



HOST PREFERENCE OF PULSE BEETLES, *CALLOSOBRUCHUS MACULATUS* (FAB.) AND *C. ANALIS* (FAB.) ON SELECTED PULSES

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ABSTRACT

The host preferences of pulse beetles, *C. maculatus* and *C. analis* to selected pulses were made under laboratory conditions. Cowpea (C-152) and green gram (KKM-3) were most preferred hosts for both the species. Field bean (GL- 66) was comparatively less preferred for oviposition (83.33 eggs /100 g seeds). The developmental period (32.33 days), adult survival (79.33 %) and weight loss of grains (1.93%) was also less followed by red gram to *C. maculatus*. Similar trend was observed in case of *C. analis* with lesser oviposition (74.00 eggs / 100g seeds), with prolonged developmental period (35.00 days), least adult survival (72.00%) and grain weight loss (1.32%).

KEYWORDS: Pulses, pulse beetle, *C. maculatus* and *C. analis*

INTRODUCTION

Pulses (grain legumes) are the second most important group of crops worldwide. Globally, 840 million people are undernourished mainly on account of inadequate intake of proteins, vitamins and minerals in their diets. Pulses are excellent sources of proteins (20-40%), carbohydrates (50-60%) and are fairly good sources of thiamin, niacin, calcium and iron. Out of total 12.6 million tones, 8.5 per cent is lost due to the non-availability of proper storage facilities with the farmers and vulnerability of pulses to store grain pests. One of the major constraints in production of pulses is the insect pests which inflict severe losses both in the field and storage. In India, over 200 species of insects have been recorded infesting various pulses (Anon, 2007). Among the storage pests, bruchids incur greater importance. Among the bruchids, pulse beetles, *C. maculatus* and *C. analis* are major pests causing serious damage and are cosmopolitan in distribution. These are known to breed on different pulses. Knowledge of the host range and biology of the pest species are essential to minimize the incidence. Considering the seriousness of the pest on stored pulses, an attempt was made to evaluate the host preference for *Callosobruchus maculatus* and *C. analis*.

MATERIAL AND METHODS

Healthy seeds of different pulses viz., cowpea, green gram, black gram, Bengal gram, red gram, field bean and horse gram were collected from pulse scheme, ZARS, GKVK, Bengaluru. The adult beetles of *C. maculatus* and *C. analis* were studied separately; 100 g of each pulse were evaluated for the host preference to pulse beetle attack in three replications. Observations based on ovipositional preference, mean developmental period, per cent adult

survival and per cent weight loss of grains in different pulses was recorded.

Two pairs of freshly emerged adult beetles of each species were drawn from stock culture and released separately into the glass jars (250 g capacity). Observations were recorded on fecundity, mean developmental period, per cent adult survival and per cent weight loss.

Per cent grain weight loss was calculated by using formula, as detailed below.

$$\text{Per cent weight loss of grains} = \frac{\text{UND} - \text{DNU}}{\text{U} (\text{ND} + \text{NU})} \times 100$$

ND = Number of damaged grains

D = Weight of damaged grains

NU = Number of undamaged grains

U = Weight of undamaged grains

RESULTS AND DISCUSSION

The results on the host preference of the two species recorded are presented in Table 1 and 2. The criteria for the host preference studies considered were ovipositional preference, adult survival, and length of the developmental period and weight loss of the grains.

a) *Callosobruchus maculatus*

Ovipositional preference

The mean number of eggs laid on the test pulses ranged from 83.33 to 125.67 egg/ 100 g seeds. Among the selected pulses, the field bean recorded significantly the lowest of 83.33 eggs /100 g seeds which was on par with red gram (88.00 eggs / 100 g of seeds) as against the highest number of eggs observed in cowpea (125.67 eggs /100 g of seeds) and green gram (114.67 eggs per 100 g of seeds) (Table 1).

TABLE 1. Host preference of pulse beetle, *Callosobruchus maculatus* on selected pulses

Host (Variety)	*No. of eggs laid per 100 g seeds	*Developmental period (Days)	**Adult survival (%)	**Weight loss of grains (%)
Cowpea (C-152)	125.67 (11.38) ^a	29.33 (5.46) ^d	91.00 (72.53) ^a	4.02 (11.56) ^a
Horse gram (Hebbal Huruli)	93.33 (9.68) ^d	31.67 (5.67) ^{bc}	86.67 (68.70) ^{ab}	3.33 (10.51) ^b
Red gram (BRG-1)	88.00 (9.4) ^{de}	36.00 (6.04) ^a	77.67 (67.81) ^c	1.82 (7.75) ^d
Bengal gram (A-1)	102.00 (10.12) ^c	31.33 (5.64) ^{bcd}	86.33 (68.33) ^{ab}	3.21 (10.31) ^b
Black gram (Manikya)	104.33 (10.24) ^c	32.67 (5.76) ^b	82.67 (65.40) ^{bc}	2.53 (9.15) ^c
Green gram (KKM-3)	114.67 (10.73) ^b	29.67 (5.49) ^{cd}	90.33 (72.05) ^a	3.82 (11.27) ^a
Field bean (GL-66)	83.33 (9.15) ^e	32.33 (5.7) ^b	79.33 (62.96) ^c	1.93 (7.97) ^d
S.Em. ±	0.13	0.07	1.38	0.18
CD (p=0.05)	0.38	0.21	4.16	0.55
CV(%)	2.15	2.10	3.53	3.21

* Figures in the parenthesis are square root transformed values

** Figures in the parenthesis are angular transformed values

Means in the same column showing similar alphabets are on par.

TABLE 2. Host preference of pulse beetle, *Callosobruchus analis* on selected pulses

Host (Variety)	*No. of eggs laid per 100 g seeds	Developmental period (Days)	**Adult survival (%)	Weight loss of grains (%)
Cowpea (C-152)	98.67 (9.96) ^{ab}	29.67 (5.49) ^{de}	87.67 (69.48) ^{ab}	3.23 (10.33) ^b
Horse gram (Hebbal Huruli)	84.33 (9.21) ^{cd}	31.67 (5.67) ^{bcd}	84.67 (66.99) ^{bc}	2.22 (8.56) ^c
Red gram (BRG-1)	100.33 (10.04) ^a	33.33 (5.82) ^{ab}	78.00 (62.06) ^e	1.80 (7.70) ^d
Bengal gram (A-1)	87.00 (9.35) ^c	30.67 (5.58) ^{cde}	83.33 (65.91) ^{cd}	2.83 (9.67) ^b
Black gram (Manikya)	79.00 (8.91) ^{de}	32.33 (5.73) ^{bc}	80.00 (63.41) ^{de}	2.03 (8.17) ^{cd}
Green gram (KKM-3)	93.33 (9.69) ^b	28.67 (5.40) ^e	90.33 (71.89) ^a	4.10 (11.67) ^a
Field bean (GL-66)	74.00 (8.63) ^e	35.00 (5.96) ^a	72.00 (58.04) ^f	1.32 (6.60) ^e
S.Em. ±	0.10	0.07	1.12	0.24
CD (p=0.05)	0.30	0.21	3.38	0.74
CV(%)	1.81	2.14	2.96	4.72

* Figures in the parenthesis are square root transformed values

** Figures in the parenthesis are angular transformed values

Means in the same column showing similar alphabets are on par.

Developmental period

The mean developmental period ranged from 29.33 to 36.00 days in different pulses (Table 1). Cowpea, green gram, bengal gram and horse gram recorded significantly the lowest developmental period of 29.33, 29.67, 31.33 and 31.67 days, respectively and were on par with each other. Where as, red gram recorded a maximum of 36.00 days developmental period followed by black gram (32.67 days) and field bean (32.33 days).

Adult survival

The mean adult survival on test pulses ranged from 77.67 to 91.00 per cent (Table 1). Significantly the lowest adult survival of 77.67, 79.33 and 82.67 per cent was registered on red gram, field bean and black gram, respectively (Table 1) and were on par with each other. Significantly the highest survival was recorded on cowpea (91.00%) followed by green gram (90.33%), horse gram (86.67%) and black gram (82.67%).

Weight loss of grains

The loss in grain weight among different pulses ranged from 1.82 to 4.02 per cent (Table 1). Red gram recorded significantly the lowest weight loss of 1.82 per cent which was on par with field bean 1.93 (%) as against the highest weight loss recorded on cowpea (4.02%) followed by green gram (3.82%).

b) *Callosobruchus analis***Ovipositional preference**

The data presented in the Table 2 showed significant variation with a range of 74.00 to 100.33 eggs / 100 g seeds. Minimum of 74.00 eggs/ 100 g seeds were recorded in field bean and was on par with black gram (79.00 eggs/100g seeds). Where as significantly higher number (100.33 and 98.67 eggs/100g seeds) of were recorded on red gram and cowpea, respectively.

Developmental period

Among the different pulses, the mean developmental period ranged from 28.67 to 35.00 days (Table 2). Significantly the lowest developmental period of 28.67, 29.67 and 30.67 days was recorded on green gram, cowpea and bengal gram, respectively as against the highest developmental period of 35.00, 33.33 and 32.33 days recorded in field bean, red gram and black gram, respectively.

Adult survival

The data of adult survival on different pulses ranged from 72.00 to 90.33 per cent (Table 2). Minimum adult survival of 72.00 per cent rerecorded on field bean was significantly superior over other pulses. The next best preferred hosts were red gram (78.00 %) and black gram (80.00%) which were on par with each other.

Per cent weight loss of grains

Weight loss caused due to feeding in different pulses ranged from 1.32 to 4.10 per cent (Table 2). The lowest weight loss of 1.32 per cent recorded on field bean was significantly superior over other treatments. The next best treatments were red gram (1.80%) and black gram (2.03%) which are being on par with each other. Significantly the highest weight loss of grains was observed on green gram (4.10%) followed by cowpea (3.23%) and Bengal gram (2.83%).

Cowpea and green gram possess smooth skinned seed texture and are bigger in size. This might have encouraged the beetles to prefer more for egg laying, larval development and weight loss. The present findings are true with reports of Girish *et al.*, (1974) where the oviposition and developmental period of *C. maculatus* (Fab.) on few stored pulses seems to be guided by smoothness of seed coat and size of the grain. Bhaduria and Jakhmola (2006) reported that the ovipositional preference and survival of pulse beetles (*Callosobruchus maculatus*) on black gram,

french bean and pigeon pea which were less preferred for oviposition (with 50.6 to 52.6 eggs laid). Cowpea was the most preferred host for oviposition (171.6 eggs) and Survival (78.4%). Losses due to seed damage was maximum in green gram (55.4%) followed by gram [chickpea] (11.1%) and pea (8.8%).

Mehta and Chandel (1990) who reported that the *Callosobruchus analis* were provided with a mixture of the seeds of various grain most of the *C. analis* preferred cowpeas (15.33 eggs/seed), peas (8.17 eggs/seed), green gram [*Vigna radiata*] (5.67 eggs/seed) and *V. mungo* (5.07 eggs/seed) for egg laying, per cent weight loss and per cent adult survival.

The present conclusively documents that cowpea and green gram were most preferred hosts for both *Callosobruchus maculatus* and *C. analis*. For *Callosobruchus maculates*, field bean was less preferred for oviposition and recorded prolonged developmental period (32.33 days), adult survival (79.33 %) and weight loss of grains (1.93%) which was followed by red gram. Similar trend was observed in case of *C. analis* with lesser oviposition (74.00 eggs / 100g seeds), with prolonged developmental period (35.00 days), least adult survival (72.00%) and grain weight loss (1.32%). In this trial, single variety was tested for each host, preference of these species across varieties/hybrids need to be tested at least in case of field bean and red gram which are considered to be less favoured.

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