



Revision of the *Empis* subgenus *Enoplempis* Bigot, east of the Rocky Mountains (Diptera: Empididae)

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Abstract

The *Empis* subgenus *Enoplempis* Bigot, east of the Rocky Mountains of North America is revised. A total of 19 species are recorded from this region including seven new species: *E. (En.) amytis* Walker, *E. (En.) appalachicola* Sinclair **sp. nov.**, *E. (En.) arthritica* Melander, *E. (En.) ctenonema* Melander, *E. (En.) enodis* Melander, *E. (En.) gladiator* Melander, *E. (En.) gulosa* Coquillett, *E. (En.) loripedis* Coquillett, *E. (En.) montywoodi* Brooks **sp. nov.**, *E. (En.) nodipoplitea* Steyskal, *E. (En.) nuda* Loew, *E. (En.) pectinata* Sinclair **sp. nov.**, *E. (En.) penicillata* Brooks **sp. nov.**, *E. (En.) prodigiosa* Cumming **sp. nov.**, *E. (En.) snoddyi* Steyskal, *E. (En.) stenoptera* Loew, *E. (En.) tridentata* Coquillett, *E. (En.) vockerothi* Cumming **sp. nov.**, *E. (En.) volsella* Sinclair **sp. nov.** The following new synonymies are designated: *E. (En.) longipes* Loew, *E. (En.) longeoblita* Steyskal, *E. (En.) deterra* Walley = *E. (En.) amytis*; *E. (En.) cacuminifer* Melander = *E. (En.)*

gulosa. Lectotypes are designated for the following species: *E. (En.) arthritica*, *E. (En.) cacuminifer*, *E. (En.) ctenonema*, *E. (En.) enodis*, *E. (En.) gladiator*, *E. (En.) loripedis*, *E. (En.) stenoptera* and *E. (En.) tridentata*. A key to eastern species is presented and distributions illustrated. The form of nuptial gift presentation displayed within this group, including the use of balloons (with or without prey) and unwrapped prey are indicated for species when known.

Key words: Diptera, Empididae, *Empis*, *Enoplempis*, dance flies, balloon flies, mating behaviours, North America

Introduction

Dance flies (Empididae: Empidinae) exhibit an interesting array of mating behaviours, including specialized mating swarms and transfer of insect prey and other items by males to females as nuptial gifts (Chvála 1976; Cumming 1994). They have been the subject of several detailed behavioural studies (e.g., Svensson & Petersen 1987; Svensson 1997; Sadowski *et al.* 1999; Funk & Tallamy 2000; LeBas *et al.* 2003, 2004; LeBas & Hockham 2005; Gwynne *et al.* 2007) exploring the process of sexual selection, and these have provided textbook examples of mating system variation (Thornhill & Alcock 1983; Slater 1999; Arnqvist & Rowe 2005). With at least 2,000 described species (Yang *et al.* 2007) and a range of variation for these behaviours, dance flies are an ideal system to study potential connections between mating behaviours, associated morphologies and enhanced rates of speciation. Nevertheless, like many complex radiations, empidine dance flies are poorly known both taxonomically and phylogenetically, and this has severely constrained study of their evolution.

Within the Empidinae, the diverse genus *Empis* L. contains over 740 described species that are distributed mostly in the Northern Hemisphere (Yang *et al.* 2007). Many southern hemisphere species currently assigned to *Empis* are now considered to be more basal members of the subfamily and are probably not congeneric (Daugeron *et al.* 2009). The majority of the remaining species are assigned to approximately 15 subgenera of *Empis* (Chvála 1994; Yang *et al.* 2007), with some (e.g., *Coptophlebia Bezzi*) considered to be paraphyletic or polyphyletic (Daugeron *et al.* 2011). The continued use and recognition of subgenera in this genus and the related genus *Rhamphomyia* Meigen needs further analysis.

The subgenus *Enoplempis* Bigot appears to be exclusively North American and its definition was expanded and refined by Melander (1928). There are currently 34 valid described species assigned to this subgenus (including the seven new eastern species described herein), which is usually characterized by modified male hind legs (projections and clusters of setae on the femur/tibia joint), and ventral tarsal spine-like setae. Six putative species of *Empis*, assigned to the subgenus *Enoplempis* Bigot, are known to form balloons of froth (with or without prey) prior to mating, rather than simply offering fresh insect prey to females (Figs 1A, B, D) [Note: species listed in Cumming (1994: 917) are now all assigned to this subgenus]. The balloon-making abilities of this group were first noted by Aldrich & Turley (1899), a behaviour otherwise only recorded for a few species of the genus *Hilara* Meigen (Cumming 1994) (see below under "Discussion"). In addition, some other species of *E. (Enoplempis)* are known to present unwrapped prey to females as nuptial gifts (e.g., *E. (En.) poplitea* Loew, see Alcock 1973). The range of variation in nuptial gift presentation displayed throughout the group is therefore of great interest.

This paper is the first of two revisions of the species belonging to this lineage, with the project divided into eastern and western Nearctic studies for practical and historical reasons. Only one species, *E. (En.) nodipoplitea* Steyskal, is distributed in both eastern and western North America, and is treated in both revisions.

Material and methods

This study is based on material borrowed from or deposited in the following institutions: American Museum of Natural History, New York, USA (AMNH); the Natural History Museum, London, UK (BMNH); California Academy of Sciences, San Francisco, USA (CAS); Crane Hollow Incorporated Collection, Laurelville, OH, USA (CHIC); Canadian National Collection of Insects, Ottawa, Canada (CNC); California State Collection of Arthropods, Sacramento, USA (CSCA); Colorado State University Insect Collection, Fort Collins, USA (CSUC); Cornell University Insect Collection, Ithaca, USA (CUIC); University of Guelph Insect Collection, Guelph, Canada (DEBU); Lyman Entomological Museum, McGill University, Ste-Anne-de-Bellevue, Canada (LEM); Museum of Comparative Zoology, Cambridge, USA (MCZ); Montana Entomological Collection, Montana State

University, Bozeman, USA (MTEC); Royal Ontario Museum, Toronto, Canada (ROM); United States National Museum of Natural History, Washington D.C., USA (USNM).

Terms used for adult structures primarily follow those of Cumming & Wood (2009), except for wing venation where the terms of Saigusa (2006) are used (Fig. 2A). In the system outlined by Saigusa (2006), the dipteran wing vein A_1 (as used in McAlpine 1981) is homologized with the mecopteran CuP, and consequently CuA_1 (of McAlpine) is termed M_4 , whereas CuA_2 is CuA, the anal cell is cell cua and the anal vein (CuA_2+A_1) is $CuA+CuP$. The following abbreviations are used in the descriptions for the following thoracic setae: acr—acrostichal setae, dc—dorsocentral setae, npl—notopleural setae, presut spal—presutural supra-alar setae; psut spal—postsutural supra-alar setae; pal—postalar setae, sctl—scutellar setae. The following abbreviations are used in the material examined sections: Ck—creek; Co.—county; E—east; for.—Forest; ft.—feet; GSMNP—Great Smoky Mountains National Park; MT—Malaise trap; N—north; NF—National Forest; NP—National Park; nr—near; Pkwy—parkway; PP—provincial park; Rd—road; Rec—recreation; S—south; St. Nat. Pre.—State Nature Preserve; str.—stream; Tr.—Trail; W—west.

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

Empis (Enoplempis) Bigot

Enoplempis Bigot, 1880a: 63 [1880b: xlvii]. Type-species, *E. mira* Bigot (monotypy) (Evenhuis & Pont 2004).

Diagnosis. Typical features of the subgenus are as follows: male head dichoptic to nearly holoptic; face and prosternum bare; labellum setose, short and fleshy, not prolonged; acrostichals and dorsocentrals usually short; apical scutellar setae often widely separated; wing (Figs 2A, B) with M_1 and M_2 complete to wing margin, anal vein ($CuA+CuP$) complete (reaching wing margin) or incomplete, axillary excision acute to obtuse, axillary lobe well or little developed; male hindleg frequently modified with tibia and femur variously armed with tubercles, lobes, series of prominent setae, or bristle pencils (e.g., Figs 6, 9, 12, 16, 23); right and left hindlegs normally symmetrical; tarsomeres 2–5 of all legs (in both sexes) usually with 2 ventral rows of short spine-like setae (Figs 2C, D, E); tarsomere 4 usually with apicolateral pair of spine-like setae; male pregenital segments generally unmodified, except some western species; ejaculatory apodeme in anterior view, often inverted Y-shaped, rarely T-shaped or flattened; female without most empidine secondary sexual features, such as expanded and darkened wings, pinnate leg scales, and silvery abdominal pruinescence; extensive eversible darkened abdominal pleural membrane observed in females of some species.

Remarks. The subgenus *Enoplempis* is most readily identified from other *Empis* subgenera by paired rows of ventral spine-like setae on the tarsi, which appears to be correlated with characteristic post-mortum tarsal curling seen in most museum specimens (Figs 2D, E). These spine-like setae are reduced in some species (see species group description) and are not unique to *E. (Enoplempis)*. Rows of ventral tarsal spines also occur in some species of other subgenera of *Empis*, such as various *E. (Coptophlebia) s. lat.* (from North America and Japan) and *E. (Kritempis) livida* L. (not as pronounced in females). *Empis (En.)* can be tentatively divided into the following three broad species groups, although final decisions on the monophyly and relationships of these groups must wait until the western species are fully analyzed.

- (1) The *E. (Enoplempis) mira*-group includes three species with male hindlegs highly modified and bilaterally asymmetrical; hind tibia geniculate at base in both sexes; acrostichals biserial; dorsocentrals uniserial; apical scutellar setae closely positioned; ventral tarsal spine-like setae absent. This group is recorded from Idaho, Oregon and California.
- (2) The *E. (Enoplempis) geneatis*-group includes at least two species and is characterized by unmodified male hindlegs; long setae on scape, palpi and back of head; acrostichals and dorsocentrals multiserial; apical scutellar setae closely positioned. This group is known from Oregon and California.
- (3) The *E. (Enoplempis) bigoti*-group comprises over 40 species and is usually characterized by modified male

hindlegs (tibia, femur and/or trochanter and coxa); apical scutellar setae widely separated; acrostichals and dorsocentrals uniserial and reduced; tarsal spine-like setae very pronounced. This group is widespread across North America.

The eastern species of *E. (Enoplempis)* all belong to the large *E. (Enoplempis) bigoti*-group. They can be further classified into at least four subgroups as indicated below under “Discussion”.

Taxonomy

Empis (Enoplempis) amytis Walker

(Figs 2C, D, 3A, B, C, 4A, 5A)

Empis amytis Walker, 1849: 493. Type locality: New York, USA.

Empis longipes Loew, 1864: 76. Type locality: New York, USA. [Preoccupied by Meigen, 1804]. **syn. nov.**

Empis longoblita Steyskal (in Melander, 1965: 460), n. name for *longipes*. **syn. nov.**

Empis deterra Walley, 1927: 96. Type locality: Niagara Glen, Ontario, Canada. **syn. nov.**

Empis (Enoplempis) longipes: Melander, 1928: 142.

Type material examined. *Empis amytis*: **HOLOTYPE**, ♀ labelled: “Type [green bordered circle]”; “R ???/ New York [hand-written]”; “N. York [circle]”; “One of Walkers/series so named/ EAW[aterhouse]”; “Apparently insect/ referred to by Walker/ presented by/ E. Doubleday not/ Ent. Club./ E.A.W[aterhouse]. 31.3.00”; “amytis,”; “Holo- type [red bordered circle]”; “BMNH(E) #/ 246165” (BMNH).

Empis deterra: **HOLOTYPE**, ♂ labelled: “HOLOTYPE ♂/ *Empis/ deterra/ Walley/ CNC No. 2448* [red label]”; “Niagara Glen, Ont./ 24 - VI 1926/ G.S. Walley” (CNC). **PARATYPES**: Same data as holotype, except 2, 9, 24, 30.vi.–1.vii.1926 (6 ♂, 8 ♀, CNC).

Empis longipes: **HOLOTYPE**, ♂ labelled: “Type/ 1101 [red label with white top border]”; “Lake George”; “273”; “longipes/ m”; “HOLOTYPE/ *Empis/ longipes* Lw. ♂/ (= *longoblita/ Steyskal*)/ teste WJ Turner 1981 [red label]” [dissected] (MCZ).

Additional material examined. **CANADA. Ontario:** Chatterton, 24.v.1954, J.C. Martin (1 ♀, CNC); Dundas, 1.vi.1978, J. Cappleman (1 ♂, CNC); Dundas, below Borer’s Falls, 43°17'25"N 79°55'60"W, 5.vi.2011, 10.vi.2012, B.J. Sinclair (1 ♂, 2 ♀, CNC); Kent Co., Rondeau PP, South Pt Tr., 42°15'42"N 81°50'49"W, savannah, MT, 29.v.–10.vi.2003, S.A. Marshall (1 ♂, 1 ♀, DEBU); Midland, swampy woods, balsam poplar, 30.vii.1956, 2.v.1959, J.G. Chillcott (3 ♂, CNC); Ridgeway, 7.vi.1912, M.C. Van Duzee (1 ♀, CAS); Vineland, 27.v.1978, 12.vi.1980, D. Yu (1 ♂, 1 ♀, DEBU). **USA. Connecticut:** Kent Falls, 13.vi.1931 (2 ♂, CNC). **Michigan:** Emmet Co., Idlewild, 21.vii.1940, C.W. Sabrosky (1 ♂, USNM). **New Jersey:** Branchville, 5.vi.1932, C.H. Curran (1 ♂, 2 ♀, AMNH). **New York:** Colden, 23.v.1909, M.C. Van Duzee Coll. (1 ♂, CAS); Freeville, 25.v.1916 (1 ♀, USNM); Helde[r]burg Mts, 6.vi.1923, S.W. Bromley, [with prey] crane fly *Limnophila subcostata* (Alex.) (1 ♂, USNM); Hamburg, 26.v.1912, M.C. Van Duzee (1 ♀, CAS); Herkimer, 8.viii.1921, M.D. Leonard (1 ♂, 1 ♀, CUIC); Ithaca (3 ♂, 3 ♀, CUIC, USNM); Ithaca, 5.vi.1897 (1 ♂, USNM); Ithaca, 23.vi.1935, 17.v.–2.vi.1936, H.K. Townes (5 ♂, 4 ♀, USNM); Ithaca, 16.v.1936, W. Middlekauff (1 ♀, USNM); Ithaca, Fall Ck, 11.vi.1920, M.D. Leonard (1 ♂, CUIC); McLean Reserve nr Dryden, 11.vi.1964, J.G. Chillcott (2 ♀, CNC); Niagara Falls, 22.vi, C.W. Johnson (1 ♂, USNM); S. Wales, 23.vi.1912, M.C. Van Duzee (1 ♂, USNM); Tompkins Co., McLean Bogs, 29.v.1915 (1 ♂, CUIC); Trenton Falls, 5–8.vi.1921, Leonard & Forbes (1 ♀, CUIC). **North Carolina:** Jackson Co., Nantahala NF, Mull Ck Rd 1737, 19.v.1994, Kondratieff & Fitzgerald (1 ♂, CSUC). **Pennsylvania:** Centre Co., The Rock nr State College, 22.v.1980, D.D. Wilder (1 ♂, CAS); Spring Branch, 21.v.1945 (1 ♀, USNM). **Tennessee:** Sevier Co., GSMNP, Elkmont, 26.iv.2000, S.A. Marshall (1 ♀, DEBU). **Virginia:** Bath Co., Blowing Sprgs, Back Ck, 24.v.2002, B. Kondratieff (1 ♂, CSUC); Giles Co., Cascade Falls Tr., 19.v.1997, S.A. Marshall (2 ♀, DEBU); Madison Co., Shenandoah NP, 3000 ft., on blossoms *Acer spicatum*, 7.vi.1962, J.R. Vockeroth (1 ♂, 1 ♀, CNC); Smyth Co., Mt. Rogers, 4700–5300 ft., 1.vi.1962, J.R. Vockeroth (1 ♂, CNC). **West Virginia:** Pocahontas Co., Sharp Knob, 3500 ft., 18.v.1965, J.G. Chillcott (1 ♀, CNC); Wayne Co., 2 mi S Kenova, Big Sandy Rd (1 ♂, CSUC).

Diagnosis. This species is distinguished by the usually yellow thoracic pleura and stout spine-like setae on inner face of hind coxae in both sexes, quadrate epandrium and very long setae of the hypandrium.

Re-description. Wing length 6.8–7.8 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons and occiput, except postgena yellow. Dichoptic, eye with ommatidia of similar size. Frons divergent towards antennae; below ocellar triangle as wide as or slightly wider than anterior ocellus, bearing short setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin pale and shining. Ocellar triangle dark, subshining, with pair of parallel ocellar setae and pair of posterior setulae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout. Postpedicel, stylus and scape mostly dark; pedicel and apex of scape slightly paler or orange-brown. Scape slightly more than 2× longer than pedicel; postpedicel nearly 5× longer than basal width, 3× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellow; apex of labrum reddish brown; labellum with dark setae.

Thorax yellow in ground-colour, largely densely grey pruinose. Scutum with pair of distinct blackish vittae between acr and dc rows, separated by broad greyish stripe; pair of indistinct stripes lateral to dc and above notopleural depression, flanked with brown along outer margin and grey along inner margin. Pleura yellow, often with darker shadows along edges of sclerites; rarely completely greyish yellow. Proepisternum with several short, dark setae; prosternum bare. Anteprototum with row of short, stout dark setae. Postpronotum with 3–4 short, dark setae and 1 long seta. Scutum with inconspicuous, sparse row of fine acr setulae; dc similar to acr, increasing in length posteriorly; 2 posterior npl, with several anterior npl setae; presut spal absent; 1 psut spal; 1 pal. Scutellum with pair of short sctl, shorter than pal, with 1–2 pairs of marginal setulae. Laterotergite with 2–4 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically (Fig. 3A). Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter with partial row of 4–6 black, spine-like setae on inner face (Fig. 3C). Femora with posteroventral row of fine dark setae, distinct on mid femur; hind femur somewhat thickened towards apex, often with 1–3 preapical spine-like anterior setae (Fig. 3B). Fore tibia clothed in long dark setae, shorter than width of tibia; lacking stout erect setae except for several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; 3–4 anterodorsal, 2–4 anterior, 2 posterodorsal, 1–2 posteroventral and several preapical setae. Hind tibia with 4–5 antero- and posterodorsal setae, 3–4 posteroventral setae and several preapical setae (Fig. 3A). Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen and lacking long outer setae.

Wing clear with yellowish veins; all veins complete (except Sc), well sclerotized. Basal costal seta short, inconspicuous, slightly stouter and longer than surrounding costal setae. R_2 and M_1 parallel near wing margin; R_3 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen yellow with long marginal setae on tergites. Marginal setae on segment 8 longer than length of sclerites. Pregenital segments unmodified; sclerites of segment 8 narrowly separated. Terminalia (Fig. 4A) largely yellow. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal inner margin with tooth-like projection beyond midlength; posterior end truncate, arched medially; clothed in setae, subequal in length to width of cercus. Hypoproct with narrow cluster of long setae. Epandrial lamella subquadrate, posterior margin somewhat projecting, bearing long apical setae. Hypandrium prolonged posteriorly with rounded margin, about 0.5× as long as epandrium; base with numerous long, curled-tipped, dark setae, longer than hypandrium. Phallus with broad base, apical half Z-shaped; apex just emerging beyond cercus; ejaculatory apodeme nearly longer than epandrium; inverted Y-shaped, with short median keel.

Female. Similar to male, except as follows: frons slightly broader; spine-like setae of hind trochanter sometimes less numerous and slightly less stout; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 5A). *Empis (En.) amytis* is known from Michigan, southern Ontario and New York, south along the Appalachian Mountains to Tennessee and North Carolina. Adults have been collected from late April to late July.

Nuptial gift presentation. A male specimen from Helderburg Mountains, New York (see “Additional material examined”) was found with a crane fly prey item pinned below the specimen. This probably indicates that males of this species present unwrapped prey to females as nuptial gifts.

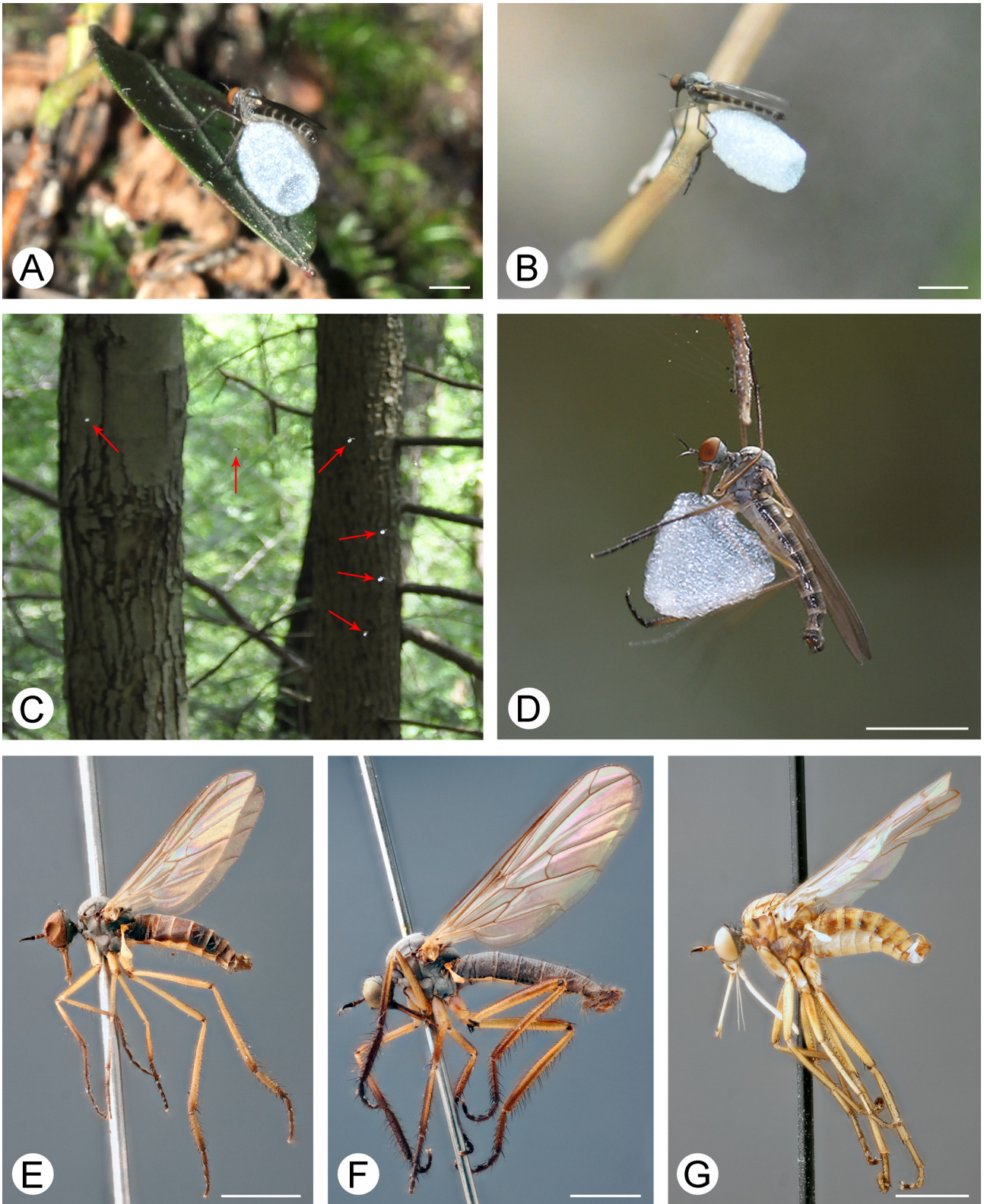


FIGURE 1. *Empis* (*Enolempis*) species. **A, B,** *E. vockerothi* (Hocking Co., OH) male with balloon (photographs by Allen Coovert); **C,** swarming males of *E. vockerothi* with balloons shown by arrows (photograph by Allen Coovert); **D,** *E. snoddyi* (Sevier, TN) apparently in the process of forming a balloon (photograph by Thomas Bentley, copyright Thomasbentley.com); **E,** *E. vockerothi*, male; **F,** *E. appalachicola*, male; **G,** *E. tridentata*, male. Scale bars = 2 mm.

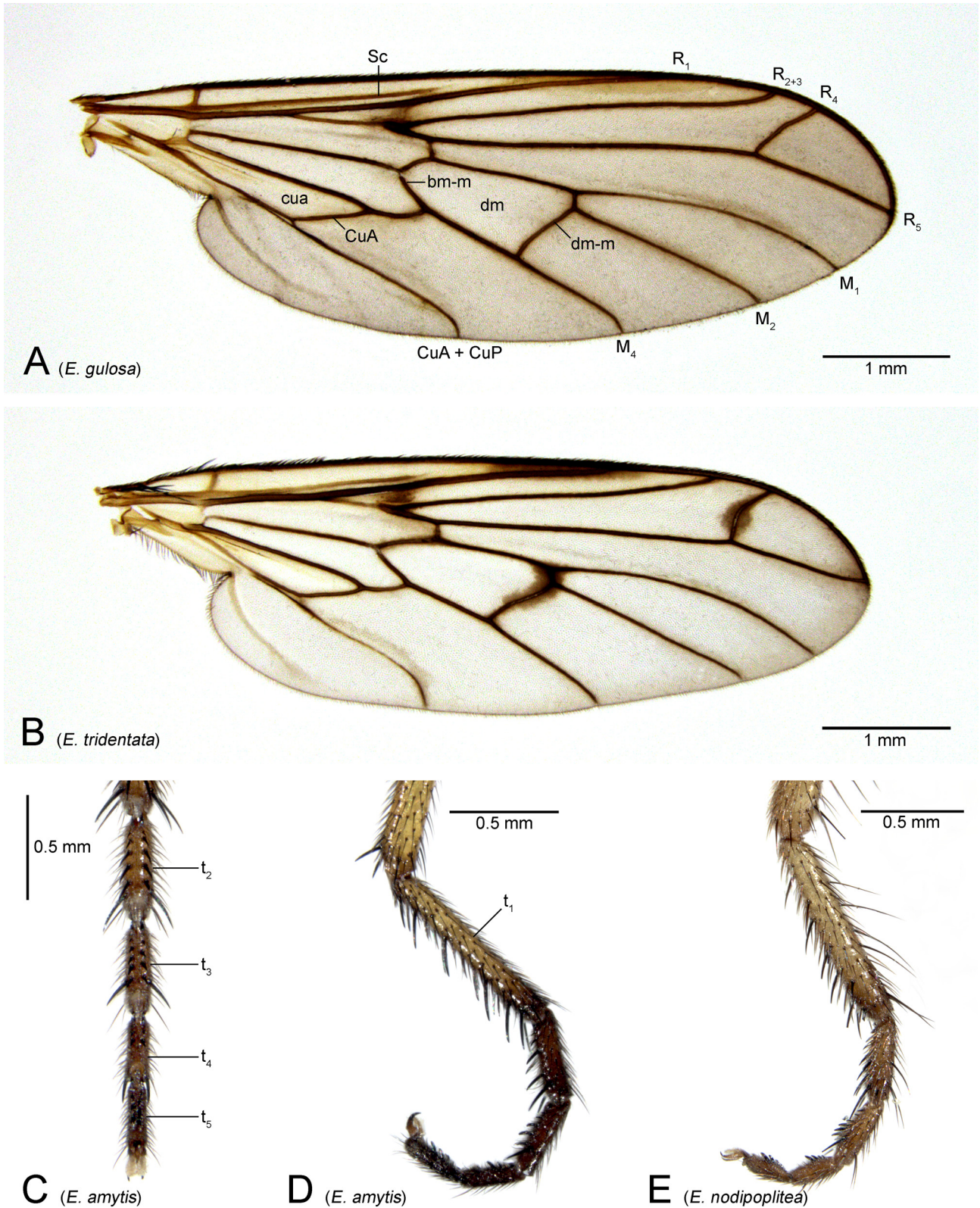


FIGURE 2. Wings and tarsi of *E. (Enoplempis)*. **A**, *E. gulosa*, male wing; **B**, *E. tridentata*, male wing; **C**, *E. amytis*, male hind tarsomeres 2–5, ventral view; **D**, *E. amytis*, male hind tarsus, lateral view; **E**, *E. nodipoplitea*, male hind tarsus, lateral view. Abbreviations: bm-m—basal medial crossvein; CuA—anterior branch of cubital vein; cua—anterior cubital (= anal) cell; CuP—posterior branch of cubital vein; dm—discal medial cell; dm-m—discal medial crossvein; M₁, M₂, M₄—medial veins; R₁, R₂₊₃, R₄, R₅—radial veins; Sc—subcostal vein; t—tarsomere.

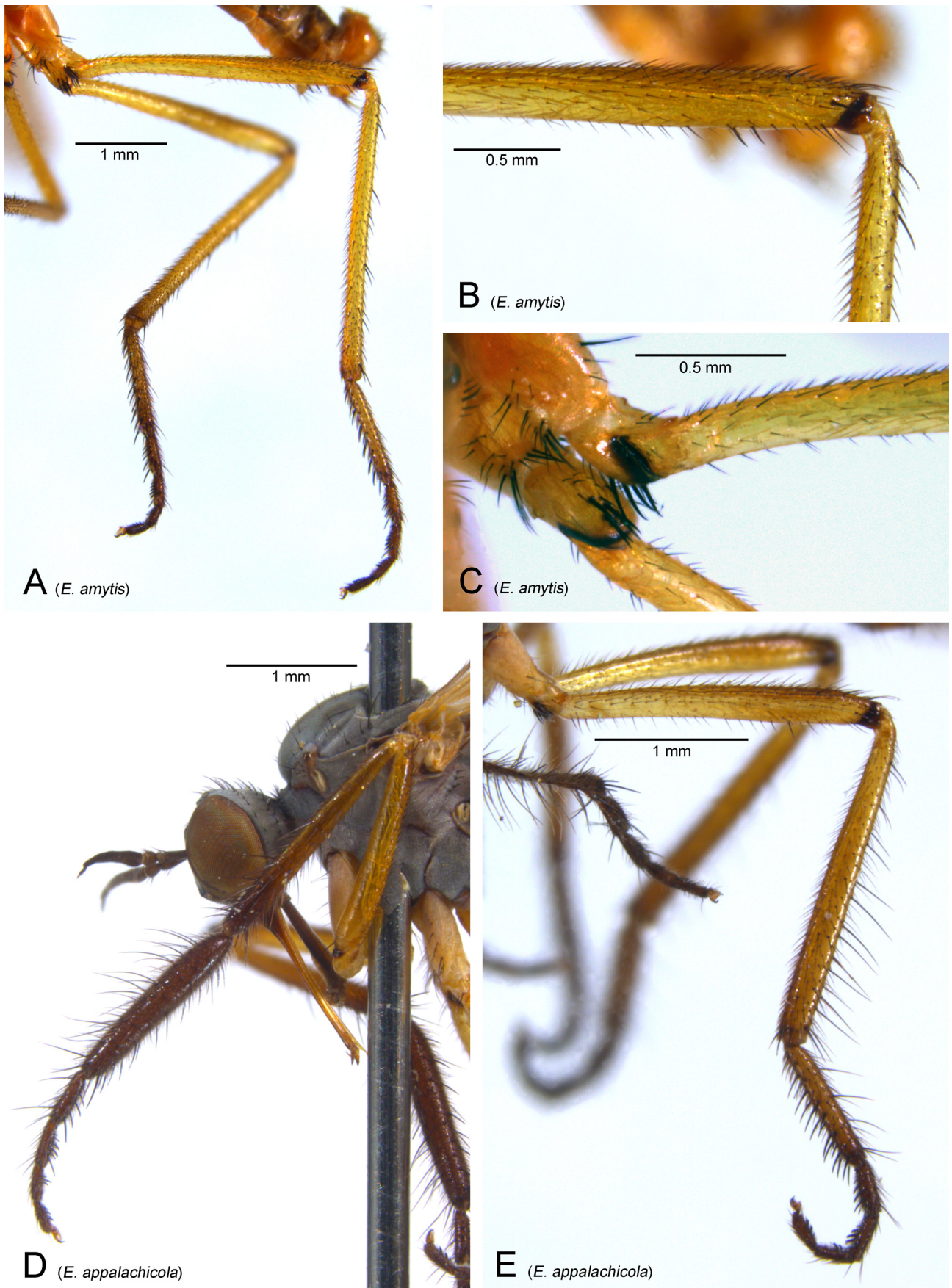


FIGURE 3. Male legs of *E. (Enoplempis)*. **A**, *E. amytis*, hindlegs, anterior view; **B**, *E. amytis*, hind femur, anterior view; **C**, *E. amytis*, hind coxae and trochanters, anterior view; **D**, *E. appalachicola*, foreleg; **E**, *E. appalachicola*, hindleg, anterior view.

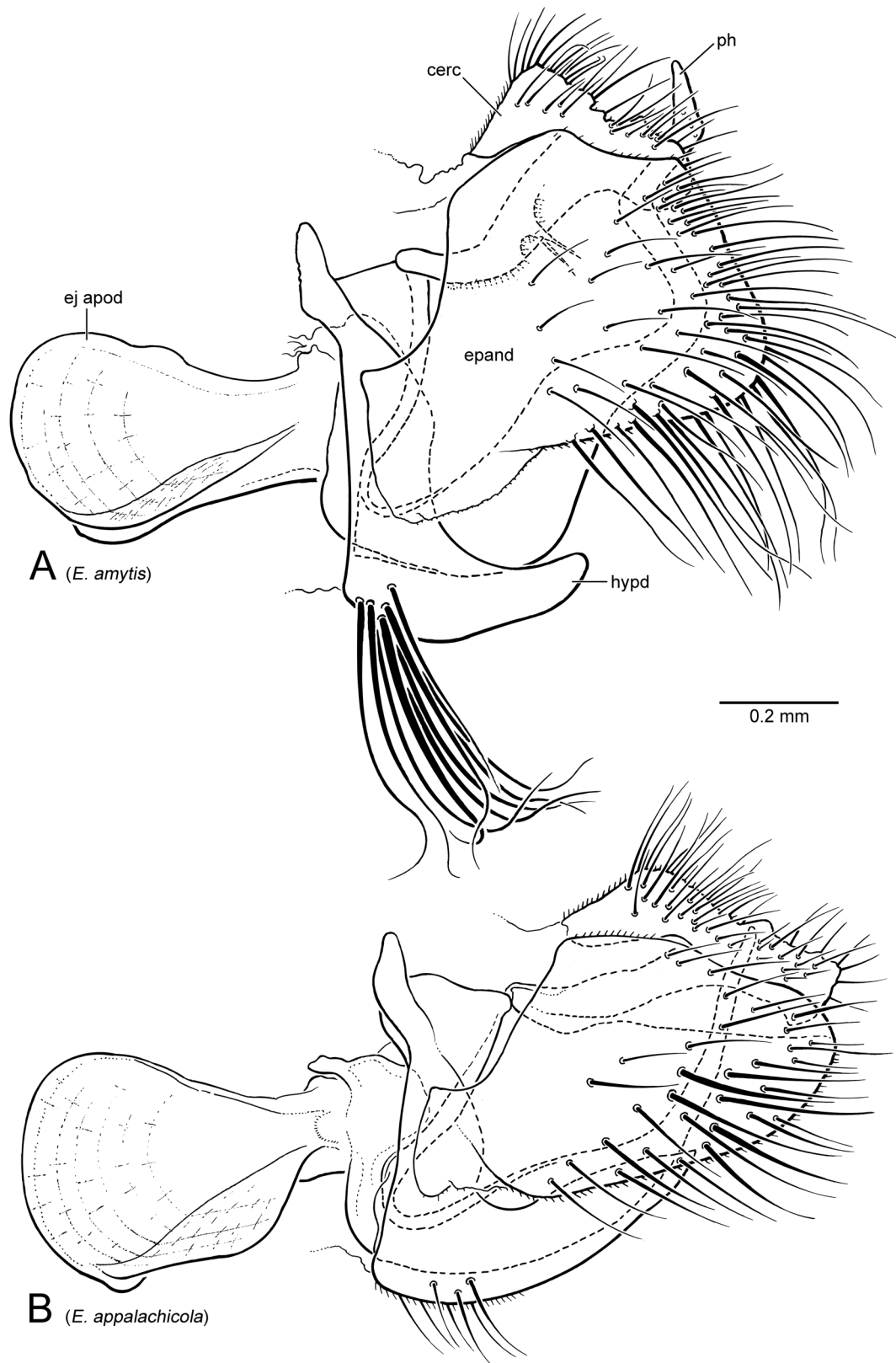


FIGURE 4. Male terminalia, lateral view of *E. (Enoplempis)*. **A**, *E. amytis*; **B**, *E. appalachicola*. Abbreviations: cerc—cercus; ej apod—ejaculatory apodeme; epand—epandrium; hypd—hypandrium; ph—phallus.

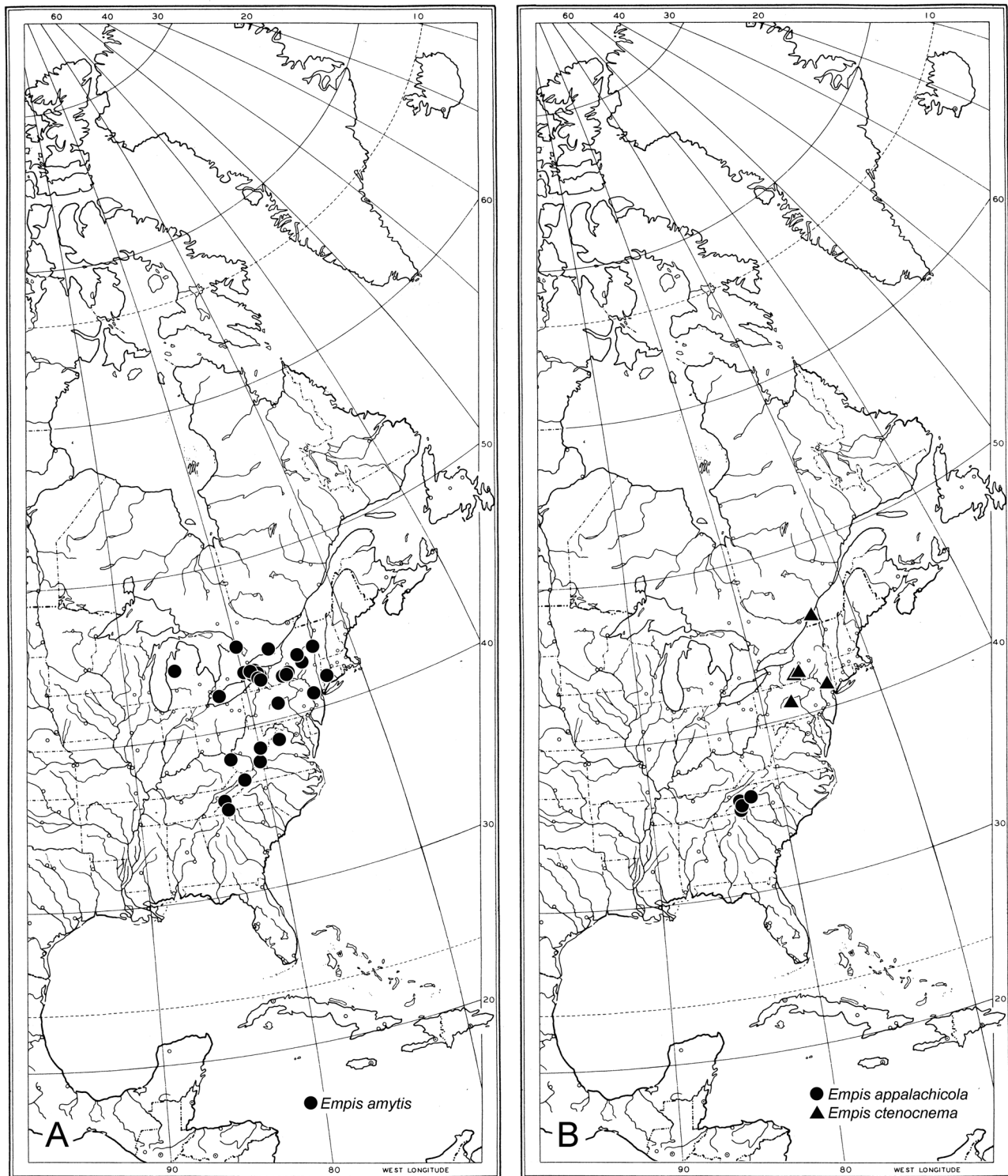


FIGURE 5. Distribution of *E. (Enoplempis)*. A, *E. amytis*; B, *E. appalachicola* and *E. ctenocnema*.

***Empis (Enoplempis) appalachicola* Sinclair sp. nov.**
(Figs 1F, 3D, E, 4B, 5B)

Type material. HOLOTYPE, ♂ labelled: “Clingmans Dome, N.C./ 6647’ 3.VI.1962/ Great Smoky M.N.P./ J.G. Chillcott”; “HOLOTYPE/ *Empis (Enoplempis) appalachicola*/ Sinclair [red label]” (CNC). PARATYPES: USA. **North Carolina:** Blue Ridge Pkwy, Mt. Richland-Balsam, 6000–6400 ft., 30.v.1965, J.G. Chillcott (1 ♂, CNC); same data as holotype (1 ♂, CNC); same locality, 18.vi.1957, J.R. Vockeroth (1 ♂, CNC); GSMNP, Andrews Bald

nr Forney Ridge Tr., 1762 m, 35°32.409'N 83°29.649'W, 12.vi.2008, B.J. Sinclair (1 ♂, CNC); GSMNP, Noland Divide Tr., 1700 m, 35°33'58"N 83°28'37"W, 4.vi.2001, J.M. Cumming (1 ♂, CNC); Highlands, 10.v.1957, W.R.M. Mason (2 ♂, 2 ♀, CNC); Mt. Mitchell, 6500–6684 ft., 5.vi.1962, J.R. Vockeroth (1 ♂, 3 ♀, CNC). **Tennessee:** Gatlinburg, GSMNP, 5900 ft., spruce-fir for., 18.vi.1947, R.H. Whittaker (2 ♂, 4 ♀, USNM).

Diagnosis. This species is distinguished in the male by the spine-like setae of hind trochanter in a broad patch, not confined to tubular process; fore tarsomere 1 enlarged, wider than tibia and tarsomere 1 on mid and hindlegs; hind tibia with rows of long slender dorsal setae, longer than width of tibia; hypandrium very long, subequal to length of epandrium, apex tapered and rounded; short setae present on base of hypandrium.

Description. Wing length 6.0–7.6 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons, postgena and occiput. Dichoptic, eye with ommatidia of similar size. Frons parallel-sided, subequal to width of ocellar triangle, bearing short setulae along inner margin of eye. Face parallel-sided towards mouthparts; bare with oral margin shining. Ocellar triangle dark, subshining, with pair of parallel ocellar setae and pair of posterior setulae 0.5× length of ocellar setae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout; white silky hairs on ventral margin. Antenna dark brown, lacking inner paler colouration. Scape about 2.5× longer than pedicel; postpedicel more than 4× longer than basal width, 4× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellowish; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose: postpronotum, supra-alar ridge and lower margin of scutellum usually yellowish orange. Scutum with pair of distinct dark vittae between acr and dc rows; indistinct pair of vittae lateral to dc and above notopleural depression. Pleura entirely grey, lacking paler highlights. Proepisternum greyish, with several short, dark setae; prosternum bare. Antepronotum with row of short, stout dark setae. Postpronotum with 1–2 long dark setae and 3–6 shorter setae. Scutum with sparse row of fine acr setulae; dc longer than acr, increasing in length posteriorly; 1–2 posterior npl, 1 anterior npl and several shorter dark setae; several short presut spal; 1 psut spal; 1 pal. Scutellum with 2 pairs of sctl, apical pair subequal in length to pal, outer pair shorter than apical pair. Laterotergite with 3–4 long dark setae and several shorter, paler setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter with curved spine-like setae confined to ventral medial patch, lacking tubular process. Femora lacking posteroventral row of fine setae; hind femur with anteroventral row of short, slender setae with dark, stout seta on apical 0.25; hind femur long and cylindrical, somewhat swollen subapically, with several preapical anterior setae (Fig. 3E). Fore tibia clothed in long dark setae, shorter than width of tibia; with 4–5 dorsal, 3–4 posterodorsal, 4–5 posterior, 3–4 posteroventral and several preapical setae longer than width of tibia. Mid tibia clothed in long dark setae, shorter than width of tibia; 2 anteroventral, 4 anterodorsal, 3 anterior, 3–4 posterodorsal, 4 posterior, 1–2 posteroventral and several preapical setae. Hind tibia with 5–6 antero- and posterodorsal setae, several posterior, several posteroventral setae and several preapical setae; setae mostly distinctly longer than width of tibia. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; hind tarsomere 1 with outer setae longer than width of tarsomere; fore tarsomere 1 enlarged, wider than tibia and longer than tarsomere 1 on mid and hindlegs (Fig. 3D), outer faces with setae longer than width of tarsomere.

Wing clear with yellowish brown veins; all veins complete (except Sc), well sclerotized. Basal costal seta not distinguished. R_2 and M_1 parallel near wing margin; R_3 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen concolorous with pleura, tergites paler along apical margins; tergal marginal setae long (at least half length of tergite) and pale brown on tergites 1–7. Marginal setae on tergite 8 shorter than length of sclerite. Pregenital segments unmodified; sclerites of segment 8 weakly fused laterally, forming complete ring, not weakly sclerotized dorsally. Terminalia (Fig. 4B) yellowish brown, except dorsal margin of cerci dark. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal margin preapically with broad, darkened tooth-like projection. Hypoproct with 3–4 setae on inner medial margin. Epandrial lamella subtriangular, posterior margin evenly rounded, bearing apical setae. Hypandrium prolonged posteriorly with rounded margin, subequal in length to epandrium; base with several short, dark setae, about 0.25× length of hypandrium. Phallus with broad base; apical half distinctly narrower, gently arched; apex not emerging beyond cercus; apex of phallus narrow, scoop-like in dorsal view, arched posteriorly; ejaculatory apodeme 0.75× length of epandrium; inverted Y-shaped, with median keel reduced.

Female. Similar to male, except as follows: frons slightly broader; spine-like setae of hind trochanter absent; foreleg tarsomere 1 not inflated, lacking long outer setae; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 5B). *Empis* (*En.*) *appalachicola* is known from the Great Smoky Mountains and Mount Mitchell area in North Carolina and Tennessee. Adults have been collected from mid-May to mid-June.

Etymology. The species name is in reference to the restriction of this species to the Appalachian Mountains.

Nuptial gift presentation. Form unknown.

***Empis* (*Enoplempis*) *arthritica* Melander**

(Figs 6A, B, C, 7A, 11A)

Empis arthritica Melander, 1902: 318. Type locality: Montgomery County, Pennsylvania, USA.

Empis (*Enoplempis*) *arthritica*: Melander, 1928: 142.

Type material examined. **LECTOTYPE** (here designated in order to fix identity of the species) ♂, labelled: “Montg[omery]Co/ 5.26.95[26.v.1895] PA”; “W.W. Wheeler,/ Collection”; “TYPE/ No./ A.M.N.H. [red label]”; “Am. Mus. Nat. Hist./ Dept. Invert. Zool./ No. 961”; “LECTOTYPE/ *Empis*/ *arthritica* Mel./ des. Sinclair, Brooks, Cumming 2012 [red label]” (AMNH). **PARALECTOTYPES:** Same data as lectotype (3 ♀, AMNH); same data as lectotype, except C.W. Johnson Collection (2 ♂, 2 ♀, USNM).

Additional material examined. **USA. Missouri:** McDonald Co., nr Lanagan, 8.v.1984, G.P. & J.F. Hevel (1 ♂, USNM). **Pennsylvania:** Dauphin Co., Grantville, 24.v.1962, J.G. Chillcott (3 ♂, CNC); Hummelstown, 25.v. C.W. Johnson (1 ♂, 1 ♀, USNM). **Tennessee:** Knoxville, v (09), J.M. Aldrich (1 ♂, 1 ♀, USNM). **Virginia:** Bedford Co., NF Goose Ck, Mile 90.2 Blue Ridge Pkwy, 29.v.2006 (1 ♂, CSUC); Giles Co., Mountain Lake, 3600 ft., 28.v.1962, J.G. Chillcott (2 ♂, CNC); Giles Co., New River, 17.v.1997, S.A. Marshall (1 ♂, DEBU); Montgomery Co., Brush Mt., Blacksburg, 2800 ft., ex. blossoms of *Rubus alleghaniensis*, 27.v.1962, J.R. Vockeroth, J.G. Chillcott (5 ♂, 7 ♀, CNC).

Diagnosis. This species is distinguished by the highly modified processes of the hind femur and tibia, including tufted setose process on anterior face of the femur.

Re-description. Wing length 6.3–6.7 mm. **Male.** Head dark in ground-colour, with dense grey pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of similar size. Frons divergent towards antennae; below ocellar triangle as wide as or slightly wider than anterior ocellus, bearing short setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin dark and shining. Ocellar triangle with grey pruinescence, with pair of short parallel ocellar setae; posterior setulae lacking. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout, subequal in length to upper postocular setae. Postpedicel, stylus and scape mostly dark; extreme base of postpedicel and inner face of pedicel slightly paler or orange-brown. Scape slightly more than 2× longer than pedicel; postpedicel more than 5× longer than basal width, more than 3× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellow; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose. Scutum with pair of distinct dark vittae between acr and dc rows; pair of distinct vittae lateral to dc and above notopleural depression. Pleura grey, often with paler upper parts of katepisternum, anepimeron, laterotergite and meron. Proepisternum with several short, dark setae; prosternum bare. Anteprepronotum with row of short stout dark setae. Postpronotum paler than scutum, with 4–8 short, dark setae and 1 long seta. Scutum with sparse row of fine acr setulae; dc similar to acr, increasing in length posteriorly; 1 posterior npl, with several anterior npl setae; 1 presut spal; 1 psut spal; 1 pal. Scutellum with pair of short sctl, shorter than pal, lacking marginal setulae. Laterotergite with 3–4 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; apex of tarsomere 1 and tarsomeres 2–5 reddish brown. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter lacking setae. Femora lacking distinct posteroventral row of setae; hind femur thickened towards apex. Fore tibia clothed in long dark setae, shorter than width of tibia; with 3–5 anterodorsal, 2–5 posteroventral and several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; several anterodorsal setae, 4 or more posteroventral and anteroventral setae and several preapical

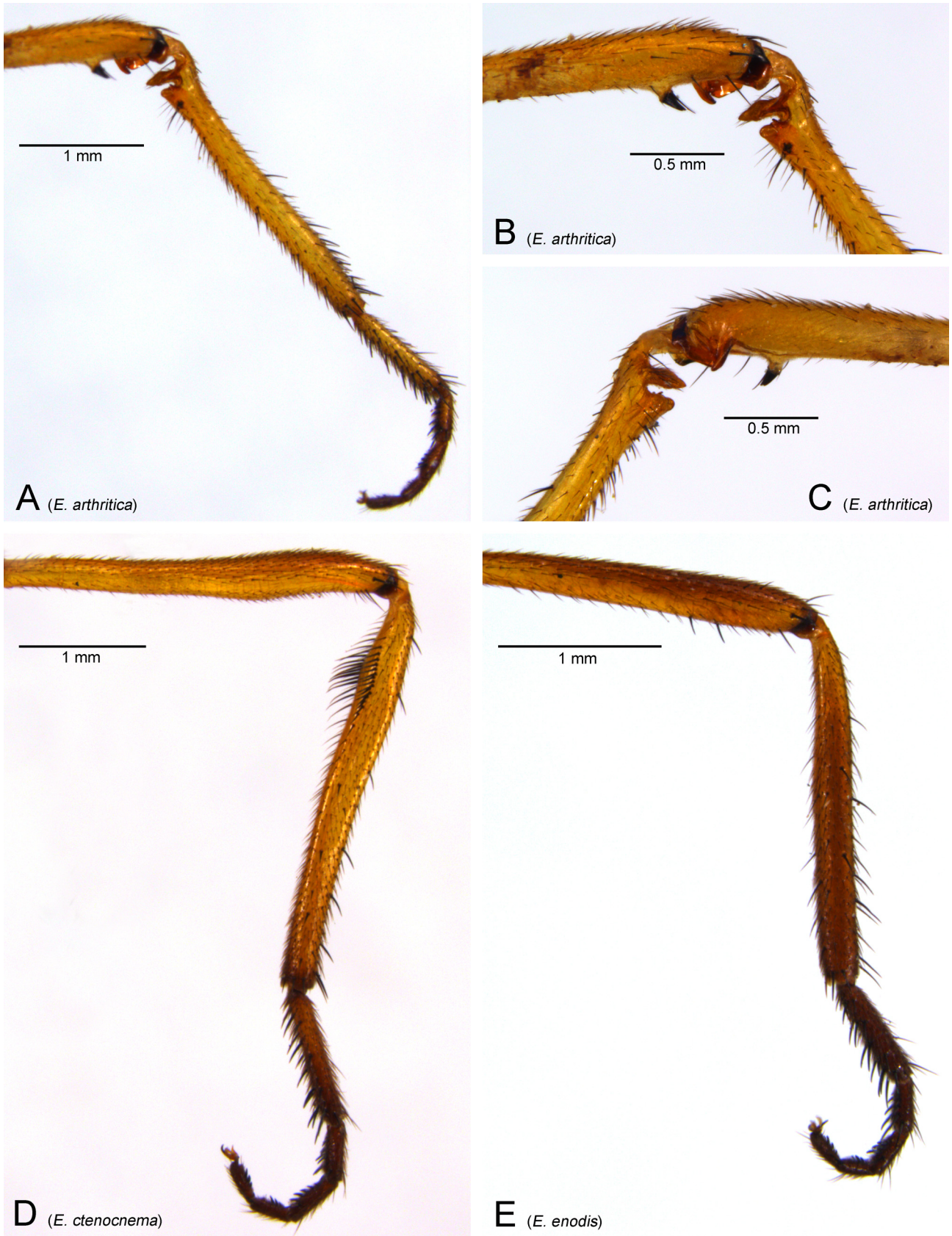


FIGURE 6. Male legs of *E. (Enoplempis)*. **A**, *E. arthritica*, hindleg, anterior view; **B**, *E. arthritica*, apex of hind femur and base of hind tibia, anterior view; **C**, *E. arthritica*, apex of hind femur and base of hind tibia, posterior view; **D**, *E. ctenocnema*, hindleg, anterior view; **E**, *E. enodis*, hindleg, anterior view.

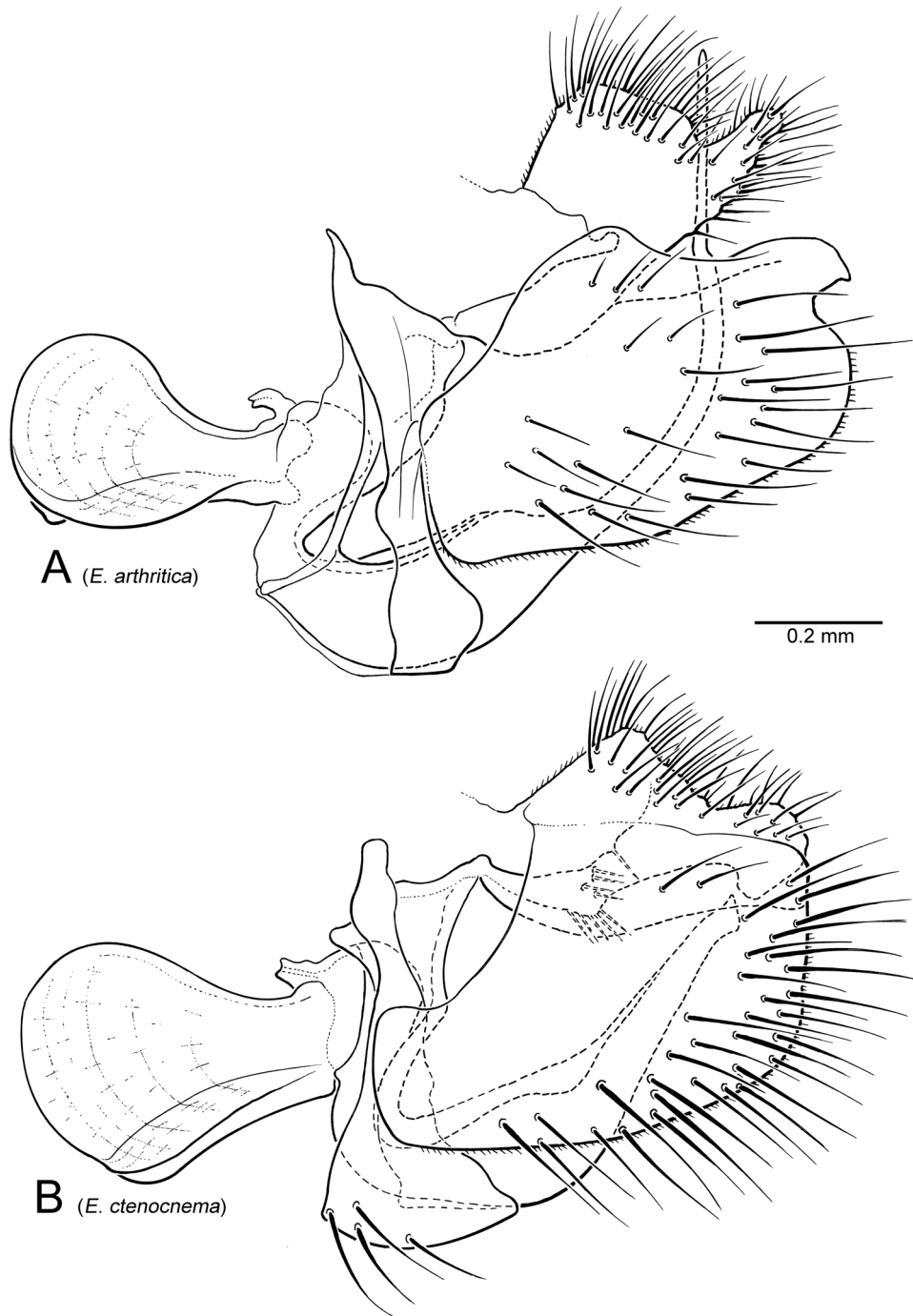


FIGURE 7. Male terminalia, lateral view of *E. (Enoplempis)*. **A**, *E. arthritica*; **B**, *E. ctenocnema*.

setae. Hind femur with short preapical anteroventral process, bearing tuft of stiff black setae, with 3 anteroventral setae distal to process (Figs 6A–C); inner apex with preapical posteroventral hook-shaped process directed ventrally, short, preapical, posterior finger-like knob and anteroventral apex produced as flange. Hind tibia somewhat twisted, geniculate and highly excavated at base, fitting posteroventral processes of femur when reflexed (Fig. 6A); outer base with short anteroventral knob with tuft of stiff, black setae, opposite tufted process of femur; inner base with posteroventral thumb-like process, apex attenuated, densely clothed in setae; anterodorsal and dorsal portions with several rows of stout, black setae of various lengths, some subequal to width of tibia; several preapical setae present. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 somewhat swollen, similar in size to hind tarsomere 1.

Wing clear with brownish veins; all veins complete (except Sc), well sclerotized. Basal costal seta short, inconspicuous, slightly stouter and longer than surrounding costal setae. R_5 and M_1 somewhat divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen yellow with median area of tergites dark, sternites yellow; long marginal setae on tergites. Marginal setae on segment 8 subequal to length of tergite. Pre genital segments unmodified; sclerites of segment 8 weakly fused laterally, forming complete ring, weakly sclerotized dorsally. Terminalia (Fig. 7A) largely yellow. Cercus broad, well separated from dorsal margin of epandrium, posterior end prolonged into finger-like, setose process arched medially. Hypoproct lacking setae. Epandrial lamella subrectangular, posterodorsal margin produced into hook-like process (lacking pubescence) with bacilliform sclerite extending to base of process; setae short. Hypandrium short, not extended posteriorly with truncate margin, about $0.2\times$ as long as epandrium; lacking setae. Phallus with broad basal 0.3, apical 0.6 gently arched dorsally and gradually tapered; apex emerging beyond cercus; ejaculatory apodeme longer than half length of epandrium; inverted Y-shaped, with median keel reduced.

Female. Similar to male, except as follows: frons slightly broader; hind femur and tibia lacking modified setae and processes; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 11A). *Empis (En.) arthritica* ranges along the Appalachian Mountains from Pennsylvania to Tennessee, west to the Ozark Plateau in Missouri. Adults have been collected throughout May.

Nuptial gift presentation. Form unknown.

***Empis (Enoplempis) ctenocnema* Melander** (Figs 5B, 6D, 7B)

Empis (Enoplempis) ctenocnema Melander, 1945: 87. Type locality: Tuxedo, New York, USA.

Type material examined. **LECTOTYPE** (here designated in order to fix identity of the species) ♂, labelled: “Tuxedo N.Y./ 29 May ’26/ ALMelander”; “HOLOTYPE/ ctenocnema [red label]”; “ALMelander/ Collection/ 1961”; “d. L. Knutson’6 [left wing, hind legs and abdomen (with genitalia) glued to bottom label]”; “LECTOTYPE/ *Empis (Enoplempis) ctenocnema* Melander/ des. Sinclair, Brooks &/ Cumming 2013 [red label]” (USNM). **PARALECTOYPES:** 1 ♂, 1 ♀ same data as lectotype (whereabouts unknown).

Additional material examined. **CANADA. Quebec:** Montreal, 10.vi.1900, vi.01, C.W. Johnson Coll. (2 ♂, 1 ♀, CNC); Ile de Montréal, 17.vi.1906, Beaulieu (1 ♀, CNC); Nun’s Island, 3.vi.1925, C.R. Twinn (1 ♂, CNC). **USA. New York:** Ithaca, 17.v.1936, H.K. Townes (4 ♂, 1 ♀, USNM); Ithaca, 2.vi.1934 (1 ♂, USNM); McLean, 31.v.1913 (1 ♂, USNM). **Pennsylvania:** Centre Co., Colyer Lake, 14.vi.1975, D.D. Wilder (1 ♂, CAS).

Diagnosis. This species is distinguished by dense antero- and posteroventral rows of stout setae on basal 0.25 of hind tibia, lacking corresponding setae on hind femur; posterior margin of epandrium truncate.

Re-description. Wing length 7.0–7.7 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of similar size. Frons divergent towards antennae; below ocellar triangle slightly wider than anterior ocellus, bearing short, dark setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin pale and shining. Ocellar triangle dark, subshining, with pair of short, parallel ocellar setae and pair of shorter posterior setae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout. Postpedicel and stylus dark; scape, pedicel and extreme base of postpedicel slightly paler or orange-brown. Scape nearly $3\times$ longer than pedicel; postpedicel nearly $4\times$ longer than basal width, $2.5\times$ longer than stylus. Palpus yellow, with setulae dark. Proboscis largely reddish yellow; apex and base of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose; apex of postpronotum and apical margin of scutellum yellowish. Scutum with pair of distinct dark, brownish vittae between acr and dc rows; pair of distinct vittae lateral to dc and above notopleural depression. Pleura grey, with yellowish margins of some sclerites. Proepisternum with several short, dark setae; prosternum bare. Anteppronotum with row of short, stout dark setae. Postpronotum with 7 or more short, dark setae and 1 long seta. Scutum with inconspicuous, sparse biserial row of fine acr setulae; dc similar to acr, increasing in length posteriorly; 2 posterior npl, with several anterior npl setae; 1 presut spal; 1 psut spal; 1 pal. Scutellum with pair of short sctl, shorter than pal, with 1–2 pairs of marginal setulae. Laterotergite with 2–4 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral and preapical setae, longer and stouter along preapical anterior margins. Hind trochanter lacking spine-like or modified setae. Fore and mid femora lacking posteroventral row of setae; subapex of hind femur thickened, with apex tapered and slightly arched; 2–3 preapical antero- and posteroventral setae; lacking preapical rows of setae as on hind tibia (Fig. 6D). Fore tibia clothed in long dark setae, shorter than width of tibia; several stout erect setae on dorsal and posterior faces, and apex. Mid tibia clothed in long dark setae, shorter than width of tibia; 5–6 anterior, 4 posterior, 3–5 anterodorsal, 2 posteroventral and several preapical setae. Hind tibia with 5–6 antero- and posterodorsal setae and several preapical setae; basal 0.25 with dense, antero- and posteroventral rows of dark, stout setae (Fig. 6D). Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen and lacking long outer setae.

Wing clear with yellowish veins; all veins complete (except Sc), well sclerotized. Basal costal seta short, inconspicuous, slightly stouter and longer than surrounding costal setae. R_5 and M_1 somewhat parallel near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen concolorous with thorax, median area of tergites dark, sternites yellowish; marginal setae long and dark on segments 1–2 on tergites, marginal setae shorter, finer and paler on apical segments. Marginal setae on segment 8 longer and darker than preceding segment. Pregenital segments unmodified; sclerites of segment 8 narrowly separated laterally, not weakly sclerotized dorsally. Terminalia (Fig. 7B) largely yellow. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal inner margin with tooth-like projection at inner apex; posterior end truncate, arched medially; clothed in setae, longer than width of cercus. Hypoproct with narrow cluster of long setae. Epandrial lamella subquadrate, posterior margin truncate, bearing long subapical setae. Hypandrium shorter than base of phallus, with rounded apical margin; base with several dark setae, shorter than hypandrium. Phallus with broad base, apical portion straight, slightly tapered; apex not emerging beyond cercus; ejaculatory apodeme nearly $0.67\times$ length of epandrium; inverted Y-shaped, with short median keel.

Female. Similar to male, except as follows: frons slightly broader; modified setae of hind tibia lacking; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 5B). *Empis* (*En.*) *ctenocnema* is known from southern Quebec, New York and Pennsylvania. Adults have been collected from mid-May to mid-June.

Nuptial gift presentation. Form unknown.

***Empis* (*Enoptempis*) *enodis* Melander**

(Figs 6E, 8A, 18B)

Empis enodis Melander, 1902: 303. Type locality: Chicago, Illinois, USA.

Type material examined. **LECTOTYPE** (here designated in order to fix identity of the species) ♂, labelled: “Chicago, Ill./ May 30 '99”; “E. enodis/TYPE Mel”; “ALMelander/ Collection/ 1961”; “LECTOTYPE/ *Empis enodis* Melander/ des. Sinclair, Brooks &/ Cumming 2013 [red label]” (USNM). **PARALECTOTYPES:** Same data as lectotype (2 ♂, 2 ♀, AMNH, 2 ♂, USNM).

Additional material examined. **USA. Iowa:** Buffalo Center, 18.v.1928, G.S. Walley (3 ♂, 2 ♀, CNC); Thompson, 18.v.1928, G.S. Walley (3 ♂, 2 ♀, CNC). **Minnesota:** Ramsey Co. (1 ♀, USNM).

Taxonomic notes. This species was described from an unspecified number of male and female specimens from two localities (i.e., Glen Ellyn and Chicago, Illinois). Only five males and two females from Chicago were located. There are two unlabelled specimens collected on 21 and 30 May 1899 (1 ♂, 1 ♀, USNM) that are possibly the missing “Glen Ellyn” syntypes. The designation of the lectotype clearly establishes the identity of this species.

Diagnosis. This species is distinguished by absence of modifications of the male hindlegs, hypandrium produced apically with cluster of short basal setae and phallus stout throughout.

Re-description. Wing length 5.5–6.0 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of similar size. Frons divergent towards antennae; below ocellar triangle nearly $2\times$ wider than anterior ocellus, bearing short, dark setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin pale and shining. Ocellar triangle dark, subshining, with pair of short, parallel ocellar setae and pair of shorter posterior setae. Occiput bearing row of postocular setae,

stout and black on upper section; shorter, paler and more slender on lower section; occipital setae black, long and stout. Postpedicel, stylus, scape and pedicel dark. Scape about 2× longer than pedicel; postpedicel more than 4× longer than basal width, more than 3× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely reddish yellow; apex and base of labrum reddish brown; labellum with dark setae.

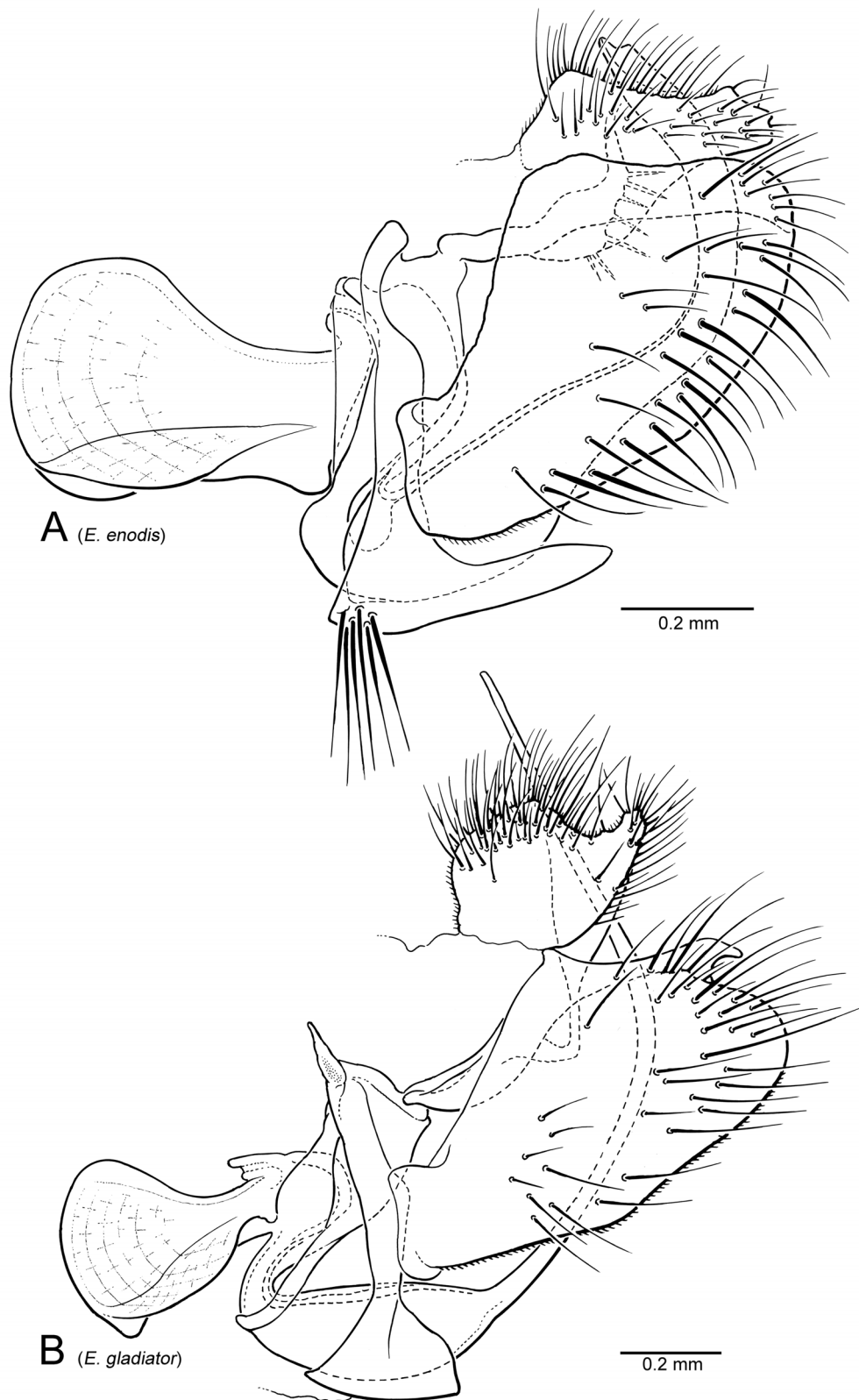


FIGURE 8. Male terminalia, lateral view of *E.* (*Enoplempis*). **A**, *E. enodis*; **B**, *E. gladiator*.

Thorax dark in ground-colour, largely densely grey pruinescent; apex of postpronotum yellowish and shiny. Scutum with pair of distinct dark, brownish vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression. Pleura grey, lacking yellowish margins on some sclerites. Proepisternum with several short, dark setae; prosternum bare. Anteppronotum with row of short, stout dark setae. Postpronotum with 8–10 short, dark setae and 1 long seta. Scutum with inconspicuous, sparse irregular row of fine acr setulae; dc longer and stouter than acr, increasing somewhat in length posteriorly; 2 posterior npl, with several anterior npl setae; 1 presut spal and several shorter dark setae; 1 psut spal; 1 pal and 1 shorter seta. Scutellum with pair of sclt, longer than pal, with 1 pair of outer marginal setae, 0.5× length of inner setae. Laterotergite with 3–4 long dark stout setae. Anterior and posterior spiracles yellowish.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral and apical setae, longer and stouter along apical anterior margins. Hind trochanter lacking spine-like or modified setae. Fore and mid femora lacking posteroventral row of setae; hind femur unmodified, stout, thickened apically; 2–3 preapical antero- and posteroventral and several preapical setae (Fig. 6E). Fore tibia clothed in long dark setae, shorter than width of tibia; several stout erect setae on dorsal and posterior faces, and apex. Mid tibia clothed in long dark setae, shorter than width of tibia; 4–6 antero- and 2–3 posteroventral, 4–5 antero- and posterodorsal, and several preapical setae. Hind tibia unmodified, with 2 anterior, 5–6 antero- and posterodorsal, 3–5 antero- and posteroventral setae and several preapical setae (Fig. 6E). Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen and lacking long outer setae.

Wing clear with yellowish veins; all veins complete (except Sc), well sclerotized. Basal costal seta short, inconspicuous, slightly stouter and longer than surrounding costal setae. R_5 and M_1 somewhat divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen slightly more brownish than thorax, tergites and sternites concolorous; marginal setae long on all tergites, shorter and paler on apical segments. Marginal setae on segment 8 longer and darker than preceding segment. Pregenital segments unmodified; sclerites of segment 8 narrowly separated laterally, not weakly sclerotized dorsally. Terminalia (Fig. 8A) largely yellow. Cercus narrow, slightly appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal inner margin with tooth-like subapical projection; posterior end truncate, not arched medially; clothed in setae, longer than width of cercus. Hypoproct with long setae. Epandrial lamella subquadrate, posterior margin rounded, bearing long subapical setae, subequal to setae on hypandrium. Hypandrium longer than 0.5× length of epandrium, with rounded apical margin; base with cluster of dark setae, shorter than hypandrium. Phallus with broad base, apical portion strongly recurved; broad throughout; apex expanded, spoon-like; apex emerging beyond cercus; ejaculatory apodeme longer than length of epandrium; inverted Y-shaped, with short median keel.

Female. Similar to male, except as follows: frons slightly broader; cercus long and slender, longer than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 18B). *Empis (En.) enodis* is known from Minnesota, Iowa and northern Illinois. Adults have been collected from mid to late May.

Nuptial gift presentation. Form unknown.

***Empis (Enoplempis) gladiator* Melander**

(Figs 8B, 9A, B, 11A)

Empis gladiator Melander, 1902: 316. Type locality: Lawrence, Kansas, USA.

Type material examined. **LECTOTYPE** (here designated in order to fix identity of the species) ♂, labelled: “Jun 8”; “Lawr/ Kans”; “E. gladiator/TYPE Mel”; “ALMelander/ Collection/ 1961”; “LECTOTYPE/ *Empis gladiator* Melander/ des. Sinclair, Brooks & Cumming 2013 [red label]” (USNM). **PARALECTOTYPES:** Same data as lectotype (2 ♂, 2 ♀, AMNH, 2 ♂, 4 ♀, USNM).

Additional material examined. **USA. Indiana:** LaFayette, 10.vi.1916, J.D. Aldrich (1 ♀, USNM). **Kansas:** Lawrence, 20.v., 4.vi.1922, C.H. Curran (2 ♂, 1 ♀, CNC).

Taxonomic notes. This species was described from “numerous specimens of both sexes” from the type locality. The designation of the lectotype clearly establishes the identity of this species.

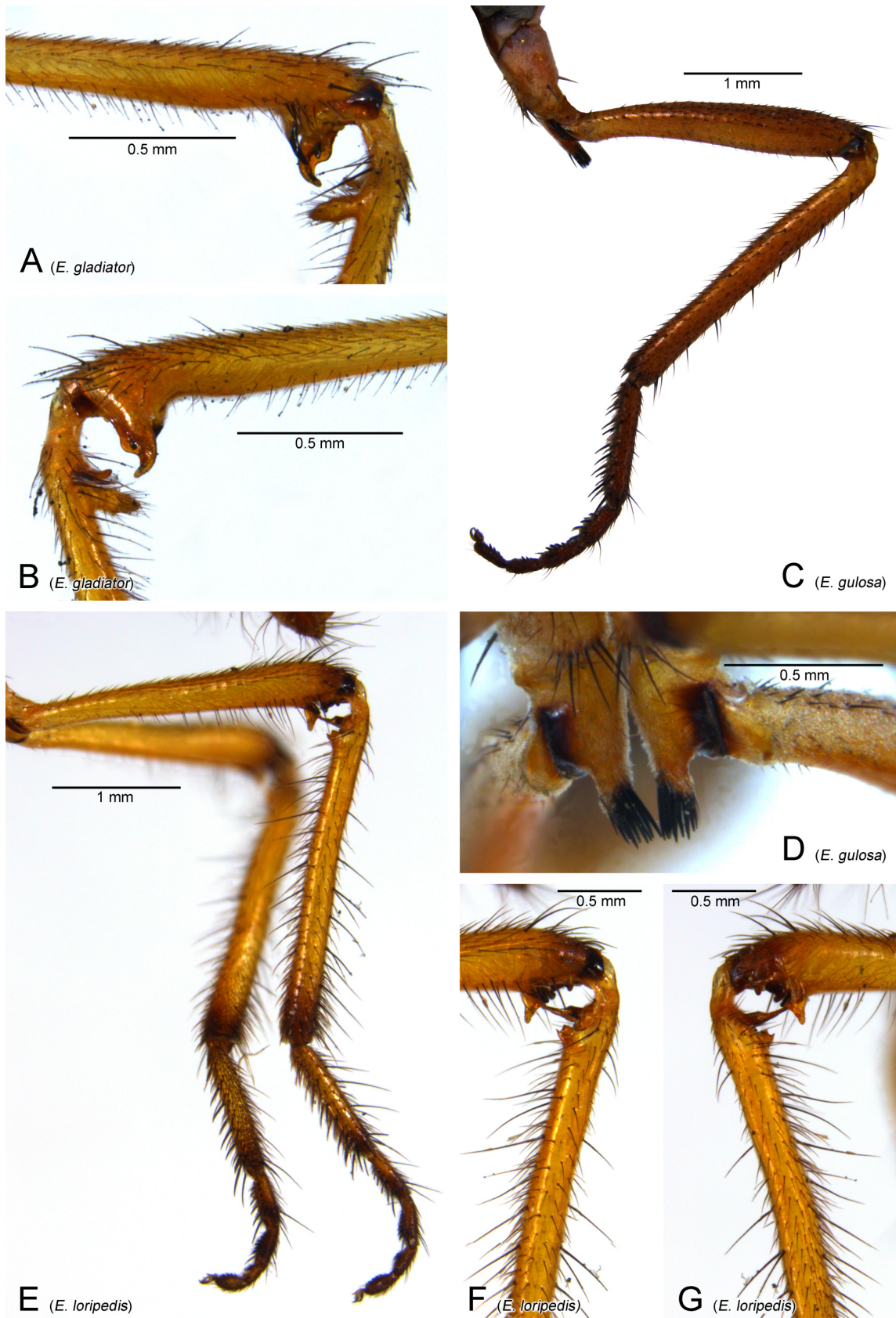


FIGURE 9. Male legs of *E. (Enoplempis)*. **A**, *E. gladiator*, apex of hind femur and base of hind tibia, anterior view; **B**, *E. gladiator*, apex of hind femur and base of hind tibia, posterior view; **C**, *E. gulosa*, hindleg, anterior view; **D**, *E. gulosa*, hind trochanter, anterior view; **E**, *E. loripedis*, hindleg, anterior view; **F**, *E. loripedis*, apex of hind femur and base of hind tibia, anterior view; **G**, *E. loripedis*, apex of hind femur and base of hind tibia, posterior view.

Diagnosis. This species is distinguished by the highly modified processes of the hind femur and tibia, with thumb-like process at base of hind tibia clothed with short, fine setae.

Re-description. Wing length 6.0–6.6 mm. **Male.** Head dark in ground-colour, with dense grey pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of similar size. Frons divergent towards antennae; below ocellar triangle slightly wider than anterior ocellus, bearing short setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin dark and shining. Ocellar triangle with grey pruinescence, with pair of short parallel ocellar setae; posterior setulae less than $0.5\times$ length of anterior. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout, subequal in length to upper postocular setae. Postpedicel, stylus and scape mostly dark; extreme base of postpedicel and inner face of pedicel slightly paler or orange-brown. Scape more than $2\times$ longer than pedicel; postpedicel more than $4\times$ longer than basal width, less than $3\times$ longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellow; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose: postpronotum, supra-alar ridge and outer margin of scutellum yellowish orange. Scutum with pair of distinct dark vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression. Pleura grey, with upper parts of katepisternum, anepimeron, laterotergite and meron paler and yellowish. Proepisternum pale yellowish, with several short, dark setae; prosternum bare. Antepronotum with row of short, stout dark setae. Postpronotum with 2–3 short, dark setae and 1 long seta. Scutum with sparse row of fine acr setulae; dc longer than acr, increasing in length posteriorly; 1 posterior npl, with several short anterior npl setae; 1 short presut spal; 1 psut spal; 1 pal. Scutellum with pair of short sclt, subequal in length to pal, lacking marginal setulae. Laterotergite with 2–4 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; apex of tarsomere 1 and tarsomeres 2–5 reddish brown. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter lacking setae. Femora lacking distinct posteroventral row of setae; hind femur thickened towards apex and somewhat bent medially. Fore tibia clothed in long dark setae, shorter than width of tibia; with 2–3 anterodorsal, 4 posteroventral and several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; several anterodorsal setae, 4 or more posteroventral, 2 anteroventral setae and several preapical setae. Hind femur lacking preapical anteroventral process, with preapical row of anteroventral setae nearly subequal to width of femur; inner apex with pair of preapical posteroventral hook-shaped processes directed anteroventrally, hook of inner process blackened and anteroventral apex produced as flange (Figs 9A, B). Hind tibia somewhat twisted, joint with femur somewhat prolonged; anteroventrally at base with thumb-like process clothed with short, fine setae and with several proximal setae longer than process; inner base with posteroventral pointed knob-like process, with tuft of dark setae on outer base (Figs 9A, B); anteroventral and dorsal portions with several rows of black setae of various lengths, some subequal to width of tibia; several preapical setae present. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 somewhat swollen, similar to hind tarsomere 1.

Wing clear with brownish veins; all veins complete (except Sc), well sclerotized. Basal costal seta short, mostly inconspicuous, slightly stouter and longer than surrounding costal setae. R_5 and M_1 somewhat divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen yellow with median area of tergites dark, sternites yellow; long marginal setae on tergites 1–5. Marginal setae on segment 8 subequal to length of tergite. Pregenital segments unmodified; sclerites of segment 8 weakly fused to form complete ring, weakly sclerotized anterodorsally. Terminalia (Fig. 8B) largely yellow. Cercus broad, well separated from dorsal margin of epandrium, posterior end prolonged into finger-like setose process arched medially. Hypoproct lacking setae. Epandrial lamella subrectangular, posterodorsal margin produced into hook-like process (lacking pubescence) with bacilliform sclerite extending to base of process; setae short. Hypandrium short, not extended posteriorly with truncate margin, about $0.2\times$ as long as epandrium; lacking setae. Phallus with broad basal 0.25 , apical 0.75 gently arched dorsally and gradually tapered; apex emerging beyond cercus; ejaculatory apodeme longer than half length of epandrium; inverted Y-shaped, with median keel reduced.

Female. Similar to male, except as follows: frons slightly broader; hind femur and tibia lacking modified setae and processes; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 11A). *Empis (En.) gladiator* is known from Kansas and Indiana. Adults have been collected from late May to mid-June.

Nuptial gift presentation. Form unknown.

***Empis (Enoplempis) gulosa* Coquillett**
(Figs 2A, 9C, D, 10A, 11B)

Empis gulosa Coquillett, 1895: 408. Type-locality: South Illinois, USA.

Empis cacuminifer Melander, 1902: 304. Type-locality: Columbus, Ohio, USA. **syn. nov.**

Type material examined. *Empis gulosa*: **HOLOTYPE**, ♀ labelled: “Robertson [collector]/ S. Illinois”; “Type/ No. 3186/ U.S.N.M. [red label]”; “Empis/ gulosa/ Type. Coq. [hand-written]” (USNM).

Empis cacuminifer: **LECTOTYPE** (here designated in order to fix identity of the species) ♂, labelled: “Columbus/ 5.20 O[hio].”; “E. cacuminifer/ TYPE Mel.”; “ALMelander/ Collection”; “LECTOTYPE/ *Empis cacuminifer* Melander/ des. Sinclair, Brooks &/ Cumming 2013 [red label]” (USNM). **PARALECTOTYPES**: Same data as holotype, except 10.18.v.1899, W.M. Wheeler Coll. (3 ♀, AMNH); same data as holotype, 29.iv.1899, S.W. Williston Coll. (1 ♀, AMNH); same data as holotype, 13.v.1899, J.M. Aldrich Coll. (1 ♀, USNM); Alabama/ 2223; W.M. Wheeler Coll. (1 ♂, AMNH); “1080” (1 ♂, 1 ♀, USNM).

Additional material examined. **USA. Illinois**: Brownfield Woods, Urbana, 26.iv.1960, J.N. Bouseman (1 ♂, MTEC); South Illinois, C. Robertson (1 ♂, USNM). **Indiana**: LaFayette, 28–29.iv.1915, 1–4.v.1918, J.M. Aldrich Coll. (9 ♂, 3 ♀, USNM). **Kentucky**: Edmonson Co. Cub Ck, KY 70, 11.v.2000, B. Kondratieff (1 ♂, CSUC). **Ohio**: Columbus, 14.v.1925, R.H. Painter (1 ♂, 2 ♀, USNM). **Pennsylvania**: Allegheny (1 ♂, USNM); Bradford Co., 5 mi SW Ulster, 1.vi.1978, D.J. Bickel (1 ♂, CUIC); Centre Co., State College, 27.v.1974, D.J. Shetlar (1 ♀, CAS); Centre Co., Pine Grove Mills, 21.v.1972, D.D. Wilder (1 ♂, CAS); Centre Co., Pine Grove Mills, 17.v.1982, MT, P.H. Adler (1 ♂, USNM). **Tennessee**: no data (1 ♂, 1 ♀, USNM).

Diagnosis. This species is distinguished by the setae of hind trochanter confined to distinct tubular process, paint brush-like; hypandrium 0.5× length of epandrium, apex tapered and rounded; setae present on membrane anterior to base of hypandrium.

Re-description. Wing length 6.4–7.5 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons, postgena and occiput. Dichoptic, eye with ommatidia of similar size. Frons divergent towards antennae; below ocellar triangle about 2× width of anterior ocellus, bearing short setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin shining. Ocellar triangle dark, subshining, with pair of parallel ocellar setae and pair of very short posterior setulae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout. Postpedicel, stylus and scape mostly dark; somewhat paler at certain angles. Scape slightly more than 2× longer than pedicel; postpedicel more than 4× longer than basal width, 2.5× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellowish; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinescent: postpronotum and supra-alar ridge yellowish orange. Scutum with pair of distinct dark vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression. Pleura entirely grey, lacking paler highlights. Proepisternum greyish, with several short, dark setae; prosternum bare. Anteppronotum with row of short, stout dark setae. Postpronotum with 2–3 long, dark setae and 3–6 shorter setae. Scutum with sparse row of fine acr setulae; dc longer than acr, increasing in length posteriorly; 1–2 posterior npl, 1 anterior npl and several shorter dark setae; 1 short presut spal; 1 psut spal; 1 pal. Scutellum with 2 pairs of sclt, apical pair subequal in length to pal, outer pair shorter than apical pair. Laterotergite with 3–5 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter with setae confined to distinct tubular process, paint brush-like (Figs 9C, D). Femora lacking posteroventral row of fine setae; mid femur with antero- and posteroventral row of stout dark setae; hind femur somewhat arched and narrowed sub-basally (Fig. 9C), with several short preapical anterior setae. Fore tibia clothed in long dark setae, shorter than width of tibia; with 2–3 anterodorsal, 3 posterodorsal, 5 posterior, 2–3 posteroventral and several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; 2 anteroventral, 4 anterodorsal, 4 anterior, 3–4 posterodorsal, 4 posterior, 1–2 posteroventral and several preapical setae. Hind tibia with 5 antero- and posterodorsal setae, several posterior, several posteroventral setae and several preapical setae; all setae at most slightly longer than width of tibia. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 somewhat swollen, similar to hind tarsomere 1.

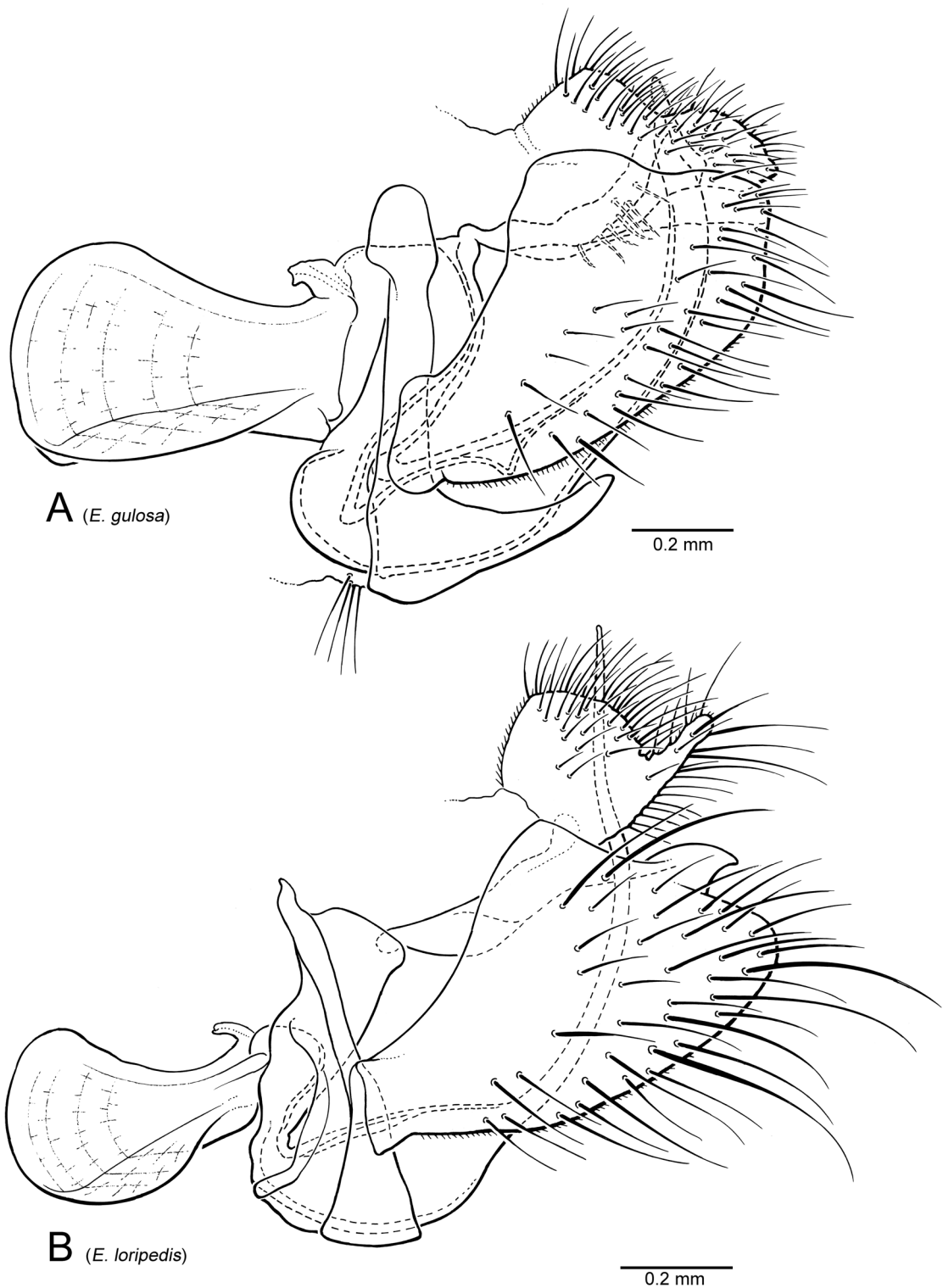


FIGURE 10. Male terminalia, lateral view of *E. (Enplempis)*. **A**, *E. gulosa*; **B**, *E. loripedis*.

Wing clear with yellowish brown veins; all veins complete (except Sc), well sclerotized (Fig. 2A). Basal costal seta not distinguished. R_5 and M_1 divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen concolorous with pleura, paler along apical margin; marginal setae long and stout on tergites 1–3; finer and short on posterior segments. Marginal setae on segment 8 longer than length of sclerites. Pregenital segments unmodified; sclerites of segment 8 weakly fused to form complete ring, not weakly sclerotized dorsally. Terminalia (Fig. 10A) largely yellow. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at

anterior end; dorsal inner margin with pair of tooth-like projections: one near middle and one preapical; posterior end attenuated, arched medially; clothed in setae, subequal in length to width of cercus. Hypoproct with upper half clothed with many long setae. Epandrial lamella subtriangular, posterior margin somewhat truncate, bearing short apical setae. Hypandrium prolonged posteriorly with rounded margin, about 0.67× as long as epandrium; base with several short, dark setae on membrane anterior to base, 0.3× length of hypandrium. Phallus with broad base, apical portion smoothly arched; apex just emerging beyond cercus; apex of phallus slightly expanded, scoop-like; ejaculatory apodeme nearly longer than epandrium; inverted Y-shaped, with median keel reduced.

Female. Similar to male, except as follows: frons slightly broader; hind trochanter lacking paint brush-like process; ventral setae of mid femur shorter and not stout; cercus long and slender, slightly shorter than tergite 8.

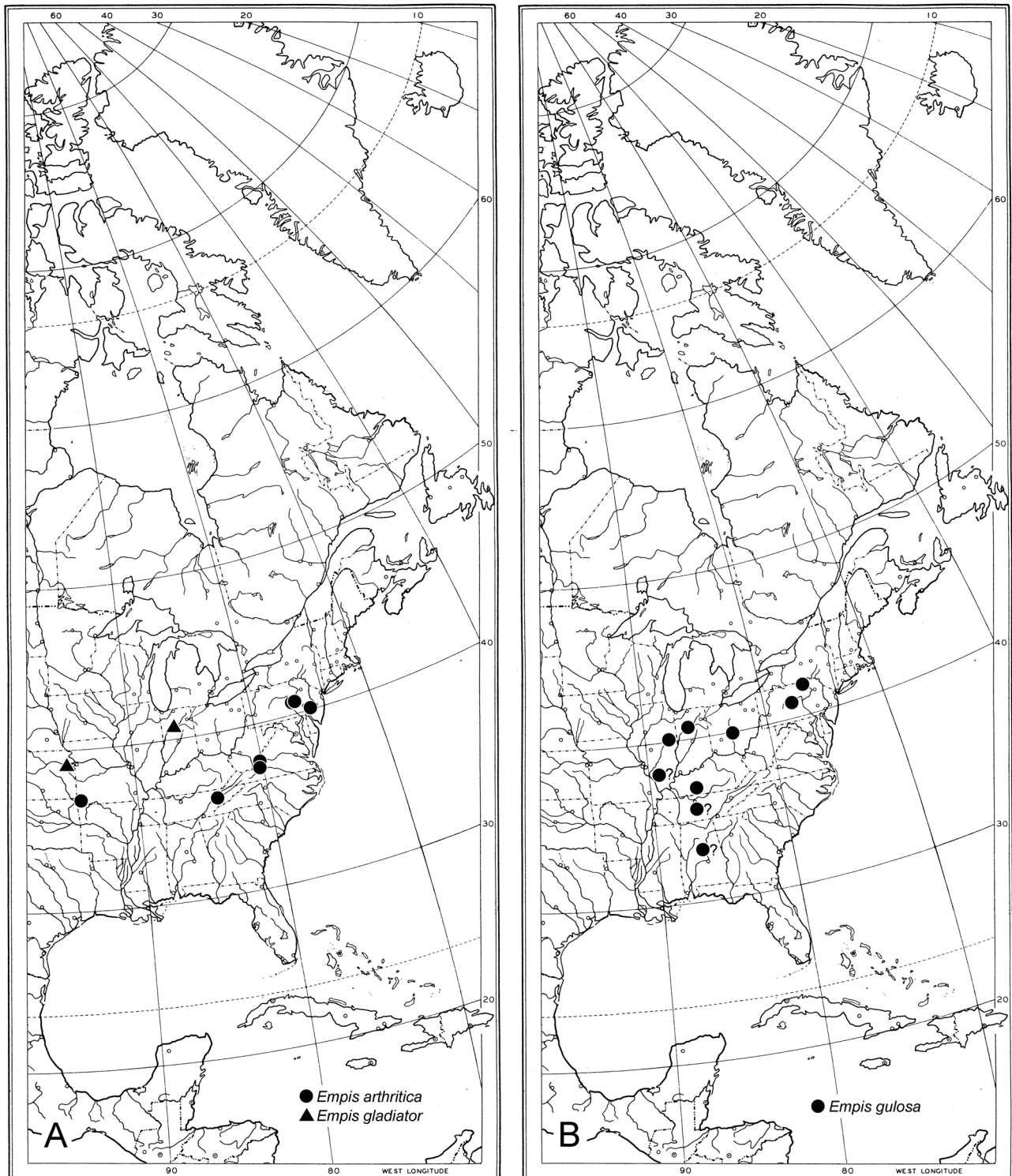


FIGURE 11. Distribution of *E. (Enoplempis)*. **A**, *E. arthritica* and *E. gladiator*; **B**, *E. gulosa*.

Geographical distribution and seasonal occurrence (Fig. 11B). *Empis (En.) gulosa* is known from northeastern USA (Illinois, Indiana, Ohio and Pennsylvania) south to Alabama. Adults have been collected from late April to early June.

Nuptial gift presentation. Form unknown.

***Empis (Enoplempis) loripedis* Coquillett**

(Figs 9E, F, G, 10B, 14A)

Empis loripedis Coquillett, 1895: 400. Type-locality: South Illinois, USA.

Type material examined. LECTOTYPE (here designated in order to fix identity of the species) ♂, labelled: “Robertson[collector]/ S. Illinois”; “Type/ No. 3163/ U.S.N.M. [red label]”; “Empis/ loripedis/ Type. Coq. [hand-written]”; “LECTOTYPE/ *Empis loripedis* Coquillett/ des. Sinclair, Brooks &/ Cumming 2013 [red label]” (USNM). **PARALECTOTYPES:** Same data as holotype (1 ♂, 3 ♀, USNM).

Additional material examined. CANADA. Ontario: Leamington, 4.vi.1937, G.S. Walley (1 ♂, CNC). **USA. Illinois:** Carlville, Robertson (1 ♂, USNM); Chicago, 20.vi.1895, 9.v.1896 (2 ♂, USNM); Chicago, 18.vi.1898, W.M. Wheeler (3 ♂, 1 ♀, AMNH). **Indiana:** LaFayette, 16, 18, 19, 28.v., 2,10.vi., J.M. Aldrich (4 ♂, 7 ♀, USNM). **Michigan:** Monroe, 30.v.1948, G. Steyskal (1 ♂, CNC); Mackinac Co., 4.vi.1959, R. & K. Dreisbach (1 ♀, CNC); Wayne Co., 28.v.1948, R.R. Dreisbach (1 ♂, CNC); Wayne Co., Grosse Ile., 26.vi.1955, G. Steyskal (1 ♂, USNM). **Ohio:** Columbus, 22–23.v.1925, R.H. Painter (2 ♂, USNM); Columbus, 13.v.1899, C.W. Johnson (1 ♂, USNM); Columbus, 30.v.1900, J.M. Aldrich (2 ♂, 1 ♀, USNM); Columbus, 30.v., 2.vi., 18.v.1899 (3 ♂, 1 ♀, USNM); Columbus, 13.v.1899, W.M. Wheeler (1 ♂, AMNH); Columbus, 30.v.1900, S.W. Williston (1 ♀, AMNH). **Pennsylvania:** Castle Rock, 9.vi.1907, 14.vi.1908, C.T. Greene (2 ♀, USNM).

Taxonomic notes. This species was described from five male and five female specimens, collected by C. Robertson and H.E. Weed. Two male (including the lectotype) and three female syntypes were found in the USNM. The location of the remaining three male and two female paralectotypes is unknown. The designation of the lectotype clearly establishes the identity of this species.

Diagnosis. This species is distinguished by apical half of fore tibia and apex of mid and hind tibiae dark, hind tibia with setae longer than width of segment; base of hind tibia with bare, pointed triangular and tapered process; hind femur with hooked, posteroventral preapical process, shorter than width of femur.

Re-description. Wing length 5.7–7.3 mm. **Male.** Head dark in ground-colour, with dense grey pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of similar size. Frons slightly divergent towards antennae; below ocellar triangle slightly wider than anterior ocellus, bearing short setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin dark and shining. Ocellar triangle with grey pruinescence, with pair of short parallel ocellar setae; posterior setulae less than 0.5× length of anterior. Occiput bearing row of postocular setae, a few stout and black setae on upper section; shorter and very slender on lower section; occipital setae black, long and stout, subequal in length to upper postocular setae. Postpedicel, stylus and scape mostly dark; extreme base of postpedicel and inner face of pedicel slightly paler. Scape more than 2× longer than pedicel; postpedicel more than 6× longer than basal width, 2.3× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellow; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose: postpronotum, supra-alar ridge and outer lower margin of scutellum yellowish orange. Scutum with pair of faint dark vittae between acr and dc rows; faint pair of vittae lateral to dc and above notopleural depression. Pleura grey, sometimes with upper parts of katepisternum, anepimeron and meron paler and yellowish. Proepisternum grey, with several short, dark setae; prosternum bare. Antepronotum with row of short, dark setae. Postpronotum with 2–3 short, dark setae and 1 long seta. Scutum with sparse row of fine acr setulae; dc longer than acr, increasing in length posteriorly; 1 posterior npl, with several short anterior npl setae; 1 short presut spal; 1 psut spal; 1 pal. Scutellum with pair of short setae, subequal in length to pal, lacking marginal setulae. Laterotergite with 2–4 long dark setae. Anterior and posterior spiracles pale.

Legs long, mostly yellow, except for dark ring at trochanter-femur junction and apices of femora; apical half of fore tibia and tarsus, apex of mid tibia, apex of tarsomere 1 and tarsomeres 2–5, and apex of hind tibia apex of

tarsomere 1 and tarsomeres 2–5 reddish brown. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter lacking setae. Fore femora lacking distinct posteroventral row of setae; mid femur with posteroventral row of slender setae; hind femur thickened towards apex, with antero- and posteroventral rows of slender setae, length of preapical setae subequal to width of femur. Fore tibia clothed in long dark setae, shorter than width of tibia; with 5–6 anterodorsal, 2 posterodorsal, 5–7 posterior, 4–5 posteroventral setae, mostly 3× width of tibia; and several long preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; about 6 anterior, 3–4 anterodorsal, 4–5 posterior, 4–5 posteroventral, 2 anteroventral setae, mostly 2× width of tibia; and several preapical setae. Hind femur with preapical, black anteroventral process, knob-like; inner apex with posteroventral preapical, ventrally-directed process, shorter than width of femur (Figs 9F, G); distal to latter process pair of preapical posteroventral hook-shaped processes directed posteriorly and posteromedially, hook of inner hook blackened; apex with short, knob-like process distal to hooked processes. Hind tibia somewhat twisted, joint with femur somewhat prolonged; base with pair of anteroventral process (Figs 9F, G): proximal process, long and tapered, subequal to width of tibia; distal process broad, tooth-like with sharp bifid apex; anteroventral, anterior, anterodorsal, posterodorsal and posteroventral portions with rows of long black setae of various lengths, some 2× width of tibia (Fig. 9E); several preapical setae present. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 somewhat swollen, wider than tibia, with long outer setae.

Wing clear with brownish veins; all veins complete (except Sc), well sclerotized. Basal costal seta inconspicuous. R₅ and M₁ somewhat divergent near wing margin; R₅ ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen dark, shining with pair of yellowish lateromedial spots on each tergite, sternites yellow; tergites with long marginal setae, longest on tergite 5. Marginal setae on segment 8 subequal to length of tergite. Pregenital segments unmodified; sclerites of segment 8 weakly fused to form complete ring, not weakly sclerotized dorsally. Terminalia (Fig. 10B) largely yellow. Cercus broad, well separated from dorsal margin of epandrium, posterior end prolonged into finger-like, setose process arched medially. Hypoproct lacking setae. Epandrial lamella subtriangular, posterodorsal margin produced into hook-like process (lacking pubescence) with bacilliform sclerite extending to base of process; some setae longer than half length of epandrium. Hypandrium short, not extended posteriorly with truncate margin, about 0.2× as long as epandrium; lacking setae. Phallus with broad basal 0.33, apical 0.66 gently arched dorsally and gradually tapered; apex emerging beyond cercus; ejaculatory apodeme longer than half length of epandrium; inverted Y-shaped, with median keel reduced.

Female. Similar to male, except as follows: frons slightly broader; hind femur and tibia lacking modified setae and processes; long setae reduced in number; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 14A). *Empis (En.) loripedis* is known from southern Ontario and the northeastern USA (Michigan, Illinois, Indiana, Ohio and Pennsylvania). Adults have been collected from early May to late June.

Nuptial gift presentation. Form unknown.

Empis (Enoplempis) montywoodi Brooks sp. nov.

(Figs 12A, B, 13A, 18B)

Type material. HOLOTYPE, ♂ labelled: “CAN: QC: Gatineau/ Masham, Duncan Lk/ N45°40'59.43" W76°3'21.38"/ 21.vi.1993/ D.M. Wood”; “HOLOTYPE/ *Empis (Enoplempis) montywoodi*/ Brooks [red label]” (CNC).

Diagnosis. This species is distinguished by the male hind tibia bearing a pair of blunt basiventral processes, each with narrow brush of long, black apical setae.

Description. Wing length 7.0 mm. **Male.** Head mostly dark in ground-colour, with dense greyish pruinescence on face, frons and occiput, postgena pale yellow. Dichoptic, eye with ommatidia of similar size. Frons parallel-sided, subequal to width of ocellar triangle, bearing short dark setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin pale. Ocellar triangle dark, subshining, with pair of short, parallel, proclinate ocellar setae and several shorter posterior setulae. Occiput bearing 2 strong, black upper postocular setae with remainder of postocular row comprised of short black setae; occipital setae black, similar in

size to strong upper postoculars. Postpedicel and stylus dark; scape, pedicel and extreme base of postpedicel pale-brownish. Scape 2× longer than pedicel; postpedicel about 3.7× longer than basal width, about 2× longer than stylus. Palpus pale yellow, with dark setulae. Proboscis largely pale; apex and base of labrum darkened; labellum with dark setae.

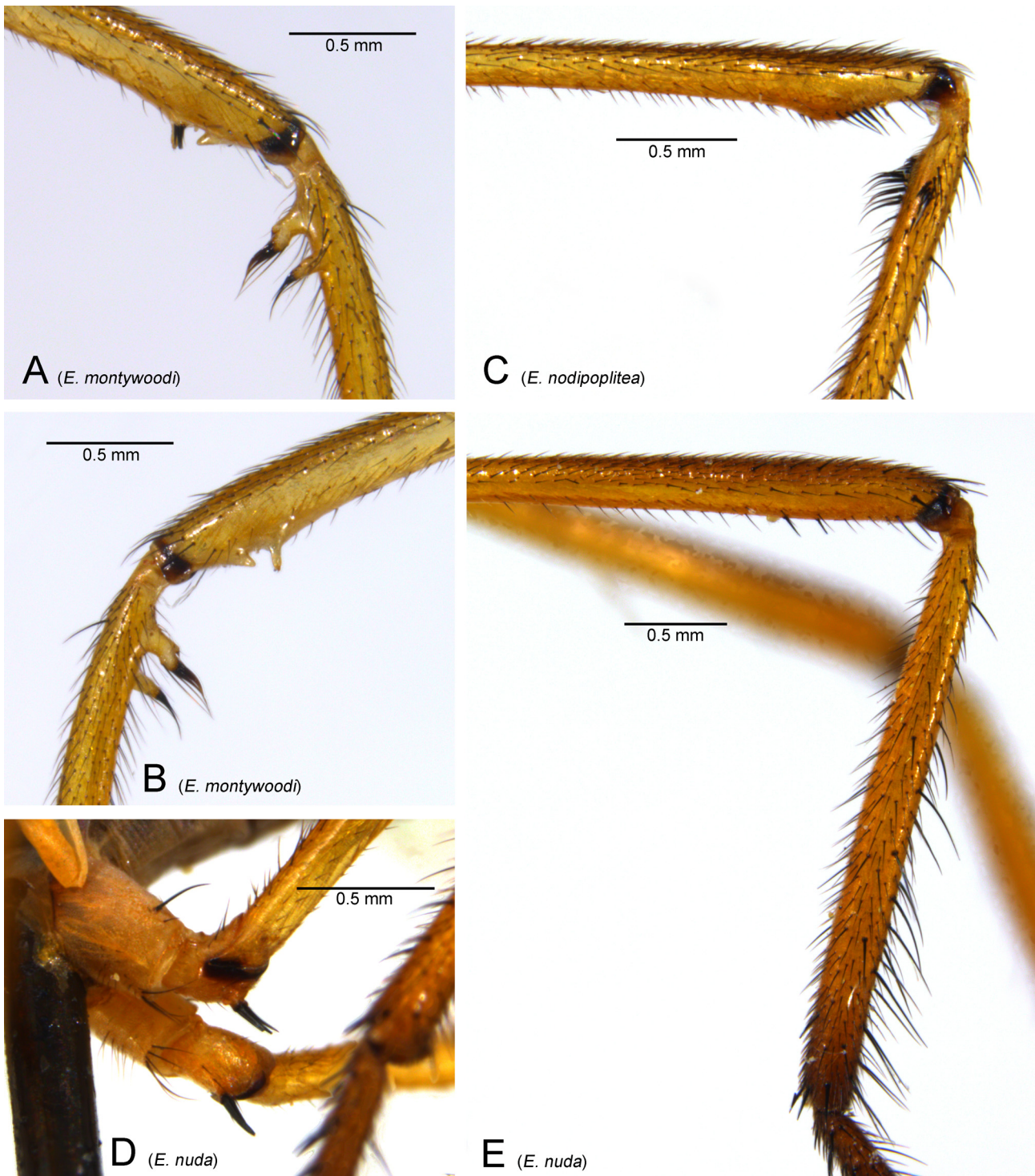


FIGURE 12. Male legs of *E. (Enoplempis)*. **A**, *E. montywoodi*, apex of hind femur and base of hind tibia, anterior view; **B**, *E. montywoodi*, apex of hind femur and base of hind tibia, posterior view; **C**, *E. nodipoplitea*, apex of hind femur and base of hind tibia, anterior view; **D**, *E. nuda*, hind trochanters; **E**, *E. nuda*, hindleg, anterior view.

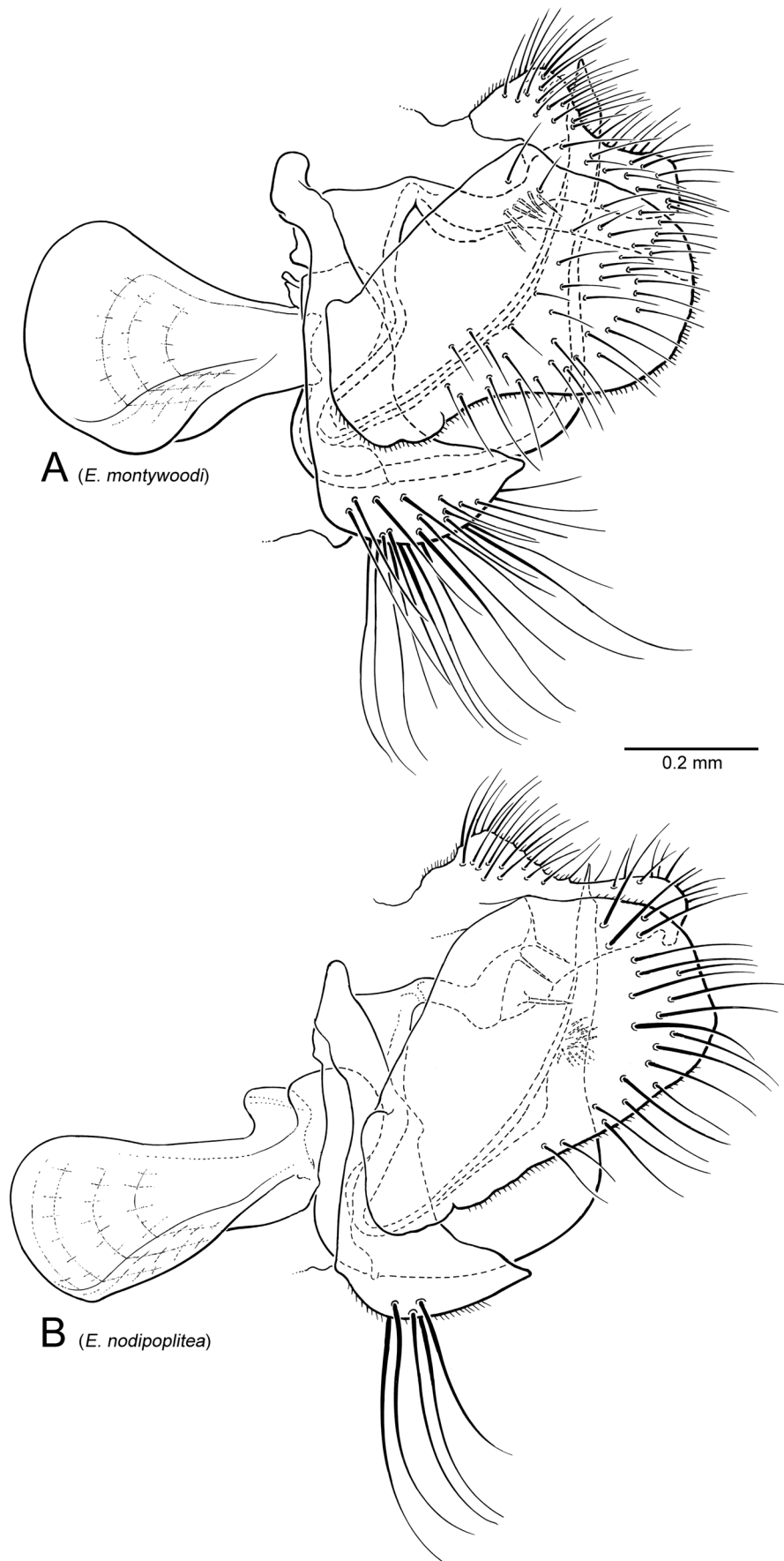


FIGURE 13. Male terminalia, lateral view of *E.* (*Enoplempis*). **A**, *E. montywoodi*; **B**, *E. nodipoplitea*.

Thorax mostly yellowish in ground-colour but with darkened scutum; postpronotum, notopleuron, postalar ridge, posteromedial region of scutum and scutellum yellowish brown. Scutum with pair of distinct blackish vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression; with greyish pruinose vittae along acr and dc rows. Pleura entirely yellowish. Proepisternum with several short, dark setae on upper part; prosternum bare. Anteppronotum with row of short dark setae. Postpronotum with several short dark setae and 1 long seta. Scutum with inconspicuous, uniserial row of fine acr setulae ending at transverse suture; dc row slightly stronger than acr; 1 strong posterior npl, with several weak anterior npl setae; 1–3 weak presut spal; 1 weak psut spal; 1 strong pal. Scutellum with pair of short sctl, similar to pal, 1–2 marginal setulae. Laterotergite with 2 long dark setae and 1 lower setula. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral and apical setae, longer and stouter along apical anterior margins. Hind trochanter lacking spine-like or modified setae. Femora clothed in short dark setae, setae longer at apex, mid and hind femora with distinct anterior preapical seta. Hind femur slender in proximal 2/3, apical third slightly swollen bearing anteroventral brush-like tuft of setae adjacent to posteroventral thumb-like process (Fig. 12A), with more distally positioned conical process ventrally. Fore tibia clothed in dark setae, shorter than width of tibia, setae dense and shorter along anterior surface; 3 posteroventral setae and 4 preapical setae. Mid tibia clothed in dark setae, shorter than width of tibia; 2–3 anterodorsal, 2 posterodorsal, 2 posteroventral and 6 preapical setae. Hind tibia weakly bowed medially, clothed in dark setae, shorter than width of tibia; basally with pair of blunt ventral processes, each with narrow brush of long, black apical setae (Figs 12A, B), distal process with anteroventral fringe of long setae proximal to base; 3 anterodorsal, 4 posterodorsal setae and 5 preapical setae. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen.

Wing clear with brownish veins; all veins complete (except Sc), well sclerotized. Basal costal seta indistinct from surrounding costal setae. R_5 and M_1 parallel near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdominal tergites 1–7 mainly dark, concolorous with scutum with marginal setae distinct and dark; sternites 1–7 pale with pale setae. Segment 8 with marginal setae dark, longer than preceding segment. Pregenital segments unmodified; sclerites of segment 8 weakly fused to form complete ring, not weakly sclerotized dorsally. Terminalia (Fig. 13A) largely yellow. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal margin lacking tooth-like projection at inner apex; posterior end simple, truncate; clothed in setae. Hypoproct with several long setae. Epandrial lamella largely clothed with short setae, posterior margin rounded. Hypandrium prolonged posteriorly with rounded margin, about 0.5× as long as epandrium; with numerous long setae, about equal to length of hypandrium. Phallus with broad base, apical portion straight; apex just emerging beyond cercus; ejaculatory apodeme slightly shorter than length of epandrium; inverted Y-shaped, with short median keel.

Female. Unknown.

Geographical distribution and seasonal occurrence (Fig. 18B). *Empis (En.) montywoodi* is known only from the holotype collected from Gatineau, Quebec in mid-June.

Etymology. This species is named after colleague, mentor and friend Dr. Monty Wood who collected the unique holotype.

Nuptial gift presentation. Form unknown.

***Empis (Enoplempis) nodipoplitea* Steyskal**

(Figs 2E, 12C, 13B, 14A)

Empis nodipes Melander, 1902: 324. Type locality: Magdalena, New Mexico, USA. [Junior primary homonym of Fallén, *Empis nodipes* 1816].

Empis nodipoplitea Steyskal (in Melander, 1965: 460), n. name for *nodipes*, see “Taxonomic notes” below.

Type material examined. HOLOTYPE ♂, labelled: “Magdalena, New Mexico.”; “W.M. Wheeler/ Collection.”; “TYPE/ No./ A.M.N.H. [red label]”; “Am. Mus. Nat. Hist./ Dept. Invert. Zool./ No. 966”; “HOLOTYPE ♂/ nodipes Melander/ (= nodipoplitea/ Steyskal)/ teste WJ Turner ’82 [red label]” [missing abdomen] (AMNH).

Additional material examined. CANADA. Ontario: Fathom Five NP, North Cove Island, dry cedar p.m. sweeps, 25.vi.1995, S.A. Marshall, debu00073542 (1 ♂, DEBU). Quebec: Mt. St. Hilaire, 500–700 ft., 4.vi.1963, J.R. Vockeroth

(1 ♂, CNC); Mt. St. Hilaire, 4.vi.1968, J.G. Chillcott (1 ♂, 1 ♀, CNC). **Saskatchewan:** Rockglen, 49°11'N 105°56'W, 21.vi.1955, J.R. Vockeroth (3 ♂, 2 ♀, CNC); Scout Lake, 49°20'N 106°0'W, 17.vi.1955, J.R. Vockeroth (1 ♂, 1 ♀, CNC). Also western specimens from Alberta, Colorado, and Montana (to be detailed in study of western species).

Taxonomic notes. *Empis nodipes* Melander, 1902 is a junior primary homonym of *Empis nodipes* Fallén, 1816. Steyskal published a replacement name for *E. nodipes* Melander in the Nearctic Diptera catalogue (in Melander 1965). The senior primary homonym is now assigned as *Rhamphomyia (Megacyttarus) nodipes* (Fallén).

Diagnosis. This species is distinguished by hind femur with anteroventral preapical row of stout setae; base of hind tibia with pair of antero- and posteroventral rows separated by clear gap; hypandrium with setae longer than length of sclerite

Re-description. Wing length 5.7–6.4 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of equal size. Frons divergent towards antennae; below ocellar triangle slightly wider than anterior ocellus, bearing short, dark setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin pale and shining. Ocellar triangle dark, subshining, with pair of short, parallel ocellar setae and pair of shorter posterior setae. Occiput bearing row of short postocular setae, black on upper section; slightly shorter and paler on lower section; occipital setae black, longer and stouter than postocular setae. Postpedicel and stylus dark; scape, pedicel and extreme base of postpedicel usually slightly paler or orange-brown. Scape nearly 2.5× longer than pedicel; postpedicel more than 4× longer than basal width, 2.5× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely reddish yellow; apex and base of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose; apex of postpronotum, postalar ridge and ventroapical margin of scutellum yellowish. Scutum with pair of distinct dark, brownish vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression. Pleura grey, with yellowish margins of some sclerites. Proepisternum with several short, dark setae; prosternum bare. Antepronotum with row of short dark setae. Postpronotum with several short dark setae and 1 long seta. Scutum with inconspicuous, sparse biserial row of fine acr setulae; dc similar to acr, increasing in length posteriorly; 1–2 posterior npl, with several anterior npl setulae; 1 presut spal; 1 psut spal; 1 pal. Scutellum with pair of short setae, shorter than pal, lacking marginal setulae. Laterotergite with 3–4 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral and apical setae, longer and stouter along apical anterior margins. Hind trochanter lacking spine-like or modified setae. Fore femur with anteroventral row of short setae; mid femur with posteroventral row of short setae; hind femur with antero- and posteroventral rows of short setae. Hind femur very slender on proximal half, subapex of hind femur thickened into short, broad protuberance; anteroventral margin of protuberance with tight row of dark setae (Fig. 12C), shorter than width of femur. Fore tibia with short, dense setae along anterior face; several stout erect setae on dorsal and posteroventral faces, and apex. Mid tibia clothed in long dark setae, shorter than width of tibia; 2–3 anteroventral, 4 posterior, 2–3 anterodorsal, 3 posterodorsal, 2–3 posteroventral and several preapical setae. Hind tibia with flattened and bare area opposite protuberance on hind femur; short rows of dense dark setae on either side of bare zone, shorter than width of tibia (Fig. 12C); 4–5 antero- and posterodorsal setae and several preapical setae. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen.

Wing clear with yellowish veins; all veins complete (except Sc), well sclerotized. Basal costal seta short, inconspicuous, slightly stouter and longer than surrounding costal setae. R_5 and M_1 somewhat divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen dark, concolorous with thorax, posterior margin with paler band, sternites yellowish; marginal setae distinct and dark on all tergites. Marginal setae on segment 8 longer than preceding segment. Pregenital segments unmodified; sclerites of segment 8 weakly separated, not weakly sclerotized dorsally. Terminalia (Fig. 13B) largely yellow. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal margin jagged, lacking tooth-like projection at inner apex; posterior end produced ventrally into narrow cylindrical projection, directed medially; clothed in setae, anterior setae longer than width of cercus. Hypoproct with 2–3 long setae. Epandrial lamella subquadrate, posterior margin truncate, bearing short subapical setae. Hypandrium shorter than base of phallus, with rounded apical margin; base with several dark setae, longer than hypandrium. Phallus with broad base, with cluster of microtrichia beyond expanded base; apical portion straight, slightly tapered; apex not emerging beyond cercus; ejaculatory apodeme nearly 0.67× length of epandrium; inverted Y-shaped, with short median keel.

Female. Similar to male, except as follows: frons slightly broader; modified setae of hind femur and tibia lacking; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 14A). *Empis* (*En.*) *nodipoplitea* is primarily distributed in western North America (Alberta, Montana, Colorado and New Mexico), with a few eastern records in Saskatchewan, Ontario and Quebec. In the eastern part of its range, adults have been collected in June.

Nuptial gift presentation. Form unknown.

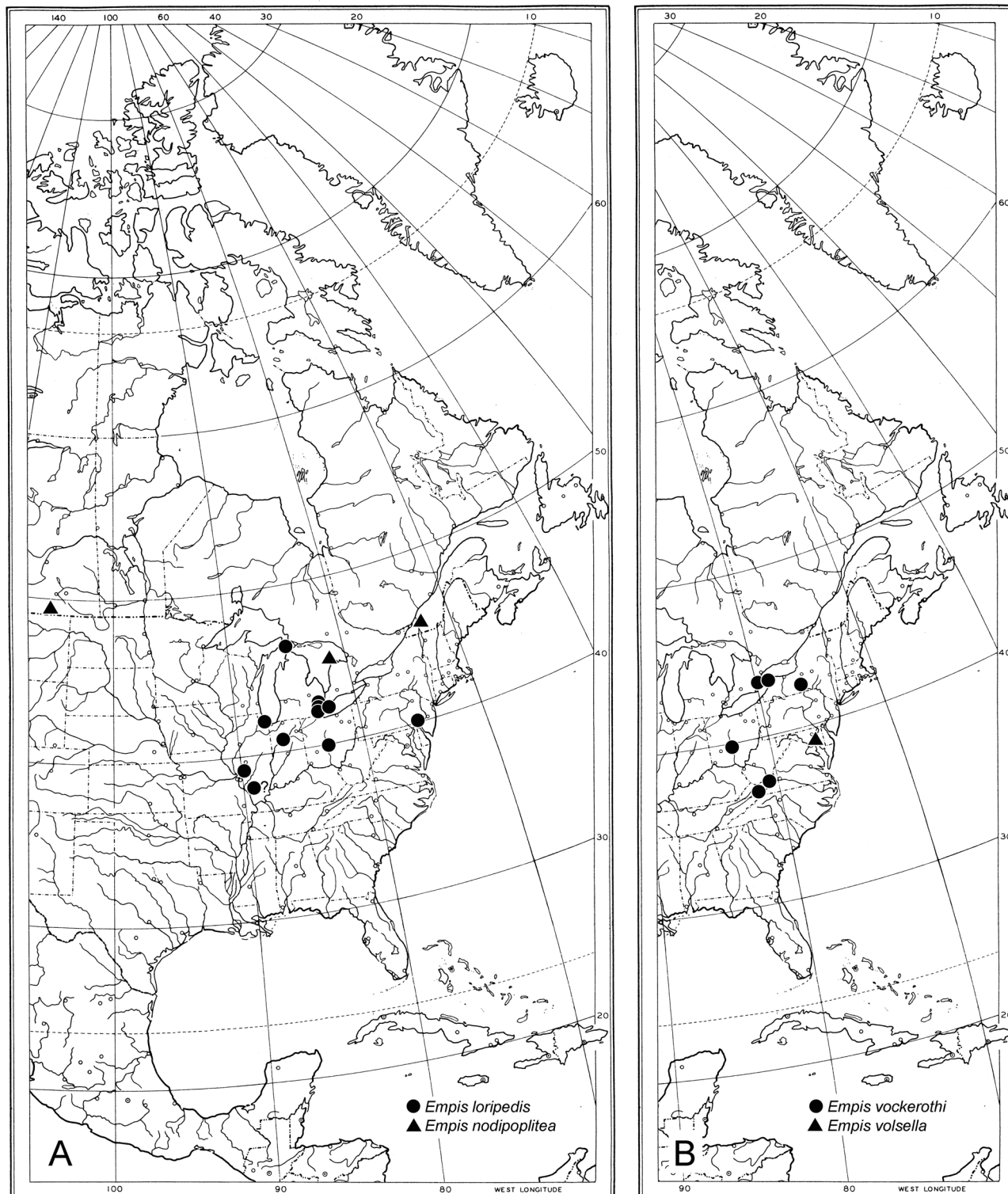


FIGURE 14. Distribution of *E.* (*Enoplempis*). **A.** *E. loripedis* and *E. nodipoplitea*; **B.** *E. vockerothi* and *E. volsella*.

***Empis (Enoplempis) nuda* Loew**

(Figs 12D, E, 15A, 18A)

Empis nuda Loew, 1862: 195. Type locality: Illinois, USA.

Type material examined. HOLOTYPE, ♂ labelled: “Type/ 1104 [red label with white top border]”; “Illinois/ Barron. [green label]”; “Loew”; “nuda/ m”; “HOLOTYPE/ *Empis* ♂/ *nuda*/ Loew/ teste WJ Turner [re label]” [dissected; hindlegs mounted on card] (MCZ).

Additional material examined. CANADA. Ontario: Essex Co., Point Pelee NP, Visitor’s Centre, MT, 29.v.-9.vi.2000, O. Lonsdale (1 ♂, DEBU); Leamington, Point Pelee NP, 14.vi.1984, B.V. Brown (3♂, DEBU); Simcoe, 2.vi.1939, G.E. Shewell (3 ♂, CNC); Wellington Co., Arkell, damp cedar stand, 31.v.2002, O. Lonsdale (2 ♀, DEBU). USA. Illinois: Chicago, 9.v.1896, W.M. Wheeler (1 ♂, 1 ♀, AMNH). New Jersey: Baleville, 28.v.1935, C.H. Curran (3 ♂, AMNH); Branchville, 13.v.1931, C.H. Curran (2 ♂, AMNH); Greenwood Lake, 19.v.1918, F.M. Schott (1 ♂, USNM). New York: Cooks Falls, 5.vi.1930, S.W. Bromley (1 ♂, USNM); Ithaca, 15.v.1915, 14.v.1916 (3 ♂, CUIC, USNM); Ithaca, 23.v.1936, H.K. Townes (1 ♂, USNM). Pennsylvania: Centre Co., Spring Ck, 550 ft., 2 mi S Bellefonte, 21.v.2005, J.B. Runyon (1 ♂, MTEC); Dauphin Co., Grantville, 24.v.1962, J.R. Vockeroth (2 ♂, CNC); Spring Branch, 23.v.1945, DDT Expt. (1 ♂, USNM).

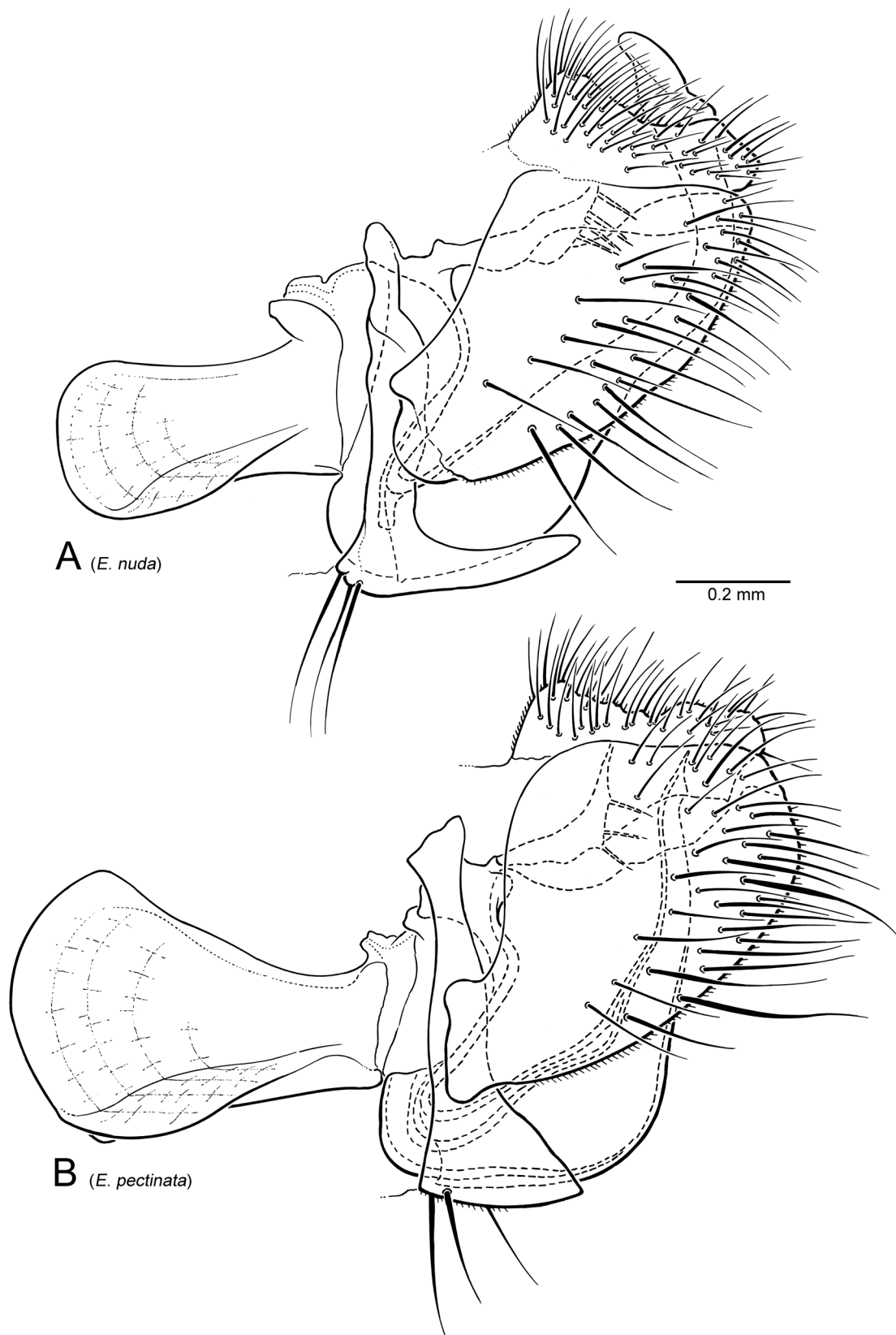
Diagnosis. This species is distinguished by the setae of hind trochanter confined to distinct tubular process, paint brush-like; hind tibia with rows of long slender dorsal setae, longer than width of tibia; hypandrium 0.5× length of epandrium, apex tapered and rounded; setae present on membrane anterior to base of hypandrium.

Re-description. Wing length 6.2–7.6 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons, postgena and occiput. Dichoptic, eye with ommatidia of equal size. Frons divergent towards antennae; below ocellar triangle slightly wider than width of anterior ocellus, bearing short setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin shining. Ocellar triangle dark, subshining, with pair of parallel ocellar setae and pair of posterior setulae 0.5× length of ocellar setae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout. Postpedicel, stylus and scape mostly dark; somewhat paler at inner base of postpedicel and inner apex of pedicel. Scape about 2× longer than pedicel; postpedicel more than 4× longer than basal width, 3× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellowish; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose: postpronotum, supra-alar ridge and lower margin of scutellum yellowish orange. Scutum with pair of distinct dark vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression. Pleura entirely grey, lacking paler highlights. Proepisternum greyish, with several short dark setae; prosternum bare. Anteppronotum with row of short, stout dark setae. Postpronotum with 1–2 long, dark setae and 3–6 shorter setae. Scutum with sparse row of fine acr setulae; dc longer than acr, increasing in length posteriorly; 1–2 posterior npl, 1 anterior npl and several shorter dark setae; 1 short presut spal; 1 psut spal; 1 pal. Scutellum with 2 pairs of setae, apical pair subequal in length to pal, outer pair shorter than apical pair. Laterotergite with 2–4 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter with setae confined to distinct tubular process, paint brush-like; usually setae tightly appressed and tapered to pointed apex (Fig. 12D). Femora lacking posteroventral row of fine setae; hind femur with anteroventral row of short, slender setae with dark, stout seta on apical 0.25; hind femur long and cylindrical, somewhat swollen subapically (Fig. 12E), with several preapical anterior setae. Fore tibia clothed in long dark setae, shorter than width of tibia; with 2–3 dorsal, 3–4 posterodorsal, 4–5 posterior, 3–4 posteroventral and several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; 2 anteroventral, 3–4 anterodorsal, 3 anterior, 3–4 posterodorsal, 4 posterior, 1–2 posteroventral and several preapical setae. Hind tibia with 5 antero- and posterodorsal setae, several posterior, posteroventral and preapical setae, mostly distinctly longer than width of tibia (Fig. 12E). Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 somewhat swollen, similar in size to hind tarsomere 1, with long outer setae.

Wing clear with yellowish brown veins; all veins complete (except Sc), well sclerotized. Basal costal seta not distinguished. R₃ and M₁ divergent near wing margin; R₃ ending beyond wing tip; radial fork acute. Halter yellow.



A (*E. nuda*)

0.2 mm

B (*E. pectinata*)

FIGURE 15. Male terminalia, lateral view of *E.* (*Enoplempis*). **A**, *E. nuda*; **B**, *E. pectinata*.

Abdomen concolorous with pleura, paler along apical margin; marginal setae long and stout on tergites 1–7. Marginal setae on tergite 8 longer than length of sclerite. Pregenital segments unmodified; sclerites of segment 8 weakly separated, not weakly sclerotized dorsally. Terminalia (Fig. 15A) largely yellow, except dorsal margin of cerci dark. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal margin with broad preapical, tooth-like projection. Hypoproct with upper half clothed with many long setae. Epandrial lamella subtriangular, posterior margin curving dorsally, bearing short apical setae. Hypandrium prolonged posteriorly with rounded margin, about 0.5× as long as epandrium; base with several short, dark setae on membrane anterior to base, more than 0.5× length of hypandrium. Phallus with broad base, with deep attenuation near base; sharply bent on apical half; apex just emerging beyond cercus; apex of phallus broadly expanded, scoop-like; ejaculatory apodeme 0.75× length of epandrium; inverted Y-shaped, with median keel reduced.

Female. Similar to male, except as follows: frons slightly broader; hind trochanter lacking paint brush-like process; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 18A). *Empis (En.) nuda* is known from southern Ontario and the northeastern USA (Illinois, New York, Pennsylvania and New Jersey). Adults have been collected from early May to mid-June.

Nuptial gift presentation. Form unknown.

***Empis (Enoplempis) pectinata* Sinclair sp. nov.**
(Figs 15B, 16A, 18B)

Type material. **HOLOTYPE**, ♂ labelled: “Great Smoky Mt./N.P.,N.C. Tenn./18-VI-1957/ W.R.M. Mason”; “Indian Gap/ 5200’ ”; “HOLOTYPE/ *Empis (Enoplempis) pectinata*/ Sinclair [red label]” (CNC). **PARATYPES:** **USA. N.C./TN:** Same data as holotype (1 ♀, CNC). **North Carolina:** Swain Co., GSMNP ATBI, MT 12, Plot: Andrews Bald, 35°32'30"N 83°29'39"W, 10–24.v.2001, I. Stocks, M. McCord., G. Middleton (5 ♂, 4 ♀, CNC).

Diagnosis. This species is distinguished by dense antero- and posteroventral rows of stout setae on basal 0.25 of the hind femur and tibia; epandrium truncate with rounded posterior margin.

Description. Wing length 7.0–7.8 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of equal size. Frons divergent towards antennae; below ocellar triangle slightly wider than anterior ocellus, bearing short, dark setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin pale and shining. Ocellar triangle dark, subshining, with pair of short, parallel ocellar setae and pair of shorter posterior setae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout; postgena with long, white silky setae. Postpedicel, scape and stylus dark brown; scape and extreme base of postpedicel slightly paler or orange-brown. Scape nearly 3× longer than pedicel; postpedicel nearly 4× longer than basal width, 3× longer than stylus. Palpus yellowish, with setulae dark. Proboscis largely reddish brown; apex and base of labrum darker; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose; apex of postpronotum shining. Scutum with pair of distinct dark, brownish vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression. Pleura entirely grey. Proepisternum with several short, pale setae; prosternum bare. Anteppronotum with row of short, stout dark setae. Postpronotum with 5 or more short, dark setae and 1 long seta. Scutum with inconspicuous, sparse biserial row of fine acr setulae; dc similar to acr, uniserial, increasing in length posteriorly; 2 posterior npl, with several anterior npl setae; 1 presut spal; 1 psut spal; 1 pal. Scutellum with pair of sclt, subequal in length to pal, with 1–2 pairs of additional marginal setae. Laterotergite with 3 long dark setae and 3–4 pale setae. Anterior and posterior spiracles pale.

Legs long, entirely reddish brown, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral and preapical setae, longer and stouter along preapical anterior margins. Hind trochanter lacking spine-like or modified setae. Fore femur lacking posteroventral row of setae; mid femur with sparse posteroventral row of short setae and stout anterior preapical seta; hind femur thickened apically with shallow, subapical, flattened ventral curvature; 1 distinct preapical anterior seta; apical 0.25 with antero- and posteroventral rows of spine-like setae (Fig. 16A), longer on posterior face. Fore tibia clothed in long dark setae, shorter than width of tibia; 5 antero- and posterodorsal setae; 3 posteroventral setae and several

preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; 3 anterior, 4 antero- and posterodorsal, 3 posteroventral and several preapical setae. Hind tibia with distinct projecting elbow-like swelling at base; about 8 antero- and posterodorsal setae; ventral setae dense, erect and longer at basal 0.25, not forming distinct rows (Fig. 16A). Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen and lacking long outer setae.

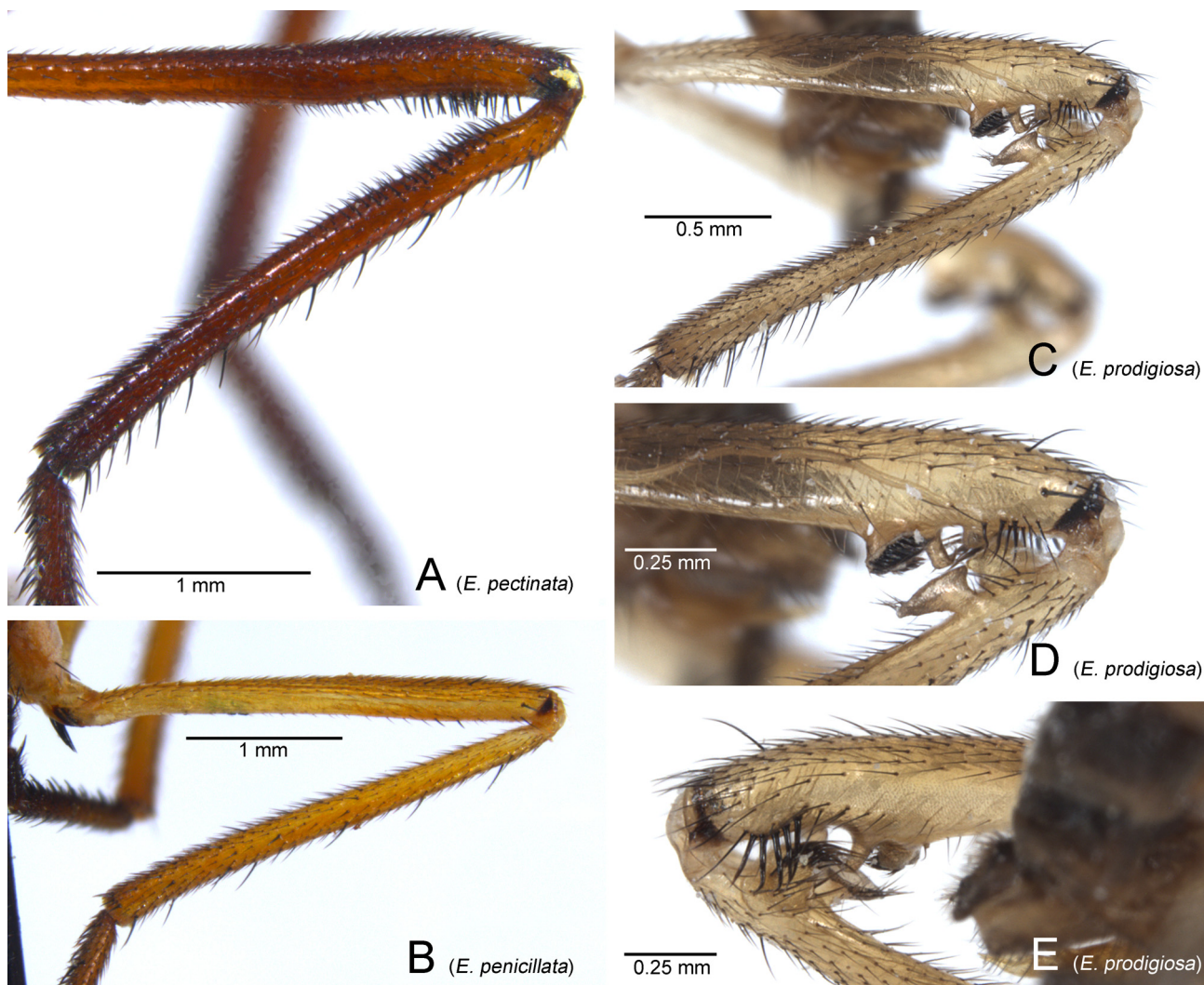


FIGURE 16. Male legs of *E. (Enoplempis)*. **A**, *E. pectinata*, hindleg, anterior view; **B**, *E. penicillata*, hindleg, anterior view; **C**, *E. prodigiosa*, hindleg, anterior view; **D**, *E. prodigiosa*, apex of hind femur and base of hind tibia, anterior view; **E**, *E. prodigiosa*, apex of hind femur and base of hind tibia, posterior view.

Wing clear with brownish veins; all veins complete (except Sc), M_1 narrower than other veins. Basal costal seta short, inconspicuous. R_5 and M_1 divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellowish.

Abdomen concolorous with thorax; marginal setae long and pale on segments 1–2 on tergites, marginal setae short, fine and pale on apical segments. Marginal setae on segment 8 longer and darker than preceding segment. Pregenital segments unmodified; sclerites of segment 8 fused laterally to form complete ring, not weakly sclerotized dorsally. Terminalia (Fig. 15B) largely yellow. Cercus narrow, appressed to dorsal margin of epandrium, linear, broader at anterior end; dorsal inner margin with tooth-like projection beyond mid-length; posterior end truncate, with ventral corner sharply pointed and arched medially; clothed in setae, longer than width of cercus. Hypoproct with 3 widely spaced, long setae. Epandrial lamella subquadrate, with rounded apex, bearing long subapical setae. Hypandrium shorter than base of phallus, with rounded apical margin; base with several dark setae, shorter than hypandrium. Phallus with broad base, apical portion slightly sinuous, tapered; apex arched posteriorly, not emerging beyond cercus; ejaculatory apodeme longer than epandrium; inverted Y-shaped, with short median keel.

Female. Similar to male, except as follows: frons slightly broader; modified setae of hind femur and tibia lacking; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 18B). *Empis* (*En.*) *pectinata* is known from the Great Smoky Mountains in North Carolina and Tennessee. Adults have been collected from mid-May to mid-June.

Etymology. The species name is derived from the Latin *pectinatus* (comb-like), in reference with the comb-like rows of setae on the hind femur.

Nuptial gift presentation. Form unknown.

Remarks. This species is most closely related to *E. ctenocnema* on the basis of hindleg chaetotaxy.

***Empis* (*Enoplempis*) *penicillata* Brooks sp. nov.**

(Figs 16B, 17A, 18B)

Type material. **HOLOTYPE**, ♂ from Virginia labelled: “Bath Co., VA/ 24 May 2002/ B. Kondratieff/ Blowing Sprgs/ Back Cr.”; “HOLOTYPE/ *Empis* (*Enoplempis*)/ *penicillata*/ Brooks [red label]” (USNM). **PARATYPES:** **USA. Virginia:** Giles Co.: Ripplemead, Rte 460 Bridge, 11–25.v.2008, 37°19'43"N 80°40'48"W, M. Zhang, ex. feeding on mayfly (1 ♂, DEBU); New River at highway 605, 625 intersection, 17.v.1997, D.C. Caloren (1 ♂, DEBU).

Diagnosis. This species can be recognized by the following combination of features: hind trochanter of males bearing a tight cluster of strong setae confined to distinct spot, not raised on tubercle; hind tibia of males with widely spaced setae, at most slightly longer than tibial width; hypandrium lacking setae.

Description. Wing length 6.7–7.6 mm. **Male.** Head entirely dark in ground-colour, with dense grey pruinescence. Dichoptic, eye with ommatidia of similar size. Frons below ocellar triangle as wide as or slightly wider than anterior ocellus, bearing short setulae along inner margin of eye; parallel-sided dorsally, sides diverging towards antennae. Face divergent towards mouthparts; bare, with oral margin dark, shining. Ocellar triangle grey pruinose, with pair of short, parallel, proclinate ocellar setae and 1–4 shorter posterior setulae. Occiput bearing 2–3 strong, black upper postocular setae with remainder of postocular row comprised of short black setae dorsally, ventrally with fine hairs; occipital setae black, similar in size to strong upper postoculars. Antenna entirely dark. Scape about 2× longer than pedicel; postpedicel about 4× longer than basal width, about 2.7× longer than stylus. Palpus pale yellow, with dark setulae. Proboscis light brownish, infuscated laterally; apex and base of labrum darkened; labellum with dark setae.

Thorax dark in ground-colour with dense grey pruinescence; posterior margin of postpronotum, postalar ridge, and posterior margin of scutellum yellowish brown. Scutum grey pruinose with pair of distinct blackish grey vittae between acr and dc rows. Pleura entirely grey pruinose. Proepisternum with 2–3 fine dark setae; prosternum bare. Anteppronotum with row of short dark setae. Postpronotum with several short dark setae anteriorly and 1 slightly longer posterior seta. Scutum with inconspicuous, uniserial row of fine acr setulae; dc row uniserial, similar to acr; 1 strong posterior npl, with 2–4 weak anterior npl setae; 1–2 fine presut spal similar to acr; 1 short psut spal; 1 strong pal with adjacent short pale pal. Scutellum with pair of short sctl, similar to pal, 1–2 marginal setulae. Laterotergite with 2–3 long dark setae and 0–3 setula. Anterior and posterior spiracles pale.

Legs long, coxae, trochanters femora and tibia entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi entirely dark. Coxae with scattered dark lateral and apical setae, setae longer and stouter along apical anterior margins, hind coxa with sparse patch of fine brown setae anteriorly. Hind trochanter of males bearing a tight cluster of strong setae confined to distinct spot (Fig. 16B), not raised on tubercle. Femora clothed in short dark setae, setae longer at apex, mid and hind femora with distinct anterior preapical seta. Hind femur slender, slightly swollen in apical half. Fore tibia clothed in dark setae, shorter than width of tibia, setae dense and shorter along anterior surface; 0–3 posterodorsal, 2–3 posteroventral, 0–4 posterior, and 5 preapical setae. Mid tibia clothed in dark setae, shorter than width of tibia; 0–2 dorsal, 2–5 anterodorsal, 2–6 anteroventral, 0–2 posterodorsal, 2–3 posteroventral, 0–2 ventral, and 6 preapical setae. Hind tibia clothed in dark setae, shorter than width of tibia (Fig. 16B); 3–6 anterior, 4–6 dorsal, 1–3 anterodorsal, 0–3 anteroventral, 1–3 ventral and 4–5 preapical setae. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen.

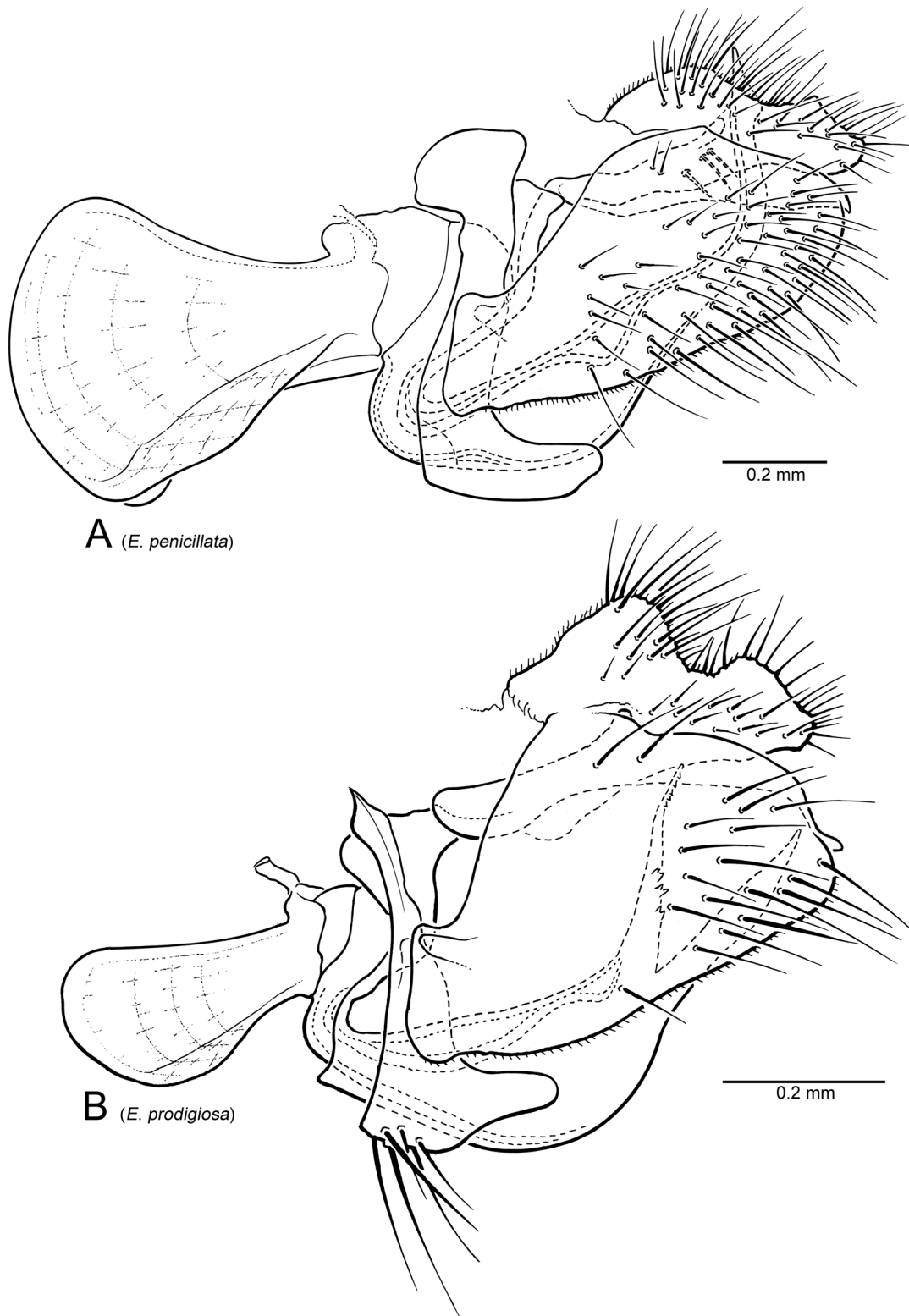


FIGURE 17. Male terminalia, lateral view of *E.* (*Enoplempis*). **A**, *E. penicillata*; **B**, *E. prodigiosa*.

Wing clear with brownish veins; all veins complete (except Sc), well sclerotized. Basal costal seta indistinct from surrounding costal setae. R_5 and M_1 parallel near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen concolorous with thorax, densely grey pruinose; setae pale except on segment 8 with dark marginal setae on tergite and sternite. Segment 8 with tergite and sternite closely approximate laterally; marginal setae longer than preceding segment, not weakly sclerotized dorsally. Pregenital segments unmodified. Terminalia (Fig.

17A) largely yellow. Cercus narrow, appressed to dorsal margin of epandrium, linear, slightly broader at anterior end; dorsal margin with tooth-like projection at inner apex; posterior end rounded in lateral view with medially projecting tooth-like projection on ventral margin. Hypoproct with several long setae. Epandrial lamella largely clothed with setae; posterodorsal margin with small process, bacilliform sclerite extending to base of process; posterior margin below process rounded. Hypandrium prolonged posteriorly with shallow notch on apical margin, about 0.33× as long as epandrium; lacking setae. Phallus with broad base, apical portion sharply bent upwards; apex just emerging beyond cercus; ejaculatory apodeme slightly shorter than length of epandrium; inverted Y-shaped, with short median keel.

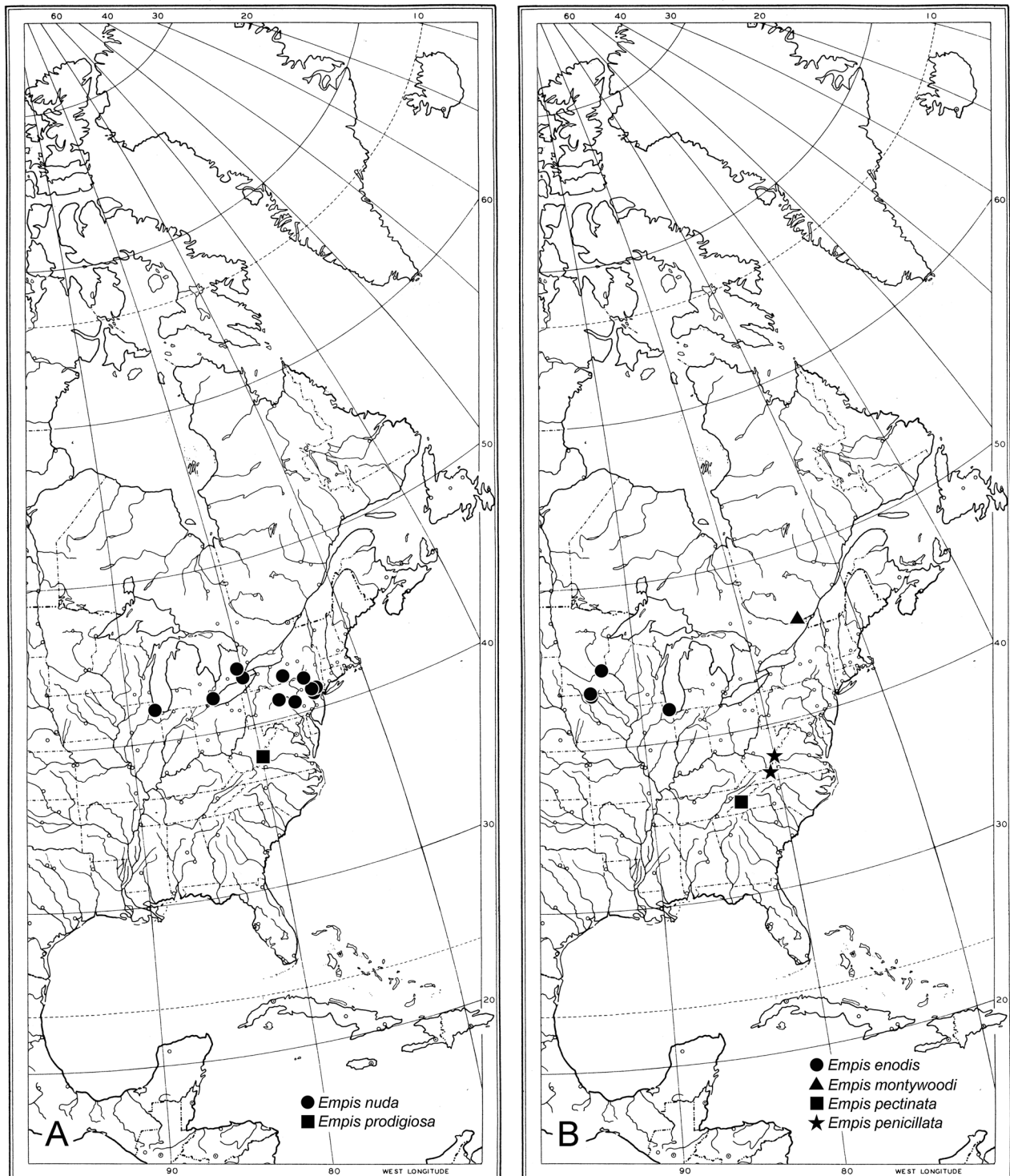


FIGURE 18. Distribution of *E. (Enoplempis)*. **A**, *E. nuda* and *E. prodigiosa*; **B**, *E. enodis*, *E. montywoodi*, *E. pectinata*, and *E. penicillata*.

Female. Unknown.

Geographical distribution and seasonal occurrence (Fig. 18B). *Empis (En.) penicillata* is known from the Allegheny Mountains in western Virginia. Adults have been collected in May.

Etymology. The specific epithet is Latin for paint brush and refers to the setal cluster on the male hind trochanter.

Nuptial gift presentation. A male specimen from Ripplemead (see “Type material”) included the observation “feeding on mayfly”. This probably indicates that males of this species present unwrapped prey to females as nuptial gifts.

Remarks. *Empis (En.) penicillata* is most similar to *E. (En.) nuda*. Both species have a similarly modified male trochanter; however, in *E. (En.) nuda* the setal cluster is raised onto a short tubercle unlike *E. (En.) penicillata* (compare Figs 12D and 16B).

***Empis (Enoplempis) prodigiosa* Cumming sp. nov.**

(Figs 16C, D, E, 17B, 18A)

Type material. **HOLOTYPE**, ♂ labelled: “[USA] Bath Co, VA/ 24 May 2002/ B. Kondratieff/ Blowing Sprgs/ Back Cr.”; “HOLOTYPE/ *Empis (Enoplempis) prodigiosa*/ Cumming [red label]” (USNM).

Diagnosis. This species is distinguished by a modified male hind femoral-tibial joint with a number of distinctive projections and setal combs at the base of the femur that articulate with a pair of blunt basiventral tibial processes, and a denticulate phallus that is flanked by stout lateral pointed projections.

Description. Wing length 6.0 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons and occiput, postgena yellowish. Dichoptic, eye with ommatidia of similar size. Frons parallel-sided, subequal to width of ocellar triangle, bearing short dark setulae along inner margin of eye. Face slightly divergent towards mouthparts, bare. Ocellar triangle dark, subshining, with pair of short, parallel, proclinate ocellar setae and several shorter posterior setulae. Occiput bearing 2 strong, black upper postocular setae with remainder of postocular row comprised of short black setae; occipital setae black, similar in size to strong upper postoculars. Postpedicel and stylus dark; scape and pedicel brownish. Scape 2× longer than pedicel; postpedicel more than 5× longer than basal width, about 4× longer than stylus. Palpus pale yellow with dark setulae. Proboscis largely pale; apex and base of labrum darkened; labellum with dark setae.

Thorax mostly yellowish in ground-colour but with darkened scutum medially. Scutum with 1 pair of broad blackish vittae between dc rows. Pleura entirely yellowish. Proepisternum with several short, dark setae on upper part; prosternum bare. Anteprototum with row of short dark setae. Postprototum with several short dark setae and 1 long seta. Scutum with inconspicuous, uniserial row of fine acr setulae ending at transverse suture; dc row uniserial, slightly stronger than acr, with 1 strong dc posteriorly; 1 strong posterior npl, with several weak anterior npl setae; 2 weak presut spal; 1 strong psut spal; 1 strong pal. Scutellum with pair of short sctl, similar to pal, 1 marginal setula. Laterotergite with 4 long, dark setae and 2 lower setula. Anterior and posterior spiracles pale.

Legs long, yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi brown, becoming darker apically. Coxae with numerous dark lateral and apical setae, longer and stouter along apical anterior margins. Hind trochanter lacking spine-like or modified setae. Femora clothed in short dark setae, setae longer at apex, mid and hind femora with distinct anterior preapical seta. Hind femur slender in proximal two-thirds, apical third (Figs 16C, D, E) swollen, bearing broad anteroventral cone of setae adjacent to slender posteroventral finger-like process, with more distally positioned knob ventrally; anteroventral and posteroventral setal combs present near apex. Fore tibia clothed in dark setae, shorter than width of tibia, setae dense and shorter along anterior surface with several preapical setae. Mid tibia clothed in dark setae, shorter than width of tibia; 1 anterodorsal, 3 anteroventral, 1 posterodorsal, 3 posteroventral and 6 preapical setae. Hind tibia weakly bowed medially, clothed in dark setae, mostly longer than width of tibia; basally with pair of blunt ventral processes (Figs 16C, D, E), proximal posteroventral process rounded with tuft of black setae, distal anteroventral process anvil-shaped with fringe of short setae apically; 4 dorsal, 2 anterodorsal, 2 anteroventral, 4 posterodorsal and 4 preapical setae. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 enlarged, slightly wider than tibia and longer than tarsomere 1 on mid and hindlegs.

Wing clear with brownish veins; all veins complete (except Sc), well sclerotized. Basal costal seta indistinct from surrounding costal setae. R_5 and M_1 parallel near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdominal tergites 1–7 mainly dark, concolorous with scutum medially, with marginal setae distinct and dark; sclerites 1–7 pale with pale setae. Segment 8 with marginal setae dark, longer than preceding segment. Pregenital segments unmodified; sclerites of segment 8 weakly fused to form complete ring, not weakly sclerotized dorsally. Terminalia (Fig. 17B) largely yellow, except cerci dark. Cercus broad at anterior end, narrow at posterior end, appressed to dorsal margin of epandrium; dorsal margin with rounded tooth-like projection at inner apex; posterior end simple, truncate; clothed in setae. Hypoproct lacking setae. Epandrial lamella subtriangular, bearing short apical setae; posterior margin with small process, bacilliform sclerite extending to base of process. Hypandrium prolonged posteriorly with broad notch on apical margin, more than $0.33\times$ as long as epandrium; base with several dark setae, subequal to length of hypandrium. Phallus with broad base terminating apically on each side in lateral pointed projection, medial denticulate apical portion sharply bent upwards with slender apex emerging at cercus; ejaculatory apodeme about $0.5\times$ length of epandrium; inverted Y-shaped, with short median keel.

Female. Unknown.

Geographical distribution and seasonal occurrence (Fig. 18A). *Empis* (*En.*) *prodigiosa* is presently known only from the holotype, which was collected in May in the Allegheny Mountains of western Virginia.

Etymology. From the Latin for extraordinary, in reference to the highly modified male hind femoral-tibial joint.

Nuptial gift presentation. Form unknown.

***Empis* (*Enoplempis*) *snoddyi* Steyskal**

(Figs 1D, 19A, 20A, 22A)

Empis snoddyi Steyskal, 1969: 292. Type locality: Clayton, Georgia, USA.

Type material examined. **HOLOTYPE**, ♂ labelled: “Rabun Co. Ga. & Macon Co. [NC], N. Cou. Line/ 10 mi. N. Clayton, Ga. Hwy 441 N./ 5-17-67 Coll. E.L. Snoddy”; “HOLOTYPE/ *Empis*/ *snoddyi*/ Steyskal/ 69701 [red label]” (USNM). **PARATYPES**: Same data as holotype (9 ♂ [3 with balloons], 1 ♀ [allotype], USNM). Remaining paratypes in collection of Georgia Experimental Station (not examined).

Additional material examined. **USA. Georgia:** 10 mi N Clayton, [Rabun] Co., Hwy 441 N, 17.v.1967, E.L. Snoddy (8 ♂, 1 ♀, USNM); Pine Mt., Rabun Co., 1400 ft., 15.v.1957, H.C. Hockett (1 ♀, CNC). **North Carolina:** 5 mi N Arrow Springs, 31.v.1965, J.G. Chillcott (8 ♂, 7 with balloons, CNC); Blue Ridge Pkwy, Pauls Gap, 2 mi E, 4700 ft., GSMNP, 8.vi.1965, J.G. Chillcott (5 ♂, CNC); Blue Ridge Pkwy, Waterrock Knob, 6 mi E, 3500 ft., mi 445, *Aruncus* blossoms, 9.vi.1965, J.G. Chillcott (2 ♂, 1 ♀, CNC); Buncombe Co., 4 km SW Black Mtn, MT, 21–27.vi.1986, W.E. Steiner (2 ♂, USNM); Cherokee-Newfound Gap, GSMNP, 4200 ft., 4.vi.1962, J.R. Vockeroth (1 ♀, CNC); GSMNP, Noland Divide Tr., 1700 m, 35°33'58"N 83°28'37"W, 30.v.–4.vi.2001, J. Skevington & J.M. Cumming (1 ♀, CNC); GSMNP, Noland Divide Tr., 1700 m, 35°33'58"N 83°28'37"W, 2, 4.vi.2001, J.M. Cumming (1 ♂, 1 ♀, CNC); Haywood Co., GSMNP, Purchase Knob, 1463 m, 11.vi.2008, B.J. Sinclair (1 ♂, 6 ♀, CNC); Highlands, 13, 22, 26, 29.v.1957, W.R.M. Mason (3 ♂, 6 ♀, CNC); Highlands, 16, 29.v., 7, 10, 20.vi.1957, at light, J.R. Vockeroth (3 ♂, 33 ♀, CNC); Highlands, Shortoff Mt., 4200–4800 ft., 23.v.1957, J.R. Vockeroth (4 ♀, CNC); Haywood Co., Soco Gap, 4337 ft., *Aruncus* blossoms, 4.vi.1962, J.G. Chillcott (1 ♂, 4 ♀, CNC); Macon Co., Wayah Bald, 20.v.1970, ROM Field Party (6 ♂, ROM); Macon Co., Highlands Bio Sta, MT, 27.v.–1.vi.1984, J.K. Liebherr (4 ♂, 4 ♀, CUIC); Macon Co., Coweeta Hydro. Lab, 35°03'N 83°26'W, MT, 11–15.v.1998, G.W. Courtney (1 ♂, 3 ♀, CNC); Swain Co., GSMNP, Clingmans Dome, Forney Ridge Tr., 1830 m, 12.vi.2008, A. Freidberg (1 ♂, 2 ♀, CNC); Swain Co., Indian Gap, Clingmans Dome Rd, 1 mi W, Newfound Gap, 3.vi.1995, J. Sadowski (1 ♂, USNM). **Tennessee:** Beech Gap, 5500 ft., with balloon, 23.vi.1947, R.H. Whittaker (3 ♂, 1 ♀, USNM); 10 mi W Bry[i]ceville, 27.v.1965 (1 ♀, CNC); Green Brier Cove, GSMNP, 12.vi.1946, R.R. Dreisbach (2 ♀, CNC). **NC/TN:** Indian Gap, 5200 ft, GSMNP, 28.v., 18.vi., 8.vii.1957, W.R.M. Mason (2 ♂, 3 ♀, CNC). **Virginia:** Amherst Co., summit, Cold Mtn, nr Hog Camp Gap, Appalachian Tr., 1256 m, 37°45'8"N 79°12'12"W, 7.vi.2001, J. Skevington (2 ♂, CNC); Blue Ridge Pkwy, Apple Orchard Mtn., 3600 ft., mi 38, blossoms of *Aruncus*, 19.vi.1965, J.G. Chillcott (1 ♂, CNC); Patrick Co., Vesta, 2800 ft., 30.v.1962, J.G. Chillcott (3 ♀, CNC); Smyth Co., Mt. Rogers, 4700–5300 ft., 1.vi.1962, J.R. Vockeroth (2 ♀, CNC).

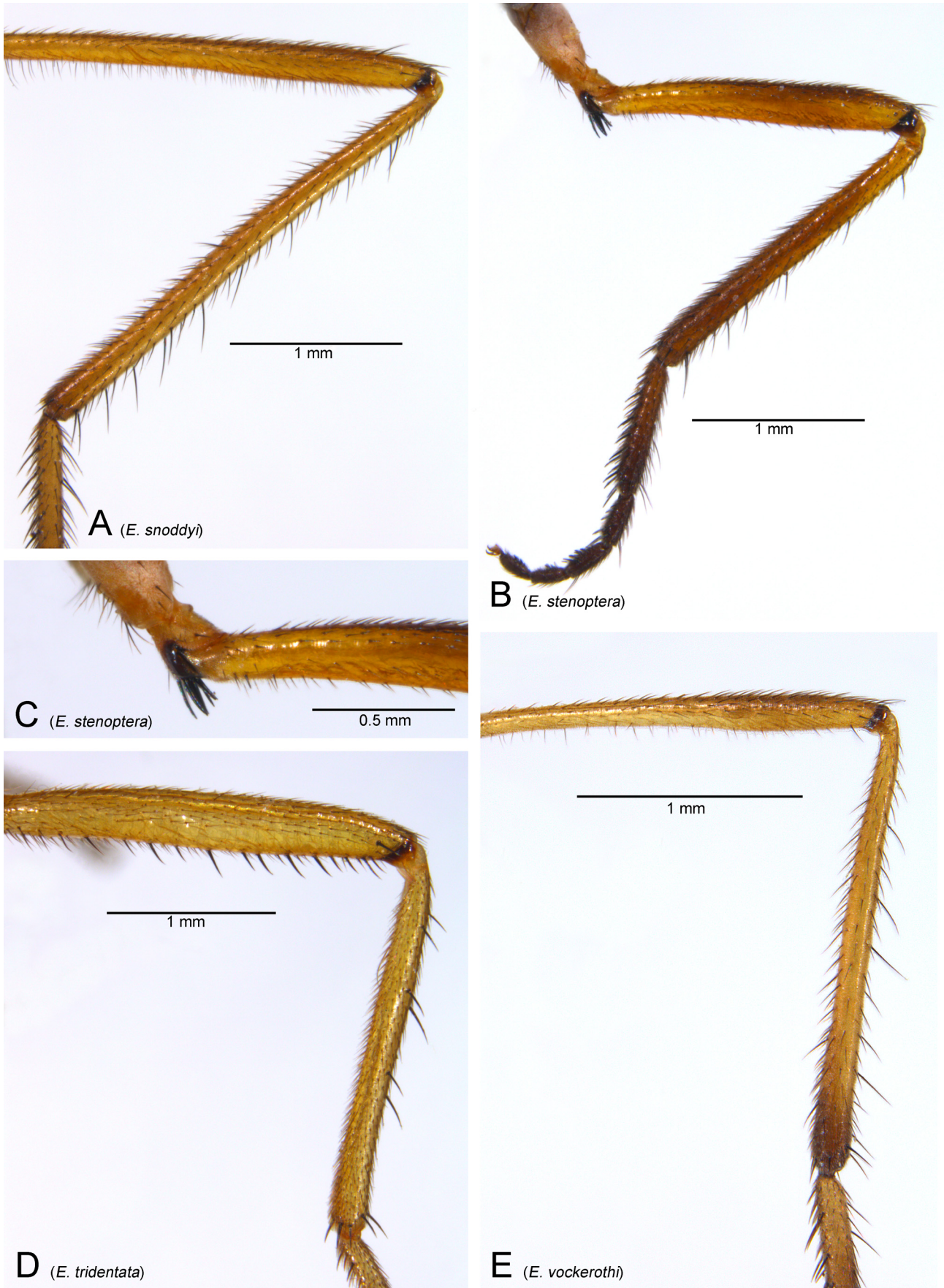


FIGURE 19. Male legs of *E. (Enoplempis)*. **A**, *E. snoddyi*, hindleg, anterior view; **B**, *E. stenoptera*, hindleg, anterior view; **C**, *E. stenoptera*, hind trochanter, anterior view; **D**, *E. tridentata*, hindleg, anterior view; **E**, *E. vockerothi*, hindleg, anterior view.

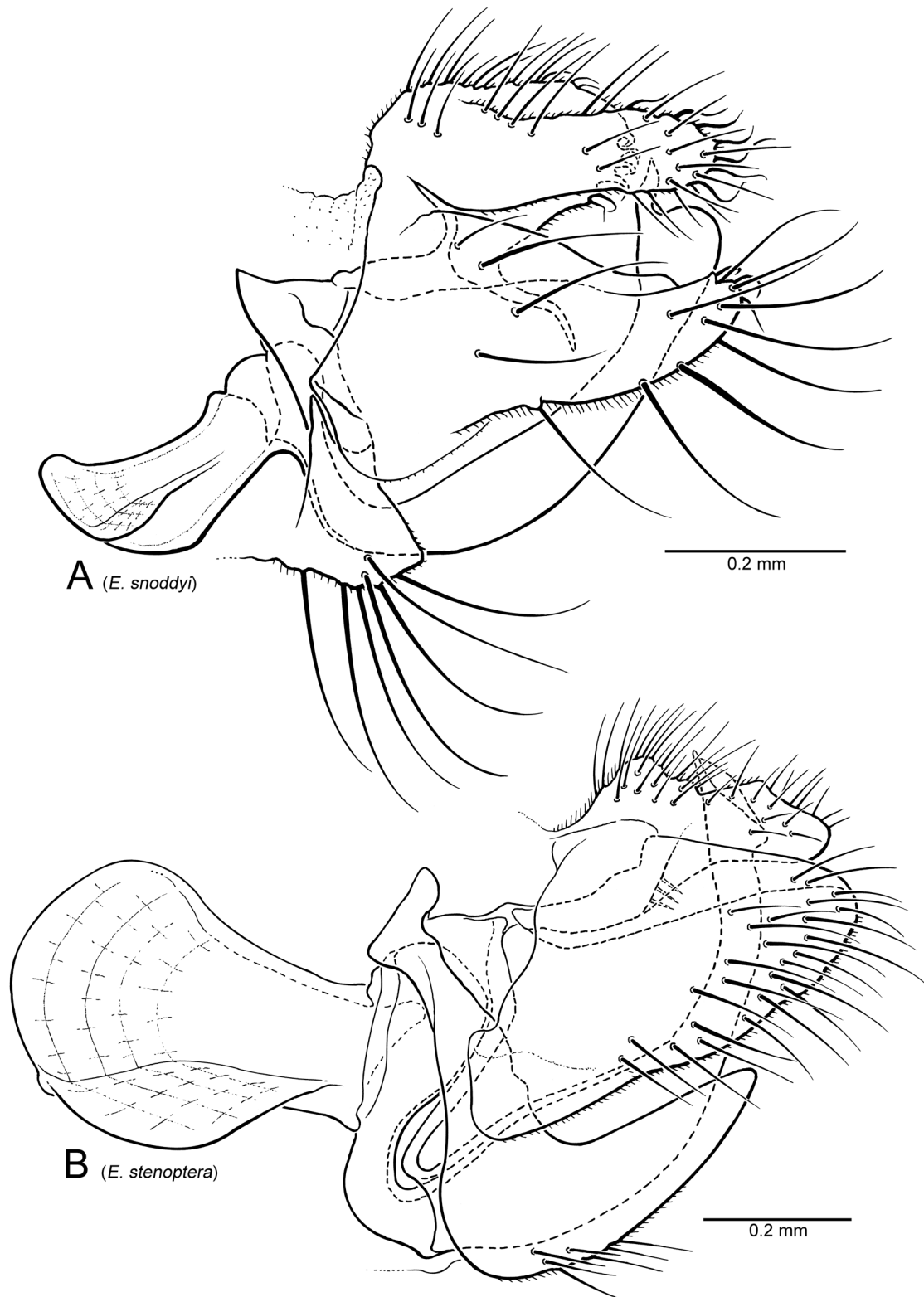


FIGURE 20. Male terminalia, lateral view of *E. (Enoplempis)*. **A**, *E. snoddyi*; **B**, *E. stenoptera*.

Diagnosis. This species is distinguished by nearly holoptic males; unmodified setae on hindlegs; apex of epandrium greatly narrowed; posterior margin of hypandrium truncate, not produced posteriorly; bearing long setae, greater than length of hypandrium; cercus broad apically.

Re-description. Wing length 5.0–8.4 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons, postgena and occiput. Very narrowly dichoptic, eye with ommatidia of equal size; short setulae

along separation of eyes; frons triangular above antennae. Face slightly divergent towards mouthparts; bare with oral margin shining. Ocellar triangle dark, subshining, with pair of parallel ocellar setae and pair of posterior setulae one-third length of ocellar setae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, longer and stouter than postocular setae. Postpedicel, stylus, pedicel and scape mostly dark; somewhat paler at inner base of postpedicel and inner apex of pedicel. Scape about 2× longer than pedicel; postpedicel more than 6× longer than basal width, 2.5× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellowish; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose: postpronotum, supra-alar ridge and lower margin of scutellum yellowish orange. Scutum with pair of very faint vittae between dc rows. Pleura grey, with yellowish margins of some sclerites. Proepisternum greyish, with several short, dark setae; prosternum bare with area between coxae yellowish. Anteppronotum with row of short setulae. Postpronotum with 1 long, dark setae and 3–4 shorter setae. Scutum lacking acr setulae; 8–10 dc short and slender, 0.5× length of posterior npl, increasing in length somewhat posteriorly; 1 posterior npl, 1 shorter anterior npl and several shorter dark setae; 1 presut spal, subequal in length to anterior npl; 1 psut spal; 1 pal. Scutellum with 2 pairs of setae, apical pair subequal in length to pal, outer pair shorter than apical pair. Laterotergite with 3–5 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter lacking modifications. Fore femur lacking ventral rows of fine setae; mid and hind femora with multiple rows of short, slender setae; hind femur long and cylindrical, barely swollen subapically (Fig. 19A). Fore tibia clothed in long dark setae, shorter than width of tibia; with 4–5 dorsal, 3–4 posterodorsal and several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia with few outstanding setae; 2–3 anterodorsal and several preapical setae. Hind tibia clothed in long dark setae, shorter than width of tibia, with row of numerous posterodorsal setae and several preapical setae; dorsal setae mostly distinctly longer than width of tibia (Fig. 19A). Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen and lacking long outer setae.

Wing clear with yellowish brown veins; all veins complete (except Sc), well sclerotized. Basal costal seta not distinguished. R_2 and M_1 divergent near wing margin; R_2 ending beyond wing tip; radial fork acute. Halter yellow.

Abdominal tergites dark brown, lacking grey pruinoscence, paler along apical and posterior margins; marginal setae long and stout on tergites 1–7; sternites pale brown. Marginal setae on tergite 8 longer than length of sclerite. Pregenital segments unmodified; sclerites of segment 8 closely approximated laterally, weakly sclerotized dorsomedially. Terminalia (Fig. 20A) largely yellow, except dorsal and apical margins of cerci dark. Cercus separated from dorsal margin of epandrium, divided into quadrate inner lobe and linear outer lobe arising subbasally; apical margin of inner and outer cercus with wavy dark, stout setae. Hypoproct lacking setae; with pair of elongate, slender, sickle-shaped projections, arched ventromedially. Epandrial lamella slender, elongate; slightly longer than cercus; subapical dorsal margin with short triangular projection. Hypandrium short, truncate posteriorly with straight margin, about 0.25× as long as epandrium; clothed with several dark setae, 2× length of hypandrium. Phallus broadly tubular, narrowed subapically with broadly rounded apex and slender, anterior apical filament; ejaculatory apodeme 0.67× length of epandrium; inverted Y-shaped, with median keel.

Female. Similar to male, except as follows: frons more widely separated than male, subequal to width of anterior ocellus; ventral setae on mid and hind femora shorter and not erect; hind femur with strong ventral preapical seta; cercus long and slender, subequal in length to tergite 8.

Geographical distribution and seasonal occurrence (Fig. 22A). *Empis (En.) snoddyi* ranges along the southern Appalachian Mountains from southern Virginia through the Great Smoky Mountains to northern Georgia. Adults have been collected from mid-May to early July.

Nuptial gift presentation. The mating system in *E. (En.) snoddyi* was described by Sadowski *et al.* (1999), where males produce and present a cylindrical, empty (prey-less) balloon to females. The balloons used by *E. (En.) snoddyi* resemble those made by *E. (En.) vockerothi* (cf. Figs. 1A, B). The production of balloons has not been observed for any species of *E. (Enoplempis)*, but the partially formed balloon held by the male of *E. (En.) snoddyi* in Figure 1D appears to be being formed by the male's mouthparts, presumably with salivary gland secretions. The photograph was taken at 1551 h in Great Smoky Mountains National Park (T. Bentley, pers. comm. 2013). Sadowski *et al.* (1999) indicated that males of *E. (En.) snoddyi* form mating swarms over landmarks (i.e., tree

stumps, bushes, rocks), for approximately three hours in the morning starting at daybreak, which are visited by females.

Remarks. Steyskal (1969) was not able to assign *E. (En.) snoddyi* to subgenus using the key by Melander (1928). Despite the unmodified male hindlegs, we confidently assign this species to *E. (Enoplempis)* on the basis of the ventral spine-like tarsal setae present on all legs.

***Empis (Enoplempis) stenoptera* Loew**

(Figs 19B, C, 20B, 22A)

Empis stenoptera Loew, 1864: 75. Type locality: New Hampshire, USA.

Type material examined. **LECTOTYPE** (here designated in order to fix identity of the species) ♂, labelled: “Type/ 1099 [red label with white top border]”; “N.H.”; “185”; “Loew.”; “stenoptera/ m” [dissected]; “LECTOTYPE/ *Empis stenoptera* Loew/ des. Sinclair, Brooks &/ Cumming 2013 [red label]” (MCZ).

Taxonomic notes. This species was described from an unknown number of specimens of both sexes, collected by Osten Sacken and sent by him to Loew for study. The designation of the lectotype clearly establishes the identity of this species.

Additional material examined. **CANADA. New Brunswick:** Jacquet River, 12.vi.1955, F.P. Ide (1 ♀, CNC). **Nova Scotia:** Cape Breton Highlands NP, P6715866, 29.vi.–3.vii.1984, H.J. Teskey (1 ♂, CNC). **Ontario:** Bells Corners, 21.v.1951, J.F. McAlpine (1 ♀, CNC); Orleans, Chapel Hill, 2.vi.1983, J.R. Vockeroth (4 ♂, 1 ♀, CNC). **Quebec:** Abbotsford, 14.vi.1937, G. Shewell (1 ♂, CNC); Gatineau Park, King Mtn. summit, 354 m, 45°29'20"N 75°51'45"W, 27.v.2004, J.M. Cumming (1 ♂, CNC); Lac Mondor, Ste. Flore, 22.vi.1951, at light, E.G. Munroe (1 ♂, CNC); Old Chelsea, 11.vi.1959, 14.vi.1987, J.R. Vockeroth (3 ♀, CNC); Old Chelsea, 30.v.1952, J.F. McAlpine (1 ♂, CNC). **USA. New Hampshire:** Coos Co., Pittsburg, 18.vi.1982, J.R. Vockeroth (7♂, CNC); White Mtns, Morrison (6 ♀, USNM). **New York:** Holland, 21.v.1911, M.C. Van Duzee (1 ♂, USNM). **Pennsylvania:** Centre Co., The Rock nr State College, liege, 22.v.1988, D.D. Wilder (2 ♂. 1 ♀, CAS). **Vermont:** St. Johnsbury, 28.vi.1906 (1 ♂, USNM).

Diagnosis. This small species, with wing less than 6 mm in length, is distinguished by the broadly separated male eyes; very short ocellar setae; stout setae of male hind trochanter widespread, not confined to distinct spot or process; hind tibia geniculate at base with sparse dorsal setae, shorter than width of tibia; hypandrium two-thirds length of epandrium, apex tapered with shallow broad notch, bearing several pairs of short setae.

Re-description. Wing length 5.0–5.6 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons, postgena and occiput. Dichoptic, eye with ommatidia of equal size. Frons parallel-sided towards antennae; slightly narrower than width of ocellar triangle, usually bearing several short setulae along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin shining. Ocellar triangle dark, subshining, with pair of very short parallel ocellar setae and pair of posterior setulae 0.5× length of ocellar setae. Occiput bearing row of short postocular setae, stout and black on upper section; shorter and slightly more slender on lower section; occipital setae black, stout, slightly longer than postocular setae. Postpedicel, stylus and scape mostly dark brown. Scape about 2× longer than pedicel; postpedicel less than 4× longer than basal width, 2.5× longer than stylus. Palpus yellow, with setulae dark. Proboscis and labrum largely reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinescent: postpronotum, supra-alar ridge and lower margin of scutellum yellowish orange. Scutum with pair of dark vittae between acr and dc rows; distinct pair of vittae lateral to dc and above notopleural depression. Pleura entirely grey, lacking paler highlights. Proepisternum greyish, with several short, dark setae; prosternum bare. Anteppronotum with row of short, stout dark setae. Postpronotum with 2 short, dark setae and several shorter setae. Scutum with sparse row of acr setae; dc subequal in length to acr, increasing slightly in length posteriorly; 1–2 posterior npl (usually one stout and long), 1 anterior npl and several shorter dark setae; 1 short presut spal; 0–1 psut spal; 1–2 pal. Scutellum with 2 pairs of short and stout sclt, apical pair subequal in length to pal, outer pair 0.5× length of apical pair. Laterotergite with 1–3 long dark setae. Anterior and posterior spiracles pale.

Legs short, usually yellowish brown, coxae mostly yellow, except for dark ring at trochanter-femur junction and apices of femora; tarsi becoming darker apically. Coxae with sparse dark lateral setae. Hind trochanter with cluster of spine-like setae not confined to distinct process (Figs 19B, C). Femora lacking posteroventral row of fine setae; hind femur with anteroventral row of short, slender setae little differentiated from surface setae; hind femur short and cylindrical, somewhat swollen subapically (Fig. 19B), with several preapical anterior setae. Fore tibia clothed in short dark setae, shorter than width of tibia; with only several distinct preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia with only several distinct preapical setae. Hind tibia with 3 tergites 3–4 antero- and posterodorsal setae (Fig. 19B), 1–5 posteroventral setae and several preapical setae; setae shorter than width of tibia. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slightly swollen, subequal in width to hind tarsomere 1.

Wing clear with brown veins; all veins complete (except Sc), well sclerotized. Basal costal seta not distinguished. R_5 and M_1 divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

Abdomen concolorous with pleura, tergites paler along posterior margin; marginal setae on tergites 1–7 short and dark, increasing in length posteriorly. Marginal setae on tergite 8 less than $0.5\times$ length of sclerite. Pregenital segments unmodified; sclerites of segment 8 weakly fused laterally to form complete ring, not weakly sclerotized dorsally. Terminalia (Fig. 20B) largely brownish yellow, except dorsal margin of cerci dark. Cercus narrow, appressed to dorsal margin of epandrium, linear, anterior and posterior ends subequal in width; dorsal margin with broad preapical, tooth-like projection. Hypoproct with several short setae. Epandrial lamella subtriangular, dorsal margin straight, bearing short apical setae. Hypandrium prolonged posteriorly with broad shallow notch on apical margin, about $0.67\times$ as long as epandrium; several short, dark setae posterior to base, less than $0.33\times$ length of hypandrium. Phallus with broad base, with deep attenuation near base; gradually curved on apical half; apex just emerging beyond cercus; apex of phallus broadly expanded, scoop-like; ejaculatory apodeme slightly shorter than length of epandrium; inverted Y-shaped, with median keel reduced.

Female. Similar to male, except as follows: frons slightly broader; stout ventral setae on hind trochanter absent; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 22A). *Empis (En.) stenoptera* is known from eastern Canada (Ontario, Quebec, New Brunswick and Nova Scotia) and the northeastern USA (New York, Pennsylvania, Vermont and New Hampshire). Adults have been collected from mid-May to early July.

Nuptial gift presentation. Form unknown.

Remarks. A female specimen from southern Manitoba appears to be conspecific, but males from this locality are required for verification.

***Empis (Enoplempis) tridentata* Coquillett**

(Figs 1G, 2B, 19D, 21A, 22B)

Empis tridentata Coquillett, 1901: 609. Type locality: Pennsylvania, USA.

Type material examined. **LECTOTYPE** (here designated in order to fix identity of the species) ♂, labelled: “Delaware Co/ 6[June].12.94 PA”; “CW Johnson/ Collector”; “Type/ No. 5491/ U.S.N.M. [red label]”; “*Empis tridentata*/ Coq.” [dissected]; “LECTOTYPE/ *Empis tridentata* Coquillett/ des. Sinclair, Brooks &/ Cumming 2013 [red label]” (USNM). **PARALECTOTYPE:** Same data as holotype (1 ♀, USNM).

Taxonomic notes. This species was based on two males and one female specimen, collected by C.W. Johnson. There are two males in the USNM with the same data as the lectotype, either of which could be the third syntype. Both lack the original type label found on the other two syntypes. The designation of the lectotype clearly establishes the identity of this species.

Additional material examined. **CANADA. Quebec:** Berthierville, 28.vi.1938, J. Ouellet (1 ♀, AMNH); Cté Vaudreuil, summit Mt. Rigaud, 16.vii.1993, D.M. Wood (1 ♀, CNC); Terrasse Vaudreuil, Molson Nature Reserve, MT, 16–25.vi.1999, S.E. Brooks (1 ♂, CNC). **USA. Connecticut:** Stamford, 5.vi.1936, B.T.R. Lab. Col. (1 ♀m USNM). **Georgia:** Forsyth Co., 2.vi.1970 (6 ♂, 1 ♀, CNC). **Maryland:** Beltsville, flowers of *Viburnum dentatum*, 18.vi.1916, W.L. McAtee (1 ♂, 2 ♀, USNM); Beltsville, 28.vi.1917, flowers of *Xolisma ligustrina*, L.O. Jackson (1 ♀, USNM); Laurel, 11.vi.1965, marsh edge (2 ♀, CNC); Laurel, 1.vii.1965, MT (1 ♀, CNC); nr Laurel, 20.vi.1967,

D.R. Smith (3 ♂, 1 ♀, USNM). **Massachusetts:** Amherst, 24.vi.1963, D. Meissner (1 ♂, USNM); Melrose Highlands, 1.vii.1911, J.D. Tothill (1 ♂, CNC); Middlesex Co., Lincoln, 6,12.vii.1982, E.T. Armstrong, MT, (9 ♂, 1 ♀, USNM). **Mississippi:** Lafayette Co., Spring 1943, iv–v.1946, F.M. Hull (10 ♂, 6 ♀, CNC); Tishomingo Co., Tishomingo State Park, Outcroppings Tr., waterfall, 34°36'32"N 88°10'31"W, 20.v.2013, J.M. Cumming (2 ♂, CNC); same locality except: stream at Pioneer Cabin, 34°36'19"N 88°11'36"W, J. Gelhaus, #1507 (1 ♀, CNC); Winston Co., Tombigbee NF, Spring Seep, along sandbottom str., MT, 33°15'18"N 89°05'29"W, 17–21.v.2013, J.M. Cumming (1 ♂, 1 ♀); Winston Co., Noxubee NWR, Loakfoma Ck at Dummy Line Rd, MT, 33°15'09"N 88°50'53"W, 17–21.v.2013, J.M. Cumming (1 ♀, CNC). **New Hampshire:** Same data as holotype (2 ♀, AMNH; 4 ♂, 3 ♀, USNM); Durham, 1.vii.1981, K. Tacewski (1 ♀, CNC); Grafton Co., Bridgewater, Whitmore Pt. on Newfound Lk, 26.vi.1998, 43.65°N 7.77°W, 27.vi.–5.vii.2004, MT, S.D. Gaimari (3 ♂, 1 ♀, CSCA); Hillsborough Co., Nashua, Long Hill, 20 m, 42°42'59"N 71°27'04"W, 27.vi.–5.vii.2004, MT, S.D. & A.V. Gaimari (14 ♂, 9 ♀, CNC). **New Jersey:** Long Branch, 9.vi.1913, C.W. Johnson (1 ♀, USNM); Woodbury, 27.vi.1896, C.W. Johnson (1 ♂, USNM). **New York:** Long Is., East Marion, 20.v.1929, R. Latham (1 ♀, CUIC). **Oklahoma:** Latimer Co., 4 mi SW Red Oak, 20.v.1993, J.M. Cumming (2 ♀, CNC). **Pennsylvania:** Roxborough, 14.vi.1908, C.T. Greene (1 ♂, USNM). **Rhode Island:** Westerly, 6.vii.1936, M. Chapman (1 ♂, USNM). **South Carolina:** Lexington Co., Lexington environs, yellow pans forest, 22–30.iv.2000, L. Masner (3 ♀, CNC). **Texas:** Shelby Co., Sabine NF, Boles Field, 304 ft., 23.iv.1990, Baumann & Nelson (1 ♂, CNC). **Tennessee:** Lynchburg, 26.v.1976, F.C. Harmston (1 ♂, CAS).

Diagnosis. This is one of the most distinctive species of this subgenus with patterned wings, three dark scutal vittae and darkly banded abdomen.

Re-description. Wing length 5.0–6.6 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of equal size. Frons divergent towards antennae; below ocellar triangle as wide as anterior ocellus, distinctly narrower at middle; setulae absent along inner margin of eye. Face slightly divergent towards mouthparts; bare with oral margin pale and shining. Ocellar triangle dark, subshining, with pair of slightly divergent ocellar setae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, long and stout; postgena with white silky hairs. Postpedicel, stylus and scape mostly dark; base of postpedicel and pedicel often slightly paler or orange-brown. Scape slightly more than 2× longer than pedicel; postpedicel length slightly less than 3× basal width, 2.5× longer than stylus. Palpus bright yellow, with setulae dark. Proboscis yellow; apex of labrum reddish brown; labellum with pale setae.

Thorax yellow in ground-colour, largely densely white pruinescent. Scutum with 3 distinct blackish vittae along acr and dc rows, acr vitta broader than dc vittae, coalescing in prescutellar depression. Pleura yellow, usually with darker shading posterior to spiracles, anterior to laterotergal setae and on ventral pleura. Proepisternum with several long, silky white setae; prosternum bare. Anteprepronotum with row of short, stout dark setae. Postpronotum with 3 dark setae and several short setae. Scutum with biserial row of fine acr setulae; dc increasing in length posteriorly, prescutellar seta subequal to sctl; 3 posterior npl, with several anterior npl setae; 1 presut spal; 1 psut spal; 1 pal. Scutellum with 2 pairs of long sctl, outer pair shorter. Laterotergite with 3 long dark setae and numerous long white silky setae. Anterior and posterior spiracles pale.

Legs long and stout, entirely yellow, except for dark ring at trochanter-femur junction and apices of femora; apical tarsi darker. Coxae with numerous dark lateral and apical setae, longer and stouter along apical anterior margins; anterior setae white, silky. Hind trochanter lacking modified setae. Fore femur inflated, wider than remaining femora; lacking rows of dark setae. Mid and hind femora with stout anterior preapical seta and several additional preapical setae; anteroventral row of spine-like setae present; mid femur with posteroventral row of black spine-like setae of various lengths, mostly confined to apical half; hind femur with poorly refined rows of short, black posteroventral setae (Fig. 19D). Fore tibia clothed in short fine setae; lacking stout erect setae, except for 3–4 anterodorsal setae and several preapical setae. Mid tibia clothed in short fine setae; 2 antero- and 2 posterodorsal setae, 1–3 posteroventral and several preapical setae. Hind tibia clothed in short fine setae; 4 antero- and posterodorsal setae (Fig. 19D) and several preapical setae. Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen and lacking long outer setae.

Wing with clouding at base of R₄, apex of discal cell, r-m crossvein, apex of basal cells and branching of Rs (Fig. 2B); all veins complete (except Sc), well sclerotized. Basal costal seta very long, subequal to outer sctl; 3 long black setae at ventral wing base. R₅ and M₁ divergent near wing margin; R₅ ending before wing tip; radial fork acute. Halter yellow.

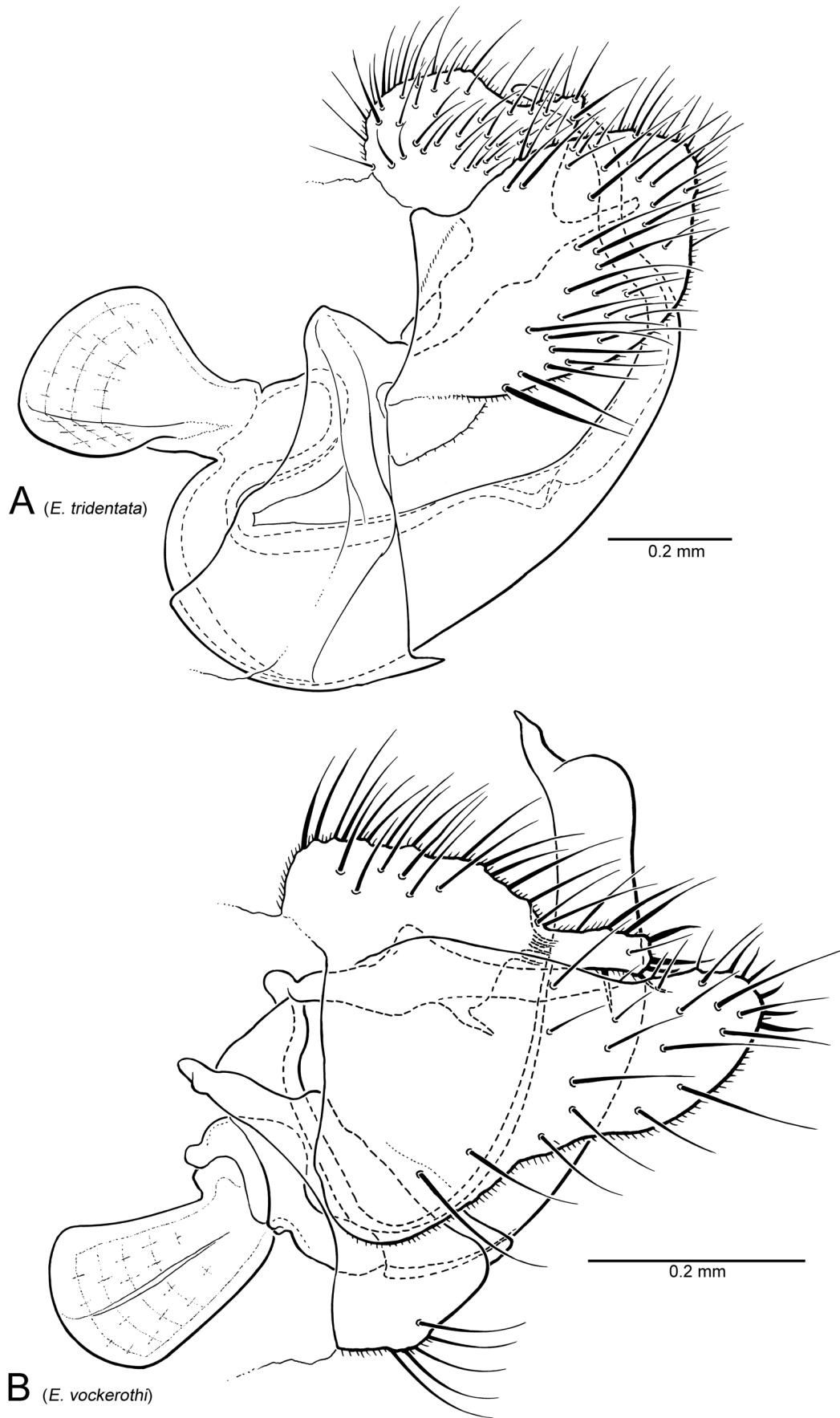


FIGURE 21. Male terminalia, lateral view of *E.* (*Enoplempis*). **A**, *E. tridentata*; **B**, *E. vockerothi*.

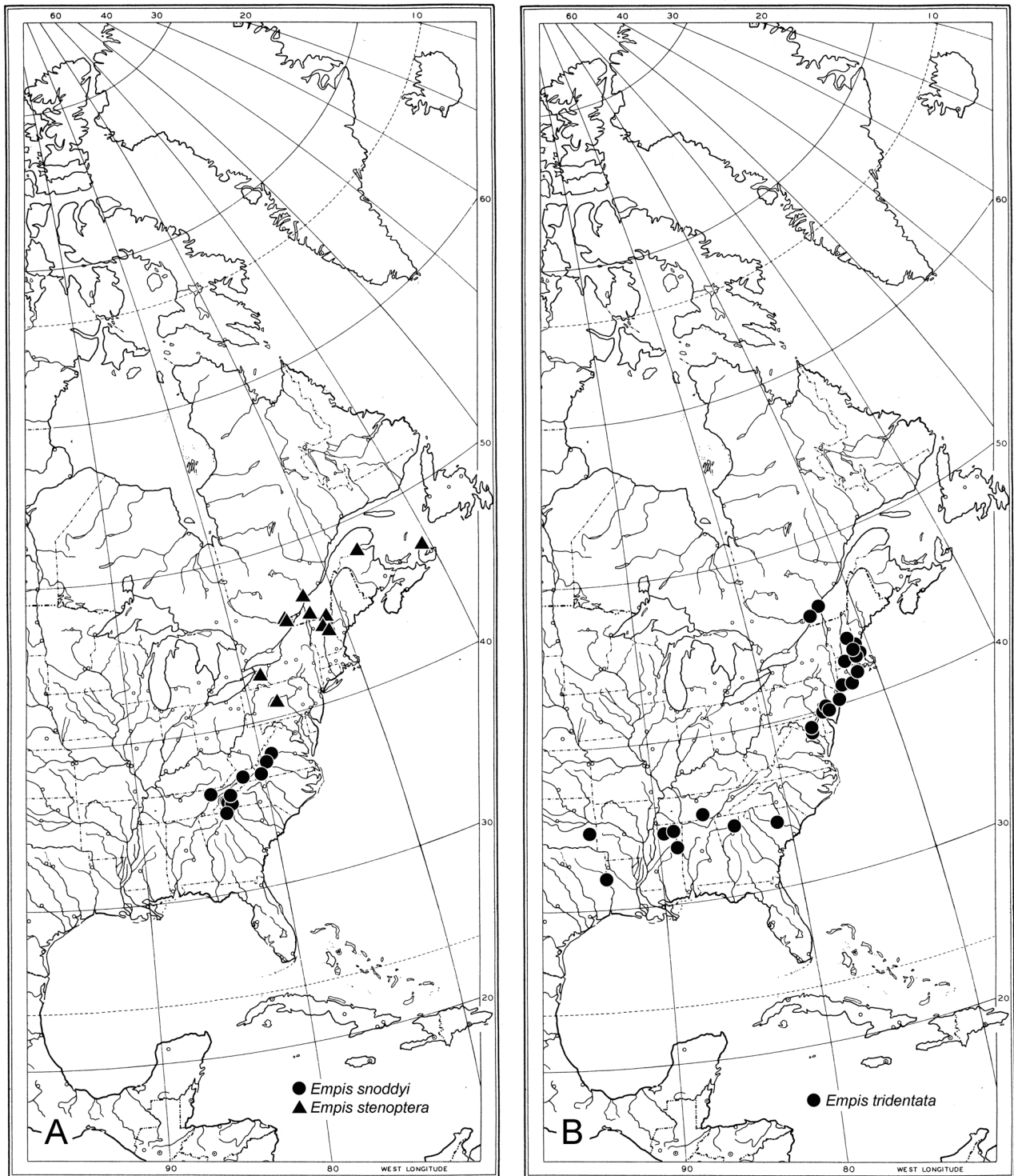


FIGURE 22. Distribution of *E. (Enoplempis)*. **A**, *E. snoddy* and *E. stenoptera*; **B**, *E. tridentata*.

Abdomen with broad, dark anterior band on tergites; tergites with dark marginal setae and clothed in shorter white setae. Marginal setae on segment 8 shorter than length of sclerites. Pregenital segments unmodified; sclerites of segment 8 widely separated, not fused, tergite weakly sclerotized anterodorsally. Terminalia (Fig. 21A) largely yellow. Cercus short, broad, separate from anterior margin of epandrium, broader at anterior end; posterior end truncate; clothed in setae, subequal in length to posterior width of cercus. Hypoproct with pair of slender, finger-like projections extending to either side of phallus. Epandrial lamella subquadrate, posterior margin somewhat truncate, bearing short apical setae. Hypandrium very reduced, with rounded apical margin, about 0.5× as long as

epandrium; lacking setae. Phallus with broad base, tapered, apical half sinuous; apex emerging beyond cercus; ejaculatory apodeme shorter than epandrium; inverted Y-shaped, with short median keel.

Female. Similar to male, except as follows: frons broader, as wide as ocellar triangle; spine-like setae of mid femur less numerous and slightly less stout; abdominal pleural membrane extensive and slightly darkened on segments 2–5, probably eversible; cercus long and slender, slightly shorter than tergite 8.

Geographical distribution and seasonal occurrence (Fig. 22B). *Empis* (*En.*) *tridentata* is a widespread species, ranging from west of the southern Mississippi river basin, north to southern Quebec. In the northern part of its range, it is apparently not found west of the Appalachian Mountains, except for outliers in the Laurentians. Adults of *E.* (*En.*) *tridentata* have been collected from late April to mid-July.

Nuptial gift presentation. Form unknown.

Remarks. Females have an extensive darkened abdominal pleural membrane that is probably eversible. This is usually considered a secondary sexual feature in female Empidinae, which is correlated with female swarming and sex-role reversal involving male choice (Cumming 1994).

Empis (*Enoplempis*) *vockerothi* Cumming sp. nov.

(Figs 1A, B, C, E, 14B, 19E, 21B)

Type material. **HOLOTYPE**, ♂ labelled: “Niagara Glen,/ Ont., 22.V.66/ J.R. Vockeroth”; “Bearing/ balloons”; “HOLOTYPE/ *Empis* (*Enoplempis*)/ *vockerothi*/ Cumming [red label]” (CNC). **PARATYPES: CANADA.**

Ontario: Dundas, below Borer’s Falls, 43°17'25"N 79°55'60"W, 5.vi.2011, 10.vi.2012, B.J. Sinclair (1 ♂, 7 ♀, CNC); Niagara Glen, 1.vi.1926, G.S. Walley (4 ♂, CNC); Niagara Glen, 29.v.1956, 43°8'N 79°3'W, J.R. Vockeroth (5 ♀, CNC); Niagara Glen, 22.v.1966, bearing balloons, J.R. Vockeroth (7 ♂, CNC). **USA. New York:** Tompkins Co., McLean Bogs Nat. Area Res., 20–27.v.1999, flight int. trap nr bog, H. Song & J.K. Liebherr (1 ♂, CUIC). **Ohio:** Hocking Co., Laurel Twp, Crane Hollow St. Nat. Pre., N. rim Brieneinger Hollow, GAC 2797, 11.v.2005, G.A. Coovert (1 ♂, CHIC); same locality, GAC 3155#5, 12.v.2009, G.A. Coovert (2 ♂, CHIC); same locality, GAC 3298#4A,B,C, 7.v.2011, G.A. Coovert [with balloons] (3 ♂, CHIC); same locality, GAC 3298#4D, 7.v.2011, G.A. Coovert [with balloons] (6 ♂, CNC); same locality except, S end of valley, GAC 2794#1, 6.v.2005, G.A. Coovert (1 ♂, CHIC); same locality except, S end of preserve below gas well #8841, GAC 3153#4, 5.v.2009, G.A. Coovert (17 ♂, CHIC); same locality except, Ellis House at blacklight, GAC 3223, 5.v.2010, G.A. Coovert (1 ♂, CHIC). **Virginia:** Giles Co., Cascades Rec. Area, 37°21'00"N 80°36'30"W, 17.v.2005, S.A. Marshall (1 ♂, DEBU); Mt. Rogers, 4500–5400 ft., 1.vi.1962, J.G. Chillcott (1 ♂, 2 ♀, CNC).

Diagnosis. This small species is distinguished by nearly holoptic males, unmodified setae on hindlegs; apex of epandrium tapered; posterior margin of hypandrium rounded, produced posteriorly; bearing short setae, less than length of hypandrium; cercus greatly narrowed apically.

Description. Wing length 4.0–5.0 mm. **Male.** Head dark in ground-colour, with dense greyish pruinescence on face, frons, postgena and occiput. Very narrowly dichoptic, eye with ommatidia of equal size; short setulae along separation of eyes; frons triangular above antennae. Face slightly divergent towards mouthparts; bare with oral margin shining. Ocellar triangle dark, subshining, with pair of parallel ocellar setae and pair of posterior setulae one-third length of ocellar setae. Occiput bearing row of postocular setae, stout and black on upper section; shorter and more slender on lower section; occipital setae black, longer and stouter than postocular setae. Postpedicel, stylus and scape mostly dark; somewhat paler at inner base of postpedicel and inner apex of pedicel. Scape about 2× longer than pedicel; postpedicel about 4× longer than basal width, 2.5× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellowish brown; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose: postpronotum and supra-alar ridge yellowish orange. Scutum grey pruinose without vittae. Pleura grey, with faint yellowish margins of some sclerites. Proepisternum greyish, with several short, dark setae; prosternum bare with area between coxae yellowish. Anteppronotum with row of short setulae. Postpronotum with 1 long, dark setae and 3–4 shorter setae. Scutum lacking acr; 8–10 dc short and slender, 0.5× length of middle npl, increasing in length somewhat posteriorly; 3 npl and 1–2 shorter dark setae, middle npl longest; 1 presut spal, subequal in length to anterior npl; 1 psut spal; 1 pal. Scutellum with 2 pairs of sctl, apical pair subequal in length to pal, outer pair shorter than apical pair. Laterotergite with 3–5 long dark setae. Anterior and posterior spiracles pale.

Legs long, entirely yellow to yellowish brown, except for dark ring at trochanter-femur junction and apices of femora; tibiae and tarsi becoming darker apically. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter lacking modifications. Fore femur lacking ventral rows of fine setae; mid and hind femora with multiple rows of short slender setae; hind femur long and cylindrical, slightly swollen subapically (Fig. 19E). Fore tibia clothed in long dark setae, shorter than width of tibia; with 4–5 dorsal, 3–4 posterodorsal and several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia with few outstanding setae; 2–3 anterodorsal and several preapical setae. Hind tibia clothed in long dark setae, shorter than width of tibia, with row of numerous posterodorsal setae and several preapical setae; dorsal setae mostly distinctly longer than width of tibia (Fig. 19E). Tarsomeres 1–5 of all legs with rows of antero- and posteroventral spine-like setae; fore tarsomere 1 slender, not swollen and lacking long outer setae.

Wing clear with yellowish brown veins; all veins complete (except Sc), well sclerotized. Basal costal seta not distinguished. R_2 and M_1 divergent near wing margin; R_3 ending beyond wing tip; radial fork acute. Halter yellow.

Abdominal tergites dark brown, lacking grey pruinescence, paler along apical and posterior margins; marginal setae long and stout on tergites 1–7; sternites pale brown. Marginal setae on tergite 8 longer than length of sclerite. Pregenital segments unmodified; sclerites of segment 8 closely approximate laterally, weakly sclerotized dorsomedially. Terminalia (Fig. 21B) largely yellow, except cerci dark. Cercus separated from dorsal margin of epandrium; quadrate anteriorly, greatly narrowed posteriorly; inner apical margin clothed in dense fine setae; narrow outer lobe with straight stout setae posteriorly. Hypoproct lacking setae; with pair of short slender projections, directed ventromedially. Epandrial lamella elongate, subtriangular; longer than cercus; posterior margin evenly tapered, bearing apical setae. Hypandrium slightly produced posteriorly, with rounded apical margin, about 0.33× as long as epandrium; bearing several short, dark setae, less than length of hypandrium. Phallus broadly tubular, with broadly rounded apex and slender, anterior apical filament; ejaculatory apodeme about 0.5× length of epandrium; flattened.

Female. Similar to male, except as follows: frons more widely separated, subequal to width of anterior ocellus; ventral setae on mid and hind femora shorter and not erect; hind femur with 1 or 2 strong ventral preapical setae; cercus long and slender, subequal in length to tergite 8.

Geographical distribution and seasonal occurrence (Fig. 14B). *Empis* (*En.*) *vockerothi* ranges from southwestern Ontario south to Virginia. Adults have been collected from early May to mid-June.

Etymology. This species is named in memory of CNC dipterist, Dr. J. Richard (Dick) Vockeroth, who collected a number of type specimens from Niagara Glenn, Ontario, including several males bearing balloons.

Nuptial gift presentation. Males of *E.* (*En.*) *vockerothi* present empty (prey-less) balloons to females (Figs 1A, B). The balloons that are formed are cylindrical with the posterior end deeply concave. Males apparently hold the fully formed balloon primarily with their midlegs, which are crossed around its tapered anterior end. Unlike the related *E.* (*En.*) *snoddyi*, mating swarms of *E.* (*En.*) *vockerothi* found in Crane Hollow, Ohio, are formed by males for one to three hours shortly after midday, under the canopy of hemlock trees (*Tsuga*) approximately 2–5 metres above the ground (Fig. 1C) (G.A. Coovert, pers. comm. 2011).

Remarks. *Empis* (*En.*) *vockerothi* appears to be the sister species to *E.* (*En.*) *snoddyi*, where the former ranges from southwestern Ontario to Virginia, and the latter occurs from Virginia south through the Great Smoky Mountains.

***Empis* (*Enoplempis*) *volsella* Sinclair sp. nov.**

(Figs 14B, 23A, B, C, 24)

Type material. HOLOTYPE, ♂ labelled: “[USA] MARYLAND: Mg.[Montgomery] Co.:/ 4 mi SW of Aston/ 39°06'30"N, 77°01'30"W/ Malaise trap/ 13 May2001, G.F. Hevel”; “HOLOTYPE/ *Empis* (*Enoplempis*)/ *volsella*/ Sinclair [red label] [left hindleg missing]” (USNM).

Diagnosis. This species is distinguished by the modified processes of the hindleg, specifically two tufted processes on the tibia and a single distinct short process on the femur.

Description. Wing length 5.1 mm. **Male.** Head dark in ground-colour, with dense grey pruinescence on face, frons and occiput. Dichoptic, eye with ommatidia of similar size. Frons divergent towards antennae; below ocellar triangle as wide as anterior ocellus, bearing short setulae along inner margin of eye. Face slightly divergent towards

mouthparts; bare with oral margin dark and shining. Ocellar triangle with grey pruinescence, with pair of short, slightly divergent ocellar setae; posterior setulae lacking. Occiput bearing row of black postocular setae, stout on upper section; shorter and more slender on lower section; occipital setae black, long and stout, subequal in length to upper postocular setae. Postpedicel, stylus and scape black. Scape slightly more than 2× longer than pedicel; postpedicel more than 5× longer than basal width, more than 4× longer than stylus. Palpus yellow, with setulae dark. Proboscis largely yellowish brown; apex of labrum reddish brown; labellum with dark setae.

Thorax dark in ground-colour, largely densely grey pruinose. Scutum with pair of distinct dark vittae between acr and dc rows and indistinct pair lateral to dc and above notopleural depression. Pleura completely grey pruinose. Proepisternum with several short, dark setae; prosternum bare. Anteprepronotum with row of short, stout dark setae. Postpronotum with shining apex, with 4 short, dark setae and 1 long seta. Scutum with sparse row of fine acr setulae; 9 short dc, longer than acr, increasing in thickness posteriorly; 2 npl, with 1 setula near anterior npl; 1 presut spal and 1 setula; 1 psut spal; 1 pal. Scutellum with 2 pairs of sclt, apical pair subequal to pal, outer pair shorter and slender. Laterotergite with 4 long dark setae. Anterior and posterior spiracles pale.

Legs long, femora and coxae entirely yellow, except dark ring at trochanter-femur junction and apices of femora; tibia yellowish brown, tarsomeres brown. Coxae with numerous dark lateral setae, longer and stouter along apical anterior margins. Hind trochanter with unmodified setae. Femora lacking distinct posteroventral row of setae; hind femur thickened towards apex (Fig. 23A). Fore tibia clothed in long, dark setae, shorter than width of tibia; with 3 anterodorsal and posterodorsal setae, 3 posteroventral and several preapical setae. Mid tibia clothed in long dark setae, shorter than width of tibia; 4 anterodorsal and posterodorsal setae, 2–3 posteroventral setae and several preapical setae. Hind femur with short preapical anteroventral knob-like process, bearing small tuft of stiff black setae (Figs 23A, B, C); posteroventral face with minute pubescent preapical swelling. Hind tibia somewhat twisted, base with 1 shorter posteroventral and 1 longer ventral tufted process, not longer than width of tibia (Figs 23A, B, C); anterodorsal and posterodorsal rows of stout black setae subequal to width of tibia; several preapical setae present. Tarsomeres 1–5 of all legs slender, with rows of antero- and posteroventral spine-like setae.

Wing clear with brownish veins; all veins complete (except Sc), well sclerotized. Basal costal seta short, inconspicuous, slightly stouter and longer than surrounding costal setae. R_5 and M_1 somewhat divergent near wing margin; R_5 ending beyond wing tip; radial fork acute. Halter yellow.

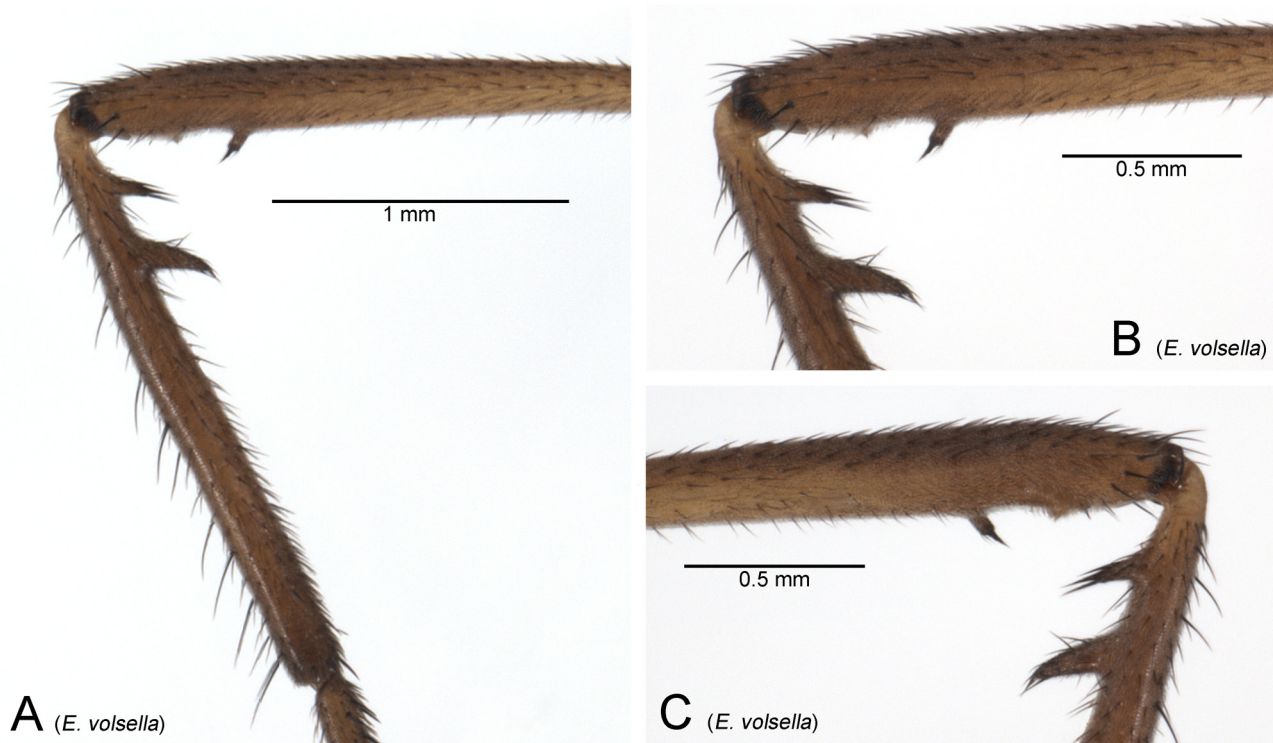


FIGURE 23. Male legs of *E. (Enoplempis) volsella*. **A**, hindleg, anterior view; **B**, apex of hind femur and base of hind tibia, anterior view; **C**, apex of hind femur and base of hind tibia, posterior view.

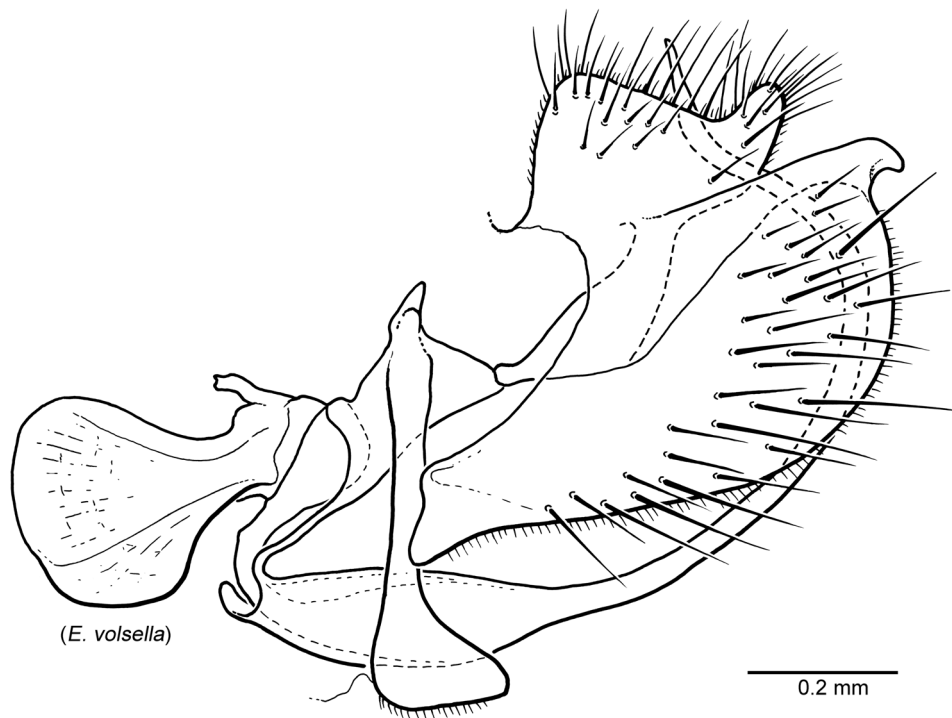


FIGURE 24. Male terminalia of *E. (Enoplempis) volsella*, lateral view.

Abdomen grey, sternites slightly paler than tergites; long marginal setae on tergites 1–4, marginal setae on tergites 5–7 subequal to dorsal setae. Marginal setae on segment 8 subequal to length of tergite. Pregenital segments unmodified; sclerites of segment 8 weakly separated laterally. Terminalia (Fig. 24) largely yellow. Cercus broad, well separated from dorsal margin of epandrium, posterior end prolonged into short finger-like, setose process. Hypoproct lacking setae. Epandrial lamella elongate, subrectangular, posterodorsal margin produced into hook-like process (lacking pubescence) with bacilliform sclerite extending to base of process; setae short. Hypandrium short, not extended posteriorly with truncate margin, about 0.2× as long as epandrium; lacking setae. Phallus with broad basal 0.25, apical 0.75 gently arched dorsally and slender; apex emerging beyond cercus and arched; ejaculatory apodeme nearly half length of epandrium; inverted Y-shaped in anterior view, with median keel reduced.

Female. Unknown.

Geographical distribution and seasonal occurrence (Fig. 14B). *Empis (En.) volsella* is only known from the holotype collected in May from Montgomery Co., Maryland.

Etymology. The specific epithet is Latin for pincer, in reference to the modified male hind femoral-tibial joint.

Nuptial gift presentation. Form unknown.

Key to males of *E. (Enoplempis)* east of the Rocky Mountains

- 1 Hind femur and tibia without processes, setal cones or distinct combs of setae (Figs 3A, E, 6E, 12E, 19A, D, E); hind trochanter with (Figs 3C, E, 9D, 12D, 16B, 19C) or without modified setae or processes. 2
- Hind femur and/or tibia with subapical/subbasal processes, setal cones or distinct combs of setae (Figs 6A, D, 9A, E, 12A, C, 16A, C, 23A); hind trochanter lacking modified setae 11
- 2 Hind trochanter bearing modified setae or processes (Figs 3C, 9D, 12D, 16B, 19C) 3
- Hind trochanter unmodified, setae unmodified 8
- 3 Thoracic pleura yellow, in contrast to dark, greyish scutum. Hind trochanter with 5–8 stout setae widespread, not confined to process or arising from single spot (Fig. 3C) *E. (En.) amytis* Walker
- Thoracic pleura greyish, concolorous with scutum (Fig. 3D). Hind trochanter with stout setae confined to process or arising from single spot; if setae more widespread, then greater than 8 present (Figs 9D, 12D, 16B, 19C) 4

4	Hind tibia with numerous rows of long slender dorsal setae, longer than width of tibia (Figs 3E, 12E)	5
-	Hind tibia with only widely spaced setae, at most only slightly longer than width of tibia (Figs 9C, 16B, 19B)	6
5	Setae of hind trochanter confined to distinct spot or short tubular process (Fig. 12D). Apex of phallus expanded, funnel-shaped (Fig. 15A)	<i>E. (En.) nuda</i> Loew
-	Setae of hind trochanter widespread, not confined to distinct spot or short process (Fig. 3E). Apex of phallus slender, tapered to narrow apex (Fig. 4B)	<i>E. (En.) appalachicola</i> Sinclair sp. nov.
6	Setae of hind trochanter widespread, not confined to distinct spot or process (Fig. 19C). Wing length less than 6 mm	<i>E. (En.) stenoptera</i> Loew
-	Setae of hind trochanter confined to distinct spot or process (Figs 9C, 16B). Wing length greater than 6 mm	7
7	Setae of hind trochanter confined to distinct tubular process (Fig. 9D). Hypandrium 0.5× length of epandrium (Fig. 10A), apex tapered and rounded; setae present on membrane anterior to base of hypandrium	<i>E. (En.) gulosa</i> Coquillett
-	Setae of hind trochanter confined to distinct spot, not raised on tubercle (Fig. 16B). Hypandrium short, about one-third length of epandrium (Fig. 17A), apex notched; setae absent from membrane anterior to hypandrium.	<i>E. (En.) penicillata</i> Brooks sp. nov.
8	Scutum with three distinct narrow vittae. Wing with clouding at base of R ₄ and apex of discal cell (Fig. 2B). Hind femur robust with anterior row of ventral spine-like setae (Fig. 19D)	<i>E. (En.) tridentata</i> Coquillett
-	Scutum with 2 or 4 indistinct broad vittae. Wing lacking clouding. Hind femur more slender, lacking ventral row of stout setae (Figs 6E, 19A, E).	9
9	Hind femur and tibia stout, with some spine-like setae; hind femur lacking rows of very slender, pale ventral setae (Fig. 6E). Epandrium quadrate, not tapered posteriorly; hypandrium prolonged posteriorly, 0.5× length of epandrium (Fig. 8A)	<i>E. (En.) enodis</i> Melander
-	Hind femur and tibia long and slender, lacking spine-like setae; hind femur with rows of very slender, pale ventral setae (Figs 19A, E). Epandrium tapered posteriorly; hypandrium short, less than half length of epandrium (Figs 20A, 21B)	10
10	Apex of epandrium greatly narrowed, less than half width of base of epandrium (Fig. 20A). Posterior margin of hypandrium truncate, not produced posteriorly; bearing long setae greater than length of hypandrium. Cercus broad apically with numerous sinuous setae	<i>E. (En.) snoddyi</i> Steyskal
-	Apex of epandrium not greatly narrowed, more than half width of base of epandrium (Fig. 21B). Posterior margin of hypandrium produced, rounded; bearing short setae less than length of hypandrium. Cercus greatly narrowed on posterior third, bearing numerous straight, stout setae	<i>E. (En.) vockerothi</i> Cumming sp. nov.
11	Hind femur and tibia with dense rows of preapical setae, lacking highly modified processes (Figs 6D, 12C, 16A)	12
-	Hind femur and tibia with highly modified processes (Figs 6A, 9A, E, 12A, 16C, 23A)	14
12	Hind femur lacking preapical row of dense setae, only hind tibia with dense setae (Fig. 6D). Epandrium quadrate with angular margins and fused anterodorsally to cercus (Fig. 7B)	<i>E. (En.) ctenocnema</i> Melander
-	Hind femur with preapical posteroventral and/or anteroventral row of dense setae, similar to setae of tibia (Figs 12C, 16A). Epandrium more rounded apically, not fused to cercus (Figs 13B, 15B)	13
13	Hind femur with anteroventral preapical row of stout setae (Fig. 12C). Base of hind tibia with pair of antero- and posteroventral rows separated by clear gap (Fig. 12C). Hypandrium with setae longer than length of sclerite (Fig. 13B).	<i>E. (En.) nodipolitea</i> Steyskal
-	Hind femur with antero- and posteroventral preapical rows of stout setae (Fig. 16A). Base of hind tibia with rows of setae dense, not separated by clear gap (Fig. 16A). Hypandrium with setae shorter than length of sclerite (Fig. 15B)	<i>E. (En.) pectinata</i> Sinclair sp. nov.
14	Thoracic pleura primarily yellow	15
-	Thoracic pleura primarily greyish, not predominantly yellow	16
15	Base of hind tibia with pair of slender ventral processes with narrow brush of black apical setae (Figs 12A, B). Hypandrium clothed in long, dense setae (Fig. 13A). Phallus without lateral projections, only slightly tapered towards apex (Fig. 13A)	<i>E. (En.) montywoodi</i> Brooks sp. nov.
-	Base of hind tibia with pair of blunt ventral processes, posteroventral process distinctly tufted, anteroventral process anvil-shaped (Figs 16C, D, E). Hypandrium with setae shorter, confined to base (Fig. 17B). Phallus flanked by stout lateral pointed projections, medial portion denticulate and slender apically (Fig. 17B)	<i>E. (En.) prodigiosa</i> Cumming sp. nov.
16	Hind tibia with setae subequal to or shorter than width of segment (Figs 6A, 23A). Hind femur with tufted preapical anteroventral process (Figs 6B, 23B)	17
-	Hind tibia with setae longer than width of segment (Fig. 9E). Hind femur lacking tufted preapical anteroventral process (Figs 9A, B, F, G)	18
17	Base of hind tibia geniculate and highly excavated, fitting posteroventral processes of femur (Figs 6B, C); apical half of phallus straight, directed dorsally (Fig. 7A).	<i>E. (En.) arthritica</i> Melander
-	Base of hind tibia not geniculate, with pair of tufted processes (Figs 23B, C); apical half of phallus strongly arched, directed anterodorsally (Fig. 24).	<i>E. (En.) volsella</i> Sinclair sp. nov.
18	Base of hind tibia with thumb-like process clothed with short, fine setae (Fig. 9A). Hind femur with hooked, posteroventral preapical process longer than width of femur (Figs 9A, B)	<i>E. (En.) gladiator</i> Melander
-	Base of hind tibia with bare, elongate, pointed triangular process (Figs 9F, G). Hind femur with triangular, posteroventral preapical process shorter than width of femur (Figs 9F, G)	<i>E. (En.) loripedis</i> Coquillett

Discussion

Enoplempis is one of the dominant subgenera among Nearctic *Empis*, comprising about one-third of the presently known species from the region. Nineteen species are now known from eastern North America, including three which are known only on the basis of the holotype. The eastern North American species can be divided into the following subgroups:

amytis subgroup (*amytis*, *appalachicola*, *gulosa*, *nuda*, *penicillata*, *stenoptera*)—defined by the modified male hind trochanter (Figs 3C, E, 9C, D, 12D, 16B, 19B, C).

loripedis subgroup (*arthritica*, *gladiator*, *loripedis*, *volsella*)—defined by the male cercus with a dorsal lobe and preapical dorsal hook-like process on the epandrium (Figs 7A, 8B, 10B, 24).

nodipoplitea subgroup (*ctenocnema*, *nodipoplitea*, *pectinata*)—defined by the male hindleg chaetotaxy (Figs 6D, 12C, 16A).

snoddyi subgroup (*snoddyi*, *vockerothi*)—defined by the elongate narrow epandrium, form of the apex of the phallus and shape of the male cercus (Figs 20A, 21B).

Unassigned to species subgroup (*enodis*, *montywoodi*, *prodigiosa*, *tridentata*)—subsequent analysis with the western Nearctic species may resolve their relationships.

Very little is known about the swarming behaviour of *E. (Enoplempis)*. Among the eastern Nearctic species, only the swarming behaviour of *E. (En.) snoddyi* (see Sadowski *et al.* 1999) and *E. (En.) vockerothi* have been observed. These appear to be sister species, which both make prey-less balloons. The only other behavioural observations for the eastern species are prey records for *E. (En.) amytis* and *E. (En.) penicillata*, which probably indicates that these species present unwrapped (or balloon-less) prey during mating.

In the west, four species of *E. (Enoplempis)* have been reported to produce balloons (reviewed in Cumming 1994). Depending on the species, the froth balloons are either small and contain relatively large prey items that are consumed by the female, or they are larger with small inedible dried-up pieces of prey stuck to the balloon. The chemical nature of the balloons also appears to vary with the species involved, with the balloons of certain species collapsing within a few hours after collection and others not deteriorating (Kessel & Kessel 1951). The balloon of *E. (En.) geneatis* (Melander) was reported by Kessel & Karabinos (1947) to be formed from a mucoprotein-like substance that did not dissolve in 70 or 95% ethyl alcohol, unlike the balloon of an undescribed species of *E. (Enoplempis)* from Oregon that dissolved in 70% ethyl alcohol (Cumming 1994). The balloon of the eastern species, *E. (En.) vockerothi*, was also found by us not to dissolve in 70 or 95% ethyl alcohol. With over 40 species of *E. (Enoplempis)* now known from western North America (many of which are undescribed), additional variation in nuptial gift presentation can be expected. For example, some western species such as *E. (En.) poplitea*, are known to present unwrapped (balloon-less) edible prey items to females as nuptial gifts (Alcock 1973). Additional observations on the swarming behaviour of both eastern and western species of *E. (Enoplempis)* are needed.

Balloons have also been found in some other Empidinae (i.e., *Hilara*). In contrast to the balloons of *E. (Enoplempis)*, which are secretions of froth presumably produced by the salivary glands (see “Nuptial gift presentation” under *E. (En.) snoddyi*), those of *Hilara* are formed by silk produced from glands on the first tarsomere of the foreleg. Silk balloons and silk production in the Hilarini has been analysed by Young & Merritt (2003).

Swarms of the few *E. (Enoplempis)* species that have been observed (see Kessel 1955; Alcock 1973; Cumming 1994) indicated that males form swarms that are visited by females who choose mates before receiving a nuptial gift. As far as is known, sex-role reversal involving male choice (in which females display and males choose mates) that is commonly seen in many other Empidinae species (Cumming 1994), appears not to be involved in the courtship behaviour of most species of *E. (Enoplempis)*. This is also correlated with a lack of secondary sexual characters displayed by females of *E. (Enoplempis)* species, such as expanded and darkened wings, pinnate leg scales, abdominal pleural sacs, and silvery abdominal pruinescence observed in empidine species with sex-role reversed mating behaviour (Cumming 1994). However, females of at least a few species of *E. (Enoplempis)* (e.g., *E. (En.) tridentata*) do have extensive darkened abdominal pleural membranes that are probably eversible and indicative of female swarming and sex-role reversed mating behaviour. In addition, Alcock's (1973) detailed

observations on the courtship behaviour of *E. (En.) poplitea*, which involves typical male swarms and female choice, indicated that the characteristic subgeneric modifications found on the hind femur/tibia joint in this species are not used to grasp the female during copulation, but are used to rub the female's abdomen presumably providing tactile stimuli while mating.

This is the first of two revisions of the species of *E. (Enoplempis)* with the second paper dealing with the western Nearctic species of the subgenus. Completion of the large western revision will hopefully allow for an analysis of the phylogenetic relationships of all the included species at some level. In an unpublished thesis, Turner (2012) provided a preliminary molecular cladogram using several *E. (Enoplempis)* exemplar species, including tracing some mating behaviours (e.g., empty balloons, balloons containing prey, and unwrapped prey). This information combined with a morphological analysis of all the included eastern and western species, should allow for more rigorous hypotheses on phylogenetic relationships within the subgenus. Observations on known and as yet unpublished mating behaviours of *E. (Enoplempis)* can then be plotted on the resulting cladograms in an effort to better understand the evolution of these complex behaviours throughout the group.

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