Small Size No Protection for Acrobat Ants: World’s Smallest Fly Is a Parasitic Phorid (Diptera: Phoridae)

BRIAN V. BROWN

Entomology Section, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, CA 90007

ABSTRACT A new species of phorid fly, Euryplatea nanaknihali (Diptera: Phoridae), is described from Thailand. This is the first Oriental Region record for this genus; it is otherwise known only from the type species from Africa, where it parasitizes ants of the genus Crematogaster Lund. The new species is probably capable of parasitizing the smallest host Crematogaster (Formicidae) ants in its range. At 0.40 mm in body length, it is the smallest known fly in the world.

KEY WORDS Diptera, Phoridae, parasitoid, Thailand, smallest fly

The family Phoridae is one of the most diverse families of Diptera (true flies), both in body form and lifestyle, with extremes extending to bizarre social insect commensals with shieldlike limuloid forms; bloated termite-mimicking abdomens; and wingless, legless ant-larva look-alike (Weissflug et al. 1995: Fig. 1). The variety of lifestyles have been well documented (Disney 1994), including many species that are parasitoids of social insects, especially ants. A few species are multiple parasitoids (Brown and Feener 1991, Brown et al. 1991), but most larvae are solitary and develop in the ant’s head. Therefore, size of the adult fly is highly correlated with ant body size. Minor worker ants and smaller species of ants seem to be free of attack because of the physical impossibility of the 1–3-mm-long parasitoids developing in their relatively tiny heads. Here, we show that even the smallest host ants in a host–parasitoid system cannot escape parasitism.

The specimen was collected by the Thailand Inventory Group for Entomological Research (TIGER) project, whose goal was to sample as widely as possible for focal groups of insects. Given that the Southeast Asian Diptera fauna is extremely poorly known (Grootaert 2009), it was expected that spectacular new flies would be found. The newly discovered species described herein is one such amazing specimen.

Diptera, or true flies, comprise ≈150,000 described species, most of which would be considered “small.” One group, the biting midges or Ceratopogonidae, even has a common name “no see-um.” The genus Nannohelea Grogan & Wirth has the smallest species of ceratopogonids, but none are as small as the species described here. Small Chironomidae bottom out at ≈0.7 mm body length (O. Saether, personal communication). The smallest acalyptrate flies, the Nanno- dastiidae, are of similar size (Mathis 2010). Of all the contenders for the title of world’s smallest species of fly, it seems that a species of Phoridae described here is the champion. At a body length of 0.40 mm, it is smaller than all of the tiny gnats, mosquitoes, and other flies so far described. Furthermore, it is remarkably a parasitoid, probably of tiny species of ants, as is the other described species in this genus. Its congener, the relatively massive 1.1-mm-long Euryplatea eidmanni Schmitz is from Fernando Po Island (now called Bioko), part of Equatorial Guinea off the West Coast of Africa. The new species, from Thailand, represents a significant range extension for the genus.

Materials and Methods

A single specimen was collected during a training course for the TIGER project, in which Malaise traps were placed in the field at Kaeng Krachan National Park. The specimen was placed in clove oil and then mounted on a microscope slide in Canada balsam. It is deposited in the collection of the Queen Sirikit Botanical Garden, Chiang Mai, Thailand.

Systematics

Genus Euryplatea Schmitz 1941

Type Species. Euryplatea eidmanni Schmitz 1941 (by original designation).

Genus Recognition. The species of this genus can be distinguished from some similar ones by the minute size, smoky gray wings, and, in the female, the pointed parasitic type ovipositor. Males are unknown.

1 E-mail: bbrown@nhm.org.
Way of Life. The type species, *E. eidmanni*, is a myrmecophile (probably a parasitoid) of *Cremato-gaster impressa* Emery ants (Schmitz 1941). Presumably, this new species has a similar life history, but hosts and behavior are unknown.

Included Species. Only *E. eidmanni* and the new species described below.

**Euryplatea nanaknihali** new species

(Figs. 2–4)

Species Recognition. This new species differs from *E. eidmanni* by the absence of a discernible scutellum, the much longer costa, and the much smaller body size (only approximately one third the size of the *E. eidmanni*).
In the latest key to phorid genera (Disney 1994), *E. nanaknihali* keys to couplet 72, where neither of the three possibilities fit. The genus *Maculiphora* Disney, although agreeing in having reduced eyes and no ocelli, has only one abdominal tergite, whereas this new species has six. It differs from *Cootiphora* Brown in lacking large body setae. The final choice, *Lepidophoromyia* Borgmeier, has eyes of normal size and ocelli present.

**Description.** Body minute, 0.40 mm in length, broad, limuloid, with sparse setulae (Figs. 2 and 4); evenly light brown. Frons bluntly rounded. Eye extremely small. Ocelli absent. Large frontal setae absent; four genal setae present on venter of head, below antennae. Flagellomere 1 pointed, arista short with long setae. Palpus normally developed, with large pointed setae. Mouthparts well developed, labella large, broad. Scutum without large setae. Scutellum absent. Legs (Fig. 3) short, sparsely setose, without isolated large setae. Hind femur enlarged, extremely broad. Hind tibia with longitudinal setal palisade. Tarsomeres short, rounded. Claws unmodified. Wing 0.23 mm in length, membrane smoky gray. Costa extremely long, >0.90-mm wing length, radial veins largely fused, vein R_{2+3} absent. Thin veins absent. Halter present, about one third wing length. All abdominal tergites present, sternites apparently absent. Ovipositor of parasitic type, apically pointed.

**Distribution.** Known from a single site in Thailand.

**Derivation of Specific Epithet.** Named for Nanak Nihal Weiss, a young entomological enthusiast in Los Angeles, CA.


**Discussion**

The only other species of *Euryplatea* is the nearly 3 times larger, 1.1-mm-long *E. eidemanni* from Fernando Po Island (now called Bioko), part of Equatorial Guinea off the west coast of Africa. The African species attacks workers of *C. impressa*, an ant that is 3.5 mm in body length. Given host fidelity in other groups of parasitoid phorids, it is extremely likely that the new species also attacks *Crematogaster* ants. Predicting
host size is problematic, however. Morrison et al. (1997) developed an equation for the size relationship between parasitic Pseudacteon flies and their hosts, Solenopsis fire ants, but such equations are not available for parasitoids of different kinds of ants.

In the Natural History Museum of Los Angeles County (LACM) collection, there are six specimens of undescribed parasitoid phorids of the genus Pseudacteon that were caught attacking small species of Crematogaster in South America. The correlation of the ant body length and fly body length is highly significant (Fig. 5; correlation coefficient = 0.911), with the regression line being $y = 1.10 + 2.33x$, where $y$ is host body length and $x$ is phorid body length. Using these data, it is predicted that the hosts of the new Euryplatea are 2.03 mm in length.

Although 2-mm-long ants are not the smallest in the world, they are close. The smallest ants in the world are minor workers of Carebara Westwood, some of which are slightly <1 mm in body length. Any ant 2 mm in length, however, is considered a notably small ant, and certainly would include the smallest Crematogaster. In Thailand, where the new species was collected, there are only five species of Crematogaster recorded (Jaitrong and Nabhitabhata 2005), none of which are known from the type locality of the fly, Kaeng Krachan National Park. All are relatively average-sized Crematogaster, with a body length of ≈3–4 mm. One series of C. rogenhoferi Mayr from Vietnam in the LACM collection, however, has among the much larger workers an extremely small specimen that measures ≈2 mm in length. Thus, it seems that the new species of Euryplatea have the ability to parasitize the smallest of Crematogaster ants known from Thailand.

With the discovery of this species, flies move into the “nanosphere” of insect life, otherwise dominated by Hymenoptera of the families Trichogrammatidae and Mymaridae. The smallest known insects are reputedly myrnarids that are only ≈0.14 mm in length, also making them the smallest animals in the world. Although E. nanaknihali is more than twice this size, it serves as a notice that further extremely small phorids could be expected and should be looked for among the microfractions of insect trap samples.

The smallest species of fly in the world lengthens the list of superlatives attributable to the family Phoridae. Previously, they have been referred to as the most biologically diverse family of insects (Disney 1990), one of the potentially largest families of Diptera (Brown 2009), and surely they have the greatest range of body forms (Fig. 1). These tiny flies have profound effects on host populations (Lewis and Monchamp 1994, Brown 1997, LeBrun 2005, Core et al. 2012) and host community structure (Feener 1981, LeBrun 2005, Wilkinson and Feener 2007). Unlike better-studied parasitic wasps, however, phorid flies are virtually unknown and uninvestigated (Feener and Brown 1997) except for those few with immediate applied importance because of their associations with fire ants (Williams et al. 1973, Feener and Brown 1992, Morrison 2000) and honey bees (Core et al. 2012) in North America. The evolution of this fantastic array of structures and lifestyles is one of the more interesting projects available to biodiversity researchers.

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