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Efficacy of selected insecticides against sucking pests of pomegranate

K. ELANGO[1], S. SRIDHARAN[1], P. A. SARAVANAN[1] and S. BALAKRISHNAN[2]

[1]Department of Agricultural Entomology, [2] Department of Spices and Plantation Crops
Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India
E-mail: elaento@gmail.com

ABSTRACT: Six insecticides *viz*., imidacloprid 17.8 SL (0.00712%), thiamethoxam 25 WG (0.005%), chlorantraniliprole 18.5 SC (0.0037%), dichlorvos 76% EC (0.076 %), dimethoate 30% EC (0.06%) and fipronil 5% SC (0.01%) were evaluated against pomegranate sucking pests *viz.,* thrips, *Scirtothrips dorsalis* Hood, whitefly, *Siphoninus phillyreae* Haliday and two tailed mealy bug, *Ferrisia virgata* (Cockerell) during 2015-16 at the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore. The study revealed that dichlorvos 76% EC (0.076%), imidacloprid 17.8 SL (0.00712%) and dimethoate 30% EC (0.06%) were effective with the maximum mortality in thrips at 48 hours after treatment. Whereas, in whiteflies dimethoate 30% EC (0.06%) with 71.11 per cent mortality followed by imidacloprid 17.8 SL (0.00712%) 70.0 per cent mortality were observed. Thiamethoxam 25 WG (0.005%), imidacloprid 17.8 SL (0.00712%) and dimethoate 30% EC (0.06%) were effective against mealybugs.

Keywords: Bioassay, insecticides, *Ferrisia virgata,* pomegranate, sucking pests

INTRODUCTION

Pomegranate (*Punica granatum* L.) is an important fruit crop of arid and semiarid regions of world. In India, it is cultivated over 1.13 lakh ha with an annual production of 7.44 lakh tonnes and productivity of 6.6 tonnes/ha. The export of pomegranate fruits is around 35,000 tonnes/annum (Pal *et al.,* 2014). Pomegranate is cultivated under high density planting in four districts of Tamil Nadu *viz.,* Coimbatore, Erode, Tiruppur and Karur. The cultivation of crop under high density demands the study on the level occurrence of various sucking pests. The sucking pests cause severe damage to flowers, fruits, twigs and leaves by desapping, which results in loss of quality of fruits and reduction in yield (Karuppuchamy *et al.,* 1998). Sucking pests were considered as minor pests in pomegranate but in recent years, they assumed a serious form (Balikai *et al.,* 2009). It was also observed that infestation resulted in significant flower and immature fruit drop (Sreedevi and Verghese, 2009). The present investigation was planned to evaluate new insecticides *viz.,* imidacloprid 17.8 SL (0.00712%), thiamethoxam 25 WG (0.005%), chlorantraniliprole 18.5 SC (0.0037%), dichlorvas 76% EC (0.076 %), dimethoate 30% EC (0.06%), fipronil 5% SC (0.01%) against pomegranate sucking pests *viz.,*Thrips, *Scirtothrips dorsalis* Hood, whitefly, *Siphoninus phillyreae* Haliday, two tailed mealy bug, *Ferrisia virgata* (Cockerell).

MATERIALS AND METHODS

Mass Culturing of Test Insects

Thrips, *Scirtothrips dorsalis* and whitefly, *Siphoninus phillyreae*

The adults of thrips and whitefly were collected from infested twigs and released on the pomegranate seedlings in the pot kept under net house at Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore. In order to increase the infestation, the plant was supplied with more nitrogen fertilizer and exposed to sunlight with the little watering. The population of pests established in the potted plant was used for the laboratory studies.

Two tailed mealy bug, *Ferrisia virgata*

Two tailed mealybug *Ferrisia virgata* was collected from the pomegranate field available at the orchard of Horticultural college and research institute, Tamil Nadu Agricultural University, Coimbatore. Red pumpkin was used to mass culture the mealy bug under laboratory condition. Initially the red pumpkin under half mature condition was purchased from the market with the stalk. The fruit was washed well with normal water to remove

Table 1. Toxicity of insecticides to thrips (*Scirtothrips dorsalis)* under laboratory condition

Treatment	Dosage (g or ml per litre)	Mortality of thrips (%)					
		Contact bioassay Hours after treatment (HAT)			Leaf dip bioassay Hours after Release (HAR)		
		24	48	Mean mortality	24	48	Mean mortality
Imidacloprid 17.8 SL (0.00712%)	0.4	61.66 (51.74)^{a}	85.00 (67.21)^{ab}	73.33	71.66 (57.83)^{ab}	93.33 (75.03)^{a}	82.49
Thiamethoxam 25 WG (0.005%)	0.2	58.33 (49.79)^{a}	75.00 (60.00)^{b}	66.66	70.00 (59.79)^{ab}	86.66 (68.57)^{ab}	78.33
Chlorantraniliprole 18.5 SC (0.0037%)	0.2	45.00 (42.13)^{a}	61.66 (51.74)^{c}	53.33	58.33 (49.79)^{bc}	76.66 (61.11)^{b}	67.49
Dichlorvos 76% EC (0.076 %)	2	56.66 (48.82)^{a}	75.00 (60.00)^{b}	65.83	55.00 (47.87)^{c}	75.00 (60.00)^{b}	65.00
Dimethoate 30% EC (0.06%)	1	68.33 (55.75)^{a}	90.00 (71.56)^{a}	79.16	76.66 (61.11)^{a}	95.00 (77.08)^{a}	85.83
Fipronil 5% SC (0.01%)	2	56.66 (48.82)^{a}	80.00 (63.43)^{ab}	68.33	60.00 (50.76)^{bc}	80.00 (63.43)^{b}	70.00
Untreated control	—	0.00 (0.00)^{b}	0.00 (0.00)^{d}	0.00	0.00 (0.00)^{d}	0.00 (0.00)^{c}	0.00
SE d			4.73	5.32	—	3.96	5.71 —
CD (P=0.05)		10.15	11.42	—	8.49	12.25	—

HAT- Hours after treatment, HAR- Hours after release;*Mean of three replications; Values in the parentheses are arc sine transformed values. Means followed by the common letter (s) are not significantly different at P=0.05 level by DMRT.

Table 2. Toxicity of insecticides to whitefly *(Siphoninus phillyreae)* under laboratory condition

Treatment	Dosage (g or ml per litre)	Mortality of thrips (%)					
		Contact bioassay Hours after treatment (HAT)			Leaf dip bioassay Hours after Release (HAR)		
		24	48	Mean mortality	24	48	Mean mortality
Imidacloprid 17.8 SL (0.00712%)	0.4	47.77 (43.72)^{a}	70.00 (56.79)^{ab}	58.88	52.22 (46.27)^{a}	92.22 (81.11)^{a}	72.22
Thiamethoxam 25 WG (0.005%)	0.2	40.00 (39.23)^{ab}	61.11 (51.42)^{bc}	50.55	45.55 (42.22)^{ab}	81.11 (64.24)^{b}	63.33
Chlorantraniliprole 18.5 SC (0.0037%)	0.2	45.55 (42.44)^{ab}	65.55 (54.00)^{ab}	55.55	44.44 (41.80)^{ab}	71.11 (57.48)^{bc}	57.77
Dichlorvos 76% EC (0.076 %)	2	43.33 (41.16)^{ab}	63.33 (52.73)^{ab}	35.53	34.44 (35.93)^{b}	65.55 (54.06)^{c}	49.99
Dimethoate 30% EC (0.06%)	1	46.66 (43.08)^{ab}	71.11 (57.48)^{a}	58.88	41.11 (39.88)^{ab}	72.22 (59.19)^{bc}	56.66
Fipronil 5% SC (0.01%)	2	37.77 (37.92)^{b}	52.22 (46.27)^{c}	44.99	42.22 (40.52)^{ab}	78.88 (62.64)^{b}	60.55
Untreated control	—	0.00 (0.00)^{c}	0.00 (0.00)^{d}	0.00	0.00 (0.00)^{c}	0.00 (0.00)^{d}	0.00
SE d		2.66	2.94	—	3.21	3.74	—
CD (P=0.05)		5.71	6.32	—	6.90	8.02	—

HAT- Hours after treatment ,HAR- Hours after release;*Mean of three replications; Values in the parentheses are arc sine transformed values. Means followed by the common letter (s) are not significantly different at P=0.05 level by DMRT

Table 3. Toxicity of insecticides to mealybug (*Ferrisia virgata*) under laboratory condition

Treatment	Dosage (g or ml per litre)	Mortality of thrips (%)					
		Contact bioassay hours after treatment (HAT)			Leaf dip bioassay hours after release (HAR)		
		24	48	Mean mortality (%)	24	48	Mean mortality (%)
T_1 - Imidacloprid 17.8 SL (0.00712%)	0.4	67.77 (55.41)^{ab}	90.00 (71.56)^{a}	78.88	77.77 (61.87)^{ab}	86.66 (68.57)^{bc}	82.21
T_2 - Thiamethoxam 25 WG (0.005%)	0.2	68.88 (55.09)^{a}	93.33 (75.03)^{a}	81.10	70.00 (59.76)^{b}	87.77 (69.53)^{b}	78.88
T_3 - Chlorantraniliprole 18.5 SC (0.0037%)	0.2	57.77 (49.47)^{bc}	80.00 (63.43)^{b}	68.88	52.22 (46.27)^{c}	73.33 (58.90)^{d}	62.77
T_4 - Dichlorvos 76% EC (0.076 %)	2	48.88 (44.35)^{cd}	71.11 (57.48)^{bc}	59.99	52.22 (46.27)^{c}	75.55 (60.36)^{cd}	63.88
T_5 - Dimethoate 30% EC (0.06%)	1	72.22 (58.19)^{a}	90.00 (71.56)^{a}	81.11	81.11 (64.24)^{a}	95.55 (77.82)^{a}	88.33
T_6 - Fipronil 5% SC (0.01%)	2	48.33 (44.04)^{d}	66.66 (54.73)^{c}	57.49	46.66 (43.08)^{c}	71.11 (57.48)^{d}	58.88
T_7 - Untreated control	—	0.00 (0.00)^{e}	0.00 (0.00)^{d}	0.00	0.00 (0.00)^{d}	0.00 (0.00)^{e}	
SE d		2.83	3.31	—	3.39	3.88	—
CD (P=0.05)		6.07	7.10	—	7.28	8.33	—

HAT- Hours after treatment, HAR- Hours after release; *Mean of three replications; Values in the parentheses are arc sine transformed values. Means followed by the common letter (s) are not significantly different at P=0.05 level by DMRT

the soil particles and other debris. Then the water washed pumpkin was treated in bavistin 0.1% solution for 30 min to remove the contamination of fungal pathogen, subsequently the pumpkin was treated with antibacterial solution streptomycin sulphate 0.05% solution for 10 minutes and dried under shade. The damage or injury on the pumpkin was filled with molten wax. The pumpkin was tied with thread along furrows and kept it inside the insect rearing cage on a iron stand kept on a spreaded filter paper. Before keeping the fruit, the cage was cleaned by removing spider and ants. The grown up mealy bugs collected was released on the fruit with the help of a brush. The setup was kept for 25-30 days. The mealy bugs slowly established on the pumpkin were utilized for efficacy study.

Test insecticides

Insecticides tested against pomegranate pests, imidacloprid 17.8% SL (Confidor®), thiamethoxam 25% WG (Actara®), chlorantraniliprole 18.5% SC (Coragen®), dichlorvos 76% EC (Nuvan®), dimethoate 30% EC (Tafgor®), fipronil 5% SC (Regent®) were procured from local market.

Bioassay

The efficacy of chemical pesticides to pomegranate sucking pests was assessed under laboratory condition in the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore.

Leaf dip bioassay

Fresh leaves of pomegranate were dipped in different insecticide solution for one minute. The leaves treated with treatment solution was shade dried on a filter paper in open air and thirty thrips, whitefly and mealy bugs adults were released on the treated leaves kept inside the separate plastic containers. Small pin holes were made on top of the container for ventilation. Totally three replications were maintained for each treatment. Based on the mobility of body parts and change in the colour of the body the mortality of pests was confirmed and the data recorded at 24 and 48 hours after treatment

(HAR). The experiment was conducted using Completely Randomized Design (CRD).

Contact bioassay

Fresh leaves of pomegranate were placed in a plastic container along with thirty thrips, whitefly and mealy bugs. The treatment solution was sprayed directly on the leaf with insects in plastic container. Totally three replications were maintained for each treatment. The mortality of pests was assessed based on the mobility of body parts and change in the colour of the body at 24 and 48 HAT and expressed as percent mortality. The experiment was conducted using Completely Randomized Design (CRD)

Statistical analysis

The data collected under laboratory experiments in completely randomized design were analyzed using analysis of variance (ANOVA) using AGRES 3.01 and AGDATA software. Data in the form of percentages were transformed to arcsine values and those in numbers were transformed to $\sqrt{\chi}+0.5$ and analyzed. The mean values of the treatments were compared using DMRT at 5 per cent level of significance

RESULTS AND DISCUSSION

Toxicity of insecticides to thrips

In contact method, dimethoate 30% EC (0.06%) showed superior performance of with 68.3 per cent mortality thrips followed by imidacloprid 17.8 SL (0.00712%) which showed 61.6 per cent mortality 24 HAT. The observation made 48 hours after treatment also showed superiority of dimethoate 30% EC (0.06%) with 90.0 per cent mortality followed by imidacloprid 17.8 SL (0.00712%) (85.0 per cent). The next effective treatment was fipronil 5% SC (0.01%) which showed 80.0 per cent mortality of thrips. In leaf tip method, results indicated the superiority of imidacloprid 17.8 SL (0.00712%) which recorded 58.8 and 84.4 per cent mortality of aphids 24 and 48 hours after treatment respectively. The next best treatment was dimethoate 30% EC (0.06%) which recorded 41.1 and 71.1 per cent mortality of aphids during same period of observation.The present results can be supported by the findings found dimethoate 0.05% and imidacloprid 0.04% effective in managing *Scirtothrips dorsalis* in bell pepper (Malik *et al.,* 2002).

Toxicity of insecticides to whitefly

The data recorded 24 hours after treatment showed superior performance of imidacloprid 17.8 SL (0.00712%) with 47.7 per cent mortality of whitefly followed by dimethoate 30% EC (0.06%) which showed 46.6 per cent mortality. The observation made 48 hours after treatment also showed superiority of dimethoate 30% EC (0.06%) with 71.11 per cent mortality followed by imidacloprid 17.8 SL (0.00712%) (70.0 per cent). The next effective treatment was chlorantraniliprole 18.5 SC (0.0037%) which showed 65.5 per cent mortality of whitefly. The data on the evaluation of acute toxicity against whitefly *(Siphoninus phillyreae)* using leaf dip method indicated that the superiority of imidacloprid 17.8 SL (0.00712%) which recorded 52.2 and 92.2 per cent mortality of whitefly 24 and 48 hours after treatment respectively. The next best treatment was thiamethoxam 25 WG (0.005%) which recorded 45.5 and 81.1 per cent mortality of whitefly during the same period of observation. Similar report of that thiamethoxam 25 WG @ 0.2 g/l and imidacloprid 200 SL @ 0.25 ml/l as effective in controlling whiteflies with 78.97 and 78.50 per cent, reduction (Ananda *et al.,* 2009). Likewise concurrence with the present finding imidacloprid, spinetoram and emamectin benzoate had the highest toxicity effect on the pomegranate whitefly nymph and adult stages with LC50 values ranged from 0.20 to 0.49, 0.23 to 0.53 respectively (Abd-Ella, 2015). Imidacloprid, diafenthiuron, acetamiprid and thiamethoxam were most effective insecticides against whitefly up to seven days after application (Afzal *et al.,* 2014).

Toxicity of insecticides to mealy bug

Results of the laboratory study conducted to assess the toxicity of different insecticides through contact method indicated that among the treatments tested, maximum mortality 93.3 per cent was achieved in thiamethoxam 25 WG (0.005%) followed by 90.0 percent each in imidacloprid 17.8 SL (0.00712%) and dimethoate 30% EC (0.06%) at 48 hours after treatment, All the treatments were statistically on par among each other followed by chlorantraniliprole 18.5 SC (0.0037%) and dichlorvos 76% EC(0.076%) which recorded a mortality 80.0 and 71.1 per cent during the same period of observation. Superiority of dimethoate 30% EC (0.06%) which recorded 81.1 and 95.5 per cent mortality of mealy bug on 24 and 48 hours after treatment respectively. The next best treatment was thiamethoxam 25 WG (0.005%) which recorded 70.0 and 87.7 per cent mortality of mealy bug during same period of observation in leaf tip method bioassay. chlorpyriphos 20EC (LC50 21 µl/l) and thiamethoxam 25 WG (LD50 44 mg/l) were the most effective against papaya mealy

bug at 24 hours after treatment (Seni and Sahoo, 2015). Imidacloprid was significantly superior in reducing the grapevine mealy bug infestation (Daane *et al.,* 2006).

CONCLUSION

Among several insecticides tested, dimethoate 30% EC (0.06%) and imidacloprid 17.8 SL (0.00712%) were effective in checking thrips population and thiamethoxam 25 WG (0.005%), imidacloprid 17.8 SL (0.00712%) and dimethoate 30% EC (0.06%) were effective against whitefly and mealy bug population in both contact and leaf dip bio assays.

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