

**NEW RECORD ON THE ASSOCIATION OF FUNGI WITH THE MARKET
FRUITS OF *MORINGA OLIEFERA* LAM. - A HIGHLY VALUED
MEDICINAL PLANT**

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Abstract

Moringa (*Moringa oliefera* Lam.) plant is a fast-growing multipurpose tree species growing throughout the world. They are used as human food, animal feed, treatments of many different human diseases, environment and industry etc. A survey on the microbial load was performed with the fruits collected from super market at Riyadh, Saudi Arabia. The collected fruits were incubated in moist chamber under laboratory conditions at 20 - 30°C for 7 - 15 days. The associated fungi were isolated in PDA medium and identified. The recorded fungi are: *Aspergillus niger*, *A. flavus*, *Alternaria alternata*; *Fusarium oxysporum*, *Macrophomina phaseolina* and *Rhizopus stolonifer*. The pathogenicity test was performed with the isolated fungi in detached fruits under laboratory conditions. *A. alternata*, *F. oxysporum* and *M. phaseolina* were proved to be pathogenic. As the fruits are usually used as vegetable and seeds are used as raw materials for oil production, so the quality of raw materials must be thoroughly monitored.

The Moringa (*Moringa oliefera* Lam., Family: Moringaceae) is a fast-growing, multipurpose tree species comprising of 13 species (Mahmood *et al.* 2010) that is well-known for its various medicinal properties, antimicrobial activities, excellent source of nutrition for human food and animal feed, fodder, forage, and other environmental, industrial and general uses (Adebayo *et al.* 2011, Anwar *et al.* 2007, Fahey 2005, Kumar *et al.* 2009, Paliwal *et al.* 2011 and <http://www.cabi.org/isc/datasheet/34868>). The moringa is thought to be indigenous to India from where they have been introduced in many different tropical and subtropical countries (e.g. Robiansyah *et al.* 2014, Sharma *et al.* 2011, <http://www.cabi.org/isc/datasheet/34868>).

Moringa is resistant to most pests and diseases, although root rot caused by *Diplodia* sp. (Ramachandran *et al.* 1980); twig canker caused by *Fusarium pallidoroseum* (Mandokhot *et al.* 1994); fruit rot caused by *Cochliobolus hawaiiensis* (Kshirsagar and D'souza, 1989) are reported and causing minor damages. *A. niger* and *A. flavus* from stem bark (Senu *et al.* 2012) and seed fungi (Martínez *et al.* 2013) are also reported. Zhao *et al.* (2012) detected an endophytic *Nigrospora* sp. from the root. The quality of fruits should be thoroughly monitored before consumption to prevent health hazards and with this understanding the present survey was conducted for the detection and identification of fungi associated with moringa fruits collected from the markets.

A survey on the fungi associated with the fruits was performed with moringa fruits collected from different super markets at Riyadh, Saudi Arabia.

The collected fruits were incubated in moist chamber under laboratory condition at 20 - 30°C for 7 - 15 days. The associated fungi were isolated from the visible growth of fungi on the surface of the fruits in PDA medium modified with antibacterial compounds. The pure cultures of the detected fungi were prepared after several cultivations of fungi in PDA medium.

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The isolated fungi were identified following Barnett and Hunter (1998). The cultures and permanent slides were maintained in the Microbiology laboratory of Soil Science Department, King Saud University for future use.

The pathogenicity test of the isolated fungi was carried out following detached fruit assay. The fruits were inoculated with mycelial block of 4 - 5 days old fungus culture under pricked and unpricked fruits. Unpricked fruits without inoculation were served as control. The selected fruits were inoculated at different sites. The fruits were kept in a moist chamber. The pathogens were re-isolated from the artificially inoculated fruits following the same procedure. The morphological characters of the re-isolated fungi were compared with the original isolates by which the fruits were inoculated.

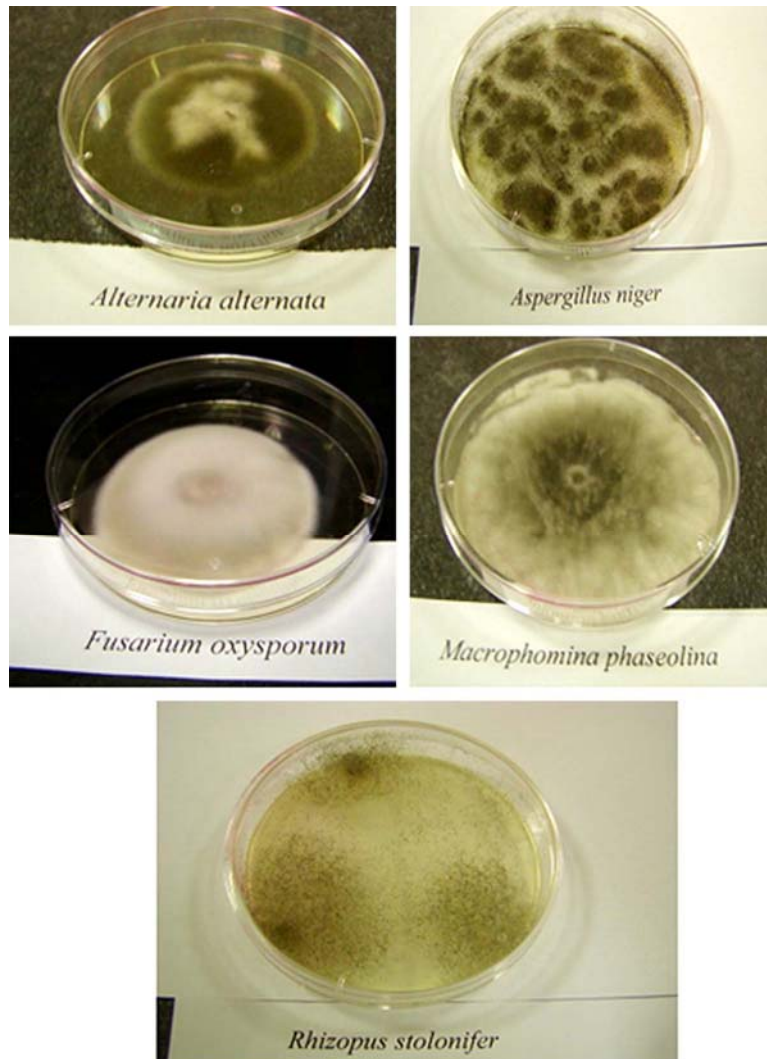


Fig. 1. Fungi isolated from moringa fruits collected from markets.

Altogether 6 different species of fungi belonging to 5 genera were isolated and identified. They are *A. niger* van Tieghem, *A. flavus* Link., *Alternaria alternata* (Fr.) Keissl., *Fusarium oxysporum* Schlecht. emend. Snyder Hansen, *M. acrophomina phaseolina* (Tassi) Goid, and *Rhizopus stolonifer* (Ehrenb.) Vuill. (Fig. 1). Most of the fungi are regarded as plant pathogenic fungi and some are saprophytic fungi. There is no record of fungi associated with market fruits available for consumption of human being. But Senu *et al.* (2012) isolated and characterized the fungal contaminants associated with deteriorated moringa stem barks after storing the freshly harvested stem barks at room temperature. Two species of *Aspergillus*: *A. niger* and *A. flavus* were identified. It was detected that the presence of *Aspergillus* spp. with samples causes bio-deterioration of *M. oleifera* during storage. They also mentioned that the quality of herbal drugs should be thoroughly monitored before consumption to prevent health hazards when consumed as herbal preparations by human. Authors have also reported two species of *Aspergillus* and a few other pathogenic fungi from moringa fruits in our study, which may be detrimental for human health. From Cuba Martínez *et al.* (2013) isolated and identified mycobiota associated with moringa imported seeds. Altogether a total of 708 isolates belonging to 47 species of 26 genera were identified by them. Out of the recorded fungi, *Fusarium*, *Aspergillus* and *Chaetomium*, with 8, 6 and 4 species, respectively were identified. These were the predominant genera constituting 44.35% of all isolates detected during the study. Our study is partly corroborating with them. In the present investigation *Aspergillus* and *Fusarium* have been identified.

Moringa is resistant to most pests and diseases, although a few diseases causing little damages to moringa were recorded. A root rot caused by *Diplodia* sp. (Ramachandran *et al.* 1980); *Fusarium pallidoroseum* causal organisms of twig canker (Mandokhot *et al.* 1994) and fruit rot caused by *Cochliobolus hawaiiensis* (Kshirsagar and D'souza, 1989) were reported. Zhao *et al.* (2012) detected an endophytic *Nigrospora* sp. from the roots of moringa for the first time. Although there is no record of fungi associated with market fruits of moringa but some of the fungi like *Alternaria*, *Aspergillus*, *Fusarium* spp., *Macrophomina*, *Rhizopus* etc. recorded during the present study are also found with seeds, stem bark and fruits as reported earlier. The quality of fruits should be thoroughly monitored before consumption to prevent health hazards because the fruits are usually used as vegetable and seeds are also used as raw materials for oil production.

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References

- Adebayo AG, Akintoye HA, Olufolaji AO, Aina OO, Olatunji MT and Shokalu AO. 2011. Assessment of organic amendments on vegetative development and nutrient uptake of *Moringa oleifera* Lam in the nursery. *Asian J. Plant Sci.* **10**: 74-79.
- Anwar F, Latif S, Ashraf M and Gilani AH. 2007. *Moringa oleifera*: A food plant with multiple medicinal uses. *Phytother. Res.* **21**: 17-25.
- Barnett HL and Hunter BB. 1998. *Illustrated Genera of Imperfect Fungi*, Fourth Edition. APS PRESS. 218 pp.
- Fahey JW. 2005. *Moringa oleifera*: A review of the medical evidence for its nutritional, therapeutic and prophylactic properties. Part 1. *Trees Life J.* **1**:5. Online at: <http://www.tfljournal.org/article.php/20051201124931586>
- Kshirsagar CR and D'souza TF. 1989. A new disease of drumstick. *J. Maharashtra Agricultural Universities* **14**: 241-242.

- Kumar AK, Chalamaiiah M, Kumar RR and Babu KN. 2000. Preliminary studies on biotransformation of drumstick (*Moringa oleifera*) and watermelon (*Citrullus lanatus*) seed oils using Baker's Yeast. *Asian J. Biol. Sci.* **2**: 118-123.
- Mahmood KT, Mugal T and Haq IU 2010. *Moringa oleifera*: A natural gift - A review. *J. Pharm. Sci. Res.* **2**: 775-781.
- Mandokhot AM, Fugro PA and Gonkhalekar SB. 1994. A new disease of *Moringa oleifera* in India. *Indian Phytopath.* **47**: 443.
- Martínez de la Parte E, Cantillo Pérez YT and Rodríguez DG. 2013. Micobiota asociada a lotes importados de semillas de Moringa (*Moringa oleifera*). *Fitosanidad* **17**: 125-129.
- Ramachandran C, Peter KV and Gopalakrishnan PK. 1980. Drumstick (*Moringa oleifera*) a multipurpose Indian vegetable. *Econ. Bot.* **34**: 276-283.
- Robiansyah I, Abdulrahman S, Hajar , Magdy A, Al-kordy and Ramadan A. 2014. Current Status of Economically Important Plant *Moringa peregrina* (Forssk.) Fiori in Saudi Arabia: A Review. *Inter. J. Theor. Appl. Sci.* **6**: 79-86.
- Paliwal R, Sharma V and Pracheta. 2011. A review on horse radish tree (*Moringa oleifera*): A multipurpose tree with high economic and commercial importance. *Asian J. Biotech.* **3**: 317-328.
- Sharma V, Paliwal R, Pracheta and Sharma S. 2011. Phytochemical analysis and evaluation of antioxidant activities of hydro-ethanolic extract of *Moringa oleifera* Lam. *Pods. J. Pharm. Res.* **4**: 554-557.
- Senu AJ, Moses EO and Taiwo E. 2012. Isolation and characterization of fungal species associated with spoilage of *Moringa oleifera* Lam. in storage. *Global Res. J. Microbiol.* **2**: 124-129.
- Watanabe T. 2010. Pictorial Atlas of Soil and Seed Fungi: Morphologies of Cultured Fungi and Key to Species, Third Edition. CRC Press. pp. 426.
- Zhao JH, Zhang YL, Wang LW, Wang JY and Zhang CL. 2012. Bioactive secondary metabolites from *Nigrospora* sp. LLGLM003, an endophytic fungus of the medicinal plant *Moringa oleifera* Lam. *World J. Microbiol. Biotech.* **28**: 2107-12.

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