Entomology 101

Safe and effective management of shade tree pests

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INSECTS ARE ONE OF THE MOST SUCCESSFUL GROUPS OF ORGANISMS ON THE PLANET. For hundreds of millions of years, insects and plants have co-evolved, sometimes antagonistically, sometimes to the benefit of both parties. Insects are also of considerable concern to arborists, but we are long past the days in which we just spray indiscriminately and hope we kill the bad ones. Insect management today requires knowledge of biology, ecology, tree physiology, phenology, and chemistry so we can protect trees with minimal impact on beneficial insects and the rest of the ecosystem. So what are the basics we need to know to safely but effectively manage shade tree insect pests?

First, we need to wrap our heads around the sheer number of insects and their diversity. The current count is more than one million named species, representing about half of all animal species alive on the planet today. The estimates of not-yet-named species is anywhere between six and 10 million species; so if you have an interest in discovering and naming new species, entomology may be the field for you. Insects are grouped with other invertebrates such as spiders, millipedes and lobsters, but have some distinguishing characteristics. Like these other arthropods (from the Greek word for "jointed leg"), insects have, of course, jointed appendages, exoskeletons made from chitin, and segmented body parts. Every organism classified into the Class Insecta will have six legs, two antennae, a three-part body consisting of a head, abdomen, and thorax, and two pairs of wings.

All insects go through some form of metamorphosis, but not all of them do it the same way. Some insects go through a complete metamorphosis (known as "holometabolis"), where the immature insect looks nothing like the adult. Look no further than the differences between a caterpillar and a butterfly to understand this process. Other examples would be grubs, maggots, and whatever you call those cool looking ladybug larvae — all of them start life with one body type, then go through a pupa stage where they emerge looking like something else altogether. The adults and their offspring not only look different, they often have completely different diets, and, often, completely different relationships to plants. As larvae, an insect may be a plant parasite eating the leaves and disfiguring the appearance, but, as an adult, they may be an important pollinator of their flowers.

Depending upon the source, North America has roughly 30 Orders of insects, 600 Families, 12,500 Genera, and, oh, let's say about 86,000 Species.

The other type of metamorphosis insects may undergo doesn't change their appearance much, just their size. Known as incomplete metamorphosis, or "hemimetabolis" if you prefer the Latin sound, these insects look pretty similar at all stages of life. Unlike the insects that undergo complete metamorphosis, you can often find hemimetabolic adults and immatures (called "nymphs") feeding right next to each other on the same leaf. As they grow, their rigid exoskeletons must be shed to make room for the next, larger exterior. Each time they go though one of these molting cycles, we call that an "instar." Some species may go through four to five instars before reaching maturity. This has some management implications, as certain treatments that may be effective on early instars are not as effective on more mature insects.

Depending upon the source, North America has roughly 30 Orders of insects, 600 Families, 12,500 Genera, and, oh, let's say about 86,000 Species. As noted earlier, insects are mind-boggling in their numbers and diversity, but, fortunately for arborists, not all of them are required reading. Due to their tremendous variety, it is easiest to lump them together and consider insects at the Order level. Of the dozens of recognized Orders, it really boils down to five that are of considerable concern for tree care. Just understanding the differences of these groups, and their management strategies, will go a long way toward successfully managing insects on shade trees.

Order: Coleoptera
Translation: "Sheath wing" Holometabolis
Key tree pests: Bark beetles, leaf beetles, flathead borers, roundhead borers, weevils

When it comes to variety and diversity, no one is bigger than the beetles. With more than 400,000 recognized species, beetles make up nearly half of all known insects. Although there are certainly beetles than beneficial to trees (like the much-loved ladybug), the ones that are tree pests can be serious or even fatal health concerns. Beetles can be secondary pests, such as bark beetles affecting stress-weakened trees, or they can be primary pests, as in the case of emerald ash borer or Asian longhorned beetle. Management tools include sprays (bifenthin, pyrethroids), systemic treatments (imidacloprid, dinotefuran), and tree injection (emmamectin benzoate, imidacloprid).


Japanese Beetles


Ladybug

Order: Hymenoptera
Translation: "Membrane wing" Holometabolis
Key tree pests: Sawfly larvae, leafminers, gall-forming wasps, carpenter ants

While bees and wasps are certainly not widely considered to be tree pests, other close relatives in this Order can do damage to trees. Sawfly larvae, often confused with caterpillars, have an appetite for pine needles, and many common leafminers are found in this Order as well. Similar to the Coleopteran pests, management tools include sprays (bifenthin, pyrethroids), systemic treatments (imidacloprid, dinotefuran) and tree injection (emmamectin benzoate, imidacloprid).

Sawfly

Order: Lepidoptera
Translation: "Scale wing"
Holometabolis
Key tree pests: Gypsy moth, winter moth, bagworms, clear-wing borers

The Order of moths and butterflies contains many common tree pests, but they tend to only be pests as larvae. Caterpillars are one of the most common leaf-feeding insects in the world. Most do insignificant damage and require no control efforts, but some — especially introduced species — can defoliate a full-size tree in just a few days. Lepidopteran larvae are mostly thought of as leaf-feeding caterpillars, but there are a few, such as the clear-winged moths, whose larvae are wood-boring pests that can be confused with other species and are considered difficult to control. Management tools include sprays (spinosad, pyrethroids, Bt), systemic treatments (acephate), and tree injection (emmamectin benzoate, acephate).

Order: Hemiptera
Translation: "Half wing"
Hemimetabolis
Key tree pests: true bugs, leafhoppers, scales, aphids, adelgids, cicadas, psyllids

This Order has been split, lumped, and reworked more than any other in the past decade, so exactly who is now in the

Boxelder bugs

Hemiptera these days depends on the source, but many well-known tree pests are generally included. With a wide variety of body types, mouth parts, and feeding preferences, this group has many easy-to-control, and difficult-to-control members, so be sure you have properly identified your target for launching any control campaign. Management tools include sprays (bifenthin, pyrethroids), systemic treatments (imidacloprid, dinotefuran) and tree injection (emmamectin benzoate, imidacloprid).

Order: Thysanoptera
Translation: "Fringed Wing"
Holometabolis
Key tree pests: thrips

Thrips, a name derived from the Greek word for "wood louse," can be disfiguring and damaging to tree leaves. In rare cases, a thrip infestation may be heavy enough to cause the death of a plant, but more often they are just damaging the leaves, buds, and flowers of trees. Although thrips are tiny, they are a well-documented vector of certain viruses that cause death to plants, particularly in agricultural or greenhouse settings. Management tools include sprays (bifenthin, pyrethroids), and systemic treatments (imidacloprid, dinotefuran).

Other Orders of insects than impact plants, but not considered prominent tree pests, include Isoptera (termites), Diptera (flies, mosquitoes), Phasmida (walkingstick) Orthoptera (grasshoppers), Odonata (dragonflies, damselflies), Mantodea (mantids) and Dermaptera (earwigs). ■

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