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RESEARCH ARTICLE

Evaluation of urdbean germplasm for resistance to leaf crinkle disease

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SUMMARY

A screening trial was conducted during *Kharif* 2014 under field conditions by infector test row method at Regional Agricultural Research Station (RARS), Lam, Guntur, Andhra Pradesh to determine the reaction of 72 *urdbean* genotypes including check (LBG 623) against the *urdbean* leaf crinkle disease caused by *Urdbean leaf crinkle virus* (ULCV). Among 72 genotypes tested, 46 genotypes displayed resistant reaction, two genotypes (DKU-6 and DKU-99) displayed moderately resistant reaction and only one genotype *viz*., LBG 623 displayed susceptible reaction to ULCV and rest of the 23 genotypes were disease free.

Key Words : ULCV**,** Genotypes, Highly resistant, Resistant, Susceptible

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Blackgram or urdbean [*Vigna mungo* (L.) Hepper], is one of the important pulse crops which is grown as a source of income and nutrition to billions of people in South East Asia. The crop is of special significance in A.P. as it fits well in rice-pulse cropping system as a relay crop particularly in Krishna – Godavari and North Coastal zones. Blackgram suffers from biotic stress due to fungal, bacterial and viral diseases resulting in heavy yield losses. Among the viral diseases leaf crinkle disease caused by urdbean *leaf crinkle virus* (ULCV) is a serious constraint in the cultivation of blackgram in recent years. The first report on the occurrence of leaf crinkle of blackgram was made by Williams *et al.* (1968) from Delhi and Uttar Pradesh. Depending on the age of the plant at which the infection occurs, yield loss may vary between 50 and 76%. Plants that are infected very early failed to produce any pods (100% loss) in susceptible cultivars T-9 and Buttaminumu (Kolte, 1971; Subbarao, 1984 and Bhagavan, 1985). The decrease in seed yield in crinkle affected plants was due to reduction in number of pods per plant (Subbarao, 1984 and Bhagavan, 1985). ULCV is transmitted through sap inoculation, grafting and seeds (Ahmad *et al.*, 1997 and Kolte and Nene, 1972). Leaf

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Table A : Disease rating scale (0-5) for ULCV

Per cent infection	Disease grade	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

HR – Highly resistant; R – Resistant; MR – Moderately resistant; MS – Moderately susceptible; S – Susceptible; HS – Highly susceptible

feeding beetle (*Henosepilachna dodecastigma* (Wied) (Beniwal and Bharathan, 1980), whitefly (Narayanasamy and Jaganathan, 1973), and two aphid species (Dhingra, 1975) have been reported as insect vectors of ULCV. A good deal of research work has been directed towards screening urdbean germplasm against ULCV, to identify resistant sources under diverse environmental conditions and a number of lines resistant to virus were selected (Iqbal *et al.*, 1991 and Bashir *et al.*, 2005). For the control of ULCV, although a number of approaches may be useful, but growing resistant varieties is the ideal and cheapest way of combating the disease. The screening of urdbean germplasm against the diseases would be of great help to identify resistant sources. Hence, present study has been taken upto evaluate germplasm of urdbean to leaf crinkle disease.

MATERIAL AND METHODS

The experiment was laid out in Randomised Block Design (RBD) with two replications at RARS, Lam, Guntur, Andhra Pradesh to evaluate 72 entries including check (LBG 623) during *Kharif* 2014 under field conditions. The sowing was done on 18th July, 2014. Each genotype was sown in two rows of five metre length with 30 cm row-row spacing and 10 cm plant-plant distance. A susceptible check variety LBG 623 was sown as infector row after every two rows of the entry to serve as spreader. All the recommended agronomic practices were followed to raise a good crop. The reaction of each of the test entries was assessed by recording the per cent disease incidence at weekly intervals from 10 DAS upto a week prior to harvest. Per cent disease incidence of ULCV was calculated by the following formula:

$$\text{Per cent disease incidence (PDI)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Genotypes were categorized based on disease rating scale of ULCV given by Bashir *et al*. (2005) (Table A).

RESULTS AND DISCUSSION

Urdbean germplasm consisting of seventy two genotypes including check LBG 623 were evaluated for their reaction to ULCV under field conditions at RARS, Lam, Guntur during *Kharif* 2014. Wavy appearance on the third trifoliate leaves followed by crinkling, puckering and rugosity of leaves, shortening of petioles and crowding of leaves were first observed on the susceptible check 23 days after sowing (DAS). The check lines manifested maximum disease incidence at the time of final observation. Depending upon their genetic make up each of the 72 test lines of Urdbean responded differently to ULCV (Table 1). Different blackgram genotypes that fall into each category were grouped in Table 2.

Out of seventy two genotypes with LBG 623 as check, screened against natural infection of ULCV, 23 genotypes *viz*., KPU-31, KPU-29, KPU-9, KPU-33, KPU-21, KPU-17, KPU-7, KPU-22, KPU-2, KPU-34, KPU 12-133, KPU 525-64, KPU 175-2, KPU 129-104, KPU 12-219,OBG-32, DKU-84, DKU-87, DKU-90, DKU-92, DKU-116, DKU-118 and PU 12-7 were found to be disease free and remained asymptomatic with zero incidence. Therefore these accessions were considered as highly resistant (HR) (Table 1, 2).

Forty six genotypes *viz*., KPU-1 (1.36%), KPU-16 (0.75%), KPU-26 (2.12%), KPU-15 (3.11%), KPU-6 (0.51%), KPU-19 (0.82%), KPU-14 (6.68%), KPU-4 (5.82%), KPU-13 (2.58%), KPU-8 (3.21%), KPU-25 (1.59%), KPU-20 (0.79%), KPU-30 (4.20%), KPU-12 (5.34%), KPU-3 (2.99%), KPU-24 (1.06%), KPU-10 (0.82%), KPU-28 (1.46%), KPU-18 (0.21%), KPU-27 (1.62%), KPU-5 (1.24%), KPU-23 (0.38%), KPU-32 (0.67%), KPU-11 (0.69%), KPU 12-1731 (6.64%), KPU 12-213 (1.78%), KPU 11-43 (2.73%), KPU 11-40 (6.24%), PU 12-5 (1.43%), AKU-9904 (5.25%), PU 12-6 (2.45%), LBG 752 (0.79%), KU 13-60 (0.94%), DKU-95 (3.00%), DKU-98 (2.86%), DKU-102 (5.86%), DKU-103 (2.94%), Hm-1 (3.70%), UG-218 (3.07%),

Table 1 : Field reaction of urdbean genotypes to ULCV at RARS, Lam during *Kharif* 2014

Sr. No.	Genotype	Disease incidence (%)	Disease grade	Disease reaction
1.	KPU-1	1.36	1	R
2.	KPU-16	0.75	1	R
3.	KPU-26	2.12	1	R
4.	KPU-15	3.11	1	R
5.	KPU-6	0.51	1	R
6.	KPU-19	0.82	1	R
7.	KPU-31	0.00	0	HR
8.	KPU-14	6.68	1	R
9.	KPU-4	5.82	1	R
10.	KPU-29	0.00	0	HR
11.	KPU-13	2.58	1	R
12.	KPU-8	3.21	1	R
13.	KPU-25	1.59	1	R
14.	KPU-20	0.79	1	R
15.	KPU-9	0.00	0	HR
16.	KPU-30	4.20	1	R
17.	KPU-12	5.34	1	R
18.	KPU-3	2.99	1	R
19.	KPU-24	1.06	1	R
20.	KPU-33	0.00	0	HR
21.	KPU-10	0.82	1	R
22.	KPU-28	1.46	1	R
23.	KPU-18	0.21	1	R
24.	KPU-27	1.62	1	R
25.	KPU-5	1.24	1	R
26.	KPU-21	0.00	0	HR
27.	KPU-17	0.00	0	HR
28.	KPU-23	0.38	1	R
29.	KPU-7	0.00	0	HR
30.	KPU-32	0.67	1	R
31.	KPU-22	0.00	0	HR
32.	KPU-11	0.69	1	R
33.	KPU-2	0.00	0	HR
34.	KPU-34	0.00	0	HR
35.	KPU 12-133	0.00	0	HR
36.	KPU 525-64	0.00	0	HR
37.	KPU 175-2	0.00	0	HR
38.	KPU 129-104	0.00	0	HR
39.	KPU 12-1731	6.64	1	R
40.	KPU 12-213	1.78	1	R
41.	KPU 11-43	2.73	1	R
42.	KPU 12-219	0.00	0	HR
43.	KPU 11-40	6.24	1	R
44.	OBG-32	0.00	0	HR
45.	PU 12-5	1.43	1	R
46.	AKU-9904	5.25	1	R
47.	PU 12-6	2.45	1	R

Table 1 contd…

Contd. Table 1

48.	LBG-752	0.79	1	R
49.	KU 13-60	0.94	1	R
50.	DKU-6	10.68	2	MR
51.	DKU-84	0.00	0	HR
52.	DKU-87	0.00	0	HR
53.	DKU-90	0.00	0	HR
54.	DKU-92	0.00	0	HR
55.	DKU-95	3.00	1	R
56.	DKU-98	2.86	1	R
57.	DKU-99	11.56	2	MR
58.	DKU-102	5.86	1	R
59.	DKU-103	2.94	1	R
60.	DKU-116	0.00	0	HR
61.	DKU-118	0.00	0	HR
62.	Hm-1	3.70	1	R
63.	UG-218	3.07	1	R
64.	PU 12-9	1.80	1	R
65.	PU 12-7	0.00	0	HR
66.	PU 12-4	1.66	1	R
67.	PU 12-2	0.60	1	R
68.	PU 12-11	2.88	1	R
69.	PLP-93	0.89	1	R
70.	Co 5	3.22	1	R
71.	Co (BG) 653	3.05	1	R
72.	LBG 623 (Check)	32.29	4	S

HR- Highly resistant R- Resistant MR- Moderately resistant S- Susceptible

PU 12-9 (1.80%), PU 12-4 (1.66%), PU 12-2 (0.60%), PU 12-11 (2.88%), PLP-93 (0.89%), Co 5 (3.22%) and Co (BG) 653 (3.05%) were rated as resistant (R) and two genotypes *viz*., DKU-6 and DKU-99 with incidence of 10.68 and 11.56%, respectively, were rated as moderately resistant (MR). Only one genotype, LBG 623 (susceptible check) with incidence of 32.29% was rated as susceptible (S). None of the test line was found to be moderately susceptible (MS) or highly susceptible (HS) to ULCV (Table 1, 2).

The overall situation of the urdbean germplasm evaluation against natural infection of ULCV revealed that out of 72 genotypes, 23 genotypes were free from the disease (highly resistant), 46 genotypes exhibited resistant reaction, two genotypes exhibited moderately resistant reaction and only one genotype (LBG 623)

Table 2 : Categorization of urdbean genotypes screened against ULCV during *Kharif* 2014

Per cent infected plants	Reaction	Disease grade	Genotypes
0	Highly resistant	0	KPU-31, KPU-29, KPU-9, KPU-33, KPU-21, KPU-17, KPU-7, KPU-22, KPU-2, KPU-34, KPU 12-133, KPU 525-64, KPU 175-2, KPU 129-104, KPU 12-219, OBG-32, DKU-84, DKU-87, DKU-90, DKU-92, DKU-116, DKU-118, PU 12-7
1-10	Resistant	1	KPU-1, KPU-16, KPU-26, KPU-15, KPU-6, KPU-19, KPU-14, KPU-4, KPU-13, KPU-8, KPU-25, KPU-20, KPU-30, KPU-12, KPU-3, KPU-24, KPU-10, KPU-28, KPU-18, KPU-27, KPU-5, KPU-23, KPU-32, KPU-11, KPU 12-1731, KPU 12-213, KPU 11-43, KPU 11-40, PU 12-5, AKU-9904, PU 12-6, LBG 752, KU 13-60, DKU-95, DKU-98, DKU-102, DKU-103, Hm-1, UG-218, PU 12-9, PU 12-4, PU 12-2, PU 12-11, PLP-93, Co 5, Co(BG) 653
10-20	Moderately resistant	2	DKU-6, DKU-99
20-30	Moderately susceptible	3	---
30-40	Susceptible	4	LBG 623
>40	Highly susceptible	5	---

exhibited susceptible reaction.

Subbarao (1984) screened 119 blackgram genotypes against ULCV and found that 61 entries were free from disease and 35 were resistant. Out of 150 genotypes screened, 73 genotypes were categorized as resistant and 66 genotypes were found to be disease free and only one genotype LBG-17 (check) showed susceptible reaction to ULCV (Suneela, 1996). Ratnam (2015) evaluated urdbean germplasm consisting of 85 genotypes of which 37 entries were disease free, 28 were highly resistant, 14 were resistant, 4 were moderately resistant and 3 were susceptible and none was found to be highly susceptible to ULCV. Genotype evaluation was documented by several workers earlier (Nene, 1972; Sharma and Dubey, 1984; Iqbal *et al.*, 1991; Vijaykumar, 1993; Murthy, 1996; Prasad *et al.*, 1998; Patel *et al.*, 2001; Bashir and Zubair, 2002; Nageswararao, 2002; Bashir *et al.*, 2005; Ashfaq *et al.*, 2007; Chaudhry *et al.*, 2007 and Binyamin *et al.*, 2011). Earlier studies indicated that identification of resistant sources to ULCV is a reliable option for controlling this viral disease. However, no information is available on the mechanism of disease resistance in these germplasms. It was observed that metabolism of the plant determines the resistance against various diseases (Dawson and Hilf, 1992). One main problem in germplasm evaluation is that some genotypes found to be resistant at one location turned out to be susceptible at another place (Iqbal *et al.*, 1991; Bashir *et al.*, 2005), and therefore, environmental genotype interaction and genetic diversity should also be studied for durable resistance. Since ULCV is seed-borne in nature, the initial source of infection under field conditions could come from seed. It is therefore, essential to evaluate the present germplasms for resistance to seed transmission also.

The present study is helpful to suggest the ULCV resistant genotypes for farmers and understanding about the resistance level of different genotypes will also be helpful for development of highly ULCV resistant varieties through future crop improvement programme. However, critical investigations are necessary to ascertain the resistance level in these germplasm lines and to further confirm them to finally include in breeding programmes.

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