MASKED CHAFERS, CYCLOCEPHALA PASADENAE
CASEY (COLEOPTERA: SCARABAEIDAE),
ARE POISONOUS TO SPIDERS

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ABSTRACT

The adult masked chafer, Cyclocephala pasadenae, is shown to be lethal when eaten by a variety of spiders. The beetles were from Lubbock, Texas. Fatalities in the pest spider, Latrodectus hesperus, were noted within 12 h of feeding. Preliminary study indicates that some individual spiders are apparently able to detect the toxin(s).

A variety of beetle families are known to have mechanical and chemical defenses (Evans 1975; Crowson 1981; Witz 1990). The majority of these chemical defenses are the use of such products as repellents. Chemical toxicants are known in only a few beetles. Some blister beetles (Meloidae), which contain especially high amounts of cantharidin, are toxic to vertebrates. Pupae of Nga beetles (Diamphidia locusta, Chrysomelidae) are used by hunters in the Kalahari desert in making poison arrows (Evans 1975). The toxic effect of D. locusta compounds is secondary to their importance as a repellent in living beetles. Chemical toxicants are essentially unknown in members of the Scarabaeidae. Borror et al. (1981) stated that the rose chafer, Macrodactylus subspinosus (Fabricius), when eaten by poultry could cause the birds to become extremely ill and often resulted in death of the birds. Unfortunately, further details on rose chafer toxin(s) are not available.

During the spring and early summer of 1991, I observed mysterious deaths of otherwise healthy spiders which I was maintaining in a variety of jars, boxes, and terraria. During this period, insects collected around porch lights at my home in Lubbock, Texas, were used as food for the spiders. Only after Cyclocephala pasadenae (Scarabaeidae) became the majority of insects collected did I notice the correlation with spider deaths. Spiders which had eaten C. pasadenae and died were from several localities and represented a variety of unrelated taxa: Ummidia sp. (Ctenizidae), Tishomingo State Park, Tishomingo Co., MS; Aphonopelma harlingena (Chamberlin) (Theraphosidae), 20 mi. NW McCook and McAllen, Hidalgo Co., TX; Aphonopelma spp., 1 mi. E Sherman, Grayson Co., 2.2 mi. NW Dermott, Scurry Co., 2.4 mi. NW Justiceburg, Garza Co., TX; Leptocenus byrrhus Simon (Ctenidae), Benton State Park, Hidalgo Co., TX; Lycosa tarantula (Linné) (Lycosidae), Madrid, Spain; Latrodectus bishopi (Kaston) (Theridiidae), Ocala National Forest, Marion Co., FL; Latrodectus hesperus Chamberlin and Ivie, 10 mi. SW Clairemont, Kent Co., TX and Tucson, Pima Co., AZ; and Latrodectus mactans (Fabricius), Bridgeport, Wise Co., TX. In the case of tarantulas and large wolf spiders, more than one beetle was eaten per spider (exact numbers were not recorded).

METHODS

To verify my suspicions about the toxic nature of the beetles, I collected as many beetles as I could find and fed them to a series of the western widow
spider (*L. hesperus*). Because it was late in the season for adult beetles (21 July), only seven specimens (three males, four females) were obtained for the test. Click beetles (*Melanotus* sp.), collected at the same porch light as the *Cyclocephala*, were fed to control widow spiders. The *L. hesperus* (adult and penultimate females) were collected at: Lubbock (alley behind porch light), Lubbock Co.; 7 mi. SW Jayton, Kent Co.; 8 mi. SW Clairemont, Kent Co.; and 7 mi. E Post, Garza Co., TX. Beetles and spiders from the controlled experiments are deposited at the Florida State Collection of Arthropods, Gainesville.

Widow spiders were placed in bare, 12 oz, plastic glasses with plastic lids one day prior to the introduction of food, thus allowing the spiders time to spin webs. A single, living beetle was placed in each glass during the night.

**RESULTS AND DISCUSSION**

Control spiders caught and wrapped the click beetles and were observed to still be feeding upon them 12 h later. Additional click beetles were fed to the spiders as needed after one week. No deaths were observed within one month and four females constructed egg cases (one female on the night of the experiment, another female on 29 July, a third female on 23 Aug. and 11 Sept., and a fourth female on 23 Aug., 4 Sept., and 11 Sept.).

All test spiders which definitely caught and killed a chafer beetle were dead within 60 h. One spider (#1) died within 12 h of killing, wrapping, and presumably feeding on a chafer beetle. Three other spiders (#2, 3, 4) killed and wrapped the beetles within the first 12 h but cut the beetles from the webs. Two of these spiders (#2, 3) died within the next 12 h; the third spider (#4) survived an additional 24 h. After 36 h, two spiders remained. One spider (#5) had apparently not caught the beetle, as the prey continued to run around in the bottom of the container. The second spider (#6) had killed, wrapped and cut the beetle from its web some 24 h earlier. The living beetle was transferred to the second container, where the spider immediately killed, wrapped and began to feed upon the beetle. The second spider (#6) started feeding at 10 am, stopped feeding by 3 pm, and was dead by 9:30 pm the same day. The spider (#5) that had seemingly never caught a beetle lived for slightly over a week and its death might not have been because of an encounter with a chafer beetle.

Toxin(s) within the chafer beetle apparently can be noticed by some widow spiders because following capture and preparation of the prey, they stop feeding and cut the beetle from their web. In one case a spider (#6), which had rejected a beetle, made a lethal choice to feed upon a second beetle. The reason one spider (#5) apparently did not attempt to catch a chafer beetle is uncertain. Possibly some injury occurred when it was collected, resulting in its abnormal behavior and death.

The widow spider (#1) collected from the same area (within 50 ft) as the chafer beetles was no better able to detect the toxic nature of the beetles. In fact, this spider was the first to perish in the experiment.

Although some of the spiders mentioned above are exotic and would never encounter *C. pasadenae* in their native lands, other congeneric species from western Texas would. Many nocturnal spiders, especially the larger species from western Texas will capture beetles whenever possible. While collecting the beetles for the experiment, a single female, comb-foot spider [*Steatoda triangulosa* (Walckenaer) (Theridiidae)] was observed in its web near the porch light feeding on a chafer beetle. The next morning the spider was absent from the web. Judging from the number of arthropod remains in and below the
spider's web, this spider had a good site and would not ordinarily leave. The area below the web was covered in leaf litter and was not searched for the spider corpse (body length of ca. 4 mm). No new webs or spiders were observed in the general area. The comb-foot spider presumably died from the chafer beetle toxin(s).

Although these results clearly show C. pasadenae is deadly to some spiders, the mechanism is unknown. Some colleagues have suggested that the chafer beetles might have contained significant insecticide residues. Several arguments suggest otherwise. First, no pesticides had been used in my yard for several years. Granted, some beetles might have flown into my yard from neighboring areas but all of the beetles tested were toxic. Secondly, the recommended period for successful treatment of chafer beetle larvae in the Lubbock area is 15 July to 15 August (Dr. Pat Morrison, pers. comm.). Thus, the deaths of spiders noted in early summer and spring could not have been caused by the same agent if it were an insecticide. Thirdly, the click beetles, which were collected from the same locality, were not toxic. It is also unlikely that a beetle could retain sufficient insecticide residues to kill a widow spider without killing itself.

It is hoped this note will stimulate others to test the toxicity of C. pasadenae and related species of chafer beetles from other regions of the country. The unknown toxicant might lead to the development of a novel araneicide.

As Evans (1975) noted, a beetle that is poisonous to a predator will be better protected if it has a signal which proclaims this before being eaten. Bright color patterns are the answer for many species but such a cue will not work for a nocturnal species and its nocturnal predators that use non-sight cues. Unlike higher vertebrates, it is doubtful that a spider could learn to avoid a particular color or pattern. The only other scarab known to be toxic, the rose chafer, is likewise tan in color. One might wonder if some of the brightly colored, diurnal scarabs are signaling predators that they are inedible.

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LITERATURE CITED


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