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Evaluation of Isabgol Genotypes for Source of Resistance against *Fusarium oxysporum* Schlecht. under Field Condition

Shaik Munnysha[1]*, R.N. Bunker[1], Amit Dadheech[2], Smriti Akodiya[1] and Mamta Beniwal[1]

[1]Department of Plant Pathology,
Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan), India.
[2]Department of Genetics and Plant Breeding,
Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan), India.

(Corresponding author: Shaik Munnysha)*

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ABSTRACT: An experiment was laid out in Randomized Block Design with three replication to screen twenty five genotypes under sick plot condition. The screening of new resistance to isabgol genotypes against this disease is an alternative approach to avoid indiscriminate use of pesticides. Out of twenty-five genotypes screened, one genotype 'UI 25' was resistant, while eight genotypes UI-11, UI-17, UI-24, UI-62, UI-121, UI-125, HI-2, UI-124 were moderately resistant. However, GI 2 showed susceptible reaction and rest fifteen genotypes were found moderately susceptible against wilt of Isabgol.

Keywords: *Fusarium oxysporum*, isabgol, pesticides, resistance, wilt disease.

INTRODUCTION

Isabgol (*Plantago ovate* Forsk.) is a medicinal annual plant with short stems grows to a height of 10 to 40 cm. Psyllium husk is primarily used as traditional herbal medicine to treat constipation and other digestive system disorders (Voderholzer *et al.*, 1997). The seeds have a 35% soluble polysaccharide content and 65% insoluble polysaccharide content (Fischer *et al.*, 2004). The oil in isabgol embryo (14%) is a good source of linoleic acid and functions as a probable as dietary hypocholestrolemic agent. Seeds that have been stripped of their husk are a by-products of isabgol industry and are used as ice-cream stabilizer (Patel and Desai 1987).

A number of fungal diseases were involved causing severe yield losses and seed quality of isabgol *viz.*, fusarium wilt, damping off, leaf blight, downy mildew and powdery mildew (Mandal, 2010). Fusarium wilt is the most common and widespread disease of Isabgol in Rajasthan, causing considerable yield losses. Incidence of Isabgol wilt in Rajasthan has been recorded10-15 percent in Udaipur, Chittorgarh, Pratapgarh, Sirohi, Jalore, Pali and Jodhpur (Annual progress Report, MAP&B, 2020-21). The most common sign of Fusarium wilt is discoloration of the vascular tissue, which mostly starts from the ground and spreads upward to the aerial parts, wilting the stem and leaves, occasionally followed by leaf abscission, eventually leading to plant death (Schwartz *et al.*, 2005).

Meena and Roy (2020) reported yield losses 18-40% in isabgol by *Fusarium oxysporum* Schlecht. In India, work on Isabgol wilt is very limited, so far only *Fusarium moniliforme*, *Fusarium oxysporum* Schlecht and *F. solani* are reported from Haryana (Mehta *et al.*, 1985; Elwakil and Ghoneem 1999), but it is not known whether other species are also prevalent in different regions. Isabgol wilt causes high yield losses across entire isabgol growing regions of the world. The pathogen survives in soil, on plant debris and invade crop plants at any stage of development, from germination to maturity. The disease incidence is influenced by several biotic and abiotic factors, with prevalence ranging from 10 to 60% (Meena and Satyajit 2020). Similarly, Abhinav (2022) assessed source of resistance against *Fusarium oxysporum* Schlecht causing wilt of isabgol. Out of nine genotypes screened, only five genotypes UI-124, UI-125, UI-6-1, UI-3-1 and UI-2-1 were moderately resistant. In present study released elite varieties and genotypes were evaluated in field under sick plot method for two consecutive years.

MATERIALS AND METHODS

Twenty five genotypes namely UI-3, UI-4, UI-2-1, UI-6-1, UI-10, UI-11, UI-16, UI-17, UI-24, UI-25, UI-29, UI-62, UI-80, UI-81, UI-89, UI-121, UI-123, UI-124, UI-125, UI-130, UI-158, UI-427, HI-2, Niharika and GI-2 received from the Incharge of AICRP on Medicinal, Aromatic and Betelvine Project, MPUAT-Udaipur were evaluated under sick plot method. The experiment was laid out in (RBD) Randomized Block Design having three replications. Seeds were sown in lines at 30×5 cm. The pathogen (*Fusarium oxysporum* Schlecht) was multiplied on autoclaved sand-corn meal (2:1) and the plots were inoculated with 15gm/sqm before 10 days of sowing to develop sick plot.

Disease incidence was calculated by counting wilted and healthy isabgol plants at different intervals. Wilted isabgol plants from each plot were selected for disease reaction. The first appearance of wilt infection were recorded and thereafter the observation were recorded at 30, 60 and 90 days interval throughout the cropping season.

The per cent disease incidence (PDI) was calculated and categorized as per the disease reaction scale given by Nene *et al*. (1981).

Table 1: Disease rating scale for scoring wilt incidence.

Per cent wilt incidence	Variety reaction category
0-10	Resistant (R)
11-25	Moderately Resistant (MR)
25-50	Moderately Susceptible (MS)
50-75	Susceptible (S)
Above 75 or above	Highly susceptible (HS)

Observation. Per cent disease incidence (PDI)

$$\text{Per cent disease incidence} = \frac{\text{Number of wilted/infected plants}}{\text{Total number of plants assessed}} \times 100$$

RESULTS AND DISCUSSION

The evaluated isabgol genotypes showed variable reaction to wilt disease in both the years 2021-22 and 2022-23. The trend of wilt incidence in Rabi 2022-23 was slightly higher compare to the year 2021-22 in each isabgol genotypes at different growth stages.

In the Rabi 2021-22, UI-25 exhibited lowest disease incidence at 30 DAS, 60 DAS and 90 DAS with per cent disease incidence 4.83, 6.13 and 9.51, respectively and comes under resistant category. Rest of genotypes viz. UI-124, UI-17, UI-121, UI-24, UI-125, UI-62, UI-11, UI-29, HI-2, UI-89, UI-2-1, UI-10, UI-130, UI-81, UI-6-1, UI-3, UI-80, UI-4, UI-16, Niharika, UI-123, UI-158, UI-427 and GI-2 showed the per cent disease incidence 11.6, 16.89, 18.89, 19.41, 21.04, 23.75, 23.85, 24.77, 24.97, 27.23, 29.03, 30.78, 33.06, 32.85, 30.54, 37.17, 37.32, 37.16, 38.52, 41.21, 42.63, 47.07, 48.2 and 52.31, respectively 90 DAS.

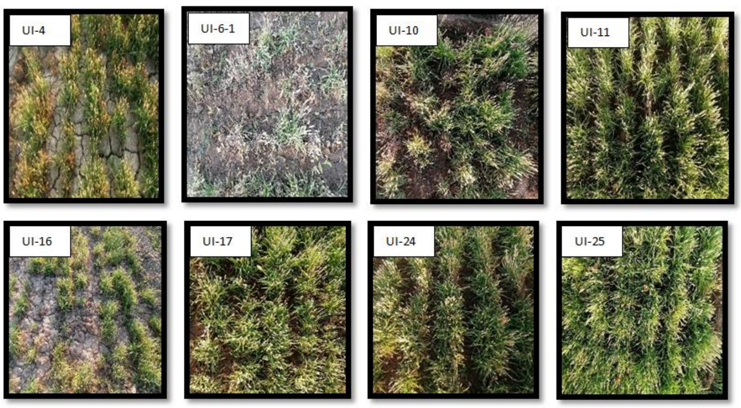
In the Rabi 2022-23, UI-25 exhibited lowest disease in the observation text 30 DAS, 60 DAS and 90 DAS with per cent disease incidence 5.03, 7.55 and 9.71, respectively and comes under resistant category. Rest of genotypes UI-124, UI-17, UI-121, UI-24, UI-125, UI-11, UI-62, HI-2, UI-29, UI-89, UI-2-1, UI-10, UI-130, UI-81, UI-80, UI-3, UI-4, UI-16, UI-6-1, Niharika, UI-123, UI-158, UI-427 and GI-2 showed the per cent disease incidence 14.27, 17.61, 20.26, 20.3, 22.12, 24.18, 24.77,25.02, 25.34, 27.98, 30.34, 30.83, 33.12, 33.44, 37.63, 37.77, 38.44, 39.7, 40.95, 42, 43.21, 48.44, 48.44 and 52.82, respectively 90 DAS.

Pooled data of Rabi 2021-22 and 2022-23 revealed that UI-25 showed the lowest per cent disease incidence 9.61 at 90 DAS. Rest of genotypes viz.,UI-124, UI-17, UI-121, UI-24, UI-125, UI-11, UI-62, HI-2, UI-29, UI-89, UI-2-1, UI-10, UI-130, UI-81, UI-6-1, UI-3, UI-80, UI-4, UI-16, Niharika, UI-123, UI-158, UI-427 and GI-2 showed the per cent disease incidence 12.93, 17.25, 19.57, 19.85, 21.58, 24.01, 24.26, 24.99, 25.05, 27.60, 29.68, 30.80, 33.09, 33.14, 35.74, 37.47, 37.47, 37.8, 39.11, 41.60, 42.92, 47.75, 48.32, 52.58, respectively at 90 DAS.

Genotypes UI-4, UI-6-1, UI-10, UI-16, UI-29, UI-80, UI-81, UI-123, UI-123, UI-158, UI-427, UI-3, Niharika, UI-89 and UI-2-1 were showed moderately susceptible reaction against *Fusarium oxysporum* Schlecht. While genotypes UI-11, UI-17, UI-24, UI-62, UI-121, UI-125, HI-2, UI-124 were showed moderately resistant reaction. Genotypes UI-25showed resistant reaction while GI-2 showed susceptible reaction against wilt of isabgol.

The incidence of wilt in each genotypes in both years increased just double from 30 DAS to 90 DAS which indicated that pathogen able to cause infection at any stage of plant growth.

The data of per cent wilt incidence revealed that among the 25 isabgol genotypes, UI-25 was found resistant against the wilt with range of 1-10% wilt incidence. The eight moderate resistant genotypes were found moderate resistant having 11-25% wilt incidence. Genotypes UI-4, UI-6-1, UI-10, UI-16, UI-29, UI-80, UI-81, UI-123, UI-123, UI-158, UI-427, UI-3, Niharika, UI-89 and UI-2-1 were found moderately susceptible having 25-50% wilt incidence. Genotype GI-2 showed susceptible reaction having above 50% wilt incidence. The findings are in agreement with Abhinav (2022) showed the popular variety Gujarat Isabgol-2 was found susceptible with 51.51 per cent disease incidence. Other workers have also made efforts to search sources of resistance to Fusarium wilt of isabgol. Vallabh Isabgol-1 recorded high wilt incidence (31%) whereas Gujarat Isabgol-2 showed 21 per cent disease incidence (Siddalingayya *et al*., 2020).



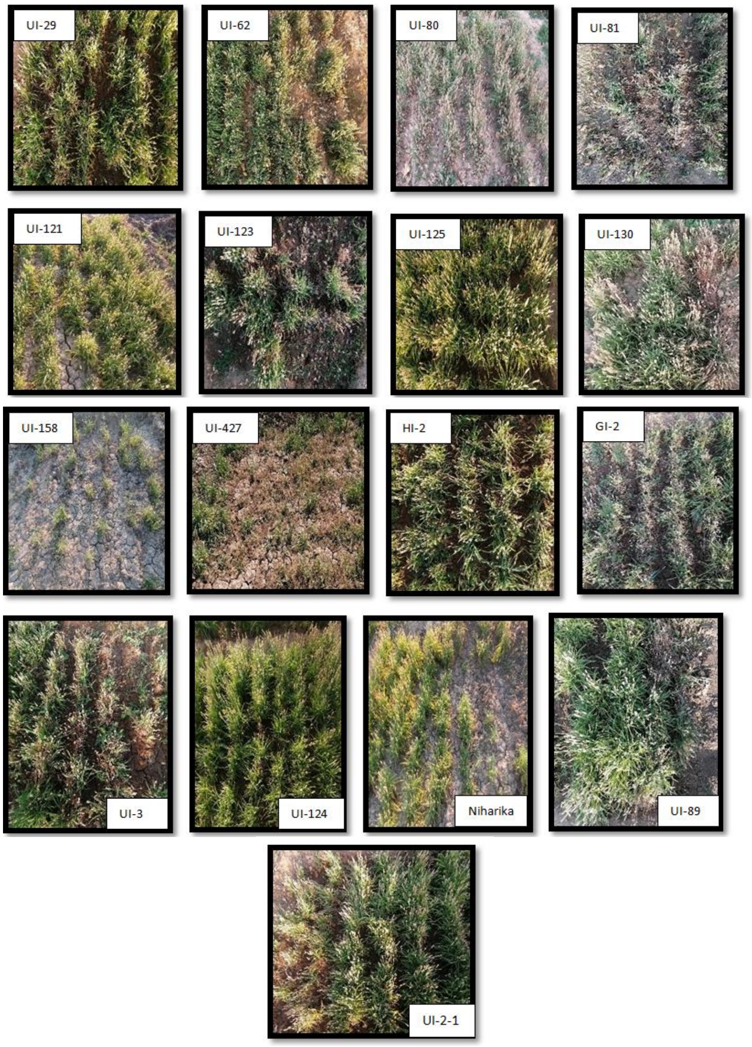


Plate 1. Reaction of isabgol genotypes for source of resistance against *Fusarium oxysporum* under field condition.

Table 2: Evaluation of Isabgol genotypes for source of resistance against *Fusarium oxysporum* under field condition.

Genotypes	Per cent disease incidence at 30 DAS*			Per cent disease incidence at 60 DAS*			Per cent disease incidence at 90 DAS*			Disease reaction at 90 DAS
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	
UI-4	19.99 (26.55)	20.61 (26.99)	20.3 (26.77)	33.71 (35.48)	34.03 (35.68)	33.87 (35.58)	37.16 (37.49)	38.44 (38.31)	37.8 (37.90)	MS
UI-6-1	21.75 (27.80)	22.21 (28.11)	21.98 (27.96)	26.62 (31.06)	37.31 (37.65)	31.96 (34.35)	30.54 (33.54)	40.95 (39.78)	35.74 (36.66)	MS
UI-10	16.17 (23.71)	17.5 (24.73)	16.83 (24.22)	25.56 (30.37)	26.43 (30.93)	25.99 (30.65)	30.78 (33.69)	30.83 (33.72)	30.80 (33.71)	MS
UI-11	11.79 (20.08)	12 (20.26)	11.89 (20.17)	19.13 (25.93)	20.11 (26.64)	19.62 (26.29)	23.85 (29.23)	24.18 (29.45)	24.01 (29.34)	MR
UI-16	17 (24.35)	17.23 (24.52)	17.11 (24.44)	24.66 (29.77)	35.34 (36.47)	30 (33.12)	38.52 (38.36)	39.7 (39.05)	39.11 (38.71)	MS
UI-17	10.87 (19.24)	11.56 (19.87)	11.21 (19.56)	12.24 (20.48)	13.32 (21.40)	12.78 (20.94)	16.89 (24.26)	17.61 (24.80)	17.25 (24.53)	MR
UI-24	12.01 (20.27)	12.39 (20.60)	12.2 (20.44)	17.14 (24.45)	17.23 (24.52)	17.18 (24.49)	19.41 (26.13)	20.3 (26.78)	19.85 (26.45)	MR
UI-25	4.836 (12.70)	5.036 (12.97)	4.93 (12.83)	6.13 (14.33)	7.55 (15.95)	6.84 (15.14)	9.513 (17.96)	9.71 (18.15)	9.61 (18.06)	R
UI-29	16.04 (23.61)	16.29 (23.80)	16.165 (23.71)	21.34 (27.51)	23.46 (28.97)	22.4 (28.24)	24.77 (29.85)	25.34 (30.16)	25.05 (30.00)	MS
UI-62	14.85 (22.66)	14.99 (22.78)	14.92 (22.72)	20.11 (26.64)	21.1 (27.34)	20.60 (26.99)	23.75 (29.16)	24.77 (29.84)	24.26 (29.50)	MR
UI-80	18.50 (25.47)	19.44 (26.15)	18.97 (25.81)	24.16 (29.43)	24.26 (29.51)	24.21 (29.47)	37.32 (37.65)	37.63 (37.84)	37.47 (37.74)	MS
UI-81	20.51	20.82	20.66	29.98	30.75	30.36	32.85	33.44	33.14	MS

	(26.93)	(27.15)	(27.04)	(33.20)	(33.68)	(33.44)	(34.97)	(35.33)	(35.15)	
UI-121	12.47 (20.68)	12.75 (20.92)	12.61 (20.80)	15.69 (23.33)	15.83 (23.44)	15.76 (23.39)	18.89 (25.76)	20.26 (26.75)	19.57 (26.25)	MR
UI-123	18.71 (25.63)	19.08 (25.90)	18.89 (25.76)	28.76 (32.43)	39.03 (38.66)	33.89 (35.55)	42.63 (40.76)	43.21 (41.10)	42.92 (40.93)	MS
UI-125	10.54 (18.94)	10.81 (19.19)	10.67 (19.07)	18.61 (25.55)	19.24 (26.01)	18.92 (25.78)	21.04 (27.30)	22.12 (28.05)	21.58 (27.68)	MR
UI-130	15.06 (22.83)	15.41 (23.11)	15.23 (22.97)	29.64 (32.98)	30.45 (33.49)	30.04 (33.24)	33.06 (35.10)	33.12 (35.13)	33.09 (35.11)	MS
UI-158	19.61 (26.28)	20.16 (26.68)	19.88 (26.48)	32.06 (34.49)	42.39 (40.62)	37.22 (37.55)	47.07 (43.32)	48.44 (44.11)	47.75 (43.71)	MS
UI-427	13.89 (21.87)	13.98 (21.95)	13.93 (21.91)	21.09 (27.33)	41.33 (40.00)	31.21 (33.67)	48.2 (43.97)	48.44 (44.11)	48.32 (44.04)	MS
HI-2	13.94 (26.69)	14.21 (22.14)	14.07 (22.03)	21.41 (27.56)	22.32 (28.19)	21.86 (27.87)	24.97 (29.98)	25.02 (30.00)	24.99 (29.99)	MR
GI-2	20.18 (25.41)	20.77 (27.11)	20.47 (26.90)	31.15 (33.92)	31.38 (34.06)	31.26 (33.99)	52.31 (46.32)	52.82 (46.62)	52.58 (46.47)	S
UI-3	18.44 (16.48)	19.06 (25.88)	18.75 (25.65)	30.2 (33.34)	31.43 (34.10)	30.81 (33.72)	37.17 (37.57)	37.77 (37.92)	37.47 (37.74)	MS
UI-124	8.046 (26.98)	8.223 (16.66)	8.13 (16.57)	10.54 (18.94)	11.49 (19.81)	11.01 (19.38)	11.6 (19.91)	14.27 (22.19)	12.93 (21.05)	MR
Niharika	20.59 (25.21)	21.01 (27.27)	20.8 (27.13)	26.13 (30.73)	36.46 (37.14)	31.29 (33.94)	41.21 (39.93)	42 (40.40)	41.60 (40.16)	MS
UI-89	18.14 (23.44)	18.48 (25.46)	18.31 (25.33)	25.43 (30.28)	26.79 (31.17)	26.11 (30.72)	27.233 (31.45)	27.98 (31.93)	27.60 (31.69)	MS
UI-2-1	15.83 (23.03)	16.08 (23.64)	15.95 (23.54)	26.74 (31.13)	24.06 (29.37)	25.4 (30.25)	29.03 (32.60)	30.34 (33.24)	29.68 (32.92)	MS
SEm±	0.364	0.342	0.216	0.432	0.464	0.274	0.764	0.944	0.526	
CD at 5%	1.036	0.975	0.608	1.228	1.319	0.770	2.174	2.684	1.476	
C.V.	2.74	2.54	2.64	2.63	2.63	2.63	4.01	4.84	4.45	

*Mean of three replications; Figure in parenthesis are arcsine per cent angular transformed values

CONCLUSIONS

In the current study, an effort was made to screen twenty five different genotypes of isabgol for source of resistance against wilt under sick plot condition. Out of twenty five genotypes screened, one genotype was resistant and eight genotypes were moderately resistant. However, genotype GI 2 showed susceptible reaction and rest fifteen genotypes were found moderately susceptible reaction against wilt disease. For effective disease management, continuous screening of genotypes is advised, focusing on potential breakdown of resistance source of major races in isabgol growing regions.

FUTURE SCOPE

The use of resistant varieties is one of the most practical and cost-efficient strategies for plant disease management. This control strategy also satisfy consumers demand for healthier foods and better environmental quality. However, the efficiency of resistant cultivars in disease management can be seriously limited by pathogenic variability occurring in pathogen populations.

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