Protecting Pollinators AND OTHER BENEFICIAL CRITTERS WHEN MANAGING PLANT DISEASES

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ABOUT THE AUTHOR

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Introduction:

Honey bee populations have been sharply declining in recent decades. This decline is usually referred to as "Colony Collapse Disorder" (CCD). Scientific studies have delved into its cause(s). Many of our human food sources (fruit, vegetables, etc.…) depend upon pollination by honey bees, other insects and animals (Photos 1 & 3). Scientists have found a variety of factors they believe are contributing to the decline of honey bee populations; these factors include pesticides, predators, parasites and pathogens.

It is not surprising that honey bees would be affected by pesticides, especially insecticides, because they are insects. As scientific research progressed, however, an unexpected discovery occurred: plant disease management by fungicides has been shown to negatively impact bees. In fact, some scientists believe fungicides may have a greater impact on bees than insecticides….at least in some situations.

Fermentation, Beer, and Bees:

There's an expression that God wanted us to be happy, the reason He/She created beer. During Prohibition, some individuals and groups (women suffrage, various religions, etc.) had sufficient influence on the U.S. government to outlaw the consumption of alcoholic products, which they believed caused sinful, uncontrollable behavior, and lawlessness. During Prohibition, lawlessness and crime actually increased as mobs controlled the flow of the elixirs enjoyed by so many. Subsequently, many of the same groups that had called for a ban on alcohol reversed course and supported Repeal of Prohibition!

Fermentation is an all-natural process that has been used successfully by humans and other earthly creatures for millennia. While we may attribute fermentation to the making of beer and wine, fermentation is also vital, for example, for baking (the alcohol is driven off by heat during the baking process). So, what does any of this have to do with bees? It turns out that bees rely upon fermentation to make bee bread and other nutritious products (Photos 2 & 4). Bee bread is composed of fermented nectar and pollen and is highly nutritious for bee larvae. Naturally occurring populations of yeasts (fungi) are required for fermentation and the making of bee bread just as naturally occurring yeasts were so important in "contaminating" grape juice 2,000 years ago for the making of wine. So, when we apply fungicides to our landscapes and nurseries, especially when those fungicides end up in nectar and pollen, we are adversely impacting the fermentation process that is so necessary for bee bread production. Without bee bread, bees tend to starve, decline and die out. "And now, you know the rest of the story."

> "If bees disappeared from the face of the earth, mankind would only have four years to live."
> — *Albert Einstein*

Protocols for Protecting Pollinators and Beneficial Arthropods:

Some companies and individuals in the Plant Health Care Industry rely upon routine broadcast cover sprays for managing diseases and pests in our landscapes, a "one size fits all" practice, which is often easier and more profitable when aimed at some clients who want no living creepy, crawly thing in their landscape or spot on the foliage of their trees. These broadcast cover sprays usually fail in

1 There are approximately 4,000 species of bees in the U.S. As with the "introduced" honey bee, many bee species are important for pollinating the foods that we as humans often take for granted. Photo credit: Lauren T. Stevenson.

2 Bees make a plethora of honey products with quite a range in color, texture and taste. Note the bottle of honey advertising "Autumn Olive" towards the back right of this photo. Perhaps there are some redeeming qualities from this objectionable, invasive plant!

3 Other critters such as butterflies, moths, other arthropods, birds and other animals are important for pollinating plants. Unfortunately, many are negatively impacted by pesticide applications.

4 Bee Bread is not only nutritious for honey bees, but for humans as well. Because the pollen is fermented, the proteins are more easily digestible by humans…. and bees. Enzymes, vitamins and other nutrients are also readily available in Bee Bread.

their objective for a pristine pest/disease-free landscape and sometimes result in more severe or other unforeseen issues (Photo 5). A more precise, tailored and targeted pest and disease management protocol often provides better results without as many impacts on our environment. Essentially, Integrated Pest Management (IPM: also known as Integrated Disease Management or Integrated Plant Problems Management (IDM and IPPM, respectively)) for the management of disease and pest problems while hopefully reducing the use of pesticides, fertilizers, etc., has been proposed and utilized for several decades. Its implementation has been met with varying degrees of skepticism and, hence, success. While best IPM practices can undoubtedly work, public acceptance and willingness to pay more for the implementation of IPM practices are continual challenges for plant healthcare providers in our industry. In regards to bees and other beneficial arthropods/critters in our environment, some states (and countries) have already adopted regulations that prohibit the use of certain chemicals and/or their use at certain times of the year (especially during flowering). I suspect we can expect these guidelines and regulations to expand both in geographical and pragmatic terms as time progresses.

As the public becomes more aware of issues with pollinators and other beneficial organisms, it is highly likely that our clients will begin demanding measures from and patronize those plant health care providers that are implementing environmentally-friendly protocols. As an industry, I believe it is better for us to lead by adopting common sense IPM practices that protect pollinators and other beneficial organisms rather than have our public clientele and/or our government force us begrudgingly into adopting appropriate policies.

Following are some protocols, precautions and guidelines that can help us "bee" sensitive to the plight of bees, other pollinators and beneficial critters in our environment.

1) **Don't Spray Flowers:** Pollinators visit trees and other plants to collect nectar and pollen when plants are flowering. Spraying flowers will also likely cause bees to come in direct contact with the pesticide, whether insecticide and/or fungicide. If bees (and other pollinators) are not killed outright, they will likely transport some of the pesticide back to the hive, which in turn will probably cause harm to the fermentation process and decline/starvation of bees (Photo 6, Schematic 1 & 2).

5 Widespread cover sprays of insecticides often eliminate beneficial insects that serve as predators of insect pests; population explosions of plant pests often occur with indiscriminant pesticide application, as in this case cottony maple scale infestation of these maples trees. The secretions by the scale and the wounded trees distribute objectionable coatings of sap and honeydew/sooty mold to nearby objects, such as decks, automobiles, etc.

6 Unfortunately for many plant diseases, the correct timing of fungicide applications is in the early spring during the flowering period of many trees, shrubs and perennials. Spraying flowers with fungicides (or insecticides) may kill the bees outright or may cause a decline in bees if the pesticide is carried back to the hive.

2) **Avoid Certain Fungicides (?):** It is likely that most fungicides have the potential to impact the fermentation process in the production of Bee Bread. However, **Captan, Ziram, Iprodione, Chlorothalonil,** and **Mancozeb** have been shown to be particularly toxic to bees and the fermentation process. While it is not necessarily advisable to absolutely avoid these fungicides, it should be our obligation to avoid the exposure of bees to them (see below).

3) **Systemic vs. Contact Fungicides:** It is important to understand which fungicides are systemic and which are contacts. Applying contact fungicides such as **Captan, Ziram, Chlorothalonil,** and **Mancozeb** (above) before or after flowering should minimize the risk of exposure to bees and their food sources (nectar & pollen). Applying systemic fungicides, such as **Thiophanate Methyl/ Ethyl, Propiconazole, Mycoblutanil**, and **Iprodione** (limited systemic activity), before flowering will likely result in translocation of the fungicide into the nectar and pollen; this should be avoided. Likewise, trunk injections of systemic fungicides before flowering will probably result in fungicide contamination of nectar and pollen. Trunk injections and sprays of systemic fungicides *after* flowering will likely not result in as much contamination, even into the following spring flowering period.

4) **Avoid the DMIs (?):** Dimethylation Inhibitors, also known as Sterol Inhibitors, such as **propiconazole, myclobutanil** and **triflumazole**, are systemic fungicides that are very toxic to bees. Again, limiting exposure to bees and their food sources will be very beneficial. Applying these fungicides after flowering will not likely result in exposure or sufficient carryover to the following year to impact bees when they visit the flowers during the following year.

5) **Avoid Propiconazole mixed with Pyrethroid Insecticides:** Research has shown that mixtures of **propiconazole** and **pyrethroids** result in a product that is 5X more toxic to bees than either ingredient alone.

6) **Avoid Drift:** When spraying trees and shrubs (or lawns), be very cognizant of nearby flowering plants that may be attracting bee and other beneficial arthropod activity (Schematic 3).

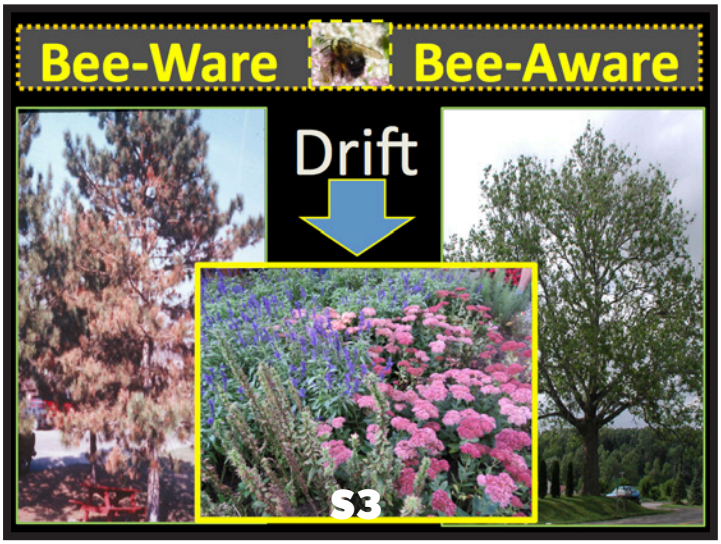
7) **Monocyclic vs. Multi-cyclic Diseases:** Diseases such as Trellis Rust on ornamental pear and Tar Spot on maple are termed monocyclic diseases because the fungi that cause them attack newly emerging foliage in the spring during a relatively narrow time period; unfortunately, that infection period often coincides with the flowering of many plants. By comparison, scab on apple and crabapple is a multi-cyclic disease that infects in early spring, followed by continuing cycles of re-infection throughout the spring and summer. For multi-cyclic diseases, we can adapt our protective fungicide applications to avoid exposure to flowers and, hence, to bees and other pollinators.

8) **Timing of Fungicides:** As alluded to in the previous precautions, the proper timing of fungicides can positively impact our treatment of bees and other pollinators. Applying a contact fungicide before or after flowering will minimize the exposure of bees to these fungicides. Applying systemic fungicides before flowering will likely result in systemic translocation of the fungicide to the nectar and pollen, which in turn will likely result in transfer of the fungicide to the bee hive where there will probably be potential for accompanying detrimental outcomes.

9) **Conifers, Don't Worry:** From what we know at this time, pesticide treatments on conifers do not greatly impact bee populations because bees generally do not visit conifers for pollen despite the abundant pollen production by conifers. However, be aware of drift when treating conifers. Lessened concern for conifers may change as our knowledge about various pollinators increases. However, we should still adopt best IPM practices and not spray conifers willy-nilly due to concerns for our environment.

10) **Humans & "The Stingers":** Because bees can sting people, our society generally possesses the attitude that "the only good bee is a dead bee". That's why we are eager to employ the "Nuclear Option" when we reach for that can of "Sure Shot Hornet Destructor" with a 25-foot range (Photo 6). Personally, I have generally found that as long as we do not disturb them, the stingers will usually leave us alone.

So, why should we care about the well-being of bees, wasps and other objectionable critters? Every living entity (yes, even mosquitos: I HATE MOSQUITOS) has its purpose and place in this complex environment. As we know, pollinators are vital for the growing of many foods upon which we humans depend. Hence, we need to protect them as vital contributors to this piece of rock we call Planet Earth. While this discussion may sound like some hysterical speech from one of those flaming left-wing liberal environmentalists, I don't think we should scoff at the importance of nature in helping to deliver a safe, plentiful



S1 For many diseases such as Trellis Rust, the primary time for treating pears would be in the spring when the galls (left inset) on the juniper alternate host (left) have opened and are releasing spores that are windblown to pears (right). Unfortunately, that period is exactly the same time the pear flowers are being visited by bees. Treatments with fungicides (or insecticides) during this period will likely harm bees.

S2 An alternative schedule for Trellis Rust might be to treat junipers in the fall when spores are being released from the undersides of the pear leaf (right), as the fungus travels back to the juniper (left).

S3 When applying any treatments that contain pesticides, be cognizant of the potential for drift of the pesticide onto nearby plants that may be flowering and attracting bees and various pollinators.

food supply for "we humans". The research on pollinators is advancing at a prodigious pace. The foregoing advice on protecting pollinators is relevant at this time, but may be altered in the future as we learn more. Please stay tuned…

NOTE: For more information on Pollinator and Pesticide interactions, please refer to: *"Protecting and Enhancing Pollinators in Managed Urban Landscapes"*. MSU Extension Bulletin E3314

Photos by David Roberts, except where noted.

7 With climate change, life on this planet can become confused. These bees emerged during a warming trend in February and began scrounging for food (especially protein); they were apparently pleased when they happened upon this discarded batch of out-of-date cornmeal. A curious friend who would never reach for that can of Sure Shot Hornet Spray snapped this photo.
Photo credit: Debbie Jaworski

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