

COMPARATIVE EFFICACY OF SOME INSECTICIDES IN CONTROLLING SAN JOSE SCALE ON PLUM IN PESHAWAR

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Carbosulfan EC (400 ppm, a.i.), chlorpyrifos + dimethoate EC (1324 ppm), deltamethrin + dimethoate EC (625 ppm), deltamethrin triazophos EC (720 ppm), and quinalphos EC (800 ppm) were tested for their potential to control San Jose scale, *Quadraspidiotus perniciosus* Comstock, on plum trees. Scale mortality recorded one day after insecticide application showed that all the insecticides, either alone or as a mixture, killed scale. No reinfestation of scale was observed on trees treated 20 days previously with chlorpyrifos + dimethoate. Some reinfestation of scale occurred on trees treated with carbosulfan and deltamethrin + triazophos, and an even higher level of reinfestation with quinalphos. The highest level of reinfestation occurred with deltamethrin + dimethoate which was comparable to the control treatment.

Key words: San Jose scale, Insecticides, Plum.

INTRODUCTION

San Jose scale, *Quadraspidiotus perniciosus* Comstock, is a serious pest of several fruit trees such as apple, peach, plum and pear. The pest attacks all parts of the tree including the trunk, branches, leaves and fruit. It remains ensheathed under a scaly cover and sucks the sap from plants. Continuous and sustained feeding by scale causes leaf desiccation, impairs leaf photosynthesis resulting in yellow leaves, causes premature fruit-drop and reduces fruit quality and yield. Fruit marketability is further reduced by the visual presence of scales.

Due to the severe impact of scale on the commercial production of fruit trees the efficacy of several insecticides, applied either alone or as mixtures, were evaluated. The effectiveness of the products that were tested in this experiment has not been reported in the literature against *Q. perniciosus*. However, the effectiveness of the products that appears as one of the constituents of the mixtures is reviewed herein. Chlorpyrifos [1-4], dimethoate [5-9] and deltamethrin [2,6] have given effective control of *Q. perniciosus*. A mixture of chlorpyrifos and dimethoate provided almost complete control of other species of scales [9].

MATERIALS AND METHODS

Small plum trees were selected from an orchard in the village of Tarnab located near to the Agriculture Research Institute of Tarnab, Peshawar. These trees were randomly assigned to each treatment. Each tree was considered a replicate. The trees were sprayed with insecticides (Table 1)

in mid-June (1987) using a manually operated compressed-air sprayer. After the insecticides applications, three leaves from each of the trees were removed for later analysis of scale mortality. A single piece of stem bark was also peeled from each tree. Using a microscope (10 x 4), scale covers were removed with a disposable syringe needle in order to determine whether they were alive or dead. The number of scales (crawlers, females, and males) were recorded on leaves (both surfaces) and bark sections and were reported on a per unit area basis. The data were transformed into $\log x + 1.5$ and subjected to analysis of variance. Significant differences in treatment means ($P < 0.01, 0.05$) were determined using Duncan's multiple range test [10].

RESULTS AND DISCUSSION

No live scale were observed on leaves one day after spraying with chlorpyrifos + dimethoate, deltamethrin + dimethoate, and deltamethrin + triazophos (Table 1). Carbosulfan and quinalphos-treated leaves showed negligible levels of live scale. No live scale were recorded on the stems treated with carbosulfan, chlorpyrifos + dimethoate, deltamethrin + dimethoate, and quinalphos, while deltamethrin + triazophos showed few live scale. Treated collectively (leaves and stems), chlorpyrifos + dimethoate, and deltamethrin + dimethoate controlled scale better than carbosulfan, deltamethrin + triazophos and quinalphos. In contrast, scale survived well on the untreated trees.

Observations made 20 days after the insecticidal applications showed there was no live scale in the chlorpyrifos + dimethoate and quinalphos leaf treatments

Table 1. Population density of live San Jose scale, *Quadraspidiotus perniciosus* Comst., and predatory mites, following insecticides applications at Peshawar, Pakistan.

Treatment	PPM(a i)	Mean scale densities/sq cm on days indicated						Mean mite densities on days indicated					
		1 days			20 days			1 day			20 days		
		Leaf*	Bark**	Both**	Leaf(ns)	Bark**	Both*	Leaf	Bark	Both	Leaf	Bark	Both
1. Carbosulfan 20 % EC (Advantage)	400	0.002a	0a	0.002a	0.002	1.11ab	1.112ab	0.002	0.00	0.002	0.002	0.00	0.002
2. Chlorpyrifos + dimethoate (48+18.2) % EC (dimlor)	1324	0a	0a	0a	0.00	0a	0a	0.00	0.00	0.00	0.008	0.00	0.008
3. Deltamethrin + dimethoate (1.25+30) % EC (decis D)	625	0a	0a	0a	0.002	7.56bc	7.57cd	0.002	0.007	0.009	0.00	0.06	0.06
4. Deltamethrin + triazophos (1+35% EC (deltaphos)	720	0a	0.23a	0.23a	0.01	0.41a	0.042ab	0.00	0.00	0.00	0.00	0.00	0.00
5. Quinalphos 40 % eC (Ekalux)	800	0.002a	0a	0.002a	0.00	3.43abc	3.43abc	0.00	0.00	0.00	0.00	0.00	0.00
6. Untreated		0.22b	17.37b	17.59b	0.07	15.98c	16.05d	0.01 (0.002 CP)	0.01 (0.002 CP)	0.02 (0.002 CP)	0.006 (0.002 CP)	0.008 (0.004 CP)	0.014 (0.006 CP)

(ns) = Not significant. * = $P < 0.05$ ** = $P < 0.05$ and 0.01. Means within columns separated by the same letters are not significantly different. CP = Black coccinellid predators *Stethorus* sp.) seen at rates given in parenthesis.

indicating a persistent effect and protection against scale reinfestation. Negligible reinfestation occurred on leaves treated with carbosulfan, deltamethrin + dimethoate, and deltamethrin + triazophos. However, relatively low levels of scale reinfestation also occurred on the leaves of untreated plants possibly due to the high temperatures caused by direct sunlight. Stems shaded by the tree canopy supported a higher level of scales in the untreated trees compared to the leaves. Interestingly, stems showed lower levels of reinfestation with applications of deltamethrin + triazophos and carbosulfan which compared with the chlorpyrifos + dimethoate treatments. Reinfestation of scale was higher with quinalphos and highest with deltamethrin + dimethoate compared to the control treatments.

Predatory mites and black coccinellid predators (*Stethorus* sp.) were relatively abundant in the control treatments throughout the experimental period (Table 1). Mites were observed one day after the insecticides applications on both leaves and stems (bark) treated with deltamethrin + dimethoate and only on leaves treated with carbosulfan. Observations made 20 days after the insecticides applications revealed the presence of the mites in case of carbosulfan and chlorpyrifos + dimethoate leaf treatments and deltamethrin + dimethoate stem treatments. These observations may suggest that these insecticides may be compatible with an integrated pest management programme.

Since the effect of the tested products has not been previously reported in the literature against this scale therefore strict comparison could not be possible. How-

ever, as reviewed earlier, separate applications of chlorpyrifos [1-4], dimethoate [5-8] and deltamethrin [2,6] were effective in killing this species of scale. One report [9] has shown that a mixture of chlorpyrifos + dimethoate provided a longer control of other species of scales and our investigations has a similar tendency too regarding this mixture.

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