

**REPORT OF *MILICHIELLA LACTEIPENNIS* LOEW  
(DIPTERA: MILICHIIDAE), ATTRACTED TO VARIOUS CRUSHED BUGS  
(HEMIPTERA: COREIDAE & PENTATOMIDAE)**

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**RESUMEN**

Diez especies en cuatro familias de hemípteros: Coreidae, Pentatomidae, Reduviidae y Rhyparochromidae fueron aplastadas con las manos para estudiar su atracción hacia *Milichiella lacteipennis* Loew (Diptera: Milichiidae). *Milichiella lacteipennis* fue atraída solamente a chinches de Coreidae y Pentatomidae, y en general más fuertemente hacia las hembras que a los machos. Cuando eran atraídas, el tiempo de la llegada del primer milichiido a los chinches aplastados tuvo un rango entre 2 a 34 segundos dependiendo del sexo y de la especie de chinche. Solo las hembras adultas de *M. lacteipennis* fueron atraídas a los chinches.

*Palabras clave: experimento de atracción, Milichiella, Coreidae, Pentatomidae, Reduviidae, Rhyparochromidae.*

**SUMMARY**

Ten species in four hemipteran families: Coreidae, Pentatomidae, Reduviidae, and Rhyparochromidae were crushed by hand to test their attraction towards *Milichiella lacteipennis* Loew (Diptera: Milichiidae). *Milichiella lacteipennis* was attracted only to bugs of the families Coreidae and Pentatomidae, and was generally more strongly attracted to females than males. When attracted, the time of arrival of the first milichiid fly to the crushed bugs ranged from 2 to 34 seconds depending on the species and sex of the bug tested. Only female flies of *M. lacteipennis* were attracted to the crushed bugs.

*Key words: attraction experiment, Milichiella, Coreidae, Pentatomidae, Reduviidae, Rhyparochromidae.*

**INTRODUCTION**

On August 5, 2009, the first author visited a pitaya farm in Restrepo, in the State of Valle del Cauca, Colombia, where he was shown a photograph in which many small shiny black flies had been

attracted to a freshly-killed coreid bug (Hemiptera: Coreidae). According to the orchard manager, the flies came almost immediately after he had crushed the coreid bug, which was feeding on a cladode of yellow pitaya, *Selenicereus megalanthus* (K. Schum. ex Vaupel) Moran

(Cactaceae). These flies were later identified as *Milichiella lacteipennis* Loew, and here we report our results of some basic attraction experiments we conducted on several species of bugs in four families.

**Family Milichiidae (Diptera).** The Milichiidae are small, mostly black acalyprate flies. The family contains about 340 species in 18 genera and is worldwide in distribution. The behavior of several species of Milichiidae is very specialized. For example, in some species the adults are myrmecophilous, whilst in some others they are kleptoparasitic, feeding on the prey of spiders or predaceous insects. *Milichiella lacteipennis* is one of these kleptoparasitic species.

***Milichiella lacteipennis* Loew.** *Milichiella lacteipennis* is cosmopolitan in distribution; it has been recorded in the New World, from southern Canada south to Chile and Argentina; southern Europe, Japan, Africa, Australia, and the Pacific islands (Brake 2009). *Milichiella lacteipennis* has been reared from the dung of various herbi- and omnivores (including birds) as well as various decaying plant matter. Adults were collected on carrion as well as on flowers of Anacardiaceae, Apiaceae, Araliaceae, Arecaceae, Asclepiadaceae, Asteraceae, Resedaceae, and Tamaricaceae. Male flies form swarms in the sunlight. The habitats in which *M. lacteipennis* has been collected include arid zones, beach forest, forest edges, mountain meadows, and ponderosa pine and meadows (Brake 2009, Brake 2010).

*Milichiella lacteipennis* has been reported associated with bugs of the families Coreidae and Pentatomidae. The species is known as a kleptoparasite on spiders with pentatomid bugs as prey (Krauss 1963, Lopez 1984, Landau & Gaylor 1987). Deeming & Báez (1985) reported these flies as seemingly feeding on secretions of the nymph of *Odius* sp. (Pentatomidae); and Krauss (1963) reported them as being attracted to *Nezara viridula* (L.) (Pentatomidae). *Milichiella lacteipennis* has been reported also as being transported on a squash bug (Coreidae) (Tucker 1917).

## MATERIALS AND METHODS

In order to collect and identify the flies, experiments were conducted at the La Cabaña orchard, in the municipality of Restrepo, located

at 1619 meters a.s.l., in the Department of Valle del Cauca, Colombia, where the photo was taken. The coreid bug species was identified as *Leptoglossus zonatus* (Dallas) (Hemiptera: Coreidae) from its morphological features. On August 13, 2009, twenty *L. zonatus* bugs were collected by hand on the leaves of maize plants grown at the Palmira research station of the Colombian Agricultural Research Corporation (Corpoica), located at 1,011 meters a.s.l. The bugs were put into a glass bottle with a mesh lid, and were taken to the laboratory where they were kept in a large (120 cm x 60 cm x 60 cm) rearing cage covered by mesh on all sides. The cage contained yellow pitaya cladodes and fruit on which the coreid bugs fed. On August 26, 2009, three specimens of *L. zonatus* were put into a glass jar with a mesh lid and were taken to the pitaya farm in Restrepo. Each of the three *L. zonatus* specimens were put on a yellow pitaya cladode and crushed by hand. The time of arrival of the flies was measured with a digital watch. The flies were collected in large glass vials soon after they arrived and were kept in 70% EtOH. The experiment was repeated on September 2, 2009 using six specimens of *L. zonatus*, and on September 9, 2009 with three specimens, but no additional flies were collected at this time. The rest of the surviving coreid bugs were released to their natural habitat in the premises of the Corpoica research station in Palmira.

## Attraction experiment

On December 11, 2009 an experiment was conducted at Corpoica, Palmira Research Station, Palmira, using eight bugs belonging to seven species distributed in four families, namely: *Leptoglossus zonatus* (Dallas) (Coreidae) [male and female]; *Leptoglossus phyllopus* (Linnaeus) (Coreidae) [male]; undetermined species (Coreidae) [sex not determined]; undetermined species (Rhyparochromidae) [sex not determined]; *Loxa* sp. (Pentatomidae) [female]; *Antiteuchus tripterus* (Fabricius) (Pentatomidae) [male]; *Zelus* sp. (Reduviidae) [sex not determined]. On January 18, 2010, an additional experiment was carried out using five bugs belonging to four species in two families, namely: undetermined species (Pentatomidae: Edessinae) [male and female]; *A. tripterus* (Pentatomidae) [female]; undetermined species (Pentatomidae) [female]; and an undetermined species of Coreidae [male]. Each specimen was put on a pitaya cladode and crushed by hand. The time of arrival of the flies was measured with a digital watch.

All hemipterans in the experiments were collected in the field at Corpoica's Palmira Research Station. The coreid bug, *Leptoglossus zonatus* was identified using the descriptions given by Buss *et al.* (2005). Other species were identified to family level using the keys by Triplehorn & Johnson (2005), and later to the genus or species level by comparing the insects with specimens deposited at the Entomology Collection at the Universidad Nacional de Colombia, Palmira campus.

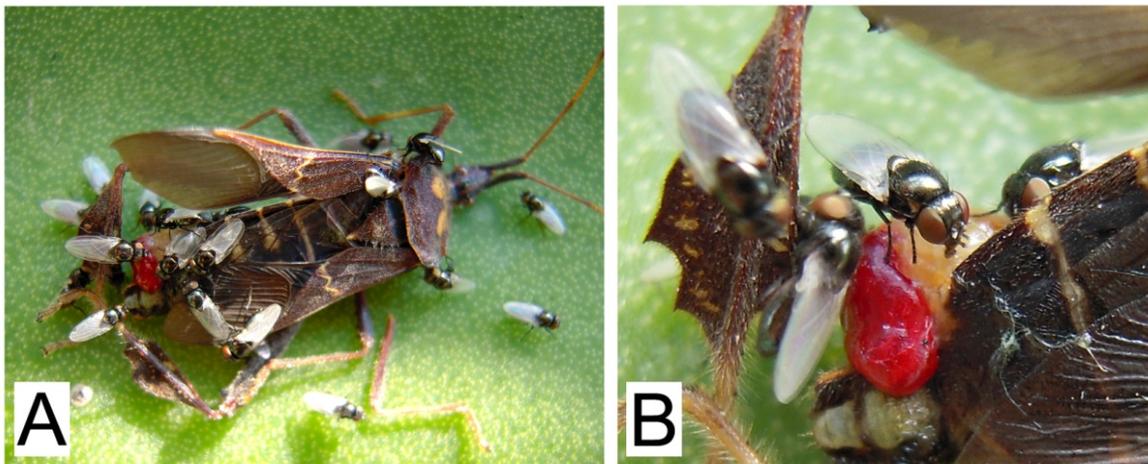
#### Material studied.

All specimens were kept in 70% alcohol and identified as *Milichiella lacteipennis* Loew (Milichiidae). Specimens deposited the Museum of Natural History, London were identified by I. Brake, all other specimens by T. Kondo. **Colombia:** Valle del Cauca, Restrepo, Finca La Cabaña, 26.viii.2009, coll. K. Imbachi, *ex* attracted to freshly killed coreid bug, *Leptoglossus zonatus* (Dallas) on yellow pitaya, *Selenicereus megalanthus* (Cactaceae). Material deposited at the Universidad de Panama, Department of Entomology, Panama (3♀) and the Laboratory of Entomology, Corpoica, Palmira, Colombia (17♀). **Colombia:** Valle del Cauca, Palmira, Corpoica, Palmira research station, 11.xii.2009, coll. K. Imbachi, *ex* attracted to freshly killed coreid bug, *Leptoglossus zonatus* (Dallas) on yellow pitaya,

*Selenicereus megalanthus* (Cactaceae). Material deposited at the Laboratory of Entomology, Corpoica, Palmira, Colombia (10♀) and Museum of Natural History, London (9♀). **Colombia:** Valle del Cauca, Palmira, Corpoica, Palmira Research Station, 23.xii. 2009, coll. T. Kondo, *ex* collected while flying in a lek over feces (probably dog feces) on lawn. Material deposited at the Laboratory of Entomology, Corpoica, Palmira, Colombia (2♀) and Museum of Natural History, London (2♀).

#### RESULTS

A total of twelve *L. zonatus* bugs were crushed on yellow pitaya cladodes on August 26, September 2 and 9, 2009. The first flies arrived 2–3 seconds after each bug had been crushed, and in 15 secs, about 20–30 flies covered each coreid bug (Fig. 1A & B). The collected flies were identified by the fourth author as *Milichiella* sp. (Diptera: Milichiidae), and these were later identified as *M. lacteipennis* Loew by the first author using an online interactive key available at: <http://milichiidae.info/content/key-males-milichiella>. The second author later confirmed the identity of the flies.



**Figure 1.** A, *Milichiella lacteipennis* (Milichiidae) flies attracted to freshly killed adult female *Leptoglossus zonatus* (Dallas) (Hemiptera: Coreidae) on pitaya cladode; B, Close-up of *M. lacteipennis* feeding on insect tissue. Photos by T. Kondo.

A total of 10 bug species in four families: Coreidae, Pentatomidae, Reduviidae, and Rhyparochromidae were crushed to see whether they attract *M. lacteipennis*. *Milichiella lacteipennis* was attracted only to bugs of the families Coreidae and Pentatomidae, and appeared to be more strongly attracted to females than males in general. When attracted, the time of arrival of the first milichiid fly to the crushed bugs ranged from 2-3 seconds for crushed female bugs and 2-34 seconds for male bugs (Table 1). For the family Coreidae, adult *Leptoglossus zonatus* females strongly attracted the milichiid flies, and the first flies always arrived two seconds after they were crushed, but the flies arrived after 34 seconds when a male bug was crushed. During the time of observation, the crushed male of *L. phyllopus*, and a coreid bug of an undetermined sex, attracted no flies; but another male coreid bug attracted flies which arrived as soon as two seconds. A species of Rhyparoch-

romidae and *Zelus* sp. (Reduviidae) attracted no flies. For the family Pentatomidae, the crushed adult *Loxa* sp. female attracted flies which arrived in three seconds; the crushed adult *Antiteuchus tripterus* female attracted the first flies in two seconds, but the male attracted no flies; both female and male adult Edessinae attracted the flies, with flies arriving to the crushed females in two seconds and to the crushed males in eight seconds; and an undetermined adult pentatomid female bug attracted the flies in two seconds. The flies of *M. lacteipennis* are incredibly fast in detecting the injured bugs, and almost immediately after the bugs are crushed, the flies become visible flying in an erratic zig-zag manner around the bug before landing on it. Uncrushed bugs attracted no flies. Only female flies of *M. lacteipennis* were attracted to the crushed bugs. No other species of flies were attracted to the crushed bugs.

**Table 1.** Time of arrival in seconds of first milichiid fly to different crushed bugs in four hemipteran families.

Species	Family	Sex	Time of arrival of first fly
<i>Leptoglossus zonatus</i>	Coreidae	Male	34 seconds
<i>Leptoglossus zonatus</i>	Coreidae	Female	2 seconds
<i>Leptoglossus phyllopus</i>	Coreidae	Male	Not attracted
Undetermined	Coreidae	Undetermined	Not attracted
Undetermined	Coreidae	Male	2 seconds
Undetermined	Rhyparochromidae	Undetermined	Not attracted
<i>Loxa</i> sp.	Pentatomidae	Female	3 seconds
<i>Antiteuchus tripterus</i>	Pentatomidae	Male	Not attracted
<i>Antiteuchus tripterus</i>	Pentatomidae	Female	2 seconds
Edessinae	Pentatomidae	Female	2 seconds
Edessinae	Pentatomidae	Undetermined	8 seconds
Undetermined	Pentatomidae	Female	2 seconds
<i>Zelus</i> sp.	Reduviidae	Undetermined	Not attracted

## DISCUSSION

With this basic experiment we have confirmed that *Milichiella lacteipennis* is attracted to the chemicals released by bugs of the families Coreidae and Pentatomidae when crushed, and that in general these flies are more strongly attracted to female than to male bugs. In our study, no flies were attracted to the tested Rhyparochromidae and Reduviidae, and only female flies of *M. lacteipennis* were attracted to the crushed bugs. We conducted experiments on pitaya cladodes in order to reproduce the conditions of the original observation in the pitaya orchard where the flies were collected, but the

flies are essentially very common and not restricted to pitaya orchards.

The alarm pheromone of one of the tested adult bugs, *L. zonatus*, has been determined to be composed of hexyl acetate, hexanol, hexanal and hexanoic acid (Leal et al. 1994), and one of these chemicals or the combination of these are thought to attract the adult female flies of *M. lacteipennis*.

There are several studies about the attractiveness of chemicals produced by heteropterans to female Milichiidae. *Milichiella arcuata* Loew, a species closely related to *M. lacteipennis*, is strongly attracted to (E)-2-hexenal and only slightly to (E)-

2-decenal, both of which are defensive chemicals (Aldrich & Barros 1995). *Paramyia nitens* Loew and *Milichiella* sp. are attracted to *trans*-2-hexenal (Eisner et al. 1991). *Leptometopa latipes* Meigen is attracted to hexyl butyrate and (E)-2-hexenyl butyrate, common metathoracic scent gland compounds of plant bugs (Heteroptera: Miridae) (Zhang & Aldrich 2004). According to these authors, (E)-2-octenyl acetate, one of the major sex pheromone components of mirids in the genus *Phytocoris*, was also strongly attractive to *Leptometopa latipes*, and another pheromone component of *Phytocoris* bugs, hexyl acetate, was inactive alone, but synergized the attraction of the milichiid species to (E)-2-octenyl acetate, and (E)-2-hexenyl (E)-2-hexenoate, a volatile component of various heteropterans (Zhang & Aldrich 2004). In their study, Zhang & Aldrich (2004) suggested that females milichiids use volatile defensive and pheromonal compounds from plant bugs as kairomones to find freshly injured or dead bugs on which to feed, and discussed that the sex-specific

attraction might indicate that females of these flies need a protein-rich meal for maximum fecundity, as do anautogenous mosquitoes. In most of these studies flies of the family Chloropidae, the sister group to Milichiidae, are attracted in addition to the Milichiidae.

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