

Biology of the mealybug, *Phenacoccus solenopsis* Tinsley (Pseudococcidae: Hemiptera) on sprouted potato and brinjal plant

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ABSTRACT

The biology of the mealy bug, *Phenacoccus solenopsis* Tinsley was studied on brinjal plant and sprouted potato tubers in the laboratory. The female nymphs moulted three times for becoming adults while the male took four moultings. The female and male nymphs completed development in 14.45 ± 0.96 days and 19.53 ± 1 days respectively on brinjal plant at $20-36.2^{\circ}\text{C}$ temperature and 15.1 ± 1 days and 18 ± 0.82 days respectively on sprouted potato. The ratio of the male: female were 1:1.75 and 1:1.87. The duration from nymphs to adult female was 28 days on brinjal plant and 25 days on sprouted potato tubers. The pre-oviposition period was 6.37 ± 1.29 days and 6.89 ± 0.84 days on brinjal and sprouted potato respectively. The average oviposition period was 5.89 ± 0.89 days and 7.5 ± 0.52 days on brinjal plant and sprouted potato tubers. Fecundity rate was 205-278 eggs/female.

Keywords: Biology, Fecundity, Moulting, *Phenacoccus solenopsis*

Introduction

Phenacoccus solenopsis Tinsley was first described originally from the U.S. in 1898 and it remained known only in the U.S., where it was widespread, until 1992. In 1992, it was reported in Central America, the Caribbean, and Ecuador. In 2002 it was recorded as a pest of *Solanum muricatum* in Chile and its first record from Brazil in 2005, India in 2006 (Vinobaba & Prishanthini 2009). They are small soft-bodied sucking insects covered with white mealy wax, which often extends laterally to form a series of waxy tassels.

They are polyphagous in nature and infest 154 plant species of 53 families comprising 20 field and horticultural crops, 45 ornamentals, 64 weeds and 25 bushes and trees (Arif *et al.* 2009). The insect weakens the plants by sucking the sap from leaves, twigs, stems, and sometimes from the roots and also from fruiting bodies. Later, the entire plant get stunted and shoot tips develop a bushy appearance and ultimately causing havoc loss of the farmer.

Brinjal is a widely grown vegetable crops in India and its production is hampered by infestation of different insect pests. *P. solenopsis* is one of them. Life history of *P. solenopsis* on brinjal plant under natural condition and sprouted potato has been lacking in literature. Understanding the life history of a pest insect is important in predicting its development, emergence, distribution, and abundance. Life history information also plays an important role in pest management, especially when applying chemical and biological control methods. Therefore, the present study has been carried out to reveal the nymphal development of male and female, pre-oviposition period, oviposition period and fecundity on brinjal plant and sprouted potatoes under the laboratory.

Materials and Methods

The experiments were carried out in the Entomological laboratory at BCKV, Mohanpur. Mealybugs were collected from brinjal (*Solanum malongena* L.) plant, at Kalyani research station. Then they were cultured on

sprouted potato. To study the biology, five impregnated females were released singly on five potted brinjal plant and were allowed to produce first instar nymphs. After 24 hours the adults were removed from the brinjal plant. Same type of experiment was also carried out on sprouted potato in glass jar. The observations on nymphal development were carried out every day. The temperature and relative humidity were recorded daily.

Results and Discussion

They were pale yellow to almost orange in colour and oblong in shape. A sub marginal line of dark mark on thorax and abdomen were observed. There were 18 pairs of short to medium sized waxy filaments around the body, anal filaments being larger. Ventral was with dark circular which secreted cottony fibres to form ovisac. Dorsal body surface was covered with dense waxy dust.

The studies on the biology of mealybug, *P. solenopsis* on potted brinjal plant gave some interesting results. The data on the duration of different nymphal stages of female and male and range of temperature and humidity for each have been provided in Table 1. About 72% of the first instar nymphs, the sexes of which were indistinguishable, moulted at the age of 6-8 days. Maximum moulting occurred at the age of 7 days. The sexes of second instar nymph also could not be recognized easily although males were bigger in size than female at the same stage. The moulting of about 85% of female nymphs were completed at the age of 10-12 days. Maximum moulting occurred at the age of 10 days and the average age of moulting was 10.86 ± 1.79 days. The oval bodied third instar nymphal females completed ecdysis at the age 13-16 days, and about 63% of them did so in 14-15 days (Fig.1). The second instar of male completed this stage at the age of 12-15 days.

Later, the second instar nymphs of male generally migrated to the isolated places of brinjal plant. There they moulted and entered into next instar by making white cocoons. The third instar completed at the age of 15-18 days of which about of 81 percent nymphs moulted at the age of 15-17 days. The fourth instar males were in cocoon and it completed at the age of 18-21 days. Males took the longer duration than compared to females. This was due to an additional molting and prepupal processes. The adult male was dipteran like insect. They had well differentiated head, thorax and abdomen, a pair of conspicuous white wings and two long white hair like waxy caudal filaments. Their longevity was only 2-3 days.

The pre oviposition period ranged from 5-8 days, the average being 6.37 ± 1.29 days. The oviposition period varied from 4-8 days during which 205-258 eggs were laid. The ovipositing females remained stationary on the host, sucked plant sap and later took globular shape. The average oviposition period and fecundity were 5.89 ± 0.89 days and 239.5 ± 23.95 eggs respectively. At that time, the temperature and relative humidity was ranged from 22-37°C and 56-95 % respectively. The male and female ratio was 1:1.75. The life cycle was completed in 28 days.

Life cycle on sprouted potato

During the Biological studies of this mealybug on sprouted potato, it was found that they completed first instar moulting at the age of 4-8 days (Table 1). About 88 % nymphs moulted at the age of 4-6 days. Maximum moulting occurred at the age of 5 days (Fig. 2). Whereas second instar female nymphs completed their moulting between the age of 8-12 days, of which about 66 percent nymphs moulted in between the age of 9-11 days. In case of third instar moulting they had finished that at the age of 13-17 days.

About 80 percent third instar female nymphs moulted at the age of 14-16 days and maximum moulting occurred at 15 and 16 days.

The moulting of second instar male nymphs completed at the age of 9-13 days with about 77.5 percent nymphs moulted at the age of 9-11 days. Third instar male nymphs moulted between the age of 14-17 days, at temperature and relative humidity ranging from 22-35.8 °C and 39- 92 % respectively, the average age of third moulting being 15.25 ± 0.82 days. About 62 percent moulting occurred at the age of 15-16 days. Whereas, the last instar moulting of male nymphs took place between the ages of 17-20 days. About 87 percent fourth instar male nymphs moulted at the age of 17-20 days. Highest moulting was observed at the age of 17 days.

The pre oviposition period ranged from 5-9 days, the average being 6.89 ± 0.84 days. The oviposition period varied from 5-10 days during which, the female laid 228-278 eggs. The average oviposition period and fecundity were 7.5 ± 0.52 days and 248.5 ± 23.23 eggs respectively. The male and female ratio was 1:1.87. The life cycle was completed in 25 days.

It was found that the nymphal development took little more time in brinjal plant than sprouted potato. This might be due to the more favourable nutritious status of sprouted potato. This point also be suitable for more fecundity rate on sprouted potato.

Akintola and Ande (2008) studied the biology of *P. solenopsis* on *H. rosa-sinensis* and found progressively increasing developmental periods of 6, 8 and 10 days for the 1st, 2nd and 3rd instars, respectively. Dasgupta (2009) also stated that pre-oviposition period, oviposition period and fecundity of *P. solenopsis* on hibiscus was 5.33 ± 1.32 days, 6 ± 1 days and 235.66 ± 87.09 eggs respectively. Vennila *et al.* (2010) also studied the biology of *P. solenopsis* and reported that male and female took 18.7 ± 0.9 and 13.2 ± 1.8 days respectively to complete their development whereas the fecundity rate was 334.4 ± 82 per female.

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Table 1.

Life stages duration of female and male nymphs of *Phenecoccus solenopsis* Tinsley

Particulars	Moulting of different nymphal instars at the age (Days)					
	Female			Male		
	1 st Instar	2 nd Instar	3 rd Instar	2 nd Instar	3 rd Instar	4 th Instar
On Brinjal						
Range	5-9	9-13	13-16	12-15	15-18	18-21
Mean (±SD)	7.28 (± 1.87)	10.86 (± 1.79)	14.45 (± 0.96)	13.50 (± 0.58)	16.33 (± 0.58)	19.33 (± 1.00)
Individual observed (No.)	25	14	11	6	6	6
On sprouted potato						
Range	4-8	8-12	13-17	9-13	14-17	17-20
Mean (±SD)	5.2 (± 3.67)	9.47 (± 1.58)	15.10 (± 1.00)	10.56 (± 0.84)	15.25 (± 0.82)	18.13 (± 0.82)
Individual observed (No.)	25	15	10	9	8	8
Temp. range (°C)	20-35.5	22-36	23-36.2	23-36	22-35.8	21-36
RH (%)	39-97	36-93	39-93	39-92	39-94	50-95

On Brinjal plant

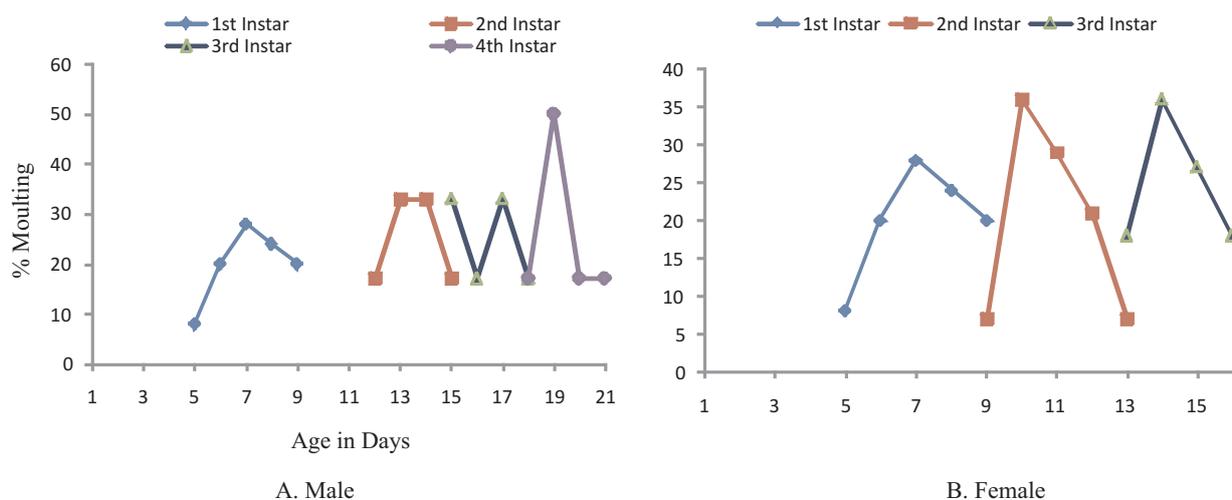


Fig. 1 *Phenecoccus solenopsis* Tinsley nymphs and their development on brinjal plant. A. Male; B. Female.

On sprouted potato

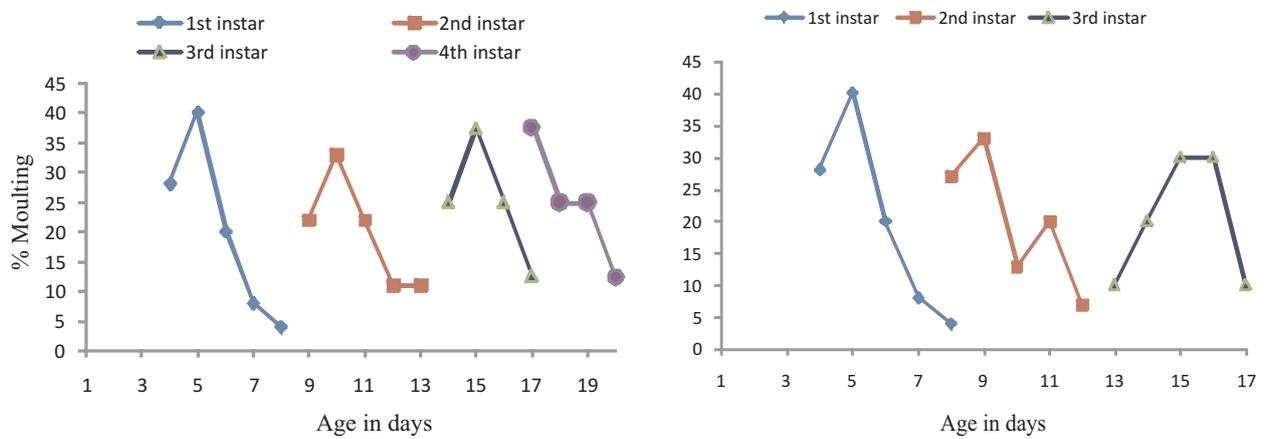


Fig. 2 Phenacoccus solenopsis nymphs and their development on sprouted potato. A. Male; B. Female.



Adult female on brinjal



Adult male



Adult female on potato



2nd instar female

Fig. 3 Some fascinating pictures of *Phenacoccus solenopsis* Tinsley