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ЕФИКАСНОСТ НА НЕХИМИЧНИ ИНСЕКТИЦИДИ ЗА КОНТРОЛ НА РОЗЕНАТА ЛИСТНА ВЪШКА *MACROSIPHUM ROSAE* (L.) (HEMIPTERA, APHIDIDAE) ПО ДЕКОРАТИВНИТЕ РОЗИ
EFFICACY OF NON-CHEMICAL INSECTICIDES FOR CONTROL OF THE ROSE APHID *MACROSIPHUM ROSAE* (L.) ((HEMIPTERA, APHIDIDAE) ON ORNAMENTAL ROSES

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Abstract

Non-chemical methods for control of the rose aphid *Macrosiphum rosae* (L.) was evaluated under field conditions at the Experimental Field of the Agricultural University in Plovdiv. Three bioinsecticides: the botanical *NeemAzal T/S* (azadirachtin) and *Pyrethrum FS EC* (pyrethrin + sesame oil + soft potassium soap) and the microbial *Preferal WG* (*Paecilomyces fumosoroseus*), allowed for application in organic farming in Bulgaria, were studied. The botanical insecticide *Pyrethrum FS EC* showed a fast initial action and good effectiveness of 75.48% on the first day after treatment. Other insecticides - *NeemAzal T/S* and *Preferal WG* had insufficient effect on the rose aphid and the efficacy at the higher concentrations reached 44.66% and 57.32% respectively on the 5th day after treatment.

Key words: *Macrosiphum rosae*, bioinsecticides, azadirachtin, *Paecilomyces fumosoroseus,* pyrethrum.

INTRODUCTION

The rose aphid *Macrosiphum rosae* (L.) originated from Europe. It is now a globally distributed species, the presence of which was described almost worldwide, except for eastern Asia (Blackman and Eastop, 2000).

The aphid feeds mostly on rosaceous plants, but it is known to feed on plant species in other families. Despite its presence on different host plants, the economic impact of *M. rosae* is primarily due to feeding damage on cultivated roses (Wöhrmann et al., 1991; Shaheen et al., 2007).

M. rosae is heteroecious (host alternating) and holocyclic between Rosa spp. (primary hosts) and Dipsacaceae or Valerianaceae (secondary hosts) in temperate regions. Where populations are host alternating (heteroecious), the primary hosts, on which sexual females lay wintering eggs, are wild and cultivated Rosa species. Secondary hosts, on which females reproduce parthenogenetically during the summer, include species of Dipsacaceae (Dipsacus spp., Succisa spp., Scabiosa spp.), Oenotheraceae (Chamaenerium spp., Epilobium spp.) and

Valerianaceae (Centranthus spp., Valeriana spp.). Other species of Rosaceae also become infested during the summer (Heie, 1994; Blackman and Eastop, 2000).

In Bulgaria the species is the most common insect pest of roses (*Rosa* sp.*)* – ornamental, essential and wild, in greenhouses and in open field (Grigorov, 1980; Yovkova et al., 2013). Aphids damage plants by sucking sap from plant tissues. Wingless females are often seen in large number on stems and buds of roses. The symptoms of damage are distortion of new leaves and flowers. The damage done at the newly-forming flower buds stage has more serious consequences than if the buds are attacked later. Aphids also excrete large amounts of honeydew, encouraging the growth of sooty moulds, which form a black covering over affected leaves and blossoms. Severe aphid infestations can result in defoliation of the plant and loss of the flower crop. Aphids breed very rapidly and build up vast numbers, especially in warm, humid weather (Boundy et al., 1980). The larges colony appears in June (Grigorov, 1980).

Pyrethrum FS is a botanical insecticide which is extracted from a species of daisy flower (*Tanacetum cinerariaefolium*). The insecticide can be used in both conventional and biological control. Pyrethrum provides superior insecticidal performance against a broad spectrum of insect pest species such as: aphids, thrips, leafhoppers, fruit flies, cucumber beetles, flea beetles, spider mites and many other insects. It is also one of the few insecticides registered for use in Certified Organic Production of crops in the USA, Europe, Australia and New Zealand. Pyrethrum FS is a fast-acting contact insecticide. Sesame oil is included as a synergist to increase effectiveness. The active ingredients are rapidly broken down by sunlight and are only effective for a short time (McLaughlin Gormley King, 2010). In Bulgaria Pyrethrum FS is registered for control of aphids on vegetables in a concentration of 0.05% (BFSA, 2014).

Azadirachtin is the main active substance extracted from the seeds and leaves of the neem tree, *Azadirachta indica* A. Juss (Schumutterer, 1990; Ascher, 1993; Mordue & Blackwell, 1993). The effects of azadirachtin on insects include feeding and oviposition deterrence, growth inhibition, fecundity and fitness reductions (Schumutterer, 1990). Laboratory and field trials with formulated neem seed oil and neem seed extract demonstrated that these materials are effective aphicides (Lowery et al., 1993). In our country this active substance is used as the registered botanical insecticide NeemAzal T/S to control spider mites primarily on vegetables in greenhouses in a concentration of 0.3%. Some authors made successful experiments with this product for control of aphids on apple and sweet cherry (Andreev et al., 2008; 2012).

Preferal WG is a microbial insecticide that provides excellent control of the greenhouse whitefly on tomatos, cucumbers and ornamentals. The product contains spores of a highly-efficient, naturally-occurring strain of the entomopathogenic fungus *Paecilomyces fumosoroseus*. Preferal is a contact insecticide, therefore it is advisable to provide a good coverage of the undersides of the leaves. The registered concentration is 0.1% (Bolckmans et al., 1995; BFSA, 2014).

The aim of the current study is to evaluate the efficacy of some bioinsecticides – NeemAzal T/S (azadirachtin), Pyrethrum FS EC (pyrethrum) and Preferal WG (*Paecilomyces fumosoroseus*) against the rose aphid *M. rosae* under field conditions.

MATERIALS AND METHODS

The experiments were carried out in the six years old plantations of roses cultivar Anny (*Rosa hybrida* L.) growing at the open air nursery (100 m^2 area) at the Experimental Field of the Agricultural University of Plovdiv. The efficacy of three non-chemical insecticides were tested. Two insecticides are based on plant extracts: NeemAzal T/S (azadirahtin) at concentrations of 0.3% and 0.5% and Pyrethrum FS EC (pyrethrin +sesame oil + soft potassium soap) at concentrations of 0.05% and 0.1%. One insecticide is based on microorganisms (fungi) – Preferal WG (*Paecilomyces fumosoroseus*), applied at concentrations of 0.1% and 0.2%. The concentrations of bioinsecticides were established according to their registration for other pests.

Natural colonies of nymphs and wingless adults of rose aphid *M. rosae* feeding on shoots of cv. Anny, were treated with tested concentrations of bioinsecticides and the control was treated with water. Each variant was implemented with three replicates. The number of surviving individuals was recorded on the 1-st, 3-rd and 5-th days after the treatment. The efficacy was estimated according to Henderson and Tilton formula (1955). The results obtained were analyzed using Independent Samples t-test of variation statistics on SPSS 19. The comparisons were made between the treated variants and the untreated control.

RESULTS AND DISCUSSION

Pyrethrum is a contact insecticide that disrupts the normal functioning of the insect's nervous system with a rapid action and knockdown effect (McLaughlin Gormley King, 2010). In our study used formulation of Pyrethrum FS showed the fastest initial action and the highest efficacy against *M. rosae* compared to other two bioinsecticides. Most of the aphids treated with Pyrethrum FS died on the 1st day after the treatment and the efficacy reached 75.48% and 56.67% at concentrations of 0.1% and 0.05% respectively (Fig. 1).

According to Lowery et al. (1993) treatments with neem products under field conditions were as effective as the botanical insecticide Pyrethrum FS for control of aphids on pepper - *Myzus persicae* (Sulzer) and on strawberry - *Chaetosiphon fragaefolii* (Cockerell), but ineffective for the control of aphids on lettuce - *Nasonovia ribisnigri* (Mosley). In our experiment the botanical insecticide NeemAzal T/S, was ineffective at both concentrations against *M. rosae*. The action of this product was delayed and the efficacy was low. On the fifth day after the treatment the efficacy reached 30.27% and 44.66% at concentrations of 0.3% and 0.5%, respectively.

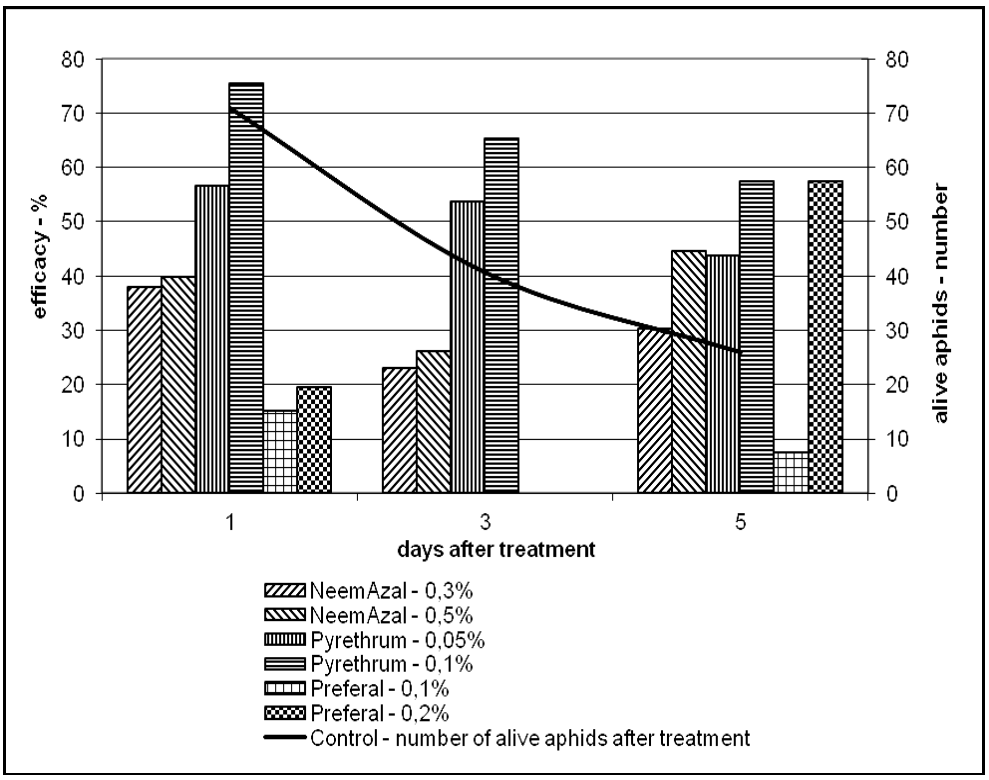

Fig. 1. *Efficacy of bioinsecticides against rose aphid, Macrosiphum rosae*

The fungal insecticide Preferal WG was with low efficacy on the first and third day after the treatment, but on the fifth day efficacy reached 57.32% at the higher concentration – 0.2% (Fig. 1).

The results of the comparative analysis with recorded % mortality of rose aphids on the 1st, 3rd and 5th days after the treatment are presented on table 1. There were significant differences between both tested concentrations of Pyrethrum FS EC and the control on the 1st, 3rd and 5th days after the treatment at significant level α=0.001. NeemAzal T/S showed significant differences compared to control at significant level α=0.05 on the 1st day after the treatment for lower dose (0.3%) and on the 3rd day for higher dose (0.5%).

The obtained results could be explained with delayed action of azadirachtin. Preferal WG showed significant differences compared to control on the 1st day after the treatment at significant level α=0.05 for higher concentration (0.2%) after that no significant differences was observed (Table 1).

Table 1

Comparative analysis of treated with bioinsecticides rose aphid, *Macrosiphum rosae* and untreated control using t-test (*Critical value of Student)

Variants	% mortality on the 1st, 3rd and 5th days after the treatment								
	1st day			3rd day			5th day		
	% mortality	SE	t	% mortality	SE	t	% mortality	SE	t
Pyrethrum 0.1%	75.4	±2.5	17.66 +++	80.1	±0.4	7.08 ++	84,3	±1,1	11.26 +++
Pyrethrum 0.05%	56.6	±7.5	38.03 +++	73.5	±2.88	5.04 ++	79,3	±2,5	5.50 ++
NeemAzal 0.5%	44.5	±21	1.65 ns	57.6	±11.6	3.34 +	79,6	±7,9	1.72 ns
NeemAzal 0.3%	32.7	±7.3	4.35 +	55.9	±14.7	0.21 ns	74,4	±8,5	1.24 ns
Preferal 0.2 %	19.4	±4.9	2.91 +	41.2	±8.0	0.55 ns	83,4	±3,5	2.35 ns
Preferal 0.1 %	15.2	±5.8	2.01 ns	31.7	±6.07	1.43 ns	67,7	±18	0.10 ns
Control	71	8.5		40.6	2.73		26	2.08	

*+ $t_{crit.}$ = 2,776, at α=0.05
++ $t_{crit.}$ = 4,604, at α=0.01
+++ $t_{crit.}$ = 8,610, at α=0.001

CONCLUSIONS

1. The bioinsecticide Pyrethrum FS EC, at registered concentration for other aphids of 0.05%, was the most efficient against *M. rosae* compared to NeemAzal T/S and Preferal WG. There was found significant differences between both tested concentrations of Pyrethrum FS EC and the control on the 1st, 3rd and 5th days after the treatment at significant level α=0.001. This product could be recommended for control of *M. rosae* in rose's open area cultivation.

2. Another two bioinsecticides NeemAzal T/S and Preferal WG showed very slow and insufficient action against the rose aphid. The action of NeemAzal T/S was delayed and on the fifth day after the treatment the efficacy reached 30.27% and 44.66% at concentrations of 0.3% and 0.5%, respectively. The efficacy of fungal insecticide Preferal WG at higher concentration of 0.2% reached

57.32% on the fifth day after the treatment. To establish the optimal dose of Preferal WG for rose aphid additional studies are needed.

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