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Screening for resistance against Tur Pod bug, *Clavigralla gibbosa* (Spinola) in long duration Pigeonpea genotypes

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Abstract
The present experiment was conducted during *Kharif* 2017-18 at the Entomological Research Field, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. In this field trial 9 long duration Pigeonpea genotypes were screened for resistance against Tur Pod bug, *Clavigralla gibbosa* (Spinola). The first incidence of pod bug was observed in the 4th standard week in all genotypes and the population persisted up to 12th standard week in all the genotypes. The peak population of pod bug irrespective of the genotype was recorded in 10th standard week. The mean populations of pod bug on different genotypes ranged from 1.84 pod bugs/plant in CRG 2015-007 to 4.40 bugs/plant in Bahar (Check). The per cent pod damage due to pod bug significantly varied from 14.33 per cent in genotype CRG 2015-007 to 29.00 per cent in genotype Bahar. The highest grain damage by pod bug was also seen in Bahar (8.97%) while the lowest grain damage was observed in CRG 2015-007 (3.85%). The grain yield of different genotypes also differed significantly and ranged from 916 kg/ha in the genotype Bahar to 1500 kg/ha in JKM 189.

Keywords: Pigeonpea, pod bug, screening, RBD, damage, genotype

Introduction
Pigeonpea, *Cajanus cajan* (L.) Millsp. is an important grain legume grown in semi-arid tropics and sub-tropical areas of the world. India accounts for more than 90 per cent of the world's pigeonpea production and area [1]. In India pigeonpea is grown on 3.88 million hectares of area with an annual production of 3.29 million tonnes and yield of 849 kg/ha [2] Though, India is largest producer of pigeonpea, its productivity has always been a concern. The low productivity of pigeonpea in the country may be attributed to many reasons, among which damage by insect pests is of paramount importance. More than 250 species of insects are known to infest pigeonpea crop at its various growth stages but of these only a few cause significant and consistent damage to the crop [3].

Among the pod damaging insect pests of pigeonpea, next to pod borers, tur pod bug, *Clavigralla gibbosa* Spinola (Hemiptera: Coreidae) has become a real threat to quality grain production in pigeonpea. The damage in grain yield due to pod bug generally ranges between 25 to 40 per cent [4]. The total grain loss due to pod sucking bugs has been worked out to the tune of 50,000 tonnes annually for U.P. alone. Both nymphs and adults of this insect feed using their piercing mouthparts to penetrate the pod wall and suck the liquid from developing seeds. Damaged seeds become shrivelled, and develop dark patches. Seeds spoiled by pod sucking bugs neither germinate nor acceptable as human food [5]. It has long been recognized that host plant resistance holds a great promise for exploitation in integrated pest management programmes because the use of resistant cultivarss provide crop protection that is biologically, ecologically, economically and socially acceptable. Since pigeonpea growers have to spend much on input like chemical pesticides, therefore also it is considered viable to search the available germplasms for sources of resistance to this insect pest for use in breeding insect resistant cultivars. Thus, keeping these views in mind, the present study was conducted to identify resistant sources so as to evolve long duration cultivars less susceptible to pod borer complex in pigeonpea.

Materials and Methods
The present investigation was carried out at Entomological Research Field, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *Kharif*, 2017–18.

Nine pigeonpea genotypes LRG 208, ICPL 87119, CRG 2015-007, BDN 2014-2, RKPV 455-02, BAUPP 15-22, JKM 189, RKPV 310-09 and Bahar were grown each in plots of 3 rows of 4 m length following row to row and plant to plant spacing of 75 cm and 25 cm respectively. The crop was grown following the normal agronomic practices in "Randomized Block Design (RBD)" with three replications. The crop was sown on 22nd July 2017 and harvested on 15th April 2018 respectively. The population of pod bug was recorded by observing 5 plants selected randomly out of 100 pods picked up from 5 selected plants in each treatment. The number of insect count recorded from all the three replications and for all the genotypes were averaged separately for each genotype on standard week basis. The sampling for pod and seed damage assessment due to pod bug was done at 80% maturity stage of the crop. For pod and grain damage assessment, five plants from the three central rows in each plot were selected randomly and all the pods from five plants were pooled together and finally 100 pods were picked up and observations were recorded. Later, the percent pod and grain damage was calculated by using the formulae.

$$\% \text{ Pod damage} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$$

$$\% \text{ Grain damage} = \frac{\text{Number of damaged grains}}{\text{Total number of grains}} \times 100$$

$$\% \text{ Grain damage} = \frac{\text{Number of damaged grains}}{\text{Total number of grains}} \times 100$$

Also the grain yield was recorded for each plot after excluding the border rows on the two sides of the plot and then extrapolated into kg/ha.

Statistical analysis

All the data recorded were subjected to statistical analysis as per the Randomized Block Design procedure. The insect population data were transformed with square root transformation √x+0.5 method and damage assessment data were transformed by arc sin (q = sin-1x) transformation method.

Results and Discussion

Nine pigeonpea genotypes were screened under unprotected conditions for studying the damage assessment in relation to per cent pod and grain damage due to pod bug during 2017-18. The results obtained from the investigation as well as relevant discussion have been summarized under the following heads:

Incidence pattern of pod bug, *C. gibbosa* on different long duration pigeonpea genotypes

During 2017-18 the first incidence of pod bug, *C. gibbosa* was observed in the 4th standard week in all genotypes. The bug was recorded from 4th to 12th standard week in all genotypes (Table. 1). The different peaks of population of pod bug were recorded from 10th to 12th standard week in different genotypes. The peak population of pod bug was found in all genotypes during 10th standard week in all genotypes. Among the nine pigeonpea genotypes, the mean population of pod bug was recorded highest in Bahar *i.e.* (4.40 bugs/plant) followed by BDN 2014-2 (3.54 bugs/plant), RKPV 455-02 (3.21 bugs/plant), and lowest in genotype CRG 2015-007 (1.84 bugs/plant), followed by RKPV 310-09 (1.99 bugs/plant) and JKM 189 (2.09 bugs/plant).

The results are in agreement with Kumar and Nath [6] who reported that the activity of pod bug (*Clavigralla gibbosa*) infestation was observed from 23rd January to 24th March. Its peak population was recorded on 7th February. Similar trend of population buildup of bug was also observed by Kumar and Nath [7]. The peak population of pod bug on pigeonpea from 8th standard week to 12th standard week [8]. Srujana and Keval [5] also studied seasonal incidence pattern of tur pod bug on long duration pigeonpea (Bahar). Highest mean population of *C. gibbosa* was observed in 9th standard week (6.4 bugs/plant), followed by 8th standard week (5.8 bugs/ plant) and lowest population (0.2 bug/plant) was recorded in the 1st standard week.

Extent of damage caused by pod bug, *C. gibbosa* in long duration pigeonpea genotypes

The data presented in Table 2 depicted the per cent pod damage and grain damage by pod bug on different pigeonpea genotypes during 2017-18. The per cent pod damage caused by pod bug on different genotypes varied significantly. It ranged from 14.33 per cent in genotype CRG 2015-007 to 29.00 per cent in genotype Bahar. Maximum pod damage due to pod bug were seen in Bahar (29.00%) followed by BDN 2014-2 (16.00%) and BAUPP 15-22 (16.00%) and lowest pod damage was observed in CRG 2015-007 (14.33%) followed by JKM 189 (14.33%) and RKPV 310-09 (14.33%).

The per cent grain damage due to pod bug also showed significant differences among the genotypes. It ranged from 3.85 per cent in genotype CRG 2015-007 to 8.97 per cent in genotype Bahar. The highest grain damage by pod bug were seen in Bahar (8.97%) followed by BDN 2014-2 (6.56%), RKPV 455-02 (5.55%) and lowest grain damage was observed in CRG 2015-007 (3.85%) followed by RKPV 310-09 (4.39%) and JKM 189 (4.57%).

Similar results were reported by Pradyumn in the year 2005[9] on fifteen early maturing genotypes of pigeonpea for their resistance to the pod bug, *Clavigralla gibbosa*. They reported that ICPL 87, ICPL 86012 and ICPL 84052 were the least preferred hosts, whereas ICPL 84023 was highly preferred by the pod bug. ICPL 87 was found completely free from pest infestation. Khan in the year 2014[10, 11] Also screened twenty four genotypes of pigeonpea at Varanasi and found genotypes ICP 10531, ICP 13212, ICPL 20036, ICPHaRL 4979-2 and ICPHaRL 4985-1 most susceptible against pod bug, as they exhibited damage rating of 8 on Pest Susceptibility Rating Index.

Table 1: Pod bug (*Clavigrella gibbosa* Spinola) population on different long duration pigeonpea genotypes during 2017-18

Genotypes	Pod bug per plant									
	4th SW	5th SW	6th SW	7th SW	8th SW	9th SW	10th SW	11th SW	12th SW	Over all mean
LRG 208	0.30 (1.135)	0.40 (1.135)	0.70 (1.135)	0.85 (1.360)	1.48 (1.575)	2.24 (1.800)	5.89 (2.630)	4.11 (2.260)	3.53 (2.128)	2.16 (1.711)
ICPL 87119	0.44	0.50	0.78	0.94	1.42	2.23	6.27	5.91	5.15	2.63

	(1.191)	(1.191)	(1.191)	(1.393)	(1.556)	(1.797)	(2.696)	(2.629)	(2.480)	(1.910)
CRG 2015-007	0.20 (1.122)	0.30 (1.122)	0.34 (1.122)	0.70 (1.269)	1.12 (1.456)	2.08 (1.755)	2.97 (1.992)	3.69 (2.165)	5.16 (2.428)	1.84 (1.755)
BDN 2014-2	0.70 (1.407)	0.98 (1.407)	1.10 (1.407)	1.68 (1.637)	2.20 (1.794)	4.07 (2.252)	7.90 (2.977)	5.96 (3.257)	5.51 (2.551)	3.54 (2.713)
RKPV 455-02	0.61 (1.269)	0.99 (1.269)	0.93 (1.269)	1.1 (1.449)	1.74 (1655)	2.67 (1.916)	7.68 (2.946)	7.27 (2.876)	5.91 (2.629)	3.21 (3.012)
BAUPP 15-22	0.58 (1.374)	0.89 (1.374)	0.90 (1.360)	1.47 (1.571)	1.99 (1.729)	4.47 (2.114)	8.32 (3.212)	5.14 (2.478)	4.42 (2.328)	3.15 (2.009)
JKM 189	0.20 (1.135)	0.30 (1.135)	0.37 (1.135)	0.56 (1.248)	0.92 (1.386)	1.51 (1.584)	7.14 (2.853)	4.95 (2.439)	2.98 (1.995)	2.09 (1.780)
RKPV 310-09	0.30 (1.158)	0.34 (1.158)	0.40 (1.158)	0.65 (1.284)	1.16 (1.47)	2.07 (1.752)	5.08 (2.466)	4.87 (2.432)	3.05 (2.012)	1.99 (1.712)
BAHAR(Check)	0.80 (1.334)	1.00 (1.382)	1.50 (1.595)	3.50 (2.114)	4.90 (2.425)	6.30 (2.670)	9.61 (3.527)	6.90 (2.814)	6.80 (2.792)	4.40 (2.226)
SEm±	0.017	0.016	0.016	0.017	0.017	0.012	0.014	0.026	0.010	0.037
CD at 5%	0.047	0.046	0.046	0.048	0.047	0.035	0.041	0.052	0.029	0.099

Figures in parentheses are √x+0.5 transformed values
SW: Standard week

Table 2: Extent of damage caused by pod yield of different long duration pigeonpea genotypes during 2017-18

S. No.	Genotypes	Per cent pod damage by *C. gibbosa*	Per cent grain damage by *C. gibbosa*	Yield kh/ha
1	LRG 208	15.33 (22.93)	5.15(13.01)	1179
2	ICPL 87119	16.00 (23.43)	5.47(13.52)	1083
3	CRG 2015-007	14.33 (22.07)	3.85(11.31)	1250
4	BDN 2014-2	16.66 (24.07)	6.56(14.83)	927
5	RKPV 455-02	16.00 (23.52)	5.55(13.54)	1049
6	BAUPP 15-22	16.00 (23.43)	5.50(13.55)	1013
7	JKM 189	14.33 (22.16)	4.57(12.28)	1500
8	RKPV 310-09	14.33 (22.16)	4.39(12.02)	1092
9	BAHAR(Check)	29.00 (32.4)	8.97(24.31)	916
	SEm±	2.58	1.08	17.74
	CD at 5%	7.20	4.13	53.65

Grain yield
The data on grain yield per hectare of different genotypes are given in Table 2. There was significant difference in grain yield among the genotypes. The highest grain yield was recorded from JKM 189 (1500 kg/ha) followed by CRG 2015-007 (1250 kg/ha) which were significantly different from other genotypes whereas the lowest grain yield was recorded from Bahar (916 kg/ha). These findings are in conformity with Borad in the year 1991[12], Sachan and Yadava [13] who also reported higher yield potential in those pigeonpea genotypes which showed lesser incidence of pod borers.

Conclusion
On the basis of the above investigation it may be concluded that host plant resistance plays a very important part in governing the pest infestation level in pigeonpea and screening is an appropriate method to identify resistant genotypes. The pod bug, *Clavigralla gibbosa* Spinola is a cardinal insect pest on pigeonpea in this zone and its incidence increases with the advancement of crop age. Actual damage to the economic produce also takes place after flowering in case of pulses. Among the nine genotypes screened, CRG 2015-007 was found to be most resistant against pod bug damage and also recorded better yield. Hence this genotype can be recommended to the farmers of Varanasi region for the successful control of pod bug.

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