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Assessment of Genotype Against Major Insect Pests of Cluster Bean in Gird Region of Madhya Pradesh

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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

In order to assess cluster bean genotypes against the major insect during the kharif 2022, Nine cluster bean genotypes were investigated in a randomised block design with three replications: T1 - RGr 20-7, T2 - GD-567, T3 - HG 2-20 (ch), T4 - CAZG 17-4-5, T5 - RGC 1066 (ch), T6 - GD-565, T7 - RGR 20-15, T8 - RGC 1033 (ch), and T9 - X-25. Aphid, whitefly, jassid, and thrips minimum infestation were found in genotype GD-565, which was succeeded by CAZG 17-4-5. Whereas, Aphid, whitefly, jassid, and thrips populations reached their maximum in genotype RGC 1066 (ch). The GD-565 genotype was shown to be the best appropriate for growing in Madhya Pradesh's Gird area.

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1. INTRODUCTION

Cyamopsis tetragonoloba (Linn.) Taub., often known as the cluster bean or guar, is one of the most important commercial crops grown in arid and semi-arid regions of the world today. (Raju and Omprakash, 2014). For every 100 g of edible part, the young cluster bean pods are a cheap source of calories, protein, fat, carbohydrate, vitamin A, vitamin C, calcium, and iron. They are also eaten as vegetables. Between 31.4 and 41.23% of its seed is made up of gum (Pathak *et al.,* 2009; Muthuselvi *et al.,* 2018). Because the cluster bean is highly nutritious and addresses anaemia, a condition that is becoming more common in practically all women, it is said to provide several health advantages. It enhances blood circulation, strengthens bones, and enhances cardiovascular health. Throughout pregnancy, it is recommended because of its advantages. One of the most extensively grown crops worldwide is cluster beans, of which India produces 82% of the world's total production. 3.14 million hectares of land with 1.52 million tonnes of cluster bean seed output and 484 kg of cluster bean productivity are found in India. Only 75280 hectares of land in Madhya Pradesh are used for the cultivation of cluster beans, which yield 750 kg/ha (Anonymous, 2021). However, the water-soluble natural polymer galactomannan gum found in the protein-free endosperm section of the seeds has helped the cluster bean gain a lot of notoriety. Its significance has grown recently, especially because guar seeds range in their gum concentration from 31.4 to 43.16% (Dawar *et al.,* 2022). The cluster bean crop was seen to be under assault by a number of pests, including aphids, jassids (*Empoasca kerri* (Pruthi)), whiteflies (*Acaudaleyrodes rachipora* (Singh)) and thrips (*Megaleurothrips distalis* (Karny)). Several insect pests target cluster beans at different phases of the crop's growth, which cumulatively results in significant output losses. According to Pandey *et al.* (1991), the pest complex caused a yield loss of 73.86%. Accurate and crucial for successful current pest control is a thorough examination and appropriation of the biotic and abiotic features of the pests' surroundings (Ruesink and Kogan, 1975). One of the best solutions for the safest and most economical way to get rid of this pest is to grow resistant kinds. An integrated control system may be built on a resistant variety (Gallun *et al.,* 1975), and it may work best when used in concert with other control techniques.

2. MATERIALS AND METHODS

The research farm, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India, was the site of the experiment. For nine genotypes, three replications of the Randomised Block Design (RBD) were used in the kharif of 2022. The plot measured 4.0 X 2.7 m2, with row-to-row and plant-to-plant spacing of 45 cm and 10 cm, respectively. The genotypes were let to naturally become infested. Aphid, jassid, whitefly, and thrips populations were observed every week from the time they first appeared until the crop was harvested. Early in the morning, each observation was made and documented. In each plot, the populations of aphid, jassid, whitefly, and thrips were noted on 10 randomly chosen plants. The data was collected as mean number of insect pests per plant and were transformed into square-root values as per the standard requisites. Then experimental data were subjected to statistical analysis using analysis of variance (ANOVA).

3. RESULTS AND DISCUSSION

3.1 To Find Out Less Susceptible Varieties / Genotypes against Major Insect Pests

3.1.1 Thrips, *Megalurothrips distalis* (Karny)

Result presented on the basis of seven observation, the result on the overall mean *M. distalis* population throughout the crop season revealed that the lowest *M. distalis* population (1.32 thrips/ plant) was recorded in the genotype GD- 565. The next potential genotypes in resisting the infestation of *M. distalis* were CAZG 17-4-5, GD- 567, X- 25, RGR 20-15, HG 2-20 (ch), RGr 20-7 and RGC 1033 (ch) exhibiting the significant difference between them. However, the highest pest population (2.65 thrips/ plant) was recorded in the genotype RGC 1066 (ch), being the most susceptible cluster bean genotype. On the basis of statistical categorization of the genotypes, out of the nine cluster bean genotypes tested, only one genotype (GD- 565) was observed with significantly lower susceptibility to *M. distalis* population compared to the rest of the genotypes. Further, RGr 20-7, GD- 567, HG 2-20 (ch), CAZG 17-4-5, RGR 20-15 and X- 25 were categorised as moderately susceptible genotypes. However, RGC 1066 (ch) and RGC

1033 (ch) were observed as highly susceptible genotypes of cluster bean throughout the crop season. Additionally, the results of Dawar et al. [3] support partially the present findings and reported that no significant differences were observed in different genotypes. According to GD 1903, GD 567, and HG 19-2-6 were genotypes that were less susceptible to thrips, while DRLGG 13-28, CAZG 18-4, GL-01, CAZG 19-9, GG 1806, RGC-1033, CAZG 17-16-1, GG 1903, DRLGG 13-39, CAZG 19-7, and GD 580 were genotypes that were moderately susceptible, and GG 1909, HG 2-20, X-25 and RGC 1066 as highly susceptible. Panwar and Patel (2011) tested 20 varieties/genotypes for their susceptibility /resistance. The present results are supported by previous studies as done by Yadav and Kumawat [7] and Kumawat [8].

3.1.2 Aphid, *Aphis craccivora* (Koch)

According to seven observations, the lowest *A. craccivora* population (1.80 aphid/ plant) was recorded in the genotype GD- 565 which was followed by CAZG 17-4-5 (2.16 aphid/ plant). The next potential genotypes in resisting the infestation of *A. craccivora* were GD- 567, X- 25, RGR 20-15, HG 2-20 (ch), RGr 20-7 and RGC 1033 (ch) exhibiting the significant difference between them. However, the highest pest population (3.26 aphid/ plant) was recorded in the genotype RGC 1066 (ch), being the most susceptible cluster bean genotype. On the basis of statistical categorization of the genotypes, out of the nine cluster bean genotypes tested, only one genotype (GD- 565) was observed with significantly lower susceptibility to *A. craccivora* population compared to the rest of the genotypes. Further, RGr 20-7, GD- 567, HG 2-20 (ch), CAZG 17-4-5, RGR 20-15 and X- 25 were categorised as moderately susceptible genotypes. However, RGC 1066 (ch) and RGC 1033 (ch) were observed as highly susceptible genotype. The present results are supported by previous studies as done by Akbar et al. [9] who found lowest numbers of jassid and aphid on variety. Yadav et al. [10] are consistent who screened fifteen genotypes of cluster bean.

3.1.3 Whitefly, *Acaudaleyrodes rachipora* (Singh)

On the basis of average of seven observations significant differences in different genotypes were observed with regards to whitefly population. The lowest *A. rachipora* population (3.22 whitefly/ plant) was recorded in the genotype GD- 565 which was followed by CAZG 17-4-5 (3.64 whitefly/ plant). The next potential genotypes in resisting the infestation of *A. rachipora* were GD- 567, X- 25, RGR 20-15, HG 2-20 (ch), RGr 20-7 and RGC 1033 (ch) exhibiting the significant difference between them. However, the highest pest population (4.67 whitefly/ plant) was recorded in the genotype RGC 1066 (ch), being the most susceptible cluster bean genotype. On the basis of statistical categorization of the genotypes, out of the nine cluster bean genotypes tested, only one genotype (GD- 565) was observed with significantly lower susceptibility to *A. rachipora* population compared to the rest of the genotypes. Further, RGr 20-7, GD- 567, HG 2-20 (ch), CAZG 17-4-5 , RGR 20-15 and X- 25 were categorised as moderately susceptible genotypes. However, RGC 1066 (ch) and RGC 1033 (ch) were observed as highly susceptible. The present results are supported by the findings of Patel et al. [11] who revealed that whitefly population differed among all the varieties. Similarly, Yadav et al. [10] also reported that the genotypes against whitefly. Panwar and Patel [12] tested 20 varieties/genotypes for their susceptibility /resistance. More relevantly, Dawar et al. [3] observed that the genotype against whitefly [13].

3.1.4 Jassid, *Empoasca kerri* (Pruthi)

In seven observations, population of jassid was recorded with significant differences in different genotypes. The lowest *E. kerri* population (3.51 jassid/ plant) was recorded in the genotype GD-565 which was followed by CAZG 17-4-5 (3.89 jassid/ plant). The next potential genotypes in resisting the infestation of *E. kerri* were GD- 567, X- 25, RGR 20-15, HG 2-20 (ch), RGr 20-7 and RGC 1033 (ch) exhibiting the significant difference between them. However, the highest pest population (4.88 jassid/ plant) was recorded in the genotype RGC 1066 (ch), being the most susceptible cluster bean genotype. On the basis of statistical categorization of the genotypes, out of the nine cluster bean genotypes tested, only one genotype (GD- 565) was observed with significantly lower susceptibility to *E. kerri* population compared to the rest of the genotypes. Further, RGr 20-7, GD- 567, HG 2-20 (ch), CAZG 17-4-5, RGR 20-15 and X- 25 were categorised as moderately susceptible genotypes. However, RGC 1066 (ch) and RGC 1033 (ch) were observed as highly susceptible genotype. The present results are supported by the findings of Yadav and Kumawat (2008) who evaluated fifteen genotype of cluster bean against jassid and whitefly.

Table 1. Screening of cluster bean genotypes/ varieties for their susceptibility against thrips, *Megalurothrips distalis* (Karny) during *Kharif 2022*

Genotypes	Different dates of observation of pest population during *Kharif* 2022									Overall Mean
	16-08-2022	**23-08-2022**	**30-08-2022**	**06-09-2022**	**13-09-2022**	**20-09-2022**	**27-09-2022**	**04-10-2022**	**11-10-2022**	
RGr 20-7	1.11 (1.27)*	2.90 (1.84)	2.09 (1.61)	1.42 (1.39)	3.61 (2.03)	3.71 (2.05)	3.15 (1.91)	1.63 (1.46)	1.17 (1.29)	2.31 (1.68)
GD- 567	0.58 (1.04)	2.38 (1.7)	1.60 (1.45)	0.90 (1.18)	3.12 (1.9)	3.19 (1.92)	2.29 (1.67)	1.11 (1.27)	0.79 (1.14)	1.77 (1.51)
HG 2-20 (ch)	1.05 (1.24)	2.86 (1.83)	2.04 (1.59)	1.38 (1.37)	3.56 (2.02)	3.67 (2.04)	3.05 (1.88)	1.59 (1.45)	1.10 (1.27)	2.26 (1.66)
CAZG 17-4-5	0.42 (0.96)	2.22 (1.65)	1.43 (1.39)	0.74 (1.11)	2.95 (1.86)	3.03 (1.88)	2.12 (1.62)	0.95 (1.2)	0.69 (1.09)	1.61 (1.45)
RGC 1066 (ch)	1.38 (1.41)	3.42 (1.98)	2.39 (1.7)	1.94 (1.56)	3.91 (2.1)	4.23 (2.18)	3.22 (1.93)	2.15 (1.63)	1.24 (1.32)	2.65 (1.78)
GD- 565	0.12 (0.79)	1.91 (1.55)	1.11 (1.27)	0.43 (0.97)	2.63 (1.77)	2.72 (1.8)	1.75 (1.5)	0.64 (1.07)	0.56 (1.03)	1.32 (1.35)
RGR 20-15	0.81 (1.14)	2.61 (1.76)	1.82 (1.52)	1.13 (1.28)	3.34 (1.96)	3.42 (1.98)	2.51 (1.74)	1.34 (1.36)	0.93 (1.2)	1.99 (1.58)
RGC 1033 (ch)	1.31 (1.35)	3.15 (1.91)	2.24 (1.66)	1.67 (1.47)	3.76 (2.06)	3.96 (2.11)	3.20 (1.92)	1.88 (1.54)	1.22 (1.31)	2.49 (1.73)
X- 25	0.72 (1.1)	2.51 (1.74)	1.73 (1.49)	1.03 (1.24)	3.25 (1.94)	3.32 (1.96)	2.42 (1.71)	1.24 (1.32)	0.84 (1.16)	1.90 (1.55)
SE(m) ±	0.017	0.006	0.018	0.008	0.014	0.006	0.019	0.008	0.028	0.008
C.D. at 5%	0.051	0.019	0.053	0.025	0.042	0.018	0.058	0.024	0.084	0.025

**figures in parentheses are square root ($\sqrt{x + 0.5}$) values*

Table 2. Screening of cluster bean genotypes/ varieties for their susceptibility against aphid, *Aphis craccivora* (Koch) during *Kharif* 2022

Genotypes	Different dates of observation of pest population during *Kharif* 2022									Overall Mean
	16-08-2022	23-08-2022	30-08-2022	06-09-2022	13-09-2022	20-09-2022	27-09-2022	04-10-2022	11-10-2022	
RGr 20-7	1.63 (1.46)*	3.04 (1.88)	3.41 (1.98)	4.30 (2.19)	4.59 (2.26)	4.02 (2.13)	2.43 (1.71)	1.68 (1.47)	1.06 (1.25)	2.91 (1.85)
GD- 567	1.11 (1.27)	2.43 (1.71)	2.89 (1.84)	3.62 (2.03)	4.07 (2.14)	3.37 (1.97)	2.01 (1.59)	1.16 (1.29)	0.64 (1.07)	2.37 (1.69)
HG 2-20 (ch)	1.46 (1.4)	2.82 (1.82)	3.24 (1.93)	4.08 (2.14)	4.42 (2.22)	3.80 (2.07)	2.36 (1.69)	1.49 (1.41)	0.99 (1.22)	2.74 (1.8)
CAZG 17-4-5	0.88 (1.18)	2.20 (1.64)	2.66 (1.78)	3.38 (1.97)	3.84 (2.08)	3.23 (1.93)	1.82 (1.52)	0.93 (1.2)	0.45 (0.97)	2.16 (1.63)
RGC 1066 (ch)	1.98 (1.57)	3.40 (1.97)	3.76 (2.06)	4.66 (2.27)	4.94 (2.33)	4.38 (2.21)	2.75 (1.8)	2.13 (1.62)	1.38 (1.37)	3.26 (1.94)
GD- 565	0.46 (0.98)	1.82 (1.52)	2.24 (1.66)	3.08 (1.89)	3.42 (1.98)	2.80 (1.82)	1.61 (1.45)	0.55 (1.02)	0.24 (0.86)	1.80 (1.52)
RGR 20-15	1.34 (1.36)	2.70 (1.79)	3.12 (1.9)	3.96 (2.11)	4.30 (2.19)	3.57 (2.02)	2.24 (1.66)	1.35 (1.36)	0.87 (1.17)	2.60 (1.76)
RGC 1033 (ch)	1.88 (1.54)	3.25 (1.94)	3.66 (2.04)	4.51 (2.24)	4.84 (2.31)	4.14 (2.15)	2.64 (1.77)	1.98 (1.57)	1.27 (1.33)	3.13 (1.91)
X- 25	1.24 (1.32)	2.55 (1.75)	3.02 (1.88)	3.81 (2.08)	4.20 (2.17)	3.44 (1.99)	2.14 (1.63)	1.28 (1.33)	0.77 (1.13)	2.50 (1.73)
SE(m) ±	0.009	0.009	0.006	0.009	0.005	0.013	0.006	0.014	0.009	0.006
C.D. at 5%	0.027	0.027	0.019	0.028	0.016	0.039	0.018	0.043	0.026	0.017

**figures in parentheses are square root ($\sqrt{x + 0.5}$) values*

Table 3. Screening of cluster bean genotypes/ varieties for their susceptibility against whitefly, *Acaudaleyrodes rachipora* (Singh) during *Kharif* 2022

Genotypes	Different dates of observation of pest population during *Kharif* 2022									Overall Mean
	16-08-2022	23-08-2022	30-08-2022	06-09-2022	13-09-2022	20-09-2022	27-09-2022	04-10-2022	11-10-2022	
RGr 20-7	3.89 (2.1)*	5.07 (2.36)	5.02 (2.35)	5.29 (2.41)	5.84 (2.52)	4.53 (2.24)	3.93 (2.11)	2.28 (1.67)	3.36 (1.97)	4.36 (2.2)
GD- 567	3.37 (1.97)	4.55 (2.25)	4.50 (2.24)	4.89 (2.32)	5.32 (2.41)	4.13 (2.15)	3.41 (1.98)	1.76 (1.5)	2.84 (1.83)	3.87 (2.09)
HG 2-20 (ch)	3.72 (2.05)	4.90 (2.32)	4.85 (2.31)	5.16 (2.38)	5.67 (2.48)	4.40 (2.21)	3.76 (2.06)	2.14 (1.63)	3.19 (1.92)	4.20 (2.17)
CAZG 17-4-5	3.14 (1.91)	4.32 (2.2)	4.27 (2.18)	4.66 (2.27)	5.09 (2.36)	3.90 (2.1)	3.18 (1.92)	1.53 (1.43)	2.61 (1.76)	3.64 (2.03)
RGC 1066 (ch)	4.24 (2.18)	5.42 (2.43)	5.37 (2.42)	5.51 (2.45)	6.19 (2.59)	4.75 (2.29)	4.28 (2.19)	2.55 (1.75)	3.71 (2.05)	4.67 (2.27)
GD- 565	2.72 (1.8)	3.90 (2.1)	3.85 (2.09)	4.24 (2.18)	4.67 (2.27)	3.48 (2)	2.76 (1.81)	1.11 (1.27)	2.19 (1.64)	3.22 (1.93)
RGR 20-15	3.60 (2.02)	4.78 (2.3)	4.73 (2.29)	5.10 (2.37)	5.55 (2.46)	4.34 (2.2)	3.64 (2.03)	2.01 (1.59)	3.07 (1.89)	4.09 (2.14)
RGC 1033 (ch)	4.14 (2.15)	5.32 (2.41)	5.19 (2.39)	5.40 (2.43)	6.01 (2.55)	4.64 (2.27)	4.10 (2.14)	2.37 (1.69)	3.53 (2.01)	4.52 (2.24)
X- 25	3.50 (2)	4.68 (2.28)	4.63 (2.27)	5.02 (2.35)	5.45 (2.44)	4.26 (2.18)	3.54 (2.01)	1.89 (1.55)	2.97 (1.86)	4.00 (2.12)
SE(m) ±	0.006	0.005	0.008	0.008	0.007	0.009	0.009	0.010	0.009	0.006
C.D. at 5%	0.018	0.015	0.023	0.025	0.022	0.027	0.026	0.030	0.028	0.017

**figures in parentheses are square root ($\sqrt{x + 0.5}$) values*

Table 4. Screening of cluster bean genotypes/ varieties for their susceptibility against jassid, *Empoasca kerri* (Pruthi) during *Kharif* 2022

Genotypes	Different dates of observation of pest population during *Kharif* 2022									Overall Mean
	16-08-2022	23-08-2022	30-08-2022	06-09-2022	13-09-2022	20-09-2022	27-09-2022	04-10-2022	11-10-2022	
RGr 20-7	4.11 (2.15)*	5.14 (2.38)	4.24 (2.18)	5.27 (2.4)	5.87 (2.52)	4.93 (2.33)	4.73 (2.29)	3.38 (1.97)	3.07 (1.89)	4.53 (2.24)
GD- 567	3.59 (2.02)	4.62 (2.26)	3.72 (2.06)	4.75 (2.29)	5.35 (2.42)	4.41 (2.22)	4.21 (2.17)	2.86 (1.83)	2.55 (1.75)	4.01 (2.12)
HG 2-20 (ch)	3.94 (2.11)	4.97 (2.34)	4.10 (2.15)	5.10 (2.37)	5.74 (2.5)	4.78 (2.3)	4.60 (2.26)	3.23 (1.93)	2.94 (1.85)	4.38 (2.21)
CAZG 17-4-5	3.36 (1.97)	4.39 (2.21)	3.67 (2.04)	4.60 (2.26)	5.35 (2.42)	4.26 (2.18)	4.17 (2.16)	2.71 (1.79)	2.51 (1.74)	3.89 (2.1)
RGC 1066 (ch)	4.46 (2.23)	5.49 (2.45)	4.59 (2.26)	5.62 (2.47)	6.23 (2.59)	5.29 (2.41)	5.09 (2.37)	3.74 (2.06)	3.43 (1.98)	4.88 (2.32)
GD- 565	2.94 (1.86)	3.97 (2.12)	3.37 (1.97)	4.42 (2.22)	4.73 (2.29)	4.08 (2.14)	3.59 (2.02)	2.53 (1.74)	1.93 (1.56)	3.51 (2)
RGR 20-15	3.82 (2.08)	4.85 (2.31)	3.95 (2.11)	4.98 (2.34)	5.58 (2.47)	4.64 (2.27)	4.44 (2.22)	3.09 (1.89)	2.78 (1.81)	4.24 (2.18)
RGC 1033 (ch)	4.36 (2.2)	5.39 (2.43)	4.49 (2.23)	5.52 (2.45)	6.12 (2.57)	5.18 (2.38)	4.98 (2.34)	3.63 (2.03)	3.32 (1.95)	4.77 (2.3)
X- 25	3.72 (2.06)	4.75 (2.29)	3.85 (2.09)	4.88 (2.32)	5.48 (2.45)	4.54 (2.25)	4.34 (2.2)	2.99 (1.87)	2.68 (1.78)	4.14 (2.15)
SE(m) ±	0.006	0.005	0.004	0.004	0.004	0.005	0.005	0.006	0.006	0.004
C.D. at 5%	0.017	0.015	0.013	0.012	0.012	0.015	0.014	0.018	0.017	0.012

**figures in parentheses are square root* ($\sqrt{x + 0.5}$) *values*

4. CONCLUSION

Cluster beans are one of the most widely cultivated crops in the world, with 82% of the total output being produced in India. Growing resistant varieties is one of the finest options for the most affordable and secure method of eradicating this pest.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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