

Bio-efficacy of insecticides against jasmine bud borer, *Hendecasis duplifascialis* (Hampson)

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Abstract

The present field investigation was carried out during 2023–24 at the Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, to evaluate the efficacy of insecticides against jasmine bud borer, *H. duplifascialis* (Hampson). The experiment was laid out in a randomized block design with three replications and seven treatments. Among the six insecticides, Chlorantraniliprole 18.5 SC (0.008%) was the best treatment and had significantly lower mean per cent damaged buds (5.69%), which was at par with Flubendiamide 39.35 SC (0.0096%) recorded 5.92 mean per cent bud damage. Quinalphos 25 EC at 0.05 per cent (13.39 mean per cent affected buds/plant) was found least effective. The highest damage of the bud borer (18.03%) was observed in the control. However, the highest flower yield (5800.00 kg/ha) was obtained in the treatment of Chlorantraniliprole 18.5 SC (0.008%) whereas, the highest incremental cost benefit ratio (1:11.50) was found in the plot treated with Flubendiamide 39.35 SC at 0.0096 per cent, which was at par with Chlorantraniliprole 18.5 SC (0.008%) (1:10.44).

Keywords: Jasmine, *H. duplifascialis*, bud borer, bio-efficacy of Insecticides

Introduction

Flowers provide aesthetic and economic value to the world. They are symbols of beauty, love, passion, purity and tranquility. Jasmine is an important ornamental flower crop native to tropical and subtropical regions and was introduced in the mid-sixteenth century (Anon. 2020) [1]. Known as the "Queen of Perfume" in the Oleaceae family, over 200 species exist, with 40 being endemic to India. Of these species, *Jasminum sambac* (Gundamalli/ Madurai malli), *Jasminum auriculatum* (Mullai), and *Jasminum grandiflorum* (Jathimalli/ pitchi) are grown commercially, primarily for their unique fragrance in rituals like marriages, religious ceremonies, and festivals (Anon. 2020; Balaji *et al.*, 2024; Kiran *et al.*, 2017) [1, 3, 7]. The preferred commercial species, *Jasminum sambac*, is an evergreen shrub also utilized in traditional medicine due to properties like anti-depressant and antiseptic effects, with its flower buds useful in treating ulcers and leaves used against breast tumors (Mohanapriya *et al.*, 2023; Anon. 2024) [8, 2].

However, jasmine cultivation is severely constrained by several insect pests, among which the bud borer *H. duplifascialis* is the most destructive, causing 30 to 70 per cent yield loss (Neelima, 2005) [9]. The bud borer *H. duplifascialis* is a major pest of jasmine, causing severe bud damage and yield loss. The larvae initially bore small pinholes at the base of the bud or stalk and later feed internally on the bud contents. In later stages, they web entire bud clusters together with silk and excreta, often extending damage to adjacent buds (Kiran *et al.*, 2017) [7]. Infested buds contain excretory pellets, turn violet, and finally drop. Under heavy infestation, multiple buds are webbed together, severely reducing flower quality and marketability (Ponsekha and Muthusamy, 2016; Kamala and Kennedy, 2017) [10, 5]. Therefore, the present investigation was undertaken to assess the bio-efficacy of insecticides against jasmine bud borer, *H. duplifascialis* under field conditions in South Gujarat.

Materials and Methods

The field experiment was conducted during the 2023-24 at Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari. The experiment was laid out using randomized block design with three replications and seven treatments. The investigation for evaluating the bio-efficacy of six insecticides *viz.*, Emamectin benzoate 5 SG @ 4 g/10 l, Chlorantraniliprole 18.5 SC @ 4.3 ml/10 l, Diflubenzuron 25 WP @ 6 g/10 l, Flubendiamide 39.35 SC @ 2.4 ml/10 l, Profenophos 50 EC @ 20 ml/10 l, Quinalphos 25 EC @ 20 ml/10 l, along with control (water spray) was carried out during 2024. A total number of two sprays were applied at an interval of 15 days between two sprays. Spraying was carried out using knapsack sprayer. To evaluate the efficacy of different insecticides, observation of damaged buds of *H. duplifascialis* was recorded from five randomly selected plants from each net plot. The observations were recorded from one day before spraying and 3, 7, 10 and 14 days after treatment. Therefore, per cent bud damage was worked out on the basis of the number of healthy and damaged buds from all the five randomly selected plants. Thus, data obtained was converted to per cent damage buds and statistically analyzed.

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

The flower yield was recorded in grams per net plot therefore it was converted into kg per ha. The per cent yield increase over control was calculated by using the following formula.

$$\text{Per cent yield increase over control (\%)} = \frac{T - C}{C} \times 100$$

Where,

T = Yield of insecticidal treatment (kg/ha), C = Yield of treated control (kg/ha)

Results and Discussion

Application of the insecticides for the control of bud borer resulted in significant variations during the both the spray (Table 2). The pooled data of the first spray revealed that the mean per cent affected buds per plant varied from 5.65 to 18.89 per plant. Significantly lowest mean per cent affected buds per plant (5.65%) was observed in plots treated with Chlorantraniliprole 18.5 SC at 0.008 per cent it was at par with Flubendiamide 39.35 SC at 0.0096 per cent (5.93%). The next best effective treatments were Diflubenzuron 25 WP at 0.015 per cent, Profenophos 50 EC at 0.1 per cent and Emamectin benzoate 5 SG at 0.002 per cent with mean per cent affected buds per plant was 9.88, 9.96 and 9.98, respectively. The remaining treatment Quinalphos 25 EC at 0.05 per cent was found less effective as they registered 13.92 per cent affected buds per plant. The highest per cent affected buds per plant (18.89%) was observed in the control.

Second spray pooled data (Table 2) revealed that the mean per cent affected buds per plant varied from 5.74 to 17.16 per plant. Significantly lowest mean per cent affected buds per plant (5.74%) was observed in plots treated with Chlorantraniliprole 18.5 SC at 0.008 per cent it was at par with Flubendiamide 39.35 SC at 0.0096 per cent (5.91%). The next most effective treatment was Emamectin benzoate 5 SG at 0.002 per cent, Profenophos 50 EC at 0.1 per cent and Diflubenzuron 25 WP at 0.015 per cent with mean per cent affected buds per plant 9.40, 9.40 and 9.46, respectively. The rest treatment Quinalphos 25 EC at 0.05 per cent was found less effective as they registered 12.87 per cent affected buds per plant. The highest per cent affected buds per plant (17.16%) was observed in the control.

The pooled data of the both spray revealed that the treatment Chlorantraniliprole 18.5 SC at 0.008 per cent (5.69%) and Flubendiamide 39.35 SC at 0.0096 per cent (5.92%) was found to most effective treatment with recorded lowest mean per cent affected buds per plant. Whereas, Quinalphos 25 EC at 0.05 per cent (13.39 mean per cent affected buds per plant) was found least effective. The highest damage of the bud borer (18.03%) was observed in the control. The order of effectiveness of insecticides against the jasmine bud borer, *H. duplifascialis* was found to be Chlorantraniliprole (0.008%) > Flubendiamide (0.0096%) > Diflubenzuron (0.015%) > Profenophos (0.1%) > Emamectin benzoate (0.002%) > Quinalphos (0.05%). The results are more closely similar to Reddy *et al.* (2016) [7] was noted that Chlorantraniliprole

was found to be the most effective (0.20 larvae/plant) insecticide in controlling bud borer in jasmine. Kiran *et al.*, (2017) [7] reported that the spraying with Chlorantraniliprole resulted in lower affected buds (6.80%) followed by Flubendiamide (8.62%). Moreover, Harini *et al.* (2018) [4] found the lowest per cent infested buds (6.21%) in the treatment of Chlorantraniliprole. According to Samata *et al.* (2019) [11] lowest damaged buds were noticed in the treatment of Flubendiamide 39.35 SC. Keshavareddy and Samata (2020) [6] noticed that Chlorantraniliprole and Flubendiamide proved to be highly efficient in controlling budworm infestations. Shrihari (2021) [12] reported that the lowest mean per cent infested buds was found in a plot treated with Flubendiamide 480 SC @ 0.0075 ml/l (10.78%), followed by Chlorantraniliprole 18.5 SC @ 0.2 ml/l (11.47%) and Emamectin benzoate 5 SG @ 0.2 g/l (13.53%). Srikanta *et al.* (2024) [13] found Chlorantraniliprole 18.5 SC (0.2 ml/l) demonstrated superior effectiveness with a recorded mean per cent of affected buds as low as 0.83.

Yield and Economics

Significant variations on yield (Table 3.) was also observed in the experiment by the spraying of insecticides. Application of Chlorantraniliprole 18.5 SC at 0.008 per cent recorded highest flower yield (5800.00 kg/ha), which was at par with Flubendiamide 39.35 SC at 0.0096 per cent (5793.33 kg/ha). The lowest yield (4717.67 kg/ha) was obtained in the untreated control. However, the maximum (22.97%) increase in flower yield over control was calculated from the plots treated with Chlorantraniliprole 18.5 SC at 0.008 per cent, which was at par with Flubendiamide 39.35 SC at 0.0096 per cent (22.83%). While, the lowest increase in yield over control was exhibited in a plot treated with Quinalphos 25 EC at 0.05 per cent (5.23%) and Emamectin benzoate 5 SG at 0.002 per cent (5.37%). The highest realization (108333 ₹/ha) was obtained in the treatment of Chlorantraniliprole 18.5 SC (0.008 %) which was at par with Flubendiamide 39.35 SC (0.0096 %) (107666 ₹/ha). Followed by Diflubenzuron 25 WP (0.015 %), Profenophos 50 EC (0.1 %) and Emamectin benzoate 5 SG (0.002 %). Whereas, the highest (1:11.50) incremental cost benefit ratio was obtained when the crop was treated with Flubendiamide 39.35 SC at 0.0096 per cent, which was at par with Chlorantraniliprole 18.5 SC at 0.008 per cent (1:10.44). Whereas, the lowest (1:7.28) incremental cost benefit ratio was found in the treatment of Diflubenzuron 25WP at 0.015 per cent.

Table 2: Bio-efficacy of insecticides against jasmine bud borer, *H. duplifascialis* (Hampson)

| Tr. No. | Treatments | Conc. (%) | Mean per cent damaged buds | | | | | | | | | | | Pooled over sprays |
|----------------|-----------------------------|-----------|----------------------------|-------------------|------------------|------------------|-------------------|------------------|------------------|------------------|-------------------|-------------------|------------------|--------------------|
| | | | BS | First spray | | | | | Second spray | | | | | |
| | | | | 3 DAT | 7 DAT | 10 DAT | 14 DAT | Pooled | 3 DAT | 7 DAT | 10 DAT | 14 DAT | Pooled | |
| T ₁ | Emamectin Benzoate 5 SG | 0.01 | 20.28 (12.13) | 18.67b (10.26) | 16.90b (8.53) | 18.12b (9.77) | 19.68b (11.34) | 18.34b (9.98) | 17.92b (9.56) | 15.54b (7.24) | 18.08b (9.66) | 20.16b (11.87) | 17.69b (9.40) | 18.01b (9.69) |
| T ₂ | Chlorantraniliprole 18.5 SC | 0.005 | 20.04 (12.32) | 14.15a (5.99) | 11.67a (4.12) | 14.41a (6.20) | 14.39a (6.28) | 13.65a (5.65) | 13.04a (5.10) | 11.25a (3.81) | 14.58a (6.34) | 16.63a (8.19) | 13.71a (5.74) | 13.68a (5.69) |
| T ₃ | Diflubenzuron 25 WP | 0.012 | 21.05 (12.91) | 18.72b (10.31) | 16.99b (8.56) | 18.04b (9.65) | 19.34b (10.99) | 18.27b (9.88) | 17.87b (9.42) | 15.63b (7.27) | 18.48b (10.13) | 20.12b (11.84) | 17.80b (9.46) | 18.03b (9.67) |
| T ₄ | Flubendiamide 39.35 SC | 0.06 | 20.75 (12.61) | 13.93a (5.94) | 12.30a (4.72) | 14.32a (6.21) | 15.05a (6.85) | 13.90a (5.93) | 13.00a (5.17) | 11.03a (3.85) | 14.20a (6.02) | 16.67a (8.22) | 13.84a (5.91) | 13.87a (5.92) |
| T ₅ | Profenophos 50 EC | 0.015 | 20.34 (12.14) | 18.72b (10.29) | 16.92b (8.51) | 18.16b (9.75) | 19.61b (11.28) | 18.35b (9.96) | 17.65b (9.20) | 14.91b (6.62) | 18.36b (9.95) | 20.11b (11.95) | 17.73b (9.40) | 18.04b (9.68) |
| T ₆ | Quinalphos 25 EC | 0.0025 | 21.86 | 22.87c | 20.30c | 21.41c | 22.91c | 21.88c | 20.96c | 17.81c | 21.64c | 23.27c | 20.92c | 21.40c |

| | | | | | | | | | | | | | | |
|----------------|---------------|------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | | (13.91) | (15.13) | (12.04) | (13.34) | (15.15) | (13.92) | (12.79) | (9.35) | (13.68) | (15.64) | (12.87) | (13.39) |
| T ₇ | Control | 0.03 | 22.57 (14.74) | 25.78d (18.97) | 26.35d (19.72) | 25.14d (18.06) | 25.72d (18.83) | 25.75d (18.89) | 24.60d (17.33) | 21.66d (13.63) | 24.63d (17.35) | 26.79d (20.33) | 24.42d (17.16) | 25.08d (18.03) |
| S.Em. ± | | | | | | | | | | | | | | |
| | Treatment (T) | - | 1.69 | 0.82 | 0.96 | 0.98 | 0.98 | 0.46 | 0.80 | 0.96 | 0.92 | 0.90 | 0.44 | 0.34 |
| | Spray (S) | - | - | - | - | - | - | - | - | - | - | - | - | 0.18 |
| | Period (P) | - | - | - | - | - | - | 0.35 | - | - | - | - | 0.33 | 0.26 |
| | T x S | - | - | - | - | - | - | - | - | - | - | - | - | 0.48 |
| | T x P | - | - | - | - | - | - | 0.93 | - | - | - | - | 0.88 | 0.68 |
| | S x P | - | - | - | - | - | - | - | - | - | - | - | - | 0.37 |
| | T x S x P | - | - | - | - | - | - | - | - | - | - | - | - | 0.97 |
| CD at 5% | | | | | | | | | | | | | | |
| | Treatment (T) | - | NS | 2.53 | 2.95 | 3.03 | 3.01 | 1.33 | 2.47 | 2.96 | 2.85 | 2.78 | 1.25 | 0.94 |
| | Spray (S) | - | - | - | - | - | - | - | - | - | - | - | - | 0.50 |
| | Period (P) | - | - | - | - | - | - | 1.00 | - | - | - | - | 0.94 | 0.71 |
| | T x S | - | - | - | - | - | - | - | - | - | - | - | - | NS |
| | T x P | - | - | - | - | - | - | NS | - | - | - | - | NS | NS |
| | S x P | - | - | - | - | - | - | - | - | - | - | - | - | 1.01 |
| | T x S x P | - | - | - | - | - | - | - | - | - | - | - | - | 2.68 |
| | CV % | - | 13.93 | 7.49 | 9.56 | 9.21 | 8.66 | 8.73 | 7.78 | 11.02 | 8.62 | 7.61 | 8.43 | 9.15 |

*Figures in parentheses are retransformed values and those outside are $\sqrt{(x + 0.5)}$ transformed value

BS- Before spray DAT- Days after treatment NS- Non-significant

Treatment means with the letter(s) in common are not significant by DNMRT at 5 per cent level of significance.

Significant parameters and its interactions: T, P, S, T x S, T x P, S x P and T x S x P

Split plot method used for pooled over sprays

Table 3: Yield and economics of jasmine influenced by effect of insecticides against bud borer, *H. duplifascialis* (Hampson)

| No. | Treatment | Conc. (%) | Yield (kg/ha) | Yield increase over control (%) | Realization (₹/ha) | ICBR |
|----------------|-----------------------------|-----------|---------------|---------------------------------|--------------------|---------|
| T ₁ | Emamectin Benzoate 5 SG | 0.002 | 4970.00 | 5.37 | 25333 | 1:9.07 |
| T ₂ | Chlorantraniliprole 18.5 SC | 0.008 | 5800.00 | 22.97 | 108333 | 1:10.44 |
| T ₃ | Diflubenzuron 25 WP | 0.015 | 5083.33 | 7.77 | 36667 | 1:7.28 |
| T ₄ | Flubendiamide 39.35 SC | 0.0096 | 5793.33 | 22.83 | 107667 | 1:11.50 |
| T ₅ | Profenophos 50 EC | 0.1 | 5050.00 | 7.07 | 33333 | 1:8.42 |
| T ₆ | Quinalphos 25 EC | 0.05 | 4963.33 | 5.23 | 24667 | 1:7.34 |
| T ₇ | Control | - | 4717.67 | - | - | - |
| | S.Em. ± | | 172.33 | | - | - |
| | CD at 5% | | 531.02 | | - | - |
| | CV % | | 5.74 | | | |

Conclusion

The order of effectiveness of synthetic insecticides against the jasmine bud borer, *H. duplifascialis* was found to be Chlorantraniliprole 18.5 SC (0.008 %) > Flubendiamide 39.35 SC (0.0096 %) > Diflubenzuron 25 WP (0.015 %) > Profenophos 50 EC (0.1 %) > Emamectin benzoate 5 SG (0.002 %) > Quinalphos 25 EC (0.05 %). The highest flower yield (5800.00 kg/ha) was obtained when the plot was treated with Chlorantraniliprole 18.5 SC at 0.008 per cent, which was at par with Flubendiamide 39.35 SC at 0.0096 per cent (5793.33 kg/ha). The highest incremental cost benefit ratio (1:11.50) was found in the plot treated with Flubendiamide 39.35 SC at 0.0096 per cent, which was at par with Chlorantraniliprole 18.5 SC at 0.008 per cent (1:10.44).

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