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Biology of *Coccinella septempunctata* on Mustard Aphid *Lipaphis erysimi*

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ABSTRACT

Seven-spotted ladybird beetle, *Coccinella septempunctata* L., a natural enemy of aphids, was reared on natural food where both the larvae and adult beetles fed on the aphids. The predator completed its developmental period from egg to adult stage on aphids in 28.66±0.87 days and 26.56±1.05 days in Generation-1 and Generation-2, respectively. There was no significant variation in the total developmental period between the two generations on natural diet. The fecundity of *C. septempunctata* was found to be highest on natural diet in Generation-2 with 324.79±8.41 eggs. The oviposition period and the weight of adult males and females were found to be significantly higher in Generation-2.

1. Introduction

The aphidophagous ladybird beetle *C. septempunctata* L. is a well known and diverse group of predator beetle feeding on soft bodied insect pests. It is found in many habitats, including fields, gardens, forests, sea coast, mountains and cities Ali and Rizvi (2009). The beetle has a wide range of prey, which include some of the most destructive group of insects, notably the aphids and the scale insects. Seven-spotted ladybird beetles are predaceous on various types of aphids (rose aphid, green peach aphid, green bug aphid and green mustard aphid), mealy bugs, sugarcane aleyrodid, citrus psyllid, mites and sorghum stem borer, *Chilo partellus*. This predator has a high potential of predation both in the immature as well as adult stage (Shepard 1998). Knowledge of biology, behaviour and rearing procedures of these predators are important to enhance their use in biological control programmes. In view of this, the present investigation was undertaken to study the biology of *C. Septempunctata* L. on *Lipaphis erysimi*.

2. Materials and Methods

The study was conducted at Division of Entomology, ICAR Research Complex for NEH Region, Umiam, Meghalaya, India during 2012-2014.

In order to have consistent supply of mustard aphids (*Lipaphis erysimi*) as a source of food for rearing of *C. septempunctata*, the seedlings of mustard were raised and grown in pots under net house conditions without any application of pesticides. All the laboratory experiments were conducted during 2013-2014 at Integrated Pest Management Laboratory of Division of Entomology, ICAR Research Complex for NEH region, Umiam, Meghalaya. All the experiments were conducted at ambient laboratory conditions having temperature of 22 ± 4°C with relative humidity of 60-70% and in the BOD incubator. Adults of *C. Septempunctata* were collected from the field infested with mustard aphid, *L. erysimi*. The collected beetles were then released in wooden rearing cages (50 X 50 X 50 cm) for mating and egg laying. Folded paper towels were placed in the cages as a substrate for oviposition by adults of *C. septempunctata*. The fresh twigs of mustard infested with mustard aphid and 10% sucrose solution were provided as food source for the adult beetles and these were replaced daily. Eggs laid on substrate were removed daily from the rearing cages to prevent cannibalism, which commonly occurs when eggs and adult Coccinellidae are kept together (Ware et al. 2009). After the eggs were removed from the cages, they were counted and kept separately in petri dishes. The eggs were allowed to hatch within the petri dishes and the neonate larvae/grubs were separated carefully with the help of wet camel hairbrush and placed in separate petri dishes (4.0cm diameter) to avoid larval cannibalism (Michaud 2000; Michaud 2005)

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Pervez et al. 2006). Depending upon the age/instar of *C. Septempunctata* larvae, about 5-10 full grown *L. erysimi*were supplied to each *C. septempunctata* larvae and the plates were cleaned with tissue paper daily. This provision was followed till the pupal formation stage. Upon formation of pupae, they were transferred carefully either in wooden cages or plastic containers. In case of plastic containers, only one pair (male and female) of *C. Septempunctata* were placed in each container.

Cotton swabs soaked in 10% sucrose solution act as a food source for the adult coccinellids and these were placed in each plastic container @2-3 swabs/cage. Observation on different biological/developmental parameters of *C. septempunctata* (pre-oviposition period, oviposition period, fecundity, incubation period, larval period, pre-pupal period, pupal period, pupal weight, male longevity, female longevity and total life span) were recorded separately. The data obtained from the experiment was subjected to statistical analysis in Statistical Analysis Software SPSS, ver 2.

3. Results and Discussion

The oviposition period of *C. Septempunctata* on natural diet was found to be more in G2 (42.46±1.00 days) than G1 (38.73±1.79 days) which was statistically highly significant (P<0.05) (Table 1). There was no obvious region for variations of oviposition period between two generations on same diet (*i.e.* natural diet). The findings on oviposition period of *C. septempunctata* of present investigation was supported by similar studies carried out on this insect by Ali and Rizvi (2007) who reported an oviposition period of 40.5-45.5 days in *C. septempunctata*. In another species *M. discolour*, the oviposition period of 35-42 days was reported by (Pradhan et al. 1995; Chowdary et al. 2008).

The fecundity of *C. septempunctata* was highest in Generation-2 than Generation-1 on natural diet. The fecundity in G1 and G2 was 266.40±7.67 and 324.79±8.41 eggs, respectively. The fecundity observed in G2 was significantly higher as evidenced from highly significant P values (P<0.05), (Table 1). But there was no obvious reason for this difference attributed on same diet in this investigation. Nevertheless, the results obtained on fecundity of *C. septempunctata* on natural diet in present investigation were supported by (Pandi et al. 2012). where the fecundity recorded for *C. septempunctata* on natural diet (*L. erysimi*) was also 333.6±51.66 eggs. Sattar et al. (2008) reported that the number of eggs laid by *C. septempunctata* was 177.0±23.03 on cotton aphid *Aphis gossypii*. However, Katsoyannos et al. (1997) reported 1780 eggs/female for *C. septempunctata* when it was reared in outdoor cages. The weight of adult male of *C. septempunctata* was found to be significantly higher (P<0.05) in G2 (35.66±0.44mg) than G1 (29.23±1.68mg) on natural diet (Table 1). Like the adult male weight, similar trend was also observed in case of female weight in G2 on natural diet.

The adult female weight of *C. septempunctata* in G1 and G2 was 47.00±2.21mg and 58.20±0.94mg, respectively. This consistent result could be attributed to the fact that *C. septempunctata* was reared consecutively for two generations on natural diet and vigour of the adults might have been improved in second generation. In general, the females are always heavier than males in *C. septempunctata*. Exactly similar findings were also obtained by Sarwar and Saqib (2010) where the weight of male and female *C. septempunctata* on natural diet (*L. erysimi*) was 32.44±1.35mg and 53.84±0.78 mg, respectively.

Total developmental period of *C. Septempunctata* on natural diet was 28.66±0.87 days and 26.56±1.05 in G1 and G2, respectively. Ali and Rizvi (2007) recorded that the total developmental period of *C. Septempunctata* was 27.80 days on *L. erysimi*, 25.9±0.8 days on *A. craccivora*, 30.3±0.6 on *H. coriandri*, 26.7±0.94 on *R. Nymhae* and 25.1±0.33 on *M. rosae* which are similar to the findings of present study. Furthermore, Sarwar and Saqib (2010) also reported that the total developmental period completed by *C. septempunctata*was 20.60 days on *L. erysimi*.

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Table 1. Comparison of biological parameters of *C. septempunctata* in Generation-1 and Generation-2 on natural diet (mustard aphid, *L. erysimi*)

Sl. No	Parameters (in days)	n	Generation-1	Generation-2	*t* value	*P* value	S/NS
1	Pre oviposition period (days)	30	6.16±0.30	6.32±0.20	-0.785	0.476	NS
2	Oviposition period (days)	30	38.73±1.79	42.46±1.00	-3.57	<0.05	S
3	Fecundity (Total eggs laid/female)	30	266.40±7.67	324.79±8.41	-4.72	<0.05	S
4	Incubation period (days)	30	4.46±0.18	4.30±0.14	0.997	0.375	NS
5	Larval period (days)	30	16.50±0.69	17.11±0.81	-0.694	0.526	NS
6	Pre pupal period (days)	30	1.60±0.08	1.60±0.08	*	*	*
7	Pupal period (days)	30	6.96±0.12	7.20±0.21	-2.08	0.105	NS
8	Pupal weight (mg)	30	28.66±0.61	27.40±0.50	1.51	0.204	NS
9	Male weight (mg)	30	29.23±1.68	35.66±0.44	-3.39	<0.05	S
10	Female weight (mg)	30	47.00±2.21	58.20±0.94	-7.22	<0.05	S
11	Male Longevity (days)	30	55.23±1.00	52.46±0.90	1.99	0.116	NS
12	Female Longevity (days)	30	65.60±0.69	65.26±0.87	0.393	0.714	NS
13	Total development period (days)	30	26.56±1.05	28.66±0.87	-1.814	0.144	NS
14	Mortality	30	10.0±6.0	10.2±4.0	-0.38	0.971	NS

* Similar values in both generations, a. S: Significant, b. NS: Non Significant

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