Original Article

Bulletin of Environment, Pharmacology and Life Sciences

Online ISSN 2277-1808
Bull. Env. Pharmacol. Life Scien. Volume 1 [11] October 2012:12-15

Website: www.bepls.com

# Mating, Oviposition, Fecundity and Longevity of *Callosobruchus maculatus* (Fab.) on Different Pigeon Pea Varieties.

**Dinesh Lal and Deepshikha Viola Raj**
School of Entomology, St. John's College, Agra -282002

**ABSTRACT**

*For observing* mating and *oviposition of Callosobruchus maculatus* Fab. *5 pairs of newly emerged male and female beetles were introduced in the variety selected at random. The eggs were isolated by the brush after each oviposition and counted with the help of lens. Observations on mating and oviposition period were recorded from each variety. For determination of fecundity one pair of male and female was introduced in specimen tubes having 25 gram grain of each variety in the controlled condition with 3 replications. Longevity of male and female adults was recorded by noting the dates of their emergence and death from each variety by releasing 10 adults of both sexes. The observations were recorded on the important aspect of biology of pest, which includes mating, oviposition period, fecundity and longevity. The higher number of eggs (68.23) was laid by the adult female on the grains of pigeon pea variety PDA - 9 while it was lesser on the variety AMAR (33.78). The variety AMAR was having comparatively large sized grains. The egg laying was significantly higher on small seeded varieties. The longevity of male and female beetle also varied in different pigeon pea varieties significantly. The longevity of adult male varied from 6.55 (ICPL 366) to 9.27 (T-7) and minimum on ICPL 366. The female beetle lived for longer time than the male in different pigeon pea varieties.*

## INTRODUCTION

The Bruchid, *Callosobruchus maculatus* Fab. which infest the seeds at storage assume special significance as it is a very serious pest causing up to 100% storage loss. The infestation of insects starts in the field and continues in storage and it takes a period of 3-4 months causing total destruction of the seeds. Within a period of six months the loss has been estimated to be around 30-40%, sometimes even in the severe periods of infestation the damage can reach even up to 100%. Bean beetles are found to exhibit two adult morphs, one being sedentary or flightless and the other is flying or dispersal form [1]. The dispersal morph is induced by high larval density in stored beans or laboratory cultures and their induction allows the new individuals to move to further higher quality habitats [2]. In the studies it has also been observed that flightless and flying morphs distinctively show different life history characteristics especially the life span where the flying type has a longer adult period whereas reduced fecundity in comparison to the sedentary morph. Bean beetles are specialized in consuming seeds and they are herbivores in nature. They are a part of food webs in that egg and larvae are prey for parasitoid wasp species [3]. The studies based on the biology of bean beetle it has been found that females lay eggs glued on the surface of a bean seed (Fabaceae), the embryonic development up to the first instar larva occurs inside the transparent egg .The first instar (maggot) burrows down through the seed coat into the endosperm of the seed there its development takes a long time. The empty egg shell is typically filled with white frass as the larva feeds. There are four larval instars that feed inside the endosperm of the seed on which the egg was laid. Pupation occurs inside the seed and an adult emerges by chewing and removing a circular piece of the seed coat to form a round exit hole [4]. Temperature, the species of bean chosen for egg laying, and relative humidity all influence development time [5]. When seeds are limiting most female C. *maculatus* Fab. readily lay eggs on previously parasitized seeds [6]; [7]; and [8]. The mean egg laying of the pest is highest during the





Bulletin of Environment, Pharmacology and Life Sciences

rainy season, resulting Peato higher adult emergence, fecundity and oviposition behaviour of *C.maculatus* Fab. and it has also been observed that eggs were preferentially laid on the largest egg free beans of *Cajanus cajan* L. and prepared a model for the oviposition behaviour accounting for the observed responses to species, size and egg load of oviposition sites [9].

## MATERIALS AND METHODS

Mass culture of *Callosobruchus maculatus* was maintained. For this study each experiment was replicated thrice having 25 g seed in separate glass vials measuring 10×3 cm. In individual treatment of each replication, 5 pairs of matured adults were released into each vial obtained from the pure culture. All vials were kept under the room temperature of 27 ± 2° and 75 ± 5 percent relative humidity. The mouth of each vial was covered with muslin cloth and tied with rubber bands. For taking the observations on fecundity, emergence, developmental period, three sets of experiments were managed separately for each study. Later on progeny adults were recorded daily when their emergence started. The varieties used for this study are IPA 613, MA2, ICP7035, T-7, ICPL366, KUDRAT, PDA9, BAHAR, T-21, AMAR.

## RESULTS AND DISCUSSION

Observations recorded on mating of adult beetles of *Callosobruchus maculatus* indicated that the beetles after emergence were found to copulate and the oviposition began 2 days after mating. The eggs were laid singly by the female among the grains. For determination of fecundity one pair of male and female was introduced in specimen tubes having 25 g grain of each variety in the controlled condition with 3 replications. The observation on the number of eggs laid was recorded at 5 days and 10 days of the release of adults in each tube. The percentage of grains having eggs after 5 to 10 days of release was also recorded. The adult beetles were removed after 10 days from each tube, so as to avoid any further egg laying and their counting with freshly emerged adults in each case.

For observing the mating and oviposition, 5 pairs of newly emerged male and female beetles isolated from the stock culture were introduced in the variety selected at random .The mouth of each tube were covered with muslin cloth and tied with rubber band to prevent the escape of beetles. The eggs were isolated by the brush after each oviposition and counted with the help of lens. Observation on mating and oviposition period was recorded on each variety. The data regarding oviposition of *Callosobruchus maculatus* are given in Table 1. The beetles after emergence were found to copulate and the eggs were laid singly by the female 2 to 3 days after mating among the grains. Messina [8] and Horng [10] also stated that females usually distribute their eggs uniformly on the eggs after copulation. There was no significant variation in oviposition of the pest in different pigeon pea varieties. The higher oviposition was observed in Amar (8.64 days ), which was followed by varieties ICPL 366, Bahar, ICP 7035, IPA 613, PDA 9, T-21, T-7, MA 2 and KUDRAT having 8.04, 7.95, 7.75, 7.20, 7.14, 7.05, 6.11, 6.08 and 6.07 days respectively. The study comes in correlation with the studies of Srivastava and Pant [11] who studied the growth and development of *Callosobruchus chinensis* L. on seeds of 11 legumes.

The fecundity of the pulse beetle was found to be variable in different varieties of pigeon pea (Table 1). The number of eggs laid by each female (fecundity) was maximum 68.23 on variety PDA 9 and it was closely followed by KUDRAT having 66.74 and minimum on AMAR having 33.78. The total number of eggs laid in each sample were significantly varying minimum in Amar (168.92 / 25 g grains) (Table 1).

Maximum egg laying was noticed on PDA 9 (341.19 eggs) which was at par with variety KUDRAT (333.70 eggs). The response of all the other varieties namely MA 2, ICPL 366, T-21, T-7 was moderate and ranged between 254.35 to 274.39 eggs/sample. The egg laying was significantly more on small seeded varieties. The number of eggs were also more on violet seed coated variety (PDA-9) followed by purplish (KUDRAT), brown (T-7 and ICPL 366) and yellowish brown (T-21). The fecundity was lowest on AMAR having comparatively larger size of grain. Chandra and Ghosh [12] reared *Callosobruchus maculatus* Fab. on whole and decorticated grains of various pulses to study its development. The average fecundity per female varied with beetles reared on whole grains. The beetles had a higher oviposition preference for whole than decorticated. Ajayi and Lale [13] in their findings also revealed that the texture of seed coats affects the oviposition as well as development.

To record the longevity of male and female adults the dates of their emergence and death were noted from each variety by releasing 10 adults of both sexes. The data regarding longevity of male and female beetles are presented in Table 2. The minimum life span of adult male of *Callosobruchus maculatus* was observed on variety ICPL 366 (6.55 days). The maximum longevity of male beetle was recorded on variety T-7 (9.27 days) the longevity of female was also maximum in T-7 (14.64 days) and minimum longevity of female was in the variety ICPL 366 (10.83 days). The female beetle lived for longer time than the male beetle in different pigeon pea varieties. These findings were same as the pattern seen by Fox et al [14] where in the study it was found that C. maculatus females have higher initial mortality rates than males, while males have a much higher rate of increase of the mortality rate with increasing age and females live longer than males.

**Table-1**

**Oviposition and Fecundity of *Callosobruchus maculatus* Fab. infesting *Cajanus cajan*.**

| VARIETIES | OVIPOSITION PERIOD ( DAYS ) | FECUNDITY | TOTAL NO. OF EGGS LAID. |
|---|---|---|---|
| IPA 613 | 7.20 | 40.42 | 202.14 |
| MA 2 | 6.08 | 50.87 | 254.35 |
| ICP7035 | 7.75 | 40.69 | 203.49 |
| T-7 | 6.11 | 54.87 | 274.39 |
| ICPL 366 | 8.04 | 52.98 | 264.90 |
| KUDRAT | 6.07 | 66.74 | 333.70 |
| PDA 9 | 7.14 | 68.23 | 341.19 |
| BAHAR | 7.95 | 42.56 | 212.84 |
| T-21 | 7.05 | 53.79 | 268.99 |
| AMAR | 8.64 | 33.78 | 168.92 |
| S EM± | 0.28 | 3.58 | 17.90 |
| CD at 5% | 0.12 | 0.22 | 0.22 |

**Table-2**

**Longevity of *Callosobruchus maculatus* Fab. Adults infesting *Cajanus cajan.***

| VARIETIES | LONGEVITY OF ADULTS (DAYS) | |
|---|---|---|
| | MALE | FEMALE |
| IPA 613 | 7.42 | 11.72 |
| MA 2 | 7.35 | 11.45 |
| ICP7035 | 8.30 | 13.14 |
| T-7 | 9.27 | 14.64 |
| ICPL 366 | 6.55 | 10.83 |
| KUDRAT | 7.55 | 11.26 |
| PDA 9 | 8.12 | 12.23 |
| BAHAR | 8.29 | 13.01 |
| T-21 | 7.03 | 11.07 |
| AMAR | 9.08 | 13.26 |
| S.EM± | 0.27 | 0.38 |
| CD @ 5 % | 0.11 | 0.09 |

## REFERENCES

1. Sarikarin, N., P. Srinivas, R. Kaveeta and P. Saksoong, (1999). Effect of seed texture layer on bruchid infestation in mungbean*Vigna radiate* (L.). *Wilczek. Sci. Asia.*, 25 : 203-206.

2. Utida, S., (1972). Density dependent polymorphism in the adult of *Callosobruchus maculatus* (Coleoptera, Bruchidae) . Journal of Stored Products Research ., 8:111-126.
3. Boeke, S.J., A.A.C. Sinzogan, R.P. de Almeida, P.W.M. de Boer, G. Jeong, D.K. Kossou and J.J.A. van Loon, (2003). Side-effects of cowpea treatment with botanical insecticides on two parasitoids of *Callosobruchus maculatus.* Entomol. Exp. Applicata., 108 : 43-51. DOI: 10.1046/j.1570-7458.2003.00066.x.
4. Patel, N.H., B.G. Condron and K. Zinn, (1994). Pair-rule expression patterns of even-skipped are found in both short and long-germ beetles. Nature, 367: 429-434. PMID: 8107801.
5. Devereau, A.D., I. Gudrups, J.H. Appleby and P.F. Credland, (2003). Automatic , rapid screening of seed resistance in cowpea, *Vignaunguiculata* (L.) Walpers , to the seed beetle *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) using acoustic monitoring. *J. Stored Products Res*., 39: 117-129.
6. Wilson, K., (1989). The evolution of oviposition behaviour in bruchid *Callosobruchus maculatus*. Ph.D. Thesis, University of Sheffield, UK.
7. Mitchell, R., (1975). The evolution of oviposition tactics in the bean weevil, *Callosobruchus maculatus*(F.).*Ecology*, 56:696-702.
8. Messina, F.J., (1991). Life-history variation in a seed beetle: Adult egg-laying vs. larval competition ability. Oecologia., 85: 447-455. DOI: 10.1007/BF00320624.
9. Mitchell, R. and C. Thanthianga, 1990. Are the oviposition traits of the South India strain of *Callosobruchus maculatus* maintained by natural selection? Entomol. Exp. Applicata, 57: 143-150. DOI: 10.1111/j.1570-7458.1990.tb01425.x.
10. Horng, S. B., (1997). Larval competition and egg-laying decisions by the bean weevil, *Callosobruchus maculatus . Animal Behaviour .,* 53:1–12.
11. Srivastava, K.M. and J.C. Pant, (1989). Growth and developmental response of *Callosobruchus chinensis* L. to different pulses. *Indian J. Entomol. Publ.,* 51: 196-199.
12. Chandra, B. and A.B. Ghosh, (2006). Development of pulse beetle, *Callosobruchus maculatus* (F.) on whole and decorticated grains of various pulses. *Environ. Ecol*., 24: 358-362.
13. Ajayi, F.A. and N.S.F. Lale, (2001). Seed coat texture, host species and time of application affect the efficacy of essential oils applied for the control of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) in stored pulses. *Int. J. Pest Manage*., 47: 161-166. DOI: 10.1080/09670870010004495.
14. Fox, C.W., L. Dublin and S.J. Pollitt, (2003). Gender differences in mortality rates in two seed beetle species. *Functional Ecol*., 17: 619-626.