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Management of jasmine leaf webworm, *Nausinoe geometralis* Guenee in *Jasminum sambac* L.

K. HARINI[1*], K. ELANCHEZHYAN

Department of Agricultural Entomology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Killikulam, Vallanadu-628 252, Tamil Nadu

*** E-mail**: harini2594@gmail.com

ABSTRACT: The efficacy of five botanicals and eleven insecticides was evaluated against jasmine leaf webworm, *Nausinoe geometralis* (Guenee) infesting *Jasminum sambac.* Among the botanicals, NSKE @ 5.0 per cent was found to be the most effective in reducing the infestation of *N. geometralis* by more than 60 per cent followed by *notchi* (*V. negundo)* leaf extract, *pungam* oil, sweet flag *(A. calamus)* and wild sage (*L. camara*) leaf extract were able to reduce the infestation by 39.10, 34.78, 28.99 and 27.54 per cent, respectively. Chlorantraniliprole 18.5 SC was the best treatment recording the greatest reduction of 82.60 per cent followed by flubendiamide 39.35 SC stood next and was followed by spinosad 45 SC; the reduction was 79.71 and 71.01 per cent respectively.

Keywords: Bioefficacy, botanicals, insecticides, jasmine, leaf webworm

INTRODUCTION

Jasmine (*Jasminum sambac* L.) is an attractive important commercial crop in India. The importance of jasmine flower is felt in all religious, social and cultural ceremonies and other functions performed by all religious people. There are around 50 distinctive insect pests species having a place within excess of eight orders harbouring fluctuated microhabitats of jasmine plants (Hemalatha, 2009). Jasmine budworm (*Hendecasis duplifascialis* Hampson), Blossom midge (*C. maculipennis*), leaf webworm (*Nausinoe geometralis* Guenee) and sucking insect *viz.,* whitefly (*Dialeurodes kirkaldyi* Kotinsky), thrips (*Isothrips orientalis* Bagnall), lacewing bug (*Corythauma ayyari* Drake), red spider mite (*Tetranychus urticae* Koch) and eriophyid mite (*Aceria jasmine* Chanana) which are economically important insect pests next to budworm cause economic losses to jasmine growers. At present, farmers depend mostly on conventional insecticides and acaricides for managing the jasmine insect pests. This can lead to problems like resurgence, residue and resistance on jasmine ecosystem. Decreased efficacy of conventional pesticides as well as increased concerns over their use in jasmine ecosystem have emphasised on the need for identifying safer, more effective botanical, insecticide and acaricide molecules for management of jasmine insect pests.

MATERIALS AND METHODS

Field experiments was conducted in a farmer's field near Vallanad village, during the period of 2017-2018 to test the efficacy of selected insecticides against leaf webworm *Nausinoe geometralis*. Randomized Block Design was adopted in each treatment, three plants and three replications were maintained for observation. Three rounds of foliar sprays were given at fortnight interval using battery operated hand sprayer. From the selected plants, webbings were examined and larvae of *N. geometralis* were counted and mean population was worked out and expressed in larvae per bush (Merlin Kamala, 2017).Pre-treatment observations on the incidence of leaf webworm were recorded one day before spraying. Post treatment counts were recorded on 1st, 3rd, 7th and 14th day after imposing treatment. The percentage data gathered were transformed into angular values for statistical scrutiny as suggested by Gomez and Gomez, (1984).

RESULTS AND DISCUSSION

Bio-efficacy of botanicals against leaf webworm, *N. geometralis*

Incidence of leaf webworm was influenced by the treatments, spray rounds as well as period of observations; interaction effect was evident (Table 1). Among the botanicals, NSKE @ 5.0 per cent was found to be the most effective in reducing the infestation of *N. geometralis* by more than 60 per cent. Other botanicals *viz.,notchi* (*V. negundo)* leaf extract, *pungam* oil, sweet flag *(A. calamus)* and wild sage (*L. camara*) leaf extract were found to be inferior as they were able to reduce the infestation by 39.10, 34.78, 28.99 and 27.54 per

Table 1. Bio-efficacy of botanicals against leaf webworm, *N. geometralis*

Treatment	Conc. (%)	No of larvae/ 10 webbing/ plant												Overall Mean	Reduction over untreated check (%)
		1st Spray				2nd Spray				3rd Spray					
		DAS				DAS				DAS					
		1	3	7	14	1	3	7	14	1	3	7	14		
Notchi (*V. negundo*) leaf extract	5.00	3.61 (1.90)a	3.95 (1.99)b	4.84 (2.20)c	5.60 (2.37)b	2.84 (1.69)b	3.46 (1.86)b	4.03 (2.01)c	4.56 (2.14)c	3.91 (1.97)e	4.25 (2.05)c	4.33 (2.06)c	4.81 (2.20)c	4.25 (2.04)c	39.10
NSKE	5.00	4.53 (2.13)b	3.96 (1.99)b	2.23 (1.49)a	2.10 (1.45)a	3.46 (1.86)bc	3.30 (1.82)b	2.51 (1.58)b	2.23 (1.49)b	2.65 (1.60)b	1.80 (1.34)b	1.32 (1.12)b	1.02 (1.01)b	2.62 (1.61)b	62.31
Pungam oil	2.00	3.85 (1.96)ab	3.90 (1.97)b	5.50 (2.35)cd	5.81 (2.41)bc	3.52 (1.88)bc	3.71 (1.93)bc	4.10 (2.02)c	5.02 (2.24)c	3.62 (1.91)c	4.63 (2.14)cd	5.20 (2.28)d	5.61 (2.37)cd	4.53 (2.13)c	34.78
Sweet flag rhizome extract (*A. calamus*)	5.00	4.06 (2.01)ab	4.23 (2.06)b	5.16 (2.27)c	5.64 (2.37)b	4.03 (2.01)c	4.26 (2.06)c	4.59 (2.14)c	5.1 (2.26)c	4.12 (2.02)c	5.21 (2.28)d	5.60 (2.37)d	6.26 (2.50)d	4.90 (2.20)c	28.99
Wild sage (*L. camara*) leaf extract	5.00	4.10 (2.02)ab	4.35 (2.09)b	5.23 (2.29)c	5.94 (2.44)bc	4.20 (2.05)c	4.36 (2.09)c	4.86 (2.20)c	5.26 (2.29)c	4.30 (2.06)c	5.60 (2.37)e	5.81 (2.41)de	6.20 (2.50)de	5.01 (2.24)c	27.54
Profenophos 50 EC (Std. check)	2.00 ml/ lit	4.50 (2.12)b	3.02 (1.74)a	3.53 (1.88)b	3.82 (1.95)b	1.45 (1.20)a	1.06 (1.03)a	0.95 (0.97)a	1.39 (1.18)a	0.80 (0.87)a	0.60 (0.75)a	0.40 (0.65)a	0.71 (0.86)a	1.86 (1.36)a	73.91
Untreated check	-	8.65 (2.94)c	7.59 (2.75)c	6.07 (2.46)d	6.76 (2.60)c	7.36 (2.71)d	6.94 (2.63)d	6.81 (2.61)d	6.42 (2.53)d	7.51 (2.74)d	5.61 (2.37)e	6.51 (2.55)e	6.92 (2.63)e	6.93 (2.63)d	0.00
Mean		4.76 (1.90)BC	4.43 (1.99)DE	4.65 (2.20)G	5.10 (2.37)H	3.84 (1.69)A	3.87 (1.86)B	3.98 (2.01)DE	4.28 (2.14)FG	3.82 (1.97) CD	3.94 (2.05)E	4.14 (2.06)E	4.52 (2.20)G		-

Mean of three replications.
Figures in parentheses are square root transformed values.
In a column/row, means followed by a common letter are not significantly different at 5% level (LSD).

	T	S	D	S x D	T x D x S
Significance	0.01	0.01	0.01	0.01	0.01
CD (P=0.05)	0.03	0.04	0.06	0.07	0.20

Table 2. Bio-efficacy of insecticides against leaf webworm, *N. geometralis*

Treatment	Dose	No of larvae/ 10 webbing/ plant												Overall Mean	Reduction over untreated check (%)
		1st Spray DAS				2nd Spray DAS				3rd Spray DAS					
		1	3	7	14	1	3	7	14	1	3	7	14		
Acetamiprid 20 SP	0.10 g / lit	4.53 (2.13)g	3.96 (1.99)c	2.16 (1.47)b	2.04 (1.43)a	3.46 (1.86)h	3.30 (1.82)f	2.51 (1.58)e	2.00 (1.41)e	2.00 (1.42)d	1.60 (1.25)e	1.00 (1.01)d	0.80 (0.89)e	2.45 (1.56)f	65.21
Chlorantraniliprole 18.5 SC	0.10 ml / lit	2.00 (1.41)a	2.10 (1.45)a	1..54 (1.24)a	1.96 (1.40)a	1.56 (1.25)b	1.79 (1.34)d	1.26 (1.12)c	0.96 (0.98)c	0.50 (0.67)a	0.30 (0.55)a	0.20 (0.49)a	0.60 (0.77)d	1.23 (1.11)a	82.60
Dimethoate 30 EC	2.00 ml / lit	3.56 (1.89)c	3.84 (1.96)c	4.75 (2.18)g	5.40 (2.32)e	2.84 (1.69)f	3.46 (1.86)f	3.95 (1.99)f	4.44 (2.11)f	3.90 (1.92)f	4.00 (2.00)f	4.30 (2.06)e	4.80 (2.20)f	4.08 (2.02)g	40.58
Fipronil 5 SC	1.50 ml / lit	4.06 (2.01)f	4.23 (2.06)d	5.16 (2.27)h	5.64 (2.37)fg	4.03 (2.01)i	4.26 (2.06)i	4.59 (2.14)h	5.10 (2.26)g	4.10 (2.02)g	5.20 (2.28)i	5.60 (2.37)g	6.30 (2.50)h	4.85 (2.20)j	28.95
Flubendiamide 39.35 SC	0.75 ml / lit	2.86 (1.69)b	3.05 (1.75)b	2.41 (1.55)c	2.56 (1.60)b	1.36 (1.17)a	1.02 (1.01)a	0.86 (0.93)a	0.51 (0.71)a	0.40 (0.63)a	0.70 (0.82)b	0.60 (0.80)c	0.80 (0.90)c	1.43 (1.20)b	79.71
Imidacloprid 17.8 SL	0.30 ml / lit	4.02 (2.00)de	4.00 (2.00)c	5.96 (2.44)j	6.03 (2.46)h	4.03 (2.01)i	3.95 (1.99)h	4.21 (2.05)g	5.32 (2.31)h	4.10 (2.01)g	5.10 (2.25)i	5.90 (2.44)h	6.30 (2.50)h	4.90 (2.21)j	28.99
Indoxacarb 14.5 SC	0.35 ml / lit	3.60 (1.90)c	3.86 (1.96)c	5.00 (2.24)h	5.49 (2.34)g	3.02 (1.74)g	3.68 (1.92)g	4.06 (2.01)fg	4.95 (2.22)g	3.50 (1.87)e	4.30 (2.06)g	4.40 (2.09)e	5.00 (2.24)f	4.23 (2.06)h	39.13
Novaluron 10 EC	1.00 ml / lit	3.85 (1.96)d	3.90 (1.97)c	5.50 (2.35)i	5.81 (2.41)g	3.52 (1.88)h	3.71 (1.93)g	4.10 (2.02)fg	5.02 (2.24)g	3.60 (1.91)f	4.60 (2.14)h	5.20 (2.28)f	5.60 (2.37)g	4.54 (2.13)i	34.78
Spinosad 45 SC	0.32 ml / lit	4.23 (2.06)f	4.50 (2.12)e	3.02 (1.74)d	3.53 (1.88)d	2.10 (1.45)d	1.45 (1.20)b	1.06 (1.03)b	0.95 (0.97)b	1.20 (1.11)c	0.80 (0.87)b	0.60 (0.75)b	0.40 (0.65)b	1.98 (1.41)c	71.01
Thiacloprid 21.7 SC	0.60 ml / lit	5.00 (2.24)h	4.85 (2.20)f	4.37 (2.09)f	3.26 (1.81)c	2.58 (1.61)f	2.03 (1.42)e	1.54 (1.24)d	1.26 (1.12)d	1.00 (1.02)b	0.80 (0.92)d	0.60 (0.77)bc	0.30 (0.55)a	2.31 (1.52)e	66.67
Thiamethoxam 25 WG	0.40 g / lit	5.53 (2.35)i	4.20 (2.05)d	3.84 (1.96)e	2.52 (1.59)b	1.93 (1.39)c	1.56 (1.25)c	1.20 (1.10)c	0.86 (0.93)b	1.20 (1.11)c	0.90 (0.95)d	0.60 (0.77)bc	0.50 (0.71)c	2.07 (1.44)d	69.57
Untreated check	-	8.65 (2.94)j	7.59 (2.75)g	6.07 (2.46)j	6.76 (2.60)i	7.36 (2.71)j	6.94 (2.63)j	6.81 (2.61)i	6.42 (2.53)i	7.50 (2.74)h	5.60 (2.37)j	6.50 (2.55)i	6.90 (2.63)i	6.93 (2.63)k	0.00
Mean		7.69 (2.08)I	4.32 (2.04)G	4.17 (2.04)G	4.15 (2.06)H	3.15 (1.77)E	3.10 (1.76)E	3.01 (1.74)D	3.15 (1.77)E	2.74 (1.65)A	2.81 (1.68)B	2.96 (1.72)C	3.20 (1.79)F		-

Mean of three replications. Figures in parentheses are square root transformed values.

In a column/row, means followed by a common letter are not significantly different at 5% level (LSD).

	T	S	D	S x D	T x S x D
Significance	0.01	0.01	0.01	0.01	0.01
CD (P=0.05)	0.01	0.01	0.01	0.01	0.04

cent, respectively over untreated check as indicated by the overall mean. However, all the botanicals were significantly inferior to the standard check profenophos 50 EC which recorded the greatest reduction of 73.91 per cent. *Pungam* oil as well as profenophos 50 EC were able to record a decline trend with a progressive in spray rounds as well as period of observations.

The efficacy of NSKE @ 5.0 per cent in managing jasmine pest brought out in the present study was supported by (Hemalatha, 2009) and (Merlin Kamala, 2017). The oviposition deterrent effect of NSKE @ 5.0 per cent against leaf webworm was also reported by (Vanitha, 2001).

Bio-efficacy of insecticides against leaf webworm, *N. geometralis*

The data on the incidence of leaf webworm as influenced by the treatment sprays, spray rounds and period of observations are presented in table 2. The infestation of *N. geometralis* ranged from 0.20 larva per 10 webbings per plant in chlorantraniliprole 18.5 SC at 7th day after third spray to 8.65 per cent per 10 webbings per plant in untreated check at 1st day after 1st round of spray. The individual influence of treatment, spray rounds and period of observations was manifested; combined effect was also evident. Overall mean ranged from 1.23 (chlorantraniliprole 18.5 SC) to 6.93 (untreated check) per 10 webbings per plant. All the treatments were able to contain the leaf webworm population by 28.95 to 82.60 per cent compared to untreated check. Chlorantraniliprole 18.5 SC was the best treatment recording the greatest reduction of 82.60 per cent over untreated check. Flubendiamide 39.35 SC stood next and was followed by spinosad 45 SC; the reduction was 79.71 and 71.01 per cent respectively. Thiamethoxam 25 WG (69.57 %), thiacloprid 21.7 SC (66.67 %) and acetamiprid 20 SP (65.21 %) were less effective recording less than 70 per cent reduction in leaf webworm infestation. Dimethoate 30 EC (40.58 %), indoxacarb 14.5 SC (39.13 %), novaluron 10 EC (34.78 %), imidacloprid 17.8 SL (28.99 %) and fipronil 5 SC (28.95 %) could brought out a reduction of less than 50 per cent only. Matching trend at each periods of observation, as well as each round of spray was noticed.

Chlorantraniliprole 18.5 SC @ 0.10 ml/lit and flubendiamide 39.35 SC @ 0.75 ml/lit belongs to the main group of ryanodine receptor modulators and chemical sub group of diamides (IRAC, 2009). They inhibit the nerve and muscle action in insects. These two insecticides were used against broad spectrum of lepidopterous insects. These molecules affect intercellular Ca^{2+} channels (Omkar Gavkare *et al.*, 2013).(Merlin Kamala, 2017) reported that thiacloprid 240 SC @ 0.6 ml/lit proved its superiority in managing blossom midge, budworm and leaf webworm followed by flubendiamide 480 SC@ 0.5 ml/lit and chlorantraniliprole 18.5 EC @ 0.75 ml/lit against leaf and flower feeders in jasmine.

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