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SCREENING OF PIGEONPEA GENOTYPES OF DIFFERENT MATURITY GROUPS AGAINST POD BORER COMPLEX

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ABSTRACT

Pigeonpea (*Cajanus cajan* L. Millsp.) yield is severely constrained by the pod borer complex comprising *Helicoverpa armigera* (Hübner), *Maruca vitrata* (Geyer) and *Melanagromyza obtusa* (Malloch). A field trial evaluating 26 genotypes was conducted during *Kharif* 2017–18, 2018–19, and 2019–20 to identify resistant germplasm sources. Significant genetic variability was recorded among genotypes for pod damage and yield per se. Genotype RP-3 demonstrated consistent resistance across years against *M. vitrata* (2.00–6.33% pod damage) and *H. armigera* (4.33–11.00% pod damage), while maintaining high yield performance (1282 kg/ha). Promising genotypes such as RP-1, RP-3 and RP-5 identified in this study serve as valuable genetic donors for developing insect-resistant pigeonpea cultivars.

***Key words*:** *Cajanus cajan*, *Helicoverpa armigera*, *Maruca vitrata*, *Melanagromyza obtusa*, germplasm screening, pod damage, host plant resistance, grain yield

Introduction

Pigeonpea (*Cajanus cajan* L.) is considered as one of the most important legume crops of India. Pigeonpea belong to the genus *Cajanus* of family Fabaceae. It is an important food legume crop of the semi-arid tropical and sub-tropical farming systems under varied agro-ecological environments. Pigeonpea is the second most important pulse crop of India after chickpea. India is the largest producer and also the largest consumer of pulses in the world. It accounts for 33 percent of the world area and 25 percent share in global production (Srivastava *et al.*, 2010).

At the national level, pigeonpea area and production stood at 4.43 million ha and 3.46 million tonnes, respectively, during 2025–26, with an average productivity of 780 kg/ha. In Chhattisgarh, pigeonpea is cultivated in 34.09 thousand ha with a total production of 21.00 thousand tonnes and productivity of 616 kg/ha. (*Source: PC, AICRP on Pigeonpea Annual Report 2025–26; DA&FW, MoAFW, GoI*).

Major constraint in the production of pigeonpea is the damage caused by insect pests with avoidable losses extending up to 78 percent in India (Lateef and Reed, 1983). Nearly 300 species of insects are known to infest pigeonpea crop at its various growth stages in India (Lal and Singh, 1998). Pod borers caused 60 to 90 per cent loss in the grain yield under favourable conditions (Lal *et al.*, 1992) and among the borers, gram pod borer (*Helicoverpa armigera* Hubner) is considered as most destructive. A number of insecticides have been reported to be effective for controlling *H. armigera* on pigeonpea (Ujagir, 2000).

The pod borer complex, which includes *H. armigera*, *E. atomosa* and *M. obtusa*, has been confirmed to target this seed, causing significant losses in grain yield ranging from 30 to 100 percent by targeting the reproductive

sections of the plant. The loss due to *H. armigera* alone contributes up to 50 percent in pigeonpea crop (Thakare,2001 and Dodia *et al*., 2009).Screening germplasm is one way of identifying the genetic base from which insect- resistance and agronomically advantageous cultivars can be developed (Sahu *et al*., 2019).In this context, little information collected will be utilized in the development of resistant cultivars, partly selected as breeding lines and help in understanding of the resistance mechanism and the effect of environmental factors. Screening germplasm and evaluating genetic diversity are primary steps for identifying resistant donors and understanding host-plant resistance mechanisms (Sahu et al., 2019, 2026). The present study was conducted to screen pigeonpea genotypes against the pod borer complex under field conditions is an effort in this direction to facilitate the development of resistant cultivars.

Materials and Methods

A set of twenty-six genotypes was sown in last week of June during*Kharif*2017-2018, 2018-2019 and 2019-2020 for screening against pod borer complex *viz*., *Helicoverpa armigera*, *Maruca vitrata* and *Melangromyza obtusa* as per the recommended agronomic practices without any plant protection measure.

Observation recorded

Pod damage (%): Pods damaged due to different pod borers based on the nature of damage was separated from 100 randomly collected pods at the time of harvest.

Nature of damage:*Helicoverpa armigera*: Large round and regular holes on the pods. *Maruca vitrata*: Irregular scrapping and holes on the pods. *Melanagromyza obtusa*: Pin head size holes at the peripheral end of the pod.

Yield parameters: Grain yield was recorded on whole plot basis.

Afterwards, the total number of pods and number of damaged pods by pod borer on each demarcated plant was counted and converted into percentage. The percentage pods damage and yield of each tested entry was compared to check. The percentage of pod damage and grain yield Kg/ ha was estimated with the help of following formula:

$$\text{Pod damage (\%)} = \frac{\text{Number of infested pods}}{\text{Total number of pods (Healthy + Damage)}} \times 100$$

$$\text{Grain yield (kg/ha)} = \frac{\text{Weight of grain in kg/plot}}{\text{Plot area in m}^2} \times 1000$$

Where,

P.D.= Mean of % pods damaged

Results and Discussion

Significant differences were observed among the 26 pigeonpea genotypes for pod damage caused by *M. vitrata*, *H. armigera* and *M. obtusa* across all three years ($P< 0.05$) (Table 1).

The incidence of *Maruca vitrata,* was recorded in terms of pod damage at harvest during *Kharif – Rabi* 2017-2018, 2018-2019 and 2019-2020. During *Kharif – Rabi* 2017-2018, genotypes showed significant differences among each other as far as percent pod damage was concerned which varied from 1.00 to 6.00 percent (Table 1). Among the tested genotypes, the minimum pod damage was recorded in RP -3 with 2.93, 2.00 percent during two year but differ in third year 6.33 percent due to unknown reason, which was at par with RP-5, Rajeevlochan, ICP 7005, RP-13, RP-7, RPS- 2007-106, ICP 7379, RP-12 with 3.09, 3.13, 3.15, 3.33, 3.6, 3.81, 3.87, 3.87and followed by ICP 7003 , ICP 6996 , ICP 7004, RP-6 , RP-16, ICP 7373, RP-15, RPS- 2007-10, RP-2, RP-8, ICP 7374, ICP 6999, RP-1 , RP-17, RP-14 with 4.33,4.47,4.8,4.79, 4.8, 5.33, 5.3,5.51,5.7, 5.79,5.96.10,5.9, 6.43, and 6.73 percent pod damage respectively, whereas maximum pod damage was recorded in the genotypes RPS- 2008-5 with 6.77 percent pod damage per plant. However, During *Kharif – Rabi* 2018-2019, the minimum pod damage was observed in RP-1 with 3.67, which was at par with RP-16, ICP 6996, RP-14, Rajeevlochan, RP-2, RPS- 2008-5, ICP 6999, ICP 7373, RP-3 with 3.67, 4.33, 4.67, 5.33, 5.33,5.33, 6.33, 6.33 percent.During *Kharif – Rabi*2019-2020, the minimum pod damage was observed in RP -3 with 2.00 percentwhich was at par with Rajeevlochan, ICP 6994,ICP 6999, ICP 7374, RP -1 with 2.00 respectively for all.

The incidence of *Helicoverpa armigera* was recorded in terms of pod damage at harvest during *Kharif – Rabi* 2017-2018, 2018-2019 and 2019-2020 separately. Genotypes showed significant differences among each other for percent pod damage which varied from4.00 – 7.00 percent (Table 1). Among the tested genotypes during *Kharif – Rabi* 2017-2018 the minimum pod damage was recorded in RP -3 with 2.23 percent which was at par with RP-8, RPS-2007-106. RP-12, ICP 7004, ICP 7374, RP -6, RPS-2007-10, RP-2 with 8.01,8.40, 8.46, 8.51, 8.53, 8.58, 8.90, 9.01 percent followed by ICP 7379, RP-5, ICP 7003, Rajeevlochan, ICP 6999, RP-17, ICP 7005, RP-1, ICP 7373, RP-7, ICP 6996, RP-16, RP-15, RP-13 with 9.14(19.07), 9.2(19.81), 9.25(19.81), 9.23(19.81), 9.32(19.92), 9.4(20.03), 9.58(20.25), 9.72(20.35), 9.79(20.46), 10.00(20.67) , 10.1, 10.3, 10.67, 10.9 percent

Table 1: Field screening and pod damage (%) caused by pod borer complex (*Maruca vitrata*, *Helicoverpa armigera* and *Melanagromyza obtusa*) in pigeonpea genotypes (*Kharif* 2017–18 to 2019–20).

S. No.	Germplasm	Average percent pod damage due to								
		M. vitrata			*H. armigera*			*M. obtuse*		
		2018	2019	2020	2018	2019	2020	2018	2019	2020
1	Rajeevlochan	3.13(11.56)	5.33(13.31)	2.00(7.94)	9.23(19.81)	5.67(13.81)	6.00(14.13)	3.70(12.56)	5.67(13.81)	11.67(19.91)
2	ICP 6994	2.67(10.76)	8.67(17.16)	2.00(7.94)	7.76(17.01)	11.33(19.55)	4.00(11.43)	2.87(11.15)	9.33(17.76)	4.67(12.45)
3	ICP 6996	4.47(13.84)	4.33(11.97)	4.33(11.99)	10.1(20.78)	8.67(17.16)	8.00(16.43)	9.27(19.92)	7.33(15.68)	8.67(17.04)
4	ICP 6999	6.10(16.11)	6.33(14.54)	2.00(7.94)	9.32(19.92)	5.67(13.81)	5.67(13.74)	5.80(15.71)	8.67(17.16)	6.00(14.14)
5	ICP 7003	4.33(13.53)	9.33(17.76)	3.33(10.49)	9.25(19.81)	6.33(14.54)	7.33(15.68)	4.67(14.14)	9.33(17.76)	3.67(11.01)
6	ICP 7004	4.8(14.29)	7.67(16.11)	3.67(10.95)	8.51(19.03)	8.67(17.16)	12.00(20.27)	3.13(11.52)	7.67(16.11)	6.33(14.56)
7	ICP 7005	3.15(11.70)	6.00(14.18)	4.33(11.93)	9.58(20.25)	7.33(15.68)	10.67(19.08)	1.57(8.34)	7.33(15.68)	10.67(19.02)
8	ICP 7373	5.33(15.01)	6.33(14.54)	7.00(15.31)	9.79(20.46)	11.67(20.00)	9.33(17.79)	3.53(12.22)	8.33(16.74)	7.00(15.33)
9	ICP 7374	5.9(15.84)	7.33(15.68)	2.00(7.94)	8.53(19.03)	9.00(17.46)	9.00(17.44)	3.03(11.33)	6.33(14.54)	8.00(16.42)
10	ICP 7379	3.87(12.73)	6.00(14.18)	3.33(10.49)	9.14(19.07)	12.00(20.27)	15.67(23.28)	5.40(15.16)	6.33(14.54)	7.67(16.04)
11	RP-1	5.9(15.84)	3.67(11.09)	2.00(7.94)	9.72(20.35)	6.00(14.18)	9.33(17.76)	6.90(17.13)	7.33(15.68)	9.00(17.43)
12	RP-2	5.7(15.57)	5.33(13.31)	1.00(5.57)	9.01(19.59)	4.67(12.52)	9.33(17.76)	5.00(14.59)	3.00(9.98)	8.00(16.42)
13	RP-3	2.93(11.15)	6.33(14.54)	2.00(7.94)	7.93(18.34)	4.33(11.97)	11.00(19.30)	2.23(9.95)	6.33(14.54)	7.33(15.65)
14	RP-5	3.09(11.52)	7.67(16.11)	1.33(6.53)	9.2(19.81)	9.00(17.46)	5.00(12.84)	3.20(11.70)	8.33(16.74)	6.00(14.17)
15	RP-6	4.79(14.29)	10.67(19.09)	2.33(8.74)	8.58(19.15)	6.67(15.00)	4.67(12.45)	5.10(14.73)	10.00(18.44)	8.00(16.42)
16	RP-7	3.6(12.40)	6.67(15.00)	1.67(7.33)	10.00(20.67)	9.33(17.76)	11.00(19.30)	5.23(14.87)	8.33(16.74)	7.00(15.33)
17	RP-8	5.79(15.71)	8.67(17.16)	3.33(10.49)	8.01(18.46)	13.67(21.72)	8.33(16.76)	3.43(12.05)	9.33(17.76)	8.67(17.11)
18	RP-12	4.21(13.38)	7.67(16.11)	2.33(8.74)	8.46(19.03)	12.67(20.88)	10.33(18.79)	2.13(9.52)	7.33(15.68)	8.33(16.76)
19	RP-13	3.33(11.88)	9.00(17.46)	1.33(6.53)	10.9(21.60)	8.00(16.43)	5.33(13.35)	3.8(12.73)	9.00(17.46)	11.67(19.93)
20	RP-14	6.73(16.88)	4.67(12.52)	3.00(9.87)	9.73(20.35)	9.00(17.46)	12.67(20.88)	4.5(13.84)	3.33(10.47)	17.00(24.31)
21	RP-15	5.3(15.09)	8.67(17.16)	3.00(9.87)	10.67(21.40)	11.33(20.18)	7.67(16.01)	6.8(17.01)	9.67(18.15)	9.00(17.43)
22	RP-16	4.8(14.29)	3.67(11.09)	2.00(7.94)	10.3(20.99)	7.33(15.68)	6.67(14.98)	5.7(15.57)	6.33(14.54)	9.33(17.75)
23	RP-17	6.43(16.50)	7.33(15.68)	2.00(7.94)	9.4(20.03)	6.00(14.18)	11.33(19.69)	4.20(13.38)	8.67(17.16)	8.00(16.42)
24	RPS-2007-10	5.51(15.29)	6.67(15.00)	4.00(11.47)	8.90(19.48)	9.33(17.76)	7.33(15.68)	4.10(13.22)	6.67(15.00)	10.67(19.03)
25	RPS-2008-5	6.77(16.88)	5.33(13.31)	3.67(10.95)	12.40(23.08)	6.67(15.00)	6.33(14.51)	6.40(16.50)	5.67(13.81)	6.33(14.56)
26	RPS-2007-106	3.81(12.73)	8.67(17.16)	2.00(7.94)	8.40(18.92)	11.33(19.64)	4.67(12.45)	3.20(11.70)	9.67(18.15)	12.67(20.80)
	C.D. at 5%	**1.64**	**2.45**	**1.52**	**2.63**	**3.69**	**2.32**	**1.85**	**2.53**	**1.92**

Note: Values represent mean percent pod damage based on 100 randomly selected pods per genotype at harvest.
Figures in parentheses are angular transformed (arcsin %) values used for statistical interpretation. C.D. = Critical Difference at P = 0.05.

respectively. Maximum pod damage was recorded in the genotype RPS-2008-5 with 12.40 percent pod damage per plant. However during *Kharif – Rabi* 2018-2019 minimum pod damage was recorded in RP -3 with 4.33 percent which was at par with RP-2, Rajeevl ochan, ICP 6999, RP-1, RP-17, ICP 7003, RP-6, RPS -2008-5, ICP 7005 with 4.67, 5.67, 5.67, 6.00, 6.00, 6.33, 6.67, 6.67, 7.33 percent and followed by RP-16, RP-13, ICP 6996, ICP 7004, ICP 7374, RP-5, RP-14, RP-7, RPS- 2007-10, ICP 6994, RP-15, RPS- 2007-106, ICP 7373, ICP 7379, RP-12 with 7.33 , 8.00, 8.67, 8.67, 9.00, 9.00, 9.00, 9.33, 9.33, 11.33, 11.33, 11.33, 11.67, 12.00, 12.67 percent pod damage respectively. Maximum pod damage was recorded in genotype RP-8 with 13.67 percent pod damage per plant. However during *Kharif – Rabi* 2019-2020 minimum pod damage was recorded in ICP- 6994 with 6.00 which was at par with RP-6, RPS-2007-106, RP-5, RP-13, ICP 6999, Rajeevlochan, RPS-2008-5, RP-16, ICP-7003 with 4.00, 4.67, 5.00, 5.33, 5.67, 6.00, 6.33, 6.67, 7.33 percent and followed by RPS- 2007-10, RP-15, ICP 6996, RP-8, ICP 7374, ICP 7373, RP-1, RP-2, RP-12, ICP 7005, RP-3, RP-7, RP-17, ICP 7004, RP-14 with 7.33, 7.67, 8.00, 8.33, 9.00, 9.33, 9.33, 9.33, 10.33, 10.67, 11.00, 11.00, 11.33, 12.00, 12.67 percent. Maximum pod damage was recorded in genotype in ICP 7379 with 15.67 percent pod damage per plant.

The incidence of *Melanagromyza obtusa* was recorded in terms of pod damage at harvest during *Kharif – Rabi* 2017-2018, 2018-2019 and 2019-2020 separately. Genotypes showed significant differences among each other for percent pod damagewhich varied from 2.00 – 7.00 percent (Table 1). Among the tested genotypes during *Kharif – Rabi* 2017-2018 the minimum pod damage was recorded in RP-3 with 2.23 percent which was at par with ICP-6994, ICP-7374, ICP-7004, RP-5, RPS-2007-106, RP-8, ICP 7373 with 2.87, 3.03, 3.13, 3.20, 3.20, 3.43, 3.53 percent and followed by Rajeev lochan, RP-13, RPS- 2007-10, RP-17, RP-14, ICP 7003, RP-2, RP-6, RP-7, ICP 7379, RP-16, ICP 6999, RPS- 2008-5, RP-15, RP-1 with 3.70, 3.8, 4.10, 4.20, 4.5, 4.67, 5.00, 5.10, 5.23, 5.40, 5.7, 5.80, 6.40, 6.8, 6.90 percent pod damage, respectively whereas maximum pod damage was observed in genotype ICP 6996 with 9.27 percent. Among the tested genotypes during *Kharif – Rabi* 2018-2019 the minimum pod damage was recorded in RP-3 with 6.33 percent and maximum in genotype RP-6 with 10.00 percent. Among the tested genotypes during *Kharif – Rabi* 2019-2020 the minimum pod damage was recorded in RP-3 with 7.33 percent and maximum in genotype RP-14 with 17.00 percent.

Identifying stable resistance under rainfed environments is critical for breeding programs, as observed in multi-environment screening against the pod borer complex (Sahu *et al*., 2025a). In terms of grain yield, significant variation was recorded over the three years (Table 2). The mean yield across three years ranged from 816 kg/ha (RP-6) to 1283 kg/ha (RP-1). High-yielding genotypes included RP-1 (1283 kg/ha), RP-3 (1282 kg/ha), RP-5 (1230 kg/ha) and RPS-2007-10 (1219 kg/ha). Genetic variability and association patterns among yield and yield-attributing traits play a vital role in selection efficiency for pigeonpea improvement (Sahu *et al*., 2025b; Tiwari *et al*., 2019). These findings align with earlier screening and donor identification studies reported by Rana *et al*., (2017) and Gupta *et al*., (2018).

Table 2: Mean grain yield performance (kg/ha) of screened pigeonpea genotypes over three consecutive years (*Kharif* 2017–18 to 2019–20).

S. No.	Germplasm	(Kg/ha)			MYP
		2017-18	2018-19	2019-20	
1	Rajeevlochan	843	873	1601	1106
2	ICP 6994	1098	1141	1115	1118
3	ICP 6996	778	945	1252	992
4	ICP 6999	815	758	1585	1053
5	ICP 7003	808	1017	1513	1113
6	ICP 7004	965	1087	1437	1163
7	ICP 7005	971	894	1298	1054
8	ICP 7373	723	965	1480	1056
9	ICP 7374	890	784	1666	1113
10	ICP 7379	1008	997	1528	1178
11	RP-1	1039	971	1839	1283
12	RP-2	858	891	1659	1136
13	RP-3	1152	1132	1561	1282
14	RP-5	970	1213	1506	1230
15	RP-6	735	691	1022	816
16	RP-7	857	857	1717	1144
17	RP-8	1014	706	1537	1086
18	RP-12	890	753	1253	965
19	RP-13	690	672	1431	931
20	RP-14	1007	971	1336	1105
21	RP-15	1023	814	1331	1056
22	RP-16	894	803	1106	934
23	RP-17	965	993	1400	1119
24	RPS- 2007-10	1228	966	1462	1219
25	RPS- 2008-5	966	853	1771	1197
26	RPS- 2007-106	853	796	1551	1067
	C.D.	**211.29**	**218.93**	**352.8**	**261.01**

MYP: Mean yield per se performance

Note: Grain yield recorded on a whole-plot basis and converted to kg/ha. C.D. = Critical Difference at P = 0.05.

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Author Contribution Statement.

NR and VS conceptualised the study, conducted the experiments and performed data analysis. MS and VS assisted in field experimentation and trait data collection. MS contributed to statistical interpretation and manuscript review. MS drafted the manuscript with input from all co-authors. All authors read and approved the final manuscript.

Conflicts of Interest / Competing Interests- No conflict of interest.

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