Integrated Management of Arthropod Pests and Root Rot Diseases of Greenhouse Floriculture

PRINCIPAL INVESTIGATORS:
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PROJECT OBJECTIVES:
• Development of multi-component biologically-based IPM programs for key floriculture pests, including thrips, whiteflies, aphids, and shore flies. Programs are based on biological and biorational control agents and cultural practices (primarily trap cropping).
• Development of integrated management techniques for *Pythium* and other soil-borne pathogens, causative agents of root rot and damping-off diseases. Techniques are based on biological, biorational and reduced-risk pesticides and cultural practices (primarily sanitation).
• Elucidation of the role of fungus gnats in the establishment and spread of root rot diseases.

ACCOMPLISHMENTS: INSECT PEST MANAGEMENT
• Described the nutritional biology and predatory feeding habits of larval hunter flies reared on fungus gnat and shore fly larvae. Determined that hunter fly larvae consumed large numbers of prey of all ages (instars) and fed actively for 12–14 days.
• Determined that eggplant is highly attractive to greenhouse whitefly (*Trialeurodes vaporariorum*) with potential for use as a trap plant against this pest, whereas neither eggplant nor cucumber are sufficiently attractive to be useful in managing *Bemisia* whiteflies. Found that selection of a host plant by *Bemisia* whiteflies is affected by presence of natural enemies.
• Conducted a survey of aphid pests in 41 northeastern commercial greenhouses. Found that green peach and foxglove aphids were the 1st and 2nd most dominant species, respectively. Melon aphid, previously the 2nd most common pest, was found in only 6 percent of greenhouses.
• Characteurized pathogenicity of new strains of the insect pathogenic fungus *Beauveria bassiana* collected from shore flies. Determined that the new strains were 40–130 times more virulent against shore flies than those used in currently available biopesticides.
• Completed studies describing the biology and pest potential of foxglove aphid. Populations were found to increase fastest at 77°F, but the aphid also did well at much cooler temperatures (≤ 50°F), indicating a need to scout this pest in spring crops. High mortality occurred at 95°F, suggesting temperature manipulation could be a useful tactic for foxglove aphid control.
• Determined that aphids, due to various aspects of their biology and behavior, are exceptionally difficult targets for microbial biocontrol. Concluded from greenhouse trials that currently available mycoinsecticides are poor aphid-control agents and that use of fungi for aphid IPM will require improvements in efficacy and integration with other control agents.
• Determined that virulence of the recently registered fungal pathogen *Metarhizium anisopliae* against aphids was enhanced by exposure of the dry spores to high humidity for 48 hours prior to use. Pre-humidification was found to protect spores from injury that can occur when they are rapidly mixed in water and to “jump start” the germination/infection process.
• Demonstrated that a banker plant system comprising barley plants infested with cereal aphids parasitized by *Aphidius colemani* has considerable potential for aphid IPM in floriculture.
• Found that marigold pollen is a poor food source for the thrips predator *Orius insidiosus*, negatively affecting longevity and reproduction. Tests of 12 varieties of marigolds showed that none was a suitable banker plant for this beneficial insect.

**ACCOMPLISHMENTS: DISEASE MANAGEMENT:** (Note: additional accomplishments related to *Pythium* management are reported by Margery Daughtrey in a separate report)

• Determined that fungus gnats are unlikely crop-to-crop or greenhouse-to-greenhouse vectors of *Pythium* root rot pathogens. Conducted studies showing that adult fungus gnats do not pick up and transmit infectious *Pythium* propagules from diseased to healthy plants.

• Developed a molecular assay (real-time PCR and probe) for species-specific detection and quantification of *Pythium aphanidermatum*. Showed that *Pythium* ingested by fungus gnat larvae does not pass to the pupal stage (adult fungus gnats do not harbor *Pythium* internally).

• Determined in laboratory tests that rather than predisposing geranium seedlings to *Pythium* infection, feeding by fungus gnat larvae induced resistance to this pathogen, significantly reducing seedling mortality. Results suggest that low-level damage by fungus gnats may actually benefit host plants by stimulating defenses that hinder disease-causing microbes.

• Demonstrated that ovipositing female fungus gnats are highly attracted to plants infected/infested with a broad range of microbes, including *Pythium*, *Thielaviopsis*, *Trichoderma*, *Beauveria*, and *Xanthomonas*. These findings underscore the importance of greenhouse sanitation in pest control and have important implications with respect to IPM.

• Determined that potting mixes from numerous commercial sources contained no *Pythium* contaminants but did harbor fungus gnats.

**TECHNOLOGY TRANSFER/IMPACT:**
Results from our research have been presented to growers, extension personnel, and agricultural researchers at national and international scientific conferences, greenhouse workshops, short courses, bedding plant schools, field days, and on our Web sites (www.greenhouse.cornell.edu and www.hort.cals.cornell.edu). Research findings and pest/disease management recommendations have been published in peer-reviewed research journals, trade magazines, and technical books. Other researchers have cited our results, and reporters have written about our work in industry media. Data from efficacy trials have been used to support registration of new control agents. Recent IPM surveys of northeastern growers have indicated adoption of ideas generated by our findings.

**ADDITIONAL FUNDING/EXTERNAL SUPPORT:**
Fred C. Gloeckner Foundation; Ken Post/Herman Schenkel Foundation; USDA Northeast IPM Grants; USDA Hatch and Smith-Lever funds; Ecke Ranch; Ball Seed; Yoder Bros.; Laverlam International.

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