Diseases and pests of moringa: a mini review

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Abstract

The multipurpose uses of moringa – as medicinal plant, its antimicrobial activities, being a source of nutrition for human food and animal feed and other environmental, industrial uses – make this crop very important. Cultivation of *Moringa oleifera* is spreading across the world under different climatic conditions that may expose the plants to different pests and diseases. The present paper highlights the status of pests and diseases of moringa. Moringa plants suffer from fruit rots, stem rots, root rot, twig canker, etc. Major pests include pod fly, budworm, hairy caterpillars, red mites, etc.

Keywords: moringa, pests, diseases, review

INTRODUCTION

Moringa (belonging to *Moringaceae* family) is a fast-growing, multipurpose tree species. The genus comprises 13 species (Mahmud et al., 2010). The crop is well known for its various medicinal properties, antimicrobial activities, nutritional value as human food and animal feed and other environmental, industrial and general uses (Adebayo et al., 2011; Anwar et al., 2007; Fahey, 2005; Fakurazi et al., 2008; Fuglie, 1999a, b; Kumar et al., 2009; Paliwal et al., 2011; Mridha, 2015) A brief summary of the uses of moringa can also be found in a CABI datasheet, which is available online (http://www.cabi.org/isc/datasheet/34868).

Moringa is also used for ecosystem services, such as erosion control, soil improvement; ornamental, boundary/barrier/support, intercropping; pollution control, etc. (http://www.cabi.org/isc/datasheet/34868; Mridha, 2015). The plants serve as animal forage, biogas, fuel, domestic cleaning agent, blue dye, fencing, fertilizer, foliar nutrient, green manure, gum, honey and sugar cane juice-clarifier, medicine, bio-pesticide, pulp, rope, tannin, water purifier, etc. Various parts of this plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods are used as medicine against multiple human diseases. This crop is thought to be indigenous to India. It is growing either as native or introduced plant in more than 60 different tropical and subtropical countries (Robiansyah et al., 2014; Sharma et al., 2011).

Moringa is resistant to most pests and diseases. But different minor diseases and many pests are recorded from various moringa growing countries. Root rot caused by *Diplodia* sp., twig canker caused by *Fusarium pallidoroseum*, and fruit rot caused by *Cochliobolus hawaiiensis* are some of the reported diseases (Patricio and Palada, 2017; Carbungco et al., 2017; Rajangam et al., 2001). Different fungi and pests are also reported to affect moringa. Hence the quality of moringa products should be thoroughly monitored before reaching the consumer to prevent health hazards. With this understanding, the present mini review was undertaken to raise awareness of the researchers and consumers to avoid health hazards. Because of its multifarious uses, medicinal properties as well as environmental importance, there is an urgent need to assess the status of pests and diseases of moringa.

DISEASES OF MORINGA

Moringa plants are widely recognized as resistant plants against the most common plant pathogenic pests and diseases and many researchers reported that the plants usually

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do not suffer from any serious disease in different regions of the world. But under certain conditions the plants may suffer from various pests and diseases. Recently the author of the present paper reported several pathogenic fungi (Mridha and Al-Barakah, 2015) from the harvested pods which are sold on the markets of the Kingdom of Saudi Arabia. Altogether six different species of fungi belonging to five genera were identified. The identified fungi are *Aspergillus niger* van Tieghem, *Aspergillus flavus* Link, *Alternaria alternata* (Fr.) Keissl., *Fusarium oxysporum* Schlecht. emend. Snyder Hansen, *Macrophomina phaseolina* (Tassi) Goid, and *Rhizopus stolonifera* (Ehrenb.) Vuill. (Figure 1).

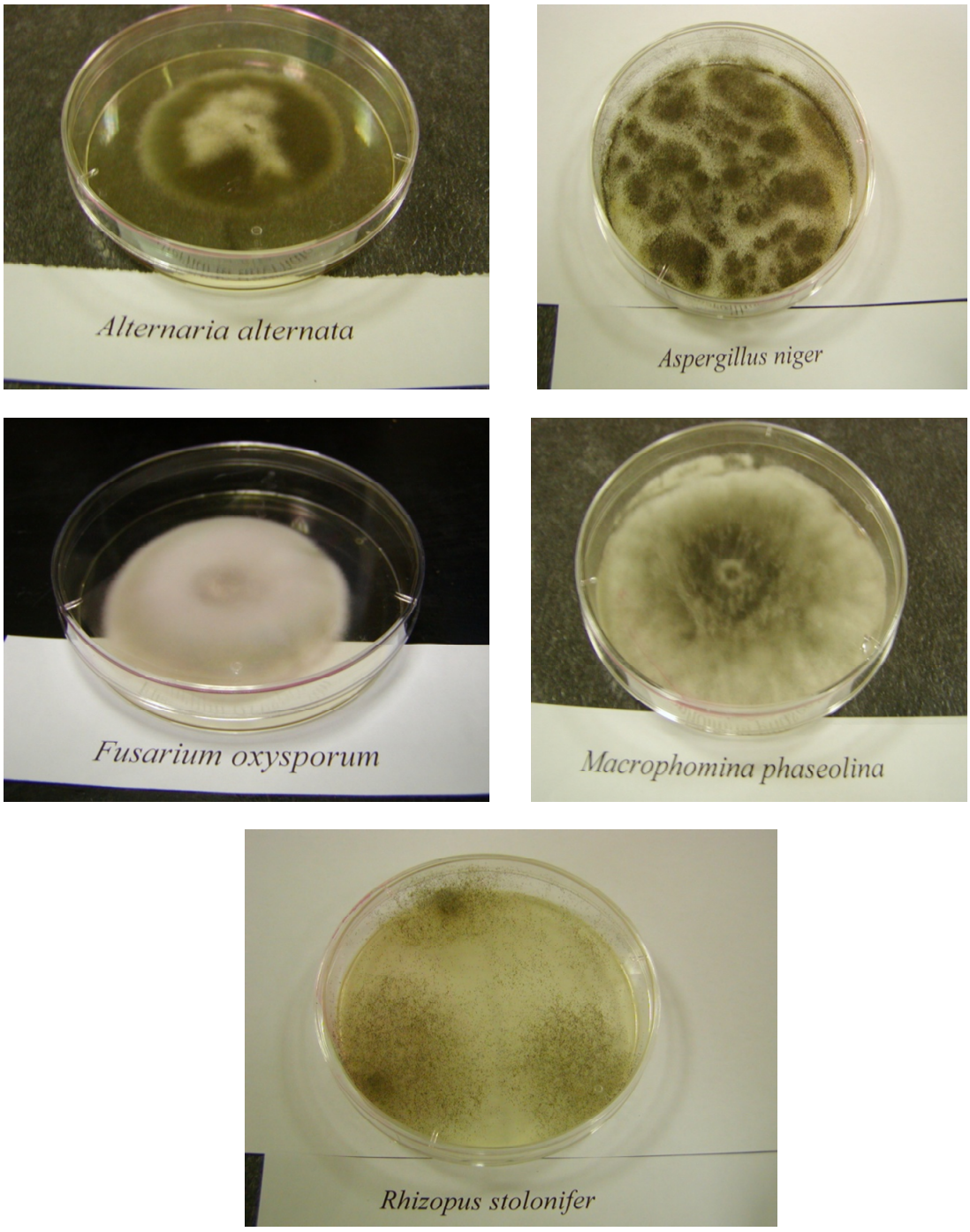

Figure 1. Fungi isolated from moringa pods collected from different markets.

Most of the reported fungi are recognized as plant pathogenic fungi, while some are saprophytic fungi. This is the first record of fungi associated with pods of moringa. In our study, we have recorded two species of *Aspergillus* which may be detrimental for human health. There is no record of fungi associated with moringa pods sold in the markets and meant for human consumption.

During an adaptability and horticultural trial with a large number of accessions of moringa in the Philippines, Patricio and Palada (2017) observed only stem rot disease. Fungal endophytes associated with leaves of *M. oleifera* were isolated, characterized and identified by Carbungco et al. (2017) from the Philippines. They isolated a total of 24 fungal morphospecies. The identified genera of fungi were *Fusarium, Xylaria, Pestalotiopsis, Aspergillus, Nigrospora, Stachybotrys, Rhizoctonia* and *Macrophomina.*

Mycobiota associated with moringa on imported seeds were isolated and identified from Cuba by Martínez de la Parte et al. (2013). A total of 708 isolates belonging to 47species of 26 genera were identified by them. They recorded *Fusarium, Aspergillus* and *Chaetomium*. These were the predominant genera constituting 44.35% of all the isolated fungi.

In their study of stored and freshly harvested stem barks at room temperature, Senu et al. (2012) isolated and characterized the fungal contaminants associated with deteriorated moringa. They observed the presence of fungal pathogens causing deterioration after 7 days of incubation. *Aspergillus niger* and *Aspergillus flavus* were identified by these researchers. They recommended that the quality of herbal drugs be thoroughly checked before use by human beings. Zhao et al. (2012) detected an endophytic *Nigrospora* species from the roots of moringa for the first time.

Rajangam et al. (2001) reported that no major disease in India is affecting the economics of the crop. However, a new disease has developed in the Maharastra region. They also mentioned that pods reaching maturity showed extensive rot. The disease symptoms are observed all over the surface of the pods, more conspicuously at the stigmatic end. On green pods, elliptical or elongated sunken spots with reddish brown raised margins can be observed. Diseased pods shrink to thinner dimensions at their stigmatic ends than healthy ones. In advanced stages of disease development, the pods get rotten and dry up prematurely, leaving uneven raised spots over the surface. The causal organism was identified as *Drechslera hawaiiensis*. This disease appears to be newly recorded for moringa in India.

Several other diseases causing minor damage to trees growing in India are reported by a few researchers: a root rot caused by *Diplodia* sp. (Ramachandran et al., 1980), a new disease of edible pods of *M. oleifera* in Maharashtra caused by *Drechslera* [*Cochliobolus*] *hawaiiensis,* a previously unreported host (Kshirsagar and D'Souza, 1989). Mandokhot et al. (1994) reported a new disease of *M. oleifera* in India. The disease was caused by *Fusarium pallidoroseum* and was reported for the first time as the causal agent of twig canker on *M. oleifera*. The tree is the collateral host of *Leveillula taurica*, a powdery mildew that causes serious damage in papaya (*Carica papaya* L.) nurseries in south India, as reported by Ullasa and Rawal (1984).

PESTS OF MORINGA

Wide spread of occurrence and severe defoliation of the crop was noted in *M. oleifera* growing in agricultural farms of the King Saud University, Saudi Arabia (personal observation of the author). Records of some major and minor pests of moringa in India can be found online at http://agridr.in/tnauEAgri/eagri50/ENTO331/lecture26/Moringa/004.html. The distribution and status of the pests as well as the cause of damage and their management were reported. The reported major pests in India are pod fly (*Gitona distigma*), a serious pest of moringa in South India, bud worm (*Noorda moringae*), a major pest in South India, leaf caterpillar (*Noorda blitealis*), a serious pest of drumstick trees, especially in South India, hairy caterpillars (*Eupterote mollifera*, *Pericallia ricini*, *Metanastria hyrtaca* and *Streblote (Taragama) siva*), are destructive and are found in the Indian subcontinent, bark borer (*Indarbela tetraonis),* long horn beetles (*Batocera rubus*) are widely distributed all

over the Indian subcontinent.

Among the minor pests, aphids (*Aphis gossypii*) is a polyphagous pest. Nymphs and adults suck vital sap from the twigs. As reproduction is mostly parthenogenic, population build-up is rapid. Other minor pests are scale insects (*Ceroplastodes cajani*), bud midge (*Stictodiplosis moringae)* and leaf eating weevils (*Myllocerus* spp.).

Pests of moringa are also mentioned in another website (TNAU Agrictech, 2016). These are: bud worm (*Noorda moringae*), pod fly (*Gitona distigma*), leaf caterpillar (*Noorda blitealis*), bark caterpillar (*Indarbela tetraonis*) and hairy caterpillar (*Eupterote mollifera*) etc.

Patricio and Palada (2017) observed red mites (*Tetranyctrus urticia*), defoliator, leaf-footed bug (*Leptoglossus phyllospus*) and whiteflies (*Bermisia* sp.) in the field during an adaptability and horticultural trial with a large number of moringa accessions in the Philippines and mentioned that the insects cause little damage to the plants. Kant et al. (2017) conducted a survey of insect pests in different parts of *M. oleifera* production fields in Samoa and reported a minor damage of flowers only. They also reported a plant hopper and stem borer causing minor damage to the plants.

Satti et al. (2013) conducted preliminary bio-ecological studies of the leaf caterpillar (*Noorda blitealis* Walker, *Lepidoptera*: *Pyralidae*) in Sudan. They reported a sudden outbreak of unfamiliar caterpillar on *M. oleifera* that caused severe defoliation to the crop in Khartoum State, Sudan. The results of preliminary investigations on certain bio-ecological features were outlined, besides the results of some botanical extracts in controlling the pest. They also mentioned that more emphasis should be given to such an important pest to indicate its distribution range and possible means of eradication, or otherwise effective means of pest management, before it invades new areas in the country. Due to the wide expansion of moringa cultivation in the world, the pest continuously widened its area of distribution during the past few years. Caterpillars on moringa were reported from most countries in Southeast Asia, the Middle East and the Arabian Peninsula. In Africa, it was reported from Ethiopia, Kenya, Somalia, South Africa, Namibia, Gambia, Niger, Madagascar and La Reunion. (Nair, 1970; Butani and Verma, 1981; Butani and Verma, 1984; Gillett, 1997; Demuelenaere, 2001; Parrotta, 2001; Anonymous, 2012).

Yusuf and Yusif (2014) studied the leaf feeding larvae reared through to pupation and to adulthood in Bayero University, Kano State, Nigeria. The adults that emerged were identified to be *Ulopeza phaeothoracica* Hampson. With regard to larval feeding, it was observed that the damage caused by the larvae was extreme on a heavily infested young moringa tree at the study location. They concluded that *U. phaeothoracica* is a leaf feeding pest of *M. oleifera* and its activity could be of serious concern especially on young trees of moringa, kept under poor management conditions.

Mahesh et al. (2014) reported for the first time of drumstick pod fly (*Gitona distigma*), a pest of moringa in India, which has become one of the most serious pests of the crop with infestation starting from pod initiation and persisting till harvest, causing severe damage, especially under poor management conditions. Saha et al. (2014) discussed the importance of several pests of moringa and their management in a popular article. They discussed about bark-eating caterpillar (*Indarbela quadrinotata* Wlk.), moringa budworm (*Noorda moringae* Tams.), moringa leaf caterpillar (*Noorda blitealis* Wlk.), hairy caterpillar (*Euptero temollifera* Wlk.), black hairy caterpillar (*Pericallia ricini* Fabricius.), fruit fly (*Gitona distigmata*) and long horn beetles (*Batocera rubus* Linn.).

Ojiako et al. (2012) conducted an experiment to determine the insect pests of *M. oleifera* Lam. at different stages of growth in the nursery. The insects identified were mainly *Zonocerus variegatus* Linn. (variegated grasshopper), *Musa domestica* Linn. (house fly), *Formica rufa* Linn. (red wood ant), *Lagria villosa* Fabricus (leaf-eating beetle), *Oedaleus nigeriensis* Uvarov (Nigerian grasshopper) and *Homorocoryphus nitidulus* vicinus Walker (edible or long-horned grasshopper). Their result was in agreement with earlier works of Akanbi et al. (2007), who reported *Z. variegatus* as a major pest of most vegetables grown in southern Nigeria. In Puerto Rico, moringa is reportedly very susceptible to attack by termites and the seeds are affected by an unidentified insect (Parrota, 2009).

Rajangam et al. (2001) reported that developing pods are damaged by the fruit fly *Gitona distigmata* which can be effectively managed by adopting integrated pest management (IPM) measures. Butani and Verma (1981) reported 28 different insect species and two species of mites from India on various parts of drumstick trees. Among them, major insect pests are bark-eating caterpillars (*Indarbela quadrinotata* Wlk., *Indarbela tetraonis* Moore.), green leaf caterpillar (*Noorda blitealis* Wlk.), budworm (*N. moringae* Tams.), hairy caterpillar (*Euptero temolifera* Wlk.), black hairy caterpillar (*Pericallia ricini* Fab.), fruit fly (*Gitonia distigmata* Meigon.) and long horn beetles (*Batocera rubus* Linn.). Kareem et al. (1974) reported severe damage of moringa pods caused by a fly of the genus *Gitona* (*Drosophilidae*: *Diptera*). Pillai et al. (1979) identified *Helopeltis antonii* Sign, as a pest of moringa. Verma and Khurana (1974) recorded *Inderbela tetraonis* as a new host of moringa grown in India.

CONCLUSIONS

Although it was reported that moringa is not very susceptible to pest and diseases, given the wide spread of moringa cultivation throughout world, under different climatic conditions; it is likely that the plants will be suffering from various important pests and diseases. Therefore, care must be taken regarding the diseases and pests of moringa to avoid damage to the plantations and subsequent economic losses.

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