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Seed Borne Mycoflora of Sesame (*Sesamum indicum* L.) and Their Effect on Germination and Seedling

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Abstract: Seed of 10 sesame (*Sesamum indicum* L.) cultivar supplied by National Agriculture Research Center, Islamabad were tested for seed borne mycoflora by standard blotter paper test. 11 phytopathogenic fungi viz., *Alternaria brassicola*, *A. radicina*, *Aspergillus alba*, *A. flavus*, *A. niger*, *A. viridis*, *Cephalosporium* sp., *Curvularia* sp., *Drechslera* sp., *Fusarium* sp. and *Penicillium* sp. were found associated with these samples. Percentage of seed sample infection and extent of fungal infection ranged from 0.75-53%. The effect of associated fungi on germination capacity was evaluated by the standard rolled paper towel method. The associated fungi decreased the germination potential. 11 fungi were isolated from abnormal seedling and ungerminated seeds.

Key words: Seed borne, mycoflora, sesame (*Sesamum indicum* L.)

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important source of oil and protein. The quality and quantity of oil and protein is adversely affected by biological agents, which consequently influence the product manufactured by sesame seed or its derivatives. The health of sesame plant is affected by fungi by causing infection of root, foliage and seeds. Sesame is grown in marginal and submarginal lands. The products and byproducts of sesame have tremendous value. The sesame seeds yield oil content of 46-52%^[1].

Seed borne mycoflora are carried over by infected seeds. They cause deterioration in seed in soil before germination, causing seedling mortality and cause infection of foliage at adult stage fungi including *Alternaria*, *Curvularia*, *Fusarium*, *Helminthosporium*, *Memnoniella*, *Penicillium* and *Rhizopus* sp. have been found associated with sesame. *Alternaria* sesame is the most destructive pathogen of sesame, as it causes small brown spots on leaf ranging from 1-8 mm in diameter. Infection of seeds reduces viability of seeds. *Alternaria* sesame produces brown necrotic spots on leaves, *Fusarium* sp. which occurs in early stage of the crop growth, yellowing of the leaves is first noticeable symptom^[2]. *Aspergillus* and *Fusarium* reduced the seed germination by causing seed rot. *Fusarium moniliforme* produces brown necrotic lesions on roots and later become seedling invader to cause root rot and seedling blight^[2].

The seed-borne diseases are most disastrous as they reduce the seed vigour and weaken the plant at the initial of its growth^[3]. Seed-borne diseases caused by fungi are relatively difficult to control as the fungal hyphae gets established and become dormant. Information on seed-borne mycoflora of sesame in Pakistan is lacking and needs to be addressed. Therefore, present study conducted to identify mycoflora of sesame seeds and their effect on seed germination and seedlings.

The aim of the present study was to investigate the incidence of seed associated fungi, their frequency of association and their effect on germination and seedling.

MATERIALS AND METHODS

Seed samples: This study was carried out on seeds of 10 cultivars of sesame including Til-93, Ti-89, Lateefi, Tabrazi, Nagari, Johi-1, Johi-2, Sehwani-1, Qallandari, P-37-40. Which were collected from NARC, Islamabad, Pakistan.

Testing procedure: Seeds of all varieties were analyzed for their association of seed-borne mycoflora by standard blotter paper method^[4]. Working samples of 400 seeds were taken at random from each variety. Seeds were plated on 40 (9 cm diameter) sterilized Petri dishes. In each dish 25 seeds were placed on three-layered blotter paper soaked with sterilized water. The seeds were disinfected with chlorox (1 : 4) for about 2-3 min and

subjected to three washing with sterilized water before plating. The plated seeds were incubated at $25 \pm 2^\circ\text{C}$ for a day. On second day, seeds were subjected to freezing for 24 h. to avoid germination. After freezing seeds were incubated again at 25°C . After seven days fungus was observed under stereomicroscope based on habit characteristics. These fungi were cultured on Potato Dextrose Agar medium (PDA) and examined under compound microscope for specific identification. The plated seeds were classified as infected and disinfected to determine the fungal incidence.

Effect on germination: Germination test was carried out by using standard rolled paper towel method^[4]. 100 untreated seeds of each variety were randomly selected and allowed to germinate between two blotter paper layers at 25°C for 7 days. At the end of incubation the number of ungerminated (including rotted) and germinated seeds were counted. The emerged seedlings were graded as normal, abnormal and infected.

Normal seedling: Seedling with well developed root and shoot and free of symptoms.

Abnormal seedling: Seedling with under developed either root or shoot or both and exhibiting disease symptoms.

RESULTS AND DISCUSSION

Fungal incidence has a ranged from 66.75 to 97.50% on cultivars of sesame and classified into four groups. In group one fungal incidence was more than 95% in second group 80-90% in third group 70-80% and in group four 60-70% was found. Cultivars with more than 95% fungal incidence include Til-93, Tabrezi and Johi-2. More than 80% fungal incidence was found on seeds of Til-89 and Johi-1. Seeds of Lateefi, Nagari and P-37-40 showed 70-80% fungal infection. Seeds of Shewani-1 and Qallandri showed fungal infection percentage between 60-70% (Table 1).

11 fungal species were found associated with sesame seed samples. Seed infection percentage fungal varied from 1-5% *Alternaria brassicola* infection % was high on seeds of Til-93 and Til-89 i.e. 13 and 9.25%. Other cultivar, including Lateefi, Tabrezi, Nagari, Johi-1, Johi-2 showed less percentage of fungus. Shewani-1 and Qallandri were free of this fungus. *Alternaria redicina* showed 11% infection on seeds of Til-93 while seeds of Til-89, Johi-1 and Johi-2 were free of this infection.

Aspergillus alba and *A. niger* were found almost on all cultivars. *Aspergillus flavus* was found on seeds of Johi-2 upto 15% while seeds of Nagari and Qallandari

Table 1: Fungal incidence on seeds of ten sesame cultivars

Cultivars	Normal seeds*	Infected seeds*	Fungal incidence %
Til-93	19	381	95.25
Til-89	51	349	87.25
Lateefi	105	295	73.75
Tabrezi	10	390	97.50
Magari	82	318	70.50
Johi-1	49	351	87.75
Johi-2	24	376	94.00
Shewani-1	121	279	69.75
Qallandari	133	267	66.75
P-37-40	87	313	78.25

*Out of 400 seeds of each cultivar

were free of this fungus. *Aspergillus viridus* ranged from 1-12.5% while seeds of Lateefi were free of this fungal disease.

Cephalosporium sp. showed highest percentage on seeds of Til-89 and the seeds of other cultivars showed 9.25% while seeds of Til-93, Shewani-1 and Qallandari were free of this fungus.

Curvularia sp. present on only two cultivars including Johi-1 and Shewani-1, similarly, *Drechslera* sp. was also present on only seeds of Johi-2 and Shewani-1. Seeds of Til-93 showed 6.25% *Fusarium* sp. was also present on only seeds of Johi-2 and Shewani-1. Seeds of Til-93 showed 6.25% *Fusarium* sp. While other cultivars including Lateefi, Johi-1, Shewani-1 and Qallandari were free of this infection. Seeds of Johi-2 showed highest percentage of *Penicillium* sp., while seeds of cultivars including Johi-1 and Qallandari were free of this fungal infection. All the *Aspergillus* sp. were dominant on seeds of ten cultivars of sesame. Two species of *Aspergillus* including *alba* and *niger* were the common fungal observed on 10 sesame cultivars. Three saprophytic organisms causing boll rot were found associated with sesamum includes species of *Alternaria*, *Cephalosporium* and *curvularia*. *Alternaria* infection range was highest on seeds of Til-93 and lowest on seeds of Tabrezi and P-37-40. (Table 2).

Six fungal species reported here namely *Flavus*, *sesami*, *Moniliforme*, *Sitophila nigricure* and *Bassicola* have been reported earlier on sesame seeds from India^[2].

During seed germination all ten cultivars showed fungal infection Johi-1 showed higher number of fungal infection and have type of fungus including *Aspergillus alba*, *A. niger*, *A. viridus*, *Cephalosporium* sp., *Curvularia* sp. showed 40% abnormal seedling, 43% normal seedling and 17% rotted seeds (Table 3).

Seeds of Tabrezi showed 29% abnormal seedling and 22% rotted seeds and showed fungus including *Alternaria redicina*, *Aspergillus alba*, *Aspergillus niger* and *Penicillium* sp. Seeds of Nagari showed 24% abnormal seedling, 41% normal seedling and 35% rotted seeds. Fungus isolated from Nagari including *Alternaria*

Table 2: Fungal infection percentage on seeds of ten cultivars of sesame

Fungus	Til-93	Til-89	Lateefi	Tabrezi	Nagari	Johi-1	Johi-2	Sehwani-1	Qallandari	P-37-40
<i>Alternaria brassicola</i>	13.00	9.25	4.25	5.00	1.25	1.50	3.75	0.00	0.00	0.25
<i>Alternaria radicina</i>	11.00	0.00	3.75	3.00	7.50	0.00	0.00	2.50	7.75	0.75
<i>Aspergillus alba</i>	29.00	28.25	25.50	53.00	24.50	22.50	33.00	25.30	25.50	28.80
<i>Aspergillus flavus</i>	3.75	9.50	6.25	12.30	0.00	12.30	15.00	3.25	0.00	6.75
<i>Aspergillus niger</i>	20.50	20.50	25.75	23.80	33.00	33.00	12.30	22.00	23.80	26.00
<i>Aspergillus viridus</i>	6.75	4.00	0.00	1.00	5.25	3.50	8.75	9.50	9.75	12.50
<i>Cephalosporium sp.</i>	0.00	10.00	0.25	0.25	3.75	7.50	8.25	0.00	0.00	1.25
<i>Curvularia sp.</i>	0.00	0.00	0.00	0.00	0.00	7.25	0.00	3.25	0.00	0.00
<i>Drechslera sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.50	0.00	0.00
<i>Fusarium sp.</i>	6.25	2.75	0.00	1.00	2.00	0.00	3.50	0.00	0.00	0.75
<i>Penicillium sp.</i>	5.00	3.00	4.75	3.25	2.25	0.00	7.50	3.50	0.00	1.25

Table 3: Effect of fungi on seed germination of ten cultivars of sesame

Cultivars	Germ- ination %	Normal seedling %	Abnormal seedling %	Rotted seeds %	Fungus
Til-93	87	67	20	20	<i>Alternaria brassicola</i> , <i>Aspergillus niger</i> , <i>Fusarium sp.</i>
Til-89	82	65	17	18	<i>Alternaria brassicola</i> , <i>Aspergillus alba</i> , <i>Aspergillus niger</i> , <i>Cephalosporium sp.</i> ,
Lateefi	71	52	19	29	<i>Alternaria brassicola</i> , <i>Aspergillus niger</i> , <i>Cephalosporium sp.</i> , <i>Penicillium sp.</i>
Tabrezi	78	49	29	22	<i>Alternaria radicina</i> , <i>Aspergillus alba</i> , <i>Aspergillus niger</i> , <i>Penicillium sp.</i>
Nagari	65	41	24	35	<i>Alternaria radicina</i> , <i>Aspergillus alba</i> , <i>Aspergillus niger</i> , <i>Fusarium sp.</i>
Johi-1	83	43	40	17	<i>Aspergillus alba</i> , <i>A. niger</i> , <i>A. viridus</i> , <i>Cephalosporium sp.</i> , <i>Curvularia sp.</i>
Johi-2	76	64	12	24	<i>Alternaria brassaria brassicola</i> , <i>Aspergillus alba</i> , <i>Aspergillus niger</i> , <i>Drechslera sp.</i>
Sehwani-1	89	68	21	11	<i>Aspergillus alba</i> , <i>A. niger</i> , <i>A. viridus</i> , <i>Curvularia sp.</i> , <i>Drechslera sp.</i>
Qallandari	92	81	11	8	<i>Alternaria radicina</i> , <i>Aspergillus alba</i> , <i>Aspergillus niger</i> .
P-37-40	84	64	20	16	<i>Aspergillus alba</i> , <i>A. flavus</i> , <i>A. niger</i> , <i>A. viridus</i> , <i>Fusarium sp.</i> , <i>Penicillium sp.</i>

radicina, *Aspergillus alba*, *Aspergillus niger* and *Fusarium sp.*

Seeds of Til-93 showed 20% abnormal seedling and 20% rotted seeds and 67% normal seedling. Seeds of P-37-40 showed 20% abnormal seedling 64% normal seedling and 16% rotted seeds. Sehwani-1 showed 21% abnormal seedlings, 68% normal seedling and 11% rotted seeds. Fungal infection is also highest on seeds of this cultivar.

Lateefi and Til-89 showed 19 and 17% abnormal seedling. 52 and 65% normal seedling, 29 and 18% rotted seeds, respectively. Johi-2 and Qallandari showed 12 and 11% abnormal seedling, 64 and 81% normal seedling, 24 and 8% rotted seeds, respectively.

Aspergillus sp. was dominant on all ten cultivars of sesamum. *Aspergillus alba* and *A. niger* were present on all ten cultivars. *Drechslera sp.* and *Curvularia sp.* infection was low on sesamum seedling (Table 3).

Fungus isolated from sesamum seeds (Table 1) were similar to fungus isolated from abnormal seedling

(Table 2) it suggest that seeds are major agent of fungal transmission, seeds should be treated with suitable chemical before sowing to reduced the fungal infection.

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