

Thermal tendencies in *Ooencyrtus fecundus* Ferriere & Voegelé (Hymenoptera: Encyrtidae) egg parasitoid of sunn pest

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ABSTRACT

Insects are poikilothermes and hence environmental factors and primarily temperature can affect their biological activities and behavior. In this study thermal range preferred by *Ooencyrtus fecundus* Ferrier & Voegelé was investigated by a device producing a thermal gradient from 16 to 47°C. Temperature of different parts of the arena was precisely recorded by eight thermometers entered the arena from marginal walls of the apparatus. Three entries were prepared in cold, middle and warm areas of the device. In order to exclude possible tendencies of the release point, experiment was done three times each from an entry. Twenty wasps were released each time and number of the parasitoids as well as current temperature of any part was recorded after 5, 15 and 30 minutes. The highest frequency of the wasp (89.25%) was occurred in a spectrum of 23.47-29.54°C while 46.66% of them were assembled in center of the arena where mean temperature was 26.03°C. Wasps' distribution was affected by release point as significant discrepancies observing between all pairs of the experiments. The results revealed that the wasp searches for the sites with desirable temperatures by limited locomotion but avoid further movements as soon as it finds tolerable temperature.

Keywords: natural enemies, thermotaxi, thermotropism.

Optimization of a wettable powder formulation for two native *Bacillus thuringiensis* strains

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ABSTRACT

The objective of the present study was to optimize a wettable powder formulation for two Iranian *Bt* strains (YD5 and KH4) in order to enhance efficiency and durability of the final products as biological agent against lepidopteran and coleopteran pests. Mass production of the mentioned strains was done in a batch fermenter based on the previously optimized economical medium and fermentation conditions. The final concentration was achieved 6×10^9 (CFU/mg). To optimize formulation for two strains, 25% spore crystal mixture of the strain and 75% adjuvants including different fillers, surfactants, materials enhancing durability, anti UV materials, suspensors, wetters, palatability materials and antimicrobial materials in the framework of five statistical treatments were used. Based on the results, the treatment containing milk powder (4%), perlite (6%), irosile (2%), sodium loril sulfate (8%), alkaline naphthalene (20%), starch (10%), gelatin (9%), sugar (10%), potassium surbate (1%), casein and gluten (2%), potassium dioxide (3%) and monosodium glutamate (0.2%) showed maximum suspensibility (73 and 71%) and wettability (25 and 24%) for YD5 and KH4 strains, respectively, and selected for the next experiments. The selected formulation for both strains had a white to grey color, 6-7% moisture content, and pH 6.1 and 6.2. Crystals in both formulations were stable without any changes during one year. The LC_{50} of the selected formulation for YD5 and KH4 strains against larvae cotton bollworm and elm leaf beetle was 550 and 510 ng/cm² leaf, respectively.

Keywords: *Bacillus thuringiensis*, biopesticide, formulation, wettable powder.

Biological and life table parameters of the green lacewing, *Chrysoperla carnea* (Neu., Chrysopidae) in feeding on different preys under laboratory conditions

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ABSTRACT

The green lacewing, *Chrysoperla carnea* (Stephens) is one of the important predators of many pests including *Helicoverpa armigera* (Hübner) and *Tetranychus urticae* Koch. In insectaries, the larvae of this predator are mainly reared on *Anagasta kuehniella* egg. In this research, biological and life table parameters of *C. carnea* in feeding on *A. kuehniella* egg as a laboratory prey and two natural preys including *H. armigera* (stages of egg and neonate larva) and *T. urticae* were studied. The experiments were carried out at 26 ± 1 °C, $70\pm 5\%$ RH and 16:8 (L:D) h. *C. carnea* larvae reared on *T. urticae* did not survive to adulthood. The maximum longevity of adult females (38.3 day), oviposition period (32.33 day) and eggs/female/day (30.52) were obtained in rearing of the predator on *H. armigera* egg. Survivorship curve of the predator on all insect preys was from type I. Net reproductive rate (R_0) and intrinsic rate of increase (r) of *C. carnea* on *A. kuehniella* egg and *H. armigera* egg and neonate larva were estimated to be 352.68, 579.64 and 385.47 per generation and 0.1816, 0.2152 and 0.2094 d⁻¹, respectively.

Keywords: cotton pests, natural enemy, biological control, intrinsic rate of increase.

**Pathogenicity of *Beauveria bassiana* and
Lecanicillium muscarium on cotton whitefly
(*Bemisia tabaci* (Homoptera: Aleyrodidae))
in simultaneously use**

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ABSTRACT

Pathogenicity of *Beauveria bassiana* strain DEBI001, *Lecanicillium muscarium* strain DAOM 198499 and their combination was investigated on 2nd nymphs and adults of *B. tabaci* in controlled condition (in 23±1°C, 95±5% and 16:8 L:D). Five concentrations from each isolates were sprayed on undersides of young eggplant leaves that involved 2nd nymphs. Experiments were carried out on adults with the same concentrations in two methods of spraying: Direct spraying on adults, and indirect spraying on plant leaves. LC₅₀ values of the *B. bassiana*, *L. muscarium* and their combination on 2nd nymphs was 4.4×10⁵, 1.8×10⁵ and 7.9×10⁵ conidia/ml., respectively. The results showed that LT₅₀ values for different concentrations (10⁶, 10⁷ and 10⁸ conidia/ml.) of *B. bassiana* were 8.3, 6 and 4.8 days; for *L. muscarium* were equal to 7.2, 5.5 and 3.9 days and 6.7, 5.1 and 4 days for their combination. In indirect application methods of isolates on host plant, high mortality rate of cotton whitefly adults was happened than control. The highest mortality due to *B. bassiana* was 89.33%; and 96.25%; while it was 78.33 % and 93.75% due to *L. muscarium*, immediately and 5 days after spraying, respectively. Adult mortality rate was lower in direct spraying method than indirect application (51.1% by *B. bassiana* and 38.32% by *L. muscarium* by 10⁸ conidia/ml.).

Keywords: biological control, cotton whitefly, entomopathogen.

Antifungal activity of plant extracts of catmint, tobacco and thyme on pathogens fungal of tobacco

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ABSTRACT

One of the new methods for plant diseases management is application of plant extracts. Soilborne pathogens fungal are world wide distributed and important phytopathogens. They cause yield losses in tobacco growing countries. The purpose of this study is to evaluate the antifungal activity of plant extracts on soilborne pathogens fungal of tobacco (*Rhizoctonia solani* and *Phytophthora nicotianae*) and determine the best concentration of extracts on antifungal activity. The experiment was done in a factorial design based on completely randomized with three factors and five replications under *in vitro* condition. The first factors, plant extract (nine plant species), the second factor, solvent (five solvent) and the third factor, concentration (three concentration) were considered. In our previous study, experiments were carried out in pot condition based on factorial design with eighteen treatments and three replications in Tirtash Reaserch and Education Center, in 2013. In this study, the first factor including three plant extracts (catmint, tobacco and thyme), the second factor, three concentration (0.5, 1 and 2 in 1000), and the third factor, treatment application of method two (spray and drench) were considered. The results indicated that different concentration of crude extracts of catmint, tobacco, thyme, fennel, hyssop and badrashbi have remarkable antifungal activity on the fungi. Methanol is perfect solvent for extraction of antifungal compounds. The maximum inhibitory concentration of each extracts was 2000 ppm. The results of analysis variance showed that the effect of plant extracts on control of soilborne pathogens fungal of tobacco was significant at 1% level. In our study, the interactions of "plant extracts \times concentration", "concentration \times application method" and also, "plant extracts \times concentration \times application method" was significant at 1% level. Comparison of treatments means showed that extracts of both plant (catmit and tobacco) at 0.2% concentration were the best treatments with 80% and 75% inhibition of fungi, respectively.

Keywords: disease management, reduced pesticide, biocontrol.

Efficiency and predatory of *Oenopia conglobata contaminata* (Menetries) feeding on green peach aphid *Myzus persicae* (Sulzer) under laboratory conditions

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ABSTRACT

The green peach aphid, *Myzus persicae* (Hem:Aphididae) is a polyphagous aphid species infecting over 400 plants species belonging to 40 different families. The *Oenopia conglobata contaminata* (Col.: Coccinellidae) is one of the most important predator of orchard pests in Iran. In this study, efficiency and predatory of this predator on green peach aphid *M. persicae* was evaluated under laboratory conditions (55±5% r.h. and a 16:8 h photoperiod). The effect of host accumulation to amount of reproduction of this ladybird was studied for 21 days. The result showed that accumulation of 40 hosts was regarded as the lowest density that the ladybird will be required to grow. Data were analyzed with SAS statistical software. Logistic regression was used to determine type of functional response and nonlinear regression to estimate parameters of searching efficiency (a) and handling time (T_h). The result showed that the functional response was type II. Searching efficiency and handling time were $0.063 \pm 0.00819 \text{ h}^{-1}$ and $0.1425 \pm 0.029 \text{ h}$, respectively. Predation rates of forth instar male and female were 45.22, 29.65 and 50.70, respectively. Our results indicated that the *O. conglobata* may be a useful candidate for the biological control of *M. persicae*.

Keywords: Biological control, functional response, IPM, predation rates.

Effect of *Metarhizium anisopliae* and *Trichoderma harzianum* on root knot nematode, *Meloidogyne javanica*

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ABSTRACT

To evaluate the effect of *Metarhizium anisopliae* and *Trichoderma harzianum* on root knot nematode (*Meloidogyne javanica*) in tomato, experiments was performed under controlled as well as greenhouse conditions. Volatile and non-volatile tests showed that there is no inhibitory effect against every one of each biocontrol agents. On the larval mortality and inhibition of egg hatching, a laboratory test was performed in a completely randomized design with eight treatments in four replicates. It has been shown that whole treatments have significantly different with control. The best treatment that caused maximum larval mortality was *T. harzianum* culture filtrate, and the most effective treatment in egg hatch inhibition was *M. anisopliae* culture filtrate. There was no significant effect of mixture of suspensions and culture filtrates of both biocontrol agents. A greenhouse test was performed in a completely randomized design with five treatments in four replicates. In this test, *T. harzianum* increased growth of plants in comparison to inoculated and inoculated controls. *M. anisopliae* improved the growth factors in comparison to negative control, but not in positive control. Both bioagents considerably decreased the nematode-related factors including root gall. *M. anisopliae* had more effect on nematode-related factors than *T. harzianum*. Under greenhouse condition, there was no significant effect of the mixture of both fungi against the tested nematode.

Keywords: biological control, *Metarhizium anisopliae*, root knot nematode, tomato, *Trichoderma harzianum*.

Biocontrol ability of some essential oils on the growth of *Botrytis cinerea*, causal agent of apple gray mold

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ABSTRACT

Chemical fungicides are considered as the primary approach for controlling postharvest fungal decay of fruit and vegetables, while continuous use of fungicides has faced to increasing public concern regarding contamination of perishables with fungicidal residues, and proliferation of resistance in the pathogen populations. So, recent researches in this area have focused on the development and evaluation of alternative control strategies to reduce dependency on synthetic fungicides. Thus, in this research *in vitro* and *in vivo* biocontrol activity of plant essential oils of *Satureja hortensis*, *Rosmarinus officinalis*, *Mentha piperita*, *Zataria multiflora* and *Cuminum cyminum* against the growth of *Botrytis cinerea*, the causal agent of apple gray mold was evaluated. *In vitro* results revealed that the essential oils of *Zataria multiflora*, *Cuminum cyminum* and *Mentha piperita* have the highest biocontrol activity among tested essential oils. *In vivo* results also indicated that those essential oils in a concentration of 1000 ppm have a significant inhibitory effect on the growth of *Botrytis cinerea*. GC-MS analysis demonstrated that carvacrol (71.19%), γ -Terpinene (30.41%) and menthol (51.19%) were the main components of the essential oils of *Zataria multiflora*, *Cuminum cyminum* and *Mentha piperita*, respectively. Based on the results, the essential oils could be suggested as an alternative to synthetic chemicals.

Keywords: essential oil, postharvest, antifungal activity, *Botrytis cinerea*.