Effect of predominant mycoflora (*A. alternata* and *M. phaseolina*) on seed quality parameters of sesamum

Abstract

Sesamum is an important oilseed crop affected by toxigenic fungal pathogens *viz.*, *Alternaria, Macrophomina, Fusarium and Aspergillus* spp. Among these, *A. alternata* and *M. phaseolina* are seed borne pathogens causing yield loss to an extent of 20 to 40 per cent. The effect of *A. alternata* and *M. phaseolina* on seed quality parameters of susceptible cv. Swetha was investigated during 2022-2023. The *A. alternata* and *M. phaseolina* inoculated and uninoculated seeds of both test pathogens were tested for germination and seedling growth by rolled paper method and pot culture studies. Significant differences in seed germination, seedling length, seedling dry mass, seedling vigour index (SVI) - I and II and seed moisture content were observed in susceptible cv. Swetha. The results indicated that *A. alternata* recorded lower seed germination percentage (60.50 %), seedling length (6.56 cm), dry mass (9.12 mg) and SVI-I and II (656 and 552 respectively) over untreated seeds recording high germination (82.25 %), seedling length (14.84 cm), dry mass (13.17 mg) and SVI-I and II (1221 and 1116 respectively). Similar results were observed in *M. phaseolina* treated seeds where the pathogen treated seeds recorded lower seed germination percentage (70.75 %), seedling length (9.42 cm), dry mass (8.71 mg) and SVI-I and II (667 and 599 respectively) than pathogen untreated seeds recording high seed germination (82.50 %), seedling length (14.25 cm), dry mass (13.30 mg) and SVI-I and II (1175 and 1097 respectively).

Key words : *Alternaria alternata, Macrophomina phaseolina,* Sesamum, Germination, Seedling Vigour.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the important oilseed crops which is used as quality food, nutrition, edible oil, biomedicine and health care, all in one. The oil is used as the base for ayurvedic preparations and known as the Queen of oil seeds. The crop is consumed due to its rich edible oil content (about 50%) and nutritious protein (about 23%) and having sufficient carbohydrates (15%) Ranganatha *et al.,* (2012). The crop is accepted worldwide due to its several medicinal benefits and it is also rich source of linoleic acid, vitamin E and vitamin B1 (Brar and Ahuja, 1979). The seeds contains amino acids such as methionine, tryptophan and have innumerable health benefits. The therapeutic benefits of sesame seeds is mainly due to the

presence of antioxidants like sesamin, sesaminol and sesamolin (Bedigian, 1985; Moazzami, 2006; El- Bramway and Mahesh, 2010).

Sesamum seeds are often infected by different seed borne mycoflora. Infected seeds disperse mycoflora from seed to seed. They cause seed to deteriorate in the soil prior to germination, resulting in seedling mortality. Many fungi are known to be associated with seeds viz., *Alternaria alernata, Alternaria sesami, Alternaria tenius, Alternaria sesamicola* , *Macrophomina phaseolina, Aspergillus flavus, Aspergillus niger* and some *Fusarium* spp. Among these diseases, leaf spot/blight caused by *Alternaria alternata* and root rot caused by M*acrophomina phaseolina* are currently widespread and pose a major threats to the production and productivity of sesame crop throughout India and with reference to Telangana state. They affect seed quality parameters minimizing the seed germination and seedling vigour.

Materials and methods

The present investigation was carried out in Seed research and technology centre (SRTC), PJTSAU, Rajendra Nagar , Hyderabad**.** Sesamum seed samples collected from different districts of Telangana state were subjected to standard blotter method for the isolation of predominant seed mycoflora *Alternaria alernata* and *Macrophomina phaseolina.*

Isolation of predominant seed mycoflora

For isolation of seed mycoflora associated with Sesamum seed samples were subjected to standard blotter method (ISTA, 2022) in order to study the effect of predominant seed mycoflora *Alternaria alernata* and *Macrophomina phaseolina* on seed germination, seedling length, dry mass and seedling vigour index. The culture filtrate was prepared as follows and data analysed in Completely Randomized Block Design (CRD).

a. Preparation of culture filtrates

The ten day old fungal growth of *Alternaria alernata* and *Macrophomina phaseolina* on the separate agar plate was sampled by scraping . The spore suspension of the predominant fungi was prepared by adding a sample of the colony scrapes to using sterile distilled water by mixing it with vortex mixer for five minutes to separate spores from mycelia. The suspension was

filtered through autoclaved cheese cloth and the concentration of the spores was adjusted to $1x10^9$ ml^{-1} by using a haemocytometer.

b. Seed inoculation

The healthy seeds of susceptible Sesamum cv. Swetha were surface sterilized with NAOH solution and soaked in spore suspension of both the pathogens viz., *Alternaria alernata* and *Macrophomina phaseolina* for 30 minutes and dried at room temperature over night. The seed of control treatment were similarly treated except that they were soaked in sterile distilled water.

c. Rolled paper towel method

This method was used to determine the effect of seed borne inoculum on sesamum seed quality parameters, i.e., germination, seedling length, dry weight and seedling vigour. A hundred seeds of previously *Alternaria alernata* treated seeds and *Macrophomina phaseolina* treated seeds are selected randomly and placed separately in between two layers of moistened germination papers and carefully rolled. The rolled germination papers of both the pathogen treated seeds were kept in slanting positions separately and incubated for 7 days at 25± 2 °C. On the seventh day, the first count of germination was made. The seedlings that looked morphologically normal were counted and germination was expressed as percentage.

d. **Germination percentage (%)**

On the seventh day, all normal developed seedlings were counted. Based on the number of normal seedlings, the germination percentage from each sample in each replication was computed. The following formulae was used to compute the germination percentage (ISTA, 2022).

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \times 100$$

e. Seedling length (cm)

Ten normal seedlings from each replication were selected randomly on 7th day, for measuring shoot and root length. The shoot length was measured from the cotyledonary node to the tip of the apical bud. The root length was measured from the cotyledonary node to tip of the primary root. The mean shoot and root length were expressed in centimetres (cm).

f. Dry mass of the seedling (mg)

The dry mass of the ten normal seedlings were selected for measurement of shoot length and root length were kept in butter paper bags and dried at a constant temperature of 60°C. After 44 hours, the seedlings were removed and allowed to cool in desiccator for 30 min after which the dry mass was recorded and expressed in milligrams (mg).

g. **Seedling vigour index (SVI- I and II)**

Ten normally developed seedlings were randomly selected from the germination test in order to measure the root length and shoot length in centimeters (cm). Vigour index was calculated by the following formulae (Abdul Baki and Anderson (1973).

Vigour Index I = Seed germination (%) x Seedling length (Shoot +Root length (cm))

Vigour index II= Seed germination (%) x Seedling dry wt (mg)

Results and Discussion

Table 1 Effect of *Alternaria alternata* on seed and seedling quality in *Sesamum* cv. Swetha during 2022 -2023

S. No	*Alternaria alternata*	Germination (%)	Seedling length (cm)	Seedling vigour index (I)	Dry mass (mg)	Seedling vigour index II	Moisture content (%)
1.	Pathogen treated	60.50 (51.04)	10.83	656	9.12	552	5.450 (13.49)
2.	Untreated	82.25 (65.07)	14.84	1221	13.17	1116	4.703 (12.50)
	Mean	**71.37**	**12.83**	**938.36**	**11.15**	**834**	**5.07**
	S.Em ±	**0.95**	**0.27**	**26.93**	**1.19**	**23.95**	0.10
	CD at 5%	**3.29**	**0.95**	**93.19**	**0.33**	**84.52**	0.36

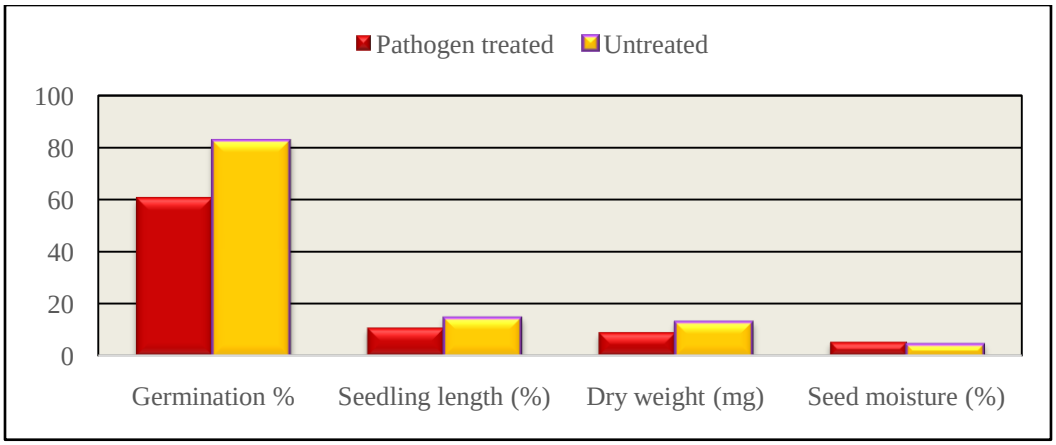

Figure 1: Effect of *Alternaria alternata* on seed quality parameters in *Sesamum* cv. Swetha

Figure 2: Germination of *Alternaria alternata* treated and untreated seeds

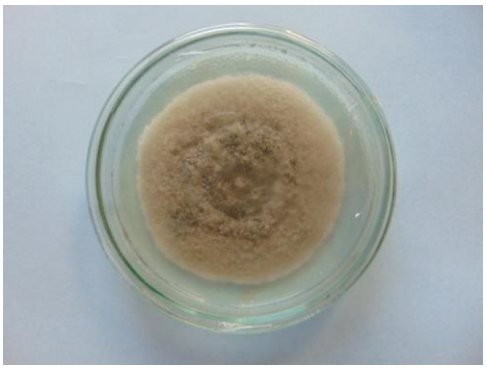

Figure 3: *Alternaria alternata* culture on Potato Dextrose Agar media plate

Significant differences in seed quality parameters were observed in susceptible *Sesamum* cv. Swetha which was artificially inoculated with conidial/ mycelial suspensions of *Alternaria alternata* compared to untreated seeds. The pathogen treated seeds showed significant differences in respect of germination percentage and treated seeds showed a lower seed germination percentage (60.50%) over untreated seeds (82.25%). The treated seeds showed 21.25% reduction in germination percentage over untreated seeds. Significant differences were observed between the seedling lengths of *Alternaria alternata* treated and untreated seeds. The treated seeds recorded lower seedling length (10.83 cm) when compared to the untreated seeds (14.84 cm). In case of treated seeds the seed vigour index - I recorded as 656 compared to untreated seeds (1221). Pathogen treated seeds recorded mean dry mass of 9.125 mg and untreated seeds recorded 13.175 mg. Seedling vigour index –II of untreated seeds was 1116 as compared with treated seeds 552). The pathogen treated seeds recorded high seed moisture content (5.45%) than the untreated seeds (4.70%). (Table 1 and Fig 1)

The reduction in % seed germination might have been due to usage of energy rich compounds by the fungi that are otherwise required for proper germination and production of the enzymes and/ or toxins by the fungi (Irshad *et al*., 2017). This may be due to seed borne fungi like *Alternaria,* which is known to produce some toxins that are detrimental to seed germination (Ramegowda and Naik, 2008). Similar reduction in germination, seed vigour, seedling blight and dry weight were reported by Bibi *et al*., (2023) , Nayyar et al., (2017) in *Alternaria alternata* and Pravallika *et al*.,(2023) in *Alternaria sesami* when inoculated the *Sesamum* seeds with the pathogen.

Table 2 : Effect of *Macrophomina phaseolina* on seed quality in *Sesamum* cv. Swetha during 2022 - 2023

S. No	*Macrophomina phaseolina*	Germination (%)	Seedling length (cm)	Seedling vigour index (I)	Dry wt (mg)	Seedling vigour index (II)	Moisture content (%)
1.	Pathogen treated	70.75 (57.24)	9.42	667	8.71	599.30	5.410 (13.44)
2.	Untreated	82.50 (65.27)	14.25	1175	13.30	1097.50	4.720 (12.54)

	Mean	**76.62**	**11.83**	**921.09**	**11.00**	**848.40**	**5.06**
	S.Em ±	**1.07**	**0.42**	**31.12**	**0.36**	**27.33**	0.13
	CD at 5%	**3.72**	**1.47**	**107.70**	**1.24**	**94.58**	0.45

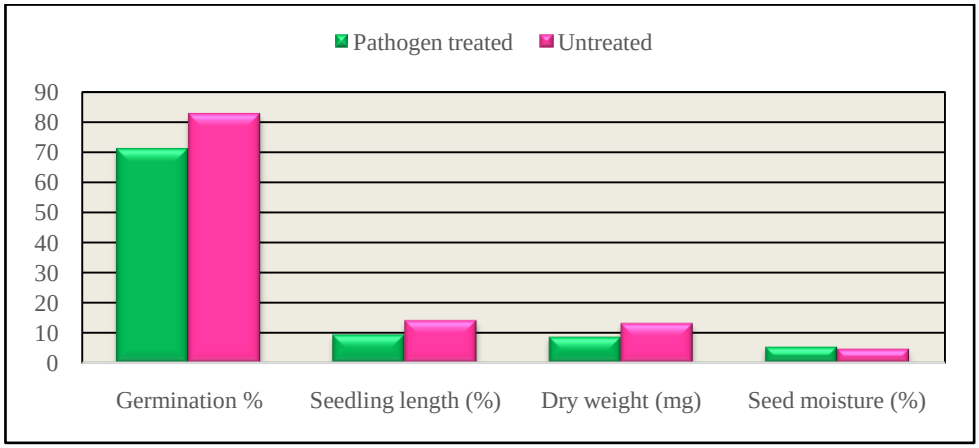

Figure 4 : Effect of *Macrophomina phaseolina* on seed quality parameters in *Sesamum* cv. Swetha

Figure 5: Germination of *Macrophomina phaseolina* treated and untreated seeds in *Sesamum* cv. Swetha during 2022-23

Figure 6: *Macrophomina phaseolina* culture on Potato Dextrose Agar media plate

Significant differences were observed between treated and untreated seeds of *Sesamum* cv. Swetha. The treated seeds showed a lower seed germination percentage (70.75%) when compared to the untreated seeds (82.5%). The treated seeds 11.75% showed reduction in seed germination percentage over untreated seeds.

The effect of *Macrophomina phaseolina* in artificially inoculated seeds of sesamum cv. swetha til recorded germination percentage (70.75%) as compared with untreated seeds (82.5%). Mean seedling length of treated seeds was 9.42 cm while untreated seeds recorded 14.25 cm. Seed vigour index I in treated seeds was 667 and the untreated seeds recorded SVI-I of 1175. Untreated seeds recorded mean dry of 8.710 mg and while untreated recorded 13.30 mg. Seedling vigour index –II of treated and untreated seeds were observed. The untreated seeds showed a higher SVI -II (1097) when compared to treated seeds (599) (Table 2 and Fig 4) The pathogen treated seed recorded higher seed moisture content (5.41%) than the pathogen untreated seeds (4.72%).

The reduction in seed germination might have been due to the enzymes and/ or toxins produced by the fungi. Similar findings were reported by Lakhran *et al*., (2018) in chick pea and Rahman *et al*.,(2002) mungbean.

Conclusion

The study concluded that seed borne fungi *Alternaria alternata* and *Macrophomina phaseolina* inhibit seed germination, seedling length, seedling dry mass, and vigour of *Sesamum* seedlings significantly. Farmers are advised to implement preventive measures such as selecting sesame seeds from healthy fields and then treating the seeds with approved fungicides to promote good germination, vigour, and optimal plant population in the field in order to obtain higher yields. **Acknowledgement**

We are grateful to Professor Jayashankar Telangana State Agriculture University for the financial support, Department of Seed Science and Technology, Seed Research and Technology Centre for providing lab facilities and RARS, Jagtial fo providing sesamum seeds.

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