Kleptoparasitism, a very unusual relationship between a spider, its bee prey and some clever, opportunistic flies

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Abstract

The paper presents a field observation of kleptoparasitic behavior of a fly species, with multiple individuals congregating on a bee caught by a crab spider. This event was observed several times, in different places, around the city of Brasov, Romania, always in cool and wet weather. A few brief notes from the literature are presented as to some possible chemical mechanisms of this behavior.

Additional Key Words: animal behavior, invertebrate behavior, insect feeding strategies

During a visit to Braşov in June 2002, I witnessed a most unusual and intriguing scene on the Lempeş Hills and on Mt. Tâmpa. In both places the wild flowers were in full bloom and the grass unmowed. As is customary for this time of the year in Brasov, the temperature was mild (16-18° C) with periods of warm sunshine interrupted by frequent afternoon showers.

In one late afternoon, the weather was clearing after an earlier shower. In a wet meadow of the Lempeş Hills I saw a male crab spider (*Thomisus* sp.) on a purple *Centaurea* sp. flower with a bee, *Apis mellifera* Linnaeus 1758, hanging from its fangs. No doubt, the spider caught this bee earlier and was in the process of consuming the meal. The strange fact was that this bee was covered entirely by a blanket of small flies, each 1-2 mm. There was also a cloud of the flies hovering around the bee, waiting for a landing place. This movement gave the bee an eerie appearance of fluidity. The spider did not seem to be bothered by the winged visitors. I witnessed the same event two more times on Mt. Tâmpa, also in the wet atmosphere after a shower and involving the same *Thomisus* sp. spider (females on these occasions) with their heminopterous prey on the *Centaurea* sp. flower covered by the blanket and cloud of small flies. Unfortunately, neither time did I have a camera with me so I could not photograph any of these events. I collected the one complex from Lempeş and one also from Mt. Tâmpa with the spider, its prey and the attending flies, killed them by refrigeration and deposited them at the Natural History Museum "Grigore Antipa" in Bucharest for identification and preservation. Noteworthy is the fact that whenever I saw this event it was in the cool and wet weather after a rain. Never was I able to see it in dry, sunny time. I did see *Thomisus* sp. feeding on *Apis mellifera* on *Centaurea* sp. flowers in full sun but no flies came to share the meal unless it was after a rain.

Kleptoparasitism is an animal behavior of obtaining food or nesting materials by stealing from another animal, either intraspecific or interspecific. It is widespread and well- recorded in birds, fish as well as reptilians and mammals.

Most observations of kleptoparasitic arthropods have been documented with spiders. Many *Argyrodes* species live on larger spiders' webs and feed on their prey (Agnarsson, 2002). Instances of phytophagous fly kleptoparasitism have been recorded in gall-forming *Lipara* species (Reader, 2003). Irina Brake created a web page with the biology of Milichiidae, a family of kleptoparasitic flies. This page has two photos by Robert Copeland of predator (mantiid and crab spider) with prey (bee) and flies. It is accessible at the following address: www.sel.barc.usda.gov/Diptera/people/ibrake.htm

Kleptoparasitic behavior has been described in several fly families e.g. Cecidomiidae, Chloropidae, Milichiidae, Phoridae.

Recently, in his book "For Love of Insects", Tom Eisner (2003) describes his observations and studies of kleptoparasitic flies. His experience revolved around *Nephila* spiders catching pentatomid and coreid hemiptera and attracting milichiid flies. With some very elegant experiments he was able to show that secretions from the dead prey actually attracted the flies. He isolated the attractant as Trans-2-hexanal, which is secreted by the live pentatomid and gives it its characteristic pungent odor. The *Apis mellifera* prey from my observations is not known to have Trans-2-hexanal secretions, so it remains a

mystery what kind of signal the flies were using to find their meal in the spider's fangs.

A noteworthy observation is that almost only female flies are involved in kleptoparasitic behavior, at least in the milichiid family (Brake). This suggests a similarity with female mosquitoes, which need a mammalian blood meal to be able to lay their eggs. Could milichiid females need a concentrated, liquefied protein meal for reproductive purposes also?

There are reports of prey caught by other predators (e.g. Reduviidae, Mantidae) that also attract kleptoparasitic flies. Interestingly, while reduviids have similar feeding habits with spiders of injecting digestive juices in their prey and subsequently sucking up the nutrient soup, the mantids chew up the prey with their strong mandibles. The externalized digestion manner takes prolonged time and has the propensity of spreading chemicals that could act as attractants to flies. In contrast, the chewing and swallowing method takes much less time and does not spread chemicals. Hence, the question arises of how the flies are able to quickly find a meal that is chemically silent. The explanation may lay in the observation that frequently the fly rides on the predator for a while (Brake). Upon achieving a successful hunt, this "scout" could send out some signals that attract the cohorts to the table.

Obviously, much remains to be learned about the interactions between species in the wild. The arthropod kleptoparasitism is an intriguing behavior that has only recently started to be reported and understood. With further observations and studies, it is likely to turn out to be a widespread and fundamental life aspect of many organisms.

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