

Giant Alien Insect Invasion Averted—

Canadian Beekeepers Thwart Apicultural Disaster

(...or at least the Zom-bee Apocalypse)

by Conrad Bérubé



(Summary: In August of 2019, two specimens of an unusually large wasp were collected in Nanaimo, British Columbia, by a beekeeper who suspected them to be new to the area. By mid-September, another four had been collected nearby and were confirmed, by provincial and international specialists, to be the first confirmed specimens of Vespa mandarinia collected in North America. With location information supplied to them by the provincial apiculturist, local beekeepers were able to locate the nest. The entire colony and brood combs were successfully removed and destroyed on September 18, 2019, in what they hoped was the eradication of a nascent introduction of an invasive species. Specimens were preserved and forwarded to the provincial apiculturist for distribution to research institutions.)

used a lot of b's there — but we saved a lot of bees here.

The Asian Giant Hornet (AGH), *Vespa mandarinia*, is the largest eusocial wasp in the world, being from 1½ inches (3.5 cm) in length for workers to about 2 inches (4-5 cm) for queens. Think of a wasp the size of a small bird. In fact, one of the common names of this beast translates as "sparrow hornet." Nepal is the north-western extremity of its native range which extends, from there, east across to Japan, and south to the limits of tropical southeast Asia. Like other members of the genus, *V. mandarinia* is a social carnivore which preys on many insects but, in particular, on other social insects, especially honey

bees. Thus, in North America, the AGH is considered an undesirable, and potentially invasive, species — somewhat ironic as honey bees themselves are an import to the Western Hemisphere and were an invasive species compared to the bee species native to the Americas. Of course, honey bees have become an integral part of the managed pollination upon which many crop systems depend in North American agriculture.

The Eastern honey bee, *Apis cerana*, shares its native range with *V. mandarinia* and has evolved a unique defense strategy against the hornet. When under attack by scouting hornets the guard bees retreat into the interior of their nest, rather than ral-

Every few decades there seems to be a spate of sci-fi movies focusing on social insects. In the 1950s, there was "Them" (gi-ants), "The Wasp Woman" (royal-jelly concoction transforms cosmetics queen into a were-wasp succubus), in the 70's "Killer Bees" (pretty self-explanatory) and "The Swarm" (rampaging honey bees ravaging Houston are ultimately defeated by a giant refrigerator), and, most recently, "Antman and the Wasp" (which, at least, casts our insect sistren in a more favourable light). Giant insects seem to hold a particular fascination for the human psyche ... and I have recently had my own close encounter with a plus-sized alien arthropod that threatened to invade our tranquil shores here on Vancouver Island in British Columbia. But a bespoke band of beekeepers beat back the bee-eating beasties by besieging their burrowed bunker. I

Parody movie poster
(Conrad Bérubé)





Screen capture from "The Wasp Woman" (Screen capture from <https://www.youtube.com/>)

lying to the entryways. When a hornet ventures into the interior of the hive and kills a worker bee, the latter's nestmates will attack en masse, "balling" the intruder. Roiling around the hornet, the bees vibrate their wing muscles and raise the CO₂ and temperature (to 115 F [46 C]) in the interior of their huddle to levels tolerable to the bees, but fatal to the marauder they have surrounded.¹ In contrast, the Western honey bee, *Apis mellifera*, did not coevolve with the AGH and has less effective defense strategies against it. Guard bees of Western honey bees tend to leave the confines of the hive to engage, just outside the hive entrance, in one-on-one defense against invading hornets. The far outweighed bees are quickly killed by the Goliath wasps. A concerted attack by several dozen workers of *V. mandarinia* can destroy an entire colony of 25,000-30,000 *A. mellifera* in a matter of a few hours.² Thus, the establishment of *V. mandarinia* in British Columbia would represent a threat to the beekeeping industry.

In addition, *V. mandarinia* will vigorously defend the area around its nest against human incursions. The sting of the AGH is approximately ¼

inch (6 mm) long and can penetrate through multiple layers of clothing or sturdy protective gear. (After my encounter with them, I removed a ¼ inch long lancet from one of my fingers — that had gone through one of the leather work gloves I was wearing.) A single sting can kill tissue around the puncture for several millimeters in radius and depth — as well as cause the pain and swelling typically associated with hymenopteran venom. People receiving multiple stings often require medical attention — and massive stinging (10 or more stings) or allergic reactions often result in serious symptoms, including death. In Japan, the AGH is responsible for approximately 40 deaths each year.³ Hence, aside from impacts to beekeeping and to other aspects of the current ecosystem, the establishment of *V. mandarinia* in suburban areas with woodland interfaces, such as Nanaimo, would result in negative public health impacts.

In early August of 2019, John Duff, a Nanaimo beekeeper, noticed several hornets of unusual size harassing honey bees at the entrance to one of his hives. The type of wasp was unfamiliar to him, so he dispatched

a couple of the slow-flying insects — by whacking them with a stick. He sent photos of his find to the provincial apiculturist, Paul van Westendorp, who was also intrigued and who requested that the specimens be sent to him. They were identified by van Westendorp as being workers of *V. mandarinia* (subsequently confirmed by Dr. Graham Thurston and David Holden of the Canadian Food Inspection Agency [CFIA], Ottawa and Burnaby, respectively, and Dr. Jun-ichi Kojima of Ibaraki University, Mito, Japan) — which indicated that a nest or nests of the AGH had been established in North America. These and other subsequent finds were reported to the Invasive Species Council of British Columbia which began coordinating intergovernmental efforts to monitor and eradicate the hornets.

As van Westendorp recognized the potential threat that the hornets posed, he contacted Peter Lange, President of the Nanaimo Beekeepers Club. Lange, in turn, alerted the club's executive board to enlist their assistance in monitoring for the hornet. Lange provided hornet sighting locations to John and Moufida Holubeshen, also officers of the club, who canvassed their contacts for assistance in a search-and-destroy effort against the AGH. The Holubeshens, informed by the sighting data and the biological requirements of colonial wasps and bees, embarked on what they expected to be a preliminary foray to familiarize themselves with the terrain. They planned to return another day for a more intensive search conducted with those who had responded to their call for volunteers.

Like movie detectives using maps of past crime sites to guess where the villain will strike next, they roughly triangulated the most likely site for a nest and headed out for their twilight



Fig. A: The author applying CO₂ at nest entrance to anesthetize *V. mandarinia*; **Fig. B:** Preserving specimens with isopropyl alcohol; **Fig. C:** The author applying domestic wasp & hornet foam to nest area following extraction. (Video stills: Moufida Holubeshen)



The author extracting CO2 anesthetized *V. mandarinia* from ground nest (Photo: Moufida Holubeshen)

reconnaissance stroll on the evening of September 18. Their deductions led them to a wooded path that is annexed to Robins Park in the south western portion of Nanaimo. While walking along the path, John Holubeshen was suddenly stung through his shirt. He described the initial pain from the sting as "like being kicked in the chest." In the fading light, the couple was able to discern a flight path of the hornets leading to the entrance of a ground nest. (The species nests exclusively in underground cavities, often abandoned rodent dens or, as in this case, natural fissures such as those formed by the uprooting of trees.) John had been stung while about 15 feet (5 m) away from the otherwise undisturbed colony.

The Holubeshens retreated home to administer antihistamines to John and to assemble an impromptu rapid response team. They contacted Peter Lange, who had been coordinating communications and location infor-

mation, and me, as I have experience, and equipment for, collecting entire colonies of several species of yellow jackets for the pharmaceutical preparation of desensitization serum. (I also have extensive experience working with defensive African-derived strains of honey bees both in Africa and the Americas — see American Bee Journal articles of July and August 1989, May and June 2003, September 2009, January 2010, and February 2010 available at <http://www3.telus.net/conrad/bees.htm> and <http://beesforbabar.org/publications.htm>.) As Moufida and I are both provincial employees in the natural resource sector, although not in conducting invasive species management, we try to keep abreast of related government bulletins and we were aware of a pest alert issued for the AGH. We were also sensitive about ensuring that our actions were in compliance with provincial regulations. So Moufida contacted the provincial apiculturist to see if he had any objections to our plan to dig out the hornets. He agreed that rapid eradication was warranted — in the hopes of destroying the nest before reproductive males and females could disperse from the nest. (As for other eusocial wasps, nests are annual, founded by a single reproductive female or "gyne," which mates in the fall and then overwinters in a sheltered locale from which she seeks a nesting site in the spring.)

Gathering near the nest site, our rapidly assembled team girded up in standard beekeeping equipment. Since I was to conduct the actual extraction, I also bore additional protection — including two pairs of pants — as well as a Kevlar vest and brac-



V. mandarinia life stages in extracted comb (Photo: Conrad Bérubé)

ers of the type commonly used to guard against chainsaw injury — or the zombie apocalypse. Nonetheless, while making an unsuccessful attempt to vacuum hornets at the nest entrance using a battery operated handi-vac (the hornets proved too large to fit through the nozzle), I was stung four times and then, during the extraction, at least another three times. Two of those stings drew blood that resulted, ultimately, in killing off lentil-sized chunks of flesh (so far, the tissue death has spread no further and I have evaded turning into a zombie). However, all the punctures were from "false stings," through clothing, which generally prevents the delivery of a full load of venom. Nonetheless, the initial pain was like having red hot thumb tacks driven into the flesh. Although I didn't swell up much (I normally don't from bee stings either), with no medication beyond 400 mg of ibuprofen taken about 6 hours post-sting, I suffered rather throbbing muscular aches in the legs — similar to that of flu — which lasted approximately 24 hours. It is possible that individuals who are not beekeepers, like John and me, who have developed some tolerance to hymenopteran venom, would



V. mandarinia workers
(Photo: Conrad Bérubé)



Clockwise from top: *V. mandarinia* worker, *V. mandarinia* queen, *Apis mellifera* worker, *Vespula germanica* worker (Photos: Conrad Bérubé)



V. mandarinia workers and, in foreground, queen (Photo: Moufida Holubeshen)



V. mandarinia, worker (Photo: Conrad Bérubé)

have more severe reactions to stings of *V. mandarinia*.

As vacuuming had proved impractical, a standard carbon dioxide fire extinguisher was used to deliver the gas into the nest entrance to subdue the hornets. (CO₂ is, similarly, commonly used to anesthetize honey bee queens during artificial insemination.) Few stings were experienced thereafter. The hornets were picked out by (leather-gloved) hand and drowned and preserved in 95% isopropyl alcohol. Both suffocation & drowning are physical, not chemical, controls and thus are not subject to provincial restrictions to the use of pesticides on public land such as the park. Further, alcohol preserved the insects' DNA for subsequent study (at the BC Museum of Natural History, Ministry of Agriculture, Ministry of Environment, CFIA and University of British Columbia). CO₂ knocked the hornets down immediately and was administered regularly in small doses as work proceeded in an improvised production line. I removed the hornets from the nest while Peter and the Holubeshens transferred the catches from collection bowls into a larger, sturdier container for shipping. The queen was found and identified, by her obviously larger size, when four dish-sized carton combs were removed from the

nest cavity. The comb, of a consistency much like cardboard and constructed by the hornets from masticated wood pulp, was bagged and later frozen to kill the developing larvae. A domestic aerosol wasp & hornet foam (again exempt from restrictions for use on public lands) was applied to the base of the nest cavity before the hole was refilled with excavated soil. Likewise, after the cavity was refilled, the foam was applied at the original nest entrance in the hopes of dispatching any workers returning to the site. (Four workers were recovered there the following day; two had succumbed to the foam and two more were killed by thwacking with a stick.)

The nest appears to have been of average size for the species, containing about 200 adults, with a little over twice that number of immatures in the four hundred or so cells making up the comb. Approximately 10% of the pupae present appeared to be reproductives (as indicated by their bullet-shaped cappings to accommodate greater body mass). There is no way

of saying for sure how the introduction occurred, but it is quite possible that a mated wasp queen arrived in Nanaimo's port cozened away inside a cranny of a shipping container or ensconced in organic material such as wood chips intended for pulp processing. There have even been instances of live wasps being seized from travelers by Canadian customs agents — as the larva and adults, when fried, are considered a delicacy. I've eaten all kinds of insects (honey bee larvae regularly / infrequently and termites, ants and diving bugs in Asia ... crickets, grasshoppers, wasp larvae in the Americas) and I suspect AGH larvae would have the same kind of bland, soft "shrimpi-ness" that honey bee larvae do. It is also my suspicion that the gastronomic potential of the wasps is exaggerated and promoted by wily Japanese beekeepers in the hopes of encouraging others to assist them in digging up and eliminating the pesky predators. Unfortunately, we disposed of the larvae before it occurred to me to do up a pupal sauté or such.



V. mandarinia sting sites, approximately 2 hours after stings: **Fig. A:** First AGH sting wound in North America — to John Holubeshen's chest (Photo: Moufida Holubeshen). **Fig. B:** Blood stain from sting puncture through the inner of two pairs of pants worn during extraction — to Conrad Bérubé's thigh (Photo: Conrad Bérubé). **Fig. C:** Exposed sting wound through two pairs of pants — to Conrad Bérubé's thigh; Note early signs of localized necrosis to tissue on right. (Photo: Conrad Bérubé)

Even the spit of the larvae has taken on an aura of glamour. Adult wasps cannot digest the flesh of the insects they collect for their brood. Instead, the workers mash up the prey and feed the ground meat to their larvae. The larvae wriggle in unison in their comb producing a rattling sound in their carton creches to elicit feeding behavior, much like bird nestlings ... but with a twist. The larvae digest the hornet-made hamburger and then regurgitate a slurry rich in amino acids and other nutrients — on which the adults subsist — so the feeding goes both ways. Most beekeepers are familiar with the honey bee equivalent of this social feeding, technically termed “trophallaxis,” which is important for maintaining colonial cohesion (and for ripening honey in the case of our Apine allies). Much in the way that honey bee royal jelly is ascribed magical human nutritive powers, the regurgitant from the wasps has been advertised, in Japan, as being an athletic performance enhancer. Larval hornet spit is now produced there synthetically and included as an ingredient in a booster tonic that is touted as improving endurance during sporting activities. I suppose, if life deals you hornets, you might as well make hornet-ade. However, ironically, the only significantly demonstrated effect in humans, in trials with cyclists, seems to be to **slow** the heart during exertion ... which would hardly seem to be beneficial.⁴ Alas, the only real confirmation that close association with hymenopteran secretions is beneficial to people remains the clear evidence that beekeepers are smarter, better looking and have a better sense of humour than everybody else.

There was much media attention following the initial discovery of the hornets — and later the extraction and, hopefully, extirpation, of the hornets’ temporary beachhead on Vancouver Island. In the wake our attention was drawn to a “News & Events” article in the September 2018 American Bee Journal which relates how radio tag tracking is being developed in England to combat a more diminutive cousin of the AGH, namely the Asian hornet, *V. velutina*.⁵ *V. velutina* has gained a foothold on continental Europe, where they are threatening honey production and native insect pollinators. As *V. velutina* has been shown to be able to carry radio transmitters, then AGH, with its greater size, should be all the more capable of carrying a micro-

transmitter back home. That would likely be more effective than gluing a cotton ball to a foraging hornet to make it more visible when returning to its nest — which is a traditional technique for hunting them down in their native range. (This is, of course, very similar to bee-lining techniques that have been used in many parts of the world to track bees back to their nests.) Paul van Westendorp has suggested a modern refinement of the technique: attaching mylar streamers to the abdomens of hornets collected at feeding stations in order, upon release, to slow their progress and make them more visible for pursuit on their homeward return. This technique would still be useful in supplementing the use of expensive (about \$5,000 U.S.) radio tag tracking systems. Although AGHs have a considerable foraging range, of up to about 5 miles (8 km),⁶ this should be considered in the same way as that of honey bees (which is up to 8.5 miles [13.5 km]).⁷ In both cases, foragers likely only go to the extremes of their foraging ranges when pickings are slim closer to home (or when they’ve encountered a very attractive resource far from the nest). It’s likely that AGH workers can be expected to stay fairly close to home if resources are nearby — making tracking significantly easier than if they were to be captured at a great distance from their colony. The Invasive Species Council of BC deployed an array of hornet traps in Nanaimo as well as on the mainland for continued monitoring. Nonetheless, the only confirmed sightings of actual *V. mandarinia* specimens following the extraction turned out to be observations of straggler workers who had es-

caped into the brush during our raid or which had overnighted elsewhere and had returned to the original nest location (which had become, from our digging operation, much more prominent to passersby). All other reports of which we are aware were cases of mistaken identity (sometimes ludicrously so, as I received an urgent report that turned out to be over a carrion beetle, an insect that is about ¼ inch (6 mm) long, and whose only resemblance to the hornets was sharing an orange and black colour scheme). Nonetheless, “we take false alarms with open arms, non-hornet critters don’t give us the jitters,” since the former are a lot less work.

Keeping with the rhyming motif, I created two other mnemonic verses for promotional purposes. People should always exercise care around hornets and yellow jackets, especially when near their nests. As with any stinging insects, the public should be advised to follow this general rule when near hymenopteran nests:

If stings have been nil,
It’s best to stand still,
But once you’ve been stung,
Cage your eyes and just run.

Additionally, those who may encounter *V. mandarinia* are encouraged to “slap, snap, zap & wrap” a specimen:

SLAP! it with a stick to kill it,
SNAP! a photo of it
ZAP! an email off to:
info@bcinvasives.ca &
nanaimobeekeepers@gmail.com
& WRAP! it in a ziplock bag & freeze, in case the sample is needed.



From left to right, the extraction/extirpation team: John and Moufida Holubeshen, Peter Lange and Conrad Bérubé. Photo: Conrad Bérubé

My wife says, as a poet, I do pretty well at expelling entire species from the continent ...

Editor's note: In late December the first report of Vespa mandarinia was confirmed in Washington State (See "News and Events" in this issue).

ENDNOTES

- 1 Sugahara, M. & Sakamoto, F. 2009. Heat and carbon dioxide generated by honey bees jointly act to kill hornets. *Naturwissenschaften* 96: 1133. Available from <https://doi.org/10.1007/s00114-009-0575-0>
- 2 Matsuura, M. & Sakagami, S.F. 1973. A Bionomic Sketch of the Giant Hornet, *Vespa mandarinia*, a Serious Pest for Japanese Apiculture. *Journal of the Faculty of Science, Hokkaido University. Series 6, Zoology*. 19(1): 125–162. Available from <https://>

[web.archive.org/web/20170818210542/http://eprints.lib.hokudai.ac.jp/dspace/bitstream/2115/27557/1/19\(1\)_P125-162.pdf](http://web.archive.org/web/20170818210542/http://eprints.lib.hokudai.ac.jp/dspace/bitstream/2115/27557/1/19(1)_P125-162.pdf)
Kenji Hashizoe, Alistair MacEwen, & Sue Western. 2007. Buddha, Bees and the Giant Hornet Queen, *BBC Natural World* (TV Series). Available from <https://www.dailymotion.com/video/x6bbkeb>

- 3 Yanagawa, Y., Morita, K., Sugiura, T. & Okada, Y. 2007. Cutaneous hemorrhage or necrosis findings after *Vespa mandarinia* (wasp) stings may predict the occurrence of multiple organ injury: A case report and review of literature. *Clinical Toxicology*. 45:7, 803-807 Available from DOI: 10.1080/15563650701664871
- 4 Mizuno, K., Asano, K., Abe, T., and Morishita, K. 2019(?). Effects of Ingestion of Hornet Larval Salivary Amino Acid

Mixture on Metabolic Responses during Exercise. <https://www.hornetjuice.com/study-2/>

A video synopsis of the AGH extraction/extirpation exercise is available at <https://youtu.be/DXZeS1g7oxM>

"Slap, snap, zap & wrap" poster is available at http://beesforbabar.org/pdf/20190923slap,snap,zap&wrap_legal.pdf

- 5 2018. Asian Hornets: Lead Me to the Nest. *American Bee Journal*. September. v. 158, no 9, p 1033 <https://americanbeejournal.com/asian-hornets-lead-me-to-the-nest/>
- 6 Matsuura, M and Sakagami, S.F. *ibid*
- 7 Eckert, J.E. 1933. The flight range of the honeybee. *Journal of Agricultural Research*, v. 47, no. 8, p 257-285 <https://naldc.nal.usda.gov/download/IND43968380/PDF>

for supplemental video see https://youtu.be/jHeA_E7NB3s



Alien Giant Hornet Invasion!

If you think you see an Asian giant hornet...

SLAP! it with a stick to kill it

SNAP! a photo of it

ZAP! an email off to info@bcinvasives.ca & nanaimobeekeepers@gmail.com

& WRAP! it in a ziplock bag & freeze it, in case the sample is needed

Please exercise care around hornets & yellow jackets, especially if you encounter a nest. As with any stinging insects follow this general rule:

**If stings have been nil,
It's best to stand still,
But once you've been stung,
Cage your eyes and just run.**



Vespa mandarinia is a large non-native hornet that feeds on large insects, especially honey bees, and could endanger our already beleaguered pollinators. Were it to become established it could represent a significant risk to public safety as the stings are quite painful and commonly lead to injuries requiring medical treatment.

For further info see: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/animal-and-crops/plant-health/pest_alert_asian_hornet.pdf