

Pest Technology

Abbreviation: Pest Tech.

Print: ISSN 1749-4818

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

Editor-in-Chief

Jaime A. Teixeira da Silva, Japan

Technical Editor

Kasumi Shima, Japan

Editorial Board and Advisory Panel

Horticulture, Floriculture and Ornamental Plant Science and Biotechnology (D11)

Chhandak Basu, USA
Emilio Cervantes, Spain
Jer-Chia Chang, Taiwan
Suriyan Cha-um, Thailand
Abdolkarim Chehregani, Iran
Samir C. Debnath, Canada
Hany A. El-Shemy, Egypt
Attila Fehér, Hungary
Manuel Fernandes-Ferreira, Portugal
C. Gopi, India
S. Dutta Gupta, India
Faouzi Haouala, Tunisia
Pranab Hazra, India
Domingo Iglesias, Spain
Sladjana Jevremovic, Serbia
Puthiyaparambil Josekutty, New Zealand
Maurizio Lambardi, Italy
Xinxian Li, Japan
Moahammad J. Malakouti, Iran
Ezaz A. Mamun, Australia
Ákos Máthé, Hungary
Reda Moghaieb, Egypt
Benkeblia Noureddine, Japan

Suprasanna Penna, India
Edouard Pesquet, France
Pio Colepicolo, Brazil
Aluri Jacob Solomon Raju, India
Moshe Reuveni, Israel
Shyamal K. Roy, Bangladesh
Shigeru Satoh, Japan
Sanjai Saxena, India
M. Mehdi Sharifani, Iran
Dharini Sivakumar, South Africa
S. Sudhakaran, India
Judith Thomas, USA
Lining Tian, Canada
Kin-Ying To, Taiwan
Daniel Valero, Spain
Teferi Yeshitela, South Africa
Adnan Younis, Pakistan
Hao Yu, Singapore

Pathology (D13)

P. Ponmurugan, India
Gamal Hassan Rabie, Egypt
Sanjai Saxena, India
Blanca Sansegundo, Spain
Lining Tian, Canada

Global Science Books, Ltd.
46 Syon Lane, Isleworth, Middlesex
TW7 5NQ, United Kingdom

Editorial Office: Takamatsu, Japan
Accounting: Lagos, Portugal



GSB homepage: www.globalsciencebooks.com
GSB Japan: <http://www17.plala.or.jp/gsbjapan>
GSB™ is a trademark of Global Science Books, Ltd.

Pest Technology ©2007 Global Science Books, Ltd.

All rights reserved. No parts of this journal may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording, or otherwise without written permission from Global Science Books, Ltd.

For additional copies, photocopies, bulk orders, or copyright permissions, please refer requests in writing to the above address, or apply online.

Cover photo: Top right: NBT reaction, in 12 h inoculated root cells of resistant tomato infected with avirulent nematodes. Bluish formazan precipitates are formed by the reaction between NBT and superoxide; bottom left: Confocal laser scanning microscope detection of intracellular DAF-2DA fluorescence, indicative of NO production in a 12 h infected tomato root with avirulent population. More details in Bleve-Zacheo *et al.*, pp 1-16.

Disclaimers: All comments, conclusions, opinions, and recommendations are those of the author(s), and do not necessarily reflect the views of the publisher, or the Editor(s). GSB does not specifically endorse any product mentioned in any manuscript, and accepts product descriptions and details to be an integral part of the scientific content.

Printed in Japan on acid-free paper.

CONTENTS

Teresa Bleve-Zacheo, M. Teresa Melillo (Italy), Philippe Castagnone-Sereno (France) The Contribution of Biotechnology to Root-Knot Nematode Control in Tomato Plants	1
Bart Lievens (Belgium), Bart P.H.J. Thomma (The Netherlands) Quantification in Multiplex Format as a Challenging Goal for Plant Pathogen Molecular Diagnostic Assays	17
Raymond A. Cloyd (USA) Management of Plant-Feeding Mites in Interior Plantscapes	27
Sylvaine Simon, Benoît Sauphanor, Pierre-Eric Lauri (France) Control of Fruit Tree Pests through Manipulation of Tree Architecture	33
G. Christopher Cutler, Cynthia D. Scott-Dupree (Canada) Novaluron: Prospects and Limitations in Insect Pest Management	38
Roman Pavela (Czech Republic) Possibilities of Botanical Insecticide Exploitation in Plant Protection	47
Marlinda Lobo de Souza, Maria Elita Batista de Castro, William Sihler (Brazil), Ewelina Krol, Boguslaw Szewczyk (Poland) Baculoviruses: A Safe Alternative in Pest Control?	53
S.E. Brown, B.O. Been, W.A. McLaughlin (West Indies) The Lethal Yellowing (16SrIV) Group of Phytoplasmas	61
Osmar Nickel, Cristiane de Jesus Barbosa, Hermes Peixoto Santos-Filho, Orlando Sampaio Passos, Francisco Ferraz Laranjeira (Brazil) Bahia Bark Scaling of Citrus: A Disease of Unknown Etiology	70
Blanka Kokošková, Roman Pavela (Czech Republic) Effectiveness of Plant Essential Oils on the Growth of <i>Erwinia amylovora</i> , the Causal Agent of Fire Blight Disease	76
Roman Pavela (Czech Republic) The Feeding Effect of Polyphenolic Compounds on the Colorado Potato Beetle [<i>Leptinotarsa decemlineata</i> (Say)]	81

Teresa Bleve-Zacheo, M. Teresa Melillo (Italy), Philippe Castagnone-Sereno (France) The Contribution of Biotechnology to Root-Knot Nematode Control in Tomato Plants (pp 1-16)

ABSTRACT

Special Feature: Root-knot nematodes (*Meloidogyne* spp.) represent a particularly serious pest for tomato crops. These pathogens have evolved a sophisticated interrelationship with the roots of their host where they induce a specific type of nurse cell system, classified as multinucleate giant cells. The structural and physiological transformation of the initial cell to become the nematode feeding site is paralleled by modifications in plant gene expression. The recent characterisation of several parasitism genes specifically expressed within oesophageal gland cells of root-knot nematodes suggests that their products can influence the host cellular metabolism. In plants with genetic disease resistance, these secreted molecules might serve as virulence factors for successful parasitism. The *Mi* gene, which confers resistance to several species of root-knot nematodes, is present in many modern tomato cultivars. Resistance mediated by *Mi* is associated with localized necrosis of host tissue at the nematode feeding site and occurs very early after nematode infection. However, how *Mi* mediates recognition of and resistance to root-knot nematodes is largely unknown. In parallel with the use of such natural resistance, several biotechnological strategies have been experienced to improve tomato resistance. They are mainly based on the over-expression of anti-nematode and/or anti-giant cell genes placed under the control of specific promoters. Here, we review the recent progress in determining the role of signal transduction pathway(s) in tomato responses during both susceptible and resistant interactions, and how such knowledge should allow the development of alternative strategies for engineering durable resistance against root-knot nematodes in tomato.

Bart Lievens (Belgium), Bart P.H.J. Thomma (The Netherlands) Quantification in Multiplex Format as a Challenging Goal for Plant Pathogen Molecular Diagnostic Assays (pp 17-26)

ABSTRACT

Invited Mini-Review: Accurate detection and identification of plant pathogens is fundamental to plant disease management. The lack of rapid, accurate and reliable means by which plant pathogens can be detected and identified has been one of the main limitations in plant disease management, and has prompted the development of alternative diagnostic technologies. Increasingly, molecular methods that are based on the detection of nucleic acids are implemented for routine plant pathogen diagnosis. Now that a number of molecular assays have been established, the latest challenge is to be able to quantify pathogen biomass, preferentially in multiplex format, with these assays. However, the development of technology for accurate quantification bears a number of pitfalls that will be highlighted in this review. The ability to perform pathogen quantification will result in a novel challenge; namely to be able to predict disease development based on pathogen densities in a specific environment. Issues that are of relevance to these topics are discussed in this review.

Raymond A. Cloyd (USA) Management of Plant-Feeding Mites in Interior Plantscapes (pp 27-32)

ABSTRACT

Invited Mini-Review: Plants grown in greenhouses, conservatories, and interiorscapes are susceptible to many different types of plant-feeding mites. Although there are a diversity of mite species that may feed on ornamental plants grown or used in interior plantscapes this paper focuses on three major species: twospotted spider mite (*Tetranychus urticae*), broad mite (*Polyphagotarsonemus latus*), and cyclamen mite (*Steneotarsonemus pallidus*). These mites are polyphagous and cause damage by withdrawing plant cell contents with their stylet-like mouthparts inducing stippling, bronzing, or leaf distortion, depending on the mite type. Cultural control of mites includes irrigation, fertility, and host plant resistance. The use of biological control has been successful in cut flower greenhouses such as roses (*Rosa* spp.) using the predatory mites *Phytoseiulus persimilis*, *Neoseiulus californicus*, and *Amblyseius fallacis*. However, the primary method of managing mites, especially in greenhouses, involves applications of miticides. Currently, there are many miticides available for control of twospotted spider mite with variable modes of action, whereas fewer miticides are available for control of broad and cyclamen mite. Due to their biology, genetics, and reproductive capacity, twospotted spider mite can develop resistance to miticides within a short period of time, which means that proper rotation programs, based on mode of action, must be implemented in order to sustain effective

miticides. The availability and extensive use of neonicotinoid-based insecticides, in particular imidacloprid, that provide control of phloem-feeding insects such as whiteflies, aphids, and mealybugs may be responsible for the increase in twospotted spider, broad and cyclamen mite populations on many ornamental crops. Although plant-feeding mites have been and continue to be a problem in interior plantscapes, there are several pest management strategies that may be implemented in order to alleviate problems with these mite types.

Sylvaine Simon, Benoît Sauphanor, Pierre-Eric Lauri (France) Control of Fruit Tree Pests through Manipulation of Tree Architecture (pp 33-37)

ABSTRACT

Invited Mini-Review: Although chemical aspects of plant-insect relationships are largely studied, the effect of within-plant structure on insects is seldom investigated, especially in perennial crops. In fruit production, the manipulation of tree architecture is generally considered to be involved in pest development through considerations of “tree vigour” or branching density. However, both physiological and physical aspects of tree architecture (i.e., canopy height, width and shape, fruiting and vegetative shoot distribution, branching, connectivity, growth rhythmicity) affect the distribution and abundance of both phytophagous arthropods and natural enemies. Tree architecture can affect arthropod pests by modifying: (a) the attractiveness of the host-plant; (b) the within-plant life conditions including microclimate, availability and accessibility of resources and reproduction sites, and enemy-free spaces; (c) the efficiency of chemical or alternative pest control methods (including the use of pheromones). Despite seasonal effects and variability in species biology, modelling and experimental approaches have shown that a more complex architecture favours phytophagous insects and is detrimental to the foraging of most natural enemies. Orchards are permanent habitats, in which the manipulation of tree architecture is potentially a powerful tool for pest regulation, through the implementation of innovating training systems.

G. Christopher Cutler, Cynthia D. Scott-Dupree (Canada) Novaluron: Prospects and Limitations in Insect Pest Management (pp 38-46)

ABSTRACT

Invited Mini-Review: Biorational insecticides are a valuable insect pest management option for growers and pest management practitioners. Novaluron is a recently developed benzoylphenyl urea insecticide with excellent activity against several important insect pests. Through inhibition of chitin synthesis, larval insect stages are targeted with death from abnormal endocuticular deposition and abortive molting. This physiological specificity lends novaluron well to integrated pest management (IPM) programs, as toxicity to mammals, birds and other vertebrates is low, and adult beneficial insects, including predators, parasitoids and pollinators, are generally unaffected. Foliar applications have demonstrated prolonged persistence, providing long-lasting control for growers, and the mode of action of novaluron, completely different from that of commonly used neurotoxic insecticides, makes it a useful alternative insecticide for resistance management. However, there are several obstacles, many inherent to IPM, which may hinder the utility of novaluron. While its narrow spectrum of activity is a key attribute, paradoxically this may be a significant detractor for growers who prefer broad-spectrum control of multiple pests. As an insect growth regulator, timing of novaluron applications is often more restrictive and delayed insecticidal activity usually occurs. The purchase price of benzoylphenyl ureas is generally greater than that of conventional insecticides, which may limit the appeal of novaluron. Further, studies have shown that some beneficial organisms are susceptible to novaluron. Knowledge reviewed here will facilitate continued development and use of biorational compounds for IPM.

Roman Pavela (Czech Republic) Possibilities of Botanical Insecticide Exploitation in Plant Protection (pp 47-52)

ABSTRACT

Mini-Review: In this article three types of botanical insecticides are shown: products of neem oil from seeds of *Azadirachta indica* Juss., pongam oil from *Pongamia pinnata* L. and essential oils from some aromatic plants. Their effective use against common greenhouse pests such as whitefly (*Trialeurodes vaporariorum* West, *Bemisia tabaci* Gennad.), two-spotted spider mite (*Tetranychus urticae* Koch), aphids and caterpillars is demonstrated. The capacity to use botanical insecticides as effective pest-controlling agents, as well as some of their limitations, are also discussed.

Marlinda Lobo de Souza, Maria Elita Batista de Castro, William Sihler (Brazil), Ewelina Krol, Boguslaw Szewczyk (Poland) Baculoviruses: A Safe Alternative in Pest Control? (pp 53-60)

ABSTRACT

Invited Mini-Review: Broad spectrum chemical pest control agents have been widely regarded as ecologically unacceptable. Due to this opinion, there is the increased social pressure to reduce their use in the future and gradually replace them by biopesticides. Viruses of a few families are known to infect invertebrates, but only those belonging to the family *Baculoviridae* have been used for biocontrol of pests. They are safe to people and wildlife, their specificity is usually very narrow. Their application as bioinsecticides was limited until recently because of their slow killing action and technical difficulties for *in vitro* commercial production. Successful protection of over 2 million hectares of soybean in Brazil revived the hopes for using baculoviruses as effective biopesticides. Wider application of baculoviruses for pest control is very likely to be implemented in the future and two approaches for improvements of baculovirus killing properties can be foreseen. In countries where the use of genetically modified organisms (GMOs) is restricted, the improvements will be mainly at the level of *in vitro* production, diagnostics, and changes in biopesticide formulations. In countries that have fewer concerns towards GMOs, the killing activity of baculoviruses may be augmented by genetic modifications of the baculovirus genome. It is expected that baculoviruses improved by genetic modifications will compete successfully with other methods of pest control in many regions of our globe, especially in most densely populated countries of the world.

S.E. Brown, B. O Been, W.A. McLaughlin (West Indies) The Lethal Yellowing (16SrIV) Group of Phytoplasmas (pp 61-69)

ABSTRACT

Invited Mini-Review: Lethal yellowing (LY) is the single most important threat to world coconut palm production. Molecular based tools, and sensitive detection procedures developed over the past decade have permitted great advances in the detection and characterization of the LY phytoplasma. The practice of RFLP analyses of PCR-amplified 16S rRNA sequences with selected restriction endonucleases has resulted in the accurate identification of different strains of the LY group of phytoplasmas associated with plants and insects. The LY phytoplasmas are currently classified as members of the 16SrIV group of phytoplasmas. This progress has facilitated studies on the epidemiology of LY phytoplasma-associated diseases and has made it possible to study LY phytoplasma ecology in greater detail. Here we present an overview of the current status of the LY disease, with emphasis on its geographical distribution, socio-economic impact, vector status, methods of control as well as current advances that have been made in the past decade in the characterization of this group.

Osmar Nickel, Cristiane de Jesus Barbosa, Hermes Peixoto Santos-Filho, Orlando Sampaio Passos, Francisco Ferraz Laranjeira (Brazil) Bahia Bark Scaling of Citrus: A Disease of Unknown Etiology (pp 70-75)

ABSTRACT

Invited Mini-Review: In the 1960's a bark scaling disorder was identified in sweet orange and grapefruit trees in Brazil. It is characterized by yellow-beige to light brown scaling lesions on the trunk or on small branches on the upper part of the plant and followed by a significant exudation of water soluble gum. The disease affects all sweet oranges and some mandarins but it is especially severe on grapefruit varieties. Because of its regional occurrence in the states of Bahia and Sergipe, and being symptomatically very similar to psorosis A, this disease was initially referred to as Bahia type psorosis (tBa). However, accumulated data on inoculated indicator plants, histopathological studies as well as attempts of RT-PCR and molecular hybridization showed that it was a novel disease. The etiology of the disorder is still not elucidated and its nature remains unknown. Nevertheless, experimental data on its epidemiology showed that it is naturally transmitted, citrus diseased plants are the main inoculum source and its progress and spread is consistent with a disease vectored by an insect of limited dispersion ability. Currently the work is aiming at the identification of the pathogen and its vector.

Blanka Kokošková, Roman Pavela (Czech Republic) Effectiveness of Plant Essential Oils on the Growth of *Erwinia amylovora*, the Causal Agent of Fire Blight Disease (pp 76-80)

ABSTRACT

Original Research Paper: *Erwinia amylovora* [(Burr.) Winslow *et al.* 1920], the causative agent of fire blight disease, threatens some species of the *Rosaceae* family. In chemical control, preparations based on copper compounds are most frequently applied, but these can be phytotoxic and not effective enough, hence other alternatives need to be considered. In our

experiment, thirty-four essential oils obtained from different plants were tested for their antimicrobial effectiveness against the fire blight pathogen. Screening was conducted *in vitro* on agar plates contaminated by *E. amylovora*. The strongest inhibitory effect (i.e. complete bacterial inhibition) was shown by essential oils from *Mellisa officinalis*, *Mentha arvensis*, *Origanum compactum*, *O. vulgare* and *Thymus vulgaris*. An inhibitory effect more than 50% higher than the standard was shown by essential oils from *Eugenia caryophyllata*, *Mentha pulegium*, and *Nepeta cataria*. An inhibitory effect up to 50% higher than the standard was found in essential oils from *Artemisia absinthium*, *Citrus aurantifolia*, *Lavandula latifolia*, *Melaleuca quinquenervia*, *Mentha citrata*, *M. spicata*, *Ocimum basilicum*, *Pelargonium graveolens*, *P. roseum*, *Rosmarinus officinalis*, *Salvia sclarea*, *Thuja occidentalis* and *Tsuga canadensis*. An antimicrobial effect comparable to the standard was found in essential oils from *Amyris balsamifera*, *Citrus limonum*, *Juniperus communis*, *J. virginiana*, *Origanum majorana*, *Salvia officinalis*, *Tagetes bipinata* and *Thymus matschiana*. Standard employed was oxychloride-Cu 84% (0.84 µg/µl), it had a weak inhibitory effect. The essential oils from *Acorus calamus*, *Lavandula angustifolia* and *Zingiber officinale* had a lower inhibitory effect than the standard. The essential oils of two plant extracts from *Abies siberica* and *Pogostemon cablin* had no effect on the growth of *E. amylovora*. Five of the most effective essential oils appear promising for the development of potential bio-pesticides.

Roman Pavela (Czech Republic) The Feeding Effect of Polyphenolic Compounds on the Colorado Potato Beetle [*Leptinotarsa decemlineata* (Say)] (pp 81-84)

ABSTRACT

Original Research Paper: Colorado Potato Beetle, *Leptinotarsa decemlineata* (Say) is a serious pest of potato plants and devastates additional crops such as eggplant, tomato, pepper, and tobacco by its voracious feeding. Plants of the *Lamiaceae* family produce a large number of polyphenols with insecticidal activity. In this study we tried to identify if some of these compounds could be used as antifeedants and if there is any influence of these compound on food conversion by the Colorado Potato Beetle whose 3rd instar larvae were fed food contaminated with quercetin, naringenin, vanillin, p-coumaric acid, catechin, caffeic acid, vanillin acid, rutin and phloroglucinol in 1.33, 0.66 and 0.11 mg/cm² doses. Several compounds remarkably decreased larval growth and inhibited their feeding. The flavonoids were almost ineffective, having little or no effect on growth and/or food deterrence of the larvae, whereas phenols and phenolic acid demonstrated a very high efficiency.