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Screening of sesame (*Sesamum indicum* L.) germplasm against major diseases

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Abstract
The root rot disease caused by *Macrophomina phaseolina* is the serious soil-borne disease affecting sesamum. Phyllody, powdery mildew and *Alternaria* leaf spot are the major foliar diseases affecting cultivation of sesamum. Nineteen entries of initial varietal trial and 11 entries of advanced varietal trial were screened against important diseases of sesame under field (sick plot) conditions. In IVT entries, the diseases severity of root rot ranged between 8.2% (IVT-17-19) to 56.6% (IVT-17-6) and the susceptible check VRI 1 recorded the disease severity of 62.4%. Phyllody disease incidence ranged between 8.7% to 16.3%. The check variety VRI 1 recorded 21.4% phyllody disease incidence. Powdery mildew incidence ranged between 0 to 2 grade and *Alternaria* leaf spot incidence ranged from 1 to 3 grade. Among the eleven AVT entries screened under sick plot conditions, AVT-17-11 recorded the lowest incidence of root rot (12.3%). The susceptible check variety VRI-1 recorded 58.4% root rot incidence.

Keywords: Screening, sesamum, IVT entries, AVT entries, diseases

Introduction
Sesame (*Sesamum indicum* L.) an ancient oilseed, is a warm-season annual crop primarily adapted to areas with long growing seasons and well-drained soils. Sesame is grown primarily for its oil-rich seeds with an oil content of around 55 per cent, which come in a variety of colors, from cream-white to charcoal-black. Major factors that limit its productivity besides narrow genetic base are extreme susceptibility to biotic and abiotic stresses. The root rot/stem rot/charcoal rot disease caused by *Macrophomina phaseolina* (Tassi.) Goid, the major disease in sesamum occurs from seedling stage to maturity stage. It is very serious and destructive in all sesame growing areas and causes about 5–100% yield loss. The most common symptom of the disease is the sudden wilting of growing plants when, mainly after the flowering stage, the stem and roots become black due to severe infection. The pathogen survives as sclerotia in the soil and crop residues and has also been reported to be seed-borne, characteristics that make it difficult to control (Maiti *et al.*, 1988) [4]. *Alternaria* leaf spot disease occurs from one month old seedling. Brown coloured, circular to irregular spots with concentric rings appear on the leaves. The pathogen is greatly influenced by weather with the highest disease incidence reported in wet seasons and in areas with relatively high rainfall (Meena *et al*., 2010) [5]. The growth of *A. alternata* was maximum in pH range of 6-6.5 and temperature range of 25-30 °C (Hubballi *et al*., 2010) [3].

Powdery mildew disease appears from 45 days old plants to maturation stage. Symptoms appear as small, cottony spots on the upper surface of the leaves. Phyllody, an important disease of sesame is caused by a pleomorphic mycoplasma-like organism (phytoplasma) and transmitted by leaf hopper. The phyllody disease occurs in the flowering stage. The affected plants become stunted and the floral parts being modified in to leafy structures bearing no fruits and seeds causing yield loss up to 33.9 per cent. Imparting resistance to these diseases will go a long way in enhancing and sustaining the crop production and, therefore, resistance breeding against these maladies needs immediate attention.

Materials and Methods
In uniform disease nursery, 19 entries of initial varietal trial and 11 entries of advanced varietal trial were screened against important diseases of sesame under field (sick plot) conditions. The IVT and AVT entries were sown along with local check VRI-1 in a Randomized block design in two rows of 3 m length and replicated thrice. The root rot and phyllody disease incidence were recorded at 90 days after sowing by counting the number of diseased plants and total plants. Leaf spot and powdery mildew disease intensity were recorded at 75 days after sowing. The leaf spot and powdery mildew disease intensity was assessed using 0-5 disease rating scale as described by Pawelec *et al*., 2006 [7] [0 : No visible disease damage; 1 : <5% leaf area

damaged; 2 : 5-20% leaf area damaged; 3 : 20-40% leaf area damaged; 4 : 40-60% leaf area damaged; 5 : severe defoliation].

Results and Discussion

The pathogenic soil microorganisms reduce seed germination, plant growth and yield. Host resistance is one of the important components of integrated disease management. Breeding for disease resistance requires efficient, low-cost and rapid screening techniques (Foolad *et al.,* 2000) [1]. In Initial varietal trial, among the nineteen IVT entries screened under sick plot condition, root rot, phyllody, powdery mildew and *Alternaria* leaf spot diseases were observed in all the entries. In IVT entries, the diseases severity of root rot ranged between 8.2% (IVT -17-19) to 56.6% (IVT-17-6) and the susceptible check VRI 1 recorded the disease severity of 62.4%. The entry IVT-17-19 recorded the lowest root rot incidence of 8.2%. Mohamed and Abdul (2006) [6] highlighted that there was highly significant variability in the progeny of all investigated crosses which might be a valuable tool for further breeding programs for root rot disease management. Phyllody disease incidence ranged between 8.7% to 16.3%. The check variety VRI 1 recorded 21.4% phyllody disease incidence. Singh *et al.* (2007) [10] documented that a single recessive gene governs phyllody resistance whereas that of interspecific combinations suggested the involvement of a single dominant gene in the analysis of F2 and backcross segregation.

Powdery mildew incidence ranged between 0 to 2 grade and *Alternaria* leaf spot incidence ranged from 1 to 3 grade (Table 1). Several sources of tolerance against Alternaria blight have been reported (Gupta *et al.,* 2001) [2]. Rani and Kiranbabu (2017) [9] reported that sesamum entries JCS 2846, JCS 2892, JCS 3102 and JCS 3258 showed maximum seed development and survival when the material was exposed to thermostress (>400 ^{o}C) during flowering, capsule formation and seed development for two weeks.

In Advanced varietal trial, among the 11 entries screened, root rot incidence ranged between 12.3% (AVT-17-11) to 56.8% (AVT-17-9). Among the AVT entries screened under sick plot conditions, AVT-17-11 recorded the lowest incidence of root rot (12.3%). The susceptible check variety VRI-1 recorded 58.4% root rot incidence. Minimum incidence of phyllody (10.3%) was recorded in AVT-17-6. In other entries, phyllody incidence ranged from 12.7% (AVT-17-10) to 19.6% (AVT-17-1). Powdery mildew incidence ranged between 0 to 2 grade. *Alternaria* leaf spot ranged between 1 to 3 grade (Table 2). Krishnia *et al.* (2000) indicated the effect of additive genes or polygene or cluster gene on mechanism of tolerance to Alternaria blight. Among forty one sesame varieties, Dasak, Namda, Jinki and Mihuek showed a higher rate of germination (14-16%) and Hansum, Poongnam, Pongan, Nambaek and Milsung expressed a lower rate of germination (less than 2%) at Fusarium disease infection condition (Radhakrishnan *et al.,* 2014) [8].

The identification of disease resistant plant varieties is a major goal for agricultural scientists and plant breeders. The results of present study described the presence of sufficient genetic variation with respect to fungal diseases within the screened germplasm and wide range of infection percent. These findings provide a major incentive for breeders to plan a significant breeding program for resistance to diseases.

Table 1: Disease incidence in IVT entries

S. No.	Entries	Root rot (%)	Phyllody (%)	*Alternaria* leaf spot (0-5 scale)	Powdery mildew (0-5 scale)
1.	IVT-17-1	32.4	16.3	2	0
2.	IVT-17-2	38.6	14.7	1	1
3.	IVT-17-3	50.7	12.4	2	1
4.	IVT-17-4	31.9	11.6	3	0
5.	IVT-17-5	37.3	15.3	1	2
6.	IVT-17-6	56.6	14.9	2	1
7.	IVT-17-7	42.3	11.4	3	1
8.	IVT-17-8	48.7	10.3	1	0
9.	IVT-17-9	42.4	12.6	2	1
10.	IVT-17-10	46.8	14.3	2	0
11.	IVT-17-11	28.3	8.7	1	2
12.	IVT-17-12	38.7	11.4	3	1
13.	IVT-17-13	32.1	16.2	3	0
14.	IVT-17-14	42.6	9.7	2	1
15.	IVT-17-15	56.4	13.7	3	1
16.	IVT-17-16	38.3	10.4	2	0
17.	IVT-17-17	34.6	12.6	1	1
18.	IVT-17-18	50.4	14.7	2	1
19.	IVT-17-19	8.2	11.5	1	0
20.	Check VRI-1	62.4	21.4	3	2

* Mean of three replications

Table 2: Disease incidence in AVT entries

S. No.	Entries	Root Rot (%)	Phyllody (%)	*Alternaria* leaf spot (0-5 scale)	Powdery mildew (0-5 scale)
1.	AVT-17 -1	46.3	19.6	2	1
2.	AVT-17 -2	42.7	15.4	1	2
3.	AVT-17 -3	54.6	18.2	3	1
4.	AVT-17 -4	51.9	16.7	3	0
5.	AVT-17 -5	45.2	13.6	2	1
6.	AVT-17 -6	52.4	10.3	2	0
7.	AVT-17 -7	38.6	14.2	2	2
8.	AVT-17 -8	52.7	13.9	3	0
9.	AVT-17 -9	56.8	14.8	1	1
10.	AVT-17 -10	48.4	12.7	2	1
11.	AVT-17 -11	12.3	15.1	2	2
12.	Check VRI-1	58.4	24.6	3	2

* Mean of three replications

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