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# BIOLOGY OF GALL FORMING BLACK CATERPILLAR, *BETOUSA STYLOPHORA* (SWINHOE) (THYRIDIDAE: LEPIDOPTERA) ON AONLA

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## ABSRACT

A study on the biology of gall forming black caterpillar (*B. stylophora*) was carried out in the field as well in the laboratory at S.K. Nagar Gujarat during the year 2012. The eggs were shiny, translucent, creamy white in colour and spherical shaped with an average diameter of 0.72 ± 0.05 mm. The mean incubation period was 6.00 ± 0.82 days; while, the hatching percentage was 83.00 ± 12.51. The mean length and breadth of newly emerged and full grown larvae were 1.50 ± 0.07 mm and 0.53 ± 0.05 mm and 10.70 ± 0.26 mm and 2.37 ± 0.09 mm, respectively. The mean development period of newly emerged larvae and full grown larva were 2.50 ± 0.53 days and 7.20 ± 0.78 days respectively. Total larval development period was 23.60 ± 1.08 days. Pupation took place on the leaflets and it was red in colour. The average length and breadth of pupa was 6.52 ± 0.32 mm and 2.34 ± 0.30 mm, respectively. Pupal period lasted for 9.10 ± 0.80 days. The adult moths were brownish in colour; forewings and hind wings were pale brown to yellowish brown with a series of dots on margins. The male and female measured 19.07 ± 1.00 mm and 20.54 ± 2.00 mm in length and 34.87 ± 2.00 mm and 36.34 ± 2.40 mm in breadth with expanded wings, respectively. The average longevity of male and female was 6.00 ± 0.82 days and 5.30 ±1.50 days, respectively.

**Keyword:** Biology, black caterpillar, *Betousa*, aonla

## INTRODUCTION

Aonla, *Emblica officinalis* is an important indigenous fruit tree of India, the fruits of which are a rich source of vitamin "C" containing 200 to 1814 mg/100 g of pulp (Srivastava et al., 1971 and Sant Ram, 1990) with leucoanthocyanins or polyphenols. The fruits are used as antiscorbutic, diuretic, laxative and antibiotic. Different parts of the tree are used to cure bronchitis, diabetes, fever, diarrhoea, jaundice, dyspepsia, cough and in tanning and dyeing industries (Bajpai and Shukla, 1966). Many insect pests including the aonla gall forming black caterpillar (*Betousa stylophora* Swinhoe); leaf roller [*Gracilaria acidula* (Meyrich)]; aphid (*Cerciaphis emblicai*); bark and shoot borer (*Indarbela* spp.); anar butter-fly [*Deuoderix isocrates* (Fabr.)] and hairy caterpillar (*Selepa celtis* Moore) cause damage to aonla tree. The gall forming black caterpillar is economically important and causes severe damage (Patel *et al.*, 1970; Masarrat *et al.*, 2000 and Masarrat, 2003). The young caterpillar feeds inside the galls on the internal woody tissues and passes out reddish frass through a small hole at one end which is covered by a mesh work of silken threads (Bose, 1935). While feeding, the larvae inject some chemical which lead to the formation of typical galls resembling "Snake Charmer's Flute" (Singh and Gupta, 1991).

## MATERIALS AND METHODS

Muslin cloth bags were prepared and tied on the damaged branches of the aonla trees in the field for the collection of adults. The adult emerged from the pupae were gathered in the muslin cloth, which were brought to laboratory for further rearing. Fresh two feet long branches of aonla cut from the aonla tree were kept in the wooden wiregauze cage (length 21", breadth 21" and height 30") for oviposition. The cut portion of aonla branches were wrapped in cotton wool and inserted in the conical flask filled with water to maintain the turgidity. Such large numbers of flasks were prepared for mass rearing and oviposition purpose. To provide the food to the adults, a small piece of sponge dipped in 5.00 per cent honey solution was provided in the petridish. The sponge with honey solution was changed every day. The wooden cage was covered with black cloth to protect from direct sun light inside the cage.

**Egg.** The eggs laid on leaflets of aonla branch were examined daily. Freshly laid eggs were observed under microscope, twenty eggs were examined under microscope for studying the colour and shape. The size of the eggs was measured under microscope with the help of ocular scale after calibrating with stage micrometer. To study the incubation period, counted numbers of freshly laid eggs

were observed daily till hatching. The incubation period was calculated from the date of egg laying to the date of hatching. Hatching percentage was calculated on the basis of number of eggs hatched, out of total number of eggs kept under observation.

**Larva.** The larvae were observed critically under the microscope to study their colour and shape. The size of the various larval stages was measured under the microscope by using ocular micrometer after calibrating the stage micrometer. The full grown larvae were measured after opening the galls.

**Pupa.** Pupation took place on the leaflets and was examined under microscope for their colour, shape and size. The length and breadth of pupa was also measured. Pupal period was counted on the basis of date of formation of pupa and date of adult emergence.

**Adult.** Adults emerged from the pupae were critically observed under microscope for their colour, shape and size. The length and breadth of adults were measured with the help of standard scales. Longevity of male and female was also calculated separately from the date of emergence to the date of death of adults.

## RESULTS AND DISCUSSION

### Egg

**Colour, shape and size.** Freshly laid eggs were shiny, translucent, creamy white in colour. The shape of the eggs was spherical. The diameter of eggs varied from 0.65 to 0.78 mm with an average of 0.72 ± 0.05 mm.

**Incubation period.** The incubation period of the eggs of *B. stylophora* was studied at room temperature. The incubation period varied from 5 to 7 days (Av. 6.00 ± 0.82 days ), when reared at an average room temperature of 33.05 ± 6.08 ºC and average relative humidity of 57.40 ± 25.40 per cent. Meshram *et al.* (2000) recorded the incubation period as seven days. The above report supports the present findings.

**Hatching percentage.** The hatching percentage of eggs of *B. stylophora* ranged from 70 to 100 (Av. 83.00 ± 12.51 %) when reared at mean room temperature of 33.05 ± 6.08 ºC and mean relative humidity of 57.40 ± 25.40 per cent.

**Larva.** The larvae of gall forming black caterpillar, *Betousa stylophora* are internal feeders of aonla. So, it is very difficult to study various larval instars separately. It was tried in the laboratory to study the various larval instars by cut-opening the galls, but the larval development was disturbed. The colour, shape and size of newly emerged larvae and full grown larvae were recorded.

### Colour, shape and size

**[A] Newly emerged larva.** The newly emerged larva was tiny, cylindrical, small, minute and black in colour. Just after hatching, the larvae became active and started feeding on the twigs of aonla tree. The tiny caterpillar bore in to twig or shoot. The damaged tissues developed in to a gall-like structure on the branch. The larva injects some chemical substances at its feeding surface by which the feeding portion swells forming a gall like structure. The measurement of newly emerged larva revealed that the length of newly emerged larva varied from 1.34 to 1.60 mm (Av. 1.50 ± 0.07mm); while, the breadth varied from 0.46 to 0.60 mm (Av. 0.53 ± 0.05 mm). The duration of newly emerged larva varied from 2 to 3 days (2.50 ± 0.53 days).

**[B] Full grown larva.** The colour of the full grown larva was black with darkish brown head. The ventral surface of the head and mouth parts were creamy to yellowish in colour. The prothorax was narrower than the meso-thorax and had a glossy, lightly chitinized shield covering the whole of the dorsal surface. The three pairs of thoracic legs were glossy and creamy to yellowish in colour. The tarsi and claws were brown or dark brown. The colour of the rest of the thorax and abdomen was jet-black. The length of full grown larva varied from 10.20 to 11.00 mm (Av. 10.79 ± 0.26 mm) and breadth varied from 2.25 to 2.50 mm (Av. 2.37 ± 0.09 mm). The duration of full grown larva varied from 6 to 9 days (Av. 7.20 ± 0.78 days).

Bose (1935) reported that the full grown larva was 10-11 mm in length and 2.25- 2.50 mm in breadth, while, Meshram *et al.* (2000) reported that the length of the full grown larva was 11.00 mm and breadth was 2.00 mm. The above reports closely support the present investigations.

**Total larval period.** The total larval period of *B. stylophora* varied from 22.0 to 25.0 days (Av. 23.60 ± 1.08 days) when reared at an average temperature of 33.05 ± 6.08 ºC and relative humidity of 57.40 ± 25.40 per cent. Singh and Gupta (1991) and Patel (1996) reported that the total larval duration of aonla gall forming black caterpillar was 24.45 ± 1.09 days at an average temperature of 30.07 ± 1.05 ºC and 78.63 ± 4.73 per cent relative humidity.

### Pupa

**Colour, shape and size.** The freshly formed pupa was red in colour. The visible spiracles were situated on the 4$^{th}$ to 8$^{th}$ abdominal segment, they were elongate, oval and narrow with light brown rims.

The length of pupa varied from 6.00 to 7.00 mm (Av. 6.52 ± 0.32 mm); while, breadth varied from 2.00 to 2.75 mm (av. 2.34 ± 0.30 mm). As per reports of Bose (1935), the pupa was 6 mm in length and 2.75 mm in breadth, while Meshram *et al.* (2000) reported that the pupa was 7 mm in length and 2 mm in breadth.

**Pupal period.** The pupal period of *B. stylophora* varied from 8.00 to 10.00 days (av. 9.10 ± 0.80 days) when reared at an average temperature of 33.05 ± 6.08 ºC. Singh and

Gupta (1991) reported that the pupal period of *B. stylophora* was 100.45 ± 1.05 days when reared at an average temperature of 28.91 ± 0.59 ºC and relative humidity of 80.77 ± 3.75 per cent while, according to Meshram *et al.* (2000) the pupal period of *B. stylophora* was 8 to 10 days at the temperature ranges from 25.5 – 35.0 ºC and 40 per cent relative humidity.

**Site of pupation.** Full grown caterpillar comes out of the galls and makes pupal chambers. Aonla leaflets were used by larvae for the preparation of pupal chamber. Bose (1935) and Meshram *et al.* (2000) reported that the pupation of the *B .stylophora* took place on the leaflets. Generally, five leaflets were used for the preparation of pupal chamber. Similar observations were made by us too at the time of pupation.

## Adult

**Colour, size and appearance.** Freshly emerged adult moths were brownish in colour. Forewings and hind wings were pale brown to yellowish brown with a series of dots on the margins. The female moth was slightly bigger than the male moth and was identified by the presence of tuft of hairs on the tip of the abdomen. Length of male moth varied from 17.00 to 22.00 mm (av. 19.07 ± 1.00mm), while, the breadth with wing expansion varied from 32.00 to 38.00 mm (Av. 34.87 ± 2.00 mm). The length of female ranged from 18.00 to 24.00 mm (av. 20.54 ± 2.00 mm), while, the breadth with wing expansion varied from 34.00 to 39.00 mm (Av. 36.34 ± 2.40 mm).

**Longevity.** The longevity of male moths varied from 5 to 7 days (av. 6.00 ± 0.82 days); while, the longevity of female moths ranged from 4 to 8 days (av. 5.30 ± 1.50 days) at an average room temperature of 33.05 ± 6.08 ºC and relative humidity of 57.40 ± 25.40 per cent. Patel (1996) and Singh and Gupta (1991) reported that the longevity of adults of gall forming black caterpillar was 5.70 ± 0.92 days at an average temperature of 28.91 ± 0.36 ºC and relative humidity of 83.87 ± 3.48 per cent.

**Total life period.** The total life span of *B. stylophora* (from egg to death of adult moth) of male varied from 40 to 49 days (av. 44.60 ± 3.30 days); while that of the female varied from 39 to 50 days (av. 43.90 ± 3.50 days) at a fluctuating temperature of 33.05 ± 6.08 ºC

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