

## First caddisfly species from Mexican amber (Insecta: Trichoptera)

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### Abstract

The first 4 new species of caddisflies (Trichoptera) are described from Mexican amber: *Culoptila aguilerai* n. sp. (Glossosomatidae), *Plectropsyche alvarezi* n. sp. (Hydropsychidae), *Antillopsyche mexicana* n. sp. (Dipseudopsidae), and *Xiphocentron chiapasi* n. sp. (Xiphocentronidae). *Culoptila*, *Plectropsyche*, and *Xiphocentron* are typical members of the Neotropical fauna and the fauna of Mexico; they now are also represented in Miocene Mexican amber. The genus *Antillopsyche*, previously known from the Greater Antilles and from Dominican amber, is now reported from Mexican amber.

**Key words:** Trichoptera, caddisflies, systematics, *Culoptila*, *Plectropsyche*, *Xiphocentron*, *Antillopsyche*, fossils, Mexican amber

### Introduction

The specimens described here belong to Mexican Chiapas amber, which is considered to be middle Miocene in age. Mexican amber is a significant source of Cenozoic insect fossils. The study of Mexican amber is of great importance to the understanding of the paleoecology and paleobiogeography of the Central American region.

Research on Mexican amber inclusions began in the 1960s on material in the collection of the University of California, Berkeley. Trichoptera were mentioned (Hurd et al. 1962) from 2 undescribed specimens belonging to Hydroptilidae (B-8413-140) and Sericostomatidae (B-7053-32). Reinvestigation of this material by the authors has shown that the specimens seem to be fragments and are badly preserved; probably they do not even belong to the noted families. Tertiary Trichoptera species have been described and reviewed from Baltic (Ulmer 1912) and Dominican amber (Wichard 2006). In comparison, knowledge of the faunal inclusions of Mexican amber is entirely lacking with

no species having been described from these deposits until now. The absence of fossil Trichoptera in Mexican amber could be an artifact of limited collections. On the other hand, aquatic insects in Mexican amber are uncommon, just as in Dominican amber.

The present study provides the first descriptions of 4 species of caddisflies from Mexican amber. The 4 families and subfamilies included are represented in tropical and subtropical areas of the world. The genera *Culoptila*, *Plectropsyche*, and *Antillopsyche* are restricted to Central America and the Caribbean, whereas *Xiphocentron* also occurs in South America (Flint et al. 1999).

### Material and methods

This study is based on 8 fossil specimens from 4 families of Trichoptera, examined from the following 2 collections: Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez, Chiapas, Mexico, and from the collection of G.O. Poinar, Jr., Oregon State University, Corvallis, Oregon, USA. All pieces of amber came from Simojovel de Allende, Chiapas, Mexico. Simojovel de Allende is a mining district located in the northern part of the state of Chiapas, 17°08'19" N, 92°42'00" W, at 600 m, approximately 50 km from the city of Tuxtla Gutiérrez, Chiapas.

To prepare the pieces for identification, the amber was cut and polished using an IsoMet® Low Speed Saw (Buehler, Lake Bluff, Illinois, USA) cutting machine and a Phoenix® Beta Grinder-Polisher (Buehler) polishing machine with SiC grinding paper for metallography, grit 800, 1200 and 2500, Microcut® Abrasive Paper (Buehler) plain backing P 4000, and paperboard. To protect holotypes and paratypes of the new species the pieces were embedded in synthetic resin Araldite® 2020/B (Huntsman Advanced Materials, Everberg, Belgium).

### Systematics

#### Family Glossosomatidae Wallengren

The glossosomatid genus *Culoptila* Mosely (type species: *Culoptila aluca* Mosely) is largely endemic to Central America, but also occurs in the United States (Blahnik & Holzenthal 2006). In the Neotropics it is distributed in Mexico, Costa Rica, Guatemala, and Honduras (Blahnik & Holzenthal 2006, Flint et al. 1999). The genus is probably closely related to *Campsiophora* and *Cariboptila*, both endemic to the Greater Antilles.

*Culoptila aguilerai*, new species

Figs. 1–2

Compared with recent forms (Blahnik & Holzenthal 2006), the first fossil species of the genus *Culoptila* is characterized by diagnostic male genitalic structures typical for the genus: the rounded posterodorsal apex of the phallobase enclosing 2 phallic spines and an additional spine, the apparent absence of sternum IX, the projecting tergum X, and the long spatulate inferior appendages. Considering all genitalic characters and their modifications, a close relationship to one of the described, extant species is difficult to establish.

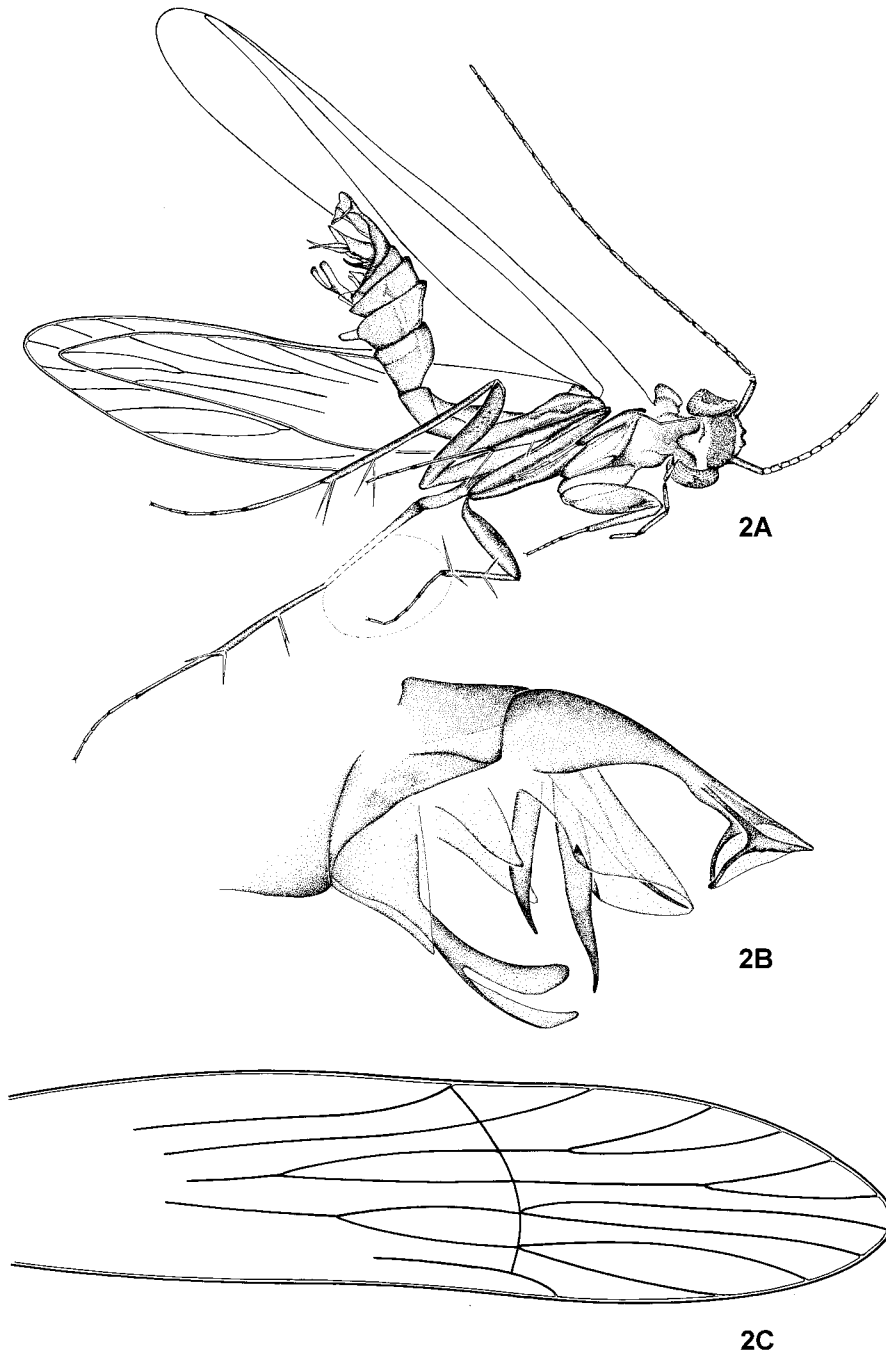
Adult. Length of forewing 2.5 mm. General structure and forewing venation typical for genus (Figs. 2A, 2C). In the forewings the genus is characterized by the presence of fork I–IV, forks I and II sessile, forks III and IV petiolate; fork V absent. Tegulae enlarged and dorsally rounded. Sternum VI of male bears a compressed apicomesal knob. Tibial spurs 0,4,4.



**FIGURE 1.** *Culoptila aguilerai*, new species. Male (holotype): fossil in Mexican amber.

Male genitalia (Figs. 2A, 2B). Segment IX rectangular in lateral aspect, sternum IX probably reduced. Segment X, in lateral aspect, long, with dorsal margin produced to a point, each lateral arm rounded apically, lightly sclerotized, together forming a ventral incomplete ring. Phallobase with dorsally rounded margin enclosing 1 pair of long, sinusoidal dorsal spines, their apices acuminate, dark colored; spines twisted (holotype) or divergent (paratype). [We think that the different position of the spines in the holotype and paratype do not indicate 2 species but rather show natural variation within a single species

or is a result of the embedding process in the resin.] Phallobase ventrally with additional spine half as long as dorsal pair of spines, dorsally arched and pointed; ventrolaterally phallobase projected as a triangular hyaline lobe. Inferior appendages long, spatulate.



**FIGURE 2.** *Culoptila aguilerai*, new species. **2A**, male (holotype): ventrolateral view; **2B**, male (paratype): genitalia in lateral view; **2C**, male (paratype): forewing.

**Holotype male:** Embedded in Mexican amber in the amber collection of the Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez, Chiapas, collection no.: IHNFA 014.

**Paratype:** Embedded in Mexican amber in the amber collection of the Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez, Chiapas, collection-no.: IHNFA 088, male.

Etymology. Dedicated to Prof. Eliseo Palacios Aguilera (1896–1944), the driving force in the study of the fossils of Chiapas, Mexico

### Family Hydropsychidae Curtis

*Plectropsyche* is a small genus with only 2 recent species, *P. hoogstraali* Ross, the type species, and *P. pitelli* Denning. It belongs to the subfamily Hydropsychinae, which was reviewed by Ross & Unzicker (1977) and recently evaluated by Schefter (2005). *Plectropsyche* is found today in Mexico and Costa Rica. Nothing is published about the immature stages or the biology of the species (Flint et al. 1999).

Based on the key of Schefter (2005) the genus *Plectropsyche* is characterized by a number of characters, including the position of crossvein *cu* near crossvein *m-cu* and the fusion of  $Cu_2$  and  $A_1$  at or before the wing margin in the forewing, by the presence of fork III and the absence of crossvein *m* in the hind wing, the absence of episternal warts on the prothorax, and the presence of bundles of seta on the foreleg tarsal claws.

In the male genitalia (Ross & Unzicker 1977) the genus *Plectropsyche* is characterized by the basal segment of the inferior appendage being at least twice as long as the apical segment and the apex of the phallus with endothelial processes and lobules of the endothelial lobe.

### *Plectropsyche alvarezi*, new species

Figs. 3–4.

*Plectropsyche alvarezi* possesses the diagnostic structures of the genus. The new fossil species differs from the 2 extant species by the position of crossvein *cu* very near crossvein *m-cu* in the forewing and by the slender, hook-shaped endothelial processes of endophallus.

Adult. Length of forewing 4.9 mm (holotype), 5.3 mm (paratype). General structure and forewing venation typical for genus (Figs. 3, 4A). Maxillary palp segment 1 as long as segment 2, segment 5 equal to or slightly longer than segments 1–4. Proepisternal warts very probably absent, but not discernable in the amber fossil. Tibial spurs 2,4,4. Forewing forks 1–5 and discoidal, median and thyridial cells present, crossvein *cu* very close to *m-cu* and  $Cu_2$ ,  $A_1$  fused before the forewing margin. Hind wing with forks 1, 2, 3, and 5 present;

crossvein *m* lost (from ventral view of male paratype).

Male genitalia (Fig. 4B). The length of the inferior appendage is in a ratio of at least 2:1 (basal segment : apical segment). Basal segment of inferior appendage enlarged, rounded; apical segment finger-like, elongate, bent mesad. Apex of phallus with pair of slender, dorsal rounded hooks (endothecal processes), lateroventrally with lobules (probably a pair, but in amber fossil not clearly visible).

**Holotype male:** Embedded in Mexican amber in the amber collection of the Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez, Chiapas, collection no.: IHNFA 067.

**Paratype:** Embedded in Mexican amber in the amber collection of the Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez Chiapas, collection no.: IHNFA 088, male.

**Etymology:** Dedicated to Prof. Miguel Alvarez del Toro (1917–1996), naturalist and founder of the Museum of Natural History and Zoo in Chiapas, Mexico.



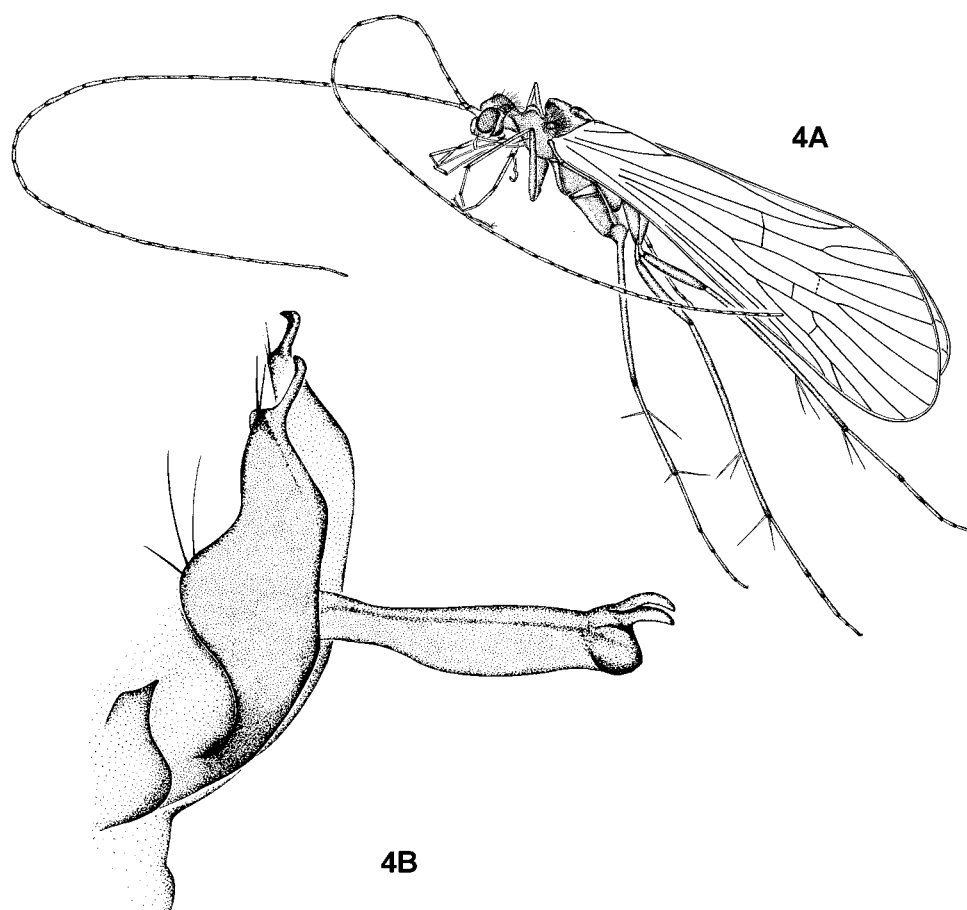
**FIGURE 3.** *Plectropsyche alvarezzi*, new species. Male (holotype): fossil in Mexican amber.

### Family Dipseudopsidae Ulmer

The genus *Antillopsyche* Banks (Type species: *Antillopsyche wrighti* Banks) belongs to the subfamily Pseudoneureclipsinae and is closely related to *Pseudoneureclipsis* from the Old World tropics. However, *Antillopsyche* is only known from the New World. Four living species are known from Cuba, Puerto Rico, and Hispaniola (Flint et al. 1999) and 3 fossil species from Dominican amber (Wichard 1985; 2006).

The adults of *Antillopsyche* are typical psychomyioids. The ocelli are absent, the

maxillary palps have an elongate terminal segment with suture-like cross striae, the mesoscutum bears a pair of setose warts, forewing apical fork 1 is present, and the tibial spurs are 3, 4, 4. They are further characterized by wing venation apomorphies: in the hind wing apical forks 2, 3, and 5 are present and the discoidal cell is open. *Antillopsyche* differs from *Pseudoneureclipsis* in the presence of fork 5 in the forewing. Hindwing venation for both taxa is the same.



**FIGURE 4.** *Plectropsyche alvarezii*, new species. **4A**, male (holotype): left lateral view; **4B**, male genitalia, (holotype): left lateral view.

***Antillopsyche mexicana*, new species**

Figs. 5–6

*Antillopsyche mexicana* differs from all other recent and fossil species by the forked pair of long spines of tergum X. In the hind wing apical fork 3 is very short compared with those of all other fossil species from Dominican amber.

Adult. Length of forewing 3.9 mm (holotype), 3.6 mm (paratype). General structure

and forewing and hind wing venation typical for genus (Figs. 5, 6A ), in hind wing fork 3 is remarkably short compared with other fossil species from Dominican amber.

Male genitalia (Figs. 6C, 6D). Tergum IX in lateral view with preanal appendage apically rounded, more than 2 times as long as wide, flat. Tergum X with mesal process deeply forked into 2 elongate lobes, as long as the apex of preanal appendage. Inferior appendage oval, approximately as long as preanal appendage, with acuminate basodorsal appendage, bent mesad. Apices of lobes of tergum X, preanal appendages, and inferior appendages all extend equally far posteriad, and are slightly surpassed by phallus (Fig. 6C). Phallus jacketed by laterodorsal membrane, apex membranous, without cluster of spines

**Holotype male:** Embedded in Mexican amber together with another male (paratype) and in the amber collection of the Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez, Chiapas, collection no.: IHNFA 232.

**Paratype:** Embedded in Mexican amber together with the holotype, in the amber collection of the Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez, Chiapas, collection no.: IHNFA 232, male.

Etymology. Named in recognition of the type country and the first evidence of the genus *Antillopsyche* in Mexico.

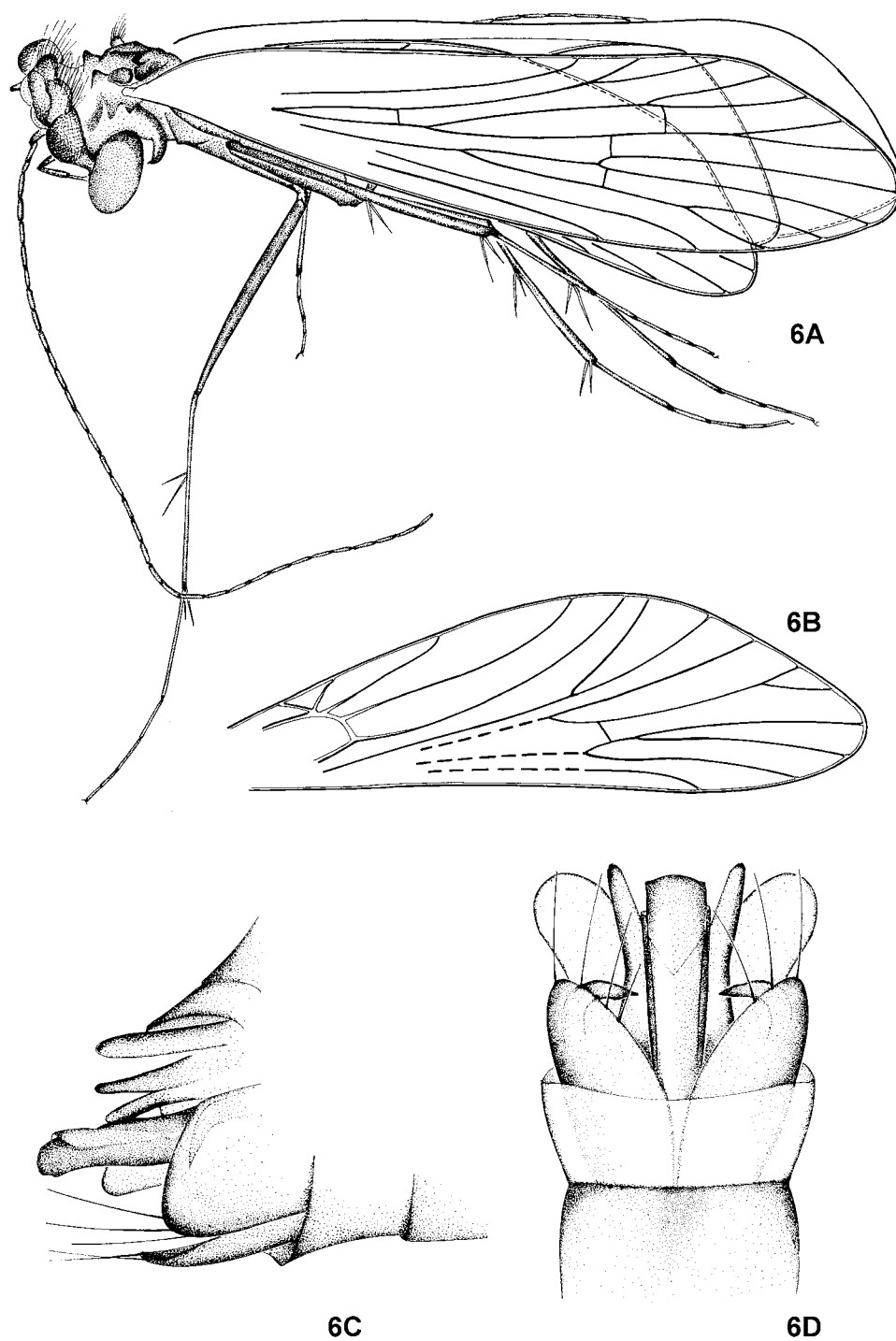


**FIGURE 5.** *Antillopsyche mexicana*, new species. Male (right: holotype, left: paratype): both fossils together in one Mexican amber.

### Family Xiphocentronidae Ross

Living species of *Xiphocentron* (type species: *Xiphocentron bilimekii* Brauer) are known from the southwestern USA through Central America and the Caribbean (Mexico, Nicaragua, Costa Rica, Panama, and Cuba) into South America (Flint et al. 1999). Adults





**FIGURE 6.** *Antillopsyche mexicana*, new species. **6A**, male (holotype): left lateral view; **6B**, male (holotype): hindwing; **6C**, male genitalia (holotype): right ventrolateral view; **6D**, male genitalia (paratype): ventrodistal view.

lack ocelli. The maxillary palps are elongate with terminal segment 5 equal to or greater in length than segments 1–4 and with suture-like cross striae. The mesoscutal setose warts are quadrate. The genus is further characterized by the forewing venation (Schmid 1982): Sc is fused to  $R_1$  at crossvein  $r_1$ -sr, forks 1, 2, and 4 are present, the discoidal and thyridial cells are closed, the median cell is open, and  $Cu_2$  and  $A_1$  reach the wing margin separately. The foreleg has 0, 1, or 2 apical tibial spurs, but always lacks preapical spurs; the middle legs have 2 preapical and 2 apical spurs; and the hind legs have 4 tibial spurs in the female, but in the subgenera *Xiphocentron* and *Rhamphocentron* some males have 2 preapical spurs and 1 modified apical spur.

*Xiphocentron (Xiphocentron) chiapasi*, new species

Figs. 7–8

This first fossil species of the genus *Xiphocentron* from Mexico is characterized by the male genitalia and differs from recent species by the pair of long mesal, spines of sternum IX.

Adult. Length of forewing 3.1 mm (holotype), 3.2 mm (paratype). General structure and forewing venation typical for genus (Figs. 7, 8A). Tibial spurs 2, 4, 3; hind leg with 2 preapical spurs and single, modified apical spur (Fig. 8D).

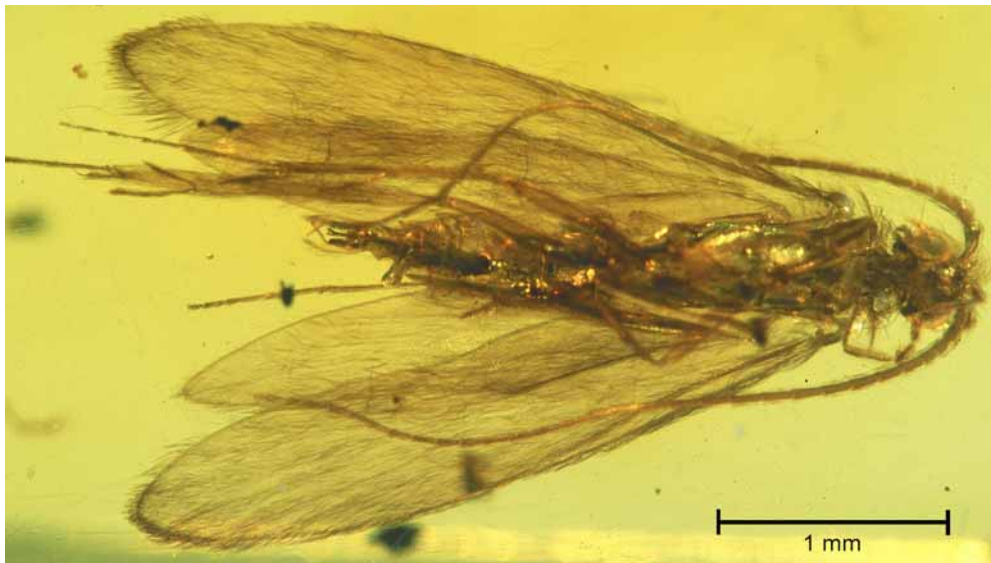
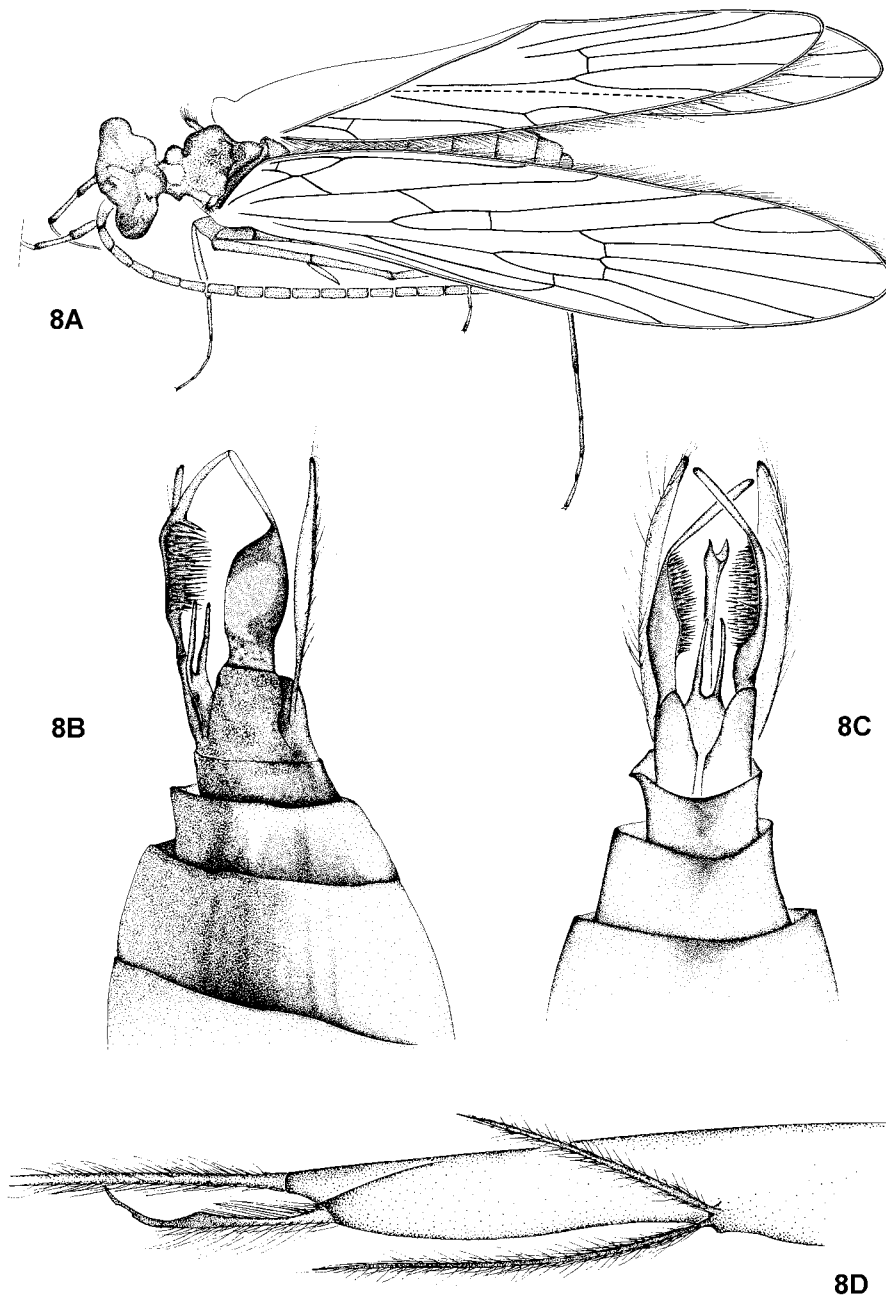


FIGURE 7. *Xiphocentron chiapasi*, new species. Male (paratype): fossil in Mexican amber.

Male genitalia (Figs. 8B, 8C). Sternum IX apically with pair of long mesal spines. Inferior appendage slender, curving evenly dorsad and mesad, inner surface of broad middle section with brush of black setae (characteristic of subgenus *Xiphocentron*), apical

section with elongate spine angled mesad and dorsad; both inferior appendages touch apically (holotype, Fig. 8B) or intersect at the apical spines (paratype, Fig. 8C). Phallus slender, tubular, open at apex, extending about 2/3 as far as preanal appendage or inferior appendage.



**FIGURE 8.** *Xiphocentron chiapasi*, new species. **8A**, male (holotype): dorsal view; **8B**, male (holotype): genitalia, lateroventral view; **8C**, male (paratype): genitalia, ventral view; **8D**, male (holotype): modified apical spur of the hind tibia.

**Holotype male:** Embedded in Mexican amber in the collection of G.O. Poinar, Jr., Oregon State University, Corvallis, Oregon, USA, collection no.: TR 2–10.

**Paratype:** Embedded in Mexican amber in the amber collection of the Instituto de Historia Natural y Ecología, Museum of Paleontology, Tuxtla Gutiérrez, Chiapas, collection no.: IHNFA 028, male.

**Etymology:** Named for the Mexican state where the amber was found.

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