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Bionomics of *Eublemma Amabilis* Moore (Lepidoptera: Noctuidae), a Major Predator of Lac insect and Its Control Measure

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Abstract

The moth, *Eublemma amabilis* Moore is very destructive to lac insect and lac encrustation. The moth is generally white-pinkish in colour and it lays gray-white and round eggs, depressed in the centre. The newly hatched larva enters the lac insect either through one of the opening in the cell or by tunneling a hole through the encrustation. A single larva damages 42-50 matured cells prior to pupation. It completes six generation in a year and causes comparatively more injury to the "Kartki" crop than to the Baishaki crop. The morphological details of this predator were studied. Several natural enemies of *E. amabilis* have been recorded.

Key words: *Eublemma amabilis*, Lac, Predator, Crop injury and Control measure.

Introduction

*Eublemma amabili*s was first described and illustrated by Moore from Sri Lanka in 1884 but Witt (1901) was the first to study the general life history and referred to its injurious nature with regard to the lac insect. Sir George Hampson has listed 128 species of genus *Eublemma* of which 44 species have been recorded from India and Sri Lanka. The number of species that have been definitely recorded as coccidophagous is six. Misra *et al.* (1930) and Glover and Chatterji (1936) also dealt briefly with this predator. Mahdihassan (1925) gave a short account of its presence in south India. Negi *et al* (1945) worked on the biological control of this predator by using its indigenous parasite, *Bracon greeni* Ashmead. As far as is known, a few published reports on the incidence of this predator are available in our country (Malhotra and Misra 1971, Islam *et al* 2001). The authors examined different samples of lac collected from different lac growing areas of Bangladesh and noted that not a single sample was free from the attack of the predator, *E amabilis.*

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Materials and Methods

Bionomics of *E. amabilis* was carried out both in the laboratory and in the field of BCSIR Laboratories, Rajshahi. In the laboratory, the room temperature ranged from 22-33^{O}C, while the relative humidity was 68-92%. Mature pupae were collected from brood lac stick and reared in plastic rearing cages (26 cm X15 cm X7.5 cm). Adult predators that emerged, were allowed to lay eggs on the brood lac stick in rearing cages. The open end of the cages were covered with fine cloth and tightened with rubber bands. Egg hatchability was studied in petri dishes. The larval, pupal and adult durations were also recorded in the rearing cages. Observations were made at every twelve hours interval. In the field, three branches were selected from each of the three host plants isolated for the study under field conditions. The selected branches on which eggs laid, kept covered with mosquito- net. Data on observations from egg to adult stages were recorded at twenty-fours interval.

Results and Discussion

The different morphological details of the predator, *E amabilis.* have been observed under the laboratory conditions. These are described below under different headings.

Imago

The maximum longevity of a female moth was found to be 23 days in February, but it was 1 day shorter in june and December. In the case of male moth, the maximum longevity was 21 days in Feruary, only I day less than in June and October. The mean longevity of a female was 7.9 $\pm$ 0.37 and in male 7.3 $\pm$ 0.31 days (Table II).

Table I. External morphological differnces between male and female imago.

Characters	Male	Female
1. Size and colour	Generally smaller and duller in colour than the female.	Generally bigger and brighter in colour than the male.
2. Antennae	47-54 jointed and hairy.	42-58 jointer and bears small hairs
3. Abdomen	Gradually tapers posteriorly	Bulges out a little in the middle and then gradually tapers posteriorly.
4. Eighth abdominal segment	Complete with an outer circular ring of scales, with 2 semicircular rings of scales on the clasper.	Incomplete, ventrally with an outer triangular ring of scales through which the ovipositor may or may not be seen projecting

Table II. Morphometry of *Eublemma amabilis* reared at the room temperature

Items		Length (mm)	Width (mm)
Egg		36.0 ± 1.58	0.8 ± 0.01
1st instar larva		1.5 ± 0.73	1.0 ± 0.24
Mature larva		9.8 ± 0.83	1.8 ± 0.37
Pupa		8.0 ± 0.24	2.0 ± 0.21
Imago	male	7.61 ± 0.57	==
	female	8.98 ± 0.83	
Longevity	male	7.3 ± 0.31	==
	female	7.9 ± 0.37	
Wing expanse	male	17.39 ± 1.07	==
	female	21.45 ± 1.27	

Reproduction

The species reproduces by sexual method only. Mating usually takes place at dusk, though moths have been noticed copulating in shady and cool places during day time.Various stages of the life cycle of this predator are described as follows.

Eggs

The moth lays grayish-white, flat round eggs, deposited in the centre with beautiful sculpturing on the chorion. The eggs are laid single on each cell of the lac insect. The eggs appears broadly circular and measures 0.34 to 0.38 mm with an average 36.0±1.58 mm across the centre (Table III).

Larva

Newly emerged larva is about 0.52 to 0.55 mm in length with an average of 0.53 ± 0.01 mm. It is creamy-white and pinkish in colour. The larva enters the lac insect either through the openings in the cell or by tunneling hole through the encrustation.

Mature larva measures about 9-11 mm in length with an average of 9.8 ± 0.83 mm and dirty yellowish-white in colour. Head is dark brown in colour and partly retractable in the prothorax. The antennae are 3-joineted, small. There are about 6 ocelli of unequal dimenstions. Thorax bears 3-jointed legs and the prolegs are borne by the 5th, 6th and 10th abdominal segments (Table III).

Pupa

Pupa is on obtect, adecticous type and dark brown in colour. It measures about 7.8 to 8.4 mm with an average of 8.0 ± 0.24 mm long and 2.0 ± 0.21 mm broad. About 13 segments are distinct from above. The eyes are small and dark brown, antennae and legs are fused ventrally. Anus lies ventrally on the 10th segment (Table III).

Table III. Incubation period and duration of egg stage of *E amabilis* observed in different months

Month	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun
Duration of eggs (days)	5-8	6-18	4-18	3-10	6-35	14-49	20-28	9-25	6-12	5-9	4-9	4-7
Incubation period (days)	1-3	6hr-15	2-13	1-6	2-15	1-27	1-9	1-5	1-6	1-3	1-2	1-3

Generation

The numbers of parasites emerged from the harvested lac stocks of the experimental cages showed the presence of *Eublemma* in large and small in the field practically througthout the year. It has been observed that this predator completes six generations in a year in the lac growing areas where only two crops viz., 'Kartiki' (October-November) and 'Baishaki' (April- May) are reaped. July was considered as the beginning of the year as it is more convenient from the point of view of lac cultivation.

The life cycle of this predator is presented in Figs. 1-5. Its life cycle is a complex one which begins with the 3rd generation. The eggs laid in October usually develop, some adults emerge in the November and the remaining adults hibernate in 'kartiki' stored lac from November to March. The eggs laid by this parasite develop and emerge as adult in different months till June. The eggs of the 5th generation are laid in the 1st week of June. The parasites of this generation do not develop due to excessive heat prevailing during this period. Scanty numbers that develop, emerge in or along with those eggs laid in the 2nd half of June, July and August. This is termed as 6th generation.

Egglaying and hatching

E. amabilis moths are more fertile during the 'Kartiki' crop than in 'Baishaki'. It has been observed that they lay enormous number of eggs in the months of July-October compared to other months of the year. It was observed both in the laboratory and in the field conditions. The maximum and minimum lengths of the eggs stage and the duration of hatching are given in Table III. The Table shows that these parameters of the eggs stage rise continuously from November-February and begin to drop from March-June and remain more or less at its lowest from June - October. The embryo

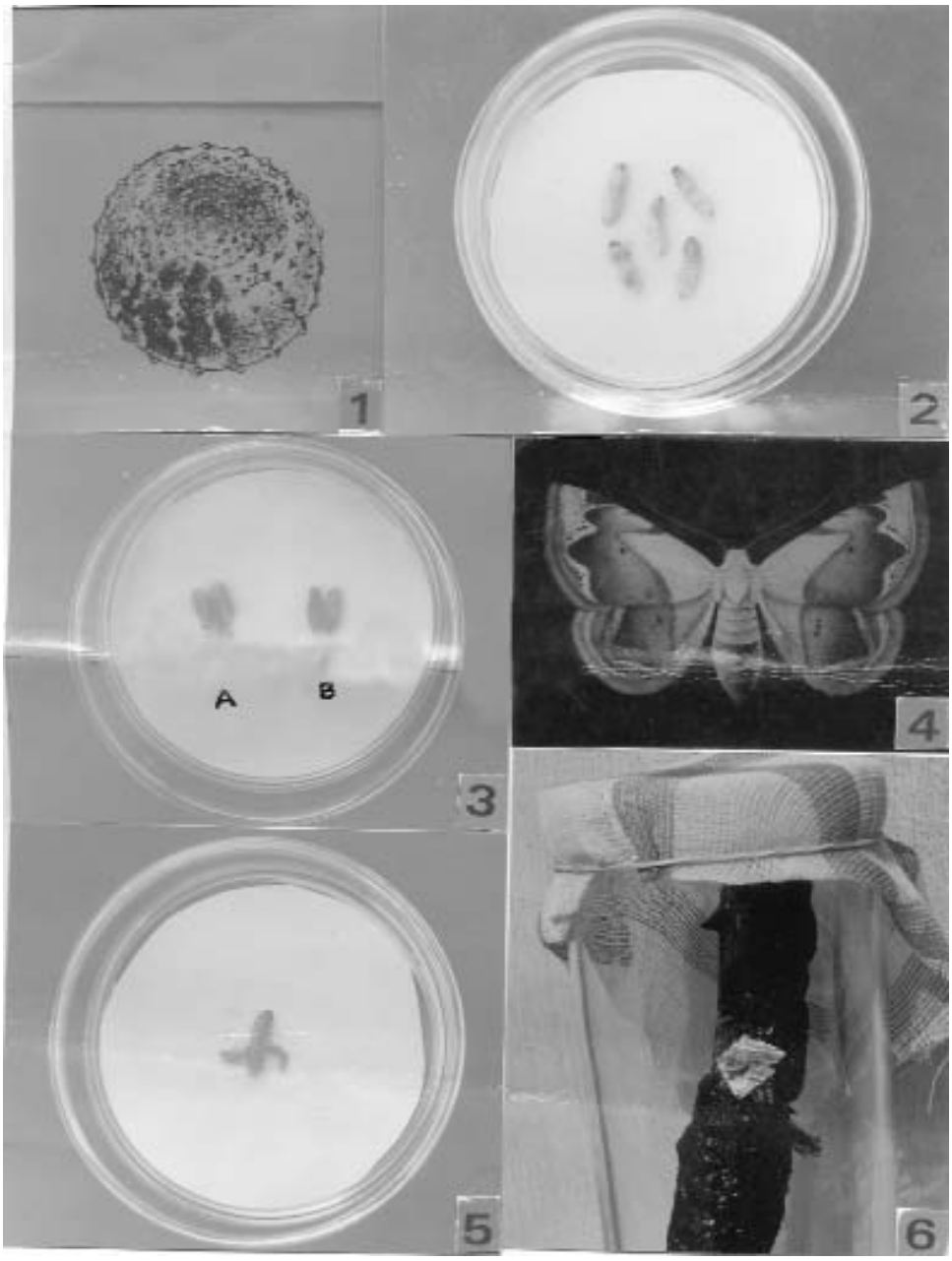

Fig. 1. Nearly mature egg of *Eublemma amabilis* x 120 (Magnification).

Fig 2. Mature larvae of *E. amabilis* (Dorsal and ventral view) X 4

Fig.3. Pupae of *E. amabilis* X 4 A. Female (Dorsolateral View), B. Male (Dorsol view)

Fig. 4. *E. amabilis* imago (female) X 8

Fig. 5. *E. amabilis* larva parasitized by *Bracon* sp.

when fully developed within the chorion, makes a hole laterally and thrusts its body showly through this opening.

Larval stages

Newly emerged tiny larva bites a small hole into the encrustations and begins to feed on the developing male and female larvae within the resinous cell. The larva as its grows, continues to make tunnels below encrustation and feeds on large number of lac insects. Prior to popation, it makes a large circular hole into the encrustation. The larva appears to moult ten times before pupation. This observation is supported to the calculations based on Dyar's Law (larval head capsule measurements) which is presented in Table IV.

Pupal stages

Full-fed larva ultimately pupates in the larval tunnel under a tough cover of its excreta. Length of pupal stage also varies with the different seasons of the year. It is lowest in generation 4 which rises in generation 6 but offspring of the generation 2 becomes highest in generation 3. The moth emerges through a rupture in the pupal coat of silken covering and files away.

Dristribution

The moth was widely distributed all over the lac growing areas of Bangladesh. It has been reared at BCSIR Laboratory, Rajshahi in the lac received from Chapai Nawabganj Shibganj, Binodpur, Nachol, Gomastapur etc. and other minor lac growing areas of Bangladesh.

Economic status

E. amabilis causes severe damage to the lac insect than any other individual species of other insect enemies. At least 30-35% of the damage caused by the predator alone. A single *Eublemma* larva damages about 46 mature cells prior to pupation. It not only destroys the lac insect but also eats the lac encrustation.

Control measures

The control measures of this predator can be divided into biological and cultural control methods. Chemical control of *E. amabilis* by insecticides should be completely abandoned because of its limited use will result in high mortality of the lac insects also. Biological control is the control of insect pests by their enemy parasies and predators. This predator has several natural enemies such as 1) *Componotus Compressus* (the big black ant) and *Solenopsis Geminata* (small red ant) pick up *Eublemma* larvae when they come out from the egg shell and tries to enter the cells by biting at the encrustation. 2)

Ephestia sp. is mainly a scanvenger but its larvae always attack *Eublemma* larva and pupa when they come in contact with them while entering into the galleries of *Eublemma.* The parasite, *Bracon greeni* (Ashm.) (Hymenoptera: Braconidae) has definitely been proved as ectoparasite of the lepidopteran, *E, amabilis* larvae. Attempt was made earlier by Negi *et al.* (1945) on biological control of this predator. Control observation of this predator by *B. greeni* was carried out in the laboratory for three years on an experimental scale. The results indicate that *Eublemma* was successfully parasitized by this insect parasite. But further investigation in this aspect is also needed to find out a concrete control method.

Cultural methods

Cultural methods are : 1. The whole crop excluding portion intended to be used as brood lac should be kept under water for 2-4 days and then taken out and allowed to dry completely preferably in the shade. If the sticks are examined, not a single living predator or parasite will be found on the sticks. 2. Selected predator and parasite free brood should be used for every crop. Self inoculation should be avoided. 3. Brood lac should be removed as soon as the tree is sufficiently covered by the lac insects in order to prevent continuation of the life cycle of *E. amabilis* which could attack crop during swarming period.

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