



## Biology of major lepidopteran pests of *Jasminum sambac* in Kerala

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**ABSTRACT:** The jasmine bud borer, *Hendecasis duplifascialis* and jasmine leaf webworm, *Nausinoe geometralis*, were identified as the major lepidopteran pest of *Jasminum sambac* in Kerala. Detailed studies on their biology revealed that *H. duplifascialis* has an egg period of  $3.35 \pm 0.11$  days, a larval period of  $11.15 \pm 0.08$  days, and a pupal period of  $5.25 \pm 0.10$  days. The female moths of this species exhibit a longevity of  $5.8 \pm 0.10$  days, while the male moths live for  $3.9 \pm 0.15$  days. The egg, larval, and pupal period of *N. geometralis* was  $3.35 \pm 0.11$ ,  $10.65 \pm 0.20$ , and  $6.65 \pm 0.11$  days, respectively. The adults recorded longevity of  $6.7 \pm 0.15$  and  $4.8 \pm 0.13$  days, respectively, for female and male moths.

**Keywords:** *Hendecasis duplifascialis*, *nausinoe geometralis*, bud borer, leaf webworm, jasmine.

### INTRODUCTION

Jasmine, known as the queen of fragrance, is extensively cultivated in India. The genus *Jasminum* comprises over 200 species, many of which are synonyms, with only ninety-two being genuinely recognized (Menninger, 1970; Abdulkhader and Kumar, 1995). The commercially significant *Jasminum* species in India is *Jasminum sambac* (L.) cultivated over 12,250 hectares, yielding 65,230 tonnes loose and 1,700 tonnes cut flowers (Pirithiraj, 2020). Jasmine cultivation is affected by approximately 50 distinctive insect species of eight insect orders (Harini *et al.*, 2018). These crops face threats from insects, mites, diseases, and nematodes. Major pests include the jasmine budworm (*Hendecasis duplifascialis* Hampson), galleryworm (*Elasmopalpus jasminophagus* Hampson), leaf webworm (*Nausinea geometralis* Guenee), leaf roller (*Glyphodes unionalis* Hubner), blossom midge (*Contarinia maculipennis* Felt), and red spider mite (*Tetranychus urticae* Koch) (David, 1958).

Despite Kerala's favorable climate and soil conditions, the potential for cultivating jasmine commercially remains largely untapped. In Kerala, *J. sambac* is primarily grown as an ornamental plant in homesteads (KAU, 2016). However, recognizing the substantial potential of jasmine as a commercial crop, entrepreneurs and self-help groups are gradually beginning to explore its commercial cultivation (Swathy, 2022). As an emerging crop in commercial agriculture, it is crucial to have basic knowledge of jasmine pests and their biology to implement effective control measures under the prevailing climatic conditions of Kerala. However, the number of studies focusing on the pests and diseases of

jasmine from Kerala is lower. In this context, the current study focuses on identifying major lepidopteran pests of *J. sambac* in Kerala and their biology.

### MATERIALS AND METHODS

The samples of lepidopteran pests of jasmine were collected from three locations in districts, viz., Thiruvananthapuram, Kollam, and Alappuzha of Kerala, for documentation, and their percentage incidence was calculated from 20 randomly selected jasmine plants from each di.

### Biology of major lepidopteran pests

The study on the biology of major lepidopteran pests identified during documentation was conducted at the Department of Agricultural Entomology, Vellayani.

The initial culture of larvae of jasmine budworm, *Hendecasis duplifascialis* and jasmine leaf webworm, *Nausinoe geometralis* (Guenee) was collected from the field. The larva was kept in rearing bottles with young tender leaves and buds. Emerged adults were transferred to separate rearing containers @ 1: 1 (male: female).

Two pairs of adults were released into each rearing bottle with tender shoots of jasmine and shoots bearing buds for *N. geometralis* and *H. duplifascialis*, respectively. The base of the shoot was secured with moist cotton to prevent drying. The container was closed using muslin cloth and undisturbed for mating and oviposition. A cotton ball dipped in diluted honey (5%) was provided as food (Gajera *et al.*, 2012). The moths were observed at every 2 to 3h. Forty-eight hours after mating, the leaves and buds were observed for the eggs of the leaf webworm and the budworm, respectively.

The eggs were collected using a moist brush and kept for larval emergence. The egg, larval, pupal period, and adult longevity were recorded during the experiment. Observations were taken from twenty pairs.

## RESULTS AND DISCUSSION

### Percentage incidence

The lepidopteran pests, jasmine budworm, *Hendecasis duplifascialis* Hampson), jasmine leaf webworm, *Nausinoe geometralis* (Guenee), *Nausinoe*

*perspectata* (Fabricius), shoot webworm, *Margaronia unionalis* Hubner), jasmine gallery worm, *Elasmopalpus jasminophagus* (Hampson) were documented from Thiruvananthapuram, Kollam, and Alappuzha districts of Kerala from twenty different locations in each district. From the Table.1 it is evident that the major lepidopteran pests infesting jasmine in Kerala are jasmine budworm and leaf webworm. Even though the infestation of shoot webworm and jasmine gallery worm was documented, their percentage of incidence was scarce.

**Table 1. Percentage incidence of major lepidopteran pests in *Jasminum sambac* from Thiruvananthapuram, Kollam, and Alappuzha districts of Kerala.**

Scientific name	*Percentage incidence			Average
	Thiruvananthapuram	Kollam	Alappuzha	
<i>H. duplifascialis</i>	90	100	90	93.33
<i>N. geometralis</i>	60	10	45	38.33
<i>M. unionalis</i>	5	5	0	3.33
<i>E. jasminophagus</i>	10	0	0	3.33

**Table 2. Biology of jasmine borers**

Parameters	<i>Hendecasis duplifascialis</i>			<i>Nausinoe geometralis</i>		
	No. of days		Mean $\pm$ SE	No. of days		Mean $\pm$ SE
	Minimum	Maximum		Minimum	Maximum	
Egg period	3	4	3.35 $\pm$ 0.11	3	4	3.35 $\pm$ 0.11
Larval period	11	12	11.15 $\pm$ 0.08	9	12	10.65 $\pm$ 0.20
Pupal period	5	6	5.25 $\pm$ 0.10	6	7	6.65 $\pm$ 0.11
Adult longevity						
Male	3	4	3.9 $\pm$ 0.10	4	5	4.8 $\pm$ 0.13
Female	5	6	5.8 $\pm$ 0.13	6	7	6.7 $\pm$ 0.15
Total lifecycle						
Male	23	24	23.7 $\pm$ 0.11	24	26	25.2 $\pm$ 0.09
Female	24	27	25.56 $\pm$ 0.20	26	29	27.6 $\pm$ 0.09

### Biology of major lepidopteran pests

The major lepidopteran pests identified during the initial documentation were later studied to get better insights into the biology of the pest. This was conducted at the laboratory of the College of Agriculture, Vellayani. The result of the study is represented as the duration of different stages of the budworm and leaf webworm in Table 2.

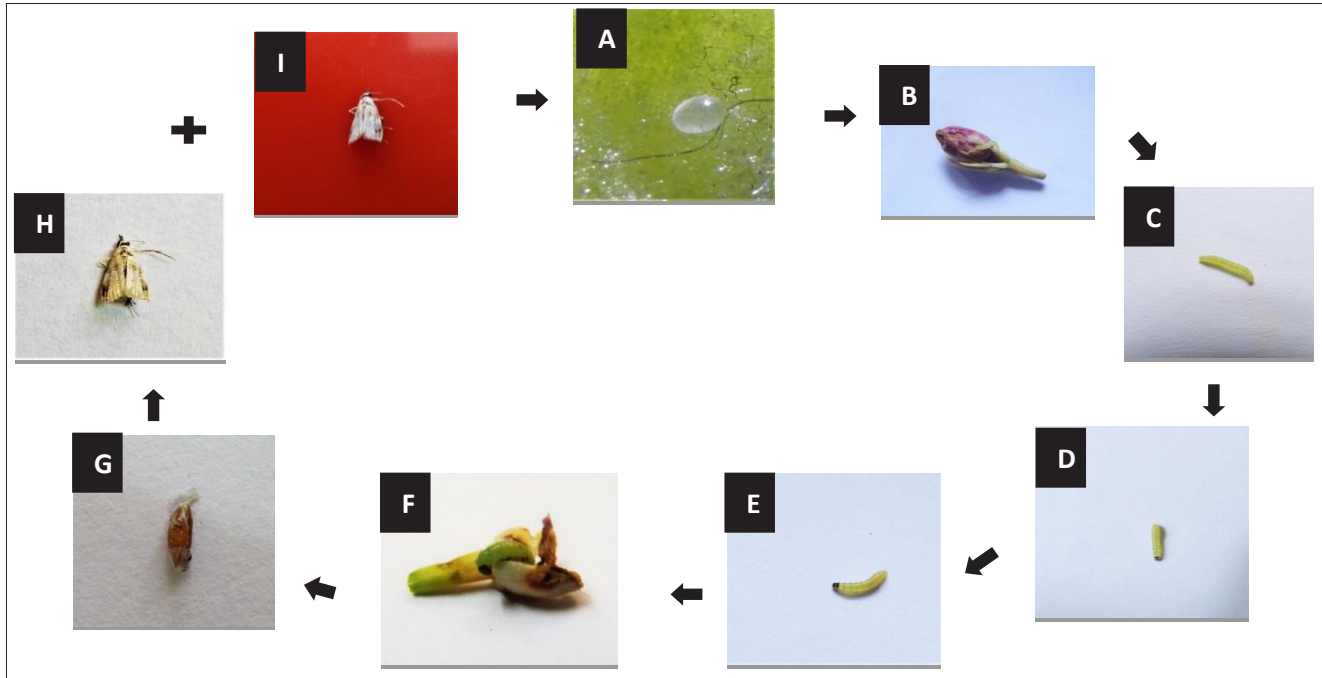
### *Jasmine bud borer, Hendecasis duplifascialis* Hubner (*Lepidoptera: Crambidae*)

The life cycle of *H. duplifascialis* is depicted in Fig. 1. The egg of *H. duplifascialis* was round, creamy white, and eggs laid on flower stems and closed buds. The egg period was 3.35  $\pm$  0.11 days, whereas the larval period extended to 11.15  $\pm$  0.08 days with five instars. The first two instars were creamy white with a dark brown

head and prothoracic shield. The third instar resembled the initial instars but differed in their size. The fourth and fifth instar larvae were yellowish green and green, respectively.

In the pre-pupal stage, the larva stopped feeding and crawled to the lower part of the container for pupation. The pupa was dark brown and oblong, with a pupal period

of  $5.25 \pm 0.10$  days. The adults were small, creamy white with well-developed scaly proboscis and wavy wing and abdomen markings. The longevity of female and male moths was  $5.8 \pm 0.13$  and  $3.9 \pm 0.15$  days, respectively. The total lifecycle (egg to death of adult) was longer for females, with  $25.56 \pm 0.20$  days, whereas the males had  $23.7 \pm 0.20$  days.



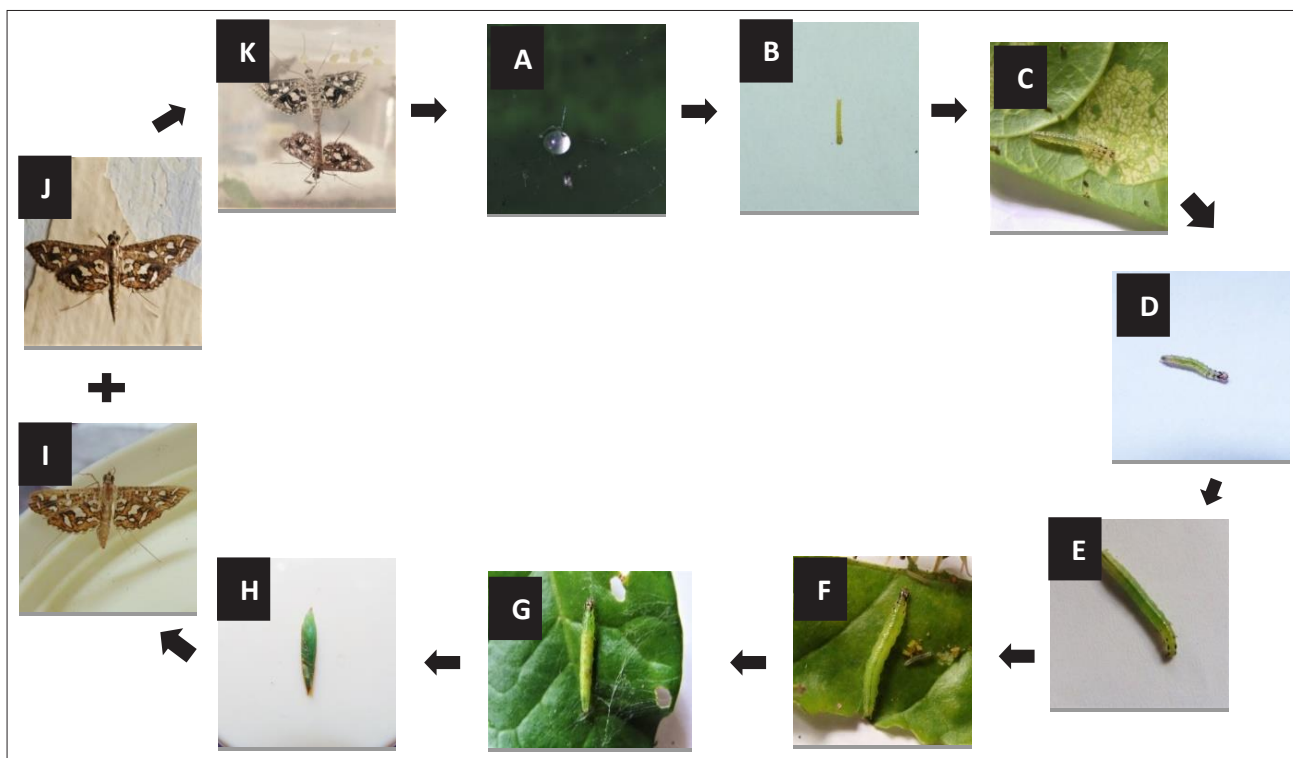
**Fig.1. Life cycle of jasmine budworm *Hendecasis duplifascialis*: A: Egg; B: 1<sup>st</sup> instar; C: 2<sup>nd</sup> instar; D: 3<sup>rd</sup> instar; E: 4<sup>th</sup> instar; F: 5<sup>th</sup> instar; G: Pupal stage; H: Female moth; I: Male moth**

Similar findings were observed in the studies conducted by Chaitanya and Kumar (2018) on the biology of budworm *H. duplifascialis*. They found that the incubation period, total larval, and pupal period were  $3.40 \pm 0.23$ ,  $11.60 \pm 1.30$ , and  $5.80 \pm 0.19$  days, respectively. The longevity of male and female moths was  $3.10 \pm 0.23$  and  $4.10 \pm 0.31$  days, respectively. Atwal and Dhaliwal (2002) studied the biology of jasmine budworm. They reported that their egg, larval, and pupal periods lasted for 3 to 5 days, 11 to 17 days, and 6 to 8 days, respectively, with an adult longevity of 2 to 3 days. Thus, the total lifecycle was recorded as 20 to 23 days. Muthukrishnan *et al.* (2005) described the larvae of budworms as green with prominent dark brown or black colored heads, and adults were small moths with white and black wavy margins on the hind wings, similar to our findings.

#### ***Jasmine Leaf Webworm Nausinoe geometralis* (Gunee) (Lepidoptera: Crambidae)**

The life cycle of *N. geometralis* is depicted in the

Fig. 2. The egg was laid singly or in small groups on the under surface of the leaf lamina. The freshly laid egg was small, oblong, and translucent, which turned to greenish yellow in later stages. The egg period lasted for  $3.35 \pm 0.11$  days. The neonate larva was yellowish-white with a reddish-yellow head. The head was less broad than the body. They were found in groups on the lower surface of webbed leaves. The second and third instar had small hairs on their yellowish-green body with black dots on the lateral sides. The brown head capsule and body hairs were more prominent and visible in the third instar larva. The fourth instar larva was green with dark brown or black head capsule. The black dots on the prothorax were more prominent, with two triangular markings, whereas the black spots on the dorsal lateral line faded towards the abdomen. The fully grown fifth instar larva had four rows of black spots on the thoracic region. The larval period was  $10.65 \pm 0.20$  days with five instars.



**Fig.2.** Life cycle of jasmine leaf webworm *Nausinoe geometralis*: A: Egg; B: 1<sup>st</sup> instar; C: 2<sup>nd</sup> instar; D: 3<sup>rd</sup> instar; E: 4<sup>th</sup> instar; F: 5<sup>th</sup> instar; G: prepupal stage; H: Pupal stage; I: Female moth; J: Male moth; K: Mating.

In the pupal stage, the larva stopped feeding. In later stages, the size of the larva was gradually reduced and sluggish, and their color changed to a yellowish-green color. The larva pupated within the web on a silken thread. The pupa was green, spindle-shaped, with tapering ends. However, the color gradually turned brown in later stages. The pupal period was  $6.65 \pm 0.11$  days.

The newly emerged adult moth was medium-sized with a pale brown body tapered towards the anal region. The wings were brown with irregular white spots and small wavy margins. The abdomen was brown with white markings. The female moth was slightly larger than the male moth. The longevity of female and male moths was  $6.7 \pm 0.15$ ,  $4.8 \pm 0.13$  days, respectively. The total life cycle (egg to death of adult) was longer for females, with  $27.6 \pm 0.09$  days, whereas the males had  $25.2 \pm 0.09$  days.

Fewer studies regarding the biology of leaf webworms than jasmine budworms. Gajera *et al.* (2012) reported the average larval period and pupal period of *N. geometralis* as  $9.98 \pm 0.84$  days and  $7.84 \pm 0.37$  days, respectively, concurrent with our findings. The total lifecycle was reported to be complete in  $26.62 \pm 2.57$  days and  $28.90 \pm 2.11$  days for males and females, respectively, similar to the current findings.

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