Bee Alarm Signals Significantly More Sophisticated Than Previously Believed

Biologists have found that the alarm signals that honey bees use to warn fellow nest mates about imminent attacks vary depending on the size and distance of predators.

By Christine Hsu | Mar 27, 2016 02:47 PM EDT

Biologists found that the alarm signals honey bees use to warn fellow nest mates about imminent attacks vary depending on the size and distance of predators. (Photo : Pixabay Commons)

Alarm signals that honey bees use to warn fellow nest mates about imminent attacks are more sophisticated than previously believed, according to new research.

A new study conducted at the University of California, San Diego reveals that a certain species of Asian honey bee is capable of producing different vibrational "stop signals" during predatory attacks. Scientists found that these stop signals, delivered via vibrational head-butts from one bee to another, appear to produce different effects depending on the type of danger and context.

"Surprisingly, this signal encodes the level of danger in its vibrational frequency, its pitch, and the danger context through the duration of each pulse," said James Nieh, biology professor at UC San Diego.

In a previous study, Nieh and his team found that foragers of the Apis mellifera, a species of honey bee in Europe, return to their nests to deliver stop signals after being attacked at a food source. Researchers had known that these stop signals inhibited recruitment, but they had no idea what triggered them.

"Stop signals are usually delivered by a sender butting her head into a recipient. Understanding that these signals can be triggered by danger and reduce recruitment for dangerous food therefore made sense," Nieh said.

To see if other honey bee species delivered stop signals, the researchers experimented with the Asian honey bee, Apis cerana. They said that these honey bees are great for studying the effects of predator threats because they share their habitat with multiple species of giant hornets.

"We hypothesized that bigger predators would pose a bigger threat and would change stop signaling, perhaps by producing more signals when attacked by a large predator," Nieh said. "However, we were very surprised to find that these Asian bees not only produced more stop signals, they also produced different kinds of stop signals."

Experimental results revealed that attacked foragers reduced recruitment-inducing "waggle dancing" and produced stop signals. However, the most surprising finding was that larger and more dangerous predators triggered higher pitched stop signals. Nieh and his team noted that higher pitch stop signals were significantly more effective at stopping waggle dancing compared to lower pitched stop signals.

"Our experiments showed that these different types of stop signals elicited different and appropriate responses. Bees attacked at food sources by bigger hornets produced a kind of stop signal that more effectively inhibited recruitment," Nieh **explained**. "Bees attacked at the nest entrance produced another kind of stop signal that inhibited foragers from exiting the nest and being exposed to the danger outside."

Nieh and his team also found that bees attacked that at the nest entrance produced longer duration stop signals to warn other bees about the danger lurking outside their nests.

The findings are published in the March 25 issue of the **journal** PLOS Biology.