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Original Research Article

Evaluation of Blackgram (*Vigna mungo* L. Hepper) Genotypes for Resistance against Powdery Mildew (*Erysiphe polygoni* DC) under Natural and Artificially Inoculated Conditions

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A B S T R A C T

The use of resistant cultivars is the most economical and effective method to control powdery mildew of Blackgram caused by *Erysiphe polygoni* DC. The identification of potential resistant sources is the most crucial step in disease resistance breeding. The present study was carried out-in field, greenhouse and a detached leaf technique to evaluate blackgram genotypes for resistance against powdery mildew under natural and artificially inoculated conditions. In the present study, out of 50 genotypes screened under field and greenhouse condition, genotype LBG-17 recorded lowest per cent disease severity of 0.82 and 0.78 respectively. Under *in vitro* condition out of 15 genotypes screened LBG-17 found to be highly resistant with 0.60×10^3 conidia colony, 1.72 per cent of leaf area covered by powdery mildew and 0.67 colonies per leaflet was recorded. Genotype LBG-17 was found to be highly resistant to powdery mildew under field, greenhouse and under *in vitro* conditions. Hence, highly resistant genotype LBG-17 can be used in further breeding programme for the development of resistant varieties of black gram against powdery mildew.

Keywords

Powdery mildew, Glasshouse screening, Detached leaf assay, Resistance, Blackgram

Introduction

Blackgram (*Vigna mungo* (L.) Hepper) is one of the most important cultivated pulse crops of the 'Vigna' group. It is a staple pulse crop in India occupying an area of 44.93 lakh ha with 29.26 lakh tonne production and 651 kg ha^{-1} productivity (Anon, 2017). In Karnataka blackgram is extensively cultivated during rabi and a limited extent in *kharif*. It is grown in an area of 0.92 lakh ha with 0.38 lakh tonne production and 416 kg ha^{-1} productivity (Anon, 2017). To meet global blackgram demand it is imperative to improve the current average global productivity as well as to expand the crop into new regions.

The yield of blackgram is affected by several biotic and abiotic factors (Anon, 2001). Among the biotic factors, Powdery mildew, MYMV and Cercospora leaf spot *etc.*, are of prime importance in reducing crop yield. Among these, powdery mildew is one of the most important diseases of blackgram which is caused by the fungal pathogen *Erysiphe polygoni* DC and it is the most troublesome foliar disease of blackgram affecting all aerial portions of plants. In India the disease is present in almost all states of the country and becomes severe in dry season causing 9.0-50.0 per cent yield loss (Pandey *et al.*, 2009). The use of synthetic fungicides to reduce yield losses is the major practice by blackgram growers which has serious implications for human health and a growing threat to environment. To overcome from

these problems development of genetically resistant cultivars is important and it is a cost effective and desirable option to reduce yield losses caused by powdery mildew. The precise selection of powdery mildew resistant sources is a prerequisite for the development of stable powdery mildew resistant and high yielding blackgram cultivars. Field screening based on natural epidemic of disease is usually employed for making selection of powdery mildew resistant plants in blackgram. Natural epidemics of powdery mildew usually don't occur every year evenly due to environmental variation leading to erroneous selection of disease resistant sources. Moreover *Erysiphe polygoni* is an obligate biotroph which grow and propagate through haustoria by redirecting the host's metabolism without causing the death of host (Perfect and Green, 2001). Powdery mildew is phylogenetically unrelated biotrophs that are difficult to culture extensively in vitro. A significant range of variability for pathogenicity, virulence, disease severity and morphological parameters exist among different geographical isolates of the causal organism. Owing to the dietary importance of blackgram; the yield losses incurred by powdery mildew; the shortcomings of field screening method; the presence of pathogenic variation and most importantly, the obligate biotrophic nature of *Erysiphe polygoni* there is a need of a reliable and reproducible method of screening for powdery mildew.

The current research was undertaken to identify the resistant genotypes to check the efficiency and reliability of powdery mildew resistant lines by using detach leaf technique under controlled conditions.

Materials and Methods

Field screening

Field experiment was conducted to identify resistant sources and to evaluate breeding materials against powdery mildew. The available genotypes and breeding lines were screened in randomized completely block design with three replication under field condition during *kharif* 2017 at K' block, Department of Genetics and Plant Breeding, University of Agricultural Sciences, GKVK, Bengaluru.

Totally 50 genotypes were screened under natural condition in K' block, University of Agricultural Sciences, GKVK, Bengaluru. All the genotypes in the germplasm collection are from different research stations of India.

The experimental material obtained from NBPGR, Hyderabad, Akola, ANGRAU, IIPR Kanpur, TNAU and ARS, Bidar. The disease severity on each genotype was recorded on 40 days after sowing five times on all the three plants in each genotype at 8 days interval *viz.*, 40, 47, 54, 61 and 68 days. Based on their reaction, genotypes categorised into immune, highly resistant, resistant, moderately resistant, moderately susceptible and highly susceptible, using 0 to 9 scale presented in table 1 (Mayee and Datar, 1986). The recorded grade values were then converted into Per cent Disease Index (PDI) by using following formula (Wheeler, 1969).

$$\text{Per cent Disease Index (PDI)} = \frac{\text{Sum of individual disease rating}}{\text{No. of leaves observed} \times \text{Maximum disease grade}} \times 100$$

Glasshouse screening

The material for glasshouse screening comprised of 50 germplasm accessions including one susceptible check (Mash-114) and one highly resistant check (K-5-572) of

black gram [*Vigna mungo* L. Hepper] collected from NBPGR, Hyderabad, Akola, ANGRAU, IIPR Kanpur, TNAU and ARS, Bidar. The experiment was carried out in the glass house at the experimental plots of Department of Plant Pathology, University of Agricultural Sciences, GKVK, Bengaluru during *Kharif* 2017.

Blackgram genotypes were screened against powdery mildew by raising each genotype in three plastic pots under glasshouse condition by using completely randomized design. Fifteen days after sowing a single plant was retained in each pot. Powdery mildew inoculum maintained on the highly susceptible genotype MASH-114 was dusted uniformly onto 25 days old test plants with the help of camel hair brush. Powdery mildew severity was assessed as per cent leaf area covered. Observations on per cent leaf area coverage were recorded 40 days after sowing five times on all the three plants in each genotype at 8 days interval viz., 40, 47, 54, 61 and 68 days using 0-9 disease scoring scale (Mayee and Datar, 1986). Based on the following scale the genotypes were classified into different categories (Table 1).

In vitro screening of parents for powdery mildew by detached leaf technique

Out of 50 germplasm accessions of blackgram screened for powdery mildew incidence in field and glass house condition, 15 genotypes were selected based on their powdery mildew reaction under field and glasshouse condition also by considering their yield and its attributes as reported by Priyanka (2015) (Table 2). For further confirmation of the disease reaction these selected genotypes along with one highly susceptible check (MASH-114) and one highly resistant check (K-5-572) were tested in laboratory conditions using cut-leaf method. The experiment was carried out in the Department of Plant Pathology, University of Agricultural Sciences, GKVK, Bengaluru during *Kharif* 2017.

Cut-leaf method procedure

Leaflets selected from fully expanded leaf from each genotype were placed on a sponge moistened with quarter concentration of Hoagland nutrient solution and 5ppm gibberellic acid solution (Chandrashekhar, 1986) in petri plates and each entry was replicated thrice. Later these leaflets were dusted uniformly with conidia using a camel brush. Observations were recorded for the maximum number of colonies per leaflet, conidia per colony and per cent leaf area covered. Conidia per colony was calculated by placing individual colonies in vials containing 5ml of distilled water and a drop of spore disperser Tween 80® and stain cotton blue. The vials were vigorously shaken to dislodge the conidia and then counted on a haemocytometer, using the formula,

$$\frac{\text{No. of spores per 0.1 ml} \times 2000 \times \text{Quantity of water taken}}{\text{No. of colonies}}$$

Results and Discussion

Responses of black gram genotypes to powdery mildew disease under field screening

Results revealed that The severity index of powdery mildew disease on blackgram genotypes ranged from 0.82 to 80.23 per cent, whereas, susceptible check, MASH 114, had severity index of 91.98 per cent. Data revealed that the lowest average disease severity index (0.82 per cent) was recorded on genotype, LBG 17 and the highest average disease severity index (80.23 per cent) was recorded on genotype TAU-1(Table 3). Out of all 50 genotypes including check screened for resistance to powdery mildew disease, none of the genotypes found to be immune.

Three genotypes LBG-17, LBG-645, IC-281977 were founded resistant. Twenty-seven genotypes IC-281978, AKU-10-1, LBG-752, LBG-623, LBG-626, RASHMI, AKU-11-2, IC-546468, BDU-3-29, LBG-20, IC-436065, KUG-216, IC-436065, KUG-216, BDU-4, KU-5-546, 2KU-14,2KU-60, KU-5-527, GP-723,2PLU-5, 865/HP-50, IC-343947, IPU-07.03, 2KU-53, IC-436773, G.333, DU-1 were showed moderately resistant reaction. Fifteen genotype IC-436834, IC-436811, IC-436792, IC-436768, BDU-3-20, AKU-15, BDU-3-22, 2KU-64, IC-426495, MBG-207, IC-546466, CO.5, SHEKAR-2, UH.04.04, IPU.02.33 were founded moderately resistance. Four genotypes TAU.2, IC-436780, IC-426749, VBN-3 were showed moderately susceptible reaction and one genotype TAU-1 showed highly susceptible reaction (Table 4) to powdery mildew disease.

Akhtar *et al.*, (2014) evaluated 17 genotypes of blackgram against multiple diseases and found five genotypes, showed highly resistant reaction, five genotypes found resistant and five genotypes showed moderately resistant reaction against powdery mildew disease. Channaveeresh *et al.*, (2014) screened 12 genotypes against powdery mildew. However, none of them was found to be immune whereas, one genotype LBG-17 was found to be resistant. Four genotypes VBN-4, VBN-5, LBG-685 and T-9 were found moderately resistant. Out of eleven blackgram genotypes only four entries *viz.*, PU 31, MASH 338, LBG 752 and MBG 1050 were found moderately resistant and remaining entries susceptible to powdery mildew disease (Bhaskar, 2017).

Responses of black gram genotypes to powdery mildew disease under glasshouse condition

Powdery mildew incidence was recorded at pod maturity stage using 0-9 scale (Mayee and Datar, 1986) and results are presented in Table 5 and 6. The highly resistant check K-5-572 recorded per cent disease severity of 0.69 per cent and the highly susceptible check MASH-114 recorded 90.03 per cent of disease severity.

The genotype LBG-17 recorded per cent disease severity of 0.78. While, per cent disease severity ranged from 1.03 per cent to 7.58 per cent in resistant genotypes, 11.05 per cent to 23.74 per cent in moderately resistant parents and 68.03 per cent in highly susceptible parent presented in Table 5. Out of 50 genotypes screened none of them was found to be immune while one genotype LBG-17 was found to be highly resistant. Thirty-two genotypes LBG-645, IC-281978, IC-281977, AKU-10-1, LBG-752, LBG-623, LBG-626, AKU-11-2, IC-546468, BDU-3-29, LBG-20, IC-436065, KUG-216, IC-436065, KUG-216, BDU-4, KU-5-546, 2KU-14,2KU-60, KU-5-527,GP-723, 2PLU-5, 865/HP-50, IC-343947, CO.5, SHEKAR-2, UH.04.04, IPU.02.33, IPU-07.03, 2KU-53, IC-436773, G.333, DU-1 were founded resistant. Sixteen genotypes IC-436834, IC-436811, IC-436792, IC-436768, BDU-3-20, AKU-15, TAU.2, IC-436780, IC-426749, BDU-3-22, 2KU-64, IC-426495, MBG-207, IC-546466, RASHMI, VBN-3 were moderately resistant and one genotype TAU-1 was highly susceptible to the powdery mildew disease (Table 6).

Similar studies were carried out by Malappa (2016) who screened 188 Blackgram genotypes under field and glass house conditions the lowest disease severity was observed in resistant genotypes *viz.*, LBG-17, IC-281977 and RASHMI under glass house conditions during *kharif*. Priyanka (2015) who evaluated 116 black gram accessions under glasshouse conditions against powdery mildew. Thirty of the 116 accessions expressed resistance reaction.

Table.1 Powdery mildew severity rating scale (0-9scale) (Mayee and Datar, 1986)

Scale	Description	Category
0	No symptoms on leaf	Immune
1	Small scattered powdery specks covering 1percent or less area	Highly Resistance
3	Small scattered powdery lesions covering 1-10 percent of leaf area	Resistance
5	Lesions enlarging with grey colored powdery mass covering 25 percent of leaf area	Moderately Resistance
7	Grey colored powdery growth covering 26-50 percent of leaf area	Moderately Susceptible
9	Grey colored patches of powdery growth covering 51 percent or more of leaf area on leaves	Highly Susceptible

Table.2 List of 15 selected black gram genotypes and checks screened for powdery mildew disease under in vitro condition

Sl.No	Genotypes	Source	Sl.No	Genotypes	Source
1	RASHMI	ARS, Bidar	10	LBG-645	ARS, Bidar
2	IC-281977	NBPGR	11	BDU-3-22	ARS, Bidar
3	LBG-17	ANGRAU	12	G.333	TNAU
4	BDU-3-29	ARS, Bidar	13	IPU-07.03	IIPR
5	IC-546468	NBPGR	14	GP-723	ARS, Bidar
6	LBG-626	ANGRAU	15	K-07-07	ARS, Bidar
7	KU-5-527	ARS, Bidar	**Check**		
8	DU-1	ANGRAU	1	K-5-572(HR)	ARS, Bidar
9	LBG-20	ARS, Bidar	2	MASH-114(HS)	TNAU

*HR- Highly resistant HS-Highly susceptible

Table.3 Powdery mildew percent disease severity of blackgram germplasm accessions under field condition

SL. No	Genotype	Percent disease severity	SL. No	Genotype	Percent disease severity
Highly resistant					
C-1	K-5-572(HR)	0.94	2	LBG-17	0.82
1	LBG-645	0.84	3	IC-281977	0.92
Resistant					
4	LBG-626	2.20	18	2PLU-5	7.40
5	2KU-14	2.98	19	DU-1	7.73
6	BDU-4	3.30	20	IC-281978	7.90
7	GP-723	4.37	21	IC-436773	8.49
8	G.333	4.41	22	BDU-3-29	8.60
9	2KU-53	4.61	23	IC-343947	8.70
10	IPU-07.03	4.98	24	KUG-216	8.70
11	KU-5-546	5.13	25	AKU-10-1	8.83
12	AKU-11-2	5.30	26	KU-5-527	9.08
13	IC-281979	5.67	27	865/HP-50	9.36
14	IC-546468	6.02	28	RASHMI	9.37
15	LBG-752	6.12	29	2KU-60	9.52
16	LBG-623	6.40	30	LBG-20	9.98
17	IC-436065	7.06			
Moderately resistant					
31	BDU-3-20	13.52	39	IC-426495	20.14
32	BDU-3-22	13.81	40	IC-436811	20.63
33	2KU-64	15.56	41	SHEKAR-2	22.13
34	AKU-15	18.23	42	MBG-207	23.31
35	IC-436792	18.82	43	IC-436768	23.34
36	IC-436834	19.45	44	IPU.02.33	23.79
37	UH.04.04	19.68	45	IC-546466	25.00
38	CO.5	19.86			
Moderately Susceptible					
46	TAU.2	29.872	48	IC-426749	37.222
47	VBN-3	35.296	49	IC-436780	41.592
Highly Susceptible					
50	TAU-1	80.23	C-2	MASH-114(HS)	91.98

*HR- Highly resistant HS-Highly susceptible

Table.4 Reaction of blackgram genotypes for powdery mildew disease under field condition

Rating	Reaction	Genotypes	No. of genotypes
0	Immune (0%)	Nil	Nil
1	Highly resistant (<1%)	**K-5-572(C-1)**, LBG-17, LBG-645, IC-281977	**3**
3	Resistant (1-10%)	IC-281978, AKU-10-1, LBG-752, LBG-623, LBG-626, RASHMI, AKU-11-2, IC-546468, BDU-3-29, LBG-20, IC-436065, KUG-216, IC-436065, KUG-216, BDU-4, KU-5-546, 2KU-14,2KU-60,KU-5-527,GP-723,2PLU-5, 865/HP-50,IC-343947, IPU-07.03, 2KU-53, IC-436773, G.333, DU-1	**27**
5	Moderately resistant (11-25%)	IC-436834, IC-436811, IC-436792, IC-436768, BDU-3-20, AKU-15, BDU-3-22, 2KU-64, IC-426495, MBG-207, IC-546466, CO.5, SHEKAR-2, UH.04.04, IPU.02.33	**15**
7	Moderately susceptible (26-50%)	TAU.2, IC-436780, IC-426749, VBN-3	**4**
9	Highly Susceptible (>51%)	TAU-1, **MASH-114(C-2)**	**1**

Table.5 Powdery mildew percent disease severity of blackgram germplasm accessions under glass house condition

SL. No	Genotype	Percent disease severity	SL. No	Genotype	Percent disease severity
Highly resistant					
C-1	K-5-572(HR)	0.69	1	LBG-17	0.78
Resistant					
2	LBG-645	1.03	18	2KU-60	2.76
3	IC-281978	1.06	19	KU-5-527	2.79
4	IC-281977	1.08	20	GP-723	3.33
5	AKU-10-1	1.23	21	2PLU-5	3.40
6	LBG-752	1.25	22	865/HP-50	3.56
7	LBG-623	1.32	23	IC-343947	3.58
8	LBG-626	1.43	24	CO.5	3.60
9	AKU-11-2	1.56	25	SHEKAR-2	3.61
10	IC-546468	1.56	26	UH.04.04	3.90
11	BDU-3-29	1.73	27	IPU.02.33	4.86
12	LBG-20	2.36	28	IPU-07.03	4.91
13	IC-436065	2.38	29	2KU-53	5.10
14	KUG-216	2.60	30	IC-281979	5.55
15	BDU-4	2.62	31	IC-436773	5.84
16	KU-5-546	2.64	32	G.333	6.86
17	2KU-14	2.69	33	DU-1	7.58
Moderately resistant					
34	IC-436834	11.05	42	IC-426749	12.71
35	IC-436811	11.25	43	BDU-3-22	12.88
36	IC-436792	11.36	44	2KU-64	13.91
37	IC-436768	11.66	45	IC-426495	14.52
38	BDU-3-20	12.01	46	MBG-207	14.68
39	AKU-15	12.06	47	IC-546466	21.34
40	TAU.2	12.43	48	RASHMI	22.07
41	IC-436780	12.61	49	VBN-3	23.74
Highly Susceptible					
50	TAU-1	68.03	**C-2**	MASH-114(HS)	90.03

*HR- Highly resistant HS-Highly susceptible

Table.6 Reaction of blackgram genotypes for powdery mildew disease under glasshouse condition

Rating	Reaction	Genotypes	No. of genotypes
0	Immune (0%)	Nil	Nil
1	Highly resistant (<1%)	**K-5-572(C-1)**, LBG-17	**1**
3	Resistant (1-10%)	LBG-645, IC-281978, IC-281977, AKU-10-1, LBG-752, LBG-623, LBG-626, AKU-11-2, IC-546468, BDU-3-29, LBG-20, IC-436065, KUG-216, IC-436065, KUG-216, BDU-4, KU-5-546, 2KU-14,2KU-60,KU-5-527,GP-723,2PLU-5, 865/HP-50,IC-343947, CO.5, SHEKAR-2, UH.04.04, IPU.02.33, IPU-07.03, 2KU-53, IC-436773, G.333, DU-1	**32**
5	Moderately resistant (11-25%)	IC-436834, IC-436811, IC-436792,IC-436768, BDU-3-20, AKU-15, TAU.2, IC-436780, IC-426749, BDU-3-22,2KU-64, IC-426495, MBG-207, IC-546466, RASHMI, VBN-3	**16**
9	Highly Susceptible (>25%)	TAU-1, **MASH-114(C-2)**	**1**

Table.7 Analysis of variance for powdery mildew reaction based on three traits in 15 blackgram genotypes along with 2 checks

Sources of variance	df	Colonies per leaflet	Percent leaf area covered	Conidia/ colony
Replication	2	48.03	26.24	274.23
Genotypes	16	41.62**	2297.92**	67481.63**
Error	32	2.7	22.725	63.25

*Significant at P 0.05 level ** Significant at P 0.01 level

Table.8 Reaction of 15 black gram genotypes along with 2 checks for powdery mildew disease under in vitro condition

Sl.No	Genotypes	Colonies per leaflet (√x+0.5 transformed values)	Percent leaf area coverage(arc sign transformed values)	Conidia per colony (Thousands)
1	RASHMI	1.00 (1.22)	0.15 (8.62)	6.00
2	IC-281977	1.00 (1.22)	0.14 (8.04)	2.67
3	LBG-752	2.67(1.78)	0.18 (10.37)	4.20
4	BDU-3-29	6.67 (2.68)	0.54 (32.67)	22.10
5	IC-546468	6.67 (2.68)	0.55 (33.35)	24.00
6	LBG-626	7.00 (2.74)	0.6 (36.86)	18.38
7	KU-5-527	7.00 (2.73)	0.65 (40.53)	28.57
8	DU-1	1.33 (1.35)	0.18 (10.37)	14.98
9	LBG-20	2.00 (1.58)	0.17 (9.78)	12.00
10	LBG-645	1.00 (1.22)	0.13 (7.47)	2.00
11	BDU-3-22	7.67 (2.86)	0.63 (39.03)	33.39
12	G-333	1.33 (1.35)	0.17 (9.78)	4.50
13	IPU-07-03	2.67 (1.78)	0.18 (10.37)	3.25
14	GP-723	2.00 (1.58)	0.16 (9.20)	2.00
15	LBG-17	0.67 (1.08)	0.03 (1.72)	0.60
C-1	K-5-572(HR)	0.33 (0.91)	0.02 (1.15)	0.36
C-2	MASH-114(HS)	13.33 (3.72)	0.92 (66.90)	93.85
Mean		3.78	0.32	16.00
S. Em±		0.88	0.06	5.50
CD (p 0.01)		2.39	0.18	15
CV (%)		0.96	0.84	1.41

*HR- Highly resistant HS-Highly susceptible

Responses of black gram genotypes to powdery mildew disease under *in vitro* condition

Analysis of variance revealed highly significant mean squares due to germplasm accessions for all traits such as colonies per leaflet, per cent leaf area covered and conidia colony^{-1} (Table 7). From the data given in the Table 7 it could be seen that out of 15 genotypes screened based on the results of three traits the highly resistant check K-5-572 exhibited 0.36×10^3 conidia per colony, 1.15 per cent of leaf area covered and 0.33 of colonies per leaflet, while the highly susceptible check MASH-114 showed 93.85×10^3 conidia per colony 66.90 per cent of leaf area covered by powdery mildew and 13.33 colonies per leaflet. Another genotype LBG-17 which was found to be highly resistant with 0.60×10^3 conidia colony 1.72 per cent of

leaf area covered by powdery mildew and 0.67 colony per leaflet. The six genotypes RASHMI, IC-281977, LBG-20, LBG-645, G-333 and GP-723 were found to be resistant with a per cent of leaf area coverage of 8.62, 8.04, 9.78, 7.47, 9.78 and 9.20 respectively for powdery mildew. DU-1, IPU-07-03 and LBG-752 were found to be moderately resistant with 10.37 per cent of powdery mildew cover on leaflet. Five genotypes *viz*., BDU-3-29, IC-546468, LBG-626, KU-5-527 and BDU-3-22 were found to be moderately susceptible (Table 8).

In similar studies carried out by Priyanka *et al.,* (2017) who conducted *in vitro* evaluation for powdery mildew and out of 30 accessions screened K-5-572 and LBG-645 were found to be highly resistant to powdery mildew. The *in vitro* studies conducted by Raju and Anilkumar (1990) were supportive to the present study. Resistant to powdery mildew in black gram was largely due to the cumulative effect of fewer colonies per leaflet, less conidia per colony and less percent of disease cover. Precisely, these are some of the main components of partial resistance (Parlevliet, 1979, and Raju and Anilkumar, 1990).

In conclusion, the management of the disease through host plant resistance has been the best and cheapest choice in all the crops. Utilization of resistant cultivars in farming systems is the most simple, effective and economical method in the management of disease. Besides this, these resistant cultivars conserve natural resources and reduce the cost, time and energy compared to the other methods of disease management. Previously several workers reported that there is variation in resistance among the genotypes against powdery mildew of blackgram (Nandarajan and Nandgupta, 2010; Prashanthi *et al.,* 2010). Though the germplasm lines are resistance source to the breeders, they have to be used in breeding programme for the development of new verities for the benefit of farmers.

From the present study, concluded that the resistant genotype LBG-17 and moderately resistant genotypes could be used in further breeding programme for the development of resistant varieties of black gram against powdery mildew.

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