Scientific Note-- Alien Invasion Thwarted: nest of Asian Giant Hornet, *Vespa mandarinia* extirpated in Nanaimo, BC. Conrad Bérubé

The Asian Giant Hornet (AGH), *Vespa mandarinia* is the largest eusocial wasp in the world (workers are about 3.5 cm in length and queens 4-5 cm). Nepal is the northwestern 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 eusocial carnivore which preys on many insects but, in particular, on other eusocial insects, especially honey bees.

The Western honey bee, *Apis mellifera,* did not coevolve with *V. mandarinia* and has little effective defense strategies against it. A concerted attack by several dozen workers of *V. mandarinia* can destroy an entire colony of more than 25,000-30,000 *A. mellifera* in a matter of a few hours[i]. Thus, the establishment of *V. mandarinia* in British Columbia would represent a substantial threat to the beekeeping industry already beleaguered by the Varroa mite and pesticide exposure.

In addition, *V. mandarinia* will vigorously defend the area around its nest against human incursions. The sting mechanism of *V. mandarinia* is approximately 6 mm long and can penetrate through leather work gloves or multiple layers of clothing. A single sting can cause tissue necrosis for several millimeters in radius and depth—as well as the pain and swelling typically associated with hymenopteran venom. People receiving multiple stings often require medical attention and massive stinging (10+) or allergic reaction may result in serious symptoms including death. In Japan, *V. mandarinia* is responsible for approximately 40 deaths each year[ii]. Hence, aside from impacts to beekeeping and other aspects of the 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 two alarmingly large wasps harassing honey bees at the entrance to one of his hives. He collected the specimens and sent his unfamiliar find to the provincial apiculturist, Paul van Westendorp, who identified them as 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 of *V. mandarinia* had been established in Nanaimo. This was the first confirmed record of the species being found in North America. These and other subsequent finds were reported to the Invasive Species Counsel of British Columbia which was coordinating intergovernmental efforts to monitor and eradicate the hornets.

van Westendorp contacted hobby beekeepers in Nanaimo to enlist their assistance in monitoring for the hornet. On the evening of September 18, 2019, as advance work for

a systematic search being planned, John and Moufida Holubeshen roughly triangulated the most likely site for a nest to a wooded path in the south western portion of Nanaimo (49.149521, -123.943553). While walking along the path, John Holubeshen saw suspected *V. mandarinia* flying above the trail every three to five seconds. They followed the flight path and located the ground nest entrance, while still on the trail, and some five meters from it. As they observed the hornets from that distance to the otherwise undisturbed colony, John was stung through his shirt (which he described as feeling like a kick to the chest). They then contacted Peter Lange, President of the Nanaimo Beekeepers Club, of which they are also officers, and Conrad Bérubé, another local beekeeper, who has experience, and equipment for, collecting entire colonies of several species of yellow jackets for the pharmaceutical preparation of desensitization serum.

The rapidly assembled team girded themselves in standard beekeeping equipment and gathered near the nest site. Bérubé, who was to conduct the actual extraction, also bore additional protection, including a Kevlar vest and bracers of the type commonly used to guard against chainsaw injury, as well as two pairs of pants. Carbon dioxide and isopropyl alcohol (physical controls that are exempt from the provincial restrictions to the use of chemical pesticides on public land) were used to subdue and preserve the wasps during (leather gloved) hand extraction of the wasps and comb. (A domestic aerosol wasp and hornet foam--again exempt from provincial restrictions-- was applied to the base of the nest cavity before it was refilled with excavated soil.) Bérubé took at least seven “false stings”, through clothing, which, generally, prevent delivery of a full load of venom. Nonetheless, the initial pain was described as "similar to having red hot thumb tacks driven into the flesh". It is likely that individuals who are not beekeepers, like Holubeshen and Bérubé who have developed some tolerance to hymenopteran venom, would have had more severe reactions to stings of *V. mandarinia*. Four dinner-plate-sized combs, consisting of roughly 400 cells, containing brood, including developing reproductives, were removed from the nest-- along with about two hundred workers and the queen. Specimens have been distributed for study to the BC Museum of Natural History, Ministry of Agriculture, Ministry of Environment, CFIA and University of British Columbia).

Like other eusocial wasps, nests are annual, founded by a single gyne, which mates in the fall and then overwinters in a sheltered locale from which she seeks a nesting site in the spring. There is no means of ascertaining how the introduction occurred, but it is quite possible that a mated gyne arrived in a cranny of a shipping container or imported goods and, hopefully, our efforts have resulted in the extirpation, of the hornets' temporary beachhead. Despite much media attention, the only confirmed sightings of *V. mandarinia* following the extraction were straggler workers that had returned to the original nest location (which had become much more prominent from the digging operation).

[i] 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

[ii] 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 repoeach rt and review of literature. *Clinical Toxicology.* **45:**7, 803-807 Available from DOI: 10.1080/15563650701664871

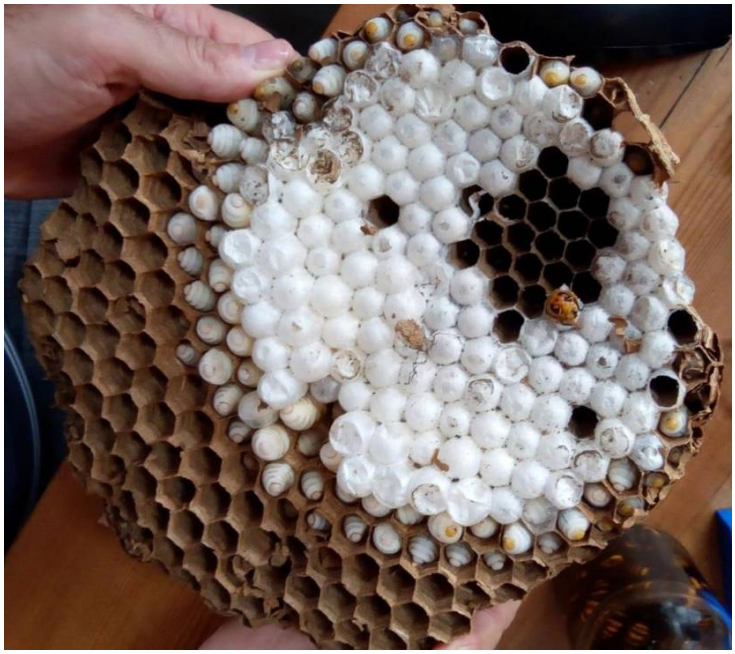
A video synopsis of the AGH extraction/extirpation exercise is available at https://youtu.be/DXZeS1g7oxM

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

Clockwise from top *V. mandarinia* worker, *V. mandarinia* queen, *Vespula germanica* worker, *Apis mellifera* worker. Photo Credit: Conrad Bérubé

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

Conrad Bérubé extracting CO_2 anesthetized V. mandarinia from ground nest.
Photo Credit: Moufida Holubeshen



Vespa mandarinia life stages in extracted comb. Photo Credits: Conrad Bérubé