Integrated Control in Protected Crops, Temperature Climate
IOBC/wprs Bulletin Vol. 32, 2008
pp. 13-16.

Study of the efficacy of different concentrations of insecticidal soap, in comparison oxydemeton-methyl (Metasystox) to control *Aphis gossypii* in greenhouse cucumber

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Abstract: Insecticidal soaps have been used to control insects and mites because of low toxicity and environmental pollution with no residual effect. At present time, because of limitation in the use of chemical insecticides in greenhouse vegetables, it is needed to use an alternative product without poisoning active ingredient such as soaps. In this study, the effect of an insecticide soap named Palizin (Kimiasabzavar product) with three different concentrations (1.5, 2.5 and 5 g/l), oxydemeton-methyl (Metasystox) (1 ml/l) and control were evaluated through a CRBD in 3 replications against *Aphis gossypii* in greenhouse cucumber of Tehran and Varamin, Iran. Mortality percentage was calculated using Henderson-Tilton formulae and the arcsine transformed mortality percentage of aphids were analysed by SAS software. The comparison of the mean effectiveness of all treatments showed that there was no significant difference among treatments, but there is a significant difference to the control. The maximum and minimum mean effect of insecticide soap were 90.63 and 75.89 percent in concentrations of 2.5 and 1.5 g/l, respectively. According to the results, insecticidal soap (Palizin) is recommended in 2.5 g/l for spraying application.

Key words: insecticidal soap, *Aphis gossypii*, greenhouse cucumber, Metasystox, Iran

Introduction

Cucumber is the main greenhouse vegetable in Iran, with 95% of the greenhouse grown area (3,500 ha). Cucumber is attacked by various pests including aphids, of which the cotton aphid *Aphis gossypii* Glover is one of the main species in open field and greenhouses. At present time, because of limitation in the use of toxic synthetic chemical insecticides in greenhouse vegetables, it is needed to use alternative products without poisoning active ingredient such as soaps. Insecticidal soaps have been used to control insects and mites because of low toxicity and environmental pollution with no residual effect. Up to this date, practically no official research projects have been performed in Iran on the insecticidal properties of soaps, while in some other countries application of insecticidal soaps to control sucking insects on greenhouse vegetable crops, has become an increasingly common practice.

Experiments have proven that insecticidal soaps can cause high fatality rates in a variety of soft bodied insect pests such as aphids, whiteflies, leaf hoppers, thrips, scale insects. Butler *et al.* (1993) studied the effect of different formulations of horticultural oils and insecticidal soaps on whitefly populations on pumpkins and tomatoes and concluded that a 1% concentration of insecticidal soap caused 85% mortality of whitefly immature stages. Gill and Raupp (1989) achieved 100% and 85% mortality rates, respectively, in their comparative study of insecticidal effects of Acephate (0.125%) and insecticidal soap (2%) on Azalia scale insects Zinnin and Vachris (1990) studied the effect of insecticidal soaps on aphids as vectors of TMV virus to find that concentrations of between 0.1 to 10 percent controlled the disease causing pests population 35 to 92%, respectively, compared to control treatment (water).

Heinz *et al.* (1998) during an IPM program effectively controlled sucking insects such as aphids in greenhouses by spot application of insecticidal soap and releasing green lacewings as aphid predators. Imai *et al.* (1997) studied the effect of relative air humidity on efficacy of insecticidal soaps and concluded that the efficacy of insecticidal soaps is adversely affected by decrease in relative humidity.

In this study the efficacy of different concentrations of a new brand of insecticidal soap manufactured by Kimiasabzavar company in Iran under the trademark Palizin in controlling *A. gossypii* has been compared with a systemic organophosphorous insecticide oxydemeton-methyl (Metasystox).

Palizin insecticidal soap contains coconut diethanolamine as the main active ingredient. This is a mildly alkaline compound (pH= 7.5-8 at 2.5 g/l) with very low oral toxicity (LD_{50} > 12,200 mg/kg). Soaps dissolve the waxy layer on insects body and damage the cell membrane. Saponification of the lipids in the cell tissues results in the cell membrane rupture and loss of vital fluids.

Materials and methods

To study the effect of a new brand of insecticidal soap under the trademark Palizin to control of *A. gossypii* and to determine the optimum dosage of this product, a one year research project was designed.

In this study a comparison was made among Palizin at three different concentrations, the systemic organophosphorous insecticide Metasystox and a control treatment (water).

Tests were performed as complete random blocks with 5 replications, at two locations, the pilot greenhouse in Tehran and a commercial greenhouse in the city of Varamin.

Insecticide treatments

The treatments were: Palizin (water soluble formulation) at 1.5, 2.5 and 5 g/l, Metasystox (EC formulation) at 1 ml/l and water as control treatment.

The tests were carried out in a 500 m^2 greenhouse where cucumber seeds (Negin variety) were planted. The test site was divided into 5 plots. Three replications were made, each in a 14 meter long row. Spraying the soap solution was performed for three times in 2 to 3 days intervals using a high pressure engine driven spray equipment with a triple nozzle. Metasystox emulsion at 1 ml/l was sprayed only once, using the same equipment.

Data collection and analysis

Samples were taken once before and four times in 1, 3, 5 and 10 days intervals after the application of pesticides. To collect samples properly, 10 leaves of equal sizes (third leaf from top of the plant) were randomly chosen and picked. The samples were then transferred to the laboratory in labelled plastic bags, and live aphids were carefully counted in a 2-cm^2 frame which was placed randomly on the backside of each leaf.

The same procedure was followed in another test site, a cucumber greenhouse located in Varamin with the exception that samples were taken in 1, 3 and 5 days intervals.

The tenth day sampling was cancelled due to heavy infestation of a neighbouring alfalfa farm with aphids, which was being harvested the same day and could interfere with sampling and lead to false results.

The collected data were converted into percent mortality using Henderson Tilton formulae. To minimize variance of the data, they were converted by Arcsine method and analysed in complete random block design using SAS software. All treatments were statistically compared by Duncan multispan test.

Results and discussion

The final results obtained on the effect of different concentrations of Palizin insecticidal soap in controlling *A. gossypii* at two test sites are shown in tables 1 and 2.

Statistical analysis showed no significant differences among soap treatments and Metasystox insecticide. Analysis of the data collected in Varamin showed the same results. But in Tehran a significant difference was observed between soap treatment at 2.5 g/l and other treatments. According to the results of Tehran test, the mean highest percent mortality (90.63%) occurred at 2.5 g/l soap concentration and the mean lowest (75.89%) at 1.5 g/l.

The comparison of the mean effectiveness of all treatments showed that there were no significant differences among treatments, but there is a significant difference with control. A 100% mortality, observed in a sample unit (2-cm^2 frame) is an estimation of the overall mortality and does not necessarily mean that the entire population of aphids in the test plot was destroyed by the treatment.

Table 1. Mean percentage mortality of *Aphis gossypii* with different treatments in Varamin.

Treatments	Average percent mortality in following observation days			
	1	3	5	10
Palizin 1.5 g/l	93.55	100	100	-
Palizin 2.5 g/l	77.49	100	83.17	-
Palizin 5 g/l	100	100	100	-
Metasystox 1 ml/l	99.7	94.61	96.1	-

Table 2. Mean percentage mortality of *Aphis gossypii* with different treatments in Tehran.

Treatments	Average percent mortality in following observation days			
	1	3	5	10
Palizin 1.5 g/l	86.78	77.78	57.19	82.31
Palizin 2.5 g/l	93.90	90.63	89.32	89.25
Palizin 5 g/l	97.81	89.55	75.55	86.01
Metasystox 1 ml/l	88.74	93.13	78.90	86.3

The primary reason for unexpected decrease in mortality at 1.5 g/l soap treatment at 5 days in Tehran test site appeared to be the placement of live aphids on the plants by ants. To avoid false results, ants were eliminated at their nest.

Similar results were obtained by Zinnin and Vachris (1990) with insecticidal soaps on aphids as vectors of TMV virus who found that a concentration of 10 percent controlled the disease causing pest populations by 92%.

Soaps are more likely to cause damage to plants when applied in hot weather and under the sun. Some plants are more sensitive to soap solutions and can be seriously damaged, so spot tests prior to complete application are strongly recommended.

Considering the satisfactory results obtained the use of Palizin insecticidal soap as a safe alternative to synthetic pesticides in controlling aphids in greenhouses is recommended.

Tips for obtaining optimum results with the insecticidal soap Palizin

1. Palizin is a contact insecticide. So the soap solution has to come into direct contact with the insect body and cover the whole body with a thin layer of solution to be most effective. Installing triple nozzles on spraying equipment is strongly recommended, since it ensures thorough coverage of infested plant parts, which is essential to proper pest control with soap solutions.
2. To achieve the highest control of insect pests and avoid phytotoxicity, spraying of soap solution must be done early in the morning or at evenings when the weather is cooler and the relative humidity is at its highest.
3. Do not spray on young transplants and flowering plants with delicate petals, before performing a spot test and waiting for at least 48 hours to check for any probable damages.
4. Avoid spraying soap solution, during drought and on plants under severe nutritional or watering stress.

Acknowledgments

I thank Dr. A. Sheikhi from IRIPP for statistical advice and Eng. S. Ahmadi for technical helps.

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