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# ATTRACTION OF MIRIDAE AND LYGAEIDAE (HETEROPTERA) TO CANTHARIDIN

**Claudia Hemp & Konrad Dettner**

Chair of Animal Ecology II, NWI, University of Bayreuth, 95440 Bayreuth, Germany

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Various insects belonging to different orders are attracted by the vesicant, deterrent, and antifeedant cantharidin. Most canthariphilous insects are found within the heteromeran beetle family Anthicidae. Further cantharidin-baited species are known from the beetle families Endomychidae, Cleridae, Chrysomelidae, and Staphylinidae. In the beetle family Pyrochroidae, species from the subfamily Pedilinae and the Pyrochroinae are canthariphilous. The insect order Diptera is represented by the families Anthomyiidae, Cecidomyidae, Ceratopogonidae, Chloropidae, Platystomatidae, and Sciaridae. Parasites of the hymenopteran family Braconidae show a positive reaction to cantharidin, as well as species from the subfamily Diapriinae of the family Diapriidae. Chemical analyses of a fulgorid and a cicadid species revealed that also species of Homoptera may contain cantharidin (Van Hille 1954; Young 1984 a,b, 1989; Feng *et al.* 1988; Holz *et al.* 1994; Dettner 1997; Hemp *et al.* 1999; Hemp & Dettner, in press)

Known natural sources of cantharidin are Meloidae (Capinera *et al.* 1985, Blodgett *et al.* 1991) and Oedemeridae (Carrel *et al.* 1986, Nicholls *et al.* 1990, Holz *et al.* 1994) that contain this terpenoid as a haemolymph poison.

Many species from the heteropteran family Miridae are known to be attracted by cantharidin, also one species from the family Tingidae (Fox 1943; Church & Gerber 1977; Pinto 1978; Young 1984 a,b; Dettner 1997; Hemp & Dettner, in press).

In this note the results of cantharidin baiting in the Dominican Republic, Costa Rica, and Tanzania are presented.

To attract canthariphilous insects 10x10 cm plastic boxes were used, with gauze-covered inlets at two sides to guarantee an exchange of air. Small "T"-shaped plastic tubes were inserted through the gauze so that insects attracted by the chemical found their way into the trap but had difficulty escaping again. Synthetic cantharidin crystals dissolved in 100% acetone and applied to filter papers in the center of the traps served as attractant. In long-term baiting experiments the bait was renewed every three to four days. In Tanzania (Mt. Kilimanjaro), control traps without a bait proved the attractancy of cantharidin for no canthariphilous species was found in a control trap (for further details on trapping methods see also Schütz & Dettner 1992, Hemp *et al.* 1997).

*Dominican Republic*. Cantharidin traps were put out in ornamental gardens in January 1995 in the city of San Francisco de Macoris in the interior of the island (for two days and two nights) and near Sosua (Casa Linda), directly on the north coast (for about 10 days). In February 1993 cantharidin baits were exposed 80 km inland from the north coast (at 800 m altitude).

*Costa Rica*. A trap was put out in April 1994 in lush vegetation fringing the beach near Quepos, National Park Manuel Antonio, and in a garden at the hotel Mimo's in Quepos. In December 1992 trappings were made on the Osa peninsula near Marenco on the Pacific Ocean. The traps were positioned in the evenings and checked the following morning.

*Tanzania*. At Old Moshi / Kidia, Mt. Kilimanjaro, long-term baitings with cantharidin were made in the plantation belt at an altitude of 1430 m. From October 1989 to April 1990, November 1991 to March 1992, November 1995 to March 1996, November 1996 to March 1997, and October 1997 to April 1998, traps were continuously put out there. Further data on the collection at Old Moshi / Kidia are given in Hemp *et al.* (1997). However, bugs were noted

only in the years 1989/90 and 1991/92 during December and January.

Traps with the cantharidin baits were put into a dense hedge with *Tabernaemontana holstii*, *Syzygium guineense*, *Bougainvillea spectabilis*, *Caesalpinia decapetala*, *Rubus steudneri*, and *Euphorbia pulcherrima* bordering a meadow with sparse vegetation.

During baiting with cantharidin in Costa Rica and the Dominican Republic, a number of hitherto unknown bug species proved to be canthariphilous, belonging to the family Miridae, tribe Eccritotarsini.

On the Osa peninsula of Costa Rica in December 1992, synthetic cantharidin baits near Marenco on the Pacific coast attracted *Pycnoderes quadrimaculatus* and *Cyrtocapsus caligineus* (leg. Schwinger). Bait experiments in April 1994 near Quepos, also on the Pacific coast of Costa Rica, brought specimens of *Pachymerocista pilosus* and two *Sixeonotus* species (see Table 1). Most of the individuals caught in Costa Rica were attracted during the evening hours between 17.00 h and 20.00 h, some also in the morning hours between 6.00 h and 8.00 h. The individuals were observed sitting motionless on an aceton-cantharidin-solution impregnated filter paper. Some minutes after a bug sat down a yellowish patch appeared in the mouth area, obviously from saliva. On disturbance the bugs immediately flew away.

In January 1995 on the north coast (about 500 m from the shore, near Sosua) of the Dominican Republic, cantharidin traps attracted 64 specimens of *Pycnoderes quadrimaculatus*. The species *Pachymerocista pilosus*, which also occurrs in Costa Rica (Table 1), was attracted to cantharidin baits about 80 km inland from the north coast of the island (leg. Schwinger 1993).

Baits put out in the interior (San Francisco de Macoris) of the Dominican Republic attracted *Pycnoderes* species; 11 individuals of *P. vanduzeei* and 23 of *P. quadrimaculatus* were trapped in the evening hours (between 16.00 h and 20.00 h). *Pycnoderes quadrimaculatus* was also trapped near Sosua in 1995 and in Costa Rica in 1992, on the Osa peninsula. In the Dominican Republic, the species caught were the same as those from Costa Rica, all of the family Miridae, tribe Eccritotarsini.

During field study periods in East Africa (Tanzania, Kilimanjaro area), during 1989/90, 17 specimens of a lygaeid bug species were attracted to traps put out

TABLE 1. Canthariphilous Heteroptera from the families Miridae and Lygaeidae trapped in Costa Rica, the Dominican Republic, and Tanzania. N: number of attracted specimens.

| Family / species | Locality | N |
|---|---|---|
| Miridae | | |
| *Pycnoderes vanduzeei* Reuter | Dominican Republic, San Francisco de Macoris, Jan. 1995 | 11 |
| *Pcynoderes quadrimaculatus* Guerin-Melneville | | 23 |
| *Pachymerocista pilosus* (Carvalho) | Dominican Republic, north coast, 80 km inland from the north coast, Feb. 1993 | 28 |
| *Pycnoderes quadrimaculatus* Guerin-Melneville | Dominican Republic, north coast, Sosua, Jan. 1995 | 64 |
| *Pycnoderes quadrimaculatus* Guerin-Melneville | Costa Rica, Quepos, beach National Park Manuel Antonio | 14 |
| *Pycnoderes quadrimaculatus* Guerin-Melneville | Costa Rica, Marenco, Pacific Ocean, Osa peninsula, Dec. 1992 | 12 |
| *Cyrtocapsus caligineus* (Stål) | | 25 |
| *Sixeonotus* sp. 1 | Costa Rica, Quepos, garden of hotel Mimo's, Apr. 1994 | 20 |
| *Sixeonotus* sp. 2 | | |
| *Pachymerocista pilosus* (Carvalho) | | 12 |
| Lygaeidae | | |
| *Dieuches* sp. | Tanzania, Mt. Kilimanjaro, Kidia / Old Moshi, hedge at 1430 m, Dec. and Jan. 1989/90 and 1991/92 | 19 |

in a meadow at 1430 m at the slopes of Mt. Kilimanjaro. The traps were maintained continuously from end of October 1989 to mid-April 1990, but specimens were noted only from 22. December 1989 to 10. February 1990. Individuals of the species belonging to the genus *Dieuches* (Subfamily Rhyparochrominae, Tribe Rhyparochromini (Hanström & Brinck 1964)) were trapped in the evening hours (traps were checked at 7.00 h, 14.00 h, and 18.00 h). Bugs that could be caught after opening the traps were nymphs. Adults were very eager to fly and so escaped. The trap method used was meant to collect mainly *Formicomus* species (Coleoptera: Anthicidae) unable to fly (Hemp 1994, Hemp *et al.* 1997). The collected bug specimens from the periods 1989/90 and 1991/92 all proved to be nymphs at later checking of the vials.

During the second field study period in East Africa from November 1991 to March 1992, only in December 1991 were two nymphs trapped using cantharidin baits available during the whole period at the same locality as during 1989/90.

The function of the terpenoid cantharidin in the biology of cantharophilous Heteroptera remains unknown.

Miridae constitute by far the largest of all heteropteran families, with about 10.000 species worldwide (Schuh & Slater 1995). Many species live on plants juices, others are predatory or saprophagous. There are highly specialised species living for example on blood, honeydew or on robber spider webs (Schuh & Slater 1995). About 30 species from the genera *Caulotops*, *Cryptocapsus*, *Eurychilella*, *Hadronema*, *Halticotoma*, *Neuleucon*, *Pycnoderes*, *Sixeonotus*, *Sysinas*, and *Thentecoris* are known to be cantharophilous (Pinto 1978; Young 1984 a,b; Mafra-Neto & Jolivet 1994; Dettner 1997).

Saliva stains left by mirid species on the cantharidin-impregnated filter papers suggest that attracted bug species ingest the terpenoid, possibly using it for self-protection as do cantharophilous species of various other orders, e.g., Ceratopogonidae (Frenzel *et al.* 1992, Frenzel 1993), Pyrochroidae (Holz *et al.* 1994) or Anthicidae (Schütz & Dettner 1992, Hemp 1994, Hemp *et al.* 1997). This hypothesis is supported also by the fact that both sexes of the mirid species were attracted to the cantharidin baits, which is also reported for *Hadronema bispinosa* Knight from Arizona (Pinto 1978).

Lygaeidae are usually plant seed feeders or live on plant juices. Some species even feed on the blood of vertebrates (Schuh & Slater 1995), which is true for the dipteran family Ceratopogonidae as well, which also contains several cantharophilous species (Frenzel *et al.* 1992, Frenzel 1993). The function of cantharidin for *Dieuches* sp. remains obscure as no saliva stains were found on the paper baits. A role as an aggregation pheromone, as is suggested for species of the anthicid genus *Formicomus* (Hemp *et al.* 1997), seems improbable as mostly nymphs were attracted to the baits. It is expected that more lygaeid species will be found to be cantharophilous since several samples of cantharidin traps put out, e.g., at the Tanzanian coast, the Usambara mountains, and near Nairobi, Kenya, contained single specimens of different lygaeid species (Hemp *et al.* 1999, Hemp, unpubl. data).

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