

## The early Eocene *Eourocus anguliterreus* gen. et sp. nov. (Hymenoptera, Siricidae) from Republic, Washington

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### Abstract

A new fossil horntail wood wasp (Hymenoptera, Symphyta, Siricidae), *Eourocus anguliterreus* gen. et sp. nov. from an early Eocene Okanagan Highlands locality at Republic, Washington, USA is described. Its forewing is most like that of the extant and fossil genus *Urocerus* Geoffroy, 1785. It is the third fossil siricid described from North America. We treat *Xeris dorbniensis* Manukyan & Smirnova, 2021 and *Xeris* sp. of Manukyan & Smirnova (2021) as *Urocerus dorbniensis* (Manukyan & Smirnova, 2021), comb. nov. and *Urocerus* sp., both tentatively belonging to the genus, *Urocerus klebsi* Brues, 1926 as *Xeris klebsi* (Brues, 1926) comb. nov., and “*Afrotremex* or *Eriotremex* sp.” of Wedmann (1998) as a species of *Eriotremex* Benson, 1943. A key to extant and extinct genera of Siricinae by forewing characters is given.

**Key words:** Hymenoptera, Siricidae

### Introduction

The horntail wood wasps (Hymenoptera, Symphyta, Siricidae) are comprised of about 122 species of fungus-feeding pests of trees. They primarily inhabit Holarctic forests, with a few ranging in lower latitudes and introduced in the Southern Hemisphere (Schiff *et al.* 2012). Wedmann *et al.* (2014) treated the subfamily Tremicinae as invalid (and see further discussion by Archibald & Rasnitsyn 2016), and so the Siricinae as its only subfamily. There is a small and unclear record of Siricidae in the Mesozoic, and some taxa thought of as closely related might be considered subfamilies of it upon revision. The only currently confident Mesozoic Siricidae are two poorly preserved unnamed specimens from the Coniacian near Okhotsk in far-eastern Russia (Rasnitsyn 1993; age according to Golovneva 2013). *Emanrisca empusa* Rasnitsyn, 1993 from the same locality is a possible but uncertain siricid (Rasnitsyn 1993).

In the Paleogene, all Siricidae are in or are close to modern genera. These first appear in the Paleocene of Argentina (*Urocerus patagonicus* Fidalgo & Smith, 1987) and France (*Urocerus ligniticus* Piton, 1940). They are better known in the Eocene, in the Ypresian of the Okanagan Highlands of British Columbia, Canada (*Ypresiosirex orthosemos* Archibald & Rasnitsyn, 2016), the Green River Formation of Wyoming, USA (*Eoteredon lacoi* Archibald, Aase & Nel, 2021), and at Messel, Germany (*Xoanon? eocenicus* Wedmann, Pouillon & Nel, 2014); and in Priabonian Baltic amber (*Urocerus klebsi* Brues, 1926, *Xeris dorbniensis* Manukyan & Smirnova, 2021, and the *Xeris* sp. of Manukyan & Smirnova 2021).

Here, we describe a new genus and species from the Okanagan Highlands site at Republic, Washington (USA), the third fossil occurrence of the family in North America.

## Material and methods

We examined a fossil forewing, part and counterpart, from exposure A0307 of the Tom Thumb Tuff Member of the Klondike Mountain Formation in the village of Republic, Washington, USA. Republic is the southern-most deposit of the Okanogan Highlands, a series of Ypresian lake basins scattered across about a thousand kilometres from Driftwood Canyon near Smithers, British Columbia to Republic, Washington, USA. Republic is about 290 kilometres south-east of the McAbee site in British Columbia, where *Ypresiosirex orthosemos* was found (Archibald *et al.* 2011). A0307 has a U-Pb maximum likelihood age of  $51.45 \pm 0.12$  Ma (Rubino *et al.* 2021).

We use the wing vein and cell terminology of Rasnitsyn (1969) as modified by Archibald & Rasnitsyn (2016). 1-Rs and 1-M are the first abscissae of Rs and of M distal to M+Cu respectively as mentioned in the text, 2-A is the last abscissa of apically fused 1A, 2A, and 3A; other abscissae are not numbered here; ad is an adventitious vein (venational malformations are common in living Siricidae).

Contrary character states of compared taxa are provided in brackets.

A0307 is a locality number designation of the Burke Museum of Natural History and Culture (Seattle, WA), also used by the Stonerose Interpretive Center (Republic, WA).

## Systematic paleontology

### Order Hymenoptera Linnaeus, 1758

### Infraorder Siricomorpha Rasnitsyn, 1980

### Superfamily Siricoidea Billberg, 1820

### Family Siricidae Billberg, 1820

### Subfamily Siricinae Billberg, 1820

### *Eourocerus* Archibald & Rasnitsyn, new genus

Figure 1, 2B

**Diagnosis.** The forewing of *Eourocerus* is most like that of *Urocerus* Geoffroy, 1785 (see below), but is most easily distinguished by shape: length/width estimated *ca.* 3.0 [*Urocerus* 3.2]; apex broadly rounded almost as in *Sirotre-mex* Smith, 1988 [*Urocerus*, angularly rounded] (Fig. 2). It may also be distinguished from those of other genera of Siricinae by the combination of: 2r-rs basal to 2r-m; 1r-rs extremely short, almost its width long; 1r-m absent, replaced with Rs+M; 2r-m and 3r-m present, 2r-m basal to 2mcu; Cu1 absent; crossvein cu-a more than half its length distal to M+Cu.

**Type species.** *Eourocerus anguliterreus*.

**Description.** As for its only species.

**Etymology.** The genus name is formed from “Eocene” and “*Urocerus*”. Gender, masculine.

**Range and age.** Ypresian Tom Thumb Tuff Member of the Klondike Mountain Formation at Republic, Washington, USA.

### *Eourocerus anguliterreus* Archibald & Rasnitsyn, new species

Figure 1, 2B

**Diagnosis.** As for genus.

**Material.** Holotype forewing SRUI-99-97-08A, B, collected by Karl Volkman at Republic A0307, April 15, 2015, on a slab about 20 X 60 cm with wings of three taxa of Cercopoidea (Hemiptera), a pair of beetle elytra (Coleoptera), a march fly (*Plecia* Wiedemann, 1828, Bibionidae, Diptera), several more fragmentary insects, an

unidentified angiosperm leaf, a leaf of *Macginitiea* (Platanaceae), *Metasequoia* and *Glyptostrobus* or *Taxodium* foliage (Taxodiaceae), and a *Koelreuteria* fruit (Sapindaceae); housed in the collections of the Stonerose Interpretive Center, Republic, Washington, USA.

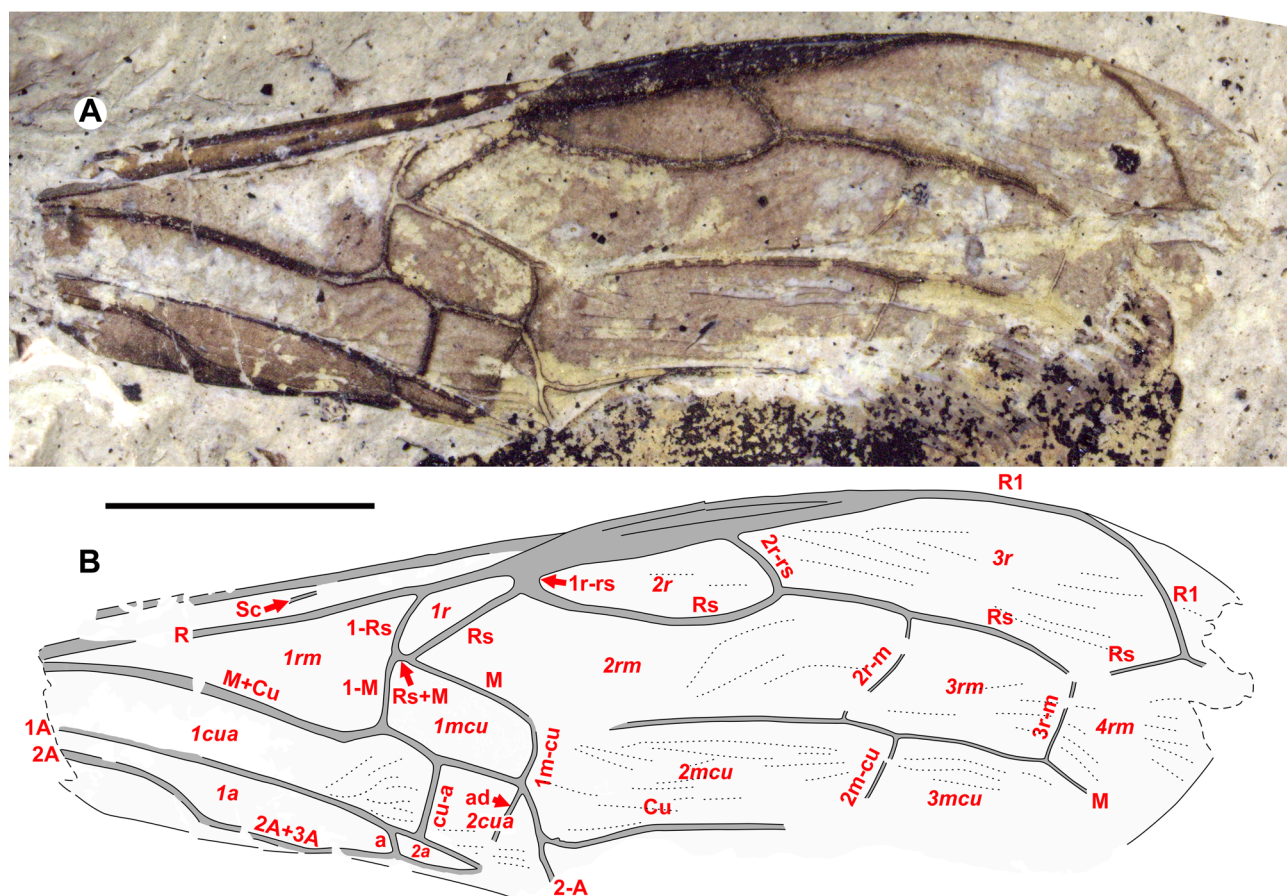


**FIGURE 1.** Holotype *Eourocerus anguliterreus* gen. et sp. nov., SRUI-99-97-08A, B. A, photograph of part, SRUI-99-97-08A; B, drawing from part and counterpart. Both to scale, 5 mm. Cell names in *italics*, vein names in *Roman font*.

**Description.** Forewing, sex unknown. Apex blunt; length estimated *ca.* 24 mm complete, maximum width estimated *ca.* 8 mm complete; membrane infusate, more darkly so near pterostigma, in cell C, anal cells; longitudinal corrugation preserved in cells 2r, 3r, 2m, 3m, 4m, 2mcu, 3mcu, apical area, longitudinal/transverse corrugation in distal portion of cell 1cu; Sc fragmentarily preserved in approximately mid C space; pterostigma narrow; 2r-rs joins pterostigma more than its length from pterostigma end; cells 1r, 1mcu joining briefly forming very short Rs+M; 1-M almost straight; 2r-m joins Rs in cell 3r, about half way between 2r-rs, 3r-m; cell 3rm longer than high (width twice length of 3r-m, about 1.3 length of 2r-m); Rs, R1 join, closing cell 3r; 2m-cu joins M at basal third of cell 3rm; cells 2rm, 2mcu 3.5 times longer than high; Cu1 absent, with characteristic bend in at M+Cu, M; adventitious crossvein in cell 2cu; crossvein a basal to cu-a; 2A+3A adjacent posterior margin about half to third length of cell 1a (basal portion missing); stub of 3A not detected; nygmata not detected.

**Etymology.** The specific epithet is formed from the Latin *anguli terra*, meaning “corner land”, referring to exposure A0307 (“the corner lot”).

**Range and age.** Tom Thumb Tuff Member of the Klondike Mountain Formation at Republic, Washington, USA, exposure A0307; Ypresian.

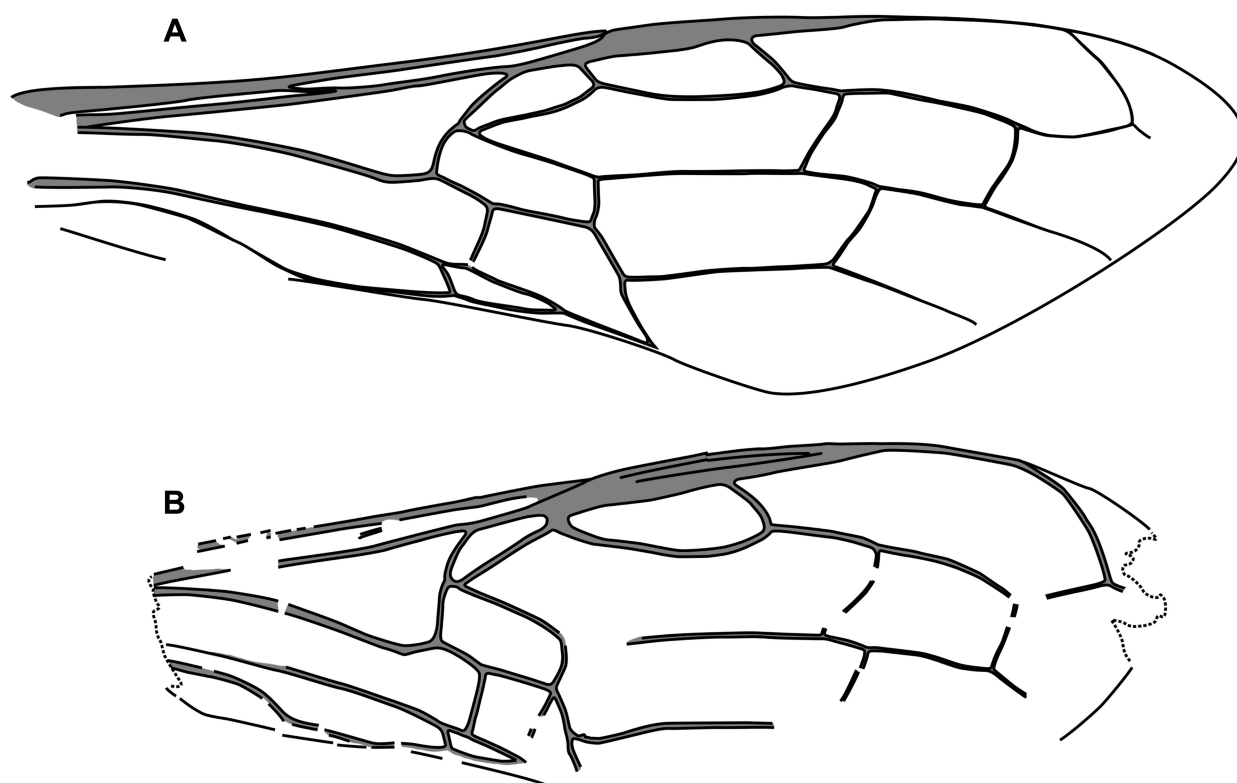


**FIGURE 2.** Comparison of forewing shapes of A, *Urocerus albicornis* (Fabricius, 1781) drawn from Schiff *et al.* (2012) figure B1.71, and; B, *Eourocerus anguliterreus*. For shape comparison, they are to different scales, aligned to the branching of M+Cu and 3r-m.

## Discussion

The forewing of *Eourocerus* is closest to that of *Urocerus*. In both, 1r-m is absent; 2r-m and 3r-m are present; 2r-m joins M basal to 2mcu; 2r-rs is basal to 2r-m; Cu1 is absent (may be rudimentary in *Urocerus*); cu-a is well postfurcal (more than half its length distal to M+Cu); and the wing membrane is not transversally corrugated basally as in *Ypresiosirex* Archibald & Rasnitsyn 2016.

All of these character states are also present in *Xeris dornikensis* Manukyan & Smirnova, 2021 and the *Xeris* sp. specimen (Kaliningrad Museum of Amber number 5656) of Manukyan & Smirnova (2021) (except the placement of 2r-rs, which is not known in this fossil by preservation). While these are like *Xeris* in many ways, cu-a joins Cu well postfurcal as in *Urocerus*, while in *Xeris* it joins Cu close to M (see Schiff *et al.* 2012 description of the genus page 244 and their figures B5.16 and B5.17). Further, these wings are shaped like those of *Urocerus*, not *Eourocerus*. As these are then closer to *Urocerus*, we treat them as *Urocerus dornikensis* (Manukyan & Smirnova, 2021), comb. nov. and *Urocerus* sp., both tentatively belonging to that genus.

The description and drawing (Brues 1926, Fig. 1, no photograph) of the forewing of *Urocerus klebsi* Brues 1926 agrees with *Xeris*, including cu-a joining M only slightly postfurcal, unlike in *Urocerus*. This cannot be confirmed, however, as the type and only specimen has been lost (Manukyan & Smirnova 2021). Assuming that this is correct, we treat the species as *Xeris klebsi* (Brues, 1926), comb. nov. Brues, however, reports 21 flagellomeres in this fossil, which is high for both a small *Xeris* and a small *Urocerus* (forewing 16 mm in length) (Schiff *et al.* 2012).

Wedmann (1998) treated a siricid (collection number 9604) from the Chattian (late Oligocene) of Enspel, Germany as “*Afrotremex* or *Eriotremex* sp.” as it resembles both genera. They may be separated, however, by the pterostigma being attenuated immediately distal to 2r-rs, 2r-rs being less than its length from pterostigmal end in *Afrotremex*, and in *Eriotremex* the pterostigma being longer and more gradually tapering distal to 2r-rs, which is

more than its length from the end of the pterostigma. While the distal portion of the pterostigma is poorly preserved in this fossil, the photograph and drawing of it (her figures 2 and 3) show this to agree with *Eriotremex*, and so we place it in that genus.

## Key to extant and extinct genera of Siricinae by forewing characters

|         |                                                                                                                                                                                                       |                                                 |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 1.      | Crossvein cu-a* antefurcal or slightly postfurcal (half or less its length distal to M+Cu) .....                                                                                                      | 2                                               |
| -       | Crossvein cu-a well postfurcal (more than half its length distal to M+Cu) .....                                                                                                                       | 6                                               |
| 2(1).   | 2r-m lost, 3r-m well developed .....                                                                                                                                                                  | 3                                               |
| -       | 2r-m and 3r-m both present (sometimes both weak or lost) .....                                                                                                                                        | 5                                               |
| 3(2).   | 2r-rs distal to 2m-cu, nearer end of long pterostigma .....                                                                                                                                           | <i>Tremex</i> Jurine, 1807                      |
| -       | 2r-rs placed more basally, near or basal to level of 2m-cu .....                                                                                                                                      | 4                                               |
| 4(3).   | 2r-rs less than its length from pterostigmal end, membrane deeply infusate basally and along anterior margin .....                                                                                    | <i>Afrotremex</i> Pasteels, 1951                |
| -       | 2r-rs more than its length from pterostigmal end, membrane pale, except darkened in anterior (especially mid-anterior) and apical parts of wing .....                                                 | <i>Eriotremex</i> Benson, 1943                  |
| 5(2).   | 1-M straight to gently curved .....                                                                                                                                                                   | <i>Xeris</i> A. Costa, 1894                     |
| -       | 1-M strongly bent .....                                                                                                                                                                               | <i>Siricosoma</i> Forsius, 1933                 |
| 6(1).   | Cu1* distinct .....                                                                                                                                                                                   | <i>Sirex</i> Linnaeus, 1758                     |
| -       | Cu1 absent or rudimentary .....                                                                                                                                                                       | 7                                               |
| 7(6).   | 1r-m long, joins R basal to Rs origin; cell 3rm shorter than high .....                                                                                                                               | <i>Sirotemex</i> Smith, 1988                    |
| -       | 1r-m short or absent, replaced with Rs+M .....                                                                                                                                                        | 8                                               |
| 8(7).   | 2r-m distal to 2m-cu .....                                                                                                                                                                            | <i>Xoanon</i> Semenov-Tian-Shanskij, 1921       |
| -       | 2r-m basal to 2m-cu .....                                                                                                                                                                             | 9                                               |
| 9(8).   | 2r-m and 3r-m lost (former positions identifiable by slight bends of Rs and M); membrane with distinct transverse corrugation basal to 1-Rs, 1-M, cu-a, longitudinal corrugation distal to this ..... | <i>Ypresiosirex</i> Archibald & Rasnitsyn, 2016 |
| -       | 2r-m and 3r-m present; wing membrane not transversally corrugated basally .....                                                                                                                       | 10                                              |
| 10(9).  | 2r-rs distal to 2r-m .....                                                                                                                                                                            | 11                                              |
| -       | 2r-rs basal to 2r-m .....                                                                                                                                                                             | 12                                              |
| 11(10). | 1r-rs extremely short, almost its width long; Rs+M distinct although short .....                                                                                                                      | <i>Teredon</i> Norton, 1869                     |
| -       | 1r-rs distinct even though shorter than 2r-rs; Rs+M extremely short, almost its width long .....                                                                                                      | <i>Eoteredon</i> Archibald, Aase & Nel, 2021    |
| 12(10). | Length/width 3.2; apex angularly rounded; 1r-rs distinct although shorter than 2r-rs .....                                                                                                            | <i>Urocerus</i> Geoffroy, 1785                  |
| -       | length/width ca. 3.0; apex broadly rounded; 1r-rs extremely short, almost its width long .....                                                                                                        | <i>Eourocerus</i> <b>gen. nov.</b>              |

\*Cu1 may be confused with cu-a; it is absent in *Sirotemex* (*contra* Schiff *et al.* 2012, *cf.* their figure C1.16).

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