

# New mesosciophilid gnats (Insecta: Diptera: Mesosciophilidae) in the Daohugou biota of Inner Mongolia, China

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## Abstract

Two extinct new species referable, respectively, to the genus *Mesosciophila* Rohdendorf, 1946 and a new genus, *Paramesosciophilodes*, within the Mesosciophilidae are described from the Daohugou Formation in Chifeng, Inner Mongolia, China: *Mesosciophila eucalla* sp. nov. and *Paramesosciophilodes ningchengensis* gen. et sp. nov. The diagnosis of *Mesosciophila* is supplemented based on information from the new species. The familial placements of four Chinese species are reassessed: *Sinosciophila meileyingziensis* Hong, *Liaoxifungivora simplicis* Hong, *Atalosciophila yanensis* Ren, Lu, Guo and Ji, and *Huaxiasciophilites jingxiensis* Zhang, Hong and Li.

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## 1. Introduction

The family Mesosciophilidae was previously proposed by Kovalev (1985) who raised the subfamily Mesosciophilinae of Rohdendorf (1946) to the rank of family. Our knowledge of mesosciophilid gnats is based mainly on impressions of wings from the Jurassic and Lower Cretaceous. Entire remains of mesosciophilid gnats are rare. Only two species, *Mesosciophila venosa* Rohdendorf, 1946 and *Mesosciophilopsis curta* Blagoderov, 1994, have been described based on nearly complete bodies with wings. To date, this family comprises eight species of four genera: *Mesosciophila venosa*, *Mesosciophilina bolshakovi* Kovalev, 1985, *M. irinae* Kovalev, 1985, *Mesosciophilodes angustipennis* Rohdendorf, 1946, *M. similis* Rohdendorf, 1964, *Mesosciophilopsis curta*, *M. expleta* Blagoderov, 1994 and *M. minor* Blagoderov, 1994.

In addition, *Eoboletina gracilis* Rohdendorf, 1946 may be a representative of the Mesosciophilidae (Blagoderov, 1994). The Australian species, *Pseudalysiinia fragmenta* Jell and

Duncan, 1986, can be transferred to the Mesosciophilidae but belongs to a new unnamed genus rather than to the extant *Pseudalysiinia* Tonnoir, 1929 within the Mycetophilidae (Blagoderov, 1994). Familial placements are uncertain for two genera: *Mesosciophilites* Kovalev, 1986 and *Sciophilites* Kovalev, 1990 from the Lower Cretaceous of Mongolia and eastern Transbaikalia, Russia, respectively. The former may be related to the Mycetophilidae whereas the latter belongs to either the Mesosciophilidae or the Mycetophilidae (Blagoderov, 1994).

A Chinese species, *Sinosciophila meileyingziensis* Hong, 1992, which has been referred to the Sciophilidae, may be a member of the Mesosciophilidae. On the other hand, another three Chinese species referable to three genera: *Liaoxifungivora simplicis* Hong, 1992, *Atalosciophila yanensis* Ren, Lu, Guo and Ji, 1995 and *Huaxiasciophilites jingxiensis* Zhang, Hong and Li, 2001 may belong to the Mycetophilidae rather than to the Pleciofungivoridae or the Mesosciophilidae (see discussion below).

Herein, two extinct new species respectively referable to *Mesosciophila* and a new genus, *Paramesosciophilodes*, within the Mesosciophilidae are described from the Daohugou Formation in Chifeng, Inner Mongolia based on a nearly complete

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male and two female(?) gnats. Wing venation in the descriptions follows Wootton and Ennos (1989), and Shcherbakov et al. (1995). The vein traditionally named 1A is, in fact, CuP.

## 2. Systematic paleontology

Order: Diptera Linnaeus, 1758

Suborder: Nematocera Latreille, 1825

Family: Mesosciophilidae Rohdendorf, 1946

Genus *Mesosciophila* Rohdendorf, 1946

*Type species. Mesosciophila venosa* Rohdendorf, 1946

*Species included.* Two species are placed in this genus: the type species *M. venosa* from the Karabastau Formation at Mikhailovka, Karatau, Kazakhstan, and *M. eucalla* described below.

*Emended diagnosis.* Medium-sized mesosciophilid gnats. Male body (including legs) covered with long, dense pubescence. Eyes large. Maxillary palps five-segmented, longer than head length. Antennae filiform, 16-segmented, with scapes and pedicels quadrate, flagellomeres cylindrical. Mesonotum convex. Scutellum clearly projecting. Venationally, Sc<sub>1</sub> ending distad to level of Rs origin, Sc<sub>2</sub> situated clearly basad to Rs origin; bRs longer than r-m; R<sub>1</sub> slightly curved; both R<sub>1</sub> and R<sub>4+5</sub> divergent terminally; Rs furcated distad to fork of M<sub>1+2</sub>; R<sub>2+3</sub> oblique; cell r moderately large, one-quarter to one-fifth of length of wing; stem of M not developed. Halteres light, with pubescence not visible. Femora, tibiae and first two tarsomeres with one or two rows of short setae.

*Remarks.* Owing to the excellent preservation of the new male specimen described below, the generic diagnosis, especially the structure of the body, of *Mesosciophila* has been improved.

*Mesosciophila eucalla* sp. nov.

Figs. 1A, B, 2A–E

*Derivation of name.* Greek, *eucalla*, beautiful, alluding to the face of mesosciophilid gnat.

*Material.* Holotype DHG200393, an almost complete impression of male, lateral aspect, from the Middle Jurassic–Lower Cretaceous Daohugou Formation in the vicinity of Daohugou, Ningcheng, Inner Mongolia, China (for detailed discussion of its age, see Zhang, 2006); deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.

*Diagnosis.* Venationally, Sc<sub>1</sub> two-fifths of wing length, Sc<sub>2</sub> well developed; R<sub>2+3</sub> not curved; both bM<sub>1+2</sub> and dM<sub>1+2</sub> subequal in length.

*Description.* Male. Head relatively short, with long, sparse setae. Eyes suboval. Maxillary palps 1.2 times longer than head length, with first two segments quite short, less than

one-half that of the others, third and fourth segments suboblong, last one tapering apically. Antennae nearly 4.5 times as long as head, with scapes and pedicels not thicker than flagellomeres, wider than long, less than one-quarter of length of first flagellomere; flagellomeres oblong, gradually reduced in length terminally, last one tapering apically. Thorax broad-oval. Wing about 2.6 times longer than wide; venationally, Sc<sub>1</sub> two-fifths of wing length, Sc<sub>2</sub> well developed; section of R (from Sc<sub>2</sub> to Rs origin) nearly as long as bRs; bRs slightly longer than r-m; R<sub>2+3</sub> not curved; cell r about 0.22 times as long as wing length; M<sub>1+2</sub> furcated distinctly basad to fork of Rs; both bM<sub>1+2</sub> and dM<sub>1+2</sub> subequal in length; M<sub>3+4</sub> running close to CuA basally, but neither coalescent; m-cu well developed, and somewhat oblique. Legs relatively thin and long, coxae and femora clavate, the former more than one-half length of the latter; tibiae of hindleg slightly shorter than tarsi, basitarsi slightly shorter than remainder combined, claws very small. Abdomen thin, cylindrical, with eighth abdominal segment more than one-half of length of seventh; gonocoxites relatively thin and long, gonostyles falcate, strongly curved upward.

Measurements in mm: length of head 0.6, antenna 2.8, thorax 1.5, abdomen 5.1, wing 4.2, width of wing ca. 1.6; length of femur of hindleg 2.0, tibia 2.6, tarsus 2.7 (1.3:0.6:0.4:0.2:0.2).

*Remarks.* The wing venation closely resembles that of *M. venosa*, but differs in the characters noted in the specific diagnosis.

Genus *Paramesosciophilodes* gen. nov.

*Type species. Paramesosciophilodes ningchengensis* sp. nov.

*Derivation of name.* Greek, *para*, beside, and the extinct genus *Mesosciophilodes* (gender, feminine).

*Species included.* The type species only.

*Diagnosis.* Medium-sized mesosciophilid gnats. Body (including legs) covered with long, dense pubescence. Mesonotum convex. Scutellum sharp, clearly projecting. Venationally, Sc<sub>1</sub> elongate, slightly shorter than one-half of wing length (0.43–0.47 times as long as wing length); Sc<sub>2</sub> situated distinctly basad to Rs origin, arising near midway between h to Sc<sub>1</sub> end; bRs markedly shorter than r-m; R<sub>1</sub> slightly curved; both R<sub>1</sub> and R<sub>4+5</sub> divergent terminally; R<sub>4+5</sub> strongly arched near its midlength; Rs furcated distad to fork of M<sub>1+2</sub>; R<sub>2+3</sub> oblique; cell r 0.16–0.18 times as long as wing length; stem of M not developed; M<sub>1+2</sub> furcated slightly distad, or basad, to level of Sc<sub>1</sub> end. Tibiae and tarsi with sparse, short setae.

*Remarks.* *Paramesosciophilodes* closely resembles *Mesosciophilopsis* Blagoderov, 1994, but the position of Sc<sub>2</sub> is quite different; cell r is one-sixth (in left wing) or slightly more (in right wing) of the wing length; and R<sub>4+5</sub> is strongly arched near its midlength. It differs from *Mesosciophila* Rohdendorf, 1946, *Mesosciophilina* Kovalev, 1985 and *Mesosciophilodes*

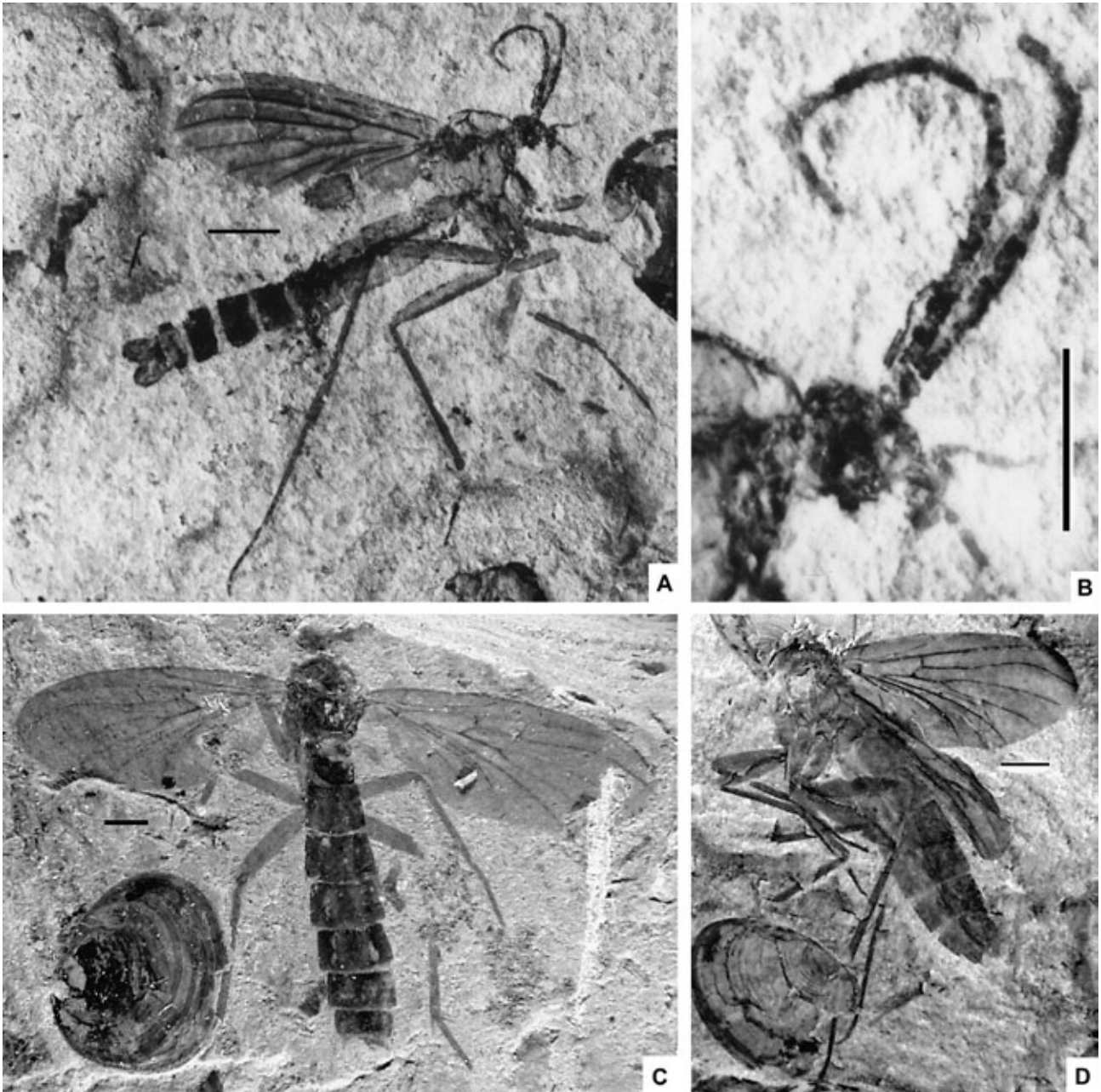


Fig. 1. A, B, *Mesosciophila eucalla* sp. nov., holotype, DHG200393. A, entire specimen. B, enlargement of head. C, *Paramesosciophilodes ningchengensis* sp. nov., holotype, DHG200394. D, *Paramesosciophilodes ningchengensis* sp. nov., paratype, DHG200395. Scale bars represent 1 mm.

Rohdendorf, 1946 in having an  $Sc_1$  that is nearly 0.43–0.47 times as long as wing length, an  $M_{1+2}$  that furcates slightly distad, or basad, to level of  $Sc_1$  end, and a smaller cell r. It also differs from *Sinosciophila* Hong, 1992 and *Eoboletina* Rohdendorf, 1946 in having a longer  $Sc_1$ , which ends slightly basad to midwing, a larger cell r and a longer r-m that is clearly longer than bRs.

*Paramesosciophilodes ningchengensis* sp. nov.

Figs. 1C, D, 2F–I

*Derivation of name.* After the fossil locality in Nincheng City.

*Material.* Holotype DHG200394, a nearly complete impression of female(?), dorsoventral aspect; paratype DHG200395, a nearly complete impression of female, lateral aspect. For locality and repository, see under *M. eucalla* sp. nov.

*Description.* Head poorly preserved. Thorax oval. Wing 2.1–2.5 times longer than wide; venationally,  $Sc_1$  0.46–0.47 times as long as wing;  $Sc_2$  well developed; section of R (from  $Sc_2$  to Rs origin) distinctly longer than bRs; bRs about two-thirds of length of r-m;  $R_{2+3}$  curved; cell r 0.16–0.18 times as long as wing length;  $M_{1+2}$  furcated distinctly basad to fork of Rs, and somewhat basad, or distad, to level of  $Sc_1$  end;  $bM_{1+2}$  slightly shorter than  $dM_{1+2}$ . Legs moderately

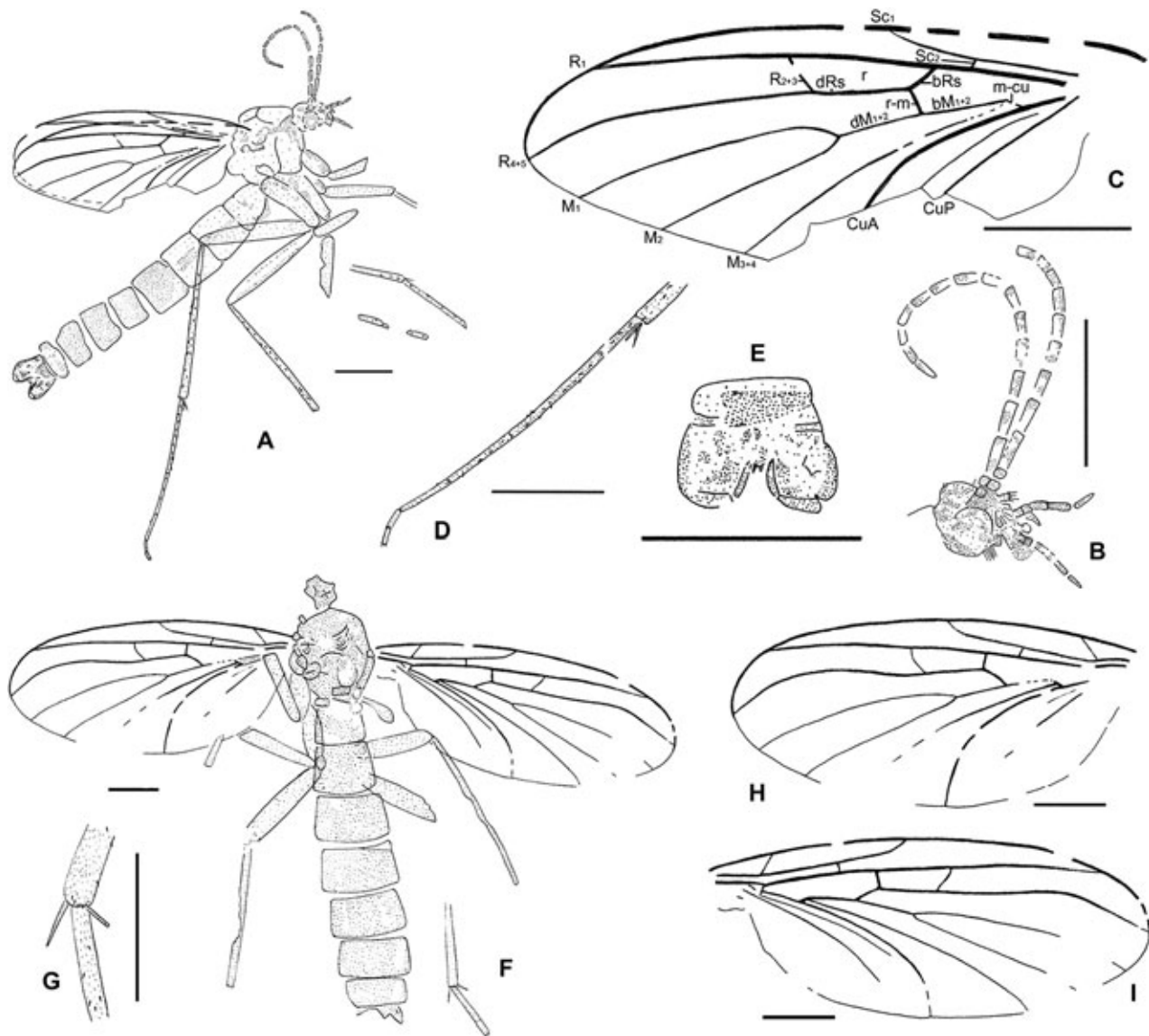


Fig. 2. A–E, *Mesosciophila eucalla* sp. nov., camera lucida drawings of specimen DHG200393, a male gnat. A, lateral aspect. B, head. C, wing. D, genital segment. E, tarsus of hindleg. F–I, *Paramesosciophilodes ningchengensis* sp. nov., camera lucida drawings of specimen DHG200394, a female(?) gnat. F, dorsoventral aspect. G, tibial spur of hindleg. H, left wing. I, right wing. Scale bars represent 1 mm.

thin and long, coxae and femora clavate, the former nearly one-half of length of the latter; tibiae nearly as long as tarsi, tibial spurs well developed, basitarsi elongate, remainder poorly preserved. Abdomen relatively massive, with fifth abdominal segment widest in dorsoventral view.

Measurements in mm: length of head, as preserved, 0.7, thorax 1.8–2.0, abdomen 5.6–6.5, wing 4.9–6.3; width of wing 2.3–2.7; length of coxa of hindleg 1.0, femur 2.0, tibia ca. 2.8, tarsus 2.8.

### 3. Discussion

*Sinosciophila meileyingziensis* from the Lower Cretaceous Shahai Formation in the vicinity of Xiwancun, Kezuo, Liaoning, was originally regarded as a member of the

Sciophilidae, a junior synonym of the family Mycetophilidae. Judging from the original illustration (Hong, 1992, p. 7, fig. 5c; Fig. 3A herein) the stem of M is well developed and  $M_{3+4}$  (originally  $M_4$ ) is clearly coalescent with  $M_{1+2}$  basally; hence, this species can be transferred to the Mesosciophilidae.

*Liaoxifungivora simplicis* from the same locality and horizon was previously assigned to the Fungivoritidae, which has been synonymized under Pleciofungivoridae (Kovalev, 1985). This species can be referred to the extant family Mycetophilidae because  $M_{3+4}$  (originally  $M_4$ ) is coalesced directly with CuA (Hong, 1992, p. 10, fig. 7b; Fig. 3B herein).

Ren et al. (1995) described *Atalosciophila yanensis* from the uppermost Jurassic–lowermost Cretaceous Yixian Formation at Gaositai in Chengde, Hebei. They considered the wing venation of this species to resemble closely that of

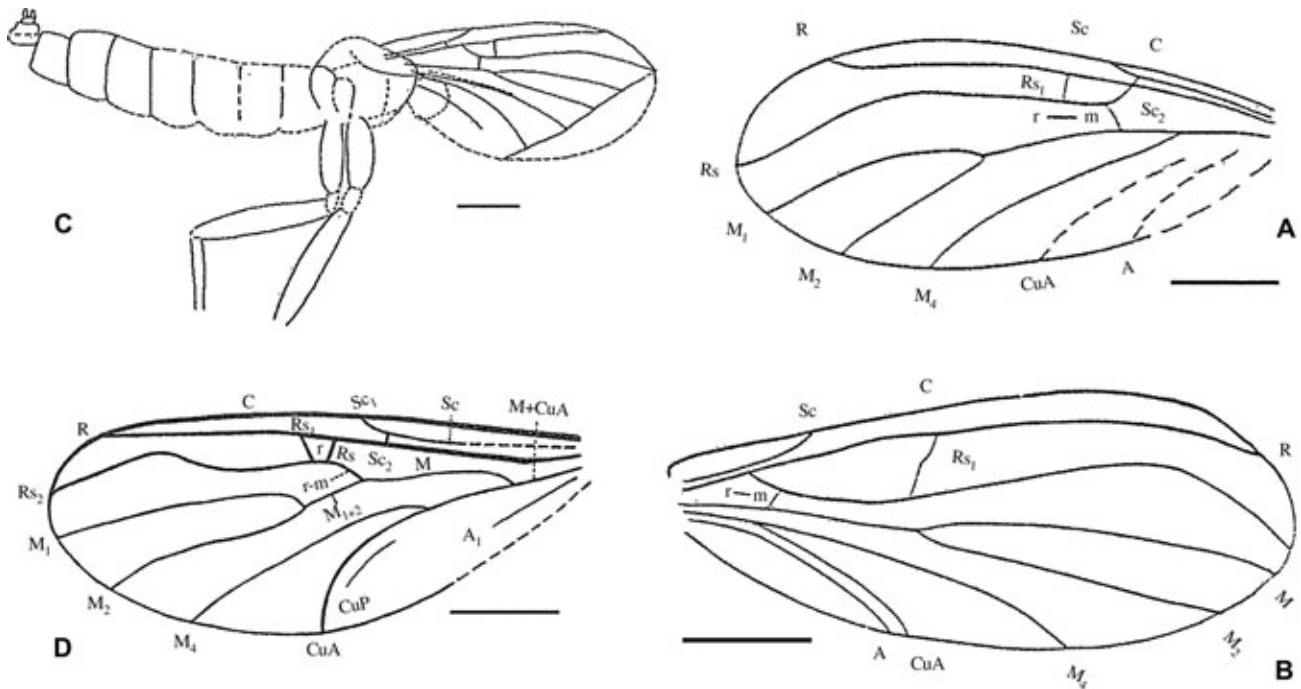


Fig. 3. A, *Sinosciophila meileyngziensis* Hong, 1992 (after Hong, 1992). B, *Liaoxifungivora simplicis* Hong, 1992 (after Hong, 1992). C, *Atalosciophila yanensis* Ren, Lu, Guo and Ji, 1995 (after Ren et al., 1995). D, *Huaxiasciophilites jingxiensis* Zhang, Hong and Li, 2001 (after Zhang et al., 2001). Scale bars represent 1 mm.

*Liaoxifungivora simplicis*, and regarded it as a member of the Mesosciophilidae. However, since  $M_{3+4}$  (originally  $M_4$ ) is coalescent with CuA and  $M_{3+4} + \text{CuA}$  are not connected to  $M_{1+2}$  (or stem of M) at the base of the wing (Ren et al., 1995, p. 105, fig. 3-64; Fig. 3C herein) it can be regarded as a member of the Mycetophilidae instead.

*Huaxiasciophilites jingxiensis* from the Lower Cretaceous Lushangfen Formation in Fangshan, Beijing District, was regarded by Zhang et al. (2001, p. 195, figs. 1–2; Fig. 3D herein) as referable to the Mesosciophilidae, but since  $M_{3+4}$  (originally  $M_4$ ) coalesces directly with CuA, it is apparent that this species is a fungus gnat (Mycetophilidae).

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