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Identification of Sources Resistance to Leaf Spot, Powdery Mildew, Mung bean Yellow Mosaic Virus and Leaf Crinkle Virus Diseases in Black gram

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ABSTRACT: Black gram germplasms were evaluated to identify the sources of resistance to leaf spot, powdery mildew, mung bean yellow mosaic virus and leaf crinkle virus diseases. Screening was done under natural field conditions at Regional Agricultural Research Station (RARS), Warangal, Telangana State, India. The experimental material consisted forty AICRP and twenty two state black gram entries with one check during Kharif-2017 and twenty five AICRP and sixteen state black gram entries with a check during Rabi-2017, which were screened against the major diseases at RARS, Warangal. Out of sixty four Black gram entries, five LBG 752, VBG 12-111,VBG 14-016,GBG-45 and DKU 87 were moderately resistant to Corynespora leaf spot disease, four entries *viz*., PU-31, MASH-338, LBG-752 and MBG-1050 were found moderately resistant to powdery mildew, forty three entries were found moderately resistant to mung bean yellow mosaic virus disease and MASH-338 entry was highly resistant to leaf crinkle virus disease. The study provides an evidence on the status of per cent leaf area coverage and disease severity index with germplasms of Warangal district in Telangana state, which helps in selection of resistant cultivars and developing multiple disease resistant germplasms in Blackgram. An attempt was made to develop host plant resistance through various screening techniques for these diseases as there is a gap still in the identification of promising germplasms against the leaf spot, powdery mildew, mymv and leaf crinkle virus disease in field conditions.

Keywords: Screening, germplasms, resistance, diseases, Black gram

INTRODUCTION

Black gram is an important pulse crop of Fabaceae, grown mainly in Telangana State. Black gram is a rich source of protein food and it contains 26.2 per cent crude protein, 1.2 per cent fat and 56.6 per cent carbohydrates (Raju *et al*., 2019). The less production of Black gram is mainly due to biotic and abiotic stresses. Among biotic stresses, leaf spot, powdery mildew, mungbean yellow mosaic virus and leaf crinkle virus are major diseases in farmers' field of Telangana State. Leaf spot severity in the wet season was causing 0.0 per cent to 100.0 per cent yield loss (Amin and Singh, 1987 and Grewal, 1988). Ambarish *et al.* (2021) stated that the *Alternaria alternate* is able to cause disease severity to an extent of 51.29 per cent in Guntur district of Andhra Pradesh. During survey, 60-70 DAS, the Alternaria leaf spot PDI was noticed range from 45.32% to 53.66% in Guntur district of Andhra Pradesh (Prathyusha *et al.,* 2021).

Powdery mildew occurs across India and Southeast Asian countries. It becomes severe in dry season causing 9.0 per cent to 50.0 per cent yield loss (Pandey *et al.,* 2009). Depending upon crop variety and location, disease incidence of MYMV was from 4% to 40% in Pakistan (Bashir *et al.,* 2006). In several cases, leaves and other plant parts become completely yellow and the losses may be as high as 100% (Malik, 1991; Bashir *et al.,* 2006). Singh *et al.* (2000) reported an incidence ranging from 0% to 58.5 % among various varieties during their evaluation program for resistance against MYMV from Uttar Pradesh. Yellow mosaic disease (YMD) remains as most important destructive viral disease of black gram production in the Indian subcontinent with the economic losses accounting up to 85% (Kasirao *et al.,* 2021).YMD is caused by a single stranded DNA containing begomovirus *viz*., Mungbean yellow mosaic virus (MYMV), which is mainly transmitted through whitefly. MYMV disease leads to severe yield reduction not only in India but also in Pakistan, Bangladesh and areas of South East Asia (Malathi *et al.,* 2008 and Biswas *et al.,* 2012) in Black gram.

Depending upon the temperature and humidity, these diseases spread rapidly in susceptible varieties. Cultivation of resistant genotypes is an effective and cheaper method to combat the disease. Hence, several genotypes need to be screened to identify the source of resistance in Black gram.

MATERIALS AND METHODS

Trial was conducted in a Randomized Block Design (RBD) with two replications during Kharif-2017 and

Rabi 2017 at RARS, Warangal, Telangana state. Recommended agronomic practices were followed.

Evaluation for leaf spot disease, powdery mildew, mung bean yellow mosaic virus and leaf crinkle virus diseases in black gram

Sixty four Black gram and forty three black gram germplasms were evaluated during kharif-2017 and rabi-2017 respectively against leaf spot disease, powdery mildew, mung bean yellow mosaic virus and leaf crinkle virus diseases under natural environmental field conditions at RARS, Warangal. Germplasms were planted in two rows of 4 meter length with row spacing of 40 cm and 10 cm between plants. The trial was laid out in randomized block design with two replications.

Based on the leaf spot disease incidence, genotypes are categorized for their reaction to leaf spot disease as detailed according to Mayee and Datar (1986) on Blackgram

Disease Scale	Per cent Leaf area coverage	Description	Reaction
0	0	No Symptom on the leaf	Immune (I)
1	<1	Lesions small, pin head sized, covering less than 1% leaf area	Resistant (R)
3	1-10	Lesions 1-2 mm in diameter, covering 1-10% of the leaf area	Moderately Resistant(MR)
5	11-25	Lesions enlarged but not coalescing covering 11-25% of the leaf area	Moderately Susceptible (MS)
7	26-50	Lesions coalescing covering 26-50% of leaf area	Susceptible (S)
9	>50	Above 50% leaf area covered by large coalescing lesions defoliation of leaves.	Highly Susceptible (HS)

Powdery mildew on Black gram (0-5 Scale -Gawande and Patil, 2003)

Disease Scale	Per cent Leaf area coverage	Description	Reaction
0	0	Plants free from infection	Highly Resistant (HR)
1	1-10	Plant showing traces up to 10 % infection on leaves, stem free from infection	Resistant (R)
2	10.1- 25	Slight infection with thin coating of powdery growth on leaves covering 10.1-25 per cent leaf area, slight infection on stem, pods usually free	Moderately Resistant (MR)
3	25.1-50	Dense powdery coating covering 25.1 to 50% leaf area, moderate infection on stems, slight infection on pods	Moderately Susceptible (MS)
4	50.1-75	Dense powdery coating covering 50.1 to 75% leaf area, stem heavily and pods moderately infected. Infected portion turns greyish	Susceptible (S)
5	>75	Severe infection with dense powdery growth, covering more than 75 % area of the whole plant including pods, plants resulting in premature defoliation and drying	Highly Susceptible (HS)

Mung bean Yellow Mosaic Virus on Black gram (0-9 scale-Mayee and Datar, 1986)

Disease Scale	Per cent leaf area coverage	Description	Reaction
0	0	No visible Symptoms on leaves	Immune (I)
1	<1	Small yellow specks covering 0.1 to 1%	Resistant (R)
3	1-10	Yellow mottling of leaves covering 1.1 to 10% leaf area	Moderately Resistant (MR)
5	11-25	Yellow mottling of leaves covering leaf area 11 to 25 %	Moderately Susceptible (MS)
7	26-50	Yellow mottling and discoloration of 26 -50% leaf area	Susceptible (S)
9	>50	Pronounced yellow mottling, discoloration of leaves and pods, reduction in leaf size and pod size, stunting of plants and no pod formation (Above 50% leaf area and pod)	Highly Susceptible (HS)

Disease rating scale (0-5) for urd bean leaf crinkle virus (ULCV) (Bashir *et al*., 2004).

Disease reaction	Disease severity index (DSI)	Reaction
All plants free of symptoms	0	HR
1-10% plants infected showing mild crinkling at the top, pods normal	1	R
11- 20% plants infected showing crinkling and curling of top leaves, pods normal	2	MR
21-30% plants infected with crinkling, puckering, malformation, shortening of pods	3	MS
31-40% plants infected showing all the typical disease Symptoms	4	S
More than 40% plants infected showing all the plants with severe symptoms, few pods containing few seeds	5	HS

RESULTS AND DISCUSSION

Leaf spot disease incidence. Leaf spot disease of sixty four black gram germplasms lines was from 3 to 9 on disease scale**.** Based on the mean disease incidence of both replications during Kharif-2017, one entry PDU-2-43 was moderately resistant; fourteen entries were moderately susceptible, remaining entries were highly susceptible to leaf spot disease (Table 1 and Table 2).

Leaf spot disease of forty three four black gram germplasms lines was from 3 to 9. The mean disease incidence of both replications during rabi-2017, eleven entries *viz*., LBG 752, VBG 12-111, VBG 14-016, GBG-45, DKU 87, LBG-20, MASH-338, PU-31, NDU-1, PDU-2-43 and WBU-108 were found moderately resistant; twenty nine entries were moderately susceptible and remaining entries were susceptible and highly susceptible to leaf spot disease (Table 3 and Table 4).

Out of 14 screened Black gram genotypes, one entry KUG 216 was found as highly resistant whereas three genotypes *viz*., BS 2-3, IPU 02-43 and B 3-8-8 were recorded as resistant to leaf spot disease (Jameel Akhtar *et al.*, 2014). Total eleven black gram entries, only one MASH-338 was moderately resistant to Corynespora leaf spot disease (Vijaya Bhaskar, 2017). Reddi Gunasri *et al*. (2018) found that sixteen blackgram genotypes were evaluated, only one genotype LBG 645was moderately resistant, seven genotypes namely KU-15-6, KU-15-13, LBG 790, LBG 787, PU31, LBG 792 and LBG 791 were moderately susceptible and three genotypes *viz*., LBG 709, KU-15-11 and LBG 752 were susceptible to leaf spot disease.

Powdery mildew disease incidence. Powdery mildew per cent disease leaf area of sixty four black gram germplasms lines was from 1 to 4 (4% to 75%). Based on the mean disease incidence of both replications during Kharif-2017, thirty three entries *i.e*. LBG 645, LBG 888, RBU-1, KU 16-07, KU 96-3, KPU 12-213, KPU 1720-140, KPU 12-1730, TPU 4, TU 94-2, TJU 98-14, RU 03-22, DBG-11, Pant U 31, Pant U 14-19, PU 14-28, AKU 13-16, NUK 15-09, NUL 242, VBG 14-016, VBG 12-034, VBG 13-003, COG 13-08, KUG 791, Barabanki Local, KUG 479, TBG-104, Pant-M-2, Pant-M-3, PDU-2-43, MASH-414, NDU-1 and WBU-108 were found resistant and remaining entries susceptible to powdery mildew disease (Table 1 and 2).

Powdery mildew per cent disease leaf area of forty three black gram germplasms lines was from 1 to 5 (5% to 100%).Based on the mean disease incidence of both replications during rabi-2017, only eight entries *i.e*. TJU 262, LBG-884, MBG-1041, MBG-1045, MASH-1, MASH-414, PU-31 and NDU-1 were found resistant and remaining entries found susceptible to powdery mildew disease (Table 3 and 4).

Out of screened 126 genotypes, none of them were found to be immune. However, three genotypes *viz*., LBG-17, LBG-685 and LBG-685×VT (F2-F3) were found to be resistant to powdery mildew disease in Black gram (Channaveeresh *et al.*, 2014). Jameel Akhtar *et al.* (2014) noticed five genotypes *viz*., Pant U 31, BS 2-3, IPU 02-43, KU 323 and KU 99-21 were highly resistant to powdery mildew disease.Out of eleven Black gram entries, four entries *viz*., PU-31, MASH-338, LBG-752 and MBG-1050 were found moderately resistant to powdery mildew disease (Vijaya Bhaskar, 2017).

According to Asif Hadimani *et al.*, (2017), total 64 genotypes were screened, none of them were found to be immune and sixteen genotypes *viz*., BDU 3-22, OBG-647, BDU 3-23, BDU 3-2, KU-5-527, BDU 3-21, BDU-5, BDU-7, BDU-9, BDU-12, LBG-645, LBG-465, LBG-685 and LBG-20 were resistant to yellow mosaic virus.

Screening of F3 progenies of 21 crosses along with 15 parents of blackgram was carried out against powdery mildew, disease score of genotypes range from 0-7 of powdery mildew was observed under field conditions (Silpa Chauhan *et al.*, 2018).

Out of 116 genotypes screened, genotype LBG645 recorded lowest per cent disease severity of 0.77 and was found to be highly resistant to powdery mildew (Priyanka *et al*., 2018).

Mung bean yellow mosaic virus disease incidence. Yellow mosaic virus disease incidence in sixty four Black gram germplasms lines was from 0% to 90%. Based on the mean disease incidence of both replications during Kharif-2017, seven entries *viz.*, MASH-1, MASH-414, MASH-338, T-9, TBG-104, NDU-1 and WBU-108 were found immune, seven entries *viz*; MBG-1044, 1045, 1047, 1050, 1051, 1052 and PDU-2-43 were resistant and remaining entries were susceptible to yellow mosaic virus disease (Table 1 and 2).

Yellow mosaic virus disease incidence in forty three Black gram germplasms lines was from 0% to 85%.Based on the mean disease incidence of both replications during rabi-2017, nine entries *viz*., MASH-1, MASH-414, MASH-338, T-9, PU-31, TBG-104, NDU-1, PDU-2-43 and WBU-108 were found immune, twenty two entries *viz*., COBG 653, LBG 752, IPU 12-30, DKU 99, DKU 95, VBG 12-034, VBG 12-111, TJU 262, TJU 111, TJU 67, LBG 884, COBG 13-08, VBG13-003, VBG 14-016, IPU 12-10, GBG-45, GBG-47, OBG 41, OBG 43, DKU 118, DKU 87 and LBG 787 were resistant and remaining entries were susceptible to yellow mosaic virus disease (Table 3 and 4).

Out of screened Black gram 45 genotypes, 19 lines *viz.*, PU-31, PU-205, PU 1075, IC-1704, IC-11668,IC-37978, IC-49203, MASH-1-1, IC -6110, PDBG-10, PU-30, MASH-114, PU-35, IC-59702, TBG-104, PU-19, TU94-2, MASH338 and IC-14691 were free from disease with one score/resistant (Prasanthi *et al.*, 2013).

From screened 56 genotypes against YMV, 22 entries *viz.*, PU-202, 205, 206, 207, 208, 209, 210, P-1051, P-1051, P-1052, P-1053, P-1058, P-1059, P-1060, P-1061, P-1062, P-1064, P-1065, P-1070, P-1075, P-715 and PU-31 showed resistance to YMV in Black gram (Obaiah *et al.*, 2013).

Out of eight genotypes of black gram, two genotypes *viz*., KU 323 and BS 23-13 were noticed as resistant to YMV disease (Jameel Akhtar *et al*., 2016).

Vijaya Bhaskar (2017) found that two entries *viz*., PU-31 and MASH-338 were found immune to mung bean yellow mosaic virus disease out of evaluated 11 black gram entries.

Hari Ram Kumar Bandi *et al.,* 2018, Observed that out of 36 genotypes, only five PU-31, KUG 216 × PU 40, TU 18, KUG 216× SPS 5 and LBG 20 were observed resistance to ymv in black gram.

Sameer Kumar Singh and Singh *et al*. (2019), noticed that seven genotypes namely., PM-5,IPM 2K 14-19, IPM 306-1, HUM 2K-14-9, HUM-1, HUM-16 and PM-4 were moderately resistant YMV disease in black gram.

Out of twenty genotypes, four genotypes namely RSU-03, TU-22, Pant-U-31 and RSU-06 were found to be resistant against yellow mosaic virus whereas nine genotypes namely Sarada, RSU-44, RSU-46, Sulata, VBG11-053, Goutam, TJU-24, KUG-725 and Uttara showed moderate resistance for Yellow Mosaic Virus disease in Black gram (Raman Babu Raman *et al*., 2019).

Among the evaluated forty eight genotypes, 14 genotypes were resistant to YMV in Urd bean (Tamilzharasi *et al.*, 2020).

Out of 102 blackgram genotypes, one VBN4 genotype showed complete resistance and 50 genotypes tolerant to YMV (Chippy *et al*., 2022).

Leaf crinkle virus disease. Leaf crinkle virus disease per cent severity index of sixty four Black gram germplasms lines was from 0 to 3. Based on the mean disease severity index of both replications during Kharif-2017,one MASH-338 entry was highly resistant, thirty nine entries were found resistant, 21 entries were found moderately resistant and remaining entries were susceptible to urd bean crinkle virus disease (Table 1 and 2).

Out of 16 black gram entries, one genotype (VH9440039-3) was found highly resistant and one ES-1 was resistant to ULCV (Muhammad Bashir *et al*., 2005).

Among evaluated Black gram 69 genotypes, four genotypes, KEU 16- 29, KEU 16-30, RUE-15-3 and TU68 were found to be highly resistant to leaf crinkle virus disease (Achanta Sravika *et al.,* 2018). Out of 27 genotypes, CO 5 recorded resistance reaction, genotypes *viz.,* APK 1 and Mash 1008 recorded moderate resistance to leaf crinkle virus disease in Black gram (Sathya Palanivelu *et al.,* 2022).

Table 1: Screening of Black gram germplasms against leaf spot, powdery mildew, yellow mosaic virus and leaf crinkle virus diseases-Kharif-2017 (AICRP MULLARP).

Sr. No.	Name of the entry	Leaf Spot		Powdery Mildew		Yellow Mosaic Virus		Leaf Crinkle Virus disease	
		0-9 scale	Reaction	0-5 scale	Reaction	0-9 scale	Reaction	Disease Severity Index	Reaction
1.	Shekhar-3	5	MS	3	MS	3	MR	1	R
2.	IPU 2-43	7	S	2	MR	3	MR	1	R
3.	IPU 94-1	5	MS	2	MR	3	MR	2	MR
4.	MDBGV -04	7	S	2	MR	9	HS	1	R
5.	LBG 752	5	MS	2	MR	7	S	2	MR
6.	LBG 787	5	MS	2	MR	7	S	1	R
7.	LBG 623	5	MS	2	MR	9	HS	2	MR
8.	LBG 645	7	S	1	R	9	HS	2	MR
9.	LBG 888	7	S	1	R	9	HS	1	R
10.	RBU-4	5	MS	1	R	3	MR	2	MR
11.	KU 16-07	7	S	1	R	3	MR	1	R
12.	KU 96-3	5	MS	1	R	3	MR	1	R
13.	KU 16-4	7	S	2	MR	3	MR	2	MR
14.	KPU 12-213	7	S	1	R	3	MR	1	R
15.	KPU1720-140	7	S	1	R	3	MR	1	R
16.	KPU 12-1730	5	MS	1	R	3	MR	1	R
17.	KPU 128-105	7	S	2	MR	3	MR	2	MR
18.	TPU 4	7	S	1	R	5	MS	2	MR
19.	TU 94-2	5	MS	1	R	5	MS	1	R
20.	TJU 98-14	7	S	1	R	5	MS	1	R
21.	RU 03-22	7	S	1	R	5	MS	2	MR
22.	RU (IU)02-1-3	7	S	2	MR	5	MS	2	MR
23.	DBG-11	7	S	1	R	5	MS	1	R
24.	Pant U 31	7	S	1	R	5	MS	1	R
25.	Pant U 14-19	7	S	1	R	3	MR	2	MR
26.	PU 14-28	7	S	1	R	3	MR	1	R
27.	PU 10-23	7	S	2	MR	3	MR	1	R
28.	AKU 13-16	7	S	1	R	9	HS	2	MR
29.	NUK 15-09	7	S	1	R	7	S	1	R
30.	NUL 242	7	S	1	R	5	MS	2	MR
31.	NUL 7	9	HS	2	MR	5	MS	3	MS
32.	VBG 14-016	7	S	1	R	3	MR	1	R
33.	VBG 12-034	7	S	1	R	5	MS	2	MR
34.	VBG 13-003	7	S	1	R	3	MR	2	MR
35.	VBG 12-111	9	HS	2	MR	5	MS	2	MR
36.	COG 13-08	7	S	1	R	3	MR	2	MR
37.	KUG 791	7	S	1	R	3	MR	1	R
38.	Barabanki Local	9	HS	1	R	3	MR	1	R
39.	NDUK 15-222	9	HS	2	MR	3	MR	3	MS
40.	KUG 479	7	S	1	R	3	MR	2	MR
41.	WBG-26(Check)	9	HS	3	MS	5	MS	3	MS

Table 2: Screening of Black gram germplasms against leaf spot, powdery mildew, yellow mosaic virus and leaf crinkle virus diseases-Kharif-2017 (Station entries).

Sr. No.	Name of the entry	Leaf Spot		Powdery Mildew		Yellow Mosaic Virus disease		Leaf crinkle Virus disease	
		0-9 scale	Reaction	0-5 scale	Reaction	0-9 scale	Reaction	Disease Severity Index	Reaction
1.	MBG.1041	9	HS	4	S	7	S	1	R
2.	MBG.1042	9	HS	3	MS	3	MR	1	R
3.	MBG.1044	9	HS	2	MR	3	MR	2	MR
4.	MBG.1045	9	HS	2	MR	1	R	1	R
5.	MBG.1047	9	HS	2	MR	1	R	2	MR
6.	MBG.1050	9	HS	2	MR	1	R	1	R
7.	MBG.1051	9	HS	2	MR	1	R	1	R
8.	MBG.1052	7	S	2	MR	1	R	1	R
9.	MBG.1054	9	HS	4	S	1	R	1	R
10.	LBG-20	9	HS	3	MS	7	S	1	R
11.	T-9	9	HS	3	MS	0	I	1	R
12.	MASH338	7	S	3	MS	0	I	0	HR
13.	Uttara	9	HS	3	MS	5	MS	1	R
14.	TBG104	5	MS	1	R	0	I	1	R
15.	Pant-M-2	7	S	1	R	3	MR	1	R
16.	Pant-M-3	9	HS	1	R	3	MR	2	MR
17.	PDU-2-43	3	MR	1	R	1	R	1	R
18.	MASH-414	5	MS	1	R	0	I	1	R
19.	MASH-1	5	MS	1	R	0	I	1	R
20.	NDU-1	5	MS	1	R	0	I	1	R
21.	WBU-108	5	MS	1	R	0	I	1	R
22.	MBG217	7	S	3	MS	7	S	1	R
23.	WBG-26(check)	9	HS	3	MS	5	MS	3	R

Table 3: Screening of Black gram germplasms against leaf spot, powdery mildew and yellow mosaic virus diseases-Rabi (AICRP MULLARP).

Sr. No.	Name of the entry	Leaf Spot (0-9)		Powdery Mildew (0-5)		Yellow Mosaic Virus (0-9)	
		0-9 scale	Reaction	0-5 scale	Reaction	0-9 scale	Reaction
1.	COBG 653	5	MS	3	MS	1	R
2.	LBG 752	3	MR	3	MS	1	R
3.	IPU 12-30	5	MS	3	MS	1	R
4.	DKU 99	5	MS	3	MS	1	R
5.	DKU 95	5	MS	4	S	1	R
6.	VBG 12-034	5	MS	4	S	1	R
7.	VBG 12-111	3	MR	4	S	1	R
8.	TJU 262	5	MS	1	R	1	R
9.	TJU 111	5	MS	3	MS	1	R
10.	TJU 67	5	MS	3	MS	1	R
11.	LBG 884	5	MS	1	R	1	R
12.	COBG 13-08	5	MS	3	MS	1	R
13.	VBG 13-003	5	MS	3	MS	1	R
14.	VBG 14-016	3	MR	3	MS	1	R
15.	MBG-1050	5	MS	3	MS	5	MS
16.	IPU 10-27	5	MS	4	S	5	MS
17.	IPU 12-10	5	MS	3	MS	1	R
18.	GBG-45	3	MR	3	MS	1	R
19.	GBG-47	5	MS	4	S	1	R
20.	OBG 41	5	MS	3	MS	1	R
21.	OBG 43	5	MS	5	HS	1	R
22.	DKU 15-12	5	MS	4	S	1	R
23.	DKU 118	5	MS	4	S	3	MR
24.	DKU 87	3	MR	4	S	1	R
25.	LBG 787	5	MS	4	S	1	R
26.	WBG-26(check)	9	HS	4	S	5	MS

Table 4: Screening of Black gram germplasms against leaf spot, powdery mildew and yellow mosaic virus diseases-Rabi (Station entries).

Sr. No.	Name of the entry	Leaf Spot (0-9)		Powdery Mildew (0-5)		Yellow Mosaic Virus (0-9)	
		0-9 scale	Reaction	0-5 scale	Reaction	0-9 scale	Reaction
1.	MBG-1041	5	MS	1	R	3	MR
2.	MBG-1045	5	MS	1	R	3	MR
3.	MBG-1047	5	MS	3	MS	5	MS
4.	MBG-1051	7	S	3	MS	5	MS
5.	LBG-20	3	MR	2	MR	3	MR
6.	LBG-645	5	MS	3	MS	3	MR
7.	MASH-1	5	MS	1	R	0	I
8.	MASH-414	5	MS	1	R	0	I
9.	MASH-338	3	MR	2	MR	0	I
10.	T-9	5	MS	3	MS	0	I
11.	PU-31	3	MR	1	R	0	I
12.	TBG-104	5	MS	3	MS	0	I
13.	NDU-1	3	MR	1	R	0	I
14.	PDU-2-43	3	MR	3	MS	0	I
15.	WBU-108	3	MR	3	MS	0	I
16.	Barabanki Local	5	MS	3	MS	3	MR
17.	WBG-26(check)	9	HS	4	S	5	MS

CONCLUSIONS

PDU-2-43 was resistant to powdery mildew, yellow mosaic virus and leaf crinkle virus diseases. IPU-94-1, KU-16-4, KPU-128-105 and MBG-1044 were moderately resistant to powdery mildew, yellow mosaic virus and leaf crinkle virus diseases. LBG-752 entry was found moderately resistant to powdery mildew and leaf crinkle virus diseases and IPU-2-43 was moderately resistant to powdery mildew and yellow mosaic virus diseases in Kharif season. TJU-262 and LBG-884 were resistant to powdery mildew and yellow mosaic virus diseases. LBG-20 was moderately resistant to leaf spot, powdery mildew and yellow mosaic virus diseases and Mash-338 was moderately resistant to leaf spot and powdery mildew diseases in rabi season.

FUTURE SCOPE

These promising black gram germplasms are to be used in crossing programme for development of further resistance to leaf spot, powdery mildew, mung bean yellow mosaic virus and leaf crinkle virus diseases.PDU-2-43 entry is to be preferred for development of multiple disease resistance to powdery mildew, yellow mosaic virus and leaf crinkle virus diseases. TJU-262 and LBG-884 entries are to be preferred for development of multiple disease resistance to powdery mildew and yellow mosaic virus diseases in Black gram.

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Conflict of Interest. None.

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