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Biology of *Callosobruchus chinensis* during infestation in two varieties of Arhar under laboratory conditions

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Abstract

Callosobruchus chinensis, is a destructive pest of large variety of pulse grains like arhar, gram moong and kabuli chana. Pulses are important source of dietary protein for vegetarian. These are also good sources of minerals. The pest causes damage to these store grain in large amount. The infestation may start from field .The growth and development of pest includes eggs, larva, pupa and adult. The total development period varies slightly during different months of the year. The size of grain also affects the number of eggs laid by the female. Present work has been done to observe the biology of the pulse beetle Different stages of life cycle of pulse beetle was observed under the high magnification of dissecting microscope. Developmental period was recorded of different duration for two varieties of same pulse. The development takes place inside the grain. Intermediate stages of development was not apparent externally

Keywords: Infestation, Vegetarian, Dissecting microscope Developmental period , Intermediate stages

1. INTRODUCTION

A balanced diet includes carbohydrates, Proteins, fats, vitamins and minerals Proteins are building blocks ensure proper growth and development of different parts of body such as bones, hairs. They also repair damaged tissue. The most commonly available proteins are pulses for vegetarians. Arhar is the one of the main pulses which is most often used. The fresh young pods are used as vegetable and split dried seeds are used as a lentil in the dishes like sambhar. Due to its lots of advantages in farming it is preferred crop in different parts of the country. The fresh young parts of plant may be used as fodder for animals. They have extreme tolerance in dry weather and excellent survival capacity in poor soil conditions. Plants are used in contour faring to prevent soil erosion. These are the best used crop plants for intercropping and crop rotation also. It is about 5% of total global legume produced and 70% of which is produced in India. Such an important crop plant gets infested by insect pest during different seasons of the year. *Callosobruchus chinensis* is a serious pest of pulses like gram, Arhar, Moong Pests cause severe damage to these pulses. Due to flying habit beetle starts infesting the plant in field Altogether five species of *Callosobruchus* are known in India.

A comparative study of biology of three species *C. chinensis*, *C.maculatus* and *C.analis* has been done on mung seeds at 30°C and 70% relative humidity by A.K.Raina (1970). According to his work an average of 78,128 and 96 eggs were laid by C.*chinensis*, C.*maculatus* and C.*analis* respectively. Largest number of eggs was observed on the first day of egg laying. But Howe and Curie (1964) noted an average of 45 eggs with range of 63-90 at similar temperature and humidity. Female adults of pulse beetle lay single egg but more than one was observed on the grain. The grubs developed inside the grain by feeding the grain and finally they made their exit to the surface of the grain. The grub pupate inside the grain and adults emerged out of the grain Pruthi (1948) and Metcalf and Flint (1962).The total time taken for complete development from egg to adult was assessed as an average of 22.3 days in C.chinensis, with a range of 22-27 days for C.maculates it was noticed as 24 days and for C.analis it was 28-31 days (A.K. Raina 1970). Adult moved about in the seed for some time and were sexually mature when they emerged. Mating and oviposition followed by emergence of adult. Adult emerging from bottom layers of seed come up for mating and oviposition (Kunhi Kanan 1919). Mortality from egg to adult stage found to be largest (Howe and Curie 1964). Life fecundity and development of Callosobruchus is affected by ageing of the pest. A cross between aged parent and young or both aged parent was found to produce a lesser number of adults as compared to a cross between two young parents (P.G.S. and S. S. Sengal (1990).

2. MATERIAL AND METHOD

Present work has been done to study the life cycle of *Callosobruchus chinensis* in the laboratory of Department of Zoology Patna University Patna. A stock culture was prepared to study the developmental period of the insect pest. Healthy seeds of arhar were taken from local market .Pulse beetles were also obtained from infested grain available with the grocers in the market. A flat bottom plastic container was taken. 100 gm of grain and jars were sterilized. After identifying the beetle 5 pairs of adults were introduced in the grain. After 35 days new adults were emerged in the container. Freshly emerged one day old pests were introduced in 100 gm seeds of different varieties of gram and arhar. Eggs appeared on the surface of the grains between 12-14 days.

A careful study of the different stages of pulse was done during the development of adults from the eggs. The different larval instars and pupa were examined under high power dissecting binocular microscope the duration of the different larval and pupal stages were recorded. Invariably all the experiments were carried out under room temperature and humidity, so that the observation thus, recorded were in tune with the usual, growth of the beetle that prevalently occurs in the storage period under normal condition of different months of the year. Three sets of experiments were arranged in the lab for both varieties of pulse. An average of the data obtained has been presented in table 1 and table 2

Table 1: Developmental Stages of *Callosobruchus chinensis* in Two Varieties of Arhar whole grains

S No.	Months	Oviposition incubation	Larva+ Pupa	Total Developmental period (in days)	Oviposition incubation	Larva+ Pupa	Total Developmental period (in days)
		Bold Variety			**Smaller Variety**		
1.	1st	4.3	24	28	9.6	19.3	28.9
2.	2nd	4.6	25.7	30.3	8.6	23	32.2
3.	3rd	3.7	21.3	25	8	22.7	30.7
4.	4th	3	23.6	26.6	7.3	22.3	29.6
5.	5th	4.3	23.7	28	7.6	20	27.6
6.	6th	3	21	24	7	19	26

Table 2: Longevity and total survival of Male and Female of *Callosobruchus chinensis*

S No.	Months	Longivity		Total Survival		T		Total Survival	
		Male	Female			Male	Female		
		Bold Variety		Male	Female	Smaller Variety			
1.	1st	8.3	11	36.3	39	7	8.3	35.9	37.2
2.	2nd	9.6	10.3	39.9	40.6	7.3	9.6	39.5	41.8
3.	3rd	11	13	37	39	8.6	10.3	39.3	41
4.	4th	12	16	38.6	42.6	9	11	38.6	40.6
5.	5th	13	18.3	41	46.3	10	11.3	37.6	38.9
6.	6th	13.6	19.6	13.6	43.6	10.6	12.6	36,6	38.6

3. RESULTS AND DISCUSSIONS

Experiment sets were monitored and checked regularly to obtain the exact data related with the egg laying emergence of larva and adult's survival longevity and reproductive success of the pest beetle. A careful observation of the morphology was also done. Observation indicated that arhar (Cajanus cajan) is a preferred host of the *Callosobrucus chinensis* .This result was also found in the work of A.K. Raina (1970) All the four stages-eggs larva pupa and adult were found in the development of pest. The adult beetle was 3-4 mm long. Sexual dimorphism was clearly noticed in the pest .Females were longer than males. The tip of the abdomen was exposed in females while in male it was covered by elytra. A dark patches on brown colored body was observed on elytra and thorax of the insect pest in case of females. Males had indented eyes. Antenna was also of different types in both the sexes. .The pests were found to be of flying habit. The flying habit enables them for infestation of grain in field. The data was generated by a survey of the pulse cultivation area and a general questionnaire with farmers cultivating these pulses. This was also noticed by (Singh1997; Nandy etal 1999). Eggs appeared on the surface of the grain immediately after harvesting. The study of the biology of beetle reveals that Eggs were elongated, whitish and stuck on the grains surface or on the wall of the container having a flat base. Grubs were cruciform. The optimum temperature for oviposition was noticed as 28-37^{o}C. The total developmental period form egg to adult varies from 21-25 days in bold variety and 26-32 days in smaller variety. A slight difference in the developmental period and longevity was observed in the two varieties of arhar. An average of which is presented in the data. Present study also indicated the survival of male and female adults during five months of observation. Survival of male in bold variety was recorded as 8.3, 9.6, 11, 12.3, 13 and 13.6 days during months of April, May June July August September and October for females it was recorded as 11, 10.3, 13, 16, 18.3 and 19.6 days respectively. This observation was found to in accordance with the work of Mohammad Usman et al. 2015 where longevity of males and females was found maximum in cowpea and recorded as 15.60 and 25.53 days respectively. In smaller variety it was little different male survived 7-10.6 days and female for 8.3 - 12.6 days. The larva bored through the test of the seed and enters into the cotyledon. The development occurred entirely inside the seed so the intermediate stages were not apparent. The seeds were cut opened to observe the intermediate stages. The adults appeared in these sets on different days of oviposition. The total development period was 24-30.3 days in bold variety 26-32.3 days in smaller variety

4. CONCLUSION

On the basis of the result obtained from present study it was concluded that Arhar was a preferred host for the *C.chinensis*. Infestation of pest start from the field. Eggs appeared on the surface of the pulse immediately after harvesting both male and female can be identified externally. The growth of the pest may be observed during six months of the year. Size of grain and atmospheric temperature and humidity both have direct effect on the development of the pest. Eggs appeared earlier during rainy season. Developmental period was found to be of lesser duration and survival of adults was more in bold variety than in smaller variety. However female survived more than males in both the variety.

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