Original Research Article

Screening of promising genotypes of Isabgol against downy mildew disease (*Peronospora plantaginis)*

Abstract

Isabgol (*Plantago ovata*) is an important *Rabi* crop grown in dry region of India. It plays important role for reducing stomach disorders. The crop of Isabgolsuffers with number of diseases. Downy mildew disease of Isabgol caused by *Peronospora plantaginis*is one of the wide spread and destructive disease in India. The symptoms of downy mildew of Isabgol appear 30-35 days after sowing. As the progressed, the leaves become necrotic and started drying from the tip to backward and plant become stunted. The genotypescreening is an eco-friendly method for management of plant diseases; hence an experiment was conducted to identify the resistant genotypes against downy mildew of Isabgol under natural field condition.Out of 36 genotypes, 8 genotypes were found resistant, 15 genotypes were found moderately resistant, 8 genotypes were found moderately susceptible and 5 genotypes were found susceptible against downy mildew of Isabgol.

Keywords: Genotypes, Downy mildew, Isabgol, Screening and Resistant.

1. Introduction

Isabgol(*Plantago ovata*) is the medicinal plant belongs to the family Plantaginaceae. Downy mildew of Isabgol is caused byfungus*Peronospora plantaginis*.*Peronospora*act as plant pathogen on fifty-four families of Dicotyledonae and two families of monocotyledonous plants[1].Appearance of white cottony growth at lower surface of leaves on infected host are called Downy mildew diseases [2].Downy mildew of Isabgol initially produces symptoms on foliage part and later infection occur on floral part as well as seeds [3]. Floral infection of Isabgol directly caused yield losses and help in long distance perpetuation of the *Peronospora*. The severity of downy mildew was found directly correlated with reduction in seed yield (45%) and husk yield (20%).

Genus *Peronospora* belongs to the family Pernosporaceae, it is obligate plant pathogen, mycelia are intercellular in host tissues and no intracellular hyphae were seen in host tissues.

They absorbed their nutrition through haustoria. *Peronospora* formed erect and dichotomously branched sporangiophores which are bearing sub-elliptical sporangia. Sporangia emerged with stomata on the lower surfaces of infected leaf. Sporangia germinate either by direct germ tube or forming biflagellate zoospore which spread the downy mildew diseases.*Peronospora* required free moisture and cool temperature for sporulation. Sexual reproduction occurred at late growing season.Resistant oospore formed after the fertilization of male and female gametes. It is appeared during over wintering phage of the downy mildew. *Peronospora* cannot grow in pure culture, so that identification was done on the basis of sporangiophore produced in to the host tissue. Downy mildew pathogen is able to sporulate repeatedly for several successive nights from same session it is depending on the species and host [4].

The *Peronospora* species are highly specific to their host and generally it found anywhere the host plant grows or is being cultivated because large portion of their life cycle is spent inside their host plant. Many species of *Peronospora* are seed borne specially *Peronosporaplantaginis* causes downy mildew of Isabgol (*Plantago ovata*) [5]. Outbreak of downy mildew disease occurs mainly on high inoculum availability, conducive temperature, Relative humidity and leaf wetness duration. Different sources of mulching are hypothesized to create adverse environmental condition within the plant canopy which are less favourable to disease development [6].For the management of downy mildew disease of Isabgolintegrated disease management is best. The varietal screening is an eco-friendly method for management of plant diseases; hence an experiment was conducted to identify the resistant germplasm/genotypes against downy mildew of Isabgol.

2. Materials and methods

The experiment was carried out atExperimental Station of Medicinal and Aromatic Plants, Acharya Narendra Deva University of Agriculture and Technology,Kumarganj, Ayodhya (U.P.) India during *Rabi*, 2021-22. The details of experimental materials, techniques followed and procedures adopted for evaluation during the course of study are given as below.

2.1 Experimental site

The Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) India is located in the Indo-Gangetic plains of Eastern Uttar Pradesh with its latitude 26.47 ^{0}N, longitude 82.12 ^{0}E and altitude 113 m above sea level.

2.2 Climatic Conditions

Kumarganj comes under sub-tropicalregion receiving annually mean precipitation approx. 1000.37 mm. The winter month are usually cool and dry but occasional light showers are also uncommon. The hot period of summer season generally start somewhere is mid-April and continue till the mid-July when the presence of monsoon in the sky. The maximum and minimum temperature, relative humidity, rainfall, sunshine and wind speed data were obtained from the mereological observatory at ANDUA&T campus during cropping period of Isabgol.

2.3 Soil characteristics

The soil of the experimental site was sandy loam with P^{H}7.5. The soil was well drained and retentive to moisture.

2.4 Collection ofIsabgol genotypesfor screening against downy mildew

The thirty-six genotypes were collected from the Department of Medicinal and Aromatic plants at Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) India and sown under natural field conditions. Four lines of each genotype were sown. Details of the genotypes are given in Table no. 1. When the crop was at flowering stage (after 90 days of sown) 10 plants of each of the germplasm/genotype were graded for disease rating scale as per following mentioned in Table no.2.

Table no. - 1.Name of genotypes of Isabgol used for screening against downy mildew.

S. No.	Name of genotype	S. No.	Name of genotype	S. No.	Name of genotype
1.	IM-1	13.	IM-13	25.	IM-25
2.	IM-2	14.	IM-14	26.	IM-26
3.	IM-3	15.	IM-15	27.	IM-27
4.	IM-4	16.	IM-16	28.	IM-28
5.	IM-5	17.	IM-17	29.	IM-29

6.	IM-6	18.	IM-18	30.	IM-30
7.	IM-7	19.	IM-19	31.	IM-31
8.	IM-8	20.	IM-20	32.	IM-32
9.	IM-9	21.	IM-21	33.	IM-33
10.	IM-10	22.	IM-22	34.	IM-34
11.	IM-11	23.	IM-23	35.	IM-35
12.	IM-12	24.	IM-24	36.	IM-36

2.5 Disease Rating Scale

To assess the intensity of disease, ten plants were randomly selected from the lineof genotype and per cent disease intensity was recorded by using percent disease intensity (PDI) formula and 0-5 rating scale as described by Anonymous (2003) [7]. Details of the disease rating scale are given in Table no. 2.

Table no. 2. Disease rating scale.

S. No	Score (0-5)	Reaction	Infested range (%)
1	0	Immune	0.00
2	1	Resistant (R)	1.00-10.00
3	2	Moderateresistant (MR)	10.01-25.00
4	3	Moderatesusceptible (MS)	25.01-40.00
5	4	Susceptible (S)	40.01-60.00
6	5	Highly susceptible (HS)	60.00 and above

The percent disease intensity (PDI) was calculated by adopting standard formula given by Wheeler (1969) [8].

$$\text{Percent disease intensity(PDI)} = \frac{\text{Sum of all numerical value}}{\text{Total number of plant examined} \times \text{maximum grade}} \times 100$$

2.6 Identification of the Pathogen

Binocular microscope was used to observe fungal downy growth and morphological characters such as colour, size, and shape of spore under compound microscope and

measured by using micrometry at 40 X. The pathogen identification was further confirmed with standard references [9].

2.7 Observations recorded

Observations were recorded at flowering stage (after 90 days of sowing) when disease intensityat highest level.

2.8 Statistical Analysis

The data collected during the study, were subjected to the statistical analysis by adopting 'Analysis of variance' techniques as described by Panse and Sukhatme[10].

Figure 1. Screening of Isabgolgenotypes against downy mildew disease.

Figure 2. Downy mildew infected leaves of Isabgol.

3. Results and discussion

3.1 Screening of promising genotypes against downy mildew disease

It is evident from the result present in table – 3& 4, that out of 36 genotypes, none of the genotype /germplasm were found immune and highly susceptible, 8 genotype were found resistance namely IM-2, IM-3, IM-4, IM-28, IM-29, IM-30, IM-32 and IM-36, 15 genotypes were found moderately resistance against downy mildew*viz;* IM-7, IM-12, IM-13, IM-14, IM-16, IM-17, IM-18, IM-21, IM-22, IM-23, IM-25, IM-26, IM-31, IM-33 and IM-35, 8 genotypes were found moderately susceptible against downy mildew i.e., IM-1, IM-8, IM-9, IM-15, IM-20, IM-24, IM-27 and IM-34, 5 genotypes were found susceptible against downy mildewi.e., IM-5, IM-6, IM-10, IM-11 and IM-19.The maximum yield/plot was recorded in IM-2 (580 gm), IM-17(580 gm) and IM-30 (580 gm) followed by IM-14 (510 gm) and IM-28 (510 gm). Whereas minimum yield/plot was found inIM-5 (80 gm) and IM-19 (80 gm) followed by IM-7 (130 gm) and IM-21 (130 gm). Islam [11] evaluated eight genotypes of Isabgol and found highest plant height (42.33 cm), number of tillers per plant (7.33), no of leaves per plant (74), length of spikes (4.03cm, seed weight (2.0g) and seed yield (823kg/ha) in PO-001 and lowest in PO-007. The maximum disease intensity (62.77%) was observed in the crop which was sown on 12th November and least disease intensity was recorded in 28thNovember [12].

Table no. 3. Screening of Isabgol genotypes against downy mildew disease.

S. No.	Genotype	Percent Disease Intensity	Reaction	Yield(g)/Plot3×2 m
1.	IM-1	32.67	MS	240
2.	IM-2	7.67	R	580
3.	IM-3	8.33	R	500
4.	IM-4	7.33	R	260
5.	IM-5	43.33	S	80
6.	IM-6	54.00	S	160
7.	IM-7	20.00	MR	130
8.	IM-8	29.00	MS	210
9.	IM-9	54.33	MS	280
10.	IM-10	51.33	S	133
11.	IM-11	56.00	S	160
12.	IM-12	17.33	MR	330

13.	IM-13	14.33	MR	390
14.	IM-14	14.33	MR	510
15.	IM-15	35.67	MS	500
16.	IM-16	17.00	MR	460
17.	IM-17	17.00	MR	580
18.	IM-18	16.67	MR	260
19.	IM-19	46.00	S	80
20.	IM-20	25.67	MS	160
21.	IM-21	14.00	MR	130
22.	IM-22	17.33	MR	210
23.	IM-23	15.33	MR	280
24.	IM-24	35.67	MS	133
25.	IM-25	17.67	MR	160
26.	IM-26	18.33	MR	330
27.	IM-27	34.67	MS	390
28.	IM-28	7.33	R	510
29.	IM-29	7.33	R	500
30.	IM-30	7.67	R	580
31.	IM-31	17.67	MR	340
32.	IM-32	8.00	R	415
33.	IM-33	21.67	MR	280
34.	IM-34	35.33	MS	470
35.	IM-35	17.67	MR	372
36.	IM-36	7.67	R	470
C.D.(P=0.05)		**4.867**	**-**	
SE(m)) ±		**1.722**	**-**	
CV %		**12.612**	**-**	

Table no. 4. Categorization and reactionof Isabgol genotypesagainst downy mildew.

Reaction	Genotypes/germplasms	No. of genotypes
Resistant (R) (0.01-10 %)	IM-2, IM-3, IM-4, IM-28, IM-29, IM-30, IM-32. IM-36	8
Moderate resistant (MR) (10.01-25 %)	IM-7, IM-12, IM-13, IM-14, IM-16, IM-17, IM-18, IM-21, IM-22, IM-23, IM-25, IM-26, IM-31, IM-33, IM-35	15
Moderate susceptible (MS) (25.01-40 %)	IM-1, IM-8, IM-9, IM-15, IM-20, IM-24, IM-27, IM-34	8
Susceptible (S) (40.01-60 %)	IM-5, IM-6, IM-10, IM-11, IM-19	5

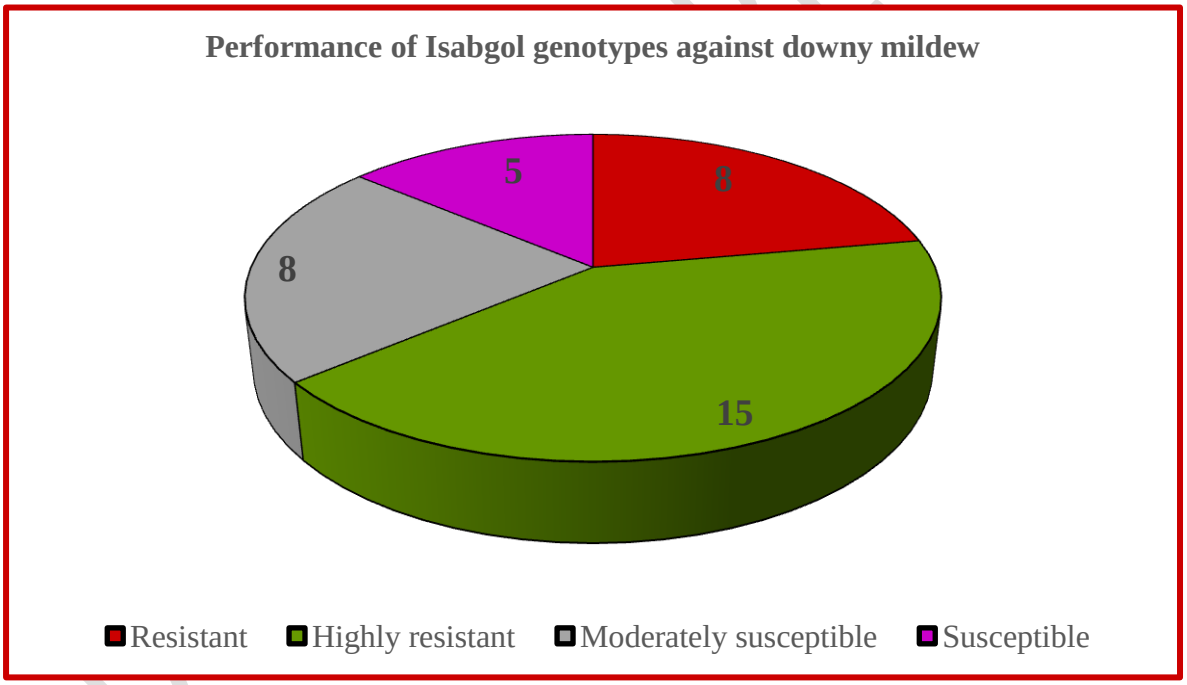

Figure3. Performance of Isabgol genotypes against downy mildew.

4. Conclusion

Out of 36 genotypes,8 genotypes were found resistance,15 genotypes were found moderately resistance, 8 genotypes were found moderately susceptible and 5 genotypes were found susceptible against downy mildew of Isabgol.

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