Efficacy of Some Insecticide on Citrus Red-scale *Aonidiella aurantii* (Maskell) (Hemiptera:Diaspidiae) Infested Orange Trees at El-Beheira Governorate, Egypt

Abdel-Fattah, Rasha S.
Plant Protection Institute, ARC, Sabahia, Alexandria, Egypt

ABSTRACT: Citrus red-scale, *Aonidiella aurantii* (Maskell) (Hemiptera: Diaspididae) is an armored scale infested orange trees at Kafr-Eldwar, El-Beheira Governorate. It was subjected to be controlled. Two experiments were performed to test five summer mineral oils (Super Masrona oil® 95%, Diver oil® 97%, Tiger oil® 97%, Kz oil® 95% and CAPL2 oil® 96.62%) and neonicotinoid systemic imidacloprid insecticide (Admire® 20% SC)against *A. aurantii* in a private orchard of orange trees (pre-flowering stage in early spring (2010) and during fruiting stages in early summer (2011)).Results indicated ascending increasable reduction effect with time intervals up to two months against *A. aurantii.* It was observed that reduction effect caused by mineral oils had increased as purification percentages increase. It could be recommended that, light summer oils gave successful control against armored red-scale insect which infest orange trees, where they were more effective and less environmental hazards than the other tested insecticide (Admire®).

Keywords: Citrus red scale, orange trees, summer mineral oils, neonicotinoid systemic imidacloprid insecticide

INTRODUCTION

Citrus red-scales, insect *Aonidiella aurantii* (Maskell) generally causes yellow chlorotic spots when attacking leaves. Yellow spots may also appear at the feeding sites on fruit. This insect appears to prefer fruit over leaves in the summer and fall; therefore, the fruit may be heavily infested, while the adjacent leaves are relatively free from them. Unlike other armored scales on citrus, the insect restrict feeding on foliage and fruit but do not attack twigs or limbs of citrus trees. Large populations of this scale insect may result in severe defoliation and fruit production would be decreased. The insect presents on the fruit will render it as unmarketable fresh fruit because it does not agree with the consumer desire. Heavily infested fruit may be downgraded in the packinghouse and, if population levels are high, serious damage can occur to trees. Severe infestations cause leaf yellowing and drop, dieback of twigs, limbs, and occasionally death of the tree. Tree damage is most likely to occur in late summer and early fall when its population is high and moisture stress on the tree is sever (Kennett *et al.,* 1999)

Egyptian citrus considered one of the popular and cheap fruits. Citrus trees are subjected to varieties of insect pests, as the armourd scale insects, mainly the red scale insect, *A.aurantii* (Habib *et al.,* 1971, Darwish, 1970 and Farag *et al.,* 1989).Orange has become the most commonly grown fruit tree in the world. Large quantities of fresh oranges and orange juice concentrate are exported to the United States and small shipments go to East Germany, Canada and Argentina. However, overproduction has glutted domestic markets and brought down prices and returns to the farmer to such an extent that plantings have declined (Florida Citrus Pest Management Guide, 2007). Because of the damage caused by this insect to citrus trees, different control

methods had been adopted by many investigators to prevent serious losses to the citrus crops in Egypt.

Local sprays of mineral oils are used for many years against scale insects, mealy bugs, thrips, aphids and mites on different crops and fruit trees, (El-Deeb *et al*., 2002 and Moursi, 1996). These oils were most commonly used in horticulture to control scale insects and mites (Chapman *et al*., 1952). Micks and Berlin (1970) and El Sebae *et al*., (1976) stated that resistance was not recorded for mineral oils which still have the advantage of being effective against the insect resistant strains.

Present study was carried out to evaluate some insecticides against citrus red-scale, [*Aonidiella aurantii* (Maskell)] and find out the most effective one, which could control infested orange trees successfully and synchronizely by the same application in an attempt to reduce its serious damage on citrus fruits.

MATERIALS AND METHODS

Two field experiments were carried out (during pre-flowering stage in early spring (2010) and during fruiting stages in early summer (2011)),in an orchard of orange trees at Kafr-Eldwar, El-Beheira Governorate, to evaluate the efficacy of certain compounds[five emulsifiable concentrate light summer mineral oils differ in its purification percentages (Super Masrona oil® 95%; Diver oil® 97%; Tiger oil® 97%; Kz oil® 95% and CAPL2 oil® 96.62%) and Imidacloprid insecticide (Admire® 20% as soluble concentrate formulation)]against the armored scale insect[citrus red-scale, *Aonidiella aurantii* (Maskell) (Hemiptera: Diaspididae).Orange trees were 15 years old and have similar uniformity in height, shape and sizeand highly infested with citrus red-scale insect.

Experiments were designed as a complete randomized block design. Spraying was accomplished by means of a conventional knapsack sprayer with a capacity of 20 liters/tank; at rate of 10-12 liters per tree to ensure complete coverage of all parts of the tree. Six treatments as well as the untreated check were replicated four times with six trees per replicate and randomly distributed over 168 trees. Random samples of thirty leaves from each replicate were selected for laboratory counts (0, 2, 4, 6 and 8 weeks) before and after spraying. Samples were put in labeled cloth bags and transferred to the laboratory for counting using the stereoscopic binocular microscope.The reduction of the inspection of both insects numbers was expressed as reduction percentages which were calculated according to Henderson and Tilton (1955). Statistical analysis of variance and LSD value for comparing the mean effects of each treatment were adopted according to Snedecor (1961).The tested compounds are shown in Table (1) .

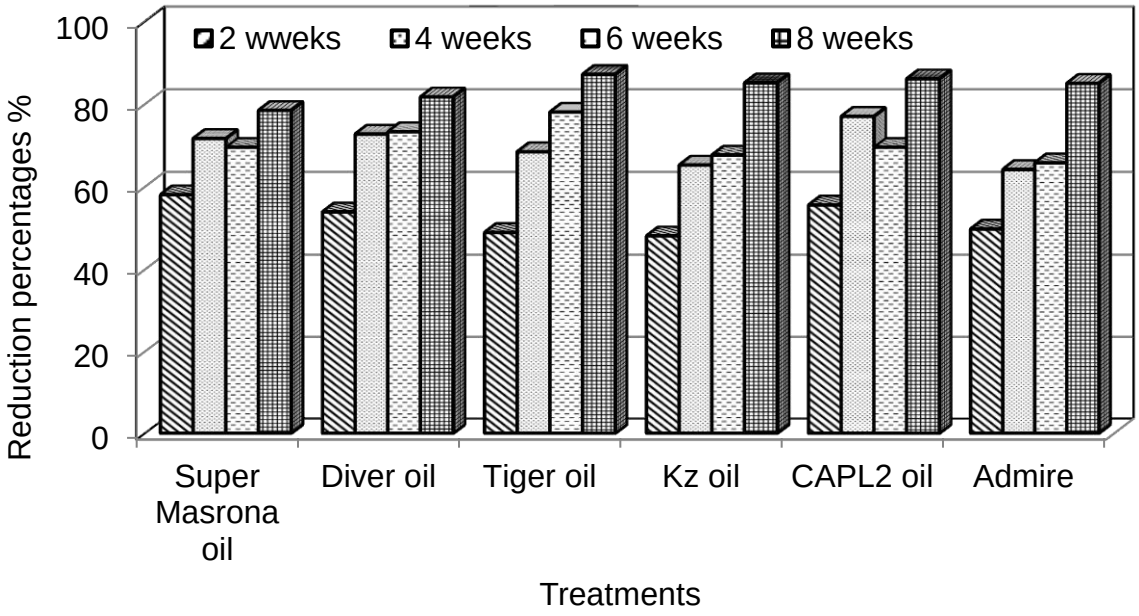
Table 1: the used insecticides in the evaluation

Compounds	Rate%	Source (Company)
Super Masrona oil® 95%, E.C	1.5	Misr Petrolium Co.
Diver oil® 97%, E.C	1.5	El-Helb pesticides and Chemical Co.
Tiger oil® 97%, E.C	1.5	
Kz oil® 95% E.C	1.5	Kafr El-Ziat Pesticides and Chemicals Co.
CAPL2 oil® 96.62%, E.C	1.5	Central Agriculture Pesticides Laboratory (CAPL)
Admire® 20% SC, (Imidacloprid)	1%	Shenzhen Cropstar Chemical Industry Co., Ltd.

RESULTS AND DISCUSSION

All tested treatments showed ascending increasable effect with time intervals against the tested insect during the two experiments periods.It was observed that the reduction of the tested insect populations caused by Mineral oils increased directly proportional with their purification percentages.

A) Effect of tested compounds during pre-flowering stage



L.S.D$_{0.05}$ (Means)= 1.59

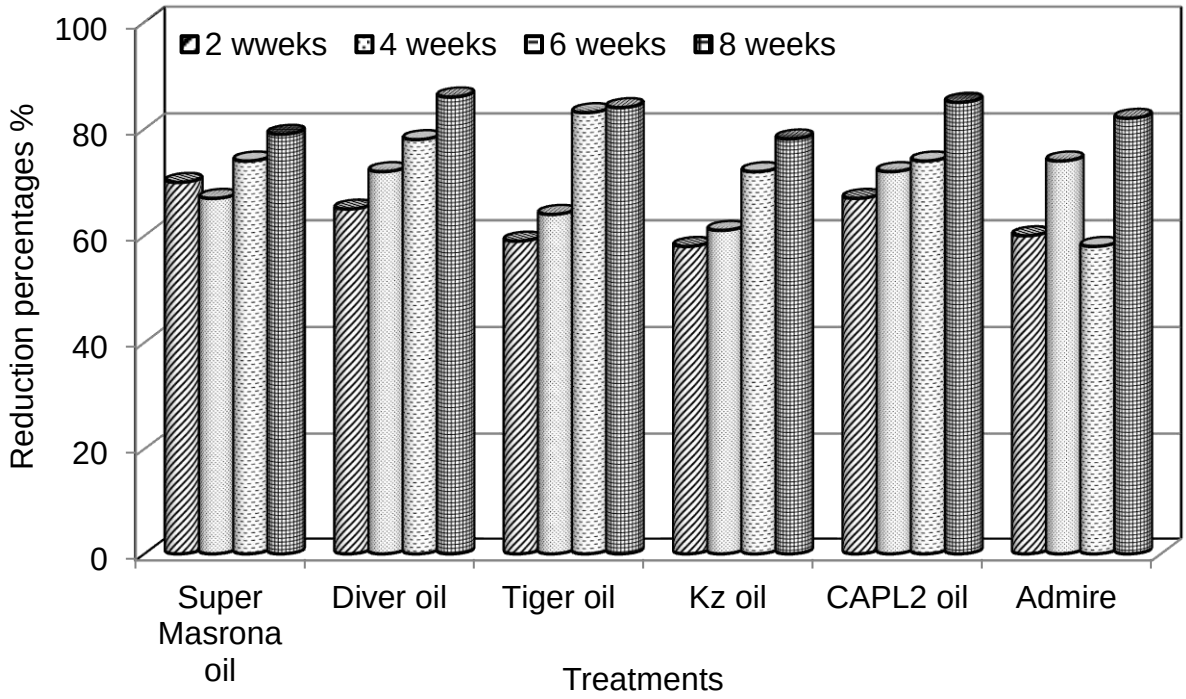
Figure1: Efficacy of tested insecticides against the citrus red-scale insect *Aonidiella aurantii* (Maskell) infested orange trees, at Kafr-Eldwar, El-Beheira Governorate, during pre-flowering stage (2010).

Data in Fig. (1) illustrate the effect of the tested compounds against the citrus red-scale *Aonidiella aurantii* (Maskell) insect (Hemiptera: Diaspididae) during pre-flowering stage. Data show that reduction percentages increased by increasing the time after treatment, where the highest reduction percentages for all tested chemicals appeared after eight weeks, while after two weeks they caused the least reduction percentages.

After two weeks from treatments of test chemicals Super Masrona oil® was the most effective one, where it caused reduction percentage (58.2%)

followed by CAPL2® oil (56.1%) without significant differences; but they differ significantly with Diver oil® (54.3%); and so withAdmire® (50.4%); Tiger oil® (49.2%) and Kzoil® (48.0%) which have not significant differences in between. After four weeks CAPL2 oil® was the most effective treatment where it caused reduction percentage (77.2%) with significant differences with the two next effective treatments Diver oil® (73.0%) and Super Masrona oil® (72.3%). Tiger oil® caused (68.2%) reduction effect differing significantly with the previous and followed treatments. Kz oil® caused reduction percentage (65.5%)without significant differences with Admire® (64.4%). After six weeks of application Tiger oil® was the most effective treatment followed by Diver oil®, Super Masrona oil®, CAPL2 oil®, Kz oil® and Admire® where they caused reduction effects as (78.1%), (73.2%), (70.6%), (70.0%), (68.0%) and (66.3%), respectively. Data Means showed that CAPL2 oil® was the most effective compound through the experiment where it caused average mean reduction effect (72.9%) followed by Tiger oil® (71.3%) and Diver oil® (70.4%) without significant differences in between. Super Masrona oil® caused reduction effect (69.2%) with significant differences with Kz oil® (67.4%) and Admire insecticide caused mean reduction effect value (66.6%) without significant differences with Kz oil®.

B) Effect of tested compounds during fruiting stage



L.S.D$_{0.05}$ (Means)= 1.41

Figure 2 : Efficacy of some insecticide; against the citrus red-scale insect *Aonidiella aurantii* (Maskell) infest orange trees, at Kafr-Eldwar, El-Beheira Governorate, during fruiting stage (2011).

Data in Fig. (2) illustrate the effect of the tested compounds against the citrus red-scale *Aonidiella aurantii* (Maskell) insect during fruiting stage. Diver oil® 97% caused the highest reduction effect influence against the tested insect and Kz oil®95% was the least effective one. Two weeks after treatment Super

Masrona oil® gave the highest reduction effect (70%) followed by CAPL2 oil® (67.1%) and Diver oil® (65.2%) without significant differences, but they significantly differed with Admire® (60%), Tiger oil® (59.6%) and Kz oil® (58.1%). After four weeks, Admire® caused the highest reduction effect (74.3%) without significant differences with CAPL2 oil® (72.6) and Diver oil® (72.1%), and significantly differed with Super Masrona oil® (67.2%), Tiger oil® (64.3%) and Kz oil® (61%). After six weeks of application Tiger oil® was the most effective treatment followed by Diver oil®, Super Masrona oil®, CAPL2 oil®, Kz oil® and Admire® where they caused reduction effects as 83%, 78.2%, 74.6%, 74.3%, 72.0% and 58.4% respectively. Diver oil® was the most effective treatment after eight weeks from application where it caused reduction effect (86%), followed by CAPL2 oil® (85.4%), Tiger oil® (84.2%) and Admire® (82.0%) without significant differences between them while they significantly differed with Super Masrona oil® (79.1%) and Kz oil® (77.9%).

Means of data showed that Diveroil® was the most effective compound through the experiment where it caused average mean reduction effect(75.3%) followed by CAPL2 oil®(74.5%) without significant differences in between, and so followed by Super Masrona oil® and Tiger oil® with significant differences by mean reduction effect (72.5%) and (72.6%) respectively. Admire insecticide caused mean reduction effect value(68.5%)without significant differences with Kz oil® which caused mean reduction effect as (67.3%).

Generally, it could be recommended that, light summer oils gave successful control against armored red-scale insect infesting orange trees in Beheira governorate, where they were more effective and less environmental hazards than the other chemical groups. The obtained results are in agreement with Helmy *et al*. (1992), Moursi (1996), EI-Deeb (1999), Abdel-Rhaman *et al.,* (2002) El-Deeb *et al*.,(2002), Mona *et al*.,(2002)and Abo-Shanab (2005).

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الملخص العربى

دراسة كفاءة بعض المبيدات الحشرية على حشرة الموالح الحمراء التى تصيب اشجار البرتقال فى محافظة البحيرة – مصر

رشا سعيد عبد الفتاح

معهد بحوث وقاية النباتات – مركز البحوث الزراعية

تم تنفيذ تجربتين لاختبار كفاءة بعض المبيدات الحشرية فى مكافحة حشرة الموالح الحمراء (حشرة قشرية مدرعة) التى تصيب اشجار البرتقال فى محافظة البحيرة. وتم اختبار كفاءة خمسة زيوت معدنية صيفية خفيفة مختلفة فى نسبة النقاوة [سوبر مصرونا 95%، زيت دايفر 97%، زيت تيجر 97%، زيت كزد 95%، زيت كابل2 96,62%] بالاضافة الى مبيد من مجموعة أشباه النيكوتين الجديدة (ادمير 20%)، ضد الحشرة الموالح المختبرة فى مزرعة اشجار برتقال خاصة خلال بداية الربيع (فترة ما قبل الازهار، 2010) وبداية الصيف (فترة الاثمار، 2011). واوضحت النتائج زيادة مطردة فى كفاءة الزيوت المعدنية المختبرة مع مرورالوقت بعد الرش خلال فترة الاختبار (شهرين) ضد الحشرة القشرية الحمراء. وكذا ازدادت الكفاءة الابادية للزيوت المعدنية بزيادة نسبة نقاوتها. ويمكن التوصية باستخدام الزيوت المعدنية الخفيفة الصيفية لمكافحة هذه الحشرة لانها تعطى كفاءة ابادية اعلى ومخاطر بيئية اقل من المجاميع الكيماوية الاخرى .