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STUDIES ON ROOT ROT OF MANGO SEEDLINGS

BY

KHALED MOHAMED ABD El- GHANY MOHAMED
B. Sc., Plant Pathology, Cairo Univ., 1995

Thesis
Submitted in Partial Fulfillment in the Requirements for the Degree of

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Faculty of Agriculture
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SUPERVISION SHEET

" STUDIES ON ROOT ROT OF MANGO SEEDLINGS"

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B .Sc., Plant Pathology, Cairo Univ., 1995

Under the supervision

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ABSTRACT

Disease survey in the nurseries of mango seedlings indicated that root rot was present in all grown areas at different governorates. The highest percentage of isolated microorganisms was obtained from Gharbia governorate, while the lowest one was found at Fayoum governorate. The most prevalent organisms were *Botryodiplodia theobromae*, *Rhizoctonia solani* and *Fusarium solani*. The three fungi proved their pathogenicity. Evaluation of three varieties of mango against the three pathogens causing root rot disease revealed that Zebda and Hindy were highly susceptible, while Alphonse was less susceptible. The three pathogenic fungi were able to produce PME, PG and Cx *in vitro* and *in vivo* experiments but at different degrees. Disease incidence was more in sandy soil than clay and calcareous soils. In the meantime, increasing of water salinity increased disease occurrence. Determination of some biochemical changes due to infection showed that healthy mango var. Zebda contained higher amount of total sugars and total phenols than var. Alphonse. The infection of var. Zebda caused an in increase in total sugars content than that in Alphonse one, while the infection caused an accumulation of phenols in the var. Alphonse than Zebda one. Histopathological studies of several transverse sections from artificially infected mango roots revealed that *B. theobromae* caused plasmolysis and disorganization with a black discoloration of epidermal and cortical cells, in case of *R. solani* caused separated the epidermal cell from the cortical cell and disorganized them, in the meantime, *F. solani* caused collapsed and disintegrated of cortical cells, chlamydospores were found inside the cortical cells and in xylem vessels. All the tested fungicides decreased the fungal growth *in vitro* and disease percentage *in vivo*, Vitavax-Thiram was the best fungicide, while Monceren was the lowest. Two bioagents namely, *Trichoderma koningii* and *Bacillus coagulans* showed an antagonistic effect. Also, the two bioagents reduced the infection percentage. Addition of two bioagents one week before applying the pathogens was the most affective.

Use Other Side if Necessary

(Cairo Univ. Press. 1524-1984-5000 ex.)

Hamdy Y. Aly

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CONTENTS

INTRODUCTION

Mango (*Mangifera indica* L.) belongs to the family *Anacardiacea* which consists of 41 different species. Mango was introduced to Egypt during 1825 and has been considered to be the " King of fruits " **(Purseglove, 1972)**. The cultivated area is annually increased and reached to 85,972 feddans in 2000 growing season. Only about 64,293 feddans are considered as a fruiting area which yielded 287,226 ton. The average fruit yield per feddan is about 4.47 ton (Reports of Econ. Agric. and Statis. Dept., Ministry of Agriculture, ARE., 2000).

Mango is subjected to attack by many diseases at all growth stages. Each plant part is vulnerable to infect by various pathogens **(Ploetz and Prakash, 1997).** The fungal diseases are the most important ones, which including powdery mildew, blossom blight, die-back, fruit drop, malformation, stem end rot and verticillium wilt. During the last few years, root rot was considered one of the most important diseases affecting mango production and causing a great losses in the nurseries **(Prakash and Singh, 1980; Kore and Patil, 1985)**.

The present research was conducted to study the root rot disease symptoms and the capability of the isolated fungi to infect the intact roots of mango seedlings in relation to their enzymatic activity and histo-pathological studies. In addition, the varietal susceptibility of mango against the root rot disease was evaluated. Also, some factors affecting disease incidence such as soil type and saline water were included. Moreover, the relationship between the chemical components of mango roots and the host susceptibility was investigated. Finally, the effect of either some fungicides or biocontrol agents to control the disease was studied.

REVIEW OF LITERATURE

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Disease symptoms:

Burr *et al.* (1978) reported that the first noticeable symptoms in the nursery caused by *Rhizoctonia solani* on young apple trees is wilting, followed by leaf necrosis and shoots. Numerous, distinct, reddish brown sunken lesions are developed on the white, newly formed roots. These lesions may coalesce to produce large necrotic areas that eventually encompass the entire root, resulting in a collapse and death of the trees. The infection extends from the infected roots to the woody stem tissues. These become discolored and the cortex sloughs off.

Prakash and singh (1980) found that the infected tissues of mango seedlings with *Rhizoctonia solani,* become soft, dark brown or black. The seedlings may ultimately and were completely girdled and collapse.

Lim and Khoo (1985) revealed that *Fusarium oxysporum, F. solani* and *Lasiodiplodia theobromae* (*Botryodiplodia theobromae*) caused sudden wilt symptoms for the young mango seedlings and subsequently defoliate. Roots exhibit a water-soaked, blackened decay, and have an unpleasant, putrid odour.

Mattos and Ames (1986) showed that *Botryodiplodia theobromae* caused defoliation, dieback, basal rot and canker on the trunk and branches of apple. Also, the authors mentioned that the affected tissues showed a dark discoloration.

Burhan (1987) indicated that *Botryodiplodia theobromae* caused blackening and necrosis of the mango tap-root.

Latham and Dozier (1989) stated that the roots of apple trees infected with *Botryodiplodia theobromae* were dull black and tough. The cortical cells were rotted away from the main root, leaving the hard,

black, woody xylem core. Some roots were covered by the remnants of epidermal tissues that appeared like a sleeve draping the central woody core.

Abd El-Hafeez (1991) studied the effect of root rot disease caused by *Fusarium moniliforme, F. moniliforme var subglutinans* and *F. oxysporum* on the morphological characters of mango seedlings, and found that the color of the rotten roots is changed from bright brown to dark one. All the outer layers form phellum to phloem can be easily removed. There is a conspicuous decrease in the number of the secondary roots, and response of arial parts to root rot appeared as pale brown or brownish yellow blotches on the leaves. As the disease progressed, the leaves are died but they do not fall.

The causal organisms:

Snowden (1920) and Small (1921) revealed that *Sphaerostilbe repens* caused a wet root rot of mango.

Small (1922) reported in Uganda that *Armillaria mella* infected the roots of mango and other plants.

Hopkins (1933) isolated *Rhizoctonia bataticola* from rot of the fibrous or very small lateral roots of mango.

Palo (1933) found several species of *Sclerotium* causing seed and seedlings rot of mango. The disease killed 10 % of the seedlings and resulted in a decay of many seed before or during germination.

Muller (1940) indicated that damping-off of mango seedlings due to [*Rhizoctonia* (*corticium*) *solani*] is liable to appear in nurseries in India.

Mircetich and George (1964) stated that *Rhizoctonia solani* caused root rot of avocado seedlings.

Latham and Dozier (1989) reported that root rot of apple rootstock was principally caused by *Botryodiplodia theobromae*.

Abd El-Hafeez (1991) stated that *Fusarium oxysporum, F. moniliforme* and *F. moniliforme var. subglutinans* were the major causal of root rot disease on mango seedlings.

Kore and Mane (1992) indicated that a dry root rot disease of mango seedlings was observed in the nursery. *Fusarium solani* was isolated from the infected seedlings and was highly pathogenic in the inoculation trials.

Mahrous (1994) identified 6 different fungi causing grapevine root rot, *i.e. Botryodiplodia theobromae, Fusarium moniliforme, F. ruseum, F. solani, F. tricinctum* and *Rhizoctonia solani.*

Abd El-Ghany (1995) found that *Botryodiplodia theobromae, Fusarium moniliforme, F. solani* and *Macrophomina phaseolina.* caused root rot disease of grapevine.

Pathological capabilities of the causal organisms:

Muller (1940) mentioned that *Rhizoctonia solani* attacked mango seedlings and caused damping-off disease.

Ragab *et al.* (1971) reported that *Botryodiplodia theobromae* was aggressive and vigorous parasite on a large number of plants, causing a variety of diseases including fruit rot, dry rot, die-back, root rot and wood staining .

Lathan and Dozier (1989) found that fifty six percent of apple trees died due to the infection with *Botryodiplodia theobromae* within 30 days after inoculation. The authors added that the dead trees showed root rot symptoms similar to that observed in the field.

Mahrous (1994) stated that during the pathogenicity test with *Botryodiplodia theobromae* and *Rhizoctonia solani* on either cuttings or rootings of grapevine, it was found that the rootings were infected more than the cuttings.

El-Habba (1997) showed that three isolates of *Botryodiplodia theobromae* isolated from mango, peach and pear were found to be pathogenic on apple fruits.

Gonzalez *et al.* (1997) recorded that *Fusarium solani* was also considered as a pathogenic on citrus trees.

Varietal susceptibility:

Abd El-Hafeez (1991) evaluated some mango varieties against root rot fungi and found that all the tested Poly-embryonic varieties (Mistkawy, Cylon 48, Hindy, Basaten 1, Fajeri klan, Kobanya, Zebda, Timour, Ewiss and Langra) were highly susceptible to root rot disease, while all the Mono-embryonic varieties (Pyri, Alphonse, Gylore and Mabroka) were moderately susceptible.

Enzymatic activities:

Husain and Kelman (1958) reported that among the factors causing rot diseases in various plants, the pectolytic and cellulolytic enzymes produced by the pathogenic organisms were very important.

Bateman (1963) stated that the water extracts prepared from diseased hypocotyls of bean (*Phaseolus vulgaris*) with *Rhizoctonia solani* contained a mixture of polygalacturonase (PG) and pectin methyl esterase (PME). The PG enzyme prepared from diseased tissues was differed from that produced by the fungus in the bean hypocotyl. The same author **(1964)** showed that the cellulase enzyme produced by the