Biological Forum – An International Journal **6**(2): 86-89(2014)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Life Cycle and Morphometric Measurement of *Callosobruchus analis* on Gram

M. Bhubaneshwari Devi and N. Victoria Devi
Laboratory of Entomology, P.G. Department of Zoology
D.M. College of Science, Imphal, Manipur, India

(Corresponding author : M. Bhubaneshwari Devi)
(Received 08 July, 2014, Accepted 01 September, 2014)

ABSTRACT: A study was conducted in the Laboratory of Entomology, D.M. College of Science, Imphal during May to June, 2014 at 28.7 ± 2.0°C and 75.2 ± 3.0 % relative humidity to study the biology and morphometry of *Callosobruchus analis*. The life cycle consisted of egg, four larval instars (L_1, L_2, L_3 and L_4), pupa and adult. The eggs hatched in 8-9 days. The larval duration varied from 18-22 days. The morphometric measurements revealed that the average length and breadth of egg were 0.68 ± 0.04 mm and 0.33 ± 0.02 mm respectively. The mean length and breadth of L_1, L_2, L_3 and L_4 were 0.51 ± 0.02 mm, 1.62 ± 0.04 mm, 2.75 ± 0.06 mm, 3.49 ± 0.06 mm and 0.33 ± 0.02 mm, 0.30 ± 0.02 mm, 0.84 ± 0.02 mm, 1.63 ± 0.04 mm respectively. The average length of male pupa and female pupa were 3.34 ± 0.04, 3.74 ± 0.03 mm and breadth were 1.56 ± 0.05 mm, 2.13 ± 0.02 mm respectively. The average length and breadth of male and female adult were 3.25 ± 0.23 mm, 3.60 ± 0.08 mm and 2.16 ± 0.05 mm, 2.02 ± 0.04 mm respectively. The life cycle took 53-62 days for completion.

Keywords: Biology, instar, relative humidity, morphometric measurement, *Callosobruchus analis*, gram.

INTRODUCTION

The cow pea weevil *Callosobruchus analis* (F.) (Coleoptera: Bruchidae) is considered as a pest of economic importance for stored-leguminous grain (Southgate 1979, Rehaman 1989, Khandwe *et. al*, 1997 and Shafique and Ahamad, 2002). This pest has been observed infesting seeds of 15 genera, including peanut, chickpea, bean, pea, cowpea and soyabean (Waterworth, 1986). Among different legume seeds, the gram is most preferred host for oviposition and development of the bruchid *Callosobruchus* under common storage conditions (Sharmila and Roy, 1994). It has been reported that seed quality of chick pea during storage is significantly affected in the damaged seed (Charjan and Tarar, 1994). The pest attacked nearly matured and dried pods during storage. It is a holometabolic insect with the egg and adult stage found on the grain and the larval and pupal stages living inside the grain. The larvae bore into the pulse grains and eat up the endosperms which become unsuitable for human consumption with reduced viability for replanting or for the production of sprouts. It was used as a model organism in many biological laboratories due to its quick generation time and ease of maintenance. Such type of work has not been studied adequately in Manipur and review in this context was also very limited. So, the present study was carried out on gram under laboratory conditions to reveal its biology by morphometric measurement of egg, larva, pupa and adult for finding out the suitable control measures.

MATERIAL AND METHODS

Test insects and maintenance: A study on the morphological measurement of *C. analis* was conducted in the Laboratory of Entomology, D.M. College of Science, Imphal during the period of May to June, 2014 at 28.7 ± 2.0°C and 75.2 ± 3.0 % relative humidity.

C. analis was collected from grocery shop of Tamenglong district. The culture was maintained on gram with 12% moisture content kept in plastic jar of 3 kg capacity. The equal sex ratio of 1-2 day old adults was released into a petridish of 9 cm size for egg laying. The bruchid beetle, *C. analis was* cultured on gram in petridish. The freshly emerged adults were allowed to lay eggs on gram for 24 hours. A pill cutter was used to make an initial cut adjacent to the bean and pin was used as leverage at the areas where the eggs were laid. A scalpel was also used for the initial incision creating a two sided cross section into the bean. The dissected portion was then examined to find the larvae. Remaining grain was deposited for observing the developmental stages of the beetle. Then the grain was bound by cello tape as the earlier one for observing the next stages of development. The observation was made in 3 days interval to confirm the stage of development. The observations on development, temperature and relative humidity were recorded every day and carefully observed for the size of egg, larva, pupa and adult. For the measurement of length and breadth of the different stages, a digital calliper was used.

The experiment was conducted using standard mean deviation with five replications. The data was analysed statistically.

RESULTS AND DISCUSSION

Biology of *C. analis*

The details of the developing stages are presented in Table 1. The different stages of *C. analis* from egg to adult are shown in Plate I. From the laboratory data, the life cycle of *C. analis* was studied.

Egg: The egg was small, glued on the grain singly but many eggs could be seen on a single grain. The eggs when freshly laid, were translucent smooth and shining, which later became yellowish white and very prominent against the contrasting background of the grain surface. The duration of egg ranged from 8-9 days. It was measured 0.68 ± 0.04 mm in length and 0.33 ± 0.02 mm in breadth. The average minimum, maximum temperature and humidity was 18.14°C, 27.14°C and 79.5% respectively.

First instar larva: Upon hatching, they bite through the base of the eggs and bored into the seeds. The first instar larva was formed within the eggs prior to penetrating the seed coat with a convenient visual marker signalling that embryonic development was nearly completed. After the formation of the pigmented larval head capsule they borrowed from the egg through the seed coat and entered into the bean endosperm.

The remaining egg shell became opaque white or mottled as it was filled with frass from the larva. The larva was curve, white, and had a small head. The larval period ranged from 10-11 days. The length of larva measured with an average of 0.51 ± 0.02 mm and the breadth measured with a mean of 0.30 ± 0.02 mm respectively. The average minimum, maximum temperature and humidity was 17.4°C, 34.4°C and 66.4% respectively.

Table 1. Morphological measurement *of C. analis* stages.

Life stage	Duration (Days)	Length (Mean ± SE) (mm)	Breadth (Mean ± SE) (mm)	Average Temperature		Average Relative Humidity (%)
				Min (^{o}C)	Max (^{o}C)	
Egg	8-9	0.68 ± 0.04	0.33 ± 0.02	20.3	32	68.5
1st instar larva	10-11	0.51 ± 0.02	0.30 ± 0.02	17.4	34.4	66.4
2nd instar larva	5-6	1.62 ± 0.04	0.84 ± 0.02	21.3	31.5	69
3rd instar larva	5-6	2.75 ± 0.06	1.63 ± 0.04	21.3	31	76.3
4th instar larva	4-5	3.49 ± 0.06	1.95 ± 0.06	22	27.2	86.6
Pre -Pupa male	1-2	3.08 ± 0.04	0.86 ± 0.2	22	30.5	78
Pre-Pupa female	1-2	3.14 ± 0.04	0.91 ± 0.2	22	30.5	78
Post-pupa male	4-5	3.34 ± 0.04	1.56 ± 0.05	22	30.2	75.8
Post-pupa female	3-4	3.74 ± 0.03	2.13 ± 0.02	22.5	31	77.5
Adult male	10-12	3.25 ± 0.23	2.16 ± 0.05	22.7	30.2	74.7
Adult female	16-18	3.60 ± 0.08	2.02 ± 0.04	22.7	29.9	76.6

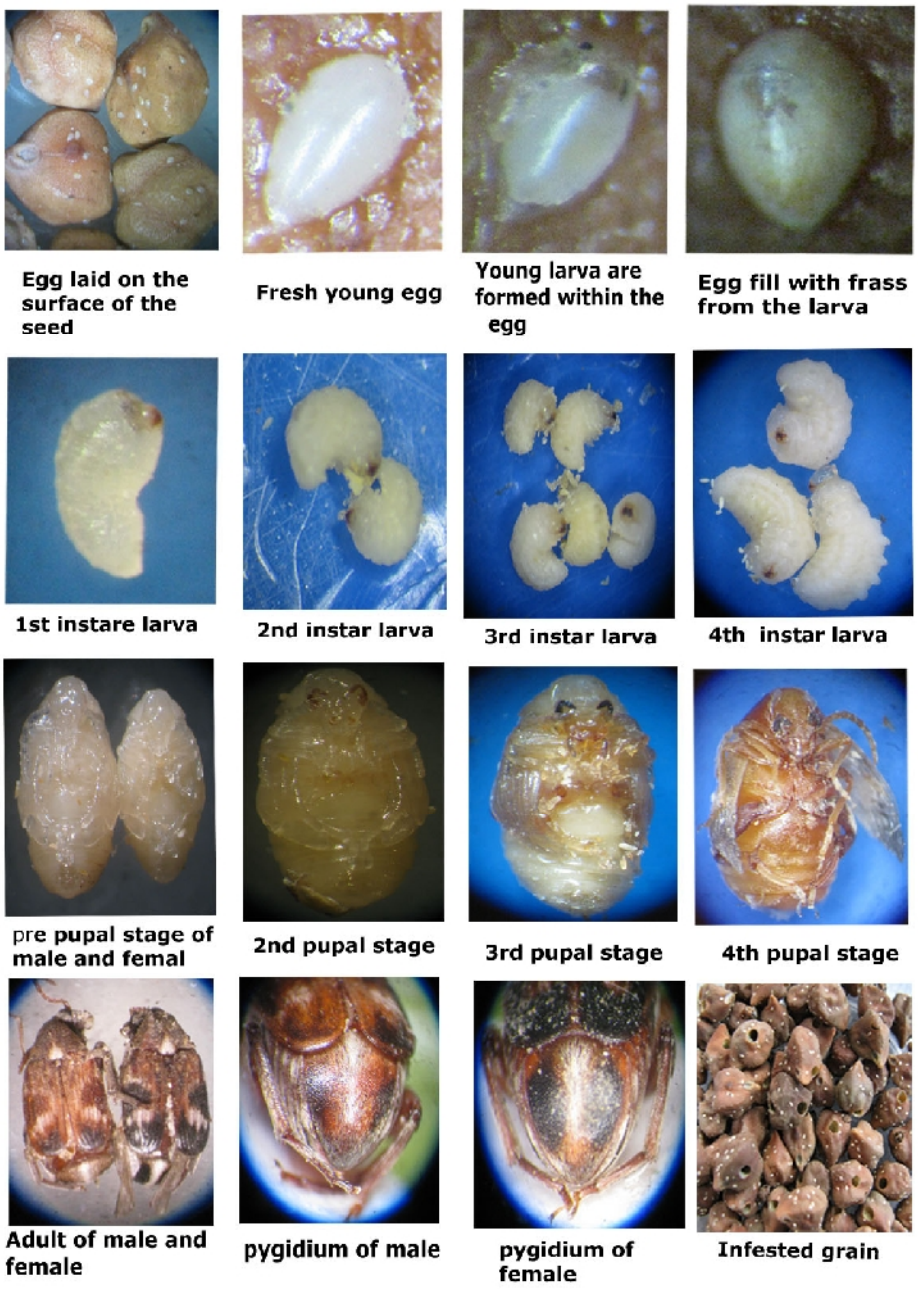

Plate-I

Second instar larva: The 2nd instar larva burrowed and fed on the bean endosperm. The larval duration ranged from 5-6 days. The length of 2nd instar larva was measured with an average 1.62 ± 0.04 mm and the breadth measured with an average 0.84 ± 0.02 mm respectively. The average minimum, maximum temperature and humidity were 21.3°C, 31.5°C and 69% respectively.

Third instar larva: The 3rd instar larva was most active and fed on the entire endosperm voraciously. The larval period ranged from 5-6 days. The length of the 3rd instar larva with an average of 2.75 ± 0.06 mm and the breadth with an average mean of 1.63 ± 0.04 mm respectively. The average minimum, maximum temperature and humidity were 21.3°C, 31°C and 76.3% respectively.

Fourth instar larva: The larva was creamy white, oval, flabby body and somewhat C-shaped with a small head. The 4th instar larvae were similar to 3rd instar but differed in size and shape. In this instar the larva seemed to become larger and fed on the entire endosperm voraciously. It burrowed into a position just underneath the seed coat prior to pupation. The duration of the larva ranged from 4-5 days. The body length of the 4th instar larva measured with an average mean 3.49 ± 0.06 mm and the breadth measured with an average of 1.95 ± 0.06 mm respectively. The average minimum, maximum temperature and humidity was 22°C, 27.2°C and 86.6% respectively.

Pre pupa: At first day pre pupa was translucent white in colour. The duration of the pre pupal period ranged from 1-2 days. The body length and breadth of pre pupa male measured with an average mean 3.08 ± 0.04 mm and 0.86 ± 0.2 mm respectively. The body length and breadth of pre pupa female measured with an average mean 3.14 ± 0.04 mm and 0.91 ± 0.2 mm respectively. The male body was slightly smaller than female.

Post Pupa: At second stage of pupa eyes, antennae, proboscis and legs developed freely and at 3rd stage eyes, mouth part, forewing and hind wing with cuticular hair developed. At 4th day almost all the parts developed but intersegmental region of the abdomen remained colourless and forewing was light brown in colour. The male and female post pupal period ranged from 4-5 days and 3-4 days respectively. The length of male post pupa was 3.34 ± 0.04 mm and breadth was 1.56 ± 0.05 mm. The length and breadth of female post pupa was 3.74 ± 0.03 mm and 2.13 ± 0.02 mm respectively. The average minimum, maximum temperature and humidity was 22.5°C, 31°C and 77.5% respectively.

Adult: The adult emerged by chewing and removing a circular piece of the seed coat to form a round hole. Adults were oval in shape, chocolate or reddish brown in colour with long and erected antennae. Both male and female more or less similar; lateral black spots on elytra surrounded by white setae and had dark stripes on each side of female dorsal abdomen. The adult male and female period ranged from 9-12 day and 10-14 days respectively. The length of male moth measured with an average 3.25 ± 0.23 mm and breadth was 2.16 ± 0.05 mm whereas the length and breadth of female moth measured with an average 3.60 ± 0.08 mm and 2.02 ± 0.04 mm respectively. The average minimum, maximum temperature and humidity was 22.7°C, 30.2°C and 74.7% respectively. The results of the study show that the developmental period of the egg to adult was 53-62 days. It took two months to complete its life cycle, which could take longer under unfavourable conditions depending on the food supply, temperature and humidity. But Ranga Rao and Shanower (1999) reported that one generation was completed in 4-5 weeks. This beetle could breed throughout the year.

ACKNOWLEDGEMENTS

The authors are thankful to the Department of Science and Technology (DST) for providing financial assistance during the work. The authors also thank to the Principal, and the Head, P.G. Department of Zoology, D.M. College of Science, Imphal for providing laboratory facilities

REFERENCES

Khandwe, N.,Gujrati, J.P. and Khandwe, R., (1997). Initial source of infestation of pulse beetle' Callosobruchus chinensis (L) on lentil and its effect on stored seed. *Lens Newsi.* **24**: 46-48.

Rehman, M.M., (1989). Loss of legumes by and control of Bruchids in Bangladesh. *In: Proc. 2nd Intern. Symp. On Bruchid and Legumes* (ed. T. Yoshida), pp. 34-37, Japan.

Shafique, M. and Ahamad, M., (2002). Screening of Pulse grains for resistance to Callosobruchus analis (F.) (Coleoptera: Bruchidae). *Pakistan J. Zool.*, **34**: 293-296.

Southgate, B.J., (1979). Biology of Bruchidae. *Ann. Rev. Ent.*, 24:449-473.

Sharmila, R. and Roy, S., *Agri. Sci. Dig.* **14** (1994)177.

Charjan, S.K.U. and Tarar, J.L., *Annal. Plant Physio.* **8**(1993) 63.

Ranga Rao, G.V., Shanower, T.G. (1999). Identification and Management of Pigeon pea and Chick pea Insects Pests in Asia. *Information Bulletin No.* **57**, Patancheru, 502324, A.P., India: International Crops research Institute for the Semi Aride Tropics. 96pp.

Waterworth, P.D. (Ed.) (1986). Internal seed infesting insects. Part I e II. Beltsville: USDA, 1986. 136P.