Winter 2018 *Volume 22, issue 1*

University *of* California

UCNFA News

Inside

What's Bugging Our Bees?

by Elina L. Niño

There are approximately 20,000 bee species in the world and 1,600 species in California. Despite this diversity, honey bees are still arguably the most important managed pollinator, and this brief overview will focus on issues plaguing this charismatic insect. However, many of the same stressors are certainly affecting other pollinator populations. In agriculture, honey bees are used for pollinating numerous food plants that make our diets more exciting and nutritious, including many fruits, vegetables and nuts, and they are a crucial contributor to healthy ecosystems. However, beekeepers in the past decade have been reporting annual honey bee colony losses that have reached 45%, which is more than double the acceptable loss deemed by beekeepers.

Editor's Note

This newsletter issue focuses on bee health and neonicotinoid insecticides. Beekeepers have been reporting significant annual honey bee colony losses. The term "colony collapse disorder" and the contributing role of pesticides has permeated headlines. However, the varroa mite has been the main cause of bee decline in recent years. The purpose of this newsletter is to further the understanding of these bee-related problems and issues surrounding the use of neonicotinoid insecticides. UC Davis bee biology expert Elina Niño introduces the subject of bee health and the significant effect of parasitic mites and pathogens in bee decline. Beekeeper Randy Oliver assesses the importance of neonicotinoids. Jim Bethke discusses the use of systemic insecticides, such as neonicotinoids, and how they are used to manage certain insects. Richard Evans provides data from the scientific literature evaluating consumer value of pollinator-friendly plants and products.

♦ **Steve Tjosvold and Julie Newman**

What's Bugging Our Bees?

continued from page 1

Unless you do not own a TV or a smart phone, or for some reason you do not follow the news, you probably have heard about colony collapse disoder (CCD). This phenomenon was reported by a Pennsylvania beekeeper in 2006 and caused widespread die-offs of honey bees in the United States.

CCD was characterized by a complete loss of the colony's adult bee population, although the queen and the developing bees (brood) were still present in the hive. Beekeepers also noted that pests and bees from neighboring hives were reluctant to enter the affected hives. What caused the death of the colony's adult bees was a mystery due to the complete absence of dead bees around the hives—as if these bees simply disappeared. However, researchers and beekeepers now mostly agree that CCD was likely caused by a combination of environmental and biological factors.

While CCD specifically is not causing large-scale colony death in the United States any longer, beekeepers still have a tremendous number of issues to contend with and are still losing a high percentage of colonies each year. Beekeepers can usually recoup at least part of their losses by splitting colonies to create new ones, but the operational costs of maintaining a sufficient honey bee supply are on the rise, predominantly due to addressing these issues. This has also caused an increase in hive rental prices for growers who use the hives to pollinate their crops.

One key issue is whether neonicotinoids, a class of insecticides that affect insects' nervous systems, are negatively affecting bees *(editor's note: see Randy Oliver's feature article for details)*. While pesticides tend to be a focus of media attention and often rightfully so, perhaps the biggest challenge for U.S. beekeepers today is *Varroa destructor*. This aptly named parasitic mite feeds on bee hemolymph ("blood"), simultaneously transmitting pathogens and suppressing bee immunity. Often, several mites feed on a single bee.

Beekeepers use a variety of integrated pest management (IPM) techniques, including miticides designed to specifically target the bee parasitic mites. However, some of the miticides have been found to cause negative effects in bees such as deformities, behavioral issues and increased mortality.

Fig. 1. Bee carrying *Varroa* mites (*upper left corner*), next to two bees with deformed wings due to an infection with deformed wing virus. A third bee (*lower right corner*) also shows symptoms of the virus. *Photo*: Bernardo D. Niño.

Additionally, some of the commercial miticides have lost their efficacy against *Varroa* due to the development of resistance. This is the reason why our laboratory is currently developing and evaluating several novel biomiticides to be used as part of an IPM plan. Prevention is usually better then intervention, so another strategy for dealing with mites is breeding *Varroa*-resistant bee stock. Supporting breeding efforts through our research in improving honey bee queen reproduction is also a part of our lab's efforts.

In addition to parasites, honey bees are also exposed to many pathogens including viruses, bacteria and fungi. Viruses have been implicated as an important factor in honey bee health declines, but we are just starting to understand how bees deal with this type of infection. The *Varroa*-virus complex (fig. 1) is a particularly prominent challenge for honey

What's Bugging Our Bees?

continued from page 2

bees, often preventing bees from performing normal work functions and leading to increased mortality.

Furthermore, potential negative effects of pesticide use on bee health have prompted a passionate public debate and have spurred concern among amateur and professional gardeners alike. But providing diverse forage to pollinators may help mitigate some of these issues. Horticulturists and nursery growers producing ornamental and native plants are under increasing pressure to provide pollinator-supportive plants that are free of harmful pesticide residues. However, not much is known about the attractiveness of specific nursery plants to the variety of bees and other pollinators, as well as how much of commonly used systemic pesticides is translocated into nectar and pollen.

Fig. 2. Honey bee foraging on *Ceanothus* 'Julia Phelps' in the Häagen-Dazs Honey Bee Haven garden at UC Davis. 'Julia Phelps' is one of seven ceanothus cultivars currently on the Häagen-Dazs Honey Bee Haven plant list. *Photo*: Bernardo D. Niño.

To fill some of those gaps, our lab is a part of a large multistate USDA grant project led by Rutgers University to specifically tackle these questions, as well as develop pollinator-safe IPM programs for growers. (*Editor's note: Randy Oliver comments in his feature article that he and Jim Bethke are also working on this grant, which was awarded to the IR-4 Project's Ornamental Horticulture Program based at Rutgers.*) The project has already identified common garden plants preferred by different bee species, preferred flower structure, and even preferred cultivars of specific plants. These interesting results have been extended at the Häagen-Dazs Honey Bee Haven demonstration garden and at the UC Davis campus annual pollinator workshops.

Future research at the Häagen-Dazs Honey Bee Haven will include studying various irrigation schemes on plant attractiveness, likely of particular interest to nursery customers. Furthermore, the Bee Biology research labs at the UC Davis Harry H. Laidlaw Jr. Honey Bee Research Facility, and research labs at other universities (see lab links listed at "Links to Others" on the Williams lab web page) are analyzing what types of flowering plants provide the best supplemental forage for bees in agricultural setting.

Nursery growers can help protect honey bees by implementing pollinator-safe pest management techniques. They can also help shield pollinator health by providing information to their retail customers about the best pollinator-supportive plants and safe pest management techniques. For an idea of great pollinator-supportive plants particularly suited for the California environment, see our Häagen-Dazs Honey Bee Haven plant list (fig. 2). And don't forget to support your local beekeeper by buying their honey. You can learn more about honey and locate California beekeepers by visiting the National Honey Board website.

Elina L. Niño is Assistant Extension Apiculturist, University of California, Davis.

Neonicotinoids: An Objective Assessment

by **Randy Oliver**

Everyone's heard about the claim that honey bees are going extinct due to the neonicotinoid insecticides. Although I'm glad that folks are concerned about the bees, the fact is that that claim is not accurate.

People have every reason to be concerned about our human impact upon the environment, and many species face extinction due to habitat conversion, pollution, overharvesting and climate change. But the honey bee is not one of them. In actuality, the number of managed hives of bees has been increasing in recent years in nearly every country in the world. Colony numbers reflect the profitability of beekeeping as a business, as reflected in figure 1. The largest number of hives in the United States occurred during World War II due to the Army's demand for beeswax and the public's demand for honey. After the War, beekeeping was less profitable, and the number of hives decreased. We then got hit by the introduction of two parasitic mites in the late 1980s, and hive numbers declined further as it became tougher to keep our colonies alive. In recent years, the offered price for hive rental for almond pollination tripled, so colony numbers are on the rise.

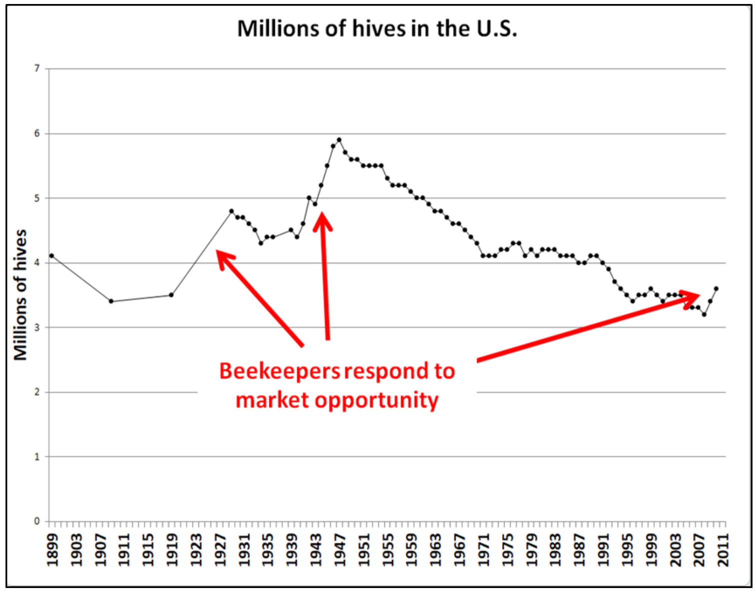

Fig. 1. Profitability of the beekeeping business over time.

In the early 2000s, our bees got hit by yet another invasive pathogen (*Nosema ceranae*), and the term "CCD" was used to describe the sudden collapse of colonies. But at the time we didn't know what was happening, which allowed the claim that a new class of insecticides — the neonicotinoids — were responsible. It was a compelling narrative — was this a repeat of DDT causing the near extinction of the pelicans and raptors? I immediately started researching the subject, but found to my surprise, that the narrative didn't fit the evidence. But that didn't stop the anti-neonic bandwagon, and researchers switched from working on our main problem — the varroa mite — to trying to pin the blame on the neonics (fig. 2). Although varroa was a hot topic upon its arrival in Europe and North America, scientific interest in the parasite was eclipsed during the CCD epidemic in the mid-2000s by the sexier claim that the neonics were to blame. (*Editor's note: see Elina Niño's feature article for details on the varroa mite.*)

Why the Neonics?

Growers have long used insecticides, many of which we now know are not at all environmentally friendly. Since the founding of the EPA in the post Silent Spring era, we are taking a better look at the impacts of pesticides upon off-target organisms, the environmental fates of the products and their long-term sublethal effects — especially upon humans.

EPA has thus phased out the "Dirty Dozen" persistent organic pollutants (POPs) and in recent years has revoked or restricted the use of a number of others. For example, the previously commonly-used organophosphate chlorpyrifos is no longer registered for use as a household bug spray.

The Neonicotinoids: An Objective Assessment

continued from page 4

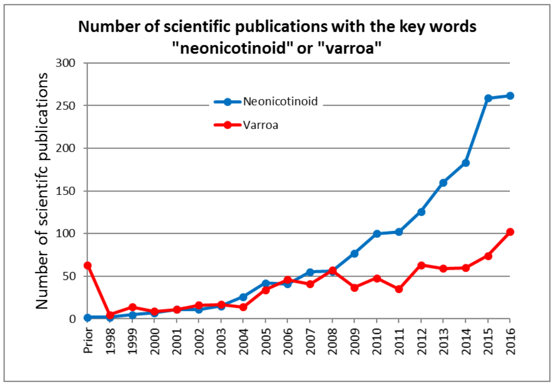

Fig. 2. Research efforts to find the cause of elevated rates of colony mortality focused much more on neonicotinoid insecticides than on varroa mites.

The problem is that as we limit the number of insecticides available to growers, pests develop resistance to regularly-applied products. Additionally, the largest portion of a sprayed insecticide never actually hits the intended pest — thus ending up in the air and water, and in the rest of the environment. Growers thus put pressure on the chemical companies to continually develop new types of pesticides, while the consumer demands safer products.

Enter the Neonicotinoids

The neonicotinoids (meaning new, nicotine-like) are synthetic derivatives of the natural plant alkaloid nicotine. The neonics affect specific receptors in the nervous system of insects that are less prevalent in vertebrate animals, so they are thus much safer for humans, other mammals, birds and fish. In fact, the most commonly-used neonic, imidicloprid, is less toxic to humans than is caffeine.

The second advantage of the neonics is that they are systemic — they can be absorbed through a plant's roots and get carried via the xylem to the rest of the plant (*editor's note: see Jim Bethke's feature article for more information about the movement of systemic pesticides such as neonicotinoids in plants*). Thus, if they are applied as a seed treatment, the only organisms exposed to the chemical are the pests that take a bite out of the plant, or consume the pollen or nectar (this is where bees enter the picture). Because of these advantages, neonics quickly became the most widely-used insecticides in the United States (fig. 3) and in the world.

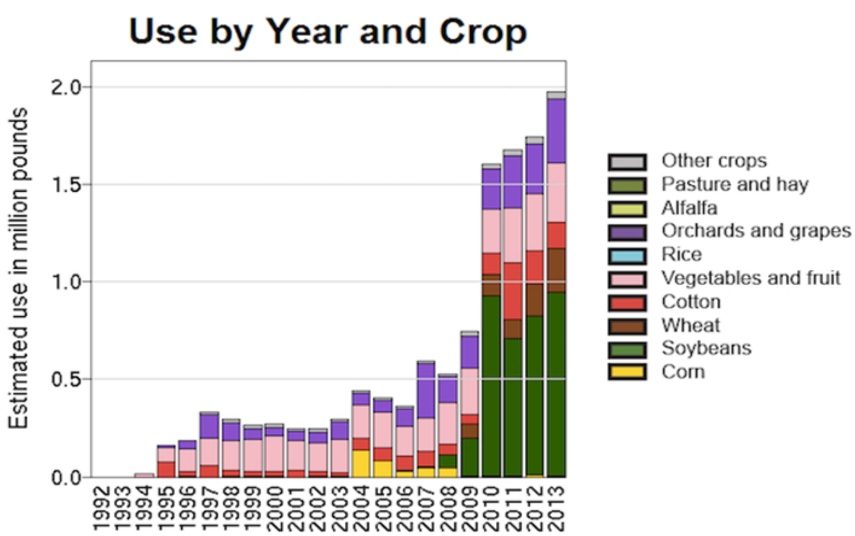

Fig. 3. Use of the neonicotinoid insecticide imidacloprid in the United States over time. Source: United States Geological Survey (USGS).

Effects of Neonics on bees

Neonics are ideally applied as seed treatments, where the amount per seed can be carefully controlled, so that by the time that a plant produces nectar and pollen, the residues are too diluted to harm pollinators. Unfortunately, during the introduction of the neonics, there were some serious incidents of inadvertent bee kills when the seed coating rubbed off in pneumatic seed planters and the dust killed bees. In most countries, this issue has now been resolved.

This leaves the question of neonic residues in nectar and pollen. In general, the residues in the nectar and pollen of properly-treated agricultural crops (typically less than 3 ppb) do not appear to cause significant adverse effects on honey bee colonies. I've personally visited beekeepers in corn, soy and canola growing areas, and they report that with the introduction of Bt genet-

The Neonicotinoids: An Objective Assessment

continued from page 5

ically-engineered crops and the use of neonic seed treatments, that the pesticide issues that they suffered from in the 1960s and '70s have largely gone away. That said…

Neonics are not without problems

Insecticides by definition are designed to kill insects. No insecticide is environmentally harmless, and as we learn more about unintended effects, our regulators must revise the approved allowable applications. We have now found that the honey bee colony is a special case, and it is able to "buffer" the sublethal effects of the neonics on the colony.

Despite clear adverse effects on individual workers, the net result to the colony is generally minimal. However, although properly-applied neonics appear to generally cause minimal measurable adverse effects on honey bee ***colonies***, they may have more deleterious effects upon bumblebees (fig. 4) and solitary native bees (fig. 5). ***This is a serious concern, of which the EPA is well aware.***
Another concern is that especially with the widespread prophylactic use of neonic seed treatment, more and more residues are ending up at agricultural field margins and in aquatic ecosystems (fig. 6). Certain uncultivated plants in the field margins concentrate neonic residues in their nectar and/or pollen. For example, a study in Saskatchewan found residues up to 20 ppb in some flowers — enough to start causing problems in bee hives (serious problems occur at 50 ppb), and strong adverse effects upon some native pollinators. ***These unintended effects upon native pollinators and aquatic invertebrates need to be addressed, and the universal use of treated seed should be restricted.***

Fig. 4. A queen black-tailed bumble bee, *Bombus melanopygus*, foraging on pansies. *Photo:* Kathy Keatley Garvey.

Uses other than as seed treatments

Fig. 5. A female solitary bee (*Svasta obliqua expurgata*) on purple coneflower (*Echinacea pupurea*). *Source:* Frankie G, Thorp R, Hernandez J, Rizzardi M, Ertter B, Pawelek J, Witt S, Schindler M, Coville R, Wojcik V. 2009. Native bees are a rich natural resource in urban California gardens. Calif Agr 63(3):113-120. https://doi.org/10.3733/ca.v063n03p113.

Neonics can also be applied as sprays, drenches, or other foliar applications, or by chemigation. There is far more room for misapplication by these methods.

And perhaps worst of all would be misapplication by homeowners, who may think that "if a little is good, more might be better." Luckily, in the studies I've seen, urban and suburban bee-collected pollen and nectar normally does not contain toxic levels of neonics.

The Neonicotinoids: An Objective Assessment

continued from page 6

And this brings us to neonic applications in nursery stock. In order to ship stock across state lines, nurseries must produce pest-free plants. This requires insecticides. But nursery managers do not want to expose employees and customers to residues of organophosphates such as chlorpyrifos. They can avoid this by placing a measured amount of a neonic in the potting soil, which then, due to its systemic action, results in "clean" plants, and no human-harmful residues. Ideally, by the time a pollinator-attractive plant produces flowers, the residues would be diluted enough so as not to cause harm. None-the-less, some consumer activists claim that plants treated with neonics are harmful to bees and advocate boycotts of plants sold at big box nurseries (see GMO Free link). The problem is, that no one has individually tested the thousands of cultivars of nursery plants for residues of imidacloprid in the flowers at time of sale.

Jim Bethke and I are currently involved in an IR-4 Project at Rutgers University to investigate the concentration of systemic pesticides in pollen and nectar and determine whether residues exceed safe levels with current ornamental horticulture production practices (*Editor's note: Elina Niño is also working on this grant; she provides a link to the USDA 2016 Specialty Crop Research and Extension Investments (SCRI) project, funded through USDA's National Institute of Food and Agriculture (NIFA), which was awarded to the IR-4 Project's Ornamental Horticulture Program based at Rutgers.*)

Currently, we can't really say which nursery plants might be problematic for pollinators. However, nursery growers can generally check a garden book to see if a cultivar is attractive to bees or butterflies; if so, at this time they may wish to avoid treating pollinator-attractive potted plants with neonicotinoids to be on the safe side and avoid controversy. (*Editor's note: also see Elina Niño's feature article for a link to a list of pollinator-attractive plants.*)

Wrap up

No insecticide is harmless. All of agriculture should shift towards integrated pest management practices to reduce reliance upon pesticides. California is the most proactive state in the Nation as far as safe pesticide use. The ag community and chemical companies have gotten the message loud and clear that the consumer wants them to reduce pesticide use and develop more eco-friendly pesticides — both of which they are doing.

Fig. 6. Water sampling monitoring conducted in watersheds in California agricultural regions indicate that neonicotinoids such as imidacloprid commonly move offsite and may contaminate surface waters at concentrations that could harm aquatic organisms. Another concern is that uncultivated plants in the field margins may concentrate neonic residues in their nectar and/or pollen. *Photo:* courtesy of UC Davis Center for Watershed Sciences, https://watershed.ucdavis.edu.

The Neonicotinoids: An Objective Assessment

continued from page 7

Growing "organic" may help, but the best future will be the adoption of agro-ecology, which goes beyond "certified organic." The field of agroecology is based upon biology, soil improvement and sustainability, rather than arbitrary rules that exclude precision breeding and environmentally-friendly synthetic pesticides, fertilizers and practices. Keep in mind that it is the consumer who can affect the most rapid change — even the largest agribusinesses respond immediately to consumer demand. *(Editor's note: see Richard Evan's "Science to the Grower" article on consumer preference and pollinator-friendly nursery products.)*

Randy Oliver is the owner of Golden West Bees in Northern California which provides migratory pollination services for almonds and produces nucleus colonies (nucs) and honey for sale. But he is much more widely known as the voice of the ScientificBeekeeping.com website, at which he interprets scientific research for the benefit of the beekeeping community.

More Reading

http://scientificbeekeeping.com/the-extinction-of-the-honey-bee/

http://scientificbeekeeping.com/neonicotinoids-trying-to-make-sense-of-the-science/

http://scientificbeekeeping.com/neonicotinoids-trying-to-make-sense-of-the-science-part-2/

Piercing-Sucking Insects and Systemic Insecticides

***by* James A. Bethke**

Quite simply, a piercing-sucking insect is one that feeds on plants by piercing cells or vascular tissues with specialized mouthparts and sucking the contents. Piercing-sucking insects are some of the most damaging pests for ornamental plant producers due to the direct damage caused by feeding — which can cause a variety of plant symptoms including plant death — and indirect damage caused by piercing plant protective tissues and vectoring many different plant diseases.

While there is a distinctive mouthpart design for each type of insect, there is a general design for piercing-sucking insects (fig. 1), which consists of a beak or rostrum that contains a pair of very fine stylets in the center. The stylets are so fine that very little pressure is needed to force them into plant tissues or between cells. As the cross section shows in figure 1, when the stylets are pressed together they form two tubes, or canals. One canal is for depositing saliva and the other is the food canal where food is drawn up into the insect by muscles strengthened for sucking. Normally these canals are enclosed and protected by the mandibular stylets and the rostrum. When the insect wants to feed, it pushes the stylets into the plant tissue in search of a specific food source. Depending on the type of insect, this tissue could be cellular tissue or one of the vascular system tubes, the xylem or phloem. Therefore, because the insect's feeding habits are selective, feeding on specific types of tissues, where the insecticide is deposited is key to insecticide efficacy.

Figure 2 represents a cross section of leaf tissue. Generally, leaves have both an upper and lower epidermal layer that covers the parenchyma. Within the leaf and stem tissues is the vascular system. The xylem brings water and nutrients from the roots of the plants up throughout the rest of the plant, including the trunk (in the case of trees), stems and leaves. The phloem begins in the leaf tissues, and it conducts food generated by photosynthesis (proteins and carbohydrates) to the

Piercing-Sucking Insects and Systemic Insecticides

continued from page 8

rest of the plant. Figure 2 also shows where specific insects and mites feed, and the entry routes where the stylets penetrate the tissues.

The damage and symptoms caused by piercing-sucking insects and the types of tissues they select to pierce and feed upon can be used to somewhat easily identify the insect. For example, cellular plant tissue damage is caused by a cellular-feeding insect, honeydew is caused by a phloem-feeding insect, and salty deposits on leaves is caused by a xylem-feeding insect.

When piercing-sucking insects feed on cellular tissues, they will usually defecate in dark spots, which can be quite distinctive. For instance, most thrips and lace bugs feed on epidermal cells, which results in silvering of the leaves, but the silvering is accompanied by dark spots of defecation (fig. 3). This type of damage differentiates thrips feeding from mite feeding because mites do not leave a distinctive fecal spot. Further, insecticides that deposit in epidermal tissues such as abamectin are much more effective against cellular feeders. With respect to the neonicotinoid systemic insecticides, it has been observed that foliar applications are more apt to deposit in epidermal tissues and cause more mortality of leaf-feeding thrips than a drench application, which disperses throughout the plant via the vascular system and must translocate to the epidermis.

Phloem feeders cause indirect plant damage by producing large quantities of sugary, sticky honeydew, which is deposited on the leaf tissues below the feeding pest. As the honeydew ages, it tends to be covered in sooty mold, a black mold that causes aesthetic damage to ornamental plants. Insects that feed in phloem include aphids, mealybugs, whiteflies, soft scales and certain plant bugs. These insects tend to be host specific because the host tissues carry plant-specific chemical compounds that serve as important host selection cues. For example, this is why aphids may prefer the Tuneful cultivar of chrysanthemum over other cultivars. Some phloem feeders, such as whiteflies, can weave their stylets between cells to reach the phloem, whereas others like planthoppers penetrate cells directly on route to the phloem. Those pests that penetrate cells directly may attain a toxic dose of pesticide prior to reaching the phloem.

Xylem feeders, such as true bugs, leafhoppers and sharpshooters, must cope with negative pressure in the xylem and very low concentrations of nutrients. This is why sharpshooters have strong muscles for sucking and why they extract extremely large quantities of xylem fluid to attain the necessary quantities of nutrients to survive and develop. The excess water and salts are excreted in large quantities and may leave salty residues on leaves below. It is well known that the systemic neonicotinoid insecticides are translocated through the xylem, and therefore, a toxic dose is more easily attained by xylem feeders.

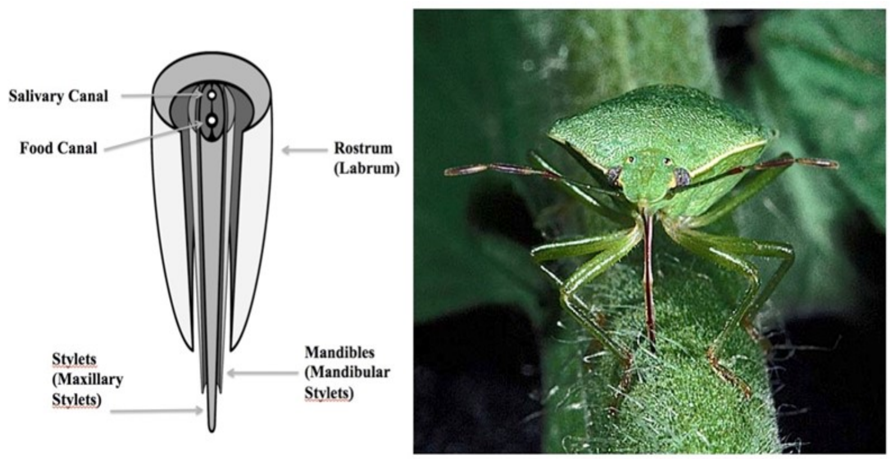

Fig. 1. Basic morphology of piercing-sucking mouthparts and the southern green stink bug feeding on a plant stem. *Diagram*: Ben Paul Diana, UC Cooperative Extension, San Diego County. *Photo*: J.K. Clark.

More About Systemic Insecticides

Systemic insecticides are taken up by the roots or leaves and translocated to all parts of the plant. They are active against a broad spectrum of economically important pests including aphids, whiteflies, leafhoppers and sharpshooters, rootworms and wireworms, planthoppers, mealybugs, soft scales, thrips and phytophagous mites. Systemic insecticides provide many advantages to ornamental plant producers, including persistence in plant tissues, residues that are less susceptible to environmental

Piercing-Sucking Insects and Systemic Insecticides

continued from page 9

degradation or wash-off, no unsightly residues, reduced effects to natural enemies, greater worker safety, reduced plant pathogen transmission and no spray drift if not applied as a foliar application. Systemic insecticides can be applied in many different ways such as seed dressing, seed pilling, soil treatment, granular application, dipping of seedlings, chemigation, soil injection and drenching, furrow application, trunk injections, bulb dipping and basal bark application. Systemic insecticides are associated with five different chemical classes (organophosphate, neonicotinoids, selective feeding blockers, tetronic acid and botanical), each with a distinct mode of action. The active ingredients in systemic insecticides include acephate, azadirachtin, flonicamid, pymetrozine, spirotetramat and the neonicotinoids, which include imidacloprid, dinotefuran, thiamethoxam, chlothianidin and acetamiprid.

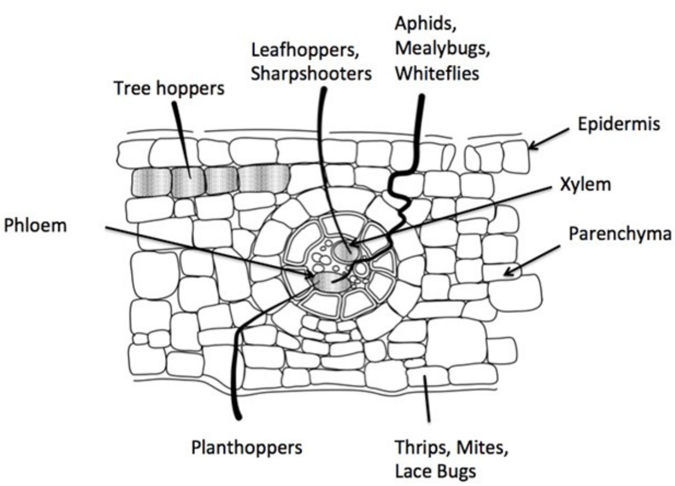

Fig. 2. Cross section of leaf tissue showing cell differentiation and possible entry routes for piercing sucking insect mouthparts. *Diagram*: Ben Paul Diana, UC Cooperative Extension, San Diego County.

Factors that can influence the activity of systemic insecticides are solubility, absorption and translocation, which in turn are affected by plant species, plant age, plant growth rate, environmental conditions, soil/growing medium and physiological variations of plants. Recent research indicates that different plant parts are associated with high or low levels of systemic insecticide concentrations, thereby causing differential mortality depending on where the pests feed. For instance, the lack of effective control against mealybugs may be associated with their feeding behavior, as they tend to congregate on plant stems, whereas systemic insecticides may be primarily located within the xylem of stems where the main transport within the plant occurs. Alternatively, the leaves may be an effective sink for systemic insecticides, and movement of systemic insecticides from the leaf xylem to the stem phloem — where mealybugs feed (fig. 2) — may be reduced or non-existent. Research is ongoing to try to understand the interaction between systemic insecticide movement in the plant and insect feeding behavior, and how these dynamics affect insecticide efficacy.

Fig. 3. Western flower thrips feeding damage on petunia. Cellular tissues have been damaged and fecal spots accompany the damage. *Photo:* J.K. Clark.

The toxicity of systemic insecticides persists for a variable period of time depending on the plant, its growth stage, the amount of pesticide applied and where the pesticide is applied. For example, in our studies we found that following a foliar application of dinotefuran to poinsettias, the concentrations of insecticide on the leaves were sufficiently high to effectively remove adult whiteflies that were present on the plants at the time of the treatments. However, as the plant grew, the level of insecticide within leaf tissues declined, and it was ineffective in controlling the emerging nymphal population, which led to a second generation of whiteflies. Conversely, when dinotefuran was drenched into the media, it effectively eliminated the parental adults and both

Piercing-Sucking Insects and Systemic Insecticides

continued from page 10

the second and third generations of adults and nymphs. Similarly, in a field trial conducted in a commercial vineyard, imidacloprid was consistently detected in the xylem for up to three months after drench application at concentrations known to be effective at managing populations of the glassy-winged sharpshooter *Homalodisca vitripennis* (Germar). Presumably this would protect the plant from direct damage caused by piercing-sucking insects that feed in the xylem and from indirect damage caused by the diseases they vector.

Conclusions

The use of systemic insecticides, which are mobile in the plant vascular tissues, is a viable management option with many advantages. Systemic insecticides are generally most effective against piercing-sucking insects that feed on the vascular tissues of plants, including aphids, whiteflies, leafhoppers and mealybugs. However, some systemic insecticides are active on mites, beetles, leafminers and thrips that feed on leaf cellular tissue. In all cases, efficacy depends on the intrinsic toxicity of the insecticide to the pest, application rates, method of application and pest feeding behavior.

James A. Bethke is Farm Advisor for Nurseries and Floriculture, UC Cooperative Extension, San Diego and Riverside Counties.

References

Byrne FJ, Castle SJ, Bi JL, Toscano NC. 2005. Application of competitive enzyme-linked immunosorbent assay for the quantification of imidacloprid titers in xylem fluid extracted from grapevines. Journal of Economic Entomology. 98(1):182–187.

Byrne FJ, Oetting RD, Bethke JA, Green C, Chamberlin J. 2010. Understanding the dynamics of neonicotinoid activity in the management of *Bemisia tabaci* whiteflies on poinsettias. Crop Protection. 29(3): 260–266.

Chapman RF. 2009. Mouthparts. In: Resh VH, Cardé RT (ed.) *Encyclopedia of Insects (Second Edition). San Diego:Academic Press. 663*–668. http://www.sciencedirect.com/topics/veterinary-science-and-veterinary-medicine/insect-mouthparts.

Cloyd RA. 2013. Control of thrips with systemic pesticides. Greenhouse Grower. http://www.greenhousegrower.com/production/insect-control/control-of-thrips-with-systemic-insecticides/.

Cloyd RA, Bethke JA, Cowles RS. 2011. Systemic insecticides and their use in ornamental plant systems. Floriculture and Ornamental Biotechnology. 5(1): 1–9.

Cloyd RA., Williams KA, Byrn FJ, Kemp KE. 2012. Interactions of light intensity, insecticide concentration, and time on the efficacy of systemic insecticides in suppressing populations of the sweetpotato whitefly (Hemiptera: Aleyrodidae) and the citrus mealybug (Hemiptera: Pseudococcidae). Journal of Economic Entomology. 105(2): 505–517.

España MU, López-Moya JJ. Interference with insect transmission to control plant-pathogenic viruses. In: *Plant Virus–Host Interaction.* 125–142.

Gray S., Cilia M, Ghanim M. 2014. Circulative, "nonpropagative" virus transmission: An orchestra of virus-, insect-, and plant-derived instruments. In: Marmorosch K, Murphy FA (ed.) *Advances in Virus Research, Volume* 89. San Diego:Academic Press. 141–199.

Hemiptera. David Darling website. http://www.daviddarling.info/encyclopedia/H/Hemiptera.html.

Simon-Delso N, Amaral-Rogers V, Belzunces LP, Bonmatin JM, Chagnon M, Downs C, Furlan L, Gibbons DW, Giorio C, Girolami V, Goulson D. 2015. Systemic insecticides (neonicotinoids and fipronil): trends, uses, mode of action and metabolites. Environmental Science and Pollution Research. 22(1):5–334.

University of Illinois Extension. 2005. Why and how insects and mites feed on your plants and flowers. Home, yard & garden pest newsletter. http://hyg.ipm.illinois.edu/pastpest/200501f.html.

Willmott AL, Cloyd RA. Mealybugs and systemic pesticides. 2013. Greenhouse Product News (GPN). https://gpnmag.com/article/mealybugs-and-systemic-insecticides/

SCIENCE TO THE GROWER: How do you put a bee in the plant-buyer's bonnet?

***by* Richard Evans**

Consumers are making a beeline to nurseries and garden centers that sell pollinator-friendly plants and products. Their interest has been piqued by news about declines in bee and butterfly populations and an increasing desire to protect pollinators. Several studies indicate that consumers are willing to spend more to protect bees and butterflies. But how should the nursery industry promote pollinator-friendly products?

Product labels can help a retail customer to differentiate among similar products, and eco-labels have proliferated in recent years because they've been shown to increase customers' trust and willingness to pay. Despite the existence of over 200 eco-labels in the United States, however, there is no eco-label for pollinator-friendly products. Instead, people in the nursery industry cook up their own promotional materials. But does a proliferation of pollinator-related labels distract or overwhelm the consumer?

A group of researchers recently tackled this issue by investigating consumer responses to labels that extol the pollinator-friendly attributes of ornamental plants (Khachatryan et al. 2017). They studied consumer preference for five attributes: plant type (hibiscus, pentas, and petunia); price (three price points, ranging from those of box stores to those in specialty stores); conventional versus organic production; origin of production (in-state, domestic, or imported); and pollinator friendliness. They also used eye-tracking equipment to find out which product information held consumers' attention.

As one would expect, consumers paid most attention to the plants themselves. Attributes like imported, organic, conventional and domestic attracted moderate attention. Pollinator-friendly labels and high price point received slightly less attention. However, when combined with results from a questionnaire about likelihood of purchasing, researchers found that the pollinator-friendly attribute increased the likelihood of plant purchase. The participants also were more likely to purchase organically-grown plants than conventionally produced plants, and locally- or domestically-grown plants rather than imported ones.

What about touting plants that are grown without use of neonicotinoid insecticides? Rihn and Khachatryan (2016) conducted an on-line consumer survey to assess whether knowledge of pollinator-related issues is correlated with awareness of neonicotinoid insecticides, and whether awareness of these insecticides makes consumers more likely to buy plants labeled "neonicotinoid-free." Only 24% of survey participants were aware of neonicotinoid insecticides. Members of that group of aware consumers know more about plants that improve pollinator health than people who are unaware of the insecticides. Awareness of neonicotinoid insecticides was associated with a greater likelihood of purchasing "neonic-free" plants, but the "neonic-free" wording was less influential than statements like "butterfly-friendly," "pollinator-friendly," or "pollinator-safe."

None of these results seems strong enough to make a convincing case for the value of a pollinator-friendly eco-label. Of course, if such a label had a huge impact on consumer behavior, we might be overrun by unscrupulous dealers trying to bilk consumers with fraudulent labels. Then regulatory agencies would have to conduct sting operations to seize the swindlers

***Richard Evans is UC Cooperative Extension Environmental Horticulturist, Department of Plant Sciences, UC Davis*.**

References

Khachatryan H, Rihn AL, Campbell B, Yue C, Hall C, Behe B. 2017.Visual attention to eco-labels predicts consumer preferences for pollinator friendly plants. Sustainability 9, 1743; doi:10.3390/su9101743.

Rihn A, Khachatryan H. 2016. Does consumer awareness of neonicotinoid insecticides influence their preferences for plants? HortScience 51:388-393.

INSECT HOT TOPICS: Sweet potato and rough sweet potato weevils

***by* James A. Bethke**

The sweet potato weevil, *Cylas formicarius* (Fabricius) (fig. 1), is considered an "A"-rated pest by the CDFA and rightfully so. In 2011, California sweet potato (*Ipomea batatas*) production for processing and fresh market consumption was estimated to be a $130-million industry, with production of about 582 million pounds on 18,200 acres (Reddy and Chi 2015). In an average year, California produces 20% of the sweet potatoes grown in the United States, and it is the second largest producing state behind North Carolina. Sweet potato production in the United States is low, largely due to the sweet potato weevil, and in some states like Louisiana, the distribution of ornamental sweet potatoes into areas where sweet potatoes are commercially grown is regulated by the Louisiana Department of Agriculture and Forestry. Plant damage can be quite significant, and includes adult feeding damage on leaf edges and grub feeding damage to the storage root.

Fig. 1. Adult sweet potato weevil adult *Cylas formicarius* (Coleoptera: Curculionidae). *Photo*: Lyle J. Buss, University of Florida.

The sweet potato weevil is found in southern states from North Carolina to Texas, and in Hawaii and Puerto Rico. Unfortunately, it has often been intercepted by CDFA inspectors, most recently on a shipment of ginger root from Hawaii. This weevil feeds on plants in the plant family Convolvulaceae, and its primary hosts are in the genus *Ipomoea* (ginger is in the plant family Zingiberaceae and is not a host plant). Suitable wild hosts include railroad vine (*Ipomoea pes-caprae*) and morning glory (*Ipomoea pandurata*). See table 1 for a list of common host plants.

A new sweet potato weevil is present in Hawaii and could threaten sweet potato production in California and nursery stock movement. It's called the rough sweet potato weevil, *Blosyrus asellus* (Olivier) (fig 2.). It was first detected in Hawaii at a commercial Okinawan sweet potato farm. Its native range includes Southeast and Eastern Asia, Philippines, Japan, Taiwan and China. It is not known to occur on the mainland United States.

Table 1. Common hosts plants for sweet potato weevil *Cylas formicarius* (Fabricius). *Source:* Plantwise Knowledge Bank.

Calystegia sepium (great bindweed)
Colocasia esculenta (taro)
Cuscuta (dodder)
Ipomoea (morning glory)
Ipomoea aquatica (swamp morning glory)
Ipomoea batatas (sweet potato)
Ipomoea cairica (five-fingered morning glory)
Ipomoea pes-caprae (beach morning glory)
Ipomoea purpurea (tall morning glory)
Ipomoea quamoclit (Cupid's-flower)
Jacquemontia tamnifolia (smallflower morning glory)
Pharbitis nil (Japanese morning glory)

A new sweet potato weevil is present in Hawaii and could threaten sweet potato production in California and nursery stock movement. It's called the rough sweet potato weevil, *Blosyrus asellus* (Olivier) (fig 2.). It was first detected in Hawaii at a commercial Okinawan sweet potato farm. Its native range includes Southeast and Eastern Asia, Philippines, Japan, Taiwan and China. It is not known to occur on the mainland United States.

At this point, there is no indication of infestations on morning glory plants in Hawaii. Obviously, the rough sweet potato weevil adults can move on infested sweet potato slips (propagative material), but it is possible that grubs could move on potted ornamental sweet potato or on other types of

INSECT HOT TOPICS: Sweet potato and rough sweet potato weevils

continued from page 13

nursery stock (e.g., ornamental plants related to sweet potatoes in the plant family Convolvulaceae or nonhost nursery plants produced near weevil-invested sweet potato fields). It has been documented that the weevils prefer the purple flesh of the “Okinawan” sweet potato (*Ipomoea batatas*). As with the sweet potato weevil, rough sweet potato weevil adults feed on leaf edges and grubs feed on the storage root.

Fig. 2. Adult rough sweet potato weevil *Blosyrus asellus* (Coleoptera: Curculionidae). *Photo*: Grant T. McQuate, USDA-ARS, Daniel K. Inouye U.S. Pacific Basin Agricultural Research Center, Hilo, HI.

In the ornamental market, there are numerous, popular *Ipomea* varieties (*Ipomoea batatas*), which include everything from groundcovers to tree form. During the 1990s, ornamental sweet potato increased in popularity due to their ease of culture and extensive exposure in gardening magazine articles, and they became widely available in nurseries. Further, new cultivars with new characteristics are making ornamental sweet potatoes more versatile than ever in the landscape. With this increasing market comes the greater chance of invasion of sweet potato weevils into California landscapes and agriculture. Therefore, if you import ornamental sweet potato varieties to finish, please take the time to check and make sure they are free from weevils, especially if they are from sweet potato weevil-infested areas.

James A. Bethke is Farm Advisor for Nurseries and Floriculture, UC Cooperative Extension, San Diego and Riverside Counties.

References

Benedict L, Smith T, Hammond AM. 2008. Managing sweetpotato weevils in South Louisiana. Louisiana State University, College of Agriculture. http://www.lsuagcenter.com/portals/communications/publications/agmag/archive/2008/winter/managing-sweetpotato-weevils-in-south-louisiana.

Brookshire B. 2014. Sweet potato weevils have favorite colors. *Science News*. https://www.sciencenews.org/blog/scicurious/sweet-potato-weevils-have-favorite-colors.

Capinera JL. 2015. Sweet potato weevil. Featured creatures, University of Florida. http://entnemdept.ufl.edu/creatures/veg/potato/sweetpotato_weevil.htm.

Gill D. 2012. Ornamental sweet potato vine is a vivid garden accent. *The Times-Picayune.* http://www.nola.com/homegarden/index.ssf/2012/05/ornamental_sweet_potato_vine_i.html.

Heu RA, Tsuda DM, Fukuda SK, Young CL, Lee MI. 2014. A rough sweetpotato weevil, Blosyrus asellus (Olivier)(Coleoptera: Curculionidae). New Pest Advisory. https://hdoa.hawaii.gov/pi/files/2013/01/NPA-Blosyrus-MASTER.pdf.

Plantwise. Sweet potato weevil (Cylas formicarius). Plantwise Knowledge Bank. https://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=17408.

Reddy, GVP, Chi H. 2015. Demographic. comparison of sweetpotato weevil reared on a major host, *Ipomoea batatas,* and an alternative host, *I. triloba.* Sci Rep. 2015; 5: 11871. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4496664/.

Sherman M, Tamashiro M. 1954. The sweetpotato weevils in Hawaii: their biology and control. https://www.ctahr.hawaii.edu/oc/freepubs/pdf/tb-23.pdf.

Look out for new diseases and pests in the Monterey Bay Area

by **Steve Tjosvold**

Stay vigilant when receiving propagation materials, plant buy-ins, or returns. There are plenty of new diseases and pests that you will not want to introduce into your nursery. Here is a smattering of them that I have seen locally in the past several months.

Downy Mildew On Iceplant

Downy mildews have been increasingly important on ornamental plants in California and in recent years has been found on iceplants. Downy mildew was detected by officials on *Aptenia cordifolia* (red apple iceplant) in San Diego County in 2016. In San Diego, it was found to be widespread in landscapes on this species in shaded areas and areas with limited periods of direct sunlight. In the Monterey Bay Area, it was found on *Delosperma* 'Orange Wonder' (fig 1–2) in a nursery following the very wet spring in 2017. It is also known to have been found on other species in the Aizoaceae including *Dorotheanthus bellidformis* (Livingstone daisy) in New Zealand and *Mesembryanthemum* in Denmark.

Fig. 1. ***Delosperma*** **'Orange Wonder' with downy mildew caused by** ***Peronospora mesembryanthemi*****. Note the production of spores on leaf surfaces. Sporulation is promoted by cool, moist conditions. Spores can be wind dispersed and cause new infections on other plants.** ***Photo*****: S. Tjosvold.**

Peronospora mesembryanthemi causes downy mildew disease in its host plants. Downy mildews are fairly specific in the host plants that they attack so, in this case, as noted, the hosts of *P. mesembryanthemi* are found within the plant family Aizoaceae. It is likely that the pathogen survives as mycelium and/or condia (spores) in infected plant buds, plant debris, leaf tissue and shoots.

Fig. 2. ***Peronospora mesembryanthemi*** **sporulating on leaf surfaces of** ***Delosperma*** **'Orange Wonder'. Spores are borne on the top of branched thread-like stalks. Photo: S. Tjosvold.**

In general, downy mildews can be severe in cool or warm (but not hot), high humid climates and when a film of water is present on plant tissue. They primarily cause foliar blights and rapidly spread in young green leaf, twig and fruit tissues. They produce spores on the ends of stalks (fig. 2), and the spores can be carried by wind and rain to new infection sites on the same plant or on different plants. The pathogen can be present in soil associated with host and non-host plants. Therefore, it can spread by any means that aids in the movement of soil and/or water from infected plants to noninfected ones. The pathogen can spread by contaminated plant cuttings and transplants, in fresh leaves and sometimes within seeds.

REGIONAL REPORT: UC Cooperative Extension Santa Cruz/Monterey Counties

continued from Page 15

Rhizopus stolonifer on Madagascar Periwinkle

Rhizopus stolonifer is usually a fungus you will find in your refrigerator on old vegetables or fruit, not on your greenhouse plants. It is found throughout the world on *harvested* fleshy organs of vegetables and fruit, and on stored bulbs, corms and rhizomes of flower crops. In a novel finding (for me), this uncommon greenhouse pathogen was found in a Monterey Bay area greenhouse causing severe dieback and even killing healthy *Catharanthus roseus* (Vinca rosea), commonly known as Madagascar periwinkle (fig. 3–4). It turns out that this was not new for others. A record was published in 1987 at the Institute of Horticultural Research in East Malling, England.

Fig. 3. *Catharanthus roseus* infected with *Rhizopus stolonifer*. Note the aggressive development (plant dieback) caused by what is normally a pathogen of harvested vegetables and fruits, and stored bulbs, corms and rhizomes. Photo: S. Tjosvold.

The researchers in England were researching mycoplasma-like organisms (now known as phytoplasmas) by side-grafting diseased scions to healthy plants and then enclosing the grafts in polyethene

Fig. 4. Close look at *Rhizopus stolonifera* mycelium and some spores on *Catharanthus roseus*. Entry of the pathogen was probably through pruning wounds and wounds made inadvertently through the frequent handling of the plants. Photo: S. Tjosvold.

bags for 4 to 5 days to maintain high humidity. The work was periodically disrupted in 1983 to 1984 by a widespread collapse and death of plants. Turns out they determined the disease could be reproduced when they inserted agar plugs of *Rhizopus stolonifer* into healthy tissue.

In the case of our local nursey, the plants were being used for breeding purposes. So there was a lot of handling and pruning of flowers and stems. Wounds existed on plants where stems had apparently broken off. It is suspected that these wounds may have been the openings needed to allow this weak pathogen to enter the plant and cause disease.

Avoiding wounding is an obvious management strategy along with reducing humidity — something that might not be practical in this situation. Here is where fungicides can help. Fungicides such as the strobulurins (pyraclostrobin, azoxystrobin) could be applied after pruning and handling procedures during periods that have high relative humidity. In this way, a protective layer of fungicide would cover the wounds during periods that are favorable for infection.

REGIONAL REPORT: UC Cooperative Extension Santa Cruz/Monterey Counties

continued from Page 16

Cymbidium Orchid Anthracnose Caused by Colletotrichum cymbiidicola

Previously found in San Diego and Santa Clara counties in 2014, *Colletotrichum cymbiidicola* was detected recently by officials in a Monterey Bay area nursery. It also has been reported in Australia, India, Japan and New Zealand. Anthracnose symptoms are expressed as dark spots or lesions in infected orchid leaves, petioles and blossoms. Initial symptoms include brown irregularly shaped sunken lesions that eventually turn dark brown with concentric brownish-black fruiting bodies Leaf wilting may occur, often resulting in dieback and reduction in plant quality. Symptoms may be most common on orchid leaves when stressed plants have been damaged by cold and hot temperatures, sun, or wind, or have chemical or mechanical damage.

It is likely that *Colletotrichum cymbidiicola* has a similar life cycle to that of other *Colletotrichum* species and survives between crops during winter as mycelium on plant residue in soil, on infected plants and on seeds. During active growth, the pathogen produces masses of hyphae (stromata) which result in fruiting bodies (acervuli) that bear conidiophores on the plant surface. Conidia (spores) are produced at the tips of the conidiophores and disseminated by wind, rain, cultivation tools, equipment and field workers.

Of course, avoid introduction into nurseries, protect from rain, avoid splashing water from irrigations and use preventative fungicides. The following fungicides could be useful: azoxystrobin (Heritage), mancozeb (such as Dithane), copper (such as Kocide, Phyton 27), and chorothalonil (such as Daconil).

Gypsy Moths

Gypsy moths were found in Santa Cruz County this year. The first detection in early August was an Asian gypsy moth (AGM) in Santa Cruz, California and the second detection later in August was a European gypsy moth (EGM) near Nicene Marks State Park in Aptos, California. These are closely related moths whose caterpillars feed voraciously on numerous ornamentals and native plants. When they were first detected by regulatory authorities in selective insect traps, trapping was greatly intensified in a detection area around the original find. If another moth was found in these expanded detection areas, then a quarantine could be triggered that would limit the movement of nursery stock, host plants and other host materials outside the quarantine area. So far there has not been another moth found in the two established detection areas.

The Asian gypsy moth and European gypsy moth are genetically very similar, and eggs, caterpillars (larvae) and moths (adults) look very much alike too. However, the AGM has a broader host range and the female moth can fly long distances, which gives it a greater potential to spread and establish in an area where it is introduced.

Both the AGM and the EGM prefer forest habitats and can cause serious defoliation and deterioration of trees and shrubs. The EGM has more than 300 known host plants but prefers oak. The AGM has a much broader host range (over 100 botanical families), including larch, oak, poplar, alder, willow and some evergreens. In the eastern United States where the EGM has established, it can defoliate an average of 700,000 acres each year, causing millions of dollars in damage. So far AGM is not established in the United States, but if it did establish itself, the damage could be even more extensive and costly.

If you notice extensive defoliation of trees, caterpillars with blue and red dots crawling on the branches or leaves (fig. 5), or velvety egg masses, then contact the Agricultural Commissioner's Office.

Fig. 5. Gypsy moth caterpillars. Mature caterpillars can be 1.5 to 2.5 inches long. They have grayish bodies with five pairs of blue spots and six pairs of red spots along their backs. Photo: Roger Zerillo.

Steven A. Tjosvold
Farm Advisor, Environmental Horticulture
UC Cooperative Extension Santa Cruz County
1432 Freedom Boulevard
Watsonville, CA 95076-2796

CDFA NURSERY ADVISORY REPORT

***by* Loren Oki *and* Jim Bethke**

The CDFA Nursery Advisory Board met on September 18, 2017 in Sacramento. Here are highlights of the meeting:

Cannabis Update

Amber Morris, the Chief of California Cannabis (CalCannabis) licensing, provided an update of the licensing process that will be implemented on January 1, 2018. Licensing involves several California departments in addition to CDFA, including the Public Health and Consumer Affairs, Division of Cannabis Control. CDFA will be issuing licenses to produce the crop at six different levels based on size and whether the plants are grown indoors, outdoors, or in both conditions. Regulatory and other support efforts occur at several levels and involves the State Water Resources Control Board; the departments of Pesticide Regulation, Fish and Wildlife, Technology, and Justice; Treasurer's Office; the division of Occupational Safety and Health; the Board of Equalization; the Medical Board of California; local city and county governments; and the Governor's office; as well as California Health and Safety codes. Amber reviewed current California legislation and their impacts on the permitting process. CalCannabis will also be implementing systems for online licensing and another for "track and trace." Amber mentioned that even if growers are properly complying with California regulations, they could still be prosecuted for violations of federal regulations.

Josh Kress is the lead for California hemp production oversight and reviewed the differences between cannabis and hemp. The main difference is that hemp cannot test at greater than 0.3% THC. It is still federally illegal, however.

PlantRight

Jan Merryweather of Sustainable Conservation's (SusCon) PlantRight Program presented information about the program that promotes information on invasive plants. The program utilizes the Plant Risk Evaluator to assess plants for invasive potential and offers alternatives for those plants that are determined to be potentially invasive. SusCon asked if CDFA could take over the program, as it is SusCon's model to initiate programs such as this, and then release it to others to carry on project management. The Nursery Advisory Board discussed that CDFA should not take on the program and suggested that a UC program would be better. The issue with the program is the amount of funding needed to maintain it, and there is no source of support.

CDFA NURSERY ADVISORY REPORT

continued from Page 18

GWSS Update

Just under 24,000 shipments (up 630 shipments from 2016) moved into GWSS-free zones. Five of these were rejected due to live life stages, compared to eight in 2016. There were single GWSS finds in many counties, but no detectable populations. Similar to last year, the program demonstrated that even though shipments were up, rejections were down. There were GWSS finds in traps at four nurseries, one each in Contra Costa, Alameda, Santa Clara and Tulare Counties.

As part of the program, 45 egg masses were treated on nursery stock at shipping sites in Southern California. The masses were sleeve-caged and shipped up north where ag commissioners in selected counties held the masses for emergence of GWSS immatures. No viable egg masses or immatures, however, were observed by any ag commissioner's office for any experimental shipment.

Moringa (*Moringa oleifera*) is confirmed as a new GWSS host plant, and unfortunately, all plant parts are edible. There is no allowable pesticide on this kind of nursery stock. It was recommended that IR4 assist in the search for pest control solutions on this specialty crop, with emphasis on products for GWSS control.

Invasive Update

Multiple fruit fly quarantines were in place in several counties with emphasis on Los Angeles County. This pest affects nurseries with fruit-bearing trees and other plants with fruits such as ornamental peppers.

ACP/HLB.

There were 37 HLB-positive psyllids and 79 new HLB-positive trees (170 total). Current HLB quarantines were expanded and there was a new quarantine in Riverside.

SANC Update

Eight nurseries have completed a required review of their properties. One of those nurseries is under new management and probably will not be able to comply at this time. There was one new nursery prospect in California. These nurseries should start shipping next spring under the new program.

Nursery Services

Nursery licensing revisions are underway. The California Agricultural Commissioners and Sealers Association (CACASA) is involved with the licensing review.

Legislative Update

Effective Jan 2018, The Nursery Advisory Board (NAB) is an official Board, signed by Governor Brown in September 2017.

CACASA Update

CACASA and the Farm Bureau are working through a roundtable discussion about funding for Detection and Exclusion from state funds.

Loren Oki is UC Cooperative Extension Landscape Horticulture Specialist, Department of Plant Sciences, UC Davis; Jim Bethke is Farm Advisor for Nurseries and Floriculture, UC Cooperative Extension, San Diego and Riverside Counties.

UCNFA PARTNERS

UCNFA News is published by the University of California Nursery and Floriculture Alliance, a statewide partnership of researchers and educators, growers, floriculture associations and allied industry.

Banner photos on cover and last page by Kathy Keatley Garvey

Follow UCNFA on Facebook!

https://www.facebook.com/UCNFA

Get updates on events presented by the University of California Nursery and Floriculture Alliance (UCNFA).

Get timely information on news and other events of interest to the California ornamental horticulture industry.

Find links to Facebook pages for nursery and floriculture businesses, organizations and people in the industry.