EUROPEAN ACADEMIC RESEARCH
Vol. IV, Issue 10/ January 2017

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Field Efficacy of Some Insecticides for Controlling Jasmine Whitefly, *Aleuroclava jasmini* on Citrus

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Abstract:

Field efficacy of eight different kinds of insecticides with various mode of action were evaluated against jasmine whitefly, Aleuroclava jasmini infested citrus trees on orchards at middle of Iraq in season of 2016. The results indicated that the recommended dose for each insecticides used showed high efficacy (88- 98%) in reducing numbers of A. jasmini adults after one week of treatment, reaching 0.5-9 insect per leaf compared to 41.9 in the control treatment. The efficacies for eggs and nymphs together were ranged between 87% and 88% after two weeks of treatment. These results will assist the control program of this pest and in implementing pest management practices to reduce resistance development chances.

Key words: Efficacy, insecticides, Jasmine whitefly, *Aleuroclava jasmini,* Citrus.

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INTRODUCTION

Citrus fruits consider the second most important in between other fruits which have nutritional and economic importance [1]. Citrus trees suffer from infestation by various pests, plant pathogens and mites. Since the nineteen's of last century, citrus trees exposed to infestation by harmful insect pest species the jasmine whitefly, *Aleuroclava jasmine* causing evaluated damages to the trees and their total production [2]. Jasmine whitefly like other types of whiteflies caused damages to plants through their sucking of cells sap, in addition to growth of sooty mold on leave surfaces which affect negatively both respiration and photosynthesis [3, 4, 5, 6, 7]. Jasmine whitefly is number one pest of citrus but, unlike most other crop and horticulture pests, lacks an effective control regimes. Many method of control were proposed including chemical insecticides and biological agents. [8] used Chloropyrifos, which had high efficacy of 95% on eggs and nymphs. [9] tested the effect of botanical insecticide, Oxymatrine on the biology of jasmine whitefly. The efficacies of nine different insecticides were recorded on nymphal instar of the jasmine whitefly [10]. [11] tested five different insect growth regulators on the nymphs and found low mortality rates. [12] evaluated the parasitization potential of *Beauveria bassiana* and *Verticillium lecani* isolates against nymphs and eggs of jasmine whitefly. [13] measured the efficacy of predator, *Clitostethus arcuatus* in controlling jasmine whitefly.

The present investigation was conducted to evaluate field efficacies of some insecticides of different mode of action to be used in the control campaign of jasmine whitefly, *Aleuroclava jasmini.*

MATERIALS AND METHODS

Experiments were conducted in citrus orchards located in the Middle of Iraq, contained Orange (*Citrus sinensis*), mandarin (*C. reticulata*), Bergamot (*C. aurantium*) and lemon (*C. limon*). Mandarin trees were used for treatment of the tested insecticides due to its preference by the pest species compared with other citrus species [14]. The population density of the pest was at its highest level (mid of April 2016) of mostly adults and eggs. Eight insecticides with different mode of action were used to spray the trees with doses as it show in Table (1). Experiments included nine different treatments, one of them consider as control treatment (only water), while the rest were for the tested insecticides. Each treatment contain three replicates (tree). Numbers of adults jasmine whitefly present were counted carefully directly on the lower surfaces of ten leave/replicate before and after treatments with one, three and seven days (one week) taken from different tree directions. Experiments with jasmine whitefly eggs and nymphs, ten leaf/replicate were randomly taken to the lab for counting numbers of eggs and nymphs before and after treatments with one and two weeks. Sprayer of 20 L was used to spray whole tree from down to up to insure exposing the pest individuals to the insecticides tested.

Complete randomized block design was used in conducting all experiments. Genstat program and LSD (0.05 level) were implied in statistical analysis and determine the significances between insecticides efficacies. Henderson-Tilton's formula [15] was used to calculate corrected insecticides efficacies% on adults jasmine whitefly, while Schneider-Orelli's formula[16] was applied for measuring efficacies of the insecticides tested on eggs and nymphs.

Table 1. Tested insecticides used in the experiments of measuring their efficacies on jasmine whitefly, *Aleuroclava jasmini* on citrus.

Insecticide brand name	Company	Recommended concentration	Mode of Action according to IRAC 2016 [17]	Active ingredients and concentration	Chemical sub-group
Desis	Bayer	75 ml /100 L	Sodium channel modulators	Deltamethrin 2.5 g/L EC	3A, Pyrethroid
Beamont	Agriscience	20 ml /20 L	Inhibitor of chitin biosynthesis, type 0	Lufenuron 5% EC	15, Benzoylureas
Grafiti	Proplan	100 ml /100 L	Sodium channel modulator	Deltamethrin 2.5% EC	3A, Pyrethroid
Levo	Sinaria	25 ml/100 L	Uncertain mode of action Unknown/	Oxymatrin 2.4% SL	UN, Plant extract
Polo	Syngenta	50 ml/100L	Inhibitors of mitochondrial ATP synthesis	Diafenthiuron 500 g/L	12A, Difanthruron
Appluad	Nihon Soda	50 g/100 L	Inhibitor of chitin biosynthesis, type 1	Buprofezin 25%WP	16, Buprofezin
Hachi-Hachi	Nihon Nothykan	50 ml/100 L	Inhibitor of mitochondrial complex I electron transport	Tolfenpyred 15% EC	21A, Tolfenpyred
Aster	Agrichem	75 ml/ 100 L	Nicotinic acetylcholine receptor (nAChR) allosteric modulators	Acetamiprid 20%	4A, Neonicotinoids

RESULTS AND DISCUSSION

The results showed that recommended doses of the tested insecticides (as in Table 1) gave high efficacies in reduction of adults, eggs and nymphs numbers of jasmine whitefly on citrus trees. Results in Table (2) indicate the significant reduction in the average number of adults/leaf (2.4-22.0) after three days of treatment in comparison with 43.3 adults/leaf in the control. The reduction in number of live adults after one week of treatment reached 0.9 – 9.0 adults/leaf and 41.9 adults/leaf in the control. Significant differences were found between results of all tested insecticides and that of the controls and for all periods. Insecticides efficacies after one week of treatment ranged between 89.5% for Appluad (buprofezin) as inhibitor of chitin biosynthesis type 1 and 98.1% for Desis (deltamethrin) as sodium channel modulator. AL-Jamaly and Al-Yassery (2007) indicated that using insecticides with Etophenoprox,

Abamectin and Methidathion as active ingredient gave high efficacies in controlling jasmine whitefly. Oxymatrin as plant based insecticide was used to treat citrus plantlets in the nursery and the result showed that jasmine whitefly adult's mortality was 47.5% after three days of treatment (Tark and Mohammed, 2011). This low mortality rate compared to the rate (96.1%) obtained during recent investigation could be attributed to the differences of the source and dose rate, in addition to the difficulty of counted adults.

The results of treatment of eggs and nymphs indicated that spraying with the recommended doses of the tested insecticides (Desis, Levo, Beamont, Grafiti) showed high efficacies in preventing eggs development to nymphs and inflect nymph mortality. The results in Table (3) showed medium effect on eggs development into nymphs after one week of treatment ranged from 7.4 nymphs/cm^2 of the leaf for Beamont (Lufenuron 5%) which act as inhibitor of chitin synthesis type 0 to 14.6 nymphs/cm^2 of leaf for Levo (Oxymatrin 2.4%) as plant based insecticide which have unknown mode of action yet, with significant differences in between insecticides tested. After two weeks of treatment, the efficacies of all insecticides were high and ranged between 87.4% and 88.7% with no significant differences in between. AL-Jamaly and Al-Yassery (2007) found that treatment of jasmine whitefly eggs and nymphs with Diazinon, Dimethoate, Imidacloprid, Etophenoprox and mineral oil as active ingredients inflect low efficacies ranged between 48.5% and 50.7%. In addition, Tark and Mohammed (2011) demonstrated relative low mortality rate 64.5% in first instar nymph of jasmine whitefly treated with Oxymatrin. Differences between this result and ours could be attributed to factors mentioned above.

In conclusion the recent results showed that tested insecticides of different mode of action were all of having high efficacies in controlling eggs, nymphs and adults of jasmine

whitefly and could be used in national campaign to suppress the elevated population density until development of other control methods, especially biological control method which include parasites, predators and entomopathogenic microorganisms to facilitate establishing of effective Integrated Management Program.

Therefore we recommend that application of insecticide must be timed correctly, targeting the most vulnerable life stage of the insect pest and mixing and applying insecticides carefully. In addition a key element of effective resistance management is the use of alternation, rotations, or sequences of different insecticide mode of action classes. It is important to avoid selecting for resistance or cross resistance by repeated use within the crop cycle, or year after year, of the same insecticide or related products in the same mode of action class.

Table 2. Field efficacies of some insecticides in controlling jasmine whitefly, *Aleuroclava jasmini* adults.

Treatment	Average no. of adults on the lower surface of the leaf									
	Before treatment	After one day after			After three days			After one week		
	adult	adult	% mortality	% efficacy	adult	% mortality	% efficacy	adult	% mortality	% efficacy
Control	*33.4*	*41.3*	----	----	*43.3*	----	*95.9*	*41.9*	----	----
Desis	*37.4*	*23.5*	*37.2*	*49.2*	*2.4*	*93.6*	*90.6*	*0.9*	*97.6*	*98.1*
Levo	*30.5*	*17.3*	*43.3*	*54.1*	*3.7*	*87.9*	*78.6*	*1.5*	*95.1*	*96.1*
Beamont	*29.5*	*33.8*	----	-----	*8.2*	*72.2*	*75.6*	*0.5*	*98.3*	*98.6*
Grafiti	*34.5*	*27.5*	*20.2*	*35.7*	*10.9*	*68.4*	*68.3*	*2.2*	*93.6*	*94.9*
Appluad	*43.0*	*28.0*	*34.9*	*51.1*	*22.0*	*48.8*	*75.8*	*9.0*	*79.1*	*88.5*
Hachi-Hachi	*41.0*	*26.0*	*36.6*	*52.4*	*15.0*	*63.4*	*74.2*	*7.0*	*82.9*	*90.6*
Polo	*41.0*	*25.0*	*39.0*	*54.2*	*16.0*	*60.9*	*76.7*	*6.0*	*85.3*	*91.9*
Aster	*37.0*	*22.0*	*40.5*	*55.2*	*13.0*	*64.9*	*95.9*	*5.0*	*86.5*	*92.5*

LSD at 0.05= 5.1420

Table 3. Field efficacies of some insecticides in controlling jasmine whitefly, *Aleuroclava jasmini* eggs and nymphs.

Treatment	Before treatment	After one week		After two weeks			
	Average eggs/cm^2 leaf	Average nymph/cm^2 leaf	% development to nymphs	Average nymph/cm^2 leaf	% development to nymphs	% mortality	% efficacy
Control	***711***	***29.5***	***4.2***	***227.4***	***31.9***	***68.1***	--------
Desis	***501***	***9.8***	***1.9***	***18.7***	***3.7***	***96.3***	***88.4***
Levo	***584***	***14.6***	***2.5***	***24.5***	***4.1***	***95.9***	***87.4***
Beamont	***665***	***7.4***	***1.1***	***24.0***	***3.6***	***96.4***	***88.7***
Grafiti	***514***	***12.3***	***2.3***	***20.2***	***3.9***	***96.1***	***87.8***

LSD at 0.05= 3.7546

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