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ORIGINAL ARTICLE

Study of Developmental Period of *Callosobruchus maculatus* Fab. and its Emergence to Assess the Index of Susceptibility of Different Varieties of *Cajanus cajan* Linn.

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ABSTRACT

A laboratory study was conducted to investigate the comparative susceptibility of seeds of ten cajanus cajan Linn varieties to infestation by Callosobruchus maculatus (fab). In order to study the susceptibility growth and development of the pulse beetle separately on each variety were recorded separately. The minimum larval period of C. maculatus was observed on variety IPA 613 (19.62 day) and it was maximum (22.21 days) on variety KUDRAT. The pupal period ranged from 4.96 to 6.87 days in different pigeon pea varieties being minimum on variety AMAR (4.96 days). Maximum emergence of beetles was noticed on varieties PDA-9 (297.91) and KUDRAT (264.29) followed by T-21 and T–7 (228.39 and 228.88, respectively). Percentage adult emergence was highest (87.31%) on variety PDA–9 and lowest (67.72%) on ICP 7035. The other varieties viz.- MA-2 (81.35%), ICPL 366 (81.55%), T-7 (83.41%) and T-21 (84.90%) showed moderate tendency of beetle emergence ranging for 206.93 to 228.88 adults. The developmental period of beetle ranged from 30.51 to 32.62 days. Longer developmental period of the beetles was in less preferred varieties viz.- AMAR, MA-2, ICP 7035 and IPA 613 being 32.62, 32.37, 32.27 and 32.16 days, respectively. A shorter life span of the pest was seen on variety T-7, ICPL366, KUDRAT, T-21, PDA 9 and BAHAR being 32.07, 32.07, 32.06, 31.50, 30.95 and 30.51 days, respectively. The minimum susceptibility index was in variety AMAR (14.71) and maximum in PDA-9 (18.40). The varieties showing higher index of susceptibility, were more suitable for oviposition and development than those having lower index of susceptibility.

Key words: *Callosobruchus maculatus (fab), Cajanus cajan Linn, susceptibility, evelopment period, adult emergence*

INTRODUCTION

Pulse beetle, *C. maculatus*, is a serious oligophagous field-to-store insect pest infesting dried cowpeas and other 14 related pulse species in the store. (Huignard, *et al*., 1996). The pulse beetle is most important damaging insect which cause infestation to pulse both in field as well as in ambient storage. This pest was first of all described in china in the year 1758 where the beetle gets its species name (Thembhare, 2007). Pulse beetle is primary pest of stored pulses. Adult is harmless, having short life span. Only grub causes damage to stored pulses. The grubs cause damage by eating out the entire internal content of the grain, leaving only the shell behind. The losses caused by this pest to the pulses have been estimated to the tune of 40 to 50 per cent in storage (Mathur and Upadhyay, 2014). The bruchids are most degraded stored grain pest, causing nearly 10-90 per cent loss of in pulses (Rathore and Sharma, 2002). However, different pulse species show various degree of susceptibility to infestation of *C. maculatus*. Developmental period and adult emergence are most important parameters which help in categorizing the genotypes into susceptible or resistant. Painter (1951) studied that extension in the period of development leads to reduction in loss during storage. Chandrakantha and Mathavan (1986) observed that the host in which development occurs affects the rate of development and there are numerous accounts of failed or exceptionally slow development in seeds of resistant cowpeas or other species. Rustamani, *et al*. (1985) reported that the varietal responses permit the growth of larvae and allow the adults to emerge, to weight loss and loss in germination. Srivastava and Pant (1989) studied the growth and development of *Callosobruchus chinensis* L. on seeds of 11 legumes. The preferred legumes were lentil, green gram, red gram, Bengal gram and cow pea. Pea and Khesari were less preferred. Bhut (Black seeded soyabean) soyabean, black gram and French bean were unsuitable

for growth and development of the pest. Talekar and Lin (1992) reported that the variety which was most tolerant showed comparatively lower development period. Muhammad, *et al.* (1997) also evaluated the susceptible nature of different varieties on the basis of the duration taken by the immature stages of the pest to complete its development in the seed. Jackai and Asante (2003) also reported that percentage adult emergence, developmental period, growth index and weight loss are indicators for resistance or susceptibility of cowpea to bruchid damage.

MATERIALS AND METHODS

Observations regarding growth and development of the pulse beetle separately on each variety were recorded separately.For observing 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 with a brush after each oviposition and counted with the help of lens. For recording the developmental period total numbers of eggs laid, 5 females in the fourth replication were kept in separate vials within 12 hours of their release on 100 grains. The period from the exposure of beetles till the initiation of the adult emergence was considered as the developmental period.

Complete development from egg to adult was recorded by counting the total number of adult beetles emerged after setting the experiment. Freshly emerged beetles were counted and removed daily for another 15 days so as to avoid the chances of their being recounted and to confirm that total emergence was over. Percentage of adult emergence was calculated on the basis of total number of eggs laid per sample and the total number of adults emerged.

For this experiment one pair of male and female beetles were released in separate specimen tube of each variety containing 25 grams grain. These were kept in desiccators under controlled condition to confirm the number of generations in the laboratory. Deposited eggs by female were examined daily and recorded the total duration from egg laying to adult emergence for the first generation. One pair of male and female beetle was again isolated from the first generation and confined in the tubes. This process was continued throughout the year to determine the total number of generations in each variety.

The susceptibility of varieties of pigeon pea to the attack of *C. maculatus* was determined by using the formula of Dobie (1974). It was calculated on the basis of natural loge of the total number of adults emerged and time taken by them for completing their development-

$$I = \frac{\text{Log}_e F}{D} \times 100$$

I = Index of susceptibility

F = Total number of adults emerged (F1)

D = Developmental period

RESULTS AND DISCUSSION

The incubation period of *C. maculatus* was minimum (4.13 days) in pigeon pea variety ICP 7035 and maximum (6.07 days) in IPA 613. In other pigeon pea varieties KUDRAT, T-7, BAHAR, PDA-9, T-21, MA-2, ICPL 366 and AMAR it varied from 4.55 to 6.02 days. The highest larval period of 22.21 days was recorded on variety KUDRAT and it was at par with the varieties ICPL 366, ICP 7035, AMAR and MA-2 (21.20, 21.95, 21.64 and 21.53 days, respectively). Thus the incubation and larval period of the pest differ on different pigeon pea varieties. The pupal period ranged from 4.96 to 6.87 days. It was maximum in variety T-21 (6.87 days), which was closely followed by IPA 613, T-7, ICP 7035 and MA-2 (6.47, 6.40, 6.19 and 5.70 days, respectively). Minimum pupal period was observed on variety AMAR (4.96 days) which was at par with BAHAR, KUDRAT, PDA 9 and ICPL 366 (5.26, 5.30, 5.44 and 5.62 days, respectively) (Table3 & 3). *C. maculatus* breeding on variety AMAR exhibited longest period of its development (32.62 days) followed by MA-2 (32.37days), IPA 613 (32.16 days), T-21 (31.50 days), KUDRAT (32.06 days), PDA–9 (30.95 days) and BAHAR (30.51 days). The basic idea in employing these criteria is that duration of developmental period is

indicative of the resistance of variety (Table- 3 & Fig- 3). Chandrakantha and Mathavan (1986) observed that the rate of development of the pest is affected by the host variety. Talekar and Lin (1992) reported that some of the varieties of seeds of the green gram were tolerant and thus showed comparatively lower development period.

Adult emergence was maximum on variety PDA-9 (297.91 adults) and which was at par with KUDRAT having 264.29 adults, whereas minimum emergence was on variety AMAR (121.39) which was at par with ICP 7035 (137.81), IPA 613 (168.76) and BAHAR (172.32) varieties. The other varieties MA-2, ICPL 366, T-21 and T-7 showed moderate tendency of beetle emergence ranging between 206.93 and 228.88 adults per sample. The percentage of beetle emergence was highest (87.31%) on PDA -9 and lowest (67.72%) on ICP 7035 (Table-4 & Fig-4).

Table 1: Incubation, larval and pupal period of *C. maculatus* on pigeon pea varieties

Varieties	Incubation period (Days)	Larval period (Days)	Pupal period (Days)	Developmental period
IPA613	6.07	19.62	6.47	32.16
MA2	5.14	21.53	5.70	32.37
ICP7035	4.13	21.95	6.19	32.27
T-7	4.65	21.02	6.40	32.07
ICPL366	5.25	21.20	5.62	32.07
KUDRAT	4.55	22.21	5.30	32.06
PDA-9	4.83	20.68	5.44	30.95
BAHAR	4.72	20.53	5.26	30.51
T-21	5.00	19.63	6.87	31.50
AMAR	6.02	21.64	4.96	32.62
S.E.M.	±0.19	±0.28	±0.19	±0.21
CD (5%)	0.12	0.04	0.10	0.02

Table 2: Adult emergence of *C. maculatus* on pigeon pea varieties

Varieties	No. of adults emerged	% adult emergence
IPA613	168.76	83.48
MA2	206.93	81.35
ICP7035	137.81	67.72
T-7	228.88	83.41
ICPL366	216.03	81.55
KUDRAT	264.29	79.19
PDA-9	297.91	87.31
BAHAR	172.32	80.96
T-21	228.39	84.90
AMAR	121.39	71.86
S.E.M.	±17.40	±1.89
CD (5%)	0.26	0.07

Table 3: Susceptibility index of *C. maculatus* on pigeon pea varieties

Varieties	Susceptibility index
IPA613	15.94
MA2	16.47
ICP7035	15.26
T-7	16.94
ICPL366	16.76
KUDRAT	17.39
PDA-9	18.40
BAHAR	16.88
T-21	17.24
AMAR	14.71
S.E.M.	-
CD (5%)	-

Fig. 1: Incubation, larval and pupal period of *C. maculatus* on pigeon pea varieties

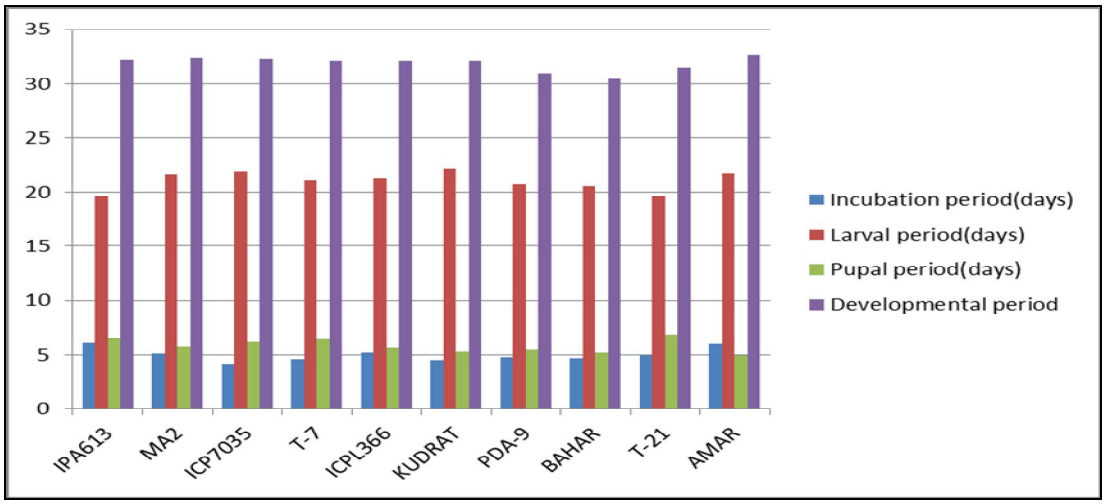


Fig. 2: Adult emergence and emergence percentage of *C. maculatus* on pigeon pea varieties

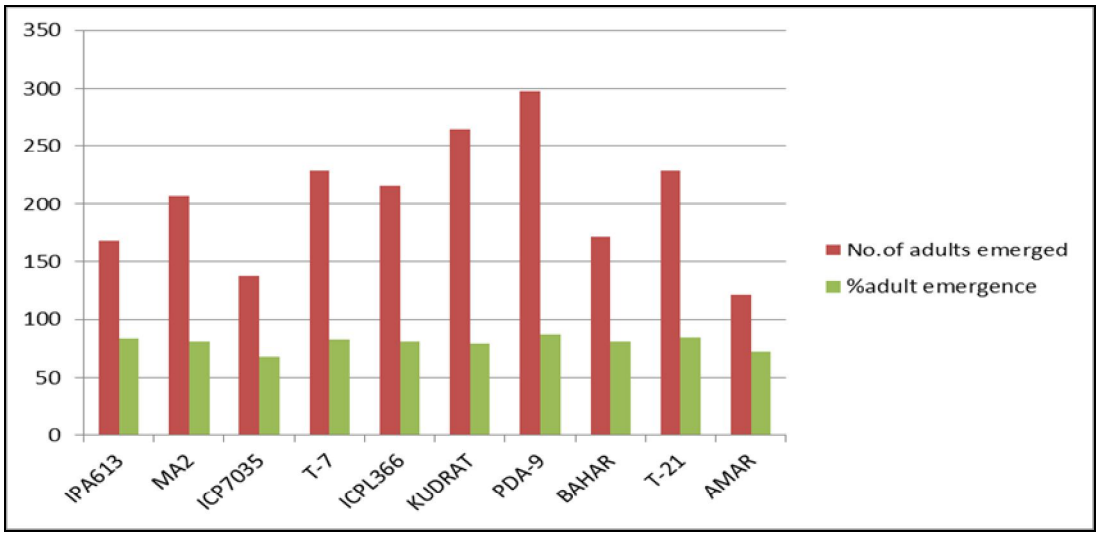
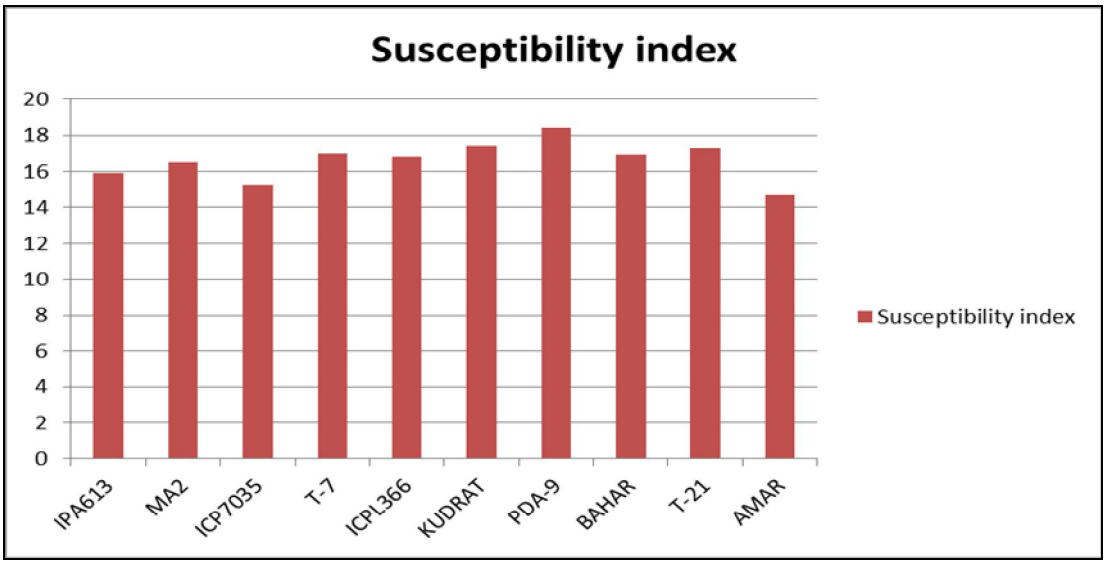


Fig. 3: Susceptibility index of *C. maculatus* on pigeon pea varieties



The susceptibility index was found to be maximum (18.40) on PDA-9. This was the most preferred host for the pulse beetle. It was minimum (14.71) on AMAR followed (ascending order) by ICP 7035 to KUDRAT ranging from 15.26 to 17.39. The susceptibility indices for different varieties are T-21 (17.24), T-7 (16.94), BAHAR (16.88), ICPL 366 (16.76), MA-2 (16.47), and IPA 613 (15.94) (Table 5 & 5). Pigeon pea varieties with high susceptibility indices were more preferred for oviposition and development by the beetle.

The present observations confirm the views that genetic variability in the varieties affect adult emergence. These findings are in correlation with the records showing susceptibility of china moong placed by Rustamani, *et al*. (1985) that varietal response permits the growth of larvae and thus allows the adults to emerge. The above results are also same as those of Ofuya and Credland (1995) where significant reduction in different populations of *C. maculatus* was observed in fecundity on varieties with known level of resistance. Painter (1951) observed that the delay in development of resistant landraces was confirmed by lower growth index values evaluated on resistant landraces compared to susceptible ones. Redden and McGuire (1983) and Jackai and Asante (2003) also reported that percentage adult emergence, developmental period, growth index and weight loss are indicators for resistance or susceptibility of cowpea to bruchid damage.

In conclusion, the obtained results clearly demonstrated that pigeon pea species differed significantly in their susceptibility to *Callosobruchus maculatus.*

REFERENCES

1. Chandrakantha J. and Mathavan, S. (1986): Changes in developmental rates and biomass energy in *Callosobruchus maculatus* Fab. (Coleoptera: Bruchidae) reared on different foods and temperatures. Journal of Stored Products Research, 22: 71-75.
2. Huignard J., Baehr J.C., Desroches P. and Mandon N. (1996): Adaptation of a Callosobruchus maculatus strain to Vicia faba, as its new host plant. Proceedings of the 9th International Symposium on Insect-Plant Relationships Series Entomologica, 53: 156-159.
3. Jackai L.E.N. and Asante S.K. (2003): A case for the standardization of protocols used in screening cowpea, *Vigna unguiculata* for resistance to *Callosobruchus maculatus* Fab, (Coleoptera; Bruchidae). J. Stored Prod. Res., 39: 251-263.
4. Mathure Y.K. and Upadhyay K.D. (1997): A text book of Entomology, pests of crops pp. 272-73.
5. Muhammad Hussain Roy G.C. and Hussain M. (1997): Laboratory Evaluation of Some Mung bean Strains for Susceptibility to Pulse Beetle, *Callosobruchus chinensis* Linn. Bangladesh J. Ent., 7: 213-216.
6. Ofuya T.I. and Credland P.F. (1995): Responses of three populations of the seed beetle, *Callosobruchus maculatus* Fab. (Coleoptera: Bruchidae), to seed resistance in selected varieties of cowpea, *Vigna unguiculata* (L) Walp. J. Stored Prod. Res., 31: 17-27.
7. Painter R.H. (1951): Insect resistance in crop plants. Macmillan, New York, 520pp.
8. Rathore Y.S. and Sharma V. (2002): Management of bruchid infestation in pulses. Indian Institute of pulse Research, Kanpur, U.P., India, 136.
9. Redden R.J. and McGuire J. (1983): The genetic evaluation of bruchid resistance in seed of cowpea. Aust. J. Agric. Res., 34: 707-716.
10. Rustamani M.A., Naqvi S.I.M., Munshi S.H. and Abro G.M. (1985): Relation resistance/susceptibility of different pulse beetles. Pak. J. Zool., 17: 99-100.
11. Srivastava K.M. and Pant J.C. (1989): Growth and developmental response of *Callosobruchus maculatus* Fab. to different pulses. Indian Journal of Entomology, 51(2): 196-199.
12. Talekar N.S. and Lin C.L. (1992): Characterisation of *Callosobruchus chinensis*, r*esistance in mung bean.* J. Econ. Entomol., 65(2): 273-276.
13. Thambhare B.D. (2007): Modern Entomology Vol. II, pest of other crops and stored grains pp. 337.