New Technologies for Pest Management

Today's pest-management technologies are changing faster than ever. With new products and a better understanding of bugs, we are able to approach pest management armed with more information than ever before. Keeping up-to-date with these new methods, technologies and products can be difficult. Here are just a few of the new concepts that can help you manage your pest problems in smarter ways.

Growers need to stay on top of the research, products and technologies that will aid them in protecting their plants against pests. Here are the highlights of some recent developments.

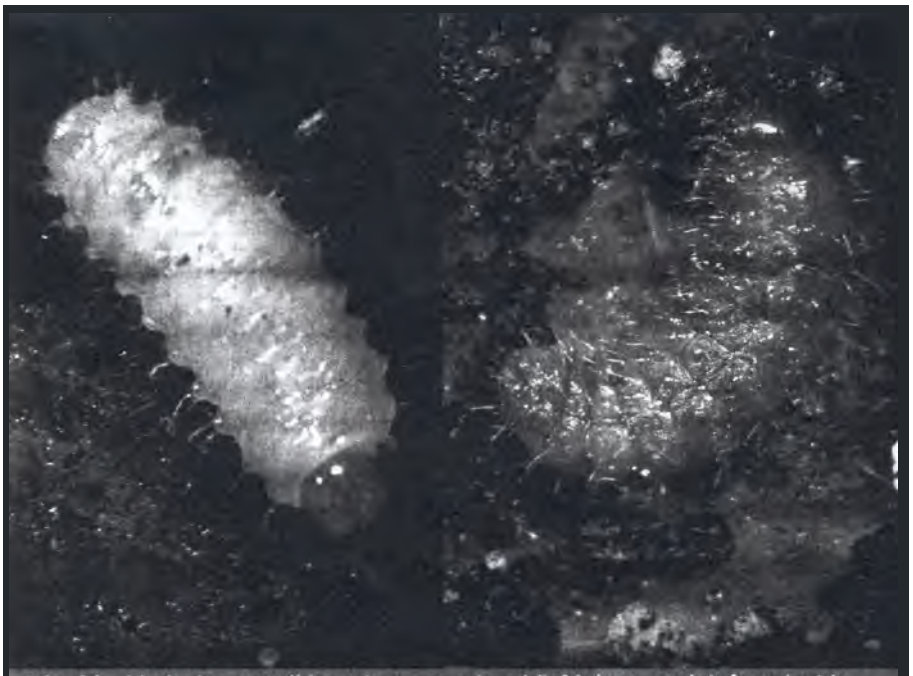
A nematode nemesis for black vine weevil. Nematodes are nothing new to pest management. What is new is the availability of a particular nematode species, *Steinernema kraussei,* now sold in the US by Becker Underwood Inc., Ames, IA. In the US, this species is being marketed as Nemasys L for control of black vine weevil. Scientists in Europe have worked with *S. kraussei* for more than 10 years.

What sets it apart from other nematodes on the market is its effectiveness at cooler soil temperatures. Other species require soil temperature above 55°, but this nematode can be applied when the soil or media is at 40°. Note that it does not control the pupa or adult stages of black vine weevil, only the larva.

For black vine weevil, *S. kraussei* are applied as a drench to the soil, putting these little worms to work in the target area. Once in the media, the nematode will penetrate the body cavity of the host and kill it.

Nematodes offer many advantages over chemical products, including: no residue; no resistance issues; safe, immediate re-entry to the treated area; and no groundwater contamination. Beneficials, like *S. kraussei,* are a good beginner product if you are looking to take a few small, initial steps into a biological control program. Being that nematodes are microscopic worms, not insects, they are compatible with many commonly used insecticides (see manufacturer's chemical compatibility charts) and can be applied with the spray equipment most nurseries already own.

Text and photos by SUZANNE WAINWRIGHT-EVANS



A healthy black vine weevil larva is cream-colored (left), but a grub infected with beneficial nematodes turns a salmon color (right).

Larval ladybugs that won't leave the site. When people think about beneficial insects, the first one that usually pops into their minds is the ladybug, or ladybird beetle, which is well-known for its voracious appetite of many pest insects and mites.

Growers often buy ladybugs and release them thinking they are practicing a sound, biological control method — yet they don't stop to think where the ladybugs are coming from. Most ladybugs sold today are collected from the wild and stored in coolers until orders are placed. Once shipped out to a well-intentioned grower, they are released into a nursery or landscape, providing little or no control of the target pest before they fly away. Another problem is harvested ladybugs can be parasitized by a small wasp, *Perilitus coccinellae.* These wasps develop as an internal parasite of lady beetles, ultimately killing your investment. To add insult to injury, in the larger picture, harvesting ladybugs from the wild is not environmentally sustainable. These practices are depleting native populations.

Researchers at Biobest Canada Ltd., Leamington, Ontario, Canada, evaluated this problem and came up with the two spot ladybird beetle, *Adalia bipunctata.* This is a laboratory-reared species, so they are disease- and parasite-free. Also, they are available in their larval form, which means they do not have wings. They will stay and feed where you place them. Once the ladybug larvae are done feeding, they pupate, and new adults hatch and fly to a new food source.

The two spot ladybird beetle will feed on many aphid species. The number of beetles that needs to be released depends on the pest population.

Destroying mites with all their might. Spider mite destroyers, *Stethorus* sp., are small, black beetles that are fierce enemies of spider mites.

Stethorus sp. are used to help control populations of two-spotted, Pacific and spruce spider mites, as well as European and Southern red mites. The tiny (one-sixteenth of an inch) adult beetles seek out populations of pest mites and lay their eggs on the undersides of the leaves among the pests. Once the eggs hatch, these gray to blackish, hairy larvae start to feed on the mites. Eventually, they will pupate, and adult beetles will emerge. Then the adults will find a new hot spot, or large population of mites, to lay their eggs.

While they occur naturally here in the US, *Stethorus* sp. now can be purchased from Sterling Insectary, McFarland, CA.

Beneficial thrips? Thrips gets a bad wrap. Everyone assumes they all are detrimental, but there is a good helper out there.

Six-spotted thrips, *Scolothrips sexmaculatus,* is a specialized mite predator that is known to feed on eggs, nymphs and adults of two-spotted spider mite. It is less than one-eighth inch in length with fringed wings. The adults can be distinguished from other thrips by the six dark spots on their backs. Both the larvae and the adults are predacious.

One nice feature about this beneficial insect is the adults can fly, meaning they can relocate to other pest populations. And once there, they will feed and reproduce. They do prefer hot, dry weather conditions, so they may not perform well in all nursery settings. Work has been done on agricultural crops, but beneficial thrips are new to the ornamental market. With a short history, research still needs to be done to figure out optimal release rates. Sterling Insectary will have saleable product in spring 2007.

A mite in a new package. One of the most commonly used predatory mites today is *Amblyseius californicus,* but its cousin, A. *andersoni,* also is showing great promise. They have an appetite for spider mites, as well as cyclamen mites.

This predatory mite occurs naturally here in the US. But now for the first time, A. *andersoni* is being reared commercially by Syngenta Bioline Inc., Oxnard, CA, in the product Anderline aa. What makes this product different than the other predatory mites is that these mites come in a patented twin sachet. This water-resistant packet will tolerate irrigation and rain, so it can be used with outdoor crops and overhead sprinklers. Just hang the sa-

Native pink spot lady beetles are aggressive feeders of aphids, and they are attracted to the AgBio Predalure sachet.

When a ladybug has been parasitized, the pupa of the parasite forms under the body of the ladybug. From the top, the ladybug looks healthy, but the problem is visible from a side view.

chet on plant material, and the mites slowly will disperse throughout the crop.

There is another advantage to employing these predators. When they cannot find mites to feed on, they will find other food sources, like pollen. Therefore, the beneficial population does not die off when pest mites are not present.

The future for Safari. Safari, from Valent USA Corp., Walnut Creek, CA, has been a key tool in the battle against the Q-hiotype whitefly. While the product is not new, a revised and expanded label should be out this winter. Even more exciting is that by 2008, Safari could be available in a granular formulation for topdressing..

Studies have shown Safari's effectiveness against armored scales in the nursery and landscape, especially when applied as a soil drench. Soil drenches also give excellent control of soft scales, hemlock woolly adelgid and azalea lace bug.

Why is Safari working so well? It is a very soluble insecticide and, therefore, more systemic. When applied to the soil, it is taken up easily by the roots and then moved through the plant more quickly than less soluble products. More Safari gets to the pest feeding site, and it gets there faster.

Another tool that is being developed for use with Safari is an ELISA (enzyme-linked immunosorbent assay) test kit. This kit will be used to analyze foliage for the presence of dinotefuran, the active ingredient in Safari, which will be a great way to help determine how quickly Safari moves into the plant tissue. Limited commercial availability of this kit is expected by the end of 2006.

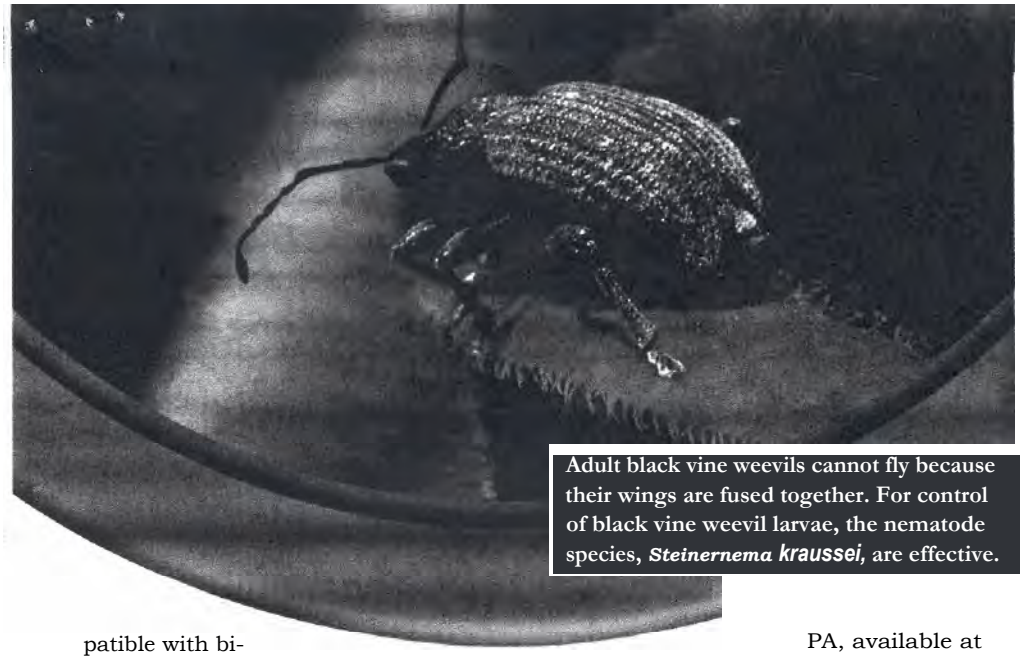
AgBio Predalure packet can attract beneficial insects, such as this lacewing larva, to control aphids and other pests.

Hover flies often are misidentified as bees. Their larvae are very aggressive feeders on many plant pests, such as spider mites, aphids and other soft-bodied insects.

BotaniGard goes organic. BotaniGard, from BioWorks Inc., Fairport, NY, has been a well-respected insecticide for many years, but now you can get this same great product with an organic label. It is called Mycotrol 0 and has a REI (reentry interval) of four hours. It is labeled for the control of adult and larval stages of whiteflies, aphids, thrips, psyllids, weevils and mealybugs.

The active ingredient is *Beauveria bassiana,* a beneficial fungus. How it works is the fungus is sprayed out like a conventional pesticide, but these microscopic fungal spores get on the bodies of pests. Then the fungus grows and kills the insect. Don't expect to see characteristic white fuzzy balls of fungi on the insect, but more of a pest color change as they die. For example, on whitefly pupae, they turn from white to a pinkish shade.

Both products, BotaniGard and Mycotrol 0, can be excellent tools for resistance management, as it would be difficult for an insect to develop resistance against the fungus. These products also are corn-



Adult black vine weevils cannot fly because their wings are fused together. For control of black vine weevil larvae, the nematode species, ***Steinernema kraussei,*** are effective.

patible with biological control programs, especially ones using predatory mites.

Cracking the cuticles. Insects had better watch out. There is a new insecticide that can pack a punch to their cuticles.

TriCon is an EPA-registered insecticide/fungicide from BioWorks. It is made of borax, orange oil and biodegradable surfactants. Once an insect has been sprayed with TriCon, death occurs within 24 to 48 hours.

The product kills in a few different ways. TriCon causes the insects' cuticles to rupture, which results in a loss of body fluids, and it suffocates the insect. Another added benefit is it disrupts an insect's ability to fly. TriCon also can be tank-mixed with other systemic or translaminar chemistries. Contact the manufacturer for a list of tank mixes.

TriCon can be an excellent part of a resistance-management program. It is labeled for use on outdoor nursery plants and has a 12-hour REI. If you are concerned about your native beneficial population, this product will have a minimal impact on them. Once the sprays are dry, your beneficials can return to the crop and get back to work.

A new mode of action against mites. Rotation, rotation, rotation. ... That's all we hear about with today's pest-management programs — and with good reason. Insects can and will develop resistance to products that are used improperly or too often. And we know that just rotating products is not enough; rotating the mode of action (MOA), or how the product kills, is what really matters. But you'll need to know the MOA, which can be obtained from the manufacturer or from a handy table produced by OHP Inc., Mainland, PA, available at www.ohp.com under "Chemical Class Chart." Armed with this information, you can find products with different MOAs to rotate in your program.

Arysta LifeScience North America Corp., Cary, NC, has a product with a new MOA and no cross-resistance. SHUTTLE is a miticide that targets all life stages of spider mites (eggs, larvae, nymphs and adults). It provides rapid knockdown of two-spotted spider mites and spruce spider mites. The active ingredient is acequinocyl, and currently there are no other miticides in the entire class. This does not mean, however, that you do not need to rotate. Smart management practices will lengthen the life of pesticides, as well as save money.

Arysta LifeScience North America has

The larvae of the beetle spider mite destroyer, *Stethorus* sp., are predatory on spider mites.

Here are the quick facts on some commonly encountered pests.

Black vine weevils

- Since the 1800s, only female black vine weevils have been found in the US, as they do not have to mate to reproduce.
- They affect approximately 200 host plant species.
- Adults feed on foliage; grubs feed on the roots.
- They can kill the host plant.
- Adults cannot fly, as their wings are fused together.
- Adult black vine weevils can lay 300 to 1,000 eggs.

Aphids

- They do not have to mate to reproduce.
- Aphids have live young, except in the northern climates where they will lay eggs for the winter.
- The key diagnostic tool for aphids is their cornicles, the two tailpipe-like projections that stick out of their backsides.
- Honeydew — a sugary, sticky substance that aphids exude — attracts ants and wasps that like to drink it.
- Before treating aphids, make sure they have not been parasitized. When parasitized, they look like brown balls often with holes cut in their backs. Use a 10X loupe to examine.

Two-spotted spider mites

- They occur on more than 150 economically important host plants.
- Immature mites (larvae) have six legs; adults have eight.
- In cooler climates, overwintering females are bright orange without the dark spots.
- At 85° to 90°, the life cycle of an aphid can be completed in eight to 12 days.
- Females lay an average of 90 to 100 eggs, but can lay upwards of 200 eggs in a lifetime.

Whitefly

- They can vector plant diseases.
- They are attracted to yellow: Use yellow sticky cards to monitor populations.
- If using whitefly parasites, make sure you know what whitefly species you have, as many of the parasites are host-specific.
- Be sure to control weeds in the nursery, which are alternate hosts for whitefly.
- Rotation of pesticides is essential in their management.

Six-spotted thrips, *Scolothrips sexmaculatus,* is a specialized mite predator that is known to feed on eggs, nymphs and adults of two-spotted spider mite.

Two-spotted spider mites can be controlled with SHUTTLE, the only miticide in the acequinocyl class that targets all life stages of spider mites.

Q-biotype whiteflies, such as these two mating among pupae, can be controlled with Safari. While this product is not new, a revised and expanded label should be out this winter, and a granular formulation for topdressing could be available by 2008.

been testing this product for its compatibility with biological control programs. So far, the results look very promising with many of the commercially produced beneficials. In addition, it is classified as an EPA reduced-risk product, which would make it a nice addition to many IPM programs.

Pheromones make 'scents.' Most people are aware that insects communicate through chemicals. What many don't know is we can simulate these same scents for use in pest management. This is not an easy process, however. It takes years of research, but once a pheromone is isolated and synthesized, it can be a great tool. In the past, this science primarily has been focused on agricultural crops. Now some new products for ornamental crops have come to market.

One example is a citrus mealybug pheromone from Syngenta Bioline called Cm Lure. This attracting pheromone, used in conjunction with a sticky card, draws flying adult male citrus mealybugs and traps them on the card. Typically, when using pheromone traps, you only want to trap the males, as you would not want to invite egg-laying females into your growing area. In this particular case, it would not matter because the female mealybugs cannot fly.

Another invasive pest that recently has become more troublesome to nursery growers is the Oriental beetle, *Exomala orientalis* (syn. *Anomala orientalis).* The larvae feed on the roots of nursery stock, and they easily can be moved around in containers. Its invasive range extends from Maine to South Carolina and west to Wisconsin. Adults closely resemble Japanese beetles in shape and size. They are about three-eighths of an inch long and can vary greatly in color and markings.

To help deal with this pest, a specific pheromone was isolated and synthesized. It now is commercially available from AgBio Inc., Westminster, CO, in the AgBio Oriental Beetle Trap. This product is used to help reduce the population of adults by attracting and trapping them, similar to a Japanese beetle hanging bag trap except with an Oriental beetle pheromone.

The company also has released AgBio Predalure, which is an attractant for a number of beneficials — like green lacewing, pink spot ladybird beetles and hover flies — that have a broad diet of pest insects. The attractant is encapsulated in a controlled-release packet that lasts for four weeks. These packets are placed in crops or the landscape and draw in beneficial insects to help deal with the pest problem. You will want to watch which pesticides are being used so as not to kill the beneficials you are attracting.

Scoping out a new ID tool. Imagine you are in the nursery. You find a pest, but you are not sure what it is. So you collect some leaves and head back to the office. In the past, you could flip through books and try to guesstimate the problem, or you could call an expert and attempt to describe it over the phone. Either method could lead you to a wrong identification. Another option is to mail off the sample to a lab, but that could take days to get an answer.

Now there is a tool that can expedite the identification of your problem. It is called IPM Scope from Spectrum Technologies Inc., Plainfield, IL. This little piece of equipment that can fit into the palm of your hand is actually three tools in one: digital camera, LED lighting and precision optics that connect to a computer. To operate it, you simply place the IPM Scope over top of the sample, and snap a photo. Once you have this image captured, you can e-mail it off for identification at a local extension office, private lab or consulting service. This handy tool has 40X and 140X magnification, making it perfect for enlarging insects and diseases.

As we start to understand more about managing pests, we realize that many other tools may be needed. More research is being conducted to find ways to help the grower. Staying on top of the newest technologies and developments will give you a growing edge.

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