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Screening of Pigeonpea *Cajanus cajan* (L.) Entries Against Pod Borer Complex

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ABSTRACT

The pigeonpea entries were screened during *kharif*-2016. The least larval population and per cent pod damage by the *H. armigera* were observed in the entry BRG 2 (1.16 larvae/plant and 20.39%). Whereas,the maximum larval population and pod damage were noticed in SJP 102 (2.59 and 54.19%). The entries BRG 2, BRG 5, LRG 41 and PUSA 153 were tolerant to *H. armigera* and SJP-102 was susceptible. Larval population and pod damage by *E. atomosa* were least in BRG 2 (1.37 and 18.96%). The entries BRG 2, BRG 5, ICP 49114 and LRG-41 were tolerant while, HaRL-7, ICP-11957 and GRG 2013 were susceptible to *E. atomosa*. Maximum maggot population and per cent pod damage were recorded in LRG 41 (3.51 and 35.47%), PUSA 151 (3.75 and 38.24%) and PUSA 153 (4.38 and 42.91%). The least maggot population and pod damage were observed in the entries *viz*., BRG 2 (1.86 and 22.18%), UPAS-120 (1.56 and 18.63%) and SJP 102 (1.69 and 20.67%), respectively. However, BRG 2, BRG 5, CRG 2012-25, GULIYAL RED, HaRL 11, SJP 102 and UPAS 120 were tolerant while, PUSA 153 was moderately susceptible to *M. obtusa*.

Keywords : Pigeonpea entries, Screening, Larval population, Pod damage

THE pigeonpea *Cajanus cajan* (L.) commonly known as redgram, tur and arhar is an erect and short lived perennial leguminous shrub. Globally 4.33 Million Tonnes of pigeonpea was produced during 2014. India is theworld's largest producer and consumer of pulses including pigeonpea. It is fifth prominent pulse crop in the world and economically it is the second most important pulse crop after chickpea in India, accounting for 12 per cent of the total pulse area and 20 per cent of the total pulse production of the country (Sharma *et al*., 2010). Ninety per cent of the global pigeonpea area is in India, contributing to the 93 per cent of the global production. In India, it is grown on nearly 3.55 million hectares, with an annual production of 2.78 Million Tonnes, with an average productivity of 783 kg per hectare.The major pigeonpea growing states are Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Bihar and Uttar Pradesh, which contribute to the tune of 85 per cent of the total pigeonpea production (Anon., 2016). Maharashtra has unique distinction of contributing about 30 per cent of the total pigeonpea production in the country. In Karnataka, it is cultivated over an area of 728 thousand hectares, with an annual production of 474 thousand tonnes and the productivity of 651 kg per hectare (Anon., 2016). Genetic resistance in plants is one of the effective and economic means of managing the insect pests, in an eco-friendly way. Resistant plants are the first line of defence against the insect pests, which can be easily adopted by the farmers.

The major constraints for the low productivity the pigeonpea are biotic and abiotic stresses. Of the biotic stresses, the insect pests cause a greater damage with an avoidable losses extending up to 78 per cent in India (Anon., 2013). Most of the insect pests attack the crop at reproductive stage causing direct losses. More than 250 species of insects belonging to 8 orders and 61 families have been found to infest pigeonpea. Among them the pod borer, *Helicoverpa armigera* (Hubner); pod fly, *Melanagromyza obtusa* (Malloch); spotted pod borer, *Maruca vitrata* (Geyer); plume moth, *Exelastis atomosa* (May); blister beetle, *Mylabris* spp; pod sucking bugs; *Clavigralla* spp and the bruchids, *Callosobruchus* spp are the most important insect pests, causing damage to the pigeonpea crop (Anon., 2014).

MATERIAL AND METHODS

A field experiment was carried at the University of Agricultural Sciences, Gandhi KrishiVignana Kendra, Bengaluru during the *kharif* 2016, in a Randomized Block Design with sixteen cultivars. Each cultivar was sown in five rows of 3m length at aspacing of 90 × 30 cm and replicated thrice. The cultivars were sown during the first week of August, all the recommended package of practices were followed except the plant protection measures. Observations on the pod borers infesting pigeonpea crop were recorded from bud initiation and continued till the harvesting of the crop. The larvae of the pod borers *Helicoverpa armigera* (Hubner); *Exelastis atomosa* (May) and *Melanagromyza obtuse* (Malloch) were recorded at an interval of 10 days, from five randomly selected and tagged plants. However, *M. obtusa* maggot population per 10 randomly selected pods per plant was recorded at 15 days interval.

From each plot, five plants were selected randomly at the time of maturity and observed for the number of damaged pods by the pod borer complex, on randomly plucked 100 pods from five tagged plants and the percentage was worked out, on the basis of external damage on the pods. The pods were sorted out to four groups to record the damage caused by *H. armigera*, *M. obtusa*, *E. atomosa* and the healthy pods. Per cent pod damage and the yield of each tested entry were compared with the check entry. Larval population of the pod borer complex was converted into square root transformation (√x +0.5). Data on the pod damage was converted into percentage. The percentage data were processed under arcsin transformation Sin-1(√x /100) prior to statistical analysis. Transformed data was analysed by the method of analysis of variance. 'F' test was used at 5 per cent level of significance.The observations on the incidence of the pod feeding insects were expressed by using the equation given below.

$$\text{Per cent pod damage} = \frac{\text{Number of damaged pods}}{\text{Total number of pods observed}} \times 100$$

Category of susceptibility

The genotypes were grouped into resistant, least susceptible, moderately susceptible and highly susceptible on the basis of 0 to 5 rating scale by the method of Mishra *et al.* (2012).

$$\text{Pest susceptibility (\%)} = \frac{\text{P.D. of infester row} - \text{P.D. of test entry}}{\text{P. D. of infester row}} \times 100$$

P.D. = Per cent pods damaged

Susceptibility rating (0 to 5 scale)

Susceptibility Rating	Susceptibility (%)	Category
1	0 to 20	Tolerant
2	21 to 40	Moderately Resistant (MR)
3	41 to 60	Moderately Susceptible (MS)
4	61 to 80	Susceptible (S)
5	81 to 100	Highly Susceptible (HS)

Results and Discussion

Sixteen entries of pigeonpea were screened for their resistance to the pod borer complex *viz*., gram pod borer *H. armigera*, plume moth *E. atomosa* and pod fly *M. obtusa*in field. Incidence of gram pod borer *H. armigera* was least (1.16 larvae/plant) in the entry BRG-2. Whereas, higher number of *H. armigera* larval population of 2.59 larvae per plant was observed in the entry SJP-102. The entry, BRG-2 recorded least larval population of plume moth (1.37 larvae/plant). Whereas, GRG-2013 recorded higher larval population of (3.01 larvae/plant). The least incidence of pod fly (1.56 maggots/50 pods) was recorded in the entry UPAS-120 and significantly higher pod fly maggots (4.38 /50 pods) was observed in PUSA-153 (Table 1).

The per cent pod damage by the *H. armigera* was least in BRG-2 (20.39). Reaction of the entry BRG-2 was similar to BRG-5, LRG-41, PUSA- 153 and PUSA-151 and per cent pod damage in these entries were 23.54, 24.52, 25.45 and 28.42 respectively. Whereas, the maximum pod damage was observed in UPAS-120 and SJP-102 (50.07 and 54.19%). Severity of the *E. atomosa* with respect to per cent pod damage was least in BRG-2 (10.67%). Maximum pod damage was recorded in the entries ICP- 1957, ICPL HaRL-7 and GRG-2013, 51.85, 53.41 and 56.08 per cent respectively. Maximum larvae of 8.63 per plant was observed in GRG-2013 (Table1). Pod damage by

TABLE 1

Larval population and pod damage by pod borer complex on pigeonpea

Germplasm	*H.armigera*		*E. atomosa*		*M. obtusa*		Grain Yield (kg/ha)
	No. larvae/plant	Mean Pod damage (%)	No. larvae/ plant	Mean Pod damage (%)	No. grubs / pod	Mean Pod damage (%)	
BRG-2	0.85 (1.16) efg	12.33 (20.39) gh	1.40 (1.37) i	10.67 (18.96) i	3.00 (1.86) ghi	14.33 (22.18) fgh	1683 a
BRG-5	1.05 (1.24) efg	16.00 (23.54) fgh	2.20 (1.63) hi	13.33 (21.34) hi	4.50 (2.22) gh	16.67 (24.01) efg	1658 ab
CO-6	3.24 (1.93) def	42.33 (40.60) efg	5.13 (2.36) bcd	50.67 (45.41) cd	9.20 (3.11) cd	28.00 (31.93) cde	810 ef
CRG-2012-25	2.61 (1.75) ef	33.67 (35.46) fg	3.61 (2.03) defg	33.33 (35.20) fgh	5.42 (2.42) fghi	18.67 (25.56) efgh	1058 c
GRG-2013	3.12 (1.90) def	38.00 (38.06) defg	8.63 (3.01) a	68.67 (56.08) a	7.68 (2.85) efg	26.33 (30.86) cde	791 efg
GULIYAL RED	3.76 (2.05) bcde	47.33 (43.49) cde	3.32 (1.95) efgh	30.33 (33.34) fgh	5.17 (2.37) fgh	17.33 (24.52) efgh	930 cde
ICP49114	2.37 (1.87) ef	30.00 (33.18) gh	2.56 (2.68) ab	15.00 (22.73) bcd	6.80 (2.69) cde	21.33 (27.40) def	1034 cd
ICP1957	3.00 (1.69) f	36.33 (37.07) fgh	6.73 (1.74) ghi	61.67 (51.85) hi	7.17 (2.77) efg	23.00 (28.64) efg	760 ef
ICPL HaRL 10	4.31 (2.19) bcd	52.33 (46.36) bcd	5.61 (2.46) bc	56.00 (48.49) bcd	8.68 (3.02) ef	27.67 (31.72) cde	687 f
ICPL HaRL 11	3.41 (1.98) cdef	45.00 (42.13) def	4.68 (2.27) cde	47.33 (43.49) def	6.33 (2.61) def	19.33 (25.97) fghi	913 de
ICPL HaRL 7	4.60 (2.26) abc	56.00 (48.50) abc	7.89 (2.89) a	64.33 (53.41) ab	10.80 (3.35) fgh	31.33 (34.02) ghi	683 f
LRG-41	1.08 (1.25) fg	17.33 (24.52) fgh	2.73 (1.79) fgh	18.33 (25.30) ghi	11.83 (3.51) d	33.67 (35.47) bcd	1413 b
PUSA-151	1.40 (1.36) g	22.67 (28.42) i	2.92 (1.84) efg	21.67 (27.68) fghi	13.61 (3.75) bc	38.33 (38.24) b	1275 bc
PUSA-153	1.11 (1.25) g	18.67 (25.45) i	4.13 (2.15) cdef	38.67 (38.47) fgh	18.72 (4.38) a	46.33 (42.91) a	1008 cd
SJP-102	6.23 (2.59) a	65.67 (54.19) a	5.36 (2.41) bc	52.33 (46.36) cde	2.40 (1.69) i	2.67 (20.67) gh	503 g
UPAS-120	4.83 (2.30) ab	58.67 (50.07) ab	4.28 (2.17) cdef	42.33 (40.59) efg	2.00 (1.56) i	10.33 (18.63) h	515 fg
S.Em±	0.10	1.97	0.13	2.08	0.15	1.56	50.00
CD (P=0.05)	0.30	5.68	0.38	6.02	0.45	4.52	144.41
CV%	10.04	9.22	10.57	9.49	9.73	11.37	12.81

Figures given in parenthesis are square root transformed and arcsin transformed values

M. obtusa was least in UPAS-120, SJP-102 and BRG-2 (18.63, 20.67) and 22.18 per cent respectively. Maximum pod damage was observed in PUSA-153 (42.91%), PUSA-151 (38.24%) and LRG-41 (35.47%) (Table 1).

There was significant difference in grain yield among the entries of pigeonpea. Highest grain yield of 1683 and 1658 kg/ha were obtained from BRG-2 and BRG-5, respectively, followed by LRG-41 and PUSA-151 which registered the grain yield of 1413 and 1275 kg/ha. The entries CRG-2012-25, PUSA-153, ICP-49114 and GULIYAL RED recorded 1058, 1008, 1034 and 930 kg/ha, respectively. Least grain yield of 503 kg/ha was obtained from the entry SJP-102 followed by UPAS-120 (515 kg/ha) (Table 1).

TABLE 2

Categorization of pigeonpea entries for their reaction against *H. armigera*

Per cent pod damage	Name of the entries	Reaction
0 – 20	BRG-2, BRG-5, LRG-41, PUSA-153	Tolerant
21 – 40	PUSA-151, ICP-11957, ICP-49114, GRG-2013, CRG-2012-25	Moderately Resistant
41 – 60	CO-6, GULIYAL RED, ICPL HaRL-10,ICPL HaRL-7, ICPL HaRL-11, UPAS-120	Moderately Susceptible
61 – 80	SJP-102	Susceptible

TABLE 3

Categorization of pigeonpea entries for their reaction against *E.atomosa*

Per cent pod damage	Name of the entries	Reaction
0 – 20	BRG-2, BRG-5, ICP-49114, LRG-41,	Tolerant
21 – 40	PUSA-151, PUSA-153, GULIYAL RED,CRG-2012-25	Moderately Resistant
41 – 60	CO-6, ICPL HaRL-10, ICPL HaRL-11, SJP-102, UPAS-120	Moderately Susceptible
61 – 80	ICPL HaRL-7, ICP-11957, GRG-2013	Susceptible

TABLE 4

Categorization of pigeonpea entries for their reaction against *M.obtusa*

Per cent pod damage	Name of the entries	Reaction
0 – 20	BRG-2, BRG-5, CRG-2012-25, GULIYALRED, ICPL HaRL-11, SJP-102, UPAS-120	Tolerant
21 – 40	CO-6, GRG-2013, ICP-49114, ICP-11957,ICPL HaRL-10, ICPL HaRL-7, LRG-41,PUSA-151	Moderately Resistant
41 – 60	PUSA-153	Moderately Susceptible

Present observations are in accordance with the findings of Dar *et al*. (2005) and Srivastava and Joshi (2011). They observed higher damage of pod fly in long duration and late maturing pigeonpea entries. The variations in population and percent pod damage recorded during the studies on early and late maturing entries of pigeonpea may be due to coincidence of phenological and pod developmental stages on these entries. Similar observations were made by the earlier workers Singh and Singh (2002) and Durairaj and Shanower (2003).

The entries BRG-2 and BRG-5 were tolerant to the borers. Whereas, the entries PUSA-151 and ICP-11957 were moderately resistant. The entries CO-6 and UPAS-120 were moderately susceptible and SJP-102 was susceptible to the gram pod borer *H. armigera* (Table 2). Entries PUSA-151and PUSA-153 were moderately resistant to the pod borer *E. atomosa*.Whereas, CO-6 and UPAS-120 were moderately susceptible. Entries ICPL HaRL-7, ICP-11957, GRG-2013 were susceptible to *E. atomosa* (Table 3). In the present study the entry PUSA-153 was moderately susceptible to pod fly *M. obtusa* and CO-6, GRG-2013, ICP-49114 were categorised as moderately resistant (Table 4). The observations made during the studies are in conformity with the findings of Chavan *et al*. (2010), Gangwar *et al*. (2009) and Kooner *et al*. (2006). They made the similar observations on the reaction of pigeonpea entries against the pod borer complex.

The early maturing entries UPAS-120 and SJP-102 were found susceptible to *H. armigera* and *E. atomosa*. Whereas, late maturing entries *viz*., LRG-41, PUSA-151 and PUSA-153 were tolerant to *H. armigera* and *E. atomosa*. The incidence and pod damage by the podfly *M. obtusa* was least in early maturing entries, UPAS-120, SJP-102 and it was high in late maturing entries, LRG-41, PUSA-151 and PUSA-153.

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