

Screening *urdbean* Genotypes under Field Conditions against Powdery Mildew Disease

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Abstract: In Kharif, forty seven genotypes including check screened against powdery mildew diseases under field conditions with LBG 623 as susceptible check showed varied per cent severity. Out of 47 genotypes, KUP-1 was immune, two genotypes KUP-30 and KUP-40 were highly resistant, and ten were moderately resistant respectively to powdery mildew, whereas, the rest of the genotypes were moderately susceptible to highly susceptible. In rabi, out of eleven genotypes, RUP-6 and RUP-9 were highly resistant against to powdery mildew disease, RUP-7 moderately resistant, RUP-4 moderately susceptible, other seven genotypes were highly susceptible, respectively.

Keywords: Blackgram, *Erysiphe polygoni*, LBG 623 (check), disease severity

1. Introduction

Blackgram [*Vignamungo* (L.) Hepper] is an important pulse containing 24% protein in its seed and is the richest source of phosphoric acid among pulses, combination with cereal it fulfils the requirement of protein in diets (Duffus and Slaughter, 1980). It is mainly used as dal and in preparation of some special dishes like the sprouted *urdbean* which is very popular in Japan and is highly valued for digestibility and freedom from the flatulence effect. Since it serves as a cheaper source of protein (24%) for the poor, it is rightly called the poor man's meat and can also be used as green manure. Blackgram crop is mini-fertiliser factory as it restores soil fertility by fixing atmospheric nitrogen and thus producing nitrogen equivalent of around 22 kg per hectare (Rachie and Roberts, 1974). Blackgram cultivation is distributed mainly in tropical to sub-tropical countries. The traditional cultivation of blackgram is confined to the South-Asia and adjacent regions. The production of blackgram globally is around 8.5 million tonnes, from the major producing countries such as India, Myanmar and Thailand. In India it is a third important pulse crop cultivated in an area of 2.29 M ha with 1.96 M t production and 500 kg ha⁻¹ productivity (Department of Agriculture and Cooperation, Government of India, 2014). In India, major *urdbean* growing areas are Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu and Uttar Pradesh and Andhra Pradesh (A.P). In *Kharif*, it is grown in 0.25 Lakh ha, producing 0.17 Lakh t with a productivity of 676 kg ha⁻¹. In *Rabi*, it occupies 4.29 Lakh ha, producing 3.39 Lakh t with a productivity of 790 kg ha⁻¹ (Department of Agriculture and Co-operation, Government of A.P. 2014). 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 (Nene, 1972). Powdery mildew reported as a serious problem in all areas of rice based cropping systems of the country (Abbaiah, 1993) causing considerable yield loss every year due to reduction in photosynthetic activity and physiological changes (Legapsi *et al.*, 1978). Although the disease was reported to cause considerable loss, information on its

prevalence particularly after the advent of blackgram genotypes.

2. Material and methods

The present investigation was carried out during *kharif* and *rabi* 2015-16. Laboratory and field studies were conducted at the Regional Agricultural Research Station, Lam, Guntur District, Agricultural College Farm and Department of Plant Pathology, Agricultural College, Bapatla, Guntur District. Geographically the Agricultural College Farm, Bapatla is situated at an altitude of 5 m above the mean sea level and at 80° 30' E Longitude and 15° 54' N Latitude and seven km away from the coast of Bay of Bengal. The meteorological data recorded during the experimental period September 2015– March 2016.

Per cent disease incidence for powdery mildew disease was calculated by using the following formula:

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

Powdery mildew severity was assessed by disease rating (AICRP, MULLaRP, 2013) (Table 1). The experiment was laid out in randomised block design (RBD) with two replications to evaluate 47 entries each during *kharif* and 11 entries *rabi* 2015-16. Each genotype was sown in two rows of five m length with a susceptible check variety of LBG 623 (standard check) sown as infector row. The reaction of the entries to powdery mildew was assessed by recording the severity at weekly interval from 35 DAS to one week prior to harvesting, using disease rating scale developed by (AICRP, MULLaRP, 2013) (AUPDC values for representative genotypes per each category will be calculated by (Kimani *et al.*, 2015)

$$\text{AUDPC} = \sum_{i=1}^k \frac{1}{2} (S_i + S_{i-1}) \times d$$

Where,

S_i = Disease incidence at i^{th} day or evaluation

k = Number of successive evaluation of the disease

d = Interval between i and $i-1$ evaluation of disease

Table 1: Modified MULLaRP scale (0-5)

Grade	Description	Reaction
0	Plants free from infection on leaves, stems free from the disease	Free (F)
1	Plants showing traces to 10% infection on leaves, stems free from the disease	Highly Resistant (HR)
2	Slight infection with thin coating of powdery growth on leaves covering 10.1-25% leaf area, slight infection on stem and the pods usually free	Moderately Resistant (MR)
3	Dense powdery coating on leaves covering 25.1-50 % leaf area, moderate infection on pods	Moderately Susceptible (MS)
4	Dense powdery coating covering 50.1 - 75% leaf area, stems heavily and pods moderately infected. Infected portion turns grayish.	Susceptible (S)
5	Severe infection with dense powdery growth covering 75% area of the whole plant including pods, stems etc. resulting in premature defoliation and drying.	Highly Susceptible (S)

The per cent disease index (PDI) was computed from the above scale by using the following formula (Wheeler, 1969).

$$PDI = \frac{\text{Sum of all the numerical ratings}}{\text{Number of observations} \times \text{maximum disease grade}} \times 100$$

Table 2: Screening under field conditions in Kharif, 2015

S. No	Genotype	Percent disease index	Reaction
T ₁	KUP-1	0.00	F
T ₂	KUP-14	23.44	MR
T ₃	KUP-21	33.55	MS
T ₄	KUP-32	36.88	MS
T ₅	KUP-15	37.40	MS
T ₆	KUP-22	49.20	MS
T ₇	KUP-5	41.18	MS
T ₈	KUP-33	41.80	MS
T ₉	KUP-40	9.03	HR
T ₁₀	KUP-23	14.44	MR
T ₁₁	KUP-6	21.59	MR
T ₁₂	KUP-12	23.34	MR
T ₁₃	KUP-31	23.06	MR
T ₁₄	KUP-7	43.56	MS
T ₁₅	KUP-10	70.23	HS
T ₁₆	KUP-13	44.03	MS
T ₁₇	KUP-28	53.13	S
T ₁₈	KUP-4	36.99	MS
T ₁₉	KUP-37	53.81	S
T ₂₀	KUP-19	40.91	MS
T ₂₁	KUP-20	46.39	MS
T ₂₂	KUP-29	48.15	MS
T ₂₃	KUP-38	47.78	MS
T ₂₄	KUP-26	70.36	HS
T ₂₅	KUP-45	35.31	MS
T ₂₆	KUP-18	40.85	MS
T ₂₇	KUP-3	21.10	MR
T ₂₈	KUP-36	24.93	MR
T ₂₉	KUP-30	39.42	MS
T ₃₀	KUP-44	52.46	S
T ₃₁	KUP-17	61.90	S
T ₃₂	KUP-8	63.97	S
T ₃₃	KUP-43	17.84	MR
T ₃₄	KUP-27	43.08	MS
T ₃₅	KUP-42	71.55	HS
T ₃₆	KUP-25	50.75	S
T ₃₇	KUP-41	68.12	S
T ₃₈	KUP-2	68.26	S

T ₃₉	KUP-39	58.00	S
T ₄₀	KUP-16	32.70	MS
T ₄₁	KUP-35	49.49	MS
T ₄₂	KUP-11	23.63	MR
T ₄₃	KUP-46	26.90	MS
T ₄₄	KUP-34	9.73	HR
T ₄₅	KUP-24	24.44	MR
T ₄₆	KUP-9	60.36	S
T ₄₇	LBG 623	85.05	HS

3. Result and Discussion

Among various strategies to manage the diseases, cultivation of resistant varieties is an eco-friendly, practically feasible and economically viable method. In recent past many resistant varieties have been developed against the powdery mildew by various workers.

Forty seven blackgram genotypes including check LBG-623 were screened against powdery mildew disease under field conditions during *kharif*, 2015 and eleven genotypes including check LBG-623 during *rabi*, 2015-16. The results indicated that powdery mildew disease severity varied among the genotypes. Among the 46 genotypes evaluated with LBG- 623 as check during *kharif*, 2015. One genotype KUP-1 free from disease (0%), two genotypes KUP-40 (9.03%) and KUP-34 (9.73%) were highly resistant (HR), ten genotypes viz., KUP-23 (14.44%), KUP-43 (17.84%), KUP-3 (21.10%), KUP-6 (21.59%), KUP-31 (23.06%), KUP-12 (23.34%), KUP-14 (23.44%), KUP-11 (23.63%), KUP-24 (24.44%) and KUP-36 (24.93%) were moderately resistant (MR). (Table. 2,3)

Table 3: Grouping of genotypes screened against powdery mildew disease in urdbean during kharif, 2015 (AICRP, MULLaRP, 2013)

Per cent of leaf area infested	Reaction	Genotypes
0%	Free (F)	KUP-1
1-10%	Highly Resistant (HR)	KUP-34, KUP-40
10.1 to 25%	Moderately Resistant (MR)	KUP-11, KUP-43, KUP-3, KUP-36, KUP-31, KUP -23, KUP-14, KUP-6, KUP-12, KUP-24
26.1 to 50%	Moderately Susceptible (MS)	KUP-16, KUP-35, KUP-19, KUP-20, KUP-29, KUP-38, KUP-45, KUP-18, KUP-21, KUP-32, KUP-22, KUP-5, KUP-33, KUP 7, KUP-13 KUP-46, KUP-27, KUP-30, KUP-15, KUP-4
50.1-70 %	Susceptible (S)	KUP-9, KUP-41, KUP-2, KUP-25, KUP-44, KUP-17, KUP-8, KUP-28, KUP-37, KUP-39
70.1-100%	Highly Susceptible	KUP-10, KUP-42, LBG-623, KUP-26

Table 3. Powdery mildew disease severity in blackgram genotypes at RARS, Lam during *kharif*, 2015

Twenty genotypes viz., KUP-46 (26.90), KUP-16 (32.705), KUP-21 (33.55%), KUP-32 (36.88%), KUP-15 (37.40%), KUP-22 (49.20%), KUP-5 (41.18%), KUP-33 (41.80%), KUP-7 (43.56%), KUP-13 (44.03%), KUP-4 (36.99%), KUP-19 (40.91%), KUP-20 (46.39%), KUP-29 (48.15%), KUP-38 (47.78%), KUP-45 (35.31%), KUP-18 (40.85%),

KUP-30 (39.42%), KUP-27 (43.08%), KUP-35 (49.49%) were moderately susceptible (MS), ten genotypes viz., KUP-9 (60.36%), KUP-41(68.12%), KUP-2 (68.26%), KUP-25 (50.75%), KUP-44 (52.46%), KUP-17 (61.90%), KUP-8 (63.97%), KUP-28 (53.13%), KUP-37 (53.81%), KUP-39 (58.00%) and four genotypes viz., KUP-10 (70.23%), KUP-26 (70.36%), KUP-42 (71.55%) and LBG-623 (85.05%) were highly susceptible. (Table 4, 5).

Table 4: Powdery mildew severity in blackgram genotypes in RARS, Lam during rabi, 2015-16

S. No	Genotype	Percent disease index	Reaction
1	RUP-6	9.77	HR
2	RUP-9	8.94	HR
3	RUP-7	12.78	MR
4	RUP-4	45.28	MS
5	RUP-1	60.40	S
6	RUP-2	64.98	S
7	RUP-5	71.95	HS

8	RUP-3	75.79	HS
9	RUP-8	78.89	HS
10	RUP-10	82.01	HS
11	LBG-623	96.52	HS

Table 5: Grouping of genotypes screened against powdery mildew disease in urdbean during rabi, 2015 (AICRP, MULLaRP, 2013)

Per cent of leaf area infested	Reaction	Genotypes
0%	Free (F)	Nil
1-10%	Highly Resistant (HR)	RUP-6, RUP-9
10.1 to 25%	Moderately Resistant (MR)	RUP-7
26.1 to 50%	Moderately Susceptible (MS)	RUP-4
50.1-70 %	Susceptible (S)	RUP-1,RUP2
70.1-100%	Highly Susceptible (HS)	RUP-5, RUP-3, RUP-8, RUP-10, LBG-623

Table 6: Area under disease progress curve (AUPDC) for selected urdbean genotypes during kharif, 2015

Genotypes	35 DAS	42 DAS	49 DAS	56 DAS	62 DAS	68 DAS	75 DAS	82 DAS	90 DAS	AUPDC
KUP-40	0.00	0.00	0.00	0.00	5.56	5.70	6.02	6.34	9.03	114.275
KUP-14	0.00	0.50	12.05	16.55	18.02	20.02	21.00	22.01	23.44	467.565
KUP-30	1.09	4.00	14.56	18.01	24.00	28.04	32.00	35.23	39.42	683.410
KUP-17	0.90	18.00	24.00	30.00	33.00	34.23	43.20	46.00	61.90	1016.155
LBG-623	10.99	22.12	30.12	38.14	50.12	62.00	78.00	79.12	85.05	1556.345

Table 7: Area Under Disease Progress Curve (AUPDC) for selected urdbean genotypes during rabi, 2015-16

Genotypes	35 DAS	42 DAS	49 DAS	56 DAS	62 DAS	68 DAS	75 DAS	82 DAS	90 DAS	AUPDC
RUP-9	0.00	0.00	0.00	0.00	4.56	7.42	8.42	8.49	8.94	132.405
RUP-7	0.00	0.00	0.45	2.33	4.33	8.15	9.78	10.23	12.78	168.175
RUP-4	0.00	0.78	2.45	10.00	15.90	16.07	22.78	36.89	45.28	525.525
RUP-1	7.89	10.22	13.56	14.78	22.45	35.42	41.47	52.19	60.40	876.715
LBG-623	11.56	12.56	21.78	24.78	29.85	40.12	65.12	71.56	96.52	1268.015

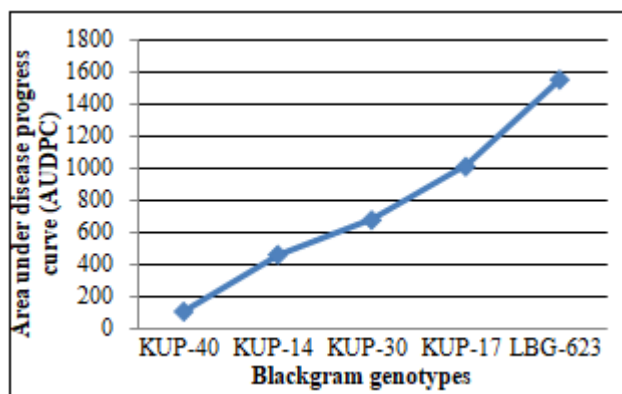


Figure 1: Area under disease progress curve of urdbean selected genotypes during kharif, 2015

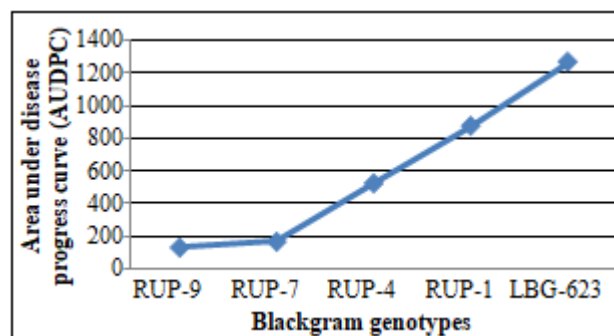


Figure 2: Area under disease progress curve of urdbean selected genotypes during rabi, 2015

Powdery mildew severity during rabi varied from 8.94 % (RUP-9) to 96.52% (LBG-623). Out of 11 genotypes, none was immune to powdery mildew, two genotypes RUP-9 (8.94 %) and RUP-6 (9.77%) were highly resistant, one RUP-7 (12.78%) was moderately resistant, RUP-4 (45.28%) was moderately susceptible, RUP-1 (60.40%) and RUP-2 (64.98%) were rated as susceptible. The genotypes viz., RUP-5 (71.95%), RUP-3 (75.79%), RUP-8 (78.89%), RUP-10 (82.01%) and LBG-623 (96.52%) were highly susceptible (Table 5).



Plate 1 A, B View of field experiment on screening of powdery mildew disease in urdbean during kharif and rabi, 2015

Agarwal *et al.* (1989) have reported that out of 85 *Vigna mungo* varieties, LBG17 was found resistant. Kaushal and Singh (1989) reported that out of 48 blackgram genotypes only P115 was found to be resistant. Raguchander *et al.* (2001) reported PDU and IC12/2 exhibited partial resistance and had lowest per cent mildew severity. Prashanthi *et al.* (2010) evaluated fifteen blackgram genotypes during kharif 2007 and found LBG-623 and LBG-648 as resistant sources against powdery mildew disease. Akhtar *et al.* (2014) screened during kharif 2008 and 2009 out of 14 genotypes of blackgram, only three genotypes viz., BS 2-3, IPU 02-43 and B 3-8-8 showed resistant or highly resistant response against powdery mildew. Tirupathiswamy *et al.* (2014) reported that out of three blackgram cultivars, LBG 17 resistant against powdery mildew. Channaveeresh *et al.* (2014) revealed that, out of 126 genotypes screened, three genotypes viz., LBG-17, LBG-685 and LBG-685×VT (F2-F3) were found to be resistant to powdery mildew. Ramakrishnan and Savithamma (2014) during kharif 2010 screened 374 entries of greengram, were six genotypes found to be highly resistant.

During kharif 2015, KUP-40 showed lowest Area Under Disease Progress Curve value (114.275), KUP-14 showed 467.565, KUP-30 showed 683.41, KUP-17 showed 1016.155 and LBG-623 showed highest 1556.345 AUPDC value. (Table.6 and Fig 1). During rabi 2015-16, RUP-9 showed lowest AUPDC value (132.45), RUP-7 showed 168.175, RUP-4 showed 525.525, RUP-1 showed 876.715 and LBG-623 showed highest AUPDC value (1268.015). (Table.7 and Fig 2, Plate 1).

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