ANTAGONISTIC ACTIVITY OF SOME *CHAETOMIUM* SPECIES AGAINST COMMON BEAN ROOT ROT PATHOGENS

By

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B.Sc. Agric. Sc. (Plant Pathology), Ain Shams University, 2003

M.Sc. Agric. Sc. (Plant Pathology), Ain Shams University, 2011

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ABSTRACT

Huda Zakaria Ahmed: Antagonistic activity of some *Chaetomium* species against common bean root rot pathogens. Unpublished Ph.D. Thesis, Department of Plant Pathology, Faculty of Agriculture, Ain Shams University, 2017.

Different root rot fungi, *i.e. Rhizoctonia solani, Fusarium solani* and *Macrophomina phaseolina* in addition to the Oomycete pathogen *Pythium* sp. were isolated from bean plants showing root rot syndromes collected from Giza and Qalyubiya governorates. Pathogenicity tests ofroot rot pathogens on bean (Giza 6) were carried out. All tested isolates were found to be pathogenic to bean plants.Fourteen isolates of *Chaetomium*spp. were collected from Mycology Res. Dept. and 19*Chaetomium*isolateswere isolated from different plant hosts. *Chaetomium*isolates were identified based on morphological and molecular characterization and werebelonged to 7 species namely; *C. globosum, C. bostrychodes, C.madrasense,C. brasiliense, C. atrobrunneum, C. nigricolor*and*C. megalocarpum*. Some isolates of *Chaetomium*spp. enhanced the germination ofbeen seeds. Thirty threeisolates of *Chaetomium* spp. suppressed the radial growth of root rot pathogens. T he mode of action of *Chaetomium* isolatestowards root rot pathogensvaried, some isolates suppressed the growth of the pathogens while some others showed mycoparasitism behaviour. Microscopical observation of antagonistic areas on petri dishes showed lysis of pathogens' mycelia due to over growth penetration through hyphal pegs and coiling by *Chaetomium*. Scanning Electronic microscope showed that *C. globosum* was able to penetrate from different sites of one compartment of *R. solani* hyphae. In addition, cytoplasm and protoplast membrane of hyphal cells of *R. solani* was broken down and organelles were no longer discernible in the highly altered cytoplasm.All partially purified culture filtrates of *Chaetomium* spp. isolates caused reduction of mycelia dry weight of root rot bean pathogens. Fourteen isolates of *Chaetomium* produced β-glucanases and chitinase during interaction with

the pathogens. Volatile metabolites of ethyl acetate extract of 3 different isolates of *C. globosum* were determined using Gas chromatography–Mass spectrometry (GC–Mass) which revealed the presence of various metabolites. The main constituents were Propionic acid, Benzenedicarboxylic acid, 1-Hexadecene, 5-Octadecene,Hexanoic acid, Butanoic acid, and Indole-3-acetic acid. Five different isolates of *Chaetomium* were chosen to study their potentiality in controlling *R. solani* and *M. phaseolina in vivo.* Five different isolates of *Chaetomium* were chosen to study their potentiality as control measures against*R. solani* and *M. phaseolina in vivo.* All isolates of *Chaetomium* spp. showed effectiveness in controlling pre-emergence damping-off and completely suppressed post-emergence damping-off. *C. globosum*1 was the best bioagent affected on shoot and root dry weight, followed by *C. globosum*2. *C.atrobrunneum*3, *C. globosum*3 and *C. madrasense*5, the increase was significant comparing with control.Three different composts and straw were used with *C. globosum*1 to study their effects on efficiency of *Chaetomium* in controlling root rot. Compost A and straw gave the best reduction in bean root rot disease when combined with *C. globosum*. Compost A with *C. globosum*1 gave the best effect on dry weight of shoot and root of bean plants.

Key words: *Chaetomium* spp. morphology and molecular characterization, bean root rot, mycoparasitism, Gc-Mass, β-glucanases and chitinase and Compost and straw effect.

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INTRODUCTION

Snap beans (*Phaseolus vulgaris* L.) are the most important grain legume for human consumption **(Broughton,*et al.* 2003).** Bean is one of the major sources of calories, protein, dietary fiber, minerals and vitamins (**Perla, *et al*., 2003** and **Hillocks, *et al*. 2006**).

In Egypt, It's considered as annually crop, beans grow for green bean and dry bean. Production of green bean was 253.1 ton while, production of dry bean was 100.9 ton(FAO, 2014).

Green bean is one of the most important vegetable crops grown in Egypt, and occupies a great part of local consumption and export. The cultivate area of bean in Egypt is 2.4% of the total world cultivated area, producing about 3.5% of the total world production of bean **(El-Noemani, *et al*. 2010).**

Damping-off disease is considered animportant and persistent problem of bean plants (**Wen, *et al.* 2005**). Bean root-rot diseases are caused by several pathogens, *i.e. Fusarium solani*, *Rhizoctonia solani*, *Macrophomina phaseolina* and *Sclerotium rolfsii* (**Siddiqui, *et al.*2001**). Root-rot diseases appear during the growing season at different stages of plant growth (**Abdel-Kader, 1997**).

Plant disease control depends mainly on fungicides. Hazards of the usage of fungicides are well known either on the environment or on the living organisms (**Rauf, 2000**). Some cultural practices, *i.e.* crop rotation, fertilizers and irrigation were suggested to be used for plant disease control. However, they didn't give substantial positive effect in disease management (**Manners, 1993**). Biological control using antagonistic microorganisms proved to control various plant diseases (**Li, *et al.*1997**)

Chaetomium Kunze (Ascomycota, Chaetomiaceae) is an ascomycete genus includes more than 350 saprophytic species (**Zhang, *et al.* 2012**). They are isolated from soil and organic compost (**Soytong and**