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## Revision of *Prosyntexis* from the Lower Cretaceous Crato Formation of Brazil (Hymenoptera: Sepulcidae: Trematothoracinae)

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### Abstract

The fossil *Prosyntexis* species from the Lower Cretaceous Crato Formation of Brazil are revised. The examination of three new specimens of the sepulcid species *Prosyntexis gouleti* Sharkey, 1990 allows amending its species diagnosis by adding new morphological characters, especially from the wing venation and from the hitherto unknown antenna. A close comparison with *Prosyntexis legitima* Martins-Neto *et al.*, 2007 demonstrates that this species is a junior synonym of *P. gouleti* (**syn. nov.**). The taxonomic position of the genus *Prosyntexis* within Sepulcidae: Trematothoracinae and of the enigmatic *Prosyntexis montsecensis* Rasnitsyn and Ansoerge, 2000 are discussed on the basis of the new morphological data.

**Key words:** *Prosyntexis legitima* junior synonym, *Prosyntexis montsecensis*, Crato Formation, taxonomy, systematic palaeontology

### Introduction

Sepulcidae Rasnitsyn, 1968 is a small Mesozoic wasp family with several species that remain rather poorly known because of the incomplete state of preservation of the fossils (see, e.g., Rasnitsyn 1993; Rasnitsyn & Ansoerge 2000; Rasnitsyn & Martínez-Delclòs 2000; Zhang *et al.* 2001). Among these, the case of the Lower Cretaceous genus *Prosyntexis* Sharkey, 1990 is emblematic with a type species *P. gouleti* Sharkey, 1990 based on incompletely preserved material from the Crato Formation of Brazil (Darling & Sharkey 1990). Here we revise the *Prosyntexis* species from the Crato Formation and provide detailed descriptions of three new specimens of *P. gouleti*. New morphological data is added to its species diagnosis and *P. legitima* Martins-Neto *et al.* 2007 from the same outcrop is placed as a junior synonym of *P. gouleti*.

### Material and methods

This study is based on the *Prosyntexis* specimens deposited in the fossil insect collections of the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris, France and the State Museum of Natural History Stuttgart, Germany. The holotypes of *Prosyntexis gouleti* Darling, 1990 and *P. legitima* Martins-Neto *et al.*, 2007 were not examined but the original species descriptions and illustrations of the type specimens allowed examination of all diagnostic features. Terms for morphological structures follow Huber and Sharkey (1993). In the descriptions, measurements always refer to the maximum width or length of the respective body parts. Images of the specimens were taken with a Leica DXM 1200 digital camera attached to a Leica MZ 16 APO microscope and processed using Auto-Montage (Syncroscopy) software. Images were edited with Adobe Photoshop CS3 and figure plates assembled with Adobe Illustrator CS3.

## Systematic Palaeontology

### Family Sepulcidae Rasnitsyn, 1968

### Subfamily Trematothoracinae Rasnitsyn, 1988

**Included genera.** *Prosyntexis* Sharkey, 1990, *Trematothorax* Rasnitsyn, 1988, *Thoracotrema* Rasnitsyn, 1988, and *Trematothoracoides* Zhang *et al.*, 2001.

### Genus *Prosyntexis* Sharkey, 1990

**Type species.** *Prosyntexis gouleti* Sharkey, 1990 (= *Prosyntexis legitima* Martins-Neto *et al.*, 2007 **syn. nov.**), other species: *P. gobiensis* (Rasnitsyn, 1993), *P. okhotensis* (Rasnitsyn, 1993), *P. montsecensis* Rasnitsyn and Ansorge, 2000.

### *Prosyntexis gouleti* Sharkey, 1990

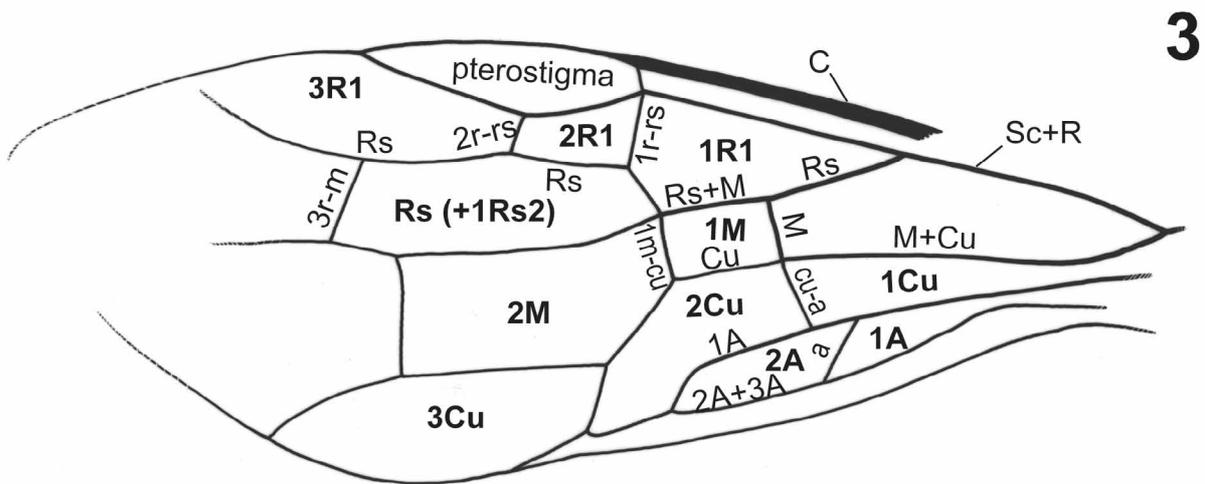
(Figures 1–10)

**Material.** Specimen MNHN.F.A43720 (coll. Borschukewitz), deposited in the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris, France; Specimen SMNS 66301 and specimen SMNS 66698a (imprint) – 66698b (counterimprint), deposited in the fossil collection of the State Museum of Natural History Stuttgart, Germany.

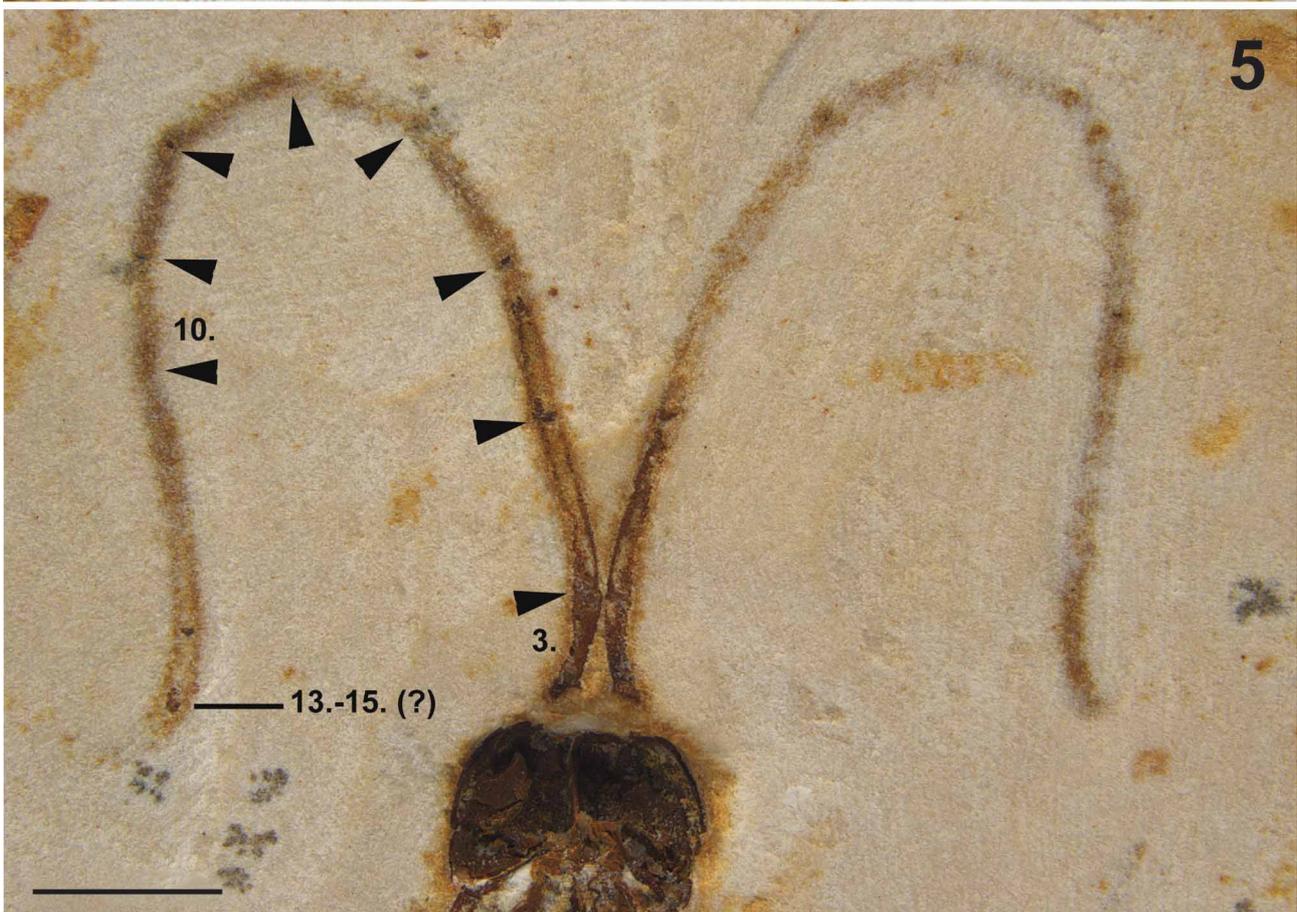
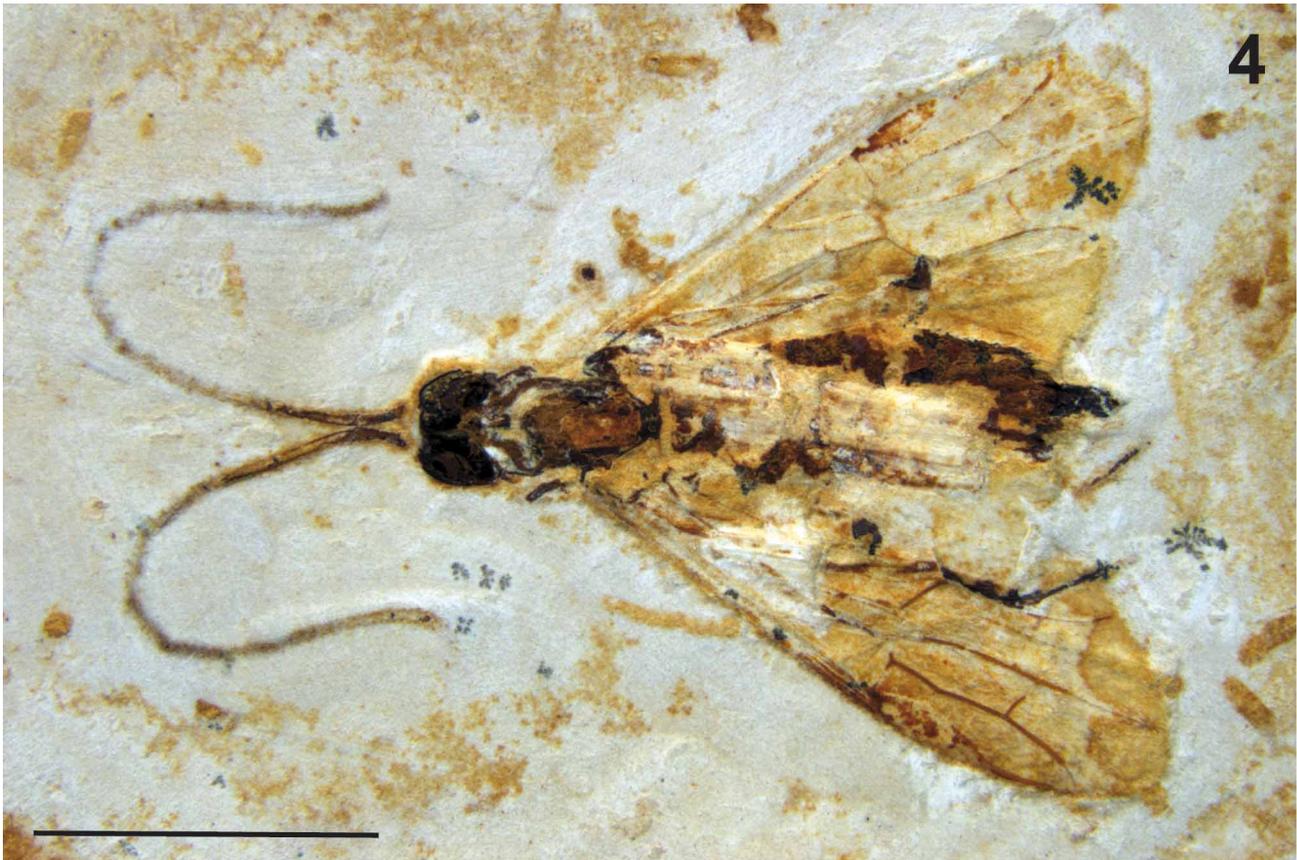
**Age and outcrop.** Lower Cretaceous Crato Formation of Northeastern Brazil.

**Description.** Specimen MNHN.F.A43720 (Figs 1–2): Body visible from below, 13.0 mm long (14.5 mm with ovipositor); head 1.2 mm long, 2.0 mm wide; antenna not preserved; thorax 5.5 mm long, 3.0 mm wide; abdomen 5.5 mm long, 2.0 mm wide; ovipositor sheath large, 5 mm long, 1.4 mm wide; ovipositor 1.7 mm long, 0.8 mm wide; six legs visible but poorly preserved. Wings without trace of coloured spots (maybe originally hyaline or uniformly coloured); fore wing 10.5 mm long, 4.0 mm wide, pterostigma brown, rather broad, 2.5 mm long, 0.5 mm wide, with its base 5.5 mm from wing base; subcosta completely fused with R; area between costal margin and R very narrow, 0.2 mm wide; Rs emerging from R 3.3 mm from wing base, with basal portion slightly curved, 1.1 mm long, rather long before its fusion with M; M+Cu basally curved and straight in its distal part; M and Cu separating 3.8 mm from wing base; basal free part of M short, 0.5 mm long; straight Rs+M 0.9 mm long; distal Rs+M forking into Rs and M slightly before 1m-cu; distal part of Rs between Rs+M and 1r-rs straight, 0.6 mm long; 1r-rs 0.6 mm long; 2r-rs 0.4 mm long, emerging from pterostigma in its basal half, 1.0 mm from its base; 2r-m absent but 3r-m clearly present and slightly curved, 0.8 mm long; cell 1R1 elongate, 2.3 mm long, 1.1 mm wide; cell 2R1 0.9 mm long, 0.65 mm wide; cell 3R1 3.0 mm long, 1.0 mm wide; cell Rs(+1Rs2) 2.8 mm long, 0.85 mm wide; cell 1M 1.1 mm long, 0.6 mm wide; cell 2M 2.4 mm long, 1.2 mm wide; crossvein cu-a present just distal of base of free part of M, 0.5 mm long; cell 1Cu 3.5 mm long; cell 2Cu larger and broader than cell 1M, 1.3 mm long, 0.8 mm wide; cell 3Cu 2.8 mm long; crossvein a present at 2.5 mm from wing base; basal part of 2A present; vein 1A fused at apex with vein 2A+3A; cell 1A 2.6 mm long, cell 2A 1.8 mm long. Hindwing only partly preserved, probably hyaline or uniformly coloured, with apico-costal part preserved, basal part of Rs very long, 2.0 mm long, distal part of Rs 1.9 mm long, cell R1 closed, 3.8 mm long, 0.6 mm wide; 1r-m 0.6 mm long, basal part of M 1.1 mm long, no crossveins 2r-m or 3r-m.

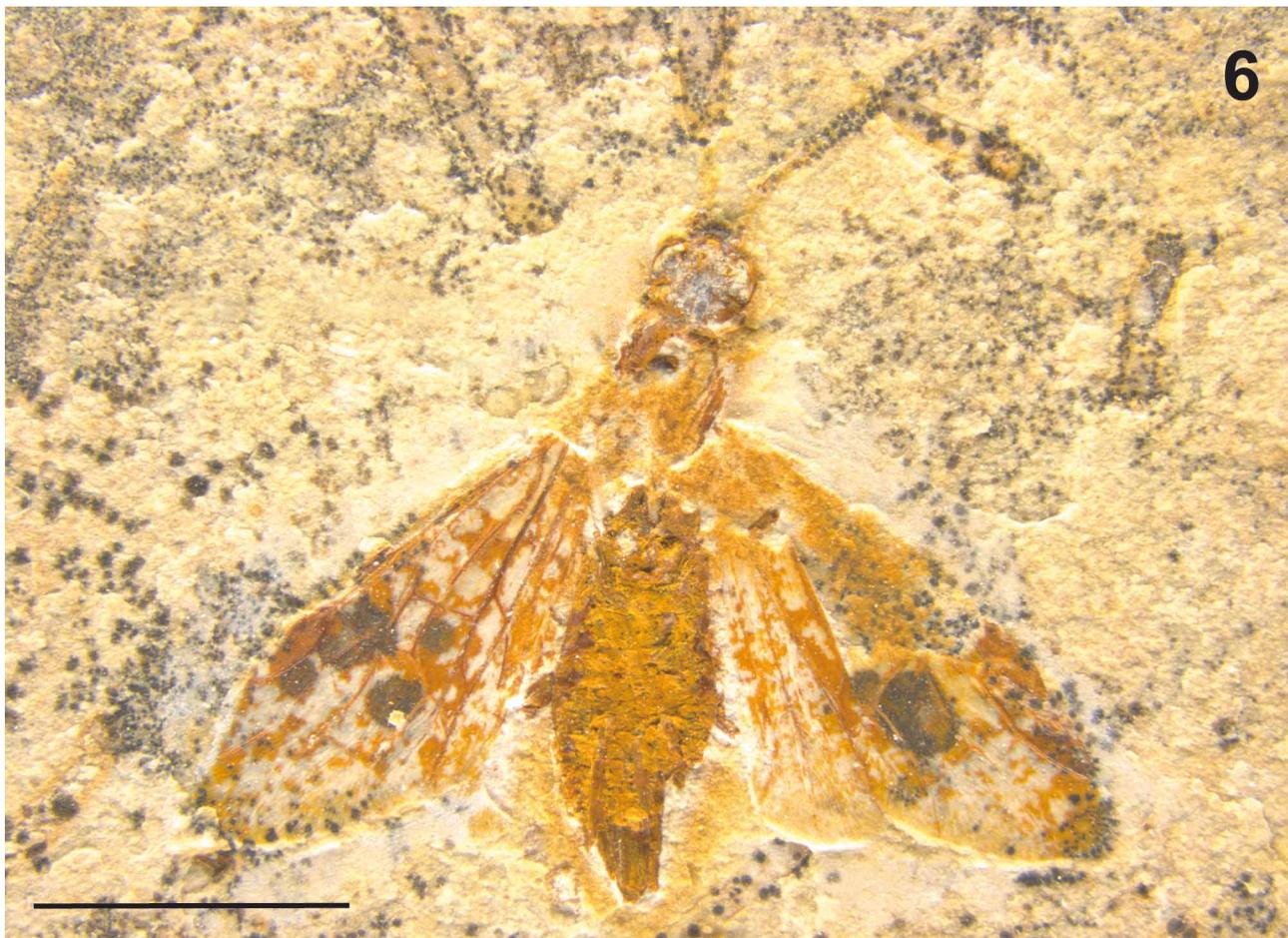
Specimen SMNS 66301 (Figs 4–5): Total body length 10.3 mm (9.44 mm without ovipositor). Head 1.17 mm long, 1.66 mm wide; antennae nearly completely preserved (apart from proximal portion); limits of scape and pedicel indiscernible; first flagellomere 0.69 mm long, 0.20 mm wide; second flagellomere 1.21 mm long, 0.18 mm wide; third flagellomere 1.10 mm long, 0.18 mm wide; limits of remaining flagellomeres not clearly indicated, total number of antennomeres 13–15 (Fig. 5). Thorax 2.60 mm long, 1.34 mm wide; metascutellum 0.29 mm long, 0.46 mm wide. Wing venation (Fig. 4) identical to that of specimen MNHN.F.A43720. Abdomen 5.89 mm long, 2.50 mm wide; ovipositor 0.86 mm long, 0.47 mm wide.



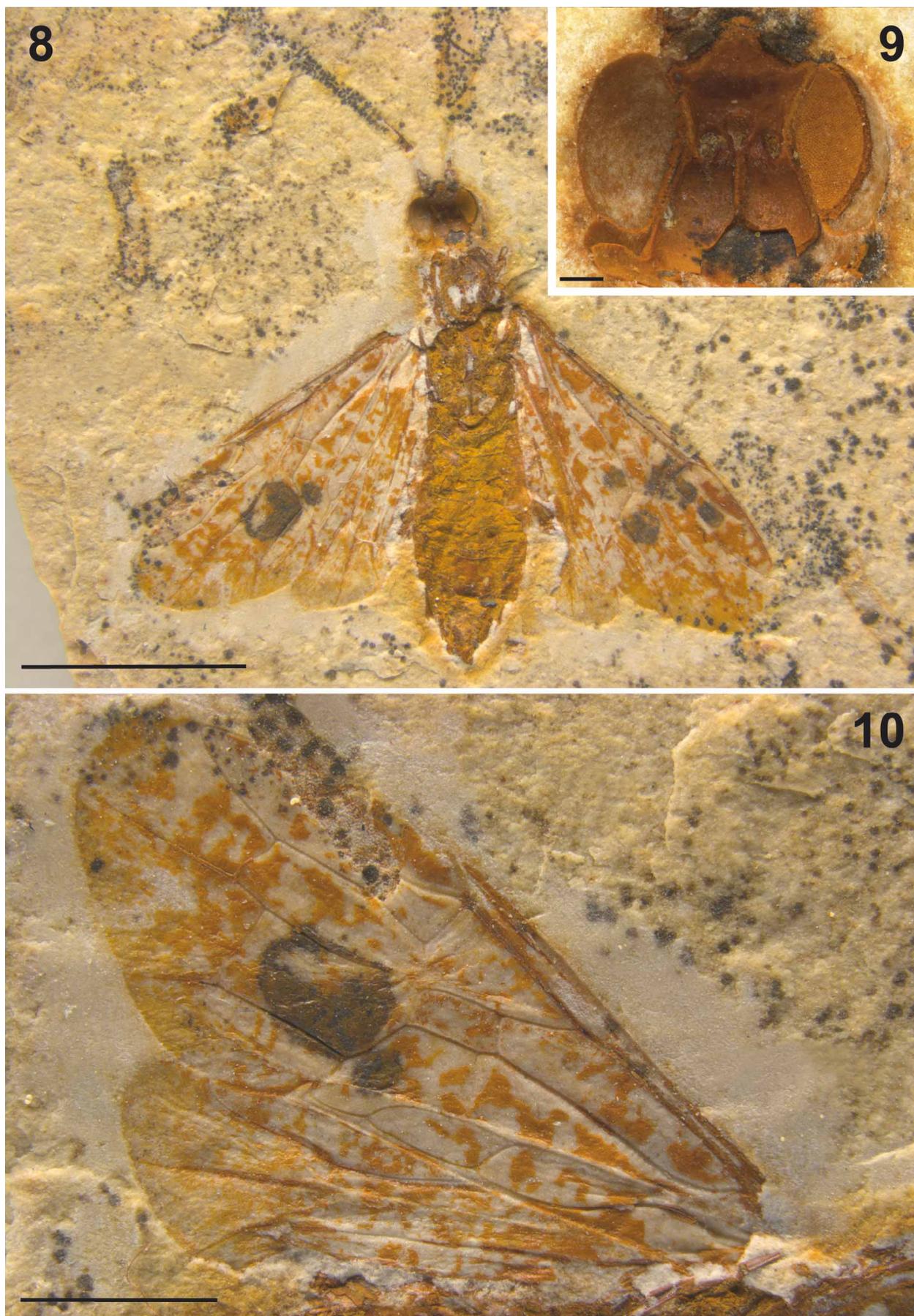
**FIGURES 1–3.** *Prosyntexis gouleti* Sharkey, 1990. (1) Specimen A43720, photograph of right forewing (scale bar: 2 mm); (2) specimen A43720, photograph of left forewing (scale bar: 2 mm); (3) holotype specimen of '*Prosyntexis legitima*' (syn. nov.), drawing of forewing venation after the original photograph of Martins-Neto *et al.* (2007: fig. 2A), wing cells in bold, veins in normal font.



**FIGURES 4-5.** *Prosyntexis gouleti* Sharkey, 1990, specimen SMNS 66301. (4) Photograph of habitus in dorsal view (scale bar: 5 mm); (5) photograph of antennae (scale bar: 1 mm), with numbers of antennomeres indicated.



**FIGURES 6–7.** *Prosyntexis gouleti* Sharkey, 1990, specimen SMNS 66698a, imprint. (6) Photograph of habitus in dorsal view (scale bar: 5 mm); (7) photograph of left forewing (scale bar: 2 mm).



**FIGURES 8–10.** *Prosyntexis gouleti* Sharkey, 1990, specimen SMNS 66698b, counterimprint. (8) Photograph of habitus in ventral view (scale bar: 5 mm); (9) photograph of head (scale bar: 200  $\mu$ m); (10) photograph of right wings (scale bar: 2 mm).

Specimen SMNS66698 (Figs 6–10): Imprint (SMNS 66698a, Figs 6–7) and counterimprint (SMNS 66698b, Figs 8–10) preserved. Total body length 11.0 mm. Head 1.52 mm long, 1.66 mm wide, eyes large, ocelli partly preserved in counterimprint (Fig. 9); antennae incompletely preserved; first flagellomere 0.74 mm long, 0.21 mm wide; remaining flagellomeres indiscernible. Posterior limit of thorax indiscernible, thorax 1.96 mm wide. Wing venation identical to that of specimen MNHN.F.A43720 (Figs 7, 10). Anterior limit of abdomen indiscernible, abdomen 2.60 mm wide; ovipositor not distinct.

## Discussion

The fore- and hindwing venation of the new fossil specimens is very similar to that of the known representatives of the genus *Prosyntexis* Sharkey, 1990 that is currently included in the sepulcid subfamily Trematothoracinae Rasnitsyn, 1988. Although the body structures of the new fossil specimens are poorly preserved, their general habitus is very similar (elongate abdomen with acute apex and large ovipositor sheath) to that of *Prosyntexis gouleti* Sharkey, 1990 and *P. legitima* Martins-Neto *et al.*, 2007 from the same outcrop (Darling and Sharkey 1990; Martins-Neto *et al.* 2007).

Martins-Neto *et al.* (2007: p. 3) proposed the following diagnosis for *Prosyntexis legitima* (female): ‘forewing 15 mm long; 1r-rs and 2r-rs not parallel; Rs+M slightly curved; M longer (‘twice greater’) than 1m-cu; cell Rs(+1Rs2) wider apically than basally’. The original drawing of the type fossil of *P. legitima* is clearly erroneous as Martins-Neto *et al.* (2007: fig. 1) attributed some veins of the hindwing to the forewing. Fortunately, these authors provided a good photograph of the wing venation (loc. cit.: fig. 2A) that allowed to propose a new drawing (see Fig. 3) and to determine that their description and diagnosis are also erroneous in the following points: 1r-rs and 2r-rs are parallel; Rs+M is as curved as in *P. gouleti*; M is as long as 1m-cu, as in *P. gouleti*; the cell Rs is only slightly wider apically as basally and identical to the situation in *P. gouleti* with the ‘ratio width near apex / width near base = 1.25’ in the two fossils. The forewing is slightly longer in the type specimen of *P. legitima* than in *P. gouleti* (these authors indicated a forewing 15.0 mm long in the diagnosis but 12.0 mm in the description, instead of 12.8 mm for *P. gouleti*), a character which we regard as insufficient to diagnose a new species of symphytan wasps. Therefore we consider *Prosyntexis legitima* as a junior synonym of *Prosyntexis gouleti*.

Sharkey (1990, in Darling and Sharkey) proposed the following diagnosis for this genus: 2r-m crossvein of forewing absent; 2R1 cell of forewing wider basally than apically; Rs+M of forewing reaching 1m-cu crossvein; 3R1 cell closed; 1M cell long and four-sided; cu-a crossvein only slightly postfurcal. All these character remain valid except for ‘Rs+M of forewing reaching 1m-cu crossvein’ because in our material, Rs+M forks slightly basal of 1m-cu, rather similarly to what occurs in the three other trematothoracine genera *Trematothorax* Rasnitsyn, 1988, *Thoracotrema* Rasnitsyn, 1988, and *Trematothoracoides* Zhang *et al.*, 2001. The antennae of the type specimens of *P. gouleti* and *P. legitima* are not or only poorly preserved, but in specimen SMNS 66301 (Fig. 5), the antennae are well preserved showing that the basal flagellomere is relatively short, compared to the condition found in Sepulcinae (see fig. 5). Rasnitsyn and Ansoerge (2000) regarded this character as typical for Trematothoracinae. Thus it would confirm an attribution of *Prosyntexis* to the latter subfamily. Contradictive to this assignment may be the shape of the ovipositor in *P. gouleti* which is not expanded after the abdomen and appears rather short, shorter than in other Trematothoracinae (i.e. *Thoracotrema caudatum* Rasnitsyn, 1988). Nevertheless, we here maintain the genus *Prosyntexis* in Trematothoracinae.

The taxonomic position of *Prosyntexis montsecensis* is unclear. This species shares with *P. gouleti* several forewing venational characters that are not present in other trematothoracine genera. They both differ from *Trematothorax* in the forewing with crossvein 2r-m absent, from *Thoracotrema* in the forewing with crossvein 2r-rs present, and from *Trematothoracoides* in the crossvein between R and C absent and crossvein 2r-m absent (Rasnitsyn 1993; Rasnitsyn and Martínez-Delclòs 2000; Rasnitsyn and Ansoerge 2000; Zhang *et al.* 2001). Nevertheless, *P. montsecensis* strongly differs from all other species within the genus *Prosyntexis* in the very narrow pterostigma and crossvein 2r-rs in a very distal position near the apex of the pterostigma. It also has a very long ovipositor, nearly as long as the body, a character state which cannot be ascertained in the other species within this genus except for *P. okhotensis* in which the ovipositor is elongate but still appears to be shorter than in *P. montsecensis*. The exact number of antennomeres in *P. montsecensis* is unknown but was estimated to be about 20 (Rasnitsyn and Ansoerge 2000) which is more than what we assume for *P. gouleti* (13–15 antennomeres, see Fig. 5). Even though the exact

number of antennomeres remains uncertain in both species, the flagellomeres are distinctly shorter in *P. montsecensis* than in *P. gouleti*. Based on the significantly different forewing venation and (to a lesser extent) on the ovipositor and antennal features mentioned above it may be justified to place *P. montsecensis* into a new genus, but we here refrain from a generic transfer. This should be done along with a proper genus diagnosis based on new, better preserved specimens of *P. montsecensis* whenever these become available. The holotype of *P. montsecensis* is incompletely preserved with many structures missing, most importantly the hindwing venation and the posterior part of the forewing (see Rasnitsyn and Ansorge 2000).

## Acknowledgements

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