Faculty of Women for Arts,
Science and Education

Biological Suppression of Some Soil Borne Pathogenic Fungi by Soil Amendment with Compost and Natural Compound of Plant Origin

A Thesis Submitted for the Degree of
Ph.D. of Science in Microbiology

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This thesis has not been submitted for degree at this or at any other university.

Mona
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Dedication

I dedicate this work to the spirit of my supervisor Prof. Dr. Fatma Abdel-Wahab Helemish and the mother of my husband.

Also, I dedicate this work to my beloved husband, daughters and sons as well as to my dearest parents, sisters and brothers and to all people who supported me.

Abstract

Plant pathogens are responsible for many acute and continual diseases of crop plants that can result in severe economic losses, the fungal diseases represent one of the major cause of decreased yields of agricultural crops all over the world. Amendment soil with compost found to be suppressive against plant diseases caused by soil-borne fungi in various cropping systems. Many naturally occurring compounds found in plants have been shown to possess antimicrobial functions and serve as a source of antimicrobial agents against plant pathogens. Therefore, the use of plants or plant products as biocides is of great importance.

Three pomegranate types (two Palestinian and one Egyptian) were investigated in an *in vitro* experiment to evaluate the antimicrobial properties of their peel powder aqueous extract against two soil-borne fungi, i.e. *Fusarium oxysporum* and *Rhizoctonia solani*. The growth response was evaluated using food-poisoning technique (%inhibition). The antimicrobial effect of different preparations of compost and the peel powder (compost tea and compost plus pomegranate peel tea) prepared using water and alkaline water were also investigated against the two tested fungi.

Results demonstrated that the aqueous extract of Palestinian Sweet pomegranate possess the highest activity against the two tested fungi, i.e. *F. oxysporum* and *R. solani*, even at the two investigated concentrations. The combination between compost plus Palestinian Sour pomegranate tea prepared either with water or alkaline water recorded the highest inhibition percent against the two tested fungi. Accordingly,

the Palestinian Sour pomegranate peels was considered to be the most potent type.

The response of soil-borne pathogens of lupine plant to the inhibitory effect of the most potent botanical plant powder, selected from the *in vitro* test, individually or combined with compost were investigated in a pot experiment using soil artificially infested with the tested fungi (*F. oxysporum* and *R. solani*) as well as under field conditions (naturally infested with soil-borne fungi). Different formulations of compost and peel powder were suggested for this evaluation. The suggested compost amendments were compost, compost with the selected botanical plant powder, compost tea, compost tea with the selected botanical plant extract and the aqueous extract of the selected botanical plant as well as the chemical fungicide Rizolex-T was also investigated.

Results of pot experiments revealed that all applied treatments either single or in combination have a positive effect and significantly reduced the incidence of damping-off caused by *R. solani* at both pre- and post-emergence stages of lupine plants compared with the untreated infested soil. In addition, all treatments also induced a marked reduction in wilt percentage of lupine plants over those untreated plants infested with *F. oxysporum.*

Results illustrated also that the highest effective treatment, which demonstrated reduction in the incidence of damping-off was observed for compost plus pomegranate peel tea. It recorded low pre- and post-emergence damping-off and recorded higher percent of survived plants

with significant differences compared to all the other treatments. Furthermore, the same treatment exhibited the lowest percentage of wilt and highest percentage of survived plants.

The highest values of nodules/plant, dry weight of nodules, nitrogenase activity and all growth parameters were due to application of the combined treatment compost plus pomegranate tea and the fungicide Rizolex-T mostly with no significant differences.

The investigated compost amendments were evaluated for the control of damping-off disease and wilt disease of lupine plants in a field trial that are naturally infested with soil borne fungi. All compost amendments and chemical treatment provided some improvement in seedling emergence (pre- and post-) of lupine plants over the untreated control. In addition, the recorded data illustrated that treatments of compost either applied alone or in combination found to be effective in decreasing disease incidence. The greatest reduction of disease incidence was achieved by compost plus pomegranate tea, which recorded 91.0% survived plants followed by compost tea (90.33%), Rizolex-T (90.0%) and the aqueous extract of pomegranate peels (90.0%).

All treatments induced a positive disease suppression, however; differences among treatments were not significant. The combination of compost plus pomegranate tea recorded the highest values of all investigated growth parameters, highest rate of nodulation status, increasing the NPK content in plant tissues (shoots and roots) and enhancing yield and its components compared to untreated control.

Key words: Lupine, *F. oxysporum R. solani*, damping-off and wilt diseases, compost, compost tea, pomegranate peel, Rizolex-T.

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