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*ORIGINAL ARTICLE*

# Biology and host stage preference of *Aenasius bambawalei* Hayat (Hymenoptera: Encyrtidae), on *Phenacoccus solenopsis* Tinsley reared on okra

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**ABSTRACT**
*Aenasius bambawalei Hayat (Hymenoptera: Encyrtidae), is a solitary endoparasitoid of Phenacoccus solenopsis Tinsley, The mean development period from oviposition to mummification of A. bambawalei on okra ranges from 6.31 ± 0.12 days, mummy formation to adult emergence* ***4.71 ± 0.11 and 6.12 ± 0.15 days*** *male and female, respectively. developmental period 11.01 ± 0.17 and 12.45 ± 0.14 days of male and female parasitoid, oviposition and post-oviposition period 24.71 ± 0.42 and 2.97 ± 0.05 days, daily and total fecundity, 4.86 ± 0.11 and 100.28 ± 1.37 (No. of parasitised host per female), adult longevity 16.21 ± 0.42 and 26.24 ± 0.60 days of male and female, male: female ratio 1:1.92. Host stage preference revealed that A. bambawalei could not parasitized 1st instar stage of P. solenopsis. The maximum percentage of parasitisation of mealybugs was 92.80, 88.80, and 42.56 per cent on adult host, IIIrd, and IInd instar respectively.*
***Key words****: Aenasius bambawalei, Phenacoccus solenopsis, biology, host stage preference, okra.*

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## INTRODUCTION

*Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Pseudococcidae), is a major invasive pest in India 2005 (Hodgson *et al*., 2008). It has become a major pest of okra in all the major cotton and okra growing states of India and is the most leading mealybug species attacking okra at present (Nagrare *et al*., 2009). The pest has been deriving to feed on several other hosts such as okra, tomato, parthenium, brinjal, tobacco, and sunflower. *Aenasius bambawalei* Hayat (Hymenoptera: Chalcidoidea: Encyrtidae), A solitary endoparasitoid apparently introduced along with the host, has been recorded from cotton growing states on *P. solenopsis* in 2008-09. This parasitoid was reported first from Pakistan as *Aenasius* sp. *longiscapus Compere*. In India, it started appearing in northwestern India (NCIPM, 2008; Tanwar *et al*., 2008) and slowly has spread to all the states in India, causing reasonable to high rates of parasitism. It was specific to *P. solenopsis* and recently taxonomically described (Hayat, 2009). In analysis of its prospective to control *P. solenopsis*, a plain analytical description of this species with illustrations is given to permit easy identification and notes on its biology on the solenopsis mealybug of okra are provided in this paper.

## MATERIAL AND METHODS

The present study was carried out at Bio-control Laboratory, Dept. of Agril. Entomology, College of Agriculture, Latur (MS) during 2015-16. The fine points of material used and methods adopted for the present investigations are described under following heads.

### Rearing of host insect, *P. solenopsis* on okra

Okra as a host plant of *phenacoccus* were planted in plastic pots in the month of June and maintained throughout the period of experimentation. The well grown host plants were transferred to laboratory. Then, the mother culture of mealybug containing about 25 to 30 gravid females of *P. solenopsis* was released and reared on okra under laboratory conditions at 27 $^0$C temperature and 50-60 per cent RH. All

these plastic pots were properly covered with iron cage with wire net to avoid any natural parasitisation on mealybug. The culture of mealybug was maintained till the end of the research work.

**Rearing of *A. bambawalei* on *P. solenopsis***

The culture of *A. bambawalei* was initially obtained from parasitised mealybugs infesting Hibiscus or *China rose* plants. The parasitoids were released carefully and mass multiplied on mealybugs reared on okra under laboratory condition. The parasitoids emerged out from field collected cocoons parasitised full-grown nymphs and adults of mealybug in the cage. These parasitised mealybugs turned in to brown colour cocoons or mummies. Within a week the adults of *A. bambawalei* emerged out from the pupae. The emerged adults were provided with 50 per cent honey solution soaked in okra swab as a source of food in each cage. In this way large numbers of *A. bambawalei* were obtained for conducting different aspects of studies.

**Biology of *A. bambawalei* on *P. solenopsis* reared on okra**

An investigation on the biology of visual stages of *A. bambawalei* was carried out on mealybugs reared on okra. Five Petri dishes (1 x 9 cm) containing okra leaves with fifteen nymphs of *P. solenopsis* in each were taken. Freshly emerged pair of *A. bambawalei* was released in each Petri dish for parasitisation. The adults were provided with 50 per cent honey solution soaked in okra swab as a source of food inside the Petri dish. The parasitised nymph's were provided okra leaves daily until the formation of pupae or mummy. The ten parasitised mealybugs (after pupal or mummy formation) were selected, transferred carefully in Petri dish and observed till the death of adult parasitoid. The experiment was replicated five times. The observations on development period (pupal and adult), longevity, sex ratio and emergence time of adult were recorded separately for parasitoids emerged from mummified nymphs of mealybug reared on okra.

**Host stage preference by *A. Bambawalei* on *P. solenopsis* reared on okra**

Experiment was initiated by collecting parasitised pupae or mummies from okra plants and placed them in Petri dishes separately until adult emergence. Newly emerged adults were collected in another Petri dish and kept them for 24 hours to ensure mating. Four host stages including three nymphal (I, II and III) and adult were used in this experiment. Five mealybugs of each instar were released on fresh leaves in Petri dish. Then mated female of *A. bambawalei* was introduced individually into a Petri dish containing a mealybug infested leaf. After 24 hours of exposure, female of *A. bambawalei* was removed from Petri dish and mealybugs of each stage were separated. Every day, this pair of parasitoid was collected and released on mixed population mealybugs (I, II, III and adult stage) on fresh leaves until death of parasitoid. The exposed mealybugs were examined up to 10 days for mummy formation. The total mummified bodies were counted and per cent mummy formation in each instar of *P. solenopsis* was calculated.

## RERSULTS AND DISCUSSION

**Biology of *A. bambawalei* on *P. solenopsis* reared on okra**

The parasitised mealybugs turned into hard leathery structure called "Mummies". The formation of mummies was started from 5$^{th}$ day and continued up to 7$^{th}$ day after oviposition. The mean development period from oviposition to mummification of *A. bambawalei* was 6.31 ± 0.12 days mean developmental period from mummy formation to adult emergence of male and female was found to be 4.71 ± 0.11 and 6.12 ± 0.15 days, mean developmental period of male and female was 11.01 ± 0.17 and 12.45 ± 0.14 days, The pre-oviposition period was less than one as mating took place soon after adult emergence and female started oviposition on same day. The mean oviposition and post-oviposition period was 24.71 ± 0.42 and 2.97 ± 0.05 days, Egg laying capacity per females was estimated on the number of parasitised mealybugs of those exposed to a mated female parasitoid in its life. The mean daily and total fecundity was 4.86 ± 0.11 and 100.28 ± 1.37. Adult longevity of male and female *A. bambawalei* emerged from *P. solenopsis* was found to be 15.74 ± 0.40 and 25.84 ± 0.51 days and male: female ratio was recorded 1:1.92 on *P. solenopsis* reared on okra (Table 1.). These results are in close agreement with findings of Vijaya *et al.* (2011), Aga (2015), Solangi and Mahmood (2011), Zain-ul-Abdin *et al.* (2012).

**Host stage preference by *A. bambawalei* on *P. solenopsis* reared on okra**

The results on the host stage preference revealed that *A. bambawalei* could not parasitise 1$^{st}$ instar stage of *P. solenopsis* reared on okra. The maximum percentage of parasitisation of mealybugs reared on okra was observed in adult host (92.80 per cent) followed by III$^{rd}$ instar (88.80 per cent) and II$^{nd}$ instar (42.56 per cent) (Table 1 and Fig 2). These findings are in close agreement with results of Arif *et al*. (2012a) revealed maximum parasitism of *P. solenopsis* due *Aenasius* on shoeflower plants (81.3 per cent) followed by on okra (76.9 per cent), and brinjal (36.4 per cent).

**Table 1: Overall biological characteristics of and host stage preference by *A. bambawalei* on *P. solenopsis* reared on okra**

| S N | Biological characteristic | | Mean | Range | S.E.± | C.D. | C.V. | No. of parasitised hosts | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Okra | | | |
| | | | | | | | | No. Obs. | Host instars | | | |
| | | | | | | | | | I | II | III | Adult |
| 1 | Oviposition to mummy formation | | 6.31 | 5.83-6.87 | 0.12 | 0.37 | 4.56 | 1 | 0 | 8.00 | 22.80 | 24.20 |
| 2 | Adult emergence after mummy formation | Male | 4.71 | 3.98-5.09 | 0.11 | 0.33 | 5.46 | 0 | 0 | 10.00 | 20.40 | 23.20 |
| | | Female | 6.12 | 5.07-7.07 | 0.15 | 0.47 | 5.84 | 0 | 0 | 12.00 | 22.80 | 22.20 |
| 3 | Developmental period | Male | 11.01 | 10.07-11.72 | 0.17 | 0.49 | 3.83 | 0 | 0 | 13.00 | 21.00 | 23.20 |
| | | Female | 12.45 | 10.90-13.94 | 0.14 | 0.39 | 2.73 | 0 | 0 | 10.20 | 24.00 | 23.20 |
| 4 | Pre-oviposition period (days) | | < 1 | < 1 | - | - | - | **Total** | 0 | 53.20 | 111.00 | 116.00 |
| 5 | Oviposition period (days) | | 24.71 | 23.84-25.94 | 0.42 | 1.26 | 3.87 | **Mean** | 0 | 10.64 | 22.20 | 23.20 |
| 6 | Post-oviposition period (days) | | 2.97 | 2.91-3.17 | 0.05 | 0.14 | 3.77 | **S.E.** | 0 | 0.09 | 0.22 | 0.20 |
| 7 | Daily fecundity | | 4.86 | 3.81-5.58 | 0.11 | 0.34 | 5.38 | **C.D.** | 0 | 0.26 | 0.65 | 0.59 |
| 8 | Total fecundity | | 100.28 | 97.89-104.10 | 1.37 | 4.04 | 3.06 | **C.V.** | 0 | 1.88 | 2.21 | 1.93 |
| 9 | Male longevity (days) | | 15.74 | 14.45-17.20 | 0.40 | 1.20 | 5.8 | **Per cent parasitisation** | 0 | 42.56 | 88.80 | 92.80 |
| 10 | Female longevity (days) | | 25.84 | 23.39-27.74 | 0.51 | 1.50 | 4.42 | | | | | |
| 11 | Sex ratio of progeny (Male :Female) | | Male : Female ratio = 1:1.92=1:2 | | | | | | | | | |

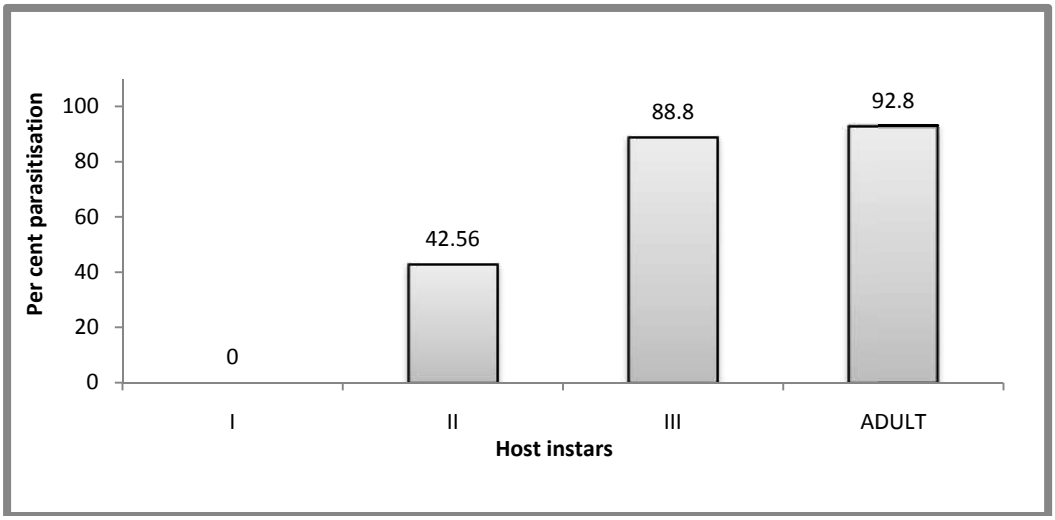


**Fig.2. Host stage preference by *A. bambawalei* on *P. solenopsis* reared on okra**

## Conclusion

Present investigations concluded that okra plants had significant influence on the biology and host stage preference of *A.* bambawalei. On *P. solenopsis* when reared on okra. The shorter development period, high fecundity and longer female longevity made *A. bambawalei* as an ideal parasitoid for the management of *P. solenopsis* infesting okra. The III$^{rd}$ instar and adult (female mealy bug) host stages were the most preferred host stages of *P. solenopsis* for mass-rearing of *A. bambawalei* in bio-control programme. The host specificity of *A. bambawalei* was directly proportional to the size of host.

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