

Background

“Their attack starts with a “slaughter phase” in which they serially bite the heads off bees with their large mandibles, within 90 minutes, a small group of Asian hornets can destroy an entire colony’s workers [sic honeybees] this way. They occupy the honeybee nest for up to a week or longer, feeding on the pupae and larvae. They then feed it to their own young.

Chris Looney, Entomologist,
 National Geographic Interview, May 2020

Problem

The Asian giant hornet, an invasive species from Asia, are a major threat to honeybees. Nicknamed by the press, “murder hornets”, their collective and successful mechanism of killing entire hives has been flashing on the radar in many counties. Honeybees aid the ecosystem that many animals rely upon and with the ongoing environmental battles honeybees fight, the Asian Giant Hornet increases the mortality of such a keystone species. With the recent introduction in the Pacific Northwest, the threat they pose on such an economically resourceful insect is alarming. An individual Giant Asian hornet can kill many bees at a time, but with three or more hornets, they can ultimately eliminate a whole honeybee hive in a matter of a day.

Honeybees are essential for the pollination of flowers, fruits and vegetables. Worldwide, economic value of pollination worldwide is about \$153 billion dollars (Gallai et. al., 2009). Asian giant hornets can destroy a whole hive within a few days, leaving many species susceptible to starvation. The critical threat the Asian giant hornet pose to agriculture and economic gain from the work of bees is a global concern; but especially to those of the Pacific Northwest, where Asian Giant Hornets were first reportedly observed in the United States.

Empirical Question:

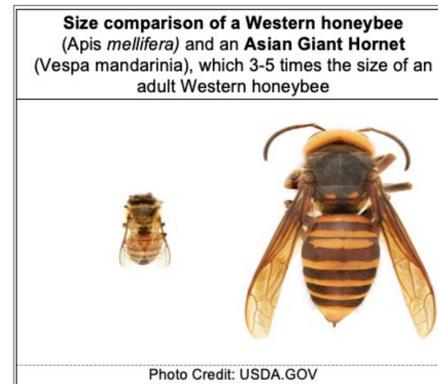
Are there vulnerability factors that make one hive more susceptible to AGH predation (or colonization) than another?



Proposed Method

Target Species

The Asian Giant Hornet (*Vespa mandarinia*) ranges in size from 1.5-2 inches long. They have a black and dull striped abdomen that is accompanied with a large yellow and orange head. In contrast, the Western honeybee (*Apis mellifera*) ranges in size from 0.3–0.7 inches long. They have red/brown bodies with black bands distributed throughout the abdomen.



Materials

The materials for this project will include 20 wireless Nest™ Cam Outdoor Security Cameras will be used for video data collection each outfitted with vertical mounts. The Nest camera series are IP65-rated with a sensor to capture 1080p video up to 30 fps. The Nest application can be downloaded and viewed on Mac iOS and Android devices or logged in from a computer to view live video footage of the hives. For those homes without Internet access or WiFi, a Nest™ WiFi Router will also be installed for the length of the study. The beekeeper and hive demographic survey will be administered through Qualtrics™ online survey application.

Design and Procedure

A solicitation letter will be sent to the American Beekeeping Federation (ABF) requesting their support with a description of the proposed project, including the value, how it benefits their keepers, the beekeeping community and the time required for the citizen science volunteers (keepers).

When a keeper returns a survey or contacts the investigator to inform them of a suspected AGH sighting, the investigator will drive to the keeper’s residence to install the Nest camera or, if they do not consent to the install, they will be Express Mailed the equipment, and the equipment loan document (a lawyer will be consulted for this). If the participant requires instructions for installation, the investigator is available to walk them through the install via the phone or through Zoom. Once the camera is in place and the WiFi footage is live, data collection will be used to assess the behavior of the honeybees in the beehive when occupied by one or more Asian Giant Hornets. The Nest cameras will stream 24-hours to the Nest cloud (part of the package). A survey link will be sent to the beekeeper to provide information about the age and design of the hive (e.g., Langstroth, Top bar, or Warre hive), location, geographic features, GPS coordinates, as well as environmental information during the colonization (i.e., temperature, precipitation, pollen count, wind speed and direction, etc.).

Proposed Results

In order to assess the empirical question of whether hive features contribute to the vulnerability of colonization or increased their risk of a AGH predation, a Chi Square Test of Independence will be performed using Spearman’s rho correlation between nonparametric ordinal variables (e.g., age, design of hive, location, environment). Additionally, the survey will be analyzed so a descriptive table and bar chart can illustrate the most reported characteristics of a hornet colonized hive. By using the proposed research, this may aid honeybees from their potential eradication due to the constant threats they are prone to by the Asian giant hornet.

Conclusions

The current economic impact of the Asian giant hornet includes not only hive size reductions up to 50% and the loss of 18–30% of honeybee hives, but also the loss of honeybee-derived products and pollination services. (Rankin, 2021).

The spread of the Asian Giant Hornets is a global concern, utilizing methods to resolve the mortality rates of honeybees due to the prey-preference of Asian Giant Hornets can include: AGH removal, honeybee hive relocation, redesigning hives to reduce their vulnerability. Beekeepers in Asia have implemented strategies to deter attacks and some or all these strategies can be practiced in North America. Honeybee predation is not only a conservation concern also an economic one, honeybees are necessary for successful crop production. Given the potential negative impacts, extensive monitoring and eradication efforts are warranted throughout North America (Zhu et. al., 2020).

Select References

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A complete list of references available upon request