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Screening of Sesame Genotypes against Powdery Mildew and *Macrophomina phaseolina* Stem/Root Rot Diseases

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

An investigation was carried out with fifty sesame genotypes to identify source of resistance to powdery mildew and macrophomina stem/root rot diseases during late kharif 2022 at RARS, Jagtial under protected conditions. Among the genotypes screened, four genotypes JCS 4047, JCS 4026, JCS 3880 and GT 10 were found resistant to powdery mildew. The powdery mildew PDI was ranged from 25.1%-73.3%. Based on the PDI score, fifty genotypes were classified into Resistant (4), moderately resistant (27) and Susceptible (19) categories. From fifty genotypes, JCS 4047

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showed highly resistant reaction and EC 182833 showed highly susceptible reaction to powdery mildew. The macrophomina stem/root rot incidence was ranged from 65%-100%. FFAT 04 shown the lowest root rot incidence (65%) among fifty genotypes screened. None of the genotypes found to be immune. Identified resistant genotypes can be utilized as parents in breeding programme for development of resistant varieties.

Keywords: Sesame; powdery mildew; macrophomina stem/root rot; PDI; resistance.

1. INTRODUCTION

Sesame (*Sesamum indicum* L.) is an oldest indigenous oilseed crop with the longest history its cultivation in India. It is chiefly confined to tropical and sub-tropical regions and has vintage value for the high-quality edible oil and seed for direct confectionery use. It is the fourth largest oilseed crop cultivated in India after soyabean, rapeseed & mustard and groundnut [1]. The importance of sesame is recognized globally and therefore holds a prime position in the international trade. In addition, the demand for sesame oil has been increasing during the last decade indicating the importance of sesame crop at the global level.

In India,2021-22 sesame is being grown over an area of 16.27 lakh hectares with production of 7.89 lakh tonnes and productivity of 485 kg ha^{-1} (Indiastat, 2022). In Telangana, it is grown over an area of 0.34 lakh hectares with an annual production of 0.26 lakh tonnes and productivity of 766 kg ha^{-1} (Indiastat, 2022).

Sesame grows well in drained soils and in various agro climatic regions. But sometimes it fails to cope with the adverse effect of environmental and biotic stresses. Among biotic stresses, powdery mildew and macrophomina root rot/stem rot are the serious diseases of sesame caused by *Leveillula taurica* or *Erysiphe cichoracearum and Macrophomina phaseolina* respectively. Powdery mildew causes yield loss up to 50% [2] and root/stem rot causes yield loss upto to 5-100% [3]. Macrophomina stem/rot disease causes 25–30% production losses each year, particularly in the turmeric fallows of Northern Telangana Zone [4].

Powdery mildew first appears as small white patches on the upper surface of the leaf, which is usually seen after 30 days after sowing (DAS) and subsequently spread over the entire leaf. In cases of severe infection, fungal spores may damage the lower portion of leaves. The most common symptom of macrophomina root /stem rot disease is sudden wilting of growing plants, which typically occurs after the flowering stage. During severe infection stem and roots of a plant turns black. It had been noted that the pathogen is also seed-borne, which makes it difficult to control [5]. The pathogen lives as sclerotia in the soil and crop residues.

Controlling of these diseases by using chemicals incurs a very high cost of cultivation and also causes adverse effects on the environmental health. Use of the chemicals also causes hazards to the human health. As a result, finding other means of avoiding the damage caused by these diseases is necessary. To combat this, breeding resistant cultivars of an organism is the only possible option. The majority of resistance genes are present in wild species, but their transfer to cultivated species is tedious because the former and latter are incompatible. Therefore, the best option is to choose resistance genotypes from developed germplasm. In the present investigation all the efforts were made to select resistance genotypes and susceptible genotypes so that these can be utilized as parents during future breeding programmes for the development of resistant varieties.

2. MATERIALS AND METHODS

The experimental material consists of 50 genotypes collected from different sources like Tikamgarh, Madhya Pradesh (6), Project Coordinate unit, JNKVV, Jabalpur(16), ARS, Yelamanchili (1), Mauranipur, Uttar pradesh (1), RARS, Polasa, Jagtial (26) and Agricultural Research Station (JAU) Amreli, Gujrat (1).The genotypes were screened during Late *Kharif* 2022 at RARS, Polasa, Jagtial under protected conditions. Each genotype was sown in 2 rows of 3 meter length with 30X15 cm spacing and raised by following all recommended package and practices. Data for screening was recorded at 45-60 days after sowing for powdery mildew screening. From each genotype five plants were selected randomly and from each plant 9 leaves were taken i.e., 3 from apical portion, 3 from middle portion and 3 from basal portion. All 9 leaves were graded and scored by adopting 0-5 score. Level of resistance/susceptibility of the

Table 1. Disease scale

Disease score	Description
0	No infection
1	1-10 % leaf area infected
2	11-25 % leaf area infected
3	26-50 % leaf area infected
4	51-70% leaf area infected
5	71-100% leaf area infected

PDI= (Sum of all numerical ratings/ Total number of leaves analyzed x maximum disease score) X 100

Table 2. Classification of the entries based on Percent Disease Index (PDI)

PDI	Disease reaction
0	Immune (I)
1-30	Resistant (R)
30-50	Moderately resistant (MR)/tolerant (T)
More than 50	Susceptible (S)

genotype was calculated by percent disease index (PDI) given by Mc Kinney [6]. The macrophomina stem/root rot disease incidence was recorded at 90 days after sowing by counting the number of diseased plants and total plants.

On the basis of the Percent Disease Index, the entries were grouped into four categories [7].

3. RESULTS AND DISCUSSION

A set of fifty genotypes were screened for powdery mildew and root rot under protected conditions. Out of fifty genotypes, four genotypes (JCS 4047, JCS 4026, JCS 3880 and GT 10) were found to be resistance against powdery mildew and their PDI varies from 25.1%-27.5%. The most resistant genotype for powdery mildew was JCS 4047 (25.1%) while other genotypes were having good level of resistance like JCS 4026 (25.5%), JCS 3880 (27.3%) and GT-10 (27.5%) (Table 3). A count of 19 genotypes were found to be powdery mildew susceptible (PDI 50.4%-73.3%) and 27 genotypes were found to be moderately resistance (PDI 35.1%-49.9%). Among the 50 genotypes, highly susceptible genotype was EC 182833 i.e., 73.3%.

The incidence of macrophomina stem/root rot was ranged from 65%-100%.Among the 50 genotypes, the lowest macrophomina stem/root incidence was recorded in FFAT 04 of 65% and highest macrophomina stem/root rot incidence was recorded in TKG 21, TKG 55, TKG 306, JTS 8, NIC 16095-A, EC 182833, IS 35-1-A , JCS 4917 and TKG 22 OF 100% .Mohamed and Abdul [8] highlighted that there was highly significant variability in the progeny of all investigated crosses which might be a valuable tool for further breeding programmes for root rot disease management. From the above observation it was cleared that incidence of disease depends on that refer type of genotype and it will change from genotype to genotype. In this investigation none of the genotype was found to be immune. The same result was also reported from the finding of [7,9,10]. But as per [11,12,13,2] few sources of immune genotypes were reported in this crop. This contradictory difference depends on genotype taken for screening, screening technique adopted and difference in scaling of disease. It was also observed that duration of crop has a great influence in disease reaction which is strongly agree with the findings of Mallaiah et al. [14]. Reaction to disease reaction also influence by some agro-botanical trait like leaf breathiness and leaf angle according to M Kabi et al. [15] in case of powdery mildew disease [16].

Table 3. Reaction of 50 genotypes to powdery mildew and root rot disease

S. No.		Powdery mildew		Root rot
	Genotype	PDI	Disease reaction	Disease Incidence (%)
1	TKG 21	53.55	Susceptible	100
2	TKG 55	60.44	Susceptible	100
3	TKG 306	64.44	Susceptible	100
4	TKG 308	54.88	Susceptible	95
5	JTS 8	69.10	Susceptible	100
6	EC3349997	56.22	Susceptible	90
7	NIC 9843	44.66	Moderately resistant	90
8	EC3349998	52.66	Susceptible	92.5
9	NIC 16095-A	34.66	Moderately resistant	100
10	ES 3196	46.88	Moderately resistant	85
11	ES 81	48.21	Moderately resistant	92.5
12	FFAT 17	40.88	Moderately resistant	90
13	ES 28	49.10	Moderately resistant	97.5
14	Madhavi	50.44	Susceptible	92.5
15	EC 182833	73.33	Susceptible	100
16	FFAT 04	42.66	Moderately resistant	65
17	FFAT 16	36.22	Moderately resistant	90
18	EC 330005	55.33	Susceptible	92.5
19	EC 182835	52.88	Susceptible	97.5
20	FFAT 13	49.99	Moderately resistant	80
21	IS 35-1-A	46.885	Moderately resistant	100
22	JCS 3880	27.33	Resistant	87.5
23	Swetha (SC)	54.85	Susceptible	87.5
24	JCS 3287	40.44	Moderately resistant	82.5
25	JCS 4047	25.10	Resistant	95
26	JCS 4026	25.55	Resistant	95
27	JCS 4022	47.77	Moderately resistant	87.5
28	JCS 4018	44.88	Moderately resistant	77.5
29	JCS DT 26	53.33	Susceptible	95
30	JCS 3889	46.44	Moderately resistant	82.5
31	JCS 4020	57.33	Susceptible	87.5
32	JCS RF2	49.32	Moderately resistant	80
33	Pragathi	57.33	Susceptible	95
34	JCS RF4	52.22	Susceptible	77.5
35	JCS 1020	35.99	Moderately resistant	97.5
36	JCS 4894	50.66	Susceptible	77.5
37	JCS 4904	38.44	Moderately resistant	80
38	JCS 4911	62.66	Susceptible	97.5
39	JCS 4917	41.10	Moderately resistant	100
40	TKG 22	39.10	Moderately resistant	100
41	JCS 3890	35.10	Moderately resistant	77.5
42	JCS 3604	40.22	Moderately resistant	87.5
43	JCS 3888	47.55	Moderately resistant	97.5
44	JCS 3758	58.66	Susceptible	85
45	JCS 3605	40.66	Moderately resistant	87.5
46	JCS 2454	47.77	Moderately resistant	82.5
47	JCS 4862	42.44	Moderately resistant	87.5
48	JCS 3202	43.99	Moderately resistant	82.5
49	GT 10	27.55	Resistant	95
50	JCS 2698	48.88	Moderately resistant	97.5

4. CONCLUSION

The present investigation concluded with the outcome that JCS 4047 shown resistant reaction against powdery mildew disease followed by JCS 4026, JCS 3880 and GT-10. FFAT 04 shown the lowest macrophomina stem/root rot incidence percentage (65%) among the screened genotypes. As this investigation was done under protected conditions, the same experiment should be done under non protected conditions to confirm the results obtained in this investigation so that these identified resistant genotypes can later be used as parents in future breeding programmes for the development of resistant genotypes of sesame.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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