NOTES AND CORRECTIONS ON STICK-TICKS, NEOTROPICAL PARASITIC MIDGE OF THE FORCIPOMYIA SUBGENUS MICROHELEA (DIPTERA: CERATOPOGONIDAE)

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ABSTRACT

“Stick-ticks” comprise a compact group of seven Neotropical species in the ixodoides Group of the genus Forcipomyia, subgenus Microhelea. A key is presented to distinguish the ixodoides Group of species that mainly feed on the Orthoptera from the fuliginosa Group of species that feed mainly on larvae of Lepidoptera. A key is presented for identification of the species of the ixodoides Group using new and more reliable characters, and two species are retrieved from erroneous synonymy.

RESUMEN

Garrapatas “stick-ticks” comprenden un grupo compacto de siete especies Neotrópicas del Grupo de ixodoides del género Forcipomyia, subgénero Microhelea. Se presenta una clave para distinguir especies del Grupo de ixodoides los cuales se alimentan principalmente de Ortoptera del Grupo de especies de fuliginosa, que se alimentan principalmente de larvas de Lepidópteros. Se presenta una clave para identificar las especies del Grupo de ixodoides usando caracteres nuevo y más seguros, y se retiran dos especies de sinónimos erróneos.

While determining some ceratopogonid midges collected by James L. Castner from walking stick insects in Peru I discovered some errors in my earlier paper on the “stick-ticks” (Wirth 1971). I take this opportunity to correct my earlier misidentifications and to offer a key utilizing more reliable characters for the separation of species. I can also offer some new distribution records.

“Stick-ticks” form a compact group in the subgenus Microhelea Kieffer of the genus Forcipomyia Meigen. In 1971 I discussed the classification and habits of this group of parasitic midges that feed on Orthoptera of the family Phasmatidae, and recently Wirth & Castner (1990) described a new species with a katydid (family Tettigoniidae) as host. Female “stick-ticks” of the ixodoides Group can be distinguished from the caterpillar parasites of the fuliginosa Group of Microhelea as follows:

1. Proboscis expanded at tip, lobes of labellum greatly expanded, platelike; mandible (Figs. 8-11) broad or expanded at tip with 15-25 fine to strong teeth; maxilla (Fig. 12) stout distally, usually with prominent transverse corrugations or stout blunt teeth; abdomen when engorged or filled with eggs swollen ticklike to several times size of thorax .................. ixodoides Group

- Proboscis subcylindrical to slightly narrowed distally with lobes of labellum appressed to other mouthparts; mandible with slender, pointed tip and 30-60 minute teeth; maxilla slender and hyaline distally with minute lateral teeth; abdomen never much larger than thorax ....................... fuliginosa Group
A diagnosis of the subgenus Microhelea, a key for the separation of the fuliginosa Group from the ixodoides Group, and for the species of the latter group, was presented by Wirth (1971). Some unreliable characters were utilized in the 1971 paper resulting in a number of misidentifications. I herein present more diagnostic characters to distinguish the species, retrieve two species from erroneous synonymy, and offer new distribution records. For explanation of the characters used, consult the earlier paper (Wirth 1971) or the chapter on Ceratopogonidae in the Canadian Diptera Manual by Downes & Wirth (1981).

**KEY TO THE SPECIES OF THE FORCIPOMYIA IXODOIDES GROUP**

1. Antenna and palpus prominently bicolored; antennal segments 11-15, palpal segments 4-5, and labellum dark brown; proximal segments of antenna and third palpal segment bright yellow; third palpal segment (Fig. 3) short and broad, palpal ratio (L/W) 1.5; legs yellowish; abdomen with sparse brownish setae ........................................... *F. amazonica* Wirth
   -- Antenna and palpus not prominently bicolored, antenna stramineous to pale brown, distal five segments may be slightly darker; palpus brownish; third palpal segment, leg color, and abdominal setae various .................................................. 2

2. Legs yellowish, at most apex of hind femur brownish .................................................. 3
   -- Legs brownish, or yellowish with broad brownish bands on femora and tibiae ............... 5

3. Legs entirely yellowish; abdomen without flattened, striated, scale-like setae, but with sparse vestiture of fine brownish setae . *F. tetigonaria* Wirth & Castner
   -- Hind femur with narrow brown apical band; abdominal terga with dark brown, flattened, striated, scalelike setae .......................................................... 4

4. Abdominal pleura with dense vestiture of long, stout, yellowish, spine-like setae, the membrane densely shagreened ..................... *F. ixodoides* Fiebrig-Gertz
   -- Abdominal pleura with sparse vestiture of short, fine, yellowish setae; membrane not dark-shagreened ........................................... *F. wagneri* Seguy

5. Legs entirely brown; halter brown; antenna yellowish on segments 3-10, brownish on 11-15; palpal ratio 1.5; abdomen with dense vestiture of slender, striated, blackish scales, especially dense on pleura ............... *F. willistoni* Wirth
   -- Legs yellowish with broad brownish bands; antenna not bicolored; palpal ratio 1.9; abdomen with sparse vestiture of yellowish or brownish setae, only a few striated scales may be present .................................................. 6

6. Maxilla (Fig. 14) with numerous blunt, knoblike teeth, without transverse corrugations; coxae with stout, long, spinelike bristles; abdomen with fine yellowish setae, without striated dark brown scales; third palpal segment (Fig. 4) short and broad, rounded distolaterally ...... *F. mayeri* Lane & Foratti
   -- Maxilla with prominent transverse corrugations, coxae without stout spinelike bristles; abdomen with numerous striated dark brown scales mixed with yellowish setae; third palpal segment relatively slender, parallel-sided, with prominent angular distolateral expansion ......................... *F. obesa* Costa Lima

*Forcipomyia (Microhelea) amazonica* Wirth

(Figs. 3, 7, 10)

*Forcipomyia (Microhelea) amazonica* Wirth, 1971. 241 (female, Brazil; fig. palpus, maxilla, mandible, spermathecae).

Diagnostic Characters. *Forcipomyia amazonica* can immediately be distinguished from the other "stick-ticks" by the dark brown color of the five distal antennal segments, the two distal palpal segments and labella, contrasting sharply with the bright yellowish proximal segments, by the broad third palpal segment (Fig. 3) with
Figs. 1-14, Forcipomyia spp.: 1, 9, 13, F. ixoides; 2, 6, F. willistoni; 3, 7, 10, F. amazonica; 4, 8, 14, F. mayeri; 5, 11, 12, F. tettigumuris; 1-5, female palp, 6, 8-11, female mandible; 7, 12-14, female maxilla.

rounded ventrodistal expansion, the unbanded yellowish legs, and the presence of only slender brown setae on the abdominal pleura, both striated scales and long golden hairs lacking on the pleura. The mandible (Fig. 10) is slender distally, without the distolateral expansion found in F. ixoides and F. obesa.

**Distribution.** Known only from the types from Manaus, Brazil.

**Type.** Holotype female, Brazil, Amazonas, Manaus, 19.ix.1969, H. A. Wright, light trap (Type no. 71145, USNM).

**Discussion.** No new records.
Wirth: Notes and Corrections on Stick ticks

Forcipomyia (Microhelea) izoides (Fiebrig-Gertz)
(Figs. 1, 9, 13)

*Ceratopogon izoides* Fiebrig-Gertz, 1928: 290 (female; Paraguay; on phasmd; figs.).
*Forcipomyia izoides* (Fiebrig-Gertz); Costa Lima, 1926: 64 (combination, compared with *F. obesa*); Wirth, 1971: 236 (in part; female redescribed from Colombia (figures refer to *F. mayeri*); synonyms: *crudelis, wagneri, mayeri*; records from Brazil, Colombia, Costa Rica, Panama, Paraguay).

*Forcipomyia obesa* Costa Lima; Lane, 1947: 163 (misdet.; redescribed; record from Belem, Brazil).

**Diagnostic Characters.** Legs yellowish, hind femur with apical brown band; abdominal pleura with dense vestiture of long, stout, yellowish, spinelike setae, the membrane appearing dark gray with dense micro-spicules; abdominal terga with dark brown, flattened, striated, scale-like setae; maxilla (Fig. 13) with transverse corrugations; third palpal segment (Fig. 1) moderately stout, palpal ratio 2.16, segments 4 and 5 combined nearly as long as 3.

**Distribution.** Brazil, Colombia, Costa Rica, Ecuador, Paraguay, Peru.

**Types.** Type specimens or type locality not mentioned by Fiebrig-Gertz, who worked in Paraguay.


**Discussion.** The distribution has been corrected to include only localities from which specimens have been re-examined, or whose description matches that of the species as presently defined. Wirth's synonymy of *F. crudelis* Mayer, *F. mayeri* Lane & Forattini, and *F. wagneri* Seguy proves erroneous, based on specimens of *F. mayeri* and *F. wagneri* reported herein. These two species are reinstated as valid and distinct species. Lane's (1947) redescriptions of *F. obesa* Costa Lima, based on specimens from Belem, Brazil, was a misidentification. His mention of yellowish legs and long yellowish pilosity implanted on distinct tubercles on the abdomen, characterize his specimen as *F. izoides*.

Forcipomyia (Microhelea) mayeri Forattini & Lane
(Figs. 4, 8, 14)

*Phasmohelela crudelis* Mayer, 1937: 233 (female; Costa Rica; fig. mouthparts, tibial comb; in key); Mayer, 1938: 13 (Colombia; fig. habitus, mouthparts).

*Forcipomyia mayeri* Forattini & Lane, 1955: 4 (new name for *F. crudelis* (Mayer), preoccupied in *Forcipomyia* by *Ceratopogon crudelis* Karsch 1886, and *Forcipomyia crudelis* Knab 1914; female redescribed from Panama; fig. antenna, palpus, tarsus, spermathecae, eggs).

*Forcipomyia obesa* Costa Lima; Wirth (in part), 1971: 239 (female from Barro Colorado Island, Panama, misdetermined; fig. maxilla, mandible, palpus, spermathecae; figs. 1.2, photographs of female sucking haemolymph from leg of phasmd).

**Diagnostic Characters.** Legs yellow with broad brownish bands on femora and tibiae; maxilla (Fig. 14) with numerous blunt knoblike teeth, without transverse corrugations; third palpal segment (Fig. 4) short and broad, rounded distolaterally; coxae with stout, long, spinelike bristles; abdomen with sparse vestiture of fine yellowish spinelike setae, no striated scales.

**Distribution.** Colombia, Costa Rica, Panama.

**Type.** Female, Costa Rica, Hamburg Farm near San Jose, 24.iv.1936, F. Neumann, ex antenna of *Crenoryulus spinosus* F. (in collection of Deutsches Ent. Inst., Berlin).

DISCUSSION. Mayer (1937) figured the mouthparts of *Phasmodochele crudelis* showing the blunt knolike teeth on the maxilla, diagnostic of this species. Forattini and Lane (1955) renamed the species *Forcipomyia mayeri* because of homonymy of *P. crudelis* in *Forcipomyia*, and their redecription of the species from Panama is consistent with Mayer's description and with the Barro Colorado Island specimen recorded and figured as *F. obesa* by Wirth (1971).

*Forcipomyia (Microhelea) obesa* Costa Lima

*Forcipomyia obesa* Costa Lima, 1928: 85 (Brazil; female; figs. habitus, wing, antenna, palpus; compared with *F. ixodoides*); Wirth, 1971: 239 (female redescribed; records from Brazil, Colombia, Costa Rica).

**Diagnostic Characters.** Legs yellowish with broad brownish bands on femora and tibiae; coxae without stout spinelike bristles; maxilla with prominent transverse corrugations; third palpal segment relatively slender, parallel-sided, with prominent angular distolateral expansion; palpal ratio 2.42; abdomen with numerous striated dark brown scales mixed with yellowish setae.

**Distribution.** Brazil, Peru; ? Colombia, Costa Rica, ? Panama.

**Type.** Female, Brazil, Alto do Rio Negro, Sao Gabriel, 11.x.1927, ex undetermined phasmid, J. F. Zikan (in Instituto Oswaldo Cruz).


**Discussion.** The Belem, Brazil, specimen described as *F. obesa* by Lane (1947) is actually *F. ixodoides* (which see). The Barro Colorado, Panama, specimen figured and described by Wirth (1971) is *F. mayeri* Lane & Forattini (which see). The distribution records of Wirth (1971) from Belem, Brazil, Colombia, Costa Rica, and Cerro Campana and Santa Rita Ridge, Panama, remain doubtful, pending re-examination of the actual specimens.

*Forcipomyia (Microhelea) tettigonaris* Wirth & Castner

*(Figs. 5, 11, 12)*

*Forcipomyia (Microhelea) tettigonaris* Wirth & Castner, 1990: 159 (female; Peru; fig. antenna, palpus, mandible, maxilla, spatmathecae).

**Diagnostic Characters.** Antenna and palpi not bicolored; legs entirely yellowish; mandible (Fig. 11) with low number of teeth (15); maxilla (Fig. 12) with highly pigmented transverse corrugations; abdomen without dark striated scales, but with sparse vestiture of fine brownish setae.

**Distribution.** Known only from the types from Peru.


**Specimens Examined.** PERU: Holotype and paratype, data as above.

**Discussion.** This species is the first to be recorded from other than a phasmid stick insect. The host record, from a tettigonid katydid, however, confines the known host range of the *ixodoides* Group to the Order Orthoptera, while perhaps making the common name “stick-ticks” a misnomer.

*Forcipomyia (Microhelea) wagneri* (Seguy)

*Phasmodochele wagneri* Seguy, 1941: 86 (female; Brazil; on phasmid; fig. lateral habitus, leg, tarsus, claws, palpus, mouthparts; in key).
Forcipomyia ixodoides (Fiebrig-Gertz); Wirth (in part), 1971: 236 (erroneous synonymy).

**Diagnostic Characters.** Closely resembling *F. ixodoides*, but abdominal pleura with sparse vestiture of short, fine, yellowish setae, membrane without dense shagreening of micro-spicules.

**Distribution.** Brazil, Costa Rica, Peru.


**Discussion.** Wirth (1971) synonymized *P. wagneri* with *F. ixodoides*, on the basis of the shape of the third palpal segment and the leg color, having confused the importance of the abdominal vestiture as a specific character. In fact, the importance of this character was not realized until the long series of females from Peru was examined, all with consistent presence of sparsely arranged, short, fine, yellowish setae, instead of the closely packed long, stiff, yellowish setae on a grayish shagreened membrane characteristic of *F. ixodoides*.

*Forcipomyia (Microhelea) willistoni* Wirth
(Figs. 2, 6)

*Forcipomyia (Microhelea) willistoni* Wirth, 1971: 242 (male, female; Brazil, Jamaica, Puerto Rico; fig. palp, mandible, spermathecae, male parameres).

**Diagnostic Characters.** This species is the least modified of the species in the *ixodoides* Group, with unmodified mandibles (Fig. 6) and maxillae, abdominal vestiture with abundant striated, slender, dark brown scales, but the expanded labella places it with the phasmid parasites. The uniformly dark brown legs and prominently bicolored antennae and dark brown palpi distinguish it from other members of the group.

**Distribution.** Brazil, Jamaica, Puerto Rico.


**References Cited**


INFECTIVITY OF INSECT PATHOGENS AGAINST
NEOCHETINA EICHHORNIAE, A BIOLOGICAL CONTROL
AGENT OF WATERHYACINTH

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ABSTRACT

Several insect pathogens were tested for infectivity against Neochetina eichhorniae Warner (Coleoptera: Curculionidae), a biological control agent for waterhyacinth, Eichhornia crassipes (Mart.) Solms. No mortality resulted from exposure to 21 strains of Bacillus thuringiensis. No significant mortality resulted from exposure to 2 strains of Mortierellum anisopliae. Although treatment of adult weevils with 6 strains of Beauveria bassiana produced no significant mortality, 2 strains (BbAFA - 35%, Bb 5647 - 65%) did result in statistically significant mortality. Exposure to 2 strains of Steinernema carpocapsae resulted in 60-70% mortality. Our results indicate limited potential for these insect pathogens to control N. eichhorniae in resource recovery or wastewater treatment facilities.

Resumen

Se probó la infectividad de varios patógenos de insectos hacia Neochetina eichhorniae Warner (Coleoptera: Curculionidae), un agente de control biológico de Eichornia crassipes (Mart.) Solms. No hubo mortalidad cuando expuestos a 21 tipos de Bacillus thuringiensis. Cuando expuestos a 2 tipos de Mortierellum anisopliae, no causaron una mortalidad significante. Aunque el tratamiento de picudos con 6 tipos de Beauveria bassiana no produjo una mortalidad significativa, 2 tipos (BbAFA - 35%, Bb 5647 - 65%) produjeron una mortalidad estadísticamente significativa. Exposición a 2 tipos de Steinernema carpocapsae resultó en una mortalidad de 60-70%. Nuestros resultados indican un potencial limitado para estos patógenos de insectos para controlar N. eichhorniae en recuperación de recursos o en facilidades de tratamiento de aguas de desecho.

The concept of using biological control to reduce or eliminate a population of released biocontrol agents is not unique. It originates in the context of conflict of interest, a frequent adjunct to weed control efforts (Huffaker 1964). Typically, conflicts arise at the time of a proposed phytophage introduction, when one interest perceives the target