International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS
International Journal of Fauna And Biological Studies

E-ISSN 2347-2677
P-ISSN 2394-0522
www.faunajournal.com
IJFBS 2022; 9(1): 23-25
Received: 28-10-2021
Accepted: 11-12-2021

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Study the biology of *Callosobruchus chinensis* L. on green gram

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DOI: https://doi.org/10.22271/23940522.2022.v9.i1a.870

Abstract
Investigation was carried out at Department of Entomology, JNKVV, Jabalpur during 2018-19. The biology of pulse beetle was studied on virat variety of green gram. Female beetles laid on an average 87.33 eggs with mean incubation period of 4.33 days, larval period took on average of 22.67. Pupal period took on average of 6.33 days. The mean developmental period was 32.67 days.

Keywords: Biology, pulse beetle, virat, green gram and incubation period

1. Introduction
The pulse beetle (*Callosobruchus chinensis* L.) is a key pest of stored pulses and mainly responsible for causing significant damage. In severe cases, the entire quantity of stored grain gets reduced to a mass of empty shells and dust. It has been reported that *C. chinensis* also harbours certain pathogenic micro-organisms that cause food poisoning and spoilage besides quantitative damage (Neelgund and Kumari, 1983) [5]. Pulses being is a vital source of protein form a major constituent of the vegetarian diet for a majority of the rural and urban population in India, where the consumption of animal protein except milk is still considered a religious and social taboo. Among the pulse crops, green gram, *Vigna radiata* (L) is important pulse crop as it is widely used as a whole grain or as a split pulse on account of its easy digestibility. It contains 24 percent protein, 56.7 per cent carbohydrates, 3.5 per cent fibre and 1.3 per cent fat. The life cycle of pulse beetle is reportedly completed in 25.2 days (Anandhi and Verma, 2010) [2], 33.5 days (Patel *et al*, 2005) [7] and 31 days (Thakur and Pathania, 2013) [13]. Use of insect resistant varieties is a safer and economic way of saving stored grains. Efforts should also be made to reduce the storage losses through eco-safe management techniques and proper utilization of the available natural resources in a compatible manner. Among the natural resources, plant materials and inert dusts possess some desirable qualities as a grain protectant and are easily available, cheaper, less persistent and leave less toxic residues on food grains. Various plant products and inert dusts have been reported to possess insecticidal activity against the bruchids.

2. Materials and methods
2.1. Nucleus culture and maintenance
The nucleus culture of pulse beetle, *Callosobruchus chinensis* (L) were obtained from the laboratory of Entomology, Collage of Agriculture JNKVV, Jabalpur. This culture was maintained in the Department of Entomology, bioagent laboratory at ambient conditions of temperature and relative humidity. Green gram varieties were procured from the department of plant breeding and genetics, JNKVV, Jabalpur, clean washed, shade dried. The sterilized green gram seeds were used to maintain the culture for experimental needs. Ten pairs of one-day old adults were released into plastic containers (250 ml capacity) containing 100g green gram seeds on different dates and replicated thrice to obtain regular supply of the test insect of uniform age. The jars were covered with muslin cloth and fastened with rubber bands. The released adults were removed from the containers of the dated culture after 3 days. Utmost care was taken to pick or transfer the seeds or test insects with the help of a forceps, camel hair brush and an aspirator.

2.2. Study of biology of *Callosobruchus chinesis* L.

The biology of pulse beetle, *Callosobruchus chinensis* was studied on virat variety of green gram, for which, three plastic containers (250 ml capacity) containing 100g seeds were taken wherein freshly emerged single pairs of *Callosobruchus chinensis* were released in each container. Identification of the sexes was made by employing the method suggested by Pandey and Singh (1997) [6]. Mouth of the containers were covered by muslin cloth and secured with rubber bands and later maintained at ambient conditions of temperature and relative humidity in the laboratory. Adults were removed from these containers after death. The number of eggs laid by a single female on host grains was recorded taking a sample of 100 grains. Eggs laid on each day were kept in separate containers covered with muslin cloth and observations were recorded for incubation, development (larval and pupal), total developmental period and the growth index. The incubation period, larval and pupal period within the grain was recorded by gently splitting open the whole grain with the help of the needle and forceps to observe the stage of insect under a stereo-zoom binocular.

3. Results and discussion

Biology of *C. chinensis* was studied on Virat variety of green gram under laboratory conditions during January 2019 to march 2019.

3.1. Development of bruchid

3.1.1. Number of eggs

The data indicated that on an average 87.33±7.09 eggs were laid by a single pulse beetle female on 100 randomly selected green gram seeds. The fecundity of pulse beetle female varied from 81 to 95 eggs with an average of 87.33 eggs in the present study. Pandey and Singh (1997) [6] reported the average egg laying per female by *C. chinensis* to be 110 eggs. Sharma *at al.* (2018) reported the average fecundity of 74.8±1.8 eggs per female. Solanki and Mittal (2018) [12] reported the average fecundity of the females was 85.6 eggs and its viability 94% during its life time.

3.1.2. Egg period

The data indicated that the average egg period of pulse beetle was 4.33±1.53 days. It was observed that the average incubation period was 4.33 days which varied from 3 to 6 days in which could be due to the impact of temperature and humidity. Earlier, Augustine and Balikai (2019) [3] reported the incubation period of *C. chinensis* ranged from 4 to 6 days with a mean of 4.6 ± 0.70 days. Singh *et al.*, (2017) [10] observed average incubation period from 4.17 days on chickpea. Incubation period of 4-5 days by *C. chinensis* was also reported by Singh and Kumari (2002) [11] on green gram and cowpea seeds at 28±2 ºC and 70±5 per cent RH. Variations in incubation period among different generations in different hosts have been reported by many workers, which were attributed to differences in temperature, relative humidity and host species.

3.1.3. Larval period

The data indicated that the average larval period of pulse beetle was 22.67±3.51 days. The larval period varied from 19 to 26 days with an average of 22.67 days during the present studies. Kumari *et al.* (1991) [4] reported the larval period of 17- 20 days in black gram. While working the biology of *C. chinensis* on green gram and cowpea, Singh *et al.*, (2017) [10] reported the combined larval and pupal period to vary from 18.9-38.3 days on different pulses at room temperature of 28±2 ºC and 70±5 per cent RH.

3.1.4. Pupal period

The data indicated that the average pupal period of pulse beetle was 6.33±0.58 days. The pupal period varied from 5 to 7 days with an average of 6.33 days during the present studies. the pupal stage lasted 7.00 to 9.33 days during the six generations of *C. chinensis*, Siddiqi (1972) [8] had reported a comparatively shorter pupal period (5.6 to 6.00 days) when compared to the present studies. Kumari *et al.*, (1991) [4] and Singal and Borah (2001) [9] reported pupal periods of 7-9 days on black gram and 7.2±0.18 days on pigeonpea, respectively.

3.1.5. Total development period

The average total development period of pulse beetle was recorded 32.67±3.51 days. The time taken by the beetle to complete total developmental period varied from 29 to 36 days (average: 33.33 days) during the present study. Earliar, Ahmad *et al.*, (2017) [1] reported the total development period from ovipositing to adult emergence (28.67-32.33 days). Singh *et al.*, (2017) [10]. The average of the total developmental period (egg to adult) was 34.62 days.

Table 3.1: Biology of pulse beetle on green gram variety virat.

S. No.	Stage of the Insect Average	Days ± S.D.
1.	Egg period	4.33±1.53
2.	Larval period	22.67±3.51
3.	Pupal period	6.33±0.58
4.	Total developmental period	32.67±3.51
5.	Fecundity	87.33±7.09

S.D. - Standard deviation.

4. Conclusion and suggestion for further work

The biology of pulse beetle was studied on virat variety of green gram. Female beetles laid on an average 87.33 eggs with mean incubation period of 4.33 days, larval period took on average of 22.67. Pupal period took on average of 6.33 days. The mean developmental period was 32.67 days.

Incidence of Pulse beetle *Callosobruchus chinensis* on different varieties of stored green gram, the wide variability against the pest, and testing the promising, i.e. comparatively resistant varieties, under different storage conditions are recommended for further work. Conformation of plant powders showing good results against *C. chinensis* will be done. Major part of food grains is stored in bags and only a minor part is kept as bulk in the public sector in Jabalpur Fumigation with aluminum phosphate is the major pest control practice in grain storages where re-infestation, especially at farm level storage, is a continuous threat along with development of resistance in insects against these insecticides. This situation supports the application of alternative measures especially use of plant materials for preventing insect losses to stored grains.

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