

## Field evaluation of urdbean germplasm against *Mungbean Yellow Mosaic India Virus* in Northwestern *Tarai* region of India

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**ABSTRACT :** A total number of 70 genotypes of urdbean were evaluated for source of resistance against *Mungbean Yellow Mosaic India Virus* (MYMIV) during the year 2012 and 2013. Yellow mosaic disease (YMD) in urdbean genotype ranged from 1.3% (IPU-2-43) to 100% (Palampur 93 and Kullu-4) during 2012 and 0.4 % (IPU-10-23) to 100% (Palampur 93) during 2013. The maximum AUDPC ('A') and ARI ('r') value for pooled data was recorded in the genotype Palampur 93 (4807.2 and 0.080) and minimum was recorded in IPU-2-43 (64.64 and 0.010) conditions. Only two genotypes, IPU-10-23 and IPU-2-43 were found to be resistant showing < than 1% YMD incidence. Maximum numbers of urdbean genotypes were found to be highly susceptible and others were moderately resistant to susceptible.

**Key words:** Disease incidence, MYMIV, MYMV, resistance screening, urdbean, YMD

Pulses represent one of the most important food categories that have been extensively used as staple foods to cover basic protein and energy needs throughout the history of humanity. India is the largest producer of pulses, with 22 per cent of the world total production, 30 per cent of total consumption and 33 per cent of global acreage under pulses. Considering the population growth, India will require around 20 Mt of pulses by 2020 to avoid protein deficiency (Anon., 2012). Urdbean or black gram (*Vigna mungo* L.) is one of the most important pulse crop of the *Vigna* group in Indian agriculture. Urdbean is grown in about 3.11 M.ha with annual production of 1.90 MT (Anon, 2014). The low productivity of this crop is attributed to several biotic and abiotic stresses. Among them, whitefly transmitted yellow mosaic virus disease (YMD), described by Nariani (1960), is the most destructive one. Yield loss per annum due to YMD was estimated to be \$ 300 million taking black gram, mungbean and soybean together in a particular epidemic (Verma *et al.*, 2003). The disease incidence of YMD is highly variable ranging from 3 to 26% (Biswas *et al.*, 2009) and in severe cases it is up to 100% (Anonymous, 2009).

The yellow mosaic disease in pulse crops is caused by whitefly transmitted begomoviruses such as *Mungbean Yellow Mosaic Virus* (MYMV), *Mungbean Yellow Mosaic India Virus* (MYMIV), *Horsegram Yellow Mosaic Virus* (Hg YMV) and *Dolichos Yellow Mosaic*

*Virus* (DoYMV) across India, those are together referred to as legume yellow mosaic viruses-LYMs (Qazi *et al.*, 2007; Malathi and John, 2008). Host plant resistance is an economical as well as desirable component in the management of viral diseases. Since, YMD is one of the destructive diseases in urdbean (*Vigna radiata*) in India, identification of genotypes that can resist/tolerate the disease during early stages of crop growth is useful in minimizing yield loss.

### MATERIALS AND METHODS

Total seventy germplasms of urdbean obtained from Pulse Pathology laboratory, GBPUA&T, Pantnagar were evaluated in the present study to obtain the source of resistance against YMD. The germplasms were screened under natural epiphytotic condition following 'Infector row technique' for over two seasons (*kharif* 2012 and 2013). Each entry was sown in 5m row with a susceptible check after every 5 entries and a susceptible border row. The disease incidence and severity was recorded at 30, 60 and 90 days after sowing (DAS). The per cent disease incidence, area under disease progress curve (AUDPC) and rate of infection of each variety were calculated using the following formulae:

#### a. Disease incidence:

$$\text{Disease incidence (\%)} = \frac{\text{No. of plant showing symptoms}}{\text{Total No. of plant in a row}} \times 100$$

**b. Area under disease progress curve (AUDPC) 'A' value**

YMD incidence was quantified using the following formulae (Nagarajan and Muralidharan, 1995).

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

Where  $S_i$  = Disease incidence at the end of the week  $i$ ,  
 $k$  = Number of successive evaluations of disease, and  $d$  = Interval between two evaluations.

**c. Apparent rate of infection (ARI) 'r'**

The apparent rate of infection was calculated by the linear model  $Y = b + rt$ , after transforming the disease incidence as the proportion (0-1) of YMD infected plants (Nutter, 1997).

The genotypes were later grouped into different categories based on 0 to 9 scale of disease incidence and from immune to highly susceptible according to Mayee and Datar (1986) with slight modifications. To compare the different genotypes for their resistance 'A' and 'r' value were also calculated for each genotype.

Scale	Description	Category
0	No plants showing any symptoms	Immune (I)
1	1% or less plants exhibiting symptoms	Resistant(R)
3	1.1-10% plants exhibiting symptoms	Moderately resistant (MR)
5	10.1-20% plants exhibiting symptoms	Moderately susceptible (MS)
7	20.1-50% plants exhibiting symptoms	Susceptible (S)
9	> 50% plants exhibiting symptoms	Highly susceptible (HS)

**RESULTS AND DISCUSSION**

The incidence of YMD in all the 70 urdbean genotypes ranged from 1.30 per cent (IPU-2-43) to 100 per cent (Palampur 93 and Kullu-4) during 2012 and 0.4 per cent (IPU-10-23) to cent per cent (Palampur 93) during 2013. The maximum AUDPC and 'r' value for pooled data was recorded in Palampur 93 (4807.2 and 0.080) and minimum was recorded in IPU-2-43 (64.64 and 0.010) (Table 1). The 'A' value and 'r' found very useful in differentiating the ability of the genotype in reducing the disease.

**Table 1: Screening of urdbean germplasm against yellow mosaic disease during of the year of 2012 and 2013**

Sl. No.	Germplasm	Per cent disease incidence			'A' Value*	'r' Value*	Disease rating scale	Reaction group
		2012	2013	Pooled				
1	KKB-02-011	93.50	85.86	100	4836.7	0.053	9	HS
2	KPU-26-10	80.00	72.36	76.18	3634.7	0.026	9	HS
3	Co-05	93.40	85.76	89.58	3846.2	0.046	9	HS
4	NDU-12-300	5.10	3.70	4.40	162.8	0.025	3	MR
5	VBG-09-005	81.30	73.66	77.48	3189.2	0.032	9	HS
6	AKU-10-1	92.40	84.76	88.58	3807.2	0.043	9	HS
7	CO-06	63.70	56.06	59.88	2383.7	0.027	9	HS
8	PU-09-35	2.30	4.10	3.20	133.5	0.017	3	MR
9	LBG-752	68.30	60.66	64.48	2539.7	0.030	9	HS
10	TU-94-2	73.40	65.76	69.58	2979.2	0.026	9	HS
11	VBG-10-024	5.20	2.10	3.65	150.0	0.016	3	MR
12	IPU-10-23	1.40	0.40	0.90	69.8	0.010	1	R
13	KUG-503	27.80	20.16	23.98	801.2	0.033	7	S
14	NDU-11-201	4.30	2.90	3.60	127.5	0.031	3	MR
15	TU-631	42.70	35.06	38.88	1510.7	0.021	7	S
16	NUL-7	21.90	14.26	18.08	768.2	0.019	5	MS
17	RVSU-60	22.50	14.86	18.68	765.2	0.023	5	MS
18	ACM-05-007	75.30	67.66	71.48	2910.2	0.029	9	HS
19	IGKU-02-1	29.80	22.16	25.98	940.7	0.025	7	S
20	AKU-10-4	82.50	74.86	78.68	3496.7	0.035	9	HS
21	Uttara	2.10	2.10	2.10	88.5	0.019	3	MR
22	UH-08-05	1.90	1.90	1.90	76.1	0.017	3	MR

Sl. No.	Germplasm	Per cent disease incidence			'A' Value*	'r' Value*	Disease rating scale	Reaction group
		2012	2013	Pooled				
23	UH-07-06	2.70	2.70	2.70	103.1	0.025	3	MR
24	Phule U-0014	43.40	35.76	39.58	1546.7	0.022	7	S
25	COBG-761	89.60	81.96	85.78	3838.7	0.039	9	HS
26	NDU-11-202	2.70	2.00	2.35	108.8	0.011	3	MR
27	RVSU-11-8	64.20	56.56	60.38	2083.7	0.032	9	HS
28	KUG-586	2.60	2.40	2.50	99.0	0.022	3	MR
29	IPU-2-43	1.30	0.5	0.9	64.64	0.010	1	R
30	KPU-1-10	3.20	2.40	2.80	114.0	0.022	3	MR
31	DBG-1	70.30	62.66	66.48	2464.7	0.037	9	HS
32	TPU-4	55.80	48.16	51.98	2082.2	0.023	9	HS
33	KU-1106	5.40	2.80	4.10	156.0	0.020	3	MR
34	COBG-10-5	33.40	25.76	29.58	1318.7	0.019	7	S
35	Kopergoan	18.90	11.26	15.08	520.7	0.036	5	MS
36	Pant U 30	16.40	8.76	12.58	433.7	0.027	5	MS
37	Co-5	46.80	39.16	42.98	1753.7	0.023	7	S
38	LBG-623	90.40	92.76	86.58	3676.7	0.049	9	HS
39	K-851	19.60	11.96	15.78	546.2	0.037	5	MS
40	Birsa urd 1	2.10	1.90	2.00	73.5	0.024	3	MR
41	BPU-1	76.30	68.66	72.48	2286.2	0.039	9	HS
42	LBG-20	48.60	40.96	44.78	1527.2	0.031	7	S
43	LBG-645	86.20	78.56	82.38	2872.7	0.054	9	HS
44	LBG-685	80.30	72.66	76.48	2923.7	0.045	9	HS
45	LBG-752	26.30	18.66	22.48	867.2	0.024	7	S
46	Naveev	35.40	27.76	31.58	1131.2	0.029	7	S
47	Palampur-93	100	100	92.58	4807.2	0.080	9	HS
48	RBU-38	32.10	24.46	28.28	1090.7	0.026	7	S
49	RUG-10	23.40	15.76	19.58	733.7	0.028	5	MS
50	RUG-44	42.30	34.66	38.48	1465.7	0.024	7	S
51	TAU-94-2	41.30	33.66	37.48	1303.7	0.031	7	S
52	UG-218	16.30	8.66	12.48	479.4	0.026	5	MS
53	VBN (BG) 3	30.20	22.56	26.38	952.7	0.031	7	S
54	VBN (BG) 4	63.20	55.56	59.38	1930.7	0.034	9	HS
55	VBN (BG) 5	83.20	75.56	79.38	3139.7	0.042	9	HS
56	VBN (BG) 7	43.20	35.56	39.38	1251.2	0.037	7	S
57	Azad-4	23.40	15.76	19.58	702.9	0.029	5	MS
58	DKU-1	76.30	68.66	72.48	2730.2	0.042	9	HS
59	DKU-11	10.30	2.66	6.48	233.7	0.021	3	MR
60	KPU-11-40	9.60	3.60	6.60	249.8	0.017	3	MR
61	KUG-310	8.40	2.90	5.65	208.4	0.020	3	MR
62	KUG-363	89.60	81.96	85.78	3028.7	0.054	9	HS
63	KUG-540	7.20	2.70	4.95	185.3	0.027	3	MR
64	KUG-503	6.80	2.90	4.85	189.0	0.018	3	MR
65	Kullu-4	100	83.96	87.78	3849.7	0.061	9	HS
66	Mash-391	6.10	2.90	4.50	182.3	0.015	3	MR
67	Mash-114	16.30	8.66	12.48	549.2	0.024	5	MS
68	OBG-33	19.40	11.76	15.58	619.7	0.023	5	MS
69	OBG-35	23.10	15.46	19.28	895.7	0.015	5	MS
70	VBN 7	7.30	3.70	5.50	241.5	0.016	3	MR

\*Average of two seasons

**Table 2: Grouping of mungbean genotypes screened against YMD during the years of Kharif 2012 and 2013)**

Scale	Description	Reaction	Genotype
0	No Plants showing any symptoms	Immune	-
1	1% or less plants exhibiting Symptoms	Resistant	IPU-10-23, IPU-2-43 (Total genotypes: 2)
3	1.1-10% plants exhibiting	Moderately resistant	NDU-12-300, PU-09-35, Symptoms VBG-10-024, NDU-11-201, Uttara, UH-08-05, UH-07-06, NDU-11-202, KUG-586, KPU-1-10, KU-1106, Birsaurd1, DKU-11, KPU-11-40, KUG-310, KUG 540, KUG 503, Mash-391, VBN 7 (Total genotypes: 19)
5	10.1-20% plants exhibiting Symptoms	Moderately Susceptible	NUL-7, RVSU-60, Kopergoan, Pant U 30, K-851, RUG-10, UG-218, Azad-4, Mash-114, OBG-33, OBG-35 (Total genotypes: 11)
7	20.1-50% plants exhibiting Symptoms	Susceptible	KUG-503, TU-631, IGKU-02 1, Phule U-0014, COBG-10-5, Co-5, LBG-20, LBG-752, Naveev, RBU-38, RUG 44, TAU-94-2, VBN (BG) 3, VBN (BG) 7 (Total genotypes: 14)
9	>50% plants exhibiting symptoms	Highly Susceptible	KKB-02-011, KPU-26-10, Co 05, VBG-09-005, AKU-10-1, CO-06, LBG-752, TU-94-2, ACM-05-007, AKU-10-4, COBG-761, RVSU-11-8, DBG-1, TPU-4, LBG-623, BPU-1, LBG-645, LBG 685, Palampur-93, VBN (BG) 4, VBN (BG) 5, DKU-1, KUG 363, Kullu-4 (Total genotypes: 24)

Based on pooled data of both the years

Among 70 genotypes screened against YMD, none of them were found to be free from YMD during both the seasons. Only two genotypes, IPU-10-23 and IPU-2-43 were found to be resistant showing incidence <1%. Maximum numbers of genotypes fell under the category of highly susceptible (24 genotypes) followed by moderately resistant (19 genotypes). Fourteen genotypes were found to be under the category of susceptible and eleven genotypes under the category in moderately susceptible (Table 2).

Development of resistant variety against a disease is continuous process. Several cultivars has been screened against YMD in mungbean and urdbean (Basandrai *et al.*, 1999; Singh and Awasthi, 2004; Bhatnagar and Dahiya, 2005; Bashir *et al.*, 2006).

Recently, Yadav and Brar (2010) evaluated forty mungbean genotypes against MYMV and identified that two genotypes 'NM57' and 'NM94' were highly resistant and four genotypes, PBM 118, PBM 121, PBM 123, and A-3 were moderately resistant. Urdbean genotypes PU 31, P 205, P 207 and P 210 were found to be resistant against MYMV (Anon, 2010).

## CONCLUSION

Host plant resistance is a reliable and one of the most economic disease management practices especially against viral diseases. Hence the germplasm lines identified as resistant in this study may be used breeding programme for the development of resistant varieties.

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