Smell-wars between butterflies and ants

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Among humans, making yourself smell more alluring than you really are is a fairly harmless, socially accepted habit that maintains a complete perfume industry. However, it is a matter of life and death for caterpillars of large blue butterflies that dupe ant workers into believing them to be one of the ant's own larvae. In a publication in the journal Science this week , researchers from the Centre for Social Evolution (CSE) at the University of Copenhagen show that caterpillar deception is also a matter of smell, and that there is an ongoing co-evolutionary arms race in smell similarity between cheaters and their victims.

Most people are familiar with animal confidence tricksters such as cuckoos, which grow up at the expense of 4-5 chicks of hapless songbirds. Less well known, but at least as spectacular, are the large blue butterflies of the genus Maculinea, whose larvae are adopted by ant colonies and deceive the ants into feeding them while letting their own brood starve. Jutland, and the island Læsø in particular, are among the last European strongholds of one of these species, the Alcon blue, which has enabled researchers from the CSE to study these spectacular butterflies in great detail.

David Nash, Jacobus Boomsma and colleagues show that superb chemical mimicry manipulates the ants into neglecting their own brood to care almost exclusively for their caterpillar parasites, but also that the ant hosts can evolve resistance against this exploitation by changing how they smell. However, this only works when the host ants that live close to the initial foodplant of the caterpillars, the rare marsh gentian Gentiana pneumonanthe, do not interbreed with ants from neighbouring sites

where the gentian does not occur. In the sites without the foodplant, ant colonies are never parasitized, so ants do not evolve resistance. Any resistance that has evolved in areas with butterflies is not effectively passed on to future generations because it is diluted by the flow of non-resistant genes from the uninfected areas.

In their study, the CSE researchers show that the two red ant species of the genus Myrmica that are host for the Alcon blue in Denmark differ dramatically in their degree of gene-flow among neighbouring sites, even though they live in the same gentian patches. Exactly as expected from evolutionary theory, they demonstrate that selection for resistance only works when the ant queens mate locally with males from colonies that have likewise suffered from butterfly parasitism.

With this study, the CSE researchers show that a study that was initially inspired by an interest in the suitable conservation of these large blue butterflies in Denmark can give important insights into the fundamentals of evolutionary biology. They achieved this result by an interdisciplinary collaboration with a British group of chemists, specializing on the study of chemical profiles on the surface of insects.

Source: University of Copenhagen