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Collecting, identifying and selecting a native strain of egg parasitoid wasps, *Trichogramma* for biological control of the codling moth, *Cydia pomonella* in Damavand region

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ABSTRACT

In order to select a suitable species of the trichogrammatid wasps for biological control of the codling moth, some of the trichogrammatid wasps were collected and identified from the apple orchards located in north east of Tehran province by direct sampling on the codling moth eggs and using egg traps. Furthermore, laboratory experiments were carried out according to completely randomized design for evaluation of fecundity and longevity of the collected wasps at temperatures 22, 24, and 26°C by using the eggs of *Sitotroga cerealla* as factitious host. Moreover, host acceptance of the codling moth eggs by the wasps was examined statistically after five generation rearing on factitious host. Three species of the trichogrammatid wasps, *Trichogramma brassicae*, *T. pintoi*, and *T. embryophagum*, were collected and identified from the studied apple orchards located in Damavand and Rodehen region. According to the obtained results, fecundity of the evaluated wasps at temperatures 24 and 26°C were higher statistically than temperature 22°C. The highest values of the fecundity of *T. pintoi* and *T. embryophagum* were 30.96 and 26.46 eggs/female at studied time interval, respectively. In order to examine host acceptance level of the wasps, the percentage of the host eggs parasitism were determined as 73.64% and 17.70%, by *T. embryophagum* and *T. pintoi*, respectively. Considering all the obtained results, collected native strain of *T. embryophagum* was introduced as a suitable choice for extension of the biological control program against the codling moth in apple orchards located in study region.

Keywords: biological control, codling moth, ecotype, egg parasitoid.

Oribatid mites (Acari: Sarcoptiformes: Cryptostigmata) fauna of Zanjan county

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ABSTRACT

During 2011-2012, a faunistic survey on oribatid mites was conducted in Zanjan county. The mites were extracted using Berlese- tullgren setup and mounted after clearing in Nesbitt's fluid. 46 species from 35 genera belonging to 24 families were identified. All of them were new records for mite fauna of Zanjan province. **Amerobelbidae:** *Amerobelba decedens*; **Brachychthoniidae:** *Brachychthonius gracilis*; **Carabodidae:** *Austrocarabodes* sp.; **Cosmochthoniidae:** *Cosmochthonius foliatus*, *Cosmochthonius* sp. nr. *reticulatus*; **Damaeidae:** *Belba* sp.; **Damaeolidae:** *Fosseremus laciniatus*; **Epilohmanniidae:** *Epilohmannia cylindrica cylindrica*; **Euphthiracaridae:** *Acrotritia ardua*; **Gymnodamaeidae:** *Jacotella frondeus*; **Galumnidae:** *Allogalumna* sp.; *Galumna iranensis*, *G. karajica*, *Pergalumna* sp.; **Haplochthoniidae:** *Haplochthonius sanctaeluciae*, *H. simplex*; **Haplozetidae:** *Haplozetes fusifer*, *Peloribates* sp.; **Hypochthoniidae:** *Hypochthonius luteus*; **Licnodamaeidae:** *Licnodamaeus fissuratus*, *Licnodamaeus* sp. nr. *itsukushima*; **Lohmanniidae:** *Papillacarus aciculatus*; **Nothridae:** *Nothrus biciliatus*; **Oppiidae:** *Anomaloppia mazandaranica*, *A. ozkani*, *Corynoppia* sp., *Multioppia wilsoni laniseta*, *Oppia denticulata*, *Oppia* sp., *Oppiella (Oppiella) nova nova*, *Rhinoppia bipectinata*, *Ramusella (Ramusella) puertomontensis*, *R. (Rectoppia) damavandica*, *R. (Rectoppia) faciata*; **Oribatulidae:** *Oribatula (Zygoribatula) connexa*, *O. (Oribatula) pallida*, *O. (Zygoribatula) sp. nr. skrjabini*; **Passalozetidae:** *Passalozetes africanus*; **Phthiracaridae:** *Phthiracarus* sp. nr. *incredibilis*; **Protoribatidae:** *Liebstadia similis*, *Protoribates (Protoribates) paracapucinus*, *Sicaxylobates* sp.; **Schelorbitidae:** *Schelorbitates praeincisus*, *Schelorbitates* sp.; **Sphaerochthoniidae:** *Sphaerochthonius splendidus*; **Tectocephidae:** *Tectocephus velatus*.

Keywords: classification, identification, Oribatida.

Bioaccumulation of some bioenergetics resources in Sunn pest, *Eurygaster integriceps* (Hem. Scutelleridae), under treatment of Neem-azal

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Abstract

Stored bioenergetic resources in overwintering adults of sunn pest, *Eurygaster integriceps*, is important in their hibernation. The present study examined some biochemical changes in the adults treated by sub-lethal concentrations ($\leq LC_{30}$) of Neem-azal T/S. Initially, adults of new generation were sprayed by different concentrations of Neem-azal (100, 300, 500 and 0 $\mu\text{l/l}$) under field conditions for 3, 6 and 12 days. Then, the adults of the first experiments were resprayed a week later by Neem-azal at the same concentrations prior to resampling for 3, 6 and 12 days. The amounts of lipid, sugar, glycogen and protein of four males and females were determined (mg/g; w/w). Results revealed significant effects Neem-azal on total lipid, glycogen, sugar, protein and energy content ($P < 0.001$). So that all of three concentration increased lipid and protein contents versus control hemipterans. The net amount of lipids and proteins were increased in 100, 300 and 500 $\mu\text{l/l}$ levels respectively 85.53%, 97.3%, 108.22% and 4.62%, 14.23%, 34.27%. The glycogen quantity decreased 27.35% in 100 $\mu\text{l/l}$ concentration level and no significant differences in other doses with respect to control. Also sugar quantity was decreased 9.9, 27.37 and 43.76% respectively in 100, 300 and 500 $\mu\text{l/l}$ concentration levels. The energy content (EC) was increased in three doses and this trend continued with the passage of time. Respraying also was affected on increasing of EC and adult sexes not significant effect on it.

Keywords: carbohydrates, lipids, Neem-azal, proteins, Sunn pest.

The effect of piperonyl butoxide on the specific activity of glutathione s-transferase of the common pistachio psyllid, *Agonoscena pistaciae*

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ABSTRACT

Glutathion S-transferase enzymes have an important role in the detoxification of pesticides compounds and the resistance of insects to insecticides. In this study, the activity of glutathione S-transferase enzyme between summer and winter forms of pistachio psyllid, were measured and the effect of different concentrations of PBO (0.5, 1,2,4 and 8 mg/Lit) on the inhibition of activity of this enzyme were investigated by using of 1- chloro- 2,4- dinitrobenzene (CDNB) as a substrate. In addition, the activity of glutathione S-transferase was determined at 0, 1, 2, 4 and 6 hour after treatment the adults by the concentration of PBO that had maximum inhibition on this enzyme. The results indicated that there is no significant deference between the activity of enzyme in different forms of pistachio psyllid ($P < 0.05$) and the lowest activity of glutathione S-transferase or highest inhibition were obtained in 0.5 mg L^{-1} of PBO and the maximum inhibition were done at 4 hour after the synergism application. According to these results, it seems that by using the suitable dose of PBO and matching the time that the synergist has maximum inhibition to the glutathione S-transferase we will be able to promote the resistance management of pistachio psyllid to pesticides.

Keywords: PBO, pesticide resistance management, pistachio psyllid, synergist.

Effect of an extracted lectin from *Sclerotinia sclerotiorum* de Bary on mortality and physiological parameters in the larvae of large cabbage butterfly, *Pieris brassicae* (Lepidoptera: Pieridae)

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ABSTRACT

In the current study, the extracted lectin from plant pathogenic fungus, *Sclerotinia sclerotiorum* was added to diet of third larval instars of Large cabbage butterfly, then its effects were determined on mortality, feeding and intermediary metabolism. Concentrations of 0.5, 1 and 2 mg/ml of the lectin caused 20-60% of mortality in the treated larvae. Amounts of nutritional indices in the treated larvae significantly decreased versus control although level of metabolic cost in the treated larvae showed statistical increase versus control. Activities of the digestive enzymes such as alpha-amylase, glucosidases, lipase, general and specific proteases (Serine and Exopeptidases) decreased in the fed larvae on lectin concentrations versus control. Although activities of aspartate aminotransferase and γ -glutamyl transferase significantly increased in the concentrations of 1 and 2 mg/ml but activity of alanine aminotransferase had a significant decrease versus control. Activity of acid phosphatase had no statistical differences among treatments and control but activity of alkaline phosphatase was significantly lower than control larvae. Activity of lactate dehydrogenase in the fed larvae on the concentration of 2 mg/ml had significant increase but activities of aldolase in the control and fed larvae on 0.5 mg/ml of lectin were higher than those of other treatments. Amounts of storage macromolecules such as protein, triglyceride and glycogen in the fed larvae on the lectin were lower than those of control so that it was more significant in the concentration of 2 mg/ml. Results of the current study demonstrated that the lectin from *S. sclerotiorum* caused mortality and interference in digestive physiology and intermediary metabolism of *P. Brassicae* larvae so it could be used as a toxic molecule to control of the pest.

Keywords: digestive physiology, intermediary metabolism, lectin, *Pieris brassicae*, *Sclerotinia sclerotiorum*.

Isolation and pathogenicity of fungi associated with root and crown rot of walnut trees in Kermanshah township

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ABSTRACT

The aim of this research, identifying the fungi taxa associated with root and crown rot of walnut trees in Kermanshah. For this purpose, the soil around root of trees and root and crown samples of walnut trees showing disease were collected in different region in Kermanshah. The purified isolates were identified using morphological characters on the different culture media, asexual and sexual organ as well as growth rates at different temperatures. In this research, 13 isolates, belong to three species including *Phytophthora cactorum*, *P. citricola* and *Pythium* sp. were identified. *Pythium* sp. maybe is a new species, because characteristics of this species did not match completely with other recognized *Pythium* species. *Pythium* sp. (1) and *Pythium* sp. (2) isolated from diseased tissue and infected soil, respectively. Pathogenicity test of these species were performed on excised shoots and seedlings *In vitro* and *In vivo*, respectively. Results of *In vitro* indicated that the most disease extension was appeared by *Phytophthora cactorum*, but was placed in one statistical group with *Pythium* sp. (1). *Phytophthora citricola* and *Pythium* sp. (2) were placed in the following statistical group. Results of greenhouse experiment shown that, *P. citricola* and *P. cactorum* caused complete death of seedlings after 8 and 12 days, respectively. *Pythium* sp. (1, 2) after 14 days caused drying of stem and leaves and death of seedlings.

Keywords: crown and root rot, pathogenicity, *Phytophthora*, *Pythium*, walnut.

Effects of ecdysteroid compounds extracted from *Silene aucheriana* and halofenozide to control *Reticulitermes* sp. (Isoptera: Rhinotermitidae) under laboratory conditions

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ABSTRACT

Ecdysteroid compounds such as phytoecdysteroids and ecdysone analogues have been considered for their potential ability to control pests. Ecdysone-agonist disrupting molting processes can induce precocious death. The aim of this research was to evaluate the effects of ecdystroid extracts of *Silene aucheriana* Boiss (family Caryophyllaceae) to control *Reticulitermes* sp. termite in comparison with halofenozide under choice and non-choice feeding conditions. Probit analysis of the data using time instead of dosage indicated that final mortality and the speed of death were dependent on dose. The percentage mortality were 54%, 60%, 76% and 80% at concentrations of 1000, 2500, 5000 and 10000 ppm, respectively at the end of the choice test period for halofenozide. The percentage mortality were 58%, 68%, 75% and 89% at concentrations of 5%, 10%, 20% and 40 %, respectively at the end of the choice test period for *S. aucheriana*. The general effects of ecdysteroid compounds, were observed including incomplete ecdysis and subsequent mortality. Overall, the results indicated that ecdysteroid compounds are effective for control *Reticulitermes* sp. Therefore it is necessary to establish comprehensive studies on the effects of ecdysteroid compounds for practical use in termites control.

Keywords: ecdysone analogues, ecdysteroid compounds, phytoecdysteroids, *Reticulitermes*.

The presence of the susceptibility gene, *Tsn1*, in some wheat lines and their reactions to ToxA infiltration produced by *Pyrenophora tritici-repentis*

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ABSTRACT

The tan spot disease caused by *Pyrenophora tritici-repentis* is one of the most important diseases of wheat causing significant losses annually. The use of accurate, quick and cost-effective techniques, for evaluation of wheat lines to important diseases have been always considered by wheat breeders. In this study, reactions of 20 wheat lines to ToxA, the most important virulence factor of *P. tritici-repentis*, were evaluated using toxin infiltration approach. The results showed that 9 lines along with Grandin cv. as the susceptible cultivar, exhibited necrosis symptoms within 48 hours after toxin infiltration and, thus, were identified as the susceptible lines to ToxA. The remaining genotypes were identified as resistant lines to the toxin. In addition, PCR assays were used to detect the susceptibility gene, *Tsn1*, using gene-specific primers. The results showed that in susceptible lines a 380 bp band could be amplified revealing that *Tsn1* gene was presented in these lines. All the resistant lines did not amplify *Tsn1* gene and confirmed the results of toxin infiltration. The results of this study showed that this approach can be used for initial screening of wheat lines as a negative selection method for identification and subsequent elimination of susceptible lines from breeding programs.

Keywords: *Pyrenophora tritici-repentis*, susceptibility gene, tan spot of wheat, ToxA toxin, *Ts1*.

Imidacloprid resistance in *Thrips tabaci* (Thys. Thripidae) populations collected from onion fields in Isfahan

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ABSTRACT

Onion thrips, *Thrips tabaci*, is the most important pest of onion in Isfahan. Onion growers often rely on the pesticide spraying. Imidacloprid is frequently used against this pest. To investigate the thrips resistance to this insecticide, 10 onion-growing regions of Isfahan were selected. After their laboratory rearing, certain concentrations of imidacloprid were applied to these populations, using a leaf dip bioassay method. LC₅₀ values of field populations were compared to Harand population as a susceptible reference strain. Different levels of resistance were observed in most populations. To investigate the resistance mechanisms, populations were pre-treated with two synergists namely PBO (piperonyl butoxide) and DEM (diethyl maleate) as inhibitors of monooxygenases and glutathione-S-transferases, respectively. Based on the results, these enzymes do not seem to play a substantial role in the resistance. The results also indicated that there is no high level of cross resistance in most imidacloprid-resistant populations against acetamiprid, another neonicotinoids insecticide.

Keywords: cross resistance, imidacloprid, insecticide resistance, *Thrips tabaci*.

Introduction of some isolates of *Rhizoctonia solani* AG-1 IA with more stable performance in virulence, nominees for resistance studies in rice plant in the north of Iran

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ABSTRACT

The present investigation was carried out to examine virulence diversity among the 291 isolates (seven populations) of *Rhizoctonia solani* AG-1 IA causing sheath blight of rice by sclerotia production and pathogenicity studies on four rice cultivars representing different observed disease reactions, using detached leaf inoculation method in conjunction with mycelia growth measuring. Based on pathogenicity test four tested cultivars were significantly differed from each other in response to each population of pathogen. In each population, all the test isolates exhibited varying degree of virulence on each four cultivars and were variable both in mycelial and sclerotial (number and weight) parameters. There was found one group in each population having more stable performance in virulence in a range of genetically different rice cultivars based on their virulence on each four cultivars and along with their coefficient of variation by cluster analysis method. According to these findings, six, two, five and one high-virulence isolates respectively from populations of Rasht, Tonekabon, Amol and Golestan can be used to future greenhouse or field tests, selecting most suitable isolates for identification of accurate reaction of rice cultivars / lines for rice breeding programs in north of Iran.

Keywords: North of Iran, pathogenesis behavior, rice cultivars, sheath blight of rice.

Identification of *Ramularia* species on some medicinal plants in Kohgiluyeh and Boyerahmad Province

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ABSTRACT

In order to identify *Ramularia* species on medicinal plants, specimens with leaf spot symptom from different localities in Kohgiluyeh and Boyerahmad Province were obtained and morphologically examined during spring-autumn 2012-13. Based on morphological characteristics of conidiophore and conidium, nine species of *Ramularia* were identified. Among these, *R. veronicae* and *R. winteri* are new records for mycobiota of Iran. Furthermore, this is the first record of *Ramularia* species including *R. beccabungae*, *R. marrubii* and *R. variabilis* on *Veronica anagallis-aquatica*, *Sideritis montana* and *Verbascum sinuatum* in Iran respectively.

Keywords: fungus, leaf spot, species, taxonomy.

The effects of three *Pseudomonas fluorescens* strains on chlorophyll, carotenoid and three nutritional elements in common bean genotypes inoculated with *Bean yellow mosaic virus*

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Abstract

Bean yellow mosaic virus (BYMV) is one of the most difficult to manage viruses because of having a wide host range and numerous vectors. In this survey the effect of three bacterial strains of *Pseudomonas fluorescens*, including CHA0, VUPF5 and Δ VUPF5 on BYMV in 16 common bean genotypes has been investigated. Common bean seeds were saturated with suspension of bacterial strains with concentration of 10^8 cfu/cc before cultivating. The experiment was performed in a completely coincidence model with three replications. Afterwards, all plants except controls were mechanically inoculated with a BYMV isolates. Finally, the concentration of chlorophyll a/b, total chlorophyll, carotenoid and three nutritional elements including Mg, Zn and Fe in common bean genotypes were determined. The results revealed that the mentioned strains could significantly reduce viral damages in most of genotypes. In general, Δ VUPF5 isolate had the best biocontrol effect among three selected bacteria.

Keywords: Bean yellow mosaic virus, chlorophyll, common bean, *Pseudomonas fluorescens*.

Effect of mating and previous parasitism on functional response of *Trissolcus djadetshkoe* (Hym.: Scelionidae) an egg parasitoid of *Eurygaster integriceps* (Hem.: Scutelleridae)

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Abstract

Trissolcus djadetshkoe Rjachowsky (Hym.: Scelionidae) is an egg parasitoid of sunn pest *Eurygaster integriceps* Puton (Hem.: Scutelleridae) in Iran. Searching efficiency of this species was determined in a functional response context. Effect of female insemination as well as parasitism experience was also investigated. Host densities of 2, 4, 7, 14, 28 and 56 eggs were offered to a single female in 20, 20, 15, 15, 10 and 10 replications in a 24 h experiment in 1.5×10 cm vials. Virgin vs. inseminated females as well as inexperienced vs. experienced ones were used in two sets of experiments. All experiments were conducted in a growth chamber (26±1°C, 50±10% RH, 16: 8 h photoperiod). Logistic regression and nonlinear regression model of random search were used for analysis. All parasitoid responses were type III. Experienced females showed lower parasitism in all densities. Maximum attack rate estimates were 14 in experienced females vs. 34 in inexperienced ones. It seems that previous reproductive efforts have depleted energy of the females. A lighter difference was observed in virgin females over inseminated ones (25 vs. 17). This difference probably concerns with costs of sex allocation for inseminated mothers.

Keywords: effect of insemination, experience of parasitism, foraging behavior.

Comparison of life history parameters of tomato leafminer, *Tuta absoluta* (Lep.: Gelechiidae) on five cultivars of tomato

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Abstract

Tomato leafminer, *Tuta absoluta* (Meyrick), is one of the most important pests of tomato, *Solanum lycopersicum* L. In this research, life history parameters of the tomato leafminer were studied on five tomato cultivars including: Super Strain B, Super Chief, Early Urbana Y111, Mobil and Early Urbana Y under greenhouse condition. The results indicated that the larval development on Mobil and Early Urbana Y was significantly slower than on the other cultivars. The number of eggs laid per female were highest on Super Strain B (114.05 ± 3.7) and lowest on Early Urbana Y (105.95 ± 4.4). The lowest survival rate from egg to adult was observed on Early Urbana Y. The intrinsic rate of natural increase (r_m) was statistically reduced on tomato cultivars in the following descending order: Super Strain B, Super Chief, Early Urbana Y111, Mobil and Early Urbana Y, respectively. The lowest finite rate of increase (λ) (1.141 day^{-1}) and the longest generation time (T) (28.44 days) were calculated on Early Urbana Y. Therefore, it could be concluded that among the tested cultivars, Super Strain B is the most suitable and Early Urbana Y is the least suitable hosts for population growth of the tomato leafminer.

Keywords: crop cultivars, demography, host resistance, life table.

**Antixenosis and antibiosis resistance of 9 wheat cultivars
(*Triticum aestivum*) to the sunn pest, *Eurygaster integriceps* (Hem.:
Scutelleridae) in the field conditions in Naghadeh region, west
Azarbaijan province**

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ABSTRACT

The Sunn pest, *Eurygaster integriceps* Put. is the most important pest of the wheat in Iran and neighbouring countries that can considerably reduce its yield. One way to control this pest is deployment of resistant cultivars. Field experiments were conducted to evaluate the antixenosis and antibiosis resistance of nine wheat cultivars to this pest. In a field choice test, the numbers of attracted overwintered adults to the cultivars were determined as antixenosis index. Also, number of eggs per m² and numbers of damaged hills, buds and spikes were used as antixenosis indices. To evaluate the antibiosis, wheat seeds were planted in pots under the field conditions in which second instar nymphs were released and reared. Nymphal weight on the 14th day after releasing, mortality of nymphal stage and the duration of this stage were considered and analyzed as the antibiosis indices. Significant differences were observed in studied traits ($P \leq 0.05$). Using cluster analysis, UPGMA procedure based on Euclidean distance, nine experimental cultivars were grouped in five distance groups that cultivars Alvand, Sardari and Azar2 by replacing in the same group, had the highest resistance to the Sunn pest.

Keywords: antibiosis, antixenosis, *Eurygaster integriceps*, resistance cultivars, Sunn pest, wheat.

Genetic structure of *Pyrenophora graminea* populations the causal agent of barley leaf stripe disease using ISSR marker

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ABSTRACT

Barley leaf stripe caused by *Pyrenophora graminea* is one of the most important diseases of barley in Ilam province. In order to determine the genetic structure of *P. graminea* populations, sampling was randomly carried out on aerial parts of barley plants with leaf brown lesions, from different regions in Ilam province. A total of 69 *P. graminea* isolates were obtained from infected samples using potato dextrose agar media. Pathogenicity test and inoculation of seeds were done with Sandwich method, because causal agent cannot produce enough spores on artificial media. A set of eight Inter simple sequence repeat primers (ISSR) were used to determine genetic diversity of *P. graminea* isolates. This set ISSR primers revealed a total of 171 alleles for *P. graminea* isolates in all populations. The number of alleles varied from 16 to 30 for each marker. Cluster analysis were carried out with according Dice similarity coefficient and UPGMA method. Based on dendrogram thirteen groups were revealed. A Comparison of the parameters of genetic diversity in seven population showed that Darehshahr population has the highest genetic diversity ($h= 0.32$) and the smallest genetic distance was observed between population Asemanabad and Sirvan (0.019). The phonogram revealed two distinct groups, one group contained Darehshahr and the other Ivan, Asemanabad, Sirvan and Chardavol populations. Molecular analysis of variance to compare the genetic diversity within and between populations showed the greatest diversity related within populations (94%) and the level of genetic variation among populations was very low (6%). High level of genetic variation within populations can be justified by highest amount of gen flow ($N_m= 4.576$).

Keywords: barley, ISSR, genetic structure, *Pyrenophora graminea*.

The ability of separate and combined application of five nematophagous fungi against *Meloidogyne javanica* on eggplant

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ABSTRACT

The infectivity of *Pochonia bulbillosa* (Pb), *Pochonia chlamydosporia* var. *catenulata* (Pccat), *Pochonia chlamydosporia* var. *chlamydosporia* (Pcc), *Lecanicillium aphanocladii* (La) and *Trichoderma harzianum* (Th) on *Meloidogyne javanica* egg masses was assessed in an in vitro experiment. These fungi were also used alone and in binary or trinary combination for the management of *M. javanica* on eggplant. There was no significant difference among fungi in their infection rate or in reducing hatch of nematode eggs. After 8 weeks, the plant growth parameter (shoot and root weight) was similar in the treatments where the fungal biocontrol agents were applied separately or simultaneously. The total number of eggs (healthy and infected) on root system was not considerably decreased compared with control. Integrated application of fungi increased the infection rate significantly. No treatment could control the nematode as the same level as cadusafos nematicide (96%), however the combined use of Pccat, La with Pcc (85%) or Th (83%) controlled the nematode satisfactorily. Therefore, simultaneous application of Pccat, La and Pcc or Pccat, La and Th are recommendable as a measure for controlling *M. javanica*.

Keywords: biological control, combination, nematopathogenic fungi.