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THE PURDUE LANDSCAPE REPORT

In This Issue

"Murder" Hornets: Should you panic? Probably not. Here's why.

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Asian giant hornets have bright yellow heads and a distinctive large body size. Image taken by LiCheng Shih of flickr.com.

Headlines all over the country have been sounding the alarm about "murder" hornets. Should you be worried? Yes and no. The presence of these hornets in the United States is bad news for bees and beekeepers alike but there's no need to panic yet.

Where did they come from and where are they right now?

The Asian giant hornet originally came from tropical and temperate Asia. We are currently only aware of introductions in British Columbia and Washington State. It's very unlikely that you've encountered one if you live in other parts of North America.

Are they in Indiana yet?

No, they have not been seen in Indiana nor have they been seen in any states near us. It is highly unlikely that there are any Asian giant hornets in Indiana.

What's with the name?

The name murder hornet is a misnomer. They're not malicious. They're just hungry, efficient hunters. If you're interested in learning more about this hornet, try looking under one of its other names: Asian giant hornet, giant Asian wasp, giant Japanese hornet, giant sparrow wasp, or, if you know a bit of Japanese, □□□ □□□□.

Are they going to hurt me or my family?

To date, only a single colony has been discovered in Washington state. It remains unclear how successful members of that colony were at overwintering and if they established new colonies this spring. Therefore, you're very unlikely to encounter an Asian giant hornet. However, should you find a colony, don't approach them as their stings can be serious and can even lead to death. Beekeepers are the most likely to encounter Asian giant hornets and should keep aware of the states in which this hornet has been found. In general, you should use the same caution that you do with any stinging insect. They are not generally aggressive but will defend their nests or the beehive they are attacking. They generally nest in wooded areas in abandoned borrows in the ground.

How do they impact bees?

Unlike Asian honeybees (*Apis cerana*), the European honeybees (*Apis mellifera*) we keep in the United States don't have any defenses against these hornets*. Asian giant hornets mark beehives with a scent that attracts other hornets. They quickly kill the bees in the hive often by decapitating them. Once they are finished with this process, some of the hornets guard the beehive while the other hornets collect and kill the larval bees. The hornets then bring the bee larvae back to their nest to feed to the larval hornets. This process generally occurs in late summer and early fall. These hornets also eat many other types of insects like praying mantises and large caterpillars.

How are they different from native or already introduced hornets?

The simplest difference? They are BIG and have a bright yellow head. These hornets are much larger than any other wasp or bee

in North America. You can find a handy size comparison here.

Can we prevent them from becoming a problem?

Officials in both Washington state and in Canada are working hard to eradicate them. There's hope of stopping them if we act aggressively right now and sustain our efforts in the coming years. It's much easier to stop invasive species before they have the opportunity to establish and multiply. You can help by learning about the invasive species that are likely to be in your area, keeping an eye out for them, and letting someone know if you see them using the resources below.

What should you do if you see one?

You probably will not see an Asian giant hornet in Indiana anytime soon but if you think you've seen this hornet or any other invasive species you should report it! Follow the steps we recommend on reportINvasive.com:

- The GLEDN Phone App
- EDDMaps
- 1-866 NO EXOTIC (1-866-663-9684)
- depp@dnr.IN.gov
- Contact your local extension educator for help!

Further reading:

- Asian Giant Hornet information from Washington State
- Information from The Entomological Society of America
- Asian Giant Hornet Factsheet

*The Asian honeybee (*Apis cerana*) has a series of really dramatic defense mechanisms that can protect them from these hornets. Once they've detected that their hive has been marked for attack by the Asian giant hornet the bees work together to make a warning noise that essentially lets the hornets know that they're prepared for a fight. Many times, the hornets will give up at this point and look for another hive. If the hornets do still land on the hive the bees will cover the hornet in a giant living ball of bees and vibrate so much that it raises the temperature of the ball high enough to kill the hornet.

Cover image photo credit: t-mizo on flickr.com

Soil Basics for Improved Plant Health

(Kyle Daniel, daniel38@purdue.edu)

Figure 1. Constructed landscapes can be amended to provide an effective growing medium for plants.

Soil is the 'lifeblood' of plant health. Many people tend to focus more on above ground portions of the plant than the below ground environment. We should always remember that a plant is only as healthy as its roots. Knowing the basics of soils will help in understanding the health of landscape plants (Fig. 1).

We know that soil takes hundreds of years to form, but what factors are needed for the formation of soil? There are five factors that contribute to soil formation, which include, parent material, climate, biota (living organisms), topography, and time. Each of these influences the soil that is located in our landscapes.

Soil texture is the proportions of sand, silt, and clay in a soil profile. The soil texture is influenced greatly by the parent material. In central and northern Indiana, glacial till has a great influence on the soils as a parent material, where thin loess is found over loamy glacial till. Since most glacial till contains higher amounts of the smallest soil particle, clay, most of the soils in the central areas of Indiana have poor drainage, compared to areas in southern Indiana. The proportions of sand, silt, and clay will determine many characteristics that are vital to plant health (i.e. water holding capacity, porosity, etc.) due to the size of the soil particle (Fig. 2).

Soil characteristics

Soil Type	Clay	Silt	Sand
Particle size	Small	Medium	Large
Pore size	Small	Medium	Large
Total porosity	Large	Medium	Small
Water Retention	High	Medium	Low
Mineral element retention	High	Medium	Low
Oxygen movement to roots	Poor	Medium	Good

Modified from Jozwik, F.X., 1992

Figure 2. Soil characteristics of sand, silt, and clay.

The ideal soil contains 45% mineral, 5% organic matter, 25% air, and 25% water (Fig. 3). As we know, constructed landscapes are far from ideal. Building up organic matter over time will improve plant health in the landscape. Mulching your landscape beds adds many benefits, such as weed control, moisture retention, and aesthetics, but an additional benefit often overlooked is the addition of organic matter. Organic matter aids in drainage, cation exchange capacity (CEC), and promotes beneficial

microbes.

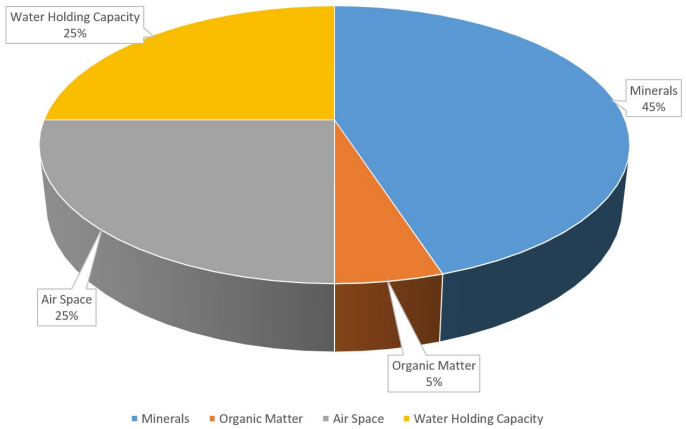

Figure 3. Soil components for ideal plant growth.

The soil horizon is the cross-section of the soil profile, which is categorized into O, A, E, B, and C horizons. The O horizon is the organic matter, which is located in the top one to two inches in most soil. The A horizon is highly weathered parental material layer which is located in the top 12 inches. The E horizon, which may or may not be present, is made of the leaching of organic matter and tends to be a white or gray in color. This should not be confused with mottled soil due to a lack of drainage. The B horizon is an accumulation of silicate clay, iron, gypsum, and/or calcium carbonates due to the washing out of previous horizons. This layer is located beneath the A horizon and is 30 inches or more below the organic layer. The final layer is the C horizon, which is the parent material and the least weathered of the layers.

There are three soil properties that are important to keep in mind for the health of plants: Physical, Chemical, and Biological (Fig. 4). We will explore in detail each of these properties in future newsletters.

Properties of Soil		
Physical	**Chemical**	**Biological**
Texture	Fertility	Soil Biota
Permeability	Cation Exchange Capacity	Microorganisms
Water Holding Capacity	pH	
Structure	Salinity	
-Porosity		
-Bulk Density		

Figure 4. Physical, chemical, and biological properties of soil.

Resources:

- USDA NRCS-Soil Texture Calculator: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/research/guide/?cid=nrcs142p2_054167
- Purdue Education Store: https://mdc.itap.purdue.edu/
- Soil Nitrogen Cycle: https://store.extension.iastate.edu/Product/Soil-Nitrogen-Cycle
- Understanding the Dynamics of Soil Diversity and Variability in the Field: https://store.extension.iastate.edu/Product/Understanding-the-Dynamics-of-Soil-Diversity-and-Variability-in-the-Field
- Soil Organic Carbon Cycle: https://store.extension.iastate.edu/Product/Soil-Organic-Carbon-Cycle

Build Soil Organic Matter to Improve Your Crop Production System: https://store.extension.iastate.edu/Product/Build-Soil-Organic-Matter-to-Improve-Your-Crop-Production-System

Foliar Nematodes

(John Bonkowski, jbonkows@purdue.edu), (Janna Beckerman, jbeckerm@purdue.edu) & *(Tom Creswell, creswell@purdue.edu)*

Earthworms are not the only wigglers in the soil beneath your feet. Nematodes, microscopic roundworms, can be found in soil across the globe (even Antarctica!) and are often a barometer of soil and environmental health. However, the nematodes we encounter more frequently feed on plants and cause us, as plant stock producers and consumers, a ton of headaches.

One subset of the plant parasitic nematodes that stands apart from the rest are the foliar nematodes (*Aphelenchoides* spp.). Unlike the vast majority of nematodes which strictly inhabit roots and soil, foliar nematodes (as their name suggests) live in and feed on leaves, stems, and buds. They enter the plant through stomates, natural openings for gas exchange in the leaf surface. As they feed, symptoms of foliar nematode injury appear as water-soaked lesions that eventually turn brown over time.

Figure 1. Vein-delimited leaf spots on Viburnum spp. Note the coalesced area of necrotic tissue near the petiole. Photo Credit: Janna Beckerman

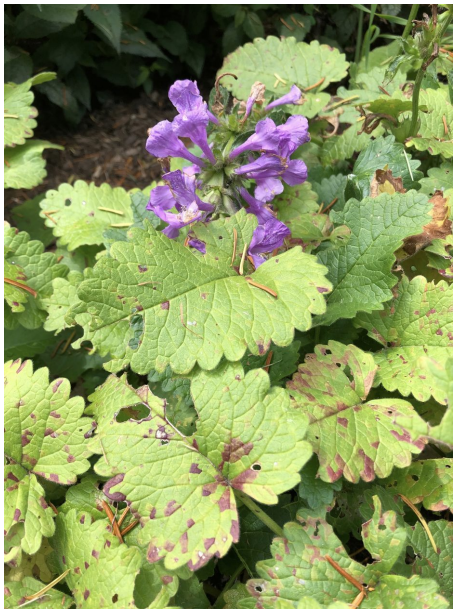

Figure 2. Angular lesions caused by foliar nematode observed on Stachys spp. Photo Credit: Janna Beckerman

Figure 3. An Aphelenchoides infested Weigela submitted to the PPDL, showing both the symptoms on the upper and lower leaf surface. Photo Credit: PPDL

With a broad host range of more than 700 different plant species, symptoms will look different on different hosts. Because the lesions caused by foliar nematode are vein-delimited (meaning the nematode cannot cross major veins), leaf venation determines the shape of the lesions. Symptoms of foliar nematode injury can appear as angular leaf spots (Figures 1, 2, 3), long thin streaks (Figure 4) or 'V'-shaped wedges (Figure 5, 6). It is fairly common for lesions to be isolated or spaced apart with healthy tissue in between due to vein delimitation. As severity increases, the lesions can expand and kill larger portions of the leaf or blighting it entirely (Figures 7, 8).

Figure 4. Symptoms caused by foliar nematodes on a fern. The intial infection begins as a thin streak, but expands over time to blight entire leaflets. Photo Credit PPDL

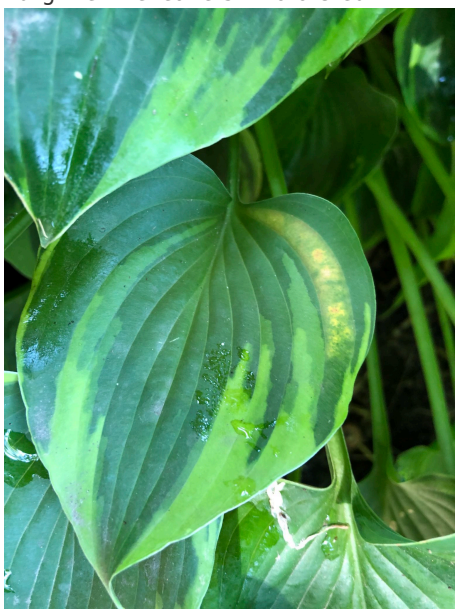

Figure 5. Hosta spp. Leaves with the typical V-shaped wedge associated with foliar nematode infestation. Photo Credit: Janna Beckerman

Figure 6. Symptom progression of Aphelenchoides infested Hosta leaves. Photo Credit: PPDL

Figure 7. Severe blighting spreading across the majority of a host leaf caused by foliar nematode. Photo Credit: PPDL

Figure 8. Widespread foliar nematode injury of leaves of an anemone plant. Photo Credit: Janna Beckerman

As the foliage dies, the nematodes migrate to the crown or buds to persist or they migrate to a new host. Foliar nematodes can only move outside of a host in the presence of free water (dew, irrigation water, etc) and can spread to healthy hosts when plants are in contact with each other or they can be splashed to a new plant by water from rain or overhead irrigation. In very dry conditions, these nematodes can survive in dead or decaying host material for multiple years, in a state called cryptobiosis.

Diagnosis and Management

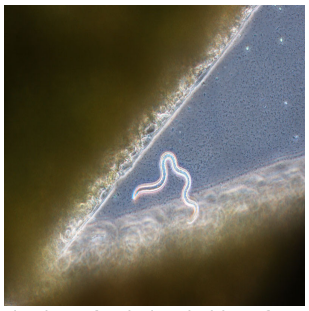

Figure 9. Microscopic view of Aphelenchoides after exiting host tissue. Photo Credit: PPDL

Lesion delimitation by the veins should make you suspicious of foliar nematodes; however, examination with a 10X hand lens is essential as other pathogens can cause angular leasions. Tear the suspected leaf and submerge it in a small dish with water. After approximately 4-24 hrs, examine the water with the hand lens. Observation of these little roundworms is a key diagnostic feature of this disease (Figure 9).

Managing this pathogen is very difficult considering it has such a broad host range and can survive in dead plant tissue for so long. Simply removing infested plants and planting different genera will not fix the problem. Reducing leaf wetness, where possible, will decrease the opportunities for the pathogen to spread. Drip irrigation will eliminate added water on the foliage and increasing plant spacing will maximize air movement which will help dry the foliage out more quickly. Removal and destruction of any living infected leaves and any dead, dried, fallen leaves and stems will remove a significant portion of the nematodes, limiting the population and further slowing the potential for spread. Do not use the leaves as mulch since this still allows the nematodes to spread.

There are few pesticides that are effective in managing nematodes, especially those active ingredients labeled for landscape use by homeowners. Insecticidal soap and ZeroTol are contact pesticides that can be used to when you first observe symptoms, and to reduce the numbers of nematodes on the leaf surface. These do not have any residual activity, so it will be necessary to make additional applications as needed.

Foliar nematodes can also be killed by using a hot water treatment on high value infected host material, provided it is fully dormant. Once dead leaves are removed, soak the dormant plant in water at temperatures from 120 to 140 degrees F for up to 10 minutes. The upper temperature limit the host can survive ultimately depends on the plant, but the longer you keep a plant in the treatment (or the higher the temperature) the more likely you will kill the nematodes, but there can be lasting damage or death in the host. Monitoring the temperature and the time when dipping your plants is extremely crucial to not over do it. Once the time is up, you want to soak the plant in cold water for up to 5 minutes to stop the heating process. This means of management is labor intensive and, potentially, harmful to the plant if misapplied, so it should be used either sparingly or only for high value plants and before re-potting or planting into the ground.

For commercial applicators, Pylon (a.i. chlorfenapyr) has been shown to be effective in managing foliar nematodes in the landscape. Gardeners and homeowners with a serious foliar nematode infestation are encouraged to contact a licensed professional to manage this problem. As always, follow the label for instructions on appropriate use.

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