

Relative susceptibility of chickpea varieties against pulse beetle in storage

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ABSTRACT

The present investigation was carried out in the laboratory of Department of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri during 2018. Among 8 Chickpea varieties, Minimum (44.3% and 23.00%) pulse beetle grain infestation (number basis and weight basis, respectively) was recorded in a variety Vikrant while the maximum (75.5% and 39.8%) pulse beetle grain infestation (Number basis and weight basis) was recorded in a variety Kripa. Minimum (30.6 %) grain weight loss was recorded in a variety Vikrant and maximum (52.9%) grain weight loss was recorded in a variety Kripa. In Free choice test, the lowest (6.33) average number of adult pulse beetles oriented towards variety Vikrant, while the highest (11.00) adult pulse beetles oriented towards kabuli variety Kripa. In “No choice test” minimum (78.60%) adult emergence was observed in variety Vikrant while the highest (90.39%) adult emergence of pulse beetle was observed in a susceptible variety Kripa. Minimum (27.66 days) development period was observed in variety Vijay while the maximum (29.66 days) development period of pulse beetle was observed in variety Virat. The minimum (2.18) growth index was observed in variety Vikrant and the maximum (2.48) growth index was observed in a variety Kripa.

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INTRODUCTION

In pulses, chickpea is an important pulse crop in India and is the main source of protein. Chickpea is mostly consumed in the form of whole grain or dal. Chickpea is a good source of minerals, proteins, CHO and vitamins besides, a source for iodine and rich essential amino acids like lysine, tyrocine, cystine and arginine

(Anonymous, 2017). Indian Council of Medical Research has recommended average daily consumption of 40g pulses in human diet. Hence there is urgent need for increasing the pulses production to meet the growing demand of consumption. Chickpea (*Cicer arietinum*) cultivated as pulse crop principally for its protein rich edible seeds was originated in south-eastern Turkey and

adjoining Syria. Chickpea production is highest in India among all pulses produced. The area under pulses estimated to be 29.46 million ha with a production of 22.95 million tones and productivity 779kg/ha (Anonymous, 2017).

Nearly 8.5 per cent of the total production of the pulses in India is lost during post-harvest and storage (Agarwal *et al.*, 1988). Bruchids cause 30.2 to 55.7 per cent losses (Gujar and Yadav, 1978). Pulse beetles have its own preference and so do not attack all kinds of pulses to the same extent and the average per cent damage has been found to be highest in green gram (55.4%) followed by black gram (35.3%), pigeonpea (22.1%), cowpea (16.8%), gram (11.1%) and pea (8.8%) (Bhaduria and Jakhmola, 2006). Pulse beetle causes serious damage to pulse grains during storage not only in the form of quantity but also in quality (Singh and Sharma, 2001). The losses caused by pulse beetle, *C. chinensis* have been reported to the extent of 55.20 per cent in chickpea (Gupta, 1985). Borikar *et al.* (1977) found 4.5 per cent weight loss in chickpea due to *C. chinensis* in Marathwada.

MATERIAL AND METHODS

The studies on “relative susceptibility of chickpea varieties against pulse beetle (*Callosobruchus maculatus*) for its damage in storage” was carried out at the laboratory of Department of Agricultural Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri during 2018-19.

Two hundred fifty g seed of eight varieties of chickpea was obtained from Pulse Improvement Project, MPKV, Rahuri. Seeds were dried in bright sunlight for three days to bring down moisture content to less than 10 per cent for conducting this study. The identification key of *Callosobruchus* spp. given by Raina (1970) was used. For initial culture, healthy seed of chickpea was kept in 32×22.5 cm size cylindrical jar and 10 pairs of adult beetles were isolated and released into jar. The top of the jar was covered with muslin cloth secured firmly by rubber band. After emergence of new adults the beetles were introduced into chickpea seed kept in a series of cylindrical jars for building up a homogenous population. A permanent colony was maintained as per procedure described by Strong *et al.* (1968). Adults of uniform age were used from this colony for the experiment. These studies were conducted at room

temperature and relative humidity was also under ambient conditions.

Under “Free choice” test, 100 grains of each variety were kept in open specimen tubes (5 x 3 cm) and arranged horizontally in circular manner in the trough (40 x 5 cm) at equidistance from centre. Hundred pairs of 10 days-old adults were released in centre giving free choice to the adults for orientation and then the trough was covered with muslin cloth. The experiment was replicated 3 times. The number of adults oriented in each variety was counted 48 hours after their release. Under “No choice” test 50 g grain of each varieties were kept in plastic container and 5 pairs of 10 days-old adults were released in each container and 48 hours after released all adults were removed. The experiment was replicated 3 times. The grains were observed daily, after 15 days onward to record the total number of adults emerged. Adult emergence, per cent grain damage and loss in grain weight in each genotype was computed. The data was subjected to statistical analysis. The weight of 100 grains, seed volume and seed hardness of each varieties was recorded. The correlation of grain weight, volume and density with infestation was also worked out. The observations on orientation of adult was studied to correlate them with the physical characters of each variety *viz.*, seed volume, seed hardness, 100 grain weight, seed length and breadth of the seed. These physical parameters of seed were correlated by applying simple correlation coefficient method.

The observations on per cent grain infestation were correlated with the physical characters of seed of each variety *viz.*, seed volume, seed length, seed breadth, seed hardness, 100 grain weight of seed and seed hardness by applying simple correlation co-efficient method. The observations on development period, growth index, per cent grain infestation, per cent weight loss of each genotype correlated with the biochemical constituents *viz.*, protein, CHO, fat, ash and moisture content by applying simple correlation co-efficient method.

RESULTS AND DISCUSSION

The present investigations were carried out on “relative susceptibility of chickpea varieties against pulse beetle (*C. maculatus*) in storage” with the objectives to screen the chickpea varieties against pulse beetle (*C. maculatus*) damage in storage and to study the physical properties of chickpea seed for beetle damage in storage.

The morphological characteristics of eight different chickpea varieties seed was categorized into seed colour, seed size, seed volume, seed length, breadth and seed hardness of each 100 grain weight chickpea. The data on seed characters are presented in Table 1. Seed colour grouped into two categories *i.e.* brown and white. Out of 8 varieties, 6 varieties had brown colour *viz.*, Vikrant, Vikram, Vishal, Digvijay, Vijay, Rajas and 2 varieties *viz.*, Kripa and Virat were of white colour. The brown and white colour seeds were grouped into two categories on the basis of seed size *i.e.* medium and bold seed. The Medium size seed variety was observed in varieties Vikrant, Vikram, Vishal, Digvijay, Vijay and Rajas. The varieties *viz.*, Kripa and Virat had shown bold seeds. Seed volume of each variety was recorded on number of seeds per 10 cc in measuring cylinder. The seed volume of given chickpea varieties ranged from 13.33 to 37.66 mm seeds per 10 cc. The variety Vijay showed significantly highest seed volume (37.66) indicating smallness in seed size, whereas, Kripa shown less seed volume (13.33) indicating boldness of seed. From the

data, it revealed that the seed length was observed in the range of 8.26 to 13.60 mm. The maximum (13.60 mm) length of seed was noticed bold sized seed of Kripa and minimum length (8.26 mm) in Vijay. The seed breadth of different chickpea varieties recorded in ranged between 6.26 mm and 9.83 mm. The minimum seed breadth (6.26 mm) was recorded in small size variety Vijay, while the maximum (9.83 mm) was observed in bold size variety Kripa. The hundred grain weight of different chickpea varieties ranged from 20.32 to 38.12 g. The maximum (38.12 g) hundred grain weight was observed in variety Kripa indicating boldness of seed with maximum seed length. The minimum (20.32 g) hundred grain weight of seed was observed in Vijay indicating small size of seeds.

The seed hardness of different chickpea varieties ranged from 15.65 to 31.20 kg/grain. The maximum hardness was recorded in the variety Vikrant (31.20 kg/grain). The variety Kripa noted less hardness (15.65 kg/grain). The seed hardness in different varieties revealed that the seed hardness in medium size seed ranged

Table 1 : Seed characteristics of different varieties of chickpea

Sr. No.	Varieties	Seed colour	Seed size	Seed volume (mm)	Seed length (mm)	Seed breadth (mm)	100 grain weight (g)	Seed hardness (kg/grain)
1.	Vikrant	Brown	Medium	36.33	8.66	7.66	20.89	31.20
2.	Vikram	Brown	Medium	36.66	9.33	7.83	21.62	29.15
3.	Virat	White	Bold	15.42	11.83	8.43	33.12	18.15
4.	Vishal	Brown	Medium	22.66	9.50	7.50	24.13	22.45
5.	Digvijay	Brown	Medium	29.00	9.23	6.83	24.18	27.65
6.	Vijay	Brown	Medium	37.66	8.26	6.26	20.32	20.75
7.	Kripa	White	Bold	13.33	13.60	9.83	38.12	15.65
8.	Rajas	Brown	Medium	25.66	8.33	6.50	20.80	23.15
	S.E. ±	-	-	0.5	0.43	0.51	1.52	1.08
	C.D. (P=0.05)	-	-	1.50	1.31	1.53	4.57	3.24

Table 2 : Reaction of *C. maculatus* adults oriented to different seeds of chickpea varieties under "free choice test"

Sr. No.	Varieties	Average number of adults oriented
1.	Vikrant	6.33 (2.61)
2.	Vikram	8.33(2.97)
3.	Virat	10.66(3.34)
4.	Vishal	8.00(2.92)
5.	Digvijay	8.33(2.97)
6.	Vijay	8.66(3.03)
7.	Kripa	11.00(3.39)
8.	Rajas	9.00(3.08)
	S.E.±	0.18
	C.D. (P=0.05)	0.55

Figures in the parenthese are transformed values of $\sqrt{x+0.5}$ where x is original value.

between 20.75 to 31.20 kg/grain and bold size seed is ranged between 15.65 to 18.15 kg/grain. The present findings are in agreement with the results reported by Regupathy and Rathnaswamy (1970) who observed no association of seed colour, seed volume and hardness of seed.

Out of hundred adults, 70 adult beetles oriented to different varieties during 48 hours and it was ranged from 6.33 (Vikrant) to 11.00 (Kripa). The highest (11.00) orientation of adult beetle was observed in variety Kripa and was at par with Virat (10.66), Rajas (9.00), Vijay (8.66), Digvijay (8.33), Vikram (8.33) and Vishal (8.00). Nwanze *et al.* (1975) and Chakraborty and Mondal (2016) suggested a combination of several factors such as texture, seed size, seed weight, volume of seed and seed colour have been responsible for ovipositional preference of bruchids to different pulses. Dark and brown coloured seeds were preferred most for oviposition over white seeds in “free choice” situation.

The least nutritious variety for pulse beetle was Vikrant which recorded 2.18 growth index and followed

by Digvijay (2.19), Vikram (2.22), Vishal (2.23), Vijay (2.28), Virat (2.35) and Rajas (2.36) (Table 3). Wadnerkar *et al.* (1978) who reported that the varieties having maximum growth index are more suitable for pulse beetle in arhar and gram.

Grain weight loss (weight basis):

The minimum per cent grain weight loss of (30.6 %) recorded in the variety Vikrant which was found statistically at par with Vikram (33.2 %), Digvijay (36.1%), Rajas (38.8%) and Vishal (40.4%). The maximum grain weight loss 52.9 per cent was observed in Kripa which was found statistically at par with Virat (50.3 %) both are bold varieties (Table 4). In the present investigation it indicated that the seed weight loss (30.6 – 40.4 and 50.3 – 52.9 %) was increased in chickpea varieties with increase adult emergence (78.69 – 81.23 and 85.77 – 90.39 %) of *C. maculatus* in medium and bold size seeds, respectively. Sarwar (2012) reported that the tolerant varieties of chickpea showed the least loss in weight due to *C. maculatus* which could be attributed

Table 3 : Growth and development of pulse beetle in different varieties of chickpea

Sr. No.	Varieties	Adult emergence (%)	Development period (Days)	Growth index
1.	Vikrant	78.60(62.51)	28.67	2.18
2.	Vikram	79.38(62.99)	28.33	2.22
3.	Virat	88.22(69.97)	29.66	2.35
4.	Vishal	80.88(64.07)	28.33	2.23
5.	Digvijay	81.23(64.33)	29.34	2.19
6.	Vijay	79.80(63.29)	27.66	2.28
7.	Kripa	90.39(71.94)	29.00	2.48
8.	Rajas	85.77(67.87)	28.66	2.36
	S.E.±	0.52		
	C.D. (P=0.05)	1.58		

Table 4 : Grain infestation caused by pulse beetle in different varieties of chickpea

Sr. No.	Varieties	% Grain infestation (No. basis)	% Damage of grain infestation (Wt. basis)	% Grain weight loss (Wt. basis)
1.	Vikrant	44.3(41.73)	23.0(28.63)	30.6(33.57)
2.	Vikram	46.3(42.88)	29.36(32.80)	33.2(35.08)
3.	Virat	73.4(58.95)	37.9(38.00)	50.3(45.17)
4.	Vishal	51.4(45.80)	32.8(33.06)	40.4(39.46)
5.	Digvijay	54.0(47.29)	31.1(33.87)	36.1(36.93)
6.	Vijay	48.5(44.14)	28.32(32.14)	30.8(33.70)
7.	Kripa	75.5(60.34)	39.8(39.11)	52.9(46.67)
8.	Rajas	56.2(47.41)	33.1(35.11)	38.8(38.53)
	S.E. ±	0.61	0.89	1.20
	C.D. (P=0.05)	1.85	2.67	3.61

Figures in parenthesis are arcsine transformed value

Table 5 : Correlation coefficient 'r' between morphological characteristics of seed of varieties of chickpea with grain weight loss on number basis and infestation by pulse beetle

Particulars	Correlation coefficient 'r' of <i>C. maculatus</i>					
	Seed hardness	Seed volume	Seed length	Seed breadth	Grain wt. loss (wt. basis)	Moisture content
% grain infestation (No basis)	0.819**	-0.914**	0.913**	0.709*	0.961**	0.871**

* and ** indicate significance of value at P=0.05 and 0.01 is 0.631 and 0.764, respectively.

to small and presence of well texture layer of seed.

Correlation coefficient 'r' between seed characters and grain infestation:

Seed hardness (0.819), seed length (0.913), grain weight loss (0.961) and moisture content (0.871) was found highly significant positive correlation with the per cent grain infestation number basis. Seed breadth (0.709) was found positive significant correlation with per cent grain infestation number basis. The highly negative correlation (-0.914) was observed between seed volume and per cent grain infestation number basis. Umrao and Verma (2002), Gawade (2010) who reported increase in hardness of seed decrease the per cent weight loss and increase in moisture content increase the per cent weight loss and *vice-versa*.

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