

Field Evaluation of Plant Derivative and Chemical Compounds and their Mixtures against *Ceroplastes floridensis* Com. (Homoptera: Coccidae) on Orange Trees

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ABSTRACT

Laboratory study showed highly superior susceptibility to Neemix by different stages of *Ceroplastes floridensis* Com. followed by Malathion, KZ oil and Super Royal oil at LC₅₀ and LC₉₀. Field experiments were carried out to evaluate effect of such insecticides against this pest infesting orange trees, *Citrus sinensis* (Limn.). The treatments suppressed significantly the population of the pest. Neemix as a plant derivative was the most effective compound against the soft wax scale insect followed by Super Royal, KZ oils and Malathion where the reduction in infestation reached 79.2, 79.2, 72.2 and 61.4%, respectively, throughout the 3 months of experiment. Adding 1.5 % super Royal oil to the lower concentration of Neemix (0.025 %) displayed also potential effect and destroyed the pest population by about 86.7 % that slightly exceeded the respective value of the standard Malathion (76.70 %).

Key Words: *Ceroplastes floridensis*, Neemix, Petroleum oils, *Citrus sinensis*, Field evaluation.

INTRODUCTION

The soft wax scale insect *Ceroplastes floridensis* Com. is a serious pest in Egyptian citrus orchards. This pest adheres firmly to the leaves and fruits and causes defoliation and dryness of the young twigs. The honeydew excreted serves as a suitable medium for shoot-mould fungus. The damage caused by this insect pest occurs as a result of sucking the juice, weakness of the trees and reduction of the fruit crop.

Conventional chemical insecticides singly and in combination with mineral oils are usually sprayed against scale insects (Salama and Amin, 1983, Aly *et al.*, 1984, Assem *et al.*, 1993, El-Imery *et al.*, 1999 and Helmy *et al.*, 2001 & 2002). So, citrus fruits contaminated with high levels of insecticide residues are rejected in most markets.

Therefore, the present work was to evaluate the effectiveness and persistence of Neemix (Botanical insecticide), some petroleum oils and a chemical pesticide (Malathion) against the soft wax scale insect.

MATERIALS AND METHODS

Chemicals used:

1- Neemix

A commercial formulation of Neem seed kernel (*Adadirachta indica*) extract containing 4.5% (C₃₅H₄₄O₁₆), formulated by Thermo trilogy CORP/NICHIMEN

2- Mineral oils:

Two types of oils, specifically formulated for pest control were used:

- a)-KZ oil 98.5 % The miscible type formulated by Kafr El-Zayat Co.
- b)-Super Royal oil 85.7 % El-Gameia El-Taawnia for Petrol Company.

3- Malathion 57 % E.C.

Organophosphorus compound.

Relative toxicity against the adult stage of *C. floridensis*.

Laboratory bioassay experiments were carried out to evaluate the relative efficacy of four treatments, Neemix, Malathion 57 % EC., KZ-Oil and Super Royal oil against the adult stage of *C. floridensis*.

Dipping method was used under laboratory conditions (30 ± 1°C and 62 ± 5 % R.H.). A serial of concentrations for each of the tested treatments were prepared by diluting the EC end product of each tested compound in distilled water. Infested orange leaves with adult stage of *C. floridensis* were transferred to the laboratory, where they were dipped into the insecticide solution for 10 seconds. Fifty leaves were used for each concentration (10 leaves per replicate).

The control leaves were dipped in distilled water only. Both treated and untreated leaves were left for dryness, and then kept in polyethylene bags. Counts of the alive and dead adults were carried out after three days from treatment. Corrected mortality counts for adults according to Abbott's formula (1925) were statistically analyzed by Finney (1952).

Field evaluation against different stages of *C. floridensis*.

An orchard of navel orange trees *Citrus sinensis* (L.) at Badre district, El-Behera Governorate was chosen for these experiments in an area of about 2 feddans. The trees about 15 years old were naturally infested with the soft wax scale insect *C. floridensis* and did not receive any insecticide treatments throughout the last two years. A randomized block design was used where each treatment was carried out on 12 trees (represents 3 replicates, 4 trees each). The other trees were left as borders between different treatments. At first set of experiment, each tested chemical was applied separately at the rate recommended by the Ministry of Agriculture in Egypt.

At second set of experiments, combined treatments of insecticide were mixed with the spray oils. Each mixture was prepared in Knapsack sprayer 20 liters capacity just before spraying at rates lower than the recommended one. Similar number of untreated trees was left as control.

Twenty leaves from each replicate were randomly picked up from different directions and core of the treated trees. The leaves were kept in plastic bags and transferred to the laboratory where they were examined by using a Stereomicroscope.

Spraying was carried out, 10th July 2003 when temperature ranged between 30 – 35 °C and R.H. 55-65 %.

Each separate chemical and its combined effects, based on the reduction of the population density of the alive individuals/replicate were evaluated according to Henderson and Tilton equation (1955). Data were statistically analyzed using Duncan's multiple range tests (1955).

RESULTS AND DISCUSSION

Relative toxicity against the adult stage of *C. floridensis*

Four compounds, Neemix, Malathion 57 % EC, KZ oil and Super Royal oil were evaluated versus adult stage of the soft wax scale insect, *C. floridensis* following the dipping technique (Abd El-Megeed *et al.*, 1991 and Kwaiz, 1999).

Results in Table (1) show the potency of the control agents against the adult stage of *C. floridensis*. Considering the LC₅₀ value, the Neemix showed the most effect whereas that of Super Royal oil was the least in this concern.

Table (1): Comparative toxicity of different treatments to the adult stage of soft wax scale insect, *Ceroplastes floridensis* Com.

Treatment	LC ₅₀ %	LC ₉₀ %	Slope	Confidence limit		* Index	** No of Folds
				Lower	Upper		
Neemix	0.0048	0.021	2.00	0.0032	0.0064	100	57.30
Malathion	0.034	0.211	1.61	0.023	0.044	14.12	8.09
KZ-oil	0.184	0.786	2.03	0.163	0.205	2.61	1.50
Super Royal	0.275	1.07	2.12	0.206	0.364	1.75	1

*=Index compared with Neemix

**=Number of folds compared with Super Royal

Starting with, Neemix, which gave the highest effect against adults of *C. floridensis* with LC₅₀ of 0.0048 followed descendingly by Malathion with (0.034), KZ oil with (0.184) and Super Royal oil (0.275).

Abd El-Salam (2000) found that different formulations of Neem gave the highest effect against the adult stage of *Lasioderma serricorne* (F.) compared with Ethyl oleate oil

The toxic effect of Neemix compound was 57.30 folds as toxic as that of Super Royal oil at LC₅₀ level (Table 1). Regarding the toxicity index referring to Neemix compound that level for Malathion compound was 14.12 %. The toxicity index for the KZ oil and Super Royal recorded 2.61 and 1.75 %, respectively.

Efficacy of the tested compounds against the soft wax scale insect

Results in Table (2) show that, the mean numbers of *C. floridensis* found on orange trees before treatments, ranged from 24.30 to 30.00, per replicate indicating a relatively uniform distribution of insect infestation.

Table (2): Efficiency of different treatments applied against *Ceroplastes floridensis* infesting orange trees

Treatment	Conc %	Before treatment	Mean number on insects/replicate and % reductions							
			1 month		2 months		3 months		Average	
			Mean No.	%R.	Mean No.	%R.	Mean No.	%R.	Mean No.	%R.
Neemix	0.05	30.00	7.70	83.40	11.70	78.90	14.70	75.30	11.40 b	79.20
Super Royal	1.50	24.30	9.30	75.30	14.00	68.80	13.30	72.40	13.30 c	72.20
KZ oil	1.50	27.30	10.70	74.70	19.70	60.90	25.70	52.40	18.41 d	62.70
Malathion	0.15	26.70	12.00	71.00	17.30	64.90	25.7	51.30	18.70 d	61.40
Control	0.00	25.70	39.70	-	47.30	-	50.70	-	34.20 a	-

% R = Percent Reduction in infestation

L.S.D. at 0.05 = 1.963

The treatments suppressed the levels of infestation to different degrees after one month of spraying compared to that of untreated control. Super Royal, KZ oils and Neemix significantly lowered the percentage of infestation to 75.3, 74.7 and 83.4 %, respectively, although they did not reach that of Malathion as conventional chemical insecticide (71.0 %). These results agree with those of Helmy *et al.*, 1983, Abd El-Megeed *et al.*, 1988 and Ibrahim 1990.

Two months post-treatment, Neemix became less efficient and had almost similar activity as the standard Malathion displaying 78.9 and 64.8 % reduction in infestation, respectively, similar results were reported by Ismail and Abdallah (2001).

The petroleum oils proved to have considerable protection where 32.70 and 32.90 % reduction were obtained for super Royal and KZ oil, respectively.

As for the 3rd month after the treatment, both Neemix and Malathion showed good residual activities against *C. floridensis* giving 75.3 and 51.3 % reduction, respectively.

Joint action of certain mixtures against *C. floridensis*

The possibility of mixing low concentration of Neemix (0.025 %) with Super Royal or KZ oils was also investigated. The data showed that all mixtures proved to be promising to control the population of this scale insect. About 7.5 % increase in the efficiency was recorded, when super Royal oil was mixed with Neemix (avg. 86.7 % reduction) throughout the whole experimental period (Table 3).

Table (3): Efficiency of certain mixtures applied against *Ceroplastes floridensis* infesting orange trees.

Treatment	Conc %	Before treatment	Mean number on insects/replicate and % reductions							
			1 month		2 months		3 months		Average	
			Mean No.	%R.	Mean No.	%R.	Mean No.	%R.	Mean No.	%R.
Neemix + Super Royal	0.025 + 1.50	32.70	3.70	92.70	8.00	86.80	12.60	80.60	8.10 c	86.70
Neemix + KZ oil	0.025 + 1.50	30.30	5.30	88.70	9.70	82.70	15.30	74.50	10.10 c	82.00
Malathion	1.50	33.30	11.30	78.10	13.7	77.70	16.70	74.3	13.90 b	76.70
Control	0.00	25.70	39.70	-	47.30	-	50.70	-	45.90 a	-

% = Percent Reduction in infestation

L.S.D. at 0.05 = 2.416

The present results showed that Neemix and the petroleum oils could be used successfully for controlling the soft wax scale insect, *C. floridensis* on orange trees. The combined effect of Neemix with oils may prolong the activity as an additional privilege for protecting citrus trees from insect attacks. Also, the efficacy of Malathion increased with increasing the rate of application by 10 fold the recommended rate (1.5 %).

Helmy *et al.*, (2002) found that mixing mineral oils with conventional pesticides gave the highest % reduction in infestation with the whitefly, *Bemisia tabaci* Genn. attacking tomato crop, while mineral oils or pesticides alone gave the lowest reduction % in infestation.

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