



Research Note

Predators and parasitoids of cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) in Perambalur district of Tamil Nadu

C. SANKAR^{1*}, R. MARIMUTHU¹, P. SARAVANAN¹, P. JEYAKUMAR², R. K. TANWAR², S. SATHYAKUMAR², O. M. BAMBAWALE², V. V. RAMAMURTHY³ and ANUPAM BARIK⁴

1. Hans Roever Krishi Vigyan Kendra (ICAR), Valikandapuram, Perambalur 621 115, Tamil Nadu, India.

2. National Centre for Integrated Pest Management (ICAR), Pusa campus, New Delhi 110 012, India.

3. Division of Entomology, Indian Agricultural Research Institute, New Delhi 110 012, India.

4. Directorate of Cotton Development, Ministry of Agriculture, Govt. of India, Mumbai 400 001, Maharashtra, India.

* Corresponding author E-mail: pblr_kv06@yahoo.co.in ; guruvaishali@gmail.com

ABSTRACT: Solenopsis mealybug, (*Phenacoccus solenopsis*) infests cotton at Perambalur district of Tamil Nadu. During the surveys carried out during 2008-10, coccinellids *Scymnus nubilus* Mulsant, *Hyperaspis maindroni* Sicard, green lacewing, spiders, *Aenasius bambawalei* Hayat, *Homalotylus eytelwenii* Ratzeburg (Encyrtidae) *Promuscidea unfasciiventris* Girault and *Coccophagus* sp. (Aphelinidae) were recorded. The per cent emergence of *S. nubilus* was highest (68%) during second week of February and lowest (6%) during last week of November. The highest percentage (18%) of *H. maindroni* was recorded during second week of February and lowest (2%) during third week of March. The highest parasitisation (76%) by *A. bambawalei* was recorded during last week of February whereas it was lowest (8%) during last week of December. Similarly, the highest parasitisation (28%) by *P. unfasciiventris* was recorded during third week of February whereas it was lowest (2%) during third week of March. But the percent parasitized mealybug by *Coccophagus* sp. was very lower than others. *A. bambawalei* and *P. unfasciiventris* were most common parasitoids on mealybug *P. solenopsis* in cotton.

KEY WORDS: Mealybug, *Phenacoccus solenopsis*, Predators, parasitoids.

(Article chronicle: Received: 28-4-2011; Sent for revision: 27-6-2011; Accepted: 27-8-2011)

Mealybugs are soft bodied insects belonging to the family Pseudococcidae of the order Hemiptera. About 5000 species of mealybug have been recorded from 246 families of plants throughout the world. Among these, 56 species have been reported from 15 genera of family Malvaceae, including cotton and many other plants of economic importance (Ben Dov, 1994). *Phenacoccus solenopsis* Tinsley, was first described from the US where it infested several ornamental and fruit crops. It has a wide geographical distribution with its origin in Central America (Fuchs *et al.*, 1991; Williams and Granara de Willink, 1992). *P. solenopsis* has been described as a serious and invasive pest of cotton in Pakistan and India (Hodgson *et al.*, 2008). It attacked many other plants including sunflower, vegetables, weeds, ornamentals, etc. (Saini *et al.*, 2009).

The mealybug feeds on phloem tissue, sucking plant sap and causing leaves to distort yellow and even die. It also produces large amount of honeydew. This pest may be present in the cropping system before the incidence

of bollworms and the same pesticides used for the bollworms may be efficient in managing this pest. In a survey conducted (Nagrare *et al.*, 2009) over 47 locations in nine cotton-growing states of India showed that two mealybug species, the solenopsis mealybug, *P. solenopsis* and the pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green), were found to infest cotton plants. However, *P. solenopsis* was found to be the predominant mealybug species, comprising 95% of the samples examined. *P. solenopsis* now appears to be widespread on cotton in almost all cotton-growing states of the country. Management of this mealybug is difficult due to its wide host range, presence of waxy coating on the body and high reproductive potential (Dhawan *et al.*, 2008). Hence, the biological control through the use of its predators is of great importance, since, they have proved their value in checking so many homopteran pests (Anil *et al.*, 2008). It is believed that natural control has played major role in limiting this pest to a minimal level. The present study was therefore aimed to identify the

predators and parasitoids for the management of mealybug *P. solenopsis*.

A total number of 20 intensive cotton cultivating villages in the Perambalur district were selected, covering, two fixed fields during the crop period from September 2009 to March 2010. The incidence was recorded on 20 plants per acre from selected field, sampled diagonally across the field. The mealybug colonies were closely observed for species identification and presence of mealybug mummy containing parasitoid or its emergence hole. Identification of *P. solenopsis* was based upon the presence of short to medium sized waxy filaments around the body and anal filaments about one-fourth the length of the body and two dark stripes on either side of the middle “ridge” of the body. This species produces ovisac which is generally present below the female’s body. To score the per cent parasitization, total numbers of mealybugs were counted along with the mealybug mummies which appeared dark brown in colour. A small piece of plant containing these mealybug mummies was kept in plastic jars provided with brass mesh for proper ventilation for emergence of parasitoids in the laboratory. Daily observations were made for the emergence of parasitoids and predators. Parasitized cocoons identified by reddish brown colour were kept separately in glass vials with cotton plugs and observed for parasitoid emergence. During the survey, the predators feeding on the mealybugs were also recorded. The collected predators and parasitoids were preserved in 70 % ethanol in a glass vial and sent for identification to Division of Entomology, Indian Agricultural Research Institute, New Delhi.

From the survey conducted about the occurrence of predators and parasitoids on mealybug *P. solenopsis* natural enemies such as *Scymnus nubilus* mulsant, *Hyperaspis maindroni* Sicard, *Aenasius bambawalei*, *Homalotylus eytelwenii* (Ratzeburg), *Promuscidea unfastiiventris*, *Coccophagus* sp. and unidentified species of coccinellids, lacewing and spiders were recorded. The incidence of mealybug started from October while the incidence of predators and parasitoids started from the end of November 2010. Among the predators, the coccinellids, green lacewing and spiders were common in all the cotton fields but *S. nubilus* and *H. maindroni* were specific to *P. solenopsis* and was seen only during the period of mealybug appearance. The per cent emergence of *S. nubilus* was highest (68%) during second week of February and lowest (6%) during last week of November whereas the highest percentage (18%) of *H. maindroni* was recorded during second week of February and lowest (2%) during third week of March. Amongst the parasitoids, *A. bambawalei* was the dominant one. The highest parasitisation (76%) by *A. bambawalei*

was recorded during last week of February whereas it was lowest (8%) during December last week. Similarly, the highest parasitisation (28%) by *P. unfastiiventris* was recorded during third week of February whereas it was lowest (2%) during March third week. But, the percent parasitized mealybug by *Coccophagus* sp. was the lowest. The highest of 10 % parasitisation was recorded during first week of February and lowest of 2% during December second week and March first week (Table 1).

From this study, it is concluded that the emergence of natural enemies was more where the incidence of mealybug *P. solenopsis* is higher. Among the predators, *S. nubilus* was most common in all mealybug damaged fields, but, *H. maindroni* emerged from one or two samples collected from the district. Also, the common predators like coccinellids, green lacewing and spiders were higher in the time of highest mealybug incidence. Among the parasitoids *A. bambawalei* and *P. unfastiiventris* were common in all samples collected from the district. The population dynamics of predators and parasitoids was directly correlated to the mealybug incidence. Rishi Kumar *et al.* (2008) suggested *A. bambawalei* as the potential parasitoid of *P. solenopsis* at Sirsa. *A. bambawalei* and *P. unfastiiventris* were recorded on *P. solenopsis* in rainfed cotton at Vidarbha by Vennila *et al.* (2008). Parasitoids such as *A. bambawalei*, *P. unfastiiventris* and *Coccophagus* sp. and predators like *S. nubilus* and *H. maindroni* were recorded on *P. solenopsis* whereas *A. bambawalei* and *P. unfastiiventris* are common parasitoids of both the mealybug species and have been reported by National Centre for Integrated Pest Management. Kharbade *et al.* (2010) reported that the parasitisation by *A. bambawalei* caused mummification in mealybug affected cotton area of Ahmednagar, Jalgaon and Dhule districts of Maharashtra. The studies revealed the potential of using *A. bambawalei* for the management of *P. solenopsis* in cotton.

ACKNOWLEDGEMENT

We acknowledge the Directorate of Cotton Development, Mumbai, Ministry of Agriculture and Cooperation, Govt. of India, New Delhi, for financial support in the project entitled “National Information System for Pest Management in Bt cotton” in collaboration with National Centre for Integrated Pest management, New Delhi, for this study.

REFERENCES

- Anil, K., Kurtadikar, J. S., Wadnerkar, D. W. and Nemade, P. W. 2008. Studies on the safety of pesticides to grapevine

Table 1 – Predators and parasitoids on cotton mealybug *Phenacoccus solenopsis* from Tamil Nadu

Sl. No.	Month (Cropping period)	Standard week	Mealybug (Grade)*	No. of samples collected	% of predators		% of parasitoids			<i>Coccophagus</i> sp.
					<i>Scymnus nubilus</i>	<i>Hyperaspis maindroni</i>	<i>Aenasius bambawalei</i>	<i>Promuscidae unfasciatiiventris</i>		
1	September 2-8	35	0	50	0	0	0	0	0	0
2	September 9-15	36	0	50	0	0	0	0	0	0
3	September 16-23	37	0	50	0	0	0	0	0	0
4	September 24-30	38	0	50	0	0	0	0	0	0
5	October 1-7	39	0	50	0	0	0	0	0	0
6	October 8-14	40	0	50	0	0	0	0	0	0
7	October 15-21	41	0	50	0	0	0	0	0	0
8	October 22-28	42	I	50	0	0	0	0	0	0
9	October 29-4	43	II	50	0	0	0	0	0	0
10	November 5-11	44	I	50	0	0	0	0	0	0
11	November 12-18	45	I & II	50	0	0	0	0	0	0
12	November 19-25	46	I & II	50	0	0	0	0	0	0
13	November 26-2	47	I & II	50	6	0	10	8	0	0
14	December 3-9	48	II	50	16	0	18	8	0	0
15	December 10-16	49	II	50	0	6	12	6	4	0
16	December 17-23	50	II	50	18	0	0	16	2	0
17	December 24-30	51	III	50	12	0	8	6	0	0
18	January 1-7	52	III & IV	50	34	4	14	14	0	0
19	January 8-14	1	III & IV	50	38	10	22	20	6	0
20	January 15-21	2	III & IV	50	44	14	24	24	0	0
21	January 22-28	3	III & IV	50	54	17	34	20	0	0
22	January 29-4	4	IV	50	42	0	42	24	0	0
23	February 5-11	5	IV	50	52	8	48	26	10	0
24	February 12-18	6	IV	50	68	18	54	24	6	0
25	February 19-25	7	IV	50	62	10	64	28	0	0
26	February 26-4	8	IV	50	58	4	76	20	0	0
27	March 5-11	9	IV	50	52	0	51	15	2	0
28	March 12-18	10	III	50	40	8	46	9	0	0
29	March 19-25	11	III	50	22	2	15	2	0	0
30	March 26-1	12	II	50	10	0	10	0	0	0

***Note:** **Grade-0**-No incidence
Grade-I-Scattered appearance
Grade-II-Full incidence on any one of the branch
Grade-III- Full incidence on more than one branch/half portion of the plant
Grade-IV-Heavy incidence on whole plant
(The formula was given by NCIPM, New Delhi)

- mealybug predator, *Cryptolaemus montrouzieri* Aiyar. *Pestology*, **32** (4):17–27.
- Ben-Dov, Y. 1994. *A systemic catalogue of the mealybugs of the World*. Intercept Limited, UK, 686 p.
- Dhawan, A. K., Sarika Saini and Kamaldeep Singh. 2008. Evaluation of novel and conventional insecticides for management of mealybug, *Phenacoccus solenopsis* Tinsley, in Punjab. *Pesticide Research Journal*, **20**: 214–216.
- 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. *South western Entomologist*, **16**: 215–221.
- Hodgson, C. J., Abbas, G., Arif, M. J., Saeed, S. and Karar, H. 2008. *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccoidea: Pseudococcidae), an invasive mealybug damaging cotton in Pakistan and India, with a discussion on seasonal morphological variation. *Zootaxa*, **1913**: 1–35.
- Kharbade, S. B., Mehetre, S. S., Chande, A. G. and Dokhe, S. D. 2010. Record of *Aenasiua bambawalei* (Hayat) parasitoid on cotton mealybug *Phenacoccus solenopsis* (Tinsley). *Pestology*, **34**: 8–10.
- 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*, **99**: 537–541.
- Rishi Kumar, Monga, D. and Kranthi, K. R. 2008. Potential parasitoid of mealybug, *Phenacoccus solenopsis* Tinsley in cotton. *Central Institute of Cotton Research, Nagpur. Newsletter*, July-September, 2008, **24**: 2.
- Saini, R. K., Palaram Sharma, S. S. and Rohilla, H. R. 2009. Mealybug, *Phenacoccus solenopsis* Tinsley and its survival in cotton ecosystem in Haryana. In *Proceedings of National Symposium on Bt-cotton: Opportunities and Prospects*, Central Institute of Cotton Research, Nagpur, November 17-19, 85 pp.
- Vennila, S., Ramamurthy, V. V., Kranthi, K. R., Ghodki, B. S. and Pinjarkar, D. B. 2008. Parasitoids on mealybugs of rainfed cotton. *Central Institute of Cotton Research, Nagpur. Newsletter*, July-September, 2008, **24**: 3–4.
- Williams, D. J. and Granara de Willink, M. C. 1992. *Mealybugs of Central and South America*. 635 pp. CAB International.