

Screening of Urdbean Germplasm for Resistance Against *Rhizoctonia solani* Kühn Causing Web Blight Disease

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Abstract

Present study on screening of urdbean germplasm for resistance against *Rhizoctonia solani* Kühn causing web blight disease revealed that in detached leaf technique, 42 genotypes of Urdbean were evaluated for web blight resistance. Out of these fourteen genotypes i.e. IPU-2-43, KPU-1-10, KU-1106, CoBG-10-5, LBG 752, VBG-10-024, NUL-7, ACM 05-007, Uttara-3, UH-08-05, UH-07-06, CoBG-761, NDU-11-202 and KUG-580 were found moderately resistant to web blight. During field screening in 2011 and 2012, lines LBG-752, VBG-10-024, NUL-7, ACM-05-007, Uttara-3, UH-08-05, UH-07-06, CoBG-761, NDU-11-202, KUG-586, IPU-2-43, KPU-1-10, KU-1106 and CoBG-10-5 showed moderately resistant reaction to web blight disease and rest of the lines shows susceptible reaction.

Highlights

- Screening of Urdbean germplasm for resistance against *Rhizoctonia solani* Kühn causing web blight disease
- Methods of screening used were detached leaf technique (*in vitro*) and field screening (*in vivo*)

Keywords: Germplasm, *Rhizoctonia solani*, Urdbean, Web blight, Detached leaf technique

Pulses represent one of the most important foods that have been extensively used to cover basic protein and energy needs in day today life. Pulses have unique property of maintaining and restoring soil fertility through biological nitrogen fixation as well as covering and improving physical properties of soil by virtue of their deep root system. Urdbean or Blackgram (*Vigna mungo* L.) Hepper is the most important pulse crop of the 'vigna' group. It is considered to have been domesticated in India from its wild ancestral form (*V. mungo* var. *Silvestris* Lukoki, Marechal & Otoul). Center of genetic diversity is found in India (Zeven and de Wet. 1982). It is an important crop of

India and extensively grown over a wide range of agro-climatic zones of the country.

In India, urdbean occupies 3.26 m ha area, production 1.74 mt and productivity 534 kg/ha (Anonymous, 2012-13). Highest productivity of urdbean is reported from West Bengal followed by Andhra Pradesh and Uttar Pradesh. Urdbean is prone to several fungal diseases, among which web blight caused by *Rhizoctonia solani* Kühn (Teleomorph: *Thanatephorus cucumeris* (Frank) Donk is one of the most important fungal disease of urdbean causing heavy yield losses particularly in Uttar Pradesh and Uttarakhand states. Disease is also reported from other states viz., Punjab,



Haryana, Bihar, Rajasthan, West Bengal, Himachal Pradesh and Jammu & Kashmir (Saksena and Dwivedi, 1973). Previously web blight was considered as minor disease. Due to change in cropping system and introduction of yellow mosaic resistant varieties it is becoming an important fungal disease and constraint in production of this crop.

Resistance is fundamental attributes of all living systems. Host plant resistance (HPR) is the most efficient and eco-friendly means of management. For exploitation of HPR, reliable field and controlled environment screening techniques are essential. Therefore, the present investigation was undertaken with an objective to identify the sources of resistance in different genotypes of urdbean against web blight.

Materials and Methods

Web blight infected urdbean plants were collected from Norman E. Borlaug Crop Research Centre (CRC), GBPUA & T, Pantnagar, Uttarakhand and the isolation was made from infected leaf showing characteristic symptoms of disease. The purified culture of *Rhizoctonia solani* was maintained on PDA slants for screening the germplasm line. In *in-vitro* screening, 42 urdbean genotypes were evaluated against web blight by using the detached-leaf technique (Takegami *et al.*, 2004).

Detached-leaf technique

This technique is used to confirm field resistance, screening against different pathotypes /races and to carryout inheritance and race identification studies. In this technique, a pure culture of *Rhizoctonia solani* was maintained on potato dextrose agar (PDA) medium which was used as inoculum for screening. Fully expanded trifoliolate leaves were detached from the plants and immediately placed in orchid tubes filled with water. The leaflets were positioned in 42 x 30 x 6 cm trays. Because the base of the trays contained moistened paper towels, the leaflets were placed on top of Petri plates to avoid immersion in water. One of the leaflets in each tray should be from a line susceptible to web blight to serve as a check. One 4 mm diameter disk of agar colonized with *R. solani* was placed on the axial side and centered on each leaflet. A disk not colonized with the fungus should be placed on one of the leaflets to serve as a control. The control and infected treatments should be applied at random. In addition; each tray should contain a leaflet of a susceptible bean line as a means to confirm that conditions were favourable for the development of

infection. Trays were placed inside plastic bags after inoculation to create a high humidity environment favourable for the development of the fungus. The trays were incubated in a laboratory at 27±1° C. Mean lesion size was measured at 24, 48 and 72 h after inoculation.

Field Screening

Each test entry was sown in RBD with two replications having 5m row length at 25 cm rows spacing. After every test entry, one row of highly susceptible variety “PU-19” was sown. Observation on disease severity was recorded starting from 30 days old plant and subsequent observations were recorded at 15 days interval using 1–9 rating scale (Stonehouse,1994). The rating scale for varieties screening was followed on the basis of disease severity and five categories were given for varieties reaction:

Disease severity(%)	Varietal Reaction
1%	Highly Resistant
1 – 25%	Moderately resistant
25.1 - 50%	Moderately susceptible
50.1 – 75%	Susceptible
75 – 100%	Highly susceptible

Results and Discussion

Detached-leaf technique

Result presented in Table 1 revealed that out of 42 screened genotypes, none of the genotype was found to be highly resistant. However, fourteen genotypes (IPU-2-43, KPU-1-10, KU-1106, CoBG-10-5, LBG 752, VBG-10-024, NUL-7, ACM 05-007, Uttara-3, UH-08-05, UH-07-06, CoBG-761, NDU-11-202 and KUG-580) were found moderately resistant to web blight. Twelve genotypes namely, KPU-26-10, Co-5, VBG-09-005, PU-09-35, TU-94-2, IPU-10-23, NDU-11-201, TU-631, RVSU-11-8, DBG-1, TPU-4 and VBN-7 were classified as moderately susceptible (MS). Nine genotypes (Kopergaon, Co-5, LBG-623, K 851, Co-6, KUG-503, RVSU-60, IGKU-02-1 and AKU-10-4) were found susceptible (S) and remaining seven genotypes *viz.*, KKB-05-011, NDU-12-300, AKU-10-1, Phule-U-0014, Pant U 30, KUG 310 and UG 218 were categorized as highly susceptible to web blight of urdbean. Similar technique has been used to screen bean lines for physiological resistance to web blight (Gonzalez *et al.*, 2008, Bautista-Perez and Echavez-Badel, 2000; Galindo *et al.*, 1982).



Table 1: Controlled Environment Screening (CES technique) of Urdbean germplasm lines against web blight .

S. No.	Genotype	% Disease severity*	Reaction®
1.	KKB-05-011	76.67 (61.12)	HS
2.	KPU-26-10	41.67 (40.18)	MS
3.	CO-5	30.33 (33.41)	MS
4.	NDU-12-300	76.33 (60.90)	HS
5.	VBG-09-005	30.00 (33.20)	MS
6.	AKU-10-1	79.67 (63.21)	HS
7.	CO-6	68.33 (55.78)	S
8.	PU-09-35	34.33 (35.86)	MS
9.	LBG-752	22.00 (27.96)	MR
10.	TU-94-2	47.33 (43.47)	MS
11.	VBG-10-024	27.33 (31.51)	MS
12.	IPU-10-23	43.67 (41.34)	MS
13.	KUG-503	62.33 (52.15)	S
14.	NDU-11-201	31.00 (33.81)	MS
15.	TU-631	37.67 (37.86)	MS
16.	NUL-7	13.33 (21.36)	MR
17.	RVSU-60	69.67 (56.59)	S
18.	ACM 05-007	14.00 (21.92)	MR
19.	IGKU-02-1	68.67 (55.96)	S
20.	AKU-10-4	63.33 (52.76)	S
21.	Uttara	17.67 (24.83)	MR
22.	UH-08-05	14.67 (22.47)	MR
23.	UH-07-06	9.33 (17.75)	MR
24.	Phule U- 0014	76.67 (61.17)	HS
25.	CoBG-761	14.00 (21.92)	MR
26.	NDU-11-202	8.67 (16.91)	MR
27.	RVSU-11-8	34.67 (36.06)	MS
28.	KUG-586	10.33 (18.72)	MR
29.	IPU-2-43	9.33 (17.69)	MR
30.	KPU-1-10	9.00 (17.39)	MR
31.	DBG-1	32.67 (34.84)	MS
32.	TPU-4	33.33 (35.24)	MS
33.	KU-1106	9.33 (17.72)	MR
34.	CoBG-10-5	9.67 (18.05)	MR
35.	Kopergaon	64.33 (53.35)	S
36.	Pant U 30	79.00 (62.78)	HS
37.	Co-5	66.67 (54.81)	S
38.	LBG 623	72.00 (58.07)	S
39.	K851	73.00 (58.71)	S
40.	KUG 310	82.33 (65.22)	HS
41.	UG 218	41.67 (40.20)	MS
42.	VBN 7	82.67 (65.51)	HS
	Sem±	1.86	
	Cd at 5%	5.22	
	Cv	7.55	

*Mean of three replications

**Figures in parenthesis are angular transformed values.

® Reactions are categorized as MR- Moderately resistant, MS – Moderately susceptible, S – Susceptible, HS - Highly susceptible

Field Screening

Under field conditions, available lines of urdbean were screened during Kharif season in 2011 and 2012. During 2011, lines namely, LBG-752, VBG-10-024, NUL-7, ACM-05-007, Uttara-3, UH-08-05, UH-07-06, COBG-761, NDU-11-202, KUG-586, IPU-2-43, KPU-1-10, KU-1106 and COBG-10-5 showed moderately resistant reaction, whereas NDU-11-201, TU-631, DBG-1, TPU-4, KPU-26-10, RVSU-11-8, IPU-10-23, TU-94-2, PU-09-35, VBG-09-005, CO-5 and VBN 7 showed moderately susceptible reaction; while Co-6, KUG-503, RVSU-60, IGKU-02-1, AKU-10-4, Kopergaon, LBG-623 and K 851 were showed susceptible reaction. The rest lines were found highly susceptible to web blight (Table 2). While during 2012, lines namely, LBG-752, VBG-10-024, ACM-05-007, Uttara-3, UH-08-05, UH-07-06, COBG-761, NDU-11-202, KUG-586, IPU-2-43, KPU-1-10, KU-1106, DBG-1, CO-5, KPU-26-10 and COBG-10-5 showed moderately resistant reaction, whereas NDU-11-201, TU-631, DBG-1, TPU-4, RVSU-11-8, IPU-10-23, TU-94-2, PU-09-35, VBG-09-005, NUL-7, AKU-10-4 and VBN 7 showed moderately susceptible reaction; while Co-6, KUG-503, RVSU-60, IGKU-02-1, Kopergaon, Co-5, NDU -12-300 and K-851 showed susceptible reaction. The rest lines were highly susceptible.

Past several researchers have screened the urdbean germplasm and reported the differences in the reactions against web blight. Varietal screening has also been reported in cowpea (Oyekan *et al* 1976) and other beans (Schroth and Cook, 1964). Two genotypes of urdbean, namely, HPBU51 and P38 were resistant against web blight while HPBU 38, HPBU153, LBG628 and UG367 were found resistant to mungbean yellow mosaic virus and web blight disease (Shailbala and Tripathi, H.S. 2007).

**Table 2:** Field screening of Urdbean germplasm lines against web blight during 2011 and 2012 crop seasons

S. No.	Genotype	2011		2012	
		% Disease severity*	Reaction	% Disease severity*	Reaction®
1.	KKB-05-011	79.00 (62.79)	HS	91.33 (73.25)	HS
2.	KPU-26-10	37.00 (37.45)	MS	20.33 (26.78)	MR
3.	CO-5	34.33 (35.83)	MS	21.00 (27.26)	MR
4.	NDU-12-300	80.00 (63.55)	HS	69.33 (56.40)	S
5.	VBG-09-005	33.67 (35.45)	MS	43.33 (41.16)	MS
6.	AKU-10-1	86.00 (68.16)	HS	92.33 (74.07)	HS
7.	CO-6	63.00 (52.59)	S	64.00 (53.15)	S
8.	PU-09-35	36.67 (37.25)	MS	47.00 (43.28)	MS
9.	LBG-752	15.67 (23.21)	MR	20.33 (26.79)	MR
10.	TU-94-2	40.33 (39.42)	MS	37.67 (37.85)	MS
11.	VBG-10-024	16.67 (24.07)	MR	14.33 (22.04)	MR
12.	IPU-10-23	34.67 (36.04)	MS	31.33 (34.00)	MS
13.	KUG-503	65.33 (53.94)	S	63.00 (52.56)	S
14.	NDU-11-201	34.67 (36.05)	MS	43.33 (41.16)	MS
15.	TU-631	36.00 (36.85)	MS	38.33 (38.24)	MS
16.	NUL-7	10.33 (18.72)	MR	36.00 (36.85)	MS
17.	RVSU-60	63.33 (52.76)	S	68.00 (55.56)	S
18.	ACM 05-007	10.33 (18.31)	MR	14.67 (22.42)	MR
19.	IGKU-02-1	55.67 (48.27)	S	72.00 (58.06)	S
20.	AKU-10-4	56.33 (48.66)	S	43.33 (41.16)	S
21.	Uttara	12.00 (20.14)	MR	18.00 (25.08)	MR
22.	UH-08-05	10.33 (18.67)	MR	6.33 (14.51)	MR
23.	UH-07-06	6.00 (14.09)	MR	7.33 (15.66)	MR
24.	Phule U- 0014	80.00 (63.45)	HS	78.33 (62.27)	HS
25.	CoBG-761	7.67 (15.93)	MR	18.00 (25.08)	MR
26.	NDU-11-202	9.33 (17.75)	MR	8.33 (16.47)	MR
27.	RVSU-11-8	28.00 (31.94)	MS	34.67 (36.05)	MS
28.	KUG-586	15.00 (22.72)	MR	10.33 (18.67)	MR
29.	IPU-2-43	9.00 (17.17)	MR	14.33 (22.12)	MR
30.	KPU-1-10	6.00 (14.09)	MR	10.33 (18.67)	MR
31.	DBG-1	30.67 (33.60)	MS	22.67 (28.41)	MR
32.	TPU-4	31.33 (33.97)	MS	29.67 (32.96)	MS
33.	KU-1106	5.00 (12.88)	MR	8.67 (16.91)	MR
34.	CoBG-10-5	7.67 (15.99)	MR	10.00 (18.38)	MR
35.	Kopergaon	61.67 (51.76)	S	67.67 (55.38)	S
36.	Pant U 30	78.33 (62.27)	HS	89.67 (72.52)	HS
37.	Co-5	68.33 (55.80)	S	65.00 (53.76)	S
38.	LBG 623	64.67 (53.60)	S	86.33 (68.41)	HS
39.	K851	64.33 (53.46)	S	68.00 (55.59)	S
40.	KUG 310	80.33 (63.70)	HS	86.33 (68.41)	HS
41.	UG 218	35.67 (36.63)	MS	45.67 (42.51)	MS
42.	VBN 7	79.33 (63.08)	HS	88.67 (70.44)	HS
	Sem±	2.38	1.93		
	Cd at 5%	6.70	5.43		
	Cv	10.32	7.77		

*Mean of three replications

**Figures in parenthesis are angular transformed values.

® Reactions are categorized as MR- Moderately resistant, MS – Moderately susceptible, S – Susceptible, HS - Highly susceptible



Conclusion

From the above studies it can be concluded that in detached leaf technique, out of 42 genotypes of Urdbean, fourteen genotypes i.e. IPU-2-43, KPU-1-10, KU-1106, CoBG-10-5, LBG 752, VBG-10-024, NUL-7, ACM 05-007, Uttara-3, UH-08-05, UH-07-06, CoBG-761, NDU-11-202 and KUG-580 were found moderately resistant to web blight. During field screening, lines LBG-752, VBG-10-024, NUL-7, ACM-05-007, Uttara-3, UH-08-05, UH-07-06, CoBG-761, NDU-11-202, KUG-586, IPU-2-43, KPU-1-10, KU-1106 and CoBG-10-5 showed moderately resistant reaction to web blight disease and rest of the lines shows susceptible reaction. The resistant genotypes identified in this study could potentially be used for urdbean breeding programme for developing the resistant cultivars against web blight disease.

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