

THE EFFECT OF BIOPESTICIDES BIONATURE R2000 AND NEEMAZAL-T/S ON THE *APHIS FABAE* SCOP. IN SPINACH

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Abstract

The trials were carried out during 2003–2004. The effect of the biopesticides BioNature R2000 (a. i. 210 g l⁻¹ *Azadirachta indica*, 180 g l⁻¹ *Pinus resinosa* and *Ricinus communis*) and NeemAzal-T/S (a. i. 10 g l⁻¹ *azadirachtin A*) on the abundance of bean aphids was studied in spinach seed plants. BioNature R2000, at a rate of 0.1% water solution and NeemAzal-T/S, at a rate of 0.5% water solution, were effective against bean aphids *Aphis fabae* Scop. In 2003 the efficacy of BioNature R2000 against bean aphids was 66.67, 63.64 and 25% – after 5, 7 and 14 days after application, respectively. The efficacy of NeemAzal T/S was 74.36, 68.18 and 25% – after 5, 7 and 14 days after application, respectively. In 2004 the efficacy of BioNature R2000 against bean aphids was 67.14, 66.67, 20.69 and 13.51% – after 5, 7, 14 and 21 days after application, respectively. The efficacy of NeemAzal T/S was 68.57, 62.50, 27.59 and 24.32% – after 5, 7, 14 and 21 days after application, respectively. Phytotoxicity symptoms of both biopesticides on plants were not found.

Key words: *Aphis fabae* Scop., *azadirachtin A*, *Azadirachta indica*, BioNature R2000, NeemAzal-T/S, phytotoxicity, *Pinus resinosa*, *Ricinus communis*.

Introduction

The conventional technology using synthetic insecticides has not been effective enough against aphids because these pests generally feed on the underside of foliage. Also, rapid differentiation of populations into insecticide-resistant strains necessitated increasing insecticidal treatments, which are economically and ecologically undesirable /Puterka et al., 1988/. An effective way to delay resistance to insecticides is to reduce the use of pesticides with the integration of other control strategies /Survilienė, Raudonis, 2003/. Complex mixtures of secondary compounds in Neem tree *Azadirachta indica* A. Juss extracts contribute to synergism that enhances the joint action of active compounds on the insect and reduces the rate of development of insect resistance /Pavela, Holy, 2003/. NeemAzal-T/S contains triterpenoid azadirachtin, as the basic active compound and other neem ingredients /Mordue, Blackwell, 1993/. This active component has a number of properties useful for insect control (repellency, feeding and oviposition deterrence, insect growth regulator) and is considered as safe for the environment /Schmutterer, 1990/. The use of insecticides on vegetable crops has caused increasing concern amongst growers, markets and consumers /Ellis et al., 1996/.

The aim of the study was to examine the toxic effect of BioNature R2000 (a. i. 210 g l⁻¹ *Azadirachta indica*, 180 g l⁻¹ *Pinus resinosa* and *Ricinus communis*) and NeemAzal-T/S (a. i. 10 g l⁻¹ *azadirachtin A*) on the abundance of bean aphids in spinach seed plants.

Materials and Methods

The trials were carried out in spinach during the growing seasons of 2003 and 2004 at the Lithuanian Institute of Horticulture's experimental field of vegetables. The general principles of the investigations were in accordance with the EPPO standards /Anon, 1997/.

BioNature R2000 (a. i. 210 g l⁻¹ *Azadirachta indica*, 180 g l⁻¹ *Pinus resinosa* and *Ricinus communis*) at a rate of 0.1 % water solution, NeemAzal-T/S (a. i. 1% *azadirachtin A*) at a rate of 0.5% water solution and untreated plants were used. The size of plot for the tested plants was 1.9 m². Four replications were arranged in a randomized block design. To determine the efficacy of the tested insecticides 4 plants per plot were observed. Mature and immature stages of bean aphids were recorded as follows: 24h before and 5, 7, 14 and 21 days after treatment. The biological efficacy of BioNature R2000 and NeemAzal-T/S in pest control was presented as percentage of pest mortality. Mortality counts of bean aphids were corrected using Abbott's formula (1925). The number of aphids was compared among the treatments in this study with a single factor analysis of variance (ANOVA) with $P \leq 0.05$.

Results and Discussion

The infestation of bean aphids was observed at the beginning of June. Before the first application there were on average 15.8 in 2003 and 19.9 in 2004 aphids per plant (Table 1). In 2004 aphids' density was higher and after application the number of pests decreased less than in 2003, when aphids' density was lower. In 2003, 21 days after application no aphids were found.

In 2003–2004 the death rate comparison between treatments and the untreated variant after 5 and 7 days after application showed significant differences ($p < 0.05$), but no significant differences between the biopesticides were found (Table 2). The efficacy of bioinsecticides was the highest 5 days after application in both years, but after 7 days the efficacy was still high. After 14 and 21 days BioNature R2000 and NeemAzal-T/S were not efficient. Biological efficacy of both biopesticides was similar, but NeemAzal-T/S was a little more effective. In 2004 after treatment aphids did not reach the population level which was before treatments.

Table 1. Abundance of aphids (*Aphis fabae*) in spinach
Babtai, 2003 and 2004

Treatment	Mean number of aphids plant ⁻¹				
	before application	after application			
		5 days	7 days	14 days	21 days
2003					
Untreated	15.25	9.75	5.50	1.00	0
BioNature R2000 0.1%	15.50	3.75	2.00	0.75	0
NeemAzal-T/S 1% EC 0.5%	16.75	2.50	1.75	0.75	0
LSD ₀₅	–	3.21	0.97	0.59	–
2004					
Untreated	18.25	17.50	12.0	7.25	9.25
BioNature R2000 0.1%	21.00	5.75	4.00	5.75	8.00
NeemAzal-T/S 1% EC 0.5%	20.50	5.50	4.50	5.25	7.00
LSD ₀₅	–	4.51	3.21	2.46	5.63

Table 2. The efficacy of bioinsecticide NeemAzal T/S against *Aphis fabae* in spinach
Babtai, 2003 and 2004

Treatment	Biological efficacy %							
	after 5 days		after 7 days		after 14 days		after 21 day	
	2003	2004	2003	2004	2003	2004	2003	2004
Untreated	–	–	–	–	–	–	–	–
BioNature R2000 0.1%	66.67	67.14	63.64	66.67	25.00	20.69	–	13.51
NeemAzal-T/S 1% EC 0.5%	74.36	68.57	68.18	62.50	25.00	27.59	–	24.32

From the point of view of plant protection, it is not very important through which mechanisms the action of the neem preparation is revealed if it leads to a visible decrease in the number of pests. From the practical aspect the direct quick killing effect is often essential /Hiisaar et al., 1998/. To save infested plants, pest-control is nearly always necessary /Survilienė, Raudonis, 2003/. Under the pressure of permanent pesticide treatments the resistance to synthetic pesticides can develop rapidly in pests /Gillespie, 2002/. Azadirachtin belongs to the most effective botanical metabolites, which are successfully used as botanical insecticides. The ability of azadirachtin to inhibit growth and induce mortality of larvae is high /Mordue, Blackwell, 1993/. For application in practice, it is important to start application not too early since there might be probably too small leaf surfaces to take up sufficient quantities of active neem ingredients. The aphids' density depends on many factors, e. g. the weather conditions, sowing time and occurrence of beneficial insects /Wojciechowicz-Żytko, 2003/. Meteorological conditions were more favourable for the development of cabbage aphids in

2004 and aphid population was more abundant than in 2003 /Duchovskienė, 2005/. In the treatment with spinach the abundance of aphids was similar. During the summer, bean aphid colonies developed winged adults, who migrated to new plants /Robak, Wiech, 1998/. We can suggest that some aphids in our treatment were migrants too, especially in 2003 at the end of treatment (after 14 days), when we found only winged adults and did not find any larvae, but in the following year there were found few larvae. On the other hand, Dimetry and Schmidt (1992) found that significant reduction in female reproduction resulted from feeding on plants topically treated with neem products. According to Ahmed et al. (2007) toxicity of neem formulations was gradually increased depending on feeding period and concentration. We found that the highest efficacy of BioNature R2000 and NeemAzal was only 5 days after treatment and did not increase any more. It is likely that aphid migration had some influence on these results because the abundance of aphids was low. According to Kaadeh et al. (2001) the disadvantage of NeemAzal is that the efficacy of this product did not persist for more than 9 days even for the youngest instar of cotton aphid.

Conclusions

1. The trial data showed that BioNature R2000 applied at a rate of 0.1% water solution and NeemAzal T/S at a rate of 0.5% water solution were effective against bean aphids *Aphis fabae* Scop. on the spinach plants to 14 days.
2. The efficacy of bioinsecticides was the highest 5 days after application.
3. The negative effect of biopesticides was not observed on the crop.

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