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Evaluation of medium duration pigeonpea genotypes against pod borers

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Abstract
An experiment on screening of different pigeonpea genotypes conducted at Regional Agricultural Research Station, Lam, Guntur during *Kharif*, 2014 revealed that based on per cent pod and grain damage five genotypes *viz.*, LRG 30, LRG 41, ICPL 87119, ICP 8863 and BSMR 853 were grouped under resistant category and nine genotypes *viz*., TDRG 33, Guliyal local, WRP 1, CO 6, LRG134, RVSA 9, SKNP 224, ICPL 4503 and WRG 79 were grouped under susceptible category against *H. armigera*. Further, four genotypes ENT 11, CRG 210-09, PT 04-307 and BRG 10-2 exhibited resistance against pod damage but showed susceptibility towards grain damage. While, the reaction was *vice versa* in genotype Kanpur local. Similarly, based on per cent pod and grain damage five genotypes *viz.*, LRG 30, LRG 41, ICPL 87119, ICP 8863 and BSMR 853 were grouped under resistant category and nine genotypes *viz.*, Guliyal local, WRP 1, CO 6, LRG 134, ENT 11, SKNP 224, Kanpur local, CRG 2010-09 and BRG 10-2 were grouped under susceptible category against *M. vitrata*. Further, five genotypes *viz.*, TDRG 33, RVSA 9, ICPL 4503, WRG 79 and PT 04-307 exhibited resistance against pod damage but showed susceptibility towards grain damage. None of the genotype showed susceptibility to pod damage and resistance to grain damage against *M. vitrata.*

Keywords: Germplasm, gram pod borer, *Helicoverpa armigera*, *Maruca vitrata*, pigeonpea, spotted

1. Introduction
Pigeonpea [*Cajanus cajan* (L.) Millsp.] is an important drought tolerant leguminous crop in semi-arid tropical and sub-tropical farming systems representing about 5% of world legume production. In India pigeonpea was grown in 5.32 million ha with a production of 4.78 million tonnes and productivity of 898 kg / ha, whereas, in Andhra Pradesh, the area, production, productivity of pigeonpea was 3.45 Lakh ha, 2.24 Lakh tonnes and 649 kg/ha, respectively during 2016-17 (AICRP report, 2017) [2]. The average global productivity of pigeonpea has remained static over the last three decades (Choudhary *et al.*, 2013) [4]. Nearly 300 species of insect pests are known to infest pigeonpea at its various growth stages. Among these insect pests, gram pod borer, *Helicoverpa armigera* (Hubner) and spotted pod borer, *Maruca vitrata* (Geyer) cause significant economic loss, especially cause damage to economical parts such as flowers, buds and pods. Under favorable conditions, *H. armigera* causes 60 to 90 per cent loss in grain yield. In all crops put together it was estimated to cause a loss of US $400 million annually (ICRISAT, 2007) [7]. Similarly, *M. vitrata* was estimated to cause 9-84% yield loss (Vishakantaiah and Jagadeesh Babu, 1980) [12] with an annual monitory loss in India was estimated around US $30 million (Saxena *et al.*, 2002) [10].
Under field conditions, large array of insecticides were used for pest control, but over the period of time, indiscriminate and over use of insecticides provoked counterproductive in crop ecosystem on many aspects such as development of insecticidal resistance, residues on produce, resurgence, destruction of natural enemies and above all endangering human habitat. Under these circumstances, the present studies were contemplated to manage these pests.

2. Materials and Methods
Twenty pigeonpea genotypes obtained from different All India Coordinated Research Project on Pigeonpea centres were sown during *Kharif*, 2014 to evaluate the resistance levels against *H. armigera* and *M. vitrata* in the field under unprotected conditions in a Randomized Block Design (RBD) with 2 replications. Each germplasm accession was accommodated in two rows each of 4 m length. For each genotype, number of days to 50% flowering and days to maturity was noted.

The webbings caused due to *M. vitrata* and the number larvae were recorded from flowering stage to pod development stage at 10 days interval on 5 randomly selected tagged plants. Similarly, on every genotype, number of eggs and larvae pertaining to *H. armigera* were recorded from flowering stage to pod formation at 10 days interval on 5 randomly selected tagged plants. To assess the degree of infestation two hundred pods were picked out randomly from each replication at the time of harvest and the per cent pod damage was calculated. The pods damaged by gram pod borer have characteristic big circular holes on pods. The pods damaged by spotted pod borer have small holes with scrapped margins and the entrance of holes plugged with larval excreta with shrivelled seeds. Grain damage due to both the pests was assessed. Plot yield obtained was converted to grain yield per ha. 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].

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

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

Table: Type of rating and %

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	

Pod yield and grain yield per plant was calculated for each genotype. The data was subjected to RBD analysis using AGRES package (Gomez and Gomez, 1984) [5].

3. Results and Discussion

The results showed a great deal of variation in respect of per cent pod and grain damage. None of the genotypes were completely free from infestation due to both the borers.

The observations made on eggs and larvae of *H. armigera* revealed that there was a significant variation among the genotypes (Table 1). The average number of eggs per plant ranged from 1.90 (LRG 41) to 3.75 (Guliyal local) with a mean of 2.44 eggs per plant. The present findings were more or less in conformity with the findings of Rathod *et al.* (2014)[9] who observed that *H. armigera* eggs on different pigeonpea genotypes ranged between 1.18 (BSMR 853) and 2.43 (ICPL 87119). Similarly, the larval population ranged from 1.72 (LRG 41) to 5.14 (Guliyal local) with a mean of 2.43 larvae per plant (Table 1). These findings were in conformity with Sunitha Devi *et al.* (2014) [11] who observed that larval incidence of 3.22 plant^{-1} in ICPL 85063. The results also indicated that per cent pod and grain damage by *H. armigera* in different pigeonpea genotypes differed significantly (Table 2 and Fig. 1). The pod damage was in the range of 5.55 (LRG 41) to 20.09 (Guliyal local) with a mean of 13.05 %, whereas, the grain damage was in the range of 7.25 (LRG 41) to 37.30 (Guliyal local) with a mean of 17.60 per cent. Out of 20 genotypes screened for resistance/tolerance against *H. armigera*, based on per cent pod damage, nine genotypes viz., LRG 30 (6.82), LRG 41 (5.55), ICPL 87119 (10.00), ICPL 88663 (10.34), ENT 11 (10.50), BSMR 853 (9.10), CRG 2010-90 (11.00), PT 04-307 (10.23) and BRG 10-2 (11.36) were grouped under resistant category as they recorded the pest susceptibility rating ranging from 1 to 5; and ten genotypes *viz.*, TDRG 33, Guliyal local, WRP 1, CO 6, LRG 134, RVSA 9, SKNP 224, ICPL 4503, Kanpur local and WRG 79 were grouped under susceptible category as they showed the pest susceptibility rating ranging from 6 to 9 (Table 2). The present findings were in agreement with Kooner and Cheema (2006) [8] who reported that pod damage due to pod borers was in the range of 11.21 to 28.21% among different genotypes. Similarly, out of 20 genotypes based on per cent grain damage, six genotypes *viz.*, LRG 30 (11.10), LRG 41 (7.25), ICPL 87119 (12.95), ICP 8863 (13.50), Kanpur local (11.54) and BSMR (11.80) were grouped under resistant category as they recorded the pest susceptibility rating ranging from 1 to 5; and 14 genotypes *viz*. TDRG 33 (21.05), Guliyal local (37.30) WRP 1 (31.75), CO 6 (18.80), LRG 134 (17.65), RVSA 9 (21.20), ENT 11 (16.35), SKNP 224 (18.20), ICPL 4503 (16.67), WRG 79 (15.91), CRG 2010-09 (18.35), PT 04-307 (16.65) and BRG 10-2 (17.50) were grouped under susceptible category as they showed the pest susceptibility rating ranging from 6 to 9 (Table 2). The observation also revealed that the genotypes with the higher rate of pod damage by the gram pod borer showed higher rate of grain infestation.

The observations made on larval population of *M. vitrata* showed that there was a significant variation among the genotypes. The average number of larvae per plant ranged from 1.42 (LRG 41) - 9.68 (Guliyal local) with a mean of 3.29 larvae per plant (Table 3). These findings were in conformity with Rathod *et al.* (2014) [9] who observed 2.47 larvae per plant in ICPL 87119. The average number of webs per plant ranged from 1.57 (LRG 41) - 9.95 (Guliyal local) with a mean of 3.50 (Table 3). These findings were in line with Gopali *et al.* (2010) [6] who observed 1.20, 4.51, 3.75 and 1.87 webs per plant in ICP 8 863, ICPL 87119, Guliyal local and WRP 1, respectively. The per cent pod damage due to *M. vitrata* in different pigeonpea genotypes varied significantly and ranged from 6.50 (LRG 41) - 22.59 (Guliyal local) with a mean of 13.76 % (Table 4). Thus, based on per cent pod damage 11 genotypes *viz.*, LRG30 (10.77), LRG 41 (6.50), ICPL 87119 (10.36), ICPL 8863 (11.70), TDRG 33 (12.64), RVSA 9 (12.50), ICPL 4503 (11.38), WRG 79 (10.50) BSMR 853 (9.24), CRG 2010-09 (14.17) and PT 04-307 (12.24) were grouped under resistant category as they recorded pest susceptibility rating ranging from 1 to 5 and the remaining eight genotypes *viz.*, Guliyal local (22.59), WRP (22.32), CO 6 (13.64), LRG 134 (14.10), ENT 11 (14.70), SKNP (18.16), Kanpur local (17.00) and BRG 10-2 (16.50) were grouped under susceptible category as they showed pest susceptibility rating ranging from 6-9 (Table 4). Similarly, the per cent grain damage due to *M. vitrata* in different pigeonpea genotypes differed significantly and ranged from 8.23 (LRG 41) - 32.73 (Guliyal local) with a mean of 18.91 % (Table 4). Thus, based on per cent grain damage five genotypes *viz.*, LRG30 (12.64), LRG 41 (8.23), ICPL 87119 (14.97), ICP 8863 (9.76) and BSMR 853 (10.22) were grouped under resistant category as they recorded pest susceptibility rating ranging from 1 to 5 and the remaining 14 genotypes *viz.*,

TDRG 33 (16.05), Guliyal local (32.73), WRP 1 (28.48), CO 6 (19.50), LRG 134 (20.89), RVSA 9 (18.37), ENT 11 (16.89), SKNP (26.14), ICPL 4503 (17.63), Kanpur local (18.86), WRG 79 (21.73), CRG 2010-09 (22.22), PT 04-307 (21.15) and BRG 10-2 (23.73) were grouped under susceptible category as they showed pest susceptibility rating ranging from 6-9 (Table 4). The observations also revealed that the genotypes with a higher rate of pod damage by the spotted pod borer showed higher rate of grain infestation (Table 4 and Fig. 2).

Based on per cent pod and grain damage due to *H. armigera*, five genotypes viz., LRG 30, LRG 41, ICPL 87119, ICP 8863 and BSMR 853 were grouped under resistant category and nine genotypes *viz*., TDRG 33, Guliyal local, WRP 1, CO 6, LRG134, RVSA 9, SKNP 224, ICPL 4503 and WRG 79 were grouped under susceptible category (Table 5). Further, four genotypes ENT 11, CRG 210-09, PT 04-307 and BRG 10-2 exhibited resistance against pod damage but showed susceptibility towards grain damage. While, the reaction was *vice versa* in genotype Kanpur local (Table 5). Similarly, against *M. vitrata* five genotypes *viz.*, LRG 30, LRG 41, ICPL 87119, ICP 8863 and BSMR 853 were found resistant and nine genotypes *viz.*, Guliyal local, WRP 1, CO 6, LRG 134, ENT 11, SKNP 224, Kanpur local, CRG 2010-09 and BRG 10-2 were found susceptible to *M. vitrata* with regard to per cent pod and grain damage respectively. Further, five genotypes *viz.*, TDRG 33, RVSA 9, ICPL 4503, WRG 79 and PT 04-307 exhibited resistance against pod damage but showed susceptibility towards grain damage. None of the genotype showed susceptibility to pod damage and resistance to grain damage against *M. vitrata* (Table 6).

The number of days taken to 50% flowering ranged from 103 (Guliyal local) to 122 (LRG 41) days with a mean of 115.5 days. Similarly, number of days taken to maturity ranged from 163.0 (Guliyal local) to 182.0 (LRG 41) with a mean of 175.7 days (Table 7). The results obtained on the pod yield showed a distinct variation among the genotypes with the mean pod yield per plant as 347.6 g. Maximum (549.5 g) and Minimum (176.8g) pod yield was recorded in LRG 41 and Guliyal local, respectively. The grain yield obtained in different genotypes ranged between 97.6 (Guliyal local) to 382.7 g (LRG 41) per plant with a mean of 216.1 g (Table 7). The results were in agreement with the findings of Banu *et al*. (2007) [3] who reported that lowest yield loss against *H. armigera* with highest grain yield was recorded in LRG 41.

4. Conclusion

The present investigation clearly concludes that five genotypes *viz*., LRG 30, LRG 41, ICPL 87119, ICP 8863 and BSMR 853 were identified resistant to both the pod borers *viz*., *H. armigera* and *M. vitrata* based on per cent pod and grain damage; four genotypes ENT 11, CRG 210-09, PT 04-307 and BRG 10-2 exhibited resistance against pod damage but showed susceptibility towards grain damage. While, the reaction was *vice versa* in genotype Kanpur local against *H. armigera*. Similarly, five genotypes *viz.*, TDRG 33, RVSA 9, ICPL 4503, WRG 79 and PT 04-307 exhibited resistance against pod damage but showed susceptibility towards grain damage due to *M. vitrata*. None of the genotypes showed susceptibility to pod damage and resistance to grain damage against *M. vitrata*.

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Table 1: Eggs of *H. armigera* on different pigeonpea genotypes during *kharif* 2014

S. No.	Name of the genotype	No. of *H. armigera* eggs/plant					No. of *H. armigera* larvae/plant					
		1st count	2nd count	3rd count	4th count	Average	1st count	2nd count	3rd count	4th count	5th count	Average
1	LRG 30	1.50(1.41)	2.30(1.67)	3.60(2.02)	1.40(1.38)	2.20(1.64)	0.85(1.16)	2.70(1.79)	2.80(1.82)	2.60(1.76)	1.00(1.22)	1.99(1.57)
2	LRG 41	1.30(1.34)	1.90(1.55)	3.20(1.92)	1.20(1.30)	1.90(1.54)	0.30(0.89)	2.60(1.76)	2.30(1.67)	2.30(1.67)	1.10(1.26)	1.72(1.49)
3	ICPL 87119	1.50(1.41)	2.40(1.70)	3.50(2.00)	1.30(1.34)	2.17(1.63)	0.20(0.84)	2.50(1.73)	2.90(1.84)	2.40(1.70)	1.30(1.34)	1.86(1.53)
4	ICP 8863	1.30(1.34)	2.10(1.61)	3.30(1.95)	1.40(1.38)	2.02(1.58)	0.20(0.84)	2.60(1.76)	2.30(1.67)	2.30(1.67)	2.00(1.58)	1.88(1.54)
5	TDRG 33	1.40(1.38)	2.70(1.79)	3.90(2.10)	1.80(1.51)	2.45(1.71)	0.50(1.00)	2.60(1.76)	2.70(1.79)	1.40(1.38)	2.00(1.58)	1.84(1.53)
6	Guliyal local	2.50(1.73)	4.00(2.12)	5.10(2.37)	3.40(1.97)	3.75(2.06)	0.80(1.14)	4.40(2.21)	7.80(2.88)	7.70(2.86)	5.00(2.35)	5.14(2.37)
7	WRP 1	2.00(1.58)	3.20(1.92)	4.90(2.32)	2.70(1.79)	3.20(1.92)	1.10(1.26)	4.60(2.26)	6.90(2.72)	6.60(2.66)	5.40(2.43)	4.92(2.32)
8	CO 6	1.25(1.32)	2.70(1.79)	3.90(2.10)	1.60(1.45)	2.36(1.69)	0.20(0.84)	3.80(2.07)	3.20(1.92)	3.10(1.90)	1.70(1.48)	2.40(1.70)
9	LRG 134	1.60(1.45)	2.70(1.79)	4.10(2.14)	1.40(1.38)	2.45(1.71)	0.30(0.89)	3.70(2.05)	3.20(1.92)	3.30(1.95)	1.60(1.45)	2.42(1.70)
10	RVSA 9	1.50(1.41)	2.30(1.67)	4.40(2.21)	1.20(1.30)	2.35(1.68)	0.20(0.84)	2.50(1.73)	3.20(1.92)	4.00(2.12)	1.70(1.48)	2.32(1.67)
11	ENT 11	1.50(1.41)	2.30(1.67)	3.60(2.02)	2.00(1.58)	2.35(1.68)	0.20(0.84)	2.60(1.76)	3.10(1.90)	4.00(2.12)	1.60(1.45)	2.30(1.67)
12	SKNP 224	1.60(1.45)	2.40(1.70)	3.60(2.02)	2.00(1.58)	2.40(1.70)	0.20(0.84)	2.60(1.76)	3.30(1.95)	4.90(2.32)	1.60(1.45)	2.52(1.73)
13	ICPL 4503	2.20(1.64)	2.50(1.73)	3.70(2.05)	1.50(1.41)	2.47(1.72)	0.20(0.84)	2.80(1.82)	4.10(2.14)	2.90(1.84)	1.90(1.55)	2.38(1.69)
14	Kanpur local	1.50(1.41)	2.30(1.67)	3.60(2.02)	2.40(1.70)	2.45(1.72)	0.20(0.84)	2.70(1.79)	3.80(2.07)	3.00(1.87)	2.40(1.70)	2.42(1.70)
15	WRG 79	1.70(1.48)	2.50(1.73)	4.10(2.14)	1.40(1.38)	2.42(1.71)	0.20(0.84)	2.60(1.76)	4.10(2.14)	2.60(1.76)	1.80(1.52)	2.26(1.66)
16	BSMR 853	1.60(1.45)	2.20(1.64)	3.70(2.05)	1.10(1.26)	2.15(1.62)	0.30(0.89)	2.60(1.76)	2.50(1.73)	3.10(1.90)	1.10(1.26)	1.92(1.55)
17	CRG 2010-09	1.70(1.48)	3.00(1.87)	3.60(2.02)	0.90(1.18)	2.30(1.67)	0.30(0.89)	2.50(1.73)	3.10(1.90)	2.80(1.82)	1.90(1.55)	2.12(1.61)
18	PT 04-307	1.70(1.48)	2.60(1.76)	4.40(2.21)	1.70(1.48)	2.60(1.76)	0.20(0.84)	2.60(1.76)	3.20(1.92)	2.50(1.73)	2.00(1.58)	2.10(1.61)
19	BRG 10-2	1.60(1.45)	2.50(1.73)	4.10(2.14)	1.40(1.38)	2.40(1.70)	0.80(1.14)	2.50(1.73)	3.20(1.92)	2.50(1.73)	1.60(1.45)	2.12(1.61)
20	ICPL 85063(Check)	1.50(1.41)	2.30(1.67)	4.20(2.17)	1.50(1.41)	2.37(1.69)	0.90(1.18)	2.70(1.79)	3.00(1.87)	2.40(1.70)	1.70(1.48)	2.14(1.62)
Mean		1.62	2.55	3.93	1.67	2.44	0.41	2.91	3.53	3.20	2.02	2.43
F-Test		Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig
SEm±		0.07	0.08	0.09	0.13	0.038	0.07	0.09	0.12	0.12	0.13	0.078
CD (P=0.05)		0.205	0.22	0.25	0.38	0.11	0.20	0.26	0.35	0.35	0.40	0.22
CV (%)		6.98	6.14	5.95	12.42	4.57	10.20	7.21	8.69	8.82	12.20	10.70

Figures in parentheses are square root (n+0.5) transformed values; Sig. – Significant; NS – Non Significant

Table 2: Pest susceptibility rating of different pigeonpea genotypes based on per cent pod damage by *H. armigera* during *kharif* 2014-15

S. No	Name of the genotype	Pod damage (%)	Pest susceptibility (%)	Susceptibility rating	Remarks	Grain damage (%)	Pest susceptibility (%)	Susceptibility rating	Remarks
1	LRG 30	6.82(15.14)	47.05	4	R	11.10(19.46)	32.72	4	R
2	LRG 41	5.55(13.63)	56.92	3	R	7.25(15.26)	56.06	3	R
3	ICPL 87119	10.00(18.43)	22.34	5	R	12.95(21.09)	21.51	5	R
4	ICP 8863	10.34(18.76)	19.70	5	R	13.50(21.56)	18.18	5	R
5	TDRG 33	14.78(22.61)	-14.79	7	S	21.05(27.31)	-27.57	8	S
6	Guliyal local	20.09(26.63)	-56.05	9	S	37.30(37.64)	-126.06	9	S
7	WRP 1	17.95(25.06)	-39.38	8	S	31.75(34.30)	-92.42	9	S
8	CO 6	18.05(25.14)	-40.20	8	S	18.80(25.70)	-13.93	7	S
9	LRG 134	17.97(25.08)	-39.58	8	S	17.65(24.84)	-6.96	6	S
10	RVSA 9	13.64(21.04)	-5.93	6	S	21.20(27.47)	-28.48	8	S
11	ENT 11	10.50(18.91)	18.46	5	R	16.35(23.85)	0.90	6	S
12	SKNP 224	15.86(23.47)	-23.18	7	S	18.20(25.25)	-10.30	7	S
13	ICPL 4503	14.40(22.30)	-11.84	7	S	16.67(24.10)	-1.03	6	S
14	Kanpur local	17.17(24.48)	-33.36	8	S	11.54(19.86)	30.06	4	R
15	WRG 79	13.35(21.43)	-3.68	6	S	15.91(23.51)	3.57	6	S
16	BSMR 853	9.10(17.56)	29.33	4	R	11.80(20.09)	28.48	4	R
17	CRG 2010-09	11.00(19.37)	14.57	5	R	18.35(25.36)	-11.21	7	S
18	PT 04-307	10.23(19.37)	20.55	5	R	16.65(24.04)	-0.90	6	S
19	BRG 10-2	11.36(19.76)	11.77	5	R	17.50(24.73)	-6.06	6	S
20	ICPL 85063 (Check)	12.87(21.02)	-	-	-	16.50(23.97)	-	-	-
Mean		13.05	-	-	-	17.60			
F-Test		Sig.	-	-	-	Sig.			
SEm±		1.53	-	-	-	2.13			
CD (P=0.05)		4.53	-	-	-	6.03			
CV (%)		10.35	-	-	-	12.33			

Pest Susceptibility Rating: 1 to 5 – resistant, 6 to 9 – susceptible; Where, R --- Resistant, S --- Susceptible; Sig. – Significant
Figures in parentheses are arc sine transformed values

Table 3: Screening of pigeonpea genotypes against spotted pod borer, *M. vitrata* during *kharif* 2014

S. No.	Name of the genotype	No. of *M. vitrata* webs / plant					No. of *M. vitrata* larvae / plant					
		1st count	2nd count	3rd count	4th count	Average	1st count	2nd count	3rd count	4th count	5th count	Average
1	LRG 30	1.20(1.30)	2.40(1.70)	2.40(1.70)	1.10(1.26)	1.78(1.51)	1.10(1.26)	1.80(1.52)	1.70(1.48)	1.10(1.26)	1.90(1.55)	1.52(1.42)
2	LRG 41	1.20(1.30)	1.50(1.41)	1.90(1.54)	1.70(1.48)	1.57(1.44)	0.70(1.09)	2.20(1.64)	1.60(1.45)	1.00(1.22)	1.60(1.45)	1.42(1.38)
3	ICPL 87119	1.30(1.34)	3.60(2.20)	2.60(1.76)	3.20(1.92)	2.67(1.78)	1.10(1.26)	2.80(1.82)	2.10(1.61)	2.40(1.70)	2.60(1.76)	2.20(1.64)
4	ICP 8863	1.50(1.41)	2.50(1.73)	1.90(1.54)	3.30(1.94)	2.30(1.67)	0.80(1.14)	3.10(1.90)	1.70(1.48)	3.20(1.92)	2.20(1.64)	2.20(1.64)
5	TDRG 33	2.35(1.68)	2.70(1.78)	2.00(1.58)	2.50(1.73)	2.38(1.69)	1.10(1.26)	2.30(1.67)	2.60(1.76)	2.70(1.79)	3.30(1.95)	2.40(1.70)
6	Guliyal local	9.90(3.22)	10.00(3.24)	10.30(3.28)	9.60(3.17)	9.95(3.23)	8.50(3.00)	12.0(3.53)	13.40(3.72)	7.50(2.83)	7.0(2.74)	9.68(3.19)
7	WRP 1	9.60(3.17)	7.90(2.89)	9.60(3.17)	6.90(2.72)	8.50(3.00)	7.00(2.74)	10.30(3.28)	11.10(3.40)	6.10(2.57)	5.40(2.43)	7.92(2.90)
8	CO 6	1.60(1.44)	4.50(2.23)	2.90(1.84)	4.00(2.12)	3.25(1.93)	1.90(1.54)	3.80(2.07)	2.60(1.76)	3.70(2.05)	5.20(2.39)	3.44(1.98)
9	LRG 134	2.60(1.76)	2.50(1.73)	2.20(1.64)	4.20(2.16)	2.87(1.83)	1.50(1.41)	1.70(1.48)	2.70(1.79)	5.40(2.43)	3.40(1.97)	2.94(1.87)
10	RVSA 9	1.95(1.56)	2.70(1.78)	2.45(1.71)	3.10(1.89)	2.55(1.74)	1.25(1.32)	3.10(1.90)	2.50(1.73)	4.20(2.17)	3.80(2.07)	2.97(1.86)
11	ENT 11	3.90(2.09)	3.00(1.87)	4.30(2.19)	3.00(1.87)	3.55(2.01)	2.20(1.64)	3.10(1.90)	4.00(2.12)	1.70(1.48)	4.80(2.30)	3.16(1.91)
12	SKNP 224	3.30(1.94)	2.70(1.78)	3.60(2.02)	3.40(1.95)	3.25(1.93)	2.20(1.64)	2.90(1.84)	2.70(1.79)	2.60(1.76)	2.30(1.67)	2.54(1.74)
13	ICPL 4503	1.80(1.51)	3.10(1.89)	5.80(2.51)	3.00(1.87)	3.42(1.98)	1.20(1.30)	3.10(1.90)	4.50(2.24)	2.60(1.76)	3.00(1.87)	2.88(1.83)
14	Kanpur local	2.30(1.67)	3.20(1.92)	2.40(1.70)	3.40(1.97)	2.82(1.82)	1.60(1.44)	2.50(1.73)	2.80(1.82)	3.60(2.02)	3.50(2.00)	2.80(1.81)
15	WRG 79	1.85(1.53)	1.90(1.54)	2.70(1.78)	3.30(1.94)	2.43(1.71)	1.55(1.43)	2.80(1.82)	2.60(1.76)	2.70(1.79)	3.90(2.10)	2.71(1.79)
16	BSMR 853	2.90(1.84)	2.10(1.61)	3.00(1.87)	1.00(1.22)	2.25(1.65)	2.50(1.73)	2.40(1.70)	2.60(1.76)	1.75(1.50)	2.5(1.73)	2.35(1.68)
17	CRG 2010-09	3.10(1.89)	2.80(1.81)	4.30(2.19)	4.20(2.16)	3.60(2.02)	2.00(1.58)	2.80(1.82)	3.80(2.07)	2.90(1.84)	3.20(1.92)	2.94(1.85)
18	PT 04-307	3.00(1.87)	2.80(1.81)	4.20(2.16)	4.60(2.25)	3.65(2.03)	2.20(1.64)	4.10(2.14)	4.00(2.12)	2.90(1.84)	4.20(2.17)	3.48(1.99)
19	BRG 10-2	3.10(1.89)	2.45(1.71)	6.20(2.58)	2.10(1.61)	3.46(1.99)	2.20(1.64)	2.90(1.84)	2.70(1.79)	3.20(1.92)	3.20(1.92)	2.84(1.82)
20	ICPL 85063(Check)	4.80(2.30)	2.60(1.76)	4.60(2.25)	3.60(2.02)	3.90(2.09)	1.90(1.55)	4.90(2.32)	3.70(2.05)	3.80(2.07)	3.50(2.00)	3.56(2.01)
Mean		3.16	3.34	3.96	3.56	3.50	2.22	3.71	3.77	3.25	3.52	3.29
F-Test		Sig.	Sig.	Sig.	Sig.	Sig	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SEm±		0.22	0.19	0.15	0.15	0.115	0.16	0.17	0.20	0.17	0.21	0.101
CD (P=0.05)		0.65	0.56	0.44	0.46	0.33	0.48	0.51	0.58	0.49	0.61	0.29
CV (%)		16.97	14.58	11.23	11.09	11.83	14.59	12.30	14.07	11.49	14.76	11.98

Figures in parentheses are square root (n+0.5) transformed values; Sig. – Significant; NS – Non significant

Table 4: Pest susceptibility rating for different pigeonpea genotypes based on per cent pod and grain damage due to *M. vitrata* during *kharif*, 2014

S. No	Name of the genotype	Pod damage (%)	Pest susceptibility (%)	Susceptibility rating	Remarks	Grain damage (%)	Pest susceptibility (%)	Susceptibility rating	Remarks
1	LRG 30	10.77(19.16)	23.88	5	R	12.64(20.83)	29.97	4	R
2	LRG 41	6.50(14.77)	54.06	3	R	8.23(16.67)	54.40	3	R
3	ICPL 87119	10.36(18.78)	26.75	4	R	14.97(22.76)	17.06	5	R
4	ICP 8863	11.70(20.00)	17.31	5	R	9.76(18.20)	45.92	4	R
5	TDRG 33	12.64(20.83)	10.67	5	R	16.05(23.62)	8.58	6	S
6	Guliyal local	22.59(28.38)	-94.98	9	S	32.73(34.90)	-81.33	9	S
7	WRP 1	22.32(28.19)	-57.33	9	S	28.48(32.25)	-57.78	9	S
8	CO 6	13.64(21.67)	3.60	6	S	19.50(26.22)	-8.03	6	S
9	LRG 134	14.10(22.06)	0.35	6	S	20.89(27.21)	-15.73	7	S
10	RVSA 9	12.50(20.70)	11.66	5	R	18.37(25.38)	-1.77	6	S
11	ENT 11	14.70(22.34)	-3.88	6	S	16.89(24.27)	6..42	6	S
12	SKNP 224	18.16(25.18)	-27.91	8	S	26.14(30.75)	-44.82	8	S
13	ICPL 4503	11.38(19.72)	19.57	5	R	17.63(24.33)	2.32	6	S
14	Kanpur local	17.00(24.35)	-19.50	7	S	18.86(25.74)	-4.48	6	S
15	WRG 79	10.50(18.91)	25.79	4	R	21.73(27.78)	-20.38	7	S
16	BSMR 853	9.24(17.70)	34.70	4	R	10.22(18.64)	43.38	4	R
17	CRG 2010-09	14.17(22.06)	-4.40	6	R	22.22(28.12)	-23.10	7	S
18	PT 04-307	12.24(20.48)	13.49	5	R	21.15(27.38)	-17.17	7	S
19	BRG 10-2	16.50(23.98)	-16.60	7	S	23.73(29.15)	-31.46	8	S
20	ICPL 85063 (Check)	14.15(22.10)	-	-	-	18.05(25.14)	-	-	
Mean		13.76	-	-	-	18.91	-	-	-
F-Test		Sig	-	-	-	Sig	-	-	-
SEm±		1.83	-	-	-	2.45	-	-	-
CD (P=0.05)		5.43	-	-	-	7.25	-	-	-
CV (%)		12.03	-	-	-	13.69	-	-	-

Pest Susceptibility Rating: 1 to 5 – resistant, 6 to 9 – susceptible Where, R --- Resistant, S --- Susceptible; Sig. – Significant
Figures in parentheses are arc sine percentage transformed values

Table 5: Grouping of genotypes based on per cent pod and grain damage by *H. armigera* during *kharif* 2014-15.

Pod damage / Grain damage	Resistant	Susceptible
Resistant	Five genotypes (LRG 30, LRG 41, ICPL 87119, ICP 8863 and BSMR 853)	One genotype (Kanpur local)
Susceptible	Four genotypes (ENT 11, CRG 2010-09, PT 04-307 and BRG 10-2)	Nine genotypes (TDRG 33, Guliyal local, WRP 1, CO 6, LRG 134, RVSA 9, SKNP 224, ICPL 4503 and WRG 79)

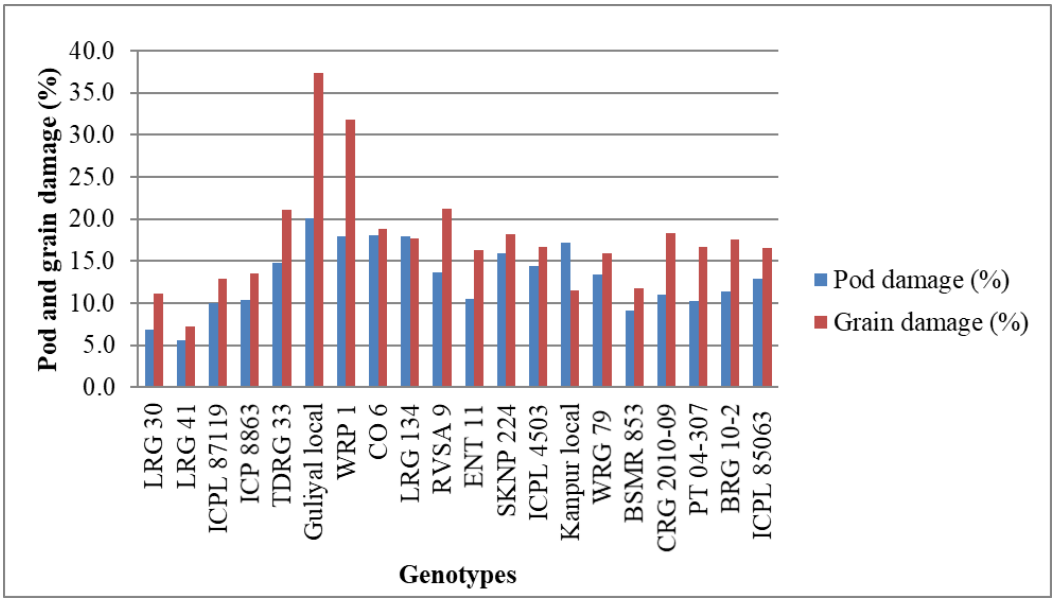

Fig 1: Response of pigeonpea genotypes to pod and grain damage (%) due to *H. armigera* during *Kharif* 2014.

Table 6: Grouping of pigeonpea genotypes based on per cent pod and grain damage by *M. vitrata* during *kharif* 2014

Pod damage / Grain damage	Resistant	Susceptible
Resistant	Five genotypes (LRG 30, LRG 41, ICPL 87119, ICP 8863 and BSMR 853)	- Nil -
Susceptible	Five genotypes (TDRG 33, RVSA 9, ICPL 4503, WRG 79 and PT 04-307)	Nine genotypes (Guliyal local, WRP 1, CO 6, LRG 134, ENT 11, SKNP 224, Kanpur local, CRG 2010-09 and BRG 10-2)

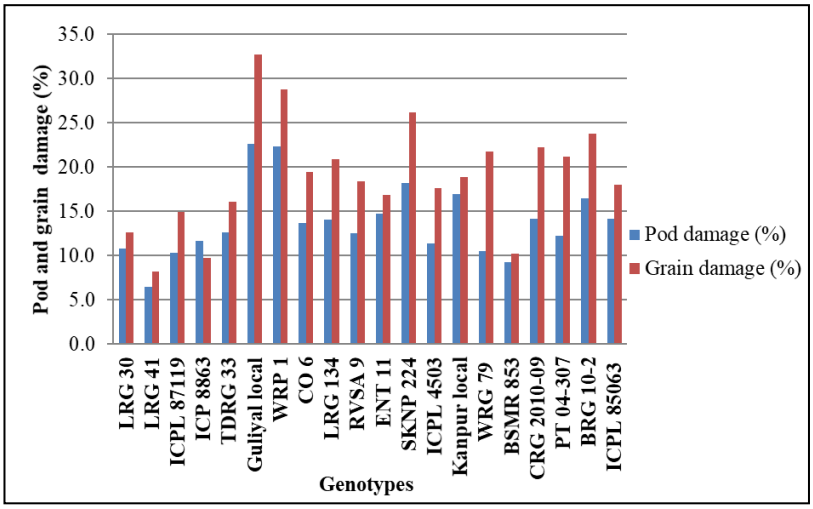

Fig 2: Response of pigeonpea genotypes to pod and grain damage (%) due to *M. vitrata* during *Kharif* 2014.

Table 7: Yield particulars of different pigeonpea genotypes during *kharif* 2014

S. No	Name of the genotype	Days to 50 % flowering	Days to maturity	Pod yield/plant (g)	Grain yield/plant (g)
1	LRG 30	115	175	452.3	271.4
2	LRG 41	122	182	549.5	382.7
3	ICPL 87119	118	178	420.1	243.0
4	ICP 8863	111	171	342.7	240.1
5	TDRG 33	115	175	334.2	220.6
6	Guliyal local	103	163	176.8	97.6
7	WRP 1	107	167	211.0	102.3
8	CO 6	115	175	309.2	222.6
9	LRG 134	115	178	240.0	147.9
10	RVSA 9	117	177	404.5	246.7
11	ENT 11	114	174	298.9	192.4
12	SKNP 224	115	175	356.2	202.60
13	ICPL 4503	119	179	399.6	246.2
14	Kanpur local	117	177	379.6	178.9
15	WRG 79	114	174	329.1	198.9
16	BSMR 853	120	180	442.2	282.1
17	CRG 2010-09	118	178	285.5	185.5
18	PT 04-307	116	176	262.8	161.7
19	BRG 10-2	120	180	401.0	256.6
20	ICPL 85063 (Check)	119	179	356.2	241.7
Mean		115.5	175.7	347.6	216.1
F-test		NS	NS	Sig.	Sig.
SEm±		3.22	4.32	39.06	20.96
CD (P = 0.05)		9.52	12.79	115.62	62.04
CV (%)		3.96	3.48	15.89	13.72

Sig. – Significant; NS – Non significant

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