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HOST SPECIES PREFERENCE AND FLOWER BUD PARAMETER INFLUENCING THE BUD DAMAGE IN JASMINE BY BUD BORER, *ELASMOPALPUS JASMINOPHAGUS* HAMPSON (LEPIDOPTERA: PYRALIDAE)

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ABSTRACT
Among the five jasmine species considered, only *Jasmine multiflorum* and *Jasmine sambac* were infested by the bud borers. Variation in flower bud and cluster characteristics were observed among different jasmine species. The mean number of buds per cluster and inter cluster distance was high in *Jasmine multiflorum* compared to other species. Whereas inter bud distance was lower in case of *Jasmine multiflorum* and *Jasmine rigidium*. Bud length and weight was higher in *Jasmine multiflorum* while the bud diameter was greater in *Jasmine sambac*. There was high positive correlation between bud damage and the number of buds present in a cluster and bud weight hence *Jasmine multiflorum* more prone to damage by bud borers. The larvae of both the bud borers *E. jasminophagus* and *H. duplifasciatus* damaged green buds, white buds and open flowers of *Jasmine multiflorum.* There was a high positive correlation between the total bud availability and the extent of damage. Earlier larval instar preferred green buds, while later larval instars preferred white buds and open flowers.

KEYWORDS: Bud damage, Flower cluster, Bud Length, Bud Borer.

INTRODUCTION
Jasmine is one of the oldest fragrant flowers that have been cultivated for various purposes since early times. India is the home for many species of jasmine and three of jasmine species *ie*., *Jasmine sambac* Ait., *Jasminum auriulatum* Vaha and *Jasminum grandiflorum* Linn. have been mentioned in ancient Tamil literature way back to 500BC to 200 A.D. In India Jasmine cultivated throughout country. It roughly occupies an area of about 8000 ha and produces flowers worth rupees eight to ten crores annually (Muthuswammy and Shanmugavelu, 1982). India exports jasmine flowers to the neighboring countries like Srilinka, Singapore, Malasia and Gulf countries. Nearly 15 tones of flowers sold daily in four cities of India *viz*. Madras, Bangalore, Delhi and Calcutta (Bose and Yadav, 1998). A number of insect pests attack jasmine crop and cause considerable damage results in drastic reduction in flower production.

MATERIALS AND METHODS
Flower bud parameters and plant parameters
Various bud parameters and plant parameters of five jasmine species were studied to know their influence on bud damage by borers. About hundreds of white harvestable buds of all the four cultivated jasmine species *J. multiflorum, J .sambac, J.auriculatum* and *J. grandiflorum* and a wild jasmine species *J. rigidium* were harvested to measure various bud parameters. The parameters recorded included total length, bud girth (bud diameter), bud weight and essential oils (Indole content and concrete recovery) present in the bud. Bud girth was measured by using vernier callipers.

Plant parameters recorded include inter cluster distance, inter bud distance within a cluster and the number of buds per cluster. These parameters were measured on five plants in a field. In each plant five branches were selected randomly to record different parameters. The distance between two clusters in each branch was measured by using a common measuring scale. Similarly the distance between the buds within a cluster in all the cluster present in each branch was measured. In case of number of buds per cluster, the total number of buds present in each cluster of each branch was considered.

Species Preference
Free choice and force feeding experiments were carried out to know the species preference of *E. jasminophagus*. In both the experiments, all the stages of jasmine buds *viz,* green bud white bud and open flowers were placed in separate 15 cm diameter petriplate along the periphery on wet blotting paper and the larvae were released at the center. Separate set of experiments were carried out for different instars and observations were recorded after twenty four hours..

In the case of free-choice experiment about five buds of all the jasmine species *J. multiflorum, J. sambac, J. auriculatum* and *J. grandiflorum* were provided simultaneously within petriplates. In each experiment, ten larvae of individual instar were released at the center of the petriplate. The number of buds damaged was recorded after twenty four hours. Each treatment was replicated thrice. Under force-feeding trials different stages of buds, namely green buds, white buds and open flowers of four jasmine species *J.multiflorum, J.sambac, J.auriculatum* and

J.grandiflorum were made available separately to different instar larvae of *E. jasminophagus.* Each experiment was replicated thrice. In each petridish twenty buds were placed on a wet blotting paper and ten larvae were released. After twenty four hours, the number of damaged by each larvae was recorded.

RESULTS AND DISCUSSION

Among the five jasmine species studied during the present investigation *Jasmine multiflorum* and *Jasmine sambac* were observed to be more damaged by the bud bores under filed conditions. Among the two species of jasmine *Jasmine multiflorum* appeared to be the most preferred one and severly damaged by the bud borers. However, Ayyar (1963), David (1958) and Gunasekaran (1989) reported *Jasmine sambac* infested by *H. duplifacialus* and *E. jasminophagus*. In exploring the reasons for this, it appears that differences among the species with respect to flower cluster patterns, and bud parameters and the load of the crude (unprocessed) essential oils seems to be operating. Srivatsava (1995) reported *Jasmine grandiflolurm* contains an indole content of 4.8 mg per 100 g fresh flower weight and concrete recovery (crude essential oil) of 0.28 per cent where there is no indole content and concrete recovery in *Jasmine multiflorum*. Thus, there was strong negative association between the indole content, load of essential oil and extent of damage among the species, going by which the most fragrant species *Jasmine grandiflorum* was least preferred by bud borers while the least fragrant *Jasmine multiflorum* was the most highly preferred (Table 1 and 2). These finding assumes importance in view of the growing popularity of *Jasmine multiflorum* cultivation in Karnataka as indicated by farmers during the survey and because of its flowering throughout year.

Further, the choice of preference for a particular species appears to be related to difference in flower cluster bud parameters (Table1). Among the five species *Jasmine multiflorum* scores high over other species with respect to the number of buds per cluster, bud weight and bud diameter, which when considered tougher make up the food resources made available for larvae. In this regard *Jasmine sambac*, *Jasmine auraiculatum*, *Jasmine grandiflorum* and *Jasmine rigidium* are less preferred in same order. This is further strengthened by the results of multiple correlation analysis of the flower cluster and bud parameter against bud damage by *E. jasminophaus* among different species (Table2). From this analysis, it was observed that the damage was positively correlated with the number of buds, bud weight and decreasing distance between buds within a cluster, which were more a characteristic of *J. multiflorum* than other jasmine species.

Similar trend was observed from the results of free-choice and force feeding trials carried out in the laboratory, where in the there was marketed preference towards the *Jasmine multiflorum* as reflected by a greater number of buds damaged compared to other species (Table 3 & 4). Ayyar (1963), David (1958) and Gunasekaran (1989) reported that both the *H. duplifascialis* and *E. jasminophagus* infesting *Jasmine sambac,* however their observations is not based on any detailed experimental studies but nearly based on filed observation.

TABLE 1: Flower bud characteristics of different jasmine species

Species	ICD(cm)	No. of Buds per cluster		IBD (Cm)		Bud length (cm)		Bud weight (g)		Indole content mg/100 gm fresh flower weight	Concrete recovery (%)
	Mean ± SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
J. multiflrum (n=100)	5.15 ± 1.43	9.34	2.36	12.7	0.16	2.75	0.38	0.15	0.09	0.00	0.00
J. sambac (n=100)	4.87 ± 1.48	3.99	1.26	3.91	1.08	1.76	0.47	0.13	0.08	3.00	0.16
J. auriculatum (n=100)	3.37 ± 0.77	6.35	2.56	4.76	1.86	1.74	0.32	0.04	0.01	3.40	0.32
J. grandiflorum (n=100)	5.00 ± 1.35	2.24	0.72	3.42	2.30	3.64	0.49	0.10	0.08	4.80	0.28
J. rigidium (n=100)	2.26 ± 0.56	2.29	0.87	0.51	0.26	3.55	0.44	0.08	0.01	0.00	0.00

TABLE 2: Multiple correlation between jasmine bud parameter and bud borer damage

	ICD	No of Buds	IBD	Bud Length	Bud weight	Indole	Concrete	Damage
ICD	0.00	0.26	0.07	-0.05	0.32	0.92	-0.14	0.44
No of Buds		0.00	0.03	-0.253	0.11	-0.34	-0.08	0.67
IBD			0.00	-0.49	0.13	0.71	0.56	-0.38
Bud length				0.00	0.15	-0.31	-0.18	0.13
Bud weight					0.00	-0.16	-0.38	0.39
Indole						0.00	0.74	-0.62
Concrete							0.00	-0.74

ICD = Inter Cluster Distance IBD = Inter Bud Distance, n = 422; P<0.05 = 0.195 0.001 = 0.321

Another aspect that has been brought forth by these two experiments in laboratory is that there was a gradual shift in preference for feeding on different types of buds by different larval instars. Thus, the earlier instars larvae tend to feed more on green buds than open flowers while the instar show a preference to feed more on white buds and open flowers (Table 3 & 4). When one tends to view this information generated in laboratory experiments in light of the infestation pattern observed in the field, it can be seen that *E. jasminophagus* female tend to prefer green buds to lay eggs compared other bud types and also earlier instar larvae damaged green buds than other bud types. Also it should be taken in to account that green buds were available in greater number in a given point of time and for

a longer duration compared to other bud types. Further, the studies of Srivastav (1995) reported that green buds contain less essential oil compared to mature buds and open flowers thus green buds were more damaged. When these aspects are taken in to considerations it appears that there could be a strategy adopted by female *E. jasminophagus* for egg laying and also resource allocation for earlier so that the earlier instar can develop by feeding on green buds which contain lesser amount of essential oils. This is further strengthened by results of jasmine species preference by *E. jasminophagus*where in it tends to feed on jasmine species which have lower levels of essential oil (Table 2). This also brings to light that essential oils have a deleterious effect on growth and multiplication of bud borer.

TABLE 3: Extent of damage by *E. jasminophagus* larvae in free choice experiment

Jasmine species	Larval Instars	Extent of Damage (%)*					
		Green Buds **		White Buds **		Open Flower**	
		Mean	SD	Mean	SD	Mean	SD
J. multiflrum	I	4.00 (80.00)	1.00	3.30 (66.67)	1.15	2.00 (40.00)	1.00
	II	3.33 (66.67)	0.57	4.33 (86.67)	0.57	1.67 (33.33)	1.53
	III	3.00 (60.00)	1.00	4.67 (93.33)	0.57	3.00 (60.00)	1.00
	IV	1.67 (33.00)	1.53	5.00 (100.00)	0.00	1.67 (33.33)	1.53
	V	0.00 (0.00)	0.00	1.33 (26.33)	0.57	1.00 (20.00)	1.00
J. sambac	I	0.67 (13.33)	0.57	0.67 (13.33)	0.57	0.67 (13.33)	0.57
	II	1.33 (26.67)	0.57	1.00 (20.00)	1.00	0.67 (13.33)	0.57
	III	0.67 (13.33)	0.57	1.00 (20.00)	1.00	0.33 (6.67)	0.57
	IV	0.33 (6.67)	0.57	2.00 (40.00)	1.00	0.67 (13.33)	0.00
	V	0.00 (0.00)	0.00	0.33 (6.67)	0.57	0.00 (0.00)	0.00
J. auriculatum	I	0.33 (6.67)	0.57	0.00 (0.00)	0.00	0.00 (0.00)	0.00
	II	0.33 (6.67)	0.57	0.33 (6.67)	0.57	0.00 (0.00)	0.00
	III	0.00 (0.00)	0.00	0.00 (0.00)	0.57	0.00 (0.00)	0.00
	IV	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00
	V	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00
J. grandiflorum	I	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00
	II	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00
	III	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00
	IV	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00
	V	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00

TABLE 4: Extent of damage by *E. jasminophagus* larvae in force feeding experiment

Jasmine species	Larval Instars	Extent of Damage (%)*					
		Green Buds **		White Buds **		Open Flower**	
		Mean	SD	Mean	SD	Mean	SD
J. multiflrum	I	16.67 (83.33)	1.15	16.33 (18.67)	0.57	12.67 (46.67)	2.51
	II	15.33 (76.67)	1.52	18.33 (91.67)	1.52	11.67 (68.33)	2.51
	III	12.00 (60.00)	1.00	18.33 (91.67)	1.15	15.00 (70.00)	2.00
	IV	6.00 (30.00)	1.70	18.67 (95.00)	1.15	13.67 (68.33)	2.08
	V	0.00 (0.00)	0.00	7.33 (36.37)	1.15	4.33 (21.67)	1.52
J. sambac	I	8.67 (43.33)	2.51	6.67 (26.67)	2.51	2.67 (13.33)	0.57
	II	10.00 (5.00)	2.64	8.33 (41.67)	2.51	3.33 (16.67)	0.57
	III	4.00 (20.00)	1.00	4.33 (21.67)	1.52	3.67 (18.33)	0.57
	IV	2.33 (11.67)	2.08	4.33 (21.67)	0.57	13.33 (16.67)	0.57
	V	0.00 (0.00)	0.00	3.33 (16.67)	0.00	0.00 (0.00)	0.00
J. auriculatum	I	4.67 (23.33)	1.15	4.00 (21.67)	1.15	2.00 (3.33)	1.15
	II	6.67 (24.33)	0.57	3.33 (31.67)	0.57	0.67 (3.33)	1.15
	III	3.67 (18.33)	0.57	2.67 (13.33)	0.57	0.00 (0.00)	0.00
	IV	1.00 (5.00)	1.73	2.67 (13.33)	0.57	0.00 (0.00)	0.00
	V	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00
J. grandiflorum	I	3.00 (15.00)	1.52	2.67 (13.33)	0.57	0.00 (0.00)	0.00
	II	2.33 (11.67)	0.57	3.67 (18.33)	0.57	0.00 (0.00)	0.00
	III	3.33 (16.67)	0.57	2.67 (13.33)	0.57	0.00 (0.00)	0.00
	IV	0.00 (0.00)	0.00	2.67 (13.33)	0.57	0.00 (0.00)	0.00
	V	0.00 (0.00)	0.00	0.00 (0.00)	0.00	0.00 (0.00)	0.00

**=Number of buds made available=20; *=Mean of three replication; Values in parenthesis are in percentage

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