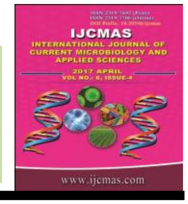
Int.J.Curr.Microbiol.App.Sci (2017) *6*(4): 51-57

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 4 (2017) pp. 51-57**
Journal homepage: http://www.ijcmas.com



Original Research Article
https://doi.org/10.20546/ijcmas.2017.604.007

Field Screening of Pigeonpea Genotypes against the Infestation of Tur Pod Bug, *Clavigralla gibbosa* Spinola

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A B S T R A C T

Keywords

Pigeonpea, Pod bug, Pod damage, Grain damage, Yield

Article Info

Accepted:
02 March 2017
Available Online:
10 April 2017

Twenty nine long duration pigeonpea genotypes were screened for their reaction against pod bug during *Kharif* 2014-15 at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The first incidence of pod bug was observed in the 4th standard week in all the genotypes and the population persisted up to 12th standard week in all the genotypes. The peak population of pod bug was found in all genotypes during 12th standard week except IVT-512, IVT-501, IVT-504, IVT-516 where the peak was recorded during 11th standard week. The mean populations of pod bug on different genotypes ranged from 1.57 bugs/ plant in IVT-520 to 3.91 bugs/ plant in IVT-510. The per cent pod damage due to pod bug significantly varied from 16.33 per cent in genotype IVT-520 to 37.33 per cent in genotype IVT-510. The highest grain damage by pod bug was also seen in IVT-510 (20.75%) while the lowest grain damage was observed in IVT-520 (6.98%). 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.

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 (Mathukia *et al.*, 2016). 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 (Anonymous, 2014). 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 (Gopali *et al.*, 2010).

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 (Gopali *et al.*, 2013). 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 (Srujana and Keval, 2014).

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 Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *kharif*, 2014–15. Twenty nine long duration pigeonpea genotypes/varieties [IVT-501, IVT-502, IVT-503, IVT-504, IVT-505, IVT-506, IVT-507, IVT-508, IVT-509, IVT-510, IVT-511, IVT-512, IVT-513, IVT-514, IVT-515, IVT-516, IVT-517, IVT-518, IVT-519, IVT-519, IVT-520, IVT-521, AVT-601, AVT-602, AVT-603, AVT-604, AVT-605, AVT-606, AVT-607, AVT-(MAL13*846)] 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 30 cm respectively. The crop was grown following the normal agronomic practices in "Randomized Block Design (RBD)" with three replications. The crop was sown on 26th July 2014 (30th standard week) and harvested on 7th April 2015 (15th standard week) respectively.

For recording the population of pod bug, five plants were randomly selected from each genotype and each unit plot and the total number of nymphs and adults of *C. gibbosa* present on them were counted at weekly intervals, from 24th January to 20th March, 2015. 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 also worked out. The grain yield was also 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

Twenty nine pigeonpea genotypes/varieties were screened under unprotected conditions for studying the damage assessment in relation to per cent pod and grain damage due to pod bug during 2014-15. 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 pigeonpea genotypes

During 2014-15 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 11th to 12th standard week in different genotypes. The peak population of pod bug was found in all genotypes during 12th standard week except IVT-512, IVT-501, IVT-504, IVT-516 genotypes. Among the twenty nine pigeonpea genotypes, the mean population of pod bug was recorded highest in IVT-510 *i.e.* (3.91 bugs/plant) followed by IVT-502 (3.76 bugs/plant), IVT-501 (3.54 bugs/plant), and lowest in genotype IVT-520 (1.57 bugs/plant), followed by IVT-509(1.65 bugs/plant) and AVT-603 (1.79 bug/plant) (Figure 1).

The results are in agreement with Kumar and Nath (2003) 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 build up of bug was also observed by Kumar and Nath (2005). Kumar *et al.,* (2010) observed the peak population of pod bug on pigeonpea from 8th standard week to 12th standard week. Srujana and Keval (2014) 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 different 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 2014-15. The per cent pod damage caused by pod bug on different genotypes varied significantly. It ranged from 16.33 per cent in genotype IVT-520 to 37.33 per cent in genotype IVT- 510. Maximum pod damage due to pod bug were seen in IVT-510 (37.33%) followed by IVT-502 (35.00%) and IVT-501 (34.00%) and lowest pod damage was observed in IVT-520 (16.33%) followed by IVT-509 (18.67%) and AVT-603 (22.67%).

The per cent grain damage due to pod bug also showed significant differences among the genotypes. It ranged from 6.98 per cent in genotype IVT-520 to 20.75 per cent in genotype IVT-510.The highest grain damage by pod bug were seen in IVT-510 *i.e.* (20.75%) followed by IVT-502 (14.45%), IVT-501 (13.43%) and lowest grain damage was observed in IVT-520 (6.98%) followed by IVT-509 (6.98%), AVT-603 (8.05%).

Similar results were reported by Pradyumn *et al.,* (2005) 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 *et al.,* (2014) 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 Population of tur pod bug, *C. gibbosa* on pigeonpea genotypes during Kharif 2014-15

Genotypes	Number of maggots per 10 pods*									
	4th S.W. 24 Jan.	5th S.W. 31 Jan.	6th S.W. 7 Feb.	7th S.W. 14 Feb.	8th S.W. 21 Feb.	9th S.W. 28 Feb.	10th S.W. 6 Mar.	11th S.W. 13 Mar.	12th S.W. 20 Mar.	Overall mean
IVT-501	0.68 (1.407)	0.98 (1.407)	1.15 (1.407)	1.68 (1.637)	2.20 (1.794)	4.07 (2.252)	5.51 (2.551)	5.96 (2.638)	9.61 (3.257)	3.54
IVT-502	1.12 (1.292)	0.67 (1.292)	1.32 (1.292)	1.89 (1.700)	2.36 (1.833)	4.05 (2.247)	5.96 (2.638)	5.91 (2.629)	10.54 (3.397)	3.76
IVT-503	0.87 (1.364)	0.86 (1.364)	1.05 (1.364)	1.17 (1.473)	1.81 (1.676)	3.14 (2.035)	4.13 (2.265)	5.57 (2.563)	7.60 (2.951)	2.91
IVT-504	0.18 (1.135)	0.29 (1.135)	0.27 (1.135)	0.56 (1.248)	0.92 (1.386)	1.51 (1.584)	2.98 (1.995)	7.14 (2.853)	4.95 (2.439)	2.09
IVT-505	0.18 (1.126)	0.27 (1.126)	0.45 (1.126)	0.82 (1.349)	1.22 (1.490)	1.90 (1.703)	2.97 (1.992)	4.67 (2.381)	5.16 (2.482)	1.96
IVT-506	0.79 (1.03)	0.62 (1.030)	0.88 (1.03)	1.11 (1.261)	1.64 (1.323)	2.80 (1.502)	4.33 (1.967)	5.45 (2.138)	7.26 (2.406)	2.76
IVT-507	0.89 (1.335)	0.75 (1.335)	0.85 (1.335)	1.30 (1.516)	1.78 (1.677)	3.02 (2.005)	5.34 (2.518)	5.67 (2.583)	7.49 (2.914)	3.01
IVT-508	0.35 (1.158)	0.34 (1.158)	0.34 (1.158)	0.65 (1.284)	1.16 (1.47)	2.07 (1.752)	3.05 (2.012)	4.87 (2.423)	5.08 (2.466)	1.99
IVT-509	0.12 (1.025)	0.05 (1.025)	0.15 (1.025)	0.51 (1.229)	0.91 (1.382)	1.46 (1.568)	2.76 (1.939)	3.87 (2.207)	5.05 (2.46)	1.65
IVT-510	1.04 (1.375)	0.89 (1.375)	1.11 (1.375)	1.78 (1.670)	2.07 (1.752)	3.98 (2.232)	5.91 (2.628)	8.01 (3.002)	10.41 (3.378)	3.91
IVT-511	0.53 (1.191)	0.42 (1.191)	0.78 (1.191)	0.94 (1.393)	1.42 (1.556)	2.23 (1.797)	5.91 (2.629)	5.15 (2.480)	6.27 (2.696)	2.63
IVT-512	0.99 (1.269)	0.61 (1.269)	0.93 (1.269)	1.10 (1.449)	1.74 (1.655)	2.67 (1.916)	5.91 (2.629)	7.68 (2.946)	7.27 (2.876)	3.21
IVT-513	0.38 (1.135)	0.29 (1.135)	0.70 (1.135)	0.85 (1.36)	1.48 (1.575)	2.24 (1.800)	3.53 (2.128)	4.11 (2.260)	5.89 (2.63)	2.16
IVT-514	0.55 (1.229)	0.51 (1.229)	0.53 (1.229)	0.95 (1.396)	1.24 (1.496)	2.29 (1.814)	3.97 (2.229)	4.78 (2.404)	6.11 (2.666)	2.33
IVT-515	1.05 (1.374)	0.89 (1.374)	0.58 (1.374)	1.47 (1.571)	1.99 (1.729)	3.47 (2.114)	4.42 (2.328)	5.14 (2.478)	9.32 (3.212)	3.15
IVT-516	0.85 (1.201)	0.44 (1.200)	0.98 (1.200)	1.23 (1.493)	1.98 (1.726)	2.85 (1.962)	4.07 (2.252)	8.24 (3.040)	7.41 (2.906)	3.12
IVT-517	0.96 (1.371)	0.88 (1.371)	0.52 (1.371)	1.39 (1.546)	2.08 (1.755)	3.15 (2.037)	4.13 (2.265)	5.15 (2.480)	7.60 (2.933)	2.87
IVT-518	0.49 (1.127)	0.27 (1.127)	0.76 (1.127)	0.97 (1.403)	1.49 (1.578)	2.36 (1.833)	3.46 (2.112)	5.57 (2.563)	5.82 (2.611)	2.35
IVT-519	0.29 (1.122)	0.26 (1.122)	0.34 (1.122)	0.61 (1.269)	1.12 (1.456)	2.08 (1.755)	2.97 (1.992)	3.69 (2.165)	5.16 (2.482)	1.84
IVT-520	0.09 (1.273)	0.06 (1.273)	0.16 (1.273)	0.59 (1.452)	0.75 (1.625)	1.29 (1.949)	2.87 (2.307)	3.57 (2.540)	4.79 (2.874)	1.57
IVT-521	0.72 (1.261)	0.59(1.261)	0.94 (1.261)	1.07 (1.439)	1.78 (1.667)	2.88 (1.970)	4.08 (2.254)	5.75 (2.598)	7.06 (2.839)	2.76
AVT-601	0.34 (1.100)	0.21 (1.100)	0.44 (1.100)	0.79 (1.338)	1.03 (1.424)	1.98 (1.726)	3.18 (2.044)	4.23 (2.287)	5.61 (2.571)	1.98
AVT-602	0.60 (1.237)	0.53 (1.237)	0.90 (1.237)	0.92 (1.385)	1.63 (1.622)	2.38 (1.838)	3.82 (2.195)	3.93 (2.220)	6.23 (2.689)	2.33
AVT-603	0.23 (1.077)	0.16 (1.077)	0.28 (1.077)	0.71 (1.308)	0.99 (1.411)	1.88 (1.697)	2.87 (1.967)	4.01 (2.310)	5.01 (2.451)	1.79
AVT-604	0.40 (1.136)	0.29 (1.136)	0.47 (1.136)	0.85 (1.360)	1.46 (1.568)	2.08 (1.755)	3.21 (2.052)	4.3 (2.302)	5.99 (2.644)	2.12
AVT-605	0.81 (1.338)	0.79 (1.338)	0.85 (1.338)	1.08 (1.442)	1.88 (1.697)	3.18 (2.044)	4.13 (2.265)	5.77 (2.602)	8.23 (3.038)	2.97
AVT-606	0.29 (1.104)	0.22 (1.104)	0.35 (1.104)	0.69 (1.300)	0.97 (1.403)	1.88 (1.697)	2.98 (1.995)	3.99 (2.234)	5.67 (2.583)	1.89
AVT-607	0.35 (1.144)	0.31 (1.144)	0.38 (1.144)	0.85 (1.360)	1.09 (1.446)	2.11 (1.763)	3.58 (2.104)	4.45 (2.335)	5.89 (2.625)	2.11
MAL13*846 (Check)	0.45 (1.140)	0.30 (1.140)	0.68 (1.140)	0.81 (1.345)	1.04 (1.428)	2.11 (1.763)	3.49 (2.119)	4.29 (2.300)	5.68 (2.585)	2.09
SE(m)±	**0.017**	**0.016**	**0.016**	**0.017**	**0.017**	**0.012**	**0.014**	**0.026**	**0.010**	**-**
CD at 5%	**0.047**	**0.046**	**0.046**	**0.048**	**0.047**	**0.035**	**0.041**	**0.052**	**0.029**	**-**

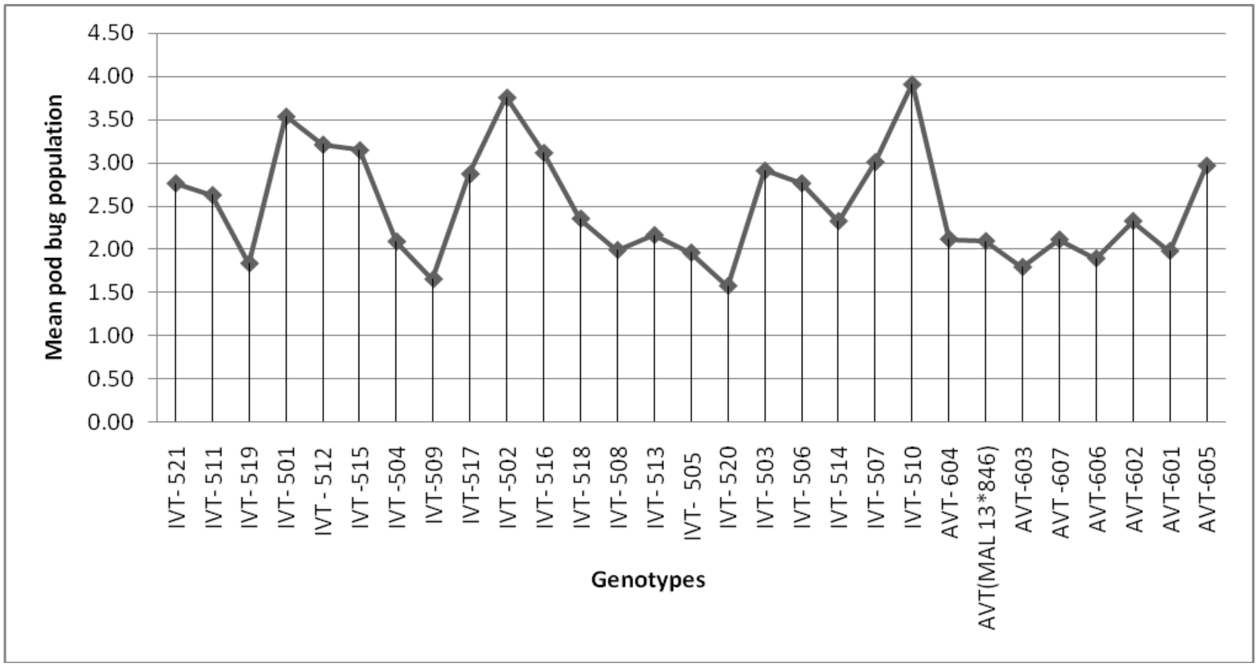
*Figures in parentheses are √x+0.5 transformed value; SW = Standard Week

Table.2 Extent of damage caused by pod bug and yield of different long duration pigeonpea genotypes during 2014-15

Genotypes	% Pod Damage*	% Grain Damage*	Yield (kg/ha)
IVT-501	34.00 (35.83)	13.43 (21.04)	1300
IVT-502	35.00 (36.43)	14.45 (22.28)	1244
IVT-503	32.67 (34.75)	14.31 (21.38)	2775
IVT-504	24.00 (29.28)	12.54 (20.59)	2801
IVT-505	30.67 (33.60)	9.72 (18.02)	1698
IVT-506	30.33 (33.25)	13.54 (21.57)	2836
IVT-507	29.67 (32.49)	11.48 (18.82)	1725
IVT-508	22.00 (27.91)	7.91 (15.97)	2166
IVT-509	18.67 (25.51)	6.98 (15.29)	3199
IVT-510	37.33 (37.59)	20.75 (26.72)	479
IVT-511	20.00 (26.50)	10.42 (18.54)	1992
IVT-512	18.00 (25.19)	12.54 (20.57)	1304
IVT-513	33.00 (34.91)	10.42 (18.80)	2295
IVT-514	20.67 (26.89)	12.97 (20.95)	2592
IVT-515	22.33 (28.01)	12.97 (21.93)	2268
IVT-516	22.33 (28.11)	9.16 (17.56)	2083
IVT-517	24.00 (29.34)	13.60 (21.62)	2381
IVT-518	24.33 (29.48)	13.43 (21.34)	2652
IVT-519	24.00 (29.32)	11.49 (19.61)	2504
IVT-520	16.33 (23.79)	6.98 (15.29)	3314
IVT-521	27.67 (31.65)	9.76 (17.81)	2674
AVT-601	25.00 (29.94)	11.10 (19.37)	2393
AVT-602	31.00 (33.79)	12.79 (20.85)	2164
AVT-603	22.67 (28.26)	8.05 (16.43)	3196
AVT-604	24.67 (29.56)	10.91 (19.17)	2752
AVT-605	24.33 (31.24)	10.44 (18.82)	2395
AVT-606	28.67 (32.10)	13.43 (21.18)	2025
AVT-607	25.33 (30.17)	10.45 (18.82)	2994
AVT-MAL13*846 (Check)	28.67 (32.04)	11.48 (19.71)	2293
SE(m)±	**1.995**	**1.584**	**-**
CD at 5%	**5.667**	**4.498**	**-**

*Figures in parentheses are arc sin transformed values

Figure.1 Population fluctuation of tur pod bug on different pigeonpea genotypes during Kharif 2014-15



Grain yield

The data on grain yield per hectare of different genotypes are given in table 3. There was significant difference in grain yield among the genotypes. The highest grain yield was recorded from IVT 520 (3314 kg/ha) which was significantly different from other genotypes where as the lowest grain yield was recorded from IVT-510 (479 kg/ha). These findings are in conformity with Khan *et al.*, (2014) and Borad *et al.*, (1991) who also reported higher yield potential in those pigeonpea genotypes which showed lesser incidence of pod borers.

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 twenty nine genotypes screened, IVT-520, IVT-509 and AVT-603 were found to be most resistant against pod bug damage and hence should be promoted.

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How to cite this article:

Maneesh Kumar Singh, Ram Keval, Snehel Chakravarty and Vijay Kumar Mishra. 2017. Field Screening of Pigeonpea Genotypes against the Infestation of Tur Pod Bug, *Clavigralla gibbosa* Spinola. *Int.J.Curr.Microbiol.App.Sci.* 6(4): 51-57.
doi: https://doi.org/10.20546/ijcmas.2017.604.007