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ALLOCAPNIA MUSKOGEE AND A. MENAWA, NEW SPECIES OF SNOWFLIES (PLECOPTERA: CAPNIIDAE) FROM THE TALLADEGA NATIONAL FOREST REGION OF EASTERN ALABAMA, U.S.A., PLUS FOUR NEW STATE RECORDS

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ABSTRACT

Allocapnia muskogee sp. n. and *A. menawa* sp. n. are described from the Talladega National Forest region of east-central Alabama, U.S.A. *Allocapnia muskogee* sp. n. is also recorded from northern Georgia. *Allocapnia muskogee* sp. n. is distinguished from closely-related *A. wrayi* Ross and *A. mystica* Frison by characteristics of the male epiproct and 8th abdominal terga. *Allocapnia menawa* sp. n. is differentiated from members of the *A. granulata* species group, most notably *A. granulata* (Claassen), *A. unzickeri* Ross & Yamamoto, and *A. warreni* Ross & Yamamoto, by the male epiproct and 8th abdominal terga. In addition, new Alabama state records are reported for *Paraleuctra sara* (Claassen), *Soyedina alexandria* Grubbs, *Taeniopteryx ughola* Ricker & Ross and *Sweltsa onkos* (Ricker).

Keywords: Plecoptera, Capniidae, *Allocapnia*, Alabama, new species

INTRODUCTION

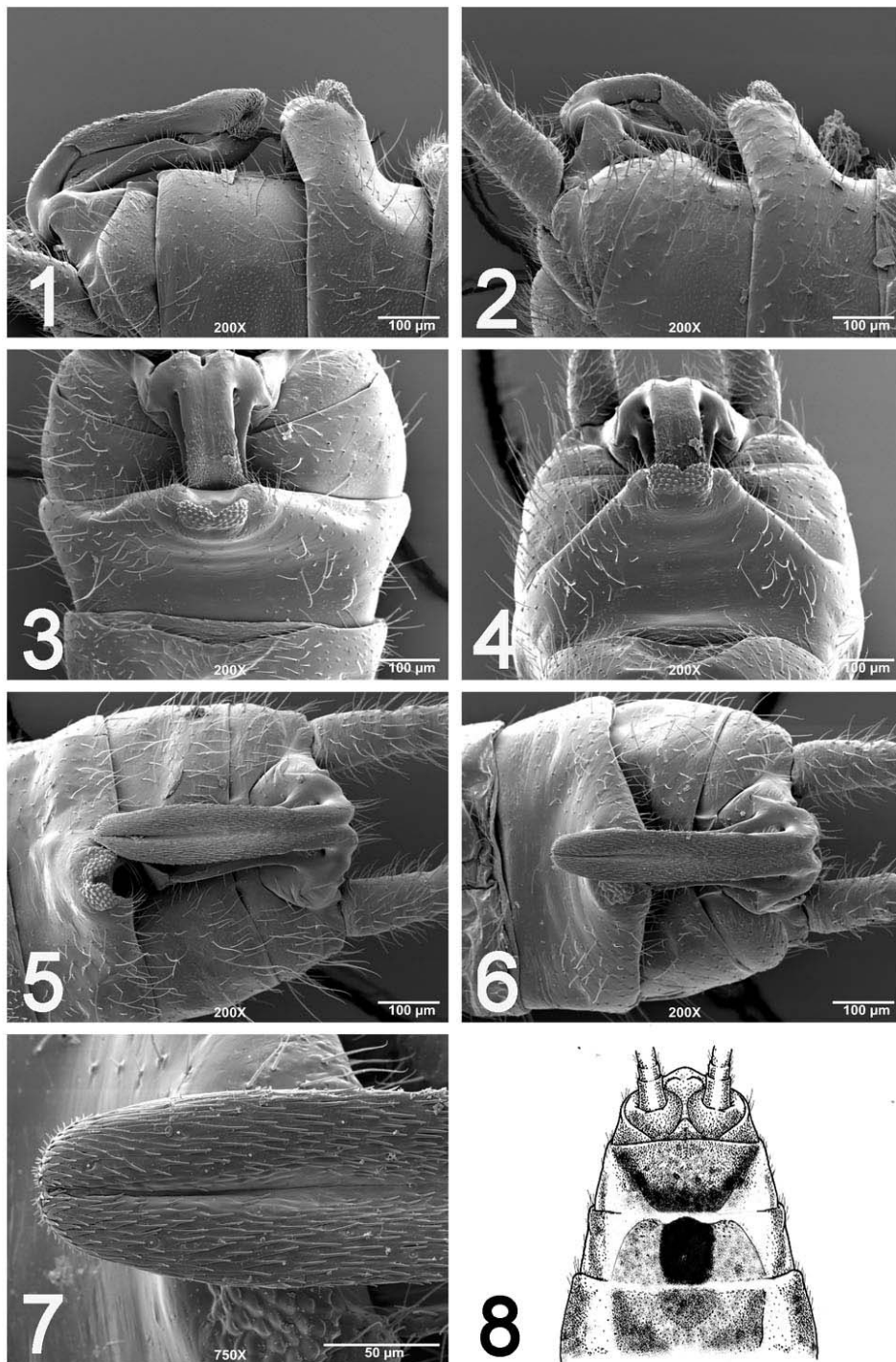
The snowfly genus *Allocapnia* is distributed mainly in the eastern Nearctic region and currently includes 45 species (Ross & Ricker 1971; Kirchner 1980, 1982; Kondratieff & Voshell 1981; Poulton & Stewart 1987; Kondratieff & Kirchner 2000; Grubbs 2006a, 2008). As part of a larger study addressing elevational and subbasin distribution patterns of stoneflies of the montane Talladega National Forest region of east-central Alabama, two distinctive forms of *Allocapnia* were discovered from small, upland streams. This study will be completed in two years, however, we are describing these two species herein to make the names available for a review of the

Capniidae of eastern North America. Specimens are deposited at the Illinois Natural History Survey (INHS) and at Western Kentucky University (WKU).

Allocapnia muskogee sp. n.
(Figs. 1-8)

Material examined. Holotype ♂ and paratype ♀, U.S.A., Alabama, Cleburne Co., unnamed tributary to Swan Branch, Shinnabone Creek, Talladega National Forest, 24 km SW Heflin, 28 December 2007, S.A. Grubbs (INHS). Additional paratypes: same but 9 ♂, 4 ♀ (WKU); same but 17 February 2003, 1 ♂, S.A. Grubbs (WKU). Clay Co., unnamed tributary to

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Figs. 1–8. *Allocapnia muskogee*. 1. Male terminalia, lateral, SEM micrograph, 200X, 2. Male terminalia, lateral, SEM micrograph, 200X, 3. Male terminalia, dorsal, SEM micrograph, 200X, 4. Male terminalia, dorsoanterior, SEM micrograph, 200X, 5. Male terminalia, dorsal, SEM micrograph, 200X, 6. Male terminalia, dorsal, SEM micrograph, 200X, 7. Male terminalia, dorsal, SEM micrograph, 750X, 8. Female terminalia, ventral.

Cheaha Creek, Talladega National Forest, 19 km N Ashland, 33.4397°N, 085.8387°W, 4 December 2006, 1 ♂, A.L. Sheldon (WKU). Cleburne Co., unnamed tributary to South Fork Terrapin Creek, Talladega National Forest, 33.8220°N, 085.5148°W, 22 December 2007, 2 ♂, A.L. Sheldon (WKU); unnamed tributary to unnamed tributary to South Fork Terrapin Creek, Talladega National Forest, 4 km S Vigo, 33.8865°N, 085.5559°W, 26 January 2008, 2 ♂, 2 ♀, S.A. Grubbs (WKU). Georgia, Lumpkin Co., fast stream, 12 mi NW Cleveland, 30 December 1964, 1 ♂, Hensley and Smith (INHS, Catalog No. 11964).

Male. Body length 3.5–5.0 mm. Wings reaching 6th to the 9th abdominal terga. Seventh abdominal terga unmodified. Dorsal process of 8th terga markedly produced, nearly perpendicular to the plane of the abdomen (Figs 1–2); process with tuberculate transverse ridge that is partially (Figs. 3–4) to nearly completely separated medially (Fig. 5), with lobes that appear subtriangular in dorsal aspect (Figs. 3, 5) to subtruncate in anterodorsal aspects (Fig. 4). Apical limb of epiproct 2X length of basal limb, moderately and roundly expanded distal half laterally (Fig. 1), nearly parallel-sided and unmodified dorsally (Figs. 6–7).

Female. Body length 4.0–5.5 mm. Wings reaching 7th terga to beyond tip of abdomen. Eighth abdominal sterna darkly sclerotized medially, only slightly sclerotized laterally, terminating in triangular projection posteriorly; separated from 7th sterna by membrane (Fig. 8).

Etymology. The specific name, used as a noun in apposition, is in reference to the indigenous Muskogee, or Creek, Native Americans who occupied the upper Coosa and Tallapoosa River valleys flanking the Talladega National Forest area prior to European settlement. The common name, Muskogee snowfly, is proposed for this species (Stark et al. 1998)

Diagnosis. *Allocapnia muskogee* is most similar to *A. wrayi* Ross and *A. mystica* Frison, the only two members of the *A. mystica* species group (Ross & Ricker 1971). *Allocapnia zekia* was described by Ross (1964) as a possible local variant of *A. wrayi* and also placed in the *A. mystica* group (Ricker & Ross 1971), but was subsequently synonymized with *A. wrayi* by Kondratieff & Kirchner (1982). *Allocapnia muskogee* is included in the *A. mystica* group.

Allocapnia muskogee is distinguished from the

other two members of this group most easily by details of the epiproct, in both lateral and dorsal aspects. The ratio of the apical limb length to the basal limb length varies across the *A. mystica* group. The apical limb of *A. mystica* is markedly shorter than the basal limb, approximately 0.75X the length (Figs. 17–18). In contrast, the apical limb of *A. muskogee* is 2X the length of the basal segment (Fig. 1) and 1X – 1.5X for *A. wrayi* (Figs. 9–10). Kondratieff & Kirchner (1982) illustrated the variability of the epiproct for Maryland and Virginia specimens of *A. wrayi*, depicting apical to basal limb ratios of 1.5X (their Fig. 1) and 1X (their Fig. 2), which is similar to the 1.5X ratio shown here for two separate series of specimens from western Maryland (Figs. 9–10). Additional specimens of *A. wrayi* examined from Maryland, Virginia, North Carolina and South Carolina pertain easily to this concept.

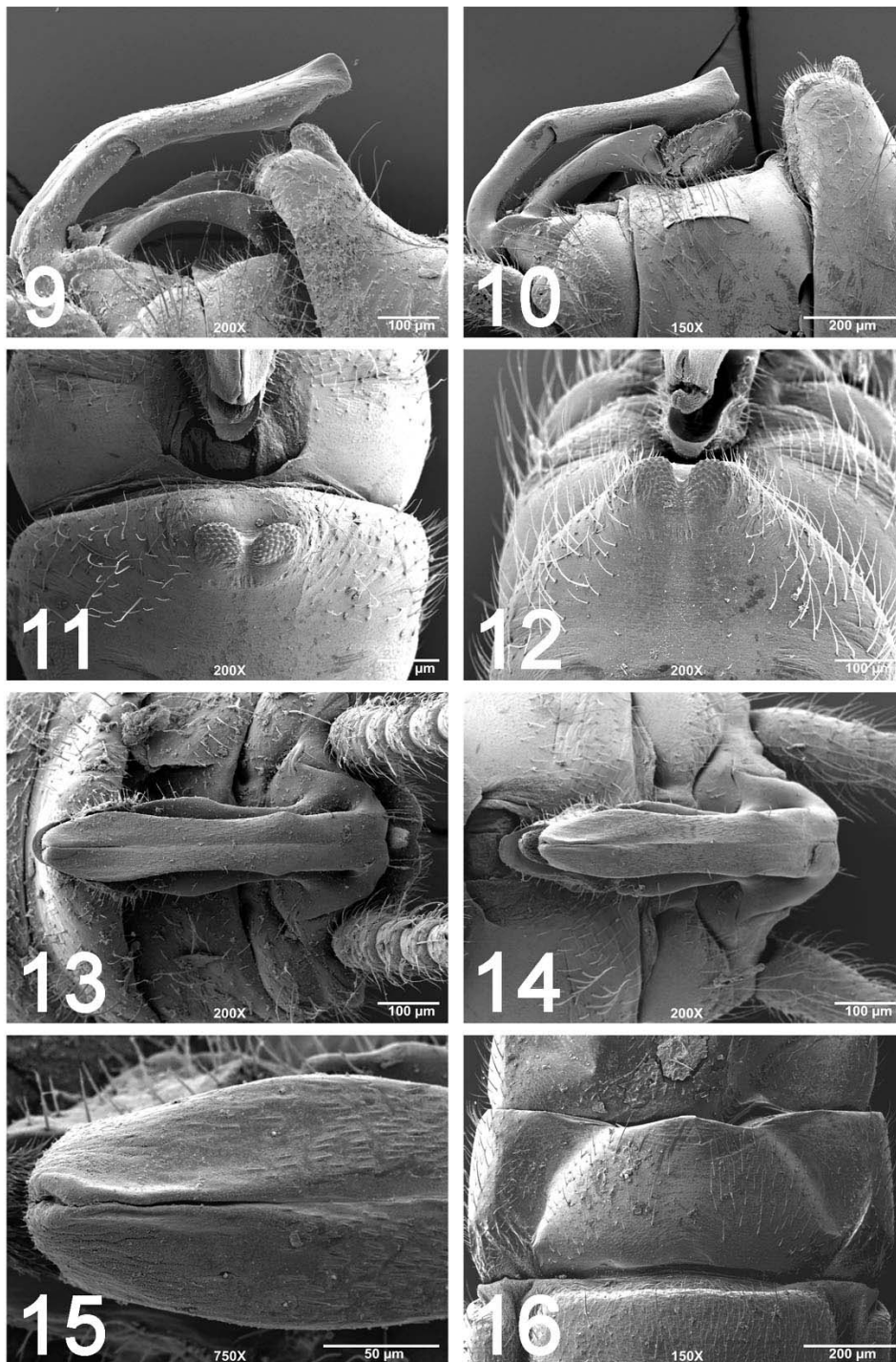
In lateral aspect the apical epiproct limb of *A. muskogee* is rounded distally (Figs. 1), and differentiated easily from both *A. wrayi* and *A. mystica*. For *A. wrayi* the distal end of the epiproct is truncate with a raised mid-dorsal keel (Figs. 9–10, 13–15), while the apical half of the epiproct of *A. mystica* bears a subdistal notch ventrally (Figs. 17–18). When viewed dorsally the epiproct apical limb of *A. muskogee* is parallel- or nearly parallel-sided and broadly rounded distally (Figs. 6–7). In contrast, the epiproct apical limb of *A. wrayi* is spatulate (Figs. 13–15) and for *A. mystica* the epiproct apical limb tapers markedly distally.

The dorsal process of the 8th abdominal terga of *A. muskogee*, *A. wrayi*, and *A. mystica* are similar and provide a less objective means of differentiating between species. The dorsal process lobes of *A. muskogee* vary from subtriangular to truncate (Figs. 3–5) while the lobes are more rounded for both *A. wrayi* (Figs. 11–12) and *A. mystica* (Figs. 19–20).

Females of *A. muskogee* can be distinguished from *A. wrayi* and *A. mystica* by the posterior triangular projection of the 8th abdominal sterna (Fig. 8). *Allocapnia mystica* bears a broadly rounded posterior margin (Fig. 24) while the posterior margin of *A. wrayi* varies from broadly rounded to slightly subtriangular (Fig. 16). Ross & Ricker (1971) did not distinguish the females of *A. mystica* and *A. wrayi*.

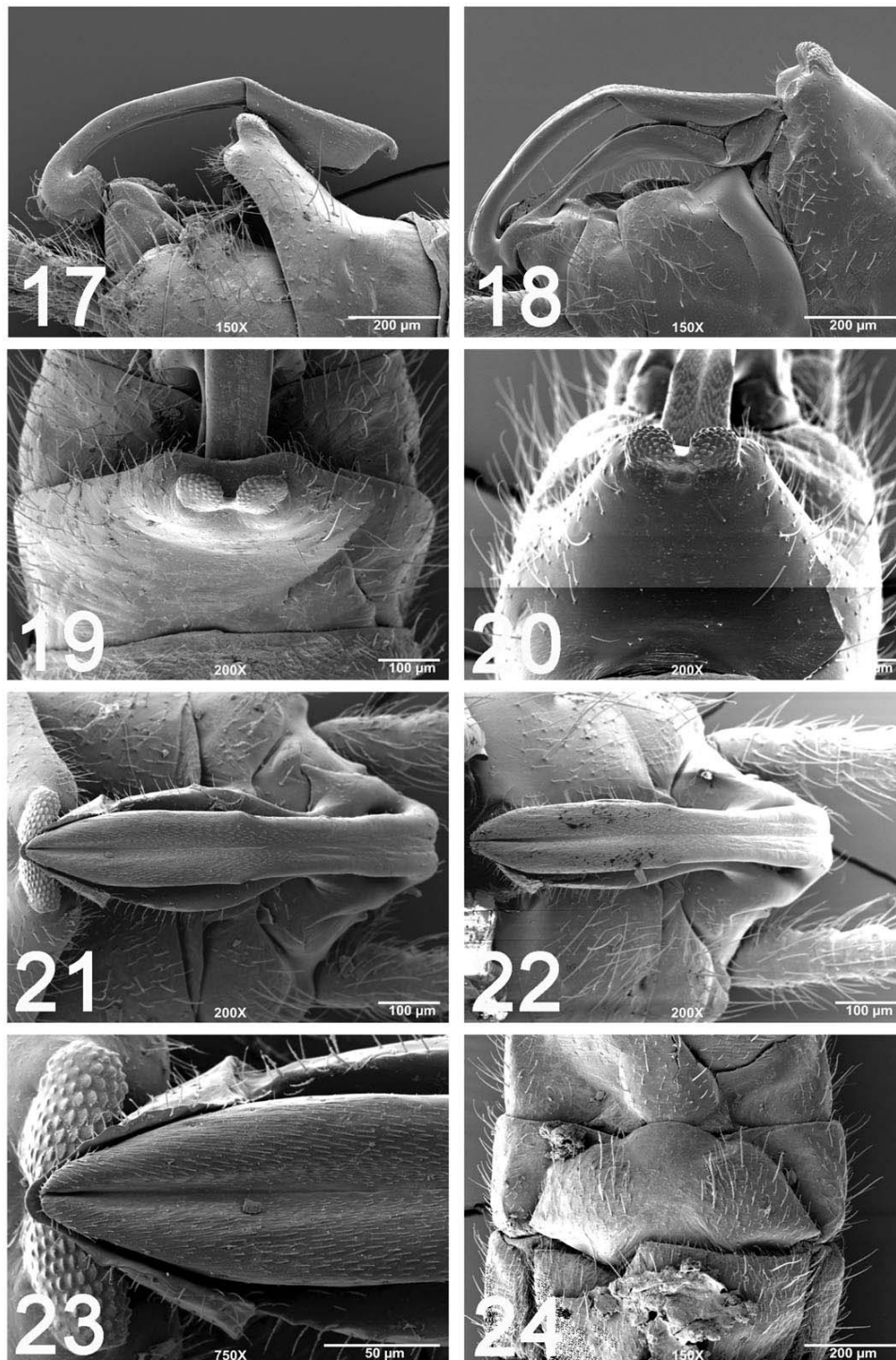
Although *A. mystica* is distributed broadly across the unglaciated landscape east of the Mississippi River (Kondratieff & Baumann 2000; Stark et al. 2008)

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Figs. 9–16. *Allocapnia wrayi* (9, 12, 14, 15: U.S.A., Maryland, Allegany Co., White Sulphur Run, 16 January 1996; 10, 11, 13, 16: U.S.A., Maryland, Washington Co., Little Tonoloway Creek, 17 December 1995). 9. Male terminalia, lateral, SEM micrograph, 200X, 10. Male terminalia, lateral, SEM micrograph, 200X, 11. Male terminalia, dorsal, SEM micrograph, 200X, 12. Male terminalia, dorsoanterior, SEM micrograph, 200X, 13. Male terminalia, dorsal, SEM micrograph, 200X, 14. Male terminalia, dorsal, SEM micrograph, 200X, 15. Male terminalia, dorsal, SEM micrograph, 750X, 16. Female terminalia, ventral, SEM micrograph, 150X.

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Figs. 17–24. *Allocapnia mystica* (17, 19, 21, 23: U.S.A., Indiana, Perry Co., East Deer Creek, 3 January 2000; 18, 20, 22, 24: U.S.A., Alabama, Lawrence Co., West Flint Creek, 27 December 2007). 17. Male terminalia, lateral, SEM micrograph, 200X, 18. Male terminalia, lateral, SEM micrograph, 200X, 19. Male terminalia, dorsal, SEM micrograph, 150X, 20. Male terminalia, dorsoanterior, SEM micrograph, 200X, 21. Male terminalia, dorsal, SEM micrograph, 200X, 22. Male terminalia, dorsal, SEM micrograph, 200X, 23. Male terminalia, dorsal, SEM micrograph, 750X, 24. Female terminalia, ventral, SEM micrograph, 150X.

and is common throughout Alabama (James 1972), it is not a resident of upland or montane streams in the Talladega National Forest area. *Allocapnia wrayi* is regionally distributed in small, upland streams from southern Pennsylvania south to northwestern South Carolina, and has yet to be collected west of the Appalachian Mountains (Ross & Ricker 1971; Kondratieff & Baumann 2000; Stark et al., 2008). The single male specimen of *A. muskogee* from northern Georgia currently represents the northern end of its range.

Remarks. The type locality is a small, intermittent stream situated within a broad, flat valley. The only other stonefly species collected with *A. muskogee*, and only from the tributary to Cheaha Creek site, were *A. aurora* Ricker, *A. menawa* n.sp., and *A. recta* (Claassen).

Allocapnia menawa sp. n.

(Figs. 25-32)

Material examined. Holotype ♂ and paratype ♀, U.S.A., Alabama, Clay Co., tributary to Cheaha Creek, Talladega National Forest, 19 km N Ashland, 33.4397°N, 085.8387°W, 28 December 2007, S.A. Grubbs (INHS). Additional paratypes: same but 14 ♂, 6 ♀ (WKU); same but 4 December 2006, 1 ♂, A.L. Sheldon (WKU).

Male. Body length 5.0–6.0 mm. Wings reaching from 5th to the 7th abdominal terga. Seventh abdominal terga unmodified. Dorsal process of 8th terga elevated steeply above the abdominal plane (Fig. 25); process generally flat or weakly convex in lateral view with paired, poorly-developed, subapical setose processes (Figs. 26–28); process rugose, outer aspect broadly u-shaped, inner aspect v-shaped, process lobes separated by shallow emargination anteriomedially (Fig. 27–28). Apical limb of epiproct upper limb subequal in length of basal limb (Fig. 25), markedly enlarged in distal half with slight subterminal emargination (Fig. 29), expanded slightly medially in dorsal view, tip broadly rounded (Figs. 30–31).

Female. Body length 6.0–7.0 mm. Wings reaching 8th terga to beyond tip of abdomen. Eighth abdominal sterna darkly sclerotized medially, only slightly sclerotized laterally, terminating in saginate projection posteriorly; separated from 7th sterna by membrane (Fig. 32).

Etymology. The species name, used as a noun in apposition, honors Menawa of the Upper Creek

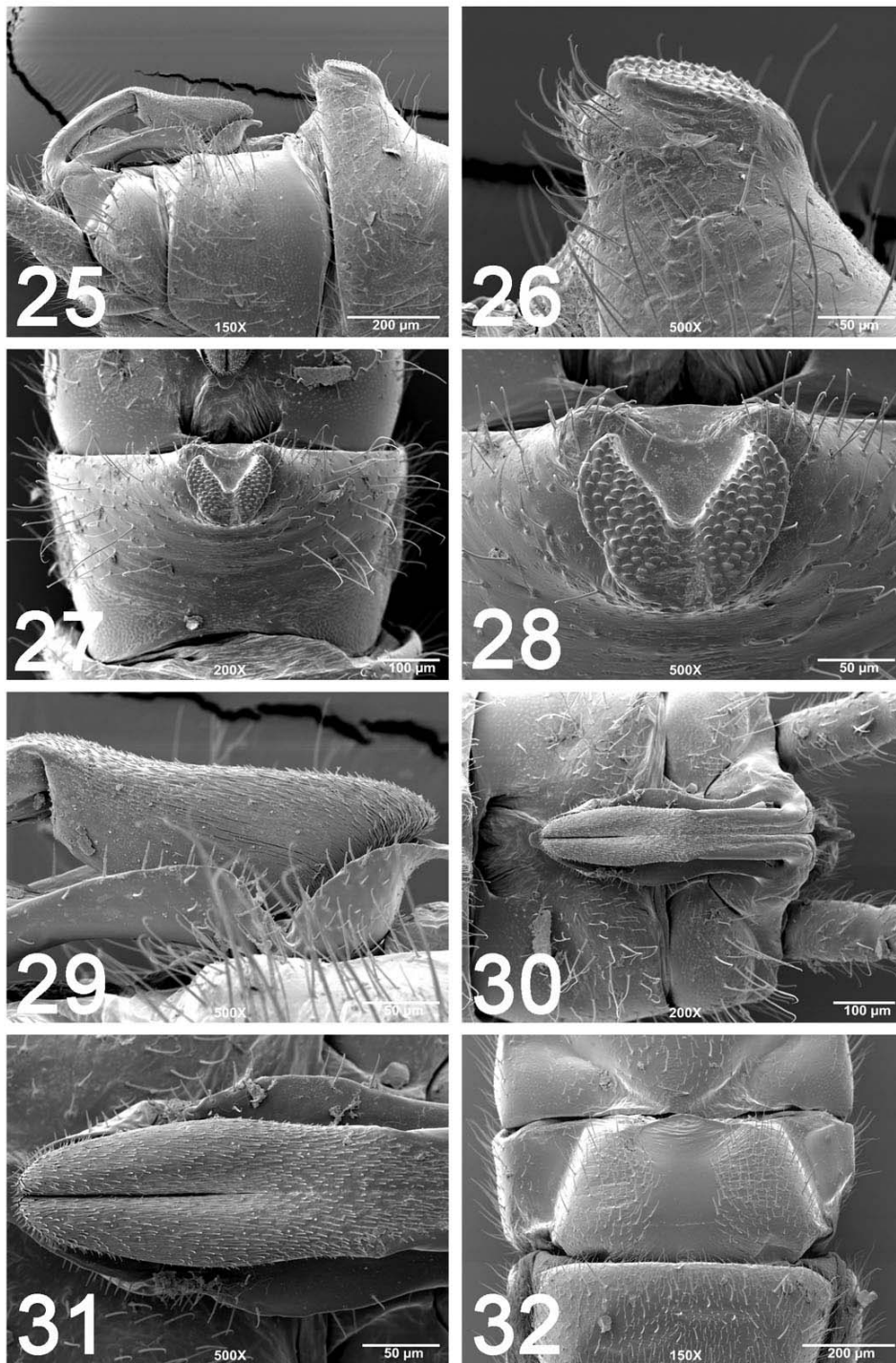
Native Americans. Menawa was a Creek leader who was instrumental in opposing encroachment on Creek lands. The common name, Menawa snowfly, is proposed for this species (Stark et al. 1998).

Diagnosis. *Allocapnia menawa* is a member of the *A. granulata* group (Ross & Ricker 1971), which is currently comprised of seven species. Five species in particular, *A. frisoni* Ross & Ricker, *A. granulata* (Claassen), *A. peltoides* Ross & Ricker, *A. unzickeri* Ross & Yamamoto and *A. warreni* Ross & Yamamoto, possess the subapical paired setose processes exhibited by *A. menawa*. The remaining two species in this group, *A. fumosa* Ross and *A. simmonsii* Kondratieff & Voshell, lack setose processes. *Allocapnia menawa* most closely resembles *A. granulata*, *A. unzickeri*, and *A. warreni*. The epiproct apical limb to basal limb ratio of 1X exhibited by *A. menawa* (Fig. 25) is readily distinguished from *A. unzickeri* and *A. warreni*. Both *A. unzickeri* (Fig. 33) and *A. warreni* (Ross & Ricker 1971, Fig. 23) possess an epiproct apical limb that is noticeably longer than the basal limb and have slim profiles in lateral aspect. Although the epiproct of *A. granulata* varies considerably across its broad range (Ross & Yamamoto 1967), the combination of the heavily enlarged epiproct apical limb and the dorsal process of the 8th abdominal terga can differentiate *A. menawa*. The moderately enlarged apical limb of *A. granulata* depicted here from southern Kentucky (Fig. 34) and western Pennsylvania (Fig. 35) are typical of the central and northern populations with eastern genitalia described by Ross & Yamamoto (1967) yet not to the extent of *A. menawa* (Figs. 25, 29). The rugose dorsal process of *A. granulata* bears lobes that vary in length but are well separated apically (Figs. 37–38). In contrast, the dorsal process lobes of *A. menawa* are nearly convergent anteriomedially and appear triangular posteriorly (Fig. 28). The lobes of *A. granulata* are broadly rounded posteriorly.

The females of *A. menawa* (Fig. 32) and *A. granulata* (Fig. 40) are very similar, and species recognition requires associated males. The female of *A. unzickeri* is easily distinguished from *A. menawa* since the 8th abdominal sterna of the former species is either broadly truncate (Fig. 39) or slightly concave. The female of *A. warreni* is unknown.

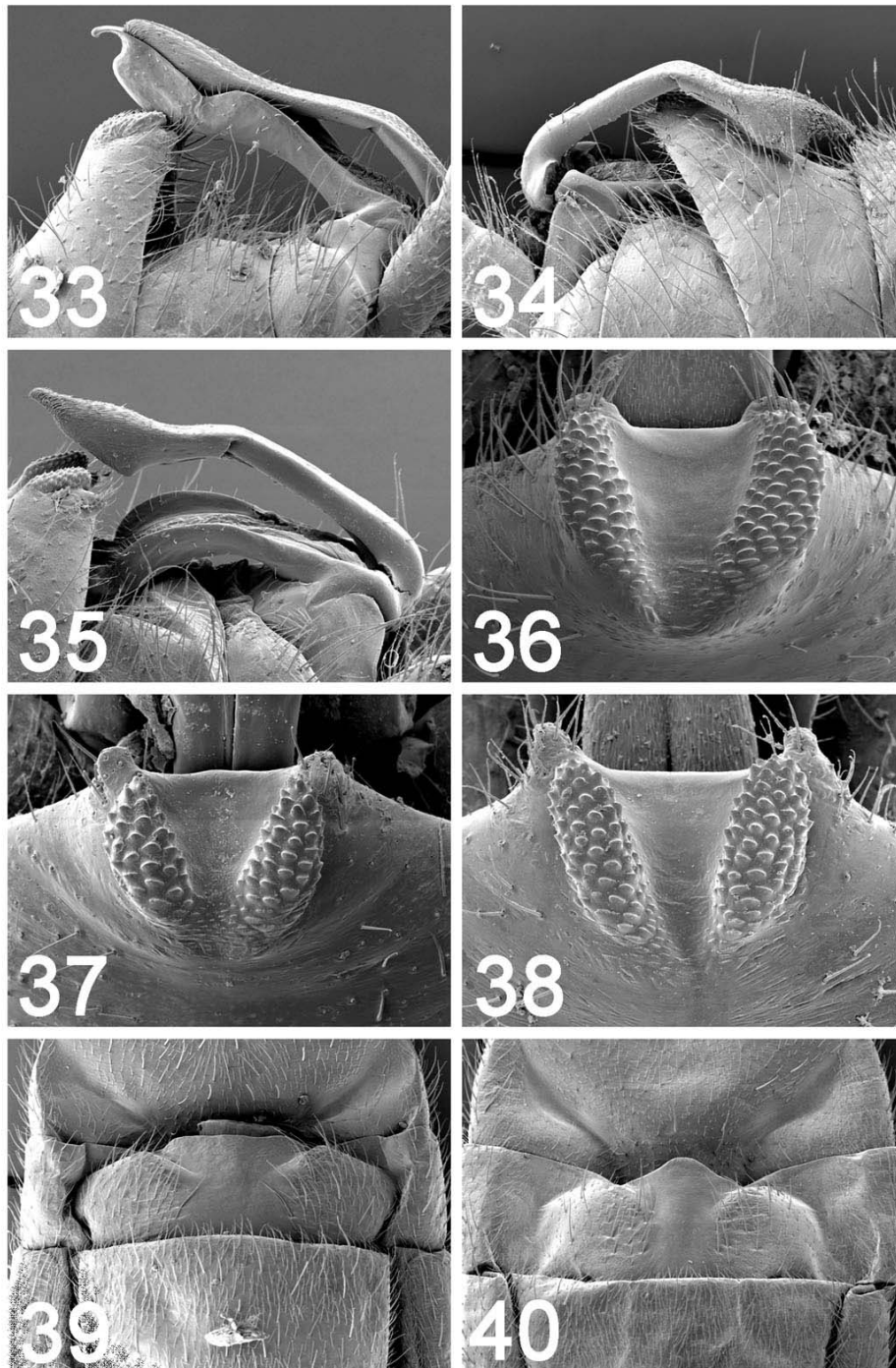
The geographic range of *A. menawa* is allopatric with *A. granulata*, *A. unzickeri*, and *A. warreni*. *Allocapnia granulata* has a broad geographical range

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Figs. 25–32. *Allocapnia menawa*. 25. Male terminalia, lateral, SEM micrograph, 150X, 26. Male terminalia, lateral, SEM micrograph, 500X, 27. Male terminalia, dorsal, SEM micrograph, 200X, 28. Male terminalia, dorsal, SEM micrograph, 500X, 29. Male terminalia, lateral, SEM micrograph, 500X, 30. Male terminalia, dorsal, SEM micrograph, 200X, 31. Male terminalia, dorsal, SEM micrograph, 500X, 32. Female terminalia, ventral.

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Figs. 33–40. *Allocaupnia unzickeri* (33, 36, 39: U.S.A., Tennessee, Marion Co., tributary to Sweeten Creek, 17 February 2007) and *A. granolata* (34, 37: U.S.A., Kentucky, Warren Co., Trammel Fork, Drakes Creek, 23 January 2000; 35, 38, 40: U.S.A, Pennsylvania, Mercer Co., Wolf Creek, 15 February 1999). 33. Male terminalia, lateral, SEM micrograph, 200X, 34. Male terminalia, lateral, SEM micrograph, 200X, 35. Male terminalia, lateral, SEM micrograph, 200X, 36. Male terminalia, dorsal, SEM micrograph, 500X, 37. Male terminalia, dorsal, SEM micrograph, 500X, 38. Male terminalia, dorsal, SEM micrograph, 500X, 39. Female terminalia, ventral, SEM micrograph, 150X, X. Female terminalia, ventral, SEM micrograph, 150X.

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in the eastern Nearctic region, recorded from Oklahoma north to Minnesota and Quebec and south to Mississippi, Alabama, and Georgia (Ross & Ricker 1971; Poulton & Stewart 1991; Kondratieff & Baumann 2000; Nations et al. 2007). *Allocapnia granulata* has also been collected from large streams flanking the Appalachian Mountains, yet does not extend to smaller, upland streams of the Talladega National Forest area. James (1972; Fig. 118) recorded this species only from two northeastern Alabama counties. *Allocapnia unzickeri* is distributed mainly within the Cumberland Plateau region in southern Tennessee and *A. warreni* is known only from northwestern Arkansas (Poulton & Stewart, 1991).

Remarks. *Allocapnia menawa* has been collected only from the type locality, but is likely to be found from additional upland stream habitats in the Talladega National Forest area. *Allocapnia aurora*, *A. muskogee* n. sp., and *A. recta* were the only other stonefly species obtained with *A. menawa*.

NEW ALABAMA STATE RECORDS

Paraleuctra sara (Claassen) is the only member of this Holarctic and Oriental genus known from eastern North America. This species is distributed from the Canadian Maritime Provinces and Ontario south to Tennessee and South Carolina, with a western extension through Indiana and Kentucky (Stark & Kyzar 2000; Grubbs 2004). This species was collected recently from Talladega National Forest, representing a new state record and a southwestern range extension along the Appalachian Mountains.

Material examined. U.S.A., Alabama, Cleburne Co., tributary of Coleman Lake, Talladega National Forest, 3 March 1991, R. W. Baumann and S. Clark, 1 ♂, 1 ♀ (WKU); tributary to South Fork Terrapin Creek, Talladega National Forest, 33.8779°N, 085.5509°W, 6 March 2007, 4 ♂, 2 ♀, A.L. Sheldon (WKU).

Soyedina alexandria Grubbs was described recently from springs and small stream habitats in the Nashville Basin area of central Tennessee (Grubbs 2006b). This species was recently obtained from springs in northern Alabama, representing a new state record, a modest southern range extension and the first state records of *Soyedina*.

Material examined. U.S.A., Alabama, Limestone Co.,

spring into tributary to Scarce Grease Branch, Sugar Creek, Smith Hollow, 2 km SE Lester, 18 February 2008, S.A. Grubbs, 5 ♂, 1 ♀ (WKU).

Taeniopteryx ugola Ricker & Ross is distributed mainly along the Appalachian Mountains, confirmed from Pennsylvania south to Georgia (Stewart, 2000). This species was collected from the Cumberland Plateau region of northeastern Alabama, representing a new state record and a small southwestern range extension.

Material examined. U.S.A., Alabama, Jackson Co., Mill Creek, Skyline Wildlife Management Area, 5 km S Hytop, 6 February 2008, S.A. Grubbs, 1 ♂ (WKU); same but 19 February 2007, 1 ♀ (WKU).

Sweltsa onkos (Ricker) is a broadly-distributed Appalachian species known from the Canadian Maritime Provinces, Quebec and Ontario south to Virginia, with a western extension through Indiana and Kentucky similar to that displayed by *Paraleuctra sara* and *Ostrocerca truncata* (Claassen) (Grubbs 2004; Surdick 2004). This species was obtained from Talladega National Forest, representing a new state record and potentially a significant southwestern range extension along the Appalachian Mountains. Stark & Harris (1986) noted that a female of *S. mediana* (Banks) had been collected from Calhoun County, presumably in or near Talladega National Forest and Surdick (1985, 2004) recorded this species from Alabama. The females of *S. mediana* and *S. onkos*, however, are difficult to separate without males. James (1972) gave a dubious record for *S. mediana* from Lawrence Co., which is unlikely since this species is a southern Appalachian-distributed species and that county is located in the northwestern portion of the state.

Material examined. U.S.A., Alabama, Cleburne Co., small stream draining Dugger Mountain, Talladega National Forest, 22 May 2006, A.L. Sheldon, 1 ♂ (WKU).

ACKNOWLEDGEMENTS

Boris Kondratieff (Colorado State University, Fort Collins, Colorado) and Paul Tinerella (Illinois Natural History Survey, Champaign, Illinois) are thanked for the loan of specimens of *Allocapnia wrayi*. Richard Baumann (Monte L. Bean Museum, Brigham Young University, Provo, Utah) kindly donated

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Talladega National Forest material of *Paraleuctra sara*. Boris Kondratieff also provided helpful comments on a prior draft of this manuscript.

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Received 30 March 2008, Accepted 31 March 2008, Published 19 September 2008