On the Finding of Dead Ants Attached to Saturniid Caterpillars: Evidence of Successful Deterrent Chemistry?

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ON THE FINDING OF DEAD ANTS ATTACHED TO SATURNIID CATERPILLARS: EVIDENCE OF SUCCESSFUL DETERRENT CHEMISTRY?

Additional key words: ant predation, anti-predator mechanism, chemical defense

Hyalophora cecropia (Saturniidae) is one of the most prominent natural history icons of North America, widely used to teach insect life history in schools and collected and reared by amateur naturalists for generation upon generation. The larvae are as striking as the colorful adults, and display a vivid array of scoli colors, which change with instar. Yet, until very recently, no reported evidence has appeared that the larvae are in any way toxic. As any breeder knows, larvae of all ages appear all too vulnerable to a host of predators and parasitoids (Collins & Weast 1961, p. 84; Tuskes et al. 1996).

Deml & Dettner (2003) discovered an unexpected chemical defense in cecropia larvae. Each scolus is associated with a secretory gland, the complex chemistry of which predictably varies by scolus color and instar. Their conclusion, based also on previous work (Deml & Dettner 1990, 1993, 1997), is that these chemicals are defensive, are released when small spines are broken off a scolus during an attack, and are directed against a sequence of instar-specific predators.

Their work also showed that the chemistry of the body haemolymph in *Hyalophora* does not contain these characteristic chemicals. Human skin seems unaffected by the larval chemistry of scoli, unlike the effect of urticating spines in other saturniid larvae such as the Hemileucinae. There is one obscure record of a robin apparently killed when attempting to eat a mature *H. columbia gloveri* larva (Duncan 1941).

On August 15, 2011 I collected a near-mature *Hyalophora* larva on coyote willow (*Salix exigua*) at 1700 m near a creek flowing into a small canyon along highway 89, just west of US 395. This area is at the eastern edge of a hybrid zone, across Monitor Pass, between *H. c. gloveri* and *H. euryalus*. The larval phenotype was intermediate between these two species; it possessed the spiny scoli typical of *gloveri*, although somewhat reduced in size. Upon close inspection I noticed a dead ant attached to the second thoracic segment, right side, near scolus L_1 (Fig. 1). The ant's abdomen was shrunken, indicating that the ant had remained attached for some days (the fifth instar in *Hyalophora* typically lasts for 7–12 days in the wild). After photographing the larva in the field, I left the ant attached to monitor the health and growth of the larva. It fed normally and spun a cocoon in 5 days. The head of the ant remained attached, but unfortunately the body of the ant became dislodged and lost before I could bring the larva into my lab. Under the microscope I noticed a single spine broken off each of two nearby scoli. From my photographs ant experts Phil Ward (Dept. Entomology, Univ. Calif. Davis) and James Trager (Shaw Nature Res., Gray Summit MO) identified it as belonging to the *Formica rufi* species group, probably either *F. ravida* or *F. moki.*

Surrounding the ant and along that side of the body of the larva were the dried remnants of what appeared to be regurgitated gut contents. *Hyalophora* larvae are not known to regurgitate gut contents unless severely attacked, but when this does occur the larva will curl its body toward the attacker and thrash about. My interpretation is that this action may have killed the ant by

Fig. 1. *Formica* ant (dead) attached to *Hyalophora* larva, Monitor Pass, Mono Co. CA. Note brown stains of dried regurgitant surrounding ant.

Fig. 2. Dead *Formica* (white arrows) attached to *Hemileuca eglanterina*, Monitor Pass, Mono. Co. CA. A similar photograph appears in Tuskes et al., 1996, p.20.

piercing its body with a scolus spine, which broke off and released a toxin. There is no evidence that the gut contents of *Hyalophora* are unpalatable.

In July 1973, coincidentally also on Monitor Pass, near the summit at 2500 m, I photographed a mature larva of *Hemileuca eglanterina* on snowberry (Fig. 2). Attached to the larva were two dead ants, appearing to be the same species of mound-building *Formica* ant as that found on the *Hyalophora*. Again, the simplest interpretation is that the ants died as a result of encountering defensive chemistry, in this case produced by a stinging larva.

Certainly, more careful work needs to be done on the subject of ant predation on lepidopterous larvae. The research on the specialized association of ants with lycaenid butterflies is a fascinating exception, but given the paramount ecological role of ants in biotic communities (Hölldobler & Wilson 1994), the importance of predatory ants in regulating the abundance and distribution of Lepidoptera is poorly understood. Michael Singer (Dept. Biology, Wesleyan U.) is currently researching these topics in temperate regions, and in our discussions pointed out to me two interesting studies: Karhu (1998) on ant exclusion experiments in a boreal forest, and Dyer (1995) on assaying ant predation on protected vs. unprotected Lepidoptera larva in the tropics. Even simple observations of ant predation on captive larvae placed in the field—'staking out lambs in lion country'—would be worthwhile, as suggested for *Eupackardia calleta* (Collins, 2007, p. 41ff), based on its blood chemistry and aposematic coloration. I hope this short note will stimulate further work.

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