Integrated Cranberry Crop Management for Wisconsin

Cranberry
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Weed profile: Swamp dodder (*Cuscuta gronovii*)

By Jed Colquhoun, UW-Extension Fruit Crops Weed Scientist

Note: This is part of a series featuring frequently questioned or increasingly troublesome weeds in Wisconsin cranberries. For weed identification, the "Weeds of the Cranberry Marsh" book is now available electronically on the WSCGA web site. For specific weed control options, please refer to the annually-updated "Cranberry Pest Management in Wisconsin" guide: http://learningstore.uwex.edu/Assets/pdfs/A3276.pdf.

Overview: Swamp dodder is an annual parasitic weed with an appearance not to be confused with other weeds on the marsh: it appears as if someone has dumped a bowl of spaghetti on the vines! This parasitic plant attaches to the cranberry vines, as well as some host weeds such as yellow loosestrife, and draws the vast majority of its energy from the host plant. As such, it can have a tremendous impact in reducing cranberry production. While dodder species are much more common in Massachusetts cranberry production, we have recently heard of new or spreading infestations here in Wisconsin.

Other common names: sometimes called common dodder

Biology: As an annual, swamp dodder originates from seed that germinates in about June in cranberries. Within 2 to 4 days of germination, the dodder seedling attaches to the host plant via the haustoria described below and then releases from the ground. Even if the twining stem is cut from the haustoria, the attached dodder will regenerate new stem material. Nearly all of the accumulated nutrients in the swamp dodder come from the host plant. Plants flower in July or August and produce hard seed that can remain viable for several decades.

Identification: Yellow to orange string-like stems attach to the host plant via a pad-like structure called a haustoria, which absorbs nutrients from the host plant. Stems become intertwined and form a thick mat above the cranberry vines. Swamp dodder has no leaves and minimal chlorophyll, thus the yellow to orange appearance. Flowers are tiny, white to yellow, with five petals. Abundant seeds are produced in July through September and become extremely hard.

General management considerations: Swamp dodder is so devastating in cranberries that the best control option is avoidance. Be sure that any incoming cranberry vines, equipment or other inputs come from dodder-free beds.

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Scout areas around the marsh, such as sand piles and on weeds near the reservoir, for swamp dodder infestations. The herbicide QuinStar 4L is one of the only herbicides in any crop system that controls swamp dodder. Timing is absolutely critical: control can be complete when the swamp dodder is just germinating and emerging at the time of herbicide application, but drops off rapidly once the swamp dodder begins to spread across the top of the cranberry canopy. QuinStar 4L has MRL export limitations in cranberry, thus **be sure to check with your handler prior to any use**, and as always, read and follow the label.

Trivia: *Swamp dodder is one of over 150 Cuscuta species. Dodder seed capsules have pontoon-like air pockets, and thus, the seed readily floats. With this in mind, the seed is often spread across the cranberry marsh with the flood water, and dodder plants are often found attached to host plants along the reservoir edges.*

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Christelle Guédot, UW-Extension Fruit Crops Entomologist/Pollination Ecologist

Finally, a good relationship with your beekeeper is crucial to ensure that your pollination needs are met for this growing season and growing seasons to come. In order to have a good beekeeper-grower cooperation, it is recommended to communicate and define expectations, possibly in the form of a contract, to make sure that all three parties (beekeepers, growers, and bees) are as happy as can be. Some things to consider are:

- Coordinate crop timing and bee arrival and departure
- Agreement on beekeeper's responsibility to provide strong hives
- Agreement on grower's responsibility to safeguard bees from poisoning
- Discuss pest management practices made before colonies arrive
- Inform beekeeper where, when, and what is applied
- Setup buffers between crops and hives
- Talk with neighboring growers about pesticide applications

Happy growing season!

[1] Pettis et al (2013) Crop pollination exposes honey bees to pesticides which alters their susceptibility to the gut pathogen *Nosema ceranae*. Plos One 8: 7, e70182.

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Pesticide Use and Pollinator Protection

By Christelle Guédot

Fruit Crops Entomologist/Pollination Ecologist

Thank you all for attending the Early Season Workshops on May 13, 2014.

Before diving into pesticides, I will first talk about colony collapse disorder (CCD) which affects honeybee colonies worldwide. Understanding the factors involved in CCD can help us understand where pesticides fit into the picture and in turn better protect both managed and wild pollinators.

CCD was first described in 2006 when beekeepers in the U.S. reported up to 90% of honeybee hive losses. The main symptom of CCD is the disappearance of worker bees with no dead bodies to be found, in an otherwise healthy looking hive with a live queen, larvae, and adequate food stores (Figure 1).

Currently, there are approximately 2.62 million colonies of honeybees in the U.S. with an annual value of their pollination contribution to U.S. agriculture estimated at $18 billion. Since CCD was described, annual losses of honeybee colonies have averaged about 30%, with about a third being attributed to CCD. The main factors that have been associated with CCD and pollinator decline involve:

- Arthropod pests and pathogens
- Poor nutrition
- Bee management practices
- Habitat fragmentation
- Agricultural practices and pesticide use
- Lack of genetic diversity

It is now recognized that it is not a single factor that is responsible for CCD or pollinator decline but rather a combination of the above mentioned factors. Research is ongoing to understand how these factors interact to cause CCD.

Since 1984, multiple introductions of invasive species of pests and pathogens affecting honey bee colonies have been recorded, from tracheal mites to the Israeli Acute Paralysis Virus and the gut pathogen *Nosema ceranae*. Among them, the most detrimental pest of honeybees is the parasitic mite *Varroa destructor* (Figure 2). These mites were introduced from Eastern Asia and were detected in U.S. hives in 1987. They are blood-sucking parasites that can also transmit viruses to bees and cause significant colony losses each year. To control *Varroa* mites, beekeepers resort to different products, including pyrethroids and organophosphates, that can affect bee health.

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Nutrition has also been shown to have a major impact on the longevity of individual bees as well as the entire colony. Availability, quality and diversity of forage can affect bee health and bee tolerance to pathogens, such as the gut pathogens mentioned above.

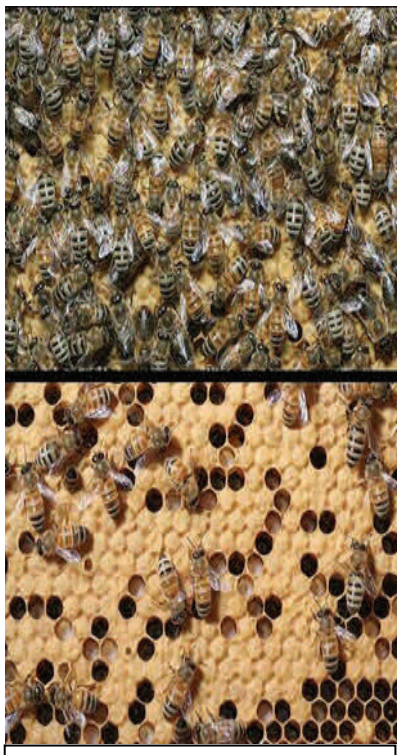

Figure 1. Frame from healthy honeybee hive (top) and from a CCD-hive (bottom). Photo credit: David McIntyre, Custom Life Science Images

Agricultural practices and pesticide exposure to bees

In agricultural landscapes, bees can be exposed to a variety of pesticides, including insecticides, fungicides, and herbicides. There are different ways that bees can be exposed to pesticides: direct exposure can occur when pesticides are applied while bees are actively foraging, but bees can also be exposed when foraging on flowers that have previously been sprayed, when collecting pesticide-contaminated nectar and pollen from plants treated with systemic pesticides, or when collecting pesticide-contaminated water from ponds or chemigation.

Figure 2. Honeybee worker with parasitic mite on its thorax (white arrow)

In a recent study[1], researchers investigated the

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presence of pesticides in pollen brought back to the hives by honeybee foragers in different agricultural landscapes. They found that all pollen collected from bees returning to the hive contained pesticides. Specifically, when they looked at bees foraging on cranberry marshes, they detected seven fungicides, including the active ingredients found in Abound (azoxystrobin), Bravo (chlorothalonil), and Indar (fenbuconazole); 15 insecticides, including the active ingredients found in Lorsban (chlorpyrifos), Diazinon (diazinon), and Imidan (phosmet) to name just a few; and two herbicides. Notably, in this study, none of the pollen brought back to the hive by honeybees foraging on cranberry marshes was actually cranberry pollen…

Fungicides were the most frequently pesticides found, with overall amounts of fungicides about 20 times higher than overall amounts of insecticides. The most common fungicide was chlorothalonil, which is found in Bravo, Echo, Equus, and Daconil, and the most common insecticide was phosmet, which is found in Imidan. We all know that insecticides can be toxic to bees (after all, bees are insects!) and as new products are being developed, registrants and researchers look at the effects (lethal and sublethal) of insecticides on bees. The newer class of insecticides that have been under scrutiny are the neonicotinoids, such as Assail, Belay, Admire Pro, and Actara. Neonicotinoids have been found to be toxic to bees, affecting bee performance (foraging, learning, ability to return to the nest, reproduction, etc...) and thus affecting colony health. So far, fungicides have been considered safe and are often sprayed during bloom. However, there is growing evidence that fungicides also have sub-lethal effects on bee health, i.e., they do not directly kill bees but might affect their susceptibility to pathogen infections and in turn their health.

Pollinator protection

There are several steps that cranberry growers can take to minimize pollinator exposure to pesticides. In a growing effort to protect bees, both managed and wild bees, here are some Dos and Don'ts that cranberry growers should keep in mind and implement whenever possible:

- Most importantly: Avoid spraying pesticides during bloom
- If you need to spray during bloom, select pesticides with lowest toxicity to bees (Table 1)
- Spraying after sunset can greatly reduce risk of exposure
- Provide sufficient time between pre-bloom sprays and placement of hives to avoid exposing bees to lethal pesticide residues
- Eliminate flowering weeds with herbicides or mow before spraying to reduce exposure while foraging on flowering weeds on the farm
- After cranberry bloom, if possible, draw wild bees away from crop plantings by providing non-crop flowering plants elsewhere on the farm
- Do not apply pesticides when unusually low temperatures or dew is expected following treatment (pesticide residues last longer in these conditions)
- If possible, avoid tank mixes of insecticides and fungicides (research suggests that synergistic detrimental effects arise when both types of pesticides are present)

Toxicity to bees	Insecticide	Comments
Highly toxic	acephate, acetamprid carbaryl, chlorpyrifos, clothianidin, diazinon, dinotefuran imidacloprid, indoxacarb, phosmet, spinetoram, sulfoxaflor thiamethoxam	Use of these pesticides at any time of day or night during blossom may result in severe bee losses. For maximum bee protection, do not use them within 7 days of blossom.
Moderately toxic	novaluron, spinosad	
Relatively nontoxic	*Bacillus thuringiensis*, chloranteraniliprole, methoxyfenozide, pyriproxyfen, tebufenozide	These products will cause a minimum amount of injury to bees.

Table 1. Relative toxicity of certain insecticides to honeybees

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By Christelle Guédot
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- Avoid pesticide drift onto hives, water sources and flowering weeds
- Do not apply bee-toxic insecticides until crop flowering is complete and all petals have fallen

In the UW-Extension Cranberry Pest Management in Wisconsin publication, you will find a table on page 15 describing the relative toxicity of certain insecticides to honey bees. As we become more aware of the effect of pesticides on bee health, we hope to be able to provide a similar rating of toxicity of fungicides to bees to help further protect our pollinators.

In response to the new research showing sub-lethal effects of neonicotinoids on bees, the EPA has issued a new bee advisory label (Figure 3) that will be applied to products containing the neonicotinoids ingredients imidacloprid (e.g. Admire Pro, Alias, Widow), dinotefuran (e.g. Venom), clothianidin (e.g. Belay) and thiamethoxam (e.g. Actara) in an effort to warn pesticide applicators of the risk that neonicotinoids pose to bees.

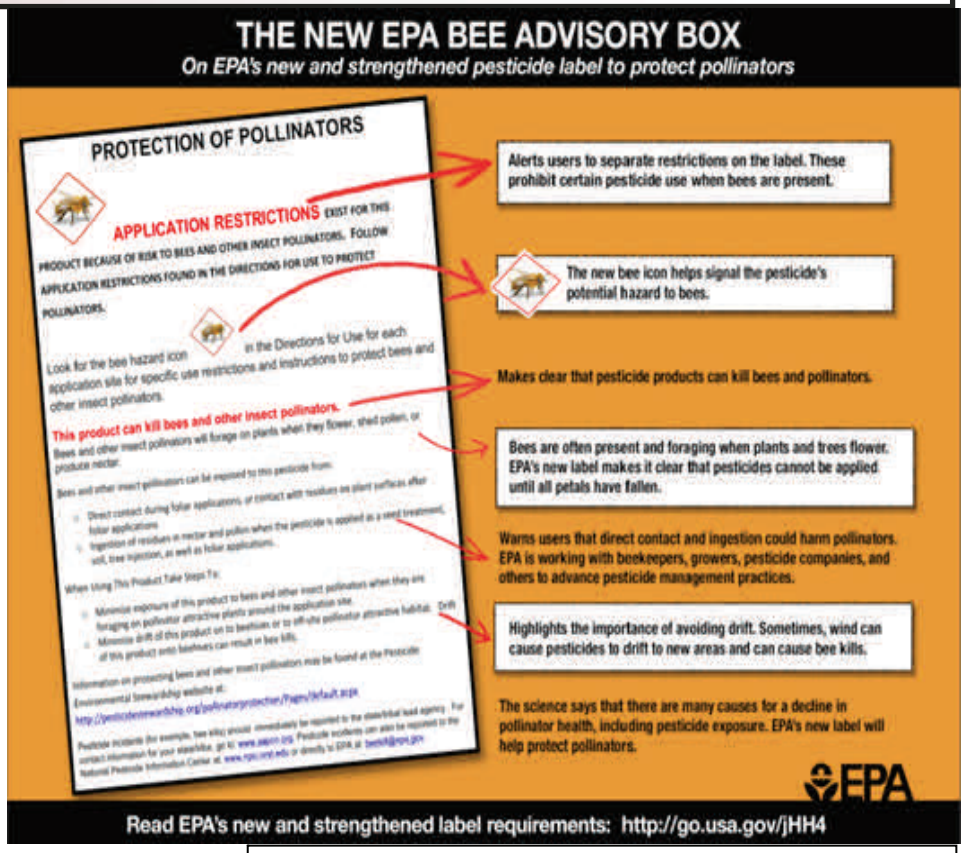

Figure 3. New EPA Bee advisory box

The Wisconsin Legislature is also leading efforts to assess the status of pollinators and develop a proposal for creating and enhancing pollinator habitat in our great state of Wisconsin. The Legislature Assembly introduced Bill 915, which was not taken up in 2014, but will hopefully be presented again in Jan 2015. See below for an excerpt of the bill (Figure 4).

> This bill requires the Department of Agriculture, Trade and Consumer Protection (DATCP), in consultation with the Department of Natural Resources (DNR), to prepare a report on pollinators, including an overview of the status of important pollinator species in this state and threats to their viability and a legislative proposal for creating and enhancing pollinator habitat. The bill requires DATCP, in consultation with DNR, to develop, and describe in the report, best management practices for the management, creation, and restoration of pollinator habitat and for agricultural practices that enhance the health of pollinator populations. DATCP must submit the report to the legislature no later than July 1, 2016.
>
> The bill also requires DNR to consider pollinator habitat creation and conservation in managing land under its management or control.

Figure 4: Excerpt of Wisconsin Legislature Assembly Bill 915

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Address Correction

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