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Quality Assessment of Two Varieties of Sesame Seeds in Bangladesh

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Abstract

Quality status of two varieties of sesame (*Sesamum indicum* L.) seeds namely BARI Til-3 and BARI Til-4 were determined by seed quality analysis. Quality analysis showed that the per cent of the pure seed varies from 97-98. Four types of abnormal seeds were also encountered. BARI Til-3 showed the highest 74 per cent seed germination, whereas, BARI Til-4 showed the highest 19.4 percent seed germination. Mortality of seedling was the highest in BARI Til-4 (20.83%) and lowest in BARI Til-3 (13.90%). The average root-shoot ratio was the highest in BARI Til-3 (8.3- and 39.80 mm) and the average root-shoot ratio was the lowest in BARI Til-4 (2.30-9.40 mm). BARI Til-4 showed the highest fungal incidence (342%) and BARI Til-3 showed the highest (246%) fungal incidence. A total of nine species of fungi *viz*., *Aspergillus flavus* Link, *A. fumigatus* Fresenius, *A. niger* van Tiegh, *Curvularia lunata* (Wakker) Boedijn, *Fusarium merismoides* Corda, a species of *Mucor*, a species of *Penicillium* Link, *Rhizopus stolonifer* (Ehrenb.: Fr.) Vuill and *Trichoderma viride* Pers were isolated from the selected sesame seeds. *Aspergillus* spp. were the most predominating fungi associated with BARI Til-3 and BARI Til-4.

Key words: Quality assessment, sesame varieties, sesame seed.

INTRODUCTION

Sesame (*Sesamum indicum* L.) belongs to the family Pedaliaceae. It is also known as beniseed, gingelley or til. It is considered as 'The queen of oil' in the west. The origin of sesame is in Africa and secondary origin in India. Out of all the edible oil yielding plants, sesame is the second edible oil in our country next to mustard. The scarcity of edible oil both from plant and animal sources is an acute problem in Bangladesh and increasing day by day (Rahman 1994). In 2012, the sesame cultivating area was 33.20 thousand hectares and production was 30 thousand tons (BBS, 2012). More precisely, the area under sesame cultivation was 90.82 thousand hectares in 1989, whereas it decreased to 35.67 thousand hectars in 2012 (Kaul and Das 1986, Miah *et al*. 2014). In Bangladesh two types of sesame are cultivated. These are called black sesame that grows in summer and white sesame that grows in winter. The summer sesame covers about two thirds of the total area of Bangladesh (Bakr and Ahmed 2009). There are many local varieties of sesame with different colors such as BARI Til-2, BARI Til-3, BARI Til-4, BINA Til-1, BINA Til-2, BINA Til-3 etc. Varieties recommended in Bangladesh are T6 and T5805. In Bangladesh, it is mainly grown in Barisal, Comilla, Dhaka, Faridpur, Khulna, Mymensingh, Pabna, Patuakhali, Rajshahi and Tangail. Bangladesh is the 13th in the world for the production of sesame oil (FAO 2010). Predominant genera of fungi associated with sesame seeds were *Alternaria*, *Aspergillus*, *Fusarium*, *Cercospora*, *Penicillium* and *Rhizopus* (Nayyar *et al.* 2013). The objectives of the study were to determine the health status, quality and fungal incidence of two selected sesame seeds of Bangladesh.

MATERIALS AND METHODS

Two varieties of sesame (*Sesamum indicum* L.) seeds namely, BARI Til-3 and BARI Til-4, were collected from Bangladesh Agricultural Research Institute (BARI),

Joydebpur, Gazipur, Bangladesh. The experiment was carried out from May 2015 to July 2016 in the Laboratory of Mycology and Plant Pathology, Department of Botany, University of Dhaka, Bangladesh.

Quality status of two varieties of sesame seeds were determined by seed quality analysis. Further, purity percentage of seeds was determined with the following formulae:

$$\text{Purity percentage of seed} = \frac{\text{Weight of pure seed}}{\text{Total weight of seed}} \times 100$$

Fungi associated with the seeds of *Sesamum indicum* were isolated separately following (a) Blotter method, (b) Tissue planting method and (c) Paper towel method.

The fungi were isolated from the samples following the Tissue Planting method on PDA medium (CAB 1968) and Blotter method as recommended by ISTA (Anonnmolous 1976 and 2014). Four hundred seeds of each samples were placed on three layers of moist blotting paper (Whatman No. 1) in Petri plates. The seeds were washed with sterile water and then surface sterilized by dipping in 10% Chlorox solution for 5 min. Seeds were placed in each plate and incubated at 25 ± 2°C.

A total of 9 species of fungi *viz. Aspergillus flavus, A. fumigatus, A. niger, Curvularia lunata, Fusarium merismoides, Mucor* sp., *Penicillium* sp., *Rhizopus stolonifer* and *Trichoderma viride* were isolated and identified from the seeds. Identification of the isolates were determined following the standard literatures (Barnett and Hunter 1972, 2000, Booth 1971 and Ellis 1976). All the isolated fungi were taken for pathogenicity test.

Pathogenicity of test fungi were done following seed inoculation technique (Chowdhury *et al.* 2015). Four hundred healthy and four hundred spotted seeds were selected from two varieties (BARI Til-3 and BARI Til-4) of sesame and soaked in distilled water in a beaker for three hours. Then the surfaces were sterilized with 10% chlorox for ten minutes. Hundred ml of spore suspension of the test fungi at 10^4 concentration were prepared in a 250 ml sterilized beaker. Four hundred seeds from each variety were inoculated with spore suspension and the beakers were placed undistrubed for 30 minutes. Two hundred of each healthy, spotted and inoculated seeds of two sesame varieties were selected and single seed was placed in sterilized 6 inch cotton plugged test tubes containing 10 ml (2% agar) water agar medium. Healthy seeds served as control. Observation was made for 4 weeks at 3 days interval. Germination percentage of seeds, development of disease symptoms and mortality root shoot ratio of seedlings were recorded on healthy, diseased and inoculated seeds of two sesame varieties.

RESULTS AND DISCUSSION

Quality analysis showed that BARI Til-3 was 98.00% pure and BARI Til-4 was 97.00% pure. Two types of contaminants were present in selected varieties of sesame. The contaminants were inert matter and other crop seeds (weed seeds). The contaminants varied in two varieties. The occurrence of inert matter varied from 0.50- 0.90%. The highest per cent of the inert matter (0.90%) was found in BARI Til-4 and the lowest (0.50%) in BARI Til-3. Ten per cent weed seeds were present in BARI Til-4 but no weed seed was noticed in BARI Til-3 (Table 1).

Table 1. Purity status of the sesame seeds collected from BARI, Gazipur.

Varieties	Pure seed highest (% weight)	Pure seed lowest (% weight)	Inert matter (% weight)	Weed seeds (% weight)
BARI Til-3	98.00	1.50	0.50	-
BARI Til-4	97.00	2.00	0.90	0.10

Abnormal seeds and its frequency of occurrence in two varieties are shown in Tables 2. The highest amount of abnormal seeds (2.00%) was recorded in BARI Til-4 whereas the lowest count (1.50%) was recorded in BARI Til-3. Four types of abnormal seeds were recorded in the present study. The abnormal seeds were discoloured, wrinkled, spotted and undersized seed (Table 2). The highest occurrence of discoloured seed (1.30%) was recorded in BARI Til-4 while the lowest (1.00%) in BARI Til-3. The highest per cent of wrinkled seed (0.10) was found in BARI Til-4 and the lowest (0.06) in BARI Til-3.

Table 2. Abnormal seeds detected in two varieties of sesame seeds collected from BARI, Gazipur.

Varieties	Abnormal Seeds (%)				Total (%)
	Discoloured	Wrinkled	Spotted	Undersized	
BARI Til-3	1.00	0.06	0.04	0.30	1.50
BARI Til-4	1.30	0.10	0.20	0.40	2.00

The highest (0.20%) spotted seed was recorded in BARI Til-4 and the lowest (0.04%) found in BARI Til-3. The highest (0.40%) undersized seed was found in BARI Til-4 and the lowest count was (0.305) in BARI Til-3.

Germination percentage of seeds and seedling mortally are shown in Table 3. The present study revealed that average germination per cent of BARI Til-3 variety was 74.6. The average germination percentage was 19.4 in BARI Til-4 variety. BARI Til-3 showed the highest seed germination (74.6%) while BARI Til-4 showed the lowest seed germination (19.4%), probably due to the fungal infection or high moisture content or poor storage facilities. The standard germination percentage was between 92-98% as recommended by Anonymous (1990). However, the differences in germination status might also be due to differences in storage and handling. The prevalence of seed-borne infection is also responsible for lower germination (Fakir 1990).

Table 3. Mean Germination percentage and seedling mortality of two varieties of sesame seeds.

Varieties	Germination (%)	Mortality (%)
BARI Til-3	74.6	13.90
BARI Til-4	19.4	20.83

The highest mortality percentage value of sesame seedling was found in BARI Til-4 (20.83) and the lowest value was found in BARI Til-3 (13.90%).

Between two varieties of sesame, in BARI Til-3, the average root length was (8.30 mm) and the average shoot length was (39.80 mm) whereas in BARI Til-4, the average root length was (2.30 mm) and the average shoot length was (9.40 mm) (Table 4).

Table 4. Plant height (root shoot ratio) of two varieties of sesame seeds. after 7th days of germination.

Varieties	Root length			Shoot length		
	Highest value (mm)	Lowest value (mm)	Average value (mm)	Highest value (mm)	Lowest value (mm)	Average value (mm)
BARI Til-3	25	4	8.30	70	17	39.80
BARI Til-4	7	3	2.30	20	6	9.40

Results of seed health test revealed the presence of 9 fungal species on seeds and these are *Aspergillus flavus, A. fumigatus, A. niger, Curvularia lunata, Fusarium merismoides, Mucor* sp., *Penicillium* sp., *Rhizopus stolonifer* and *Trichoderma viride*. Among these fungi *Aspergillus* spp. was predominant in both varieties of sesame.

Table 5. Fungal infestation in RARI Til 3 and BARI Til-4.

Fungi	BARI Til-3	BARI Til-4
Aspergillus flavus	71	342
A. Fumigatus	39	25
A. Niger	246	90
Curvularia lunata	-	2
Fusarium merismoides	26	-
Mucor sp.	17	3
Penicillium sp.	28	18
Rhizopus stolonifer	15	12
Trichoderma viride	14	8

;-; = No fungal colony

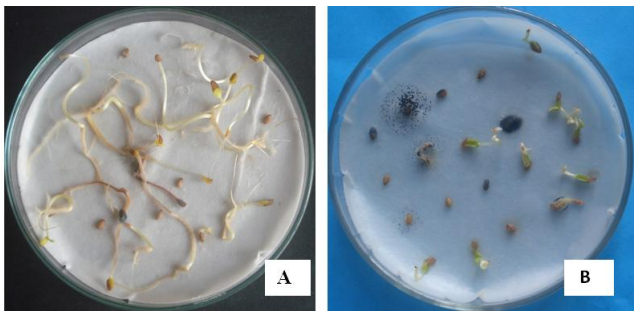

Plate 1. Germinated seeds of *Sesamum indicum* with fungal infestation. BARI Til- 3 and B. BARI Til-4.

Out of 9 species of fungi *A. niger* and *F. merismoides* were reisolated from the inoculated seeds. *Curvularia lunata* did not grow in reisolation but it had bad effect in seeds and seedlings of sesame. It reduced the length of root and shoot of sesame (Hosen 2016).

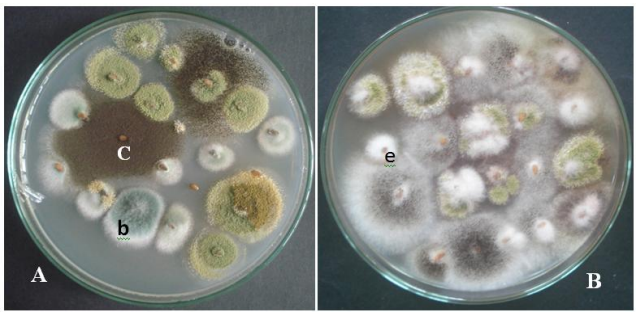

Plate 2. Fungi associated with the seeds of BARI Til-3 variety: Ab. *Aspergillus fumigatus*, c. *A. niger* Be. *Fusarium merismoides*.

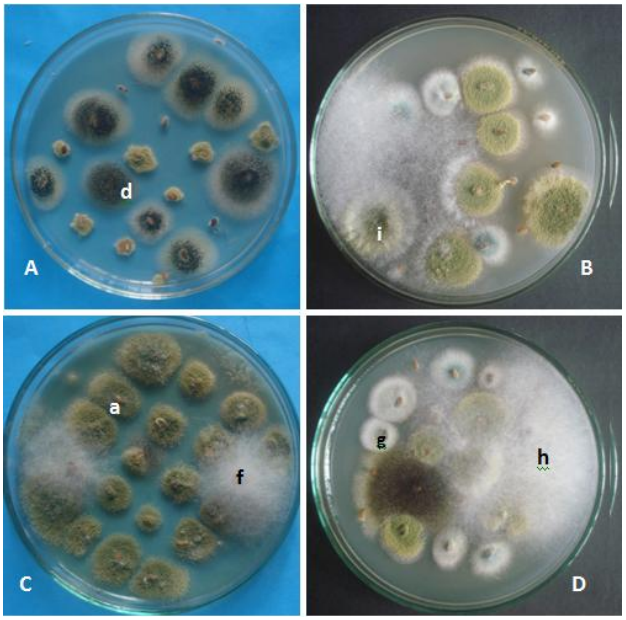

Plate 3. Fungi associated with the seeds of BARI Til-4 variety: Ad. *Curvularia lunata*, Bi. *Trichoderma viridae*, a. *A. flavus*, f. *Mucor* sp., Dg. *Penicillium* sp. and h. *Rhizopus* sp

Nayyar *et al.* (2013) reported a total number of 36 species belonging to 10 genera of fungi were isolated from sesame seeds in Sialkot, Pakistan. The prevalent genera were *Penicillium* (10 species), *Alternaria* (7 species), *Fusarium* (5 species), *Cercospora* and *Cladosporium* (4 species each), *Penicillium*, *Alternaria* and *Fusarium*. Mbah and Akueshi (2000) reported *A. flavus* and *A. niger* as seed borne fungi from sesame in Nigeria. Venkatesagowda *et al.* (2012) reported *A. niger*, *Mucor remosus*, *Penicillium crysogenum* and *Rhizopus stolonifer*s from sesame in Tamil Nadu, India.

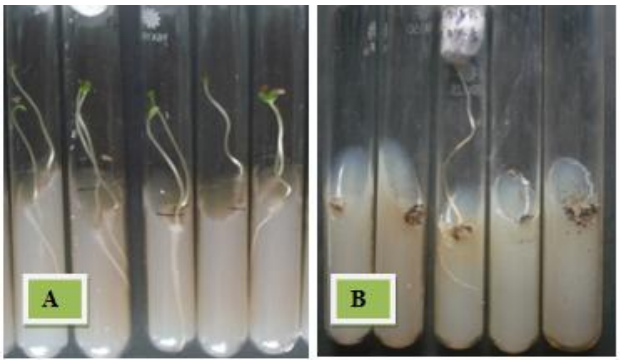

Plate 4. Pathogenicity test of *Aspergillus niger*: A. Healthy seeds and B. Inoculated seeds.

Results of present investigation slightly differ from findings of aforesaid scientist. This may be due to use of difference varieties, location and climate of Bangladesh.

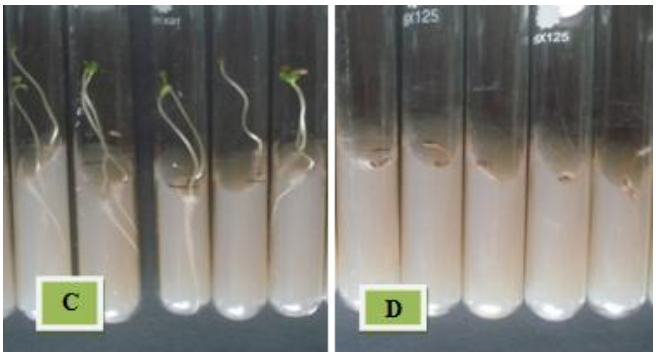

Plate 5. Pathogenicity test of *Fusarium merismoides*: A. Healthy seeds and B. Inoculated seeds

Sesame is one of the oil yielding plants of Bangladesh. Weather and soil of Bangladesh is suitable for large scale production of the plant. Diagnosis of the seed borne diseases of the plant and its control will be helpful for production of healthy sesame plant.

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