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Field screening of pigeonpea genotypes to pod borer, *Helicoverpa armigera*

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Abstract
A field experiment was conducted during *Kharif*, 2018 to screen twenty pigeonpea genotypes for their resistance or susceptible to gram pod borer, *Helicoverpa armigera*. The results showed that the genotypes, RKPV 527-01, GJP 1606, JKM 189, BDN 711, ICPL-87119, RVSA 16-4, IPA 15-05 and LRG 467 were found resistant with regard to per cent pod damage and eight genotypes *viz.*, RVSA 16-4(1.59), JKM 189(1.64), LRG 467 (2.20), GJP 1606(2.23), BDN 711(2.29), RKPV 527-01(2.58), ICPL 87119(2.58) and IPA 15-05(2.88) were found resistant with regard to per cent seed damage and were grouped under resistant category as they have recorded the pest suspectibility rating ranging from 1 to 5. Maximum seed yield was recorded in RVSA 16-4 (987.33 kg ha^{-1}), followed by LRG 467(958.00), WRP 1(812.33) and RKPV 527-01(793.87), while minimum seed yield was recorded in ICPL 8863 (360.67 kg ha^{-1}).

Keywords: Pigeonpea, genotypes, *Helicoverpa armigera*

Introduction
Pulses are referred as poor man’s meat since they provide a concentrated source of valuable, digestible and high quality vegetarian protein. They are well known as cheap source of dietary proteins of food, feed and fodder for animals. Pulses are grown in semi-arid regions under a wide variety of agro climatic conditions. India is the major pulse growing country in the world of which pigeonpea *Cajanus cajan* (L.) ranks second in area and production and contribute about 90% in the world’s pulse production. In Andhra Pradesh, it is cultivated in an area of 2.76 lakh hectares with 1.39 lakh tonnes of production and with productivity of 504 kg/ha (Anonymous, 2019) [2]. The production of pigeonpea is very low even in the era of green revolution. In recent years, there has been significant decline in the pigeonpea production in India, leading to price increase and reduction in per capita availability. The relatively low crop yields may be attributed to non-availability of improved cultivars, poor crop husbandry and exposure to a number of biotic and abiotic stresses in pigeonpea growing regions. Among the various constraints, insect pests are one of the major and important ones affecting the productivity of pigeonpea apart from ecological and biological constraints. It is attacked by more than 300 species of insects of which gram pod borer, *Helicoverpa armigera* (Hubner) is the most important pests causing heavy yield loss (Sachan *et al.*, 1994) [9]. It accounts for 90-95% of total damage. A single larva can damage 25-30 pods of gram in its life time. It feeds on tender shoots and young seeds. It make holes in pods and insert its half body inside the pod to eat developing seeds (Ojha *et al.*, 2017) [8]. The yield loss due to *H. armigera* was estimated to be more than 60% (Vishakantaiah and Babu, 1980). The annual monitory loss was estimated globally as US $ 400 million (ICRISAT, 2007) [6]. Farmers depend heavily on the use of synthetic insecticides to combat these insect pests. Extensive use of synthetic insecticides has resulted in disturbances of the environment, pest resurgence, pest resistance to pesticides and lethal effect to non-target organisms in the agro-ecosystem in addition to direct toxicity to users. Therefore, it has now become necessary to search for the alternative means of pest control, which can minimize the use of synthetic pesticides. Out of several approaches available for the management, identification and use of resistant varieties is viable and cost effective option. Keeping all these in view, the present studies on screening of pigeonpea genotypes against *H. armigera* was contemplated at Regional Agricultural Research Station, Lam, and Guntur during 2018-19.

Material and methods
A Field experiment was conducted at Regional Agricultural Research Station (RARS), Lam,

Guntur during *kharif* 2018-2019. All the agronomic practices were adopted as per the recommendation of Acharya N G Ranga Agricultural University in raising the crop during the experimental period. After sufficient amount of rain, sowing was taken up under saturated conditions of soil by adopting 1.5 x 0.2 m spacing between rows and plants with the help of gorru. Gap filling and thinning was done at 15 and 30 days after sowing, respectively to maintain uniform population. Recommended fertilizer dosage of 20 kg N and 50 kg P_2O_5 ha^{-1} was adopted. Nitrogen was applied in split doses and was phosphorus applied as basal dose one month after sowing. Twenty genotypes including resistant check (LRG 52) obtained from different All India Coordinator Research Project on Pigeonpea centers across the country were sown during *kharif*, 2018 to evaluate the resistant/tolerance levels against *H.armigera* in field under unprotected conditions in Randomized block design (RBD) with three replications. Each germplasm accession was accommodated in two rows each of 4m length. The larval counts from flowering to pod maturation stage was recorded at ten days interval on five randomly tagged plants. To assess the degree of infestation, two hundred pods were picked out from each replication at the time of harvest and per cent pod damage was calculated. The pods damaged by gram pod borer have characteristic big circular holes (Sharma, 1998) [10].

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

At the time of harvest, two hundred pods per replication were collected at random and were split open to count healthy and damaged seeds and the per cent seed damage was calculated (Gangwar *et al.*, 2009) [5].

$$\text{Per cent seed damage} = \frac{\text{Number of damaged seeds}}{\text{Total number of seeds}} \times 100$$

In order to group the genotypes, the pest susceptibility was calculated using the following formula and then converted to 1 to 9 rating scale as given by Abbott (1925) [1].

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

Where
P.D. = mean of per cent pods or seeds damaged

Pest Susceptibility rating	Pest Susceptibility (%)	Remarks
1	100	A rating of scale 1-5 was considered as resistant, 6 was equal to check and from 7-9 as susceptible.
2	75 to 99.9	
3	50 to 74.9	
4	25 to 49.9	
5	10 to 24.9	
6	-10 to 9.9	
7	-25 to -9.9	
8	-50 to -24.9	
9	-50 or less	

Seed yield per plant was calculated for each genotype. Pods collected from each plant were threshed, cleaned, dried and seed weight was measured for all genotypes using a balance. Seed yield per plot was coverted to seed yield kg/ha.

Plate 1: Gram pod borer, *H. armigera* and its pod damage on pigeonpea

Results and Discussion

The genotypes showed a great deal of variation in respect to per cent pod and seed damage due to *H. armigera*. However, none of the genotypes were found free form infestation.

Larval population (No.)

The observations made on larval population of *H. armigera* revealed that there exists a significant difference among genotypes (Table 1**).** The average number of *H. armigera* larvae per plant ranged from 0.18 (RVSA 16-4) to 5.59 (ICPL 8863) with a mean of 2.18 larvae per plant. These findings were in conformity with Khorasiya *et al.* (2014) [7] who observed larval incidence of 2.17 $plant^{-1}$ in BDN 2.

Pod Damage (%)

The results indicated that per cent pod damage due to *H.armigera* in different pigeonpea genotypes differed significantly and was in range of 3.33 (RVSA 16-4) to 18.67 (ICPL 8863) with a mean of 9.80%. Out of 20 genotypes screened for resistance/tolerance against *H.armigera*, based on per cent pod damage, eight genotypes *viz.*, RVSA 16-4 (3.33), JKM 189 (4.67), GJP 1606 (5.33), BDN 711 (5.33), LRG 467 (5.33), IPA 15-05 (5.33), ICPL 87119 (6.00) and RKPV 527-01(6.00) were grouped under resistant category as they recorded the pest suspectibility rating ranging from 1 to 5; and eleven genotypes *viz.*, WRP 1 (10.00), BDN 716 (10.67), TJT 501 (12.00), GRG 152 (12.00), LRG 463 (13.33), BDN 2 (13.33), LRG 460 (14.00), LRG 466 (15.33), LRG 464 (16.00) and ICPL 8863 (18.67) were grouped under susceptible category as they recorded the pest suspectibility rating ranging from 7 to 9 (Table 1 and Fig 1). The present findings were in agreement with Chauhan and Dahiya (1993) [8] who reported that pod damage due to pod borers was in range of 5.00 to 26.3% among different genotypes.

Seed Damage (%)

The results indicated that per cent seed damage by *H.armigera* in different pigeonpea genotypes differed significantly and was in range of 1.59 (RVSA 16-4) to 10.65 (ICPL 8863) with a mean of 5.00%. Out of 20 genotypes screened for resistance/tolerance against *H.armigera* based on per cent seed damage, eight genotypes *viz.*, RVSA 16-4(1.59), JKM 189(1.64), LRG 467 (2.20), GJP 1606(2.23), BDN 711(2.29), RKPV 527-01(2.58), ICPL 87119(2.58) and IPA 15-05(2.88) and were grouped under resistant category as they recorded the pest suspectibility rating ranging from 1 to

5; and ten genotypes *viz.*, BDN 2(4.82), PA 440(5.36), TJT 501(6.29), LRG 466(6.48), LRG 463(6.61), WRP 1(6.91), LRG 464(6.97), LRG 460(8.97), BDN 716(9.92), and ICPL 8863(10.65) were grouped under susceptible category as they recorded the pest suspectibility rating ranging from 7 to 9. The genotype GRG 152(4.61%), with pest susceptibility rating of 6 was equal in performance to check genotype LRG 52(4.37%) (Table 3). The observations also revealed that the genotypes with high rate of pod damage by pod borers show high degree of seed infestation. The number of days taken for 50% flowering ranged from 121(RVSA 16-4) to 101(ICPL 8863) days with a mean of 110 days. Whereas, the number of days taken for maturity ranged from 181 (RVSA 16-4) to 161(ICPL 8863) days with a mean of 169 days. The results obtained on seed yield of different genotypes showed distinct variation with a mean yield of 674 kg ha^{-1}. Maximum (987 kg ha^{-1}) and minimum (361 kg ha^{-1}) seed yield was recorded in RVSA 16-4 and ICPL 8863 respectively (Table 5). The results were in agreement with findings of Sreekanth *et al.* (2017) [11] who reported that seed yield of 760.00 kg/ha with WRP 1.

Table 1: Pest susceptibility rating for different pigeonpea genotypes based on per cent pod damage by *H.armigera* during *Kharif*, 2018-2019

S. No.	Name of the genotype	No. of *H.armigera* larvae /plant	Pod damage (%)	Pest suscepbility (%)	Susceptibility rating	Remarks
1	TJT 501	2.83 (1.89)*	12.00 (20.26)**	-63.71	9	S
2	LRG 463	3.32 (2.07)	13.33 (21.14)	-81.85	9	S
3	RKPV 527-01	0.65 (1.26)	6.00 (13.83)	18.14	5	R
4	PA 440	2.95 (1.97)	12.00 (20.26)	-63.71	9	S
5	GJP 1606	0.49 (1.20)	5.33 (13.16)	27.28	4	R
6	JKM 189	0.49 (1.19)	4.67 (12.16)	36.28	4	R
7	WRP 1	3.25 (2.06)	10.00 (18.43)	-36.42	8	S
8	GRG 152	2.69 (1.91)	12.00 (20.22)	-63.71	9	S
9	BDN 711	0.52 (1.21)	5.33 (13.16)	27.28	4	R
10	ICPL 87119	0.41 (1.16)	6.00 (13.83)	18.14	5	R
11	RVSA 16-4	0.18 (1.08)	3.33 (6.14)	54.57	3	R
12	BDN 716	3.24 (2.05)	10.67 (18.98)	-45.56	8	S
13	IPA 15-05	0.55 (1.22)	5.33 (13.16)	27.28	4	R
14	LRG 460	3.09 (2.02)	14.00 (21.85)	-90.99	9	S
15	LRG 466	3.01 (1.98)	15.33 (22.85)	-109.14	9	S
16	LRG 467	0.38 (1.14)	5.33 (7.86)	27.28	4	R
17	BDN 2	3.68 (2.16)	13.33 (21.19)	-81.85	9	S
18	ICPL 8863	5.59 (2.56)	18.67 (25.38)	-154.70	9	S
19	LRG 464	4.15 (2.26)	16.00 (23.57)	-118.28	9	S
20	LRG 52 (RC)	2.19 (1.76)	7.33 (15.59)	-	-	-
Mean		2.18	9.80	-	-	-
F-test		Sig.	Sig.	-	-	-
SEm±		0.34	3.85	-	-	-
CD (p=0.05)		0.99	11.03	-	-	-
CV (%)		11.79	12.97	-	-	-

Pest Susceptibility rating:
1 to 5 –Resistant, 6- Equal to check, 7 to 9 – Susceptible R ---Resistant S---Susceptible;
Sig. – Significant

* Figures in parentheses are square root $\sqrt{(n+1)}$ transformed values
**Figures in parentheses are arc sine transformed values

Table 2: Pest susceptibility rating for different pigeonpea genotypes based on per cent seed damage by *H.armigera* during *Kharif*, 2018-2019

S.No.	Name of the genotype	Seed damage (%)	Pest suscepbility (%)	Susceptibility rating	Remarks
1	TJT 501	6.29 (14.51)	-43.93	8	S
2	LRG 463	6.61 (14.83)	-51.25	9	S
3	RKPV 527-01	2.58 (7.36)	40.04	4	R
4	PA 440	5.36 (13.38)	-22.65	7	S
5	GJP 1606	2.23 (8.58)	48.97	4	R
6	JKM 189	1.64 (6.01)	62.47	3	R
7	WRP 1	6.91 (15.10)	-58.12	9	S
8	GRG 152	4.61 (9.79)	-5.49	6	Equal to check
9	BDN 711	2.29 (6.97)	47.59	4	R
10	ICPL 87119	2.58 (7.36)	40.96	4	R
11	RVSA 16-4	1.59 (4.20)	63.61	3	R
12	BDN 716	9.92 (18.33)	-127.00	9	S
13	IPA 15-05	2.88 (9.71)	34.09	4	R
14	LRG 460	8.97 (17.26)	-105.26	9	S
15	LRG 466	6.48 (14.16)	-48.28	8	S
16	LRG 467	2.20 (4.96)	49.65	4	R
17	BDN 2	4.82 (12.59)	-10.29	7	S
18	ICPL 8863	10.65(19.04)	-143.70	9	S

19	LRG 464	6.97 (15.08)	-59.49	9	S
20	LRG 52 (RC)	4.37 (11.47)	-	-	-
Mean		5.00	-	-	-
F-test		Sig.	-	-	-
SEm±		3.27	-	-	-
CD (p=0.05)		9.37	-	-	-
CV (%)		16.39	-	-	-

Pest Susceptibility rating:
1 to 5 –Resistant, 6- Equal to check, 7 to 9 – Susceptible
R ---Resistant S---Susceptible; Sig. – Significant
Figures in parentheses are arc sine transformed values

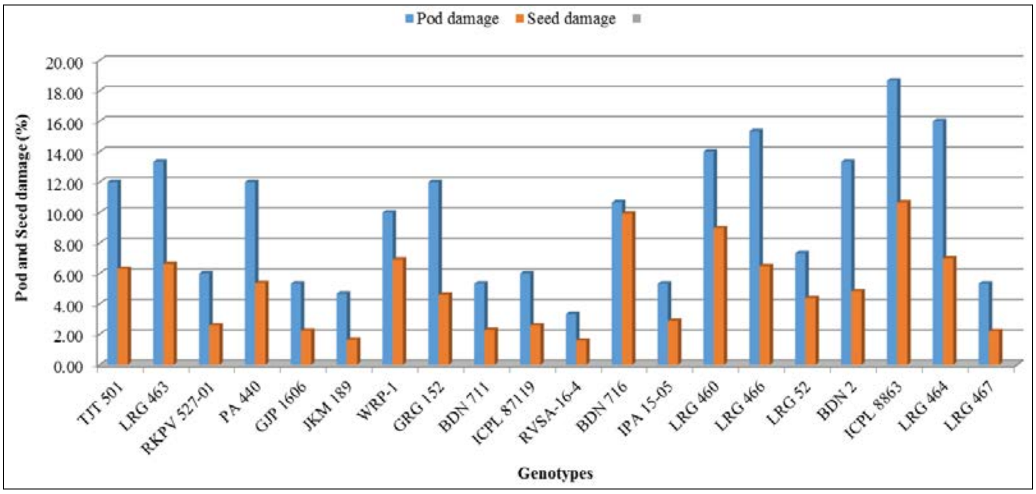

Fig 1: Response of pigeonpea genotypes to per cent pod and seed damage due to H.armigera during Kharif, 2018-2019

Table 3: Yield particulars of different pigeonpea genotypes during *Kharif*, 2018-2019

S. No.	Name of the genotype	Days to 50% flowering	Days to maturity	Seed yield (kg ha^{-1})
1	TJT 501	105	165	677
2	LRG 463	111	171	520
3	RKPV 527-01	105	165	794
4	PA 440	103	163	662
5	GJP 1606	108	168	762
6	JKM 189	112	172	731
7	WRP 1	105	165	812
8	GRG 152	106	166	498
9	BDN 711	107	167	679
10	ICPL 87119	115	175	658
11	RVSA 16-4	121	181	987
12	BDN 716	107	167	746
13	IPA 15-05	104	164	553
14	LRG 460	111	171	511
15	LRG 466	109	169	667
16	LRG 467	111	171	958
17	BDN 2	108	168	726
18	ICPL 8863	101	161	361
19	LRG 464	117	177	621
20	LRG 52 (RC)	119	179	560
Mean		110	169	674
F-test		NS	NS	Sig.
SEm±		4.63	4.63	64
CD (p=0.05)		13.26	13.26	182
CV (%)		7.34	4.74	16.34

Sig. – Significant
NS –Non significant

Conclusions

The experimental results showed that the genotypes RKPV 527-01, GJP 1606, JKM 189, BDN 711, ICPL-87119, RVSA 16-4, IPA 15-05 and LRG 467 were found resistant to *H.armigera* with regard to per cent pod damage with pest suspectibility rating ranging from 1 to 5. Maximum seed yield was recorded in RVSA 16-4 (987.33 kg ha^{-1}), followed by LRG 467(958.00), WRP 1(812.33) and RKPV 527-01(793.87), while minimum seed yield was recorded in ICPL 8863 (360.67 kg ha^{-1}).

References

1. Abbott WS. A method of computing the effectiveness of an insecticide. Journal of Economic Entomology 1925;18:265-267.
2. Anonymous. All India Co-ordinated Research Project on Pigeonpea. Project Co-ordinator’s Report (2018-19), 2019, 23-24.
3. Chauhan R, Dahiya B. Response of some pigeonpea genotypes to pod borer, *Helicoverpa armigera* and pod fly, Melanagromyza obtuse in Haryana. Indian Journal of Plant Protection 1993;21(2):21-25.
4. Gomez KA, Gomez AA. *Statistical procedures for Agricultural Research*. John Wiley and Sons, New Delhi 1984,680.
5. Gangwar KL, Bajpai GC, Kerkhi SA, Sachan SK. Pod borer susceptibility reaction in interspecific hybrids of pigeonpea. Indian Journal of Genetics 2009;69(1):58-61.
6. ICRISAT. The medium term plan. International Crops Research Institute for the Semi Arid Tropics, Patancheruvu, 502324, AP, 2007, 3.
7. Khorasiya SG, Vyas HJ, Jethva DM, Joshi PH. Screening of pigeonpea varieties for resistance against *Helicoverpa armigera* (Hubner) Hardwick. International Journal of Forestry and Crop Improvement 2014;5(2):25-27.
8. Ojha PK, Kumari R, Chaudhary RS. Field evaluation of certain biopesticides against *Helicoverpa armigera* Hubner (Noctuidae:Lepidoptera) and its impact on pod damage and per plant yield of chickpea. Journal of Entomology and Zoology Studies 2017;5(2):1092-1099.
9. Sachan J, Yadav CP, Ahmad R, Katti G. Insect pest management in pulse crops. In G.S. Dhaliwal and Ramesh Arora (eds) - Trends in Agricultural Insect Pest Managment, New Delhi, 1994, 308-344.
10. Sharma HC. Bionomics host plant resistance and management of legume pod borer, *Maruca vitrata*- a review of crop protection 1998;17:373-386.
11. Sreekanth M, Rajmani S, Ramana MV. Screening of pigeonpea (*Cajanus cajan* (L.) millsp.) genotypes against major insect pests. International Journal of Biology Research 2017;2(4):94-96.
12. Vishakantaiah M, Babu JCC. Bionomics of the tur web worm, *Maruca testulalis* (Lepidoptera: Pyralidae). Mysore Journal of Agricultural Sciences 1980;14:52-53.