

Interaction of different nitrogen fertilization regimes of canola with mustard aphid (*Lipaphis erysimi* Kalt.) and the predatory gall midge (*Aphidoletes aphidimyza* Rondani)

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ABSTRACT

The host plant quality not only influences on herbivorous insects but also indirectly could impact on their natural enemies' performance. The current study was conducted to determine the effect of different nitrogen fertilization levels of canola (*Brassica napus* L.) on life table parameters of the predatory gall midge, *Aphidoletes aphidimyza* Rondani; Diptera: Cecidomyiidae, in feeding of mustard aphid, *Lipaphis erysimi* Kalt.; Hemiptera: Aphididae, under controlled temperature (day: 25±2, night: 19±2) and humidity (60±10%) conditions. Mustard aphids were reared on canola plants grown under four nitrogen fertilization levels including 0, 0.055, 0.11, and 0.165 g N. kg soil⁻¹ to produce different prey quality. The developmental time of the predatory gall midge growth stages were recorded daily and life table parameters were evaluated by two-sex life table procedure. The results showed that increased nitrogen fertilization of canola significantly decreased the developmental time of larva and pupa of the predatory gall midge and increased the oviposition period of females. Actually, using high and medium nitrogen fertilization levels improved the performance of the predatory gall midge. In addition, the maximum amounts of net reproduction rate (32.54 offspring per individual) and the intrinsic rate of increase (0.163 d⁻¹) with significant differences were observed in the mediate nitrogen fertilization level (0.11 g N.kg soil⁻¹). So, this level could introduce as the best level for the predatory midge growth.

Keywords: Cecidomyiidae, fecundity, intrinsic rate of increase, prey quality, trophic level.

Increased disease resistance in *Arabidopsis thaliana* through perception of well-known pathogen-associated molecular patterns

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ABSTRACT

Microbe-associated molecular patterns (MAMPs) play key roles as activators of the innate immune response in animals and, analogously, as elicitors of defense responses in plants. However, there are not many investigations concerning their real importance in plant resistance against pathogens. Here we used derivatives of flagellin and Ef-Tu as two well-known MAMPs against some important fungal and bacterial pathogens on *Arabidopsis thaliana*. Pretreatment of Col-0 plants with both MAMPs, significantly increased the resistance of plants against *B. cinerea* and *A. brassicicola*. Growth curve of *Pseudomonas syringae* pv. *tomato* (Pst DC3000) in *Arabidopsis* leaves was significantly influenced by both of the MAMPs. Moreover *Xanthomonas axonopodis* pv. *citri* (Xac 306) that is a non-pathogenic bacteria on *Arabidopsis*, neither grow nor decline in Col-0 leaves for 48 hours after inoculation. However, the number of bacteria in the plants pretreated with elf18 was significantly decreased. Results of this study clearly showed the role of innate immunity in plant resistance against pathogens.

Keywords: *Alternaria*, *Arabidopsis*, *Botrytis*, innate immunity, PAMP, *Pseudomonas*, *Xanthomonas*.

Evaluation of biocontrol of *Rhizoctonia solani* in cotton by *Pseudomonas fluorescens* isolates

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ABSTRACT

Plant growth-promoting rhizobacteria (PGPR) is an alternative to chemical pesticides against harmful microorganisms especially soil-borne diseases. *Rhizoctonia solani* is one of the most important soil-borne fungal pathogens that causes serious damages to important crops. In this study, to screen successful *Pseudomonas* bacterial isolates, the inhibition of pathogen growth was evaluated *in-vitro*. Moreover, isolates were screened based on the ability to auxin and ACC-deaminase production, phosphorus solubilization, siderophore production and possession of *PhlD* gene. From isolates studied for the extent of inhibition, 20 isolates were selected for further studies, among them, three isolates (33, 139 and 137) showed the highest rate of P solubility and ability to produce auxin. There was a correlation between the phosphorus solubility and pH reduction. Six isolates were selected to evaluate their capability for ACC-deaminase enzyme production based on the higher auxin production and better *in-vitro* inhibitory effect on the growth of *Rhizoctonia solani*. All of the six strains appeared to have produce ACC-deaminase enzyme. *PhlD* gene that plays a key role in 2,4-diacetylphloroglucinol antibiotic biosynthesis pathway, was detected in the isolates 153, 139, 137, CHA0 and 58A. According to the characteristics, five isolates were selected for greenhouse experiments. In greenhouse experiments, all five isolates controlled the disease significantly, and among them, the isolate 137 showed the highest control level.

Keywords: biocontrol, cotton, *Pseudomonas fluorescens*, *Rhizoctonia solani*.

Phenotypic and genotypic study of *Pseudomonas fluorescens* strains PGU0 and assessment of its biocontrol against *Rhizoctonia solani*, the causal agent of bean damping-off

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ABSTRACT

Fluorescent pseudomonads producing 2,4-diacetylphloroglucinol (DAPG) antibiotic have been well studied for use as biocontrol agents around the world. *Pseudomonas fluorescens* PGU0 strain was isolated from the rhizosphere of sunflower in Bushehr Province. Dual culture test showed that this strain had antagonistic activity against *Rhizoctonia solani* fungus on different media cultures; moreover, under growth chamber condition, the strain reduced disease severity by 52% and caused an increase in dry weight of infected bean seedlings by 80%. The polymerase chain reaction (PCR) using specific primers, demonstrated the presence of key genes (*phlD*, *hcnBC* and *pltB*) involved in the biosynthesis of antimicrobial metabolites Phl, Pyoluteorin (PLT) and hydrogen cyanide (HCN), respectively. Antibiotic production was examined by high-performance liquid chromatography (HPLC) and it was found that these bacteria are capable of producing DAPG and PLT antibiotics. On the other hand, production of hydrogen cyanide and siderophore by the bacterium was demonstrated under lab conditions. Phylogenetic analysis of 16S rDNA proved similarity of this strain with other world biocontrol strains capable of producing antimicrobial metabolites like Phl and Plt.

Keywords: biocontrol, 2,4-diacetylphloroglucinol, pyoluteorin, hydrogen cyanide.

The effect of garlic essential oil plants, mancozeb and metalaxyl-mancozeb on damping-off diseases caused by *Phytophthora* spp.

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ABSTRACT

This study was carried out to evaluate the antifungal efficacy of garlic essential oil (*Allium sativum*L.) and two fungicides including metalaxyl-mancozeb and mancozeb against *Phytophthora melonis*, *P. drechsleri* and *P. capsici* the causal agent of damping-off on Pepper, Melon and Cucumber, *in vitro* and greenhouse conditions. The fungal radial growth for each concentration of garlic oil on *Phytophthora* species was measured. The Median Effective Concentration (EC₅₀) values (ppm) of garlic oil measured. The chemical composition of the essential oils was determined by gas chromatography-mass spectrometry (GC-MS). Results of *in vitro* studies indicated that plant extract of garlic caused a significant decrease in the mycelial growth of phytophthora species and it had fungistatic properties. The inhibitory effect of plant essential oil was observed for *P. capsici* (EC₅₀= 43.293 ppm) and *P. drechsleri* (EC₅₀= 50.236 ppm), respectively. The profile of the extract components of *Allium sativum* showed that diallyl tetra sulphide (31.32%), allyl disulphide (26.78%), nitrosothymol (8.64%), 1H-1,2,4-triazole, 3-thiol-5-methyl (8.4%) and Allyl sulphide (6.15%) were the main compounds. The results of greenhouse showed that plant essential oil significantly reduced disease as compared to control (P≤0.05). Based on results from this research, the garlic essential oil was found to be fungistatic effect against damping-off disease and may be used in the production of organically grown vegetables.

Keywords: damping-off, garlic essential oils, mancozeb, metalaxyl-mancozeb, *Phytophthora*.

Effects of nano-emulsion of cinnamon oils in decreasing strawberry post-harvest rots

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ABSTRACT

There are numerous problems for using essential oil due to its low solubility in water, high vapor pressure and chemical and physical instability. Use of nano-emulsions is a good idea for decreasing the side effects of the essential oils and enhance their efficiency as well as delivery to hot spot. In addition, nano-emulsion system make smaller size particles and increase stability and shelf-life of the active compounds to enhance their antimicrobial activity. In this study, nano-emulsion of essential oil of cinnamon (*Cinammon zeylanicum*) was prepared and their physicochemical characteristics were determined. The particle size of nano-emulsions was determined 115.33 ± 3.97 nm. Various concentrations of emulsion and nano-emulsion as well as fungicides thiabendazole were studied to control of fruit rot fungi, *Rhizopus stolonifer* and *Botrytis cinerea*, on both PDA medium and strawberry fruit. Generally, there was no significant difference between emulsion and nano-emulsion of oil to inhibit fungal growth in PDA medium. Both of them could completely inhibit *B. cinerea* and *R. stolonifer* at 500 and 1000 μ l/l respectively. There was significant difference between emulsion and nano-emulsion to reduce fruit spoilage decay on strawberry. The nano-emulsion showed stronger antifungal properties than emulsion to suppress fungal strawberry decay. At concentration of 2:1000, there was no significant difference between thiabendazole with cinammon nano-emulsion to suppress *Rhizopus* fruit rot. However, nano-emulsions of cinnamon at concentration of 2:1000 as well as cinnamon at 1:1000 exhibited the best impact to control gray mold caused by *B. cinerea*. Nano-emulsion of cinnamon can be recommended for making a natural fungicide.

Keywords: control of fruit spoilage, essential oil of cinnamon, nano-emulsion, strawberry.

Host stage preference and effect of temperature on functional response of *Aphidius matricariae* (Hym.: Aphididae) on common wheat aphid

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ABSTRACT

In this research, host stage preference of parasitoid wasp, *Aphidius matricariae* Haliday in both choice and no-choice tests and functional response of the parasitoid were investigated on common wheat aphid, *Schizaphis graminum* Rondani on the Alvand cultivar in laboratory conditions at 20, 25 and 30°C, RH 70±10% and a photoperiod of 16 h L: 8 h D. The maximum mean parasitisms in choice and no-choice assays was observed on third instar nymph of the aphid which were 5.1±0.43 and 10.3±0.61 nymphs, respectively. The minimum mean parasitism was achieved on first instar nymph. The results of logistic regression showed that functional response of the parasitoid to different densities of the aphid is an example of type II reaction at 20, 25 and 30°C. By using Rogers equation, attack rate and handling time were estimated. The maximum attack rate and minimum handling time were obtained at 20°C.

Keywords: attack rate, parasitism, *Schizaphis graminum*, third instar nymph.

Investigation on effect of essential oil lavender (*Lavandula angustifolia*) and Savory (*Satureja hortensis*) against the *Fusarium solani* fungus

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ABSTRACT

Most essential oil extractions from medicine plants has shown the properties of antimicrobial of parasites, bacteria, fungi and viruses. The fungus from genus of *Fusarium* is one of the prevalent crop diseases that infect a wide range of crops. *Fusarium solani* is one of the species of this fungus genus that various crops are host for it. A laboratory experiment was conducted to investigate the effect of alone and in combination application of essential oils of medicine plants, lavender (*Lavandula angustifolia*) and Savory (*Satureja hortensis*) on suppressing the growth of the fungus. The experiment was completely randomized factorial design with two factors, different essential oils (essential oil of lavender and Savory) and various concentration of essential oils (0, 50, 75 and 100 ppm). Treatments were replicated in five. Result showed that essential oil extracted from Savory is more effective in inhibitory growth of *F. solani* than essential oil of lavender. Using both essential oils at the various levels of their concentrations did not completely inhibit the growth of the fungus *F. solani*. But using an intermixed essential oils of both plants and at the highest concentration level (100 ppm) completely inhibited the growth of *F. solani*.

Keywords: antimicrobial, *Fusarium solani*, intermixed mediums, plant compounds.