Study shows how beetle larvae adapt to different bee hosts

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H. miserabilis with larvae. Credit: Leslie Saul-Gershenz.

A team of researchers at the University of California has discovered adaptations made by a species of beetle to survive in different geographic locations. In their paper published in *Proceedings of the*

National Academy of Sciences, the group describes their study of a parasitic blister beetle and their digger bee hosts living in different areas on the West Coast of the United States.

Blister beetles have evolved in a unique way. Their larvae emit chemicals that smell like a female bee to a male bee. When a male shows up ready to mate, the larvae attach themselves to his body and are carried off when he flies away. When a larvae-carrying male bee encounters a real female bee and engages in copulation, the larvae move from the male to the female bee. After copulation, the larvae remain attached to the female bee until she lays eggs. At that point, the larvae release themselves from the female and make their way into her nest—and once there, they consume the eggs she has laid and the food she has gathered for her offspring. The larvae remain in the nest until they grow to adults. In this new effort, the researchers wondered how the same species of blister beetle might adapt with access to different hosts. To find out, they studied two male bee hosts, one called H. miserabilis, which lives on Oregon's coast, and the other called H. pallida, which lives in the Mojave Desert in California.

Larval aggregates of M. franciscanus. Credit: Leslie Saul-Gershenz.

The researchers found that the males were more attracted to local beetle larvae than they were to larvae from another area. They suggest this indicates that the larvae have adapted by changing the chemical composition of the pheromones they emit. The researchers also found that the beetles deposited their larvae at heights related to the cruising altitude of local male bees, a physical adaptation meant to give their larvae the best chance of attracting a male bee host.

The researchers note that their work demonstrates that parasites can evolve in ways that give them an advantage when faced with different hosts.

H. pallida with larvae. Credit: Leslie Saul-Gershenz.

More information: Leslie Saul-Gershenz et al. Deceptive signals and behaviors of a cleptoparasitic beetle show local adaptation to different host bee species, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1718682115

Abstract

Chemosensory signals play a key role in species recognition and mate location in both invertebrate and vertebrate species. Closely related species often produce similar but distinct signals by varying the ratios or

components in pheromone blends to avoid interference in their communication channels and minimize cross-attraction among congeners. However, exploitation of reproductive signals by predators and parasites also may provide strong selective pressure on signal phenotypes. For example, bolas spiders mimic the pheromones of several moth species to attract their prey, and parasitic blister beetle larvae, known as triungulins, cooperatively produce an olfactory signal that mimics the sex pheromone of their female host bees to attract male bees, as the first step in being transported by their hosts to their nests. In both cases, there is strong selection pressure on the host to discriminate real mates from aggressive mimics and, conversely, on the predator, parasite, or parasitoid to track and locally adapt to the evolving signals of its hosts. Here we show local adaptation of a beetle, Meloe franciscanus (Coleoptera: Meloidae), to the pheromone chemistry and mate location behavior of its hosts, two species of solitary bees in the genus Habropoda. We report that M. franciscanus' deceptive signal is locally host-adapted in its chemical composition and ratio of components, with host bees from each allopatric population preferring the deceptive signals of their sympatric parasite population. Furthermore, in different locales, the triungulin aggregations have adapted their perching height to the height at which local male bees typically patrol for females.