

## Seed-borne Fungal Contaminants of Sesame (*Sesamum indicum* L.) Seed in Saudi Arabia

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ABSTRACT. Five cultivars of Sesame (*Sesamum indicum* L.) were screened for seed-borne mycoflora. *Alternaria* and *Aspergillus* were the predominant genera represented by five species each. Other genera isolated were *Chaetomium*, *Cladosporium*, *Curvularia*, *Drechslera*, *Fusarium*, *Helminthosporium*, *Mucor*, *Penicillium*, *Pleospora*, *Rhizopus*, *Setosphaeria*, *Stemphyllium*, *Syncephalastrum*, *Trichoderma*, and *Ulocladium*. *Alternaria alternata* followed by *Aspergillus niger* and *A. flavus* exhibited the highest percent occurrence.

*Sesamum indicum* L. is cultivated widely in the South Western part of Saudi Arabia (Jizan region). This crop has multipurpose economical importance. The seeds of sesame are used to garnish bread loafs in sweets and in desserts, also the seeds are used for extraction of sesame oil and the debris of seed after oil extraction is used for animal feed.

Previous studies in Saudi Arabia on sesame are restricted to pathogenic fungi only causing leaf blight, wilt, powdery mildew and anthracnose disease (Abu-Thuraya 1982, Kassim *et al.* 1983). However, none of the investigations have been focused on the seed-borne fungi of sesame seeds. Seed-borne mycoflora from other kinds of seeds have been reported from Saudi Arabia (Abdel-Hafez 1984, Abou-Heilah 1984, Bokhary 1987, 1991).

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**Key Words:** Seed-borne fungi, *Sesamum indicum*, Jizan, Saudi Arabia.

The damage caused by seed-borne fungi, both in the field and in storage, is well known (Neergard 1977, Subeiah *et al.* 1982). It includes deterioration of seeds, reduced germinability and discoloration. It also results in reduced quality and economical value of the seeds (Pettit and Taber 1978, Handoo and Aulakh 1979, El-Shafie and Webster 1981, William and Rao 1981).

The government of Saudi Arabia is currently paying much attention to local agricultural production. The goal is to achieve self-sufficiency in agricultural products of economic value. Since it is deemed necessary, to get economically best crop, to sow best and healthy seeds. Therefore, it is also necessary to have knowledge of seed-borne fungi of seeds of a particular type of crop. Hence, the aim of this research was to study the seed-borne fungi of sesame seeds to catalogue these fungi for a better control measure.

### Materials and Methods

Five cultivars of sesame seeds were obtained from local markets in Jizan and Riyadh, Saudi Arabia. The cultivar (Jizan CvI) was collected immediately after harvest.

Seed-borne fungi were studied according to the "International Rules of Seed Testing Association" (ISTA 1966). The standard blotter and agar method were used. Agar media used were potato dextrose agar (PDA), potato dextrose agar + 3gL<sup>-1</sup> yeast extract (PDA = Y), Czapek-dox agar (CzA) and malt extract agar (MEA). All these media were supplied by Oxoid Limited London.

A total number of 400 seeds from each cultivar (25 seeds per plate) were cultured on each type of media and incubated in the dark at 25°C. Each cultivar was composed of 200 clean seeds and 200 discolored seeds (sixteen plates per cultivar). After seven days of incubation, fungi were examined and isolated. Isolated cultures were maintained on PDA. The percent germination of seeds in soil was determined according to the method of Elshafie and Webster's (1981). The percent germination, percent contamination and percent occurrence were calculated according to Bokhary (1987). Identification of fungi was carried out with the help of description given in the monographs (books) of Raper and Fennel 1965, Zycha *et al.* 1969, Gilman 1971, Barnett and Hunter 1972, Ellis 1971, 1976, Pitt 1979, and Ramirez 1982. Confirmation of the identification of some of the isolates was made by the Commonwealth Mycological Institute, Kew, Surrey, England (1991).

$$\text{Percent germination} = \frac{\text{No. of seed germinated}}{\text{Total No. of seeds}} \times 100$$

$$\text{Percent contamination} = \frac{\text{No. of seed contaminated}}{\text{Total No. of seed incubated}} \times 100$$

$$\text{Percent occurrence} = \frac{\text{Total count of each species}}{\text{Total count of all species}} \times 100$$

### Results and Discussion

A total of 34 fungal species belonging to 18 genera were isolated from five cultivars of sesame seeds (Table 1). The genera *Aspergillus* and *Alternaria* were predominant with five species each, followed by *Curvularia* with three species, *Chaetomium*, *Drechslera*, *Fusarium*, *Mucor*, *Penicillium*, *Ulocladium* with two species each and other genera like *Cladosporium*, *Helminthosporium*, *Pleospora*, *Rhizopus*, *Setosphaera*, *Stemphyllium*, *Syncephalastrum*, *Trichoderma* and *Trichothecium* were represented by a single species each. *Alternaria alternata* exhibited the highest percent of occurrence followed by *Aspergillus niger* and *A. flavus*. These three species were found in all the types of cultivars of sesame seeds. *Alternaria triticiniae* and *Rhizopus oryzae* exhibited the least percent occurrence and were both found only in the seeds of cultivar number five. Both the blotter and agar medium methods exhibited almost the same pattern for percent occurrence of individual fungi, although percent occurrence was higher on agar medium than on filter paper. For both methods, the number of species found and the percent occurrence was higher for discolored than for normal seeds.

The percent emergence of *Sesame* seeds in soil was generally higher for normal seeds than for discolored seeds for all cultivars (Table 2). These results are similar to the earlier findings by El-Shafie and Webster (1981) and Bokhary (1986).

The percent germination of normal seeds (clean seeds) was highest on potato dextrose agar and lowest on filter paper (Fig. 1). While the percent contamination was generally highest on PDA+Y medium and lowest on filter paper (Fig. 2). The percent germination and contamination of discolored seeds were generally highest on malt extract agar and lowest on filter paper (Fig. 1,2) for sesame seed from all cultivars.

**Table 1.** Percent occurrence of fungi on Sesame seeds

Isolates	% Occurrence*				Cultivar***
	AM**		BM**		
	N	D	N	D	
<i>Alternaria alternata</i> (Fr.: (Fr.) Keissler	14.3	76.3	18.4	34.3	1-5
<i>A. chlamydospora</i> Mouchacca	0.4	1.3	-	-	5
<i>A. tenuissima</i> (Kunze: Fr.) Wiltshire	-	0.6	-	-	3, 5
<i>A. triticina</i> Prasada & Pradhu	-	0.3	-	-	5
<i>Alternaria</i> sp.	-	1.6	-	-	3, 5
<i>Aspergillus flavus</i> Link	16.4	31.9	12.2	14.6	1-5
<i>A. niger</i> van Tieghem	31.5	56.6	6.3	20.3	1-5
<i>A. ochraceus</i> Wilhelm	12.6	14.6	-	4.6	3, 4, 5
<i>A. sacchari</i> Chaudhuri and Sachar	-	2.9	-	-	5
<i>A. terreus</i> Thom	-	4.3	-	2.0	4, 5
<i>Chaetomium globosum</i> Kunze ex Fries	-	1.6	-	-	5
<i>Chaetomium</i> sp.	2.3	6.6	-	-	2, 4, 5
<i>Cladosporium cladosporioides</i> (Fres.) de vries	-	4.6	-	-	3, 5
<i>Curvularia affinis</i> Bodijn	-	3.0	-	-	5
<i>C. lunata</i> (Wakker) Bodijn	13.4	21.3	-	7.3	2, 3, 4, 5
<i>C. verruculosa</i> Tandon & Bilgrami	-	1.3	-	-	5
<i>Drechslera australiensis</i> (Bugnicourt) Subram. & Jain ex M.B. Ellis	5	15.9	3	7.0	2, 3, 4, 5
<i>D. rostrata</i> (Drech.) Rich & Fras	6.2	8.3	-	2.3	3, 4, 5
<i>Fusarium oxysporum</i> Schlecht ex Fr.	-	0.6	-	-	5
<i>F. moniliforme</i> Scheldon	-	12.3	-	-	2, 4, 5

Table 1. Contd.

Isolates	% Occurrence*				*** Cultivar
	AM**		BM**		
	N	D	N	D	
<i>Helminthosporium</i> sp. Link	-	0.6	-	-	3
<i>Mucor circinelloides</i> (Van Tieghem) V. arx	-	2.0	-	1.0	3, 5
<i>Mucor</i> sp.	-	1.3	-	-	3
<i>Penicillium digitatum</i> Sacc.	3.2	10.9	1.6	4.6	5
<i>Penicillium</i> sp.	-	2.9	-	-	5
<i>Pleospora infectoria</i> Fuckel	-	1.3	-	-	3, 5
<i>Rhizopus oryzae</i> Went & Prinsen Geerligs	-	0.3	-	-	3, 5
<i>Setosphaeria rostrata</i> Leonard	-	1.3	-	-	5
<i>Stemphylium</i> state of <i>Pleospora</i> <i>herbarum</i> (Pers. ex Fr.) Rabenh.	-	3.0	-	1.0	3, 5
<i>Syncephalastrum racemosum</i> Cohn ex Schroeter	-	1.3	-	-	5
<i>Trichoderma</i> sp.	1.2	3.3	-	-	3, 5
<i>Trichothecium roseum</i> (Pers.) Link & Gray	0.6	1.6	-	-	3, 5
<i>Ulocladium alternariae</i> (Cooke) Simmons	1.2	2.3	-	-	5
<i>U. chlamydosporum</i> Mouchacca	-	1.3	-	-	5

\*% Occurrence from 200 seeds of each cultivar.

\*\*AM: Agar plate method (PDA), BM : Blotter method, N: Normal seeds, D: Discoloured seeds.

\*\*\*Sample number : 1, Jizan Cv1 : 2-5, Unidentified local cultivars.

**Table 2.** Percent germination of *Sesamum indicum* seeds in soil

Cultivars	Percent emergence from soil after 5 days*		Percent healthy seedling after 10 days*		Percent healthy seedling after 20 days*	
	Normal	Discoloured	Normal	Discoloured	Normal	Discoloured
JCv1	91 ± 5	76 ± 7	83 ± 6	52 ± 6	43 ± 5	36 ± 6
Cv2	85 ± 4	66 ± 5	69 ± 8	34 ± 6	34 ± 4	23 ± 6
Cv3	87 ± 5	47 ± 9	64 ± 6	21 ± 5	35 ± 5	18 ± 3
Cv4	89 ± 6	53 ± 6	65 ± 8	26 ± 6	31 ± 5	18 ± 2
Cv5	89 ± 8	36 ± 5	56 ± 7	18 ± 4	26 ± 6	12 ± 3

\*Data are the means of 3 replicates. Numbers adjacent to the means are the standard error.

This is the first record of seed-borne fungi from sesame seeds in Saudi Arabia. The fungal genera and species isolated here were similar to seed-borne fungi reported earlier from other types of seeds in Saudi Arabia (Abdel-Hafez 1984, Abou-Heilah 1984, Sejiny *et al.* 1984, Bokhary 1987, 1991) and from elsewhere (Abughnia and Farraj 1978, Sulaiman and Husain 1985, Zad and Ale-Agha 1985).

Sesame cultivar number 5 was most susceptible to seed-borne fungi, as exhibited by the results in Table 2. This was followed by cultivar number 3 and number 4. Cultivar number 1 was the least susceptible as only 3 fungal species were isolated from this cultivar. Moreover, it had the highest percent seedling emergence after 20 days of incubation.

We have shown that there is a large number of fungal species associated with *Sesame* seed in Saudi Arabia. The greatest numbers of fungi were recovered from seeds purchased from local markets. These seeds also exhibited reduced germination, indicating that contamination with fungi interferes with the germination process. Discolored seeds from the cultivars examined had large numbers of fungi and the greatest reduction in germination compared to clean seed.

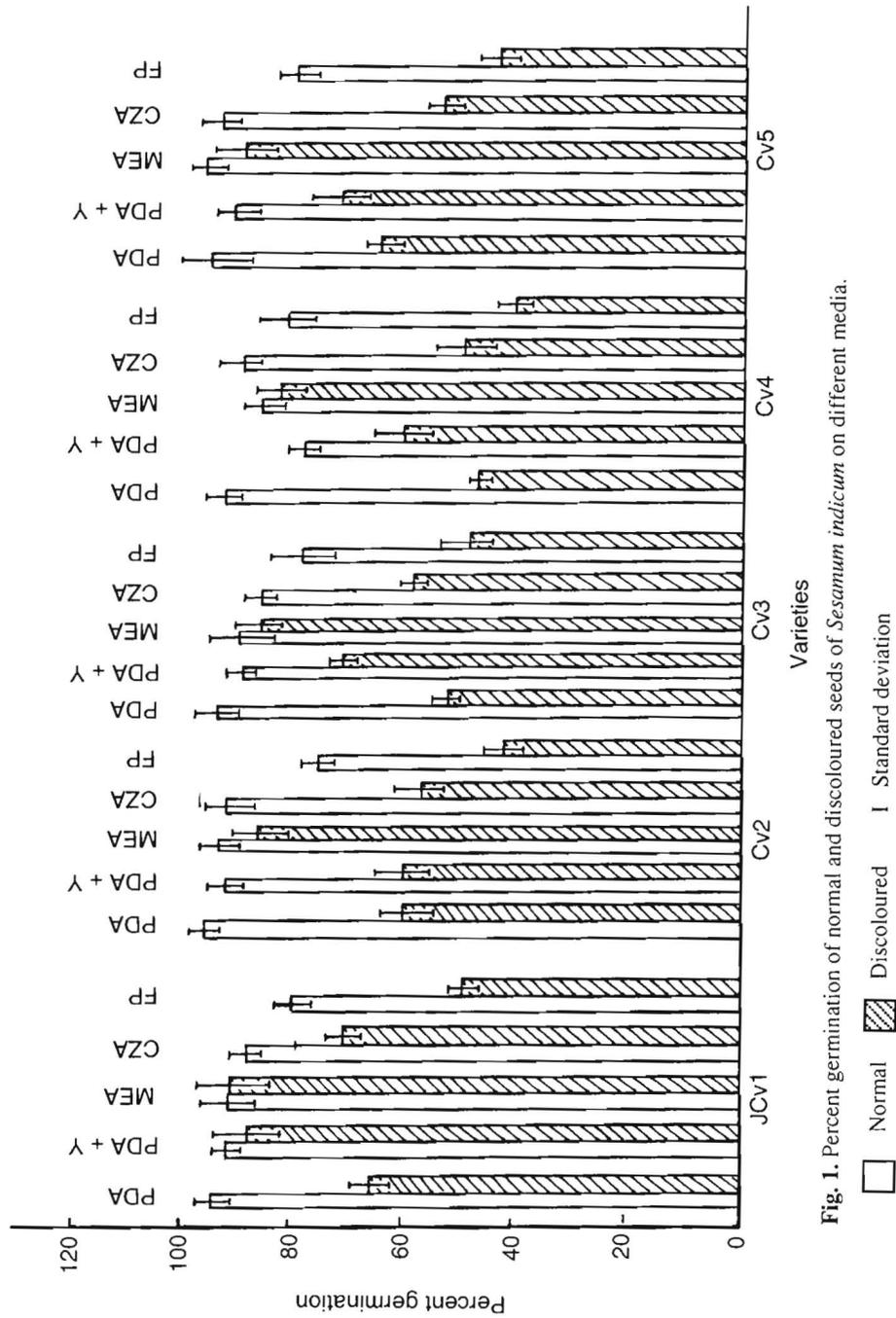


Fig. 1. Percent germination of normal and discoloured seeds of *Sesamum indicum* on different media.

□ Normal    ▨ Discoloured    I Standard deviation

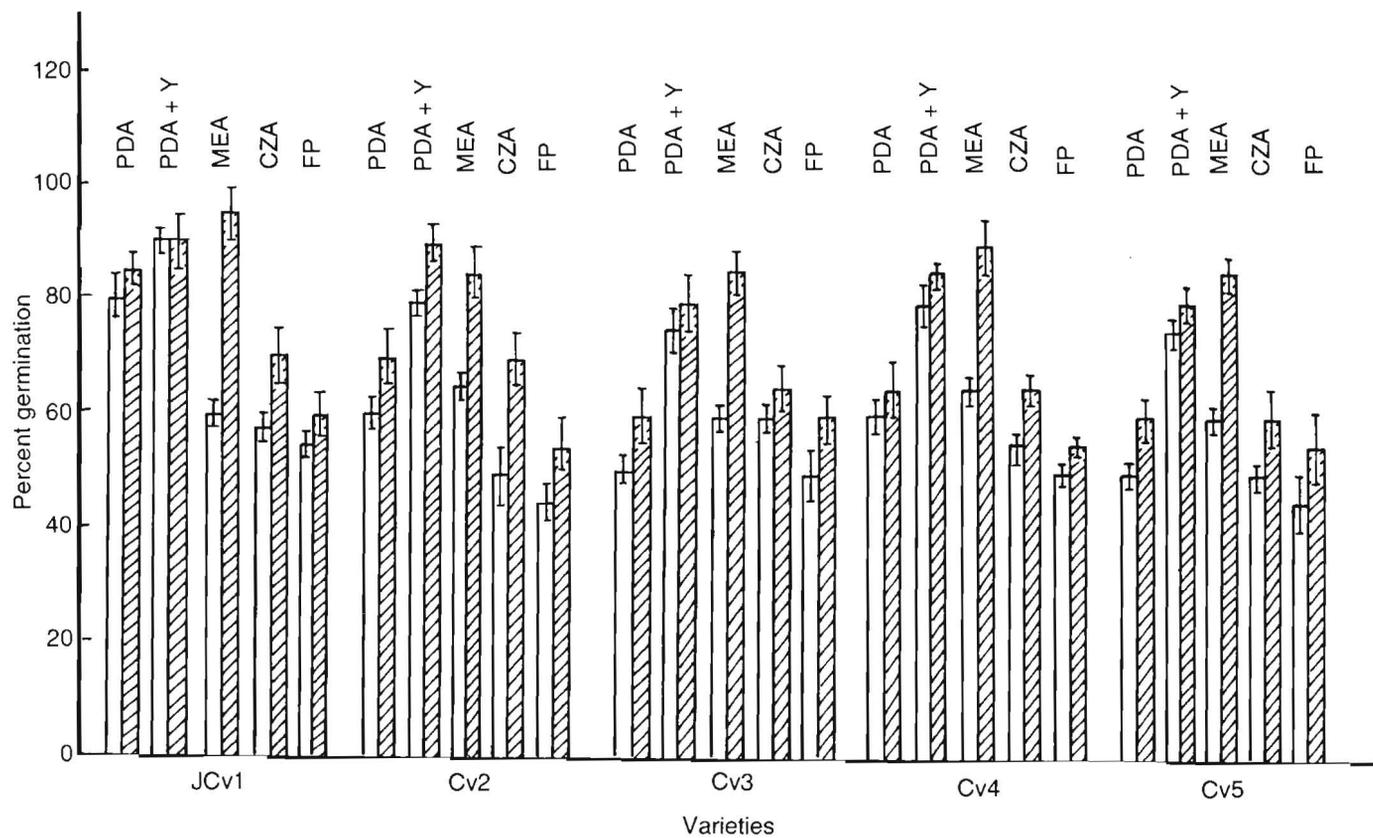


Fig. 2. Percent contamination of normal and discoloured seeds of *Sesamum indicum* on different media.

□ Normal    ▨ Discoloured    I Standard deviation

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## الفطريات الملوثة المنقولة ببذور السمسم في المملكة العربية السعودية

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يعتبر السمسم من أوسع المحاصيل انتشاراً في الجزء الجنوبي الغربي من المملكة العربية السعودية (منطقة جازان) وهذا المحصول متعدد الأغراض في أهميته الاقتصادية . حيث تستخدم بذور السمسم لاستخلاص زيت السمسم الذي يشكل أهمية بالغة في غذاء الانسان وتستخدم كسب هذه البذور في تغذية الحيوان . الأضرار التي تسببها الفطريات المحمولة بالبذور سواء في الحقول أو أثناء عمليات التخزين معروفة للكثير من المشتغلين بعلوم الأمراض النباتية حيث تسبب هذه الأضرار تحللاً للبذور واختزالاً للمراحل الإنبات ، مما يؤدي إلى نقص ملحوظ في الجودة والقيمة الاقتصادية لهذه البذور .

ولقد عنيت المملكة العربية السعودية بالزراعة في خطتها التنموية حيث أصبحت هذه المحاصيل جزءاً هاماً في هذا المجال .

تركزت الدراسات التي أجريت في المملكة على الأمراض الفطرية التي تصيب السمسم كاللفحة والذبول والبياض الدقيقي والأثراكنوز ، بيد أنه لا توجد دراسة على الفلورا الفطرية المحمولة والمنقولة بوساطة بذور السمسم .

لذا التجهت هذه الدراسة لمسح خمس أصناف من السمسم المنتج احدها محلياً لتحديد الفلورا الفطرية المحمولة على بذوره .

أثبتت الدراسة أن جنسي (*Alternaria* and *Aspergillus*) هما الجنسان السائدان حيث يمثل كل جنس بخمس أنواع . . . كما تم أيضاً عزل أجناس أخرى هي :

*Chaetomium*, *Cladosporium*, *Curvularia*, *Drechslera*, *Fusarium*,  
*Helminthosporium*, *Mucor*, *Penicillium*, *Pleospora*, *Rhizopus*,  
*Setosphaeria*, *Stemphyllium*, *Syncephalastrum*, *Trichoderma*, and  
*Ulocladium*.

أعطت فطرة *Alternaria alternata* أعلى نسبة مئوية للحضور تليها فطرة

. *A. flavus* و *Aspergillus niger*