Detecting explosives with honeybees

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Scientists at Los Alamos National Laboratory have developed a method for training the common honey bee to detect the explosives used in bombs.

Based on knowledge of bee biology, the new techniques could become a leading tool in the fight against the use of improvised explosive devices, or IEDs, which present a critical vulnerability for American military troops abroad and is an emerging danger for civilians worldwide.

By studying bee behavior and testing and improving on technologies already on the market, Los Alamos scientists developed methods to harness the honey bee's exceptional olfactory sense where the bees' natural reaction to nectar, a proboscis extension reflex (sticking out their tongue), could be used to record an unmistakable response to a scent.

Using Pavlovian training techniques common to bee research, they trained bees to give a positive detection response, via the proboscis extension reflex, when they were exposed to vapors from TNT, C4, TATP explosives and propellants.

According to Tim Haarmann, principal investigator for the Stealthy Insect Sensor Project, the project applies old knowledge to a pressing new problem. Haarmann said, “Scientists have long marveled at the honey bee's phenomenal sense of smell, which rivals that of dogs,” said Haarmann. “But previous attempts to harness and understand this ability were scientifically unproven. With more knowledge, our team thought we could make use of this ability.”

The team that Haarmann put together began with research into why bees are such good detectors, going beyond merely demonstrating that bees can be used to identify the presence of explosives. By looking at such attributes as protein expression, the team sought to isolate genetic and physiological differences between those bees with good olfaction and those without.

They also determined how well bees could detect explosives in the presence of potentially interfering agents, such as lotions, motor oil, or insect repellant. In addition, the team studied structural units in the honey bee's antenna and looked for biochemical and molecular mechanisms that could advance their ability to be trained and retain their training for longer periods of time.

Source: DOE/Los Alamos National Laboratory