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Host plant resistance in urdbean genotypes (*Vigna mungo*) against *Colletotrichum lindemuthianum* (Sacc. and Magn.)

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Abstract
Urdbean (*Vigna mungo* L. Hepper), which is also known as black gram, udad, urd and udid in India. It is one of the commercially important legume crop, domesticated from *V. mungo var. silvestris*, belongs to the sub-genus *Ceratotropis*. It is extensively cultivated in the Indian sub-continent in all the three seasons such as in *Kharif, Rabi*, and Summer throughout the country and to a lesser extent in Thailand, Australia along with other Asian and South-Pacific countries. The food value of urdbean lies in its high and easily digestible protein. Being one of the important legume crop of India. It is edible in the form of 'dal' (split, whole, husked and un-husked) or perched. Apart from this, urdbean is very nutritive and useful for milch cattle in the form of green fodder. *Colletotrichum lindemuthianum* (Sacc. and Magn.) in urdbean cause considerable yield damage to the crop upto 80-100 percent under suitable weather conditions. The screening of twenty urdbean genotypes against anthracnose disease showed, none of the them were found to be highly resistant to *C. lindemuthianum*. Two cultivars (PU 1617 and PU 1514) were found moderately resistant. Three cultivars (VBG 12-034, KPU 520-69 and KU 96-3 were found moderately susceptible. Thirteen cultivars (Azad -3, PU 31, LBG 752, PU 14-19, TBG 12, NGU 24, IPU 72, KU 17-08, TPU 4, Uttara, TU 94-2 and T-9 were found to be susceptible, while two cultivars (AKU 1608 and SBC 50) were found to be highly susceptible.

Keywords: Urdbean, screening, *Colletotrichum lindemuthianum*

Introduction
Urdbean (*Vigna mungo* L. Hepper), which is also known as black gram, udad, urd and udid in India. Blackgram is native to India (De Candolle, 1986) [4]. It is one of the commercially important legume crop, domesticated from *V. mungo var. silvestris*, belongs to the sub-genus *Ceratotropis*, (Lukoki *et al.* 1980) [7]. It is extensively cultivated in the Indian sub-continent in all the three seasons such as in *Kharif, Rabi*, and Summer throughout the country and to a lesser extent in Thailand, Australia along with other Asian and South-Pacific countries. Ninety-five percent of black gram production comes from 11 states of India *viz*; Madhya Pradesh, Andhra Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh, Maharashtra, Jharkhand, Gujarat, Karnataka and West Bengal. India being the largest producer as well as consumer of urdbean, produces about 1.96 million tonnes of urdbean from about 3.55 million hectare of area annually with an average productivity of 552 kg/ha (Anon., 2021) [3]. In Madhya pradesh, it covers an area of about 1.44 mh with production of 829 thousand tonnes and productivity of 575 kg/ha (Anon., 2021) [3]. The food value of urdbean lies in its high and easily digestible protein. Its seeds contain approximately 62-65% carbohydrates, 25-28% protein, 4.5-5.5% ash, 3.5-4.5% fiber on dry weight basis, while it also contains some macro and micro nutrients in minor quantity. Being one of the important legume crop of India. It is edible in the form of 'dal' (split, whole, husked and un-husked) or perched. Apart from this, urdbean is very nutritive and useful for milch cattle in the form of green fodder. As a leguminous crop, it has the capacity to restore soil fertility by fixing atmospheric nitrogen. In terms of balanced human nutrition (Tiwari, Shivhare and Kumar, 2017) [13].

The disease is now widespread in India, which is caused by all *Colletotrichum* spp. and occurs every year but in severe form only in *Vigna mungo*. The symptoms mainly appear as minute water-soaked necrotic spots around 2-4 mm on the margins of the leaflets, which were dark brown in colour. The initial symptoms appear as small, circular or irregular, brown spots with greyish centre, which measures around 3-5 mm in diameter, which on later enlarge to form

dark brown concentric rings with greyish area in center, giving a appearance of target board effect. At later stage, spots coalesced together giving papery appearance, papery spotted portion falls off the from the leaves, which caused shot hole and defoliation of the plant (Agrawal, 1991) [1].

Limited work has been done to breed resistant varieties and fungicidal control is largely practiced. However, host plant resistance is more eco-friendly and effective as it also will also reduce utilization chemicals as fungicides control is hazardous for soil as well as not economic for farmers (Aggarwal *et al*. 2019) [2]. Considering the above facts the present study was, therefore, undertaken to identify the host resistance against anthracnose disease as which resistant cultivars are best and eco-friendly to manage the disease.

Materials and Methods

The field experiment was conducted at the experimental field of Department of Plant Pathology, College of Agriculture, Gwalior, Rajmata Vijayaraje Scindia Krishi Vishwa Vidhyalaya, Gwalior (M.P) during the *kharif*-2021 [3].

Screening of urdbean genotypes against anthracnose

Twenty genotypes of urdbean were evaluated in the *kharif*-2021 [3] against anthracnose of blackgram caused by *Colletotrichum lindemuthianum* in the field. Cultivars were sown with row to row and plant to plant spacing of 30 and 10 cm respectively. The experiment was conducted in randomized block design with two replications with fertilizer dose of Nitrogen 20 Kg/ha and Phosphorus 50 Kg/ha. The disease severity of anthracnose on genotypes were recorded at 70 days after planting. The data on the disease severity were recorded and calculated as follows:

$$\text{Disease Severity} = \frac{\text{Sum of individual rating} \times 100}{\text{Number of leaf observed x Maximum rating value}}$$

The incidence of disease severity was recorded with the help of 0-9 disease severity rating scale (Mayee and Datar, 1986), which are as follows:

Table 1: Disease severity rating scale.

Grade	Percent Disease Severity	Reaction
0	No infection	Highly Resistant
1	0.1 – 1.00	Resistant
3	1.1 – 10.00	Moderately Resistant
5	10.1 – 25.00	Moderately Susceptible
7	25.1 – 50.00	Susceptible
9	More than 50	Highly Susceptible

Result

Anthracnose disease is incited by *Colletotrichum lindemuthianum*. In this study urdbean genotype were screened for resistance to *C. lindemuthianum* under field condition. Several genotypes with high level of resistance under field condition were identified.

A total of twenty genotypes/ cultivar were screened under field condition. Data recorded in Table-2, clearly indicates that the maximum disease intensity was recorded in genotype AKU 1608 (57.65%), followed by SBC 50 (51.76%), Azad-3 (43.20%), NGU 24 (35.41%), PU 31 (34.27%), TBG 125 (33.91%), LBG 752 (31.80%), PU 14-19 (31.62%), IPU 172 (31.57%), Uttara (29.76%), TU 94-2 (29.00%), TPU 4 (28.93%), T-9 (28.86%), MU 52 (28.28%), KU 17-08 (27.59%), VBG 12-034 (24.61%), KPU 520-69 (22.42%), KU 96-3 (17.38%) and PU 1514 (9.97%), while minimum disease severity was recorded in genotype PU 1617 (5.09%).

Table 2: Evaluation of urdbean cultivars against anthracnose under field condition.

Genotypes	Scale grade	Percent disease severity
Azad-3	7	43.20 (41.07)
VBG 12-034	5	24.61 (29.73)
KPU 520-69	5	22.42 (28.24)
AKU 1608	9	57.65 (49.38)
PU 31	7	34.27 (35.82)
LBG 752	7	31.80 (34.31)
PU 14-19	7	31.62 (34.20
TBG 125	7	33.91 (35.60)
NGU 24	7	35.41 (36.50)
MU 52	7	28.28 (32.12)
IPU 172	7	31.57 (34.17)
SBC 50	9	51.76 (45.99)
KU 17-08	7	27.59 (31.67)
PU 1514	3	9.97 (18.38)
TPU 4	7	28.93 (32.52)
Uttara	7	29.76 (33.04)
KU 96-3	5	17.38 (24.62)
TU 94-2	7	29.00 (32.57)
PU 1617	3	5.09 (12.97)
T-9	7	28.86 (32.48)
S.Em.±		0.62
C.D. at 5%		1.84

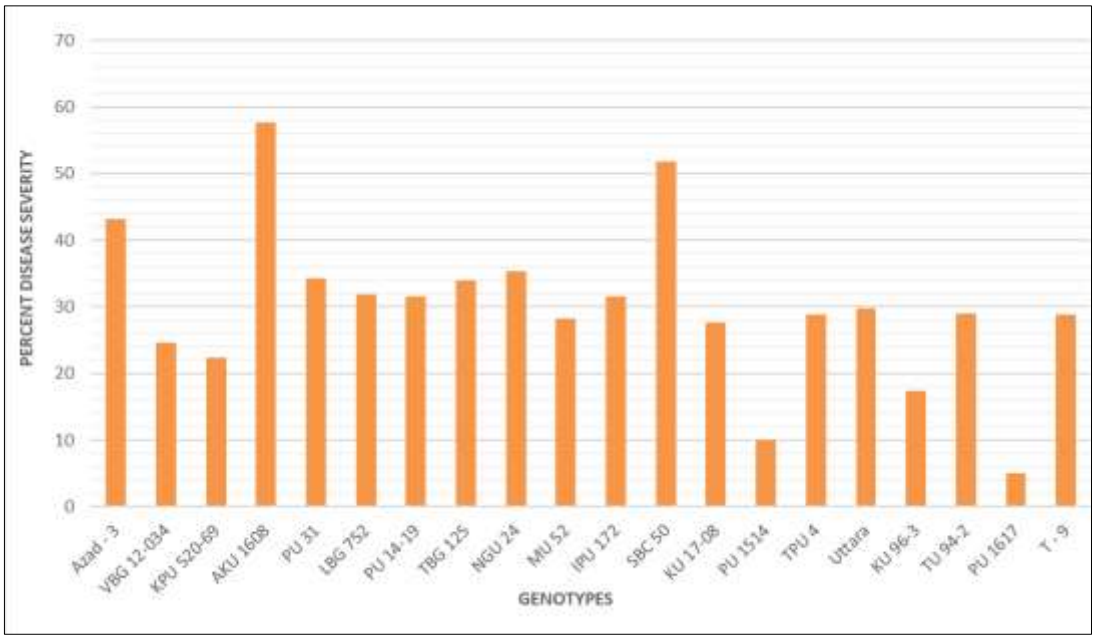

Fig 1: Influence of percent disease severity of anthracnose on urdbean genotypes

Out of the screened twenty cultivars none of the cultivar belong to the highly resistant and resistant category. Two cultivars *viz*; PU 1617 and PU 1514 were found to be in moderately resistant category. Three cultivars *viz*; VBG 12-034, KPU 520-69 and KU 96-3 belong to moderately susceptible category. However thirteen cultivars *viz*; Azad-3, PU 31, LBG 752, PU 14-19, TBG 125, NGU 24, MU 52, IPU 172, KU 17-08, TPU 4, Uttara, TU 94-2 and T-9 were found to be placed in under susceptible category, while two cultivars namely; AKU 1608 and SBC 50 belong to highly susceptible class.

Table 3: Disease reaction category.

Reaction	Entries	Genotypes
Highly Resistant	0	NIL
Resistant	0	NIL
Moderately Resistant	2	PU 1617, PU 1514
Moderately Susceptible	3	VBG 12-034, KPU 520-69, KU 96-3
Susceptible	13	Azad-3, PU 31, LBG 752, PU 14-19, TBG 125, NGU 24, MU 52, IPU 172, KU 17-08, TPU 4, Uttara, TU 94-2, T-9
Highly Susceptible	2	AKU 1608, SBC 50

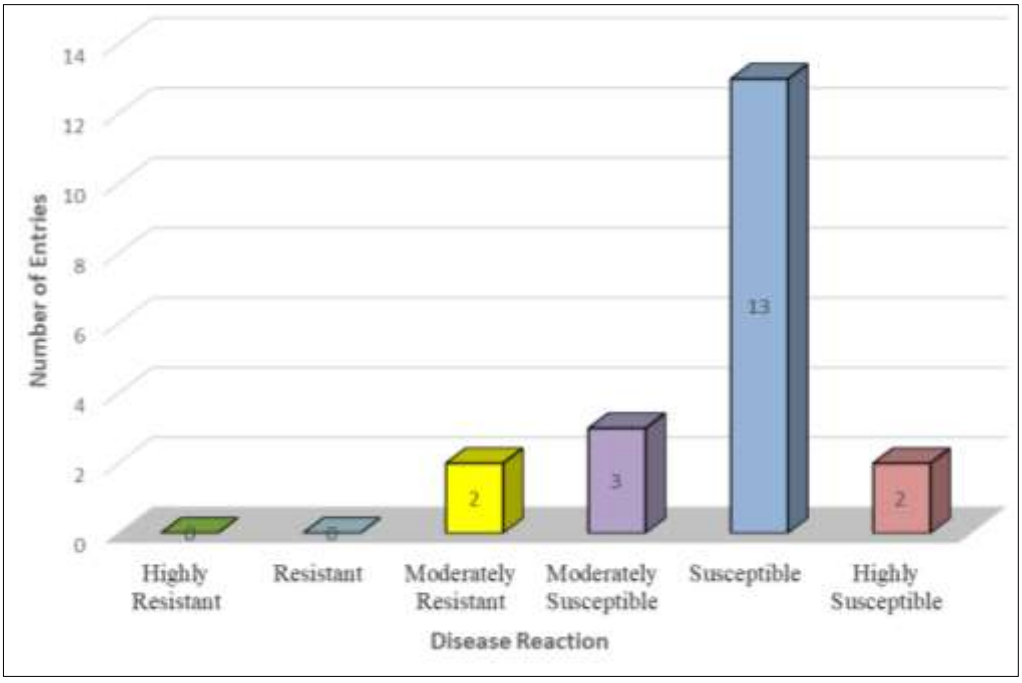

Fig 2: Influence of disease reaction of urdbean genotypes against *C. lindemuthianum*

Discussion

In contrast to reduce and jusdicious use of chemical fungicide, the development of resistance in host against plant pathogen is noble and sustainable implement, not only in reducing health hazards and environmental pollution but also in declining development of fungicidal resistant strains of the pathogen. The development of host plant resistance for the managements of plant disease increased in recent years, which proved to be very effective against plant disease. To find out possibilities of replacing fungicides with host plant resistance for management of plant diseases. In regard to this a field trial was conducted to evaluate the twenty genotypes of urdbean against anthracnose caused by *Colletotrichum lindemuthianum*. The study showed that out of twenty genotypes evaluated, none of the them were found to be highly resistant. Two cultivars (PU 1617 and PU 1514) were found moderately resistant. Three cultivars (VBG 12-034, KPU 520-69 and KU 96-3 were found moderately susceptible. Thirteen cultivars (Azad -3, PU 31, LBG 752, PU 14-19, TBG 12, NGU 24, IPU 72, KU 17-08, TPU 4, Uttara, TU 94-2 and T-9) were found to be susceptible, while two cultivars (AKU 1608 and SBC 50) were found to be highly susceptible. The recent study was in correspondence to the similar observations done earlier by Santosh *et al.* 2015 [11]; Sharma, 2011 [12]; Kumar and Mukhopadhyay, 1987 [6]; Aggarwal *et al*. 2019 [2]; Pathania *et al*. 2006 [9] and Rajesha *et al.* 2010 [10]. Evaluation of five varieties and thirty-nine germplasms of Indian bean against anthracnose in Rabi 2008. It was reported that out of three varieties (Kapasi, JNP-4, Katagram) two germplasms (NWP 12, 19, 20, 22, 24, 25, 26, 27, 28, 29, 30, 32, 35, 37, 39) were found to be moderately resistant, whereas variety NPS 1 was found to be highly susceptible to anthracnose of Indian bean (*Lablab purpureus* L.) under south Gujrat conditions (Deshmukh *et al*. 2012) [5].

Conclusions

To know source and wide base of resistance in urdbean genotypes, screening of all the twenty urdbean genotypes was done for calibrating their resistant to promote sustainable agriculture and eventually to bring down the unchecked uses of chemical fungicide in disease control. The study proved successful to know about the wide base of resistance in urdbean genotypes and it was found that maximum disease severity was recorded in AKU 1608 (57.65%) and found to be highly susceptible, while minimum diease severity was recorded in PU 1617 (5.09%) and PU 1514 (9.97%) which were found to be moderately resistant against *C. lindemuthianum* and can be utilized in resistant breeding programme.

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