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New taxa of Sepulcidae (Hymenoptera) from mid-Cretaceous Kachin amber

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Abstract

Three new species of the genus *Prosyntexis* Sharkey, 1990 in the extinct sawfly family Sepulcidae, *Prosyntexis aristovi* **sp. nov.**, *P. lata* **sp. nov.** and *P. antennata* **sp. nov.**, are described from five well-preserved specimens from the mid-Cretaceous Kachin amber. These new species, the first records of the family Sepulcidae in Kachin amber, are placed in *Prosyntexis* (Trematothoracinae) based on the mesonotum membranous centrally with sides ridge transversely; forewing with the basally arched M+Cu; basal third or half of costal space narrowed; and 2r-m absent. The conspecific male and female of *Prosyntexis lata* with well-preserved genitalia are reported for the first time in the family Sepulcidae. A key to fossil species of *Prosyntexis* is provided. These new findings improve our understanding of *Prosyntexis* by adding more morphological features, such as antenna with no fewer than 16 segments, basal and distal hamuli present, tibia apical spurs 1-2-2, etc. The new taxa suggest that the Sepulcidae should range in age from at least from the Middle Jurassic to the mid-Cretaceous.

Keywords: sawfly, Cephoidea, mesonotum, Symphyta, Trematothoracinae

Introduction

The Sepulcidae is a small Mesozoic sawfly family (Jattiot *et al.*, 2011). To date, 54 species within 16 genera referred to 5 subfamilies of Sepulcidae have been reported, all of which are from compression fossils (Darling & Sharkey,

1990; Rasnitsyn, 1993; Rasnitsyn & Ansoerge, 2000; Jattiot *et al.*, 2011; Kopylov & Rasnitsyn, 2014, 2017a, b). These taxa range in age from the Middle Jurassic (Rasnitsyn, 1968) to the Early Cretaceous (Darling & Sharkey, 1990; Rasnitsyn, 1993; Jattiot *et al.*, 2011; Kopylov & Rasnitsyn, 2014, 2017a, b; Jouault & Nel, 2021). Trematothoracinae, the largest subfamily of Sepulcidae, is special for its distinctive mesonotal structure with transverse ridge stripes along the lateral border enclosing a membranous center (Kopylov & Rasnitsyn, 2014). Trematothoracinae has 22 species grouped into three genera: *Prosyntexis* Sharkey, 1990, *Thoracotrema* Rasnitsyn, 1988, and *Trematothorax* Rasnitsyn, 1988. *Prosyntexis*, originally placed in Anaxyelidae (Darling & Sharkey, 1990) but transferred to Trematothoracinae by Rasnitsyn *et al.* in 1998 (Rasnitsyn *et al.*, 1998), comprises five species: *P. gobiensis* Rasnitsyn, 1993 (Mongolia), *P. gouleti* Sharkey, 1990 (Brazil), *P. montsecensis* Rasnitsyn & Ansoerge, 2000 (Spain), *P. okhotensis* Rasnitsyn, 1993 (Magadan), and *P. sennlaubi* Jouault & Nel, 2021 (Brazil). Based on the examination of three new specimens of *P. gouleti*, Jattiot *et al.* (2011) revised the diagnosis of species of *Prosyntexis*, i.e., Rs+M may either reach 1m-cu or fork slightly basal of 1m-cu in different fossil specimens.

Herein we describe three new species, *Prosyntexis aristovi* **sp. nov.**, *Prosyntexis lata* **sp. nov.**, and *Prosyntexis antennata* **sp. nov.**, from the mid-Cretaceous Kachin (Burmese) amber, which has preserved many significant discoveries of insects (Ross, 2022; Yu *et al.*, 2019; Wang *et al.*, 2022). These are the first amber fossil records of

the Sepulcidae, further enhancing the diversity of fossil sepulcids. In addition, the holotype and paratype of *P. lata* **sp. nov.** with same venational morphology are the first pair of male and female specimens documented in Trematothoracinae and Sepulcidae in general.

Material and methods

All type specimens were collected from Kachin (Hukawng Valley) in northern Myanmar, deposits of which were dated at 99 Mya (Cruickshank & Ko, 2003; Shi *et al.*, 2012; Zhao *et al.*, 2020). The amber specimens described herein are housed in the Key Laboratory of Insect Evolution and Environmental Changes, College of Life Sciences, Capital Normal University, Beijing, China (CNUB; Curator, Dong Ren). Specimens were examined under a Leica M205C dissecting microscope and photographed using a Nikon SMZ 25 microscope with an attached Nikon DS-Ri2 digital camera system.

Wing venation nomenclature was modified after Rasnitsyn (1969, 1980), with the following abbreviations: A, anal vein; C, costal vein; Cu, cubital vein; M, median vein; R, radial vein; R1, first radial; Rs, radial sector; 1cu-a, crossvein between 1-Cu and A; 2rs-m and 3rs-m, crossveins between Rs and M; 1m-cu and 2m-cu, crossveins between M and 1-Cu; 1-R, 2-R, 1-M, 2-M etc., succeeding sections of respective veins counted from base to apex of wing.

Systematic palaeontology

Order Hymenoptera Linnaeus, 1758

Family Sepulcidae Rasnitsyn, 1968

Subfamily Trematothoracinae Rasnitsyn, 1988

Genus *Prosyntexis* Sharkey, 1990

Type species. *Prosyntexis gouleti* Sharkey, 1990 (late Aptian, Sierra do Araripe, Brazil).

Prosyntexis aristovi* Li, Shih & T. Gao **sp. nov.*

(Figs 1, 2)

Type material. Holotype: CNU-HYM-MA2015105, male specimen. Most of body preserved, but major parts of head and mesonotum obscured by inclusions in ventral view. Left forewing and left and right hind wings folded over abdomen obscuring abdomen dorsally.

Etymology. The specific name “*aristovi*” is dedicated to the memory of the late Dr Daniil Sergeevich Aristov, for his outstanding contribution to palaeoentomological research.

Diagnosis. The new species is unique within *Prosyntexis* in having 2+3A widely interrupted before the cu-a crossvein. It also differs from other species in having a short and thin crossvein-like Sc in the forewing.

Locality and horizon. Hukawng Valley, Kachin State, northern Myanmar; lowermost Cenomanian, mid-Cretaceous.

Description. Body about 4.91 mm long, antenna 7.86 mm long in dorsal view; forewing about 4.66 mm in length, maximum width 2.08 mm (Fig 1A, B).

Head nearly 0.93 mm wide and 0.67 mm long, rather large and subquadrate. Compound eyes rather small and oval. In ventral view, maxillary palpus with at least five palpomeres; labial palpus indiscernible. Antenna elongate and filiform with 16 segments; scape 0.22 mm long, maximum width 0.14 mm, slightly swollen apically; pedicel 0.40 mm long, maximum width 0.10 mm, slightly swollen apically and thinner than scape; flagellomere I longer than scape and pedicel 0.77 mm long, 0.10 mm wide; flagellomere II 0.76 mm long, 0.09 mm wide, as wide as individual widths of remaining flagellomeres (Fig. 2B).

Thorax only partially visible with a deep medial membranous depression in the mesonotum bordered laterally by strong striate surfaces (Fig. 2C). Legs spindly, meso- and metafemur thicker than associated tibiae; metafemur length 0.95 mm, metatibia 1.50 mm long, maximum width 0.07 mm. Protibia with one apical spur (Fig. 2E), mesotibia with two apical spurs (Fig. 2F), metatibia with two apical spurs (the smaller spur thick, less than half length of larger spur) (Fig. 2G); basitarsomere long but shorter than remaining tarsomeres combined; tarsomere V not elongate; pretarsal claws short, with curved apices and additional inner teeth (Fig. 2D).

Forewing (Fig. 1C) with C strongly thickened; R greatly thickened before base of Rs; basal third of costal space narrowed; crossvein-like Sc short and thin, appearing just before origin of Rs; 1-Rs slanted toward wing apex and 1.4× as long as 1-M; pterostigma broad, oblong and 3× as long as wide with center slightly translucent; 1-M+Cu bent basally; 2-M+Cu exceptionally short, nearly 0.05 mm long, scarcely present owing to the proximal position of cu-a near the origin of 1-Cu. 2-Rs+M short and 1/5× as long as 1-Rs+M; end of 2-Rs weakened; 1r-rs connected to pterostigma at its base and nearly as long as section of Rs between 1r-rs and 2r-rs; 2r-rs issuing from 1/4 of pterostigma and at 1/3 of 2+3rm length; 2rs-m absent; 3-M slightly shorter than 3rs-m. Cell 1mcu subquadrate, about 2× as long as wide; cell 2mcu hexagonal, about 1.5× as long as wide. 2+3A widely interrupted before 1a-2a. Hind wing with cell r closed, other parts indiscernible. Abdomen visible only ventrally, with hypopygium triangular with widely rounded apex; male genitalia not exerted, with only narrow gonocoxa partly visible.

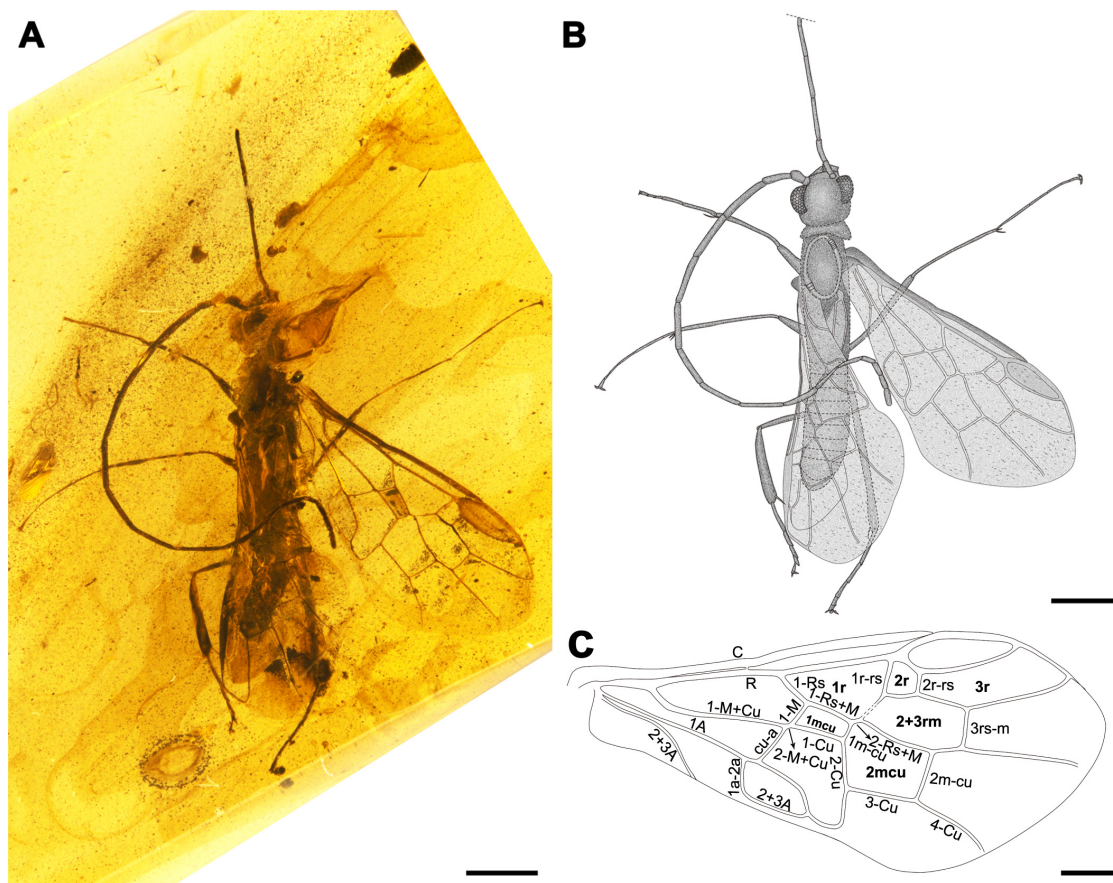


FIGURE 1. One photograph and two line drawings of *Prosyntexis aristovi* **sp. nov.**, holotype (specimen CNU-HYM-MA2015105) male. **A**, Habitus in dorsal view. **B**, Line drawing in dorsal view. **C**, Line drawing of the right forewing. Scale bars: 1.0 mm for **A** and **B**; 0.5 mm for **C**.

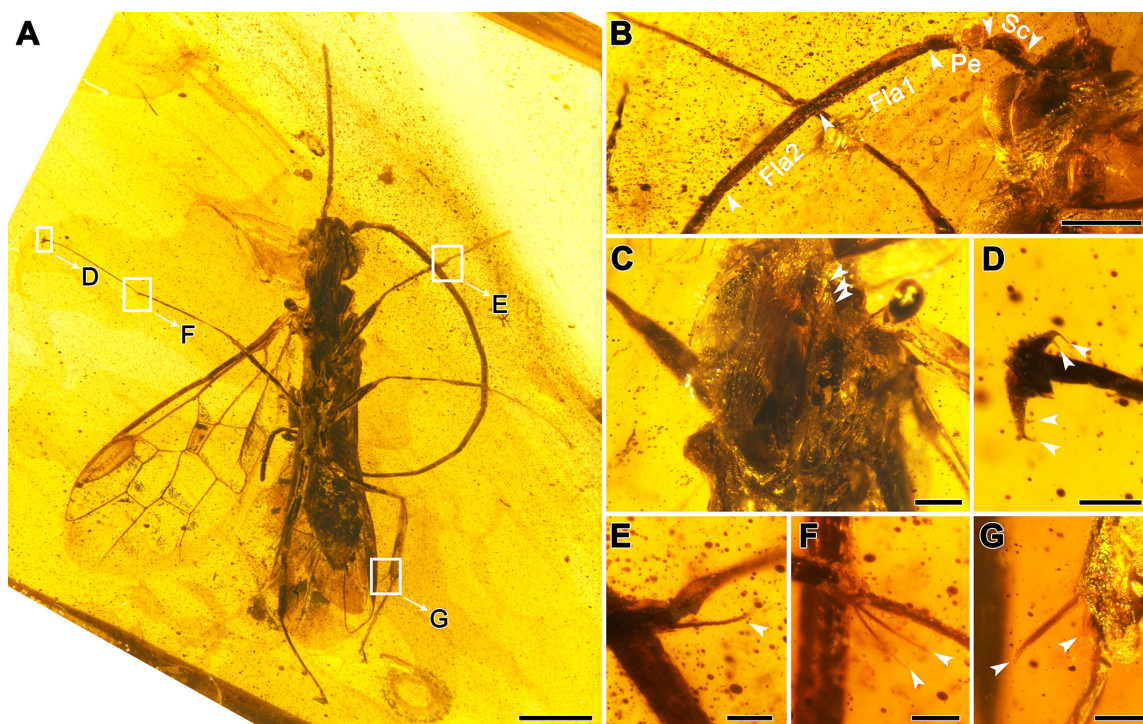


FIGURE 2. Photographs of *Prosyntexis aristovi* **sp. nov.**, holotype (specimen CNU-HYM-MA2015105) male. **A**, Photograph of habitus in ventral view. **B**, Part of antenna. **C**, Mesonotum, with arrows indicating transverse ridges. **D**, Right mesotarsal pretarsal claw. **E**, Left protibial spur. **F**, Right mesotibial spurs. **G**, Left metatibial spurs. Abbreviations: Fla1 and Fla2, flagellomeres I and II; Pe, pedicel; Sc, scape. Scale bars: 1.0 mm for **A**, **D**, **E–G**; 0.5 mm for **B**; 0.2 mm for **C**.

***Prosyntexis lata* Li, Shih & T. Gao sp. nov.**
(Figs 3–7)

Type material. Holotype: CNU-HYM-MA2015108 (Figs 3, 4), female. Most of body preserved, except apex of right antenna lost; left antenna compressed diagenetically and right metatarsus fractured. The specimen is indistinct in left lateral view. Paratype: CNU-HYM-MA2015106 (Figs 5, 6), male. Most of body parts preserved except for missing apices of both antennae. CNU-HYM-MA2015109 (Fig. 7), male. Apices of forewings and hind legs missing.

Etymology. The name *lata* is derived from the Latin word *latus*, referring to the broad pterostigma.

Diagnosis. The new species is unique within *Prosyntexis* in having very long cell 1mcu (ratio of length to width more than 3). It also differs from other species,

except *P. gobiensis* Rasnitsyn, 1993, in having 3r-m very close to 2m-cu in the forewing (ratio of length of 2m-cu to length of 3-M more than 5).

Locality and horizon. Hukawng Valley, Kachin State, northern Myanmar; lowermost Cenomanian, mid-Cretaceous.

Description. Holotype. Body about 6.52 mm long in lateral view, antenna 7.07 mm long in lateral view; forewing about 5.23 mm in length, maximum width 1.71 mm; hind wing about 4.01 mm in length (Fig. 3A, B).

Head 0.57 mm long in lateral view. Compound eye medium sized and oval. Labial palpus with at least two palpomeres. Antenna elongate and filiform with 16 segments preserved; scape 0.23 mm long, maximum width 0.12 mm; pedicel 0.57 mm long, maximum width 0.09 mm; flagellomere I longer than scape and pedicel,

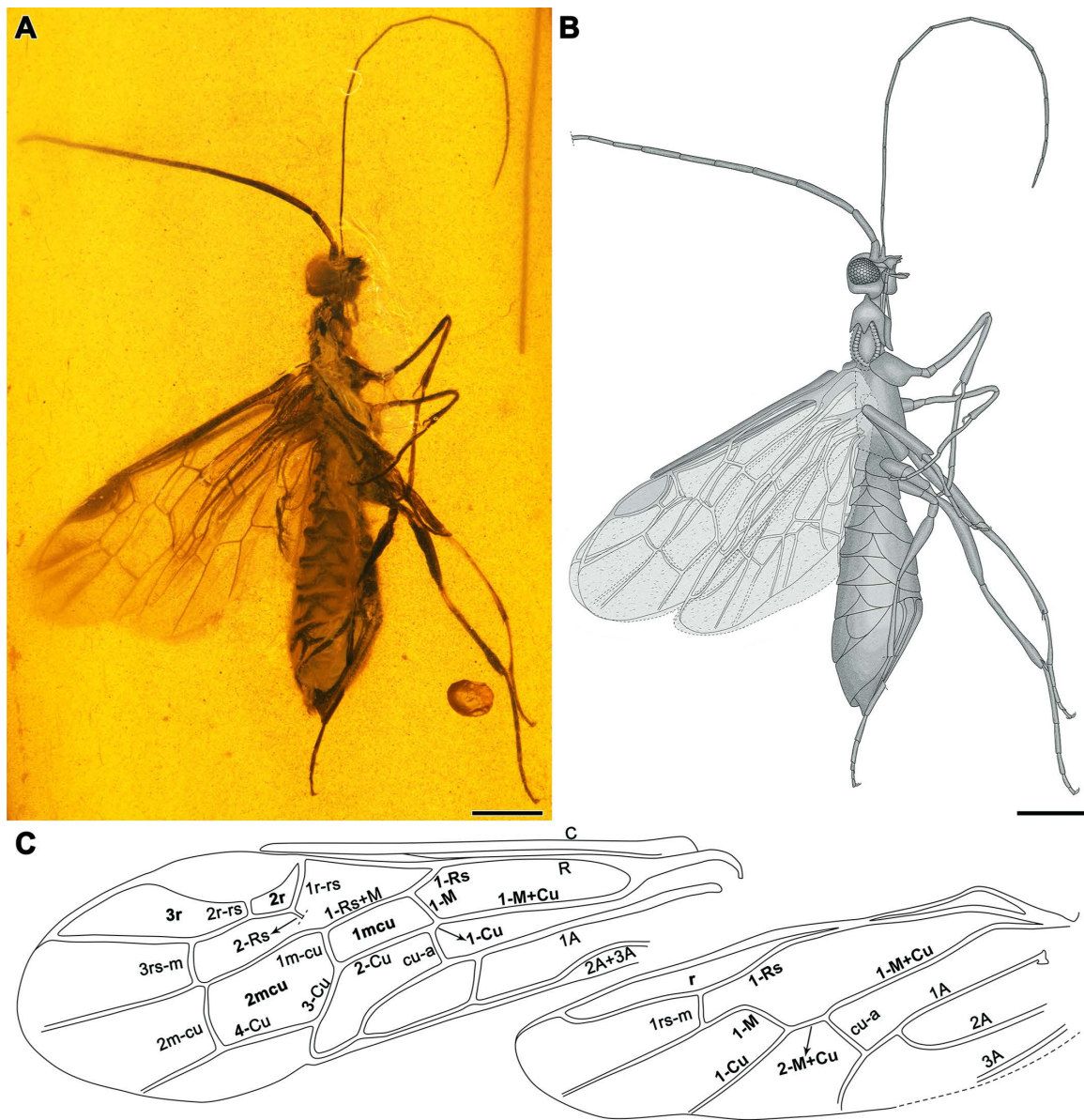


FIGURE 3. One photograph and two line drawings of *Prosyntexis lata* sp. nov., holotype (specimen CNU-HYM-MA2015108) female. **A**, Habitus in right lateral view. **B**, Line drawing in right lateral view. **C**, Line drawing of the right forewing and hind wing. Scale bars: 1 mm.

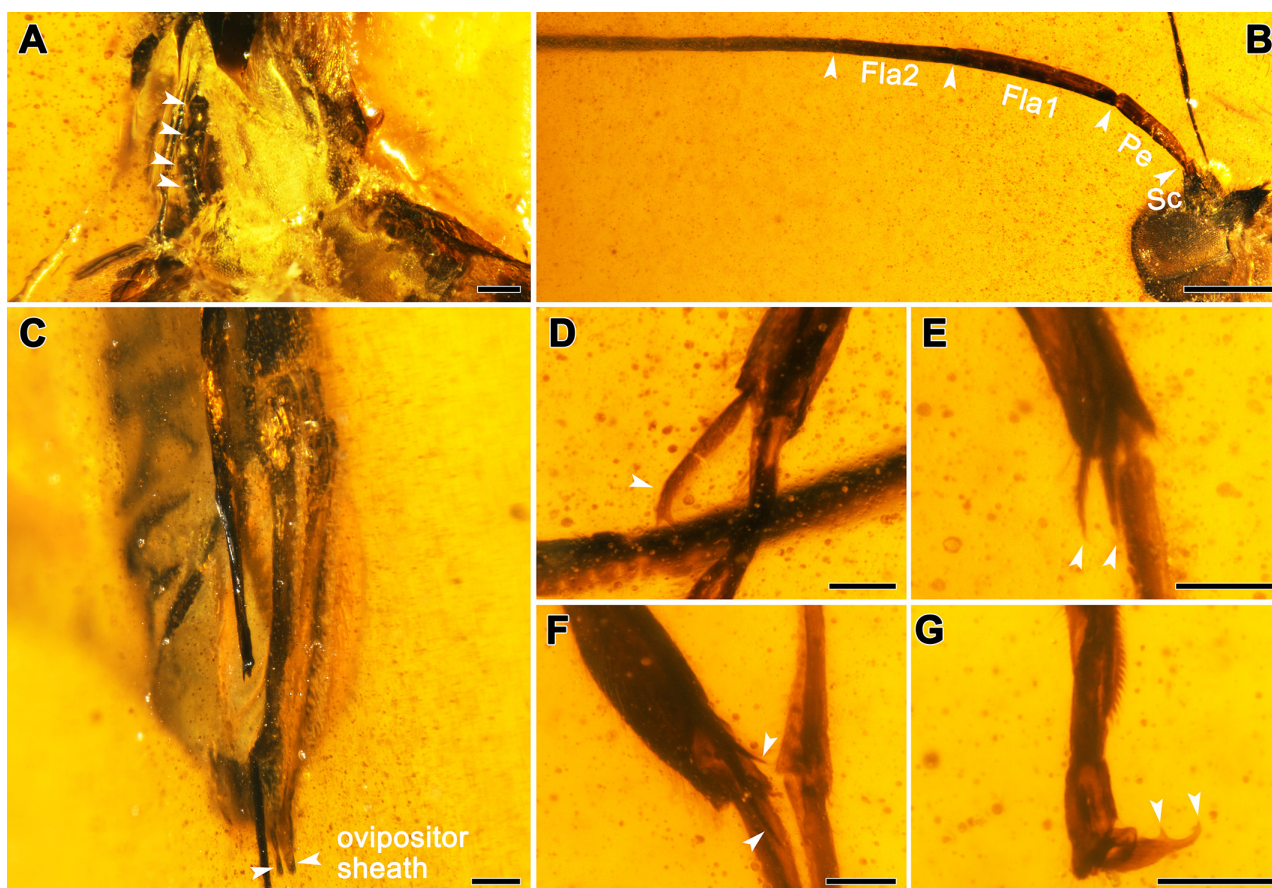


FIGURE 4. Photographs of *Prosyntexis lata* sp. nov., holotype (specimen CNU-HYM-MA2015108) female. **A**, Mesonotum, with arrows indicating the transverse ridges. **B**, Part of antenna. **C**, Ovipositor sheath. **D**, Right protibial spur. **E**, Right mesotibial spurs. **F**, Left metatibial spurs. **G**, Right metatarsal pretarsal claw. Abbreviations: Fla1 and Fla2, flagellomeres I and II; Pe, pedicel; Sc, scape. Scale bars: 0.1 mm for **A**, **D**, **E–G**; 0.5 mm for **B**; 0.2 mm for **C**.

0.90 mm long, 0.10 mm wide, flagellomere II 0.66 mm long, 0.09 mm wide, as wide as remaining flagellomeres (Fig. 4B).

Thorax with a deep medial membranous depression in the mesonotum bordered laterally by strong striate surfaces (Fig. 4A). Legs slender, profemur slightly longer than protibia; metafemur length 1.03 mm, metatibia 1.45 mm long, maximum width 0.13 mm. Single protibial spur, cleft apically (Fig. 4D); mesotibia with two apical spurs (Fig. 4E); metatibia with two apical spurs (the smaller spur less than half length of larger spur and not wide) (Fig. 4F). Tarsi pentamerous, basitarsomere long but shorter than remaining tarsomeres combined; tarsomere slightly elongate; pretarsal claws short, with curved apices and additional inner teeth (Fig. 4G).

Forewing (Fig. 3C) with C strongly thickened; Sc+R present; costal space narrow, slightly enlarged at two-thirds of its length; 1-Rs slanted toward wing apex and 0.8 as long as 1-M; pterostigma broad, oblong and 3.5× as long as wide; 1-M+Cu bent basally; distal part of 2-Rs undeveloped in both left and right forewings; 1r-rs connected to pterostigma at its base and slightly longer

than 3-Rs; 2r-rs issuing from 1/3 of pterostigma and at nearly 0.4 of 2+3rm length; 2rs-m absent; 3-M extremely short and 0.2× as long as 2m-cu. Cell 1mcu subquadrate, about 2.6× as long as wide; cell 2mcu pentagonal, about 1.6× as long as wide. 2A+3A wavy medially.

Hind wing (Fig. 3C) with cell r close; Sc+R present; 1-Rs about 0.99 mm in length, nearly 1.6× as long as 1-M; 1rs-m about 0.25 mm in length, short and slightly proclival; 1-M bent; 2-M+Cu present. 2rs-m, 3rs-m and 1m-cu absent; terminal abscissa of Cu and cu-a well-developed; 1-Cu and cu-a straight.

Abdomen with short ovipositor sheath 1.85 mm long in ventral view and slightly protruding beyond apex of abdomen (Fig. 4C).

Paratype (CNU-HYM-MA2015106). Body about 4.30 mm long in lateral view; forewing about 3.98 mm in length, maximum width 1.29 mm; hind wing about 3.02 mm in length (Figs 5, 6).

Head 0.63 mm long and 0.43 mm wide in lateral view, rather small and subquadrate. Compound eyes medium sized and round. Maxillary palpus with six palpomeres (Fig. 6C); labial palpus with at least three palpomeres.

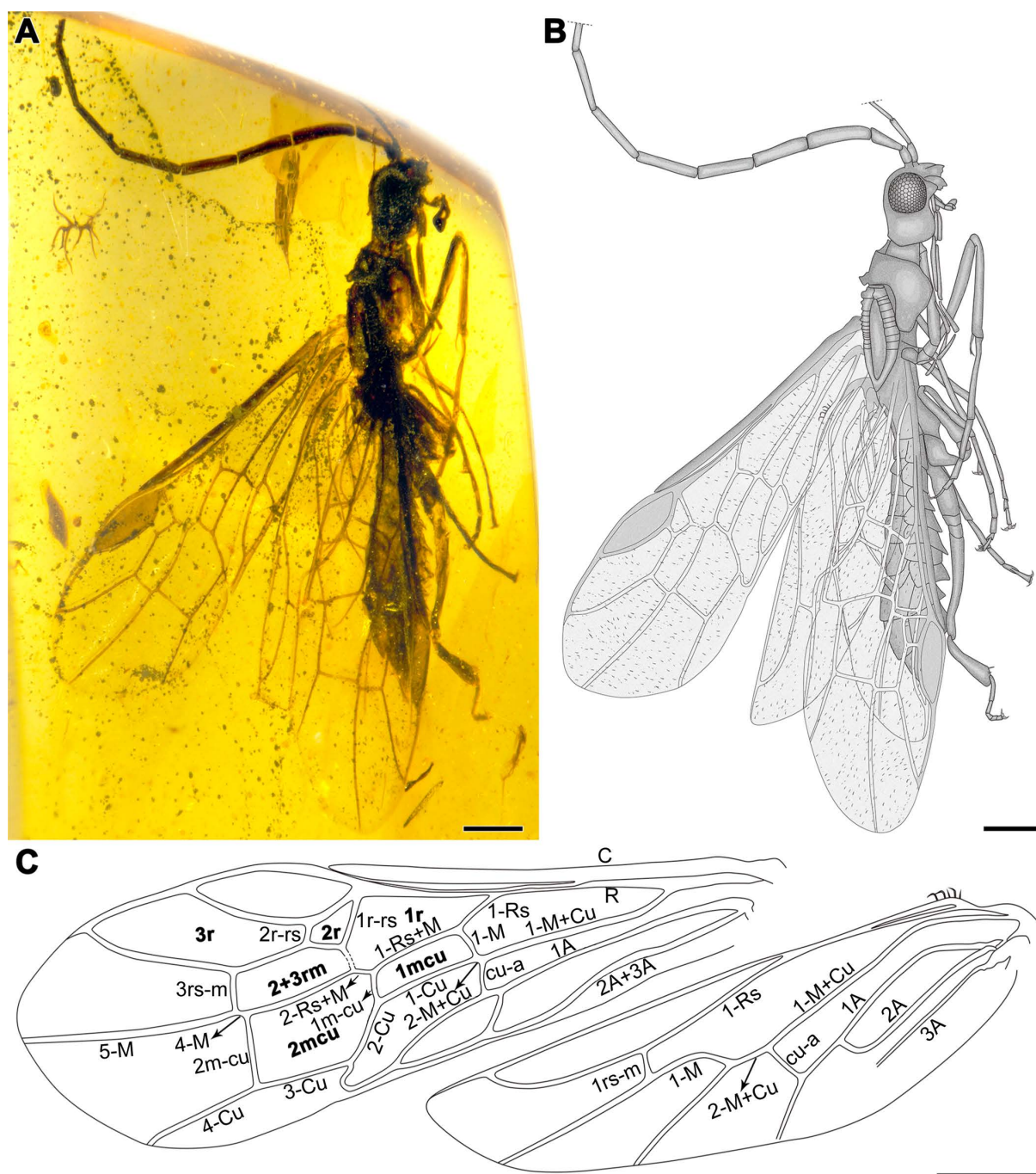


FIGURE 5. One photograph and two line drawings of *Prosyntexis lata* **sp. nov.**, paratype (specimen CNU-HYM-MA2015106) male. **A**, Habitus in right lateral view. **B**, Line drawing in right lateral view. **C**, Line drawing of the right forewing and hind wing. Scale bars: 0.5 mm.

Antenna elongate and filiform with 9 segments preserved; scape 0.20 mm long, maximum width 0.10 mm; pedicel 0.28 mm long, maximum width 0.10 mm, slightly swollen apically; flagellomere I longer than scape and pedicel, 0.56 mm long, 0.11 mm wide, flagellomere II 0.49 mm long, 0.11 mm wide (Fig. 6B).

Thorax with deep medial membranous depression in the mesonotum bordered laterally by strong striate surfaces (Fig. 6D). Legs slender, profemur slightly longer than protibia; metafemur length 0.84 mm, metatibia 0.76 mm

long, maximum width 0.14 mm. Protibia with one apical spur (Fig. 6F), mesotibia apical spurs not visible. Metatibia with two apical spurs (the smaller spur thick, less than half length of larger spur) (Fig. 6G). Tarsi pentamerous, basitarsomere long but shorter than remaining tarsomeres combined; metatarsomere elongate and claws 0.08 mm long with curved apices and additional inner teeth.

Forewing (Fig. 5C) with C strongly thickened; Sc+R present; costal space distinctly narrow, slightly enlarged at the middle; basal section of Rs slanted toward wing

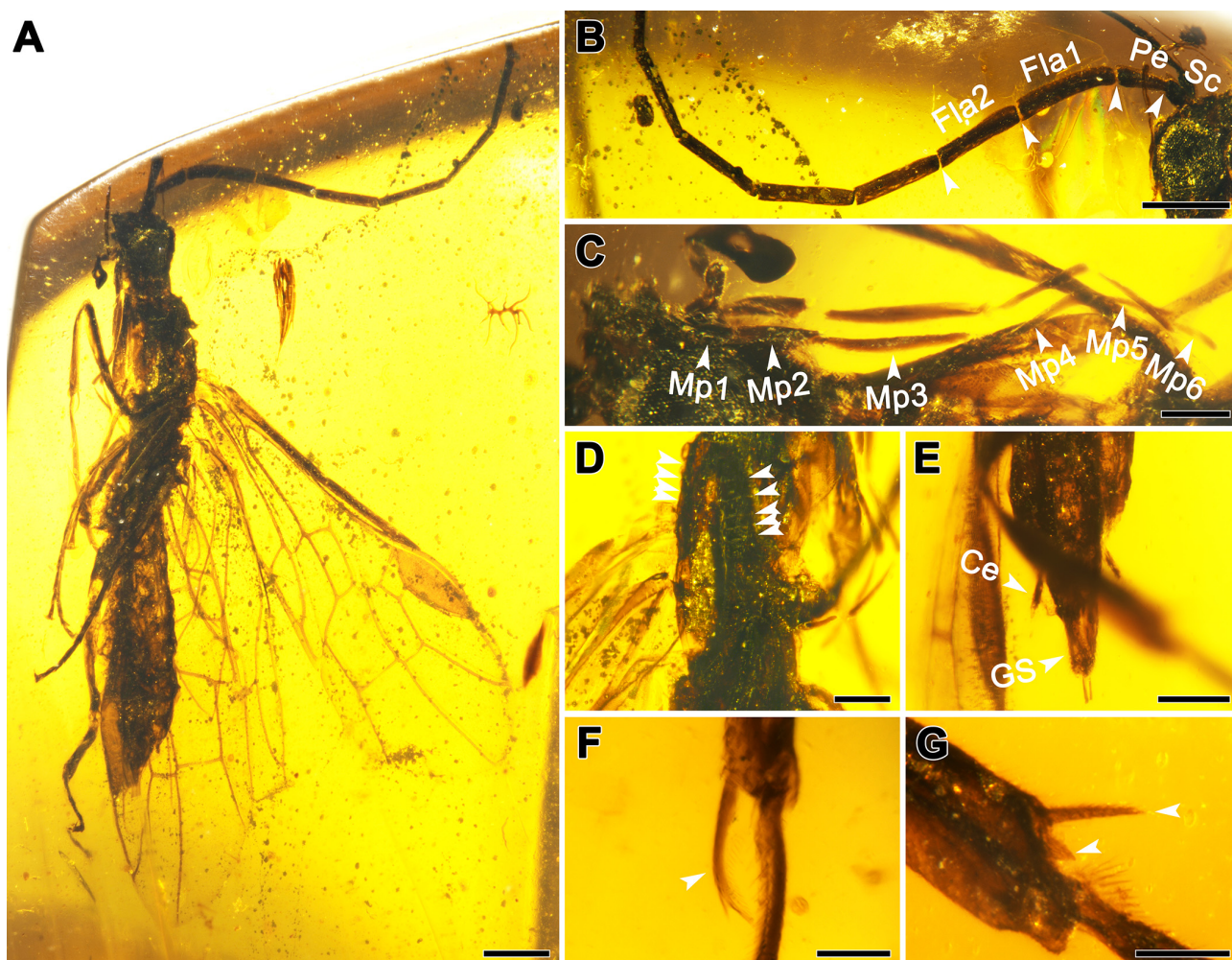


FIGURE 6. Photographs of *Prosyntexis lata* **sp. nov.**, paratype (specimen CNU-HYM-MA2015106) male. **A**, Photograph of habitus in left lateral view. **B**, Part of antenna. **C**, Maxillary palpus. **D**, Mesonotum, with arrows indicating transverse ridges. **E**, Male genitalia in hemi lateral view. **F**, Left protibial spur. **G**, Right metatibial spurs. Abbreviations: Fla1 and Fla2, flagellomeres I and II; Pe, pedicel; Sc, scape; Mp1–6, maxillary palpus I–VI; Ce, cercus; GS, gonostyle. Scale bars: 0.5 mm for **A** and **B**; 0.2 mm for **C**–**E**; 0.1 mm for **F** and **G**.

apex and $1.6\times$ as long as basal section of M; pterostigma broad, oblong and $2.8\times$ as long as wide; 1-M+Cu bent basally; 2-M+Cu exceptionally short and nearly 0.05 mm long, scarcely present owing to proximal position of cu-a near origin of 1-Cu. 1-Rs+M 0.48 mm long and $4\times$ as long as 2-Rs+M; end of 2-Rs very weak; 1r-rs connected to pterostigma at its base and longer than section of Rs between 1r-rs and 2r-rs; 2r-rs issuing from one-third of pterostigma and at one-third of 2+3rm length; 2rs-m absent; section of M between 2m-cu and 3rs-m extremely short and $0.2\times$ as long as 2m-cu. Cell 1mcu subquadrate, about $3\times$ as long as wide; cell 2mcu hexagonal, about $1.7\times$ as long as wide. 2A+3A waved medially.

Hind wing (Fig. 5C) with cell r closed and large; Sc+R present; 1-Rs about 0.86 mm in length, nearly $2\times$ as long as 1-M; 1rs-m about 0.11 mm in length, short and slightly proclival; 1-M bent and 0.44 mm long; 2-M+Cu present and 0.20 mm long. 2rs-m, 3rs-m and 1m-cu

absent; terminal abscissa of Cu and cu-a well-developed; 1-Cu and cu-a straight.

Abdomen with nine distinguishable segments in lateral view. Hypopygium narrower rounded apically comparing *P. aristovi* **sp. nov.** Male genitalia (Fig. 6E) distinct, narrow, tightly closed obscuring details except gonostyle about 0.17 mm long, very narrow and with two thin threads of obscure identity at their apex. Cercus about 0.13 mm long.

Paratype (CNU-HYM-MA2015109). Differs from the above paratype in shorter distance between compound eyes and postoccipital sulcus. Compound eyes rather large and oval. Antenna elongate and filiform with 16 segments, flagellomere I longer than scape and pedicel combined (Fig. 7A, B). Pronotum lateral edge slightly contracted inward. Hypopygium apparently as in other paratype. Genitalia internalized with very narrow gonostyli partially visible, with no threads visible.

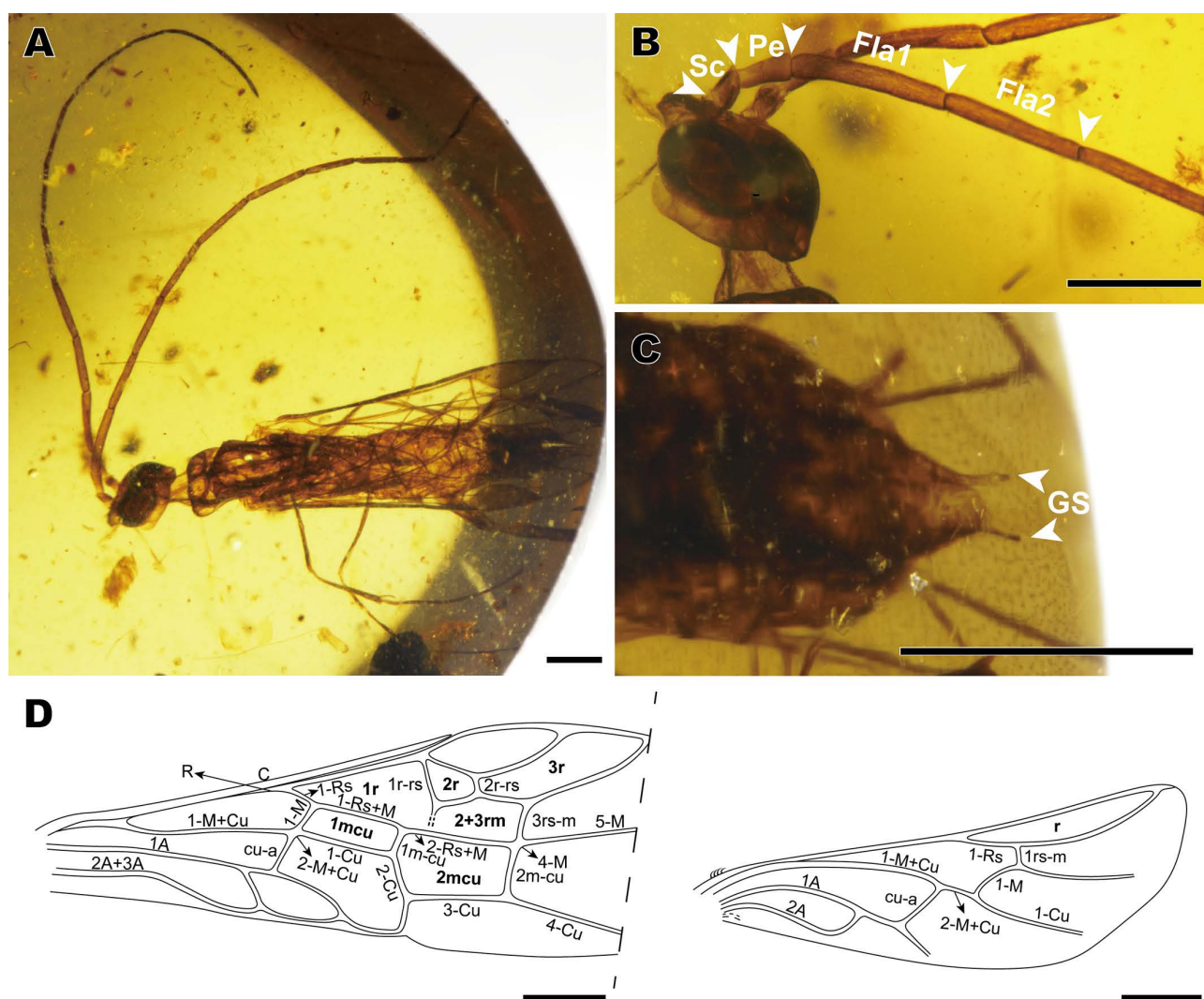


FIGURE 7. Photographs of *Prosyntexis lata* sp. nov., paratype (specimen CNU-HYM-MA2015109) male. **A**, Photograph of habitus in dorsal view. **B**, Left lateral view of head and part of antenna. **C**, Male genitalia in dorsal view. **D**, Line drawing of the right forewing and hind wing. Abbreviations: Fla1 and Fla2, flagellomeres I and II; Pe, pedicel; Sc, scape. GS, gonostyle. Scale bars: 0.5 mm.

***Prosyntexis antennata* Li, Shih & T. Gao sp. nov.**
(Figs 8, 9)

Type material. Holotype: CNU-HYM-MA2015107, a male specimen. Most of body preserved except left antenna broken and with apex lost, and left forewing broken.

Etymology. The name *antennata* is derived from the Latin word *antennatus* referring to the long antennae.

Diagnosis. The new species is unique within *Prosyntexis* in having cu-a behind the fork of M+Cu in the hind wing (hind wings not preserved or very incomplete in *P. gouleti*, *P. gobiensis*, *P. montsecensis* and *P. aristovi*). It also differs from other species, except for *P. aristovi*, in having a short and thin Sc in the forewing; and distinguished from *P. aristovi* by short 3-M (3r-m and 2m-cu approaching).

Locality and horizon. Hukawng Valley, Kachin State, northern Myanmar; lowermost Cenomanian, mid-Cretaceous.

Description. Body about 6.51 mm long in lateral view, antenna 8.31 mm long in lateral view; forewing about 5.89 mm in length, maximum width 2.56 mm; hind wing about 4.31 mm in length, maximum width 1.82 mm (Fig. 8A, B).

Head 0.60 mm long and 0.68 mm height in lateral view, slightly small and subquadrate. Compound eyes slightly large and preserved in a shrunken state. In lateral view maxillary palpus with six palpomeres, palpomere I short and thick; palpomere II 0.33 mm long and swelled apically; palpomere III elongate and almost 0.71 mm long; palpomere IV 0.46 mm long; palpomere V 0.43 mm long and palpomere VI 0.44 mm. Labial palpus with two palpomeres with inflated last segment (Fig. 9C). Antenna

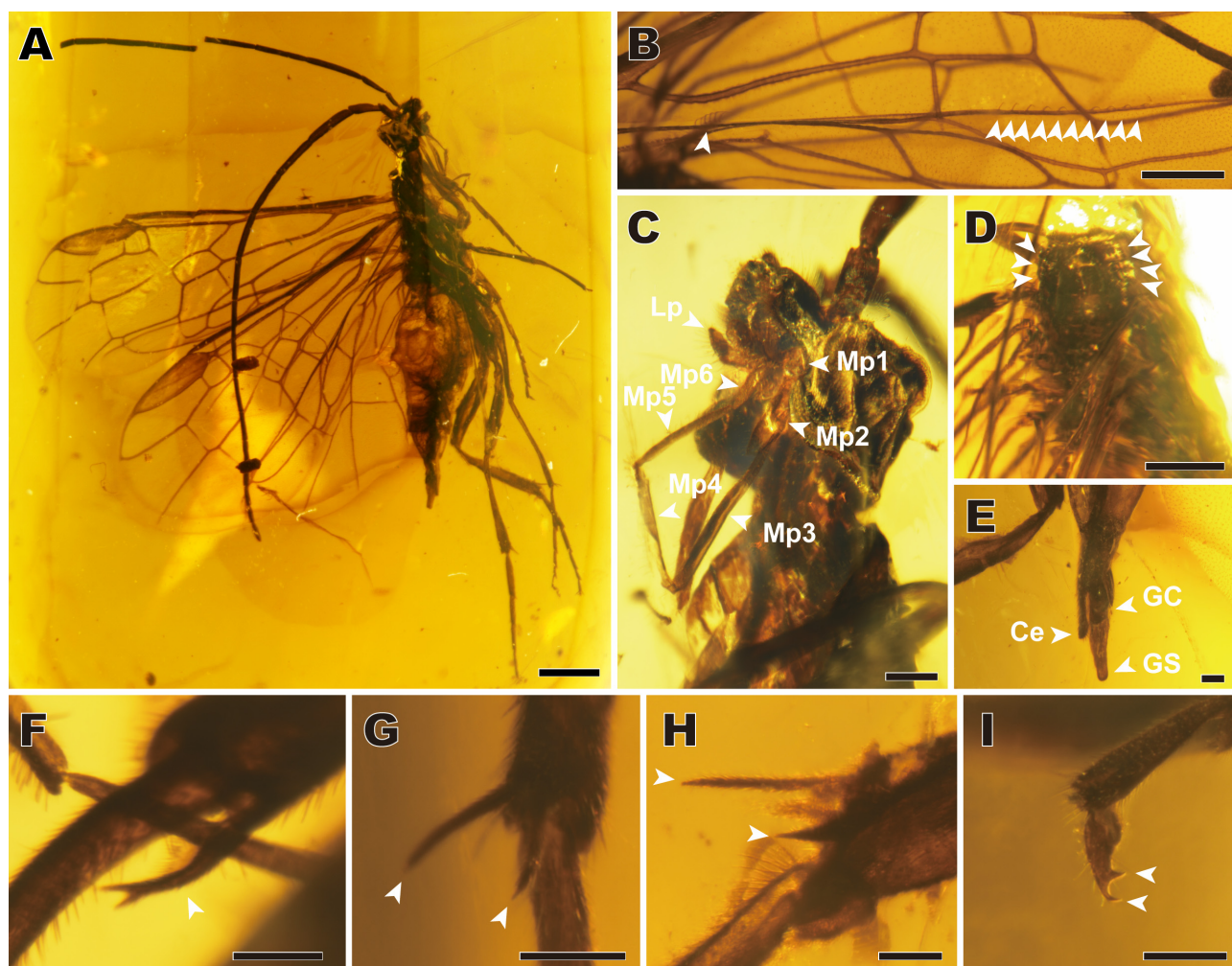


FIGURE 9. Photographs of *Prosyntexis antennata* sp. nov., holotype (specimen CNU-HYM-MA2015107) male. **A**, Photograph of habitus in right lateral view. **B**, Hamuli of right hind wing. **C**, Maxillary palpus and labial palpus in ventral to the left view. **D**, Mesonotum, with arrows indicating transverse ridges. **E**, Male genitalia in left lateral view. **F**, Left protibial spur. **G**, Left mesotibial spurs. **H**, Left metatibial spurs. Abbreviations: Ce, cercus; GC, gonocoxa; GS, gonostyle; Lp, Labial palpus; Mp1–6, maxillary palpus I–VI. **I**, Left mesotarsal pretarsal claw. Scale bars: 1 mm for **A**; 0.5 mm for **B**, **D**, **E**; 0.2 mm for **C**; 0.1 mm for **F**–**I**.

rs and 2r-rs; 2r-rs issuing from 1/4 of pterostigma and at two-fifth of 2+3rm length; 2rs-m absent; 3-M short and 0.3× as long as 2m-cu. Cell 1mcu subquadrate, about 2.4× as long as wide; cell 2mcu hexagonal, about 2× as long as wide. 2A+3A wavy medially. Aberrant vein extending from 4-Cu near 2m-cu of left forewing, towards posterior margin of the wing (Fig. 8C).

Hind wing (Fig. 8C) with basal and distal hamuli present (no intermediate ones found); cell r close; Sc+R present; 1-Rs about 1.08 mm in length, nearly 1.7× as long as 1-M; 1rs-m about 0.30 mm in length, proclival and short; 1-M bent; 2rs-m, 3rs-m and 1m-cu absent; terminal abscissa of Cu and cu-a well-developed; 1-Cu and cu-a straight, 1-Cu especially short and nearly 0.2× as long as cu-a in left hind wing; right hind wing lacking 1-Cu (cu-a coinciding with M+Cu fork).

Abdomen with nine distinguishable segments in lateral view. Male genitalia (Fig. 9E) narrow, with

gonostyle slender and about 0.36 mm long; cercus about 0.24 mm long.

Key to species of *Prosyntexis*

1. Forewing with pterostigma narrow; 2r-rs joining pterostigma near its apex; cell 2r more than twice as long as wide..... *P. montsecensis* Rasnitsyn & Ansoorge, 2000
- Forewing with pterostigma wide; 2r-rs joining pterostigma before its midlength; cell 2r less than twice as long as wide..... 2
2. Forewing with costal area normal..... *P. gobiensis* Rasnitsyn, 1993
- Forewing with basal third or half of costal area narrowed..... 3
3. Forewing with cell 1mcu small, length to width ratio far less than 2..... *P. okhotensis* Rasnitsyn, 1993
- Forewing with cell 1mcu normal size, length to width ratio more than 2..... 4
4. Forewing with 3r-m joining cell 3r almost at its midlength..... *P. sennlaubi* Jouault & Nel, 2021

- Forewing with 3r-m joining cell 3r at well before its midlength..... 5
- 5. Forewing with 2-Rs not behind 1m-cu (no 2-RS+M); forewing length more than 10 mm *P. gouleti* Sharkey, 1990
- Forewing with 2-Rs behind 1m-cu (2-RS+M present); forewing length less than 10 mm..... 6
- 6. Length of 2m-cu to the length of 3-M of forewing less than 2 *P. aristovi* Li, Shih & Gao **sp. nov.**
- Length of 2m-cu to the length of 3-M of forewing distinctly more than 2..... 7
- 7. Forewing with Sc present; 1-RS almost as long as 1-Rs+M; hind wing 2-M+Cu absent..... *P. antennata* Li, Shih & Gao **sp. nov.**
- Forewing with Sc absent; 1-RS short; hind wing 2-M+Cu present..... *P. lata* Li, Shih & Gao **sp. nov.**

Discussion

Three new species of Sepulcidae are described from Kachin amber. These new species are attributed to the subfamily Trematothoracinae based on their mesonotum having a membranous medial depression bordered laterally by strong striate surfaces; forewing with the basally arched M+Cu, and the basal third or half of costal space narrowed in the forewing. The three new species can be further placed within *Prosyntexis* Sharkey, 1990 because their 2r-m is absent (single r-m present) in forewing (Zhang *et al.*, 2001).

The new sepulcids have the antennae 16-segmented, basal hamuli and distal hamuli present, and tibia apical spurs 1-2-2, all of which are similar to extant Cephidae (superfamily Cephoidea) (Gauld & Bolton, 1988). Moreover, based on the new findings, it is clear that the minimal number of antennomeres in Trematothoracinae is higher than those in Xiphydriidae (not less than 13 segments) and in Siricidae (not less than 14 segments), which are phylogenetically more distantly related to Cephidae (Gauld & Bolton, 1988; Sharkey *et al.*, 2012).

The newly described *P. lata* **sp. nov.** holotype and paratype (with same venational morphology) are the first pair of male and female specimens known in Trematothoracinae. With the good preservation in amber, it's obvious that the body shape of female can be larger than that of the male, with thinner antennae and a wider abdomen. The smaller metatibia spur of the female is less than half the length of the larger spur and looks like a small needle. In contrast, all male *Prosyntexis* have their smaller spur very thick, almost triangular in outline. Apparently this is a form of sexual dimorphism possibly connected with the courtship behavior that can be a novelty in Symphyta. However, we still need more *Prosyntexis* female samples to confirm this conclusion.

Xylobiont hymenopterans often have specialized structures that support the body or remove debris

when newly hatched adults leave the developed wood (Vilhelmsen & Turrisi, 2011), *e.g.*, *Pristaulacus kostylevi* Alekseyev, 1986 (Aulacidae) usually has well-developed transverse sculpture dorsally on the thorax (Turrisi & Vilhelmsen, 2010). At present, among the well-preserved fossils of Trematothoracinae, it is obvious that the lateral boundary of the mesonotum has transverse ridge stripes, which were not found in other Cephoidea groups or even the basal stems of Hymenoptera, commonly known as Symphyta. The specialized mesonotum is supposed to help clinging the thorax into walls of the wooden tunnel under blood pressure rendering a reliable support of the head when the wasp is chewing its way out through the wood (Kopylov & Rasnitsyn, 2014).

Specimens of Symphyta have been very rare in Kachin amber until the appearance of the first species of *Syspastoxyela rhapsidia* Engel & Huang, 2016. Since then, more and more fossils of Syspastoxyelidae, Anaxyelidae, Xiphydriidae, and Burmorussidae have been reported (Engel *et al.*, 2016; Zhang *et al.*, 2018, 2020; Gao *et al.*, 2021a, b), referring to three superfamilies of Symphyta (Xyeloidea, Siricoidea, and Orussoidea), suggesting a relatively high diversity in Kachin amber. The present work adds the fourth superfamily Cephoidea from there. Furthermore, these new findings and studies indicate that the fossil record of Sepulcidae is about 99 million years ago, which extends the survival time of the Sepulcidae from the Middle Jurassic to mid-Cretaceous. Meanwhile, Symphyta are really much more common in Kachin amber as compared to Cenozoic ambers, which may reflect a distinct decrease of the group after the Cretaceous.

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