



LARVAE OF EIGHT EASTERN NORTH AMERICAN SWELTSA (PLECOPTERA: CHLOROPERLIDAE)

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ABSTRACT

Larval descriptions are provided for eight eastern Nearctic species of *Sweltsa*. Larvae of *Sweltsa hoffmani* Kondratieff & Kirchner, *S. lateralis* (Banks), *S. mediana* (Banks), *S. naica* (Provancher), *S. palearata* Surdick, *S. pocahontas* Kirchner & Kondratieff and *S. urticae* (Ricker) are described for the first time and compared with *S. onkos* (Ricker). A provisional key is presented for larvae of these eastern Nearctic species.

Keywords: *Sweltsa*, Plecoptera, Larval descriptions, Eastern Nearctic

INTRODUCTION

The chloroperlid genus *Sweltsa* currently includes 34 Nearctic species, 10 of which occur in eastern North America. Their larvae are distinct in having a patch of thick, depressed, dark clothing hairs laterally on all thoracic sterna (Stewart & Stark 2002). Only *Sweltsa onkos* (Ricker) of the eastern species has been described in the larval stage (Fiance 1977). As part of an ongoing effort to comparatively study and provide species level keys for stonefly larvae in genera where few species are known (Stark & Stewart 2005; Stark & Kondratieff 2010) we present herein, the results of our study of eight eastern *Sweltsa* species. Surdick (2004) indicated "The eight eastern Nearctic species of *Sweltsa* exclusive of *S. naica* (Provancher) appear closely related..." and all except *Sweltsa naica* are included in the *Sweltsa onkos* complex by Kondratieff & Kirchner (2009). The

adults are well illustrated and diagnosed by Surdick (2004) except for *S. hoffmani* Kondratieff & Kirchner, subsequently described by Kondratieff & Kirchner (2009). As a result of the close relationship among species in this complex, the morphological distinctions between their larvae are small and larval determination may at times require use of geographic proximity.

MATERIALS AND METHODS

Pharate larvae and larval skins of reared and field associated *Sweltsa* specimens were examined with light microscopy. Drawings were prepared using an Olympus SZH10 or Wild M5 dissecting microscope with drawing tube. Setal patterns were documented on single specimens and compared with other specimens in the sample to check for variation. However, all samples are small and limited in

geographic distribution. Specimens are deposited in the C.P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado (CSU), the S.A. Grubbs Collection, Western Kentucky University, Bowling Green, Kentucky (WKU), the R.F. Kirchner Collection, Huntington, West Virginia (RFK), the Stark Collection, Mississippi College, Clinton, Mississippi (BPS) and the K.W. Stewart Collection, University of North Texas, Denton, Texas (KWS).

RESULTS AND DISCUSSION

Sweltsa hoffmani Kondratieff & Kirchner (Figs. 1-5)

Sweltsa hoffmani Kondratieff & Kirchner, 2009:297. Holotype ♂ (United States National Museum), West Virginia, Logan Co., Frogtown Hollow of Copperas Mine Fork

Material examined. WEST VIRGINIA: Cabell Co.: Lusher Hollow of Mud River, 24 April 1977, R.F. Kirchner, 3♂, 1♀ (reared), 6 pharate larvae (RFK).

Mature larva. Body length 7.0-8.0 mm. General color pale brown without distinctive pigment pattern except underlying adult pattern in pharate individuals. Pronotal grooves slightly darker than background pigment (Fig. 1). Pronotum bearing ca. 10 anterolateral setae, ca. 18 posterolateral setae, and ca. 2 widely spaced lateral setae near margin; longest anterolateral and posterolateral setae subequal in length. Mesonotum with ca. 7 moderately long outer marginal setae (Fig. 2); mesonotum and metanotum without conspicuous intercalary setae on wingpads. Fore femora with a few (ca. 7 long dorsal setae near margin and ca. 10 ventral setae; femoral fringe setae obscure but usually 2-3 present. Fore tibiae bearing a sparse outer fringe of short setae, inner margin with ca. 6 thick setae (Fig. 3). Posterior fringe of abdominal terga 8-9 typically bearing 4 long setae and interspersed shorter setae; median field with thin setae and usually a grouping of 3-4 short thick setae between thin median setae and innermost long seta (Fig. 4); lateral intercalary setae include 1-2 thick, long setae in each cluster. Cerci broken but basal 12 segments shown in Fig.5; longest dorsal setae in segmental whorls exceed segments in length and

occur on segments 8-10.

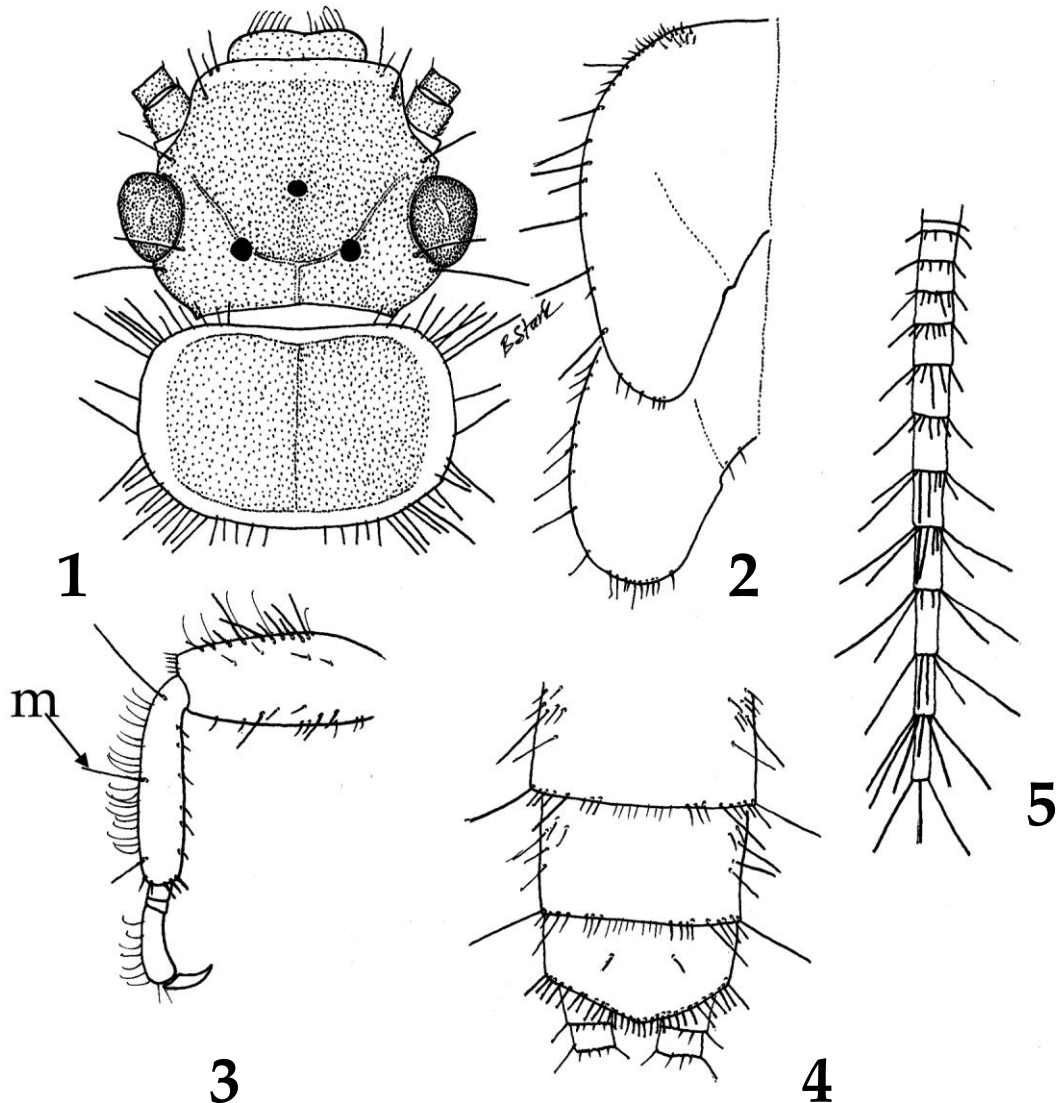
Comments. Surdick (2004) recognized *S. mediana* (Banks) and *S. onkos* as sister species lacking dark pigment on the adult pronotal margins and Kondratieff & Kirchner (2009) recently recognized *S. hoffmani* as a third species sharing this feature. The three species appear to be allopatric, at least in the southern part of their ranges. *Sweltsa hoffmani* is not currently known to geographically overlap the range of *S. mediana* and does so uncommonly with *S. onkos* in the northeastern portion of their ranges. *Sweltsa mediana* is known from the Carolinas to Tennessee and southwestern Virginia (Grubbs 2010; Kondratieff & Kirchner 2009; Surdick 2004), *S. onkos* from north of the Mt. Rogers area of Virginia into Atlantic Canada (Kondratieff & Kirchner 2009) and *S. hoffmani* is reportedly found from the unglaciated region of New York west through the Interior Plateau region in Indiana, and south to northwestern Alabama (Grubbs 2011; DeWalt & Grubbs 2011); the species is also reported from Kentucky, Ohio, Tennessee and West Virginia (Kondratieff & Kirchner 2009).

Larvae of these three species can be distinguished by length of the longest dorsal setae on mid-apical cercal segments. Those on *S. onkos* are about two segments in length, whereas those on *S. hoffmani* and *S. mediana* are generally less than 1.5 segments in length. *Sweltsa hoffmani* larvae are distinct from *S. mediana* and *S. onkos* in having the fore tibial fringe composed of short, sparse setae (Fig. 4) and from all eastern *Sweltsa* examined on the basis of the lack of intercalary setae on the metanotal wingpads (Fig. 2).

Sweltsa lateralis (Banks) (Figs. 6-10)

Alloperla lateralis Banks, 1911:337. Holotype ♀ (Museum of Comparative Zoology), North Carolina, Black Mountains

Material examined. NORTH CAROLINA: Avery Co.: Gragg Prong Lost Cove Creek, Rosenborough Road, 19 April 2007, B.C. Kondratieff, R.F. Kirchner, D. Lenat, 2♂, 3 larvae (CSU). **Macon Co.:** Berties Falls, Wayah Bald, 23 May 1984, B. Stark, 3♂ (1 reared), 2♀, 3 pharate larvae (BPS). Rattlesnake Spring, Wayah Bald, 18 May 1983, B. Stark, 2♂, 1 pharate larva (BPS). Same site, 18 April 1981, J.S.

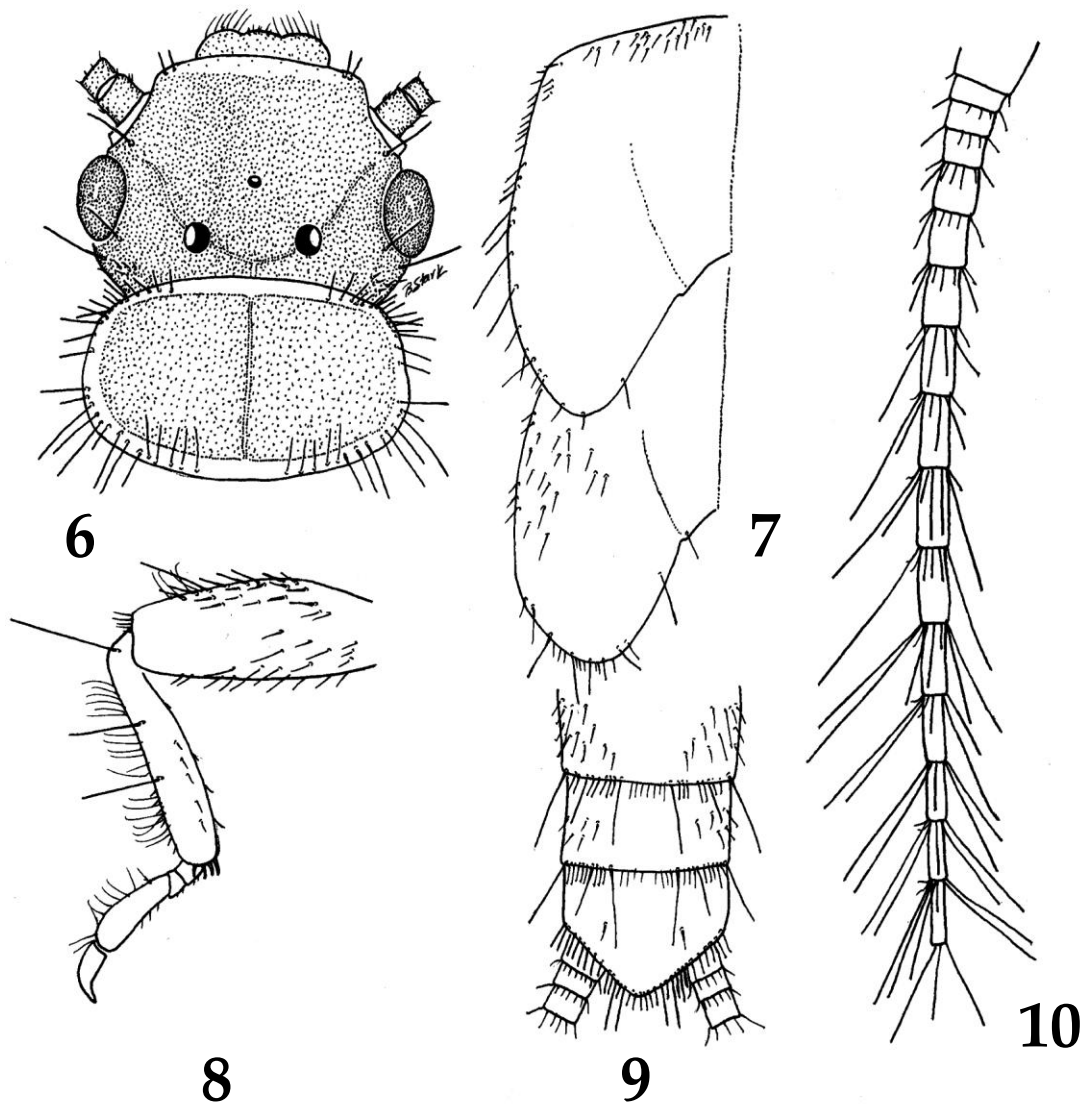


Figs. 1-5. *Sweltsa hoffmani* larval structures. 1. Head and pronotum. 2. Mesonotum and metanotum. 3. Right foreleg (m = median outer tibial seta). 4. Abdominal terga 8-10. 5. Lateral aspect of cercus, dorsum left.

Weaver, R.W. Holzenthal, 6 larvae (BPS). Robin Branch, Wayah Bald, 19 May 1983, B. Stark, 1♂, 1 larva (BPS). **Yancey Co.:** Mt. Mitchell State Park, 25 May 1994, B. Stark, S.W. Szczytko, J. Sandberg, 1♂, 1 larva (BPS). **WEST VIRGINIA: Pocahontas Co.:** Right Fork Tea Creek, 9 May 1986, K.W. Stewart, R.F. Kirchner, 2♂, 4♀ (reared) (KWS).

Mature larva. Body length 7.0-8.0 mm. General color pale brown without distinctive pigment pattern except underlying adult pattern in pharate

individuals. Head with a slightly paler area forward of median ocellus and pronotum with slightly darker submarginal grooves. Pronotum bearing ca. 15 anterolateral setae and ca. 15 posterolateral setae near margin (Fig. 6); setal length variable but longest occur on posterolateral angles. Mesonotum bearing prominent setae scattered along outer margins from base to apex, and a few inner marginal setae are present above notch (Fig. 7). Metanotum with several thin intercalary setae on wingpad and outer and



Figs. 6-10. *Sweltsa lateralis* larval structures. 6. Head and pronotum. 7. Mesonotum and metanotum. 8. Right foreleg. 9. Abdominal terga 8-10. 10. Lateral aspect of cercus, dorsum left.

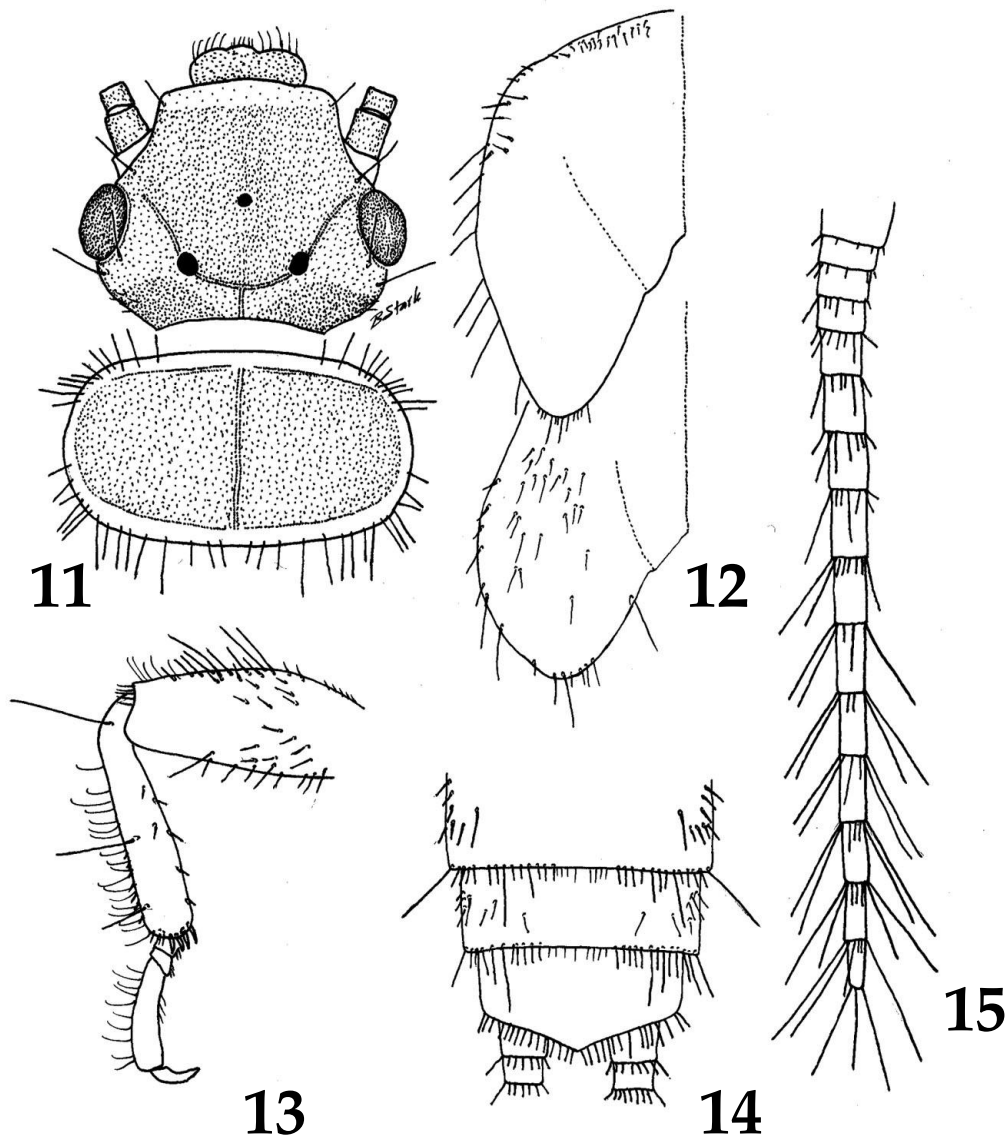
inner margins scattered around wingpad; apex of wingpad with long and interspersed short setae. Fore femora without fringe setae, tibiae sparsely fringed on outer margin (Fig. 8). Thick setae present along much of dorsal and ventral margins of femora and scattered on surface; tibiae bearing long thin setae interspersed within fringe setae on outer margin. Posterior abdominal fringe on tergum 8 with very thin setae between innermost long setae (Fig. 9); intercalary setae clustered in lateral group of ca. 10.

Cerci with 15-16 segments (Fig. 10); each segmental whorl beyond segment 7 with 1 or 2 dorsal setae about two segments in length.

Comments. *Sweltsa lateralis* is widely distributed throughout much of eastern North America (Surdick 2004). It is a common species of headwater seeps, rheocrenes and smaller streams of the higher Appalachians where it is often sympatric with all other eastern Nearctic *Sweltsa*. The male epiproct is generally similar to *S. onkos*, *S. pocahontas* Kirchner &

Kondratieff and several other species, particularly in dorsal aspect (Surdick 2004), however the presence of a pair of basolateral lobes on the epiproct are unique to this species. Larvae of *S. lateralis* are similar to *S. naica* and *S. onkos* in having the longest dorsal cercal setae subequal to two segments in length, but differs from both in having the fore tibial fringe setae sparse and about half as long as the median outer marginal seta. The larvae of *S. lateralis* share more features with *S. pocahontas* than with other species examined, but the longest dorsal cercal setae for that species are

about 1.5 times as long as the midapical segments. The combination of short tibial fine fringe setae (Fig. 9), few or no intercalary metanotal wingpad setae (Fig. 7), and the long dorsal cercal setae (Fig. 10) usually is sufficient to distinguish larvae. These characters, however, should be used with caution if larvae are immature or missing numerous cercal segments. Caution is also needed because larvae of two sympatric species, *S. holstonensis* Kondratieff & Kirchner and *S. voshelli* Kondratieff & Kirchner, are unknown.



Figs. 11-15. *Sweltsa mediana* larval structures. 11. Head and pronotum. 12. Mesonotum and metanotum. 13. Right foreleg. 14. Abdominal terga 8-10. 15. Lateral aspect of cercus, dorsum left.

***Sweltsa mediana* (Banks)**
(Figs. 11-15)

Alloperla mediana Banks, 1911:336. Holotype ♀ (Museum of Comparative Zoology), North Carolina, Black Mountain, North Fork of Swannanoa River

Material examined. NORTH CAROLINA: Haywood Co.: Great Smoky Mountains National Park, Cataloochee River, 4 May 1985, K.W. Stewart, B.C. Kondratieff, R.F. Kirchner, 7♂, 4♀, 7 larvae (KWS). **TENNESSEE: Sevier Co.:** Great Smoky Mountains National Park, 2 mi below Newfound Gap Summit, 18 May 1993, B. Stark, B.C. Kondratieff, R.F. Kirchner, 1 pharate larva. Great Smoky Mountains National Park, Greenbriar Cove, 3 mi above Ranger Station, 17 May 1983, B. Stark, B.C. Kondratieff, R.F. Kirchner, 3♂, 3♀, 1 larva (BPS).

Mature larva. Body length 7.0-8.0 mm. General color pale brown without distinctive pigment pattern except underlying adult pattern in pharate individuals. Pronotum bearing ca. 14 anterolateral setae and ca. 16 posterolateral setae near margin; posterolateral setal row extends to median suture (Fig. 11). Mesonotum bearing prominent setae scattered along outer margin from base to apex (Fig. 12), and a few inner marginal setae near notch. Metanotum with several outer marginal setae and a large grouping of intercalary setae on wingpad surface; apex of wingpads with interspersed long and short setae. Fore femora with a few fringe setae, tibiae sparsely fringed on outer surface (Fig. 13). Thick setae present on dorsal and ventral margins and a few scattered on femoral surface; tibiae bearing long thin setae and a row of short thick setae along outer margin. Posterior abdominal fringe on tergum 8 with a mixture of thin and thick setae between innermost long setae (Fig. 14); intercalary setae clustered in lateral group of ca. 7. Cerci with ca. 15 segments; long dorsal setae in segmental whorls about as long as 1.5 segments (Fig. 15).

Comments. This southern Appalachian species is found in the upper Tennessee River drainage southward in the mountainous regions of North Carolina, South Carolina, Tennessee and Virginia (Surdick 2004) and earlier records from Alabama were recently assigned to *S. hoffmani* by Grubbs (2010). Generally *S. mediana* occurs in larger streams

than *S. lateralis*, but they are known to be sympatric at numerous sites. Mature larvae of *S. mediana* are the only southern Appalachian *Sweltsa* species with a long tibial fine setal fringe (Fig. 14). See additional comments above for *S. hoffmani*.

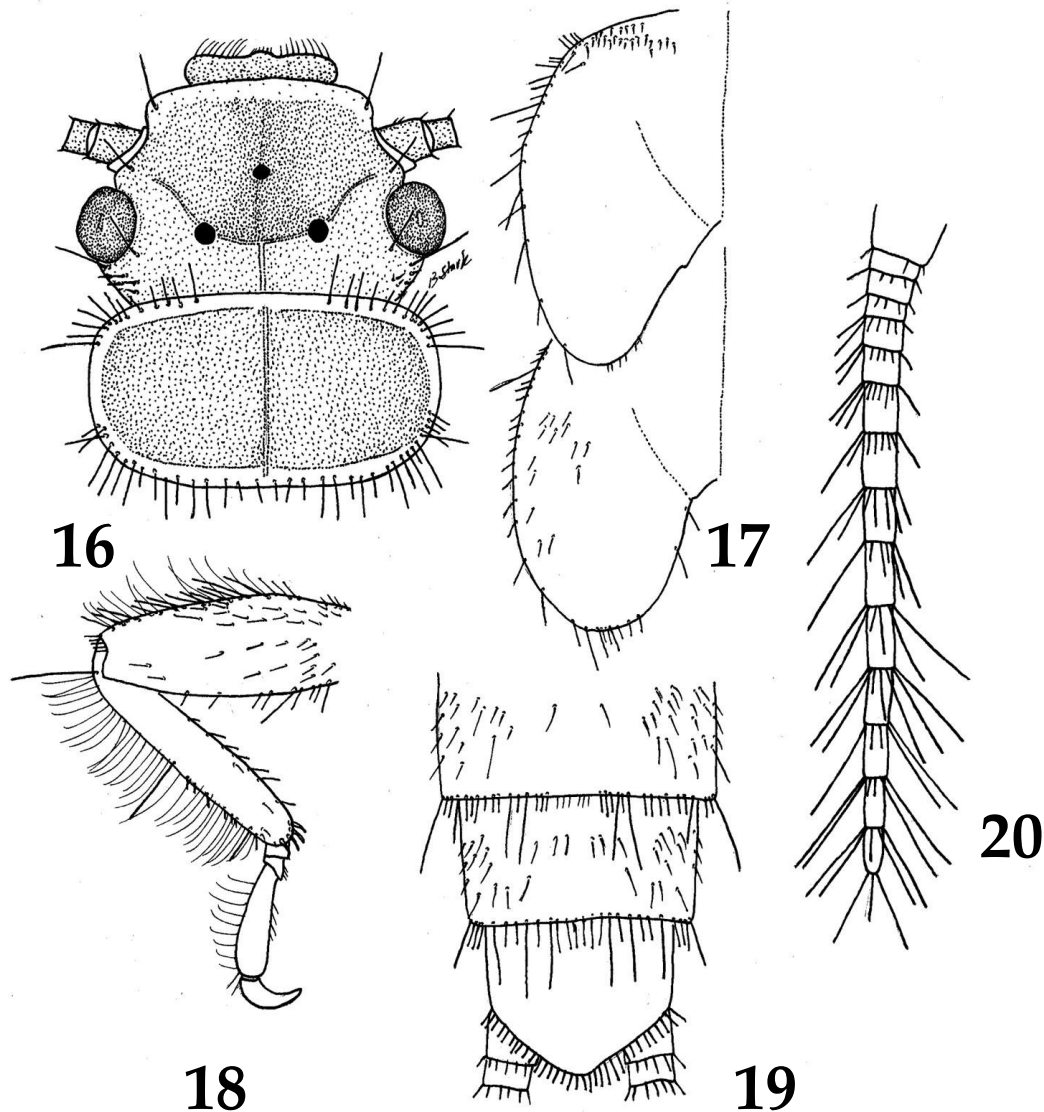
***Sweltsa naica* (Provancher)**
(Figs. 16-20)

Perla naica Provancher, 1876:214. Holotype ♂ (Quebec Provincial Museum), vicinity of Quebec City
Alloperla novascotiana Needham & Claassen, 1925:113. Holotype ♂ (Cornell University), Nova Scotia, Truro, synonymy by Ricker, 1952

Material examined. NEWFOUNDLAND: Bowed Brook, Hwy 430, Bellburns, 5 June 1998, B.C. Kondratieff, R.W. Baumann, 13♂, 1 pharate larva (CSU). **PENNSYLVANIA: Westmoreland Co.,** Powdermill Run, Powdermill Nature Reserve, 15 May 1993, S.A. Grubbs, 6♂, 2♀, 7 larval skins (WKU). Same site, 16 May 1993, S.A. Grubbs, 21♂, 13♀, 5 larval skins (WKU).

Mature larva. Body length 10 mm. General color brown, head darker over frons (Fig. 16). Pronotum bearing ca. 14 anterolateral setae and ca. 19 posterolateral setae near margin; posterolateral row extends to median suture. Mesonotum bearing ca. 13 prominent outer marginal setae and metanotum bearing ca. 17 prominent outer marginal setae (Fig. 17); intercalary surface of metanotal wingpad with numerous setae. Fore femora with numerous thick setae in basal half and along dorsal margin (Fig. 18); dorsal margin with a few fringe setae. Tibiae with outer fringe setae and inner row of thick setae. Posterior abdominal fringe on tergum 8 with median field occupied by a small group of thin setae, tergum 9 fringe with thick setae in median field (Fig. 19). Cerci with ca. 15 segments; long dorsal setae in segmental whorls about as long as 2 segments (Fig. 20); most apical segments with several long setae visible in profile.

Comments. The distinctive shoehorn shaped male epiproct for *S. naica* suggests it is not closely related to other eastern Nearctic members of the genus, however Surdick (2004) presents evidence which support the species being more closely related to members of the *S. onkos* complex than to *S.*



Figs. 16-20. *Sweltsa naica* larval structures. 16. Head and pronotum. 17. Mesonotum and metanotum. 18. Right foreleg. 19. Abdominal terga 8-10. 20. Lateral aspect of cercus, dorsum left.

oregonensis (Frison) or other western species with similar epiproct structure. Geographically, *S. naica* is known from West Virginia and Virginia, north through Atlantic Canada (Surdick 2004), where it is often sympatric with *S. onkos* and sometimes with *S. lateralis*. Larvae of *S. naica* are generally similar to those of *S. onkos*, particularly in sharing long dorsal cercal setae (Fig. 20) and long tibial fringe (Fig. 19), but pre-emergent larvae of the two are distinguished on the basis of abdominal and occipital pigment

patterns. *Sweltsa naica* larvae are the only eastern Nearctic *Sweltsa* species known to have a dark frons and a relatively pale occipital area.

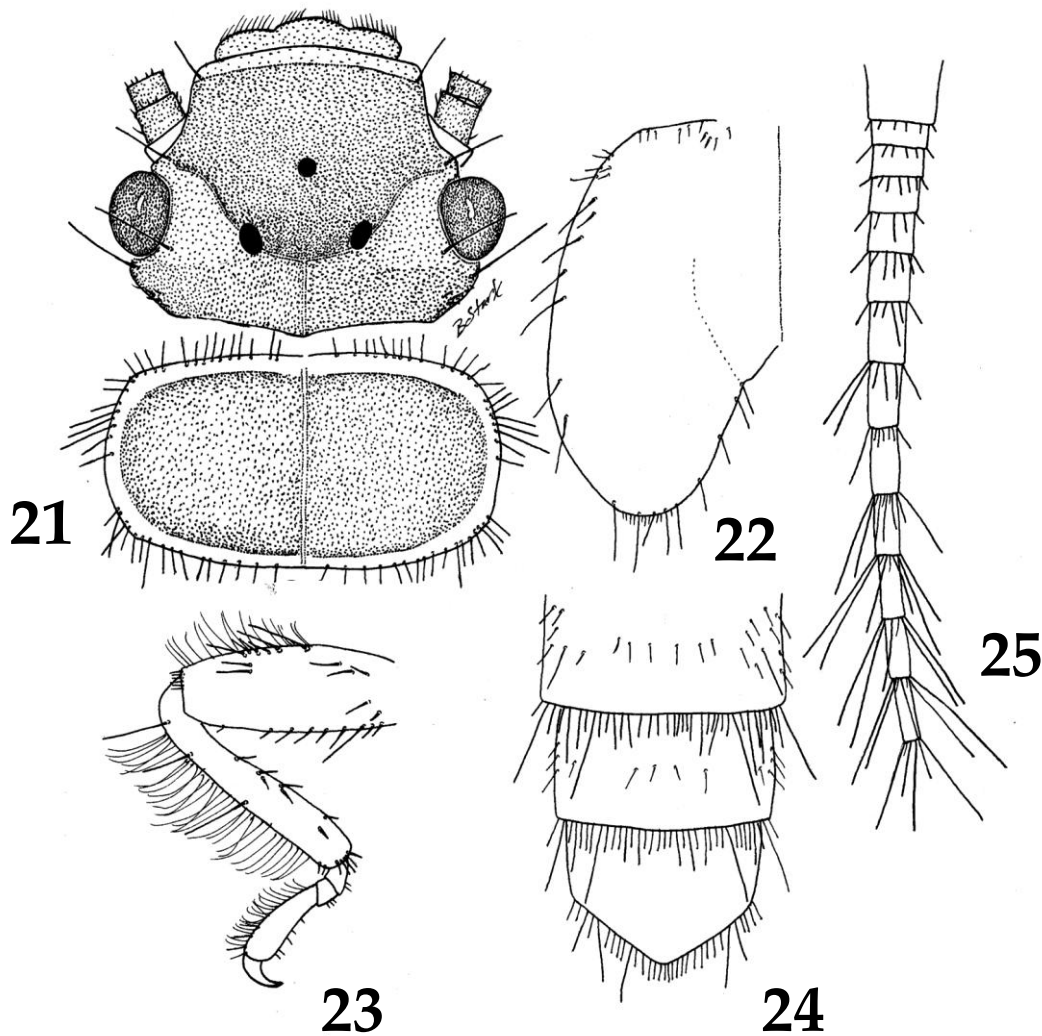
***Sweltsa onkos* (Ricker)**
(Figs. 21-25)

Alloperla onkos Ricker, 1935:256. Holotype ♂ (Royal Ontario Museum), Ontario, Dufferin Co., Horning's Mills, headwaters of Pine River

Material examined. QUEBEC PROVINCE: Diable Parc, Mont-Tremblant, Lac Monroe, 8 June 1997, B.C. Kondratieff, R.W. Baumann, 20♂, 1 pharate larva (CSU). River Rems, north of Baie St. Paul, 9 June 1997, B.C. Kondratieff, R.W. Baumann, 13♂, 2 larval skins (CSU).

Mature larva. Body length 7.5-8.5 mm. General color brown, abdomen chestnut brown; body without distinctive pattern except underlying adult features in pharate individuals. Thorax and abdomen covered with abundant dark clothing hairs. Pronotum bearing ca. 20 anterolateral setae, and ca. 19 posterolateral setae; both rows extend to near median suture (Fig.

21). Mesonotum bearing ca. 13 outer marginal setae and a few inner marginal setae (Fig. 22). Foreleg with sparse femoral and more extensive tibial fringe setae; femora with ca. 5 long thick setae on dorsal margin and ca. 9 on ventral margin (Fig. 23); tibiae bearing 3-4 long thin outer marginal setae and ca. 5 inner marginal thick setae. Abdominal tergum 8 with posterior fringe complete; mesally fringe includes mixed thin and thick setae (Fig. 24); lateral intercalary setal cluster includes ca. 14 thick setae. Cerci with ca. 14-15 segments; long dorsal setae in apical segmental whorls about as long as two segments (Fig. 25).



Figs. 21-25. *Sweltsa onkos* larval structures. 21. Head and pronotum. 22. Mesonotum and metanotum. 23. Right foreleg. 24. Abdominal terga 8-10. 25. Lateral aspect of cercus, dorsum left.

Comments. *Sweltsa onkos* is a common species that occurs from Atlantic Canada, Newfoundland, Ontario and Quebec south to Virginia (Kondratieff & Kirchner 2009). Fiance (1977) provides a habitus drawing of larvae of this species and several figures showing setal arrangements for several larval body parts, based on material from Bear Brook, New Hampshire. These figures are in general agreement with our data derived from Quebec specimens, except the length of cercal setae appear shorter, the lateral pronotal setae much more extensive, and dorsal femoral fringe setae more numerous in Fiance's (1977) illustrations. Larvae appear most similar to the sympatric *S. naica* but the meso and metanotum are densely covered with long clothing hairs (Fig. 22). See additional comments above for *S. hoffmani*, *S. lateralis* and *S. naica*.

***Sweltsa palearata* Surdick**
(Figs. 26-30)

Sweltsa palearata Surdick, 2004:29. Holotype ♂ (United States National Museum), West Virginia, Hardy Co., Lost River State Park

Material examined. MARYLAND: Allegany Co.: Tributary Fifteenmile Creek, Fifteenmile Creek Rd, 13 May 1995, S.A. Grubbs, 2♂, 5 pharate larvae (WKU). Tributary Fifteenmile Creek, Treasure Rd, 13 May 1996, S.A. Grubbs, 16♂, 11♀, 3 pharate larvae. Spring, Sidling Hill Creek drainage, Swain Hollow Rd, 5 May 1996, S.A. Grubbs, 8♂, 4♀, 3 larvae (WKU). Tributary Maple River, Twigg Rd, 4 May 1996, S.A. Grubbs, 1♂, 4♀, 8 pharate larvae (WKU).

Mature larva. Body length 8.0-9.5 mm. General color pale brown without distinctive pigment pattern except underlying adult pattern in pharate individuals. Pronotum bearing ca. 12 anterolateral setae and ca. 20 posterolateral setae along margins (Fig. 26); setal length variable but longest set near anterolateral and posterolateral angles. Mesonotum and metanotum with sparse row of long marginal setae; metanotum with ca. 3-5 erect intercalary setae beyond mesonotal apex (Fig. 27). Fore femora and tibiae with few fine fringe setae; tibiae bearing three long thin setae on outer margin (Fig. 28). Abdominal terga with ca. 6 long thin setae interspersed in posterior fringe and with few, mainly lateral

intercalary setae on terga 8-9, tergum 10 without intercalary setae (Fig. 29). Cerci with ca. 17 segments (Fig. 30); each segmental whorl beyond ca. segment 10 with 1 or 2 dorsal setae about 1.5 segments in length.

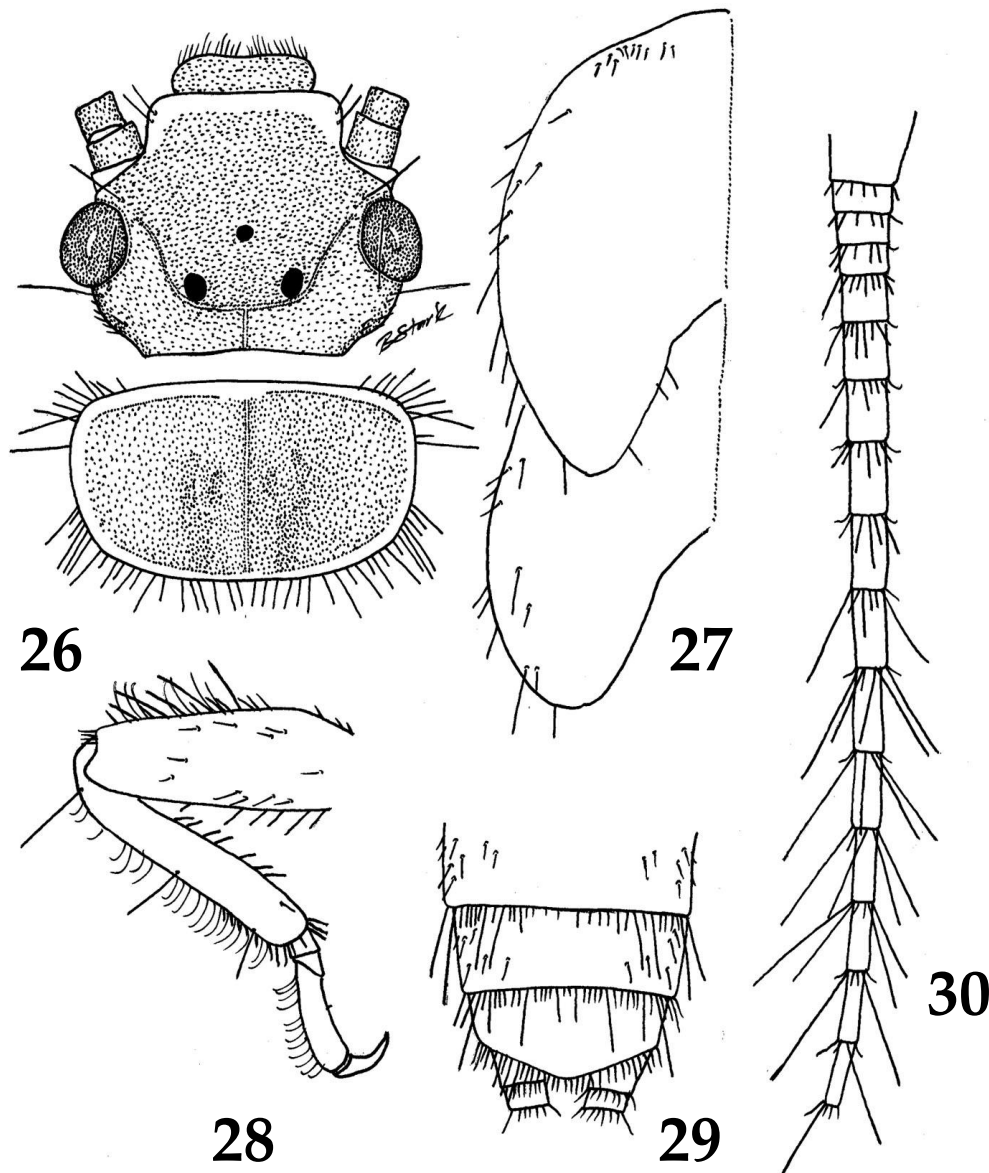
Comments. The known distribution of *S. palearata* currently includes sites in Maryland, Virginia and West Virginia, primarily in the drainages of the upper Potomac and North and South Forks of the Shenandoah (Surdick 2004). Adult characters place this species as a close relative of *S. pocahontas* but larvae are more similar to *S. hoffmani* in having few, usually less than five intercalary setae on the metanotal wingpad. Among available specimens these species appear to differ in numbers of intercalary setae on tergum 10 with *S. hoffmani* usually having two and *S. palearata* usually with none.

***Sweltsa pocahontas* Kirchner & Kondratieff**
(Figs. 31-35)

Sweltsa pocahontas Kirchner & Kondratieff, 1988:233. Holotype ♂ (United States National Museum), West Virginia, Pocahontas Co., Monongahela National Forest, Right Fork of Tea Creek

Material examined. MARYLAND: Garrett Co., Spring to Elk Lick Run, Westernport Rd, 1.7 mi upstream Savage River confluence, 17 May 1995, S.A. Grubbs, 2♀, 3 larvae (WKU). **WEST VIRGINIA: Pocahontas Co.:** North Fork Cherry River, Hwy 39/53, 17 May 1993, B.C. Kondratieff, R.F. Kirchner, 8♂, 1♀, 2 pharate larvae (BCK).

Mature larva. Body length 8.5-9.0 mm. General color brown, without distinctive pigment pattern except underlying adult features in pharate individuals. Pronotum bearing ca. 16 anterolateral setae near margin and ca. 17 posterolateral setae (Fig. 31); both setal rows extend near median suture. Mesonotum bearing ca. 10 long outer marginal setae and an irregular submarginal row of ca. 6 setae beyond basal grouping (Fig. 32). Metanotum with numerous intercalary setae on wingpad and an outer marginal row of mostly short thick setae extending to apex of wingpad; a few inner marginal setae on meso and metanota. Fore femora with a sparse grouping of several fringe setae and a few long thick setae along



Figs. 26-30. *Sweltsa palearata* larval structures. 26. Head and pronotum. 27. Mesonotum and metanotum. 28. Right foreleg. 29. Abdominal terga 8-10. 30. Lateral aspect of cercus, dorsum left.

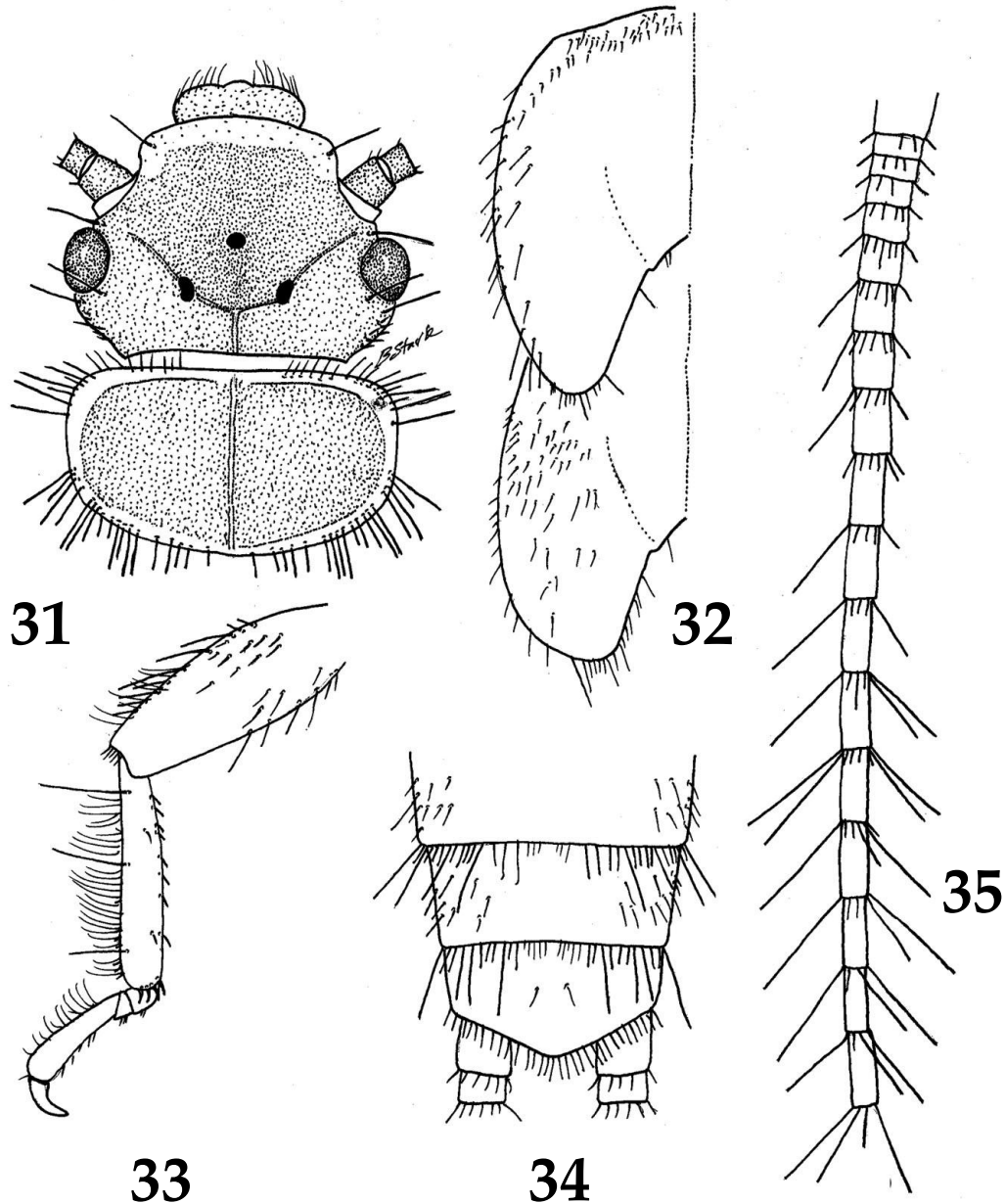
dorsal margin (Fig. 33); additional thick setae on femoral surface and along ventral margin; fore tibiae fringed along outer margin and bearing three long outer setae and ca. 9 thick inner setae. Abdominal tergum 8 with posterior fringe incomplete mesally; lateral intercalary cluster includes ca. 12 setae (Fig. 34). Cerci with ca. 18 segments; long dorsal setae in

apical segmental whorls about as long as 1.75 segments (Fig. 35).

Comments. As Surdick (2004) noted, this species is restricted to the Ridge and Valley Province and Allegheny Plateau of West Virginia and Maryland. It is sympatric with *S. lateralis* and may also be sympatric with *S. palearata*. Larvae of *S. lateralis* and

S. pocahontas generally occur in headwater seeps and rheocrenes. The two species can be distinguished on the basis of dorsal cercal setation length which in *S. pocahontas* is about as long as 1.5 cercal segments whereas in *S. lateralis* these setae

are typically as long as two segments. Also the larvae of *S. palearata* may be distinguished from similar *S. hoffmani* by the absence of intercalary setae on tergum 10. See additional comments above for *S. lateralis*.



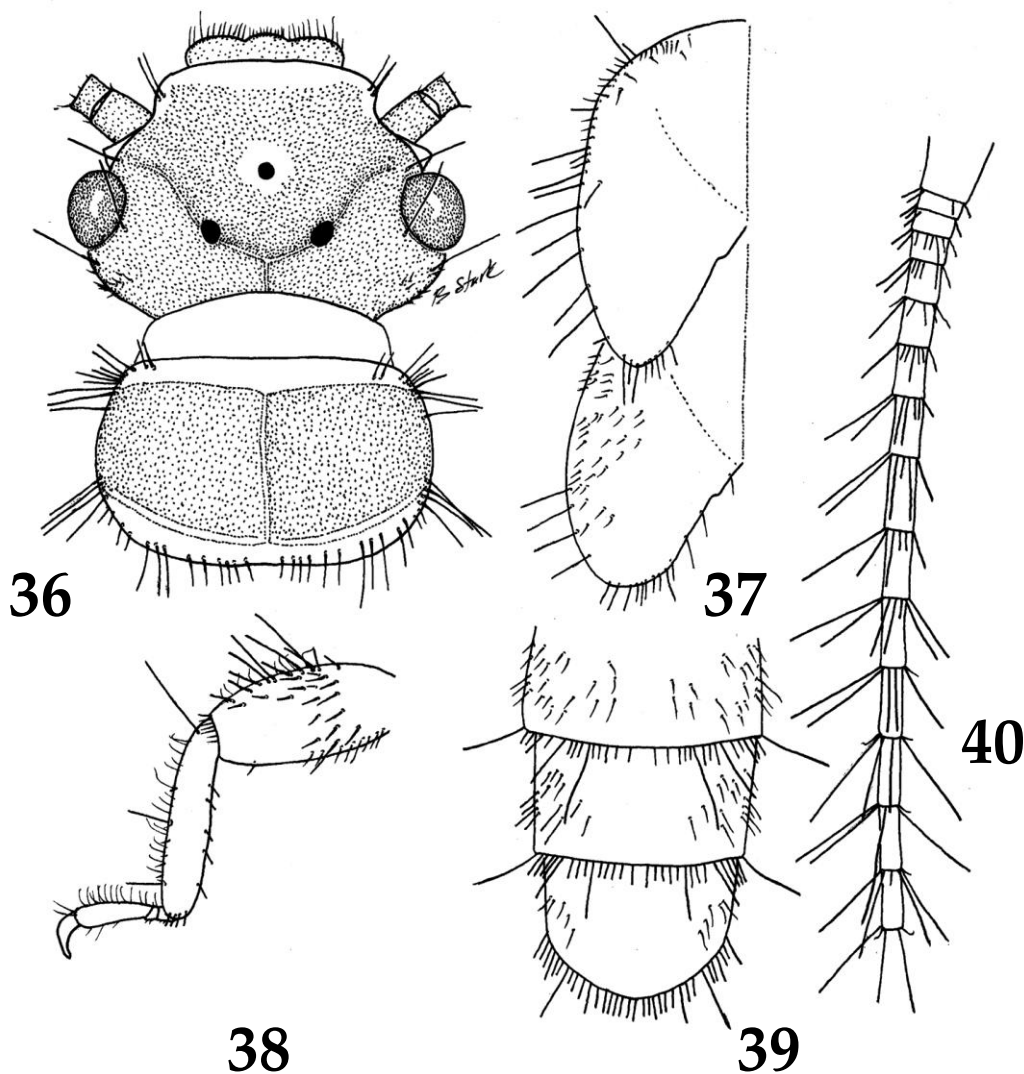
Figs. 31-35. *Sweltsa pocahontas* larval structures. 31. Head and pronotum. 32. Mesonotum and metanotum. 33. Right foreleg. 34. Abdominal terga 8-10. 35. Lateral aspect of cercus, dorsum left.

***Sweltsa urticae* (Ricker)**
(Figs. 36-40)

Alloperla (*Sweltsa*) *urticae* Ricker, 1952:185. Holotype ♂ (Illinois Natural History Survey), North Carolina, Great Smoky Mountains National Park, Wild Cherry Branch

Material examined. VIRGINIA: Smyth Co.: headwaters of Big Branch, Whitetop, Rt 600, 28 May 1983, B.C. Kondratieff, 4♂, 1♀, 3 pharate larvae (CSU).

Mature larva. Body length 7.0-7.5 mm. General color pale brown without distinctive pattern except for pale median ocellar spot due to underlying features of pharate adult. Pronotum bearing ca. 14 anterolateral setae near margin and ca. 18 posterolateral setae (Fig. 36); posterolateral setal row extends to median suture. Mesonotum bearing ca. 12 long outer marginal setae and shorter marginal setae basally and near wingpad apex (Fig. 37); mesonotal surface with few intercalaries. Metanotum with



Figs. 36-40. *Sweltsa urticae* larval structures. 36. Head and pronotum. 37. Mesonotum and metanotum. 38. Right foreleg. 39. Abdominal terga 8-10. 40. Lateral aspect of cercus, dorsum left.

numerous intercalary setae and a mixture of long and short outer marginal setae; several inner marginal setae occur on both meso and metanota. Fore femora with sparse fringe setae and a few long and short thick setae near dorsal margin (Fig. 38); ventral margin with few thick setae. Fore tibiae with sparse outer fringe made up of hairs much shorter than the three long, thick outer setae; inner margin with ca. five short thick setae. Abdominal tergum 8 with posterior fringe widely spaced mesally; lateral intercalary cluster includes ca. 18 setae (Fig. 39). Cerci with ca. 15 segments; long dorsal setae much more prominent than longest ventral setae through segment 10; longest setae only slightly longer than segment (Fig. 40).

Comments. *Sweltsa urticae* is a southern Appalachian species recorded from higher elevation rheocrenes and streams of southwestern North Carolina into the Great Smoky Mountains and north to the Mount Rogers area in southwestern Virginia (Surdick 2004). It is sympatric with *S. lateralis* and *S. mediana* but is more closely related to *S. holstonensis* and *S. voshelli* in epiproct structure than to other members of the genus (Surdick 2004). Unfortunately, no larval material for either of these latter species is available. Mature larvae of *S. urticae* can usually be recognized by the combination of short tibial fine fringe setae (Fig. 34), metanotal wingpads with at least 10 intercalary setae (Fig. 32), and tergum 10 bearing about 10-12 intercalary setae in lateral clusters (Fig. 33). Larvae of the species are more similar to those of *S. pocahontas* than to other known eastern species, but the two appear distinct on the basis of number of intercalary setae on tergum 10 and in geographical distribution.

Provisional Key to Eastern Nearctic *Sweltsa* Larvae
(*S. holstonensis* and *S. voshelli* unknown)

- 1 Tibial fine fringe setae sparse and about half as long as median outer marginal seta (Fig. 3) 2
- 1' Tibial fine fringe setae more abundant and about as long as median outer marginal seta (Fig. 23) 6
- 2 Metanotal wingpads with less than five intercalary setae (Fig. 2) 3
- 2' Metanotal wingpads with at least 10 intercalary setae (Fig. 37) 4
- 3 Tergum 10 bearing 2 intercalary setae (Fig. 4)

- *hoffmani*
- 3' Tergum 10 without intercalary setae (Fig. 29) *palearata*
- 4 Tergum 10 bearing ca. 10-12 intercalary setae in two lateral clusters (Fig. 39) *urticae*
- 4' Tergum 10 usually with at most, two intercalary setae (Fig. 9) 5
- 5 Longest dorsal cercal setae on ca. segment 12 subequal in length to two cercal segments (Fig. 10) *lateralis*
- 5' Longest dorsal cercal setae about as long as 1.5 cercal segments (Fig. 35) *pocahontas*
- 6 Longest dorsal cercal setae about as long as 1.2-1.5 cercal segments (Fig. 15) *mediana*
- 6' Longest dorsal cercal setae subequal in length to two cercal segments (Fig. 25) 7
- 7 Abdominal terga dark brown, occiput about as dark as frons (Fig. 21); meso and metanota rather densely covered with long, dark clothing hairs *onkos*
- 7' Abdominal terga pale brown, occiput almost entirely pale (Fig. 16); meso and metanota with sparse brown clothing hairs *naica*

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