



LIFETABLE OF MEALY BUG *PHENACOCCLUS SOLENOPSIS* TINSLEY IN COTTON UNDER LABORATORY CONDITIONS

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ABSTRACT

Phenacoccus solenopsis Tinsley is a destructive pest of cotton, which originated from USA and co-evolved with plentiful food plants. The devastating outbreak of *P. solenopsis* is reported to cause nearly 30 - 60% yield losses from India and Pakistan during 2005-2009. The lifetable characters of *P. solenopsis* were carried out at 25°C on cotton under the laboratory conditions. The data stated that one generation *P. solenopsis* was completed in 37.225 days at 25°C. Doubling time, intrinsic rate of natural increase and finite rate of increase at 25°C were 5.500, 0.126 and 1.134 days, respectively. This paper describes the lifetable and discusses about the population parameters of *P. solenopsis* under laboratory conditions which can be stimulated to field for pest management.

Key words: *Phenacoccus solenopsis*, lifetable, population parameters, survivorship curve, egg sac, nymphs, mortality, adults

The cotton mealybug, *P. solenopsis* Tinsley (Hemiptera: Pseudococcidae) 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). Mealy bugs, which were considered to be minor pests in many crops, have acquired the status of major pests during the last few years, especially in cotton, vegetables, fruits and ornamentals. Widespread incidence of mealy bug was reported in almost all cotton growing regions in India (Nagrare et al., 2009). In ecological aspects, lifetable is a most important analytical tool, which provides detailed information of population dynamics to generate simple and informative statistics which gives a comprehensive description of the survivorship, development and expected of life of an organism (Ali and Rizvi, 2007). The present investigation was carried out to construct lifetable of *P. solenopsis* under laboratory conditions in order to generate information on the weak links in its life cycle suitable for formulating feasible management strategy for the pest.

MATERIALS AND METHODS

Study was done at the Biocontrol laboratory,

Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, using the adult females collected from unsprayed cotton plants. These females were kept in petri dishes (90x 10 mm) lined with blotting paper and maintained 25±1°C, 70% RH. Fresh leaves of cotton (cv. CO 14) were provided as food. The eggs laid were counted (350- 400 eggs/ ovisac) and twenty eggs were transferred to each petri dish (5 replications) with soft camel hair brush. For the construction of lifetable, eggs were also placed in petri dish, and hatching % was recorded. Thereafter, each individual was examined daily to monitor its development, fecundity and survivorship. During the reproductive period, newly hatched nymphs were counted daily and then removed. Cotton leaves were replaced after every alternate days throughout the study period. Data obtained were statistically analyzed with software AGRES (ver. 3.01).

RESULTS AND DISCUSSION

The data revealed that *P. solenopsis* required maximum of 37.225 days to complete one generation as given in Table 1. Net reproductive rate was 109 individuals/ female at 25°C and 70% RH. These observations corroborate with those of Kumar et al. (2013). Chen et al. (2015) observed this as 244.6

Table 1. Life history parameters of *P. solenopsis* on cotton

Parameters	Duration
Age of first oviposition (days)	30
Age of 50% mortality (days)	25
Age of last oviposition (days)	37
Length of oviposition (days)	12
Net Reproductive Rate (R_0) (females/female)	109
Intrinsic rate of natural increase (r_m) (day^{-1})	0.126
Finite rate of increase (λ) (day^{-1})	1.134
Mean generation time (T) (days)	37.225
Doubling time (Dt) (days)	5.500

Relationship between age and probabilities of survival

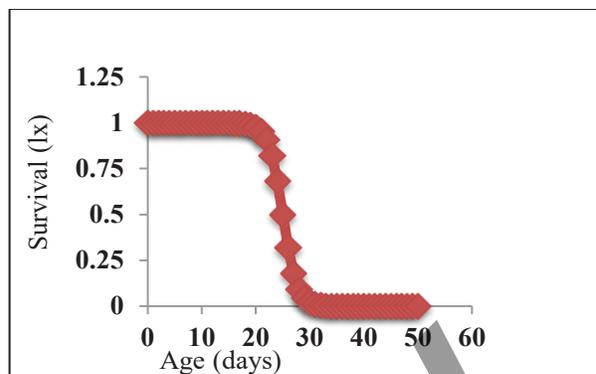
'a' (50% mortality)	'b' (Intercept)	R ² value
25	1.312	0.791

(Where, R_0 - Net reproductive rate (Number of females produced in each generation); r_c - Innate capacity for increase (Capacity of species to increase in number (approximate)); r_m - Intrinsic rate of natural increase (Capacity to increase in number (accurate)); λ - Finite rate of increase (Number of female offspring per female per day); Dt- Doubling time (Time taken by species to double its population)).

hatched eggs at 27.5°C and 45% RH in shoe flower. The mean generation time was 37.225 days, similar to observation of Kumar et al. (2013). The survivorship (l_x) was of type III survivorship as depicted in Fig. 1. Using the Doesn't Use Derivative (DUD) method, survivorship curves were smoothened. Parameters (a and b) of the smoothened curves were estimated at 25 and 1.312, respectively. There was 50% mortality after 25 days. This Type III curves indicate high mortality in early life, followed by a period of much lower and relatively constant losses which is evident in the present studies also.

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Fig. 1. Survivorship curve of *P. solenopsis*

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REFERENCES

- Ali A, Rizvi P Q. 2007. Age specific survival and fecundity table of *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) on different aphid species. *Annals of Plant Protection Sciences* 15: 329-334.
- Chen H S, Yang L, Huang L F, Wang W L, Hu Y, Jiang J J, Zhou Z S. 2015. Temperature- and relative humidity dependent life history traits of *Phenacoccus solenopsis* (Hemiptera: Pseudococcidae) on *Hibiscus rosa-sinensis* (Malvales: Malvaceae). *Environmental Entomology* 44(4): 1230-1239.
- Dublin L I, Lotka A J. 1937. Uses of life table in vital statistics. *American Journal of Public Health* 27: 481-491.
- Fuchs T W, Stewart J W, Minzenmayer R, Rose M. 1991. First record of *Phenacoccus solenopsis* Tinsley in cultivated shoe flower in the United States. *South Western Entomologist* 16 (3): 215-221.
- Hodgson C, Abbas G, Arif M J, Saeed S, Karar H. 2008. *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccidae: Pseudococcidae), an invasive mealybug damaging cotton in Pakistan and India, with a discussion on seasonal morphological variation. *Zootaxa* 19(13): 1-35.
- Kumar S, Kular J, Mahal M S, Dhawan A K. 2013. Life table of *Phenacoccus solenopsis* Tinsley (Pseudococcidae: Hemiptera) on various phenological stages of cotton. *African Journal of Agricultural Research* 8: 1669-1676.
- Nagrare V S, Kranthi S, Biradar V K, Zade N N, Sangode V, Kakde G, Shukla R M, Shivare D, Khadi B M, 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.
- Williams D J, Granara de Willink M C. 1992. Mealybugs of Central and South America. p. 635. CAB International.

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