
Growth and Development of *Macroglossum corythus* Walker (Lepidoptera: Sphingidae)

S. Tigvattananont* and S. Bumroongsook

Department of Plant Production Technology, Faculty of Agricultural Technology, King Mongkut 's Institute of Technology Ladkrabang, Bangkok 10520, Thailand

S. Tigvattananont and S. Bumroongsook. (2016). Growth and Development of *Macroglossum corythus* Walker (Lepidoptera :Sphingidae) International Journal of Agricultural Technology 12(7.2):2131-2139.

Macroglossum corythus (Lepidoptera : Sphingidae) was studied under laboratory conditions. External morphology of different stages of hawk moths, :egg, larval instars, prepupa, pupa, and adults was described and illustrated in this paper. Biological characteristics of each life stage are described. In an experiments in with larval were fed on the noni , *Morinda citrifolia* L. (Rubiaceae). Males and females were fed with honey solution. Eggs are deposited singly on the underside or upperside of noni foliage. The female hawk moth lay 64-91 eggs. The egg incubation period was 3.09 ± 0.19 days. The mean duration time of five larval instars of hawk moth was 1.72 ± 0.16 , 1.36 ± 0.15 , 1.33 ± 0.18 , 1.50 ± 0.35 and 4.42 ± 0.54 , respectively. The total larval period including prepupal stage was 10.33 ± 0.76 days. The pupal stage lasted 11.51 ± 0.71 . The longevity of mated males and female was 5-13 and 7-14 days, respectively. The mean head capsule width for instar 1-5 was 0.64 ± 0.55 , 1.01 ± 0.22 , 1.56 ± 0.50 , 2.42 ± 0.04 and 3.47 ± 0.11 mm, respectively. The larval dorsal horn lengths were 1.96 ± 0.06 , 3.93 ± 0.12 , 6.62 ± 0.24 , 8.71 ± 0.56 and 9.84 ± 0.76 mm, respectively.

Introduction

Macroglossum is a hawk moth that is commonly known as a hummingbird hawk moth (Barlow, 1982). Some adults are nocturnal feeders and many of them are diurnal and sucking nectar from flowering plants which were belonged to family Verbenaceae like *Duranta erecta* L. in Hong Kong (Kendrick, 2010)

There are 25 species of *Macroglossum* reported in Thailand including *M. corythus* (Inoue *et al.*, 1997) This insect species can be found all year round from lowland to high elevation up to 2,000 metres. Azuma (1990) surveyed hawk moths in the dam areas of Chulaborn and Nam Prom, Kuansan district, Chaiyapoom province and stated that there were 42 species of hawk moths

* **Coressponding Author:** S. Tigvattananont, **E-mail:** janez_8888@hotmail.com

including 6 species found on Noni plants. The hawkmoth larvae are: *Macroglossum gyrans*, *M. prometheus*, *M. sitiene*, *Neogurelca hyas*, *M. belis* and *M. corythus* (Kliangklaio, *et al.* 2015; Bumroongsook, 2016). They are very destructive and cause damage to the noni leaves

Objectives: to study on external morphology and growth and development of *M. corythus*

Materials and methods

There are 6 species of noni hawk moth. Eggs and larvae were collected from several parts of Thailand. Eggs were placed in the petri dish (9 cm of diameter) and larvae were kept in different sizes of plastic boxes depending upon the number of larva. These samples were brought back to the entomological laboratory, Faculty of Agricultural Technology, King Mongkut's Institute of Technology Ladkrabang. When new adult emergence occurred, they were then sex separation. The adults were placed in rearing cages for copulation and egg production. Record the morphology of eggs, larvae, pupa and adults of each developmental stage including measurement of moths. Sex dimorphism was observed, measured and photographed (n=30).

M. corythus adult emerged from the pupa, bring both male and female insects into the cage in size 40 × 60 × 60 cm, and feed them adult honey solution (1:3 ratio) on tissue paper. Honey water using a ratio of 1: 3 in the glass plate and the glass plate with a paper. In the cage, there is a noni plant seedling for the female to lay eggs on. Collect the newly eggs and placed each one on the plastic plates. The first instar larva was fed with young noni leaves and recorded their behavior and duration time for development. The leaves were changed everyday till we know the life cycle.

Results

External morphology of *M. corythus*

Eggs are spherical shape, green color and reflective surface with diameter of 0.90-1.15 mm (Fig. 1). Newly hatched larvae fed on young noni leaves. The hawk moth larvae have three pairs of leg appendages, and proleg at the 3rd to 6th abdominal segments and the last segment (the 10th segment). A dorsal horn or a postero-dorsal horn was located on the 8th abdominal segment (Fig. 2). Thus, their common name are hornworms and the larvae are not gregarious. Its head has *six stemmata on each side and 5 developmental larval instars and each instar has different size, color and character.*

The body length of the 4th instar was 21-42 mm. There are 3 forms: green, brown and dark brown. Green caterpillars form is typical form. The head,

thorax and abdomen are green and yellow. Horn color is towards the green. The horn will be rounded up with a wide black stripe along the body length slightly to the side of the body. The anal shield or anal plate and the horn are green and yellow (Fig 3.). The area surrounding the hole is the green and yellow. Some hawk moth larvae have green and yellow dorsal horns.

Brown form larvae basically their body are brown except for the black longitudinal stripes on each side of its body starting from the second abdominal segment extending to the basal of dorsal horn. Next to this black stripe is a wider brown stripe extending along the spiracles of each abdominal segment. slightly to the side next to the body. Highlights of this form is dorsal sides of thorax and abdomen, anal shield and proleg on the last abdominal segment are brown color.

The dark brown form larvae had brown color on their head and the first thorax segment. The dorsal sides of the rest are black. Three pairs of true legs and prolegs are black color.

There are 3 forms of the 5th instar larva: dark brown, black and green. They are different in color on different part of instar larvae.

Pupa of *M. corythus* generally brown and yellow, length 33-44 mm not including the length of proboscis sheath (Fig. 4) and cremaster. No spiracle was seen on the first abdominal segment, but they appear on the 2nd-8th of abdominal segment. These spiracles were surrounded by black color. The final segment is pupa cremaster extended out schematically laterally rolled inward and rounded edges. On the ventral side of pupa, 2 genital opening on the 8th abdominal segment, it will turn to be the female hawk (Fig. 5). On the contrary, a genital opening on the 9th abdominal segment it will turn to be the male hawk (Fig. 6).



Figure 1 Eggs of *M. corythus*



Figure 2 The dorsal horn on the 8th abdominal segment



Figure 3 Anal shield of the 4th instar larva



Figure 4 A proboscis sheath



Figure 5 Femal genital aperture on the eighth abdominal sternum



Figure 6 Male genital aperture on the ninth abdominal sternum

The body of adult has a length of 29-36 mm (average 30.67 mm) not including a fantail. Hawk moths' antenna is filiform (thread-like) namely mustache thick and thin mustache, the ends of the mustache. apiculus is a hook (hook).

The body has a length of 29-36 mm (average 30.67 mm) overall length is now a fan Patel (Fantail) antennae of adult butterflies, hawks will be filiform, thick and slender at the distal part and the ends of the antenna is a hook. The length of antenna is averaged 11.70 mm with big red brown compound eyes.

Dimorphism between females and males: The female is generally similar to the male, however the difference on external morphology of male and female: filiform antenna for female adult and ciliate antenna with arita for males; many frenula for female and one frenulum for males; and crescent shaped fantail in females and trilobite fantail in males.

Biology of *M. corythus*

Noni is the principal host plant of *M. corythus*. The adults sucking nectar from flower during daytime. They can be found throughout the year from lower altitude through high mountains. The detail of growth and development and sizes of males and females was summarized in Table 1-3. Under the laboratory condition, adult emergence for 1-2 days, the copulation occurred then they will lay eggs singly attached to young and mature leaves on the next day. Eggs are green with refractive smooth surface. The females can lay eggs up to 94 eggs/insect and it takes 3.42 days to become the first instar larva. When the larvae first hatched, it would consume egg shell for its first meal, later on the noni leaves will be their food. The larvae ecdysed 5 time and exhibited 5 instar larvae which each instar will eat their their own shedded skin except the last instar. The head capsule width for instar 1-5 was 0.64 ± 0.55 , 1.01 ± 0.22 , 1.56 ± 0.50 , 2.42 ± 0.04 and 3.47 ± 0.11 mm, respectively. The dorsal horn length was 1.96 ± 0.06 , 3.93 ± 0.12 , 6.62 ± 0.24 , 8.71 ± 0.56 and 9.84 ± 0.76 mm, respectively. The developmental duration was 1.72 ± 0.16 , 1.36 ± 0.15 , 1.33 ± 0.18 , 1.50 ± 0.35 and 4.42 ± 0.54 days, respectively. The total larval period including prepupal period 8.67-11.79 days. The last larval stage, the larvae would change the color and dropped into the soil to pupate. It will get debris, leaves and soil around the host plant to create a cocoon. But in the rearing room, it can go pupation without cocoon. The pupation period is 11.51 days. The adults emerged during nighttime. Age of adult males and females 5-13 days 7-14 days, respectively.

Table1. Growth and Developmatal stages of *M. corythus*

stages	Developmental time(day)	Head capsule width(mm)	Caudal horn length(mm)
egg	3.09±0.19		
1 st instar	1.72 ±0.16	0.64±0.55	1.96±0.06
2 nd instar	1.36±0.17	1.01±0.00	3.93±0.12
3 rd instar	1.33±0.18	1.56±0.50	6.62±0.24
4 th instar	1.50±0.35	2.42±0.04	8.71±0.56
5 th instar	4.42±0.54	3.47±0.11	9.84±0.76
pupa	11.51 ±0.71		
male	8.80 ±1.90		
female	9.47 ±2.00		

Table 2 Length of body, antenna and proboscis in mm of males and females

sex	Body length	Antennal length	Proboscis length
male	30.67±1.86	11.70±0.44	30.17±1.49
female	29.33±1.46	10.66±0.49	29.07±1.21

Table 3 Sizes in mm of forewing, hindwing and wingspan of *M. corythus*

sex	forewing	hindwing	wingspan
male	26.40±1.07	11.24±0.19	57.13 ±1.89
female	26.32±1.32	14.98±0.84	57.80±3.48

Discussions

M. corythus is a nocturnal hawk moth, sucking nectar from flowers of various kinds and a pollinator. Features hairy yellow and yellow marks appear on the lateral of the 1st-3rd abdominal segments and pronounced much the same as the adult. Host Plants of *M. corythus* larvae were *Morinda citrifolia* *Paederia foetida*, *Strychnos nux-vomica* (Barlow, 1982; Inoue *et al.*, (1997 The fourth and fifith instar larvae had 3 different color forms and the reasons for the difference was not known. It might be related to host plants, light intensity, temperature or pigments. Highlight features of these larvae were white marking on the side of the abdomen. However, some larvae were not found a certain color.

Conclusions

Macroglossum corythus (Linnaeus) is a hawk moth in the order Lepidoptera, family Sphingidae. The larvae consumed mainly on Noni leaves. The life cycle took about one month from eggs to adults. Female hawk moths laid egg singly on both young and mature leaves. Eggs were glued to the ventral side of leaves 1-2 eggs/leaf. It is placed near the edges or near the midrib of the leaf. It has a complete metamorphosis: egg duration 3.09 days; 5 larval period 10.33 days, pupal period 11.51 days and adult period for male and female 8.8 and 9.47 days, respectively. Head capsule width for larval instar 1-5 was 0.06, 1.01, 1.56, 2.42 and 3.47 mm, respectively, dorsal horn length 1.96, 3.93, 6.62, 8.81 and 9.84 mm, respectively.

Acknowledgement

The author would like to offer particular thanks to Mr. Jirawat Luengtrakun and Ms. King Saengsaiko, responsible for insect rearing and photograph taking.

References

- Azuma, S. (1990). Some Sphingidae collected in Thailand. (Lepidoptera). ESAKIA, Special Issue No. 160-155 :1
- Barlow, H.S. (1982). An introduction to the moths of southeast Asia. 305pp., 50pls., 70figs. Kuala Lumpur.
- Bumroongsook, S., Tigvattananont, S and Hongsamoot, D. (2016). External morphology and development of the hawk moth, *Microglossum belis* (Linnaeus) (Lepidoptera: Sphingidae). Proceeding of ISER international conference, August 19, 2106: Boston, USA.
- Inoue, H., R.D. Kennett and I. J. Kitching. (1997). Moth of Thailand, Volume Two Sphingidae. ChokChai Press, Bangkok. 149pp, 44col. pls.
- Kendrick, R.C. (2010). The genus *Macroglossum Scopoli* (1777) (Lepidoptera : Sphingidae, Macroglossinae) in Hong Kong. HKE B .21-13 :(1)2
- Kitching IJ., Kendrick, R. and Smetrecek, P. (2014) .A list of hawkmoth species (Lepidoptera: Sphingidae) of India, Nepal, Bhutan and Sri Lanka, including their Common names. [Online.] Available. http://www.Flutters.Org/home/docs/Hawkmoths_of_India_et_al.pdf
- Kliangklaio, Tigvattananont, S. and Bumroongsook, S. (2015). Distribution and life history of hawk moths on Noni plants in Thailand. Journal of Agricultural Technology 11(8): 2505-2513
- Yen, S.H., Kitching, IJ. and Tzen, C.S. (2003). A new subspecies of hawkmoth from Lanyu, Taiwan with a revised and annotated checklist of The Taiwanese Sphingidae (Lepidoptera). Zoological Studies .306-292 :(2)42