An Overview of Integrated Pest Management for Plant Propagation

Michael P. Parrella
Department of Entomology, University of California, Davis, California 95616

IPM AND PLANT PROPAGATION

The following conditions and considerations should be considered when implementing an IPM program in a propagation facility:

- When plants are in close proximity; pest damage can be extensive
- Pest infestations are seeded as plants are put into production
- Pest infestations are sent with the plants to other producers
- Generally fewer pests and smaller greenhouse and nursery areas are involved
- Wet conditions (misting) presents unique problems

Arthropod Pests of Plants in Propagation. Mother block, tissue culture, and rooting areas are subject to attack from the following arthropod pests:

Common name	Species	Plants attacked
Thrips	*Frankliniella* & *Thrips* spp.	All plants; tissue culture
Fungus gnats	*Braydesia* spp.	Rose, bedding plants, greenhouse crops
Leafminers	*Liriomyza trifolii*	Marigold, verbena, chrysanthemum, etc.
Whiteflies	*Trialeurodes* & *Bemisia*	Poinsettia, verbena, ageratum, etc.
Beet armyworm	*Spodoptera exigua*	Chrysanthemum, etc.
Snails and slugs	*Helix aspersa* and many other species	All plants
Citrus mealybug	*Planococcus citri*	Coleus, kalanchoe, etc.
Black vine weevil	*Otiorynchus sulcatus*	Euonymus, etc.

Thrip Control in Plant Tissue Culture. *Allothrips* has been found as a contaminant in cultures of proliferating shoots of jojoba. Orthene at 10 and 100 ppm in the basal tissue culture media provided 100% control with no phytotoxicity observed. Autoclaving at 121°C. did not breakdown the pesticide (Klocke and Myers, 1984).

FUNGUS GNATS: *BRAYDESIA COPROPHILA* OR *B. IMPATIENS*.

Identification. Fungus gnats are small delicate flies with long legs, a 'Y' shaped vein in each wing, and long beaded antennae. Larvae are worm-like, small, translucent to white, with a distinct black head capsule.

Damage. Adults can be a nuisance, however, larvae feed on young roots and root hairs.

Biology. Eggs are laid during dim periods of light in clusters in cracks on the soil surface. They hatch in 7 days and four larval stages develop in 2-3 weeks. The young larvae feed in groups with soil fungi the main diet. The larvae pupate under the soil surface in a silken cocoon; adults emerge in 7 days, mate and lay 75 eggs in 3 to 5 days of adult life. They are weak flyers and prefer to run. They cannot survive on root hairs and roots alone.

Control Strategies.

l) Cultural methods include:

- Sanitation
- Weed control
- Under bench treatments (hydrated lime at 1.5 lb/gal water or copper sulfate at 1 lb/gal water) (Check on registration uses of these products in your state or country)
- Soil mixes
- Avoid over watering/wet greenhouses

2) Biological Control

- Some promising results with nematodes, but large numbers must be released

Use of Nematodes For Control Fungus Gnats and Other Root Feeders. Commercially available nematodes include *Steinernema* sp. and *Heterorhabdus* spp. in association with the bacterium *Xeizorhabdus* spp. They are suggested for control of black vine weevil larvae, fungus gnats, and other root feeders in pots. In the U.S., Exhibit can be used at the rate of one package per 10,000 sq ft at 7 day intervals—at least 3 applications are required.

IPM

IPM is the intelligent selection and use of actions that will insure favorable economic, ecological, and sociological consequences. It includes the integration of many pest control techniques (cultural, physical, mechanical, political, chemical and biological). Well-defined or mandated IPM programs may be the future for local production and for imports/exports.

IPM Can no Longer be Ignored. Most greenhouse managers/horticulturists have had extensive training in plant production but limited education in control of plant pests. This lack of plant pest control knowledge leads to conservative management strategies—the application of pesticides. The knowledge of an insect's biology can lead to better management strategies using all the tenets of IPM.

IPM must be viewed as part of the overall production system used in the greenhouse. Arthropod and disease control must be considered along every step in the crop production process—IPM strategies in the propagation phase are critical. Unless this is done, growers will continue to be reacting to pest problems in a conservative manner which is no longer acceptable. In addition, it is becoming more and more difficult to achieve successful control.

Pesticides will always be important for pest control in aesthetic-value crops; however, a definite move away from hard pesticides is occurring. If you rely heavily on pesticides to keep your crop/propagation area clean, you have problems ahead. IPM will allow growers to survive the changing pesticide scene and still produce a high quality crop.

WHAT IS THE ORIGIN OF YOUR PEST PROBLEMS?

Knowledge of the origin of your pest problems enables you to become proactive in dealing with pest problems rather than reactive. Possible sources include: contamination of propagative material, migration into the greenhouse, plant material already in the greenhouse, contaminated mother block or propagative areas, and contaminated greenhouse structures.

The detection and appropriate action needed to control such sources include:

Source	Detection Method	Appropriate Action
Propagative material	Inspect a % upon arrival	Contact propagator; preproduction treatment
Migration	Use yellow/blue cards outside and inside the greenhouse	Screening; weed control outside the greenhouse
Greenhouse plant material	Yellow cards; visual plant searches	Treat; discard; planning location of next crop
Mother block	As above	As above; preproduction or propagation treatments; screening areas
Contaminated structures	Inspection; pest and severity	Disinfect prior to next crop

TENETS OF IPM

Monitoring. Monitoring is an essential aspect of any IPM program. It includes: using sticky cards both inside and outside the greenhouse; setting thresholds appropriate for your operation; inspecting plants for the presence of insects using a regular and defined sampling program (concentrate on sensitive cultivars); keeping accurate and timely records; and making use of sentinel plants for evaluation of chemicals and biocontrol.

Cultural Aspects. Cultural aspects include: proper sanitation and weed control inside and outside the greenhouse (western flower thrips and leafminers); avoiding excessive fertilization (aphids and leafminers); and avoiding wet spots in the greenhouse (fungus gnats).

Host Plant Resistance. While this is not a panacea it can be important. Make use of the knowledge of host plant resistance/susceptibility: eliminate sensitive cultivars; plant sensitive cultivars away from vents, doorways, etc., monitor sensitive cultivars more closely (early detection); and possibly spot treat (chemicals, natural enemies).

Physical/Mechanical Control Methods. Propagation areas are usually easier to screen because of their small size. Examples of such methods include: soil sterilization between crops; use of screening; and modify greenhouses to have a double door entry system.

Management of Pesticides. The proper management of pesticides is a very important and integral part of any IPM program. Proper management includes: the appropriate selection of pesticides; the proper application equipment, correct timing of pesticide sprays (efficacy and compatibility, proper rotation of chemicals); effective tank mixes; and preproduction treatments.

Building an IPM Program. University/extension personnel can offer a blue print for an ideal IPM program. It will be unusual for a grower to be able to put all the tenets of this "ideal" program into practice. The grower must chose what can be implemented based on the particular operation (no two IPM programs will be the same). The resources available are critical but the grower must be committed to the concept.

Reasons for Reducing Pesticide Use.

1) Less hazardous to the environment
2) Fewer problems with insecticide resistance
3) Fewer problems with phytotoxicity: stress
4) Loss of registered materials; few new registrations
5) Minimal risk to workers and the general public
6) Increasing compatibility with natural enemies
7) Cost is increasing; economics/liability
8) Confusing, conflicting, and ever-changing regulations
9) Municipalities may be able to set their own regulations
10) The pesticides used on imported flowers may be more tightly controlled in the future

Biological Control. There are still more questions that research must answer, but rapid strides are being made. Pathogens may be the only recourse in the future for some pests. An integrated approach utilizing the proper selection of pathogens; choosing compatible pesticides; deciding on threshold levels (imports vs. local consumption); and becoming knowledgeable about the pathogens you are using (symptoms of infection, spread, etc.) will characterize a well-balanced IPM program.

LITERATURE CITED

Klocke and Myers. 1984. HortScience 19(3):400.