STUDIES ON SOME ROOT ROTS FUNGAL DISEASES OF TURFGRASS IN EGYPT AND THEIR CONTROL

By

AMANY MOHAMED EL-HAREEDY

B.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Cairo Univ., 1999
M.Sc. Agric. Sci. (Plant Pathology), Fac. Agric., Cairo Univ., 2004

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APPROVAL SHEET

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Approval Committee

Dr. EBTSAM MOHAMED EL-SHERIF …….....
Head of Research Plant Pathology, Res. Inst., Res. Center

Dr. MONA MAHER RAGAB…….....……...
Professor of Plant Pathology, Fac. Agric., Cairo University

Dr. HAMDY YOUSEF ……..
Professor of Plant pathology, Fac. Agric., Cairo University

Dr. OLFAT MOHAMED MOUSA.....……..…….
Professor of Plant pathology, Fac. Agric., Cairo University

Date: / / 2011

SUPERVISION SHEET

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SUPERVISION COMMITTEE

Dr. OLFAT MOHAMED MOUSA
Professor of Plant Pathology, Fac. Agric., Cairo University

Dr. HAMDY YOUSEF ALY
Professor of Plant Pathology, Fac. Agric., Cairo University

Dr. SAMY ABDEL-FATTAH EL-MORSY
Senior Researcher, Plant Pathology Res., Inst., Agric. Res. Center.

Name of Candidate: Amany Mohamed El-Hareedy **Degree:** Ph.D.
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Supervisors: Dr. Olfat Mohamed Mousa
Dr. Hamdy Yousef Aly
Dr. Samy Abdel Fattah
Department: Plant Pathology
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ABSTRACT

Some factors were evaluated for controlling root rots affecting *Paspalum vaginatum* plants. Fungi belonging to 10 genera were isolated from the diseased plants. The survey showed a difference in the frequency of the isolated fungi. In general, *Fusarium semitectum, Helminthosporium tetrmera, Macrophomina phaseolina, Pythium splendens* and *Rhizoctonia solani* were found to be the most frequently isolated fungi. The percentages of post-emergence damping-off caused by the tested fungi were decreased by using all the tested treatments compared with the check ones.

Some of physiological studies were carried out using the tested fungi.

Several rates of inoculum potential of the tested fungi were studied and found that the percentages of 3 and 4% were the favourable inoculums since they gave 50% infested plants.

The root exudates of paspalum plants help fungi to growth under specific conditions. Irrigation regime has an effect on plant health and the daily irrigation is the favorite one. Fertilization with nitrogen sources such as urea, ammonium and ammonium nitrate were evaluated.

Biofertilization, such as microbin, phosphoren and potassiumag were studied using the tested fungi *in vitro* and *in vivo*. Chitosan and salicylic were also studied *in vitro* and *in vivo*. Each of chemical and biological control were studied on paspalum plant *in vitro* and *in vivo*.

Key words: Paspalum-compost-chitosan-salsylic-biofertilizer

DEDICATION

I dedicate this work to whom my heartfelt thanks; to my grandfather, my parents and my sisters for their patience and help, as well as to my husband Waleed for all the support they lovely offered along the period of my post graduation.

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CONTENTS

INTRODUCTION

Seashore *(Paspalum vaginatum* Elliot) as an ornamental plant is considered one of the most important turfgrasses plants all over the world. Nowadays, which used in most cases like it was maintained on and around airfields to reduce dust and thereby extend airplane engine life and increase safety.

Turfgrass is used widely to control water and wind erosion and as a utilitarian cover around homes, businesses, parks, cemeteries, and other facilities. Paspalum suffer from different root rots fungal diseases such as, *Fusarium* spp., *Rhizoctoni solani*, *Helminthosporium* spp., *Pythium* spp., *Macrophomina phaseolina*, (Baldwin, 1990) as well as bacterial diseases as well as nematodes and insects. In Egypt, it was suffered from these diseases especially fungal root rots.

No much work is available on Paspalum root rots diseases in Egypt, and little is known about their effect and control. Therefore, the objectives of the present work were to study in details the associated fungal pathogens, their effect on host and their control.

This research also aimed to study the effect of some inducers in controlling root rots in seashore. Systemic acquired resistance (SAR) and induced systemic resistance (ISR) are two forms of the induced resistance; in both SAR and ISR, plant defences are preconditioned by prior infection or treatment that results in resistance (or tolerance) against subsequent challenge by a pathogen and to identify some associated biochemical changes in treated plants compared with chemical control.

REVIEW OF LITERATURE

Isolation, symptoms, identification and causal organisms

Alderman (1988) studied the distribution of *Gloeotinia temulenta, Clavicips purpurea* and *Anguina agrostis* among grasses in the Willamette Valley of Oregon during the summer of 1988 season. The survey was initiated to determine the distribution and severity of the grass and diseases ergot (*C. purpurea*), blind seed (*G. temulenta*) and seed gall nematode (*A. agrostis*). The included grasses were *Agrostis tenuis, Poa paratensis, Festuca rubra* sub sp. *Commutata, F. arundinacea, Lolium multiflorum, L. perenne* and *Dactylis glomerata*. A total of 492 fields were examined. *C. purpurea* was detected in all grasses except *D. glomerata*. The percentages of fields infested with *C. purpurea* were 52% for *P. paratensis*; 13% for *A. tenuis* and 1-3% for *F. arundinacea, L. perenne* and *L. multiflorum*. A survey of weed grasses indicated that *C. purpurea* was a widespread through the Willamette Valley and *F. arundinacea, L. multiflorum* and *Agropyron repens* were the most infested common weed grasses.

Ciccarone and Mazzucchi (1988) stated that the pathogen causing grey patches of lawns was identified as *Physarum polycephalum* according to its characters of the sporangia and spores.

Valle *et al*. (1988) showed that the transmission of endophyte infection *via* the female parent was confirmed on progenies of festulolium hybrids, *i.e*., the dissemination of the fungus occurs only

through the seed of infested plants. The effect of perloline content on the synthesis of the pyrrolzidine alkaloids was not confirmed, which suggests that growth of the fungal endophyte in the host was not affected by the perloline content. Two types of endophyte were found, *i.e.* *Acremonium coenophialum* and another *Gliocladium*-like or *Phialophora*-like species with branched septate mycelium. A high infection with *Erysiphe graminis*, was observed in spring of 1987 season in festulolium plants which heavily infected by *A. coenophialum*. Skipp and Christensen (1989) reported that the fungal invasion of *Lolium perenne* roots was took place during autumn, from 18 sites in New Zealand.

Tisserat *et al*. (1989) found that *Ophiosphaerella herpotricha,* the causal organism of spring dead spot (SDS) of bermuda-grass in Kansas, was consistently isolated from stolons and roots of *Cynodon dactylon*. The fungus was sterile in culture but occasionally produced fertile pseudothecia on the inoculated plants. The optimum growth on PDA was occurred between 20-25ºC. In the greenhouse tests, inoculation with *O. herpotricha* significantly increased root discoloration ratings and decreased root weight of bermuda-grass. The fungus colonized root tissue at soil temperature of 15 and 25ºC. In the field tests, symptoms of SDS were produced on 18 cultivars (1-2 years) after inoculation with *O. herpoticha*.

Baldwin (1990) stated that *Cladochytrium caespitis* causes seedlings damping-off in *Agrostis* spp., *Festuca* spp. and *Poa* spp. A

tentative host range of 21 turf-grass species were susceptible to attack by *C. caespitis*.

Newell and Baldwin (1990) mentioned that natural occurrence of dollar spot disease caused by *Sclerotinia homoeocarpa* was found on *Festuca rubra*, *F. longifolia* and *F. tenuifolia* in cultivar evaluation trials under different management strategies. The disease was recorded on all subspecies of *F. rubra* in the trials. This was the first report of *S. homoeocarpa* on Chewings fescues in the UK. However, the disease was markedly less destructive of the chewings fescues than the slender and strong creeping red fescues.

Yildiz *et al.* (1990) found that the diseased turfgrass plant yielded isolates of *Rhizoctonia* sp. (68.3%), *Curvularia* (68%), *Fusarium* sp. (56%), *Alternaria* sp. (14%) and *Helminthosporium* sp. (5%). Meantime, the commercial seed samples yielded principally *Penicillium, Alternaria* and *Aspergillus* spp. In the pathogenicity tests, *Rhizoctonia* sp., *Fusarium* sp*; Helminthosporium* sp; and *Curvularia* sp. were the most virulent fungi. Varieties of *Lolium,* sp.; *Festuca* sp.; and *Poa* sp. showed differences in their susceptibility to these pathogens.

Johnson-Cicalese and White (1990) revealed that in the laboratory studies, *Festuca arundinacea* and *Lolium perenne* infected by *Acremonium coenophialum* led to a significant greater mortality of curculionids adults.

Nelson and Craft (1991) tested the pathogenicity of 121 isolates of *Pythium* which were isolated from roots and crowns of creeping bent-grass and annual bluegrass under laboratory growth chamber and field conditions. It was found that 46 isolates were pathogenic (disease rating≥2.0) in laboratory tests. From the pathogenic species, *P. graminicola* was isolated most frequently (18.2% of all isolates) and nearly all the tested isolates were highly virulent to creeping bentgrass and perennial ryegrass (*Lolium perenne). P. torulosum* was the most frequently recovered species from turf-grass roots and crowns, but nearly all isolates were not pathogenic. Five pathogenic isolates of *P. torulosum* were recovered and with the exception of one isolate, all were only weakly virulent to creeping bent-grass at 13 or 28ºC.

Kane and Wilkinson (1992) noticed a spreading foliar disease of *Poa annua* during August 1988 and 1991 on golf course putting greens in Northern Illinois, U.S.A. Both growing seasons were hotter and dried than the normal. The causal organism was isolated and identified as *Sclerotium (Corticium) rolfsii*.

Pillo and D'Ercole (1993) isolated the most commonly fungi that identified as *Helminthosporium* spp., *Fusarium avenaceum* (*Gibberella avenacea*), *F. graminerum (G. zea), Alternaria alternata* and species of *Cephalosporium* sp. and *Rhizoctonia* spp. from the leaves and basal portions of stems of turfgrasses collected from Italy.

Pronczuk (1996) identified the causal agents causing diseases for turfgrass at the Institute of Plant Breeding. These diseases included

snow mould (*Microdochium nivale*), red thread (*Laetisaria fuciformis*) and pink patch (*Limonomyces roseipellis*) which may be a problem in *Lolium perenne*. Meantime, important diseases in *Festuca* spp. were pink snow mould (*M. nivalis*), brown patch (*Rhizoctonia* spp.), *Fusarium* blight (*Fusarium* spp.). The turf of *Deschampsia cespitosa* was susceptible to brown patch (*R. solani*) and rust (*Puccinia graminis*).

Hyakumachi *et al*. (1998) studied the isolates of *Rhizoctonia solani* AG2-2 obtained from turf (*Zoysia tenuifolia, Stenotaphrum secundatum* and *Cynodon dactylon*). Also, the symptoms of large-patch disease of warm-season turf-grasses were compared with the known A2-2 isolates belonging to cultural types 3 and 4. Some isolates that were previously identified as type 4 have been separated and named LP isolates. Comparisons among isolates were based on cultural morphology, hyphal growth rate, and pathogenicity test and restriction fragment length polymorphism (RFLP) analysis. LP isolates varied from those of types 3 B and 4. LP isolates did not show any distinct sclerotial formation, zonation, color of mycelia and the pigment deposition was dark brown.

Kim and Park (1999) mentioned that eleven species of *Pythium* were isolated from leaf blight symptoms on creeping bentgrass (*Agrostis palustris*), Kentucky bluegrass (*Poa paratensis*) and Zoysiagrasses (*Zoysia japonica*) on golf courses in Korea Republic. The mycelia growth *in vitro* showed that *Pyhium* species obtained

could be divided into 4 groups based on their responses to temperature conditions. *P. vanterpoolii* was found to favor at low temperature conditions, with an optimum temperature of 25ºC, whereas *P. aphanidermatum* and *P. myriotylum* favored relatively at high temperatures, with an optimum of 35ºC. Other species were the intermediate group with an optimum of 25 -35 ºC. Zoysiagrass was susceptible to *P. arrhenomanes* and the heterothallic *Pythium* sp. (Ht-F), showing stem and crown rot of turf grasses at poorly drained areas under cool and humid or rainy conditions. *P. oligandrum* and the heterothallic *Pythium* sp. (Ht-L) were isolated from creeping bent grass, and were avirulent to all species of tested turfgrasses.

Mercier *et al.* (1999) found that during the summer of 1998, several fairy rings with the fruiting bodies of a bird's nest fungus on 2 greens at the University of Minnesota turf plots in St. Paul, Minnesota, U.S.A. Greens, a 3-years-old annual bluegrass (*Poa annua*) green and a 2-year-old creeping bent-grass were constructed of a 90% sand: 10% reed sedge peat soil mix. The fungus was identified as *Cyathus stercoreus*. On annual bluegrass, chlorotic and necrotic grasses were noticed at the edge of the rings. No symptoms were associated with the rings in creeping bentgrass.

Weber (2004) reported that brown spot, powdery mildew, sharp eyespot and crown rust were the most common diseases observed in grasses in Poland. *Pyrenophora dictyoides* was the most common causal agent of brown spot on *Festuca rubra* and *Pyrenophora lolii* on

Poa paratensis. *Pyricularia frisea* was the causal agent of gray leaf spot occurring sporadically on all the tested plant species.

Inoculum potentials

French (1965) showed that increasing the spore concentration of *Fusarium oxysporum* f.sp. *batatus* resulted in an initial linear increase of disease incidence. Pratt *et al.* (1975) mentioned that when the zoospores of various plant pathogenic members of the Oomycetes were placed directly on the susceptible plants, the infection resulted from one or few zoospores.

Mitchell (1978) found that adding each of *Phytophthora cinnamomi, P. parasitica* and *P. palmivora*, and mixed together into the soil at the rate of 0.05-0.1 chlamydospore/gram soil weight led to low percentage of infection, while 100% infection was obtained at 5-10 chlamydospores / gram of soil weight.

Hilal (1985) indicated that minimum inoculum potentials (MIP) for *Verticillium dahlia, Phytophthora splendens, Fusarium solani* and *P. cinamomi* (the main causal pathogens of root rot and/or wilt diseases of pelargonium in Egypt) were 1.5, 2.0, 2.5, and 3.0% of soil weight, respectively.

Heweidy (1985) revealed that increasing the inoculum potentials of *Fusarium equiseti, F. solani* or *Rhizoctonia solani* added to the soil grown with violet plants (plants producing volatile oil) resulted in an increment the infected plants. However, 4% of fungal inoculum was