



New Cimbrophlebiidae (Insecta: Mecoptera) from the Early Eocene at McAbee, British Columbia, Canada and Republic, Washington, USA

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Abstract

Four new scorpionfly species of the family Cimbrophlebiidae (Mecoptera) are described in the genus *Cimbrophlebia* Willmann from two localities of the far-western North American Early Eocene Okanagan Highlands: *C. flabelliformis* sp. n. and *C. Leahyi* sp. n. from McAbee, British Columbia, Canada; and *C. brooksi* sp. n. and *C. westae*, sp. n. from Republic, Washington, U.S.A. A further, partially preserved specimen of a large cimbrophlebiid from McAbee is treated as *Cimbrophlebia* sp. A. This is the first record of the extinct family in the Western Hemisphere, which was previously known with confidence from the Early Eocene of Denmark (*C. bittaciformis* Willmann) and the Jurassic of Germany (*Malmocimbrophlebia buergeri* Bechly & Schweigert and an undescribed genus and species); *Telobittacus fragosus* Zhang from Early Cretaceous of China may also belong to the family. These Okanagan Highlands occurrences further reflect Early Eocene cross-North Atlantic distributions that have been well documented in plants and mammals, and are increasingly seen in insects.

Key words: Mecoptera, Cimbrophlebiidae, Eocene, Okanagan Highlands, McAbee, Republic

Introduction

Cimbrophlebiidae is an extinct, little-known family of large scorpionflies (Mecoptera) considered to be the sister group of Bittacidae, which together form the infraorder Raptipeda (Willmann 1977, 1989). Bittacid and cimbrophlebiid wings are tipuliform, with much of their venation similar; both have long, slender legs, each bearing a single, large, raptorial tarsal claw (Willmann, 1989: Fig. 136). Cimbrophlebiid wings are easily distinguished from those of Bittacidae, however, by their long, branched 2A, which is short and unbranched in Bittacidae. Novokshonov (1997, 2002) considered the family to be a junior synonym of Bittacidae.

Cimbrophlebiids have only been confidently reported from Europe: an undescribed genus from the Jurassic (lower Toarcian) of Grimmen, Germany (Ansorge 1996, 2003); *Malmocimbrophlebia buergeri* Bechly & Schweigert, 2000, from the Late Jurassic Solnhofen limestone of Bavaria, Germany; and *Cimbrophlebia bittaciformis* Willmann, 1977, from the Early Eocene Fur Formation of Denmark. Novokshonov (1997) found that *Telobittacus fragosus* Zhang, 1993 (Early Cretaceous; Shaanxi Province, China), assigned to the Bittacidae, is very similar to *C. bittaciformis* and might belong to *Cimbrophlebia* Willmann.

The first occurrences of Cimbrophlebiidae from the Western Hemisphere are reported here, from two Early Eocene Okanagan Highlands localities in far-western North America. Four new species are described, all assigned to the genus *Cimbrophlebia*: *C. flabelliformis* and *C. Leahyi* from McAbee, British Columbia, Canada; and *C. brooksi* and *C. westae* from Republic, Washington, U.S.A. Another, partially preserved, large cimbrophlebiid from McAbee is treated as *Cimbrophlebia* sp. A. The occurrence of *Cimbrophlebia* in both North America and northern Europe in the Early Eocene is consistent with distribution patterns seen at that

time in plants, mammals, and reported in the last few years in insects (*e.g.*, Beard & Dawson, 1999; Manchester, 1999; Tiffney & Manchester, 2001; Hooker & Dashzeveg, 2003; Archibald & Makarkin 2006 and references therein; Petrulevičius *et al.* 2007).

Material and methods

The McAbee fossils examined were borrowed from Thompson Rivers University (formerly the University College of the Cariboo, hence UCC catalogue numbers), Kamloops, British Columbia, Canada, abbreviated as TRU; and from their collector (subsequently donated to TRU, see acknowledgements). The Republic fossils were borrowed from the Stonerose Interpretive Center, Republic, Washington, U.S.A., abbreviated as SR. In some cases, a small amount of light preparation was done with an insect pin held in a pin vise. They were drawn directly using a camera lucida. Venational terminology follows that of Willmann (1989). Contrary character states of species being compared are given in brackets.

Localities. The McAbee and Republic localities are part of the Early Eocene Okanagan Highlands series of lacustrine shale and coal deposits which occur sporadically over about 1000 km from north-eastern Washington State, USA, to west-central British Columbia, Canada. The McAbee locality is an outcrop of Kamloops Group shales of an unnamed formation near the town of Cache Creek in the Thompson-Okanagan region of south-central British Columbia. It is considered to be about 51 Ma (Ewing, 1981). The Republic locality is an exposure of shale of the Tom Thumb Member of the Klondike Mountain Formation in the town of Republic in Ferry County, north-central Washington State, assigned an age of 49.42 ± 0.54 Ma by ^{40}Ar - ^{39}Ar (Wolfe *et al.*, 2003). Greenwood *et al.* (2005) and Moss *et al.* (2005) recently examined the climate and ecology of these and other Okanagan Highlands localities.

Family Cimbrophlebiidae Willmann, 1977

Genus *Cimbrophlebia* Willmann, 1977

Cimbrophlebia flabelliformis, sp. n.

(Fig. 1A–B)

Diagnosis. Wing distinguished from those of other *Cimbrophlebia* species by the following: 1), *2A morphology*: four pectinate branches separates it from *C. bittaciformis*, [seven branches: three basal branches pectinate, four distal branches dichotomous], *C. leahyi* [six branches: two basal branches pectinate, minimum of four dichotomous distal branches], not known to be distinct from *C. brooksi*, *C. westae*, where 2A is little known by preservation; 2), *Shape*: length about four times width separates it from *C. brooksi* [distinctly narrower: length about five times width], *C. bittaciformis* [similarly slender (see remarks)], (*C. leahyi*, *C. westae* length also about four times width); 3), *Colouration* distinct from that of *C. brooksi*, *C. westae*, *C. bittaciformis* (see below); closest to that of *C. leahyi* (as below) differing from *C. leahyi* by more overall dark colouration, including 2A region [*C. leahyi*: light], further differentiated from *C. leahyi* by distinctly round / oval light spots [*C. leahyi*: differing position, sizes of more irregularly shaped light spots], (see descriptions, remarks, Figs. 1A; 2A, B; 4A, C; 6A, C; 7A).

Description: holotype wing. As in diagnosis, Fig. 1A, B, and the following. Length 28 mm, width 7 mm. Colouration as in Fig. 1A: dark, with eight light spots (possibly more in basal-most region?) four along anterior portion, basal two smaller, distal two larger; four smaller spots along posterior portion. Sc: Sc₁ terminates on C ~2/3 wing length; Sc₂ separates from R₁ at pterostigmal region, joins with C at steep angle. R₁ branched, curved around pterostigma to join C. Rs with four dichotomous branches. M with four dichotomous branches; not preserved in basal quarter of wing. Branching of Cu₁, Cu₂ not preserved; Cu₁ long, straight, until

2/3 wing length, bent posteriad at m-cu to hind margin; Cu₂ straight for preserved portion, close to Cu₁, not preserved distad bend of Cu₁. 1A: long, straight, close to Cu₂ in basal 2/3 of wing, apicad gently bent posteriad, meeting hind margin. 2A with four pectinate branches (second branch with crossvein to posterior margin). 3A: not detected. Few crossveins detected as preserved (Fig. 1B).

Type material. Holotype: UCCIPR L-18 F-763 (part), UCCIPR L-18 F-764 (counterpart). A well preserved fore- or hind wing; housed at TRU; labelled: Holotype *Cimbrophlebia flabelliformis*, Archibald, 2009. Collected by unknown person at McAbee in 2002, donated to TRU by David Langevin, 2002.

Locality and age. McAbee, British Columbia, Canada; Early Eocene.

Etymology. The specific epithet *flabelliformis* is formed from the Latin *flabellum*, “fan”, and *forma*, “shape”, referring to the overall impression of the somewhat evenly separated wing veins, radiating apicad in a fan-like manner.

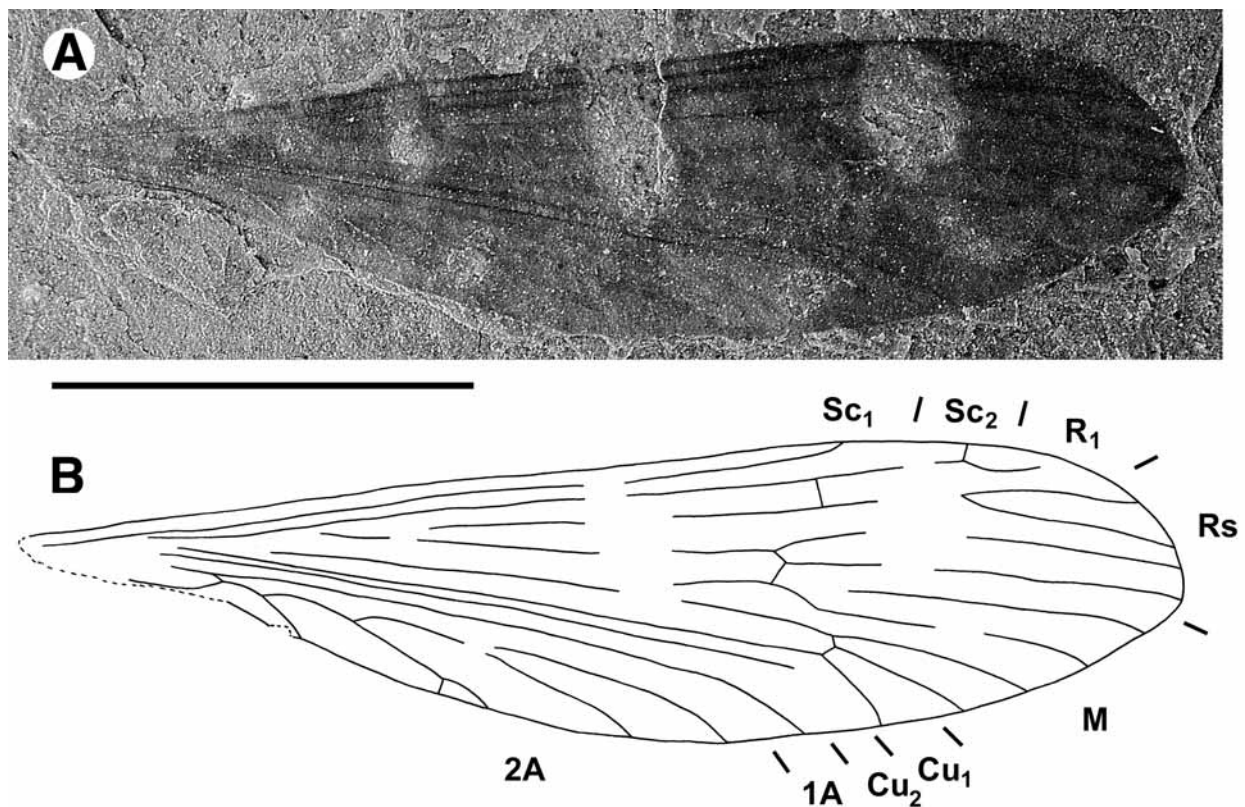


FIGURE 1. *Cimbrophlebia flabelliformis*, holotype wing UCCIPR L-18 F-763. A, photograph (part); B, drawing from part and counterpart. A, B to scale = 1 cm.

Remarks. The configuration of the basal portion of 2A seen in *C. flabelliformis* and *C. sp. A* corresponds with the vein fragment of *C. bittaciformis* previously identified as 3A (Willmann, 1977: Fig. 2) and subsequently with uncertainty (Willmann, 1989: Fig. 135), indicating that this similarly-placed vein on *C. bittaciformis* may also be a portion of 2A.

The wing of *C. flabelliformis* is about four times as long as wide, as is that of *C. leahyi* (see bottom wing in Fig. 2C), *C. westae*, and apparently *C. sp. A* judging by the shape of its preserved portion. This is distinct from the more slender wings of *C. brooksi*, length / width about 4.9, and *C. bittaciformis* (width not reported, but these appear distinctly long and slender: see Willmann, 1977: Fig. 1, complete wings of the holotype, and Fig. 2, incomplete wing of the paratype). These are confidently not simply forewing / hind wing differences, as shape appears reasonably consistent between them (comparable in *C. leahyi* and *C. bittaciformis*).

The lengths of complete (or mostly so) cimbrophlebiid wings vary from about 25 to 38 mm: *C. westae* ~25 mm; *C. flabelliformis*, 28 mm; *C. leahyi*: ~31 mm; *C. bittaciformis*, hind wing 31.5 mm and forewing

34.5 mm; *C. brooksi*, ~38 mm. These differences, however, fall within variation found in the scorpionfly *Panorpa communis* (Ohm, 1961); further, where known, hind wings are a bit smaller than forewings. Only the great size differences between that modelled for the incomplete wing of *C. sp. A* (estimated as > 40 mm long) and the much smaller *C. flabelliformis* and *C. westae* are here considered meaningfully distinctive, given current knowledge.

The holotype of *C. flabelliformis* bears four branches of Rs, unlike those of *C. leahyi*, *C. brooksi*, and *C. westae*, which have five branches. Willmann (1977) found this character to be plastic within *C. bittaciformis* (and see *P. communis*: Ohm, 1961), and so this is not considered diagnostic here.

Wing colouration of the Okanagan Highlands species may be separated into three groups: 1), that of the McAbee species *C. flabelliformis* and *C. leahyi*; 2), of *C. brooksi* (Republic); and 3), of *C. westae* (Republic). *C. flabelliformis* and *C. leahyi* have variations of a general pattern consisting of mostly dark wing, with a series of large, irregular to oval light spots extending along the length of the anterior portion of the wing, touching the anterior margin: the smallest one or two in the basal quarter, a large one at about mid-wing, and a large one between this and the apex. There are various smaller spots along the posterior half of the wing. The preserved portion of *C. sp. A* indicates that it may belong to this group.

The colouration of the *C. westae* wing is somewhat similar to that of the McAbee species, but with more, exaggerated light regions, which extend the length of much of the posterior wing as known, and a further light band apicad the large spot in the corresponding position of the apical-most one of *C. flabelliformis* and *C. leahyi*. The resultant remaining dark colouration is arranged as a lengthwise zigzag touching the anterior, but not posterior margin (Fig. 6C). Much of this colour pattern is evident on regions of the wing not preserved in the single specimen of *C. sp. A*, which cannot be confidently excluded from this colouration group.

The colour of *C. brooksi* is distinctly different from the above, with four dark bands extending from the anterior margin across about 2/3 of the wing width to about Cu₂ or 1A. These are separated by light bands that connect with a light region that extends the length of the posterior portion of the wing. The apical region is preserved as generally light, and may have had complex light colouration in life.

The wing of the Danish *C. bittaciformis* has a complex series of light and dark bands and spots (Willmann 1977: Figs. 1–2); the undescribed German species figured by Ansorge (2003: Fig 4G) has a dark wing densely covered with small light spots.

***Cimbrophlebia leahyi*, n. sp.**

(Figs. 2A–C; 3A–C)

Diagnosis. Wing distinguished from those of other *Cimbrophlebia* species by the following: 1), *2A morphology*: six branches: two basal branches pectinate, minimum of four dichotomous distal branches separates it from *C. bittaciformis* [seven: three basal branches pectinate, four distal branches dichotomous], *C. flabelliformis* [four pectinate branches], not known to be distinct from *C. brooksi*, *C. westae* (2A is little known by preservation); 2), *Shape*: wide wing, length about four times width is similar to that of *C. westae*, *C. flabelliformis*, separates it from *C. brooksi* [distinctly narrower: length about five times width], *C. bittaciformis* [also slender (see *C. flabelliformis* remarks)]; 4), *Colouration*: distinct from that of *C. flabelliformis*, *C. brooksi*, *C. westae*, *C. bittaciformis* (see descriptions, *C. flabelliformis* remarks, Figs. 1A; 2A, B; 4A, C; 6A, C; 7A).

Description: holotype (sex undetermined). As in diagnosis, Figs. 2A–C; 3A–C, and the following. **Head:** preserved characters as known in *C. bittaciformis*: long rostrum; large compound eyes; long antennae, ~14 mm preserved (incomplete). **Thorax:** poorly preserved. **Legs:** long, thin; tibial spurs, single, large tarsal claw preserved; dense, small hairs, some interspersed coarse, larger hairs detected on femur, tibia. **Wing:** length ~31 mm, width ~8 mm (likely, by preservation). Colouration (as preserved, see Fig. 2A, B): wing mostly dark, but 2A region light, light spots as above, Fig 2A–B. Membrane rugose, except possibly in apical portion. Sc, R₁ as in *C. flabelliformis*. Rs with five branches. M with four branches; Cu₁, Cu₂, 1A: little known

by preservation; 2A, long, branched as in diagnosis; 3A not detected. Crossveins detected: one r1-sc, three c-sc2, two rs-rs, one rs-m. **Abdomen:** partially, indistinctly preserved.

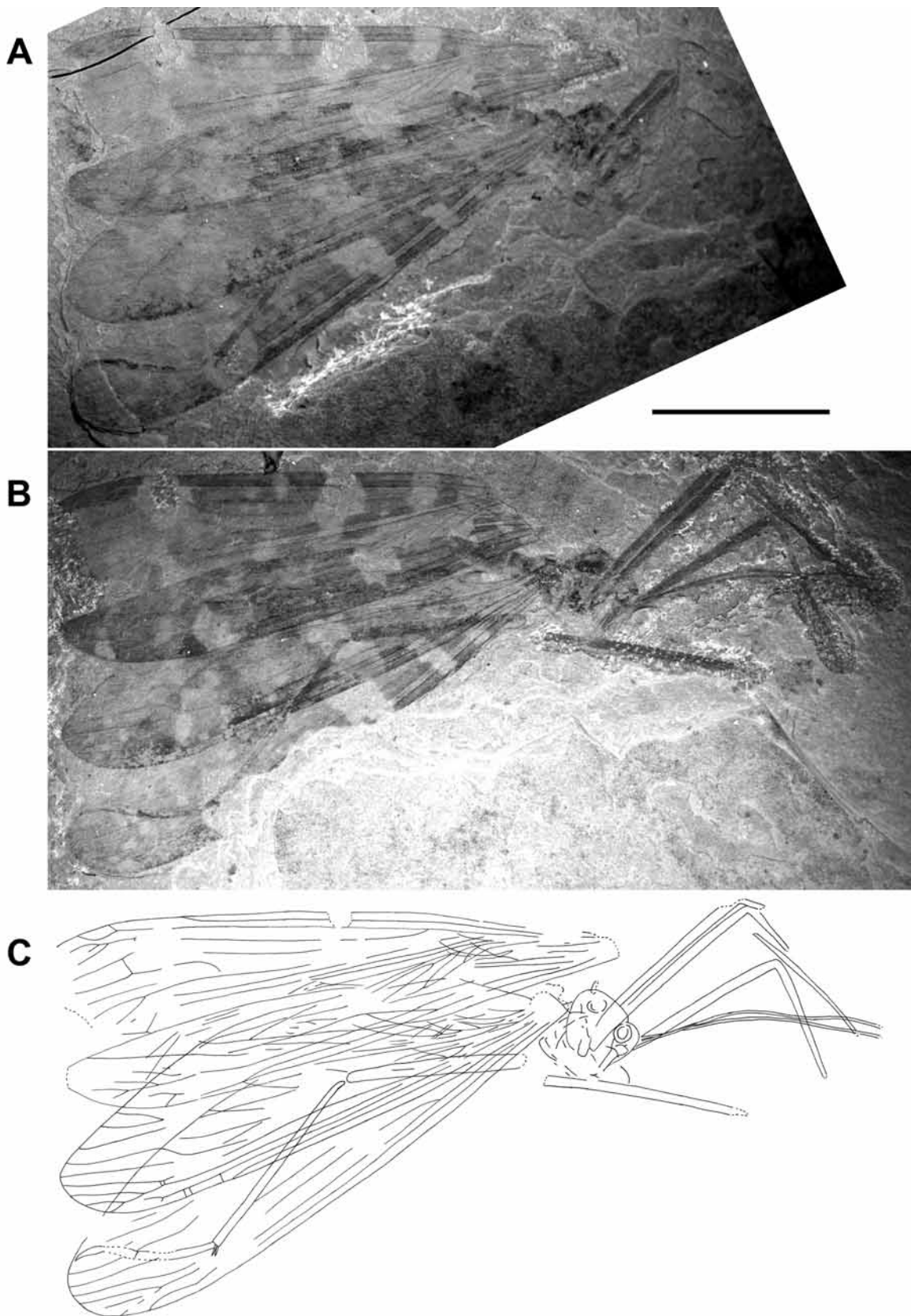


FIGURE 2. *Cimbrophlebia leahyi*, holotype. A, photograph of the counterpart TRUIPR L-018 F-1161; B, photograph of the part TRUIPR L-018 F-1160; C, drawing from both the part and counterpart. A–C to scale = 1 cm.

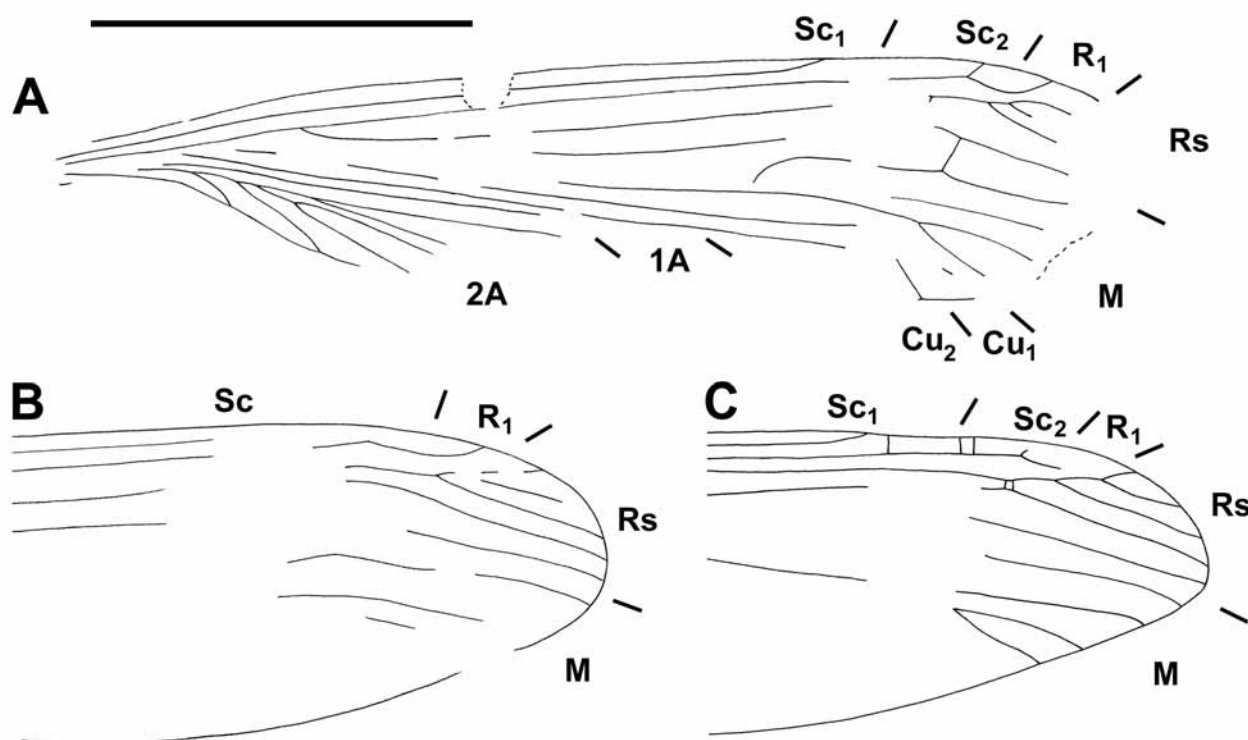


FIGURE 3. *Cimbrophlebia leahyi*, holotype. A, drawing of top wing from part and counterpart; B, C, drawings of apical portions of two bottom wings from part and counterpart. A–C to scale = 1 cm.

Type material. Holotype: TRUIPR L-018 F-1160 (part) and TRUIPR L-018 F-1161 (counterpart). A rather complete specimen, in the collection of TRU. Labelled: Holotype *Cimbrophlebia leahyi* Archibald, 2009. Collected and donated to TRU by John Leahy, 2008.

Locality and age. McAbee, British Columbia, Canada; unnamed formation of the Kamloops Group, Okanagan Highlands; Early Eocene.

Etymology. The specific epithet is a patronym formed from the surname of the collector, John Leahy, recognizing his generosity by the loan of the holotype (and numerous other specimens) to the author and subsequent donation to the TRU collection.

Remarks. The holotype is the most complete specimen of the family reported here, with body parts and all four wings attached. Preserved body parts conform to those reported for *C. bittaciformis* (Willmann, 1977) and *Malmocimbrophlebia buergeri* (Bechly & Schweigert, 2000), although preservation does not allow determination of whether the small hairs on the leg are arranged in rows as in *C. bittaciformis* (Willmann's Fig. 6).

***Cimbrophlebia brooksi*, sp. n.**

(Figs. 4A–D, 5)

Diagnosis. Wing distinguished from those of other *Cimbrophlebia* species by the following: 1), *Shape*: narrow, length about five times width separates it from wider wings of *C. leahyi*, *C. westae*, *C. flabelliformis* [length about four times width], (*C. bittaciformis* similarly slender); 2), *Colouration*: distinct from that of *C. flabelliformis*, *C. westae*, *C. bittaciformis*, *C. leahyi* (see descriptions, *C. flabelliformis* remarks, Figs. 1A; 2A, B; 4A, C; 6A, C; 7A).

Description: holotype wing. As in diagnosis, Figs. 4A–B, and the following. Length ~31 mm long as preserved (incomplete, basal portion missing), 7 mm wide. Colouration as in Fig. 4A, above. Membrane

rugose, except possibly in apical portion. Sc as for genus. Rs with five branches, Rs_1 , Rs_2 both branched apicad pterostigmal region, Rs_{3+4} apparently not branched. M apparently with four branches, but region poorly preserved. Cu, Cu_1 , Cu_2 , 1A poorly, fragmentarily preserved. 2A: with four branches evident, most likely more branches. 3A: not preserved. Crossveins: none detected.

Paratype wing. As in diagnosis, Fig. 4C–D, 5, and the following. Length ~38 mm as preserved, width not reliably measurable. Colouration as in Fig. 4C, as in holotype, except more completely preserved (cf. Fig. 4A, C). Membrane rugose, except possibly in apical portion. Sc: Sc_1 as for genus, Sc_2 not preserved. R_1 poorly preserved. Rs with four branches detected, region poorly preserved. Veins posteriad poorly, fragmentarily, or not preserved. Crossveins: none detected.

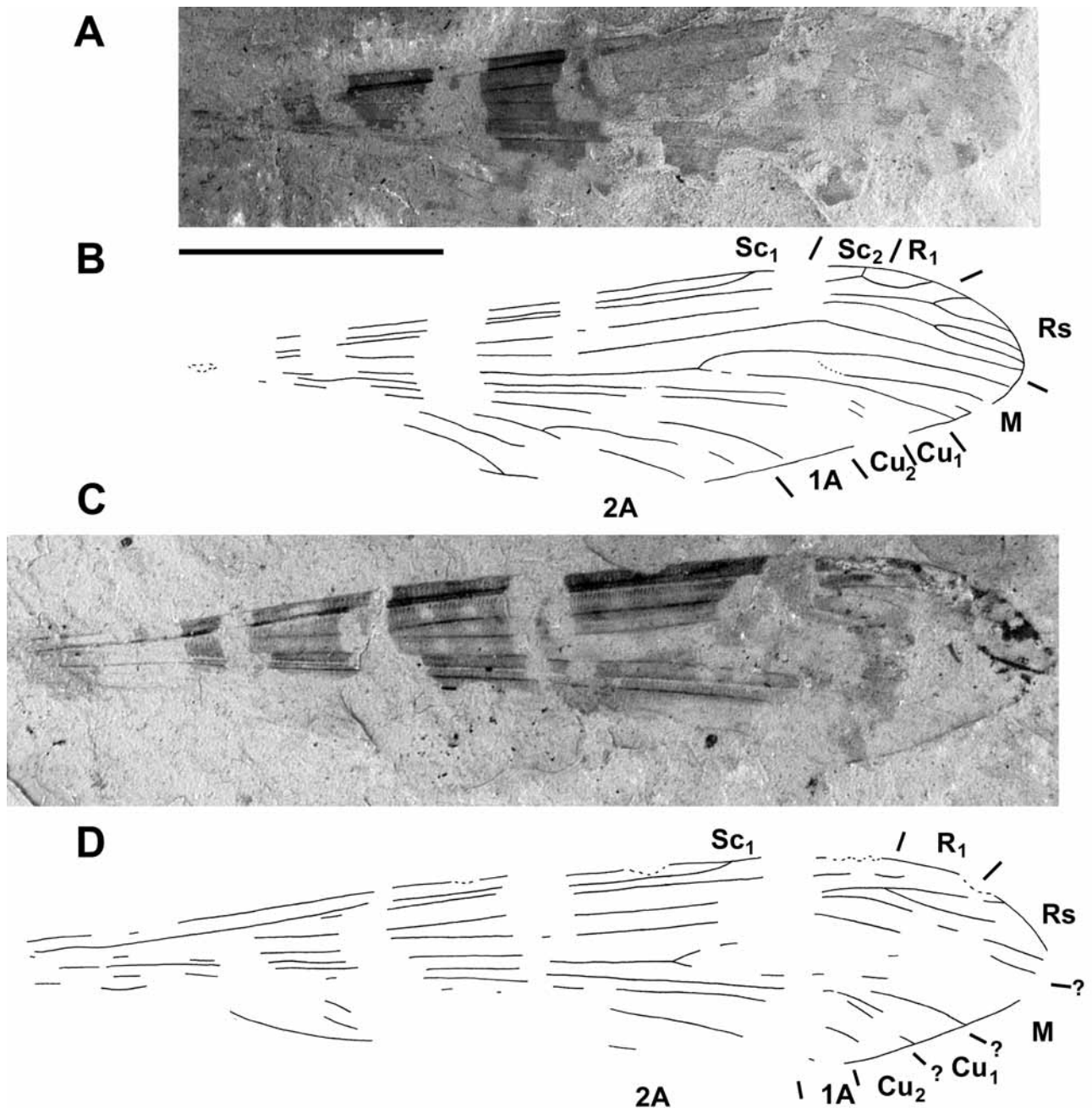


FIGURE 4. A, B, *Cimbrophlebia brooksi*, holotype wing SR062005: A, photograph (part); B, drawing from part and counterpart. C, D, *C. brooksi*, paratype wing SR990405: C, photograph (part); D, drawing from part and counterpart. A–D to scale = 1 cm.

Type material. Holotype: SR062005A, B, part and counterpart. A well-preserved fore- or hind wing, missing basal portions; housed at SR; labelled: Holotype *Cimbrophlebia brooksi*, Archibald, 2009. Collected by Karl Volkman at Republic locality B4131, June 2006. Paratype: SR990405, part only. A mostly well-preserved fore- or hind wing, but posterior region indistinct; housed at SR; labelled: Paratype *Cimbrophlebia brooksi*, Archibald, 2009. Collected by Caleb Brooks at Republic locality B4131, October 1999.

Locality and age. Republic, Washington, USA, University of Washington / Burke Museum locality B4131; Early Eocene.

Etymology. The specific epithet is a patronym formed from the surname of Caleb Brooks, the collector of the paratype specimen, recognizing his generosity in this donation to SR.

Remarks. The rugose membrane of much of the wings of *C. brooksi* (Fig. 5) is not mentioned as present in *C. bittaciformis* by Willmann (1977) nor seen in his figures, nor on the wings of *C. sp. A* or *C. flabelliformis*. It is found in *C. leahyi*, and *C. westae*, however.

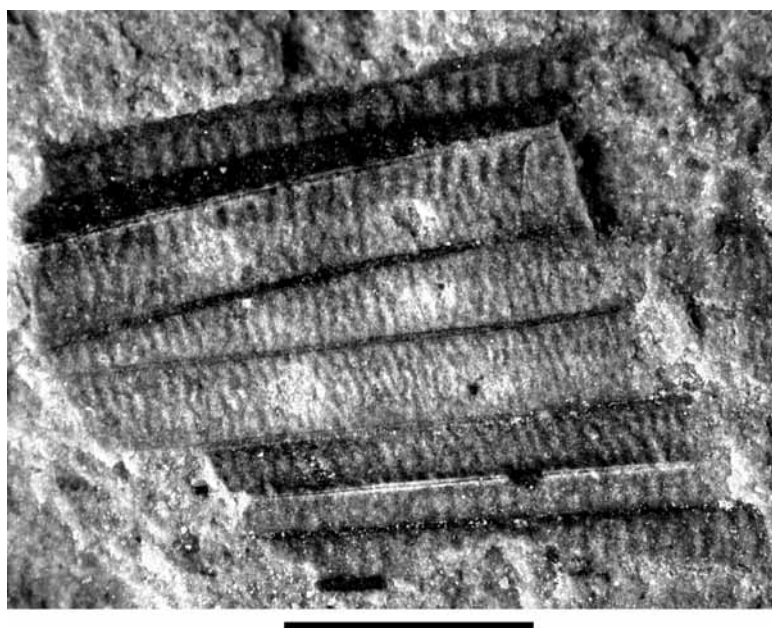


FIGURE 5. Close-up of mid-anterior portion of *C. brooksi* paratype wing showing rugose membrane. Scale = 2 mm.

***Cimbrophlebia westae*, sp. n.**
(Fig. 6)

Diagnosis. Wing distinguished from those of other *Cimbrophlebia* species by the following: 1), *Shape*: length about four times width separates it from *C. brooksi* [distinctly narrower: length about five times width], *C. bittaciformis* [similarly slender (see *C. flabelliformis* remarks)], (*C. leahyi*, *C. westae* length also about four times width); 2), *Colouration*: distinct from that of *C. flabelliformis*, *C. brooksi*, *C. leahyi*, *C. bittaciformis* (see *C. flabelliformis* remarks); closest to that of *C. leahyi*, further differentiated from *C. leahyi* by distinctly round / oval light spots [*C. leahyi*: differing position, sizes of more irregularly shaped light spots (see descriptions, *C. flabelliformis* remarks, Figs. 1A; 2A, B; 4A, C; 6A, C; 7A)].

Description: holotype wing. Wing as in diagnosis, Fig. 6, and the following. Length ~25 mm, width ~6 mm. Colouration (basal third colouration poorly preserved) as in diagnosis. Membrane rugose, except in apical quarter, anal region. Sc, R₁ generalized for genus. Rs with five branches. M with three branches evident, region partly not preserved; Cu₁, Cu₂, 1A generalized for genus; 2A with five branches known (only apical portion clearly preserved); 3A region not preserved. Crossveins: few detected as preserved; one r1-rs, one m-m, one m-cul.

Type material. Specimen SRUI 099600, part only. A mostly well-preserved wing missing part of the apical posterior portion, with basal portion of 2A region obscured, and basal third colouration obscured by mineral staining. Collected by Joanne West, April 19, 2009 at Republic. Housed at SR.

Locality and age. Republic, Washington, USA, University of Washington / Burke Museum locality B4131; Early Eocene.

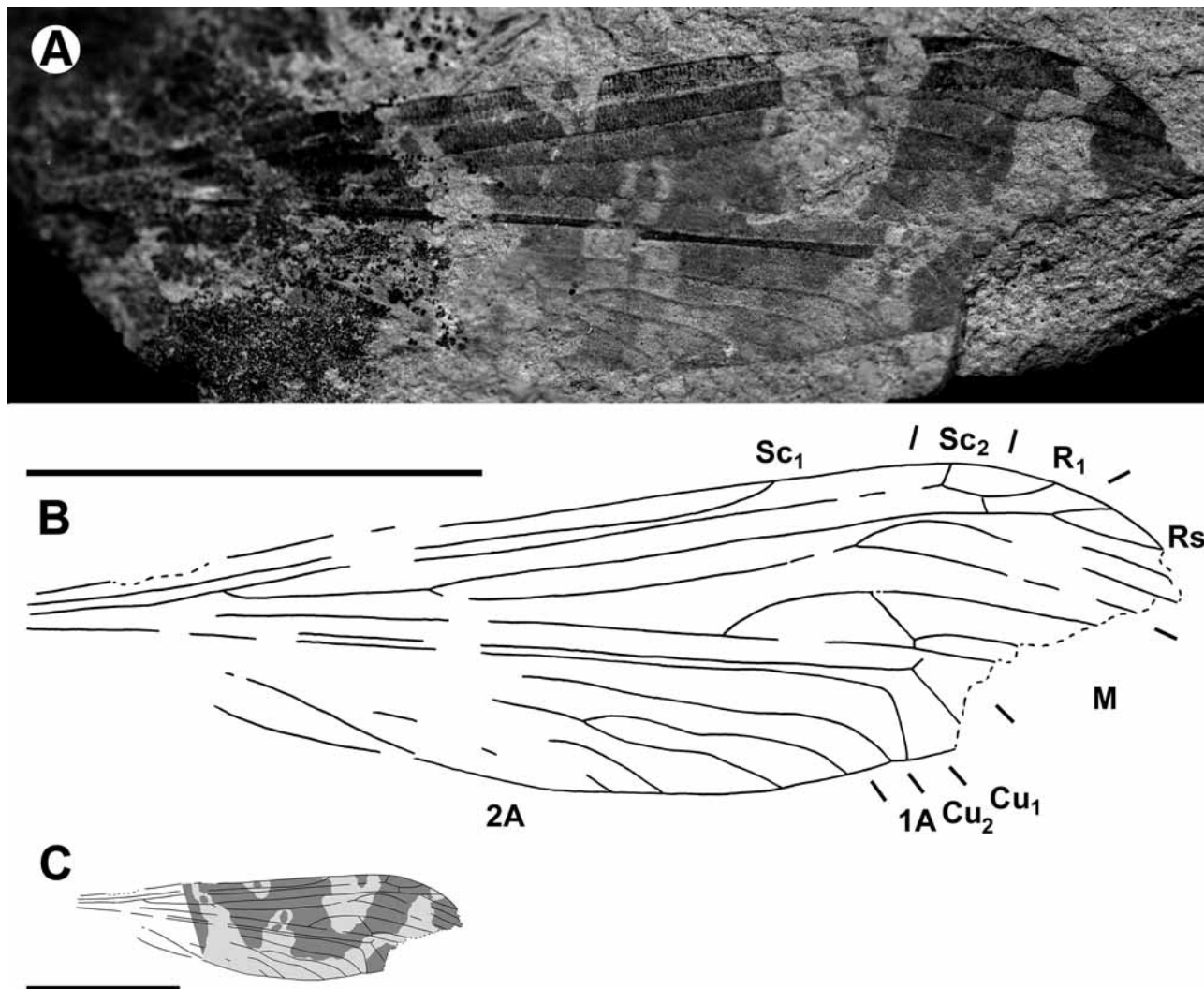


FIGURE 6. *Cimbrophlebia westae*, holotype wing SRUI 099600. A, photograph; B, drawing; C, colouration (simplified to two shades) of *C. westae* wing, note basal portion obscured by staining, rendered blank. A, B to scale = 1 cm; C scale = 1 cm.

Etymology. The specific epithet is a patronym formed from the surname of Joanne West, the collector of the holotype specimen, recognizing her generosity in this donation to SR and valued participation in a collecting project on behalf of the author's research.

Cimbrophlebia sp. A.

(Fig. 7A–C)

Description. Wing as in Fig. 7A–C, and the following. Length of portion preserved ~28 mm (estimated complete > 40 mm, see remarks, below), width ~7.5 mm (preserved portion, not maximum). Colouration as in Fig. 7A, similar (preserved portion) to *C. flabelliformis*, *C. leahyi*; possibly, but less likely *C. westae*. Sc, R,

Rs, M, small basal portions preserved. Cu₁, Cu₂, 1A: preserved portions generalized as for genus. 2A: six pectinate branches. Crossveins: none detected as preserved.

Material. UCCIPR L-18 F-998 (part), F-1137 (counterpart). Fore- or hind wing, missing apical third and about two thirds of the anterior portion, and a small portion of basal hind margin; in the collection of TRU. Labelled: hypotype, *Cimbrophlebia* sp. A, Archibald, 2009. Collected by unknown person at McAbee in 2002, donated to TRU by David Langevin, 2002.

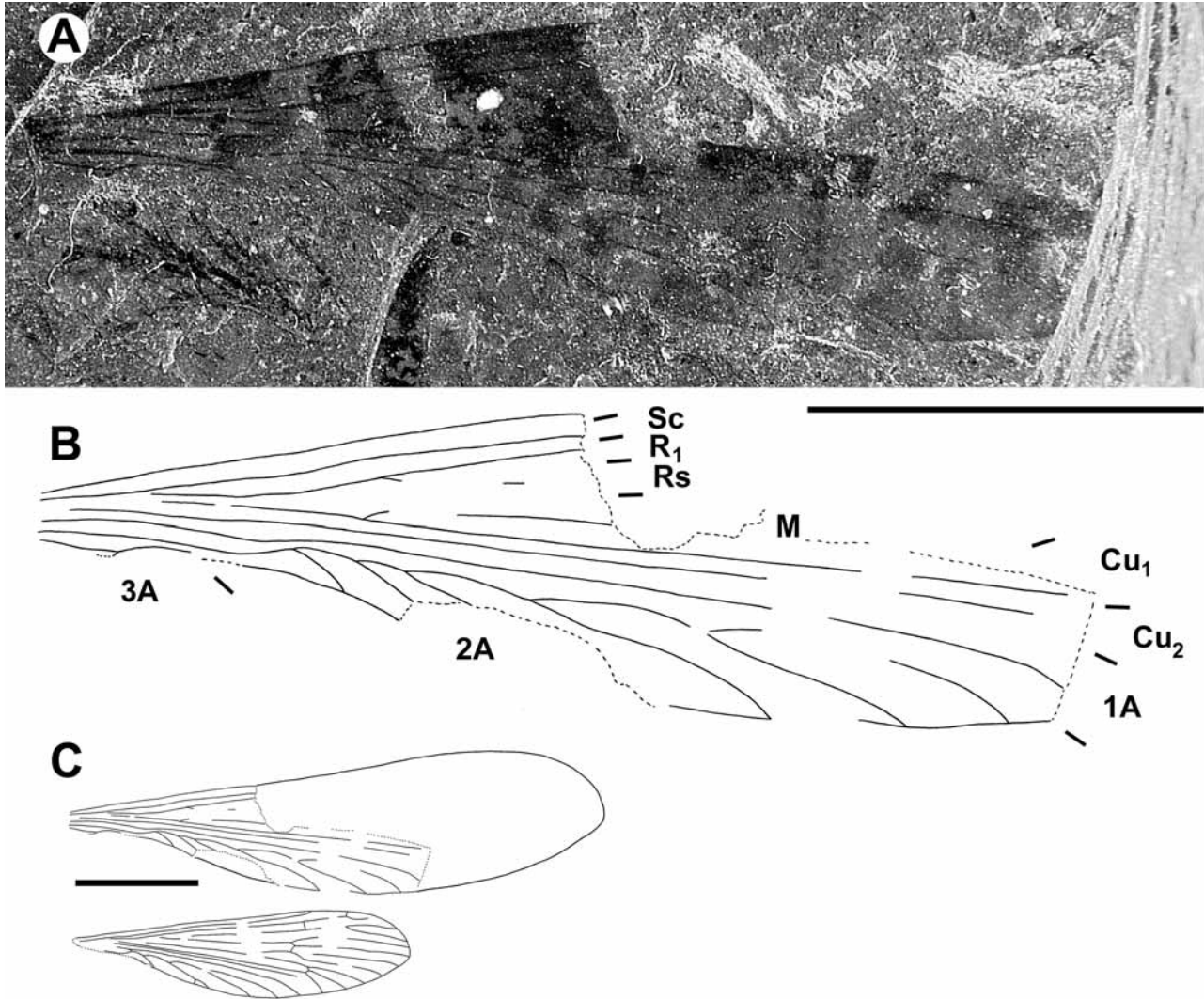


FIGURE 7. *Cimbrophlebia* sp. A, UCCIPR L-18 F-998. A, photograph (part); B, drawing (part, no additional information on counterpart); C, reconstruction of the hypothesized complete size and shape of *C. sp. A* wing (top) based on that of *C. flabelliformis* (bottom). A, B to scale = 1 cm; C to scale = 1 cm.

Locality and age. McAbee, British Columbia, Canada; Early Eocene.

Remarks. The preserved portions of the wing of *C. sp. A* indicate that its shape is consistent with that of *C. flabelliformis* (Fig. 7C). If so, its complete length would be likely over 40 mm. The width of the preserved portion (not maximum) is ~7.5 mm. By its large size, this is confidently separated from *C. flabelliformis* [length ~28 mm; width 7 mm] and *C. westae* [length ~25 mm, width ~6 mm]. The 2A with six pectinate branches preserved separates it from *C. bittaciformis* [seven branches: three basal branches pectinate, four distal branches dichotomous], from *C. Leahyi* [six branches: two basal branches pectinate, minimum of four dichotomous distal branches], and from *C. flabelliformis* [four pectinate branches], although not from *C. brooksi* and *C. westae*, where 2A is little known by preservation. *Cimbrophlebia* sp. A apparently has a similar shape as known to *C. flabelliformis*, *C. Leahyi* and *C. westae*, which are relatively wide, differing from the

narrower wings of *C. brooksi* and *C. bittaciformis* (see above). Colouration, when known from a complete wing will surely be informative (see *C. flabelliformis* remarks above). Better-preserved specimens are needed to clarify supposition that this represents a distinct, separate species.

Discussion

Cimbrophlebiids were large insects, with known wing lengths ranging from ~25 to ~38 mm (*C. westae*, ~25 mm; undescribed German species, 27 mm: Ansoerge, 2003; *M. buergeri*, 28.6 mm: Bechly & Schweigert, 2000; *C. flabelliformis*, 28 mm; *C. leahyi* ~31 mm; *C. bittaciformis*, 34.5 mm: Willmann, 1977; *C. brooksi*, ~38 mm). The wing of *C. sp. A* may have been much larger yet, likely over 40 mm in length (Fig. 7C). It would then be amongst the largest Cenozoic Mecoptera, of similar size to the largest Dinopanorpidae, also from McAbee (Archibald, 2005).

The species of the Okanagan Highlands reported here represents the greatest known diversity of the family. This is consistent with high diversity seen in other insect groups (*e.g.*, Polystoechotidae, Archibald and Makarkin, 2006; and current research).

This is also the first occurrence of the family in the Western Hemisphere. The cross-North Atlantic distribution of *Cimbrophlebia* reflects the well-documented pattern of early Paleogene mammal and plant dispersals between North America and Europe, then tectonically close (above references). This is increasingly reflected in similarity known between the Early Eocene insects of the Okanagan Highlands and the Danish Fur Formation (Archibald & Makarkin, 2006; Archibald *et al.*, 2006).

Novokshonov (1997) suggested that the Early Cretaceous *Telobittacus fragosus* from China is closely related to, and perhaps a congener of *C. bittaciformis*. Examination of figure 3 of Zhang (1993) indicates possible support for this opinion. Considering the media to have four branches, CuA (and CuP) would then be anterior to the vein labelled CuA, which would then be 1A, with a long, multi-branched 2A posterior that, as in Cimbrophlebiidae. Placement of *T. fragosus* in this family and assignment to the genus *Cimbrophlebia* is, however, premature; re-examination of the type is necessary to confirm this possibility.

The family has not been found in other, well-studied Cenozoic localities, such as the Early Eocene Green River Formation of Colorado, Wyoming and Utah (U.S.A.); later Eocene Baltic amber; and Late Eocene Florissant, Colorado (U.S.A.). The youngest known occurrence is in the latest Early Eocene at Republic.

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