Pest Management in Horticultural Ecosystems
Vol. 27, No.2 pp 147-152 (2021)

Evaluation of insecticides and biorationals against bud worm, *Hendecasis duplifascialison* Hampson on jasmine

HANUMANTHAPPA SHRIHARI[1], A. PRABHURAJ[2], ARUNKUMAR HOSAMANI[3] and SUSHILA NADAGOUDA[2]

[1]Agricultural Extension Education Centre, Huvinahadagali, Ballari Dist., Karnataka, India

[2]College of Agriculture, Raichur, India

[3]University of Agricultural Sciences, Raichur, Karnataka, India

E-mail: hmpento@rediffmail.com, hmpento@gmail.com

ABSTRACT: Field experiments were conducted to study the efficacy of newer molecules against jasmine budworm *Hendecasis duplifascialison* Hampson during *kharif*, 2017 and 2018. The results revealed that the lowest mean per cent infested buds was recorded with flubendiamide 39.35 SC @ 0.075 ml/l followed by chlorantraniliprole 18.5 SC @ 0.2ml/l, emamectin benzoate 5 SG @ 0.2 g/l, lambda-cyhalothrin 5 EC, *Bacillus thurengiensis*, diclorovas 76 EC and commercial neem. Similarly the maximum flower yield of 7215.33 kg/ ha was obtained with flubendiamide 39.35 SC followed by chlorantraniliprole 18.5 SC (6925.67 kg/ha), emamectin benzoate 5 SG @ (6453.67 kg/ha), lambda-cyhalothrin 5 EC (6331.33 kg/ha) whereas, lowest flower yield was recorded in untreated control (2549.33 kg/ha).

Keywords: Jasmine**,** bud worm, per cent incidence, flower yield

INTRODUCTION

Jasmine (*Jasminum* spp.) is one of the most marketable traditional flowers of India. It is exquisitely scented to soothe and refresh, and one of the oldest fragrant flowers cultivated by man. The genus *Jasminum* which belongs to the family Oleaceae comprises of more than 200 species and is mostly tropical in distribution (Khader and Kumar, 1995). It is one of the most sought after flowers in all religious, social and cultural ceremonies (Thakur *et al.,* 2014). In south India, large quantities of jasmine flowers are used by women folk for adorning their hairs, making garlands, floral decoration of the wedding ceremony and for religious offerings. The flowers are also used for the production of perfumes and attars (Arumugam *et al.,* 2002). Apart from flower, other parts of jasmine like leaf, stem, bark and root are also used for medicinal purposes (Bose and Yadav, 1989). India exports jasmine flowers to the neighboring countries like Sri Lanka, Singapore, Malaysia and Gulf. There are about ninety *Jasminum* species found in India (Muthukrishnan and Pappiah, 1980), of these only twenty species are cultivated in South India. In Karnataka the most commonly cultivated jasmine species are *Jasminum sambac* Ait. (vernacular name: Dundu mallige), *Jasminum auriculatum* Vohl. (vernacular name: Sooji mallige), *Jasminum grandiflorum* L. (vernacular name: Jaji mallige) and *Jasminum multifloum* Andre. (vernacular name: Kakada or Bengalore jasmine) (Ashoka *et al*., 2017).

Jasmine flower is native to India cultivated over an area of 25,530 hectares with a production of 1,87,190 tonnes of loose flowers and 10,710 tonnes of cut flowers in 2017-18 (Annon., 2017). The largest area under jasmine cultivation lies in Tamil Nadu and Karnataka from where it is distributed to metropolitan cities. Karnataka is the second highest producer of jasmine flowers with a production of 43,600 tonnes from an area of 6,600 hectares (Anon., 2017). The major jasmine growing districts are Bengaluru, Belagavi, Ballari, Bidar, Bijapur, Chitradurga, Dhakshina Kannada, Dharwad, Kolar, Hassan, Kodagu, Shivamogga, Mandya, Mysuru and Tumkur.

Since the commercial value of the Hadagli jasmine is high due to its GI tag and special flower characters, farmers are resorting to high input cultivation. Over the years this has resulted in increased biotic stresses in the form of insect and mite pests. They form a major suppression factor and their management assumes an important task, as these cause considerable direct damage to the crop in general and flower in particular. Jasmine is being attacked by more than twenty insect pests and mites. Among the different pests like, bud and shoot web worm (*Elasmopalpus jasminophagus* Hampson), blossom midge (*Contarinia maculipennis* Felt.) and eriophyid mite and redspider mites the bud borer, *Hendecasis duplifascialis* Hompson found to directly cause heavy damage to flowers which are the commercial products (Reddy *et al*., 1978). The larvae of bud worm feed on the innermost petals of the closed bud in the initial stages and emerge through a circular hole made usually on the tubular portion of the corolla for tunneling into other buds causing damage up to 40-50 per cent and yield loss of 30-70 per cent (Kamala *et al*., 2017).

Farmers are clueless about the existing problem due to budworm in Hadagali jasmine and they are following non-scientific mode of pest management practices without understanding efficacy of novel chemicals or bio-agents and botanicals. In keeping the above views, the present study was carried out to know the effective chemicals for the management of budworm in Hadagali jasmine.

MATERIALS AND METHODS

Field experiment was conducted to manage the bud worm, *Hendecasis duplifascialis*. Ten treatments including untreated control were imposed in Randomized Block Design with three replications during the year 2017-18 for two seasons at Huvinahadagali, Bellary Dist., Karnataka. For conducting the experiment, five to six year old bushes were selected, with four bushes in each plot for each treatment and tagged. After taking first count on healthy and damaged, the buds were removed from the bushes and insecticides were sprayed with hand operated knapsack sprayer. Totally two sprays were imposed at peak coincidence during July and August months in one cropping season.

The observations were made from the selected shoots at one day before spray and two, seven, 14 and 20 days after each spray. The per cent bud damage was calculated by recording total number of flower buds and number of flower buds damaged with bored holes.

Flowers were harvested from individual treatments daily and weighed in kilograms and recorded the same throughout the flowering season (from April to September). The plot yield was extrapolated into kg per hectare.

Table 1. Effect of insecticides on budworm, *Hendecasis duplifascialis* on jasmine during *kharif* 2017

Treatment	Dosage/ litre	Per cent bud damage						Reduction over control (%)
		1 DBS	2 DAS	7 DAS	14 DAS	20 DAS	Mean	
Flubendiamide 39.35 SC	0.075 ml	27.32 (31.51)[a]	15.71 (23.35)[a]	2.03 (8.18)[a]	5.22 (13.21)[a]	5.70 (13.81)[a]	11.20	60.61
Emamectin benzoate 5 SG	0.2 g	25.74 (30.49)[a]	16.70 (24.12)[a]	5.17 (13.14)[b]	10.64 (19.04)[c]	10.45 (18.86)[b]	13.74	51.66
Chlorantraniliprole 18.5 SC	0.2 ml	25.32 (30.21)[a]	15.60 (23.27)[a]	3.02 (10.01)[a]	7.16 (15.52)[b]	7.48 (15.88)[a]	11.72	58.77
Lambdacyhalothrin 5 EC	0.5 ml	25.95 (30.62)[a]	19.08 (25.90)[b]	6.84 (15.16)[c]	13.03 (21.16)[d]	13.10 (21.22)[c]	15.60	45.11
Dichlorvos 76 EC	0.5 ml	25.22 (30.14)[a]	21.13 (27.36)[bc]	11.13 (19.49)[e]	14.18 (22.12)[e]	14.41 (22.31)[cd]	17.21	39.44
Bacillus thuringiensis var. *Kurustroki* 0.5 % WP	1.0 ml	24.08 (29.39)[a]	21.25 (27.45)[bc]	8.86 (17.32)[d]	14.44 (22.34)[ef]	14.69 (22.54)[cd]	16.67	41.36
Metarhizium anisopliae 1X10[8]	3.0 g	26.59 (31.04)[a]	21.93 (27.92)[cd]	12.04 (20.30)[ef]	16.03 (23.61)[f]	18.50 (25.48)[e]	19.02	33.08
Commercial Neem 1500 ppm	3.0 ml	25.17 (30.11)[a]	22.71 (28.46)[cd]	13.10 (21.22)[f]	15.16 (22.91)[ef]	15.55 (23.23)[d]	18.34	35.48
Neem cake	200 kg/ ac	26.03 (30.68)[a]	23.96 (29.31)[d]	19.36 (26.11)[g]	21.29 (27.48)[g]	22.11 (28.05)[f]	22.55	20.66
Control	--	25.35 (30.23)[a]	28.29 (32.13)[e]	29.16 (32.68)[h]	28.98 (32.57)[h]	30.32 (33.41)[g]	28.42	0.00
S. Em. ±		**1.12**	**0.65**	**0.46**	**0.48**	**0.59**		
C.D. at 5%		**NS**	**1.89**	**1.35**	**1.41**	**1.72**		
CV (%)		**9.86**	**12.05**	**9.44**	**11.45**	**13.72**		

Note: DBS- day before spray, DAS- days after spray
Figures in the parentheses are arcsine transformed values

RESULTS AND DISCUSSION

Efficacy of newer insecticides was screened against *H. duplifascialis*. The studies were carried out during *kharif*, 2017 and 2018 and results of the effectiveness of chemicals are furnished here.

First season (pooled *kharif*, 2017)

Pooled results of treatments imposed during the first season of the year 2017 revealed that, the minimum per cent bud damage was reported in flubendiamide 39.35 SC, chlorantraniliprole 18.5 SC, emamectin benzoate 5 SG and found superior at all the spray intervals. The mean per cent bud damage was also very less in flubendiamide 39.35 SC (11.20), chlorantraniliprole 18.5 SC (11.72), emamectin benzoate 5 SG (13.74), lambdacyhalothrin (15.60), *B. thurengiensi* (16.67). Neem cake (22.55) was not found effective compared to all the treatments and control recorded 28.42 per cent bud damage. With respect to the per cent reduction over control, the maximum reduction in infestation was in flubendiamide (60.61) followed by chlorantraniliprole (58.77) compared to rest of the treatment application (Table 1).

Second season (pooled *Karif*, 2018)

The overall efficacy of the treatments imposed during the second season of 2018. The pooled results revealed that, the lowest mean per cent bud damage confirmed in flubendiamide 39.35 SC (10.45), chlorantraniliprole

Table 2. Effect of insecticides on budworm, *Hendecasis duplifascialis* on jasmine during *kharif* 2018

Treatment	Dosage/ litre	Per cent bud damage						Reduction over control (%)
		1 DBS	2 DAS	7 DAS	14 DAS	20 DAS	Mean	
Flubendiamide 39.35 SC	0.075 ml	23.53 (29.02)[a]	15.59 (23.25)[a]	2.02 (8.17)[a]	5.30 (13.31)[a]	5.82 (13.936)[a]	10.45	67.34
Emamectin benzoate 5 SG	0.2 g	23.91 (29.28)[a]	16.58 (24.03)[ab]	5.17 (13.14)[b]	10.71 (19.11)[c]	10.57 (18.97)[b]	13.39	54.75
Chlorantraniliprole 18.5 SC	0.2 ml	23.50 (29.00)[a]	15.48 (23.17)[a]	3.02 (10.00)[a]	7.23 (15.60)[b]	7.60 (16.01)[a]	11.37	61.58
Lambdacyhalothrin 5 EC	0.5 ml	24.12 (29.42)[a]	18.96 (25.82)[abc]	6.83 (15.15)[bc]	13.11 (21.23)[d]	13.39 (21.46)[c]	15.28	48.35
Dichlorvos 76 EC	0.5 ml	23.39 (28.93)[a]	21.01 (27.28)[bcd]	11.12 (19.48)[d]	14.53 (22.40)[de]	14.64 (22.50)[c]	16.94	42.75
Bacillus thuringiensis var. *Kurustroki* 0.5 % WP	1.0 ml	22.26 (28.15)[a]	21.13 (27.37)[bcd]	8.86 (17.32)[c]	14.71 (22.56)[de]	14.81 (22.63)[c]	16.35	44.73
Metarhizium anisopliae 1X10^8	3.0 g	24.77 (29.85)[a]	21.64 (27.72)[cd]	12.03 (20.29)[d]	16.11 (23.66)[e]	18.79 (25.68)[d]	18.67	36.91
Commercial Neem 1500 ppm	3.0 ml	23.3 4 (28.89)[a]	22.59 (28.38)[cd]	13.10 (21.22)[d]	14.71 (22.55)[de]	15.50 (23.19)[c]	17.85	39.68
Neem cake	200 kg/ ac	24.21 (29.47)[a]	23.84 (29.23)[d]	19.36 (26.10)[e]	21.36 (27.53)[f]	22.39 (28.24)[e]	22.23	24.87
Control	--	25.50 (30.33)[a]	28.17 (32.06)[e]	30.61 (33.59)[f]	31.54 (34.17)[g]	32.12 (34.52)[f]	29.59	--
S. Em. ±		**0.86**	**1.01**	**0.53**	**0.44**	**0.52**		
C.D. at 5%		**NS**	**2.96**	**1.55**	**1.28**	**1.52**		
CV (%)		**10.11**	**11.14**	**10.65**	**12.60**	**14.53**		

Note: DBS- day before spray, DAS- days after spray
Figures in the parentheses are arcsine transformed values

Table 3. Effect of insecticides on budworm, *Hendecasis duplifascialis* on jasmine (Two season data pooled*)

Treatment	Dosage/ litre	Per cent bud damage						Reduction over control (%)	Flower Yield (Kg/ ha)
		1 DBS	2 DAS	7 DAS	14 DAS	20 DAS	Mean		
Flubendiamide 39.35 SC	0.075 ml	25.43 (30.28)[a]	15.65 (23.30)[a]	2.02 (8.18)[a]	5.26 (13.26)[a]	5.57 (13.65)[a]	10.78	62.61	7215.33
Emamectin benzoate 5 SG	0.2 g	24.83 (29.89)[a]	16.64 (24.07)[ab]	5.17 (13.14)[b]	10.68 (19.07)[c]	10.32 (18.73)[c]	13.53	53.11	6453.67
Chlorantraniliprole 18.5 SC	0.2 ml	24.41 (29.61)[a]	15.54 (23.22)[a]	3.02 (10.01)[a]	7.20 (15.56)[b]	7.19 (15.55)[b]	11.47	60.23	6925.67
Lambdacyhalothrin 5 EC	0.5 ml	25.04 (30.02)[a]	19.02 (25.86)[bc]	6.84 (15.16)[c]	13.07 (21.20)[d]	13.02 (21.15)[d]	15.40	46.62	6331.33
Dichlorvos 76 EC	0.5 ml	24.31 (29.54)[a]	21.07 (27.32)[cd]	11.13 (19.48)[e]	14.45 (22.34)[e]	14.08 (22.04)[de]	17.00	41.05	4987.33
Bacillus thuringiensis var. *Kurustroki* 0.5 % WP	1.0 ml	23.17 (28.77)[a]	21.19 (27.41)[cde]	8.86 (17.32)[d]	14.68 (22.53)[e]	14.16 (22.11)[de]	16.41	43.10	5282.33
Metarhizium anisopliae 1X10[8]	3.0 g	25.68 (30.45)[a]	21.78 (27.82)[de]	12.03 (20.30)[ef]	16.07 (23.63)[f]	18.45 (25.44)[f]	18.80	34.81	4343.00
Commercial Neem 1500 ppm	3.0 ml	24.25 (29.50)[a]	22.65 (28.42)[de]	13.10 (21.22)[f]	14.93 (22.73)[ef]	15.17 (22.92)[e]	18.02	37.52	4525.67
Neem cake	200 kg/ ac	25.12 (30.08)[a]	23.90 (29.27)[e]	19.36 (26.10)[g]	21.33 (27.50)[g]	21.89 (27.90)[g]	22.32	22.63	3612.67
Control	--	25.43 (30.28)[a]	28.23 (32.10)[f]	29.88 (33.14)[h]	30.26 (33.37)[h]	30.42 (33.48)[h]	28.85	–	2549.33
S. Em. ±		**0.74**	**0.65**	**0.43**	**0.34**	**0.43**			**340.87**
C.D. at 5%		**NS**	**1.89**	**1.24**	**1.01**	**1.24**			**994.98**
CV (%)		**6.71**	**7.10**	**8.61**	**5.24**	**6.39**			**14.70**

Note: DBS- day before spray, DAS- days after spray
Figures in the parentheses are arcsine transformed values, * Mean of four sprays

18.5 SC (11.37) and emamectin benzoate 5 SG (13.39) andfound superior to all the treatments. Further, highest per cent reduction of bud damage over control witnessed in flubendiamide (67.34) followed by chlorantraniliprole 18.5 SC (61.58), emamectin benzoate 5 SG (54.75), lambdacyhalothrin 5 EC (48.35), *B. thurengiensis* (44.73), diclorovas 76 EC (42.75), commercial neem (39.68) and *M. anisopliae* (36.91). Very negligible per cent reduction in bud damage reported in neem cake (24.87) (Table 2).

The present investigations are in close agreement with the reports of Sudhir (2002) who found that indoxacarb 14.5 SC at 0.0073 per cent and spinosad 45 SC at 0.023 per cent were effective. Similarly, efficacy of clorantriniliprole (at 0.1 ml/ l) is supported by the results of Roopini (2016).

The chlorantraniliprole used in the present study is a new chemical under anthranilic diamide group with green label. Its superior efficacy could be due to novel mode of action. It activates ryanodine receptors via stimulation of the release of calcium stores from the sarcoplasmic reticulum of muscle cells (i.e., for chewing insect pests) causing impaired regulation, paralysis and ultimately death of sensitive species (Cordova et al., 2006). In the same line, the differential selectivity of chlorantraniliprole is towards insect ryanodine receptors that explains the outstanding profile of low mammalian toxicity. It is active on chewing pests primarily by ingestion and secondarily by contact, and shows good ovilarvicidal and larvicidal activity (Bassi et al., 2007). Lambda cyhalothrin was also effective and this is in line with the report of Suganthi et al. (2006).

The present study is also in line with the results of Harini *et al.* (2018), who conducted the field experiment in Killikulam and Tuticorin, India, during summer season in 2018.The efficacy of five botanicals and eleven insecticides were evaluated against jasmine bud worm, *H. duplifascialis* (Hampson) infesting *J. sambac*. Chlorantriniliprole 18.5 SC at 0.1 ml/l, flubendiamide 39.35 SC at 0.75 ml/l, thiacloprid 21.7 SC at 0.30 ml/l, dimethoate 30 EC at 2.0 ml/l and novaluron 10 EC at 1.00 ml/l recorded lower infestation of 6.21, 6.64, 7.64, 7.92 and 13.69 per cent infested buds per five clusters per 10 plants, respectively. Among, the botanicals NSKE at 5.0 per cent and pongamia oil at 2.0 per cent was superior against budworm followed by pongamia oil at 2.0 per cent with 81.67 and 76.10 per cent reduction, respectively.

After the newer insecticides the neem based products were found better. These findings are in agreement with the results of experiment conducted by Neelima (2005) according to them neem products, NSKE was effective in reducing bud borer *H. duplifascialis* damage. Similarly, Peaula and Muthusamy (2016) reported the efficacy of neem oil and pungam oil for the management of the jasmine budworm (*H. duplifacialis* Hampson) in the laboratory.

In present investigation, *B. thurengiensis* also was equally effective as that of lambda cyhalothrin. This finding is in close agreement with Hemalatha (2009) who observed that application of *B. thuringiensis* at 0.1 per cent was the most effective treatment against jasmine budworm, *H. duplifascialis.* Pillai et al. (2016) reported the efficacy of entomopathogens against jasmine pests. Efficacy of *B. thuringiensis* is also documented by Mirlin and Kennedy (2016) against jasmine bud worm e under both *in vitro* and field conditions.

Yield

The effect of different insecticides sprays on flower yield is presented in the Table 53. As per the results obtained, the impact of insecticides application on flower yield was significantly higher in treated plots than untreated control. The highest flower yield per hectare was recorded in flubendiamide 35.35 SC (7215.33 kg) followed by chlorantraniliprole 18.5 SC (6925.67 kg), emamectin benzoate 5 SG (6453.67 kg), lambdacyhalothrin 5 EC (6331.33 kg), *B. thurengiensis* (5282.33 kg), dichlorvos 76 EC (4987.31 kg), commercial neem (4525.67 kg). Least yield was recorded in untreated control (Table 3).

ACKNOWLEDGEMENTS

Authors are very much grateful to the Agricultural Extension Education Centre, Huvinahadagali, Ballari district for providing the laboratory and field facilities for conducting the experiment. All sort of assistance rendered by the Head of the Department, Dept. of Agricultural Entomology, College of Agriculture, Raichur for the above study is gratefully acknowledged.

REFERENCES

Anonymous, *Annu. Rep*. (2017-18). Indian Hort. Database. NHB Ministry of Agriculture, Government of India, 2017. 286 p.

Arumugam,T., Jawaharlal, M., Vijaykumar, M. and Bhattacharjee, S. K. 2002. Jasmine Technical Bulletin No. 17. *Indian Agricultural Research Institute,* New Delhi (India).

Ashoka, N., Shrinivasulu, G. B., Anupama, G., Harshavardhan, M. and Kattimani, K.N. 2017. Economic analysis of production and marketing of jasmine in Hyderabad-Karnataka Region: A case in Koppal district, India. *International Journal Current Microbiology Applied Sciences,* **6** (9): 1702-1711.

Bassi, A., Alber, R., Wiles, J. A., Rison, J. L., Frost, N. M., Marmor, F. W. and Marcon, P. C. 2007. Chlorantraniliprole: A novel anthranilic diamide insecticide. In: *XVI Intl. plant Protection Congress.* 2007; 10-12th October, Berlin.

Bose, T. K. and Yadav, L. P. 1989. Commercial flowers, Naya Prakash, Culcutta, India. 487-544 p.

Cordova, D., Benner, E. A., Sacher, M. D., Rauh, J. J., Sopa, J. S., Lahm, G. P., Seleby, T. P., Stevenson, T. M., Flexner, L., Gutteridge, S., Rhoades. D. F., Wu, L., Smith, R. M. and Tao, Y. 2006. *Anthranilic diamides*: A new class of insecticides with novel mode of action, ryanodine receptor activation. *Pesticide Biochemistry and Physiology*, **84**: 196-214.

Gopalakrishna, K., Pillai, C. J., Nethravathi, P. N., Visalakshy, G. and Swathi, C. 2016. Bio-efficacy of fungal pathogens against jasmine gallery worm, *Elasmopalpus jasminophagus* (Lepidoptera: Phycitidae). *Pest Management Horticultural Ecosystems,* **22** (1): 67-70.

Harini, K., Elanchezhyan, K., Murugesan, N., Allwin, L. and Prabhu, T. 2018. Seasonal incidence and management of budworm, *Hendecasis duplifascialis* (Hampson) in *Jasminum Sambac* L. *International Journal of Advanced Agricultural Science. Technolology,* **8** (2): 42-51.

Hemalatha, G. 2009. Biorational management of key pests of jasmine (*Jasminum sambac*) *M. Science (Agricultural) Thesis*, Kerala Agr. Univ., Thrissur (India).112 p.

Kamala, I. M., Kennedy, J. S. and Devanand, I. I. 2017. Technology gaps analysis and prominence of blossom midge, *Contarinia maculipennis* felt of jasmine (*Jasminum sambac* I.) in Tamilnadu. *Indian Journal of Ecology,* **44** (3): 604-607.

Khader, A. J. B. and Kumar, N. 1995. Genetic resources of jasmine. In: Advances in horticulture, ornamental plants. Malhotra Publishing House (India), New Delhi, 121-132 p.

Mirlin, K. I. and Kennedy, J. S. 2016. Evaluation of microbial agent against jasmine budworm, *Hendecasis duplifascialis* Hompson in jasmine (*Jasminum sambac* L.). *Current Biotica,* **10** (3): 230.-240.

Mirlin, K. I. and Kennedy, J. S. 2018. Evaluation of entomopathogens against blossom midge, *Contarinia maculipennis* Felt in Jasmine (*Jasminum sambac* L.). *Journal of Biological Control,* **32** (2): 121-127.

Muthukrishnan, C. R. and Pappiah, C. M. 1980. Production for commercial crops paper. In: Nat. seminar on production of commercial flowers. University of Agriculture Tamilnadu, 1-3 p.

Neelima, Y. 2005. Bio-ecology and management of jasmine pests, *M. Sc. (Agri.) Thesis,* Acharya N. G. Ranga Agricultural University, Rajendra nagar, Hyderabad, 87 p.

Peaula, P. C. and Muthusamy, M. 2016. Effect of neem oil, pungam oil and monocrotophos against the larvae of jasmine budworm *Hendecasis duplifacialis* (Pyraustidae: Lepidoptera). *International Journal of Advancement in Life Science Research,* **9** (2): 185-189.

Reddy, A. S., Krishnamurthy Rao, B. H. and Wilson Y. 1978. Chemical control of jasmine pests. *South Indian Horticulture,* **26:** 25-27.

Sudhir, B. 2002. Survey and management of insect and mite pests of *Jasminum* spp., *M. Sc. Thesis,* University of Agricultural Sciences, Dharwad, 86 p.

Suganthi, A., Chandrasekaran, S.and Regupathy, A.2006. Bio-efficacy of lambda-cyhalothrin against bud worm, *Hendecasis duplifascialis* (Hampson) on jasmine. *Pesticide Research Journal,* **18** (2): 138-140.

Thakur, A., Naqvi, S. M. A., Aske, D. K. and Sainkhediya. 2014. Study of some ethno-medicinal plants used by tribals of Alirajpur, Madhya Pradesh, India. *Research Journal Agriculture and Forestry Sciences,* **2** (4): 9-12.

MS Received 23 August 2021
MS Accepted 15 October 2021