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EVALUATION OF BLACKGRAM GENOTYPES FOR RESISTANCE AGAINST THRIPS AND WHITEFLY IN RELATION TO LEAF CURL AND YELLOW MOSAIC VIRUS

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ABSTRACT

A field experiment was conducted to screen the blackgram genotypes at dry land farm, S.V. Agricultural College,Tirupati during *rabi*2018-19 for identification of resistance source for utilization in developing the resistant varieties of blackgram. Total 20 genotypes along with two susceptible checks *viz.,* TBG-140 and LBG-645 were screed for Leaf Curl and Yellow Mosaic Virus (YMV). The results revealed that PU-31 genotype recorded lowest incidence of leaf curl followed by GBG-1 and found resistant with 1 scale rating. Sixteen genotypes *viz.,* NDUK-15-222, SRI, IPU-2-43, TBG-130, TBG-104-1, TBG-129, Butta Minumu, OBG-32, KPU-12-213, Tuti Minumu, VBG 12-111-1, LBG-787, GKB-3, LBG-623 and LBG-685 were recorded to be moderately resistant with 2 scale rating. Whereas TU-40 and LBG-752 genotypes are found to be moderately susceptible with 3 scale rating. The genotype LBG-20 found susceptible with 4 scale rating followed by two susceptible checks *viz.,* TBG-104 and LBG-645. In case of YMV among screened genotypes none of the entry recorded zero scale rating which comes under highly resistant. While 11 genotypes *viz.,* PU-31, TBG-130, GBG-1, NDUK-15-222, LBG-787, LBG-623, IPU-2-43, Tuti Minumu, KPU-12-213, LBG-752 and TBG-129 were recorded less incidence of YMV and found to be resistant with 1 scale rating. The remaining 7 balckgram genotypes *viz.,* Butta Minumu, GKB-3, TBG 104-1, VBG-12-111-1, LBG-20, LBG-685 and SRI recorded to be moderately resistant with 2 scale rate. But two genotypes *viz.,* OBG-32 and TU-40 were found to be moderately susceptible with 3 scale rating along with two susceptible checks TBG-104 and LBG-645. The results indicated that none of the genotype found to be susceptible and highly susceptible during *rabi* 2018-19.

KEYWORDS: *Yellow Mosaic Virus (YMV), leaf curl,* blackgram genotypes.

INTRODUCTION

Blackgram, *Vigna mungo* (L.) Hepper which is commonly called as urdbean is the fourth important pulse crop in India. India is the world's largest producer as well as consumer of balckgram. In India, the area, production and productivity of Pulses were 24.91 million hectares, 16.35 million tones and 733 kg per hectare, respectively during 2015-2016 (Shani *et al.,* 2017). The annual yield loss due to the insect pests has been estimated at about30 per cent in urdbean and mungbean. On an average, 2.5 to 3.0 million tones of pulses are lost annually due to pest problems (Rabindra *et al*., 2004). Eleven sucking pests were identified in blackgram as sap feeders among them whitefly (*Bemisia tabaci*),thrips (*Scirtithrips dorsalis*), jassid (*Empoasca* spp.) and green leafhopper (*Nephotettix* spp.) and defoliatrs appeared as foliage feeders. Flower thrip (*Caliothrips*sp.) and leaf miner (*Chromatomyia horticola*) were classified as pollen feeder and tissue borer, respectively. (Kumar *et al*., 2007). Among them, sucking insect pests such as thrips and whitefly are the most important pests during early stages of crop growth which not only reduce the plant vigour and also act as vectors of deadly viral diseases *viz*., leaf curl and YMV.

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Thrips are the major sucking insect pests in pulses mainly on blackgram and greengram causing considerable damage by sucking cell sap from different tender parts of plant. And also act as vectors of different plant viruses which cause leaf curl and bud necrosis, besides direct injury by feeding (Ananthakrishnan, 1980). Whitefly is another most important insect pest of pulses causing damage by sucking cell sap from leaves or tender parts and excretes honeydew on which sooty mold develops which hinders photosynthesis. Besides, it also acts as a vector for mungbean Yellow Mosaic Virus, (YMV) which is a serious threat to pulse production in India. The mungbean Yellow Mosaic Virus (YMV) disease results in irregular alternate yellow and green chlorotic patches on older leaves and causes complete yellowing of young leaves of susceptible varieties thereby reducing the photosynthetic ability, finally leading to yield reduction to the tune of 25-78 per cent (Vir, 1984). One of the important tool of integrated pest management is host plant resistance by use of resistant verities or cultivars, due to its broad adaptability and environmental safety it becomes the best choice to overcome pest incidence.

MATERIALS AND METHODS

A field experiment was conducted with blackgram genotypes at dry land farm, S.V. Agricultural College, Tirupati during *rabi* 2018-19 to identify the resistance source for utilization in developing the resistant varieties of blackgram. A total of twenty blackgram genotypes along with two susceptible checks *viz.,* TBG-104 and LBG-645 were screened to thrips and whitefly incidence which transmit leaf curl and Yellow Mosaic diseases respectively in blackgram and results are presented in Table 1. The field trial was laid in a Randomized Block Design (RBD) with 20 genotypes along with two susceptible check verities was sown after each five lines as treatments in three replications. Each entry was sown in a row length of 4 meters with row to row 30 cm and plant to plant 10 cm duly following the recommended agronomic practices (ANGRAU) except plant protection measures.

Method of observations

Thrips population was recorded on top three young leaves and whitefly nymphs were recorded from each leaf let of lower surface of the trifoliate leaf in the middle canopy using a magnifying lens at weekly intervals on 10 randomly selected genotypes. The per cent of disease incidence was assessed by recording the number of plants showing disease symptoms of leaf curl virus and the total number of plants per row. While the per cent incidence of YMV was given as per disease rating scale. The observations were recorded on total plant stand and those attacked by leaf curl virus and YMV at 70 Days After Sowing (DAS).

RESULTS AND DISCUSSION

The results pertaining to the mean number of thrips and whitefly population was observed in different blackgram genotypes at 35 DAS and 70 DAS and presented in Table 1. The incidence of thrips population was recorded at 35 DAS of blackgram and the entries PU-31 and GBG-1 were recorded lowest incidence of thrips population with 1.96 and 2.58 thrips per plant on top three leaves while in 12 genotypes *viz.,* IPU-2-43, TutiMinumu, ButtaMinumu, LBG-787, GKB-3, LBG-685, NDUK-15-222, SRI, TBG-130, TBG-104-1, TBG-129 and VBG-12-111-1 population of thrips has recorded with a range of 3.14 to 4.83 thrips per plant on top three leaves and in other genotypes *viz.,* KPU-12-213, OBG-32, TU-40, LBG-623 and LBG-752 the thrips population was observed from 5.24 to 5.96 thrips per plant on top three leaves. But in LBG-20 the highest population was recorded with 6.72 thrips per plant on top three leaves which was more than susceptible checks *viz.,* TBG-104 and LBG-645 (6.13 and 6.47 respectively) (Table 1). In case of whitefly population, the entries PU-31 and GBG-1 were found low preferred by the whitefly (1.3 and 1.50 whitefly/plant on trifoliate leaves from middle canopy). While 12 genotypes *viz.,*IPU-2-43, Tuti Minumu, Butta Minumu, LBG-787, GKB-3, LBG-685, NDUK-15-222, SRI, TBG-130, TBG-104-1, TBG-129 and VBG-12-111-1 recorded whitefly population with a range of 1.57 to 2.72 whitefly/plant on trifoliate leaves from middle canopy of the plant and another 5 genotype *viz.,* KPU-12-213, OBG-32, TU-40, LBG-623 and LBG-752 were recorded moderately high whitefly population with a range of 2.89 to 3.11 whitefly/plant on trifoliate leaves from middle canopy, where as in LBG-20 the highest population was recorded with 3.52 whitefly/plant on trifoliate leaves from middle canopy along with susceptible checks *viz.,* TBG-104 and LBG-645 (3.48 and 3.92 whitefly/plant on trifoliate leaves from middle -

canopy respectively). The incidence of thrips population at 70 DAS was observed similar trend and presented in the Table 1.

The leaf curl incidence was recorded at 70 DAS in 20 genotypes ranged from 5.38 to 48.13 per cent at 70 DAS. The genotype PU 31 recorded significantly lowest leaf curl incidence (5.38 per cent) followed by GBG-1 with 8.31 per cent incidence. Sixteen genotypes *viz.,* NDUK-15-222, SRI, IPU-2-43, TBG-130, TBG-104-1, TBG-129, Butta Minumu, OBG-32, KPU-12-213, Tuti Minumu, VBG 12-111-1, LBG-787, GKB-3, LBG-623 and LBG-685 recorded leaf curl incidence with 11.93 to 36.87 per cent. Whereas TU-40 and LBG-752 recorded highest leaf curl disease incidence (42.55 and 45.24 per cent respectively) followed by the susceptible checks *viz.,* TBG-104 and LBG-645 with highest incidence of leaf curl (46.89 and 48.13 per cent respectively) (Table 2). The results indicated that PU-31 genotype recorded lowest incidence of leaf curl followed by GBG-1 and found resistant with 1 rating scale. Sixteen genotypes *viz.,* NDUK-15-222, SRI, IPU-2-43, TBG-130, TBG-104-1, TBG-129, Butta Minumu, OBG-32, KPU-12-213, Tuti Minumu, VBG 12-111-1, LBG-787, GKB-3, LBG-623 and LBG-685 were recorded to be moderately resistant with 2 rating scale. While genotypes TU-40 and LBG-752 are found to be moderately susceptible with 3 rating scale. The genotype LBG-20 found susceptible with 4 rating scale followed by two susceptible checks *viz.,* TBG-104 and LBG-645 (Table 3). The present results were in conformity with Chaudhry *et al.* (2007) reported that out of 67 blackgram germplasm lines screened against leaf crinkle virus, among them two lines *viz.,* CM-707 and CH-Mash 97 were found to be moderately resistant and all others were moderately susceptible to leaf crinkle virus and all others were moderately susceptible. Chhabra and Malik (1992) tested 70 entries of summer mungbean (*V. radiata*) germplasm for resistance to thrips and reported that genotypes SML 77, UPM 82-4 and Pusa 107 were identified as tolerant donors to thrips and they can be use in a breeding programme.

In general, the incidence of YMV was less during *rabi* 2018-19 and it ranged from 2.45 to 27.67 per cent. The genotype PU 31 recorded significantly lowest YMV incidence (2.45 per cent) which followed by TBG-130 (4.52 per cent), GBG-1 (5.72 per cent), NDUK-15-222 (7.23 per cent), LBG-787 (7.33 per cent), LBG-623 (7.85 per cent), IPU-2-43 (8.33 per cent), TutiMinumu(8.29 per cent), KPU-12-213 (8.67 per cent), TBG-129 (8.71 per cent) and LBG-752 (9.23 per cent) recorded less than 10 per cent YMV with a range of 2.45 to 9.23 per cent YMV incidence. The genotypes *viz.,* Butta Minumu, (10.56 per cent), LBG-685 (11.41 per cent), GKB-3 (12.08 per cent), TBG-104-1 (15.26 per cent), VBG 12-111-1, (17,42 per cent), LBG-20 (17.67 per cent), and SRI (19.75 per cent) recorded the incidence of YMV with range of 10.56 to 19.75 per cent while the highest incidence of YMV was recorded by OBG-32 and TU-40 with 22.33 and 23.58 per cent along with two susceptible checks *viz.,* TBG-104 and LBG-645 with 25.33 and 27.67 per cent respectively (Table 4). The genotypes were categorized based on their resistant reaction to the incidence of YMV on 0-5 scale rating. The results indicated that among screened genotypes none of the genotype recorded zero scale rating which comes under highly resistant. While 11 genotypes *viz.,* PU-31, TBG-130, GBG-1, NDUK-15-222, LBG-787, LBG-623, IPU-2-43, Tuti Minumu, KPU-12-213, LBG-752 and TBG-129 were recorded less incidence of YMV and found to be resistant with 1 scale rating. The remaining 7 balckgram genotypes *viz.,* Butta Minumu, GKB-3, TBG 104-1, VBG-12-111-1, LBG-20, LBG-685 and SRI recorded to be moderately resistant with 2 scale rate. But two genotypes *viz.,* OBG-32 and TU-40 were found to be moderately susceptible with 3 scale rating along with two susceptible checks TBG-104 and LBG-645. The results were indicated that none of the genotypes were found to be susceptible and highly susceptible during *rabi* 2018-19 (Table 5). The present results were with the conformity of Bag *et al*. (2014) who reported that four accessions *viz.,* IC 144901, IC 001572, IC 011613 and IC 485638 were resistant out of 344 accessions of blackgram germplasm evaluated for resistance to mung bean YMV. Singh *et al.* (2008) reported that the blackgram genotypes IPU 245, KARS-114, KARS-14 and KUG-50 recorded low YMV incidence due to low infestation by whitefly. Similarly,Yadav and Dahiya (2000) reported that out of thirty genotypes, the maximum incidence of YMV was recorded in Copergoan (70%) and minimum in ML5 (13%).

Table. 1 Screening of blackgram genotypes to thrips and whitefly incidence during *rabi* 2018-19

S. No.	Blackgram genotypes	Thrips (mean no. of thrips/plant on top three leaves)		Whitefly (mean no. of whitefly/ trifoliate leaves in middle/plant)	
		35 DAS	70 DAS	35 DAS	70 DAS
1	NDUK-15-222	3.81 (11.26)^{a}	9.78 (17.19)^{b}	1.98 (7.90)^{b}	4.53 (11.15)^{bc}
2	LBG-787	3.67 (11.04)^{a}	6.33 (13.62)^{a}	1.72 (7.30)^{a}	4.31 (10.64)^{b}
3	IPU-2-43	3.28 (10.07)^{a}	8.67 (16.62)^{b}	1.33 (6.23)^{a}	4.05 (9.79)^{b}
4	TBG-130	3.97 (11.23)^{a}	10.68 (17.62)^{b}	2.28 (7.89)^{b}	4.67 (12.28)^{cd}
5	TBG-104-1	5.24 (12.44)^{bc}	11.26 (19.59)^{cd}	2.45 (8.34)^{b}	4.81 (12.67)^{d}
6	PU-31	1.96(9.58)^{a}	7.14 (14.29)^{a}	1.30 (6.14)^{a}	2.50 (8.47)^{a}
7	LBG-752	5.97 (13.54)^{c}	13.92 (21.83)^{d}	3.11 (8.79)^{b}	5.13 (12.68))^{d}
8	TBG-129	4.56 (12.13)^{b}	11.95 (20.21)^{c}	2.56 (8.61)^{b}	4.97 (11.99)^{c}
9	VBG-12-111-1	4.83 (12.51)^{c}	12.53 (20.69)^{d}	2.72 (8.97)^{b}	5.67 (12.51))^{d}
10	TU-40	6.45 (14.44)^{d}	13.22 (21.24)^{d}	3.02 (8.34)^{b}	4.82 (11.72)^{c}
11	OBG-32	5.32 (12.57)^{c}	12.85 (20.64)^{d}	2.97 (9.49)^{d}	4.59 (12.17)^{cd}
12	KPU-12-213	5.24 (12.44)^{bc}	12.73 (21.25)^{d}	2.89 (9.49)^{d}	4.36 (11.83)^{c}
13	TutiMinumu	3.55 (10.55)^{a}	8.83 (20.62)^{d}	1.67 (9.33)^{cd}	4.17 (10.25)^{b}
14	ButtaMinumu	3.62 (10.66)^{a}	8.97 (19.58)^{c}	1.33 (7.17)^{a}	4.24 (10.46)^{b}
15	SRI	3.88 (11.09)^{a}	10.17 (19.62)^{c}	2.15 (6.23)^{a}	4.59 (12.17)^{cd}
16	GKB-3	3.67 (10.24)^{a}	9.29 (21.96)^{d}	1.79 (7.47)^{ab}	4.36 (10.77)^{b}
17	LBG-623	5.36 (11.87)^{b}	13.51 (22.41)^{d}	3.60 (7.47)^{ab}	4.95 (11.95)^{c}
18	LBG-20	6.72 (14.19)^{d}	14.68 (22.24)^{d}	3.52 (10.09)^{d}	5.71 (12.59)
19	LBG-685	3.77 (10.44)^{a}	9.48 (21.49)^{d}	1.67 (9.91)^{d}	4.45 (11.97)^{c}
20	GBG-1	2.58 (9.12)^{a}	7.58 (18.47)^{b}	1.50 (7.17)^{a}	3.78 (10.46)^{b}
21	TBG-104	6.13 (13.31)^{c}	15.67 (25.88)^{e}	3.48 (6.73)^{a}	5.67 (12.51))^{d}
22	LBG-645	6.47 (13.83)^{c}	19.33 (26.29)^{e}	3.92 (9.82)^{d}	7.33 (15.61)^{e}
SEm		1.83	2.34	2.52	2.90
CD 0.05 %		5.24	6.37	7.23	8.56
CV		4.33	5.82	5.11	3.98

DAS: Days After Sowing
Values in parenthesis are arc sine transformed values
Values with the same alphabet are not significantly different

Table. 2 Screening of blackgram genotypes for the incidence of leaf curl disease during *rabi* 2018-19

S. No.	Blackgram genotypes	Leaf curl incidence at 70 DAS
		Mean per cent incidence
1	NDUK-15-222	16.38 (30.63)[f]
2	SRI	15.01 (22.60)[c]
3	IPU-2-43	12.52 (19.40)[c]
4	TBG-130	24.79 (29.54)[ef]
5	TBG-104-1	36.87 (37.35)[g]
6	PU-31	5.38 (12.66)[a]
7	TU-40	42.55 (40.65)[h]
8	TBG-129	27.93 (31.66)[f]
9	ButtaMinumu	17.96 (25.01)[d]
10	GBG-1	8.31 (16.68)[b]
11	OBG-32	26.34 (30.60)[f]
12	KPU-12-213	18.00 (25.08)[d]
13	TutiMinumu	11.93 (20.20)[c]
14	VBG 12-111-1	14.85 (22.67)[cd]
15	LBG-787	26.97 (31.28)[f]
16	GKB-3	16.98 (24.33)[d]
17	LBG-623	21.59 (27.26)[e]
18	LBG-20	24.89 (29.92)[ef]
19	LBG-685	20.92 (26.77)[e]
20	LBG-752	45.24 (42.26)[h]
21	TBG-104 (Susceptible check)	46.89 (43.22)[i]
22	LBG-645 (Susceptible check)	48.13 (43.93)[i]
SEm		1.99
CD 0.05 %		5.88
CV		5.62

DAS: Days After Sowing
Values in parenthesis are arc sine transformed values
Values with the same alphabet are not significantly different

Table. 3 Categorization of blackgram genotypes based on resistant reaction to leaf curl incidence (1-4 scale).

Disease scale	Percent infection	Genotypes	Infection category
1	1-10 %	PU-31, GBG-1	Resistant
2	11-40 %	IPU-2-43, TutiMinumu, ButtaMinumu, LBG-787, GKB-3, LBG-685, NDUK-15-222, SRI, TBG-130, TBG 104-1, TBG-129, VBG-12-111-1, KPU-12-213, LBG-623, OBG-32,	Moderately resistant
3	41-50 %	TU-40, LBG-752	Moderately susceptible
4	51-100 %	LBG-20, TBG-104, LBG-645,	Susceptible

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Screening of blackgram genotypes for thrips transmitted leaf curl and Whitefly transmitted YVMV

Table. 4 Evaluation of blackgram genotypes for the incidence of YMV during *rabi* 2018-19

S. No.	Blackgram genotypes	YMV incidence at 70 DAS
		Mean per cent
1	NDUK-15-222	7.23(14.43)^{cd}
2	SRI	19.75 (25.88)^{h}
3	IPU-2-43	8.33 (16.45)^{de}
4	TBG-130	4.52 (11.13)^{b}
5	TBG-104-1	15.26 (22.81)^{g}
6	OBG-32	22.33 (28.19)^{i}
7	LBG-752	9.23 (17.54)^{ef}
8	TBG-129	8.71 (16.86)^{e}
9	ButtaMinumu	10.56 (18.61)^{f}
10	TU-40	23.58 (29.02)^{IJ}
11	PU-31	2.45 (8.34)^{a}
12	GBG-1	5.72 (13.18)^{c}
13	TutiMinumu	8.29 (16.40)^{de}
14	VBG-12-111-1	17.42 (24.65)^{h}
15	LBG-787	7.33 (15.49)^{d}
16	GKB-3	12.08 (20.30)^{f}
17	LBG-623	7.85 (16.08)^{d}
18	LBG-20	17.67 (24.83)^{h}
19	LBG-685	11.41 (19.73)^{f}
20	KPU-12-213	8.67 (16.82)^{e}
21	TBG-104	25.33 (30.15)^{J}
22	LBG-645	27.67 (31.73)^{J}
SEm		2.79
CD 0.05 %		8.24
CV		4.17

DAS: Days After Sowing
Values in parenthesis are arc sine transformed values
Values with the same alphabet are not significantly different

Table. 5 Categorization of blackgram genotypes based on resistant reaction to YMV incidence (0-5 scale).

Disease scale	Percent infection	Genotypes	Infection category
0	All plants free of disease symptoms	-	Highly resistant
1	1-10 %	PU-31, TBG-130, GBG-1, NDUK-15-222, LBG-787, LBG-623, IPU-2-43, TutiMinumu, KPU-12-213, LBG-752,TBG-129	Resistant
2	11-20 %	ButtaMinumu, GKB-3, TBG 104-1, VBG-12-111-1, LBG-20, LBG-685, SRI	Moderately resistant
3	21-30 %	OBG-32, TU-40, TBG-104, LBG-645	Moderately susceptible
4	31-50 %	-	Susceptible
5	More than 50 %	-	Highly susceptible

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