



Biology of the mealy bug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on cotton in India

Rishi Kumar*, Shravan Lal Jat, Vijander Pal and Rahul Chauhan

Central Institute for Cotton Research, Regional Station, Sirsa 125 055, Haryana, India

Email: rishipareek70@yahoo.co.in

ABSTRACT: *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) reported on cotton in India in 2007 is an exotic species originally described from USA in 1898. The oblong shaped, wingless female of *P. solenopsis* laid eggs in uniformly secreted ovisac covered under its body. The mean number of ovisacs per female was 2.9. The mealy bug is a prolific breeder and produced a mean of 390.7 crawlers per female on cotton. The female has three nymphal instars whereas the male has two nymphal instars and a pupal stage (cocoon). The 1st and 2nd nymphal instars of male and female are indistinguishable. The 1st instar nymph (crawler) showed high motility and had no permanent feeding site. The mean total nymphal duration of male was 23 d and of female, 24.6 d. The mean longevity of male was 1.2 d and of female, 16.9 d. The population of *P. solenopsis* had a positive correlation with temperature.

© 2010 Association for Advancement of Entomology

KEYWORDS: *Phenacoccus solenopsis*, development, biology

Until 2007, there has been no published evidence of occurrence of mealy bug (Hemiptera: Pseudococcidae) on *Gossypium hirsutum* (Linn.) which currently occupies over 80% of the total cotton cultivated area in India although there were isolated reports of occurrence of *Maconellicoccus hirsutus* (Green) on the native cotton, *Gossypium arboreum* (Dhawan *et al.*, 1980) and the new world cotton, *G. herbaceum* (Murlidharan and Badaya, 2000). But during 2007, mealy bug infestation was recorded in all nine cotton growing states of India, and taxonomic study showed that two species, *Maconellicoccus hirsutus* and *Phenacoccus solenopsis* were involved. *P. solenopsis* which was not reported earlier from India was found as the predominant species. It is an exotic species introduced from USA (Nagrare *et al.*, 2009).

P. solenopsis is a known pest of ornamental and fruit trees world wide. Its first report on cotton was published in the USA in 1991 (Fuchs *et al.*, 1991). Subsequently it was reported from Pakistan in 2006 and from Gujarat, followed by Punjab and

*Corresponding author

TABLE 1. Biological parameters of *Phenacoccus solenopsis*

Parameter	Mean \pm SE
Instar I, duration (days)	4.80 \pm 0.25
Instar II, duration (d)	4.90 \pm 0.28
Pupa, male, duration (d)	13.30 \pm 0.42
Instar III, female, duration (d)	14.90 \pm 0.51
Adult longevity, male (d)	1.20 \pm 0.07
Adult longevity, female (d)	16.90 \pm 0.53
Pre-oviposition period (d)	5.00 \pm 0.26
Oviposition period (d)	5.80 \pm 0.39
Post-oviposition period (d)	4.50 \pm 0.34
Total crawlers/female (No.)	390.70 \pm 25.89
Ovisac/female (No.)	2.90 \pm 0.23

Values given are the mean and standard error of 10 replicates.

Haryana in India (Monga *et al.*, 2009). Information on the biology and development of *P. solenopsis* is scanty. In the present study an attempt was made to understand its biology on cotton in India as it would be useful in Integrated Management of this pest.

Observations on biology were made under polyhouse conditions during July (peak of cotton season). Ten ovisacs obtained from *P. solenopsis* reared on potted cotton plants were placed separately on 10 cotton plants of one month age (one ovisac/plant). The ovisacs were removed after 24 h and observations were recorded on the development of the crawlers that were released from the ovisac and settled on the cotton plants during the 24 h period. The number and interval between moulting were carefully noted. Fecundity was studied by leaving one crawler on a potted plant (10 replications) till the formation of ovisacs by the females and counting the number of crawlers emerging from the ovisacs. To study the mode of reproduction, two sets of 10 third instar females were removed from cotton plants and reared on potato sprouts, one set with males and one set without.

The effect of temperature, humidity and rainfall on the development of the mealybug was studied by recording weekly the mealybug population from 10 fixed locations. The number of mealybugs from 5 cm length of the central shoot of 10 plants was counted.

Table 1 shows the biological parameters of *P. solenopsis*.

The adult female is nymph-like, oblong, and light to dark grey greenish, with two black stripes on the dorsal side of the abdomen. Survival percentage from 3rd nymphal instar to the adult stage was 89.1%. This stage lasted from 14 to 19 days (mean 16.9 d).

Eggs were not observed as they remain in ovisac. The 1st instar and early 2nd instar females are not distinguishable from the males and both are oblong in shape. The 1st instar (crawler) is yellow greenish in color, with a pair of seven- to eight-segmented antennae. It preferred the apical portion of the plant but infestation was noticed on other parts like leaves, petioles, squares and bolls. This stage was the most active as

it lacked mealy wax secretion, and responsible for dispersal of the bugs. The mean duration of this stage was 4.8 days. The survival percentage from the 1st to 2nd instar was 69.32. The 2nd instar female is oblong and grey greenish, with seven-segmented antennae. The tip of the abdomen is protruded and has two setae. This stage lasted for 4.9 days. The 3rd instar female is grey greenish in colour and oblong in shape. At this stage white cottony substance appears and covers the entire body. The antennae are straight, filiform and 7-segmented. The mean duration of this stage is 14.9 d with survival percentage of 74.16. Formation of puparium was not observed in the case of female.

The male of *P. solenopsis* has a pair of wings and long waxy caudal filaments (cerci). It is short lived with longevity of 1.2 days. Survival percentage from pupa to the adult male was 83.12%. The males were not available throughout the year. In 2007, the males were observed in the month of October whereas in 2008 they were observed in August.

As noted earlier, the 1st and 2nd instar males are not distinguishable from the female. At the end of 2nd instar (from 8th to 12th day of nymphal life) formation of puparia (cocoon) started. The pupal stage has two small wing buds, one on each side of the mesothorax. The mean duration of the pupal stage was 13.3 days. The survival percentage from 2nd instar to pupa was 61.2.

In experiments in which adult female mealy bugs were kept with and without male to study reproduction, occurrence of both sexual and asexual reproduction was confirmed. In the case of asexual reproduction only female offsprings were produced. Only asexual reproduction was recorded during the active growth season of cotton (May to August).

The mealybug population ranged from 59.6 insects per 5 cm central shoot in May to nil in October. The population build up had a significant positive correlation with temperature. Akintola and Ande (2008) recorded the total duration of developmental stage of *P. solenopsis* as 24 days. In the present study it was 23 days in male and 24.6 days in female.

ACKNOWLEDGEMENT

The facilities provided by Head, CICR for conducting this study are gratefully acknowledged.

REFERENCES

- Akintola A. J. and Ande A. T. (2008) First record of *P. solenopsis* Tinsley (Hemiptera: Pseudococcidae) on *Hibiscus rosa sinensis* in Nigeria. *Agricultural Journal*, 3(1): 1-3.
- Dhawan A. K., Singh J and Sindhu A. S. (1980) *Maconellicoccus* sp attacking *Gossypium arboreum* cotton in Punjab. *Science and Culture*, 46: 258.
- Fuchs T. W., Stewart J. W., Minzenmayer R. and Rose M. (1991) First record of *Phenacoccus solenopsis* Tinsley in cultivated cotton in the United States. *Southwestern Entomologist*, 16(3): 215-221.
- Monga D., Rishi Kumar M. C., Vijendra Pal and Jat (2009) Mealybug, a new pest of cotton crop in Haryana-a survey. *Journal of Insect Science*, 22(1): 100-103.

- Murlidharan C. M. and Badaya S. N. (2000) Mealybug (*Maconellicoccus hirsutus*) (Pseudococcidae: Hemiptera) outbreak on herbaceous cotton in Waged cotton belt of Kachchh. *Indian Journal of Agricultural Sciences*, 70: 705-706.
- Nagrare V. S., Kranthi S., Biradar V. K., Zade N. N., Sangode V., Kakde G., Shukla R. M., Shivare D., Khadi B. M. and Kranthi K. R. (2009) Widespread infestation of the exotic mealybug species, *Phenacoccus solenopsis* (Tinsley) (Hemiptera: Pseudococcidae) on cotton in India. *Bulletin of Entomological Research*, 1-5.

(Received 2 March 2009; accepted 15 August 2009)