

**A note on morphometry and post larval life stages of *Aenasius bambawalei* Hayat \***

Solenopsis mealybug, *Phenacoccus solenopsis* Tinsley (Homoptera: Pseudococcidae) has been first documented on cultivated cotton crop in United States (Fuchs *et al.*, 1991). Later on, it was spread in other countries including India. In Gujarat, *P. solenopsis* was first time reported by Jhala *et al.* (2009a). Two hymenopteran parasitoids viz. *Aenasius* sp. from Delhi and *Promuscidea unfasciatiiventris* from Maharashtra have been reported on *P. solenopsis* (Tanwar *et al.*, 2008). Further, Jhala *et al.* (2009b) recorded *Aenasius bambawalei* Hayat (Hymenoptera: Encyrtidae) parasitizing *P. solenopsis* in Gujarat. Survey in cotton fields of middle Gujarat indicated 17.6 % parasitism on cotton mealybugs by *A. bambawalei* (Anon. 2011). This parasitoid has well established and regarded as key natural enemy of *P. solenopsis* exerting a great deal of natural control now in India. Hence, in its conservation and multiplication understanding the biology was felt essential wherein the information is almost meagre. Therefore, a study on this aspect was done at Biological Control Research Laboratory, Anand Agricultural University, Anand (Gujarat) during the year 2010.

Initial culture (cocoons) of *A. bambawalei* was obtained from parasitized mealybug, *P. solenopsis* from cotton fields and kept in plastic cage (60 x 30 x 30 cm). Adults emerged were released on sprouted potatoes infested with *P. solenopsis* in a plastic cage. The female is an endoparasitoid and parasitized full-grown nymphs and adults of mealybugs in cage. A brown colour barrel shaped pupal case of the parasitoid was observed in mealybugs

colonies within a week from which adults emerged out. Honey streaks were provided on inner wall of plastic cage as food to the adults. Thus, culture of *A. bambawalei* was established in laboratory for life-cycle and morphometric studies.

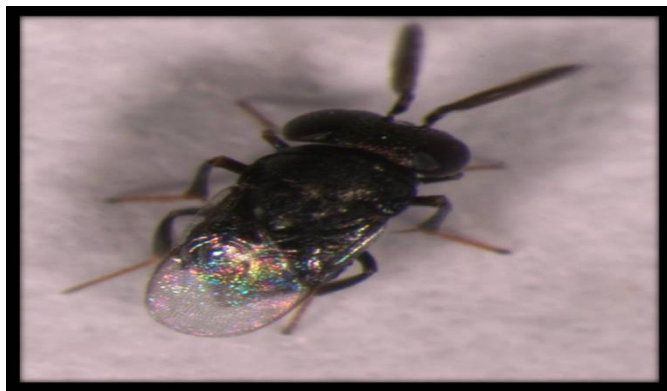
In order to study the life-cycle of visual stages of *A. bambawalei*, five petridishes (1 x 9 cm) having cotton leaves with fifteen nymphs of *P. solenopsis* in each petridish were taken. Freshly emerged pair of *A. bambawalei* was released in each petridish for parasitization. The parasitized nymphs were provided with fresh cotton leaves daily until the formation of pupae. Thirty parasitized mealybugs were selected and kept individually in petridish. Observations on duration of pupae and adults were recorded. Different visual stages such as pupae and adults were critically examined under binocular microscope for their colour and shape. Morphometric observations of these stages were made by using Magnus-pro software.

Life-cycle of *A. bambawalei* studied in laboratory revealed that the egg and larval stages of the parasitoid did not visible being an internal feeder, but swelling and poor movement of the parasitized mealybugs were observed after 2 to 3 days of parasitization. The parasitized mealybugs transformed into dark brown mummies within 4 to 7 days. This observation is in accordance with the report of Solangi and Mahmood (2011). The pupae of *A. bambawalei* were barrel shaped with dark brown colour. Duration of pupal period ranged from 5 to 8 days with an average of  $6.05 \pm 0.24$  days. Length and width of pupae

Table 1. Duration and measurements of different stages of *A. bambawalei*

Parameters	Duration (days)		Measurement (mm)	
	Range	Mean ( $\pm$ S.E.m)	Range	Mean ( $\pm$ S.E.m)
Pupa	5 - 8	6.05 $\pm$ 0.24	-	-
Length	-	-	3.43 - 3.53	3.48 $\pm$ 0.01
Width	-	-	1.75 - 1.94	1.85 $\pm$ 0.02
Area (sq. mm)	-	-	3.48 - 5.49	4.63 $\pm$ 0.12
Adult Male	4 - 8	5.85 $\pm$ 0.31	-	-
Length	-	-	0.79 - 1.27	1.04 $\pm$ 0.04
Width	-	-	0.30 - 0.51	0.38 $\pm$ 0.01
Head width	-	-	0.34 - 0.49	0.42 $\pm$ 0.01
Length of foreleg	-	-	0.39 - 0.61	0.49 $\pm$ 0.01
Length of middle leg	-	-	0.48 - 0.62	0.55 $\pm$ 0.01
Length of hind leg	-	-	0.51 - 0.70	0.58 $\pm$ 0.01
Antenna	-	-	0.69 - 1.09	0.88 $\pm$ 0.03
Wing length	-	-	0.80 - 1.17	1.00 $\pm$ 0.03
Wing width	-	-	0.41 - 0.59	0.50 $\pm$ 0.01
Adult female	9 - 17	12.55 $\pm$ 0.56	-	-
Length	-	-	1.40 - 1.79	1.63 $\pm$ 0.03
Width	-	-	0.71 - 0.89	0.80 $\pm$ 0.01
Head width	-	-	0.78 - 0.96	0.90 $\pm$ 0.01
Length of foreleg	-	-	1.23 - 1.33	1.28 $\pm$ 0.01
Length of middle leg	-	-	1.33 - 1.41	1.38 $\pm$ 0.01
Length of hind leg	-	-	1.43 - 1.52	1.49 $\pm$ 0.01
Antenna	-	-	0.88 - 1.27	1.11 $\pm$ 0.03
Wing length	-	-	1.20 - 1.41	1.31 $\pm$ 0.01
Wing width	-	-	0.60 - 0.72	0.65 $\pm$ 0.01

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Male



Female

Plate: Male and female of *Aenasius bambawalei* Hayat

varied from 3.43 to 3.53 and 1.74 to 1.94 mm with an average of  $3.48 \pm 0.01$  and  $1.85 \pm 0.02$  mm, respectively (Table 1). The area of pupae was ranged from 3.48 to 5.49 sq. mm with an average of  $4.63 \pm 0.12$  sq. mm.

Adults emerged out by cutting a circular small hole on mummies after completion of pupal period. Males and females of *A. bambawalei* could be easily separated by their morphological characters. Head of male (Plate) was somewhat dumb-bell shaped, small and attached narrowly with the thorax, whereas in female it was somewhat oval shaped, slightly larger than thorax and broadly attached with it. Though adults of both the sexes were blackish in colour, the female body was shiny black in colour with large thimble like setigerous punctures on head. In case of male head colour and thimble-like punctures were more or less similar as in female.

Length and width of male was varied from 0.79 to 1.27 (av.  $1.04 \pm 0.04$ ) and 0.30 to 0.51 (av.  $0.38 \pm 0.01$ ) mm, whereas in female it varied from 1.40 to 1.79 (av.  $1.63 \pm 0.03$ ) and 0.71 to 0.89 (av.  $0.80 \pm 0.01$ ) mm, respectively. It showed that males were smaller in size than females. Antennae were covered with small hair like structures. The apex of antennae was clubbed like with light black colour. Measurement of female and male antennae ranged from 0.88 to 1.27 and 0.69 to 1.09 mm with an average of  $1.11 \pm 0.03$  and  $0.88 \pm 0.03$  mm, respectively. Head width of male was varied from 0.34 to 0.49 mm with an average of  $0.42 \pm 0.01$  mm, while in female it was 0.78 to 0.96 mm with an average of  $0.90 \pm 0.01$  mm.

Femur and tibia of all the three pairs of legs in both the sexes of *A. bambawalei* were black in colour with tarsi yellowish and pre-tarsi light black in colour. A conspicuous spur was present

at the junction of tibia and tarsi on all the 3 pairs of legs. Length of spur was increased from fore leg to hind leg. Length of fore, middle and hind leg of male ranged from 0.39 to 0.61, 0.48 to 0.62 and 0.51 to 0.70 mm with an average of  $0.49 \pm 0.01$ ,  $0.55 \pm 0.01$  and  $0.58 \pm 0.01$  mm, respectively, whereas in female it ranged from 1.23 to 1.33, 1.33 to 1.41 and 1.43 to 1.52 mm with an average of  $1.28 \pm 0.01$ ,  $1.38 \pm 0.01$  and  $1.49 \pm 0.01$  mm, respectively.

Wings of both the sexes of *A. bambawalei* were transparent, however the basal portion of wings of female was somewhat black in colour. Length and width of wings in male ranged from 0.80 to 1.17 and 0.41 to 0.59 mm with an average of  $1.00 \pm 0.03$  and  $0.50 \pm 0.01$  mm, respectively. In female it ranged from 1.20 to 1.41 (av.  $1.31 \pm 0.01$ ) and 0.60 to 0.72 (av.  $0.65 \pm 0.01$ ) mm, respectively.

Longevity of male adults varied from 4 to 8 days with an average of  $5.85 \pm 0.31$  days while in female it was 9 to 17 days with an average of  $12.55 \pm 0.56$  days (Table 1). Longevity of *A. bambawalei* noticed in present study is in agreement with the finding of Solangi and Mahmood (2011), with slight deviations due to changes in environmental conditions. The morphometric descriptions have been elaborated probably for the first time.

*A. bambawalei* is an endoparasitoid hence there is a great scope to study its immature stages i.e. egg and larva which are not covered here. Present findings regarding the lifecycle of the parasitoid will be of immense importance to exploit the parasitoid as a bioagent. The basic information of duration of male and female could be used during mass multiplication and release of parasitoid in the infested fields to manage the mealybugs.

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