
Morphological Aspects of *Trilocho varians* Walker (Lepidoptera: Bombycidae)

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Chuenban S., S. Bumroongsook and S. Tigvattananont. (2017). Morphological Aspects of *Trilocho varians* Walker (Lepidoptera:Bombycidae). International Journal of Agricultural Technology 13(7.2): 1559-1565.

Morphological studies of *Trilocho varians* was performed under the laboratory and on the *fig* trees. Different stages of this insect from egg to adult was observed and recorded. There are 4 developmental stages: egg, larva, pupa and adult. The eggs are round, with a diameter of 0.60-0.70 mm The larvae undergo for 4 molts. It is the eruciform larva with 3 pairs of thoracic legs and 5 pairs of abdominal prolegs. There is a caudal horn on the dorsal part of the 8th abdominal segment. The caudal horns of the 1st to the 3rd larvae are curved shape but the ones of the 4th and the 5th larvae are short and straight. The body of the second to the fourth of larval instars was covered with a white powdery secretion. Different stages of the larvae can be reared together and they showed no cannibalistic or aggressive behavior toward each other. The pupa is an obiect type with appendages which attached to the body and found inside the boat shaped cocoon. The pupa has a large compound eyes, a black head and pale color of abdomen and a light yellow of thoracic part. Sex of the pupa is to determine by the suture on a ventral side of the ninth abdominal segment: the presence (female) or absence (male). An adult is a small moth including bipectinate antenna. Ocelli, proboscis and maxillary palpus are not developed. It does not has tibial spur on 3 pairs of legs and without tympanum organs observed on the thoracic and abdominal segments.

Keywords: Banyan tussock moth, host plants, *fig* tree, life history

Introduction

Ficus is classified in Moraceae family. It is a medium to large perennial plant with a height of 10-20 meters. It has single leaves which grow alternately. In Thailand, there are more than 72 species of *Ficus*.and some species have been cultivated for commercial. Billy C. Wolverton, a researcher from NASA's Space Research Institute discovered the ability and efficiency of *Ficus* is to eliminate the pollutants in the air as well. The reduction of hazardous

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substances effectively such as formaldehyde, trichloroethene benzene, ammonium, xylene, tungsten and carbon monoxide. In addition, the plants can also be used in many ways. It is a source of food for human use, medicine, shade, clothing. It also involves religious beliefs (Lansky and Paavilainen, 2011). *Trilocho varians* is caterpillars usually eat and caused the leaves of the Moraceae family mainly the leaves of the *Ficus* (Zolotuhin and Witt, 2009) silkworms destroy the leaves. The severe outbreak of both caterpillars will cause the leaves to dry and falling off and results in the death of the banyan trees. Most of them will destroy the *Fig* trees along roadside *Fig* trees and ornamental *Ficus*. Daimon *et al.*, (2012), Navasero *et al.*,(2013) and many species of Artocarpus (*A. heterophyllus*) (Navasero *et al.*, 2013). Chinese in Thailand brought from abroad, there are many species *A. heterophyllus* (Navasero *et al.*, 2013). *Ficus* species in Thailand, such as *F. microcarps* var. *F. microcarps* rassitfolia, *F. microcarps* var. Nitida and *ficus* (*F. microcarps* cv. Golder Leaves) (2001). The report (2001) reported that *T. varians*, the flower eating of rambutans and jackfruit These insects are found in Saraburi, Prachin Buri, Chanthaburi and Bangkok, the spread of butterfly caterpillars. It is reported that insects in India, Nepal, Vietnam, Thailand, China, Indonesia, Taiwan (Zolotuhin and Witt, 2009), Japan, Philippines

Materials and methods

Morphology studies of T. varians in laboratory.

Eggs, all larval instars, pupa and adults was placed under the stereoscopic microscope for photographic documentation and measurement. . Along with photography and external morphology is observed and recorded.

Eggs: record egg shape, color and size measurement.

Larva: color variation and main characteristics of each larval instar; measurement of head capsule width, body and horn length.

Pupa: pupal development, characteristics and color change of cocoon, measurement of pupa

Adult: general characteristics of both males and females. Measurement of body, wingspan, mustache, width and length of fore- and hind- wings including number of frenulum.

Results and Discussion

External morphology

T. varians has a complete metamorphosis. It has to go through 4 stages in its life cycle: egg, larva, pupa and adult. The eggs are flat and roundlike flat style round cake shape. (Fig 1) The larva of *T. varians* is eruciform, with 3 pair of true legs in the thorax and 5 pairs of abdominal prolegs. There are 5 instar larvae. The average head capsule width of the larval instar 1-5 is 0.29 ± 0.01 , 0.45 ± 0.06 , 0.92 ± 0.09 , 1.50 ± 0.32 , 2.07 ± 0.07 mm, respectively. body length 2.07 ± 0.44 , 4.02 ± 0.52 , 8.63 ± 1.40 , 13.18 ± 2.15 , 22.27 ± 5.17 mm, respectively. (Table 1) The 2-4 larval instars are often covered with white powdery secretions. All larva have caudal horn on the dorsal part of the 8th abdominal segment (Fig. 2). The horn of this insect species has a special feature and is divided into 2 parts: the proximal part is long and brown. or dark brown color; the terminal end is retracable, short ($0.30-0.40$ mm) and white color. When the larva being disturbed, the terminal part of the caudal horn will be extended and white color noticeable. No cannibalism is observed. The prepupal stage will pupate in a cocoon like a boat shape (Fig. 3). The pupation process will start from the head and tail of insect first. Some thin silk filaments connect the head to the tail, forming another cocoon layer covering the body. The size of the cocoon measured is averaged 4.78 ± 0.54 mm wide and 9.93 ± 1.01 mm long for the male; 5.58 ± 0.64 mm wide and 11.62 ± 0.88 mm long for the female. (Table 2). The color of the cocoon was different, with no difference in color between sexes. The pupa is oblong. The male pupa has an average width of 2.86 ± 0.16 mm and a length of 7.97 ± 0.67 mm. The average female pupa is 3.68 ± 0.22 mm wide and the length is 9.59 ± 0.81 mm long (Table 3). The difference between male and female pupa is that having or not suture. At the venter of the 9th segment of the pupa, if there is no suture, a male pupa, and there is a suture at the venter of the 9th section the female pupa (female) or absence (male). The adult of this insect is a small moth and hiding in the fig trees during the day. Newly emerged adult, the forewing are fully expanded and the tip of the abdomen is bent upward (Fig. 4). The wingspan. of male and female was 18.43 ± 1.56 and 5.68 ± 0.53 mm, respectively. body length 8.83 ± 0.89 and 10.0 ± 0.73 mm, respectively. antennal length 3.19 ± 0.42 and 2.72 ± 0.32 mm, respectively. (Table 4).

Table 1 Head capsule width and body length of different instar larva of *T. varians*

| Larval instar | n | Head capsule width (mm) | | Body length (mm) | |
|---------------|----|-------------------------|-----------|------------------|-------------|
| | | Mean \pm SD | Range | Mean \pm SD | Range |
| 1 | 30 | 0.29 \pm 0.01 | 0.25-0.30 | 2.07 \pm 0.44 | 1.20-2.60 |
| 2 | 30 | 0.45 \pm 0.06 | 0.40-0.60 | 4.02 \pm 0.52 | 3.00-5.00 |
| 3 | 30 | 0.92 \pm 0.09 | 0.80-1.20 | 8.63 \pm 1.40 | 6.50-11.00 |
| 4 | 30 | 1.50 \pm 0.32 | 1.40-1.70 | 3.18 \pm 1.15 | 9.00-17.00 |
| 5 | 30 | 2.07 \pm 0.07 | 2.00-2.20 | 22.27 \pm 5.17 | 14.00-30.00 |

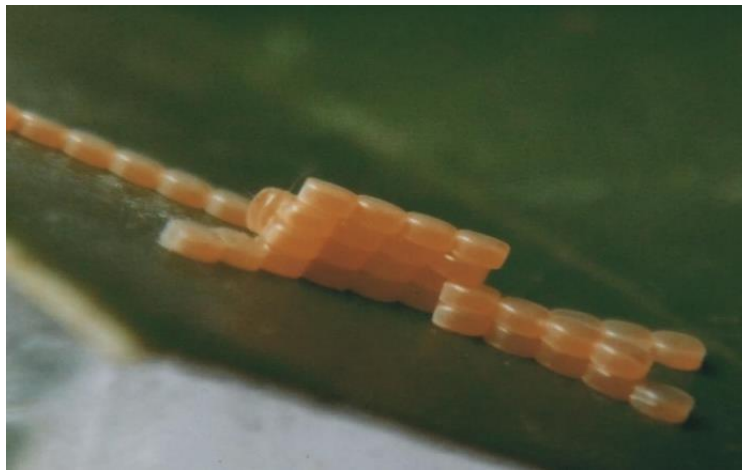


Fig 1 Egg group of *T. varians*



Fig 2 Eruciform caterpillars, with short, straight, and small caudal horn.

Table 2 Dimentions (mm) of cocoons of *T. varians*

| | Male cocoon | | Female cocoon | |
|-----------|--------------------|-------------|----------------------|--------------|
| | width | Length | width | Length |
| Mean ± SD | 4.78 ± 0.54 | 9.93 ± 1.01 | 5.58 ± 0.64 | 11.62 ± 0.88 |
| Range | 3.50-5.50 | 7.50-12.00 | 4.50-6.50 | 9.50-13.00 |

Table 3 Dimentions (mm) of pupa of *T. varians*

| | Male pupa | | Female pupa | |
|-----------|------------------|-------------|--------------------|-------------|
| | width | Length | width | Length |
| Mean ± SD | 2.86 ± 0.16 | 7.97 ± 0.67 | 3.68 ± 0.22 | 9.59 ± 0.81 |
| Range | 2.50-3.20 | 6.50-9.00 | 3.10-4.00 | 8.00-11.00 |

Table 4 Dimentions (mm)of adult males and female

| | Body length | Antennal length | Forewing | | Hindwing | |
|---------------|--------------------|------------------------|-----------------|-------------|-----------------|-------------|
| | | | Width | Length | Width | Length |
| Male | | | | | | |
| Mean ± SI | 8.83 ± 0.89 | 3.19 ± 0.42 | 18.43 ± 1.56 | 8.56 ± 0.77 | 4.80 ± 0.64 | 7.16 ± 0.68 |
| Range | 7.50-10.50 | 2.50-3.60 | 14.0-21.0 | 7.00-10.0 | 3.20 ± 5.60 | 5.50±8.00 |
| Female | | | | | | |
| Mean ± SI | 10.0±0.73 | 2.72 ± 0.32 | 5.68 ± 0.53 | 10.48±0.87 | 5.64±0.57 | 8.58±0.71 |
| Range | 8.00-10.00 | 2.50-3.20 | 4.50-6.50 | 9.00-12.50 | 4.00- 6.50 | 7.00-9.50 |



Fig. 3 Characteristics of cocoon



Fig 4 The tip of the abdomen is bent upward

Discussion

The eggs are round flat in shape or cake shaped like a tube. Its color is yellow and then turns to black color before hatching (Daimon et al. 2012; Singh and Brar, 2016). Egg width is 0.9-1.0 mm (average 0.98 ± 0.04 mm) and thickness 0.50 mm (Navasero and Navasero, 2014). Our studies indicated that the egg diameter is 0.60 - 0.70 mm which smaller diameter than Navasero and Navasero is report (2014).

The caterpillars are covered with white powdery. A caudal horn is located on dorsal part of the eight abdomen. No annulet was observed on each abdominal segment like the hawk moth caterpillars. The horn is a remarkable feature for retraction. When the horn retreat, will look like curved. When it stretches, the horn will be straight and elongate. The horn is consisted of two parts: the proximal part is brown or dark brown and the terminal end is rather short (0.30-0.40 mm long) and has white color. Larval instars 1-4 had white and black lines along the lateral side of abdominal segments. Daimon *et al.*, (2012) reported rearing temperature had effect on the number of larval instars, 20 degrees Celsius 7 larval instars, The 25 degrees Celsius, 6 or 7 larval instars; at 30 degrees Celsius 5 or 6 larval instars. The last larval instar pupate in a boat-shaped cocoon. It has many colors: white, pale yellow or light yellow, dark yellow or pinkish in color. The pupa is obtect type. The pupal color changed from brownish or yellow and turns to grayish before adult emergence. Suture appearance is used for sex separation between male and female during pupal stage. The female pupa had a suture on the venter of the ninth abdominal segment and no suture was observed in male. The nymphs are not suture (male)

of the suture (Navesro and Navasero, 2014; Daimon *et al.*, 2012) Our work had similar results on the color of cocoon however the cocoon color can not be used for sex determination. Our studies had the measurement values slightly different from these previous work mentioned above.

Acknowledgement

The travel expense and registration fee for the 6th International Conference Integrating Science and Technology for Sustainable Development is supported by the King Mongkut's Institute of Technology Ladkrabang.

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(Received 20 October 2017 ; accepted 25 November2017)