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Revision of the Nearctic species of *Acanthocnema* Becker, 1894 (Diptera: Scathophagidae)

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Abstract. The Nearctic species of *Acanthocnema* Becker, 1894 are revised, including the description of three new species: *A. albibarba* (Loew, 1869), *A. capillata* (Loew, 1872), *A. nigrimana* (Zetterstedt, 1846), *A. pulchripennis* sp. nov., *A. rainierensis* sp. nov., *A. ruficauda* Curran, 1929 and *A. torrenticola* sp. nov. *Acanthocnema nigrimana* is newly confirmed from North America. All species are illustrated, distributions mapped and an identification key to species is presented. The larval cephaloskeleton and puparium of *A. torrenticola* sp. nov. are briefly described and illustrated and the puparium of *A. albibarba* is illustrated.

Keywords. Aquatic, new species, identification key, immature stages.

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Introduction

The family Scathophagidae Robineau-Desvoidy, 1830 is confined primarily to the northern hemisphere and includes more than 360 species (Bernasconi & Šifner 2021). Adults appear to be mostly predacious on insects, whereas larvae have varied habits (Vockeroth 1987). Most larvae are phytophagous, including leaf miners, while some larvae are coprophagous in dung and decaying plants or predaceous in plant tissue, water or soil (Vockeroth 1987).

Acanthocnema Becker, 1894 is an aquatic genus of Scathophagidae, with adults frequently swept or aspirated from emergent rocks in streams, creeks and small rivers (Figs 1–3) (Suwa 1986; Ozerov & Krivosheina 2018). Females of *A. glaucescens* (Loew, 1864) have been observed crawling beneath the water to the underside of rocks and ovipositing in other fly and caddisfly egg masses (Hinton 1981), where larvae prey on the eggs (Nelson 1992; Purcell *et al.* 2008). *Acanthocnema* has a bivoltine life cycle, with the first generation of adults emerging in early spring and a second generation in autumn (Nelson 1992; Purcell *et al.* 2008).

Prior to this study, there were 10 described species of *Acanthocnema*, with three species known from the Nearctic Region, one species described from Nepal and six species from the Palaearctic Region

(Suwa 1986; Vockeroth 1987; Ozerov & Krivosheina 2018; Ozerov 2019). The genus can be recognized using the key to genera in Vockeroth (1987). In this study, the Nearctic species are revised, including the description of three new species.

Material and methods

Institutional abbreviations

CNC = Canadian National Collection of Insects, Ottawa, Canada
DEBU = University of Guelph Insect Collection, Guelph, Canada
EMEC = Essig Museum of Entomology, University of California, Berkeley, USA
KUMF = Biosystematics Laboratory, Kyushu University, Fukuoka, Japan
MCZ = Museum of Comparative Zoology, Harvard University, Cambridge, USA
UBCZ = Spencer Entomological Museum, University of British Columbia, Vancouver, Canada
USNM = National Museum of Natural History, Washington, USA

Numerous specimens from the CNC were partially sorted to species by the late Richard Vockeroth, including manuscript names, which were used in this publication.

Label data for primary types are cited from the top downward, with the data in quotation marks. Labels are cited in full with original spelling, punctuation, and date, with label lines delimited by a slash (/) and individual labels delimited by a double slash (//). Additional information is included in square [] brackets. Secondary type data are abridged and listed alphabetically.

Terms used for adult structures follow those of Cumming & Wood (2017) and those of immature structures follow those of Borkent & Sinclair (2017). Specimens were photographed using Leica Application Suite X (LASX) with a Leica M205C microscope and a Leica DMC5400 camera.

Abbreviations used in the material examined sections

Cpgd = campground
Ck = creek
Co. = county
Hwy = highway
MT = Malaise trap
NF = National Forest
NP = National Park
Pk = park
PP = Provincial Park
R = river
Rd = road

Geographic coordinates for collecting localities were compiled for each species using data on the specimen labels. For specimen labels lacking geographic coordinates, latitude and longitude values were estimated by the author using Google Earth or Google Maps and appear in square brackets following the locality name. Coordinates were uploaded to SimpleMappr.net (Shorthouse 2010), which was used to produce the species distribution maps.

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Diptera Linnaeus, 1758
Family Scathophagidae Robineau-Desvoidy, 1830
Subfamily Scathophaginae Robineau-Desvoidy, 1830

Genus *Acanthocnema* Becker, 1894

Acanthocnema Becker, 1894: 136 (preocc. Costa, 1859). Name conserved by ICZN (1954: 91).

Clinoceroides Hendel, 1917: 36. Type species: *Cordylura glaucescens* Loew, 1864, by original designation.

Type species

Cordylura nigrimana Zetterstedt, 1846, by original designation.

Diagnosis

The genus *Acanthocnema* is characterized by the following combination of characters (modified from Ozerov & Krivosheina 2018): arista short pubescent basally, bare apically; palpus elongate, spatulate,



Figs 1–3. 1. Bronte Creek, Lowville Park, Burlington, Ontario, Canada. 2. *Acanthocnema torrenticola* sp. nov., adult, on emergent rock, Grand River, Fergus, Ontario, Canada (photograph by S.A. Marshall). 3. *A. torrenticola* sp. nov., mating pair, Carroll Creek, Elora, Ontario, Canada (photograph by S.A. Marshall).

without strong apical/subapical seta; proepisternum with setulae anterior to spiracle; anepisternum covered with setulae along dorsal margin and posteriorly only, without setulae posterior to anterior spiracle; katepisternum with one strong seta in posterodorsal corner; anepimeron bare; postmetacoxal bridge absent; fore femur with or without black spine-like setae ventrally; fore tibia with ventral apical spur, with or without rows of short spinules ventrally; scutellum with a pair of strong apical and a pair of strong basal setae; male sternite 5 usually bilobate posteriorly; ovipositor short and compact, proctiger shifted dorsally bearing long setae; female tergite and sternite 7 fused anteroventrally, tergite 7 subtriangular, strongly tapered and narrowly divided dorsally; female tergite 8 U-shaped, narrowly divided dorsally and encircling proctiger; female sternite 8 divided medially into pair of narrow, tapered lobes.

Eggs

The egg of *A. glaucescens* was illustrated by Hinton (1981: pl. 129) with the respiratory ridges or horns surrounding the plastron projecting above the jelly-mass of the host eggs.

Larvae

The larval instars of *A. glaucescens* were described and illustrated by Nelson (1992). The final instar is densely covered in setae, with posterior spiracles surrounded by well-developed lateral tubercles. The mouthhooks have dense and pronounced dentation. The prothoracic spiracles are bicornate with 17 papillae.

Puparium

The puparium was briefly described by Nelson (1992) and photographed by Purcell *et al.* (2008).

Acanthocnema albibarba (Loew, 1869)

Figs 4–12, 63

Cordilura albibarba Loew, 1869: 183. Type locality: New Hampshire, USA.

Acanthocnema albibarba – Curran 1929: 133 (new combination). — Vockeroth 1965: 835 (catalogue); 1987: 1091, fig. 103.33 (fore leg).

Diagnosis

This species is distinguished by the yellowish to yellowish-brown body and legs, base of postpedicel yellow, proepimeral seta present, wing crossveins cloudy, and posthumeral (presutural intra-alar) seta present.

Type material

Holotype (based on online images: <https://mczbase.mcz.harvard.edu/guid/MCZ:Ent:13156>)
USA – **New Hampshire** • ♂; “N.H.; *albibarba* / m. // Loew / Coll. // Type / 13156 [red label] // *albibarba* / Loew // MCZ-ENT / 00013156 / data matrix code”; MCZ.

Other material examined

CANADA – **Newfoundland and Labrador** • 1 ♀; St. John’s, Agric. Exp. Stn.; [47.514° N, 52.784° W]; 20 Jul. 1967; J.F. McAlpine leg.; CNC. – **Nova Scotia** • 1 ♀; Cape Breton Highlands NP, Lone Shieling; [46.810° N, 60.733° W]; 11 Jul. 1983; J.R. Vockeroth leg.; swept along fast rocky stream; CNC. – **Ontario** • 1 ♀; Dunrobin; [45.42° N, 76.02° W]; 28 May 1967; H.J. Teskey leg.; CNC • 1 ♀, 1 puparium;

Fergus; [43.691° N, 80.386° W]; 18 Apr. 1993; S.A. Marshall leg.; puparium in watercress; DEBU. – **Quebec** • 1 ♀; Abbotsford; [45.443° N, 72.863° W]; 29 May 1968; G.E. Shewell leg.; CNC.

USA – **Maine** • 1 ♂, 1 ♀; Mt Katahdin, Hunt Trail; [45°53'44" N, 68°58'53" W]; 1600–2400 ft a.s.l.; 1–6 Jul. 1968; D.M. Wood leg.; CNC • 1 ♂; same data as for preceding; KUMF • 1 ♀; same data as for preceding; [45°53'53" N, 68°57'14" W]; 3800 ft a.s.l.; 29 Jun. 1968; CNC • 1 ♀; Pittston; [44°13'18" N, 69°45'20" W]; 3 Aug. 1930; A.L. Melander leg.; USNM. – **New Hampshire** • 1 ♂; Lost River; [44.020° N, 71.742° W]; 7 Jul. 1931; A.L. Melander leg.; USNM • 1 ♀; White Mtns, The Flume; [44°06' N, 71°14' W]; 7 Jul. 1938; A.L. Melander leg.; USNM • 1 ♀; White Mtns, Morrison; USNM. – **New York** • 1 ♀; Adirondacks, Avalanche Trail; [44.182° N, 73.963° W]; 30 Jul. 1929; A.L. Melander leg.; CNC • 1 ♂; Whiteface Mt; [44°22'43" N, 73°53'06" W]; 4000 ft a.s.l.; 19 Jul. 1962; J.R. Vockeroth leg.; CNC. – **Vermont** • 1 ♀; Peru; [43.233° N, 72.893° W]; 15 Jul. 1931; A.L. Melander leg.; USNM.

Description

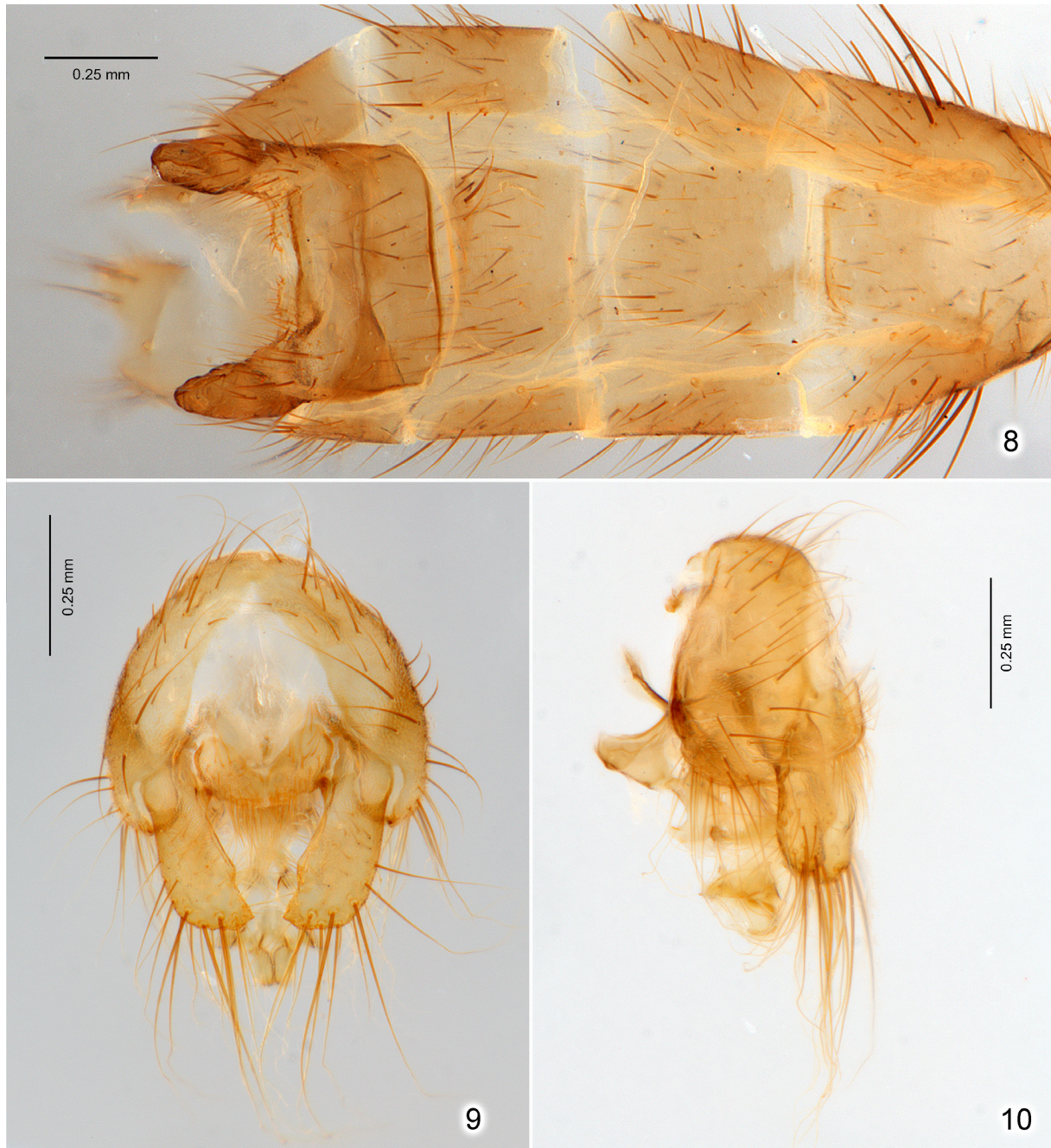
Body yellowish to yellowish brown, with dense white pruinescence. Body length: 4.2–5 mm; wing length: 4.3–5.0 mm.



Figs 4–7. *Acanthocnema albibarba* (Loew, 1869), ♂ (CNC), Mt Katahdin. **4.** Head, oblique lateral view. **5.** Habitus, lateral view. **6.** Thorax, lateral view. **7.** Wing. Abbreviations: presutrial s = presutural intra-alar seta; prepm s = proepimeral seta; R_{2+3} = second branch of radial view.

Male

HEAD (Fig. 4). Frontal vitta yellow to yellowish brown anteriorly, matt; fronto-orbital plate brown, with numerous dark setulae. Chaetotaxy: anterior orbital seta proclinate, posterior 2 orbital setae latero-clinate; 3 inclinate frontals; 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae weak, divergent; row of dark postocular setae; 1 vibrissa, 1 strong subvibrissa. Gena silvery pruinescent, depth one-quarter eye height; postgenal setae white, soft, longer than width of postgena. Face, parafacial and occiput silvery pruinescent. Palpus yellowish white with long white setae. Proboscis with broad, shiny prementum, with long scattered white setae, longer than width of prementum. Antenna brown, postpedicel yellow at base



Figs 8–10. *Acanthocnema albibarba* (Loew, 1869), ♂ (CNC), Whiteface Mt. **8.** Abdomen, ventral view. **9.** Terminalia posterior view. **10.** Terminalia, lateral view.

of arista insertion; postpedicel rounded apically, $2 \times$ as long as broad. Arista pubescent on basal third and bare apically.

THORAX (Figs 5–6). Dark brown, paler laterally; whitish vitta along acrostichal series anteriorly. Acrostichals biserial, short, slender; 2+3 dorsocentrals; 1+2 intra-alars; 1+1 supra-alars; 1–2 postpronotals; 2 notopleurals, 2 postalars; scutellum with pair of strong apical setae and pair of strong basal setae; scutellar disc with a few scattered setulae. Proepisternal seta present. Proepimeral seta present. Anepisternum with dark setulae on posterior half and 1 long seta and several long thinner setae near posterior margin. Katepisternum with 1 strong, long seta in posterodorsal corner and numerous yellow setulae.

LEGS (Fig. 5). Yellow, slightly darker apically or posterior face of femora and tibia brown. Fore femur with 3 posteroventral setae extending beyond dense setulae; 5–6 evenly spaced dorsal setae, shorter than width of femur. Fore tibia with ventral apical spur, 1 anterodorsal slightly beyond mid-length, 1 preapical dorsal seta and 1 posteroventral seta proximal to spur; biserial row of short spinules ventrally. Fore tarsomere 1 with dense mat of anterior setulae. Mid femur with 2 long anteroventral setae on basal half; row of 5–6 anterior setae; 1 preapical anterior and 2 posterior preapical setae. Mid tibia with 1 anterodorsal seta beyond mid-length and 1 preapical dorsal seta; 1 anteroventral seta and 1 posteroventral apical seta. Hind femur with row of 4–6 anterodorsal setae; several widely spaced anteroventral and posteroventral setae. Hind tibia usually with 2 anterodorsal setae on either side of mid-length; 1 posterodorsal seta near mid-length; 1 dorsal preapical seta; 1 anteroventral apical seta.

WING (Fig. 7). Infusate, with clouding about apex of R_1 and r-m and dm-m crossveins and R_{2+3} distal to cell dm; veins black; crossvein dm-m nearly at right angles, not aligned with M_4 ; M_4 beyond cell dm weakened to wing margin, one-half length of crossvein dm-m; CuA+CuP weakened beyond basal third, not reaching wing margin. Calypteres and halter yellow.

ABDOMEN. Similar to thorax, brownish dorsally, with greyish pruinescence; with long setae. Sternite 4 slightly wider than long (Fig. 8). Sternite 5 broad, with pair of cylindrical lobes; long setae on basal half of lobes, apex slightly boot-shaped (Fig. 8). Terminalia (Figs 9–10): Epandrium rounded, narrow with long setae, especially ventrolateral setae long and wavy, nearly as long as height of epandrium. Cercus



Figs 11–12. *Acanthocnema albibarba* (Loew, 1869), puparium (DEBU), Fergus. **11.** Terminal segment, caudal view. **12.** Terminal segments, dorsal view.

short, apical margin rounded in lateral view; cerci closely approximated medially, with setae longer than cercus. Surstylus digitiform, somewhat flattened; apex rounded, with medial marginal tip; long wavy setae on apical half, longer than length of surstylus (projecting free in dry, undissected specimens). Phallapodeme elongate, rod-shaped. Pregonite strongly recurved with several long setae at mid-length; apex flattened with single short subapical seta. Postgonite gently arched with rounded apex. Ejaculatory apodeme C-shaped with expanded ejaculatory duct. Distiphallus sickle-shaped with jagged inner margin.

Female

Similar to male except, palpus yellowish brown; without long pale setae on occiput and proboscis; abdomen dark, subshiny; terminalia not dissected.

Distribution

This species is known from northeastern North America, recorded from Newfoundland to central southern Ontario (Fig. 63).

Remarks

A female specimen was reared from a puparium (Figs 11–12) collected in watercress. The fore leg of this species was illustrated in Vockeroth (1987: fig. 33).

Acanthocnema capillata (Loew, 1872)

Figs 13–20, 61

Cordilura capillata Loew, 1872: 98. Type locality: New Hampshire, USA.

Acanthocnema capillata – Curran 1929: 133 (new combination). — Vockeroth 1965: 835 (catalogue).

Diagnosis

This species is distinguished by the blackish ground colour, male palpus yellow, orbital setae laterocline, fore tibia with row of short, strong, black anteroventral setae proximal to ventral preapical spur and male sternite 5 with paired apical lobes.

Type material

Holotype (based on online images: <https://mczbase.mcz.harvard.edu/guid/MCZ:Ent:13158>)
USA – **New Hampshire** • ♀; “N.H. // *capillata* / m. // Loew / Col I. // Type / 13158 [red label] // MCZ-ENT / 00013158 / data matrix code”; MCZ.

Other material examined

CANADA – **Quebec** • 1 ♂; Forillon NP, Gaspésie, La Chute Trail; 48°50' N, 64°16' W; 24 Aug. 2016; B.J. Sinclair leg.; waterfall spray zone; CNC • 2 ♂; Mt Orford; [45.328° N, 72.186° W]; 29 Aug. 1937; G.E. Shewell leg.; compared with holotype by Vockeroth, 1960; CNC.

USA – **Maine** • 1 ♂, 1 ♀; Mt Katahdin, Hunt Trail; [45°53'44" N, 68°58'53" W]; 1600–2400 ft a.s.l.; 1–6 Jul. 1968; D.M. Wood leg.; CNC.

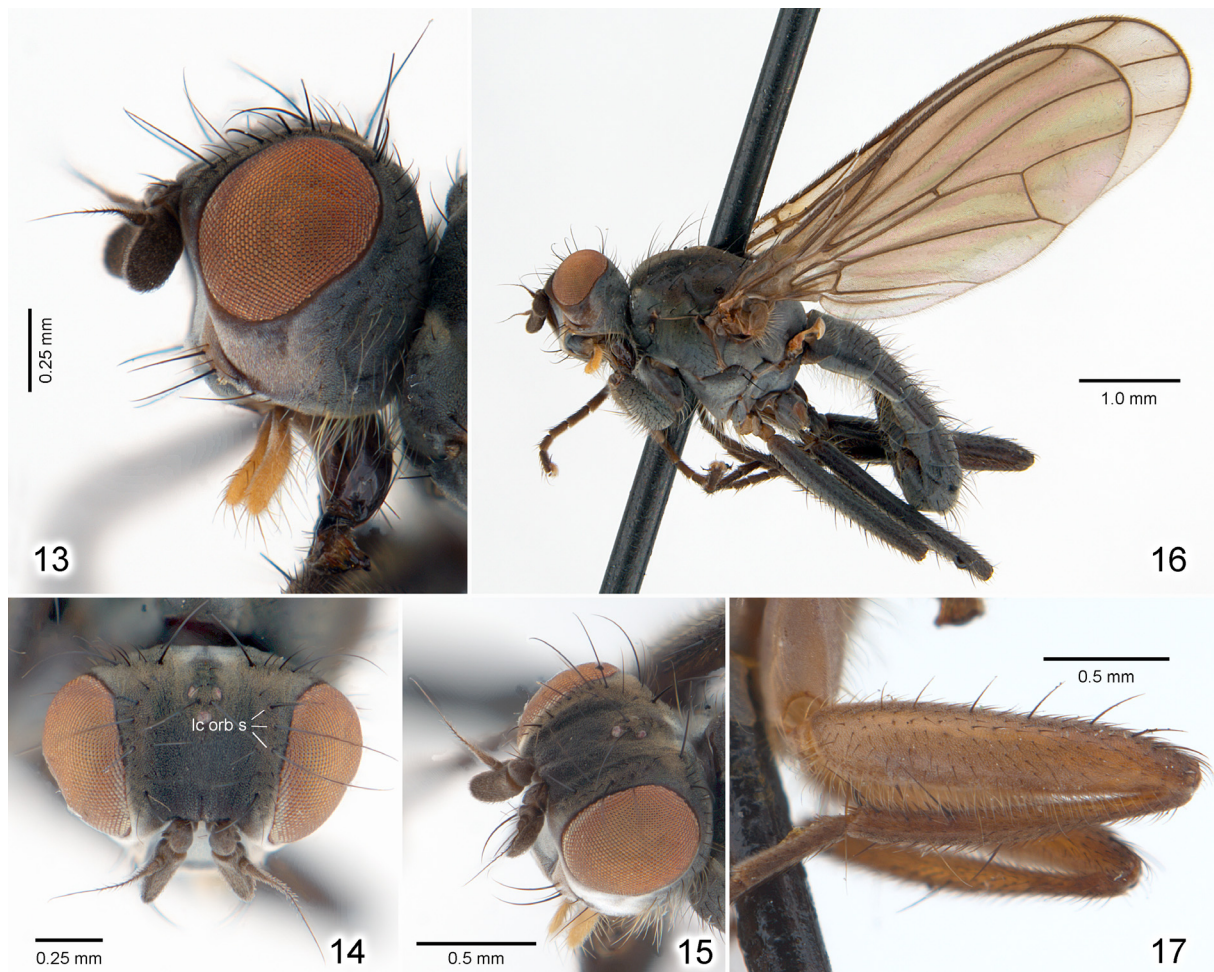
Description

Body blackish in ground colour, densely blue-grey pruinescent laterally, dark brown dorsally. Body length: 4–5 mm; wing length: 4.2–4.6 mm.

Male

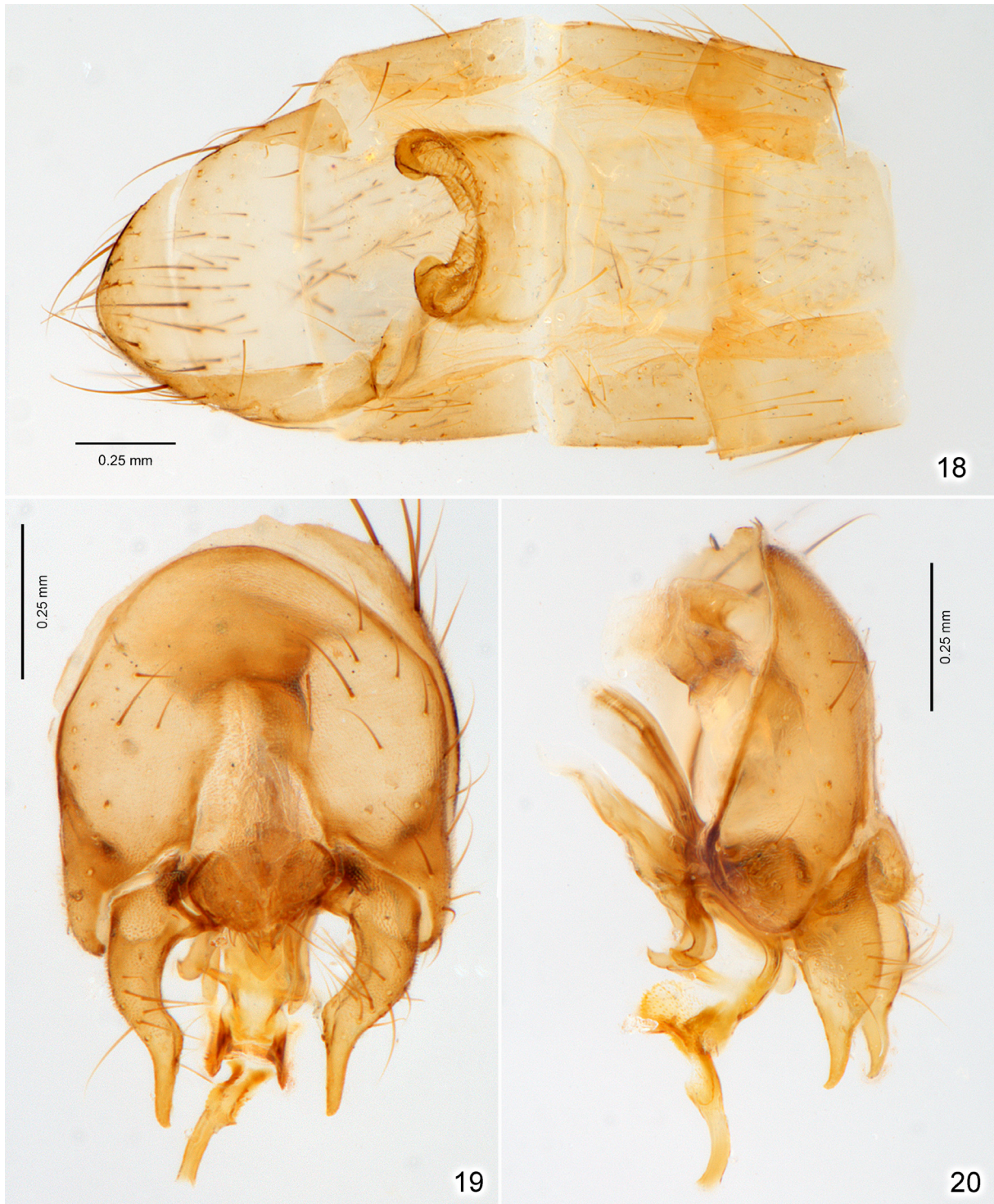
HEAD (Figs 13–15). Frontal vitta black, paler ventrally, matt; fronto-orbital plate black, grey pruinescent, with numerous black setulae. Chaetotaxy: 3 laterocline orbitals; 2 inclinate frontals; 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae absent; row of dark postocular setae; 1 vibrissa, 1 strong subvibrissa. Gena silvery pruinescent, broad, depth below eye subequal to length of postpedicel; postgenal setae white to golden, soft, slightly shorter than width of postgena. Face, parafacial and occiput silvery pruinescent. Palpus yellow with long white setae. Proboscis with broad, shiny prementum, without setae. Antenna black; postpedicel rounded apically, 2 × as long as broad. Arista pubescent, bare on apical third.

THORAX (Fig. 16). Dark brown with greyish postpronotal lobe, lower notopleuron and scutellum; indistinct whitish vitta along acrostichal series anteriorly; pleura and mediotergite with greyish pruinescence. Acrostichals biserial, short, slender; 2+4 dorsocentrals; 1+2 intra-alars; 1+1 supra-alars; 1 postpronotal; 2 notopleurals, 1 postalar; scutellum with pair of strong apical setae and pair of strong basal setae; lateral margins and dorsal surface of scutellum apically with black setae and setulae. Pale proepisternal seta present. Proepimeral seta dark. Anepisternum with dark setae on posterior half and



Figs 13–17. *Acanthocnema capillata* (Loew, 1872). 13–16. ♂ (CNC), Mt Katahdin. 13. Head, lateral view. 14. Head, dorsal view. 15. Head, dorsolateral view. 16. Habitus, lateral view. 17. ♂ (CNC), Mt Orford, fore legs, lateral view. Abbreviation: lc orb s = laterocline orbital setae.

1 long seta and several long thinner setae near posterior margin. Katepisternum with 1 strong seta in posterodorsal corner and numerous long yellow setulae.



Figs 18–20. *Acanthocnema capillata* (Loew, 1872), ♂ (CNC), Mt Orford. **18.** Abdomen, ventral view. **19.** Terminalia, posterior view. **20.** Terminalia, lateral view.

LEGS (Figs 16–17). Black, densely greyish pruinescence. Fore femur with 2 basal posteroventral setae extending well beyond dense setulae; row of long posterodorsal setae. Fore tibia with ventral apical spur, 1 anterodorsal at mid-length, usually 1 posteroventral seta near mid-length, 1 posteroventral seta beyond mid-length, 1 preapical posteroventral seta, slender, as long as basal width of fore femur and row of short, strong, black anteroventral setae proximal to spur. Mid femur with row of anterodorsal setae, with 1–2 posterior preapical setae. Mid tibia with 1 anterodorsal seta and 1 posterodorsal seta beyond mid-length; 1 preapical dorsal seta; 1 anteroventral and 1 posteroventral apical seta. Hind femur with row of anterodorsal setae and 1 anteroventral seta on apical fifth, all longer than width of femur. Hind tibia with 2 anterodorsal setae and 1 posterodorsal seta; 1 dorsal preapical seta and 1 anteroventral apical seta.

WING (Fig. 16). Infusate, without band; veins black; crossvein dm-m at right angles, not aligned with M_4 ; M_4 strong or weak beyond cell dm, one-quarter to one-half length of crossvein dm-m; CuA+CuP strong on basal two-thirds, weakened to wing margin. Calypteres pale brown; halter whitish yellow.

ABDOMEN. Similar to thorax, brownish dorsally, blue-greyish pruinose laterally; with long slender setae. Sternite 4 wider than long (Fig. 18). Sternite 5 broad, with pair of slightly C-shaped lobes; short setae on basal half with apex slightly flattened (Fig. 18). Terminalia (Figs 19–20): Epandrium rounded, broad. Cercus short, apical margin rounded in lateral view; cerci closely approximated medially, not projecting. Surstylus digitiform, tapered, elbowed beyond mid-length in posterior view; apex very narrow and rounded. Phallapodeme elongate, rod-shaped. Pregonite strongly recurved on distal half, with 1 short seta at mid-length; apex tapered to point with several short subapical setae. Postgonite gently arched with rounded apex. Ejaculatory apodeme anvil-shaped with expanded ejaculatory duct. Distiphallus narrow, tube-shaped.

Female

Similar to male except, palpus brown; terminalia not examined.

Distribution

This species is known from northeastern North America, recorded from Gaspésie (Quebec) to Mt Washington (New Hampshire) (Fig. 61).

Acanthocnema nigrimana (Zetterstedt, 1846) Figs 21–28, 60

Cordylura nigrimana Zetterstedt, 1846: 2040. Type locality: “Jemtlandia boreali” [= northern Jämtland], Sweden.

Hydromyza tiefi Mik, 1884: 252. Type locality: Salzburg, Austria.

Diagnosis

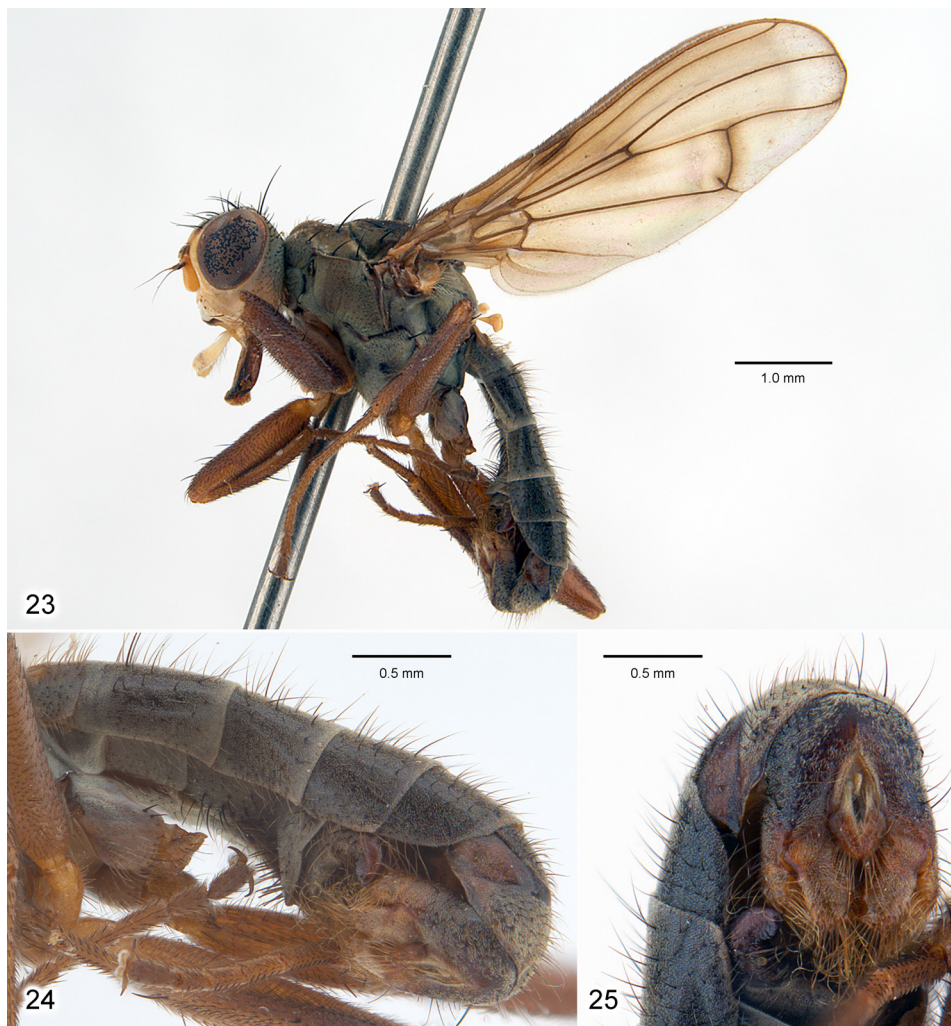
This species is distinguished by the yellowish-brown mid and hind femora, male postpedicel yellow (Figs 21, 23), proepimeral seta present (Fig. 21), wing crossveins cloudy, R_{2+3} distal to cell dm without surrounding infuscation (Figs 22–23), posthumeral (presutural intra-alar) seta usually present (Fig. 21). Sternite 5 bilobate with medially curved apex (Fig. 26) and epandrium prolonged laterally and surstylus truncate apically with long setae (Figs 24–25, 27–28).

Material examined

AUSTRIA • 1 ♂; Bad Vellach; 24 Jul. [no year]; Oldenberg leg.; USNM.



Figs 21–22. *Acanthocnema nigrimana* (Zetterstedt, 1846), ♂ (USNM), White Mtns. **21.** Head and thorax, lateral view. **22.** Wing. Abbreviations: presutal s = presutural intra-alar seta; prepm s = proepimeral seta; R_{2+3} = second branch of radial vein.



Figs 23–25. *Acanthocnema nigrimana* (Zetterstedt, 1846), ♂ (CNC), Exmouth. **23.** Habitus, lateral view. **24.** Abdomen and terminalia, lateral view. **25.** Terminalia, ventral view.

CANADA – **British Columbia** • 1 ♂; Ketchum Lake; [58.25° N, 131.5° W]; 3600 ft a.s.l.; 26 Aug. 1960; W.W. Moss leg.; moss-grass bog; CNC. – **Newfoundland and Labrador** • 1 ♀; Hebron; [58.199° N, 62.625° W]; 12 Jul. 1954; J.F. McAlpine leg.; CNC • 1 ♂; Nutak; [57.466° N, 61.866° W]; 24 Jul. 1954; E.E. Sterns leg.; CNC. – **Northwest Territories** • ♂; Exmouth Lake, M.T.S. Gravity Survey Camp; 65°02' N, 115°54' W; 22 Aug. 1966; G.E. Shewell leg.; CNC.

CZECH REPUBLIC • 1 ♂; Carlsbad; 24 Aug. [19]15; Oldenberg leg.; USNM.

USA – **New Hampshire** • 1 ♂; White Mtns; [44°16'16" N, 71°18'18" W]; Morrison leg.; USNM • 1 ♂; Mt Washington; [44°16'13" N, 71°18'11" W]; 3500 m a.s.l.; 23 Aug. 1988; J.M. Cumming leg.; stream bed; CNC. – **Colorado** • 1 ♀; Loveland Pass; [39.663° N, 105.879° W]; 12000 ft a.s.l.; 7 Aug. 1961; J.G. Chillcott leg.; summit; CNC.

Description

This species was thoroughly redescribed by Suwa (1986).

Distribution

This Holarctic species is presently widely disjunct in the Nearctic Region, currently recorded from New Hampshire, Labrador, British Columbia, Northwest Territories and Colorado (Fig. 60). In the Palaearctic Region, *A. nigrimana* is known from Europe (Gorodkov 1986).

Remarks

Vockeroth (1965) noted that *A. nigrimana* did not occur in the Nearctic Region and that previous records were confused with *A. capillata*. However, since that publication several Nearctic specimens have been identified as conspecific with a specimen identified as *A. nigrimana* from Austria (whose identification was confirmed by comparison with the type specimens by Vockeroth). This represents new verified Nearctic records for this species.



Figs 26–28. *Acanthocnema nigrimana* (Zetterstedt, 1846), ♂ (USNM), White Mtns. **26.** Sternite 5, ventral view. **27.** Terminalia, posterior view. **28.** Terminalia, lateral view.

Acanthocnema pulchripennis sp. nov.

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Figs 29–34, 62

Diagnosis

This species is distinguished by the yellowish to yellowish-brown body, proepimeral seta present, fore femur with three long spine-like posteroventral setae, wing with discal crossband, without dark spot at apex of M_1 , and crossvein dm-m obliquely aligned with apex of M_4 .

Etymology

The specific epithet is derived from the Latin ‘*pulcher*’ (‘beauty’) and ‘*penna*’ (‘wing’), in reference to the unusually patterned wing.

Type material

Holotype

CANADA – **Alberta** • ♂; “CAN: AB: Peter Lougheed / PP; Boulton/Fox Ck Tr / 14.vii.2015; 1730 m / N50°37.03’W115°06.67’ / B.J. Sinclair; ex. creek/trail // CNC / 905982 // HOLOTYPE / *Acanthocnema pulchripennis* / Sinclair [red label]”; CNC, CNC905982.

Paratypes

CANADA – **Alberta** • 1 ♂; Moraine Lake; [51°19’21” N, 116°11’08” W]; 3 Aug. 1923; J. McDunnough leg.; CNC • 1 ♀; Waterton Lakes NP; [49°02’45” N, 113°54’55” W]; 1–5 Jul. 1980; H.J. Teskey leg.; CNC. – **British Columbia** • 1 ♂, 1 ♀; Lisadele Lake; 58°41’ N, 133°4’ W; 4800 ft a.s.l.; 10 Aug. 1960; W.W. Moss leg.; CNC • 1 ♂; Manning PP, Cascade Lookout road; 20–21 Jul. 2015; 49°04.00’ N, 120°46.79’ W; 1240 m a.s.l.; B.J. Sinclair leg.; stream; CNC • 1 ♂; Manning PP, Heather Trail to Buckhorn Camp; 49°06.19’ N, 120°45.56’ W; 1785–1995 m a.s.l.; 21 Jul. 2015; B.J. Sinclair leg.; CNC • 2 ♂♂, 1 ♀; Penticton, Apex Mt; [49.390° N, 119.903° W]; 5800 ft a.s.l.; 13 Aug. 1967; J.R. Vockeroth leg.; CNC • 1 ♂; same data as for preceding; KUMF • 1 ♂; same data as for preceding; 5000 ft a.s.l.; 4 Aug. 1967; CNC • 1 ♂; Silver Star PP, Sovereign Lake Rd; 50°21.64’ N, 119°06.14’ W; 1665 m a.s.l.; 23 Jul. 2015; B.J. Sinclair leg.; CNC • 1 ♂; Stagleap PP, Bridal Lake Trail; 49°03.52’ N, 117°02.44’ W; 18 Jul. 2015; B.J. Sinclair leg.; CNC • 1 ♂, 1 ♀; Vancouver Is, Helen Mackenzie Lake; 48°42’ N, 125°19’ W; 1160 m a.s.l.; 27 Jul. 1994; H. Goulet leg.; wet meadow MT; CNC. – **Yukon** • 1 ♀; Whitehorse, Wolf Ck, Cpgd; [60.608° N, 134.942° W]; 17 Jun.–14 Jul. 1987; S.A. Marshall leg.; pits near spring; DEBU.

Other material examined

CANADA – **British Columbia** • 1 ♂ (identification based on online image); Robson; [49.337°N 117.665°W]; 24 Jul. 1958; H.R. Foxlee leg.; UBCZ.

Description

Body yellowish to yellowish-brown (Fig. 29), with dense white pruinescence. Body length: 5–6 mm; wing length: 4.5–5.3 mm.

Male

HEAD (Fig. 29). Frontal vitta yellow to yellowish-brown anteriorly, matt; fronto-orbital plate brown, with numerous dark setulae. Chaetotaxy: anterior orbital seta proclinate, posterior 2 orbital setae latero-clinate; 3 inclinate frontals; 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae weak, divergent; row of dark postocular setae; 1 vibrissa, 1–2 strong subvibrissae. Gena silvery pruinescent, depth $\frac{1}{4}$ eye height; postgenal setae white, soft, length subequal to width of postgena. Face, parafacial and occiput silvery pruinescent. Palpus yellowish white with long white setae. Proboscis with broad, shiny prementum,

with scattered white setae, shorter than width of prementum. Antenna yellow, pedicel slightly darker; postpedicel rounded apically, $2 \times$ as long as broad. Arista pubescent on basal third and bare apically.

THORAX (Fig. 29). Yellowish-brown, darker along dorsocentral series; greyish vitta along acrostichal series. Acrostichals biserial, short, slender; 2+3 dorsocentrals; 1+2 intra-alars; 1+1 supra-alars; 1–2 postpronotals; 2 notopleurals, 2 postalars; scutellum with pair of strong apical setae and pair of strong basal setae; scutellar disc with a few scattered setulae. Proepisternal seta present. Proepimeral seta present. Anepisternum with dark setulae on posterior half and 1 long seta and several long thinner setae near posterior margin. Katepisternum with 1 strong, long seta in posterodorsal corner and numerous yellow setulae.

LEGS (Fig. 30). Yellowish, gradually darker apically. Fore femur with 3 posteroventral spine-like setae on basal half, longer than width of femur; weakly defined row of anteroventral setae, stronger near mid-length; 4 posterodorsal setae on apical half, shorter than width of femur. Fore tibia with ventral apical spur, 1 anterodorsal slightly proximal to mid-length and 1 preapical dorsal seta; biserial row of short spinules ventrally. Fore tarsomere 1 with dense mat of anterior setulae. Mid femur with 4 long



Figs 29–31. *Acanthocnema pulchripennis* sp. nov., holotype, ♂ (CNC905982). **29.** Habitus, lateral view. **30.** Fore legs, lateral view. **31.** Wing. Abbreviations: prep m s = proepimeral seta; dm-m = discal medial crossvein.

posteroventral setae on basal half, shorter than width of femur; row of 5–6 anterior setae; 1 preapical anterior seta and 1 posterior preapical seta. Mid tibia with 1 anterodorsal seta beyond mid-length and 1 preapical dorsal seta; 1 anteroventral seta and 1 posteroventral apical seta. Hind femur with row of 4–6 anterodorsal setae; several widely spaced posteroventral setae. Hind tibia with 3 anterodorsal setae; 1 posterodorsal seta near mid-length; 1 dorsal preapical seta; 1 anteroventral apical seta.



Figs 32–34. *Acanthocnema pulchripennis* sp. nov., paratype, ♂ (CNC), Lisadele Lake. **32.** Abdomen, ventral view. **33.** Terminalia, posterior view. **34.** Terminalia, lateral view.

WING (Fig. 31). Infusate, with discal crossband from costa to M_4 , without dark spot at apex of M_1 , veins black; crossvein dm-m obliquely aligned with M_4 ; M_4 beyond cell dm strong to wing margin, one-third length of crossvein dm-m; CuA+CuP weakened but reaching wing margin. Calypteres and halter yellow.

ABDOMEN. Darker dorsally than thorax, with greyish pruinescence; with long erect setae on tergite 2 anteriorly. Sternites 3 and 4 expanded laterally with elongate setae (Fig. 32). Sternite 5 broad, with pair of cylindrical lobes with long setae, apex slightly tapered and incurved (Fig. 32). Terminalia (Figs 33–34): Epandrium rounded, narrow with short setae. Cercus short, apical margin rounded in lateral view; cerci closely approximated medially, with setae longer than cercus. Surstylus digitiform, apex tapered, with wavy setae of various lengths, some longer than length of surstylus. Phallapodeme elongate, rod-shaped. Pregonite strongly recurved on distal half, with 1 short seta at mid-length; apex tapered to point with several short subapical setae. Postgonite gently arched with rounded apex. Ejaculatory apodeme flattened and expanded with tapered ejaculatory duct. Distiphallus narrow, tube-shaped with jagged inner margin.

Female

Similar to male except, abdomen darker, lacking long lateral setae on sternites 3 and 4; terminalia not dissected.

Distribution

This species is known from northwestern North America, recorded from Yukon to southern British Columbia (Fig. 62).

Acanthocnema rainierensis sp. nov.

urn:lsid:zoobank.org:act:6B8D324D-49B8-43C3-AEB4-A2AC7988C10A

Figs 35–40, 62

Diagnosis

This species is distinguished by the yellowish body, proepimeral seta present, fore femur with four long, spine-like posteroventral setae and distal row of strong posteroventral setae, wing with discal crossband and dark spot at apex of M_1 , and crossvein dm-m not aligned with apex of M_4 .

Etymology

The species is named after the type locality, Mt Rainier National Park.

Type material

Holotype

USA – Washington • ♂; “MtRainier, Wn [Washington] / VanTrump Crk [46°47'34" N, 121°46'33" W] / Sep. 1, 1917 / A.L. Melander // ALMelander / Collection / 1961 // HOLOTYPE / *Acanthocnema rainierensis* / Sinclair [red label]”; USNM.

Paratypes

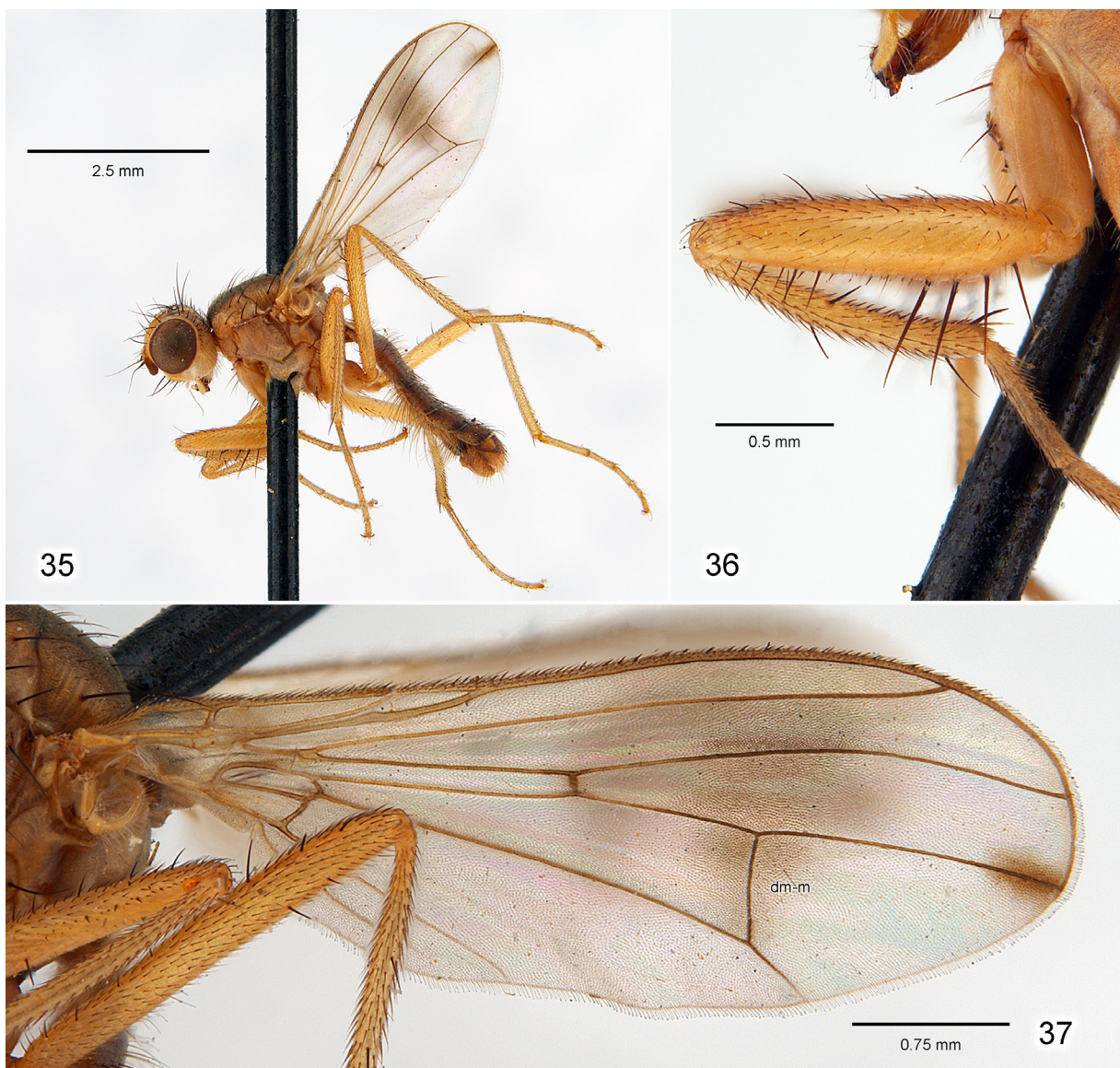
USA – Washington • 1 ♀; same data as for holotype; USNM • 1 ♀; Mt Rainier, Longmire; [46°44'56" N, 121°48'51" W]; 18 Jul. 1922; A.L. Melander leg.; USNM • 1 ♂; Mt Rainier NP, Wonderland Trail, Narada Falls to Cougar Rock; 46°46'22.11" N, 121°44'52.30" W; 1317 m a.s.l.; 29 Jul. 2016; R.J. Pivar leg.; creek; CNC, CNC5288369.

Description

Body yellowish laterally and brown dorsally (Fig. 35), with dense white pruinescence. Body length: 4.4–5.0 mm; wing length: 4.4–4.7 mm.

Male

HEAD (Fig. 35). Frontal vitta yellow to yellowish brown anteriorly, matt; fronto-orbital plate brown, with numerous dark setulae. Chaetotaxy: anterior orbital seta proclinate, posterior 2 orbital setae latero-clinate; 3 inclinate frontals; 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae weak, divergent; row of dark postocular setae; 1 vibrissa, 1 strong subvibrissa. Gena silvery pruinulent, depth one-quarter eye height; postgenal setae white, soft, length shorter than width of postgena. Face, parafacial and occiput silvery pruinulent. Palpus yellowish white with white setae. Proboscis with broad, shiny prementum, with scattered white setae, shorter than width of prementum. Antenna dark, with inner face of pedicel and inner basal half of postpedicel yellow; postpedicel rounded apically, 2 × as long as broad. Arista pubescent on basal third and bare apically.



Figs 35–37. *Acanthocnema rainierensis* sp. nov. **35.** Holotype, ♂ (USNM), habitus, lateral view. **36.** Paratype, ♀ (USNM), Van Trump Ck, fore leg, lateral view. **37.** Holotype, ♂ (USNM), wing. Abbreviation: dm-m = discal medial crossvein.

THORAX (Fig. 35). Brown dorsally, broadly yellow laterally; greyish vitta along acrostichal series. Acrostichals biserial, short, slender; 1–2+3 dorsocentrals; 1+2 intra-alars; 1+1 supra-alars; 1 postpronotal; 2 notopleurals, 2 postalars; scutellum with pair of strong apical setae and pair of strong basal setae; scutellar disc with few scattered setulae. Proepisternal seta present. Proepimeral seta present. Anepisternum with dark setulae on posterior half and 1 long seta and several long thinner setae near posterior margin. Katepisternum with 1 strong, long seta in posterodorsal corner and numerous yellow setulae.



Figs 38–40. *Acanthocnema rainierensis* sp. nov., paratype, ♂ (CNC5288369). **38.** Abdomen, ventral view. **39.** Terminalia, posterior view. **40.** Terminalia, lateral view.

LEGS (Fig. 36). Yellow. Fore femur with 4 posteroventral spine-like setae on basal half, longer than width of basalmost seta; row of strong posteroventral setae on distal half; distinct row of anteroventral setae, stronger near mid-length; 4 posterodorsal setae on apical half, shorter than width of femur. Fore tibia with ventral apical spur; 1 anterodorsal slightly proximal to mid-length, 1 posteroventral near mid-length and 1 preapical dorsal seta; biserial row of short spinules ventrally. Fore tarsomere 1 with dense mat of anterior setulae. Mid femur with 4 long posteroventral setae on basal half, several longer than width of femur; row of anteroventral setae on distal half, shorter than width of femur; row of 5–6 anterior setae; 1 preapical anterior seta and 1 posterior preapical seta. Mid tibia with 1 anterodorsal seta beyond mid-length and 1 preapical anterodorsal seta; 1 anteroventral seta and 1 posteroventral apical seta. Hind femur with row of 4–6 anterodorsal setae; 1–2 distal anteroventral setae. Hind tibia with 3 anterodorsal setae; 1 posterodorsal seta near mid-length; 1 dorsal preapical seta; 1 anteroventral apical seta.

WING (Fig. 37). Infusate, with discal crossband from costa to M_4 and dark spot at apex of M_1 , veins black; crossvein dm-m not aligned with M_4 ; M_4 beyond cell dm weakened apically, reaching wing margin, more than one-half length of crossvein dm-m; CuA+CuP weakened but reaching wing margin. Calypteres and halter yellow.

ABDOMEN. Dark dorsally, similar to thorax, with greyish pruinescence; with long erect setae on tergite 2 anteriorly. Sternites 3 and 4 expanded laterally with elongate setae (Fig. 38). Sternite 5 broadly expanded laterally with elongate setae, with pair of triangular lobes with narrow, incurved apex (Fig. 38). Terminalia (Figs 39–40): Epandrium rounded, narrow with short setae; prolonged ventrally beyond base of surstylus. Cercus short, apical margin rounded in lateral view; cerci closely approximated medially, with short apical setae. Surstylus digitiform; distal half expanded laterally, with wavy setae of various lengths, some longer than length of surstylus. Phallapodeme elongate, rod-shaped. Pregonite strongly recurved on distal half; apex tapered to rounded point with single short subapical seta. Postgonite gently arched with rounded apex. Ejaculatory apodeme flattened with expanded ejaculatory duct. Distiphallus narrow, tube-shaped with jagged inner margin.

Female

Similar to male except, abdomen darker, lacking long lateral setae on sternites 3 and 4; tergite 7 subtriangular, fused with sternite 7, dorsally tapered and medially divided; tergite 8 U-shaped, enclosing proctiger, narrowly divided medially, obliquely angled; sternite 8 divided into pair of tapered digitiform lobes, directed dorsally with pointed apex; epiproct and hypoproct small, triangular; cercus oval, thinly sclerotized. Three spermathecae tubular, narrow and recurved posteriorly into duct, expanded anteriorly.

Distribution

This species is currently known only from Mt Rainier National Park in the state of Washington, USA (Fig. 62).

Acanthocnema ruficauda Curran, 1929

Figs 41–48, 62

Acanthocnema ruficauda Curran, 1929: 133. Type locality: Tennessee Pass, Colorado, USA.

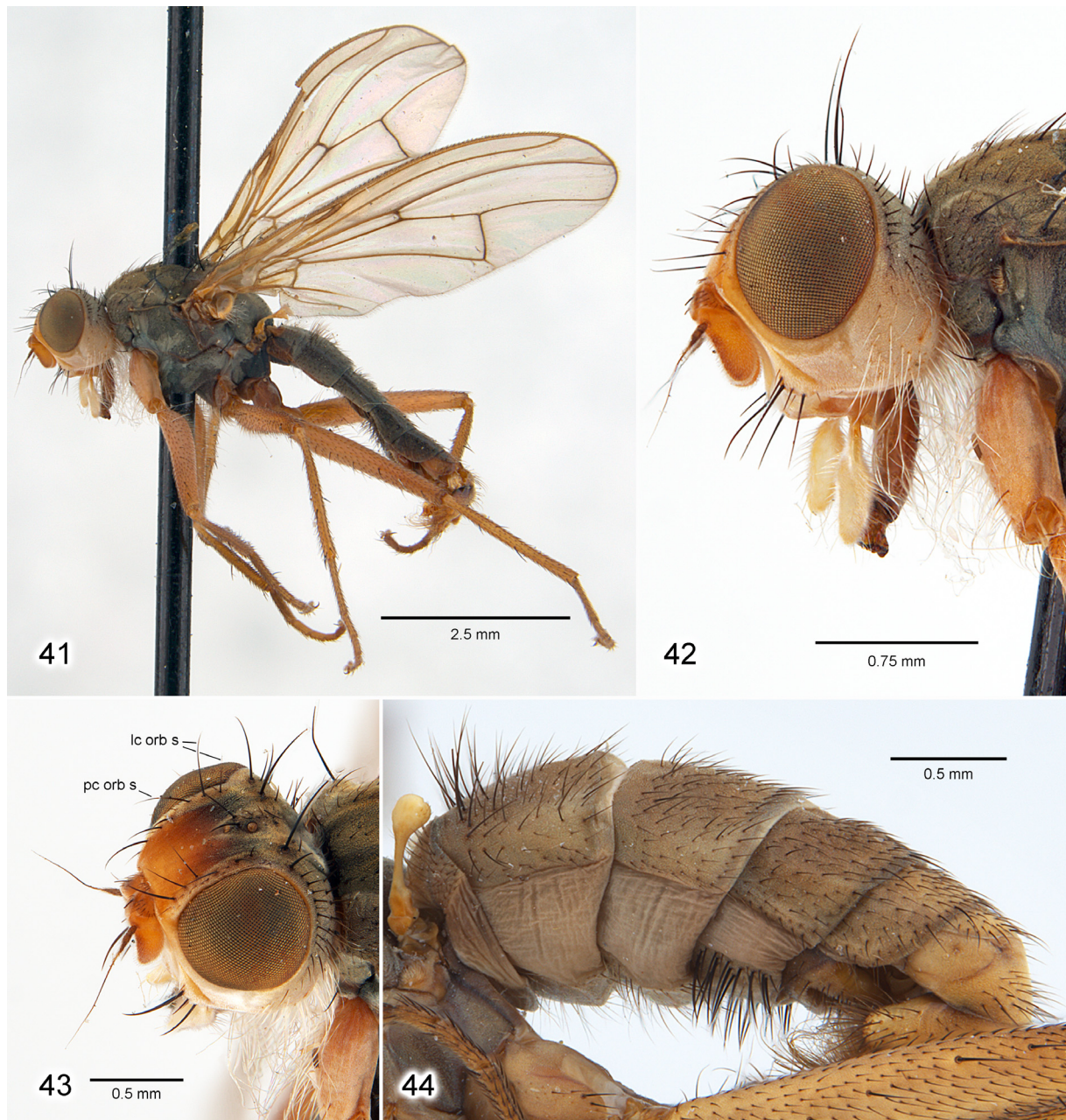
Diagnosis

This species is distinguished by the brownish body and yellowish legs, male postpedicel yellow, anterior orbital seta proclinate, proepimeral seta absent, wing infusate, and male postgena, prementum and fore coxae with long silky white setae.

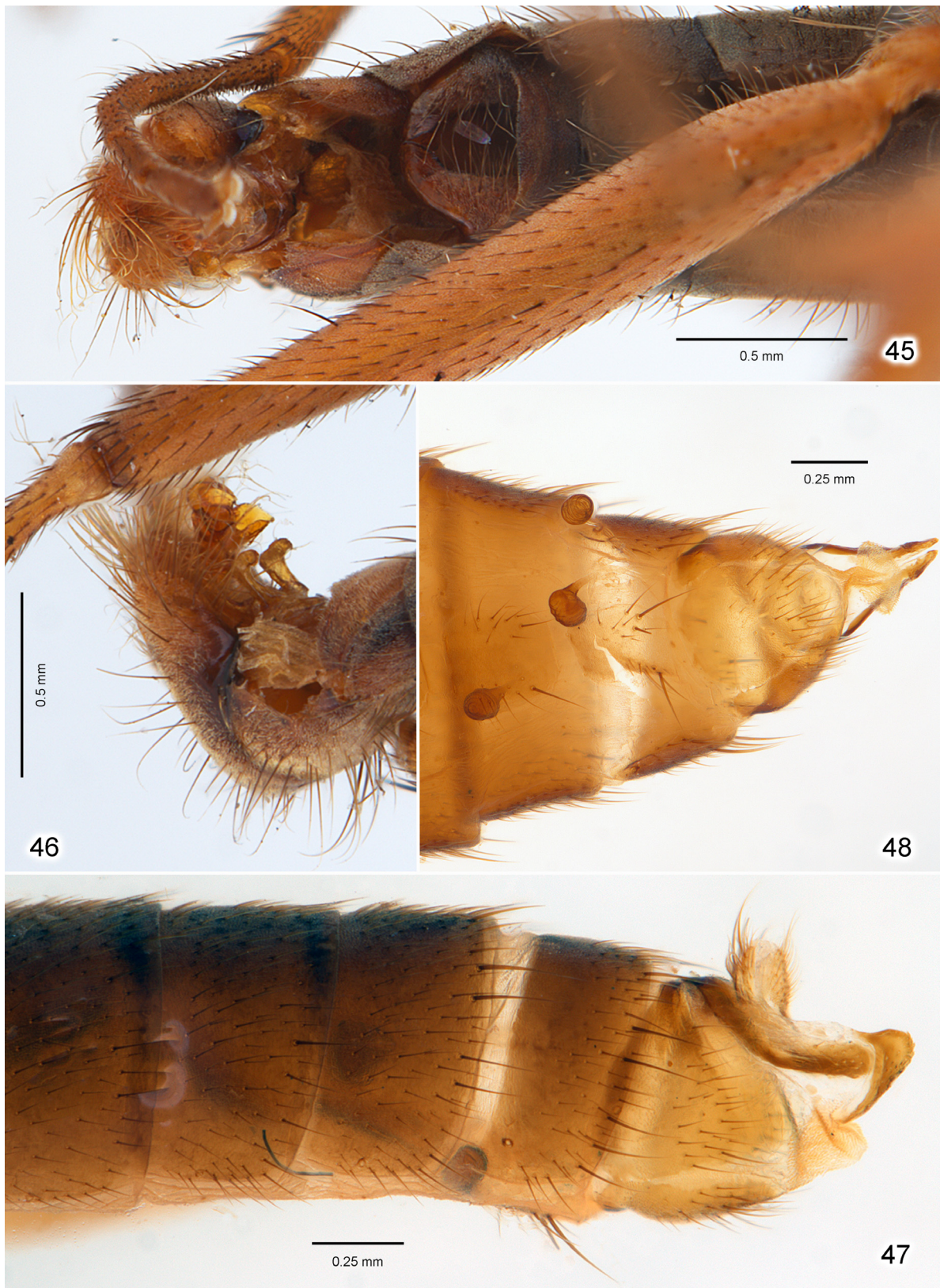
Type material

Holotype

USA – Colorado • ♂; “Tennessee Pass [39°21'45" N, 106°18'40" W] / 10240ft Colo // JM Aldrich / VII-[2?]7 coll // Type No. / 41178 / U.S.N.M. [red label] // *Acanthocnema* / TYPE / *ruficauda* / Curran [red label] // *Acanthocnema* / *ruficauda* / Curran / det. / C.H. Curran // USNMNT / 01234705 [data matrix]”; USNM.



Figs 41–44. *Acanthocnema ruficauda* Curran, 1929. **41–43.** Holotype, ♂ (USNM). **41.** Habitus, lateral view. **42.** Head, lateral view. **43.** Head, dorsolateral view. **44.** Paratype, ♂ (CNC828172), abdomen, lateral view. Abbreviations: lc orb s = latero-clinate orbital setae; pc orb s = proclinate orbital seta.



Figs 45–48. *Acanthocnema ruficauda* Curran, 1929. **45–46.** Holotype, ♂ (USNM). **45.** Abdomen and terminalia, ventral view. **46.** Male terminalia, lateral view. **47–48.** Paratype, ♀ (CNC), Mt Evans. **47.** Abdomen, lateral view. **48.** Terminalia, ventral view.

Other material examined

USA – **Colorado** • 1 ♀; Mt Evans, Doolittle Ranch; [39°40'34" N, 105°36'08" W]; 9800 ft a.s.l.; 25 Jul. 1961; W.R.M. Mason leg.; CNC • 1 ♂; San Juan Co., Pasture Ck; 37°38'48" N, 107°50'55" W; 10154 ft a.s.l.; 18 Jun. 2017; J.M. Cumming leg.; CNC. – **New Mexico** • 1 ♂; Otero Co., Sacramento Mtns, Bluff Springs, ca 16 mi. of W Mayhill; [32.831° N, 105.738°W]; 8000 ft a.s.l.; 15 Aug. 1993; J.E. O'Hara leg.; CNC, CNC828172.

Description

Body brownish (Fig. 41), with dense white pruinescence. Body length: 5.5–6 mm; wing length: 5.8–5.9 mm.

Male

HEAD (Figs 41–43). Frontal vitta yellow to orange anteriorly, matt; fronto-orbital plate brown, with numerous dark setulae. Chaetotaxy: anterior orbital seta proclinate, posterior 2 orbital setae latero-clinate; 3–4 inclinate frontals; 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae weak, divergent; row of dark postocular setae; 1 vibrissa, 1–2 strong subvibrissae. Gena yellow with silvery-white pruinescence, depth one-third eye height; postgenal setae white, soft, silky and wavy, longer than width of postgena. Face, parafacial and occiput silvery pruinescent. Palpus yellowish white with long white setae. Proboscis with broad, shiny prementum, with long silky, wavy setae, similar to postgenal setae. Antenna with scape and pedicel yellow to brownish, postpedicel yellow; postpedicel rounded apically, 2 × as long as broad. Arista pubescent on basal third and bare apically.

THORAX (Fig. 41). Brown, darker beneath dorsocentral row. Acrostichals biserial, short, slender; 2+3 dorsocentrals; 0+2 intra-alars; 1–2+1 supra-alars; 1 postpronotal; 2 notopleurals, 2 postalars; scutellum with pair of strong apical setae and pair of strong basal setae; scutellar disc with a few scattered setulae. Proepisternal seta present. Proepimeral seta absent (Fig. 42). Anepisternum with dark setulae on posterior half and 1 long seta and several long thinner setae near posterior margin. Katepisternum with 1 strong, long seta in posterodorsal corner and numerous yellow setulae.

LEGS (Fig. 41). Yellowish brown. Fore femur with row of 5–6 widely spaced, pale posteroventral setae extending beyond long, dense setulae; 5–6 evenly spaced dark dorsal setae, shorter than width of femur. Fore tibia with ventral apical spur, 1 anterodorsal slightly beyond mid-length, 1 preapical dorsal seta and 1 posteroventral seta proximal to spur; biserial row of short anteroventral spinules; long posteroventral setae near mid-length, longer than width of tibia. Fore tarsomere 1 with dense mat of anterior setulae. Mid femur with row of 5–6 widely spaced, extending beyond long, dense setulae; row of 5–6 anterior setae; 1 preapical anterior seta and 1 posterior preapical seta. Mid tibia with 1 posterodorsal seta at mid-length, 1 anterodorsal seta beyond mid-length and 1 preapical dorsal seta; apex of circlet of 4–5 strong setae. Hind femur with row of 4–6 anterodorsal setae and several widely spaced anteroventral and posteroventral setae. Hind tibia usually with 2 anterodorsal on either side of mid-length; 1 posterodorsal seta beyond mid-length; 1 dorsal preapical seta; 1 anteroventral apical seta.

WING (Fig. 41). Infusate, with faint clouding about r-m and dm-m crossveins; veins dark; crossvein dm-m nearly at right angles, not aligned with M₄; M₄ beyond cell dm weakened to wing margin, one-quarter length of crossvein dm-m; CuA+CuP weakened beyond basal third, reaching wing margin. Calypteres and halter yellow to orange.

ABDOMEN. Similar to thorax, brownish dorsally, with greyish pruinescence; with short dark setae, tergite 2 with longer setae. Sternite 4 rectangular with strong black lateral setae, nearly as long as sternite (Fig. 44). Sternite 5 broad, with pair of cylindrical lobes, curved medially; long setae on basal half of lobes (Fig. 45). Terminalia (Figs 45–46) (undissected): Epandrium rounded, narrow with long setae.

Cercus long, narrow, apical margin rounded in lateral view; cerci closely approximated medially, with apical setae. Surstylus elongate with round apex; long wavy setae on apical half, longer than length of surstylus.

Female

Similar to male except, pedicel brown; without long pale setae on occiput, proboscis and fore coxa; tergite 7 subtriangular, fused anterolaterally with sternite 7, dorsally tapered and medially divided (Fig. 47); sternite 7 subtriangular, fused anterodorsally with tergite 7; tergite 8 U-shaped, enclosing proctiger, narrowly divided medially, obliquely angled; sternite 8 divided into pair of rounded digitiform lobes, directed dorsally and slender in dorsal view; epiproct and hypoproct small, triangular; cercus oval, thinly sclerotized (Fig. 47). Three spermathecae spherical, narrow and tapered posteriorly into duct (Figs 47–48).

Distribution

This species is recorded from Colorado and New Mexico (Fig. 62) and Utah (Vockeroth 1965), but specimens from the latter state were not located during this study.

Acanthocnema torrenticola sp. nov.

urn:lsid:zoobank.org:act:CD39CE73-763C-4174-8D51-C1CFC368A732

Figs 1–3, 49–60

Diagnosis

This species is distinguished by the blackish ground colour, densely blue-grey pruinose laterally, brown dorsally, palpus pale to dark brown in both sexes, orbital setae laterocline, fore tibia without row of short, black anteroventral setae and male sternite 5 without apical lobes.

Etymology

The specific epithet is derived from the Latin ‘*torrens*’ (‘rushing’, ‘rapid’), in reference to the fast-flowing streams, creeks and rivers where it has been collected.

Material examined

Holotype

USA – **Idaho** • ♂; “USA: ID: Idaho Co. / Clearwater NF; Hwy 12 / Apgar Ck, 13.vi.2011 / N46°12'53.0"W115°32'13.6" / B.J. Sinclair // CNC / 905983 // HOLOTYPE / *Acanthocnema* / *torrenticola* / Sinclair [red label]”; CNC, CNC905983.

Paratypes

CANADA – **Alberta** • 1 ♂; Peter Lougheed PP, Grizzly Ck; 50°45.890' N, 115°8.379' W; 1695 m a.s.l.; 9 Jul. 2012; B.J. Sinclair leg.; forest and creek; CNC. – **British Columbia** • 1 ♂, 1 ♀; Cathedral PP, Ashnola River; 49°08.13' N, 120°02.12' W; 750 m a.s.l.; 19 Jul. 2015; B.J. Sinclair leg.; CNC • 1 ♂, 1 ♀; Cowichan Lake, Honeymoon Bay; [48.818° N, 124.172° W]; 6 Jun. 1955; G.E. Shewell leg.; CNC • 1 ♀; Marysville, Marysville Falls, Mark Ck; 49°38.13' N, 115°57.64' W; 940 m a.s.l.; 16 Jul. 2015; B.J. Sinclair leg.; CNC • 1 ♂; Mt Revelstoke NP, Giant Cedar Trail; [51.106° N, 117.906° W]; 700 m a.s.l.; 2 Jul. 1989; B.J. Sinclair leg.; cascading stream; CNC • 1 ♀; Terrace, Eliza Ck; [54.420° N, 128.532° W]; 22 Jun. 1960; G.E. Shewell leg.; resting on black fly cage; CNC • 1 ♂; same data as for preceding; 26 Jun. 1960; CNC • 1 ♀; same data as for preceding; 29 Jun. 1960; from black fly cage in stream; CNC • 1 ♂; same data as for preceding; 13 Jul. 1960; cage trap in stream; CNC • 1 ♂; 20 mi. N of Terrace, Kitsumkalum Lake; [54.725° N, 128.773° W]; 31 May 1960; G.E. Shewell leg.; CNC • 1 ♂; 49 mi. W of Terrace, Slickenslide Ck; [54.211° N, 129.603° W]; 9 Jul. 1960; J.G. Chillcott leg.; CNC • 1 ♀; Perry

Creek Falls Trail; 49°32.977' N, 115°59.837' W; 1095 m a.s.l.; 11 Jun. 2012; B.J. Sinclair leg.; cascading stream; CNC • 1 ♂, 2 ♀♀; W Creston, Hwy 3, Topaz Ck; 49°08.76' N, 116°45.65' W; 825 m a.s.l.; 18 Jul. 2015; B.J. Sinclair leg.; CNC. – **Ontario** • 1 ♂; Collingwood Twsp, Black Ash Ck; [44.494° N, 80.242° W]; 15 May 1948; F.P. Ide leg.; CNC • 1 ♂; Grey Co., Eugenia; [44.313° N, 80.526° W]; 27 Apr. 2008; S.A. Marshall leg.; DEBU • 1 ♂; Forks of the Credit PP, Credit R; 43°48'49.60" N, 80°0'56.95" W; 19 Jun. 2023; B.J. Sinclair leg.; CNC • 1 ♀; Halton Co., Lowville Pk, Bronte Ck; 12 May 1990; B.J. Sinclair leg.; CNC • 1 ♂, 4 ♀♀; same data as for preceding; 43°26'3.35" N, 79°54'12.83" W; 23 Apr. 2023; CNC • 1 ♂, 2 ♀♀; Wellington Co., Fergus; [43.691° N, 80.386° W]; 3 Apr. 2000; S.A. Marshall leg.; on rocks in river; DEBU • 1 ♀; same data as for preceding; 10.Sep. 1995; DEBU • 1 ♂, 1 ♀ (in copula), 1 ♂; same data as for preceding; 20 Sep. 1995; DEBU • 1 ♂, 1 ♀ (in copula), 2 ♂♂, 2 ♀♀; same data as for preceding; Grand River; 2 Oct. 1995; DEBU • 1 ♀; Wellington Co., Guelph, Speed R. at Victoria Rd; [43.588° N, 80.273° W]; 1 May 1998; S.A. Marshall leg.; on rocks in riffle; DEBU. – **Quebec** • 1 ♀; Old Chelsea; [45.499° N, 75.814° W]; 20 Sep. 1955, J.R. Vockeroth leg.; CNC • 1 ♂, 3 ♀♀; same data as for preceding; 26 Sep. 1955; CNC • 1 ♀; same data as for preceding; 27 Sep. 1955; KUMF. – **Yukon** • 1 ♀; Whitehorse, Lewes River; [60.391° N, 134.833° W]; 24 Jun. 1949; L.R. Pickering leg.; CNC • 1 ♂; same data as for preceding; 30 Jul. 1949; CNC • 1 ♂, 1 ♀; same data as for preceding; 2 Jul. 1949; cage N.2; CNC • 3 ♂♂, 2 ♀♀; same data as for preceding; 4 Jul. 1949; CNC • 3 ♂♂; same data as for preceding; 6 Jul. 1949; CNC • 1 ♂; same data as for preceding; 7 Jul. 1949; S.1; CNC • 1 ♀; same data as for preceding; 8 Jul. 1949; cage S.1; CNC • 7 ♂♂, 1 ♀; same data as for preceding; 9 Jul. 1949; CNC • 1 ♀; same data as for preceding; KUMF • 1 ♂; same data as for preceding; 13 Jul. 1949; cage S.2; CNC • 1 ♀; same data as for preceding; 19 Jul. 1949; S.2; CNC • 1 ♀; same data as for preceding; 22 Jul. 1949; CNC • 2 ♂♂; same data as for preceding; 27 Jul. 1949; cage N.2; CNC • 1 ♀; same data as for preceding; 29 Jul. 1949; cage N.2; CNC • 1 ♂, 1 ♀; same data as for preceding; 1–17 Aug. 1949; CNC • 1 ♂; same data as for preceding; 9 Aug. 1949; KUMF • 1 ♂; same data as for preceding; mile 906; 9 Sep. 1949; cage S.5; CNC • 1 ♂; same data as for preceding; 31 Aug. 1949; CNC.

USA – **Alaska** • 1 ♂; mile 14, Richardson Hwy; [61.067° N, 145.905° W]; Horsetail Falls; 18 Jul. 1993; T. Saigusa leg.; KUMF • 1 ♂, 1 ♀; mile 206, Richardson Hwy; [63°11'15" N, 145°33'29" W]; 20 Jul. 1987; M. Wood leg.; beaver pond; CNC. – **California** • 1 ♀; El Dorado Co., South Fk American River, Eagle Rock river access; 38°46'34.6" N, 120°16'00.7" W; 18 Jul. 2012; J.M. Cumming leg.; CNC • 1 ♀; Marin Co., Alpine Lake, Lily Pond; [37.953° N, 122.634° W]; 1500 ft a.s.l.; 1–12 Mar. 1970; D.D. Munroe leg.; MT; CNC • 1 ♂, 1 puparium; Marin Co., Mt Tamalpais SP, Redwood Ck, 12 mi. N of San Francisco; 37°52' N, 122°34' W; 20 m a.s.l.; 23 Nov. 2005; A.H. Purcell leg.; em. 23–24 Jan. 2006; CNC • 1 ♂; same data as for preceding; em. 21 Mar. 2006; CNC • 1 ♀, 1 puparium (in alc.); same data as for preceding; em. 6 Feb. 2006; EMEC • 1 ♂, 1 puparium (in alc.); same data as for preceding; em. 24 Feb. 2006; EMEC • 1 ♀, 1 puparium (in alc.); same data as for preceding; em. 24 Feb. 2006; EMEC • 1 ♂, 1 puparium (in alc.); same data as for preceding; em. 28 Mar. 2006; EMEC • 1 ♀, 1 puparium (in alc.); same data as for preceding; em. 7 Apr. 2006; EMEC • 1 ♀; Nevada Co., Prosser Ck at Hwy 89; 39°23'50.2" N, 120°11'13.9" W; 14 Jul. 2012; S.E. Brooks leg.; CNC. – **Colorado** • 1 ♀; Archuleta Co., Devil's Ck; 37°12'58" N, 107°17'41" W; 6660 ft a.s.l.; 17 Jun. 2017; J.M. Cumming leg.; CNC • 1 ♂; Boulder Co., So. St. Vrain Ck; [40°16' N, 104°52' W]; 8 Sep. 1950; W.W. Wirth leg.; USNM. – **Idaho** • 2 ♀♀; Gooding Co., Niagara Springs; [42.662° N, 114.671° W]; 29 Apr. 1972; R.L. Newell leg.; CNC • 1 ♂; same data as for preceding; 30 Jan. 1973; R.L. Newell and D.S. Potter leg.; USNM • 1 ♀; Idaho Co., Clearwater NF, Hwy 12, 3 Devils Picnic Area, 2–3 km W of Lowell; 46°08.155' N, 115°38.681' W; 450 m a.s.l.; 13 Jun. 2014; B.J. Sinclair leg.; small stream; CNC • 1 ♂, 1 ♀; same data as for holotype; CNC. – **Maine** • 1 ♂, 2 ♀♀; Mt Katahdin, Katahdin Falls; [45.909° N, 68.950° W]; 1600 ft a.s.l.; 2 Jul. 1968; P. Ward leg.; CNC. – **New Mexico** • 1 ♂; James Springs; [34.549° N, 104.364° W]; 4 Jul. 1953; W.W. Wirth leg.; USNM. – **Oregon** • 1 ♂, 1 ♀; Benton Co., Alsea Falls; 44°19'31.70" N, 123°29'25.11" W; 250 m a.s.l.; 5 Jul. 2014; J.M. Cumming leg.; CNC • 1 ♂; Hood River Co., 2 mi. E of Parkdale, East Fk Hood River; [45.530° N, 121.578° W]; 11 Jul. 1989; B.J. Sinclair leg.; CNC • 1 ♀;

Marion Co., Willamette NF, French Ck Rd, French Ck; 44°46.423' N, 122°12.683' W; 840 m a.s.l.; 10 Jul. 2013; B.J. Sinclair leg.; CNC • 1 ♀; E Wallowa; [45.570° N, 117.529° W]; 15 Jul. 1949; G.H. and J.L. Sperry leg.; USNM. – **Pennsylvania** • 1 ♂; Sullivan Co., Wyoming SF, 8 km NW of Laporte; [41°0'2" N, 76°27'14" W]; 6 May 1987; J.M. Cumming leg.; CNC. – **Utah** • 1 ♂; Salt Lake Co., Red Butte Canyon; [40°48'51" N, 111°44'51" W]; 1 Jul. 1953; B.V. Peterson leg.; CNC • 1 ♂; “Wheeler Sawmill & Cabin”; 39.958° N, 111.267° W; 9 Jun. 2011; B.J. Sinclair leg.; spring stream; CNC. – **Washington** • 1 ♂; Husum; [45.800° N, 121.485° W]; 26 Jul. 1921; A.L. Melander leg.; USNM • 2 ♀♀; Whatcom Co., Mt Baker, Dead Horse Ck; [48.898° N, 121.835° W]; 8 Aug. 1982; M. Wood leg.; CNC • 2 ♂♂, 2 ♀♀; Mt Rainier, Ohanapcosh; [46.732° N, 121.569° W]; 11 Aug. 1940; A.L. Melander leg.; USNM. – **Wyoming** • 1 ♀; Yellowstone Pk, Cascades, Y.R. [Yellowstone River?]; [44.71° N, 110.49° W]; 22 Jul. 1923; A.L. Melander leg.; USNM.

Description

Body blackish in ground colour (Fig. 49), densely blue-grey pruinescent laterally, brown dorsally. Body length: 4–5 mm; wing length: 4–5.6 mm.

Male

HEAD (Figs 49–50). Frontal vitta completely black, matt; fronto-orbital plate black, grey pruinescent, with numerous black setulae. Chaetotaxy: 3–4 laterocline orbitals; 1–2 inclinate frontals; 1 ocellar, 1



Figs 49–51. *Acanthocnema torrenticola* sp. nov. **49, 51.** Holotype, ♂ (CNC905983). **49.** Habitus, lateral view. **50.** Paratype, ♀ (CNC5233091), head, oblique dorsal view. **51.** Fore tibia, lateral view. Abbreviations: lc orb s = laterocline orbital setae.

inner vertical, 1 outer vertical; postocellar setae very weak, convergent; row of dark postocular setae; 1 vibrissa, 1 strong subvibrissa. Gena silvery pruinulent, broad, depth below eye subequal to length

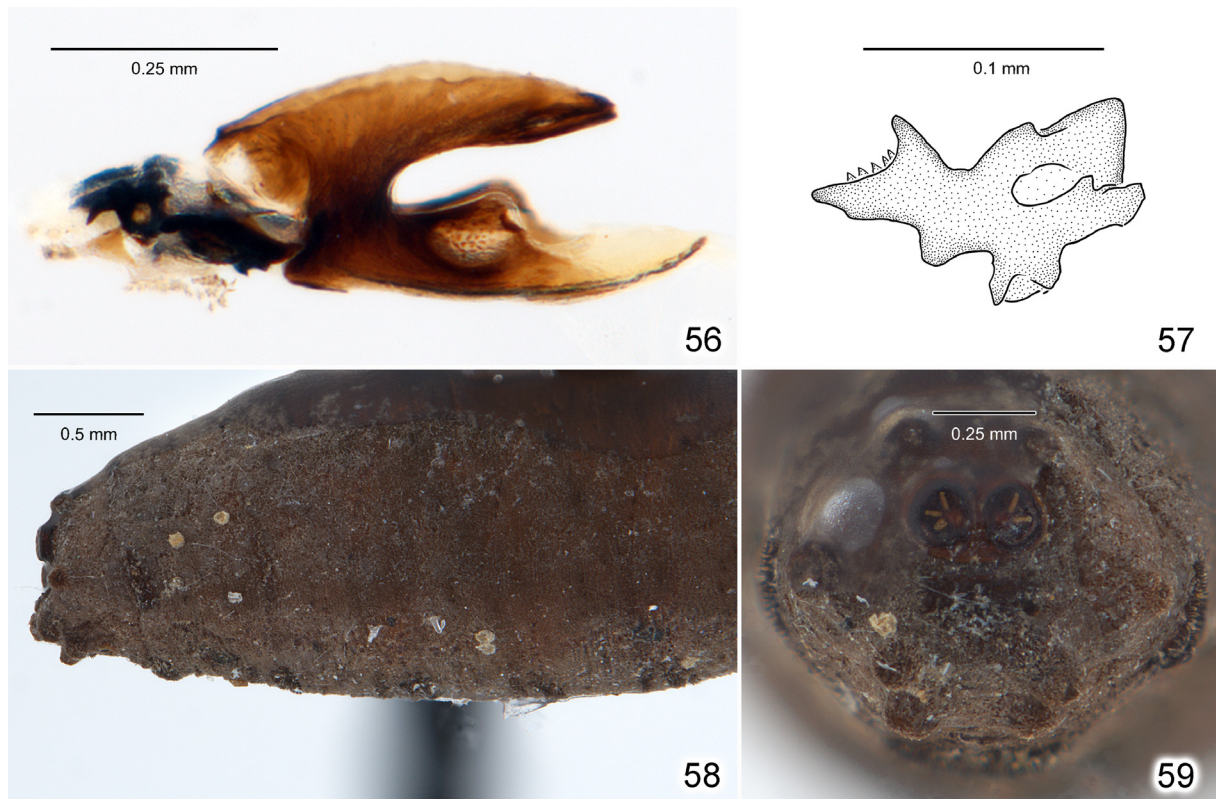


Figs 52–55. *Acanthocnema torrenticola* sp. nov. **52.** Paratype, ♂ (CNC5233089), abdomen and terminalia, ventral view. **53–54.** Paratype, ♂ (CNC), Alaska. **53.** Terminalia, posterior view. **54.** Terminalia, lateral view. **55.** Paratype, ♀ (CNC), Clearwater, terminalia, lateral view.

of postpedicel; postgenal setae white, soft, shorter than width of postgena. Face, parafacial and occiput silvery pruinescent. Palpus pale yellowish brown with long white setae. Proboscis with broad, shiny prementum, without setae. Antenna black; postpedicel rounded apically, $2 \times$ as long as broad. Arista pubescent on basal quarter and bare apically.

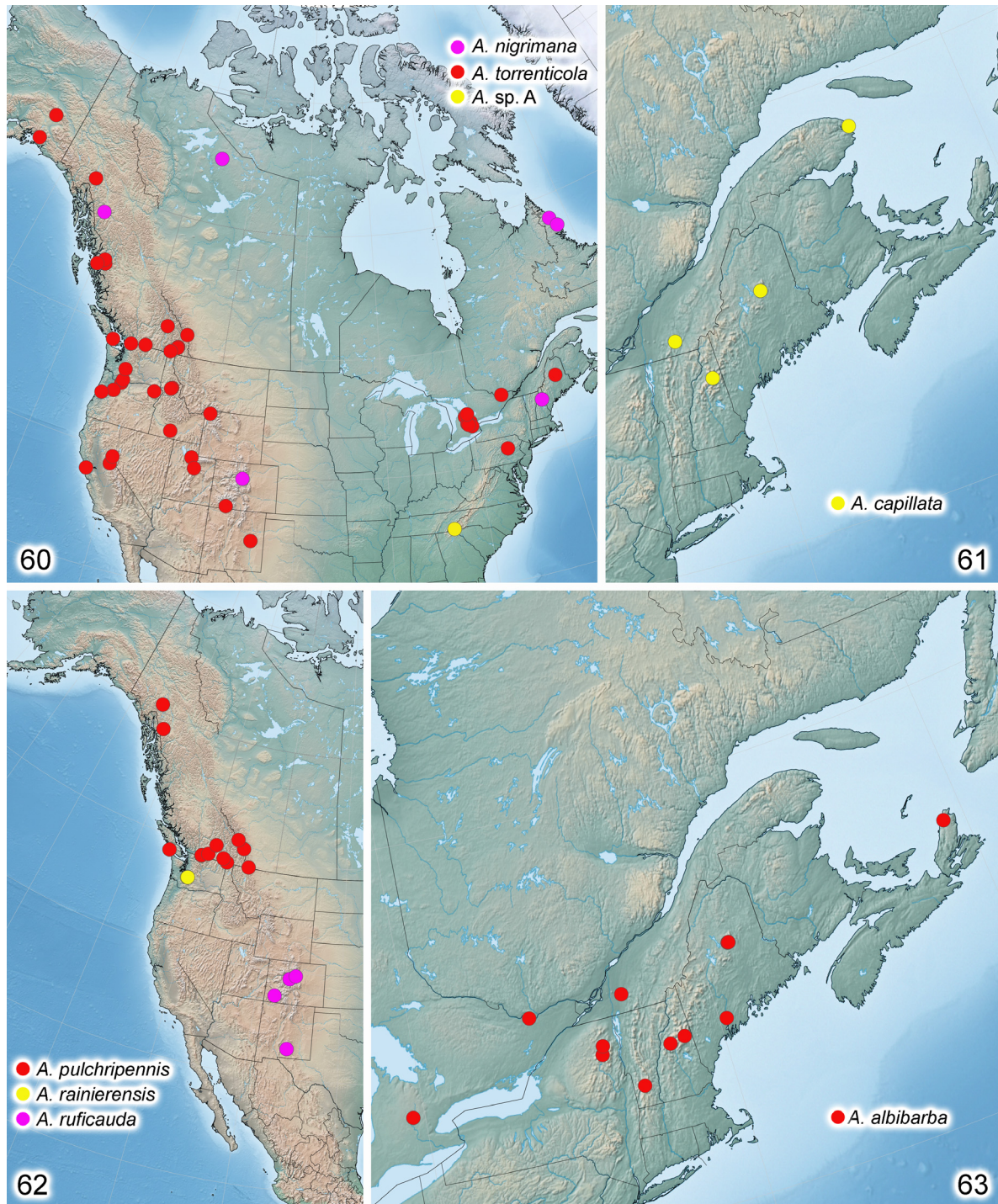
THORAX (Fig. 49). Dark brown with greyish postpronotal lobe, notopleuron, prescutellar depression and scutellum; whitish vitta along acrostichal series anteriorly; pleura and mediotergite with greyish pruinescence. Acrostichals biserial, short, slender; 2+(3–4) dorsocentrals; 1+2 intra-alars; 1+1 supra-alars; 1 postpronotal; 2 notopleurals, 2 postalars; scutellum with pair of strong apical setae and pair of strong basal setae; lateral margins and dorsal surface of scutellum apically densely clothed in black setae and setulae. Dark proepisternal seta present. Proepimeral seta present. Anepisternum with dark setae on posterior half and 1 long seta and several long thinner setae near posterior margin. Katepisternum with 1 strong seta in posterodorsal corner and numerous yellow setulae.

LEGS (Fig. 51). Black, densely greyish pruinescence. Fore femur with 4–6 posteroventral setae extending beyond dense setulae. Fore tibia with ventral apical spur, 1 anterodorsal at mid-length and 1 posteroventral seta at apical fourth; without row of short spinules ventrally. Mid femur with row of anterodorsal setae, with 1 preapical posterodorsal and 1–2 posterior preapical setae. Mid tibia with or without 1 anterodorsal seta and 1 posterodorsal seta beyond mid-length; 1 anteroventral seta and 1 posteroventral apical seta. Hind femur with row of anterodorsal setae. Hind tibia usually with 1 anterodorsal seta and 1 posterodorsal seta beyond mid-length; 1 dorsal preapical seta.



Figs 56–59. *Acanthocnema torrenticola* sp. nov. **56, 57.** Puparium (EMEC), Mt Tamalpais. **56.** Cephaloskeleton (removed from puparium). **57.** Mouthhook, ventral view. **58–59.** Puparium (CNC5245404). **58.** Terminal segments, lateral view. **59.** Terminal segment, caudal view.

WING (Fig. 49). Infusate, without band; veins black; crossvein dm-m at right angles, not aligned with M_4 ; M_4 strong beyond cell dm, one-quarter length of crossvein dm-m; CuA+CuP strong on basal two-thirds, weakened to wing margin. Calypteres and halter pale brown.



Figs 60–63. Known geographical distribution of *Acanthocnema* Becker, 1894. **60.** *A. nigrimana* (Zetterstedt, 1846), *A. torrenticola* sp. nov., *Acanthocnema* sp. A. **61.** *A. capillata* (Loew, 1872). **62.** *A. pulchripennis* sp. nov., *A. rainierensis* sp. nov., *A. ruficauda* Curran, 1929. **63.** *A. albibarba* (Loew, 1869).

ABDOMEN. Similar to thorax, brownish dorsally, blue-greyish pruinose laterally; without long ventrolateral setae. Sternite 4 narrow, about $2 \times$ as wide as long, slightly tapered (Fig. 52). Sternite 5 broad, without lobes; posterior margin with slight median cleft (Fig. 52). Terminalia (Figs 53–54): Epandrium rounded, broad. Cercus short, apical margin rounded in lateral view; cerci closely approximated medially. Surstylus digitiform, sinuous in posterior view; apex rounded with series of ridges on margin. Phallapodeme elongate, rod-shaped. Pregonite short, straight lobe, with several short apical setae. Postgonite gently arched with rounded apex. Ejaculatory apodeme flattened and expanded with expanded ejaculatory duct. Distiphallus narrow, tube-shaped.

Female

Similar to male except, palpus brown; tergite 7 subtriangular, fused anterolaterally with sternite 7, dorsally tapered and medially divided; sternite 7 subtriangular, fused anterodorsally with tergite 7; tergite 8 U-shaped, enclosing proctiger, narrowly divided medially, obliquely angled; sternite 8 divided into pair of tapered digitiform lobes, directed dorsally; epiproct and hypoproct small, triangular; cercus oval, thinly sclerotized (Fig. 55). Three spermathecae tubular, narrow posteriorly, expanded anteriorly.

Larval cephaloskeleton (removed from puparium)

Robust, brown (Fig. 56); intermediate sclerite enlarged, well sclerotized; cibarial pump without ventral ridges; base of mouthhook broad with hollow central region; apex of mouthhook bifid with row of distinct teeth between projections, best seen in ventral view (Fig. 57).

Puparium

Dark brown, clothed in microtrichia; terminal abdominal segment with pair of rounded dorsal tubercles, single rounded lateral tubercle and paired of rounded ventral tubercles (Fig. 58). Posterior spiracular plate with ecdysial scars positioned at 3 and 9 o'clock positions; spiracular opening straight, radiating from ecdysial scar at less than right angles (Fig. 59).

Distribution

This is the most widespread species, extending across the continent from New Brunswick to the Alaska and south to New Mexico (Fig. 60).

Remarks

The life history of this species (as *Acanthocnema* sp.) was studied by Purcell *et al.* (2008). Females oviposit on the egg masses of aquatic insects found on the downstream faces of rocks and in their study mostly on egg masses of the caddisfly *Neophylax rickeri* Milne, 1935. Purcell *et al.* (2008) found that in California, *A. torrenticola* had a bivoltine life cycle. The first generation fed exclusively on *N. rickeri* egg masses in the winter and the second generation fed on the egg masses of a variety of species, including other Trichoptera (Brachycentridae) and Diptera (Ceratopogonidae, Chironomidae) in the spring.

In Ontario, adults have been collected in early spring and mating pairs were collected in September and October based on the material examined above.

Acanthocnema sp. A

Fig. 60

Material examined

USA – **North Carolina** • 1 ♀; Macon Co., Wayah Gap; [35.153° N, 83.581° W]; 4100 ft a.s.l.; 28 Jul. 1957; J.G. Chillcott leg.; CNC.

Distribution

This species is known from the southern Appalachians of eastern North America (Fig. 60).

Remarks

This species is closely related to *A. pulchripennis* sp. nov. and *A. rainierensis* sp. nov. based on the presence of three long, spine-like posteroventral setae on the fore femur, but unlike these two species the wings lack a discal crossband and the fore tibia has a long posteroventral spine-like seta. Males are required to fully assess the status of this species.

Key to Nearctic species of *Acanthocnema* Becker, 1894

1. Anterior orbital seta proclinate, posterior 2 orbital setae more or less laterocline (Fig. 43); yellowish to pale greyish species; at least base of postpedicel yellow (Figs 4, 21, 29, 35, 41) 2
 - All 3 orbital setae laterocline (Figs 14, 50); dark greyish species, with dark postpedicel (Figs 16, 49) 7
2. Proepimeral seta absent (Fig. 42) *A. ruficauda* Curran, 1929
 - Proepimeral seta present (Fig. 6) 3
3. Fore femur without spine-like posteroventral setae on basal half (Figs 4, 21); wing with clouding about crossveins (Figs 7, 22) 4
 - Fore femur with 3 long, black spine-like posteroventral setae on basal half (Figs 30, 36); wing often with discal crossband (Figs 31, 37) 5
4. Male and female postpedicel with base narrowly yellow (Fig. 4); wing with infuscation around R_{2+3} distal to cell dm (Fig. 7); lateral margin of scutum paler than medially
 - *A. albibarba* (Loew, 1869)
 - Male postpedicel entirely yellow (Figs 21, 23); female postpedicel with base narrowly yellow; wing without infuscation around R_{2+3} distally (Figs 22–23); scutum not paler laterally
 - *A. nigrimana* (Zetterstedt, 1846)
5. Wing without discal crossband; fore tibia with long, strong posteroventral seta on apical third, length twice width of tibia [male unknown] *Acanthocnema* sp. A
 - Wing with discal crossband (Figs 31, 37); fore tibia without long, strong posteroventral seta on apical third (Figs 30, 36) 6
6. Fore femur with 3 long spine-like posteroventral setae, without distal row of strong posteroventral setae (Fig. 30); crossvein dm-m oblique, aligned with apex of M_4 (Fig. 31) *A. pulchripennis* sp. nov.
 - Fore femur with four long spine-like posteroventral setae and distal row of strong posteroventral setae (Fig. 36); crossvein dm-m not aligned with apex of M_4 (Fig. 37) *A. rainierensis* sp. nov.

7. Male palpus yellow (Fig. 13), dark in female; male sternite 5 divided into pair of divergent lobes (Fig. 18); fore tibia usually with 1 posteroventral seta near mid-length, 1 preapical posteroventral seta, slender, as long as basal width of fore femur and row of short, strong, black anteroventral setae proximal to ventral spur *A. capillata* (Loew, 1872)
- Palpus pale to dark brown in both sexes (Figs 49–50); male sternite 5 not divided into pair of divergent lobes (Fig. 52); fore tibia with 0–1 posteroventral setae near mid-length, similar to ventral spur, without row of short, black anteroventral setae *A. torrenticola* sp. nov.

Discussion

There are now seven described and one undescribed species of *Acanthocnema* known from the Nearctic Region. In eastern North America, several species are sympatric, having been collected together in the same stream, i.e., *A. albibarba*, *A. capillata* and *A. torrenticola* sp. nov. Most specimens collected by the author in this study were ‘side catches’ during attempts to collect aquatic empidids (i.e., Clinocerinae), consequently new records and species are likely to be discovered in the future through focussed surveys, especially west of the Appalachian Mountains, Midwestern United States and central Canada. In a world checklist, Bernasconi & Šifner (2021) listed *A. glaucescens* (Loew, 1864) from the Nearctic Region, but this remains doubtful especially since the source of this record could not be determined.

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