COMPARISON BETWEEN AERIAL AND GROUND SPRAYING AGAINST THE CALIFORNIA RED SCALE, AONIDIELLA AURANTII (MASK.) AND DIALEURODES CITRI (ASHMEAD) ON CITRUS TREES .

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Abstract

Efficiency of Misrona Super oil to various life stages of the California red scale, *Aonidiella aurantii* and the citrus white fly, *Dialeurodes citri infesting* orange trees by ground spray motor (48 l. M.S. oil/fed.) and aerial spray by helicopter (10 l.M.S. oil/fed.) in Sharkiya Governorate was investigated.

Both methods gave satisfactory results and no phytotoxicity was observed after winter application with a superior efficacy for helicopter. Insects existing on the low and high levels of orange trees were the most responsive to the miscible oil activity especially in aerial application. Also, the immature stages of both pests were most sensitive to the m.s. oil efficacy than the pupal and adult stages. Therefore, it seems that helicopter might be introduced as a useful technique for controlling scale insects and white flies by using miscible oil especially in case of large areas of citrus trees. This method saves great amount of chemicals, water, time, cost and minimizes the environmental pollution.

INTRODUCTION

California red scale insect *Aonidiella aurantii* (Mask.) and the citrus white fly *Dialeurodes citri* (Ashm.) are the most destructive pests of citrus in Egypt. Severe infestation with both pests reduces photosynthetic activity, causing defoliation and substantial reduction in the fruit yield and quality if not controlled (El-Imery, 1991, Helmy *et al.* 1991 and Hassan, 1993).

The common method for controlling the intended pests is wash spraying the trees with oils and organophosphorus insecticides by the traditional spray motors (El-Imery, 1991, Helmy *et al.*, 1991, Madkoury, 1991 and Abou-Zahw *et al.* 1993).

This method of application consumes huge amount of pesticides, water, time and cause paramount drift and environmental pollution. Modern trend in this respect

is to utilize the helicopter at a low volume rate of application especially in large areas of citrus trees (Helmy *et al.* 1984; Hassan 1993 and Helmy *et al.* 1994 .

The present investigation aims to evaluate the efficiency of the low-volume spray with summer oil, Misrona Super oil by means of a medium size helicopter compared with the high-volume spray by motor for controlling *A.aurantii* and *D. citri on* citrus trees.

MATERIALS AND METHODS

Experimental design

Field tests were carried out at Belbeis district, Sharkiya Governorate on December, 25th 1994, in an orchard of sweet orange trees, twelve years old, highly infested with California red scale *Aonidiella aurantii* (Mask.) and citrus white fly *Dialeurodis citri* (Ashm.).

The present study was conducted to evaluate the efficacy of the high-volume spraying with summer oil, Misrona Super oil by means of the conventional spray motor (2400 l./fed.), and the low-volume spraying with a medium size Rotary helicopter Mi-2 at (40 l./fed.). Area of experiment consisted of 5 fed. in case of ground equipment application, and 15 fed. for aerial application treatment. Rates of the miscible oil used in helicopter treatment was (10.0 l oil + 30.0 l water/fed.), (Helmy *et al.* 1984 and Hassan 1993), but in conventional motor treatment the rate was (48 l. oil + 2352 l. water/fed.) Rawhy *et al* (1976) and Helmy *et al* (1991).

Phytotoxic effect of Misrona Super oil on rate of defoliation and fruit dropping two weeks following ground and aerial application were estimated according to Helmy *et al* . (1991).

Samples of 50 infested leaves, 10 orange fruits and 25 branches were taken from the three levels of the tree; low, medium and high and replicated four times for each plot either treated with spray motor or helicoper. Samples were collected immediately before spraying and two weeks after. The reduction percentage of population of both *A.aurantii* and *D.citri* were estimated for different development stages (immature and adults) at different levels of the trees according to Stafford and Summers statement (1963). The reduction percentage of all samples was subjected to a simple analysis of variance aided by computer.

Meteorological conditions recorded were : Temp. 18°C, Relative humidity 73.5% and Wind velocity 1.5 m./sec. during execution of the experiments.

Calibration of Mi-2 helicopter and the mean values of droplet data of the plots obtained under airstrip and field conditions are demonstrated and detailed in the 1st paper (Hindy *et al*, 1996).

RESULTS AND DISCUSSION

1. Phytotoxic effect

Examination of the sweet orange trees two weeks after winter application showed negligible phytotoxic effects of the miscible Misrona Super oil (M.S. oil). Defoliation was between normal and light, in ground and aerial applications. However, no fruit dropping was observed in both cases at the two tested concentrations 48 and 10 l/fed., respectively. These results are in agreement with those obtained by El-Sebae *et al.* (1976), El-Imery (1991) and Helmy *et al* (1991).

2. Efficiency of Misrona Super oil on *Aonidiella aurantii*

2.1. On sweet orange leaves

Data presented in table 1, clearly showed the higher effect of aerial application at 10 l. M.S. oil/fed. than the ground application at 48 l. M.S. oil/fed., without significant difference between them. Reduction percentage was 92.70 and 86.03% of A.aurantii population, respectively. Considering the efficiency of Misrona Super oil against the different stages, analysis of variance showed insignificant difference between stages affected after aerial and ground applications. Reduction percentages were (95.53 and 88.63) of nymphs, (92.40 and 85.66) of adult females and (90.16 and 83.80) of adults + nymphs for the two mentioned treatments, respectively.

Ground application recorded highly significant difference between the three levels of the tree, with higher efficacy in case of the low level followed by the medium then the high canopy. However, the reduction percentages were 91.80, 86.00 and 80.30, respectively. On the contrary, no significant difference was recorded between the three levels in case of aerial treatment by helicopter. Results obtained are in harmony with those obtained by Akesson and yates (1976), Helmy *et al.* (1984), Hassan (1993) and Helmy *et al.* (1994).

2.2. On sweet orange fruits

As shown in table 2, data demonstrated the superiority of aerial application for controlling A.aurantii population infesting orange fruits, than the ground application. The mean percentage of reduction being 80.10 and 77.03, respectively. Both methods of application at the different rates of summer oil gave satisfactory results on the various stages of the insect. Percentages mean of reduction of nymphs, adult females and (adult and nymphs) were 82.70, 80.66 and 76.93% and 76.93% in case of aerial application, and 79.46, 77.43 and 73.20% with ground application, respectively. Data clearly showed that A.aurantii nymphal stage was the highest sensitive to the different treatments, followed by adult females then ovipositing females.

Table 1. Efficiency comparison between ground and aerial application against the red scale insect Aonidiella aurantii (Mask.) infesting sweat orange leaves after winter spraying using Misrona Super oil.

Treatment Levels	% reduction of population on leaves							
	Ground app. 48 l. M.S. oil /F.			Mean	Aerial app. 10 l. M.S. oil /F.			Mean
	Stages				Stages			
	Ny.	Ad.	Ad+NY		Ny.	Ad.	Ad+NY	
Low level	95.50	90.80	89.10	91.80A	96.30	91.60	89.00	92.30A
Medium level	88.20	86.30	83.50	86.00B	93.60	90.50	88.30	90.80A
High level	82.20	79.90	78.80	80.30C	96.70	95.10	93.20	95.00A
General mean	88.63 A	85.66 A	83.80 A	86.03	95.53 A	92.40 A	90.16 A	92.70

NY = Nymphal stages. Ad = Adult female stages.
Ad. + NY. = Adult laying nymphs under the scale .
" F" between levels = 45.292 High Sign. = 2.445 Insign.
L.S.D. at 0.05 for levels = 3.354
"F" between stages = 6.945 Insign. = 4.788 Insign.
" F " between ground and aerial appl. = 2.514 Insign.

Data in table 2, showed that, there is significant differences between the three height levels. However, mean of percentages reduction of A.aurantii populations were (82.80 and 81.50) at low level, (75.80 and 75.50) at medium level and (72.50 and 83.30) at high level in case of ground and aerial applications, respectively. These results are in agreement with Helmy *et al.* (1984), El-Imery (1991), Hassan (1993), Helmy *et al.* (1994) and Hindy *et al* (1996).

Table 2. Efficiency comparison between ground and aerial application against the red scale insect Aonidiella aurantii (Mask.) infesting sweat orange leaves after winter spraying using Misrona Super oil.

Treatment Levels	% reduction of population on fruits							
	Ground app. 48 l. M.S. oil /F.				Aerial app. 10 l. M.S. oil /F.			
	Stages			Mean	Stages			Mean
	Ny.	Ad.	Ad+NY		Ny.	Ad.	Ad+NY	
Low level	86.00	83.90	78.50	82.80A	83.60	82.40	78.50	81.50A
Medium level	77.30	76.80	73.30	75.80B	78.30	76.20	72.00	75.50 B
High level	75.10	71.60	70.80	72.50B	86.20	83.40	80.30	83.30A
General mean	79.46 (A)	77.43 (A)	74.20 (A)	77.03	82.70 (A)	80.66 (A)	76.93 (A)	80.10

" F" between levels = 15.061 Sign. = 9.967 Sig .
L.S.D. at 0.05 for levels = 5.321 = 4.435
"F" between stages = 2.588 Insig. = 3.096 Insig .
" F " between ground and aerial appl. = 3.966 Insign.

3. Efficiency of Misrona Super oil on *Dialeurodes citri* on orange twigs

It is worthy mentioning that this is the first trial to apply miscible mineral oils against citrus white fly D.citri in Egypt. However, all the pervious attempts were by applying organophosphorus compounds, (Koli and Makar, 1981, Madkoury, 1991 and Abou-Zahw *et al.*, 1993).

Data in Table 3, indicated superiority of the aerial application by helicopter (10 l.M.S. oil /fed.), the mean reduction percentages of D.citri population being 92.77 and 84.81%, respectively.

Analysis of data indicated significant differences, between the three height levels of trees in case of ground application treatment. The highest effect on white fly different stages was on those found on the low level of the trees followed by the medium then the high level. However, the population reduction means recorded were 89.67, 84.03 and 80.73%, respectively. On the other hand, no significant variations were obtained between the different levels in case of aerial spray method. The superior effect occurred at high level (92.77), followed by the low (88.83), then the medium level with (86.17%) reduction on the average. Data in the same table 3, proved the high susceptibility of the eggs followed by the nymphs than the pupal

stage to the oil spray in the two mentioned methods of application. These results seem to be similar to results mentioned by Koli *et al.* (1981), Madkoury (1991) and Helmy et al. (1994).

Table 3. Effiçiency comparison between ground and aerial application against citrus white fly Dialeurodes citri (Ashm.) infesting sweat orange trees after winter spraying using Misrona Super oil.

Treatment Levels	% reduction of population on leaves							
	Ground app. 48 l. M.S. oil /F.			Mean	Aerial app. 10 l. M.S. oil /F.			Mean
	Stages				Stages			
	Eggs.	NY.	Pupae		Eggs.	NY.	Pupae	
Low level	92.50	89.80	86.70	89.67A	92.00	88.20	86.30	88.83A
Medium level	88.40	82.20	81.50	84.03B	89.80	86.70	82.00	86.17A
High level	84.20	81.30	76.70	80.73B	94.30	92,50	90.50	92.77A
General mean	888.36 (A)	84.43 (A)	81.63 (A)	84.81	92.03 (A)	89.46 (A)	86.26 (A)	92.77

" F" between levels = 26.487 Sign. = 3.389 Sig .
L.S.D. at 0.05 for levels = 3.446
"F" between stages = 4.364 Insig. = 4.321 Insig .
" F " between ground and aerial appl. = 2.261 Insign.

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مقارنة بين الرش الجوى والارضى لمكافحة الحشرة القشرية الحمراء وذبابة الموالح البيضاء على الموالح باستعمال الزيت المعدنى الصيفى

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أجريت تجربة للرش الشتوى خلال ديسمبر ١٩٩٤ بمحافظة الشرقية لتقييم فاعلية زيت سوبر مصرونا على الاطوار المختلفة للحشرة القشرية الحمراء وذبابة الموالح البيضاء وذلك بالرش الارضى بمعدل ٤٨ لتر زيت /ف والرش الجوى بالطائرة الهليكوبتر بمعدل ١٠ لتر زيت /ف وذلك فى ثلاث مستويات لاشجار البرتقال السكرى.

أثبتت الدراسة فاعلية الرش بالطائرة الهليكوبتر عن الرش الارضى ولكن بدون فرق معنوى. ولم يلاحظ اى اثار جانبية على الاشجار المعالجة فى الحالتين. وجد فرق معنوى لكفاءة الرش فى المستويات المختلفة حيث ان المستوى السفلى والمتوسط كانت نسبة الابادة اعلى منها فى المستوى العلوى فى حالة الرش الارضى، فى حين كانت فاعلية الرش افضل فى المستوى العلوى والسفلى عنها فى المتوسط فى حالة الرش الجوى. كذلك حققت الاطوار غير الكاملة اكبر استجابة لفاعلية الرش سواء الارضى او الجوى عن الاطوار المتقدمة (حشرات كاملة واضعة حوريات) فى حالة الحشرة القشرية الحمراء و (العذارى) فى حالة ذبابة الموالح البيضاء.

وبناءا على ما تقدم يمكن التوصية باستخدام الطائرة الهليكوبتر فى مكافحة الحشرات القشرية والذباب الابيض التى تصيب أشجار الموالح خاصة فى المساحات الكبيرة حيث ان استخدام هذة الوسيلة يمكنها توفير كميات كبيرة من الكيماويات والمياة والوقت والجهد والتكاليف هذا بالاضافة الى خفض معدل التلوث فى البيئة الى اقل حد ممكن.