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VARIETAL SCREENING OF STORED CHICKPEA *CICER ARIENTINUM* L. AGAINST PULSE BEETLE, *CALLOSOBRUCHUS CHINENSIS* L.

D.R. PATIL*, KL RAGHVANI, R.P. JUNEJA AND G.M. PARMAR**

Division of Entomology, Millet Research Station, Junagadh-361006 (Gujarat)

ABSTRACT

Twenty different varieties / genotypes were screened against *C. chinensis*. On the basis of ovipositional preference chickpea varieties / genotpyes, Vishal, Gulabi and Avrodhi were found least preferred, whereas Mexican dollar and PKV-2 were more preferred for oviposition by *C. chinensis*. In respect of developmental preference and susceptibility, ICCV-2, Avrodhi, L-550, Gulabi, GG-2, Radha, KAK-2, Vihar, C-235, GJG-0305, Vishal and GG-4 were found less susceptible, while Mexican dollar, PKV-2 and JG-62 were found more susceptible varieties / genotypes to *C. chinensis.*

Key words : screening, *Callosobruchus chinensis,* Chickpea

Among the pulses, chickpea (*Cicer arietinum* L.) is one of the important *rabi* pulse crops which is cultivated in about 6.25 million hectares area with an annual production of 4.44 million tonnes with yield of 711 kg per hectare in India (Mishra, 2005). The stored chickpea is attacked by pulse beetle (*Callosobruchus chinensis* L.) which is only the major pest causing heavy losses to the tune of 10 to 60 per cent (Gupta and Kashyap 1971). Infestation starts right from the field and continues to the store (Butani *et al.*, 2001). The pulse beetle causes not only quantitative but also qualitative losses like nutritive loss, germination loss and make the chickpea unfit for marketing as well as for human consumption. With introduction of high yielding varieties, the problem of *C. chinensis* in storage has also enhanced as the released varieties viz., Chaffa, Dahod Yellow and ICCC-4 are found comparatively more susceptible to this pest. Farmers generally store the chickpea for seed as well as their own consumption. It is very difficult to manage the pulse beetle which causes heavy losses during storage. Under such situation it is necessary to find out some varieties which are comparatively less susceptible to the attack of *C. chinensis* as compared to prevailing varieties. The search of resistant cultivars of legumes for safe storage is being given more emphasis by several research workers. Reduced oviposition, number of adult emergence and duration of development of various stages of pest are the most suitable characters to screen out resistant cultivars to insects in storages. Texture of the testa, its thickness, size and weight of the grain and composition of the grain have great bearing on the susceptibility to insect infestation and its development. But very little information is available in literature regarding relative resistance, susceptibility and extent of damage in chickpea varieties due to *C. chinensis.* It becomes absolutely necessary to have comprehensive knowledge of such important information regarding the pest, for farmers and scientists for large scale adoption and future line of work.

MATERIALS AND METHODS

Twenty varieties / promising genotypes of chickpea were procured from the Pulse Research Station, Junagadh Agricultural University, Junagadh (Table-1). The study was carried out at 30 ± 1°C in BOD incubator at Storage Entomology and Packaging Research Laboratory, Department of Entomology, College of Agriculture, Junagadh Agricultural University, Junagadh during the year 2006-2007. The experiment was laid out in Completely Randomized Design with three replications. Ovipositional preference of *C. chinensis* L. was studied by using multiple-choice test. One hundred grains of each variety / genotype of chickpea were placed randomly and separated in the twenty compartments prepared by partitioning the round galvanized cage (45×10cm) with the stripe of thermo Cole. In the centre of the cage, a Petri dish (10×1.5cm) was placed for releasing the insects. Fifty pairs of one or two day's old adults of *C. chinensis* were released in the Petri dish

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** Research Scientist (Entomology), Department of Entomology, Millet Research Station, Junagadh Agril. University, Jamnagar-361006 (Gujarat).

Table 1: Effect of different chickpea varieties on growth and development of *C. chinensis* and the losses in stored chickpea

Variety / Genotype	Seed colour	Seed texture surface	Total number of eggs laid by 50 females	Adult emergence (%)	Total developmental period (Days)	Growth index	Grain damage (%)	Weight loss (%)	Germination loss (%)
GG-1	Yellowish brown	Rough	11.2* (123.3)	78.9** (96.3)	30.4	2.6	24.4** (17.0)	50.9** (60.3)	31.9** (28.0)
Annigeri	Brown	Rough	10.6 (112.6)	71.6 (90.0)	31.9	2.2	25.7 (18.9)	49.5 (57.8)	32.6 (28.9)
GG-2	Dull brown	Rough	11.4 (130.3)	68.9 (86.9)	32.9	2.1	29.2 (23.9)	49.0 (56.9)	32.6 (28.9)
Dahod yellow	Dull yellowish brown	Rough	11.7 (135.9)	66.1 (83.6)	30.9	1.7	24.8 (17.6)	53.3 (64.3)	33.6 (30.7)
ICCV-2	Creamy white	Rough	11.9 (143.3)	56.8 (70.0)	32.6	1.9	27.0 (20.6)	48.1 (55.3)	33.8 (31.0)
Avrodhi	Brownish	Rough	10.1 (101.6)	63.4 (80.0)	32.7	2.2	24.7 (17.4)	51.6 (61.4)	34.0 (31.3)
Vishal	Dark brown	Rough	9.9 (97.6)	68.9 (86.9)	31.7	2.4	25.2 (18.1)	51.5 (61.2)	31.3 (27.0)
GG-4	Dark brown	Rough	10.7 (113.6)	77.7 (95.5)	32.6	2.1	23.9 (16.5)	51.4 (61.1)	31.7 (27.7)
KAK-2	Creamy white	Rough	13.3 (176.3)	66.1 (83.6)	31.7	2.0	31.7 (27.6)	53.3 (64.3)	32.6 (29.0)
Vihar	Dull creamy white	Rough	12.6 (159.3)	63.4 (80.0)	31.4	2.1	25.9 (19.1)	51.2 (60.8)	32.4 (28.7)
L-550	Creamy white	Smooth	12.8 (164.9)	68.9 (86.9)	33.0	2.3	27.6 (21.5)	51.9 (61.9)	30.4 (25.7)
JG-62	Brownish yellow	Rough	12.2 (149.2)	66.1 (83.7)	28.8	1.9	25.2 (18.1)	52.1 (62.2)	31.3 (26.9)
Radha	Small seeded Dark brown	Rough	12.9 (168.7)	59.0 (73.5)	31.7	2.3	25.8 (18.9)	54.2 (65.7)	31.5 (27.3)
C-235	Dull yellow	Rough	11.8 (138.3)	75.0 (93.3)	32.4	2.4	22.5 (14.7)	52.6 (63.1)	32.4 (28.6)
GJG-0201	Dark brown	Rough	12.7 (161.3)	72.8 (91.2)	30.5	2.1	27.5 (21.3)	51.8 (61.7)	33.2 (29.9)
GJG-0301	Dull brown	Rough	10.5 (109.9)	66.1 (83.6)	31.0	2.1	24.0 (16.6)	50.6 (59.7)	33.2 (29.9)
GJG-0305	Brown	Rough	10.8 (116.3)	66.1 (83.6)	31.6	1.9	27.6 (21.5)	52.1 (62.2)	31.6 (27.3)
Gulabi	Brick yellow	Rough	11.2 (126.3)	63.4 (80.0)	32.5	2.7	28.4 (22.7)	51.4 (61.1)	33.2 (29.9)
Mexican Dollar	Bold seeded Pure creamy white	Smooth	14.1 (198.5)	83.9 (98.9)	31.9	2.4	30.9 (26.5)	62.0 (77.9)	34.4 (31.9)
PKV-2	Bold seeded Dull creamy white	Smooth	14.0 (197.3)	77.7 (95.5)	32.7	0.2	29.2 (23.8)	57.1 (70.4)	33.6 (30.7)
SEm±			0.1	4.3	0.8	0.2	1.0	1.6	0.7
CD (0.05)			0.4	12.2	2.4	0.4	2.9	4.7	2.1
C.V.%			1.9	10.7	4.5	11.7			

(*) indicates square root transformed values, (**) Are sine transformation, figure in bracket are retransformed values.

so that insect had an equal chance to choose the genotype for egg laying. The cage was then covered with muslin cloth and fastened with rubber band. Number of eggs laid on each variety was counted after 72h of the release of *C. chinensis*.

Developmental preference in terms of number of adults emerged from known number of eggs was studied. A single egg per grain was kept while other eggs on the grain were punctured with the help of needle and these grains were kept individually in plastic vials in BOD incubator. A set of ten grain with single egg was kept per replication. After 23 days from the day of initial start of experiment, the first observation for the numbers of adult emerge was recorded and observations were continued up to 55 days after which no adult emergence noticed.

The total developmental period was calculated by multiplying the days with number of adults emerged on the day and then divided by total number of adults emerged on the given genotypes.

The growth index was calculated by the formula given by Singh and Pant (1955) as- Growth Index = S / T, Where, S = % of adult emergence, T = Average development period (days).

The varietal susceptibility to *C. chinensis* was determined on the basis of percent grain damage & loss in seed weight due to adult development. The damaged and healthy grains were sorted out and counted in each replication. One or more holes per seed were considered as damaged grains. Following formula was used to work out the per cent damage.

$$\text{Per cent grain damage} = \frac{\text{No. of holded grains}}{\text{Total no. of grains}} \times 100$$

For working out the weight losses, the beetles, frass, excreta etc. were removed from each container and then weighted using single pan electronic balance. The per cent loss in weight was calculated by using following formula.

$$\text{Per cent weight loss} = 1 - F / 1 \times 100$$

Where, I = initial weight of grains,

F = final weight of grains after removal of beetles, frass and excreta etc.

RESULTS AND DISCUSSION

The data presented in Table-1 revealed that significantly maximum numbers of eggs (198.5) were found on variety Mexican dollar which was statistically at par with PKV-2 (197.3). While, the least number of eggs were found on variety Vishal (97.6), which was at par with variety Avrodhi (101.6). Remaining varieties fall in intermediate group in which numbers of eggs laid were ranging fro 109.9 to 176.3. In present findings comparatively higher numbers of eggs were laid on the seeds of Mexican dollar and PKV-2, which had larger seed size, cream in colour and smooth surface. Further, less number of eggs was laid on the seeds of Vishal and Avrodhi, which had the medium seed size and rough surface. Almost similar finding in respect to relationship between seed size, seed surface as well as shape of seed and ovipositional preference were made by Chavan *et al.* (1997a) and Kaur and Ramzan (1998).

Significantly higher per cent adult emergence was recorded in Mexican dollar (98.9%) and found more preferred for adult development (Table-1). The varieties/ genotypes GG-1 (96.3), GG-4 (95.5%), PKV-2 (95.5%), C-235 (93.3%) and GJG-0201 (91.2%) were found statistically at par with the Mexican dollar in respect of adult emergence. Whereas, ICCV-2 recorded the significantly lowest per cent adult emergence (70.7%). Thus, the results indicated that seed surface and seed colour had not much influence on adult emergence, however bold seeded varieties / genotypes with higher seed weight had some influence for the development of this pest. Bhatnagar *et al.* (2001) reported that the adult emergence was higher in highly susceptible lines genotypes and it was reduced in less susceptible lines genotypes.

The longest total developmental period (Table-1) was found in chickpea variety L-550 (33.0 days) which showed no significant no significant difference over the rest of varieties / genotypes except GJG-0201 (30.5 days), GG-1 (30.4 days) and JG-62 (28.8 days). Shortest total developmental period (28.8 days) was recorded in JG-62 but it did not showed significant difference over the varieties / genotypes GG-1 (30.4 days), GJG-0201 (30.5 days) and GJG-0301 (31.0 days) which favours the development of *C. chinensis* showing susceptibility against this pest. More or less similar results were also reported by Singh and Sharma (2003) who reported that the developmental period was significantly longer in resistant varieties of cowpea than the susceptible varieties.

Higher growth indices were recorded on more preferred varieties / genotypes Mexican dollar, Annigeri, JG-62, C-235, GG-4, PKV-2, GJG-0201 and GG-1 which has maximum food value for the development of *C. chinensis* as compared to the resistant variety (ICCV-2 (Table-1). Similarly, Chavan *et al.* (1997b) also differentiated the various cultivars of cowpea into most susceptible and least susceptible group on the basis of their growth indices. They observed the higher growth index values in susceptible varieties of various pulses.

As far as grain damage is concerned it clearly indicated that the chickpea variety KAK-2 recorded the

highest percent grain damage *i.e.* 27.6% and thus found susceptible to pulse beetle (Table-1). While, C-235 recorded the least per cent grain damage (14.7%) and found tolerant. Earlier to this, Akhtari *et al*. (1993) and Bhatnagar *et al.*(2001) reported 10 to 31 and 81.1 per cent grain damage in bean and cowpea genotypes by *C. chinensis* and *C. maculatus*, respectively.

Significantly the highest weight loss (77.9%) due to *C. chinensis* infestation was recorded n variety Mexican dollar as compared to rest of varieties / genotypes (Table-1). White it was significantly lowest in ICCV-2 (55.3) however it was at par with almost all the varieties / genotypes except Dahod yellow (64.3%), KAK-2 (64.3%), Radha (65.7%) and PKV-2 (70.4%) which was intermediate group of varieties / genotypes pertaining to percent weight loss. Manoha and Yadav (1990) reported 16.25 and 44.97 per cent weight loss in least susceptible and most susceptible cultivars of cowpea, respectively.

As far as the viability of the seed is concerned it is evident from the results presented in Table-1 the Maxican dollar registered the highest loss in germination percentage of 31.9%, while it was minimum *i.e.* 25.7% in C-235. Almost similar observations were also made by Kim and Choi (1987).

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