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STREPSIPTERA (INSECTA) OF MEXICO – A REVIEW

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ABSTRACT Strepsiptera are obligate endoparasites in other insects. They are cosmopolitan in distribution and parasitize 34 families of Insecta. The males are free-living and the females are totally endoparasitic (except in one family). A list of Strepsiptera from Mexico is given.

KEYWORDS Strepsiptera, parasitoid, Mengenillidia, Stylopidia, Mexico.

RESUMEN Los Strepsiptera son endoparasitoides obligados de otros insectos. Su distribución es cosmopolita y parasitan a 34 familias de Insecta. Los machos son de vida libre y las hembras son completamente endoparasíticas (excepto en una familia). Se incluye una lista de Strepsiptera de México.

DESCRIPTORES Strepsiptera, parasitoide, Mengenillidia, Stylopidia, México.

INTRODUCTION

Strepsiptera are obligate entomophagous parasites of cosmopolitan distribution with free-living adult males and endoparasitic females (except in one family). The males have large raspberry-like eyes, flabellate antennae, shortened forewings and large hind wings (Fig. 1). The females are neotenic and except for the extruded cephalothorax the rest of the body is bag-like and is endoparasitic (Fig. 2, 3). They parasitize Apterygota, Exo- and Endopterygota belonging to seven orders and 34 families of Insecta. Hosts include Thysanura, Blattodea, Mantodea, Orthoptera, Hemiptera, Diptera and Hymenoptera. There are about 600 described species of Strepsiptera world wide so far and 15 of these are from Mexico (Pierce 1909, 1961, Bohart 1943, Oliveira & Kogan 1959, Kinzelbach 1971, Brailvosky 1974, 1981, Brailovsky & Márquez 1974, Kifune & Brailovsky 1987, 1988, Kathirithamby & Moya-Raygoza 2000, Cook 2001, Kathirithamby & Johnston 2004, Kathirithamby & Hughes 2006). Recent studies however indicate that there might be many more as cryptic species have been identified (Kathirithamby & Johnston 2004), and if so the true estimate might be nearer double the number. Here I review the natural history and classification of these insects and a list of Strepsiptera from Mexico is given.

LARVAL STAGES

1st instar larva. They are the host-seek stage of the strepsipteran and emerge live from the viviparous female mother to seek and parasitize new hosts. They have a sclerotized external cuticle with highly serrated ventral regions of the head, thorax and abdomen which is made-up of microtrichia with serrated edges with fringes which is presumably used to clinging to hosts before entry. Serrated

edges are also present on the intercoxal sternites (Pohl & Beutel 2004). The head has a pair of antennae, mandibles and labrium. The legs are slender with single-jointed tarsi without claws which are ventrally modified as adhesive pads. The tarsi of the pro- and mesothorax are similar but that of the metathorax are different. The abdomen has a pair or two of long cerci which are used for jumping.

Endoparasitic larval stages. There are a total of four larval stages (Kathirithamby et al. 1984) although previous estimates have been from one to seven instars (Nassonow 1910, Kirkpatick 1937, Hassan 1939, Williams 1957, Baumert 1959, Greathead 1968, Riek 1970, Kathirithamby 1978, 1982, Waloff 1981). Scanning scanning and transmission electron microscopy found that the larval stages go through apolysis but not ecdysis (Kathirithamby et al. 1984).

On entering into the host the 1st instar moults to an apodous 2nd instar. The sexes are indistinguishable at this stage. A mouth and a gut are evident in the endoparasitic larval stages (Kathirithamby 2000).

Males at the 3rd instar possess three pairs of prolegs and a bulbous head, and the female has a rounded anterior region with a tapering abdomen.

Pupal stage of the male. In the family Mengenillidae at the end of the 4th instar both male and female emerge from the host to pupate externally (Fig. 4, 5). The free-living puparium of the male and female have antenna, mouth, eyes, legs and abdominal segments. The adult free-living male and a free-living neotenic female emerge from the free-living puparia. Unlike the Stylopidae the free-living female Mengenillidae have eyes, antennae, mouth parts, legs and a genital opening but are without wings (Silvestri 1941a, 1941b, 1943, Hofeneder 1910a) (Fig. 6).

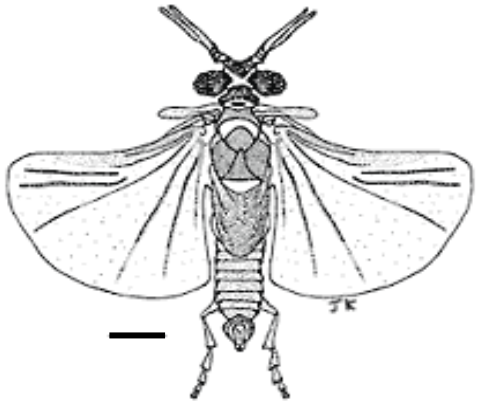

Fig. 1. Adult male *Xenos vesparum* Rossi from Italy. Scale bar = 0.8 mm.

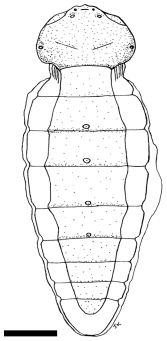

Fig. 2. Neotenic female *Xenos vesparum* Rossi from Italy. Scale bar = 0.8 mm.

Fig. 3. Cephalothorax of female *Elenchus varleyi* Kathirithamby from Australia (x 230).

In the subfamily Stylopidia at the late 4th instar just before extrusion through the host cuticle the bulbous head of both the male and female develops mandibles. These are used during extrusion of the anterior region between the intersegmental membrane of the host cuticle. After extrusion the anterior region the head region sclerotizes to form the cap of the puparium (cephalothecae). The male hereafter pupates in a living host. The metamorphosis of the male takes place in two stages within the puparium (the pupal stage and pre-adult stage). During the pre-adult stage (the cuticle of the pupa is shed and is therefore not a pharate adult) the cuticle hardens (tans), the sperm matures, the wings expand and the flight muscles are developed (Kathirithamby 2009). The male emerges as a free-living adult by breaking the cephalothoeca along the line of weakness (Kathirithamby 1983a, Kathirithamby et al. 1990). The only task a free-living adult male performs on emergence from the puparium is to excrete its meconium (waste products of pupal metabolism). It then takes flight immediately in order to seek and fertilize a female: the adult male has a very short life span (~ 5- 6 h) and there is no teneral period (when the cuticle is incompletely hardened) after emergence from the puparium. Unlike most other insects the metamorphosis to a free-living adult male in Strepsiptera therefore occurs within the puparium, during the pre-adult stage (Kathirithamby 2009).

Neotenic female. The female of Stylopidia, on extrusion the anterior region, forms the cephalothorax and becomes a neotenic female without undergoing a pupal instar and the posterior region remains endoparasitic. The cephalothorax has a brood canal opening which leads to brood canal. In the brood canal there are varying number of genital tubes which lead into the body cavity where the oocytes are situated.

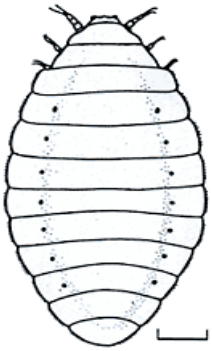

Fig. 4. *Eoxenos laboulbenei* De Peyerimhoff male pupa (after Kinzelbahc 1971). Scale bar = 500 μm.

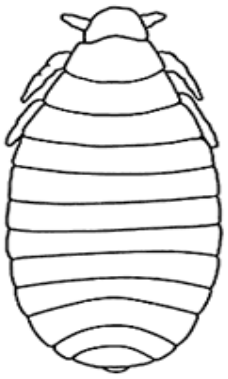

Fig. 5. *Mengenilla chobauti* Hofeneder female pupa (after Silvestri 1943). Total length 5800-6500 μm.

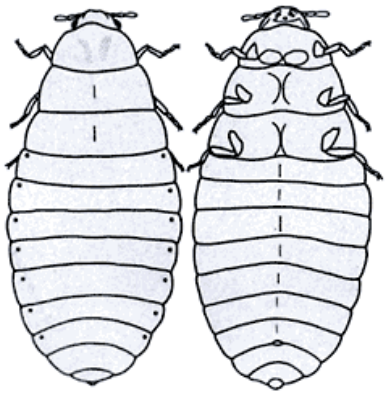

Fig. 6. *Mengenilla chobauti* Hofeneder female adult (after Kinzelbach 1971). Total length 3200-7400 μm.

The male inserts the sperm in the brood canal opening, which travel down the brood canal, and via the genital tubes enter the body cavity. The oocytes are then fertilized after which the numerous embryos develop within the viviparous female. The 1st instar larvae leave the female via the genital tubes, up the brood canal and out to the open via the brood canal opening (Kathirithamby 2000).

ADULT MORPHOLOGY

Males have conspicuous flabellate antennae with raspberry-like compound eyes which have 15-150 individual ommatidia separated by cuticle or setae (Fig. 1). The mouthparts are composed of blade-like mandibles (absent in the family Corioxenidae) and maxillae. The mandibles in fossil strepsipterans are robust and very large (Grimaldi et al. 2005, Pohl et al. 2005).

The head is connected to a short, inconspicuous prothorax. The mesothorax bears the reduced forewings, which are analogous to the halteres in Diptera (Kathirithamby 1989a, Pix et al. 1993). The large (sometimes ten times larger) metathorax bears the asynchronous-type flight muscles (Smith & Kathirithamby 1984), and the large hind wings with reduced venation. The trochanter is absent in the fore- and mid legs and tarsi may be 2-5 segmented. There are ten abdominal segments, of which the ninth bears the aedeagus with no parameres, and the tenth segment overhangs the adeagus.

Female strepsipterans are neotenic and viviparous (Fig. 2, 3) and in the family Mengenillidae are free-living and have a distinct head, eyes, antennae, legs, and genital orifice, but are wingless (Fig. 6). Neotenic females of the suborder Stylopidia are devoid of all adult characteristics, and except for the extruded cephalothorax (Fig. 2). Posteriorly (the part that is endoparasitic in the host) is a mere "bag of eggs". On the dorsal surface is a specialised area the structure of which is analogous to the peritrophic matrix of the midgut of insects. Sperm is inserted by the male in the brood canal opening in the cephalothorax and this same opening is used for the emergence of the 1st instar larva. The brood canal has genital ducts (varying in number depending on the family) that lead to the haemolymph in the female where the free-floating oocytes are situated. Fertilization is by haemocoelic insemination and reproduction is by haemocoelous viviparity (Kathirithamby 2000).

BIOLOGY

The females of the extant Mengenillidia are free-living as adults, and both the males and females emerge to pupate externally. Pohl et al. (2005) speculate that the females of the fossil *Protoxenos janzeni* and Mengeidae were free-living as adults as the males lack specialized hairs on the tarsi, which in the extant males of Stylopidia are used for attachment to hosts during mating (Pohl & Beutel 2004).

There are only two free-living stages in Strepsiptera: the adult male and the 1st instar larva. The 1st instars emerge live from the viviparous female and are the host-seeking stage. The 1st instars have a segmented body with a head and thorax and would seek and enter the nymph or larval host. On entry they moult to a 2nd instar which is an apodous larva, thereby having hypometamorphic larval stages (Kinzelbach 1971, Kathirithamby 1989a, 1991, 2009). The 1st instar larvae of the family Stylopidae have also been reported to enter eggs of endopterygote hosts (Linsley & MacSwain 1957, Maeta et al. 2001, Hughes et al. 2003). 1st instar larvae of *Stichotrema dallatorreanum* Hofeneder in Papua New Guinea have been observed to enter their orthopteran hosts via the tarsi. On entry the 1st instar almost immediately moults to the 2nd apodous larval instar and then moves up the tibia and femur and eventually into the

abdomen of the host (Kathirithamby 2001).

Larval strepsipterans undergo unusual means of moulting whereby apolysis is not followed by ecdysis (Kathirithamby et al. 1984). There are four larval instars. At the end of the 4th instar the male extrudes the anterior region (cephalotheca) through the host cuticle and begins the pupal instar, and the female extrudes the cephalothorax and becomes a neotenic female, without an intervening pupal instar (Kathirithamby 2000).

At the end of the pupal instar the adult free-living male emerges from the puparium and seeks a female. The adult male has a very short life (~ 5-6 h). After insemination via the brood canal opening of the female the male dies almost immediately. The viviparous female is highly fecund and the numerous 1st instars (3,000-750,000) develop within her. The 1st instars emerge via the brood canal opening to seek new hosts (Kathirithamby 2000).

MORPHOLOGICAL EFFECTS OF STYLOPIZATION

Early work on the effects of stylopization was on Hymenoptera (Saunders 1850, Perez 1886, Wheeler 1910, Smith & Hamm 1914, Perkins 1918a, 1918b, Salt 1927). The most significant changes due to stylopisation is that male *Andrena* tend to resemble normal females and the pollen collection basket is reduced in females and males display a marked development.

The interchange of characters in stylopised bees have been referred to as "intersexes" (Salt 1927). Like bees stylopised, Delphacidae (Hemiptera) were also thought to be "intersexes" and "intermediate" forms (Otake et al. 1976). Esaki & Hashimoto (1931-1934, 1940) said that the sexes converged to a "neutral form", or, that the host undergoes changes to resemble the sex of the parasite (Raatikainen 1966).

A detailed study of stylopised Delphacidae (Kathirithamby 1978, 1979, 1981, 1982, 1983b, 1985, 1988, 1989b) and studies in recently light trapped specimens in Tapachula, Chiapas in collaboration with Juan Barrera and colleagues revealed the following:

i) Loss/reduction of the external (secondary sexual) organs such as ovipositor, aedeagus and genital rudiments which are more pronounced in the male than the female.

ii) Loss of tertiary characters which are found only in the males such as the tymbal organs on the second abdominal segment and the apodemes, and the pygophore with only vestiges of the parameres and aedeagus or loss.

These features suggest that the development stops at a certain pharate stage but there is no interchange of sexual characters. Hence stylopised Delphacidae have a reduced/loss of sexual characters. Unlike the Hymenoptera there is no positive acquisition of sexual characters in the Delphacidae.

CLASSIFICATION

Strepsiptera is a monophyletic group. Kinzelbach (1971, 1978) divided the order into two suborders (Mengenillidia and Stylopidia), and nine families based on Hennigian approach of morphological characters of adults (mainly males). Mengenillidia (*Mengea, Mengenilla, Eoxenos, Congoxenos*) were considered sister group to the Stylopidia. *Mengea* (family Mengeidae) is a fossil family from the Baltic amber (Menge 1866, Kulicka 1979). Pohl (2002) carried out a cladistic analysis of morphological characters of the 1st instar larva and the results supported the suborder Stylopidia, but the monophyly of the Mengenillidia could not be verified as the larvae of *Mengea* are not known. With the discovery of the fossil *P. janseni* (Pohl et al. 2005) from the Eocene Baltic amber the basal relationships within the order Strepsiptera were re-evaluated (Pohl et al. 2005) in which

the monophyly of the Mengenillidia was not confirmed in the analysis. A sister group relationship between the *Protoxenos* and all remaining subgroups, and between *Mengea* and extant Strepsiptera was well supported (Pohl et al. 2005). One fossil genus *Cretostylops* (Grimaldi et al. 2005) from the Cretaceous Burmese amber has also been described. Phylogenetic analysis confirmed the primitive position of *Cretostylops*, but it is not as primitive as *Protoxenos*. However, the generalized structure of the mandibles of both fossils is inconsistent with the hypothesis that Strepsiptera are related to Diptera, or closely related to the Mecopterida. The suborder Mengenillidia is not represented in the Neotropics or in Mesoamerica.

The suborder Stylopidia has 7 Recent families (McMahon & Kathirithamby 2008), and is distinct from the Mengenillidia in that the females during the neotenic stage remain endoparasitic except for the extruded cephalothorax.

The five families of Stylopidia present in Mexico are marked with species numbers in parenthesis and total of 15 species of Strepsiptera have been described from Mexico.

Suborder Mengenillidia
- Mengeidae
- Mengenillidae

Suborder Stylopidia
- Corioxenidae (4) (1 undescribed)
- Myrmecolacidae (4)
- Stylopidae
- Xenidae (2)
- Borhartillidae
- Elenchidae (3)
- Halictophagidae (2) (1 undescribed)

Corioxenidae

There are three genera: three species of *Triozocera* (Fig. 7) have been described by Pierce (1909), Brailovsky & Márquez (1974) and Kifune & Brailovsky (1987); one species of *Corioxenos* by Cook (2001); and in our recent studies with Juan F. Barrera and colleagues the genus *Malayaxenos* sp. n. has been found in traps in Tapachula (Barrera et al. 2008). Neither the females nor the hosts of the above genera are known.

Halictophagidae

Two species of *Halictophagus* have been recorded of which the females and cicadellid hosts are known: *Halictophagus naulti* Kathirithamby and Moya-Raygoza which is a parasite of the corn leafhopper, *Dalbulus maidis* (Delong & Wolcott) (Fig. 8); and *H. acutus* Bohart the hosts of which are *Draeculacephala minerva* Ball and *D. mollipes* (Say). In collaboration with Juan F. Barrera and colleagues another species has been found in traps in Tapachula, the hosts are *Hortenisia similas* (Walker) and *Tylozygus bifidus* (Say) (unpublished) (Fig. 9).

Elenchidae

Three species have been described (Pierce 1908, 1961, Brailovsky 1981) which are morphologically similar to those collected in Tapachula by Juan F. Barrera and colleagues, and the taxonomy of this genus has to be studied by molecular characterization as they might be cryptic species (unpublished).

Myrmecolacidae

There are four genera in this family: *Caenocholax, Stichotrema, Lyncholax* and *Myrmecolax* of which only two, *Caenocholax* and *Stichotrema*, have been described from Mexico.

The males of Myrmecolacidae parasitize Hymenoptera (ants) and females parasitize Orthoptera (grasshoppers, crickets), and Mantidae (mantids) (Ogloblin 1939, Kathirithamby & Hamilton 1992, Kathirithamby & Johnston 2004).

Caenocholax fenyesi sensu lato (Fig. 10)

This is the only genus of Myrmecolacidae that is found in abundance throughout Mesoamerica and the Neotropics (Kathirithamby et al. 2007a, Hayward et al.

Fig. 7. *Triozocera* sp. Total length = 3 mm.

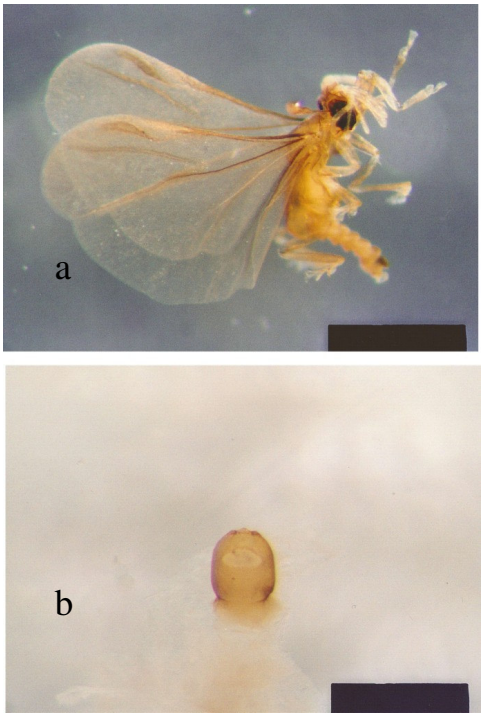

Fig. 8. *Halictophagus naulti* Kathirithamby & Moya-Raygoza from Morelos. a) Adult male (scale bar 400 µ); b) Frontal view of female cephalothorax (scale bar= 0.2 mm).

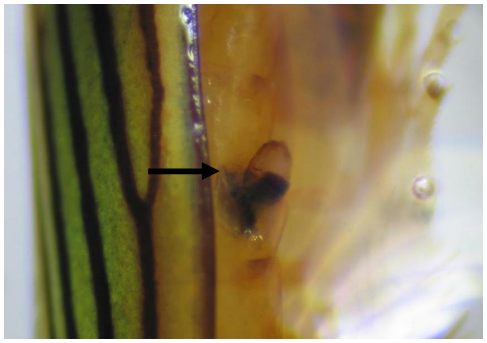

Fig. 9. *Halictophagus* sp. female cephalothorax (arrow). Width of cephalothorax = 0.2 mm.

Fig. 10. Adult male *Caenocholax fenyesi sensu lato*. Total length 1.3 mm.

Fig. 11. Male pupa of *Caenocholax fenyesi waloffi* Kathirithamby & Johnston (arrow) parasitic in *Dolichoderus bispinosus* Olivier Hymenoptera: Formicidae: Dolichoderinae), Los Tuxtlas, Veracruz, x7.5.

Fig. 12. Cephalothorax of female *Caenocholax fenyesi waloffi* Kathirithamby (arrow) parasitic in *Macroanaxipha macilenta* (Sussure) (Orthoptera: Gryllidae) from Los Tuxtlas. x5.

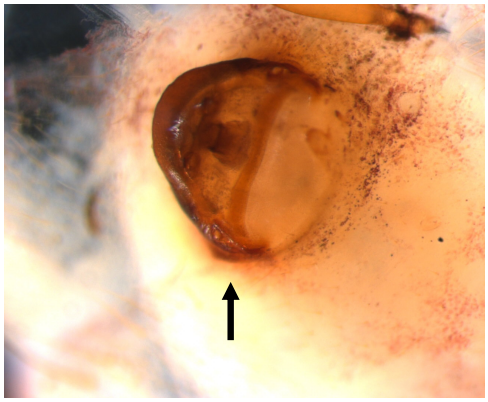

Fig. 13. Cephalothorax of female *Caenocholax fenyesi waloffi* Kathirithamby & Johnston (arrow) from Los Tuxtlas. x60.

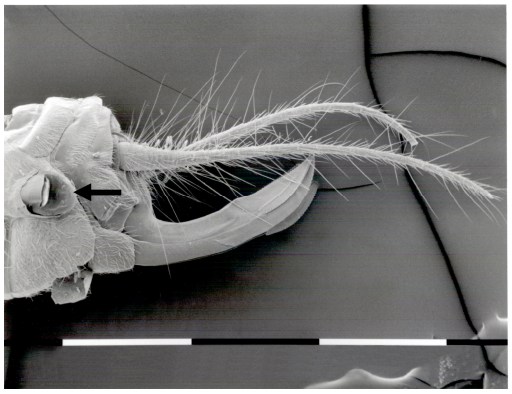

Fig. 14. Scanning electron microscope picture of cephalothorax of *Caenocholax fenyesi waloffi* Kathirithamby & Johnston (arrow) from Los Tuxtlas. Bar line = 1.0 mm.

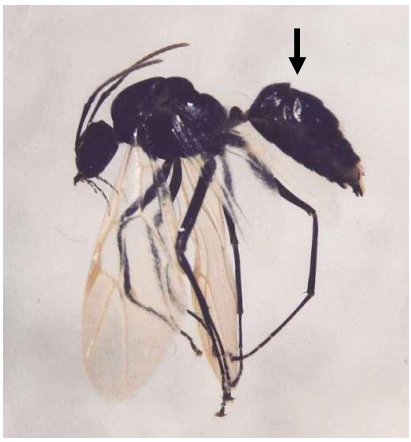

Fig. 15. *Camponotus planatus* Rodger with a male cephalotheca (arrow). Total length of ant = 5.2 mm.

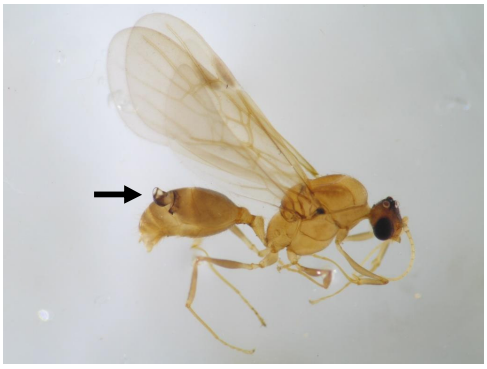

Fig. 16. A *Pheidole* sp. with a broken male cephalotheca of *C. fenyesi sensu lato* (arrow). Total length of ant = 4.1 mm.

Fig. 17. Lateral view of male *Xenos hamiltoni* Kathirithamby & Hughes from Los Tuxtlas. x10.

2008, Kathirithamby & Henderickx 2008, Kathirithamby 2009). Pierce (1909) described *C. fenyesi sensu lato* from Veracruz but there were no host records, or females. In 2001 male *C. fenyesi sensu lato* were found parasitic in *Camponotus planatus* Roger (Formicidae: Formicinae) in Los Tuxtlas, Veracruz (Kathirithamby & Hughes 2002).

In 2002 male *C. fenyesi sensu lato* were found parasitic in *Dolichoderus bispinosus* Olivier (Formicidae: Dolichoderinae) (Fig. 11), and the females were found in *Macroanaxipha macilenta* (Sussure) (Orthoptera: Gryllidae) (Fig. 12-14). Molecular characterization found that the male from the ant and the female from the cricket were 100% match and hence after 94 years of the discovery of *C. fenyesi sensu lato* the females were unambiguously matched and this species pair was named *C. fenyesi waloffi* (Kathirithamby & Johnston 2004). Hughes et al. (2003) reported the parasitization of the *C. planatus* by *C. fenyesi sensu lato* in Los Tuxtlas (Fig. 15). A dolichoderin ant was found in a trap with a broken cephalotheca of *C. fenyesi sensu lato* in Los Tuxtlas (Kathirithamby et al. 2007b); and a *Pheidole* sp. was found in a black light trap (run by Juan F. Barrera and colleagues) with a broken cephalotheca of *C. fenyesi sensu lato* from Tapachula (Fig. 16). *Camponotus atriceps* (Smith) was found to be parasitized by *C. fenyesi sensu lato* in Tapachula.

Morphologically similar *C. fenyesi sensu lato* were found to parasitize the red imported fireant *Solenopsis invicta* Buren (Formicidae: Myrmicinae) in Texas (Kathirithamby & Johnston 1992) and a comparison with *C. fenyesi waloffi* showed they were 14% divergent. The species from Texas was named *C. fenyesi texansis* Kathirithamby & Johnston 2004). This shows that *C. fenyesi sensu lato* is a species group (Kathirithamby 2009) and work with Juan F. Barrera and colleagues is being conducted to study the cryptic species in Mexico.

Stichotrema

Two species have been described: *S. trilobulatum* Brailovsky (1974) and *S. mexicanum* Kifune & Brailovsky (1987).

LIST OF STREPSIPTERA FROM MEXICO

This is a more up to date list to that of Kathirithamby (1992) and Kifune & Brailovsky (1988).

Family Corioxenidae Kinzelbach 1970: 106
Subfamily Triozocerinae Kinzelbach 1970: 105

Genus *Triozocera* Pierce 1909: 86
Genotype: *Triozocera mexicana* Pierce

T. mexicana Pierce 1909: 86
Triozocera texana Pierce 1911: 491
Triozocera paulistan Kogan 1958: 421
Host: *Pangaeus bilineatus* (Say) (Hemiptera. Cydnidae) Johnson 1972; Smith & Pitts 1974 (in the USA)
Female: unknown (in Mexico)
Distribituon: Veracruz, Oaxaca

T. tecpanensis Brailovsky & Márquez 1974: 106
Host: unknown
Female: unknown
Distribution: Tecpan de Galeana, Guerrero

T. vernalis Kifune & Brailovsky 1987: 132
Host: unknown
Female: unknown
Distribution: Juárez, Puebla

Subfamily Corioxeninae Kinzelbach 1970: 106

Genus *Corioxenos* Blair 1936: 116

C. acucyrtophallus Cook 2001: 397
Host: unknown
Female: unknown
Distribution: San Cristóbal, Chiapas

Genus *Malayaxenos* Kifune 1981: 323

Malayaxenos sp. n.
Host: unknown
Female: unknown
Distribution: Tapachula, Chiapas

Family Halictophagidae Perkins 1905: 98

Subfamily Halictophaginae Perkins 1905: 98

Genus *Halictophagus* Dale (in Curtis 1832: 433)
Genotype: *Halictophagus curtisi* Dale

H. acutus Bohart 1943: 352
Host: *Draeculacephala mollipes* (Say), *D. minerva* Ball (Hemiptera: Cicadellidae) Johnston & Morrison 1979 (in USA)
Female: unknown in Mexico
Distribution: Atzcapotzalco, D. F.

H. naulti Kathirithamby & Moya-Raygoza 2000
Host: *Dalbulus maidis* (Delong & Wolcott) (Hemiptera: Cicadellidae)
Distribution: Morelos, Tlatizapán

Halictophagus sp. n.
Host: *Hortenisia similas* (Walker) and *Tylozygus bifidus* (Say) (Hemiptera: Cicadellidae)
Distribution: Tapachula, Chiapas

Family Elenchidae Perkins 1905: 106
Genus *Elenchus* Curtis 1831: 385
Genotype*: Stylops walkeri* Curtis (=*Elenchus tenuicornis* (Kirby))

E. butzei Brailvosky 1981: 374
Host: unknown
Female: unknown
Distribution: Tecolutla, Veracruz

E. koebelei Pierce 1908: 81
Elenchus tenuicornis Baumert 1959 :400
Elenchinus heidemanni Pierce 1918: 481
Host: *Liburnia* sp., *Prokelisia marginata* (Van Duzee), *Prokelisia dolus* Wilson, *Sogatella kolophon* (Kirkaldy) (Hemiptera: Delphacidae) (in USA)
Female: unknown in Mexico
Distribution: Northern States

E. mexicanus (Pierce 1961: 467)
Sogatelenchus mexicanus Pierce 1961: 467
Elenchus mexicnaus Kinzelbach 1971: 156
Host: *Sogatodes* (*Sogata*) *cubanus*

(Crawford) (Hemiptera: Delphacidae) (in USA)
Female: unknown in Mexico
Distribution: Cotaxtla, Veracruz

Family Myrmecolacidae Saunders 1872: 20

Genus *Caenocholax* Pierce 1909: 88
Genotype: *Caenocholax fenyesi* Pierce 1909

C. fenyesi Pierce 1909: 88
Host: unknown
Female: unknown
Distribution: Veracruz, Tabasco

C. fenyesi waloffi Kathirithamby & Johnston 2004
Host: *Dolichoderus bispinous* Olivier (male) *Macroanaxipha macilenta* (Saussure) (female)
Distribution: Veracruz, Los Tuxtlas

Genus *Stichotrema* Hofeneder 1910b: 47
Genotype: *Stichotrema dallatorreanum* Hofeneder
S. mexicanum Kifune & Brailovsky 1988: 135
Host: unknown
Female: unknown
Distribution: Los Tuxtlas, Veracruz

Family Stylopidae Kirby 1813

Genus *Melittostylopus* Kinzelbach 1971: 170
Genotype: *Melittostylops hesparapium* Kinzelbach

M. hesparapium Kinzelbach 1971: 170
Host: *Hesperapis rhodocerata* (Cockerell), *H. leucra* (Cockerell) (Hymenoptera: Melittidae)
Female: unknwn
Distribution: Chihuahua, Baja California

Genus *Xenos* Rossi 1793: 49
Genotype: *Xenos vesparum* Rossius

X. hamiltoni Kathirithamby & Hughes 2006: 37
Host: *Polistes carnifex carnifex* F. (Hymenoptera: Vespidae)
Distribution: Los Tuxtlas, Veracruz

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