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POSSIBILITY FOR CONTROL WITH BOTANICAL INSECTICIDES AGAINST THE MEALY PLUM APHID *HYALOPTERUS PRUNI* GEOFFROY, 1762 (*HEMIPTERA*: *APHIDIDAE*) ON THE PLUM IN SOUTHERN BULGARIA

Pavlin Vasilev*[1], Mariya Hristozova [2]

[1] Agricultural University of Plovdiv, Bulgaria
[2] Fruit Growing Institute, Plovdiv, Bulgaria
***Corresponding author's Email: p_vasilev@au-plovdiv.bg**

Abstract

The aim of this study was to evaluate the efficacy of botanical insecticides recommended for control of the mealy plum aphid *Hyalopterus pruni* (*Hemiptera: Aphididae*). The experiment was carried out in 2024 in the experimental field of the Fruit Growing Institute-Plovdiv, Bulgaria. The tested insecticides were orange oil (Limocid), liquid extract of *Urtica spp*. (Basictec) and pyrethrins (Abanto). The insecticides were applied at the recommended concentrations for control of aphids, whiteflies, thrips and other pests. All tested botanical insecticides showed high biological efficacy and can be used to control the mealy plum aphid.

Keywords: mealy plum aphid, biological control, botanical insecticides, Limocid, Basictec, Abanto, *Hyalopterus pruni*

INTRODUCTION

Aphids (*Insecta: Hemiptera: Aphididae*) are known to be around 4700-5000 species (Remaudiire & Remaudiire, 1997; Blackman & Eastop, 2006). Aphids are considered important pests that affect the yield`s most important characteristics. The mealy plum aphid *Hyalopterus pruni* (Geoffroy) (*Hemiptera: Aphididae*), is a major pest of the stone fruit trees, especially on plum (*Prunus domestica*) in Bulgaria (Vasilev & Andreev, 2013). It has a cosmopolitan distribution (Blackman & Eastop, 1984; Bodenheimer & Swirski, 1957; Eastop, 1966; Holling, 1959; Sokal & Rohlf, 1981). In spring it develops large populations on the undersides of the leaves of invaded plants. The heavily attacked trees lose vigour, reduce shoot growth, and increase fruit cracking. *H. pruni* also produces large amounts of honeydew, which can reduce the photosynthetic capacity of the leaves, promotes the growth of sooty mould, and reduces fruit bud production on the following year (UCIPM, 1999). *Hyalopterus pruni* is a holocyclic facultative migratory species which main hosts are *Prunus domestica*, *P. instititia*, *P. cerasifera* and *P. spinosa* (Grigorov, 1980; Grigorov et al., 2004; HYPPZ, 2018). The secondary hosts of the species are: *Phragmites communis*, *Calamagrostis*, *Elymus* and *Arundo donax* (Nevskii, 1929; Bodenheimer & Swirski, 1957; Blackman & Eastop, 2004; HYPPZ, 2018). Neonicotinoids, organophosphates and pyrethroids are mainly used to control the aphids in Bulgaria (Lecheva et al., 2006). The aphids have already developed resistance to many of these chemical products (Sun et al., 1994).

Chemical insecticides have a negative impact on nontarget organisms and human health. This problem requires alternative control strategies such as biological control, application of essential oils, and other approaches (Ikbal & Pavela, 2019). Al-Antary et al. (2017) tested extracts from lemon essential oil against *Myzus persicae* (*Hemiptera: Aphididae*). They

recorded a mortality rate between 94.25% and 97.75%. In other study Al-Antary et al. (2018) estimate the potential effect of orange oil against *Myzus persicae*. It turns out that orange oil is a promising botanical insecticide that provides effective control against aphids. The essential oils of *Citrus aurantium* had a toxicity effect against *Aphis punicae* and *Alkanindiges illinoisensis* (Alotaibi et al., 2022).

According to Campolo et al. (2018), botanical extracts are promising alternatives to synthetic insecticides.

This study aims to establish the efficacy of nonchemical insecticides, of plant origin, for exerting effective control of the mealy plum aphid *Hyalopterus pruni* found on the plums in Bulgaria.

MATERIALS AND METHODS

The study was carried out in May 2024 in an experimental plum orchard, at the Fruit Growing Institute – Plovdiv, Bulgaria. The efficacy of three botanical insecticides against the mealy plum aphid *Hyalopterus pruni* were tested – orange oil (Limocid), liquid extract of *Urtica spp*. (Basictec) and pyrethrins (Abanto) (Table 1). The aphid identification was confirmed on slide preparations of wingless adult females, using the modified Martin's method (1983). The modification concerns the use of heated lactic acid to enlighten the individuals (removal of soft tissue), instead of KOH. The identification was made by using the Blackman and Eastop (2004) identification keys.

Table 1. List of the tested botanical insecticides against *Hyalopterus pruni* at field conditions.

Active ingredient	**Trade name**	**Concentration**
orange oil	Limocid	0.15% and 0.3%
liquid extract of *Urtica spp*.	Basictec	0.15% and 0.3%
pyrethrins	Abanto	0.05% and 0.1%

Limocid is a natural fungicide, insecticide and acaricide, containing orange oil. It is approved for organic farming. Limocid is included in the list of biocontrol plant protection products. It is a contact curative treatment with a unique mode of action: it desiccates soft-bodied insects and the aerial organs of phytopathogenic fungi. This product has a quick knock-down effect and eradicates disease, perfectly complementing the measures of preventive protection.

Basictec is a concentrated extract produced from 75 g/l fresh leaves of *Urtica spp*. (*Urtica dioica* and *Urtica urens*). A filtered aqueous extract is obtained by steeping and mixing two types of nettles. Basictec is a product with a wide spectrum of action for plant protection. The nettle extract has nourishing, insecticidal, miticidal, bactericidal and fungicidal effects. It has an effect against pest species such as aphids, moths, and mites, as well as against plant diseases such as blight, powdery mildew, grey rot, leaf spot, etc. It is an organic biodegradable product, ideal for crop production without residues.

Abanto is multipurpose insecticide registered on numerous tree and herbaceous crops. It does not contain piperonyl butoxide but instead, a vegetable oil has been included in the formulation. This inclusion significantly improves the c insecticide knock-down effect and adhesiveness, ultimately improving its effectiveness. This particular formulation also allows the use of the product in organic farming.

The poor persistence and toxicological profile of pyrethrum allow the use of Abanto in close proximity of beneficial insects or pollinating bumblebees on which it has no harmful effect, thus respecting the biological balance. Abanto has a very low toxicity for humans and warm-blooded animals and has a very limited withdrawal period (1-2-3 days, depending on the crop), thus allowing treatment on the harmful insects up to a few days before

the harvest.

The test concentrations of the botanical insecticides were chosen according to their registrations for different species of aphids. The treatment was carried out with a hand sprayer on the selected, medium-sized colonies of the aphid (Figure 1), in which the individuals were previously counted. The control variant was treated with water. The live individuals were counted on the 1st, 3rd, 5th 7th and 9th day after the treatment. All variants were set in five replicates, including the control. Henderson & Tilton (1955) formula was used for biological efficacy assessment.

Fig. 1. Colonies of the mealy plum aphid *Hyalopterus pruni* on plum leaves.

a **b**

Fig. 2. The mealy plum aphid on the 9th day after the treatment with Limocid 0.3% (a) and Abanto 0.1% (b).

RESULTS AND DISCUSSION

All three studied botanical insecticides showed a delayed initial effect and a relatively high aphid mortality rate on the 3rd and 5th day after the treatment. (Figure. 3 and Figure 4). The product with the active substance pyrethrins (Abanto) showed good biological activity against *Hyalopterus pruni*. Similar results were reported for the aphid populations on *Solanum scabrum* (*Solanaceae*) (Korir et al., 2021). At the higher concentration (0.1%), the efficacy did not reach 100% (Figure 4). However, on the 9th day, the efficacy was high and reached almost 90%. Similar results are confirmed for the rosy apple aphid (*Dysaphis plantaginea*) (Cross et al., 2007). This insecticide can be recommended for use in *H. pruni* control programs. At the lower concentration (0.05%) the mortality reached 84.7% on the 9th day after treatment (Figure 3). The product with the active ingredient orange oil (Limocid) also showed a good control effect. At the higher concentration (0.3%), the efficacy was over 83.3% on the 9th

day after the treatment. Smith et al. (2018) observed similar results, for *Myzus persicae* (*Aphididae*) (85% mortality). At the lower concentration (0.15%), the efficacy was lower and reached 75.5%. Apart from the mortality effects several authors observed also a repellent effect on aphid populations (Alotaibi et al., 2022).

The biological efficacy of the product with the active ingredient liquid extract of *Urtica spp.* (Basictec) against *H. pruni* was lower than the other products (Figure 3 and figure 4). Basictec showed a satisfactory effect, and on the 9th day after the treatment, the efficacy reached 75.1% at the higher concentration (0.3%) and 70.0% at the lower concentration (0.15%).

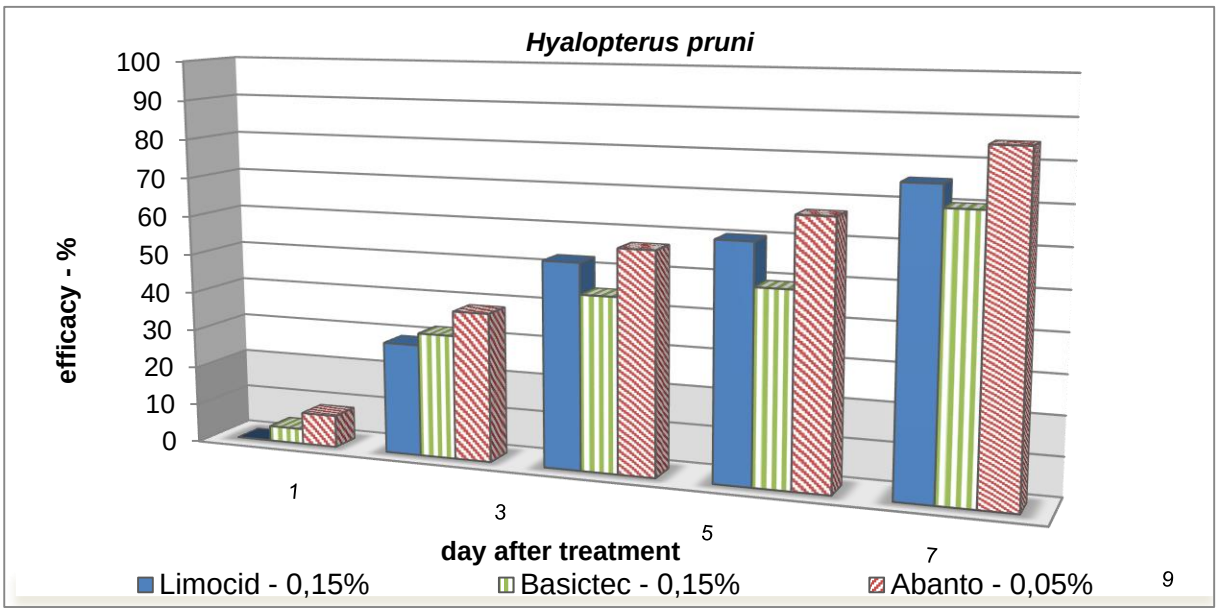

Fig. 3. Biological efficacy of botanical insecticides against the mealy plum aphid *Hyalopterus pruni* on plum at the lower concentration.

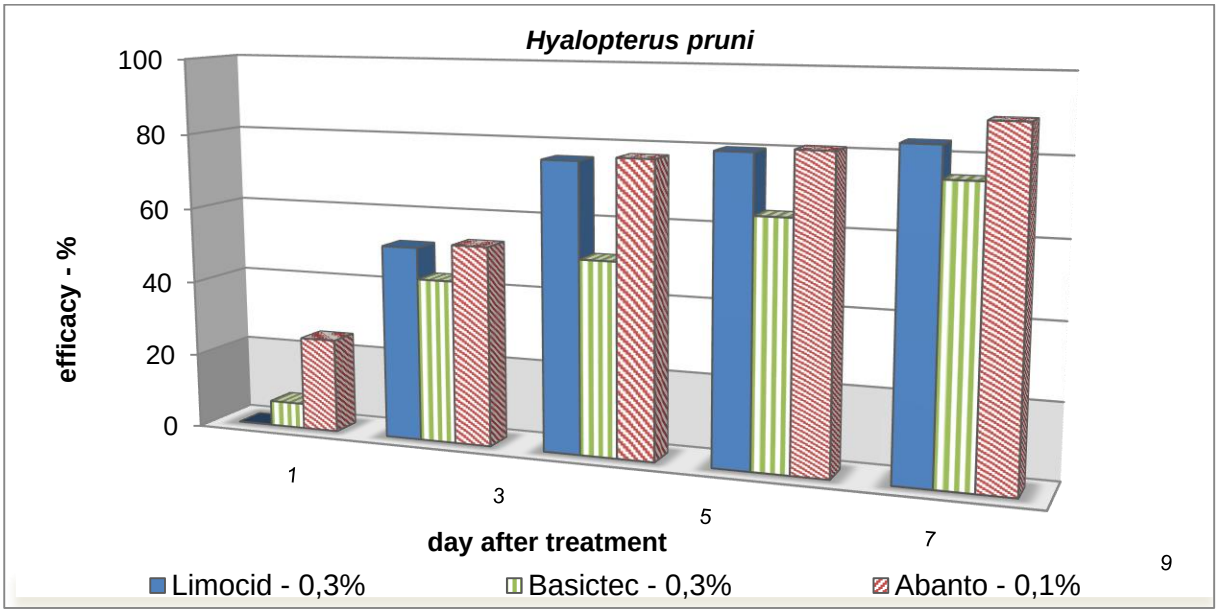

Fig. 4. Biological efficacy of botanical insecticides against the mealy plum aphid *Hyalopterus pruni* on plum at the higher concentration.

CONCLUSION

1. The tested botanical insecticides have had high biological efficacy against *Hyalopterus pruni*. The product Abanto (pyrethrins) showed the best results. In a concentration of 0.1% it reached almost 90% biological efficacy on the 9th day after the treatment.
2. The product Limocid (orange oil) also showed a good biological effect. At the higher concentration (0.3%) the efficacy was 83.3% on the 9th day after the treatment.
3. Basictec (liquid extract of *Urtica spp*.) also reached 75.1% and 70.0% efficacy, respectively at 0.3% and 0.15% concentration on the 9th day after the treatment.
4. All tested botanical insecticides are suitable for efficient control of the mealy aphid *Hyalopterus pruni* on plum at both registered concentrations.

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