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Biology of *Coccinella septempunctata* (Linnaeus) on mustard aphid, *Liphaphis erysimi* (Kalt.)

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Abstract

During the biological studies of *Coccinella septempunctata* (Linnaeus) under laboratory conditions on mustard aphid, *Liphaphis erysimi* (Kalt.). It was revealed that the egg incubation period averaged 3.33 ± 0.33 days. The first, second, third and fourth grubs instars respective duration were averaged 2.33 ± 0.33 , 2.33 ± 0.33 , 3.67 ± 0.33 and 4.67 ± 0.33 days. The pupal period lasted for 5.67 ± 0.33 days. Adult male and female longevity was 30.67 ± 0.67 and 36.67 ± 0.33 days respectively. Pre-oviposition and post-oviposition periods averaged 6.00 ± 1.16 and 4.33 ± 0.88 days respectively. The mean fecundity of *C. septempunctata* on *L. erysimi* were 349.67 ± 10.11 eggs/ female during her life.

Keywords: Biology, *Coccinella septempunctata* and *Liphaphis erysimi*

Introduction

The impact of predacious arthropods in natural communities and agricultural crops is receiving more attention in recent years. The importance of natural enemies as controlling agents is coming into closer focus, based on modern investigations (Bailey, 1991) [1]. Indigenous populations of parasites and predators could often be a more important cause of pest mortality if not inhibited by the insecticides used in an attempt to obtain 'Chemical control' (Hagen and Tassan, 1965) [3]. The predators are scattered in about 167 families of 14 orders of class insecta. Among the predacious orders, Coleoptera, Neuroptera, Hymenoptera, Diptera and Hemiptera are the important. It is estimated that possibly up to one third of the successful biological insect pest control programmes are attributable to the introduction and release of insect predators (Williamson and Smith, 1994) [10]. Natural enemies play an important role for the suppression of arthropod pests in field crops. Approximately 400 species of lady bird beetles are present worldwide, however most of them eating on many soft bodied insects. Coccinellidae is a very heterogeneous group with respect to feeding behaviour and the evolution of their food specificity includes transitions across kingdoms (Plantae, Animalia and Fungi) and trophic levels (herbivorous and primarily carnivorous) (Sutherland and Parrella, 2009) [9]. Food resources used by predatory coccinellids depend heavily on the abundance of prey available in the environment where they live (Dixon, 2000) [2]. This fact makes many of these predators polyphagous, making it difficult to determine for some groups a correct relationship between predator and prey. Polyphagous species can have great importance in the use of integrated pest control, because they can be more easily mass-produced with artificial diets, or even their numbers increase considerably in the field with alternative food sources (Hodek and Honek, 1996) [4].

Materials and Methods

All the experiments were carried out during Ravi, 2016-2017 under laboratory conditions at room temperature $26 \pm 2^\circ\text{C}$ and $65-75 \pm 5$ relative humidity. To study the biology of *C. septempunctata* initial culture was started with fifty pair of field collected *C. septempunctata*. A collection of five pairs *C. septempunctata* adults was placed in a rearing glass cage and provided mustard aphid as food for adult *C. septempunctata*. Every day aphids were provided in the glass cage. The *C. septempunctata* female laid eggs on the glass cage and black muslin cloths. The eggs were removed every day from glass cage and muslin cloths. Total ten homeopathic vials each with one egg were taken to determine the incubation period of *C. septempunctata* eggs. This experiment was repeated two times.

These eggs were checked recorded twice per day *i.e.* 10 am and 5 pm to observe the incubation period and the number of eggs hatched. Each neonate grub hatched from the egg was collected and kept in a separate vial for the second experiment. The grub period was recorded from date of hatching. Neonates grubs which hatched from the eggs kept for incubation period were used for the study. Rearing of the grubs were carried out individually in plastic vials (14×1.5 mm) and aphid for *C. septempunctata* of almost different sizes were provided as food. Fresh aphids were provided to growing grubs every morning. To observe the moulting of the developing grubs, the exuviae were checked twice daily at morning and evening hours. The duration of all grubs instar were recorded continuously from 1st to 4th instar. The prepupal period was also observed. The studies on food consumption of *C. septempunctata* mustard aphids (*L. erysimi*), were carried out. The daily consumption by instars all of grubs and adult of *C. septempunctata* was calculated. The actual number of aphids consumed by grubs and adult was obtained by subtracting the number of aphids left over from the total number of aphids supplied every day. For studying the pupal period, freshly formed pupae were kept in rearing homeopathic vials and observation on the emergence of *C. septempunctata* adults from the pupae were recorded every day. This experiment was repeated two times. Pair of newly emerged adults were released in rearing cage to observe the duration of mating and oviposition period. It was observed that the males were smaller than the females in general. After pairing, their mating behaviour was also studied by daily visual observations. To study adult longevity, newly emerged adults were kept in rearing glass cage and *L. erysimi* were provided as food material for the *C. septempunctata*. Fresh food was provided every day and observations were recorded.

Results and Discussion

The field collected *C. septempunctata* adults were kept in rearing units and provided natural diet (*L. erysimi*.) as food. Mating of adults normally occurred early in the morning.

After mating, a single female of *C. septempunctata* laid 25-30 eggs/day. The freshly laid eggs of *C. septempunctata* were collected from rearing unit and placed in vials which became pale yellowish before hatching. During peak of oviposition period, a single female laid 349.67 ± 10.11 eggs during her life. The present observations are in accordance with the finding of Singh and Singh (2013) [8] and Singh *et al.*, (2009) [7] who reported the female fecundity in the laboratory 378.00 ± 26.5 and 357.45 ± 22.41 eggs/female respectively.

It is clearly documented from the (Table-1) that, the average incubation period of eggs of *C. septempunctata* was 3.33 ± 0.33 days. The result are in conformity with findings of Singh *et al.*, (2009) [7] and Kumar *et al.*, (2012) [5] who reported the respective egg incubation period of 4.32 ± 0.26 and 3.67 ± 0.33 days. The average durations of first instar grub, second instar grub, third instar grub and fourth instar grubs were 2.33 ± 0.33 , 2.33 ± 0.33 , 3.67 ± 0.33 and 4.67 ± 0.33 days respectively. The mature grubs stop feeding and became inactive for a period of 12 to 36 hours before pupation they go on the plant and attach themselves to the leaf surface and sometimes stem also with the help of anterior end of head and the posterior end of its abdomen. The present observations showed that the total grub period was 12-14 days. The present observations showed that the pupal period lasted for 5.67 ± 0.33 days. The present observation are in approximation with finding of Singh (2009) [7], Kumar *et al.*, (2012) [5] and Singh and Singh (2013) [8] who reported the pupal period of 5.35 ± 0.15 , 5.00 ± 0.58 and 5.60 ± 0.18 days respectively. Pupal and adult survival of *C. septempunctata* on mustard aphid was 8.67 ± 0.33 and 9.67 ± 0.33 respectively. Total feeding potential of grub and adult was 203.00 ± 1.73 and 826.67 ± 14.53 aphids respectively. Duration of female longevity ranged from 36 to 37 days with an average of 36.67 ± 0.33 days. Average pre-oviposition and post-oviposition periods were 6.00 ± 1.16 and 4.33 ± 0.88 days respectively. Male duration ranged from 30-32 days. There are in partial agreement with the findings of Shukla and Jadhav (2014) [6] who reported the female longevity of 29 to 41 days and male duration 21 to 40 days respectively.

Table 1: Development period of lady bird beetle, *Coccinella septempunctata* during Rabi, 2016-17

Development stages	Duration (Days)	
	Range	Mean
Egg (incubation period)	3-4	3.33 ± 0.33
Larva-First instar	2-3	2.33 ± 0.33
Second instar	2-3	2.33 ± 0.33
Third instar	3-4	3.67 ± 0.33
Fourth	4-5	4.67 ± 0.33
Total larval period	12-14	13.00 ± 0.58
Pupal period	5-6	5.67 ± 0.33
Total food consumption- Grub	200-206	203.00 ± 1.73
Adult	800-850	826.67 ± 14.53
Pupal and adult survival- Pupal survival	8-9	8.67 ± 0.33
Adult survival	6-10	9.67 ± 0.33
longevity of male	30-32	30.67 ± 0.67
Female-	36-37	36.67 ± 0.33
Pre oviposition	4-8	6.00 ± 1.16
post oviposition	3-5	4.33 ± 0.88
Fecundity of female	332-367	349.67 ± 10.11
C.D.		12.94
SE(m)		4.47

Conclusion

On the basis of results which was obtained present experiment, the following conclusion are brought out, which

may be useful for scientists, research workers and farmers. The predator *C. septempunctata* completed their life cycle in 30-36 days. The single beetle of *C. septempunctata* during

whole life consumed significantly 1030 aphids (*L. erysimi*). *C septempunctata* was a good bio control agent of aphids and best substitute of chemicals to management of aphids.

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