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No Such Thing As a “Murder Hornet”: Asian Giant Hornet, an Invasive Species to Monitor

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Introduction

THE ASIAN GIANT HORNET, *Vespa mandarinia* (Hymenoptera: Vespidae), is a species of wasp native to southeastern and eastern Asia. In 2019, the presence of Asian giant hornet (AGH, hereafter) in North America was confirmed in the state of Washington, as well as British Columbia, Canada. There has been no confirmed sighting of AGH in Idaho as of September 2020, but it is important for all of us to keep an eye open and report if we come across a nest or an individual. However, there are several native wasps and other insect species that resemble AGH in size and/or color pattern.

This bulletin presents information on AGH identification, ecology, and management. Also included is a visual guide of AGH and several look-alike species. Note that only six out of more than 5,000 public reports of AGH sightings in Washington have turned out to be accurate. If you live in or frequently visit a habitat that may be a suitable AGH nesting site, please review the visual guide thoroughly to familiarize yourself with AGH physical characteristics and its life cycle and behavior in different stages of nest development.

If you see an AGH, try to take a clear photo, if it is possible to do so safely. Do not try to catch and handle the wasp alive. AGH stings are extremely painful and penetrate through regular beekeeper suits. Record location, preferably exact GPS coordinates, for later confirmation and follow-up by specialists. If you think you are seeing a nest entrance with multiple AGHs present, keep your distance and record the location.

Submit your report, along with a photo and/or a dead specimen, to Paul Castrovillo at the Idaho State Department of Agriculture (Tel: 208-332-8627; email: paul.castrovillo@isda.idaho.gov).

Distribution

Asian giant hornets are native to temperate southeastern and eastern Asia with a range across several countries including India, Nepal, Sri Lanka, Thailand, Vietnam, and stretching north to Hokkaido (Japan), and neighboring regions of the Korean Peninsula, Russia, and China. They possibly found their way to North America “hitchhiking” in commercial shipping containers. Since the AGH specimens found in Canada and the United States appear to be genetically distinct, there may have been more than one introduction event.

In the United States, they were first reported in northwestern Washington in December 2019, where they have remained localized. However, ecogeographic similarities and the volume of commercial traffic between Washington and Idaho makes AGH’s eventual arrival and establishment in Idaho conceivable, particularly in northern Idaho.

The arrival of AGH in North America has been widely reported in the news. Do we need to be concerned about this wasp? *Yes, but there is no reason to panic.* The steps for a species to cause environmental and economic harm include: 1) introduction, 2) establishment, and 3) dispersion/spread. To date, AGHs have only been *introduced* into the United States; they have not become established. Awareness is critical, as we all should be on the lookout for this insect invader. Eradicating an invasive species is easiest when they are detected early and prior to their establishment.

Description

Asian giant hornets are the largest hornet species in the world, with a wingspan of 3 inches and a body length reaching up to 2 inches for the queen caste. Workers and males have similar color patterns as the queen. However, they are slightly smaller, around 1.5 inches in length. All castes can resemble other wasps of similar color and body size that are common in Idaho ([Appendix](#)).

Western cicada killer wasps, yellow jackets (multiple species), bald-faced hornets, sawflies, and horntails are examples of native wasps that can be mistaken for AGH. There have also been instances where nonwasp insects have been reported as AGH, simply

because of being notably large. Appendix provides a visual guide comparing AGH with a few insect species that it has been confused with.

Close-up, AGH is strikingly black- and yellow/orange-colored, with a yellow/orange-head, bean-shaped eyes (Figures 1–3), and a large pair of dark orange to brownish “jaws” or mandibles. The antennae are dark, except for the long orange basal segment. The thorax, the middle section of the insect body to which the legs and wings are attached, is black, often with a pair of orange or yellow spots toward the posterior end.

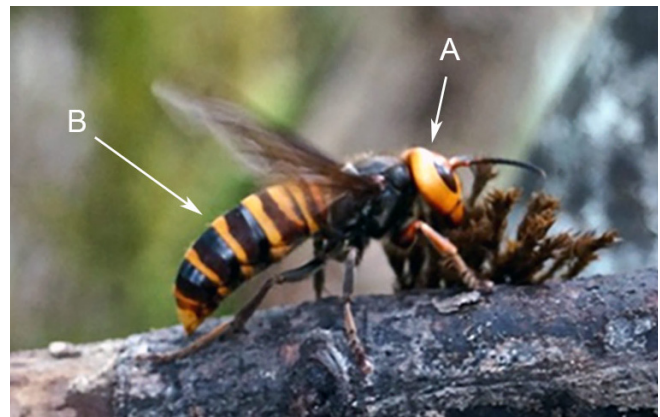


Figure 1. Asian giant hornet in their natural habitat; note the (A) yellow/orange head, (B) abdominal color pattern. Photo provided by Paul van Westendorp.

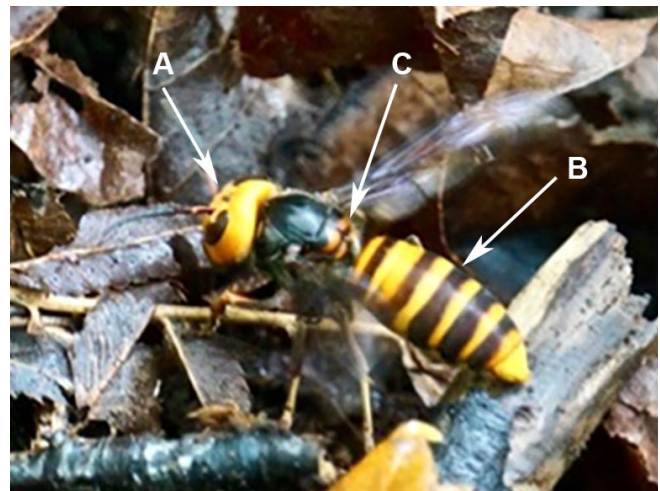


Figure 2. Asian giant hornet in their natural habitat; note the (A) yellow/orange head, (B) abdominal color pattern, and (C) yellow spots on the dorsal (top or back) side of the thorax. Photo provided by Paul van Westendorp.

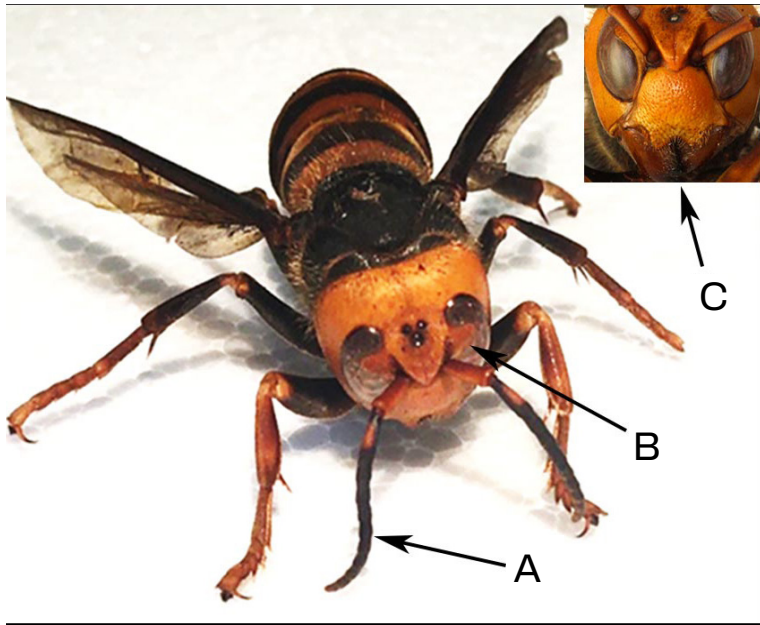


Figure 3. Asian giant hornet; note the (A) dark antennae, (B) bean-shaped eyes, and (C) large brownish mandibles. Photo provided by Paul van Westendorp. The embedded face shot (C) is provided by the Washington State Department of Agriculture. Cus, occus aut aut

Life Cycle

Asian giant hornets build a new nest every year. Generally only the new queens hibernate, although workers who have been attacked by specialized parasites in the insect order Strepsiptera can also successfully overwinter.

The queen emerges from her winter refuge of an excavated underground hole, or other similar protected habitats, in spring to find another habitable underground shelter in which to establish her nest. Ideal nesting sites include abandoned rodent nests or other burrows as well as underground cavities at the base of trees. The entrance is usually narrow and connects to the nest cavity, which resembles an upside-down bowl with multilayer combs hanging from the top. The AGH queen feeds on tree sap as she raises the first batch of sterile female workers that will go on to perform colony duties as the nest develops through spring and summer. At its peak size, the nest can potentially include hundreds of individual workers. During the fall, the queen begins to produce males and next-generation queens. These young queens and males emerge to leave the old nest and mate. Most of the young queens (> 60%) will not mate, and only the mated queens can establish

new nests the following spring. The life span of an AGH queen can last almost a year, whereas workers' life expectancy is approximately two weeks, and typically does not exceed five weeks.

Workers forage mostly within a 1.2-mile radius of the nest. Queens may fly longer distances of up to 5 miles to find nesting and/or overwintering sites.

Damage by AGHs

Asian giant hornets, like most social wasps, are predators of other insects including honeybees. Thus, in addition to their direct damage to the honeybee industry, they could indirectly impact agricultural production by hindering insect pollination. Asian giant hornet females are also protected by their venomous sting. Therefore, AGH is potentially of apicultural, agricultural, and human health concern.

The European honeybees, *Apis mellifera*, cultured for pollination and honey production by beekeepers in the United States, are largely vulnerable to AGH because their stingers cannot penetrate AGH bodies. Even so, they will vigorously attempt to defend their hive until most of them are slaughtered by the hornets. Asian giant hornet attacks on honeybee hives may consist of three different phases, influenced by the size and developmental stage of the AGH nest.

The initial phase is the **hunting** phase during which one to five hornets wait near the hives and prey upon individual honeybees. A hornet captures the bee, flies away, and bites her victim to death. She removes the head, wings, and legs of the prey, forms a "meatball" from the bee's thorax, and takes it back to the nest. Asian giant hornets are not particularly agile and generally do not capture prey while flying.

The hornets may remain in this initial hunting phase or proceed to a **slaughter** phase, especially when the beehive is located near the hornet's nest. During the slaughter phase, multiple hornets attack a single beehive, ignoring adjacent hives. Like in the hunting phase, the AGHs wait around the beehive entrance to promote counterattacks from honeybees. During this stage, AGHs kill bees but do not take the dead bees back to the nest, instead dropping the bee body

and moving on to attack another honeybee. Within 2–6 hours, the number of counterattacks by the bees drops considerably as the hive population decreases. The number of honeybee casualties varies depending on the bee colony size and the frequency of the counterattacks. Some calculations suggest that a single AGH can kill one honeybee every 14 seconds.

The final phase is the **occupation** phase, when the beehive caves under persistent attacks from AGHs. As the defending honeybees die or escape, AGHs enter the hive in search of immature bees, leaving the stored honey largely untouched. They make many trips, transporting the honeybee larvae and pupae back to their nest, a process which can take days to complete. During the occupation phase some of the hornets guard and protect the occupied hive from other predators. Approaching predators (including AGHs of a different colony), animals, or humans will be chased away with vigorous attacks; this defensive behavior is not observed during the hunting or slaughter phases.

Unlike European honeybees, Japanese honeybees (*Apis cerana japonica*) have adapted a defensive strategy to effectively protect themselves against AGHs. These bees, which have coevolved with AGHs in their native habitat, rush to surround and cover the invader in a highly coordinated counterattack. Through intense buzzing from vibrating their flight muscles, they generate so much heat and CO₂ that it results in the invader's death. The Japanese honeybee's ability to survive higher temperatures than the wasp makes this strategy highly effective.

Asian giant hornets can also attack nests of other "social" wasps. Attacks on other wasp nests, such as yellow jackets, usually end quickly as the victim wasps escape and leave the nest to AGHs. Although yellow jackets and bald-faced hornets can inflict greater mortality on AGHs than honeybees, they are not as fierce as honeybees in defending their relatively smaller nests.

Asian giant hornets can be a human health concern because, like other social wasps, AGHs use their stinger repeatedly to defend their nest or food source. The extreme pain associated with their sting, their ability to sting through common beekeeper suits or other thick clothing, and their striking size

and bright coloration make them feared creatures. Allergic reaction to the venom is a primary reason for concern with AGHs. Fatality may occur in rare cases, especially if a large amount of venom from multiple AGHs is injected into a human body. Although approximately 50 human deaths per year are attributed to AGH in its native range (see Distribution), considering, on average, 62 people die from bee and wasp attacks in the United States, the mortality rate associated with AGH is similar to that of other wasps and bees. Indeed, despite being extremely painful, AGH venom may not be as deadly as venom from some yellow jacket species on a volume basis. However, because of the *amount* of venom that AGHs can inject per sting, their attack is more likely to promote allergic reactions.

Although AGHs are primarily considered pests, in their native range they are sometimes consumed as food or used as traditional medicine. Some studies have suggested that the amino acid composition of their larvae may offer human health benefits such as increased exercise tolerance and fat metabolism. With such cultural and nutritional values, smuggling should not be ruled out as one potential introduction pathway.

Monitoring and Management

Asian giant hornets are currently not present in Idaho and AGH sightings in Washington remain limited. Therefore, there is no immediate need for control at this point. Monitoring efforts will, however, be worthwhile because eradication can only be successful at the early stage of an invasion.

Visual presentations in this bulletin should help for recognizing and identifying this hornet. Various bait traps (Figures 4 and 5) are also available and have been deployed in northwestern Washington to collect AGHs; the first AGH was trapped on July 14, 2020, in Whatcom County, Washington. The trapped specimen was examined by United States Department of Agriculture researchers, who determined it to be an unmated queen.

Detailed instructions for making an AGH bottle trap are provided by the Washington State Department of Agriculture ([link to trapping instructions](#)). However, there is likely no compelling reason to trap for AGHs



Figure 4. Setting up a bottle trap for monitoring and collecting AGHs. Photo courtesy of Washington State Department of Agriculture.



Figure 5. Setting up a bottle trap for monitoring and collecting AGHs. Photo courtesy of Washington State Department of Agriculture.

in Idaho at this time. The traps used in Washington state are nonspecific, and primarily capture native species. For example, so far in 2020 Washington trappers have captured over 20,000 native yellow jackets, but only three AGHs.

Beekeepers in eastern Asia have been using cultural and chemical approaches to manage AGH. Cultural controls vary from eliminating landing sites (e.g., using glass sheets) and deploying screens and various traps near the hive entrance to the labor-intensive method of killing worker hornets with wooden sticks (during hunting and slaughter phases). Although technically simple, cultural controls can offer considerable protection against the predatory wasp compared to leaving beehives unprotected.

Although worker wasps are encountered most frequently and are the caste that robs and vandalizes beehives, keep in mind that the mated queen is the caste that overwinters and establishes the nest. Thus, managing reproductive castes in early spring and fall may prove effective. Unfortunately, as AGH is a newly introduced species, not much information on flight periods in the region is currently available.

Although AGHs have been reported in Washington in 2019 and 2020, they are not yet considered established in the United States. Therefore, there is currently no insecticide registered for use against this invasive species. Some putatively effective insecticides are available but have yet to be tested and approved.

Further Reading

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