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Studies on biology of *Caryedon serratus* (Olivier) on groundnut *Arachis hypogaea* (L.)

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Abstract

The present research was aimed to study the biology of *Caryedon serratus* (Olivier) on groundnut, *Arachis hypogaea* (L.) under laboratory conditions from August to December, 2014. A female laid 45 mean numbers of eggs (range 40 to 50). The ovipositional, incubation, larval, pupal and total developmental period (egg to adult) were found to be with an average of 14 days (range 8 to 20 days), 6.5 days (range 5.25 to 8.25 days), 19 days (range 16.75 to 22.75 days), 17.50 days (range 15.00 to 19.65 days) and 44 days (range 40 to 47.75 days), respectively. The longevity of male was recorded with an average of 19.5 days (range 13.75 to 25.25 days), whereas, in female, it was 22.5 days (range 15.25 to 29.75 days).

Keywords: *Caryedon serratus*, biology, groundnut kernels

Introduction

Groundnut, *Arachis hypogaea* (L.) is one of the major oilseed crop of India [25] and popularly known as peanut or earthnut. Groundnut kernel is rich in easily digestible protein (26%) and edible oil (48%) as compared to other oilseed crops and known to be poor man's almond. It contains different types of vitamins viz; thiamine, riboflavin, vitamin E and minerals like phosphorus, calcium and magnesium [24]. Globally 50 per cent of groundnut produce is used for oil extraction, 38 per cent for confectionary use and 12 per cent for seed purpose. In India, about 80 per cent is used for oil extraction, 11 per cent as seeds, 8 per cent as direct food and one per cent for export to other countries.

India contributes about 20 per cent area and less than 10% production of oil seeds of world, whereas groundnut crop accounts for 40% of the area (4.19 million ha) and 30% of the production (5.62 million tonnes) of total oilseeds grown in India [1]. In Rajasthan, groundnut crop is cultivated in an area of 3.97 lakh hectares with 4.18 lakh tonnes of production and having an average productivity of 1051 kg per hectare [2].

About 100 insect species have been reported to infest stored groundnut. Out of these, *Caryedon serratus* (Olivier), *Tribolium castaneum* (Herbst), *Oryzaephilus mercator* (Fawel), *Ephestia cautella* (Walker) and *Elasmolomus sordidus* (Fab.) are very important and cause considerable losses. However, *C. serratus* (Coleoptera: Bruchidae) is of economic importance and posed to be a potential threat to stored groundnut [27]. The bruchid is native of the tropics and subtropics of the globe [7] and has been introduced into different parts of the World [18]. In India, it has been reported from South India [10], Rajasthan, Gujarat, Madhya Pradesh, Maharashtra and Uttar Pradesh [15], Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh, Tamil Nadu, Kerala and some of the Islands in the Indian ocean [3]. In recent years in India, it has become a serious pest of stored groundnut wherever, groundnut is grown and stored [9]. Beside groundnut, the infestation of *C. serratus* was noticed for the first time infesting *Oryza sativa* L [3], *Acacia nilotica* (L.), *A. tortilis* (Forssk.) and *Prosopis cineraria* (L.) [21], *Pongamia pinnata* (L.) Pierre [22], *Bouhinia variegata* L [19] and *Cassia moschata* HBR [20]. In 1957, this bruchid was reported on stored groundnut at Gambia and resulted in poor germination which ultimately led to poor yield [11]. The larvae of *C. serratus* bored into the seeds via small holes and fed on the embryo and the endosperm [6]. Insect infestation caused considerable quantitative and qualitative losses to the groundnut either stored in shell for seed purpose or unshelled for milling purpose. As a result of feeding by this beetle, acidity of oil in nuts increased, ultimately deteriorated the quality of oil. Biology of *C. serratus* has been studied by various workers [6, 12, 16, 17]. Keeping in view, an experiment conducted on biology of the pest, *C. serratus* on groundnut *Arachis hypogaea* (L.) from Jobner, Rajasthan, India in relation to their relative behavior under conditions of ambient temperature and humidity.

Materials and Methods

Experimental site

The present studies on biology of *C. serratus* on groundnut were conducted under laboratory conditions in the Department of Entomology, S.K.N. College of Agriculture, Jobner during, August to December, 2014, which is situated at 75° 28' East longitudes, 26° 05' North latitude and at an altitude of 427 meters above mean sea level. It falls under agro-climatic zone IIIrd A, the "Semi-Arid Eastern Plain Zone" of Rajasthan. The climate of this area is typically semi-arid, characterized by extremes of temperature both in summer and winter with low rainfall and moderate humidity. Maximum temperature in summer reaches as high as 45 °C and

minimum temperature in winter falls down below 0 °C. The average annual rainfall of locality varies from 400-500 mm occurring mostly from the last week of June to September.

Experimental procedure

The biology of bruchid, *C. serratus* was studied on groundnut kernels under laboratory conditions at 29±1.5 °C temperature and 70±5 per cent relative humidity. Twenty kernels of groundnut were taken in plastic container (8 × 7cm diameter). One pair of 0-24 hours old adult (male and female) was released in each container. Sex determination of the insect was done on the basis of characters as detailed in (Table-1).

Table 1: Sex determination characters of *C. serratus*

S. No.	Male	Female
1.	Length –7.16 to 7.24 mm.	Length – 7.16 to 7.75 mm.
2.	Pygidium or sixth visible tergite black in colour with the apex dark brown, vertical and as long as width	Pygidium sub-vertical and longer than width
3.	Pygidium project downwards and hidden by elytra	The pygidium can be seen in dorsal view projecting beyond the elytra
4.	The fifth visible sternite is deeply incurved anteriorly	The fifth sternite is fully extended

Observations

The total number of eggs laid was counted at weekly interval till the observations became constant. The kernels having eggs laid on them were separated after one day and 20 eggs along with the kernels were kept in petri dishes (5 cm diameter) to determine the incubation, larval, pupal periods and longevity of male and female adults. The survival of the eggs was recorded after examining the egg chorion as well as recording the number of the hatched larvae. As soon as the kernels were infested, these were transferred into the glass vials (10× 2.5 cm). The duration or longevity of larva and pupa was recorded combined as most of the period was spent in the grain. A separate culture of the pupa was also maintained on groundnut kernels to record the pupal period separately. For determining the number of larval instars, the infested kernels were soaked in 70 per cent ethyl alcohol and carefully dissected out to find out the number of cast off exuviae in the kernels. The cast off exuviae and different size of grubs were used as an indication of possible number of larval instars. The adult emergence was recorded every 24 hrs. The survival of different stages was recorded. The total number of adults emerged and developmental periods were also recorded. To observe the adult longevity, the individuals of different sexes (0-24 hrs. old) were placed in separate petri dishes (5 cm diameter) and observations on natural mortality were recorded.

Results and Discussion

The data presented in Table2 indicated that the ovipositional period ranged from 8 to 20 days with an average of 14 days and the number of eggs laid per female by *C. serratus* ranged from 40 to 50 with an average of 45 eggs. The findings get support from the observations of [26] who observed an average of 59.40 eggs laid by *C. serratus* on groundnut kernels at 29±3 °C temperature and 50±5 per cent relative humidity, respectively [23]. found an average number of eggs laid per female ranged from 29.00 to 50.00, whereas, [5]. observed highest mean number of eggs (106-115) at 27.5-30 °C temperature and 70-90 per cent relative humidity support the present finding. However [16]. recorded an average of 42 eggs of *C. serratus* on *Tamarindus indica* at 30 °C temperature and

70 per cent relative humidity contradicts the present findings. The hatching period varied from 5 to 8 days with an average of 6.5 days. The present finding are in close agreement with that of [9]. Who reported the mean incubation period of 8.00 days of *C. serratus* on groundnut pods at 30±2 °C temperature and 70 per cent relative humidity. Similarly, [26].found hatching period as 7.60 days on groundnut kernels at 29±3 °C temperature and 50±5 per cent relative humidity. However, [13]observed average duration of egg to grub emergence of *C. serratus* as 5.09 days on groundnut under laboratory conditions also support the present results.

In the present investigations, the larval period on groundnut kernels ranged from 16.75 to 22.75 days with an average of 19.75 days. These finding are in close conformity with that of [9]. who reported mean duration of larva of *C. serratus* as 22.90 days on groundnut at 30±2 °C temperature and 70 per cent relative humidity. However, [26] observed the larval period of *C. serratus* on groundnut kernels as 25.40 days at 29±3 °C temperature and 50±5 per cent relative humidity. The present findings also get support from the observations of [5, 14] who found mean larval period of *C. serratus* as 40 to 45 and 18.88 days (including oviposition), respectively. Contrary to the present results, [13]. recorded mean larval period of *C. serratus* as 34.69 days on groundnut under laboratory conditions. However, the pupal period varied from 15 to 20 days with an average of 17.50 days. It was observed that the bruchid completed its life cycle with an average of 44 days (range 40 to 48 days). The longevity of male adult ranged from 14 to 25 days with an average of 19.5 days whereas, the longevity of female adult varied from 15 to 30 days with an average of 22.50 days. In the present findings the pupal period on groundnut kernel ranged from 15.00 to 19.65 days with an average of 17.50 days. The present observations corroborate with the findings of [9, 26] who observed an average pupal period of *C. serratus* on groundnut as 15.5 days at 30±2 °C temperature and 70 per cent relative humidity and 15.0 days at 29±3 °C temperature and 50±5 per cent relative humidity, respectively. Similarly, [4]. recorded an average duration of pupa of *C. serratus* on groundnut as 25 to 30 days. However, [13, 14] observed mean pupal duration of *C. serratus* as 12.88 days and 22.85 days under laboratory conditions, respectively.

Table 2: Biology of *Caryedon serratus* on groundnut kernels

S. No.	Parameters	Range	Mean + S.Em.
1.	Ovipositional period	8-20	14 + 3.979
2.	Egg per female (No.)	40-50	45 + 0.451
3.	Hatching period (days)	5-8	6.5 + 0.154
4.	Larval period (days)	16-22	19 + 0.254
5.	Pupal period (days)	15-20	17.5 + 0.315
6.	Total development period (days)	40-48	44 + 0.391
7.	Longevity		
	Female (days)	15-30	22.5 + 0.291
	Male (days)	14-25	19.5 + 0.315

The total developmental period of *C. serratus* varied from 40 to 47.75 days with an average of 44.35 days in the present investigations. The present findings are in close agreement with those of ^[9, 26] who found mean duration of developmental of *C. serratus* on groundnut as 48.6 days at 29±3 °C temperature and 50±5 per cent relative humidity and 47.90 days at 30±2 °C temperature and 70 per cent relative humidity, respectively. The present results also get support from the observations of ^[13] who recorded the duration of development of *C. serratus* on groundnut as 40.96 days under laboratory conditions. Similarly, ^[7] reported the development period as 42 days at 30 °C temperature and 91-98 days at 25 °C temperature and 70 per cent relative humidity. Contrary to the present findings ^[4, 14] reported that the pest completed its life cycle (egg to adult) within 65-75 days and 82.00, respectively. It is clearly depicted from the data that female life span was longer than male. In the present investigations, the longevity of male adult ranged from 13.75 to 25.25 days with an average of 19.5 days whereas, the longevity of female adult varied from 15.25 to 29.75 days with an average of 22.5 days. The present observations are in agreement with that of ^[9] who reported an average adult longevity of male and female as 27.4 and 30.2 days, respectively. However, ^[23] reported that male and female lived for 11.72 to 14.47 days. Similarly ^[14] also observed female life span longer as compared to male i.e. 42.20 and 27.70 days with the range of 11 to 69 and 12 to 45 days, respectively. However, ^[5] recorded adult life span at different combinations of temperature and relative humidity. The minimum and maximum life span of male and female was 3 and 4 days at 45 °C temperature and 70 per cent relative humidity and 18 and 21 days at 27.5 °C temperature and 75 per cent relative humidity, respectively ^[8] reported female had a mean life span of three months.

Conclusion

The biology of *C. serratus* from egg to adult stage revealed mean number of eggs laid by a female as 45 eggs. The ovipositional, Incubation, larval, pupal and total developmental period were found to be with an average viz; 14 days, 6.5 days, 19 days, 17.50 days and 44 days, respectively. The longevity of female and male adults were 22.5 days and 19.5 days, respectively.

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