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Efficacy of insecticides against citrus leaf miner, *Phyllocnistis citrella* Stainton (Gracillariidae: Lepidoptera) in acid lime (*Citrus aurantifolia*)

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ABSTRACT: The citrus leaf miner (*Phyllocnistis citrella*) Stainton is one of the key pests of acid lime. A field experiment on the efficacy of selected new molecules of insecticides against citrus leaf miner revealed that two applications of spinosad 45 SC (0.30 ml/l) and flonicamid 50 WG (0.30 g/l) were significantly effective. Other insecticides *viz*., thiamethoxam 25 WG (0.25 g/l), emamectin benzoate 5SG (0.40 g/l) and chlorantraniliprole 18.5 SC (0.10 ml/l) were found moderately effective in control of the pest. The imidacloprid 70 WG (0.30 g/l) and fipronil 5 SC (1.00 ml/l) were found to be least effective against citrus leaf miner. The effective insecticides can be used in scheduling for control of citrus leaf miner on acid lime.

Keywords: Acid lime, *Phyllocnistis citrella*, spinosad 45 SC, flonicamid 50 WG, thiamethoxam 25 WG

INTRODUCTION

Citrus assumes prominent place in contribution to the world's fruit area and production. In India, citrus is the third most important fruit crop after mango and banana. The acid lime, *Citrus aurantifolia* Swingle is one of the important citrus crops grown in India. In recent times, the remunerative nature of crop has resulted in bringing large proportion of area under cultivation of acid lime. The changed scenario of cultivation led to severe incidence of citrus leaf miner, *Phyllocnistis citrella* on acid lime (Dileep kumar *et al*., 2022). The pest attacks acid lime crop both at nursery and orchard conditions (Patil, 2013). The larvae prefer to feed on young and new flush of the plant. Larva mines the leaves and feeds on mesophyll tissues by remaining inside the mines. As a result of feeding long tail like serpentine mining can be seen on affected portions of the plant (Sarada *et al*., 2014). The curling, crumpled and distortion of leaves is observed at the later stage of infestation. Overall, photosynthetic activity and vigour of plant reduces and finally affects the fruit production in mature trees (Heppner, 1993; Grafton-Cardwell *et al*., 2008). In addition to direct damage, the pest is also known to predispose the plant to canker infection (Junior *et al*., 2006).

The activity of pest is normally observed to be throughout the year with overlapping generations (Dileepkumar *et al*., 2023). About 45 % new leaf area is estimated to lose due to infestation of citrus leaf miner(Garcia-Mari *et al*., 2002).The pest is reported to cause 17 to 57 per cent damage on citrus crops (Boughdad *et al*., 1999). So the management of this pest largely revolves around use of synthetic insecticides. Keeping in view the importance of the crop and damage potential of pest, the present study was conducted with an objective of evaluating the efficacy of selected insecticides against citrus leaf miner on acid lime.

MATERIALS AND METHODS

A field experiment was conducted in Randomized Block Design (RBD) at College of Agriculture, Vijayapura, Karnataka (16°49'39.1620" N 75°43'31.1772" E) during *rabi* 2020-21 and *kharif* 2021-22 to evaluate the efficacy of insecticides against citrus leaf miner. The experiment consisted of eight treatments including untreated check and replicated thrice. The acid lime crop (cv. Kagzi lime) was grown with all the package of practice (except plant protection measures) recommended with row to row and plant to plant geometry of 6 × 6 m. The weekly observations were made to check for incidence of pest. The insecticides applications were taken up as per treatment details (Table 1.) when pest reached economic threshold status. Two acid lime plants were considered as one replication and five branches were tagged in each plant for taking observation on pest density. During the study, two applications were taken up with the help of knapsack sprayer. The insecticides *viz*., chlorantraniliprole 18.5 SC(0.10 ml/l), emamectin benzoate 5SG (0.40 g/l), spinosad 45 SC (0.30 ml/l), flonicamid 50 WG (0.30 g/l), fipronil 5 SC(1.00 ml/l), imidacloprid 70 WG (0.30 g/l) and thiamethoxam 25 WG (0.25 g/l) (standard check) along with untreated control (water spray) were used

Table 1. Efficacy of insecticides against citrus leaf miner, Phyllocnistis citrella Stainton infesting acid lime during rabi 2020-21

Treatment	First spray: Number of live mines/ shoot					ROC (%)	Second spray: Number of live mines/ shoot					ROC (%)
	1DBS	1DAS	3DAS	5DAS	10DAS		1DBS	1DAS	3DAS	5DAS	10DAS	
Chlorantraniliprole 18.5 SC	12.13 (3.55)	10.17 (3.26)^{b}	6.83 (2.71)^{bcd}	5.00 (2.34)^{bc}	3.00 (1.86)^{c}	54.06	6.25 (2.60)^{ab}	5.00 (2.34)^{b}	3.25 (1.94)^{b}	1.83 (1.53)^{b}	1.25 (1.31)^{bc}	79.27
Emamectin benzoate 5 SG	12.04 (3.54)	9.96 (3.23)^{b}	6.50 (2.64)^{abc}	4.63 (2.26)^{abc}	2.18 (1.63)^{ab}	57.24	6.17 (2.58)^{a}	4.92 (2.33)^{b}	3.04 (1.88)^{b}	1.67 (1.47)^{b}	1.08 (1.26)^{b}	80.41
Spinosad 45 SC	12.33 (3.58)	8.00 (2.91)^{a}	5.33 (2.41)^{a}	3.50 (2.00)^{a}	1.50 (1.41)^{a}	66.31	5.75 (2.50)^{a}	3.04 (1.88)^{a}	1.50 (1.41)^{a}	0.54 (1.02)^{a}	0.25 (0.86)^{a}	90.24
Flonicamid 50 WG	12.38 (3.59)	9.38 (3.14)^{ab}	5.79 (2.51)^{ab}	3.92 (2.10)^{ab}	1.54 (1.43)^{a}	62.09	5.96 (2.54)^{a}	3.75 (2.06)^{a}	1.96 (1.57)^{a}	0.84 (1.16)^{a}	0.38 (0.92)^{a}	87.34
Fipronil 5 SC	12.04 (3.54)	10.71 (3.35)^{b}	7.92 (2.90)^{d}	6.25 (2.60)^{d}	4.83 (2.31)^{e}	45.41	7.21 (2.78)^{bc}	6.42 (2.63)^{c}	4.50 (2.23)^{c}	3.25 (1.93)^{d}	2.29 (1.67)^{d}	69.89
Imidacloprid 70 WG	12.13 (3.55)	10.08 (3.25)^{b}	7.29 (2.79)^{cd}	5.42 (2.43)^{cd}	4.00 (2.12)^{d}	50.77	7.84 (2.89)^{c}	6.00 (2.55)^{c}	4.08 (2.14)^{c}	2.58 (1.75)^{c}	1.75 (1.50)^{c}	73.63
Thiamethoxam 25 WG	12.08 (3.54)	9.75 (3.20)^{b}	6.50 (2.64)^{abc}	4.92 (2.32)^{bc}	2.42 (1.71)^{bc}	56.66	6.17 (2.58)^{a}	4.75 (2.29)^{b}	3.00 (1.87)^{b}	1.67 (1.47)^{b}	1.00 (1.22)^{b}	80.95
Untreated control	12.17 (3.56)	12.42 (3.59)^{c}	13.29 (3.71)^{e}	13.96 (3.80)^{e}	14.75 (3.90)^{f}		12.33 (3.58)^{d}	12.58 (3.62)^{d}	13.42 (3.73)^{d}	14.13 (3.82)^{e}	14.54 (3.88)^{e}	
S.Em±	0.57	0.55	0.42	0.37	0.26		0.33	0.32	0.25	0.20	0.16	
CD @ 5%	NS	1.68	1.27	1.13	0.78		1.02	0.98	0.77	0.62	0.50	
CV (%)	8.13	9.57	9.80	10.86	10.53		8.12	9.67	10.14	10.76	10.27	

ROC- Reduction over control, DBS-Days before spray, DAS-Days after spray

during this investigation.

Data recording and analysis: The observations were recorded from five randomly selected young shoots per tree from different direction of the tree. To record the incidence of citrus leaf miner, from each shoot, number of leaves having live citrus leaf miner larvae were counted, later average number of live mines per shoot was worked out. The observations on pest density were recorded at one day before and one, three, five and ten days after imposition of treatments. The data of each spray was pooled and later transformed data was subjected to ANOVA and Duncan's multiple range tests (Gomez and Gomez, 1984). Further, obtained data was converted into per cent reduction of pest population over untreated control by using formula suggested by Abbott (1925).

RESULTS AND DISCUSSION

Efficacy of insecticides against citrus leaf miner during *rabi* 2020-21

At one day before spray, the average number of live mines ranged from 12.04 to 12.38 per shoot (Table 1). Prior to imposition of treatments, non-significant difference was observed among treatments with respect to number of live mines per shoot. The application of insecticides resulted in considerable decrease in pest density in the experimental plot. At ten days after first application, a significantly less number of live mines per shoot were recorded in spinosad 45 SC treated plants (1.50 live mines/ shoot) and which was found on par with flonicamid 50 WG (1.54 live mines/ shoot) and emamectin benzoate 5 SG(2.18 live mines/shoot). The insecticides, thiamethoxam 25 WG (2.42 live mines/ shoot)and chlorantraniliprole 18.5 SC(3.00 live mines/ shoot) were found on par in controlling the pest. However, imidacloprid 70 WG (4.00) and fipronil 5 SC (4.83) were found to be least effective against this pest. Second round of application further reduced the pest population. At 10 days after spray, significantly less population of citrus leaf miner was observed in spinosad 45 SC treated plants (0.25live mines/ shoot) and which was found on par with flonicamid 50 WG (0.38 live mines/ shoot). The insecticides *viz*., thiamethoxam 25 WG, emamectin benzoate 5 SG and chlorantraniliprole 18.5 SC were found at par with 1.00, 1.08 and 1.25 live mines per shoot, respectively. The imidacloprid 70 WG (1.75) and fipronil 5 SC (2.29) were found to be least effective in control of pest. With respect to per cent reduction in mine population over untreated control, a significantly higher per cent reduction was noticed in spinosad 45 SC (90.24 %) treatment, which was followed by flonicamid 50 WG (87.34), thiamethoxam 25 WG (80.95), emamectin benzoate 5 SG (80.41), chlorantraniliprole 18.5 SC (79.27), imidacloprid 70 WG (73.63) and fipronil 5 SC (69.89) treated plots.

Efficacy of insecticides against citrus leaf miner during *kharif* 2021-22

During *kharif*, before imposition of treatments a non-significant variation was observed among all the treatments with population ranging from 11.84 to 12.17 live mines per shoot. The imposition of treatments in the experimental plot resulted in decrease in pest population. At ten days after first application, spinosad 45 SCwas found to be superior in controlling citrus leaf miner (1.33 live mines/ shoot) and which was found on par with flonicamid 50 WG (1.46 live mines/ shoot) and emamectin benzoate 5 SG (2.00 live mines/shoot). Thiamethoxam 25 WG and chlorantraniliprole 18.5 SC were found on par with 2.25 and 2.75 live mines per shoot, respectively where as imidacloprid 70 WG (4.00) and fipronil 5 SC(4.92) were found less effective against this pest. Second round of sprays further reduced the pest population. At 10 days after second spray, spinosad 45 SC (0.33live mines/ shoot) and flonicamid 50 WG (0.42live mines/ shoot) were found highly effective in controlling citrus leaf miner. The insecticides *viz*., thiamethoxam 25 WG, emamectin benzoate 5 SG and chlorantraniliprole 18.5 SC were found at par with 1.08, 1.08 and 1.17 live mines per shoot, respectively. However, imidacloprid 70 WG (1.92) and fipronil 5 SC(2.29) were found to be least effective in control of pest. With respect to per cent reduction in mine population over untreated control, a significantly higher per cent reduction was observed in spinosad 45 SC (90.35 %) treatment, which was followed by flonicamid 50 WG (88.23), thiamethoxam 25 WG (81.75), emamectin benzoate 5 SG (81.00), chlorantraniliprole 18.5 SC(79.04), imidacloprid 70 WG(74.43) and fipronil 5 SC (69.38) treated plots. The population of mines were at high density in untreated control plots (Table 2).

Pooled data on efficacy of insecticides

At ten days after the first spray, a significantly less population of live mines were observed in spinosad 45 SC (1.42) treatment and it was at par with flonicamid 50 WG (1.50 live mines/ shoot) and emamectin benzoate 5 SG (2.09 live mines/shoot). Thiamethoxam 25 WG (2.33) and chlorantraniliprole 18.5 SC (2.88) were found on par with respect to efficacy on citrus leaf miner. The imidacloprid 70 WG (4.00) and fipronil 5 SC (4.88) were found to least effective against the pest. Similar trends were observed after second round of application. Spinosad 45 SC (0.29live mines/ shoot) and flonicamid 50 WG (0.40) treated plots were recorded significantly

Table 2. Efficacy of insecticides against citrus leaf miner, *P. citrella* infesting acid lime during *kharif* 2021-22

Treatment	First spray: Number of live mines/ shoot					ROC (%)	Second spray: Number of live mines/ shoot					ROC (%)
	1DBS	1DAS	3DAS	5DAS	10DAS		1DBS	1DAS	3DAS	5DAS	10DAS	
Chlorantraniliprole 18.5 SC	11.92 (3.52)	9.96 (3.23)^{b}	6.50 (2.64)^{bcd}	4.83 (2.31)^{cd}	2.75 (1.80)^{b}	56.52	6.50 (2.64)^{ab}	5.33 (2.41)^{bc}	3.17 (1.91)^{bc}	1.92 (1.55)^{b}	1.17 (1.28)^{b}	79.04
Emamectin benzoate 5 SG	12.17 (3.56)	9.75 (3.20)^{b}	6.50 (2.64)^{bcd}	4.58 (2.25)^{bc}	2.00 (1.58)^{ab}	58.71	6.25 (2.60)^{a}	5.00 (2.34)^{bc}	3.00 (1.87)^{b}	1.42 (1.38)^{b}	1.08 (1.25)^{b}	81.00
Spinosad 45 SC	12.25 (3.57)	7.58 (2.84)^{a}	5.04 (2.35)^{a}	3.50 (1.99)^{a}	1.33 (1.35)^{a}	68.42	5.92 (2.53)^{a}	3.00 (1.87)^{a}	1.50 (1.41)^{a}	0.50 (0.99)^{a}	0.33 (0.91)^{a}	90.35
Flonicamid 50 WG	12.08 (3.54)	9.17 (3.11)^{b}	5.34 (2.41)^{ab}	3.63 (2.03)^{ab}	1.46 (1.40)^{a}	64.57	6.08 (2.57)^{a}	3.50 (2.00)^{a}	1.88 (1.54)^{a}	0.71 (1.10)^{a}	0.42 (0.96)^{a}	88.23
Fipronil 5 SC	11.84 (3.51)	10.54 (3.32)^{b}	7.71 (2.86)^{d}	5.83 (2.51)^{d}	4.92 (2.33)^{d}	47.55	7.42 (2.81)^{bc}	6.67 (2.68)^{d}	4.46 (2.23)^{d}	3.50 (2.00)^{d}	2.29 (1.67)^{c}	69.38
Imidacloprid 70 WG	11.96 (3.53)	10.00 (3.24)^{b}	7.00 (2.74)^{cd}	5.29 (2.41)^{cd}	4.00 (2.12)^{c}	52.45	7.92 (2.90)^{c}	5.50 (2.45)^{c}	3.92 (2.10)^{cd}	2.79 (1.81)^{c}	1.92 (1.55)^{c}	74.43
Thiamethoxam 25 WG	12.00 (3.53)	9.75 (3.20)^{b}	6.42 (2.63)^{bc}	4.50 (2.24)^{abc}	2.25 (1.66)^{b}	58.55	6.33 (2.61)^{ab}	4.50 (2.23)^{b}	2.92 (1.85)^{b}	1.58 (1.43)^{b}	1.08 (1.26)^{b}	81.75
Untreated control	12.08 (3.54)	12.33 (3.58)^{a}	13.50 (3.74)^{e}	14.38 (3.86)^{e}	15.08 (3.95)^{e}		12.42 (3.59)^{d}	12.58 (3.62)^{e}	13.50 (3.74)^{e}	14.21 (3.84)^{e}	14.96 (3.93)^{d}	
S.Em±	0.56	0.48	0.42	0.35	0.25		0.37	0.32	0.25	0.19	0.17	
CD @ 5%	NS	1.46	1.28	1.07	0.76		1.12	0.97	0.77	0.58	0.52	
CV (%)	8.10	8.43	10.14	10.59	10.30		8.73	9.69	10.32	10.01	10.25	

ROC- Reduction over control, DBS-Days before spray, DAS-Days after spray

Table 3. Pooled data on efficacy of insecticides against citrus leaf miner (2020-21 and 2021-22)

Treatment	First spray: Number of live mines/ shoot						ROC (%)	Second spray: Number of live mines/ shoot						ROC (%)
	1DBS	1DAS	3DAS	5DAS	10DAS	Mean		1DBS	3DAS		5DAS	10DAS	Mean	
Chlorantraniliprole 18.5 SC	12.02 (3.54)	10.06 (3.25)^{bc}	6.67 (2.68)^{c}	4.92 (2.33)^{c}	2.88 (1.83)^{c}	6.13	55.30	6.38 (2.62)^{ab}	5.17 (2.38)^{bc}	3.21 (1.93)^{b}	1.88 (1.45)^{b}	1.21 (1.30)^{b}	2.86	79.15
Emamectin benzoate 5 SG	12.11 (3.55)	9.86 (3.22)^{bc}	6.50 (2.64)^{bc}	4.61 (2.26)^{bc}	2.09 (1.61)^{ab}	5.76	57.98	6.21 (2.59)^{a}	4.96 (2.34)^{b}	3.02 (1.88)^{b}	1.54 (1.43)^{b}	1.08 (1.26)^{b}	2.65	80.70
Spinosad 45 SC	12.29 (3.58)	7.79 (2.88)^{a}	5.19 (2.38)^{a}	3.50 (1.99)^{a}	1.42 (1.38)^{a}	4.47	67.38	5.83 (2.51)^{a}	3.02 (1.87)^{a}	1.50 (1.41)^{a}	0.52 (1.01)^{a}	0.29 (0.89)^{a}	1.33	90.29
Flonicamid 50 WG	12.23 (3.57)	9.27 (3.13)^{b}	5.57 (2.46)^{ab}	3.77 (2.07)^{ab}	1.50 (1.41)^{a}	5.03	63.34	6.02 (2.55)^{a}	3.63 (2.03)^{a}	1.92 (1.55)^{a}	0.77 (1.13)^{a}	0.40 (0.94)^{a}	1.68	87.79
Fipronil 5 SC	11.94 (3.53)	10.63 (3.34)^{c}	7.81 (2.88)^{d}	6.04 (2.56)^{d}	4.88 (2.32)^{e}	7.34	46.48	7.31 (2.79)^{bc}	6.54 (2.65)^{d}	4.48 (2.23)^{c}	3.38 (1.97)^{d}	2.29 (1.67)^{d}	4.17	69.63
Imidacloprid 70 WG	12.04 (3.54)	10.04 (3.24)^{bc}	7.15 (2.77)^{cd}	5.36 (2.42)^{cd}	4.00 (2.12)^{d}	6.64	51.61	7.88 (2.89)^{c}	5.75 (2.50)^{c}	4.00 (2.12)^{c}	2.69 (1.78)^{c}	1.83 (1.53)^{c}	3.57	74.03
Thiamethoxam 25 WG	12.04 (3.54)	9.75 (3.20)^{bc}	6.46 (2.64)^{bc}	4.71 (2.28)^{c}	2.33 (1.68)^{bc}	5.81	57.61	6.25 (2.60)^{a}	4.63 (2.26)^{b}	2.96 (1.86)^{b}	1.63 (1.54)^{b}	1.04 (1.24)^{b}	2.56	81.35
Untreated control	12.13 (3.55)	12.38 (3.59)^{d}	13.40 (3.73)^{e}	14.17 (3.83)^{e}	14.92 (3.93)^{f}	13.71		12.38 (3.59)^{d}	12.58 (3.62)^{e}	13.46 (3.73)^{d}	14.17 (3.83)^{e}	14.75 (3.91)^{e}	13.74	
S.Em±	0.43	0.42	0.34	0.30	0.24			0.31	0.22	0.23	0.15	0.11		
CD @ 5%	NS	1.30	1.05	0.91	0.73			0.95	0.68	0.71	0.46	0.35		
CV (%)	7.28	7.45	8.19	8.89	9.80			7.50	8.19	9.42	8.94	8.73		

ROC- Reduction over control, DBS-Days before spray, DAS-Days after spray

less population of citrus leaf miner. The insecticides *viz*., thiamethoxam 25 WG (1.04), emamectin benzoate 5 SG (1.08) and chlorantraniliprole 18.5 SC (1.21) were found on par in control of the pest. Imidacloprid 70 WG (1.83) and fipronil 5 SC (2.29) were found comparatively less effective in control of this pest. After two rounds of spray, spinosad 45 SC recorded significantly higher per cent reduction (90.29) of population of citrus leaf miner which was followed by flonicamid 50 WG (87.79), thiamethoxam 25 WG (81.35), emamectin benzoate 5 SG (80.70), chlorantraniliprole 18.5 SC (79.15), imidacloprid 70 WG(74.03) and fipronil 5 SC (69.63) treated plots in decreasing order of toxicity. The population of live mines were at high density in untreated control plots (Table 3).

It is evident from present investigation that spinosad 45 SC and flonicamid 50 WG were highly effectively in control citrus leaf miner on acid lime.The present findings are supported by Besheli (2009) who found that spinosad was superior in controlling the larvae of citrus leaf miner where about 98 per cent mortality of pest was observed after 96 hours of exposure to insecticide. Similarly, Bhut and Jethva (2019) reported that spinosad 45 SC was found to reduce leaf damage caused by *P. citrella* on Kagzi lime. More recently, Sharma (2021) also reported that spinosad 45 SC was highly effective in control of citrus leaf miner. Spinosad, a spinosyn group of insecticide produced from actinomycetes, *Saccharopolyspora spinosa* consists of mixture of spinosyn A and spinosyn D, two active metabolites responsible for insecticidal activity of spinosad. Spinosad has two modes of action, the first mode of action involves disrupting the binding of acetylcholine at nicotinic acetylcholine receptors located at the post-synaptic cell junctures, which prolongs stimulation of the nicotinic acetylcholine receptors. Consequently, this results in excitation of the insect central nervous system, paralysis and eventually death. The second mode of action is affiliated with negatively affecting GABA-gated ion channels. Therefore, these two kinds of novel modes of action may have resulted in improved efficacy of spinosad over other selected insecticides in this study.

Flonicamid of pyridincarboxamide group has excellent translaminar and systemic activity, rapidly inhibits the feeding behavior of pests. The citrus leaf miner larva mainly feed on the epidermal tissues of the young leaves, and act as sucking pest. The translocation of flonicamid through vascular bundles of plant system may have contributed to effective control of citrus leaf miner on acid lime. Similarly, Kattebennnuru (2017) reported significant control of citrus leaf miner upon exposure to flonicamid 50 WG. The treatments emamectin benzoate 5 SG and chlorantraniliprole 18.5 SC were found moderately effective in controlling citrus leaf miner on acid lime. The observations made during this study are supported by Kattebennuru (2017) who found that emamectin benzoate 5 SG and chlorantraniliprole 18.5 SC were recorded 35.57 and 32.36 per cent reduction in larval population, respectively after single application of insecticides. A slight change in the efficacy may be due to frequency and numbers of application taken up during the study. The citrus leaf miner is known to occur throughout the year with decreasing and increasing population, so multiple applications are needed for successful control of pest on acid lime. On the contrary, Sharma (2021) found that emamectin benzoate 5 SG was least effective in managing citrus leaf miner. The possible reason may be weather factors that were existing and quantity of insecticide used during the investigation.

The neonicotinoids, thiamethoxam 25 WG and imidacloprid 70 WG were found moderately effective in controlling citrus leaf miner. These observations are supported by Mohamed and Satti (2015), they reported that thiamethoxam 25 WG and imidacloprid 200 SL were highly effective in minimizing pest load on citrus seedlings, and kept seedlings pest free for more than a month. Similarly, Shinde *et al*. (2017) found that thiamethoxam 25 WG and imidacloprid 17.8 SL showed lowest leaf infestation by larvae of *P. citrella* on Nagpur mandarin. Iqbal *et al*. (2018) also observed that thiamethoxam 25 WG and imidacloprid 20 SL recorded significantly higher mortality of citrus leaf miner after 96 hours of exposure to insecticides. The present study reveals effectiveness of insecticides for management this severe pest of acid lime thus widening the choice of chemicals as use of insecticides of different chemistries will also help to delay development of resistance in the pest against insecticides.

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