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## A new species of Axymyiidae (Diptera) from western North America and a key to the Nearctic species

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### Abstract

Adult, pupal and larval stages of the western Nearctic axymyiid, *Protaxymyia thuja* Fitzgerald and Wood n. sp., are described. The generic placement of this taxon is discussed in the context of the world axymyiid fauna and a key to differentiate all known life stages of Nearctic axymyiids is provided.

**Key words:** systematics, taxonomy, Axymyiomorpha, Bibionomorpha, larva

### Introduction

The enigmatic family Axymyiidae (Diptera) is a small group of Holarctic flies in which the larval stages are restricted to burrowing in water-permeated wood. When first discovered, the larvae of the eastern North American species, *Axymyia furcata* McAtee, were believed by Alexander (1920) to be the larvae of the tanyderid, *Protoplasa fitchii* Osten Sacken, but their true identity was established by Krogstad (1959) who reared them and described their biology. Over the intervening years, *Axymyia* McAtee has been placed in the Bibionidae, Pachyneuridae, and Anisopodidae, but its unusual larval structure has necessitated treatment as a separate family, Axymyiidae. Placement of the family within one of the nematoceran infraorders remains controversial, although the family is most commonly placed in either a variably defined Bibionomorpha (Oosterbroek & Courtney 1995; Wiegmann *et al.* 2011) or within the superfamily Axymyioidea (Mamaev & Krivosheina 1966) or the infraorder Axymyiomorpha (Wood & Borkent 1989), which includes either the family Axymyiidae alone, or includes Axymyiidae, Perissomatidae, and Pachyneuridae (Hennig 1973; Amorim 1992). Considering that the infraordinal placement of axymyiids remains unresolved it is no surprise that the sister group to Axymyiidae also remains controversial (Wood & Borkent 1989; Fitzgerald 2004; Blagoderov *et al.* 2007; Bertone *et al.* 2008; Borkent & Sinclair 2012; Sinclair 2013; Sinclair *et al.* 2013; Schneeberg *et al.* 2013).

Axymyiidae includes four extant genera and eight described species, listed below in the Systematics section. With the recent flurry of papers on axymyiid biology, ecology, morphology and taxonomy it is timely that the present study formally describes all life stages of a new species from the northwestern United States that has been known of and referred-to informally in the literature for many years (Wood 1981; Dudley & Anderson 1982; Pereira *et al.* 1982; Wood & Borkent 1989; Young & Lisberg 2001; Fitzgerald 2004; Wihlm 2009; Zhang 2010; Wihlm & Courtney 2011; Wihlm *et al.* 2012; and Sinclair 2013).

### Material and methods

Terminology for adults and larvae follows McAlpine (1981) and Teskey (1981) respectively except wing vein

## Key to adults and larvae of Nearctic Axymyiidae

Adult (the male of *Plesioaxymyia* is unknown).

1. Sc short, not reaching Rs; crossvein r-m transverse, proximal to middle of wing; stem of veins  $M_1$  and  $M_2$  several times as long as r-m and about as long as  $M_1$  or  $M_2$ ; vein CuP vestigial, scarcely extending beyond posteromedial angle of wing; vein  $A_1$  apparently absent (Sinclair 2013, fig. 3); small species; wing under 4.0 mm; Alaska and Washington . . . . . *Plesioaxymyia vespertina* Sinclair
- Sc long, extending beyond Rs; crossvein r-m oblique, distal to middle of wing; stem of veins  $M_1$  and  $M_2$  shorter than r-m and much shorter than either  $M_1$  or  $M_2$ ; vein CuP extending nearly to wing margin; vein  $A_1$  present (Fig. 21); larger species; wing ca. 5.0 to 14.0 mm. . . . . 2
2. Length of wing approximately 11.0–14.0 mm. Known only from western USA, emerging in November or December; male with lateral lobe of gonocoxite broad (ca. 1/3 width of hypandrium), broadly rounded at apex (Fig. 20). Female sternite 8 elongate and laterally compressed (Figs 18, 19) . . . . . *Protaxymyia thuja* n. sp.
- Length of wing approximately 5.0–8.0 mm. Known only from central and eastern North America, emerging March to May. Male with lateral lobe of gonocoxite narrower (ca. 1/4 to 1/5 width of hypandrium), pointed apically (Wood 1981, figs 4, 5). Female sternite 8 short and not laterally compressed . . . . . *Axymyia furcata* McAtee

Larva (the larva of *Plesioaxymyia* is unknown).

1. Anal papillae unbranched, simple, sausage-link-like (Figs 4–5) and head capsule as in Figs 9–10 with maxillary lacinia much shorter in length than maxillary palpus; presently known only from Oregon and Washington; found most commonly in prostrate, partially water-soaked logs of Western Red Cedar, but reported from Douglas-fir and Alder . . . *Protaxymyia thuja* n. sp.
- Anal papillae branched (pectinate) (Fig. 7) and head capsule as Figs 11–12 with maxillary lacinia subequal in length to maxillary palpus. Eastern North America; found most commonly in prostrate partially water-soaked logs of Elm, Black Ash, Maple, Aspen, and Hickory. . . . . *Axymyia furcata* McAtee

Pupa (the pupa of *Plesioaxymyia* is unknown).

1. Prothoracic respiratory organs strongly curving away from body in dorsal view (Fig. 3), typically shoe-horn-shaped with apex broadly rounded, flattened, and scoop-like. . . . . *Protaxymyia thuja* n. sp.
- Prothoracic respiratory organs parallel to body in dorsal view (curving anteroventrally as in Fig. 8), apically tapered to a point . . . . . *Axymyia furcata* McAtee

Egg (the egg of *Plesioaxymyia* is unknown).

1. Chorion smooth. . . . . *Protaxymyia thuja* n. sp.
- Chorion with longitudinal ridges on one side but smooth on other side (Wihlm *et al.* 2012, fig. 1) . . . *Axymyia furcata* McAtee

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