

The first Praesiricidae (Hymenoptera) from Northeast China

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Abstract: A new subfamily Rudisiricinae Gao, Rasnitsyn, Ren & Shih, **n. subfam.** and a new genus *Rudisiricius* Gao, Rasnitsyn, Ren & Shih, **n. gen.** with three new species *R. belli* Gao, Rasnitsyn, Ren & Shih, **n. sp.**, *R. crassinodus* Gao, Rasnitsyn, Ren & Shih, **n. sp.**, and *R. celsus* Gao, Rasnitsyn, Ren & Shih, **n. sp.** are described and illustrated from the family Praesiricidae. The type specimens were collected from the Late Jurassic to Early Cretaceous Yixian Formation, northeastern China. The new subfamily also includes *Aulidontes* Rasnitsyn from the Upper Jurassic of Karatau in Kazakhstan. This is the first record of Praesiricidae in China. These well-preserved nearly-complete new fossils reported here provide additional material and structure characters about this family, which helps filling some gap in the evolution of Lower Hymenoptera.

Résumé. Le premier Praesiricidae (Hymenoptera) du nord-est de la Chine. Une nouvelle sous-famille Rudisiricinae Gao, Rasnitsyn, Ren & Shih et un nouveau genre *Rudisiricius* Gao, Rasnitsyn, Ren & Shih, avec trois espèces nouvelles *R. belli* Gao, Rasnitsyn, Ren & Shih, *R. crassinodus* et *R. celsus* sont décrits de la famille Praesiricidae et illustrés. Les spécimens types ont été collectés dans la formation Yixian (Jurassique supérieur - Crétacé inférieur) du Nord Est de la Chine. La nouvelle sous-famille comprend aussi *Aulidontes* Rasnitsyn du Jurassique supérieur de Karatau au Kazakhstan. Ces taxons sont les premiers Praesiricidae connus de Chine. Ces fossiles bien conservés et presque complets fournissent de nouvelles informations sur la morphologie de cette famille, qui aide à combler des lacunes dans l'évolution des Hymenoptera 'basaux'.

Keywords: Symphyta, Rudisiricinae, new subfamily, new genus, Yixian Formation.

Praesiricidae is a small family of Symphyta erected by Rasnitsyn in 1968. It was first considered to be a subfamily of the superfamily Siricoidea (Rasnitsyn 1968, 1969). In 1983, Rasnitsyn raised it to the rank of family and transferred it from the Siricoidea to the Pamphilioidea (Rasnitsyn 1983). Up to date, there have been only four genera with five species reported throughout the world; *Praesirex* Rasnitsyn 1968 from the Lower Cretaceous of Transbaikalia, *Xyelodontes* Rasnitsyn 1983 from the Lower Cretaceous of Mongolia, *Aulidontes* Rasnitsyn 1983 from the Upper Jurassic of Southern Kazakhstan, and *Turgidontes* Rasnitsyn 1990 from the Lower Cretaceous of Transbaikalia (Rasnitsyn 1990).

Recently we collected three well-preserved fossil specimens from Northeast China; they are attributable to the Praesiricidae and constitute the first record of the family in China. All these fossils were found from

the Late Jurassic to Early Cretaceous Yixian Formation of the western Liaoning, China: one from the village of Dawangzhuangzi, Songzhangzi Township, Lingyuan City; and the others from the Huangbanjigou area, near Chaomidian Village of the Shangyuan Township, Beipiao City (Wang *et al.* 2004; Wang *et al.* 2005). Both localities have provided rich fossil insects (Ren *et al.* 1995; Zhang & Zhang 2000; Rasnitsyn *et al.* 2006; Yao *et al.* 2006; Zhang *et al.* 2007; Liu *et al.* 2008; Gao & Ren 2008). Based on these nearly-complete fossils, a new genus with three new species is erected. Characters of these new species show particular similarity to the genus *Aulidontes* Rasnitsyn 1983 known after a single species *A. mandibulatus* Rasnitsyn 1983 from the Upper Jurassic Karabastau Formation of Karatau in South Kazakhstan (Rasnitsyn 1983). This similarity is specific enough to permit erection of a new subfamily to include these two genera. Furthermore, these fossils with clear head, antenna and wing venation provide abundant materials and detailed information for us to understand the structure and evolution of the Praesiricidae.

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Material and Methods

The fossils were examined under a Leica MZ 12.5 stereo microscope and illustrated with the aid of camera lucida attached to the microscope. The figure is drawn by Illustrator CS 13.0 and Photoshop CS 13.0. These specimens studied here are deposited in the Key Lab of Insect Evolution and Environmental Change, College of Life Science, Capital Normal University, Beijing, China. The holotype of *Aulidontes mandibulatus* Rasnitsyn 1983 was re-studied using a Leica MZ 9.5 stereomicroscope and Nikon D70 camera at the Arthropoda Laboratory, Paleontological Institute, Russian Academy of Sciences, Moscow, Russia. The wing venation nomenclature used in this paper is based on the interpretation of Huber and Sharkey 1993.

Results

Systematic descriptions

Order Hymenoptera L. 1758

Suborder “Symphyta” Gerstaecker 1867

Superfamily Pamphilioidea, Cameron 1890 (1834)

Family Praesiricidae Rasnitsyn 1968

Subfamily Rudisiricinae n. subfam.

Type genus. *Rudisiricius* Gao, Rasnitsyn, Ren & Shih n. gen.

Diagnosis. Scape thick and long (subequal to head in length), flagellum long, multi-segmented, 3rd antennal segment much longer but only slightly wider than following flagellomeres. Mandible long, robust, falcate. Fore wing with cell 1M short, and crossvein cu-a at base of cell 1M.

Genera included: Type genus and *Aulidontes* Rasnitsyn 1983 with one species from the Upper Jurassic of Karatau, Kazakhstan.

Remarks. Unlike the new subfamily, Praesiricinae Rasnitsyn 1968 **stat. nov.**, with its constituent monotypic genera *Praesirex* Rasnitsyn 1968, *Xyelidontes* Rasnitsyn 1983, and *Turgidontes* Rasnitsyn 1990, from the Lower Cretaceous of Transbaikalia and Mongolia, has a scape shorter than head length and the forewing cell 1M large, with cu-a branching near its midlength.

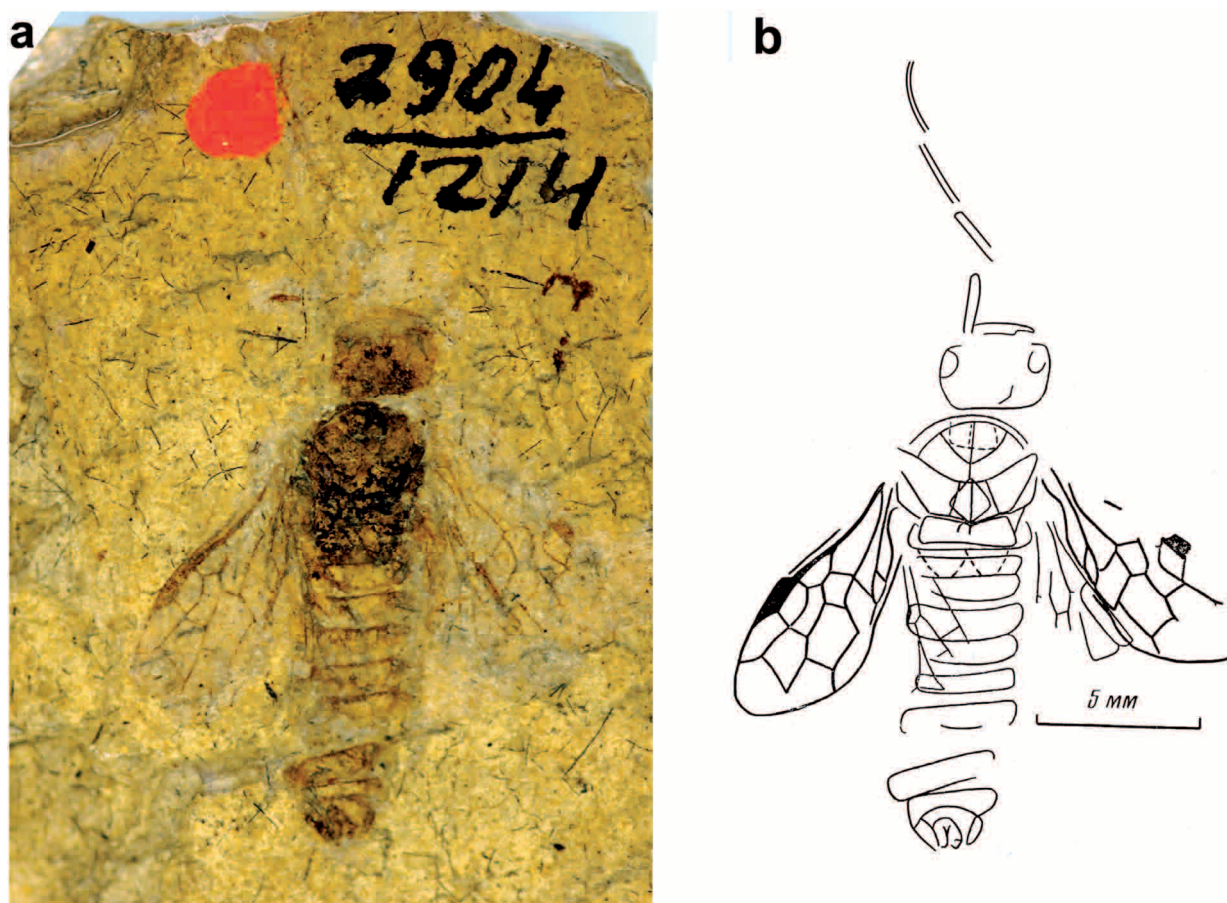


Figure 1
Aulidontes mandibulatus Rasnitsyn 1983, holotype, PIN 2904/1214, dorsal view. **a**, Photograph; **b**, line drawing corrected after Rasnitsyn (1983: fig. 3b).

The preservation state of these Chinese fossils made possible to reveal that the type specimen of *Aulidontes mandibulatus* possesses unusual structure of antenna similar to that in *Rudisircius* which was overlooked earlier (Fig. 1. a, b).

Enigmatically, all four known Rudisircinae fossils are males, in contrast to usual prevalence of females among the symphytan fossils. This might indicate either unusual sexual dimorphism preventing preservation of females of these insects, or secretive habits of females, or else just sampling of rare fossil specimens.

Genus *Rudisircius* n. gen.

Type species. *Rudisircius belli* n. sp.

Diagnosis. Head ovoid, very large, as wide as thorax; antenna with 3rd segment much shorter than scape and as long as, or longer than, two following flagellomeres combined; flagellum distinctly decreasing in width towards apex. Forewing with dark transverse band downward from pterostigmal base toward posterior margin, 1st abscissa of RS short, subvertical to R or reclivous, 2r-m distal of 2r-rs, M+Cu strongly arching.

Etymology. The name is a combination of Greek prefix “*Rudi-*” = wide and crude, referring to the broad and robust head, and “*siric*” from the family Praesiricidae.

Species included. The type species, *R. crassinodus* n. sp., and *R. celsus* n. sp.

Remarks. Unlike the new genus, *Aulidontes* has head of rather ordinary size, the 1st abscissa of RS long (subequal to that of M) and distinctly proclivous, 2r-m only placed slightly distal in comparison to 2r-rs, and M+Cu much less arching. Unfortunately, poor preservation of the sole specimen known does not permit revelation of details of its antenna, legs and other structures.

Rudisircius belli n. gen., n. sp.

(Fig. 2. a, b)

Holotype. Male, body (17.5 mm excluding antenna) with wings nearly complete (11.0 mm preserved), precise structure of head and thorax poorly preserved, antenna with 24 visible segments (including scape and pedicel, about 13.0 mm visible), legs poorly preserved, abdomen thinner than thorax.

Material. Holotype, No. CNU-HYM-NN-2008015, a well-preserved male sawfly in ventral view.

Description. Head large, 6.0 mm wide and 4.3 mm long; eyes oval and small. Antenna with scape much longer and thicker than other segments (3.0 mm in length and 0.6 mm in width), 1.5 times as long as the 3rd segment of antenna, pedicel trapeziform. 3rd segment of antenna as long as combined length of two following ones, flagellomeres gradually shortening toward apex.

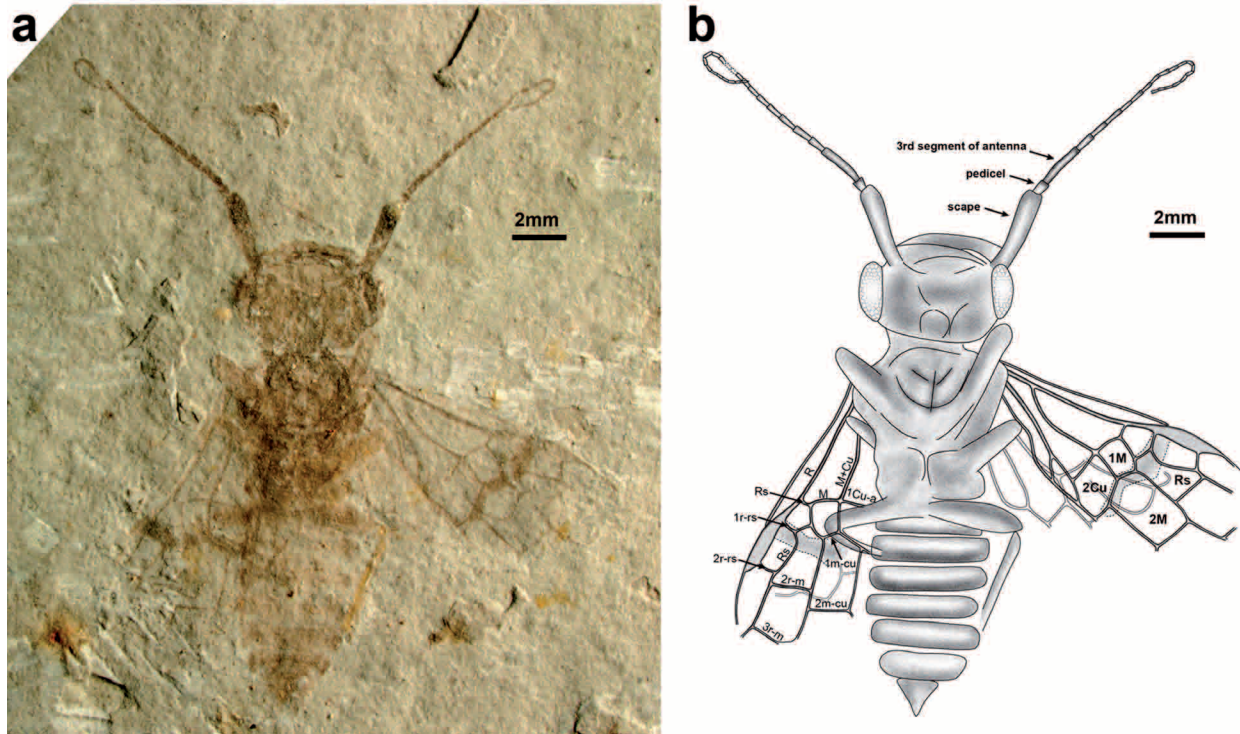


Figure 2
Rudisircius belli n. gen., n. sp., holotype, CNU-HYM-NN-2008015, ventral view. **a**, Photograph; **b**, line drawing.

Forewing with Sc absent, vein R nearly straight, thickening before pterostigma. Basal part of M twice as long as first free abscissa of Rs which is vertical to R. M+Cu obviously arching, vein M branching from M+Cu at fork between 1cu-a and Cu. Crossvein 1r-rs slightly shorter than 2r-rs, section of Rs between 1r-rs and 2r-rs strongly arching posteriorly. 1m-cu distinctly shorter than segment of Cu before it, 1cu-a very long. Cell 1M small, half of cell 2Cu, or 1/4 of 2M, cell Rs a little shorter than 2M in length. Pterostigma long and narrow, fully sclerotized. A prominent brownish translucent band surrounding a “curve” from pterostigma toward the posterior margin, which is a combination of veins 1r-rs, the second free abscissa of Rs, the second free abscissa of M, crossvein 1m-cu, Cu and 2cu-a.

Etymology. The specific name is dedicated to Mr. Nigel Bell, for providing guidance, mentorship and inspiration to CKS.

Locality and horizon. Yixian Formation, Dawangzhangzi Village, Songzhangzi Township, Lingyuan City, Liaoning Province, China.

Rudisiricius crassinodus n. sp.

(Fig. 3. a, b)

Holotype. Male, Body slim (16.0 mm without antenna), forewing 11.0mm preserved, and antenna at least 7.0 mm, 11 segments including scape and pedicel as preserved, abdomen segments unclear, a little broader than thorax.

Material. Holotype, No. CNU-HYM-LB-2008016, a well-preserved specimen in dorsal view.

Description. Head distinctly larger than meta- and mesosoma, 5.6 mm in width and 4.2 mm in length, mandible strong, but detailed structure unclear. Antenna with scape partly visible, but

much thicker than other segments, 3rd segment of antenna nearly as long as the following three flagellomeres combined. Remaining flagellomeres slightly shortened and thinning toward the apex.

Forewing with crossvein 1cu-a originating from Cu a short distance after separation of first free abscissa of M, 1cu-a nearly equal to basal section of M in length. 1r-rs slightly shorter than 2r-rs, both inclining to wing apex. 1m-cu inclining to wing base, much shorter than Cu segment distal of it. Pterostigma completely sclerotized.

Hind wing with basal section of Rs slightly curving, first free abscissa of M aligned with 1r-m.

Etymology. From Latin “*crassinodus*” = thick node, referring the broad scape of antenna.

Locality and horizon. Yixian Formation, Huangbanjigou, Chaomidian Village, Beipiao City, Liaoning Province, Northeast China.

Remark. Differs from *R. belli* in having a thicker scape and flagellomeres following the 3rd antennal segment shorter.

Rudisiricius celsus n. sp.

(Fig. 4. a, b)

Holotype. Male, body thin (14.2 mm excluding antenna, with male genitalia present). Head huge (nearly 5.5 mm in width, 3.8 mm in length), forewing (10.0 mm visible) nearly complete.

Material. Holotype, No. CNU-HYM-LB-2008017, a well-preserved male sawfly in ventral view.

Description. Antenna with 13 visible segments, scape darkening toward its apex, 1.5 times as long as, and 3 times as thick as, 3rd segment of antenna. 3rd segment slightly shorter than following

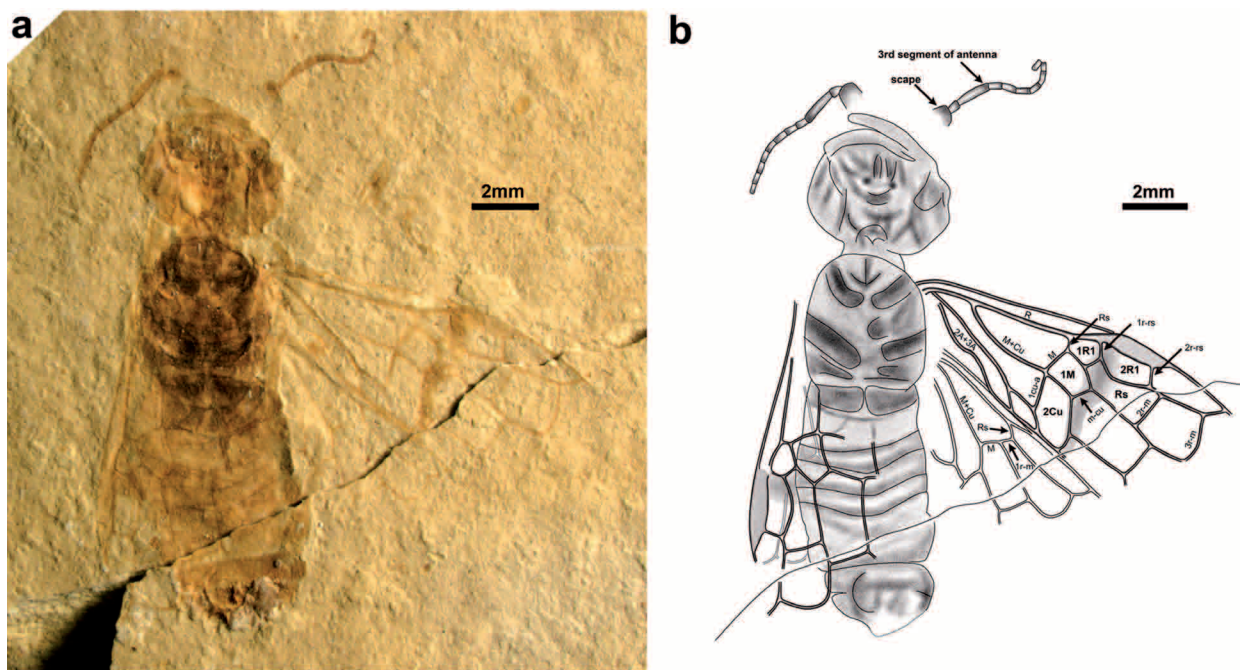


Figure 3
Rudisiricius crassinodus n. sp., holotype, CNU-HYM-LB-2008016, dorsal view. a, Photograph, b, line drawing.

three segments combined. Flagellomeres gradually shortening toward the apex of antenna.

Forewing with the basal section of Rs shorter than half length of M, obviously inclining to basal of the wing and aligned with the first free abscissa of M. Crossvein 1cu-a originating from Cu just after separation of M. Vein 1r-rs distinctly shorter than 2r-rs, and the section of Rs between them arching in the middle.

Etymology. From Latin “*celsus*” = noblest, referring to this pretty specimen.

Locality and horizon. Yixian Formation, Huangbanjigou, Chaomidian Village, Beipiao City, Liaoning Province, Northeast China.

Remark. Differs from *R. belli* Gao, Rasnitsyn, Ren & Shih. and *R. crassinodus* Gao, Rasnitsyn, Ren & Shih by its very thick scape, reclivous RS base aligned with M base and crossvein 1cu-a originating from Cu just distal of separating from M. Although the wing venation of the three described specimens is similar, we tentatively classify them as three new species mainly based on their different structure of antenna.

Discussion

There is a brownish transverse band midlength across forewings in all of them, an evident case of disruptive coloration known in some symphytans, both extant, e.g., in *Zaraea* Leach and *Abia* Leach (Cimbicidae), *Arge* Schrank and *Pamphylota* Konow (Argidae), *Cephalcia* Panzer, and extinct, e.g., in *Ghilarella* Rasnitsyn 1988

(Sepulcidae; Rasnitsyn 1988) and *Syntexyela* Rasnitsyn 1968 (Anaxyelidae; Zhang & Rasnitsyn 2006). This feature indicates a possible existence of visually-oriented predators of Praesiricidae but gives no clue concerning their nature.

Modification of the head and mandibles of the new genus is of particular interest because of striking even if incomplete parallelism to *Ferganolyda* Rasnitsyn 1983 of the family Xyelydidae (Rasnitsyn 1983; Rasnitsyn *et al.* 2006) in the huge head size and modified antennae and mandibles. In fact, large head and sickle-shaped mandibles are characteristic of the extant Pamphilioidea as well, viz., Pamphiliidae and Megalodontesidae, although they are all different to some extent. Unfortunately, we are not aware what are adaptation and function for these unusual heads, mandibles, and antennae (Rasnitsyn *et al.* 2006).

Similar but not identical characters in head and its appendages among *Rudisircius*, *Ferganolyda*, Pamphiliidae and Megalodontesidae do not necessarily mean their monophyly. Indeed, other characters particularly wing venation, gives different phylogenetic signals which might be of equal or higher strength. Praesiricidae, with their absent forewing vein Sc form a transition to Megalodontesidae, supported with the diminished, sometimes rectangular cell 1M with 1cu-a near its base in Rudisircinae, and it is further supported with the

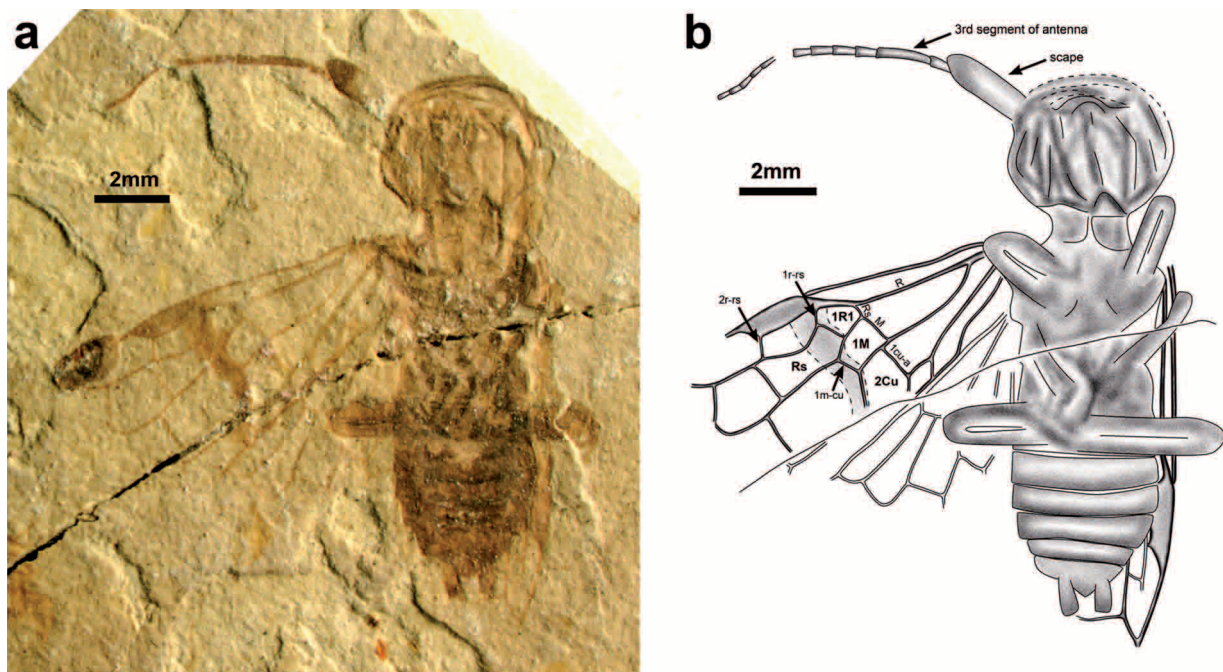


Figure 4
Rudisircius celsus n. sp., holotype, CNU-HYM-LB-2008017, ventral view. **a**, Photograph, **b**, line drawing.

weakly arching M+Cu in *Aulidontes* and short, subvertical or even reclivous 1st section of Rs in *Rudisircius*, similarly or at least approaching to the state known in Megalodontesidae. On the other hand, Pamphiliidae, as well as *Ferganolyda*, with their Sc present, may have no apparent synapomorphies with Rudisircinae. Phylogenetic structure of Pamphilioidea certainly needs further investigation.

The last note concerns the genus *Sagulyda* Rasnitsyn 1983 described in Xyelydidae after three badly preserved incomplete specimens from the upper Lower Jurassic of Kyrgyzstan, lacking preserved costal area (Rasnitsyn 1983). In other words, the genus is unknown in respect of presence vs. absence of Sc and hence of their position in Xyelydidae vs. Praesiricidae. Following a conservative approach we leave them in Xyelydidae pending future findings of more complete fossils.

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