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2023
INSECT CONTROL REPORT
Find out how growers across North America are managing insect pests. Plus, get expert advice on using selective pesticides and biopesticides.

Continued commitment

Envu is dedicated to finding solutions and creating partnerships.

Envu is proud to once again partner with *Greenhouse Management* in support of the State of the Market special report. The past year has brought a lot of changes as we built on our 50-year legacy of excellence to create a new, more agile company dedicated to environmental science: a new name, new systems and new processes. One thing that has not changed is our commitment to developing innovative solutions to help you solve your toughest challenges.

Just as Envu has evolved over the past year, so too have the challenges faced by greenhouse and nursery growers. As new threats have emerged, from invasive species like *Thrips parvispinus* to complex disease challenges like vascular streak dieback and beech leaf disease, our team of experts has been on the front lines, working alongside growers, university researchers and private industry partners. The insights gained from these collaborations are helping to drive Envu research and development efforts as we work to meet the needs of the industry.

In addition to pest and disease issues, you're also facing mounting pressure from labor challenges and environmental concerns. The good news is you're not alone. As a trusted partner in your success, Envu is ready with the solutions and expertise you need. A labor-saving tool, Marengo® herbicide delivers up to eight months of control of economically important weed species. By choosing a product with industry-leading residual control, you can reduce the number of applications needed and hours spent hand-weeding. To help take the guesswork out of developing herbicide rotations, we created a guide for weed management with programs customized to your production type and geographic region.

For growers looking to combine biocontrol methods with traditional chemistry, we offer a portfolio of reduced-risk insecticides that are compatible with many biological control agents. Altus® insecticide provides systemic control of piercing and sucking pests, with flexibility to apply before, during and after bloom. Kontos® insecticide targets sucking insects as well as tough-to-control mite species and provides true systemic activity, moving both up and down in plant tissue. For pests with a high risk of resistance development, like spider mites and whiteflies, Savate® insecticide offers quick knockdown control with a unique mode of action. Because we know it can be difficult to find reliable information, we compiled data on the compatibility of our insecticides with common BCAs in an easy-to-use table.

You can count on the greenhouse and nursery team at Envu to be partners in cultivating beautiful results. We are here to help you face new challenges, develop solutions and provide best-in-class support. Now, as always, our priority is your success. Thank you to *Greenhouse Management* for providing this update. We are fortunate to work in an industry that makes the world a more beautiful place!

Visit **us.envu.com/ornamentals** to explore resources and learn more about Envu.

– Jane Stanley
Green Solutions Team Specialist
Envu Turf & Ornamentals

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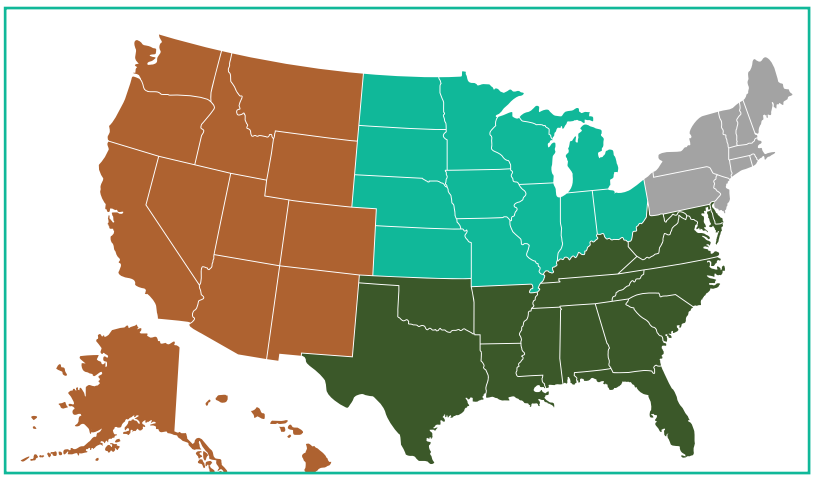
Dialing in on greenhouse pest control

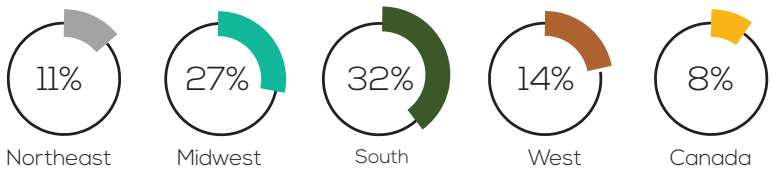
Our exclusive research reveals how North American growers oversee insect pest management, from insect pressures and IPM programs to scouting and budgets.

This summer, *Greenhouse Management* magazine surveyed North American growers about administering pest management plans, which pests are the most problematic, scouting protocols, pest control budgets and much more. Our survey of more than 315 growers revealed that three-quarters of respondents have an integrated pest management plan and most review IPM plans once a year; more than half said their crews scout for insect pests daily; and 60% practice preventive measures compared to curative.

Editor's note: Due to rounding, not all percentages add up to 100.

Where is your primary operation located?





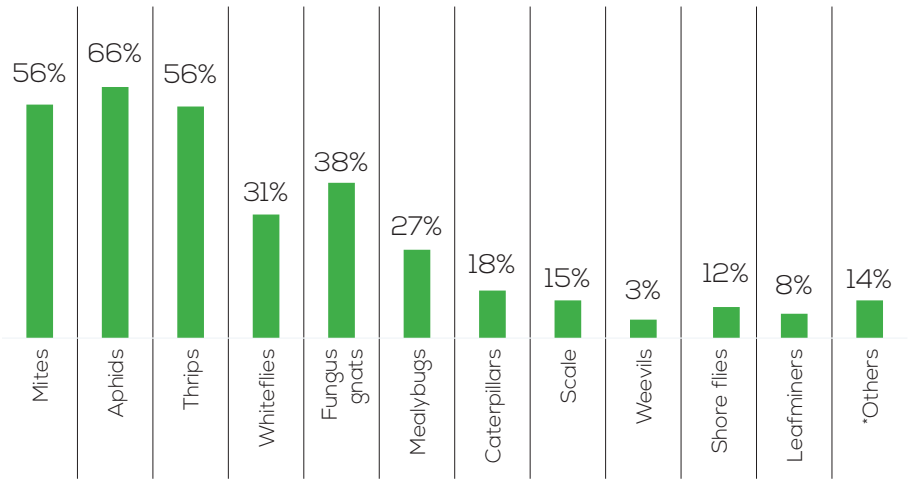
How many square feet is your location's total growing capacity under cover?

Less than 2,500	22%
2,500 to 4,999	9%
5,000 to 9,999	10%
10,000 to 24,999	11%
25,000 to 49,999	10%
50,000 to 99,999	13%
100,000 to 249,999	8%
250,000 to 499,999	8%
500,000 or more	11%

The top five most problematic pests reported are aphids, thrips, mites, fungus gnats and whiteflies. While specific problematic pests don't vary much from year to year, aphids were identified as the biggest problem for the second consecutive year, and mealybugs didn't make the top five this year.



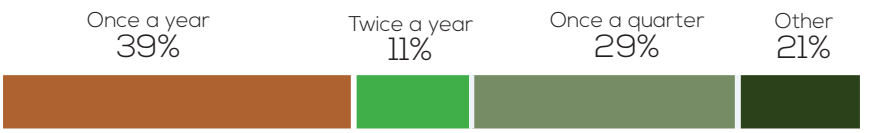

What are your most problematic pests? Select all that apply.



Other answers include: slugs, red-headed flea beetle, ants

Do you have an integrated pest management plan?

How often do you review your IPM program?



Other answers include: Every month, constantly adapting as we go, every week

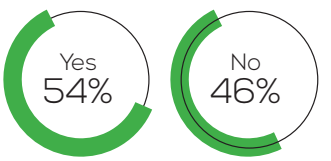
How many labor hours on average are spent on pest management during a 12-month period?

1 to 25 hours	14%
26 to 50 hours	19%
51 to 100 hours	20%
101 to 250 hours	16%
More than 250 hours	24%
Unknown	9%

Just over half of growers said they have a dedicated IPM manager to help keep track of insect pressures, spray plans, beneficial releases and scouting crews. Nearly a quarter of respondents said they spend more than 250 hours of labor hours annually on pest management.

Do you have a dedicated IPM manager?

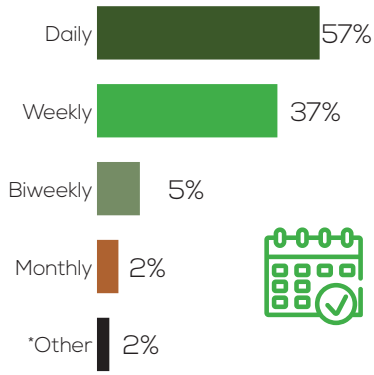
If you don't already have an IPM program, are you planning to implement one in the next 12 months?



How many crew members typically scout for pests?

30%	55%	10%	5%
1	2 to 4	5 to 10	More than 10

How often do you scout for pests during active growing seasons?

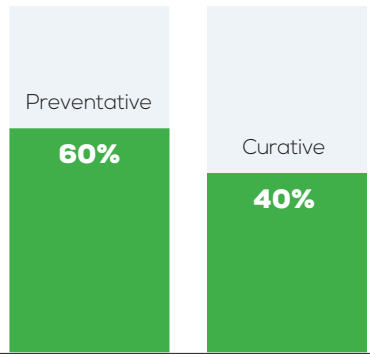


Other answers include: Several times a week, varies

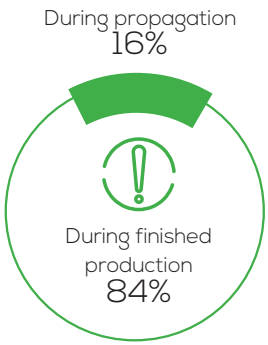
How much do you budget each year for pest management expenses?

Less than $5,000	34%
$5,000 to $9,999	17%
$10,000 to $24,999	13%
$25,000 to $49,999	7%
$50,000 to $99,999	10%
$100,000 or more	19%

On average, what percentage of your pest management processes are preventative? Curative?



During which stage of production do you experience the greatest pest pressure?



What is your biggest problem when it comes to pest management?

Other answers include: REI times during peak season; not enough time during peak season; program failure with not enough time to react; new grower with a lack of knowledge

Nearly 50% of growers identified price of treatments and lack of labor as their biggest problems regarding pest management. Price ranked higher this year, which was in second place behind labor for the last two years of this survey.

Photo: (left): ©Mulderphoto | Adobe Stock

Photo: (left): ©Tomasz | Adobe Stock

Do any of your customers have restrictions on what type of pest control products are used during production (i.e., specific chemistries, organic producers/retailers)?

Do you use biocontrol measures?

Have you discovered Thrips parvispinus at your facility?

19%	49%	32%
YES	NO	I'M NOT SURE

Are you comfortable with the amount of rotation with chemical active ingredients and modes of action in your pest control program?

Have you discovered red-headed flea beetle at your growing operation?

14%	78%	8%
YES	NO	I'M NOT SURE

The discovery of Thrips parvispinus in Florida has caused concern because of the large amount of plant material being shipped out of the Sunshine State. But nearly 50% of respondents said they have not discovered the pest yet. For more details on T. parvispinus, turn to **S14**.

Nearly a quarter of respondents said they use biocontrol measures and 88% said they use them in conjunction with traditional pest control methods. When it comes to the type of biocontrol products used, predators are the top method. Out of the 46% of respondents who are not using biocontrols, most said they haven't adopted those methods because they need more education and training.

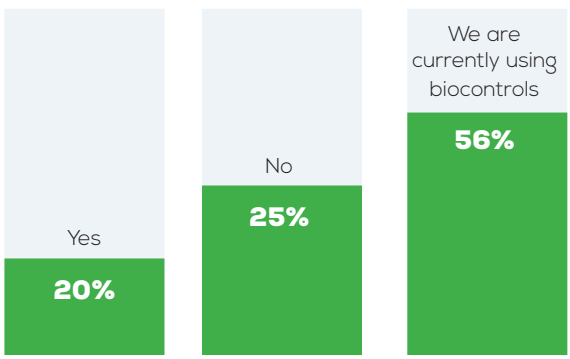
Do you use biocontrol measures exclusively or in conjunction with traditional pest control methods?

Exclusively	12%
In conjunction	88%

Which biocontrol products do you use? Please select all that apply.

Predators	85%
Parasitoids	58%
Pathogens	59%

Do you plan to adopt biocontrol measures in the next 12 months?



If you do not use biocontrol measures, explain why.

Price	13%
Product performance is not good enough	18%
Need more education/training	30%
We are using biocontrol measures	54%

Photo: © Natalia | Adobe Stock

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Pesticide selectivity and biopesticides

Understand the benefits and drawbacks of selective pesticides for an improved IPM program. **By Raymond A. Cloyd**

Pesticides — in this case, insecticides and miticides — are widely used in greenhouse production systems to manage insect and mite pest populations and maintain populations below plant-damaging levels. Some greenhouse producers are minimizing the use of broad-spectrum pesticides and are using more selective or narrow-spectrum pesticides. This article discusses the different types of pesticide selectivity and biopesticides.

SELECTIVITY

There are two types of selectivity: physiological and ecological selectivity. Physiological selectivity refers to greater activity of a pesticide on an insect or mite pest than on a biological control agent (e.g. parasitoid or predator) when both organisms have been exposed to direct contact with a pesticide. Ecological selectivity involves limiting pesticide exposure of a biological control agent through application timing, application method, and or distribution of application. In short, physiological selectivity is a result of physiological differences in the susceptibility of an insect or mite pest and biological control agent to a pesticide. Ecological selectivity is associated with exposure differences between an insect or mite pest, and biological control agent to a pesticide.

Selectivity can also be based on the number of target insect or mite pests that the pesticide is effective in managing. Selective pesticides are active on specific insect or mite pests with minimal direct or indirect effects on non-target organisms such as biological control agents. So, what are the benefits and drawbacks associated with selective pesticides? The benefits include: 1) minimal direct effects to biological control agents, 2) safer to humans than conventional pesticides, 3) less harmful to plants than conventional pesticides, and 4) less persistent in the environment than conventional pesticides. The drawbacks are: 1) narrow spectrum of insect and/or mite pest activity, 2) may indirectly affect

Benefits	Drawbacks
Less toxic to humans than conventional pesticides.	Slower rate of killing insect or mite pests compared to conventional pesticides.
Narrow spectrum of insect or mite pest activity.	Narrow spectrum of insect or mite pest activity.
Short residual activity (persistence).	Short residual activity (persistence).
Less susceptible to resistance development than conventional pesticides.	Effectiveness reduced when exposed to unfavorable environmental parameters, such as, temperature and relative humidity.

Table 1. Benefits and drawbacks associated with biopesticides.

biological control agents, 3) minimal persistence (residual activity), and 4) length of time required to kill insect and mite pests is longer than conventional pesticides.

There is overlap between the benefits and drawbacks. In addition, an unintended consequence of pesticides with selective activity is that greenhouse producers still need to manage multiple insect and mite pest complexes. Therefore, greenhouse producers, especially those with multiple cropping systems (polyculture) will mix several selective pesticides together to expand the spectrum of activity against multiple insect and/or mite pest complexes. Consequently, this nullifies the purpose of having selective pesticides. However, if only a single crop is grown (monoculture) with only one insect or mite pest then using selective pesticides may be an option.

BIOPESTICIDES

Biopesticides, in general, are considered selective pesticides, although based on the targeted insect and mite pests on commercially available product labels, this is not always the case. Biopesticides are types of pesticides derived from natural materials, such as animals, plants, bacteria and certain minerals. There are three major classes of biopesticides:

Microbial pesticides: Consist of a microorganism as the active ingredient, such as, a fungus, bacterium, virus, or protozoa, that is selective in activity against specific target insect or mite pests.

Plant-incorporated protectants: Substances that plants produce based on genetic material, which are incorporated into plants.

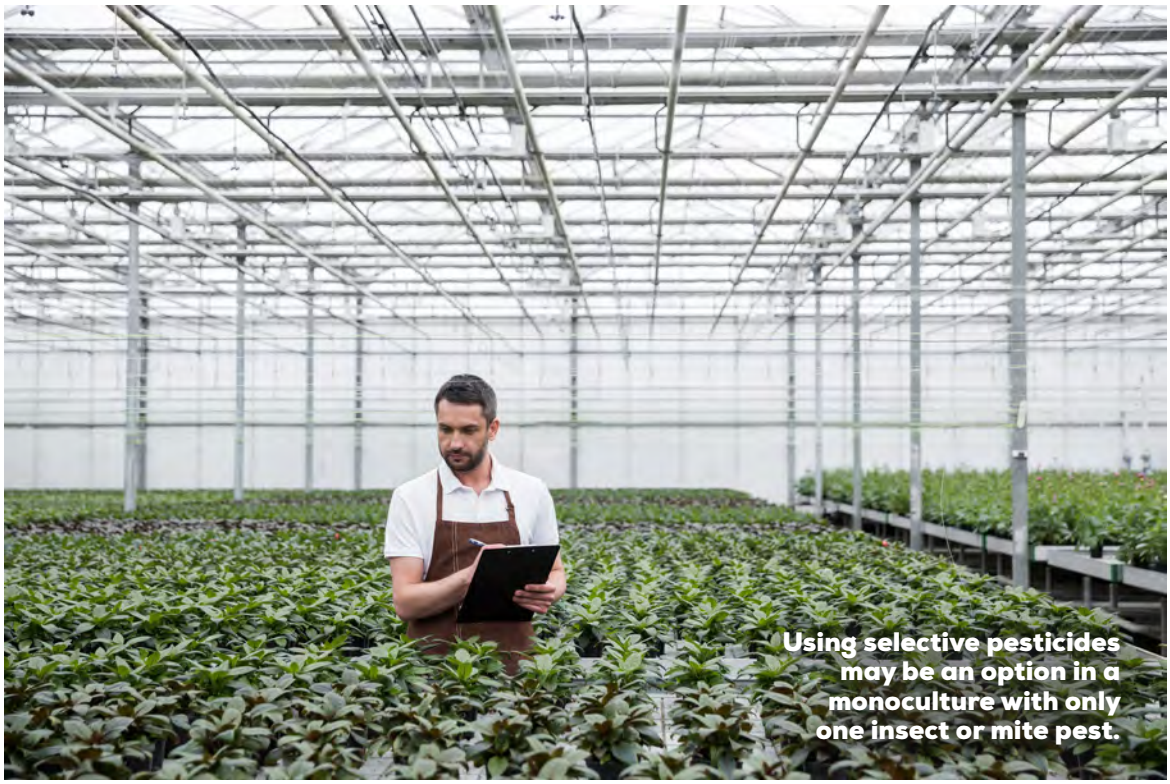
Biochemical pesticides: Naturally occurring substances such as semiochemicals that control insect pests by non-toxic mechanisms (e.g. insect sex pheromones).

The general characteristics of bio-

Photo: © evgeny | Adobestock

Microbially Based Entomopathogenic Fungi	
Active Ingredient	Trade Name(s)
Beauveria bassiana Strain GHA	BotaniGard, Mycotrol
Beauveria bassiana strain PPRI 5339	Velifer
Isaria fumosorosea Apopka Strain 97	Ancora
Metarhizium brunneum (formerly *anisopliae*)	Met52
Microbially Based Entomopathogenic Bacteria	
Active Ingredient	Trade Name
Bacillus thuringiensis subsp. *kurstaki*	Dipel
Bacillus thuringiensis subsp. *israelensis*	Gnatrol
Chromobacterium subtsugae Strain PRAA4-A^T	Grandevo
Heat-killed Burkholderia spp. Strain A396	Venerate
Plant-Incorporated Protectants	
Active Ingredient	Trade Name (s)
Streptomyces avermitilis (abamectin)	Avid
Saccharopolyspora spinosa (spinosad)	Conserve
Azadirachtin	Azatin, Ornazin, Molt-X

Table 2. Active ingredient and trade name(s) of commercially available microbially based entomopathogenic fungi and bacteria, and plant-incorporated protectants in the U.S.



Using selective pesticides may be an option in a monoculture with only one insect or mite pest.

pesticides are: 1) narrow target insect or mite pest activity, 2) complex modes of action, 3) timing of application is important, 4) limited residual activity (persistence), 5) safe to environment and humans, and 6) effectiveness is influenced by environmental factors, such as, temperature, relative humidity, day length, and light intensity. The benefits and drawbacks of biopesticides are listed in **Table 1**.

Microbial pesticides are used in greenhouse production systems to manage certain insect and/or mite pests with the main organisms being entomopathogenic fungi and bacteria. The characteristics of microbial pesticides include: 1) short residual activity, 2) sensitive to ultra-violet light degradation and rainfall, 3) primarily active on the young (immature) stages of insect pests, 4) generally less harmful to biological control agents, such as, parasitoids and predators than broad-spectrum conventional pesticides, 5) low mammalian toxicity, and 6) usually take longer to kill insect pests than conventional pesticides.

Microbially based entomopathogenic bacteria and fungi differ in how they kill insect and/or mite pests. Bacteria must be consumed (stomach poison) by the insect pest. After ingestion, bacteria cause septicemia, which results in death of the insect pest. Fungi can directly penetrate through the insect or mite pest cuticle and initiate an infection. Fungi use a combination of enzymes and mechanical pressure to penetrate an insect or mite pest cuticle. The fungus grows into and proliferates inside the body cavity (hemocoel) of an insect or mite pest with death occurring within four to seven days. **Table 2** lists the commercially available microbially based entomopathogenic fungi and bacteria, and plant incorporated protectants registered for use in the U.S.

Raymond A. Cloyd is a professor and extension specialist in horticultural entomology/plant protection at Kansas State University; **rcloyd@ksu.edu**

Diamondback moth, *Plutella xylostella*

The moth's larva defoliates a large variety of vegetables, annuals and perennials both outdoors and in greenhouse production.

The diamondback moth's caterpillar larvae chew small circular holes in leaves from the undersides, giving the leaves a shot-hole appearance. Very high populations can defoliate plants. It is a particularly avid attacker of cruciferous vegetable crops, like cabbage, kale and watercress. Affected flowers include perennials like candytuft and annuals like sweet alyssum.

APPEARANCE

The adult is a small, slender, grayish-brown moth with pronounced antennae. It is about 6 mm long and marked with a broad cream or light brown band along the back. The band is sometimes constricted to form one or more light-colored diamonds on the back, which is the basis for the common name of this insect. The larvae are colorless in the first instar, but thereafter are green. The yellowish pupa is 7 to 9 mm in length.

LIFE CYCLE

The diamondback moth has four instars. Initially, the feeding habit of first instar larvae is leaf mining, although they are so small that the mines are difficult to notice. The larvae emerge from their mines at the conclusion of the first instar, molt beneath the leaf, and thereafter feed on the lower surface of the leaf. Pupation occurs in a loose silk cocoon, usually formed on the lower or outer leaves. The duration of the cocoon averages about 8 ½ days (range 5-15 days). Adult males and females live about 12 and 16 days, respectively, and females deposit eggs for about 10 days. Total development time from the egg to pupal stage averages 25 to 30 days, depending on weather, with a range of about 17 to 51 days. The number of generations varies from four in cold climates such as southern Canada to perhaps 8 to 12 in the south.

CULTURAL CONTROL

Because these pests feed on a large variety of plant species, keep production areas free of weeds (e.g., mustards) that serve as hosts to diamondback moths. For greenhouse operations, exclusion of winged adults can be accomplished by covering openings to greenhouses with screens. Screens are especially important when lights are used at night in greenhouses to control flowering because lights attract adult moths. Individual seedling flats may also be covered with

Photo courtesy of Alton Sparks, University of Georgia

screens to exclude adults and larvae. Row covers can be a practical measure to exclude moths in field production as long as the mesh prevents entry of adults, and the row cover is held above the plant surface to eliminate oviposition through the fabric. Also, intermittent overhead irrigation can disrupt oviposition by diamondback moth.

SCOUTING AND TREATMENT

If Bt sprays are planned, use pheromone traps to determine adult flight activity and mating. Once adults are caught in traps, it is very likely that larvae are present and Bt should be applied as soon as possible because it is most effective against young larvae. Use regular visual inspections of plants to detect larvae and their damage. Diamondback moth may be resistant to many insecticides.

BIOLOGICAL CONTROL

A number of parasites, both tachinid flies and parasitic wasps, attack Lepidoptera larvae and reduce their population growth rate. Viruses do not usually kill the larvae until later instars. The parasitic stingless wasps *Cotesia plutellae*, *Diadegma insulare* and *Microplitis plutellae* are commercially available for control of diamondback moth. Applying insecticides other than *Bacillus thuringiensis* (Bt) products are likely to exclude parasites because the residues are lethal to these beneficial insects.

Source: University of California Agriculture & Natural Resources IPM department, University of Florida Entomology Department

Pest alert

Keep a close watch out for *Thrips parvispinus*, an invasive species now spreading in Florida.

An invasive thrips species has been wreaking havoc in Florida. The insect was first detected in Florida in 2020 but has since spread significantly across the state. What once was isolated to greenhouses now has begun to harm a wide range of plants.

The insect, *Thrips parvispinus* — commonly known as pepper thrips — is one of the smallest thrips species in Florida. Its size makes it challenging to detect.

"It isn't that the sky is falling, but we have to pay attention to this and not ignore it," says Lance Osborne, UF/IFAS entomologist at the Mid-Florida Research and Education Center. "Growers of any crop should be aware. This insect seems to have a fairly broad host range. This won't just impact peppers and ornamental plant growers."

A new website (**bit.ly/thrips-ufl**) developed in collaboration between UF/IFAS and USDA provides detailed information on the insect's biology, early detection and damage symptoms with detailed videos and images. This website also includes a downloadable scouting sheet and means of contacting the proper professionals for any grower who detects the pest in their operation.

The pest has been detected on a wide variety of plants including 43 species from 19 plant families including ornamental plants, vegetables and fiber crops. Muhammad "Zee" Ahmed, USDA research entomologist, expects the list to grow.

"In order to minimize any kind of negative impacts, we started warning people right away that this pest had made its way to Florida," says Osborne. "We better be careful. This insect is notorious for damaging peppers around the world but now it has moved from the greenhouse to the environment and has established itself in several areas around the state."

"While damage symptoms are the most noticeable indicators of its infestations, they may not appear until after the plant has sustained considerable harm," says Ahmed. "As they say, prevention is always better than cure, and this is particularly true when dealing with *T. parvispinus.*"

The research team including Ahmed, Cindy McKenzie of USDA, and UF/IFAS Extension agent John Roberts conducted a survey of garden centers in Palm Beach County

Photo by Lance Osborne, UFL

to understand how widespread the pest is. Eight out of nine stores that entomologists visited had the pest.

Entomologists encourage growers to scout often and inspect their plants carefully.

"Now that we know more about the insect, we need to do more research to know how to manage them," says Osborne. "We want to help growers avoid wasting money and chemicals, so we are working to develop effective spraying strategies for controlling their populations."

Researchers are conducting controlled experiments in quarantine facilities, including Alexandra Revynthi at the UF/IFAS Tropical Research and Education Center and Osborne at MREC. But scientists are eager to test their findings in real-word scenarios.

The regulations for research on controlled pests of this kind are strict. Scientists cannot move plant material or the live insects outside of infested areas, or work with them in university facilities accept in an approved quarantine room.

As such, research into how to manage the pest is still in its early stages, but researchers have made some progress.

"We're interested in working with growers to help manage the pest so we can better understand how to treat these thrips in a commercial setting," says Osborne.

Growers who detect *T. parvispinus* should immediately report their findings to the Florida Department of Agriculture and Consumer Services Division of Plant Industry. Then, researchers can work with growers to help manage the pest and develop the best treatment options available.

"This information will be critical in developing effective control strategies and preventing the further spread of this invasive species in the U.S.," says Ahmed.

Photo courtesy of Iowa Department of Natural Resources

USDA announces strategic plan to fight spotted lanternfly

The five-year plan aims to limit the pest's spread and continue research into management tools.

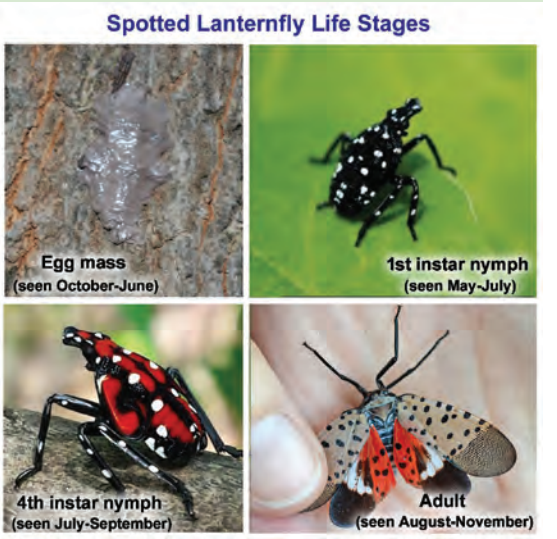
The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) Spotted Lanternfly Strategic Planning Working Group has released its five-year strategic plan to combat the invasive insect. While you may not find it destroying greenhouse crops, you may see it on your property. Reporting it will help stop the spread of this harmful pest.

USDA-APHIS brought together the Spotted Lanternfly Strategic Planning Working Group working group in August 2022 with representatives from APHIS, the National Association of State Departments of Agriculture (NASDA) and the National Plant Board (NPB). The working group developed a unified approach to reduce the spotted lanternfly's spread and impacts through the effective use of available State and Federal resources.

"Spotted lanternfly is an invasive pest that feeds on crops and natural resources," says USDA Marketing and Regulatory Programs Under Secretary Jenny Lester Moffitt. "Over the next five years, Federal and State partners will work to limit the spotted lanternfly's advancement as we further scientific research that will help us develop better pest management tools and options."

The five-year strategy prioritizes the following goals:

- Effectively limit the advancement of spotted lanternfly and efficiently respond to its introduction within Federal and State authority and resource availability.



- Support continued scientific research towards practical management and risk mitigation.
- Establish a consistent national and state-level outreach message and educational campaign for the public and industries at risk for spreading spotted lanternfly.

Read the entire five-year strategy here: bit.ly/SLF-Plan

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