

Asian Giant Hornets

Asian giant hornets, which are sometimes called sparrow wasps and murder hornets, are a potentially invasive wasp from eastern Asia. A colony was found on Vancouver Island in 2019 and destroyed.



Asian giant hornets. Photograph by Alpsdake via Wikimedia, used under a CC BY-SA 3.0 license.

Summary

A nest and workers of Asian giant hornets were discovered on Vancouver Island, British Columbia and in Washington state in the fall of 2019 and eradicated. It is currently unclear if they are established and reproducing in those areas. **Asian giant hornets do not occur in Pennsylvania or eastern North America more generally.**

Classification

Common name: Asian giant hornet, sparrow wasp

Scientific name: *Vespa mandarinia* Smith, 1852

Order: Hymenoptera (bees, wasps, and related insects)

Family: Vespidae (yellowjackets, hornets, and paper wasps)

Distribution

Asian giant hornets are, as the name suggests, native to temperate and tropical eastern Asia, including parts of Japan, China, India, and Sri Lanka. They are most commonly encountered in rural areas of Japan and one former subspecies was called the Japanese giant hornet. In September 2019, a nest of Asian giant hornets was discovered and destroyed on Vancouver Island, British Columbia and in December the Washington State Department of Agriculture confirmed a dead specimen had been found in Washington. That was the first record of this species in the United States. At this time, **Asian giant hornets are not known to occur outside of Washington state and Vancouver Island and are not present in Pennsylvania.** It's not clear if the hornets are established and reproducing in North America or how widespread they are in the Pacific Northwest, although given the lack of specimens, it's likely that they are not widely established. DNA evidence showed that the hornets in Washington and Vancouver were unrelated and came from different nests, which suggests there may have been multiple independent introductions of the wasps. Because they were only discovered a few months ago, official news about them is scarce, although there will likely be an effort to find and eradicate them from North America before they spread too far.

Description

Asian giant hornet queens are among the largest wasps in the world and can grow in excess of 2 inches with a wingspan of 3 inches. However, they are only seen outside the nest when they are hibernating or in the spring before workers have emerged. Asian giant hornet workers (Figures 1, 2) can grow to 1.5 inches in length and are similar in size to other wasps that occur in Pennsylvania and may be confused with Asian giant hornets. Asian giant hornets are strikingly colored, with yellow heads, a black thorax, and yellow and black or brown striped abdomens.





Figure 1. Asian giant hornet. Photograph by the Washington State Department of Agriculture via [Flickr](#), used under a CC BY-NC 2.0 license.



Figure 2. Asian giant hornet in flight. Photograph by Fufill via [Wikimedia](#), used under a CC BY-SA 3.0 license. Cropped from original.

Asian giant hornets typically build their nests underground, usually in abandoned rodent burrows in forests, often in association with pine roots (Figures 3–5). Nests are sometimes constructed in dead, hollow trunks or roots of trees, but these are never more than 3 to 6 feet above the ground. Aerial nests are rare – of 1,756 nests examined in Japan, only three were constructed above ground. Because of their subterranean nesting habit, locating the nests of Asian giant hornets can be very difficult.



Figure 3. Entrance to an underground Asian giant hornet nest. Photograph by Kashiwagi via [his blog](#), used with permission.



Figure 4. Partially excavated Asian giant hornet nest. Photograph by Kashiwagi via [his blog](#), used with permission.



Figure 5. Excavated Asian giant hornet nest. Note how it is in and amongst the roots. Photograph by Kashiwagi via [his blog](#), used with permission.

Look-alike species

While Asian giant hornets do not occur in eastern North America, there are a number of other large wasps that may be confused for them, including European hornets and cicada killers.

European hornets (*Vespa crabro*) (Figure 6) are the species most commonly mistaken for Asian giant hornets as they are similar in size, shape, and color. However, they can be distinguished by a number of features including the color and of the abdomen (banded yellow, black, and brown in Asian giant hornets vs black anteriorly and yellow posteriorly with rows of black teardrops in European hornets) and thorax (mostly black with a yellow spot between the wings in Asian giant hornets vs black and reddish brown in European hornets) and the forward facing eyes of Asian giant hornets, which appears as a larger gap between the rear of the eye and the rear of the head compared to European hornets.



Figure 6. European hornet. Photograph by Judy Gallagher via [Flickr](#), used under a CC BY 2.0 license.

European hornets typically build their nests inside of natural cavities such as hollow trees and sometimes inside the walls of buildings (Figure 7), although they occasionally build exposed aerial nests in protected places such as in barns or under overhangs as well (Figure 8). Their nests are usually six feet or

higher above the ground, unlike Asian giant hornets, which are generally build nests in the ground or within six feet of the ground. For more information about European hornets, please refer to this Penn State Extension [fact sheet](#).



Figure 7. European hornet nest inside of a hollow tree. Photograph by AJ Cann via [Flickr](#), used under a CC BY-SA 2.0 license.



Figure 8. Exposed aerial European hornet nest built in a protected space. Photograph by Michael Apel via [Wikimedia](#), used under a CC BY-SA 3.0 license.

Thirteen species of **yellowjackets** (*Vespula* species) occur throughout North America, 10 of which are found in eastern North America. Most yellowjackets have abdomens that are banded with yellow and black, but are smaller in size (up to 0.5 inches) so unlikely to be confused for Asian giant hornets. However, queen southern yellowjackets (*Vespula squamosa*) (Figure 9) are larger than other species (up to 0.65 inches) and are sometimes confused for Asian giant hornets when they are active in the spring. Southern yellowjackets can be distinguished from Asian giant hornets by their smaller size, differences in coloration, and the distinctive longitudinal stripes on the prothorax, which also distinguish southern yellowjackets from other *Vespula* species. Yellowjacket species in North America can be differentiated based on the pattern of the gaster (the "abdomen" of bees, wasps, and hornets); examples of different gaster patterns can be found [here](#), [here](#), and [here](#). Different yellowjacket species preferentially build their nests in the ground or in aerial situations, such as under house eaves.



Figure 9. Southern yellowjacket queen. Note the longitudinal stripes on the prothorax. Photograph by Andrew Hoffman via [Flickr](#), used under a CC BY-NC-SA 2.0 license.

Eastern cicada killers (*Sphecius speciosus*) (Figure 10) are native wasps that are similar in size to Asian giant hornets. However, they can be distinguished from Asian giant hornets based on coloration and behavior. Cicada killers have the terminal abdominal segments completely black instead of banded with yellow and lack any yellow on the head.



Figure 10. Cicada killer. Photograph by Katja Schulz via [Flickr](#), used under a CC BY 2.0 license. Cropped from original.

Both Asian giant hornets and cicada killers nest in the ground. However, cicada killers typically nest in exposed areas (e.g., lawns) and often create an obvious pile of dirt at the nest entrance (Figure 11), while Asian giant hornets typically nest in forested areas. Additionally, cicada killers are solitary, so each female digs her own nest. Cicada killers may nest communally, with many nests in a small area that has the right soil substrate, while Asian giant hornets do not.



Figure 11. Cicada killer nest. Note the pile of dirt that leads to the nest entrance. Photograph by Sarah Zukoff via [Flickr](#), used under a CC BY 2.0 license.

Baldfaced hornets (*Dolichovespula maculata*) (Figure 12) are native wasps that are important predators on caterpillars, flies, and other soft bodied insects. They can be distinguished from Asian giant hornets by their smaller size, black and white coloration, and aerial nests that are commonly found on tree limbs and house eaves (Figure 13). For more information about baldfaced hornets, please refer to this Penn State Extension [fact sheet](#).



Figure 12. Asian giant hornet compared to a baldfaced hornet. Photograph by the Washington State Department of Agriculture via [Flickr](#), used under a CC BY-NC 2.0 license.



Figure 13. Baldfaced hornet nest in an apple tree. Photograph by Dave Biddinger, Penn State.

Common name

There is no accepted common name for *Vespa mandarinia* in English. Asian giant hornet is the common name most frequently used for the species in English and so is the name used throughout this article. Japanese giant hornet was used for a now-defunct subspecies of *V. mandarinia* that occurs in Japan (it is now recognized to be just a color morph instead of a valid subspecies). In their native range, *V. mandarinia* is referred to as "great sparrow bee" (Japanese, ■suzumebachi), "tiger head bee (Chinese), and "general officer hornet" (Korean). Since 2008, some Japanese media outlets have also referred to the species as "murder hornets" (satsujin suzumebachi), a name that a viral [New York Times article](#) used in the headline and throughout the article.

As far as any entomologist in the United States can tell, "murder hornet" was not used in English prior to the NY Times article. Therefore, it is not recommended to refer to *V. mandarinia* as "murder hornets". "Asian giant hornet" is somewhat problematic as *Vespa velutina* has the common name "giant hornet", which may lead to confusion. Until the Entomological Society of America (which governs the use of common names for insects in the United States) decides on the official common name for *V. mandarinia*, the author suggests the use of "sparrow wasp" or "sparrow hornet" as it is distinctive, reflects a name used in the wasps' native range and does not carry the sensationalist tone of "murder hornet".

Life history

Like other social wasps, Asian giant hornets are an annual species that build new nests every year. When winter arrives, the current seasons' nests die out and the only individuals that survive are overwintering queens. When overwintering queens emerge in the spring, they seek out protected areas in the ground to begin building a nest, which often includes abandoned rodent burrows. Unlike other social wasps which build exposed aerial nests (e.g., baldfaced hornets) or nests in protected aerial spaces such as hollow tree trunks (e.g., European hornets), Asian giant hornet nests are always in the ground. While queens are building their nests and raising the first broods of workers, they feed on tree sap (Figure 14) where they outcompete other insects, including other hornet species. The nests grow slowly through the spring and summer until they reach a peak population of around 100 workers in August. The queen begins to produce males and queens in September. Males and queens leave the nest in October and early November to mate. Interestingly, queens fight off the males, which results in a large percentage (up to 65%) not being fertilized. Both fertilized and unfertilized queens overwinter, but only fertilized queens go on to found new nests the following year. After males and queens are produced and begin to leave, the colony falls into disarray until it eventually dies off with the coming winter.



Figure 14. Asian giant hornet feeding on sap. Photograph by urasimaru via [Flickr](#), used under a CC BY-NC 2.0 license.

Impact on honey bees

Asian giant hornets, like other social wasps, are predators of other insects. For reasons that aren't clear, Asian giant hornets switch from other prey sources to honey bees beginning in August and peaking in September and October. This switch may be related to the size of the colony (colonies are largest at this time, so the largest number of worker hornets can be recruited to raid the target honey bee colony) or the production of reproductive queens and workers.

Japanese honey bees (*Apis cerana japonica*), which have coevolved with Asian giant hornets, have defenses against them. Specifically, the worker bees **form a ball around the hornet, buzz their wing muscles to create heat, and raise CO2 levels so that the invading hornet is killed** (Figure 15). This form of defense works because the hornets die at temperatures above 115°F, while honey bees can survive temperature up to 122°F.



Figure 15. Japanese honey bees that have formed a ball around a marauding Asian giant hornet to kill it. Photograph by Takahashi via [Wikimedia](#), used under CC BY-SA 2.1 JP license.

However, western/European honey bees (*Apis mellifera*), which are the species used in commercial honey production and did not coevolve with Asian giant hornets, do not form balls around hornets in this manner. Rather, individual guard bees attack the hornets in the air away from the nest. In this contest, the much larger hornet always wins. Because the hornets are targeting bees for protein, they only utilize the muscle-rich bee thorax and discard the head, abdomen, and legs. After the bee is killed, the hornet prepares the thorax into a "meat ball", which is carried back to the nest.

While an individual hornet can kill many bees in this manner, it is not likely to destroy the honey bee colony. However, when three or more hornets from the same nest attack the same honey bee hive, they can enter a state that has been referred to as the "slaughter phase". The trigger for this phase is unclear, but it has only been observed when more than two hornets are present. Hornets in the slaughter phase do not return to their nest after killing a bee or at all for the rest of the day, but rather drop the corpse and kill the next bee they

capture. If the attack is still ongoing when night falls, the hornets return to their nest but then continue to attack the same honey bee colony the following morning.

The slaughter continues until the colony is decimated and only a few bees remain. The hornets then enter the "occupation phase", where they enter the honey bee hive and predate the pupae and larvae, as well as the bees they had previously killed. During this phase, the hornets make continual trips from the occupied hive to their nest for several days to up to two weeks as they devour the honey bee brood.

If they enter the slaughter phase, a group of 20–30 Asian giant hornets can kill 5,000–25,000 honey bees in a few hours. However, Asian giant hornets only fly 0.5– 1.25 miles (1–2 km) on average (and never more than 5 miles (8 km)) from the nest in search of food and there is some evidence that hornets do the worst damage to honey bee colonies that are less than 0.5 miles (1 km) from the nest and that, while nests further away may be molested by one or a few hornets they are not generally slaughtered.

If Asian giant hornets become established in North America, it's not clear how they will impact honey bees and American bee keepers, although there probably will be some impact if they become widespread. Beekeepers in Asia have implemented a variety of strategies to combat Asian giant hornets and deter/eliminate attacks that enter the slaughter phase. Presumably, some or all of these strategies can also be implemented in North America if necessary.

Medical importance

Asian giant hornets, like other social wasps, can be defensive when they feel their nest is threatened or when they are defending a food source, such as an occupied honey beehive. However, they do not seek people out just to sting them for no reason like some human-hating guided missile.

Stings from Asian giant hornets, when they do occur, are **extremely painful**. There is some evidence in the scientific literature that Asian giant hornet stings [may cause skin necrosis and hemorrhaging](#). However, it should be noted that the reports are likely based on rare, extraordinary events (because if it wasn't an extraordinary event, it wouldn't be published), so it's not clear how common those reactions are.

Asian giant hornets have been reported to kill 50 people a year due to sting-induced allergic reactions and, more rarely, multiple organ failure due to a large number of stings. This statistic is often alarming for people. However, for perspective, [an average of 62 Americans are killed every year by bees and wasps](#) for the same reasons. Further, the reported death count is from across the entire range of Asian giant hornets, which includes large swaths of eastern Asia. In Japan, where they are most common and abundant, an average of 21 people from 2000–2018 died per year from all wasp, hornet, and bee stings combined, with Asian giant hornets accounting for only a subset of those deaths.

The venom of Asian giant hornets isn't even as deadly as some native wasps on a per volume basis; for example, southern

yellowjacket venom has an LD₅₀ of 3.5 mg/kg compared to 4.0 mg/kg for Asian giant hornets. However, Asian giant hornets are large and deliver a proportionally large volume of venom per sting, so on a per sting basis are delivering more venom. That being said, it's not clear that Asian giant hornets are "more deadly" or more likely to induce an allergic reaction than honey bees, yellowjackets, and other social wasps.

Control

Asian giant hornets do not occur in Pennsylvania or eastern North America more generally, so control information is unnecessary at the time. If they do become established here, this section will be updated to reflect the best current strategies. If you live in an area Asian giant hornets are found and wish to control them, please refer to the USDA publication "New pest response guidelines, *Vespa mandarinia*, Asian giant hornet", which includes sections on "Survey and eradication" and "Control options" and details ways in which beekeepers in Asia protect their honey bee colonies from attack.

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