

Bionomics and biometrics of Greater wax moth *Galleria mellonella* Linnaeus

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Investigations on the biology of *Galleria mellonella* revealed that the incubation period was 8.6 ± 0.48 days. The seven successive larval instars occupied 4.40 ± 0.48 , 5.20 ± 0.4 , 6.5 ± 0.67 , 7.3 ± 0.45 , 8.30 ± 0.45 , 8.40 ± 0.66 and 9.20 ± 0.4 days, the total larval period was observed to be 49.3 ± 1.62 . The duration of prepupa and pupa were 2.1 ± 0.53 and 8.6 ± 0.73 days respectively. The adult males lived for 16.4 ± 2.69 days, while female lived shorter only 6.9 ± 0.7 days. The pre oviposition, oviposition and post oviposition periods were 1.1 ± 0.3 , 4.6 ± 0.66 and 1.2 ± 0.4 days, respectively. Females laid 750.90 ± 169.78 egg/female with 159.70 ± 46.87 eggs/day.

Key words : Biology, Greater wax moth

INTRODUCTION

Honey bees are affected by several natural enemies. The greater wax moth *Galleria mellonella* is considered as a notorious pest of honey bee colonies which is well distributed throughout the world. The larvae of wax moth cause no direct damage to bees at any living stage, but are very destructive to the combs. They eat the wax of the comb and other associated materials viz., pollen, propolis dead bees and pupal cases of bees. The larvae of waxmoth bore in to the combs and make tunnels in the middle of the comb. Later black excreta can also be noticed in the web. As a result of serious infestation, weak bee colonies abscond, while in strong colonies bee population quickly reduced and complete destruction of colonies have also been recorded (Hanumantha Swamy,2000). It caused considerable damage to honey bee colonies which resulted in heavy economic losses to bee keepers (Kapil and Sihag,1983).

MATERIALS AND METHODS

Initial culture of greater wax moth was collected in *Apis cerana* colonies from apiary and developed in the laboratory. The eggs from the laboratory culture were kept in separate containers and were observed at 24 hr interval and the incubation period was recorded. Length and breadth of eggs were also measured by using a stereo binocular microscope with ocular micrometer fixed at one eye piece. After hatching, the observations were made daily for moulting, the number of moults and instars passed

during the larval development. Larval, Prepupal, pupal durations, length and breadth were also measured. After adult emergence a pair of male and female moths were released separately in to wide mouthed plastic containers for egg laying. The paper strips were removed once in 24 hours and number of eggs, if any, were counted under stereobinocular microscope and later paper strips were kept in plastic vials for incubation. Pre oviposition, oviposition and post oviposition periods were recorded, simultaneously. Fecundity and eggs per day were calculated for female.

RESULTS AND DISCUSSION

Egg :

Eggs are small, elliptical and pearly white in colour when laid but turns cream colour on exposure to air. The shell has a number of wavy lines running across it diagonally. Eggs were laid in mass, glued to the inner side of the paper strips provided for egg laying under laboratory conditions, but the moths laid eggs in cracks and crevices of hives under nest conditions. Few eggs were also noticed on the combs of weaker colonies. Oviposition occurred during night between 19.00 to 03.00hr. During the development of the larva inside the egg, the prominent black head of the pre-emerged larva was observed inside the egg shell shortly before hatching. Hatching was observed mainly during morning hours between 8-11 AM. The per cent hatching was almost 100 during summer months. Eggs measured 0.44 ± 0.02 mm long , 0.29 ± 0.02 mm broad and the duration was 8.6 ± 0.48 days (Table 1).

Elsawaf(1950) reported that the egg stage lasted 9-10 days. The reasons for the variations may be attributed to possible differences in the ecological conditions that prevailed during the study periods.

Larva :

The freshly hatched larva is pale white in colour. After emerging from the eggs, the larva started moving in search of food. Larva start feeding on the combs after perceiving the gustatory stimuli emanating from the bee combs. Larva burrow into the outer edge of cell walls. After reaching the comb they generally move towards the midrib of it. Developing larva extend their tunnels to the midrib of the comb where they continue to feed. As the larva grows in size its colour changes to dirty grey. The growth rate of the larvae depends upon the temperature and the nature of food. The growth is quick on old or darker combs containing brood and pollen, but very slow and restricted upon white or fresh combs. The fast growth leads to the total destruction of the combs within a week of infestation. *Galleria* larvae are capable of surviving even if food is available intermittently. Under such conditions the total development period greatly extends and the adults are

correspondingly smaller. The larvae do not prefer processed wax and fresh or white combs. When the larva was about to moult feeding cessation occurred, and lost its colour and cast off the exuvium of head capsule and rest of the body separately.

Seven larval instars could be recognized in the present investigation as also reported by Sehna (1966) and Anderson and Mignat (1970). The seven successive larval instars occupied 4.40 ± 0.48 , 5.20 ± 0.4 , 6.5 ± 0.67 , 7.3 ± 0.45 , 8.3 ± 0.45 , 8.4 ± 0.66 and 9.2 ± 0.4 days. The total larval duration was 49.3 ± 1.62 days in the present investigation. The larval period was reported from 39-62 days(Elswaf, 1950),22-27 days (Sehna, 1966). The variations could be attributed to the difference in the quality and quantity of food and also prevailing ecological conditions.

Prepupa and cocoon :

The full grown larva after seventh instar started moving in search of suitable site for pupation and the larva scrapes the surface slightly before pupation. The larva entered crevices of the hive for pupation in apiary .The full fed larva shrivel in size slightly and construct the cocoon out

Table 1: Biology of Greater waxmoth *Galleria mellonella* on the combs of *Apis cerana*

Life stages	Duration(Days) Mean \pm sd	Length(mm) Mean \pm sd	Breadth(mm) Mean \pm sd	Head capsule width(mm) Mean \pm sd	Wing expanse (mm) Mean \pm sd
Egg	8.60 \pm 0.48	0.44 \pm 0.02	0.29 \pm 0.02	-	-
Larva					
I instar	4.40 \pm 0.48	1.28 \pm 0.47	0.25 \pm 0.06	0.21 \pm 0.07	-
II instar	5.20 \pm 0.40	2.40 \pm 0.66	0.46 \pm 0.06	0.32 \pm 0.06	-
III instar	6.50 \pm 0.67	4.80 \pm 0.60	1.25 \pm 0.51	0.54 \pm 0.05	-
IV instar	7.30 \pm 0.45	9.10 \pm 0.70	1.55 \pm 0.65	1.15 \pm 0.43	-
V instar	8.30 \pm 0.45	15.40 \pm 0.66	2.60 \pm 0.66	1.28 \pm 0.47	-
VI instar	8.40 \pm 0.66	21.30 \pm 0.64	3.25 \pm 0.51	1.55 \pm 0.41	-
VII instar	9.20 \pm 0.40	24.40 \pm 1.17	4.85 \pm 0.36	2.30 \pm 0.50	-
Prepupa/Cocoon	2.10 \pm 0.53	22.85 \pm 1.95	8.05 \pm 0.92	-	-
Pupa	8.60 \pm 0.73	13.97 \pm 0.58	4.25 \pm 0.29	-	-
Adult male	16.40 \pm 2.69	-	-	-	24.60 \pm 0.53
Female	6.90 \pm 0.70	-	-	-	25.18 \pm 1.22
Pre-oviposition	1.10 \pm 0.30	-	-	-	-
Oviposition	4.60 \pm 0.66	-	-	-	-
Post- oviposition	1.20 \pm 0.40	-	-	-	-
Fecundity					
Eggs/F	750.90 \pm 169.78	-	-	-	-
Eggs/F/day	159.70 \pm 46.87	-	-	-	-

of the silk and excreta by remaining inside. The cocoon is spindle shaped elongated, hard and leathery. The anterior part of cocoon was wider with an exit hole made by the pupating larva for the emergence of the moth. Before pupation the exit hole was closed by a thin layer of silken material and later pushed away at the time of moth emergence. The duration of prepupa was 2.1 ± 0.53 days. The mean length of the cocoon was 22.85 ± 1.95 mm, mean breadth of cocoon was 8.05 ± 0.92 mm (Table 1).

Pupa :

The freshly formed obtect pupa was pale and gradually reached dark brown towards its maturity. A row of small spines were found just behind head and extended to abdominal segment. The mean duration of the pupa was 8.6 ± 0.73 days. However, the pupal period was 6.5-8 days (Sehnal, 1966) and 8-9 days (Kannagara, 1940). These minor variations could be ascribed to the change in the climatic factors. The mean length and breadth of the pupae were 13.97 ± 0.58 and 4.25 ± 0.29 mm respectively (Table 1).

Adults :

Emergence of the moths occurred only during night and late evening hours. The moths remained inactive till the wings were fully stretched and hardened. The moth is ashy grey in colour and one third of each front wing being bronze coloured. The hind wing is uniformly grey coloured. The colour and size of moth vary according to the food ingested during the larval period. Dark brown combs give rise to darker and bigger adults. The larvae fed on fresh combs, develop in to moths of lighter colour and smaller size. The antennae are filiform, longer than the head and thorax. The moths prefer dark places for hiding and very rarely they are attracted to light.

Adults were different in their size, males were smaller than females. The outer margin of the front wing of the males has a semi lunar notch and the labial palpi are rudimentary, whereas that of the female is smooth and without notch. The labial palpi is long and prominent. The wing expanse of female was 25.18 ± 1.22 mm, whereas in male, it was 24.6 ± 0.53 mm. Males lived for 16.4 ± 2.69 days and females lived only for 6.9 ± 0.7 days (Table 1). While, Elswaf (1950) observed adult longevity of 21-30 days for males and 8-15 days for females. The variation of the adult longevity could be attributed to the

change in ecological factors and also the quality of food consumed in their larval stage.

Biological parameters of females :

The moths began to oviposit from one day after their emergence and continued it for a maximum period of one week. The moths were found to lay eggs during night in masses. The egg masses did not have any definite pattern but the eggs were usually arranged in some what netted line pattern. Pre-oviposition, oviposition and post-oviposition periods for females were 1.1 ± 0.3 , 4.6 ± 0.66 and 1.2 ± 0.4 days, respectively. Females laid an average of 750.9 ± 169.78 eggs/female with 159.70 ± 46.87 eggs/day (Table 1). These results are in partial agreement with those of Warren and Huddleston (1962) the females laid an average of 705 eggs in their life span.

REFERENCES

- Adamson, A. M. (1943).** Enemies and diseases of the honeybee in Trinidad. *Proc. Agri. Soc. Trin. Tob.*, **43** (1): 37-39.
- Anderson, M.A. and Mignat, E.C. (1970).** The number of larval instars of greater wax moth *Galleria mellonella* with characters for identification of instars. *J. Georgia Entomol. Soc.*, **5**(2): 65-68.
- Elsawaf, S.K. (1950).** The life history of the greater wax moth (*G. mellonella*) in Egypt with special reference to the morphology of the mature larva (Lepidoptera : Pyralidae). *Bull. Soc. Fouad Ier Ent.*, **34**: 247-297.
- Hanumantha Swamy, B.C. (2000).** Natural enemies of honey bees with special reference to bioecology and management of greater wax moth *Galleria mellonella* (Lepidoptera: Pyralidae). *Ph.D. Thesis*, UAS Bangalore, 257. PP.
- Kannagara, A.W. (1940).** Bee keeping –The waxmoth. *Trop. Agric.*, **94** (2): 94-98.
- Kapil, R. P. and Sihag, R.C. (1983).** Wax moth and its control. *Indian Bee J.*, **45** (2/3): 47-49.
- Sehnal, F. (1966).** Critical study of the bionomics and biometrics of the waxmoth *Galleria mellonella* reared under different conditions. *Z. wiss. Zool.*, **174**(1/2): 53-82.
- Warren, L.O. and Huddleston, P. (1962).** Life History of the greater waxmoth, *Galleria mellonella* in Arkansas. *J. Kans. Ent. Soc.*, **35** (1): 212-216.

