

Evaluation of diversity among some melon (*Cucumis melo*) accessions for resistance to fusarium wilt based on biochemical enzymes activity

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ABSTRACT

Fusarium wilt is a restrictive disease of melons in the world and Iran. In this research, fifty seven accessions of *Cucumis melo*, planted in a randomized complete block design with three replications. The relationship between resistance and changes in biochemical activity were evaluated for these accessions. The wounded root of seedlings after reaching at one to two true leaf stage were placed in inoculum concentrations of 1×10^6 spores ml^{-1} of *Fusarium oxysporum* f. sp. *melonis* for 3-4 min and then they were transferred to cultivation trays. Area under disease progress curve (AUDPC), disease severity and five physiological traits were measured. Analysis of variance showed significant differences among genotypes for all traits. The correlation coefficient between different traits showed that the AUDPC and disease severity have a negative correlation with Peroxidase, Polyphenol oxidase, Phenol Compound, Superoxide dismutase and Catalase. The grouping results of genotypes based on squared Euclidean distance measurement and Ward method were clustered these accessions in three groups; resistant, moderately resistant and susceptible. In this study the farthest distance (28.67) was observed between Isabelle and Shadegani2. These accessions recognized as the most resistant and susceptible genotypes, respectively. It seems that due to the distance between them, with make crossing and use of heterosis, we may achieve to progeny that are more resistant in comparing to the evaluated genotypes of this study.

Keywords: cluster analysis, correlation, fusarium wilt, melon.

Generation of transgenic lines for studying of the brain development in *Tribolium castaneum* (Coleoptera: Tenebrionidae)

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ABSTRACT

Germ-line transformation of insects is now widely used for analyzing gene function and for the development of genetically modified strains for various purposes. There is not enough information on the embryonic development of some brain parts in insects. In order to study the genetic control of embryonic brain development, we established some transgenic lines to identify some genes involved in embryonic brain development. The genome has been sequenced and transgenic approaches are established for this model organism. Transposable element *piggyBac* was used as a vector for the transformation of *T. castaneum*. *Tc-vermilion* line- a *Tribolium* eye-color mutant- was also used for the microinjection of the donor vector. The donor vector contained the *Tc-vermilion* gene under the control of 3xP3 promoter, resulting in black eyes as a marker of their identity. In the present study, several transgenic lines bearing the regulatory regions of some important genes were generated. Additionally, transgenic lines for tracing of neuroblast development from the onset to the respective fully developed structure in the brain were established. Taken together, valuable tools which allow investigations of the complex genetic network needed for embryonic brain development in *T. castaneum* were established. Furthermore, the system will allow identification of genes and their functions in *Tribolium* brain formation.

Keywords: transposable elements, insect transgenesis, germ-line transformation, microinjection.

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***Scirtothrips dorsalis* (Thysanoptera: Thripidae) as a pest of citrus in Fars province, Iran**

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ABSTRACT

Species of the genus *Scirtothrips* Shull are minute insects of which several are major pests on the leaves of various crops around the world. In this study, *S. dorsalis* is recorded for the first time from Iran. Body mainly yellow but antecostal ridge on tergites and sternites is dark brown and distal antennal segments are brown. Abdominal sternites covered with rows of microtrichia except anteromedially. A huge population of the species was collected in citrus orchards of Jahrom, Fars province, southern Iran in spring and summer of 2015. Thrips feeding causes several distortions on the leaves including narrowing and thickness on the leaves. On fruits, this pest punctures epidermal cells, leaving silvery scars or scabby on the rind. The effects of *S. dorsalis* on leaves as well as fruits are described and illustrated. The possibility of virus transmission by *S. dorsalis* has been discussed. Diagnosis characters as well as relative figures are provided.

Keywords: fars province, new record, pest, *Scirtothrips dorsalis*, thrips.

Effect of soil texture and organic matter (leaf litter) content on the ability of *Trichoderma longibrachiatum* in promoting the growth of kidney bean and controlling *Meloidogyne javanica*

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ABSTRACT

This research was conducted in two separate factorial experiments based on completely randomized designs with four replications. The ability of *Trichoderma longibrachiatum* in stimulating kidney bean (*cv.* Goli) growth was assessed in the first experiment with three factors including soil texture (sandy loam, loam, clay loam), organic matter (0.5 and 2% of leaf litter) and fungal application (0 and 10^6 spore ml^{-1} suspension) when the plants was not inoculated with *Meloidogyne javanica*. In the second experiment, the effect of soil texture, organic matter and managing method (no control, 10 ml of *T. longibrachiatum* containing 10^6 spore ml^{-1} , and 2 mg active ingredient cadusafos 10G kg^{-1} soil) was tested on kidney bean growth, fungal controlling ability and *M. javanica* reproduction. The growth promoting effect of the fungus was not prominent. In the sandy loam or loam soil amended with 2% organic matter (leaf litter), the fungus showed its maximum efficacy and could decrease the nematode reproduction rate same as the chemical nematicide. Clay loam soil was not a suitable bed for kidney bean plants since no growth was seen if the soil that was not amended with organic matter and soil amended with 2% organic matter (leaf litter) resulted in poor growth.

Keywords: Biological control, growth promoter, nematophagous fungi, root-knot nematode, soil amendment, soil texture, soil type.

The effect of endophyte-infected plant residues on the population of tomato leaf miner, *Tuta absoluta*

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ABSTRACT

In this study, the effect of soil incorporated with endophyte-infected plant residues (*Lolium perenne* infected with *Epichloe festucae*) in tomato pot media was investigated on the tomato leaf miner, *Tuta absoluta*, population. Treatments were tomato plants planted in pod media containing 1.5% or 3.5% endophyte-infected and endophyte-free plant residues and control (without residues). Based on the results, population reared on plants which treated by 3.5% endophyte infected residue showed the highest larval mortality (14.28%) and doubling time of population (8.67 ± 0.05 days) and lowest intrinsic rate of increase ($0.08 \pm 0.01 \text{ day}^{-1}$), gross reproductive rate (15.86 ± 3.45 offspring), finite rate of increase ($1.08 \pm 0.01 \text{ day}^{-1}$), net reproductive rate (11.46 ± 2.96 offspring), mean of eggs per female (36.45 ± 1.90) and percentage of hatched egg (33.75 ± 0.01). According to the results, it seems that application of endophyte-infected plant residues in tomato growing media, by reducing the *T. absoluta* fitness, can be considered as potential mean for the control of this pest, especially in greenhouse cultures.

Keywords: tomato, pod media, pest control, intrinsic rate of increase.

Demography of pistachio fruit hull borer moth, *Arimania komaroffi* (Lepidoptera: Pyralidae) on three pistachio cultivars under laboratory condition

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ABSTRACT

Pistachio (*Pistacia vera* L.) is one of the most important horticultural crops in Iran. The pistachio fruit hull borer moth, *Arimania komaroffi* Ragonot (Lepidoptera: Pyralidae) has been emerged as a major pest of pistachio in Iran. The purpose of this research was the study of reproduction and population growth parameters of this pest on three common pistachio cultivars with the highest acreage includes Ohadi, Kaleghochi and Ahmadaghahi. Experiments were conducted under laboratory conditions, at temperature $27.5 \pm 1^\circ\text{C}$, $65 \pm 5\%$ RH, and 16:8 L:D photoperiod. The results showed that the highest rate of developmental time was 50.37 day on Ahmadaghahi cultivar. The gross fecundity rates on Ohadi, Kaleghochi and Ahmadaghahi cultivars were calculated as 50.65, 44.99 and 27.14 eggs per female, respectively. The net fertility rate was significantly differed between Ohadi and Ahmadaghahi cultivars. The lowest mean daily number of eggs per female was observed on Ahmadaghahi cultivar that was significantly differed with its value on Ohadi cultivar. Intrinsic rates of increase (r_m), intrinsic rates of birth (b) and finite rates of increase (λ) of this pest were the lowest on Ahmadaghahi cultivar and the values of these parameters were significantly different with Ohadi cultivar. Moreover, the highest mean generation time (T) was observed on Ahmadaghahi cultivar. As a result, Ahmadaghahi was the less suitable host and had most negative impact on life-history statistics of *A. komaroffi* in compare with the other two tested cultivars.

Keywords: pistachio cultivars, *Arimania komaroffi*, fecundity, life table.

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The effect of pH and NaCl on the aflatoxin production of *Aspergillus parasiticus*

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ABSTRACT

Aspergillus parasiticus causes adverse effects on its consumers of food infected with this fungal toxins by producing aflatoxin B₁. In this study, the effects of different treatments of pH and NaCl concentration on the growth and toxin production of this fungus was investigated using three methods including coconut-agar medium, TLC, and HPLC. Based on our examinations, the aflatoxins produced by this fungus had fluorescence effect under UV light. The highest growth and production toxin of *A. parasiticus* was, respectively, occurred at pH 6 and 5 and NaCl concentration of 3 and 0 percent. High concentrations of salt suppressed this fungi growth and consequently its toxin production. Aflatoxin B₁ was the most common toxin produced by *A. parasiticus*. As a result, by controlling these two factors, the growth and aflatoxin production of this fungus can be largely inhibited to avoid its adverse effects.

Keywords: *Aspergillus*, toxin, pH, NaCl.

Overwintering and cold tolerance in pupae of large cabbage white, *Pieris brassicae* (Lepidoptera: Pieridae) in Iran

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ABSTRACT

Large cabbage white, *Pieris brassicae*, is a major pest of Brassicaceae family which overwinters as pupa on different shelters. In spite of increase in oilseed cropping area, there is little information available about its overwintering condition. In this study, overwintering pupae were collected during November 2012 to April 2013 and the diapause conditions, the whole body supercooling point (SCP), cold tolerance at subzero low temperatures (-10, -15, -20, -25 and -30°C) as well as lower lethal temperatures (Ltemp₅₀ and Ltemp₈₀) were investigated. The results showed that these pupae were in the main phase of diapause during three months of winter when the highest level of cold-hardiness capacity was observed. Also, the SCPs were significantly decreased and reached near to Ltemp₅₀ at this time. Therefore, it could be concluded that these pupae use freeze avoidance strategy and there is a close linkage between diapause and cold-hardiness in this species, so, the highest level of cold tolerance could be expected during the deep phase of diapause in winter.

Keywords: large cabbage white, *Pieris brassicae*, diapause, cold-hardiness, Ltemp₅₀.

Study on the life table parameters of diamondback moth, *Plutella xylostella* (Lep., Plutellidae) on three plant hosts under laboratory conditions

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ABSTRACT

Diamondback moth, *Plutella xylostella* (L.) (Lep.: Plutellidae), is the most destructive insect pest of cruciferous crops throughout the world. Crucifer production has been seriously affected by developing resistance of *P. xylostella* populations to a wide range of insecticides. In population studies, the knowledge of herbivore's population growth on different host plants is of prime importance. In the present study, the influence of host-plant species including rapeseed cv. Okapi, cauliflower cv. Arizona and Chinese cabbage cv. Hero on *P. xylostella* life-history parameters was studied in the laboratory condition ($25\pm 1^\circ\text{C}$, $70\pm 10\%$ RH and 16L:8D h photoperiods). The parameters longevity, the intrinsic rate of natural increase (r_m), net reproductive rate (R_0), mean generation time (T) and finite rate of increase (λ) were measured on these host plants. Differences between host plants for fertility life table's parameters were analyzed using the Birch and Jack-knife methods. The results showed that there were significant differences for the studied parameters between host plants. The lowest and highest rate of *P. xylostella* regeneration occurred on rapeseed ($63.67_{(\text{♀♀/♀/generation})}$) and Chinese cabbage ($86.08_{(\text{♀♀/♀/generation})}$), respectively. Generation period of *P. xylostella* on rapeseed and Chinese cabbage was estimated 23.78 and 18.1 days, respectively. The lowest rate of finite population increase was obtained on rapeseed, $1.191_{(\text{♀♀/♀/day})}$, and the highest on Chinese cabbage, $1.279_{(\text{♀♀/♀/day})}$. The maximum and minimum time needed for doubling *P. xylostella* population were found on rapeseed (3.965 days) and Chinese cabbage (2.814 days). The highest and lowest intrinsic rates of population were on Chinese cabbage and rapeseed with 0.246 and 0.174 (♀♀/♀/day), respectively.

Keywords: diamondback moth, host plant, population growth rate, reproduction.

Efficacy of ethyl cellulose-based nanocapsules containing imidacloprid for the control of *Microcerotermes diversus* (Isoptera: Termitidae) under laboratory conditions

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ABSTRACT

Microcerotermes diversus (Silvestri) (Isoptera: Termitidae) is a major species of termites that attacks cellulosic materials and is an economically important pest, damaging buildings in Khuzestan Province (Iran). In the last decade, use of nanotechnology for the production nanocapsules made from various materials, resulting in reduction of the contained chemicals. Neonicotinoids, such as imidacloprid, are a group of chemical compounds that have recently been introduced for use in pest control programs. In the present study the evaluating effectiveness of ethyl cellulose-based nanocapsules containing imidacloprid and ethyl cellulose-based nanocapsules without imidacloprid has been performed for the first time. The effects of ethyl cellulose-based nanocapsules without imidacloprid and those containing 50, 100, 500 or 1000 ppm imidacloprid were evaluated against *M. diversus*. The ethyl cellulose in this formulation did not induce lethal effects against the termite and showed feeding attractancy. Treated filter papers with this formulation caused a gradual increase in mortality during the 14-day trial. Our results suggest that ethyl cellulose-based nanocapsules containing imidacloprid could be an effective termiticide formulation.

Keywords: termite, imidacloprid, ethyl cellulose-based nanocapsules, feeding attractancy.

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The combined effect of root-knot nematode and broomrape on tomatoes chlorophyll content, fluorescence parameters and relative water content under greenhouse conditions

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ABSTRACT

Different species of the root knot nematodes (*Meloidogyne* spp.) and broomrape *Orobanche aegyptica* are parasitic of different plants roots. In order to study the interaction between the parasites of tomato, an experiment was conducted in a completely randomized design with four treatments 1- control, 2- nematode (2000, second stage juveniles), 3- seeds of orobanche (30 mg per kg of soil) and 4- nematode (2000, second stage juveniles), with seeds of orobanche (30 mg per kg of soil) with four replications under greenhouse conditions. Treated seeds were planted in sterilized soil. Four-leaf stage seedlings were inoculated with treatments and transferred to pots and fluorescence parameters were measured after 60 days. The results showed that both biological stresses caused a significant reduction in shoot dry weight, number of galls, chlorophyll, leaf number, leaf area, plant height, root length, stem diameter and photosystem II quantum efficiency in both light and darkness compared with control. Also the number of second stage larvae, egg sacs, accessories orobanche, nematode reproductive factor, the M, F, QP, QN, NPQ, Fo, Fm and Fv of both light and darkness in the combined treatment were increased. Whereas the dry weight of root in nematodes tension increased and were decreased in stress of aegyptian orobanche. The root volume was highest in alone nematode treatment. The results indicated that root- knot nematode and orobanche had a synergistic effect.

Keywords: chlorophyll, fluorescence, *Meloidogyne incognita*, *Orobanche aegyptica*, tomato.

Comparison Between spring and autumn growth types of different wheat (*Triticum aestivum*) genotypes in response to Take-all disease

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ABSTRACT

Wheat take-all disease caused by the fungus *Gaeumannomyces graminis* var. *tritici* is an important diseases of wheat that damaged to root and crown. Evaluation of germplasm and identification of sources resistance is the first step for production of resistant varieties. In this study, 221 genotype of bread wheat, received from different location of Iran and other countries, were evaluated to take-all (T-41 isolate) in greenhouse conditions. For this purpose, 221 genotypes including spring and winter wheat received from University of Tehran were evaluated to take-all (T-41 isolate) in greenhouse conditions. The amount of root and crown pollution (disease score), biological dry weight and height of spring genotypes were measured (Due to the fact that winter genotypes verbalization's need didn't meet, spring genotypes jointing and just in spring genotypes height had been measured). The genotypes were classified into six groups on the basis of mean scores. The groups are including; 4 genotypes were in highly resistant group (42 genotypes in resistant ($0 < Sc \leq 1$), 42 in moderately resistant ($1 < Sc \leq 2$), 70 genotypes in moderately sensitive ($2 < Sc \leq 3$), 45 genotypes in sensitive ($3 < Sc \leq 4$) and 18 genotypes in highly sensitive groups ($4 < Sc \leq 5$). Analysis of variance, logistic regression and χ^2 -square have showed a high genetic diversity to diseases resistance and its relationship with growth types (spring and winter) of wheat. Winter types were more resistant in response to take-all. The infected plants in compare to their control showed that this disease should stimulate the immune system of plants and consequently caused the more growth.

Keywords: *Gaeumannomyces graminis* var. *tritici*, germplasm, logistic regression, resistance.

Biological control of major fungal causal agent of root and crown rot of bean in Zanjan province with antagonistic bacteria

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ABSTRACT

Root and crown rot of bean caused with *Fusarium solani*, *Rhizoctonia solani* and *Fusarium oxysporum*, is one of the important diseases of bean in Zanjan province. Using native biocontrol agents integrated with chemical agents is one of the effective management strategies. This is also important to choose control methods effective against all major fungal pathogens and mixed contamination of bean, with them. This research was conducted to study synergistic effect of three major fungal pathogens and biocontrol effects of some native rhizobacteria on disease. During the mid-summer of 2011, 46 bacterial isolates were obtained from bean rhizosphere in Zanjan bean fields. Two isolates of each three fungal species (pathogenic on bean) were also received from mycology collection of Zanjan University. Two isolates of Rhizobacteria were chosen as the best biocontrol agents against all three fungi in terms of production of antibiotic, volatile metabolites, HCN and protease and selected for in-vitro antagonistic experiments. Greenhouse results showed that, seed treatment of bean with bacteria, decreased the disease and increased some vegetative factors of the plant. There was synergistic effect among the fungal species.

Keywords: synergistic effect, biocontrol, rhizobacteria, fungal agent, bean.

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Lethal and sublethal effects of four insecticides on egg and first larvae green lacewing *Chrysoperla carnea* in laboratory conditions

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ABSTRACT

The common green lacewing is one of the important predators in the field and greenhouse. In this study, lethal effects of azadirachtin, flonicamid, thiacloprid and thiocyclam against egg and first instar of *Chrysoperla carnea* were studied in the laboratory. Larval bioassay was carried out with contact method in glass Petri dishes, while egg bioassay was conducted with immersion method. Mortality of eggs and larvae were measured after 72 h and 96 h, respectively. In order to study the sub-lethal effects of the treatments, first instars were subjected to LC_{25} of each treatment, and the effects were estimated based on IOBC method. Experiments were conducted at 25 ± 2 °C, $65 \pm 5\%$ relative humidity and a photoperiod of 16: 8 h (L:D). The estimated LC_{50} of azadirachtin, flonicamid, thiacloprid and thiocyclam for eggs were 510, 451, 394, 862 ppm, while for the first instar, it was 596, 37, 124, 271 ppm, respectively. The mean fertility rate for control, azadirachtin, flonicamid, thiacloprid and thiocyclam were 291.32 ± 13.7 , 279.67 ± 11.86 , 235.75 ± 12.84 , 177.84 ± 13.87 and 99.85 ± 10.58 eggs, respectively. Based on IOBC classification method, azadirachtin and flonicamid were categorized as 'not harmful', while thiacloprid and thiocyclam were categorized as 'slightly harmful' against *C. carnea*. If our results are corroborated with field tests, flonicamid and azadirachtin can be incorporated in integrated pest managements of the field where this predator is active.

Keywords: lethal effects, sublethal effects, green lacewing, bioassay, insecticides, IOBC method.

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Mycelial compatibility of *Valsa sordida* isolates in Iran

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ABSTRACT

In order to study of mycelial compatibility of *Valsa sordida* isolates on two culture media including potato dextrose agar and oat meal agar, 91 isolates that were collected from different provinces in 2004 and 2011 were used. In the prepared test, each isolate was paired with itself and with any of the other isolates. Dark barrage zone that shows incompatibility between two isolates, were observed seven days after pairings. According to the results, thirty-eight single mycelial compatibility (MC) groups and eight multi-merge groups were identified on PDA culture medium and twenty-five single m-c groups and ten multi-merge groups on OMA culture medium were detected, showing the existence of high genetic diversity among the fungal isolates. In this study, no relationship between obtained MC groups on two culture media with geographic distribution and host plant origins of the fungal isolates was observed.

Keywords: fungus, *Cytospora chrysosperma*, genetic diversity, heterokaryon and barrage zone.

An investigation on the correlation of some virulence factors with ice nucleation activity in *Pseudomonas syringae* strains isolated from stone fruit trees

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ABSTRACT

The quorum sensing is a phenomenon which controls the production of virulence factors in some bacteria. But the correlation between the ice nucleation activities which is one of the most important virulence factor in *P. syringae* with this system is unknown. In order to investigate that, in spring of 2013, 248 samples (including leaves and flowers) were collected from twigs of stone fruit trees in Khorasan Razavi province. Ice nucleation active bacteria, were identified and among them the *P. syringae* isolates were distinguished by LOPAT tests. Among virulence factors three of them such as swarming motility, susceptibility to hydrogen peroxide and pyoverdine production were studied. The swarming motility of the isolates with high ice nucleation activity were significantly more than those isolates which indicated low ice nucleation activity. There was no significant difference in susceptibility to hydrogen peroxide and pyoverdine production between high and low ice nucleation active isolates. The production of homoserine lactones in six selected *P. syringae* belonged to the different groups of ice nucleation activity were extracted and detected using *Chromobacter violaceum* CV026 which was overlaid on Thin-layer chromatography plates. Our results indicated direct correlation between ice nucleation activity and the amount of homoserine lactone production and confirmed that the hypermotile isolates have high ice nucleation activity.

Keywords: bacteria, homoserine lactone, ice nucleation, quorum sensing.

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Effect of chitosan on gene expression and activity of enzymes involved in resistant induction to fusarium of wheat

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ABSTRACT

In this research, the role of chitosan as a bio-inducer of defense mechanism in infected wheat by *Fusarium graminearum*, the causal agent of Fusarium head blight was investigated. To investigate the expression of genes associated with pathogenicity and enzymatic activity, a factorial experiment in a completely randomized design with four replications was done under greenhouse condition. The adjusted solution containing different concentrations of chitosan (0, 100, 200 and 500 mg l⁻¹) were used via spray. Treated plants after 24 hours with a spore suspension (at a concentration of 10⁶ Macro conidia ml⁻¹) were inoculated by spikelet injection and were kept under greenhouse conditions. Sampling was performed at various time points after inoculation and then the expression level of some genes involved in resistance and activity of relative enzyme was studied. Data analysis showed that disease severity was reduced in treated plants compared with control plants. Enzyme measurement showed the greatest variation for peroxidase and polyphenol oxidase enzymes. The results of molecular analysis by qRT-PCR showed significantly increased mRNA expression levels of beta-1, 3-glucanase and oxalate oxidase genes. The results of this research indicate that chitosan could influence plant resistance against pathogenic fungi through induction of systemic acquire resistance.

Keywords: chitosan, head blight, peroxidase, polyphenol oxidase, qRT-PCR.