Pest Technology

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Scope and target readership: *Pest Technology* provides authoritative coverage of research developments and advances in the fight against pests that affect plants or plant production systems. Through peer-reviewed original research papers and informative contributions on current topics, the journal acts as a bridge between academic research and application. We focus on plant protection and damage inflicted by insects, fungi, bacteria, weeds, invertebrates and vertebrates. *Pest Technology* reports in the areas of agriculture, horticulture, forestry, conservation, stored products research, and health and safety aspects.

Pest Technology also accepts papers on the following topics:

1) Mycology and Mycopathology (applied industrial mycology; crop protection; entomopathogenic fungi; environmental aeromycology; medical and veterinary mycology; molecular mycology; mycotoxicoses and mycotoxins; plant mycology);
2) Plant pathology (fundamental and applied aspects): bacteriological, mycological, and virological topics, entomological, nematological and plant protection. IPC (integrated pest control), IPM (integrated pest management). Plant diseases or their control, including pathogen characterization, identification of pathogens, disease physiology and biochemistry, molecular biology, morphology and ultrastructure, genetics, disease transmission, ecology and epidemiology, chemical and biological control, disease assessment;
3) Biological control (reducing or mitigating pests and pest effects through the use of natural enemies). Use of genes or gene products for the enhancement of biological control agents. The journal encompasses biological control of viral, microbial, nematode, insect, mite, weed, and vertebrate pests in agriculture, aquatic, forest, natural resource, stored product, and urban environments. Biological control of arthropod pests of human and domestic animals is also included if it furthers the understanding of parallel systems in plants. Ecological, molecular, and biotechnological approaches to the understanding of biological control are strongly encouraged. *Pest Technology* covers: (a) Entomology – parasitoids, predators, and pathogens and their use through importation, augmentation, and/or habitat management strategies; (b) plant pathology – antagonism, competition, cross-protection, hyperparasitism, hypovirulence, and soil suppressiveness through naturally occurring and introduced agents; (c) nematology – predators, parasitoids, and pathogens in biological control through augmentation and/or habitat management strategies and suppressive soils through naturally occurring and introduced agents; (d) weed science – vertebrates, invertebrates, and pathogens and their use through classical, augmentative, or bioherbicidal tactics;
4) Applied entomology: chemical and sensory ecology and infochemicals; (co-)evolution; host-plant selection mechanisms; natural and transgenic plant resistance; parasitoid-host interactions.

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Cover photos: Top, left: Microscopic observation of transversal section of *Culex pipiens* L_4 larvae body (control) (Chaieb *et al*., pp 73-75); Top, center: Control without NMO10 (Ibrahim and Omar, pp 45-49); Top, right: Life cycle of the western flower thrips, *Frankliniella occidentalis* (Pergande) (Cloyd, pp 1-9); Bottom, left: *L. migratoria migratoria* larval gastric caeca structure after 8 days of 3125 ppm GA_3 treatment (Abdellaoui *et al*., pp 28-33); Center: Exuviation difficulties for *L. migratoria migratoria* larvae after ingestion of GA_3 (Abdellaoui *et al*., pp 28-33); Bottom, center: Reduction in plant height and leaf area in AMV plants respect to Vr plants (Sipahioglu *et al*., pp 63-66). Bottom, right: The effect of AMF+PVY combination and PVY infection on root system of potato (Sipahioglu *et al*., pp 63-66).

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ABSTRACT

Invited Review: Western flower thrips, *Franklinella occidentalis* (Pergande) is considered the most destructive insect pest of greenhouse-grown crops due to direct feeding damage to plant parts such as foliage and flowers, and indirect damage by vectoring the tospoviruses; impatiens necrotic spot and tomato spotted wilt virus. Furthermore, western flower thrips (WFT) is difficult to manage in greenhouse production systems due to a number of factors including broad range of ornamental plants fed upon, high female reproductive capacity, rapid life cycle (egg to adult), residence in cryptic habitats such as unopened terminal buds that protect them from exposure to contact insecticides, and resistance to various insecticide chemical classes. As such, the management of WFT involves a holistic or complex approach including the concurrent implementation of scouting, cultural, physical, insecticidal, and biological strategies. Due to the lack of new insecticides being introduced for control of WFT, it is important that greenhouse producers preserve the longevity of currently existing products by establishing rotation schemes based on different modes of action. In addition, greenhouse producers must utilize sanitation and biological control practices to avoid solely relying on insecticides. The advent of resistance among WFT populations worldwide has led to a general interest among greenhouse producers in adopting the use of biological control as a long-term strategy to deal with WFT, and still produce and sell a quality crop.

ABSTRACT

Review: Many of the agrochemicals used in controlling pests and diseases are also implicated in ecological, environmental and human health hazards. To find an effective alternative approach with minimum deleterious effects, biological control of soilborne pathogens by application of specific antagonistic microorganisms to seeds, soil or planting material has been studied intensively in the last two decades. Certain bacteria were characterized from rhizosphere of different crop plants that inhibited deleterious and pathogenic bacteria and fungi by producing antibiotics, bacteriocins, siderophores, hydrolytic enzymes and other secondary metabolites. However, the use of these bacteria to protect crops sometimes fails because antagonistic rhizobacteria are unable to compete or colonize the rhizosphere of inoculated plants. Tremendous progress made in characterizing the process of rhizosphere colonization and competence, identification and cloning of bacterial genes contributing to pathogen suppression will contribute to our current understanding of the mechanisms involved in biocontrol. The limitations of these biocontrol products can be addressed by enhancing biocontrol through manipulation of the environment, using mixtures of beneficial organisms, physiological and genetic enhancement of the biocontrol mechanisms, manipulation of formulations and integration of biocontrol with other alternative methods that provide additive effects. These biocontrol agents will subsequently be utilized in sustainable agriculture for improving growth of crop plants.

ABSTRACT

Short Communication: Currently biological methods are commonly applied to control agricultural pests. The organisms used to do this, so-called beneficials, must be produced in bio-factories without incidental field releases occurring. Furthermore, the quality of beneficials is important to ensuring the success of the technique. The IOBC has established certain guidelines by which the quality of commercially produced beneficials can be checked. The case of beneficials used in the control of vegetable pests clearly demonstrates this issue. We have studied the quality of some commercial shipments of *Eretmocerus mundus*, a parasitoid that is widely used in the biological control of the whitefly *Bemisia tabaci*. Our results demonstrate that greater attention should be paid to checking the quality of biological control agents in order to avoid failures in their practical application.

ABSTRACT

Short Communication: Diseases at the post-harvest stage cause significant yield losses in banana, both quantitatively and qualitatively, reducing its demand in hypermarkets. Two isolates of *Fusarium* recovered from banana fruits were identified as *Fusarium thapsinum.* The resulting cultures were purified and grown on potato-dextrose agar (PDA), malt yeast agar (MYA), and dextrose sabroud agar (SDA) under light for cultural identification. A slowly growing white colony that turned grey-violet in pigmentation on the agar was quite variable on PDA and MYA. On SDA medium bright white mycelia were produced, and macro and microconidia are present but sprase and chlamydospores were absent. The morphology of this species is unique and includes two types of microconidia, mostly pyriform to citriform, 0- or 1-septate forming chains. The pathogenicity of the isolated *Fusarium* was tested on banana fruits. Brownish spots formed 1 week after inoculation of *F. thapsinum* isolates on wounded fruit of green banana. These results suggest that *F. thapsinum*, which has not been reported yet in Saudi Arabia, could be introduced into the country along with imported bananas and may cause diseases on other plant species.

ABSTRACT

Original Research Paper: Oral toxicity of gibberellic acid (GA_3), a plant growth regulator, was evaluated on *S. littoralis* (Lepidoptera, Noctuidae) and *L. migratoria migratoria* (Orthoptera, Acrididae) larvae. These insects were exposed to various concentrations of GA_3 incorporated into the diet. GA_3 significantly reduced food consumption of both insect species leading to larval weight loss. GA_3 toxicity was also demonstrated by some larval mortality caused by exuviation difficulties. Different types of malformations observed were due to difficulties in rejecting the nymphal integuments. Additionally, digestive tract softness, particularly for *L. migratoria migratoria*, was observed. A subsequent histological study of the foregut and gastric caeca revealed the cytotoxic effect of GA_3. In fact, we noted the destruction of epithelial cells and a total disorganization of the cellular structure of these organs. Consequently, this experiment led us to conclude that ingested GA_3 caused perturbation in development and death of both insect species, which may be caused by antifeedant properties and by cytotoxic effect via alteration of the digestive system.

ABSTRACT

Original Research Paper: Eight *Bacillus thuringiensis* strains (Sn-2, Gh-4, Ts-5, Is-8, Qa-2, Fa-7, As-3 and As-4) were isolated from soils of seven Egyptian governorates and identified according to their morphology, presence of parasporal crystals and a 1400 bp band PCR amplification of the 16S rRNA gene. A bioassay revealed that Ts-5 and As-3 were highly toxic to 2nd instar larvae of cotton leafworm (*Spodoptera littoralis*) with 100 and 90% mortality, respectively after 4 feeding days. After 7 days, Ts-5 and As-4 were toxic with similar mortality values, while toxicity caused by As-3 reached 85%. Two other isolates, Qa-2 and Fa-7, displayed high toxicity (75%) after 4 and 7 feeding days. Moreover, As-4 and Fa-7 showed high mortality (90 and 80%) against northern house mosquito (*Culex pipiens*) larvae after a two-day feeding period and most isolates showed more than 50% mortality at half of the original concentration (1.5×10^7 cells/ml). The eight isolates were resistant to six antibiotics and five of them showed variable patterns to gentamycin (Gm) and neomycin (Nm). A plasmid profile revealed divergent patterns in the number, molecular size and existence of plasmids, whereas Ts-5 and Sn-2 showed the highest number (7) and Qa-2 the lowest (3). A 3-kb plasmid was found in all isolates and the seven other plasmids varied noticeably among the eight isolates. SDS-PAGE analysis of the spore/crystal mixture individually characterized each of the eight isolates. Protein analysis revealed that each of the eight isolates possess a unique protein pattern either in their absence, presence or in the total numbers, even between isolates from the same location, such as As-3 and As-4, although they displayed a similar total variable 10 bands, but varied in the appearance among the bands.

ABSTRACT

Original Research Paper: A study was conducted to determine the effect of tomato variety on the infestation and population

development of root-knot nematode, *Meloidogyne incognita* (Kofoid and White) in pot experiments. Seven tomato varieties namely T_{245}, B-1 'Ravi', HT-148-3-11 'Tharindu', BT-15-1 'Thilina', HT 01 'Rashmi', HT.01.16.38 'Rajitha', and 'Maheshi' were tested against the second stage juveniles of *M. incognita* at a rate of 15 and 30 nematodes per plant. The nematodes could multiply rapidly within the root system of all the tomato varieties tested. However, T_{245} and B-1 'Ravi' did not show significant damage by the nematodes at any of the doses tested. In contrast, there was a significant reduction of root length and root weight in HT.01.16.38 'Rajitha' and 'Maheshi' at the higher nematode dose. These four varieties had comparatively less root gall formation at both doses tested. Significant reduction in plant height, root length and root weight and a high rate of gall formation and nematode reproduction were observed in HT-148-3-11 'Tharindu', BT-15-1 'Thilina' and HT 01 'Rashmi'. Overall the tested varieties exhibited a higher number of chlorotic leaves at the higher dose of nematodes. By integrating the experimental data, T_{245} and B-1 'Ravi' could be categorized as less susceptible, HT.01.16.38 'Rajitha' and 'Maheshi' as susceptible and HT-148-3-11 'Tharindu', BT-15-1 'Thilina' and HT 01 'Rashmi' as highly susceptible to *M. incognita*.

ABSTRACT

Original Research Paper: The NMO10 bacterial isolate was isolated from the rhizosphere of cotton plants. This isolate showed high potentiality to fix nitrogen and a high ability to colonize the phyllosphere of cotton plants. Based on this, plasmid pHTNC3 harboring the *cry*IC gene was used to transform NMO10. The transformed bacterial isolate (tNMO10) had a dual action both in the biocontrol of the Lepidopteron insect *Spodoptera littoralis* and as a bio-fertilizer. The presence of an expressed 135 kDa CryIC protein in the protein pattern of tNMO10, microscopic examination of the bipyramidal crystals that characterize the CryIC protein and immuonoblot analysis indicated efficient expression of the *cry*IC gene in the heterologous host NMO10. Bioassays against the neonate larvae of the cotton leaf worm *S. littoralis* revealed that the protein preparations from the tNMO10 were toxic.

ABSTRACT

Original Research Paper: Three *Photorhabdus luminescens* and one *Xenorhabdus nematophila* strains were isolated from *Heterorhabditis bacteriophora* and *Steinernema carpocapsae* nematodes, respectively. The nematodes were isolated from soil samples collected from four Egyptian governorates using *Galleria* larvae as bait. Toxicity of the four isolates on the 3rd instar wax moth larvae of *Galleria mellonella* L. showed that BA1 and MH had the highest mortality (66.6 and 60%, respectively) at a concentration of 5.35×10^3 after 9 days using direct feeding. By using direct spray, BA1 displayed the highest mortality (73.3%) followed by MH (66.6%) and BAA1 (60%) after 8 days at the same concentration. Using direct injection, BA1 and BA2 revealed complete mortality after 48 h and after 24 h BA1 showed 90 and 70% mortality with 0.67×10^3 and 0.33×10^3 concentrations, respectively followed by BA2 with 80 and 70% mortality with 1.04×10^3 and 0.52×10^3 concentrations, respectively. The other two isolates showed complete mortality after 72 h. Moreover, at 2.67×10^3 BAA1 showed a high mortality (60%) after 8 days of direct spray. BA2 displayed a similar high mortality after 120 h of direct feeding and spray with 60% using three concentrations (8.35×10^3, 2.08×10^3 and 1.04×10^3). RAPD analysis revealed 46 polymorphic fragments that ranged in size from 7.25 to 0.15 kb. The mean percentage of polymorphism shown by the four primers was 67.6%, decreasing in this order: UBC-37 (75%), UBC-89 (73.3%), UBC-16 (65%) and UBC-28 (58.8%). BA2, belonging to *Xenorhabdus nematophila*, had the highest number (6) of specific fragments, followed by MH with two and both BA1 and BAA1 with one. SDS-PAGE of proteins displayed remarkable genetic variation between the four isolates. Several toxic protein bands were detected among the four isolates, for instance 40 kD in BA2, 283 kD in BA1, BAA1 and MH and 37 kD in BA1 and MH.

ABSTRACT

Original Research Paper: Phytochemical studies of *Aframomum meleguata* and *Monodora myristria* seed and leaf extracts revealed the presence of bioactive compounds comprising alkaloids (0.29–5.64%), flavonoids (0.12–8.29%), saponins

(0.02–1.24%), tannins (0.03–0.39%), and phenols (0.02–0.39%). The growth of *Sclerotium rolfsii*, which causes basal stem rot in cowpea (*Vigna unguiculata*) and other crops such as tomatoes and tobacco, was inhibited *in vitro* by the extracts of both plants. The extracts from *A. meleguata* seed, *M. myristica* and *A. meleguata* leaves and *M. myristica* seed showed 86.65, 53.19, 43.47 and 39.31% inhibition, respectively. Analysis of chemical composition through infrared spectroscopy showed that the most active phytoconstituents are aldehydes, ketones, amines and phenolic compounds contained in *A. meleguata* seeds. The fungitoxicity of the extracts from *A. meleguata* seed was higher (86.65%) than that of benomyl (86.20%), a synthetic fungicide.

ABSTRACT

Original Research Paper: The effects of systemic infection by *Potato virus Y* (PVY) and arbuscular mycorrhizal fungus (AMF) *Glomus intraradices* on host reaction were quantified in potato symtomatologically, morphologically, serologically, and physiologically. Reduction in plant height and root development was significantly greater with the AMF+PVY combination than with single PVY infection. Inoculation of AMF increased the symptoms of PVY infection. The *G. intraradices* x PVY pathosystem significantly increased disease severity and reproduction of the virus in potato. The chlorophyll contents increased in AMF plants by 18.8% more than the control. The results suggest that the inoculation of AMF reduced vegetative development in the presence of PVY infection in potato but it increased viral activity considerably.

ABSTRACT

Original Research Paper: In this study, the role of a fungal endophyte identified as *Fusarium* spp. UPM31P1 in suppressing Fusarium wilt development in susceptible banana plantlets via induced host resistance was established. The endophyte, isolated from roots of wild banana, elicited the production of host enzymes related to induced resistance upon reintroduction into the commercial cultivar Pisang Berangan “Intan”. A significant increase in all levels of enzymes and biochemical markers assayed (peroxidase, polyphenoloxidase, phenylalanine ammonia lyase, phenol content and lignothioglycolic acid) was observed as compared to levels in plantlets from control. In comparison between diseased plantlets pre-treated and non-treated with endophyte UPM31P1, enzymatic levels were also significantly higher in plantlets pre-treated with endophytes. As a result, the endophyte pre-treated plantlets recorded lower percentages of disease incidence and disease severity, suggesting the possible role of induced host resistance triggered by the endophytic UPM31P1 as a mechanism for Fusarium wilt suppression.

ABSTRACT

Short Communication: *Cestrum parqui* is a plant largely described for its insecticidal effect. This activity comes mainly from saponins. Our study shows an interesting toxicity of the crude saponic extract on *Culex pipiens* larvae. The LC_{50} values were 100 and 111 p.p.m. after 24 and 48 hours, respectively of treatment. The treated larvae showed a destroyed cuticle structure, a change in the colour, form and size of the fat body cells and a deterioration of the digestive walls with a separation of its peritrophic membrane.

ABSTRACT

Original Research Paper: A study was conducted for two seasons to assess the mean performance of yield, yield contributing traits and root knot nematode resistance in 14 genotypes (CLN 2026C, CLN 2026E, CLN 1466J, CLN 1466S, CLN 1464A, PT 4671A, PT 4716A, CO 3, LE 812, Arka Ahuti, Hisar N_1, Hisar N_2, Patriot and SL 120) of tomato (*Lycopersicon esculentum* Mill.). PT 4716A, Hisar N_1, SL 120, Patriot, Hisar N_2 and LE 812 showed superior yield and other yield-related characters but lower root weight. PT 4716A, LE 812, Hisar N_1, Hisar N_2, Patriot and SL 120 did not show any root knot nematode infestation. Total phenol and orthodihydroxy phenol content were highest in SL 120 and LE 812. This evaluation study showed that LE 812, CLN

2026C, CLN 2026E and CLN 1464A showed best yield and root knot nematode resistant characters.