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Biology of *Callosobruchus chinensis* in stored mung beans (*Vigna radiata*) in Muzaffarpur, Bihar, India

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Abstract

Among pulse crop, mung bean (Vigna radiata) is one of the most important pulse crops in Muzaffarpur, North Bihar which is affected by its conmon pest called pulse beetle common pest, (Callosobruchus chinensis) due to which, it faces qualitative and quantative losses both during its storage. Therefore, its control is utmost priority which ultimately requires the knowledge about its various life stages. The current work is conducted in the laboratory, to study the biology of pulse beetle on ten different parameters. The results obtained showed pre-oviposition, oviposition and post-oviposition perio as 6.50 ± 1.08 h, 6.30 ± 0.82 days and 2.60 ± 0.51days respectively, incubation period 4.70 ± 0.82 days, total larval period and pupal period 15.30 ± 1.44 days and 6.20 ± 0.78 days, respectively , average lifespan of male and female adult 6.50 ± 1.08 days and 9.10 ± 1.19 days, respectively and fecundity 92.7 ± 9.21 eggs /female. Whole life cycle of male was 28.00 ±2.44 days and female was 30.60 ± 2.83 respectively. The study is important not only in understanding the life cycle but also for the control of pulse beetle.

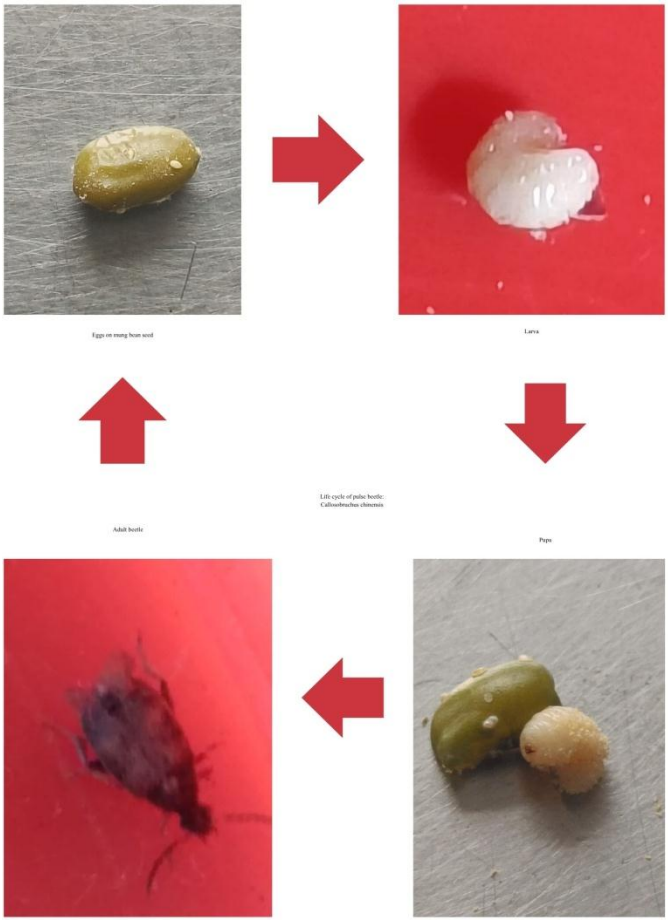
Keywords: Pulse beetle, biology, life cycle, mung, Callasobruchus chinensis, stored grain pest.

Introduction

Legumes such as lentils, chickpeas, and beans, these are the main source of plant protein which play an important role in vegetarian diets. They are always low in fat and inexpensive, making them a healthy choice. These help in maintaining soil fertility & also supports the sustainable agriculture[1]. The main pests that are widely distributed in our country and cause significant damage are *C. analis, C. maculatus and C. chinensis*. The species takes its name from the genus name of the plant, chinensis, it was first described in 1758 in china..It is the major pests of pulses such as green gram, lentil, chickpea, cowpea, pigeon pea and other pea species. Among all the pulses, the preferred host of *C. chinensis* is green bean[2]. Economic losses due to bean beetles in beans range from 30% to 40% in six months and can go up to 100% if left untreated[3-5]. Bean beetle (C. *chinensis*) requires special care during storage because in India about 8.5% of losses occur during postharvest handling. There is only minor damage. The maggots burrow into the pods and hide inside the seed coats, creating a latent infection[6]. The larvae of the pest making burrow into the bean pods & it feeds on them, it reducing its germination and also its commercial value of the bean pods[7]. The adult female of the legume beetle lays only one egg, but large numbers of eggs have been found in rice. The maggots penetrate the surface of the grain, feed on the grain, develop inside the grain. The maggots pupate in the grain and the adults emerge from the grain[8,9]. Better understanding of the biology of pea beetles will help in improving management strategies to reduce pea beetle infestation. Many researchers including have studied the biology of *C. chinensis*[10,11,12]. Therefore, this study aimed to investigate the life cycle of bean beetle so that this pest can be better controlled at appropriate time before bean beetle infestation.

Materials and Methods

The experiment was done in the laboratory of Department of Zoology, Mahant Das Mahila College, Babasaheb Bhimrao Ambedkar Bihar University, Muzaffarpur, Bihar, India. The Biology of pulse beetle *Callosobruchus chinensis* was studied on seeds of green gram *(Vigna radiata*) purchased from Gola road markets of Muzaffarpur. 100g of g seeds of mung bean were kept in ten separate glass jars. Males & females were distinguished on the basis of size of body. i.e females are larger than males, with distinguishing features such as exposed abdominal tips and darker patches on their bodies. Female have pectinate type antennae whereas Male have serrate type antennae. 10 pairs of newly hatched adult beetles were put in each jar. The jar was covered with the muslin cloth and tightened with the help of rubber bands. After egg laying, individually eggs were kept for further observation. The beetles were removed from the containers which were dead & removed from the jar. Total egg laying period, incubation period, total number of eggs laid by a single female, total number of eggs hatched, percent egg hatchability, larval period, pupal period, adult longevity, total developmental period and total life cycle were recorded. This information is needed to explain workers *C. chinensis* biology for better control of the pest.



Figures-1: show life cycle of pulse beetle (Callosobruchus chinensis) on mung bean.

Results and Discussion

Experiment sets were monitored and checked regularly and reproductive success of the pest beetle. The observations exposed that the eggs of *C. chinensis* are bright yellow & cigar shaped, smooth and transparent in appearance The results obtained as shown in Table 1 reveal that average duration of pre-oviposition was (6.50 ± 1.08 h), oviposition was (6.30 ± 0.8) days. Post-oviposition was (2.60 ± 0.51 days). 4.70 ± 0.82 days was incubation period. Total larval period was 15.30 ± 1.44 days and pupal period was 6.20 ± 0.78 days. The average lifespan of male adult pulse beetle and female adult beetle were 6.50 ± 1.08 days and 9.10 ± 1.19 days, respectively. The fecundity was 92.7 ± 9.21 eggs which ranged between 79- 105 eggs/female. Total life cycle was completed in 24 - 31 days with an average duration of 28.00±2.44 days in case of male while 26 - 35 days with an average duration of 30.60 ± 2.83 days in female. Male adult and female adult were 6.50 ± 1.08 days and 9.10±1.19 days, respectively. The fecundity was 92.7 ± 9.21 eggs which ranged between 79-105 eggs/female. Total life cycle was completed in 24-31 days with an average duration of 28.00±2.44 days in case of male while 26 - 35 days with an average duration of 30.60 ± 2.83 days in female.

Table-1: Lifecycle parameters of C. chinensis on green gram.

Parameters	Mean ± SD (n=10)
Pre- oviposition (In hours)	06.50±01.08 (05.00-08.00)
Oviposition/ Egg laying period (in days)	06.30±00.82 (05.00-08.00)
Post-oviposition	02.60±00.57 (02.00-03.00)
Incubation period (in days)	04.70±00.82 (04.00-06.00)
Total number of eggs laid/female	92.7±09.21 (79.00-105.00)
Number of eggs hatched	79.60±11.75 (60.00-93.00)
Percentage egg hatchability	85.57±6.68 (73.00-92.80)
Larval period (in days)	15.30±1.94 (13.00-18.00)
Pupal period (in days)	06.20±00.78 (05.00-07.00)
sAdult longevity of male (in days)	06.50±01.08 (05.00-08.00)
Adult longevity of female (in days)	09.10±01.19 (08.00-11.00)
Total life cycle in Female (in days)	30.60±02.83 (26.00-35.00)
Total life cycle in Male (in days)	28.00±02.44 (24.00-31.00)

SD- Standard deviation, n- Sample size.

Discussion: Table-1 shows the Biological study of *C. chinensis* in seeds of green gram which mean egg laying period was 06.30±00.82 days which ranged from 5 to 8 days. It is more or less similar to the Chakraborty et al.[12] findings that egg laying period of *C. chinensis* ranged between 3 and 8 days. The incubation period observed 4 to 6 days and the average mean is 04.70±00.82 days which is not matched the findings of Chakraborty et al.[12] whose incubation period ranged was 6 to 8 days and average mean was 7.03±0.54 days. The incubation period of pulse beetle on mungbean seeds reported by Varma and Anandi ranged from 3 to 5 days & average is 4.0±1.0 days[13]. The current findings were very close to that of Rana Kiran who observed that the eggs were laid by female beetle singly on seeds[14]. A single female laid eggs from 79 to 105 with the average of 92.7±09.21 number of eggs. It was almost similar to that of the Thakur and Pathania[15] whose average number of eggs laid by single female was 99.00 in July-August[15]. Singh and Kumari observed the fecundity of pulse beetle was on an average of 70 eggs per female on stored pulses grain (cowpea and chickpea)[7,16]. This observation is slightly different from the present result. Hatchability of eggs from single female was 79.60±11.75 ranged from 60 to 93 eggs. The mean egg hatchability was 85.57±6.68 with the limit of 73to 91% which

aligns with the findings of Chakraborty et al.[12]. The average larval period lasted 13 to 18 days, mean value was 15.30±1.94 days which corresponds to Hosamani et al.[17]. According to Ravindra the average mean number o*f C. chinensis* in cowpea was 13.2 days Augustine[18] and Balkai[19] reported the larval period of beetle was 14-23 days in cowpea, which is dissimilar to the findings of Ravindra of 13.20 days[18]. Present result is in agreement with the observation of Patel et al.[20] and Solanki and Mittal[21] who reported mean durations of pupal period was 6 ±1.00 and 6.82 days respectively for C chinensis on chickpea. The average mean pupal period was 06.20±00.78 days, which ranged between 5 & 7 days. It is slightly different from the Thakur and Pathania[15] findings, who found longer pupal period (7 to 9.33 days) with the average of 8.11 days in different generations in black gram. Adult longevity showed sexual dimorphism, adult male lived (5-8 days) and female was ranged between (8-11 days), respectively. Which is in agreement with Augustine and Balikai[22], as well as Chakraborty and Mondal[12]; Augustine and Balikai[19]; Verma and Anandhi[13]. The mean duration of entire life cycle of C. chinensis was 30.60±02.83 days in females which ranged 26 to 35 days in female and 28.00±02.44 days in males which ranged from 24-31 days. This results partial support with the finding of Hosamani et al.[17], WHO recorded a mean of 32±1.50 days in mung bean with limit of 29 to 32 days. Patel et al.[2] who reported a developmental period of life cycle of *C. chinensis* in mung bean was 28-38 days.

Conclusion

This study on the biology of bean beetle *(Callosobchus chinensis)* provides valuable information on its life cycle, reproduction and impact on bean crops. The findings show that bean beetles are short-lived. The present study will be useful for farmers and government extension workers to reduce insect damage under storage conditions. It can also be used to understand the biology of bean beetles. The spread of diseases from fields to storage will help protect the target, reduce crop losses and ensure food security. Future research should focus on predators, resistant plants and environmental management to control legume insect infestations.

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