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RESEARCH PAPER

Evaluation of insecticides for bud borer, *Hendecasis duplifascialis* Hampson control in *Jasmine multiflorum* (*Burm.* f.)

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Abstract: A field experiment was conducted in farmer's field at Nigadi village of Dharwad district during 2019-20. Among the eight insecticides evaluated against the bud borer, *Hendecasis duplifascialis*(Hampson) infesting *Jasminum multiflorum,* spinetoram 11.7 SC @ 0.5 ml/l, chlorantraniliprole 18.5 SC @ 0.2 ml/l, emamectin benzoate 5 SG @ 0.2 g/l and spinosad 45 SC @ 0.2 ml/l emerged as most promising treatments in managing bud borer with lowest mean per cent affected buds (6.35, 9.43, 13.03 and 13.39, respectively). Profenophos 50 EC @ 2.0 ml/l, azardirachtin 3000 ppm @ 3.0 ml/land lambda cyhalothrin 5 EC @ 0.5 ml/l had moderate effect in bringing down the per cent bored buds (16.41, 16.73 and 16.95, respectively). However, Malathion 50 EC @ 2.0 ml/l found less effective as compared to the rest of treatments with highest mean percent affected buds (19.52).

Key words: Bud borer, Insecticide, Jasmine, Spinetoram

Introduction

Jasmine is one of the attractive traditional flowers, grown commercially in India. It belongs to olive family (Oleaceae) of the order Oleals and genus *Jasminum*. The name jasmine comes from an Arabic word "Jessamine" and is named in Persian as "Yasmin," which means fragrance. It is known as the "Queen of fragrance" and is one of the oldest scented flowers grown by human beings (Khader and Kumar, 1995). Major pests that are found to affect the jasmine are *viz.,* bud borer, *Hendecasis duplifascialis* (Crambidae), bud borer/ gallery worm, *Elasmopalpus jasminophagus* (Pyraustidae), leaf web-worm, thrips, eriophyid mite and spider mite, which can cause considerable economic damage (Kiran, 2017). Among these, bud borers, *E. jasminophagus* and *H. duplifascialis* pose a serious threat to flower production. These bud borers can cause a maximum of 41.38 per cent bud damage (Roopini, 2016). The area under jasmine cultivation is increasing, as the demand for jasmine flowers and its products is increasing day by day. Among the different problems associated with the cultivation of jasmine, the question of pests remains higher. Hence the management of these pests is very important to avoid damage to the crop, in particular to the flowers. In Karnataka state, many small and marginal farmers grow jasmine for their livelihood. Since from last one-decade jasmine farmers are experiencing difficulty in cultivation due to few insect and mite pests. In view of Jasmine's high economic value and at the same time serious damage caused by pests, a research programme has been taken up.

Material and methods

The field experiment was conducted in a farmer's field during 2019-20 at Nigadi village, of Dharwad district to evaluate the insecticides against bud borer, *H. duplifascialis* infesting *J. multiflorum.* The experiment was laid out in Randomized Block Design (RBD) with nine treatments, including untreated control and replicated thrice. Before treatments imposition, the selected shrubs for the experimentation were labelled. Each replication contained five shrubs in each treatment and among these, three shrubs were selected for observation. From each labelled shrub, three shoots were randomly selected and tagged. The observations on the infestation of bud borer was recorded prior to treatment imposition as pre-count data and at three, seven and fourteen days after treatment imposition. Two rounds of foliar sprays were given at fortnight interval by using a high-volume knapsack sprayer. After each observation, the infested buds were removed from the plants to avoid the statistical errors. The data on the percentage of infestation was first transformed to angular values and then subjected to statistical analysis. Percentage of infestation was calculated by using the following formula:

$$\text{Per cent bored buds} = \frac{\text{Number of buds with bore holes}}{\text{Total number of buds}} \times 100$$

Results and discussion

Two field trials were conducted to evaluate the efficacy of insecticides against jasmine bud borer, *E. jasminophagus.*

First spray

The results obtained on the efficacy of different insecticides against the bud borer, *H. duplifascialis* indicated that mean per cent bored buds on a day beforeimposition of treatments ranged from 21.81 to 26.17 and were not differing significantly (Table 1).

At three days after the first spray, all the treatments were significantly superior over control. However, significantly lowest mean per cent bored buds due to bud borer,

H. duplifascialis was recorded in spinetoram 11.7 SC @ 0.5 ml/l (9.95), followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (13.84). The next best treatments were found to be emamectin benzoate 5 SG @ 0.2 g/l (18.28) and spinosad 45 SC @ 0.2 ml/l (18.47) in reducing the per cent bud borer damage and were on par with each other. These were followed by lambda cyhalothrin 5 EC @ 0.5 ml/l (23.00), profenophos 50 EC @ 2.0ml/l (23.17), azadirachtin 3000 ppm @ 3.0 ml/l (23.64) and malathion 50 EC @ 2.0ml/l (23.51) (Table 1).

The observations revealed that at seven days after the first spray, mean per cent bored buds was found significantly lowest in spinetoram 11.7 SC @ 0.5 ml/l (5.35) followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (8.04). The next best treatments were found to be emamectin benzoate 5 SG @ 0.2 g/l (11.33) and spinosad 45 SC @ 0.2 ml/l (12.05) in reducing the per cent bud borer damage and were on par with each other. These were followed by lambda cyhalothrin 5 EC @ 0.5 ml/l (14.85), profenophos 50 EC @ 2.0 ml/l (16.16), azardirachtin 3000 ppm @ 3.0 ml/l (19.47) and malathion 50 EC @ 2.0 ml/l (18.82). Meanwhile, highest mean per cent bored buds were recorded in control (24.04) (Table 1).

At fourteen days after first spray, spinetoram 11.7 SC @ 0.5 ml/l was found superior by recording significantly lowest mean per cent bored buds (7.10) followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (10.65). The next best treatments were emamectin benzoate 5 SG @ 0.2 g/l (14.43), spinosad 45 SC @ 0.2 ml/l (14.57), azardirachtin 3000 ppm @ 3.0 ml/l (14.92), profenophos 50 EC @ 2.0 ml/l (16.23) and lambda cyhalothrin 5 EC @ 0.5 ml/l (18.50) in reducing the per cent bud borer damage and were on par with each other. Meanwhile, malathion 50 EC @ 2.0 ml/l was found to be less effective (19.92) in controlling the bud borer damage but superior over control (Table 1).

Overall mean bored buds after the first spray ranged from 7.47 to 25.01. Among the treatments spinetoram 11.7 SC @ 0.5 ml/l showed the lowest mean bored buds (7.47), followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (10.84). These were followed by emamectin benzoate 5 SG @ 0.2 g/l (14.68) and spinosad 45 SC @ 0.2 ml/l (15.03) and were on par with each other. However, significantly higher per cent bored buds (25.01) were noticed in control (Table 1).

Second spray

A day before spraying the mean per cent bored buds due to bud borer were indicated a statistically significant difference among the insecticide treatments.

At three days after the second spray all the treatments were found significantly superior over the control for per cent borered buds. However, spinetoram 11.7 SC @ 0.5 ml/l was recorded lowest mean per cent bored buds (5.43), followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (8.45). Next best treatments were emamectin benzoate 5 SG @ 0.2 g/l (12.01) and spinosad 45 SC @ 0.2 ml/l (12.38) in reducing the bud borer damage and were on par with each other. These were followed by lambda cyhalothrin 5 EC @ 0.5 ml/l (16.31), azadirachtin 3000 ppm @ 3.0 ml/l (16.32), profenophos 50 EC @ 2.0 ml/l (16.55) and malathion 50 EC @ 2.0 ml/l (18.54) in reducing the bud borer damage (Table 1).

The observations at seven days after the second spray revealed that, spinetoram 11.7 SC @ 0.5 ml/l was recorded lowest mean per cent bored buds (4.27), followed by chlorantraniliprole

Table 1. Evaluation of insecticides against bud borer, *(Hendecasis duplifascialis)* in Jasmine during 2019-20

Sl. No.	Treatment details	Dosage	Mean per cent bored buds (1st spray)					Mean per cent bored buds (2nd spray)				
			DBS	3 DAS	7 DAS	14 DAS	MEAN	DBS	3DAS	7DAS	14DAS	MEAN
1	Chlorantraniliprole 18.5 SC	0.2 ml/l	25.15 (30.09)	13.84 (21.83)^{b}	8.04 (16.47)^{b}	10.65 (19.04)^{b}	10.84 (19.22)^{b}	10.65 (19.04)	8.45 (16.89)^{b}	6.96 (15.29)^{b}	8.64 (17.09)^{b}	8.02 (16.44)^{b}
2	Lambda cyhalothrin 5 EC	0.5 ml/l	23.46 (28.96)	23.00 (28.65)^{de}	14.85 (22.65)^{de}	18.50 (25.47)^{cd}	18.78 (25.67)^{de}	18.50 (25.47)	16.31 (23.81)^{de}	13.77 (21.77)^{cd}	15.30 (23.01)^{d}	15.13 (22.88)^{de}
3	Emamectin benzoate 5 SG	0.2 g/l	21.81 (27.83)	18.28 (25.30)^{c}	11.33 (19.66)^{c}	14.43 (22.32)^{c}	14.68 (22.52)^{c}	14.43 (22.32)	12.01 (20.27)^{c}	10.04 (18.47)^{c}	12.11 (20.36)^{c}	11.39 (19.71)^{c}
4	Spinosad 45 SC	0.2 ml/l	22.18 (28.09)	18.47 (25.44)^{cd}	12.05 (20.31)^{cd}	14.57 (22.43)^{c}	15.03 (22.80)^{cd}	14.57 (22.43)	12.68 (20.85)^{cd}	10.21 (18.63)^{c}	12.36 (20.57)^{c}	11.75 (20.04)^{c}
5	Azardirachtin 3000 ppm	3.0 ml/l	24.06 (29.36)	23.64 (29.08)^{f}	19.47 (26.17)^{f}	14.92 (22.71)^{c}	19.34 (26.08)^{e}	14.92 (22.71)	16.32 (23.82)^{de}	13.74 (21.75)^{cd}	12.31 (20.53)^{c}	14.12 (22.07)^{cd}
6	Profenophos 50 EC	2.0 ml/l	23.27 (28.83)	23.17 (28.76)^{ef}	16.16 (23.70)^{ef}	16.23 (23.75)^{cd}	18.52 (25.48)^{de}	16.23 (23.75)	16.55 (24.00)^{de}	13.89 (21.87)^{cd}	12.46 (20.66)^{c}	14.30 (22.21)^{cd}
7	Spinetoram 11.7 SC	0.5 ml/l	24.82 (29.87)	9.95 (18.38)^{a}	5.35 (13.37)^{a}	7.10 (15.44)^{a}	7.47 (15.85)^{a}	7.10 (15.44)	5.43 (13.47)^{a}	4.27 (11.92)^{a}	6.02 (14.19)^{a}	5.24 (13.22)^{a}
8	Malathion 50 EC	2.0 ml/l	26.17 (30.76)	23.51 (28.99)^{f}	18.82 (25.70)^{f}	19.92 (26.49)^{d}	20.75 (27.09)^{e}	19.92 (26.49)	18.54 (25.49)^{ef}	17.73 (24.89)^{d}	18.57 (25.52)^{e}	18.28 (25.30)^{e}
9	Untreated control	-	23.93 (29.28)	25.99 (30.64)^{g}	24.04 (29.35)^{g}	25.02 (30.00)^{e}	25.01 (30.00)^{f}	25.02 (30.00)	23.93 (29.28)^{f}	22.16 (28.07)^{e}	23.38 (28.91)^{f}	23.16 (28.75)^{f}
S.Em. ±			NS	1.10	0.91	1.06	0.92	1.06	1.08	1.06	0..72	0.86
C.D. (p=0.05)			NS	3.30	2.73	3.18	2.78	3.18	3.25	3.16	2.16	2.59
C.V. (%)			NS	7.26	7.22	7.99	6.74	7.99	8.56	9.02	5.91	7.07

DBS- Day before spray DAS- Days after spray NS- Non significant

Figures in the parentheses are angular transformed values

Values in the columns followed by common letters are non-significant (P = 0.05) as per DMRT

Table 2. Efficency of insecticides to control bud borer, *(Hendecasis duplifascialis)* in Jasmine (Pooled)

Treatment details	Dosage	Mean per cent bored buds					
		First spray		Second spray		Pooled mean	
		Mean	Per cent reduction over control	Mean	Per cent reduction over control	Mean	Per cent reduction over control
Chlorantraniliprole 18.5 SC	0.2 ml/l	10.84	56.64	8.02	65.39	9.43	61.01
Lambda cyhalothrin 5 EC	0.5 ml/l	18.78	24.90	15.13	34.69	16.95	29.79
Emamectin benzoate 5 SG	0.2 g/l	14.68	41.30	11.39	50.83	13.03	46.07
Spinosad 45 SC	0.2 ml/l	15.03	39.90	11.75	49.27	13.39	44.59
Azadirachtin 3000 ppm	3.0 ml/l	19.34	22.66	14.12	39.02	16.73	30.84
rofenophos 50 EC	2.0 ml/l	18.52	25.94	14.30	38.25	16.41	32.10
Spinetoram 11.7 SC	0.5 ml/l	7.47	70.15	5.24	77.39	6.35	73.77
Malathion 50 EC	2.0 ml/l	20.75	17.03	18.28	21.07	19.52	19.05
Untreated	-	25.01		23.16		24.09	

18.5 SC @ 0.2 ml/l (6.96). However, emamectin benzoate 5 SG @ 0.2 g/l, spinosad 45 SC @ 0.2 ml/l, azardirachtin 3000 ppm @ 3.0 ml/l, lambda cyhalothrin 5 EC @ 0.5 ml/l and profenophos 50 EC @ 2.0 ml/l were recorded 10.04, 10.21, 13.74, 13.77 and 13.89 mean per cent bored buds respectively and were statistically on par with each other (Table 1).

At fourteen days after the second spray, spinetoram 11.7 SC @ 0.5 ml/l was recorded lowest mean per cent bored buds (6.02), followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (8.64). However, emamectin benzoate 5 SG @ 0.2 g/l, azardirachtin 3000 ppm @ 3.0 ml/l, spinosad 45 SC @ 0.2 ml/l and profenophos 50 EC @ 2.0 ml/l were found on par with each other. These followed by lambda cyhalothrin 5 EC @ 0.5 ml/l recorded 15.30 mean per cent bored buds (Table 1).

Overall mean affected buds after the second spray ranged from 5.24 to 23.16. Among the treatments spinetoram 11.7 SC @ 0.5 ml/l (5.24) showed the lowest mean affected buds, followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (8.02). However, emamectin benzoate 5 SG @ 0.2 g/l, spinosad 45 SC @ 0.2 ml/l, azadirachtin 3000 ppm @ 3.0 ml/l and profenophos 50 EC @ 2.0 ml/l were recorded 11.39, 11.75, 14.12 and 14.30 mean per cent bored buds, respectively and were on par with each other (Table 1).

Pooled mean

Pooled mean of both the sprays revealed that lowest mean per cent affected buds noticed in spinetoram 11.7 SC @ 0.5 ml/l (6.35) followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (9.43), emamectin benzoate 5 SG @ 0.2 g/l (13.03), spinosad 45 SC @ 0.2 ml/l (13.39), profenophos 50 EC @ 2.0 ml/l (16.41), azardirachtin 3000 ppm @ 3.0 ml/l (16.73), lambda cyhalothrin 5 EC @ 0.5 ml/l (16.95) and malathion 50 EC @ 2.0 ml/l (19.52). Highest per cent reduction over the control was recorded in spinetoram11.7 SC @ 0.5 ml/l (73.77 %), followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (61.01 %), emamectin benzoate 5 SG @ 0.2 g/l (46.07 %) and spinosad 45 SC @ 0.2 ml/l (44.59 %). Meanwhile, lowest reduction over the control was recorded in malathion 50 EC @ 2.0 ml/l(19.05 %) (Table 2).

Among the different chemicals tested against bud borer *H. duplifascialis,* the lowest mean per cent bored buds were noticed inspinetoram 11.7 SC @ 0.5 ml/l (6.35) followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (9.43), emamectin benzoate 5 SG @ 0.2 g/l (13.03), spinosad 45 SC @ 0.2 ml/l (13.39). Highest per cent reduction over the control was recorded in spinetoram 11.7 SC @ 0.5 ml/l (73.77 %), followed by chlorantraniliprole 18.5 SC @ 0.2 ml/l (61.01 %), emamectin benzoate 5 SG @ 0.2 g/l (46.07 %) and spinosad 45 SC @ 0.2 ml/l (44.59 %).

These results are in confirmative with Harini *et al.* (2018) who opined that chlorantraniliprole 18.5 SC was effective in controlling bud borer (6.21 %) with 81 per cent reduction over control.Kamala and Kennedy (2017) reported the effectiveness of chlorantraniliprole 18.5 SC in managing the bud borer and found superior over all the treatments.Roopini (2016) tested eight chemicals against bud borers, among them chlorantraniliprole 18.5 SC found effective followed by spinosad 45 SC in controlling mean larval population. Azardirachtin 3000 ppm @ 3 ml/l found less effective in managing the bud borer. However, Suganthi *et al.* (2019) and Samata (2019) reported the least effectiveness of azadirachtin 1500 ppm @ 2 ml/l and azadirachtin 0.5 % @ 3 ml/l, respectively in managing the bud borer. The results are also line with Hosamani *et al*. (2008) and Sreenivas *et al*.(2008)also reported that chlorantraniliprole and flubendiamide are very effective against *Helicoverpa armigera* in chilli ecosystem

Since the jasmine ecosystem is associated with a rich pool of natural enemies, there is a need to come up with good management practices by using green labeled insecticides like spinetoram 11.7 SC, chlorantraniliprole 18.5 SC and emamectin benzoate 5 SG. Since these insecticides are having a different mode of action, they can be best utilized in managing the bud borer effectively.

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