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Host preference studies on *Callosobruchus chinensis* (Linnaeus) in different pulses

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Abstract
The host preference studies on *Callosobruchus chinensis* in different pulses were made under laboratory conditions. Cowpea (C-152) and greengram (S-4) were most preferred hosts. Blackgram was significantly less preferred for oviposition in F_1 generation followed by redgram. In F2 generation Blackgram was significantly less preferred for oviposition followed by redgram. The developmental period (34-36 days in F_1 and F_2 generation) in redgram, adult (76% to 79% in both generations) and grain weight loss (1.50 to 1.70 percent) was also less followed by Blackgram. Initial germination percentage was not much variation in seed germination among the different pulse varieties redgram (TS-3R) variety (83.67) which was on par with greengram (S-4) (83.33) and least germination was in cowpea (80.00%). Moisture per cent significantly high in red gram (10.00) and least variety mothbean (Vijayapura local) (9.3). Final germination (%) on different pulses after two months were significantly highest observed in blackgram (64.33) followed by redgram and least germination percentage was observed in cowpea C-152 (52.67).

Keywords: *Callosobruchus chinensis*, pulse beetle, germination percentage

Introduction
Pulses (grain legumes) are the second most important group of crops worldwide. Globally 840 million people are under nourished 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 tons, 5.5% is lost due to the non-availability of proper storage facilities with the farmers and vulnerability of pulses to stored grain pests which inflict severe losses mainly in the storage Pandey and Singh [1]. 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* [2].
Among the storage pests, bruchids occcur greater importance. Among the bruchids, pulses beetles, *C. maculatus, C. chinensis*, *C. phaseoli, C. theobromae* and *C. analis* are major
Pests causing serious damage and are cosmopolitan in distribution. Among the storage pests, bruchids particularly the pulse beetle, *Callosobruchus chinensis* L. greater importance as the pest having cosmopolitan distribution and causing serious damage to pulses from the field. Pulses suffer losses both qualitatively and quantitatively by this pest due to this habit Gujar and Yadav [3]. 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. It is as well-established fact that lot of efforts should be put forth production of "every single grain" but this is of no use if the produced seeds are not saved, which recall the proverb "a grain saved is a grain produced'. This adage depends mainly on how 'best' we protect the quality of grains during storage. Considering the economic importance of this pest, an attempt has been made to study the host preference of *C. chinensis* on some major different pulses.

Material and Methods
The experiment on Host preference of *C. chinensis* was conducted for consecutive two generations in the laboratory of Department of Agricultural Entomology, college of Agricultural Science Vijayapura, University Of Agricultural Science, Dharwad in 2014-2015. Adult beetles were collected from ware house and stock culture was maintained for first generation while second generation (fresh seeds were used). The experiment was conducted in the laboratory with three replications and the design used for Analysis Complete randomized

design (CRD). Different pulse varieties of 100 grams seeds of cowpea (C-152), greengram (S-4), redgram (TS-3R), chickpea (A-1), mothbean (Vijayapura local), horsegram (kavalagi local), blackgram seeds were collected from local farmers and kept in a glass jar of 1kg capacity covered with muslin cloth and released one pair of *C. chinensis*. After eggs laid on seeds, the adults were removed from the Jar. Before storing different pulses into the jar, the jar was disinfected with formaldehyde and glass materials were sterilized with autoclave. Observations were recorded on fecundity, mean developmental period, percent adult survival and percent weight loss, Germination test was conducted as per the International Seed Testing Association (ISTA) *Anon* [4] and moisture percentage is recorded

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

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

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 *C. chinenis* both F_1 and F_2 generation 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, weight loss of the grains, moisture percentage and germination percentage.

Ovipositional preference

From the (Table 1) it is evident that, oviposition response varied significantly. Mean number of eggs laid on different pulse varieties ranged from 109.67 to 80.0 eggs/100 gram seeds. Significantly higher egg count per 100 gm seeds were recorded in varieties cowpea (109.67) and were on par with greengram (103.00).Significantly lowest numbers of eggs per 100 gm of seeds were recorded in blackgram (75.33) which was on par with redgram (80.00) and chickpea (90.00).

Similar in F_2 generation relatively higher egg count of bruchids were recorded on significantly higher oviposition on cowpea (110.33/100 g seeds) which was on par with greengram (107.33). The least oviposition of 77.33 eggs per 100 gram seeds were recorded on blackgram followed by redgram, respectively. The present investigation are similar with the findings by Chakraborty *et al* [5] (2015), who reported that mean number of eggs laid by each female on different pulses ranged from 79.20 to 160.20 in the first generation, while in second generation the range was 83.50 to 111.00 eggs/female. Tiwari *et al* [6] (2012) reported that cowpea and greengram were most preferred hosts for pulse beetle. Among the selected pulses lowest number of eggs (87.67 eggs/100g seeds) was recorded in redgram as against highest number of eggs was observed in cowpea (125.00 eggs/100g seeds).

Developmental period

The mean developmental period varied significantly. Mean number of development period (days) ranged from 29.00 to 35.67 days in different pulses in first generation which were selected for laboratory studies. Cowpea (29.00) recorded significantly lowest developmental period and was on par with greengram. The significantly highest development period is of 35.67 days was recorded on redgram which was varied followed by a chickpea (32.00) and blackgram (32.00). However last two treatments were on par with each other (Table 1).

Similar results were recorded in F_2 generation it was observed from (Table 2) that means developmental period varied significantly. The mean number of development period (days) ranged from 28.33 to 34.33 days in different pulses in second generation. Cowpea recorded significantly lowest developmental period (28.33 days).The highest development period of 34.33 days was recorded on redgram followed by a chickpea (32.00 days).The present findings were agreement with the findings of Chakraborty *et al* [5] (2015) who observed that mean developmental period ranged from 26.70 to 32.20 days in different pulses in first generation while in the second generation the range was 26.00 to 35.20 days. Tiwari *et al* [6] (2012) also revealed that the lowest developmental period (29.00 days) was recorded on cowpea.

Adults survival

The mean adult survival on different pulses ranged from 76.00 to 90.33 (Table 1). Significantly the lowest adult survival of 76.00 percent registered on redgram, blackgram (81.00) and chickpea (84.33). Significantly the highest percentage of survival was recorded on cowpea (90.33) followed by greengram (86.00), horsegram (kovalagi local) (85.00) and mothbean (Vijayapura local) (84.67).

Similar observations were recorded in F_2 generation the mean adult survival on different pulses ranged from 78.67 to 93.00 percent (Table 2). Significantly the lowest percentage of adult survival were recorded in redgram (78.67) which differed significantly from all different pulses respectively. Significantly the highest survival was recorded on cowpea (93.00) followed by greengram (88.00%) and horsegram (88.67 %), latter two treatments were on par with each other. The present investigation was similar with the findings by Shivanna *et al* [7] (2011) who recorded that the mean adult survival ranged from 79.33% to 91.00% on Callosobruchus maculatus.

Grain Weight loss

The loss in grain weight among different pulses ranged from 1.50 to 4.17 (Table1). Redgram TS-3R recorded significantly the lowest weight loss of 1.50 percent. Highest weight loss recorded on cowpea (4.17) followed by greengram (4.13). The varieties green gram, chickpea and horse gram were on par with each other as they recorded 3.33, 3.00, and 3.00 per cent weight loss, respectively.

Similar observations were recorded in F_2 generation grain weight loss in different pulses ranged from 1.70 to 4.57 per cent (Table 2). Redgram recorded significantly the lowest weight loss of 1.70 percent as against the highest weight loss in moth bean (4.57) and was on par with cowpea (4.07).

The present findings were agreement with the findings of Chakraborty *et al* [5] (2015) who recorded that, the loss in grain weight among different pulses ranged from 2.61 to 5.21% in first generation and 2.76 to 6.25% in second generation.

Initial germination (%) and moisture (%) of different pulses

Initial Germination (%)

As evident from (Table3) initially there was not much variation in seed germination among the different pulse varieties which ranged from 83.67 to 80.00 per cent. Maximum germination percent was recorded in the different pulses. Redgram TS-3R variety (83.67) which was on par with greengram (S-4) (83.33).The blackgram and mothbean

(Vijayapura local) were on par with each other (80.67).Significantly minimum germination was recorded in the variety cowpea (80.00).

Moisture (%)

Moisture content of different pulses cultivars used for host preference against pulse beetle presented in Table3. Initially moisture content of different pulse varieties ranged from 9.30 to 10.00 percent. Significantly highest moisture content was observed in red gram (10.00) which was on par with horsegram (kouvalagi local) and blackgram (9.9), greengram (S-4variety) (9.8). The lowest moisture content observed in variety mothbean (Vijayapura local) (9.3) (Table3).

Final germination (%) on different pulses after two months

As evident from (Table 4) the germination percentage after two month ranged from 60 to 52.67. Maximum germination percent was recorded in the blackgram (64.33) which was on par with redgram TS-3R (60.00). The lowest germination percentage was observed in the different pulses like cowpea C-152 (52.67) followed by greengram S-4 (55.00).

Table 1: Host preference studies on *Callosobruchus chinensis* in different pulses (F_1 generations)

Different pulse variety	No of eggs laid per 100 g seeds	Development period (Days)	Adult survival (%)	Grain weight loss (%)
Cowpea	*109.67 (10.51)^{a}	* 29.00 (5.48)^{d}	**90.33 (71.89)^{a}	** 4.17 (11.77)^{a}
Greengram	103.00 (10.20)^{ab}	29.33 (5.51)^{cd}	86.00 (68.06)^{b}	3.33 (10.51)^{b}
Redgram	80.00 (9.00)^{d}	35.67 (6.06)^{a}	76.00 (60.67)^{d}	1.50 (7.03)^{d}
Chickpea	90.00 (9.54)^{d}	32.00 (5.74)^{b}	84.33 (66.71)^{bc}	3.00 (9.97)^{b}
Horsegram	95.33 (9.81)^{bc}	30.67 (5.63)^{bc}	85.00 (67.26)^{b}	3.00 (9.97)^{b}
Blackgram	75.33 (8.74)^{d}	32.00 (5.74)^{b}	81.00 (64.16)^{c}	2.33 (8.77)^{c}
Moth bean	100.00 (10.04)^{abc}	31.00 (5.66)^{bc}	84.67 (66.99)^{b}	4.13 (11.73)^{a}
S.Em ±	0.17	0.03	0.85	0.19
CD @ 1%	0.50	0.08	2.57	0.57
CV %	2.95	1.42	2.20	3.28

*Figures in the parenthesis are square root transformed values√x+1
**Figures in the parenthesis are angular transformed values

Table 2: Host preference studies on *Callosobruchus chinensis* in different pulses (F_2 generations)

Different Pulse variety	No of eggs laid per 100 g seeds	Developmental period (Days)	Adult survival (%)	Weight loss of grains (%)
Cowpea	*110.33 (10.55)^{a}	* 28.33 (5.41)^{d}	** 93.00 (74.68)^{a}	** 4.07 (11.63)^{ab}
Greengram	107.33 (10.41)^{a}	29.00 (5.48)^{cd}	88.00 (69.77)^{b}	3.67 (11.02)^{bc}
Redgram	82.67 (9.15)^{d}	34.33 (5.94)^{a}	78.67 (62.49)^{d}	1.70 (7.49)^{e}
Chickpea	90.00 (9.54)^{c}	32.00 (5.74)^{b}	85.33 (67.48)^{c}	4.00 (11.54)^{abc}
Horsegram	97.00 (9.90)^{b}	30.67 (5.63)^{bc}	88.67 (70.35)^{b}	3.48 (10.74)^{c}
Blackgram	77.33 (8.85)^{d}	32.67 (5.80)^{ab}	84.00 (66.43)^{c}	2.40 (8.89)^{d}
Mothbean	107.00 (10.39)^{a}	31.00 (5.66)^{bc}	86.33 (68.32)^{bc}	4.57 (12.33)^{a}
S.Em±	0.10	0.05	0.65	0.26
CD@1%	0.30	0.16	1.98	0.80
CV %	1.77	1.60	1.65	4.35

*Figures in the parenthesis are square root transformed values√x+1
**Figures in the parenthesis are angular transformed values

Table 3: Initial Germination (%) and moisture content (%) of different pulses.

Different pulse varieties	* Germination (%)	* Moisture (%)
Cowpea	80.00 (63.44)^{b}	09.60 (18.05)^{bc}
Greengram	83.33 (65.91)^{a}	09.80 (18.24)^{ab}
Redgram	83.67 (66.18)^{a}	10.00 (18.43)^{a}
Chickpea	80.33 (63.68)^{b}	09.90 (18.31)^{ab}
Horsegram	80.33 (63.68)^{b}	09.90 (18.37)^{ab}
Blackgram	80.67 (63.92)^{b}	09.80 (18.28)^{ab}
Mothbean	80.67 (63.92)^{b}	09.30 (17.79)^{c}
S.Em±	0.73	0.10
CD @ 1%	2.20	0.31
CV %	2.03	0.96

**Figures in the parenthesis are angular transformed values

Table 4: Final germination (%) of different pulses after 2 months

Different pulse varieties	* Germination (%)
Cowpea (C-152)	52.67 (46.53)^{d}
Greengram (S-4)	55.00 (47.87)^{cd}
Redgram (TS -3R)	60.00 (50.77)^{ab}
Chickpea (A-1)	58.00 (49.61)^{bc}
Horsegram (kouvalagi local)	53.50 (47.01)^{cd}
Blackgram	64.33 (53.33)^{a}
Mothbean (Vijayapura local)	55.67 (48.25)^{bcd}
S.Em	0.86
CD @ 1%	2.60
CV %	3.03

**Figures in the parenthesis are angular transformed values

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