

Biological attributes of jasmine bud borer, *Hendecasis duplifascialis* hampson under laboratory condition

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Abstract

A laboratory investigation on the biology of the jasmine bud borer, *Hendecasis duplifascialis* was conducted at the Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari, during the summer season of 2024. The life cycle of *H. duplifascialis* comprised four distinct stages: egg, larva (five instars), pupa and adult. Female moths laid eggs singly on the outer surface of unopened flower buds. The mean incubation period of eggs was 3.28 ± 0.44 days. The eggs were oval in shape, with an average length and breadth of 0.63 ± 0.03 mm and 0.54 ± 0.02 mm, respectively. The larval stage consisted of five instars, with a total larval duration of 11.56 ± 1.33 days. The mean duration of the first, second, third, fourth, and fifth instars was 2.76 ± 0.42 , 2.28 ± 0.66 , 1.52 ± 0.70 , 2.40 ± 0.49 , and 2.60 ± 0.80 days, respectively. Among the instars, the fifth instar larva was the largest, recording a mean length of 12.92 ± 0.15 mm and breadth of 2.19 ± 0.05 mm. The pre-pupal period lasted for 2.52 ± 0.51 days. The pupal period averaged 5.40 ± 0.50 days. Adult emergence showed sexual dimorphism, with females being larger than males. The mean longevity of female and male adults was 5.72 ± 0.46 days and 3.72 ± 0.46 days, respectively. The average fecundity of a female moth was 17.68 ± 1.63 eggs. The total life cycle duration from egg to adult emergence was 25.96 ± 1.70 days for females and 23.96 ± 1.54 days for males.

Keywords: *Hendecasis duplifascialis*, Jasmine bud borer, *Jasminum sambac*, Biology

Introduction

Jasmine is an important ornamental flower crop native to tropical and subtropical regions and was introduced in the mid-sixteenth century (Anon. 2020). Jasmine is known as "Queen of Perfume" in the Oleaceae family. There are over 200 species of jasmine, 40 of which are endemic to India. Of these species, *Jasminum sambac* (Gundamalli/Madurai malli), *Jasminum auriculatum* (Mullai) and *Jasminum grandiflorum* (jathimalli/pitchi) are grown commercially. Jasmines are widely cultivated for the unique fragrance of their flowers. In India, jasmine is cultivated for use in rituals like marriages, religious ceremonies and festivals (Balaji *et al.*, 2024) ^[2]. However, most farmers prefer *Jasminum sambac*, an evergreen shrub that grows up to 3 meters high with leaves and flowers (Mohanapriya *et al.*, 2023) ^[6].

Jasmine cultivation is severely affected by insect pests, leading to significant yield losses. It is estimated that approximately 50 different insect pest species infest jasmine plants (Swathy, 2022). Among these, the jasmine bud borer, *Hendecasis duplifascialis* (Hampson) was considered the most devastating pest (Hosamani *et al.*, 2022) ^[5]. The budworm, *Hendecasis duplifascialis*, was first reported in 1896 by Hampson in West Africa, India, recorded in South India and Delhi (David *et al.*, 1958) ^[4]. The jasmine budworm, *Hendecasis duplifascialis* is widely distributed in all jasmine planting areas with jasmine as the only host species. It occurred from April to October, with the ovipositional peaks in July, August and September. A successful management plan requires information about a species biology including its diet and lifecycle, how it interacts with the environment and with other species as well as species behaviour can be manipulated to prevent or reduce yield losses.

Infested flowers turn pinkish-green and drop prematurely. In very large diseases, adjacent buds are interwoven with silk and fed on leaves. The marketable quality of the flower is greatly reduced as the small larvae feed on the flower buds. Jasmine growers often have to use pesticides to control pests. Antibiotics have been shown to be effective, fast-acting and suitable for all conditions.

Materials and Methods

The present investigation on the biology of jasmine bud borer, *H. duplifascialis* was conducted in the PG laboratory, Department of Entomology, N. M. College of Agricultural University, Navsari. To raise the initial culture of *H. duplifascialis*, the infected buds of jasmine along with larvae collected from the unsprayed *Jasminum sambac* var. Barmasi crops grown at a floriculture farm and introduced on the potted plants for the development of laboratory culture. The pupae were collected from the potted plant and kept in petri dishes. These petri dishes were kept inside the oviposition cage for adult emergence. Five per cent sugar solution with cotton swabs was provided in a vial as food for adults. For egg laying fresh unopened branches with buds were placed in a 250 ml conical flask filled with water and plugged with cotton swabs to maintain the turgidity of the plant and the conical flask was placed in an oviposition cage. Branches were replaced with fresh branches at regular intervals. The adult moth on emergence allows for oviposition on the buds. For the purpose of biology, 25 eggs along with fresh buds were kept in petri dishes. The moist cotton swab was provided in petri dishes to maintain the turgidity of the buds. After the hatching of the eggs, fresh buds were provided to the neonate larvae and changed at regular intervals for further study on biology attributes.

Result and Discussion

The results on the biology of budworm, *H. duplifascialis* was given in Table 1 and 2. It was found that jasmine bud borer females lay eggs singly on the outer surface of the petal, sepal and stalk portions of the unopened flower buds under laboratory conditions. The eggs were small in size, oval or round in shape. The freshly laid eggs were translucent white in colour at an initial stage, later it changed into a creamish colour before hatching. Neelima (2005) ^[7] and Samata (2019) ^[8] were reported female moths laid eggs individually in each bud, either on the stalk or around the petals of unopened buds. Swathi (2022) ^[9] and Mohanapriya *et al.* (2023) ^[6] recorded eggs of bud borer were round and creamy white in colour. The length and breadth of eggs ranged from 0.58 to 0.70 mm (0.63±0.03 mm) and 0.50 to 0.58 mm (0.54±0.02 mm). The incubation period of eggs was varied from 3 to 4 days with an average of 3.28±0.44 days. Hatching percentage ranged from 53.85 to 88.46 per cent and the average hatching percentage of eggs was 72.55±7.97 per cent. Mohanapriya *et al.* (2023) ^[6] reported that the length of eggs of *H. duplifascialis* varied from 0.65±0.06 mm while, breadth varied from 0.53±0.05 mm when larvae were reared on jasmine buds.

The larvae passed through five instars. The newly hatched larva was translucent white in colour with the head and prothoracic shield brown in colour. Freshly molted second instar larvae were creamy white or light green in colour with a brown head and a prothoracic shield. The third instar larvae were larger in size with light green and black colour prothoracic shields. The colour of the head capsule was dark back in colour. The fourth instar larvae were greenish in colour with pale hairs distributed throughout the larval body including the head with a prothoracic shield. Four pairs of whitish prolegs are present from 3rd to 6th segments of the larva. The fifth instar larvae were larger in size as compared to the fourth instar larvae. The larval body is dark green in colour with a black head and well-developed prothoracic shield and with few hairs on the body.

The average length of first, second, third, fourth and fifth instar larvae was 6.47±0.09, 6.91±0.12, 8.34±0.12, 9.20±0.11 and 12.92±0.15 mm respectively, while the average breadth was 1.53±0.10, 1.77±0.03, 1.90±0.05, 1.99±0.04 and 2.19±0.05 mm, respectively. When *H. duplifascialis* reared on jasmine buds, the first to fifth instar larval durations were recorded as 2 to 3, 1 to 3, 1 to 3, 2 to 3 and 1 to 4 days, respectively with an average of 2.76±0.42, 2.28±0.66, 1.52±0.70, 2.40±0.49 and 2.60±0.80 days, respectively. The total larval period varied from 9 to 14 days with an average of 11.56±1.33 days. Chaitanya and Kumar (2018) ^[3], Samata (2019) ^[8], Swathi (2022) ^[9] and Mohanapriya *et al.* (2023) ^[6] were reported the average

duration of the larva of jasmine bud borer was 11.60±1.30, 11.00±0.57, 11.15±0.08 and 11.10±1.28 days, respectively.

During the beginning of the pre-pupal stage, the fifth instar larva became sluggish, stopped feeding and then searched for a suitable place. The body was shrunken during the formation of the pre-pupa. The duration of pre-pupa and pupa varied from 2 to 3 days and 5 to 6 days with an average of 2.52±0.51 and 5.40±0.50 days, respectively. The freshly formed pupa is whitish in colour and oblong in shape, later it turned brown as time advanced. The average length and breadth of the pupa were measured as 2.78±0.25 and 0.65±0.05 mm, respectively. According to Chaitanya and Kumar (2018) ^[3], Samata (2019) ^[8], Swathi (2022) ^[9] and Mohanapriya *et al.* (2023) ^[6] were reported the average pupal duration was 5.80±0.19, 5.5±0.57, 5.5±10.00 and 5.60±0.17 days respectively, which is similar to present findings.

Newly emerged adults were soft-bodied. The forewings and hindwings of the adult moth were creamy white with wavy markings on the wings. The abdomen was creamy white with black markings present on the 5th and 6th abdominal segments. In a female moth's ovipositor is pointed. Males were smaller in size than the females.

The length of male and female was measured about 3.97 to 5.07 and 4.78 to 5.15 mm with an average of 4.61±0.33 and 5.00±0.11 mm, respectively. The breadth with wingspan of male and female was measured about 9.84 to 10.98 and 10.63 to 10.99 mm with an average of 10.52±0.29 and 10.82±0.12 mm, respectively. The male and female longevity recorded was 3 to 4 days and 5 to 6 days with an average of 3.72±0.46 and 5.72±0.46 days, respectively. Chaitanya and Kumar (2018) ^[3] reported that the average longevity of male and female was 3.10±0.23 and 3.20±0.31 days, respectively. While, Samata (2019) ^[8] observed the life span of bud borer was 3.00±0.00 days for male and 3.50±0.57 days for female adult. Swathi (2022) ^[9] detected the male and female adult period of *H. duplifascialis* was 3.90±0.10 days and 5.80±0.13 days, respectively. The total life cycle of males and females was completed in 21 to 27 days (23.96±1.54 days) and 22 to 29 days (25.96±1.70 days), respectively. Chaitanya and Kumar (2018) ^[3] found the average total life cycle of male and female of *H. duplifascialis* was 23.90±1.95 days and 24.90±2.35 days, respectively. While, Swathi (2022) ^[9] reported a total developmental period of bud borer was 23.70±0.11 days for male and 25.56±0.20 days for female.

The average sex ratio of males and females was 1:1.50±0.31. The average pre-oviposition, oviposition and post-oviposition periods were 1.12±0.33, 1.40±0.50 and 1.20±0.41 days, respectively. The fecundity was of 13 to 19 eggs with an average of 17.68±1.63 eggs. Neelima (2005) ^[7] reported sex ratio (Female: male) was 1:1.50.

Table 1: Period of different stages of *H. duplifascialis* under laboratory condition

Sr. No.	Particulars	Period (Days)		
		Minimum	Maximum	Mean±S. D.
1.	Egg period	3	4	3.28±0.44
2.	Hatching percentage	53.85	88.46	72.61±5.85
3.	Larval period			
	1 st instar	2	3	2.76±0.42
	2 nd instar	1	3	2.28±0.66
	3 rd instar	1	3	1.52±0.70
	4 th instar	2	3	2.40±0.49

	5 th instar	1	4	2.60±0.80
	Total larval period	9	14	11.56±1.33
4.	Pre-pupal period	2	3	2.52±0.51
5.	Pupal period	5	6	5.40±0.50
6.	Adult period			
	Pre-oviposition	1	2	1.12±0.33
	Oviposition	1	2	1.40±0.50
	Post-oviposition	1	2	1.20±0.41
7.	Adult longevity			
	Female	5	6	5.72±0.46
	Male	3	4	3.72±0.46
8.	Total life period			
	Female	22	29	25.96±1.70
	Male	21	27	23.96±1.54
9.	Sex ratio (Male: female)	1:1.17	1:2.50	1.50±0.31
10.	Temperature	24.50	28.60	26.9±1.35
11.	Relative humidity	39	63	51.55±5.76

Table 2: Measurement of different stages of *H. duplifascialis*

Sr. No.	Life stage	Particulars	Measurement (mm)		
			Minimum	Maximum	Mean±S. D.
1.	Egg				
	-	Length	0.58	0.70	0.63±0.03
		Breadth	0.50	0.58	0.54±0.02
2.	Larva				
	1 st instar	Length	6.32	6.61	6.47±0.09
		Breadth	1.35	1.69	1.53±0.10
	2 nd instar	Length	6.70	7.12	6.91±0.12
		Breadth	1.71	1.83	1.77±0.03
	3 rd instar	Length	8.11	8.65	8.34±0.12
		Breadth	1.84	2.03	1.90±0.05
	4 th instar	Length	8.98	9.34	9.20±0.11
		Breadth	1.92	2.05	1.99±0.04
	5 th instar	Length	12.62	13.15	12.92±0.15
		Breadth	2.09	2.28	2.19±0.05
3.	Pupa				
	-	Length	2.50	3.01	2.78±0.25
		Breadth	0.60	0.71	0.65±0.05
4.	Adult				
	Male	Length	3.97	5.07	4.61±0.33
		Breadth	9.84	10.98	10.52±0.29
	Female	Length	4.78	5.15	5.00±0.11
		Breadth	10.63	10.99	10.82±0.12



Photograph 1: Potted plants



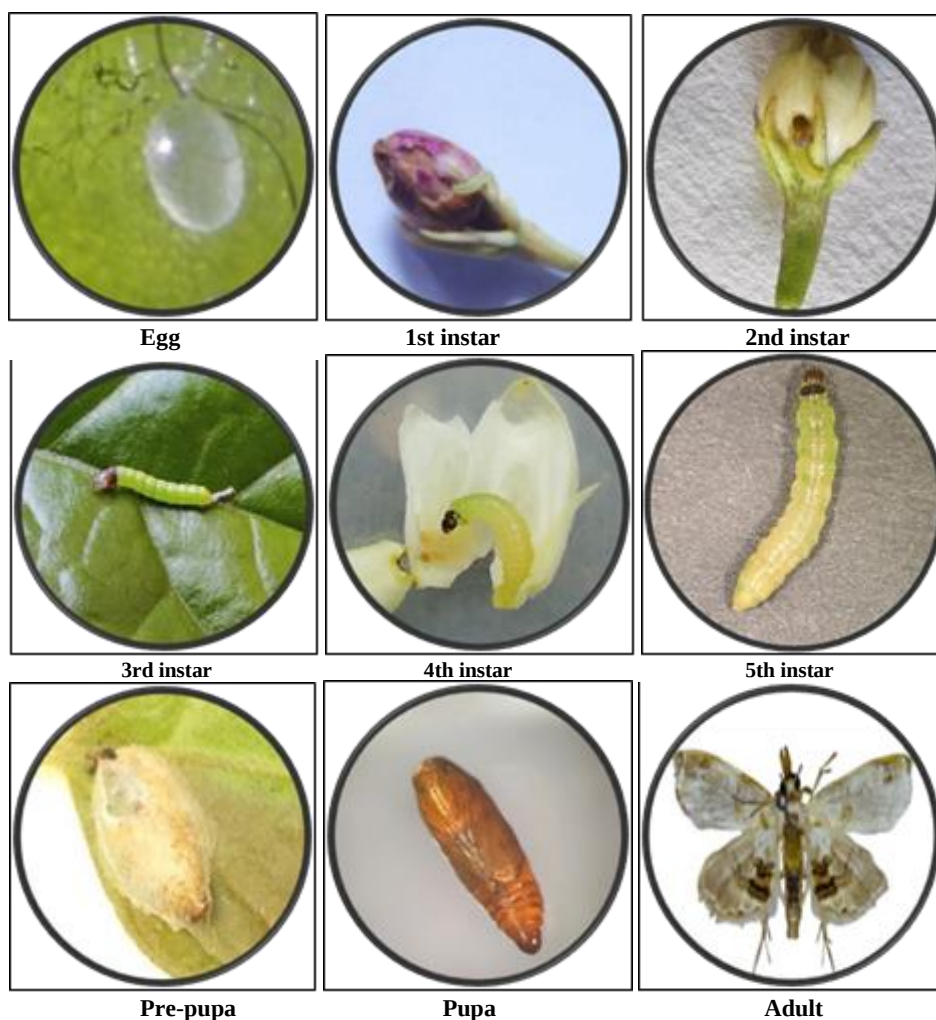
Photograph 2: Oviposition cage



Photograph 3: Fresh branches for eggs laying



Photograph 4: Rearing of jasmine bud borer



Photograph 5: Different stages of jasmine bud borer, *H. duplifascialis*

Conclusion

The present investigation successfully elucidated the complete life cycle and morphometric characteristics of the jasmine bud borer, *Hendecasis duplifascialis*. The female of *H. duplifascialis* laid translucent white colour eggs singly on the outer surface of unopened flower buds. The incubation period of eggs was varied from 3 to 4 days (3.28 ± 0.44 days) and hatchability was 72.55 ± 7.97 per cent. The larvae passed

through five instars and the total larval period was completed in 11.56 ± 1.33 days. The average pre-pupal and pupal period was 2.52 ± 0.51 and 5.40 ± 0.50 days, respectively. The average male and female longevity recorded was 3.72 ± 0.46 and 5.72 ± 0.46 days, respectively. The total life cycle of males and females was completed in 21 to 27 days (23.96 ± 1.54 days) and 22 to 29 days (25.96 ± 1.70 days), respectively. The average sex ratio of

males and females was 1:1.50±0.31. The average pre-oviposition, oviposition and post-oviposition periods were 1.12±0.33, 1.40±0.50 and 1.20±0.41 days, respectively. The average fecundity of the female was 17.68±1.63 eggs.

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