INTERNATIONAL JOURNAL OF PLANT PROTECTION / VOLUME 5 | ISSUE 2 | OCTOBER, 2012 | 329-332

IJPP

RESEARCH ARTICLE

Survival of solenopsis mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on cotton in relation to abiotic and biotic factors

■ S.C. KEDAR*, R. K. SAINI AND PALA RAM

Department of Entomology, Chaudhary Charan Singh Haryana Agricultural University, HISAR (HARYANA) INDIA

ARITCLE INFO

Received : 23.05.2012
Revised : 18.06.2012
Accepted : 02.09.2012

Key Words :
Survival,
Phenacoccus solenopsis,
Parasitization,
Aenasius bambawalei

*Corresponding author:
santoshkedar56@yahoo.com

ABSTRACT

Survival of solenopsis mealybug, *Phenacoccus solenopsis* Tinsley, on cotton was studied under field conditions, both under caged and exposed during *Kharif*, 2009 at CCS Haryana Agricultural University, Hisar. First instar nymphs (crawlers) were released on cotton plants during different months and observations on the number surviving after 10 and 20 days of release were recorded. The results indicated that as compared to exposed conditions, mealybug survival was higher under caged conditions, and the rate of decline of mealybug population was also quite slow. The ambient conditions of temperature and relative humidity did not seem to have much effect on mealybug population. However, sharp reductions in mealybug populations were observed after heavy rains. It signified the role of heavy rains in suppressing mealybug population. Among the biotic factors, the mealybug parasitoid, *Aenasius bambawalei* Hayat, was found to be active on mealybug colonies through out the observation period (i.e. July to October) and caused on an average 32.6, 42.4, 6.6 and 16 per cent reduction in the mealybug population during July, August, September and October, respectively, when observed after 20 days of release of crawlers.

How to view point the article : Kedar, S.C., Saini, R.K. and Ram, Pala (2012). Survival of solenopsis mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on cotton in relation to abiotic and biotic factors. *Internat. J. Plant Protec.*, **5**(2) : 329-332.

INTRODUCTION

Solenopsis mealybug, *Phenacoccus solenopsis* Tinsley, (Hemiptera: Pseudococcidae), has recently emerged as a major pest of cotton in India (Dhawan *et al*., 2007; Nagrare *et al.,* 2009). In Gujarat during 2006 *P. solenopsis* caused 50 per cent reduction of yield in highly infested cotton field (Jhala *et al.,* 2008) and in Punjab during 2007, the pest emerged in a serious proportion causing 30 to 40 per cent losses in the yield of cotton in Punjab (Dhawan *et al*., 2007). In Haryana, the pest was initially observed attacking cotton crop in Dabawali area of Sirsa district during 2006. Later on, the pest spread to several districts of the state causing serious crop losses in certain pockets during 2007 and 2008 (Saini and Ram, 2008).

Survival of mealybug is affected by various biotic and abiotic factors. However, information on these aspects is scanty. Therefore, the present investigations were carried out during *Kharif* season, 2009 at Research Farm of Department of Entomology, CCS Haryana Agricultural University, Hisar.

MATERIALS AND METHODS

The studies on survival of solenopsis mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on cotton in relation to abiotic and biotic factors was studied during *Kharif* season, 2009 under field conditions of Research Farm of Department of Entomology at Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana).

Freshly emerged crawlers from the ovisacs of the adult females were collected in glass vials from the laboratory

maintained culture of mealybug and released during different months on terminal leaves of 12 cotton plants @50 crawlers/ plant in the field. Six plants were caged while the remaining six were kept in exposed (uncaged) condition. The cage consisted of a cylindrical iron frame having 40 cm diameter towards the broader end and 20 cm on the narrower end with a height of 85 cm (Plate A). This frame was covered with muslin and such cages were put over the plants in the field after the first instar mealybugs (crawlers) were released on the plants. Such releases of the crawlers were made four times *i.e.* during July, August, September and October, both under caged and exposed conditions. Population count was made after 10 and 20 days after release of crawlers to determine their survival. After each observation, the cages were again put in their original position on the plants. Mean number of mealybugs present per plant was worked out. The number of mealybug mummies (*i.e.* mealybugs parasitized by *Aenasius bambawalei* Hayat) and the number of coccinellids (immature and adult stages) present on the exposed plants were also counted to determine the extent of parasitization and predation. Cumulative parasitization by *A. bambawalei* was computed.

Plate A : Cage used for field experiment

RESULTS AND DISCUSSION

Data on mean *P. solenopsis* survival, its parasitization by *Aenasius bambawalei* Hayat and number of coccinellid predators present per plant during July, August, September and October are represented by Fig. 1. (a), (b), (c) and (d), respectively.

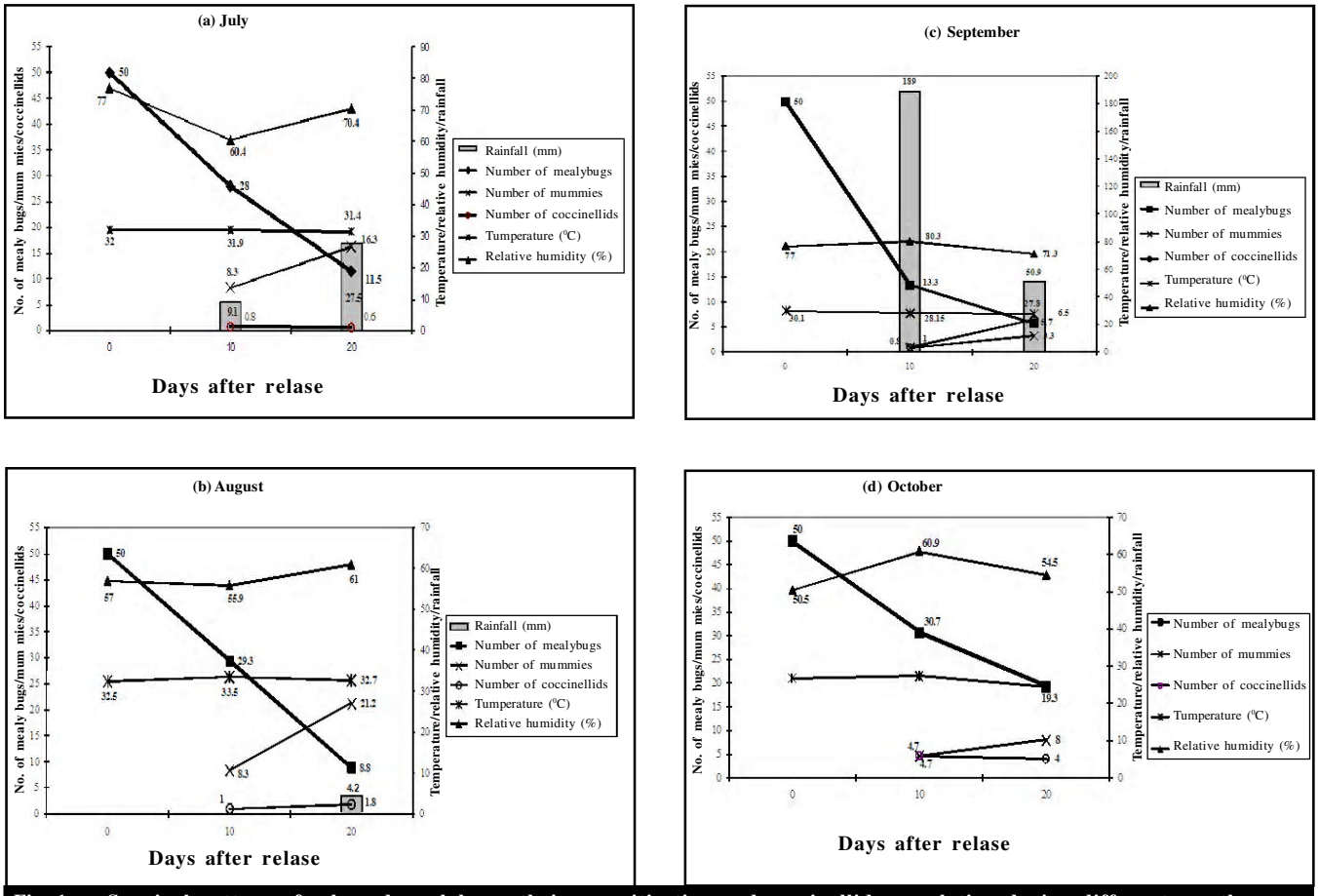

Fig. 1 : Survival pattern of released mealybugs, their parasitization and coccinellids population during different months under exposed condition

On the basis of mealybug survival during different months, it was found that there was 44, 41.4, 73.4 and 38.6 per cent reduction in mealybug population within 10 days of release of crawlers on cotton plants in the field during July, August, September and October, respectively. When the observations were recorded after 20 days of release of crawlers there was further decline in mealybug survival. The reduction in mealybug population was gradual during July and August. The ambient temperature did not seem to have any significant effect on mealybug population as there were insignificant fluctuations in mean temperature, which ranged between 31.4 and 33.5°C. No information on favourable temperature for *P. solenopsis* survival is available. However, other species of genus *Phenacoccus* have been reported to have good survival at constant temperature of 25°C under laboratory condition. Survival rate of *P. solani* was high at different constant temperature ranging from 20-30°C in the laboratory (Nakahira and Arakawa, 2006). Under laboratory condition temperature of 25° and 27°C were found to be more favourable for the development, survival and reproduction of *Maconellicoccus hirsutus* (Chong *et al*., 2008). Survival rates of nymphal instars of *P. madeirensis* when reared on chrysanthemum ranged between 92 and 100 per cent (Chong *et al*., 2003). Similarly, medium range (*i.e*. 55.9 and 77.0%) of mean relative humidity during July and August did not seem to have any significant effect on mealybug survival.

There was drastic reduction in mealybug population in September when observed after 10 days of release. This sharp reduction in population was probably due to heavy rains (189 mm) on 10th and 11th September (*i.e*. two days prior to the date of observation). This heavy down pour might have dislodged the mealybugs, particularly the young stages. Jeyakumar *et al*. (2009) also reported that intense rainfall adversely affected the mealybug population and its spread. Negative effect of heavy rains on mealybug population has been highlighted by other workers also (Dhawan *et al*., 2009; Akintola and Ande, 2009; Hanchinal *et al*., 2010; Kedar *et al.,* 2011). Mean relative humidity during the period of observation in September was relatively higher than in other months. However, its effect on mealybug population could not be established. In Pakistan, the increase in incidence of mealybug population was reported to be positively correlated with the increase in humidity (Anonymous, 2008). During October also, the decline in mealybug population was gradual as both mean temperature (24.5 to 27.5) and relative humidity (50 to 60.9 %) fell in medium range. Jeyakumar *et al.* (2009) observed that high rainfall favoured growth of entomopathogens.

The mealybug parasitoid (*A. bambawalei*) was found to be active through out the observation period (*i.e.* July to October). On uncaged plants, it caused on an average 32.6, 42.4, 6.6 and 16 per cent reduction in mealybug population during July, August, September and October, respectively, when observed after 20 days of release of crawlers. Role of *A. bambawalei* in affecting mealybug survival was prominent during August wherein it parasitized 21.2 per cent of mealybugs. Earlier *A. bambawalei* was reported to bring about 70 per cent (Ram *et al*., 2009), 20-70 per cent (Tanwar *et al*., 2008) and 20.65 per cent (Hanchinal *et al*., 2010) mortality of *P. solenopsis*.

Different coccinellid predators were recorded during July to October. Among these, maximum coccinellid population was recorded during September and October. No information is available on the extent of *P. solenopsis* mortality caused by different coccinellid predators.

It was concluded that under natural field conditions, the ambient temperature during the period of studies did not seem to have significant adverse effect on mealybug survival. Similarly, relative humidity also remained in the moderate range (*i.e*. 50.5 to 77 %) for most part of the observation period, except during September (71.3 to 80.3%) did not seem to affect mealybug survival. On the other hand, sharp reductions in mealybug population were observed after heavy rains. It signifies the role of heavy in rains suppressing mealybug population. Among the biotic factors, parasitization by *A. bambawalei* had significant role in checking mealybug population. Being general predators, the coccinellid predator seemed to play some role in regulating *P. solenopsis* population under field condition but their actual contribution could not be established. Since *P. solenopsis* population continued to decline after the release of crawlers, the important regulating factors of *P. solenopsis* population were heavy rains, parasitoids, coccinellid predators and unknown reasons. The rate of decline of mealybug population under caged condition was quite slow, which indicated that biotic factors, particularly parasitization, and direct effect of rains seemed to have significant role in regulating mealybug population under exposed condition.

REFERENCES

Akintola, A.J. and Ande, A.T. (2009). Pest status and ecology of five mealybugs (Family: Pseudococcidae) in the Southern Guinea Savanna of Nigeria. *J. Ent. Res.,* **33** (1): 9-13.

Anonymous (2008). Annual report of the Central Cotton Research Institute 2007-08, Multan, Pakistan Central Cotton Committee, Ministry of Food, Agriculture and Livestock, ISLAMABAD, PAKISTAN.

Chong, J., Oetting ve, R.D. and Iersel M.W. (2003). Temperature effects on the development, survival, and reproduction of the maderia mealybug, *Phenacoccus madeirensis* Green (Hemiptera: Pseudococcidae), on chrysanthemum. *Ann. Ent. Soc. Am.* **96** (4): 539-543.

Chong, J.H., Roda, A.L. and Mannion, C.M. (2008). Life history of the mealybug, *Maconellicoccus hirsutus* (Hemiptera: Pseudococcidae), at constant temperatures. *Environ. Ent*., **37** (2): 323-332.

Dhawan, A.K., Singh, K., Aneja, A. and Saini, S. (2009). Distribution of mealybug, *Phenacoccus solenopsis* Tinsley in cotton with relation to weather factors in South-Western districts of Punjab. *J. Ent. Res*., **33** (1): 59-63.

Dhawan, A.K., Singh, K., Saini, S., Mohindru, B., Kaur, A., Singh, G. and Singh, S. (2007). Incidence and damage potential of mealybug, *Phenacoccus solenopsis* Tinsley, on cotton in Punjab. *Indian J. Ecol.,* **34**: 110-116.

Hanchinal, S.G., Patil, B.V., Bheemanna, M. and Hosamani, A.C. (2010). Population dynamics of mealybug, *Phenacoccus solenopsis* Tinsley and its natural enemies on *Bt* cotton. *Karnataka J. Agric. Sci.,* **23**(1):137-139.

Jeyakumar, P., Tanwar, R.K., Singh, J., Singh, S., Singh, A., Dhandapani, A., Satyakumar, S., Brar, J.S. and Bambawale, O.M. (2009). Impact of weather factors on cotton mealybug, Phenacoccus solenopsis Tinsley. In: Proc. Nat. Symp.on IPM strategies to combat emerging pests in the current scenario of climate change, January 28-30, 2009, College of Horticulture and Forestry, Central Agricultural University, Pasighat (ARUNACHAL PRADESH) INDIA p. 39.

Jhala, R.C., Bharpoda, T.M. and Patel, M.G. (2008). Phenacoccus solenopsis Tinsley (Hemiptera: Pseudococcidae), the mealybug species recorded first time on cotton and its alternate host plants in Gujarat, India. *Uttar Pradesh. J. Zool.,* **28**: 403-406.

Kedar, S.C., Saini, R.K. and Ram, P. (2011). Population dynamics of solenopsis mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on cotton. *Pestol.,* **35** (7): 36-38.

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. *Bull. Ent. Res.,* **99**: 537-541.

Nakahira, K. and Arakawa, R. (2006). Development and survival of an exotic pest mealybug, *Phenacoccus solani* (Homoptera: Pseudococcidae) at three constant temperatures. *Appl. Ent. Zool.,* **41** (4): 573-575.

Ram, P., Saini, R.K. and Vijaya (2009). Preliminary studies on field parasitization and biology of solenopsis mealybug parasitoid, *Aenasius bambawalei* Hayat (Encyrtidae: Hymenoptera). *J. Cotton Res. Dev.,* **23**(2): 313-315.

Saini, R.K. and Ram, P. (2008). Incidence, nature of damage and chemical control of mealybug,*Phenacoccus* sp., on cotton in Haryana. In: Proc.2nd Congress on Insect Science, February 21-22, Punjab Agricultural University, Ludhiana (PUNJAB) INDIA pp.192-193.

Tanwar, R.K., Bhamare, V.K., Ramamurthy, V.V., Hayat, M., Jeyakumar, P. and Bambawale, O.M. (2008). Record of new parasitoids on mealybug, *Phenacoccus solenopsis*. *Indian J. Ent.,* **70**(4): 404-405.

****