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Evaluation of Medium Maturity Pigeonpea Genotypes for Resistance to Pod Borer Complex

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was conducted during Kharif 2022-23 at the experimental area of Department of Entomology, AICRP on Pigeonpea, Research cum Instructional Farm, IGKV, Raipur, (C.G.). The aim of the study was to screen the different pigeonpea genotypes against pod borer complex. The different pigeonpea genotypes were screened against pod borer complex which showed significant difference between tested genotypes on different parameters viz., percent pod damage and grain yield. Genotypes CG Arhar-2 (19 per cent), showed least affected by pod borers and RPS-15-50 (40.00 %) was found most affected by pod borers. The highest grain yield was observed in CG Arhar-2 (1927.78 kg/ha) and lowest grain yield was observed in RPS-15-21 (875 kg/ha)).

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1. INTRODUCTION

Pulses are an essential part of the human diet since these cover the majority of people's nutritional needs. They even contain several vital vitamins, minerals and essential amino acids that are required for a proper development and growth [1-4]. Pulses unique nitrogen-fixing mechanism contributes to the preservation of soil fertility. Legumes are crucial parts of conventional agriculture because of their ability to improve soil structure, boost the quality of micro-organism population and enrich soil nitrogen status. The pigeonpea [*Cajanus cajan* (L) Millspaugh] is an important legume crop in India. The crop is typically planted during the *Kharif* season in our nation, although in regions with warm winters and short growing seasons, like West Bengal, it can also be grown throughout the Rabi season [5]. This legume's cultivation as a Rabi crop not only has a great production potential but it also shortens the duration, which means less harm from disease and pest infestation.

"Pigeonpea is one of the major grain legume crops in the tropical and subtropical regions of the Asia and Africa and it is considered as a second important pulse crop of India after chickpea. It is commonly known as Arhar or red gram or tur in India. India is the largest producer of pigeon pea contributing more than 93% of the global production. It is grown in an area of 4.46 million hectares with production of about 4.18 million tones and the productivity levels range from 937 kg/ ha during 2017-18" [6].

One of India's most significant legume crop is the pigeon pea, [*Cajanus cajan* (L.) Millsp]. It belongs to the genus *Cajanus* of the family Fabaceae. It is a significant food, legume crop grown in semi-arid tropical and sub-tropical agricultural systems across a range of agro-ecological conditions. India is world's largest producer and consumer of pulses. According to Srivastava et al*.* [7], it makes up 25% of worldwide production & 33% of the world's land area.

"Pigeonpea [*Cajanus cajan* (L.) Millspaugh] is a short-lived permanent shrub, grown through custom as a grain legume crop in tropical and subtropical areas. Dry whole seed, split seed and dehulled seed are used to cook various dishes. In addition to its use as a food crop, the plants also cultivate such as forages, fuel, basket making, lac culture etc. Pigeonpea has a deep root system that enables them to withstand the drought and are cultivated on mountain slopes to tie the soil and to reduce the erosion of the soil. Pigeonpea is slowly grown because of its deep-root system, therefore extensively used with cereals, like millets, sorghum and maize in inter-cropping systems and is also a good way of improving fertility in fallows. During the early vegetative stage, pigeonpea grows slowly and does not interfere with accompanying crops. Pigeon pea continues to grow after harvesting the accompanying crop and they can fill the land with the appearance of a single crop" (Singh, 1990).

"Pigeon pea provides high quality vegetable protein to human beings and is one of the sources of animal feed and fire wood. Carbohydrates (67%) and protein (22%) are main constituents of pigeonpea seeds (Singh, 1990). It is a good source of dietary minerals such as calcium, phosphorus, magnesium, iron, Sulphur and potassium. It is also a good source of water-soluble vitamins, especially thiamine, riboflavin, niacin and choline" [8].

"Globally the area and production of pigeon pea has increased from 4.43 million hectares (mha) and 3.16 million tons (mt) in 2002 to 5.32 mha and 04.32 mt in 2012, respectively [9]. India is the world's largest producer of pulses, accounting for 25% of global production. Important pulse crops include chickpea, pigeonpea, mungbean, urdbean, lentil and field pea" [10].

"In India, pigeonpea was grown on 4.78 million hectares in 2018-19, producing about 3.59 million tons at a productivity of 791 kg/ha. In Chhattisgarh, it was grown on approximately 63.25 thousand hectares producing 25.75 thousand tons at productivity of 407 kg/ha [11]. In Raipur district, it was grown on 0.36 thousand hectares with a productivity of 306 kg/ha and a total production of 0.11 million tons in 2017" [12].

"Among various constraints for low productivity, the insect pests are one of the major biotic constraints for the production, especially pod borer complex which can cause an estimated annual loss of over $2 billion in the semi-arid tropics, despite application of insecticides costing over $500 million annually [13]. Pod borer complex causes 60 to 90% loss in the grain yield under favorable conditions. Economic losses due to biotic factors have been estimated to be US $ 8.48 billion. The pod fly, *Melanagromyza obtusa* alone causes a yield loss of 60 to 80% and the losses have been estimated at US $ 256 million annually" [14].

The pigeonpea is attacked by over 250 species of insects from 61 families and 8 orders over 30 species of Lepidoptera consume pigeonpea pods and seeds on a global scale [15], only a small number of species are significant economic pests, like the tur plume moth, *Exelastis atomosa* (Walsh) (Lepidoptera: Pterophoridae) and the spotted pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) and pod fly, *Melanagromyza obtusa* (Mall) (Diptera: Agromyzidae), generally known to as "Pod borer complex" [16,17]. This pod borer complex reported economic losses ranging from 30% to 100% in diverse locations; as a result, India was forced to invest heavily in the importation of pulses from foreign nations, causing direct loss to producers in past years.

"The pod borer complex, which also comprises *H. armigera, M. vitrata,* and *M. obtusa*, has been confirmed to be a target this seed, by attacking the reproductive parts of the plant, the complex results in large reductions in the yield of grains ranging from 30 to 100 per cent. Up to 50% of the pigeonpea crop loss is attributable to *H. armigera* alone" [18,19].

2. MATERIALS AND METHODS

The experiment was conducted during *Kharif* 2022-23 at the Research cum Instructional Farm, IGKV, Raipur (C.G.) by growing of medium maturity group of twenty- seven pigeonpea genotypes.

Population dynamics of pod borers on pigeonpea crop were recorded from five randomly selected tagged plants from insecticide free plots at weekly interval started from date of sowing.

Afterwards, the total number of pods and number of damaged pods by pod borers on each demarcated plants were counted and converted into percentage. The percentage pod damaged and yield of each tested entry were calculated. The percentage of pod damaged and grain yield kg/ha were calculated with the help of following formula:

$$\text{Pod damage (\%)} = \frac{\text{No.of infested pod}}{\text{Total No.of pods (Healthy+Damaged)}} \times 100$$

$$\text{Grain Yield (Kg/Ha)} = \frac{\text{Weight of grain in Kg/Plot}}{\text{Plot area in m}^2} \times 1000$$

The genotypes were grouped in to highly resistance, moderately susceptible, susceptible and highly susceptible on the basis of Pest Resistance Rating (PRR) 1 to 9 rating scale as suggested by Abott, [20].

$$\text{Pest Resistance (\%)} = \frac{\text{P.D.of check} -- \text{P.D.of test genotypes}}{\text{P.D.of check}}\ 100$$

Where-

P. D. = Mean of % pod damaged

2.1 Statistical Analysis

The data obtained were analyzed statistically after using appropriate transformation. The data of pod damage were converted into square root transformation, by using the formula (√x +0.5). The data on pod and grain damage was first recorded from the plants and then converted into percentage. The percentage data were processed under arcsine transformation Sin-1 (√x /100) before statistical analysis. This transformed data was then analyzed by the method of analysis of variance as described by Gomez and Gomez [21]. The "F" test was used at 5 per cent level of significance.

The following formula were used for standard error, critical difference and coefficient of variance estimations:

$$\text{C.D.} = \frac{\sqrt{2\text{EMS}}}{\text{R}} \times t(\text{df at } 5\%)$$

Where,

R=Number of Replications,
D.F=Degrees of Freedom
T =Number of Treatments,
S.S.=Sum of Square
C.D.=Critical Difference,
EMS= Error Mean Square
M.S.S=Mean Sum of Square,
GM=Grand Mean

Table 1. Treatment details

Maturity type	**:** Medium
Total genotypes	**: 27**
Design	**:** RBD
Replication	**: 3**
Plot size	**: 2.40 m × 4 m**
Date of sowing	**:** 02/07/2022

Table 2. Nature of damage and Yield parameters

Pod damage (%)	Per cent pods damaged due to different pod borers based on the nature of damage were 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

Table 3. Pest resistance rating (PRR) category

Pest Resistance Rating (PRR)		**Pest Incidence (%)**
1.	Immune	100
2.	Highly resistant	75 to 99
3.	Resistant	50 to 75
4.	Moderately resistant	25 to 50
5.	Tolerant	10 to 25
6.	Equal to check	-10 to 10
7.	Moderately susceptible	-25 to -10
8.	Susceptible	-50 to -25
9.	Highly susceptible	-50 or less

Source: Technical program, IIPR, Kanpur, 23

Table 4. The skeleton of the analysis of variance

Source of variation	**DF**	**SS**	**MSS**	**F cal**	**F tab**	**CD 5%**
Replication (R)	(R-1)	RSS				
Treatment (T)	(T-1)	TrSS				
Error	(R-1) (T-1)	ESS				
Total	(R x T) - 1	TSS				

3. RESULTS AND DISCUSSION

3.1 Screening of Medium Maturity Group of Pigeonpea Germplasm against Pod Borer Complex during *kharif* 2022-23

The present investigations were aimed to identifying the tolerant and susceptible germplasm accessions of pigeonpea against pod borers. In the current Study, 27 medium duration pigeonpea genotypes were evaluated against the tur pod borer (*Helicoverpa armigera*), spotted pod borer (*Maruca vitrata*) and pod fly (*Melanagromyza obtusa*) under field condition.

3.1.1 Tur pod borer, *Helicoverpa armigera* (Hubner)

The infestation of pod borers was measured in terms of per cent pod damage (Table 5) at harvesting stage of the crop during *Kharif* 2022-23. These medium genotypes were showed significantly difference with each other for per cent pod damage by tur pod borer (*H. armigera*) which varied from 7.00% to 14.33%. Among the all-tested genotypes, minimum pod damage by *H. armigera* was observed in genotype of CG Arhar-2 with 7.00 per cent, whereas the maximum pod damage was observed in RPS-2015-50 with 14.33%.

The current results are also in agreement with the findings of Sinha et al*.* [22] who reported that among all the tested germplasm, minimum pod damage by tur pod borer (*H. armigera*) and turn pod fly (*M. obtusa*) was observed in GJP1915, whereas in case of spotted pod borer (*M. vitrata*) minimum pod damage was observed in GRG 622. The highest grain of pigeonpea was recorded in CG Arhar-2.

Similar results were obtained by Divyasree et al*.* [23] who reported that the different genotype of pigeonpea, genotypes RKPV 527-01, GJP 1606, JKM 189, BDN 711, ICPL-87119, RVSA 16-4, IPA 15-05 and LRG 467 were resistant with regard to per cent pod damage and 8 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 resistant with regard to per cent seed damage, while minimum seed yield was recorded in ICPL 8863 (360.67 kg ha-1). Similarly, Netam et al*.* [24] also reported that among genotypes, RPS-2007-109 recorded significantly highest pod damage, whereas RPS-2007-73 was recorded less pod damage. The losses in yield due to infestation by pod borer no. of pods/plant was highest recorded in the genotypes UPAS-120, grain yield/plot (kg/plot) and grain yield kg/ha was highest recorded in the genotypes BDN-2.

3.1.2 Spotted pod borer, *Maruca vitrata* (Fabricius)

At the crop harvesting stage, the prevalence of pod borers was quantified in terms of the percentage of damaged pods during *Kharif* 2022-23 (Table 5). The percentage of pod damage by spotted pod borer (*Maruca vitrata*) in the medium genotypes was ranged from 5.33% to 12.33%, indicated a significant variation between the genotypes. The examined genotype CG Arhar-2 had the least amount of pod damage with 5.33% and maximum per cent pod damage was observed in RPS-2015-50 with 12.33 per cent.

The current results are also in agreement with the findings of Sharma et al*.,* [25] observed "significant differences in the consumption and utilization of flowers by the 3rd instar larvae of *M. vitrata*. He found that the larvae reared on ICPL 84023 had lower larval and pupal mass than those reared on ICPL 90036-MI-2. He further stated that fecundity was low when the larvae were reared on the pods of *Maruca* resistant cultivar MPG 537-M 1-M5".

3.1.3 Tur pod fly, *Melanagromyza obtusa* (Malloch)

During the harvesting stage of the crop, the infestation of pod fly was measured in terms of per cent pod damage during *Kharif* 2022-23 (Table 5). Genotypes were showed significantly difference with each other for per cent pod damage by tur pod fly (*M. obtusa*) which was varied from 6.67% to 13.67%. Among the tested genotypes, minimum pod damage by *M. obtusa* was observed in genotype CG Arhar-2 (RC) with 6.67% whereas the maximum pod damage was observed in RPS-15-50 with 13.67%.

More or less our findings were similar to Singh et al*.,* [26] who reported against that "the first incidence of pod fly was observed in the 4th standard week in all genotypes except IVT-509, AVT-607 and AVT-605 and the population persisted up to 12th standard week in all the genotypes. The mean populations of pod fly on different genotypes ranged from 0.61 pod fly maggots/ 10 pods in IVT520 to 1.57 pod fly maggots/ 10 pods in IVT-510. The per cent pod damage due to pod fly significantly varied from 22.33 per cent in genotype IVT-520 to 46.67 percent in genotype IVT-510. The highest grain damage by pod fly was also seen in IVT-510 (20.96%) while the lowest grain damage was observed in IVT-520 (10.67%)". Similarly, Akhauri et al*.* [27] also reported that "susceptibility of pigeonpea genotypes against pod boring insect pod fly (*Melanagromyza obtusa*, Malloch) on the basis of extent of pod damage showed that the genotypes ICPL83015 and Pusa -6 were relatively less susceptible as against ICPL-151 which was found highly prone to the borer attack under the Agroclimatic of North Bihar".

3.1.4 Reaction of medium duration pigeonpea genotypes against pod borer complex

During *Kharif* 2022-23, among all the 27 genotypes of medium duration pigeonpea, no genotype was found to be immune, highly resistant, Moderately susceptible, susceptible, Highly susceptible and resistant with respect to per cent pod damage whereas genotype RP-1, RP-3, ICP-7374, ICP-6994, ICP-6996, RPS-2015-1, RPS-2015-10, RPS-2015-21, RPS-2015-34, RPS-2015-40, RPS-2015-41, CG ARHAR-2(RPS-2008-5) registered as moderately resistant, genotype RP-7, BDN-716, RPS-2015-2, RPS-2015-4, RPS-2014-26, RPS 2015-22, RPS-2015-23, RPS-2015-35, RPS-2015-38 registered as tolerant and genotype RPS-2014-23, RPS-2015-36 RPS-2015-50, RPS-2015-51, PT002 (RAJESHWARI), ICPL-87119 (ASHA) against *H. armigera*, *Maruca vitrata*, and *M. obtusa*.

The current investigation is in match with the findings of Sreekanth et al*.,* [28] who reported that among different germplasm lines screened, none of the genotype showed resistance to *H. armigera*. The genotypes, LRG 120, LRG 119, LRG 116, LRG 86, LRG 61 and LRG 52 showed moderate resistance with pod damage ranging from 16.8 to 21.4% to *M. vitrata*. Similarly, the genotypes, LRG 121, LRG 108, LRG 104, LRG 61 and LRG 52 showed moderate resistance with pod damage ranging from 16.9 to 21.2% to *M. obtusa*. Similarly, under advanced varietal trial, the genotypes, LRG 52 (4.5%), WRG 181 (5.3%) and RVSA 34 (5.5%) were categorized as moderately susceptible to gram pod borer, *Helicoverpa armigera* with pest susceptibility rating (PSR) of 5 and 6; and the genotypes, SKNP 224 (14.4%), WRG 79 (14.8%) and SKNP 207 (15.2%) were categorized as moderately resistant to spotted pod borer, *Maruca vitrata* with PSR of 4. The pod damage due to pod fly, *Melanagromyza obtusa* ranges from 11.8% (SKNP 207) to 35.5% (RVSA 81) and were categorized from moderately susceptible to highly susceptible with PSR ranging from 5 to 9.

The local check, LRG 41 has recorded highest yield (1611.0 kg/ha), followed by WRG 181 (1556.0 kg/ha).

Similar findings were reported by Tyagi et al*.,* [29] that pest susceptibility rating revealed that none of the genotypes felt in resistant and highly-resistant categories. Pod damage of some other genotypes viz. IVT-208 (*M. obtusa*-31.3%, *H. armigera*4.8%), IVT-12-904 (*M. obtusa*-29.5%, *H. armigera*-7.3%) also accounted for their lower levels of susceptibility to the insect pest complex.

Present findings were more or less related to Kavitha and Vijayaraghavan [30] when they screened 145 entries to identify the sources of resistance in pigeonpea to the *Maruca vitrata* and *Helicoverpa armigera*. Among the 145 entries, nine entries i.e., ICP 11007, H 23, BAHAR, DA 322, GR 28, ICP 49114, ICP 11957, SMR 1693158, BRG–10–02 were promising by exhibiting stable resistant reaction to *M. vitrata*. Seventeen entries showed resistance consistently to *H. armigera* during all the three years. In case of *M. vitrata*, minimum pest susceptibility index (PSI) of 2.0 was noted in ICP 11957 followed by 2.3 in SMR 1693158 and 2.7 in BRG-10-02, Bahar and H 23. For *H. armigera*, less PSI was noted in CORG 9900134, H 23, JKE 110, GR 28, WRG 42, ICP 11957 and ICPL 8719.

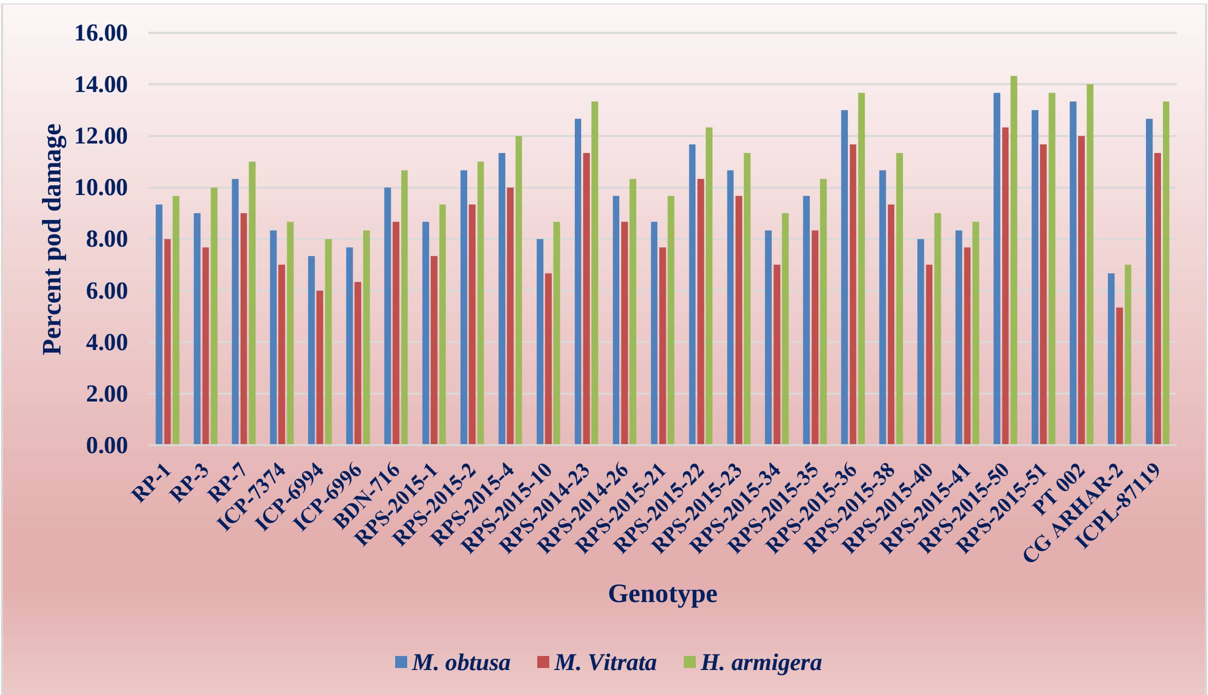

Fig. 1. Percent pod damage due to different pod borers in pigeonpea genotypes (2022-23)

Table 5. Screening of medium maturity group of pigeonpea during *kharif* 2022-23

S.N.	Germplasm	% Pod damage			Total % Damage by pod borer complex	PRR	Yield (kg/ha)
		M. vitrata	*H. armigera*	*M. obtusa*			
1	RP-1	8.00(16.40)	9.67(18.05)	9.33(17.78)	27.00(31.29)	4	1730.56
2	RP-3	7.67(16.02)	10.00(18.30)	9.00(17.38)	26.67(30.98)	4	1854.00
3	RP-7	9.00(17.16)	11.00(18.98)	10.33(18.31)	30.33(32.97)	5	1565.45
4	ICP-7374	7.00(15.31)	8.67(17.04)	8.33(16.73)	24.00(29.27)	4	1537.68
5	ICP-6994	6.00(14.14)	8.00(16.29)	7.33(15.65)	21.33(27.42)	4	1865.28
6	ICP-6996	6.33(14.56)	8.33(16.65)	7.67(16.02)	22.33(28.12)	4	1218.06
7	BDN-716	8.67(17.04)	10.67(18.96)	10.00(18.25)	29.33(32.64)	5	1873.61
8	RPS-2015-1	7.33(15.60)	9.33(17.75)	8.67(17.00)	25.33(30.10)	4	1708.33
9	RPS-2015-2	9.33(17.75)	11.00(19.33)	10.67(19.00)	31.00(33.77)	5	912.50
10	RPS-2015-4	10.00(18.41)	12.00(20.22)	11.33(19.61)	33.33(35.22)	5	1520.84
11	RPS-2015-10	6.67(14.95)	8.67(17.11)	8.00(16.40)	23.33(28.87)	4	1236.11
12	RPS-2014-23	11.33(19.64)	13.33(21.35)	12.67(20.82)	37.33(37.62)	6	1216.67
13	RPS-2014-26	8.67(17.09)	10.33(18.68)	9.67(17.97)	28.67(32.27)	5	1144.44
14	RPS-2015-21	7.67(16.02)	9.67(18.05)	8.67(17.04)	26.00(30.57)	4	**875.00**
15	RPS-2015-22	10.33(18.71)	12.33(20.53)	11.67(19.89)	34.33(35.82)	5	1151.39
16	RPS-2015-23	9.67(18.07)	11.33(19.64)	10.67(19.00)	31.67(34.19)	5	1555.56
17	RPS-2015-34	7.00(15.14)	9.00(17.43)	8.33(16.68)	24.33(29.44)	4	1473.61
18	RPS-2015-35	8.33(16.65)	10.33(18.74)	9.67(18.07)	28.33(32.10)	5	1412.50
19	RPS-2015-36	11.67(19.94)	13.67(21.69)	13.00(21.12)	38.33(38.23)	6	990.28
20	RPS-2015-38	9.33(17.68)	11.33(19.59)	10.67(18.96)	31.33(33.93)	5	1348.61
21	RPS-2015-40	7.00(15.31)	9.00(17.43)	8.00(16.34)	24.00(29.28)	4	1591.67
22	RPS-2015-41	7.67(16.02)	8.67(17.11)	8.33(16.68)	24.67(29.71)	4	1230.56
23	RPS-2015-50	**12.33(20.45)**	**14.33(22.16)**	**13.67(21.52)**	**40.33(39.32)**	6	1370.83
24	RPS-2015-51	11.67(19.94)	13.67(21.65)	13.00(21.04)	38.33(38.20)	6	1748.61
25	PT002 (RAJESHWARI)	12.00(20.22)	14.00(21.96)	13.33(21.37)	39.33(38.81)	6	1111.11
26	CG ARHAR-2(RPS-2008-5)	**5.33(13.26)**	**7.00(15.31)**	**6.67(14.85)**	**19.00(25.74)**	4	**1927.78**
27	ICPL-87119 (ASHA)	11.33(19.64)	13.33(21.32)	12.67(20.71)	37.33(37.58)	6	1726.39
	C.D.	**3.14**	**3.05**	**3.78**	**6.22**		**408.91**
	SE(m)	**1.10**	**1.07**	**1.33**	**2.18**		**144.49**
	C.V.	**11.19**	**9.82**	**12.56**	**11.56**		**19.536**

Figure in parenthesis is arc sine percentage transformed values; RC Resistant check

Table 6. Reaction of pigeonpea medium duration genotypes against pod borers during *kharif* 2022-23

Pest resistance rating (PRR)	Category	Germplasm	Total % Pod damage by pod borers	Grain yield (kg/ha)
1	**Immune**	**-**	**-**	**-**
2	**Highly resistant**	**-**	**-**	**-**
3	**Resistant**	**-**	**-**	**-**
4	**Moderately resistant**	RP-1, RP-3, ICP-7374, ICP-6994, ICP-6996, RPS-2015-1, RPS-2015-10, RPS-2015-21, RPS-2015-34, RPS-2015-40, RPS-2015-41, CG ARHAR-2(RPS-2008-5).	21.33-27.00	875.00-1927.78
5	**Tolerant**	RP-7, BDN-716, RPS-2015-2, RPS-2015-4, RPS-2014-26, RPS-2015 22, RPS-2015-23, RPS-2015-35, RPS-2015-38.	28.33-33.33	912.00-1873.61
6	**Equal to check**	RPS-2014-23, RPS-2015-36, RPS-2015-50, RPS-2015-51, PT002 (RAJESHWARI), ICPL-87119 (ASHA)	37.33-40.33	990.00-1748.61
7	**Moderately susceptible**	**-**	**-**	**-**
8	**Susceptible**	**-**	**-**	**-**
9	**Highly susceptible**	**-**	**-**	**-**

3.1.5 Grain yield

During *Kharif* 2022-23, among the all screened pigeonpea genotypes of medium duration, the highest grain yield of pigeonpea was recorded in CG Arhar-2 as 1927.78 kg/ha. Whereas, the lowest grain yield was recorded in RPS-2015-21 as 875.00 kg/ha.

More or less our findings were similar with Gupta et al*.,* [31] who reported that the highest yield was obtained in ICP 7398 during both years with 12.23 q/ha and 13.65q/ ha. But the germplasm RP-3 recorded highest per cent pod damage with 36.26 per cent, highest per cent grain damage of 26.72 per cent and also lowest grain yield was obtained in both years with 2.50 q/ha and 1.59 q/ h. Similarly, Srivastava and Seghal [32] also reported that ICPL 151 give the highest yield among all entries. Singh et al*.,* [26] The grain yield of different genotypes also differed significantly and ranged from 479 kg/ha in the genotype IVT-510 to 3314 kg/ha in IVT-520.

4. CONCLUSION

The screening of various genotypes revealed significant variations among them in terms of percent damage of pod and grain yield. The genotype RPS-2015-50 exhibited the highest total percent damage of pod due to *H. armigera*, *M. vitrata*, and *Melanagromyza obtusa* at 40.33%, whereas the lowest total pod percent damage was found in the genotype CG ARHAR-2 at 19.00%. In case of grain yield, BDN-716 recorded the maximum grain yield at 1927.78 kg/ha, while the minimum yield of grain was recorded in RPS-2015-21 at 875.00 kg/ha.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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