REFERENCES CITED

CLARKE, J. F. G. 1958. Catalogue of the Type Specimens of Microlepidoptera in the British Museum (Natural History) Described by Edward Meyrick. Volume 3. Tortricidae, Olethreutidae, and Noctuidae. Trustees of the British Museum, London. 600 pp.

DIAKONOFF, A. 1974. The South Asiatic Polyorthini with notes on species of *Polyortha* Dognin (Lepidoptera, Tortricidae). Zool. Verh. 131: 1-86.

HEPPNER, J. B. 1982. Synopsis of the Hilarographini (Lepidoptera: Tortricidae) of the world. Proc. Entomol. Soc. Washington 84: 704-715.

HORAK, M. 1984. Assessment of taxonomically significant structures in Tortricinae (Lep., Tortricidae). Bull. Soc. Entomol. Suisse 57: 3-64.

———, AND R. BROWN. 1990. Taxonomy and phylogeny, *in* van der Geest (ed.), Tortricoid Pests and Their Control. Elsevier Science Publ., Amsterdam (in press).

NIJHOUT, H. F. 1978. Wing pattern formation in Lepidoptera: a model. J. Exp. Zool. 206: 119-136.

POWELL, J. A. 1964. Biological and taxonomic studies on tortricine moths, with reference to the species in California. Univ. California Publ. Entomol. 32: 1-317.

———. 1983. Tortricoidea (Families Tortricidae and Cochylidae), pp. 31-42, *in* R. W. Hodges (ed.), Checklist of the Lepidoptera of America north of Mexico. E. W. Classey Ltd. and Wedge Entomol. Res. Foundation, London.

RAZOWSKI, J. 1987. Neotropical Chlidanotini (Lepidoptera, Tortricidae). Bull. Polish Acad. Sci., Biol. Sci. 35: 61-71.

TUCK, K. 1981. A new genus of Chlidanotini (Lepidoptera, Tortricidae) from New Caledonia, with a key to genera and check-list of species. Syst. Entomol. 6: 337-346.

NEW NEOTROPICAL SPECIES OF "STICK-TICK" (DIPTERA: CERATOPOGONIDAE) FROM KATYDIDS

WILLIS W. WIRTH
Research Associate, Florida State Collection of Arthropods, and
Cooperating Scientist, Systematic Entomology Laboratory, USDA
1304 NW 94th St., Gainesville, FL 32606 USA

J. L. CASTNER
Department of Entomology and Nematology, University of Florida
Gainesville, FL 32611 USA

ABSTRACT

Forcipomyia (Microhelea) tettigonaris Wirth and Castner new species is described from two females captured while attached tick-like to the scutellum of the katydid *Roxelana crassicornis* (Stal)(Orthoptera: Tettigoniidae) near Iquitos, Peru, on the Amazon River. Hosts of the four previously described species of this group of tick-like biting midges have been confined to stick insects (Orthoptera: Phasmatidae). A third female of this species is reported from a katydid in Costa Rica.

RESUMEN

Se describe la nueva especie *Forcipomyia (Microhelea) tettigoniaris* Wirth y Castner, de dos hembras capturadas cuando estaban pegadas al estilo-garrapata, al escutelo del cigarrón *Toxelana crassicornis* (Stal) (Ortóptera: Tetigonida), cerca de Iquitos, Perú, en el rio Amazona. Hospederos de las cuatro especies previamente descritas de este grupo de mosquitas que pican parecido a las garrapatas, han sido confinados a los insectos de palo (Ortóptera: Fasmítida). Se reporta una tercera hembra de esta especie de un cigarrón de Costa Rica.

Female midges of the dipterous family Ceratopogonidae have evolved an amazing variety of feeding habits dependent on the basic nematocerous piercing-sucking arrangement of their mouthparts (Downes 1955, 1958, 1978). Distinct patterns of feeding have generally evolved in parallel with structural features which form the basis of subfamily and tribal classification, even as far as genera. For example, most Leptoconopinae as well as the genus *Culicoides* Latreille in the tribe Culicoidini are blood-feeders on vertebrates. All members of the subfamily Ceratopogoninae, except those in the tribe Culicoidini, are predaceous. They capture and suck haemolymph from insects smaller or not much larger than themselves, causing death of the prey. All members of the subfamily Dasyheleinae are autogenous and subsist on nectar and sugar-rich plant products. It is in the subfamily Forcipomyiinae that the most amazing variety of feeding habits has evolved, ranging from carrion and pollen-feeding, to feeding on haemolymph of meloid beetles (Wirth 1956b, 1980). In the genus *Forcipomyia* Meigen, various subgenera have evolved a variety of parasitic feeding patterns, none of which seriously harms the host (Wirth 1956a). Midges of the subgenus *Lasiohelea* Kieffer have retained what is thought to be the primitive habit of sucking vertebrate blood; species of *Trichohelea* Goetghebuer and *Pterobosca* Macfie are ectoparasitic on the wings of dragonflies or on the bodies or appendages of a wide variety of insects and other arthropods larger than themselves. In the subgenus *Microhelea* Kieffer one group of species sucks haemolymph from a variety of smooth-bodied caterpillars and sawfly larvae (Wirth 1972), while another group feeds on phasmid stick-insects. The abdomens of the latter swell with developing eggs to grotesque tick-like proportions, for which the common name "stick-ticks" was coined (Wirth 1971).

The junior author has recently collected a new species of this group of "stick-ticks" on the River Amazon near Iquitos (Department of Loreto), Peru. It was observed feeding on the katydid *Roxelana crassicornis* (Stal) (Orthoptera: Tettigoniidae), a habit previously unrecorded in the New World. Wirth (1971) summarized our knowledge of the "stick-ticks," pointing out the difference in structure and habits separating this group of species from the caterpillar parasites in the subgenus *Microhelea*; giving host records for the two common and widespread species, *F. ixodoides* (Fiebrig-Gertz) and *F. obesa* Costa Lima, known to feed on stick insects; and describing two new species, *F. amazonica* Wirth from Manaus, Brazil, and *F. willistoni* Wirth from Brazil, Jamaica and Puerto Rico. The present new species from Peru also feeds on an orthopteran, but is the first American species known to feed on a host other than a phasmid.

Debenham (1987) recorded two females of *Forcipomyia (Microhelea) willisi* Debenham feeding on the abdomen of a katydid (*Polichne* sp.: Tettigoniidae, Phaneropterinae) in Queensland, Australia, the first record of a *Microhelea* species from this host family. *Forcipomyia willisi* is closely related to *F. fuliginosa* (Meigen) and the group of caterpillar parasites, and does not have the morphological modifications of the Neotropical "stick-ticks." An unidentified species of *Microhelea* which Wirth (1971) placed close to but not identical with *F. fuliginosa* was reported by Edwards (1926) from a large phasmid on Buru Island, Indonesia, as *F. hirtipes* (de Meijere).

The terminology used in this paper is the same as that used in previous papers by Wirth (1971, 1972) on Neotropical species of the *Forcipomyia* subgenus *Microhelea*.

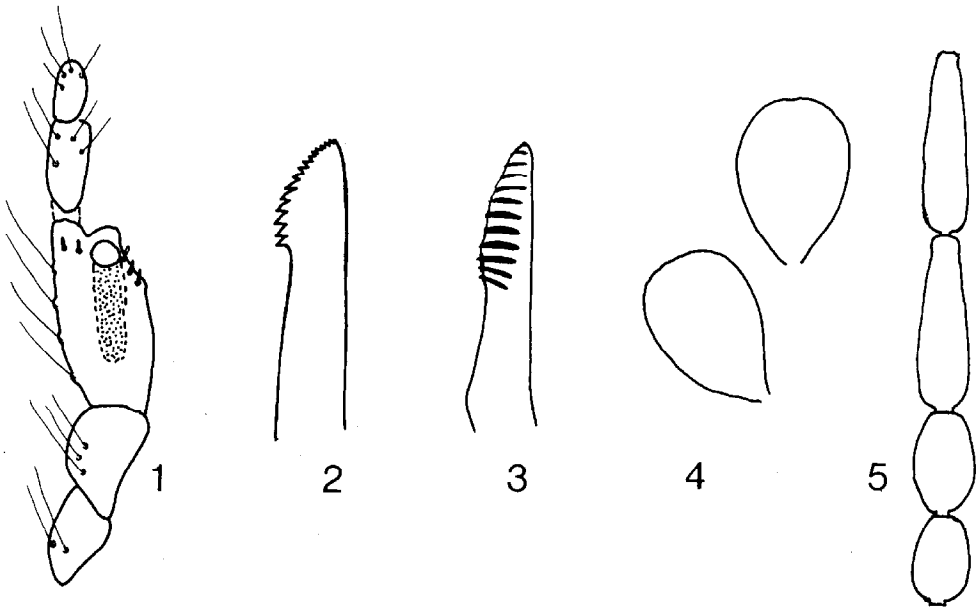
Forcipomyia (Microhelea) tettigonaris Wirth and Castner, new species
(Figs. 1-5)

Holotype Female.—Wing length 1.25 mm; breadth 0.51 mm.

Head: Dark brown, antennal segments 3-10 yellowish. Antenna with lengths of flagellar segments in proportion of 12-11-11-11-11-11-12-15-26-28-x-x-x (segments 13-15 missing); segment 11 2.0 times as long as 10 (Fig. 5). Palpus (Fig. 1) with lengths of segments in proportion of 12-15-31-15-8; third segment swollen on one side from base nearly to tip, swollen portion obliquely truncated distally, sensory pit extending from pore near tip of swollen portion of segment nearly to base of segment; several tear-shaped hyaline sensilla scattered on surface near pore opening; palpal ratio 2.2. Mandible (Fig. 2) with 15 dark brown teeth in a curving row, gradually increasing in size from minute teeth at apex to large, somewhat proximally curved teeth at base of row, proximal teeth forming a distinct lateral expansion of mandible. Maxilla (Fig. 3) well sclerotized and gradually tapering distally, with 11 well-sclerotized, dark-pigmented, transverse corrugations.

Thorax: Dark brown; mesonotum with moderately long yellowish setae. Legs yellowish including coxae and trochanters, with long yellow setae; tarsal ratios (T1/T2) of fore, mid and hind legs 0.68, 0.43, and 0.54 respectively. Wings damaged, much abraded; membrane infuscated; costal ratio of paratype 0.54. Halter color not observed.

Abdomen: Both specimens gravid witih abdomen much distended tick-like, with numerous fully-developed, spindle-shaped, yellowish eggs. Terga and sterna reduced to small, quadrate, transverse, brownish sclerites with long yellowish setae on lateral ends. Pleural membrane much distended, with sparse vestiture of short, pale brown setae arising from brownish-pigmented punctures. Spermathecae (Fig. 4) two, ovoid, without necks, slightly unequal, measuring 0.091 by 0.070 mm and 0.082 by 0.065 mm.



Figs. 1-5. *Forcipomyia tettigonaris*, female: 1, palpus; 2, mandible; 3, maxilla; 4, spermathecae; 5, antennal segments 9-12.

Male.—Unknown.

Distribution.—Peru, Costa Rica.

Types.—Holotype female, 1 female paratype, both taken from scutellum of the katydid *Roxelana crassicornis* (Stal), Iquitos, Loreto Department, Peru, 30.vii.1987, J. L. Castner (Holotype deposited in National Museum of Natural History, Smithsonian Institution, Washington, D.C.; paratype in Florida State Collection of Arthropods, Gainesville, Florida).

Etymolgy.—The species takes its name from the family name of the host insect, a katydid in the subfamily Pseudophyllinae and tribe Pterachrozini.

Discussion.—When he reviewed this paper, Art Borkent of Agriculture Canada recalled a female specimen in the Canadian National Collection which he kindly loaned us. The female, collected from a katydid thorax, La Selva, Costa Rica, 18.ii.1980, D. M. Wood, is conspecific with the types from Peru. This extension of the range of the species indicates to us that perhaps these midges are not rare in nature, and that special efforts should be made to look for them when observing katydids.

Acknowledgments

The authors thank David Nickle, Jackie Belwood and Gary Fritz who participated in the field research in Peru. Funding for this work came from the following sources: Earthwatch/The Center for Field Research, The Tinker Foundation, Amazon Research and Training Proigram, through the Center for Latin American Studies (University of Florida), and Sigma Xi. Peter Jenson and the staff of Exploraciones Amazonicas were instrumental in providing research facilities and logistical support in Peru. We are greatly indebted to Art Borkent of Agriculture Canada for reviewing the manuscript and loaning us the Costa Rican specimen. T. J. Walker and J. H. Frank reviewed the manuscript and made helpful comments.

References Cited

Debenham, M. L. 1987. The biting midge genus *Forcipomyia* (Diptera: Ceratopogonidae) in the Australasian Region (exclusive of New Zealand) IV. The subgenera allied to *Forcipomyia*, s. s., and *Lepidohelea*, and the interrelationships and biogeography of the subgenera of *Forcipomyia*. Invertebr. Taxon. 1: 631-684.

Downes, J. A . 1955. The food habits and description of *Atrichopogon pollinivorus* sp. n. (Diptera: Ceratopogonidae). Trans. R. Entomol. Soc. London 106: 439-453.

Downes, J. A. The feeding habits of biting flies and their significance in classification. Annu. Rev. Entomol. 3: 249-266.

Downes, J. A. 1978. Feeding and mating in the insectivorous Ceratopogoninae (Diptera). Mem. Entomol. Soc. Canada 104: 1-62.

Edwards, F. W. 1926. Fauna Buruana. Diptera, Subordo, Nematocera. Treubia 7: 134-144.

Wirth, W. W. 1956a. New species and records of biting midges ectoparasitic on insects (Diptera, Heleidae). Ann. Entomol. Soc. Amer. 49: 356-364.

Wirth, W. W. 1956b. The biting midges ectoparasitic on blister beetles (Diptera: Heleidae). Proc. Entomol. Soc. Washington 58: 15-23.

Wirth, W. W. 1971. A review of the "stick-ticks," Neotropical biting midges of the *Forcipomyia* subgenus *Microhelea* parasitic on walking stick insects (Diptera: Ceratopogonidae). Entomol. News 82: 229-245.

Wirth, W. W. 1972. The Neotropical *Forcipomyia (Microhelea)* species related to the caterpillar parasite *F. fuliginosa* (Diptera: Ceratopogonidae). Ann. Entomol. Soc. Amer. 65: 564-577.

Wirth, W. W. 1980. A new species and corrections in the *Atrichopogon* midges of the subgenus *Meloehelea* attacking blister beetles (Diptera: Ceratopogonidae). Proc. Entomol. Soc. Washington 82: 124-139.