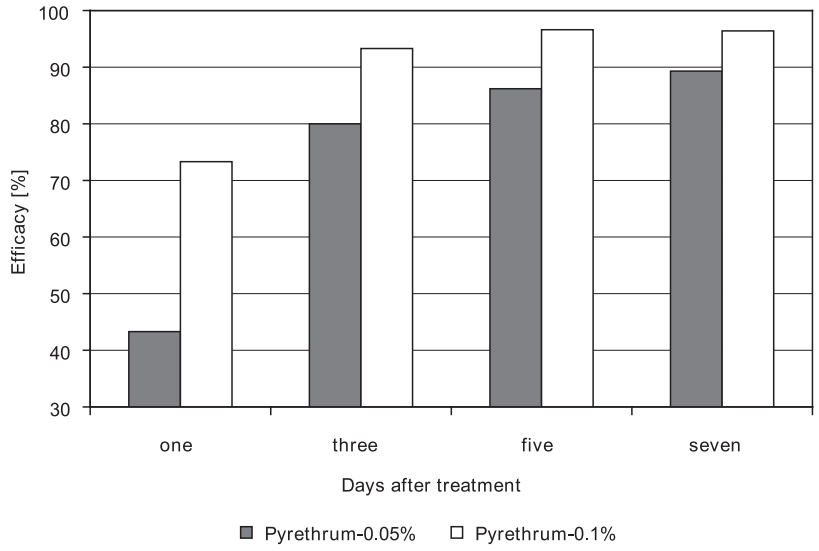


Fig. 4. Efficacy of botanical insecticide Pyrethrum FS against adults of cherry weevil, tested in laboratory conditions

## CONCLUSIONS

The insecticides based on plant products, NeemAzal T/S and Pyrethrum FS as well as insecticides based on micro-organisms, Naturalis, PreFeRal WG and BMP 123WP, applied at right concentrations, present a chance of controlling economically important pests on sweet cherry – black cherry aphid, fall webworm and cherry weevil, and thus allow to develop organic cherry production, harmless for people and natural environment.

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## POLISH SUMMARY

### ZWALCZANIE WAŻNYCH SZKODNIKÓW CZEREŚNI METODAMI NIECHEMICZNYMI

Oceniano skuteczność niektórych niechemicznych insektycydów w zwalczaniu trzech ważnych szkodników czereśni występujących w Bułgarii – mszycy czereśniowej, *Myzus cerasi* (Fabr.); oprzędnicy jesiennej, *Hyphantria cunea* (Drury), i tutkarza złocistego, *Rhynchites auratus* (Scop.). Doświadczenia nad oprzędnicą i tutkarzem prowadzono w warunkach laboratoryjnych, a nad mszycą czereśniową w warunkach polowych. Efektywność zwalczania oceniano stosując formułę Hendersona i Tiltona. W zwalczaniu mszycy czereśniowej najlepsze okazały się: NeemAzal T/S, insektycyd na bazie ekstraktu roślinnego (azadyrachtyna), stosowany w stężeniu 0,5% oraz Naturalis, produkowany na bazie grzyba *Beauveria bassiana* – w stężeniach 0,2 i 0,3%. Preparaty te wykazywały skuteczność powyżej 95%. Dobrą skuteczność (80–90%) uzyskano również przy użyciu Pyrethrum FS (pyretryna + olej sezomowy + szare mydło) stosowanego w stężeniach 0,05 lub 0,1%, NeemAzal TS w stężeniu 0,3%, PreFeRal WG (insektycyd na bazie grzyba *Paecilomyces fumosoroseus*) w stężeniu 0,2% oraz Naturalis – 0,1%. PreFeRal WG w stężeniu 0,1%, wykazywał niedostateczną skuteczność. W zwalczaniu larw czwartego stadium oprzędnicy jesiennej, 100% skuteczności uzyskano przy zastosowaniu Pyrethrum (0,05 i 0,1%) oraz Naturalis (0,1 i 0.2%). Bardzo dobrą skutecznością odznaczał się też BMO 123WP, sporządzany na bazie bakterii *Bacillus thuringiensis*, stosowany w stężeniu 0,1%. Mniejszą, aczkolwiek jeszcze dostateczną, skuteczność wykazał też NeemA T/S w stężeniu 0,5%. Do zwalczania tutkarza złocistego stosowano Pyrethrum FS; skuteczność jego wyniosła 96,6 % przy użyciu stężenia 0,1%, a 89,3% przy stężeniu 0,05%.