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A NEW SPECIES OF EASTERN NEARCTIC *ISOPERLA* FROM ALABAMA AND MISSISSIPPI, U.S.A. (PLECOPTERA: PERLODIDAE; ISOPERLINAE)

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ABSTRACT

Isoperla jamesae sp. n. (Perlodidae: Isoperlinae) is described from northwestern Alabama and northeastern Mississippi, U.S.A. Detailed descriptions of the adult male and female are supported by line drawings. Scanning electron micrographs are used to illustrate details of the male aedeagus and egg.

Keywords: Plecoptera, Isoperlinae, *Isoperla*, stonefly, new species, Alabama, Mississippi

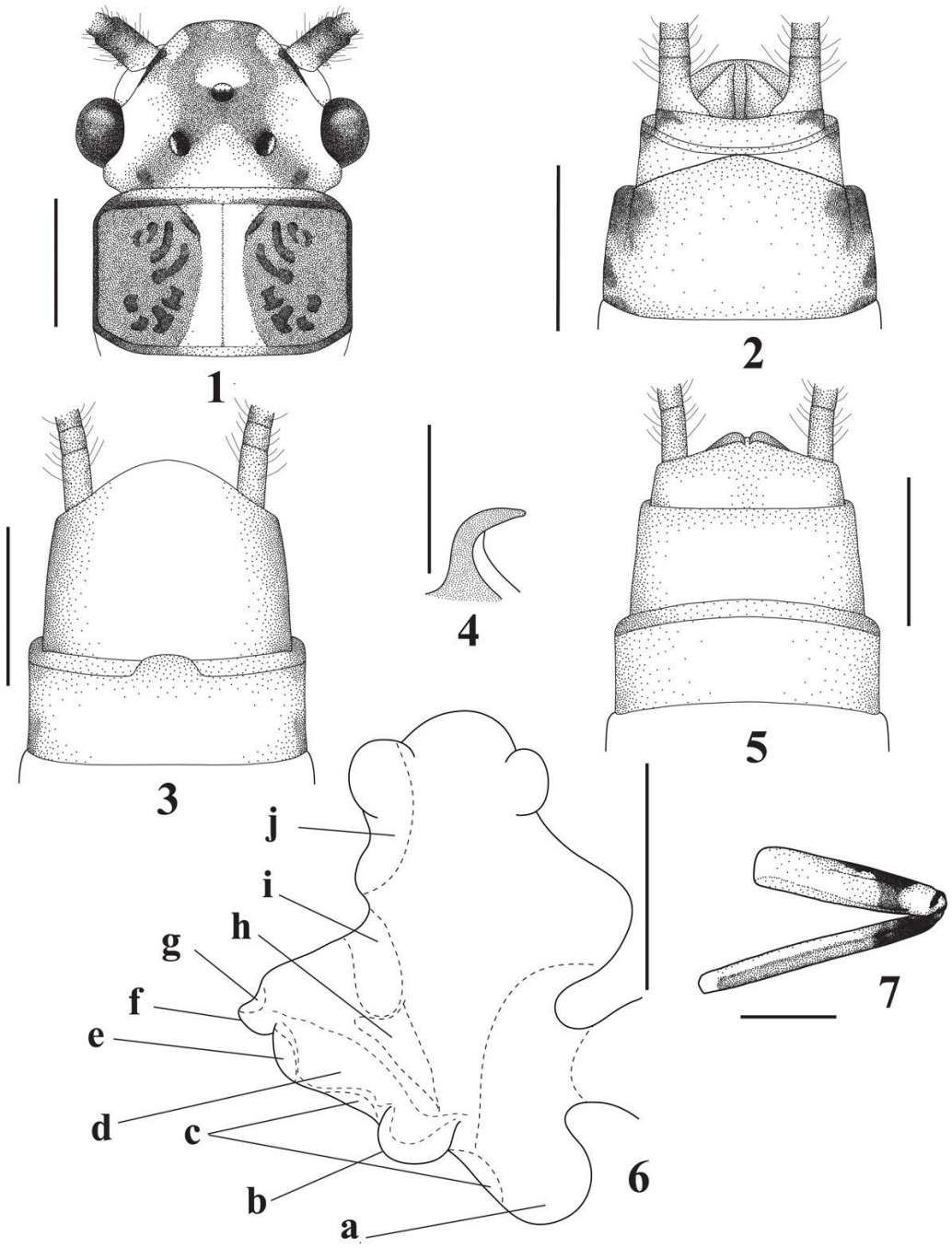
INTRODUCTION

Currently, there are 34 species of *Isoperla* known from eastern North America (Stark et al. 2009, DeWalt et al. 2010). This group has been historically problematic due to the similarity of adult secondary sexual characters and color patterns of many species. In addition, the wide variation in the shape of the female subgenital plate has contributed to the confusion between similar species and uncertainty of identification. Detailed study of armature, spinule patterns and shape of the male aedeagus is essential for accurate species identification.

Audrey James, in her Ph.D. research of Alabama Plecoptera (James 1972), described three species of *Isoperla*: *I. davisi, I. scotti*, and *I. grahami*. Only *I. davisi*, however, was subsequently described formally (James 1974). The remaining two species have remained unrecognized. *Isoperla scotti* was initially described from northwestern Alabama (Lauderdale Co., 6.2 mi S. Junct. Hwy 20 and Natchez Trace Pkwy on Pkwy, Rick Spring Crk., 6/V/1971, A.M. James and H.B. Cunningham, 2 males). She designated one male as the holotype and the additional male as a paratype, and indicated that they were deposited in the Illinois Natural History Survey. The proposed holotype and paratype, however, were examined recently and are in very poor condition. Recent collecting efforts near the *I. scotti* type locality by the senior author in May–June 2008 and April 2010 resulted in large series of fresh adult and nymphal material and after a detailed study it was apparent that these specimens are the same as the original type material. The purpose of this study is to resolve the identity of the informally designated *I. scotti* species and make a valid species name available for the ongoing review of the Isoperlinae of eastern North America (Szczytko and Kondratieff, in preparation).

MATERIALS AND METHODS

The aedeagus of male specimens was everted from live specimens using a stereo dissecting microscope to ensure that complete eversion was



Figs. 1-7. *Isoperla jamesae*. 1. Adult head-pronotal color pattern (line = 0.5 mm). 2. Female subgenital plate 3. Male 8th and 9th sternum (line = 0.5 mm). 4. Male paraprocts (line = 0.5 mm). 5. Male 8-9 terga (line = 0.5 mm). 6. Male aedeagus (line = 0.5 mm). a. Spinule pattern of postero-basal lobe. b. Spinule pattern of paired postero-ventral lobes and inner margin. c. Stout spinule patch above and below paired postero-ventral lobes. d. Long hair-like spinulae on paired postero-ventral lobes and posterior margin. e. Concentrated stout, thick spinulae below paired postero-median finger-like lobes. f. Paired postero-median finger-like lobes. g. Flat scales above postero-median finger-like lobes. h. Posterior slender, long hair-like spines. i. Stout spinulae with apical long hairs above scale patch. j. Short stout, blunt spinulae on postero-apical area. 7. Male hind leg (line = 0.5 mm).

achieved. Outlines of male and female genitalia and were made using a Leica MZ 12-5 stereo dissecting microscope equipped with a camera lucida. Detailed color images were made using the Leica microscope equipped with a JVC TK-107OU color video camera and a Sony Mavigraph UP-2300 thermal color video printer. Habitus drawings were completed using the computer program Adobe Illustrator CS4® from the outline drawings made with the camera lucida and referencing the digital images, color prints and specimens.

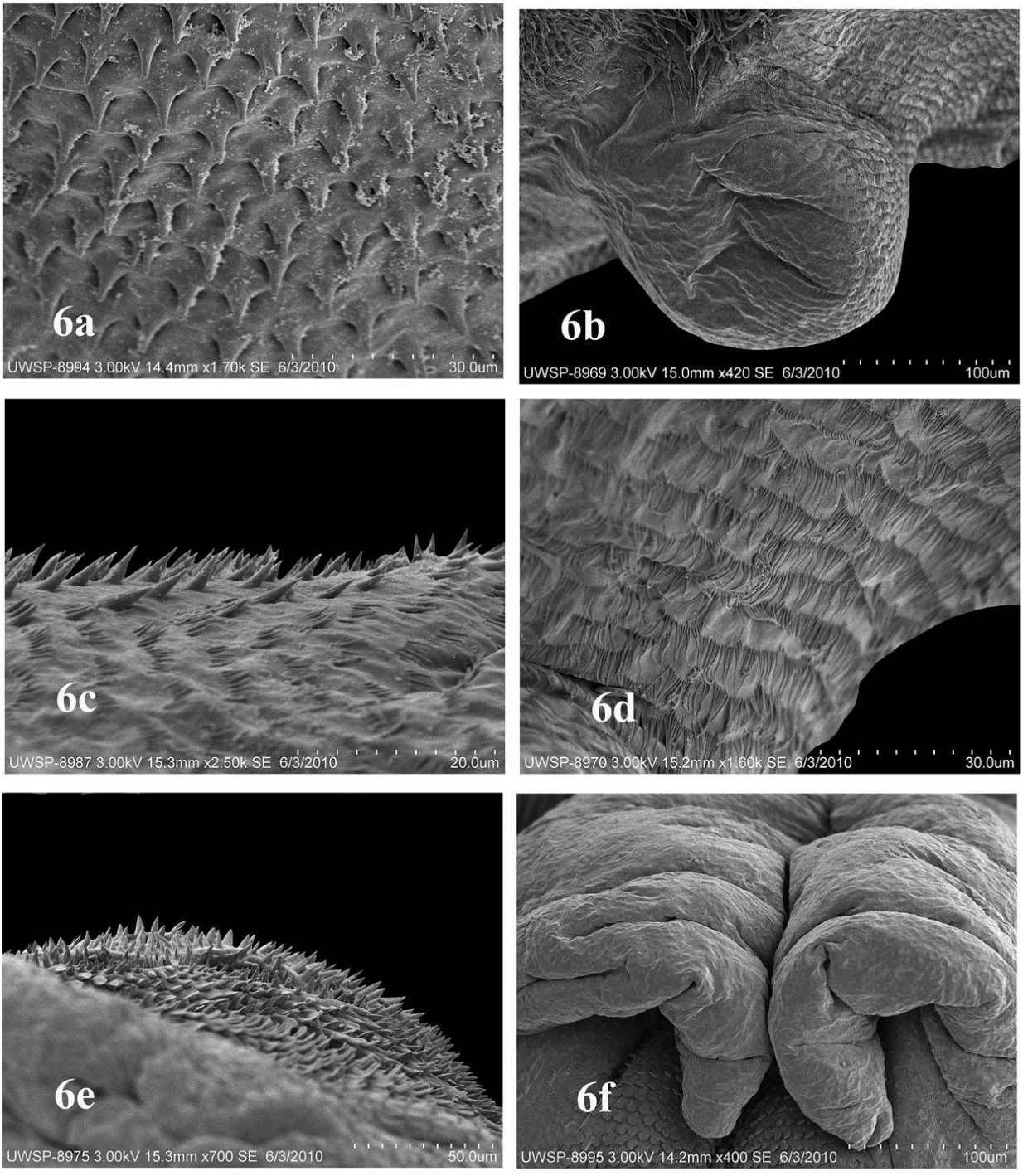
The methods of Stark and Lacey (2005) were used to prepare the male aedeagus for scanning electron microscopy. Ova were dissected from preserved gravid females and were prepared for scanning electron microscopy as described by Szczytko and Stewart (1979). Scanning electron micrographs of aedeagus and ova were made with a Hitachi S-3400 Environmental scanning electron microscope at University of Wisconsin Stevens-Point.

RESULTS AND DISCUSSION

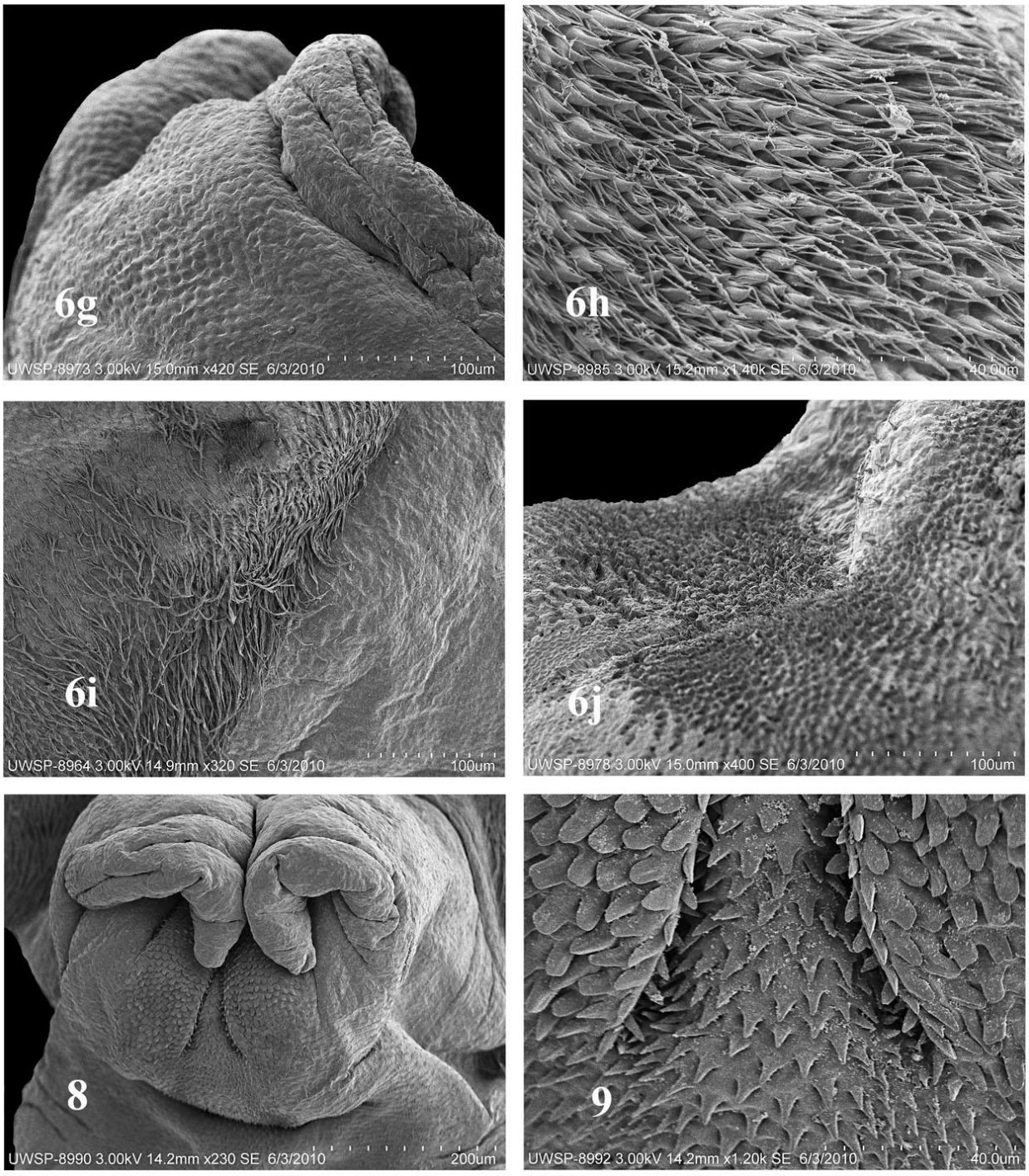
Isoperla jamesae sp. n.
(Figs. 1–13)

Material Examined. Holotype ♂, USA: Alabama, Lauderdale Co., North Fork Cypress Creek, CR 5, 3 km N Threet, 34.9765°, -87.8252°, 28/IV/2010, S.A. Grubbs. Paratypes: USA, Alabama, Lauderdale Co., same as holotype, 28/IV/2010, S.A. Grubbs, 11♂, 6♀; same as holotype, 3/V/2008, S.A. Grubbs, 3♂; Threet Creek, CR 5, 23 km ENE Waterloo, 34.9559°, -87.8248°, 3/V/2008, S.A. Grubbs, 2♀; Colbert Creek, CR 14, 16 km NE of Cherokee, 34.8754°, -87.8773°, 4/V/2008, S.A. Grubbs, 3♂, 8♀; Rock (sic) Spring Creek., 6.2 mi S Junct. Hwy 20 and Natchez Trace Pkwy on Pkwy, 6/V/1971, A.M. James and H.B. Cunningham, 2♂; Mississippi: Tishomingo Co., Clear Creek, Hwy 172, 4 mi. east of Iuka, 12/V/2010, B.P. Stark, 1♂, 1♀; same but 18/V/2009, B.P. Stark, 1♂, 1♀. The holotype is deposited at the United States National Museum, Smithsonian Institution, Washington, D.C. Paratypes are deposited in the following collections: S.A. Grubbs collection (Western Kentucky University), B.P. Stark collection (Mississippi College), S.W. Szczytko collection (University of Wisconsin/Stevens Point) and the Illinois Natural History Survey collection.

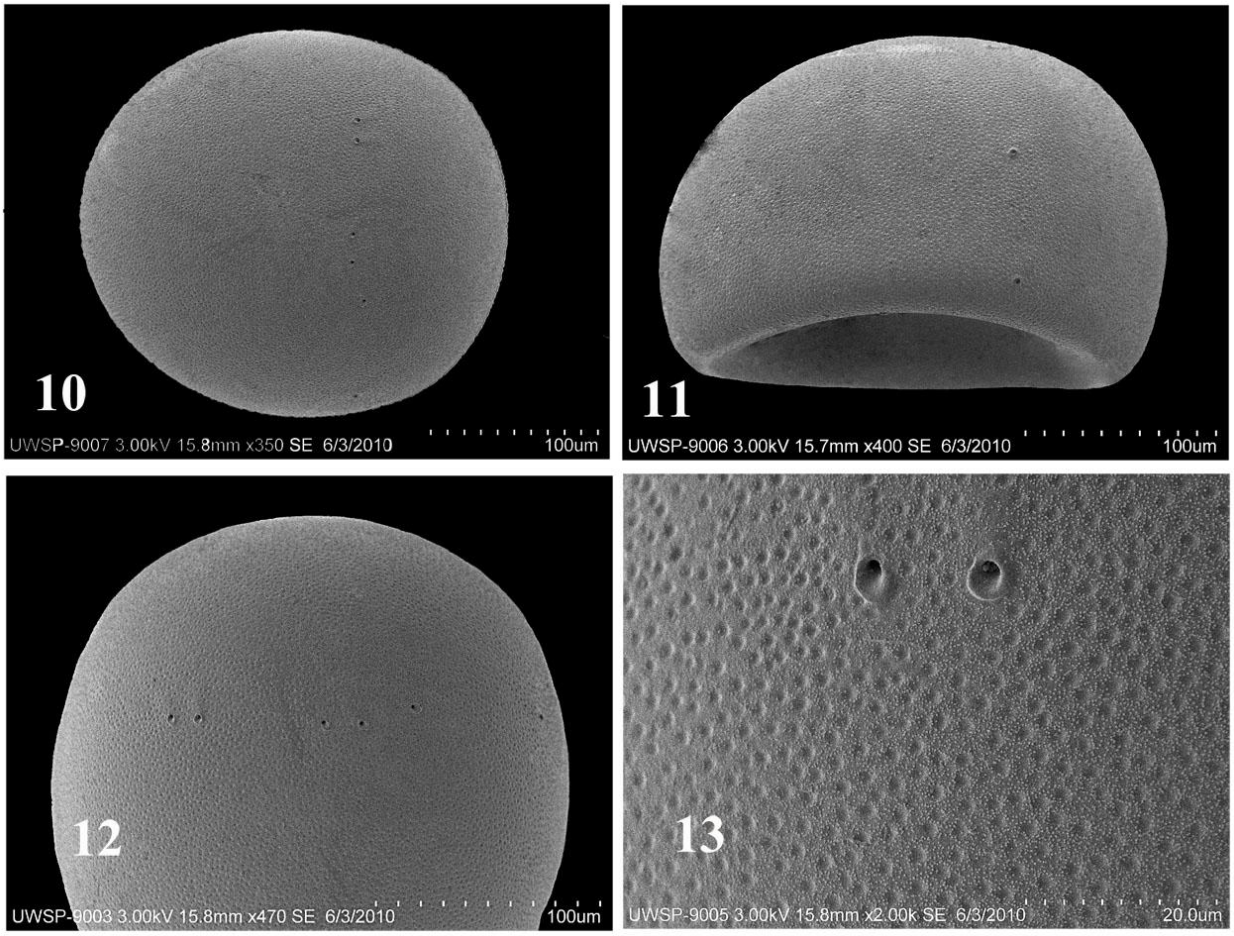
Male. Macropterous. Body length 6.0–7.0 mm; forewing length 7.0–8.0 mm. General body color light brown with dark brown markings. Dorsum of head with diffuse wide medium brown bands connecting ocelli and extending to posterior margin of head, terminating in two darker brown spots; interocellar area mostly dark usually with a faint, thin median light line, occasionally completely dark; thin medium brown bands extending anteriorly and deflected inward from median ocellus, bands wider on frons; triocellate (Fig. 1). Antennae and scape dark brown. Pronotum with wide median light stripe; disks medium brown, rugosities darker, thick and rounded; anterior margin dark brown; lateral margins medium brown (Fig. 1). Mesonotum and metanotum medium brown with irregular darker markings. Wings light, veins dark brown. Outer surface of femora light tan, with wide dark brown band near distal end (Fig. 7), numerous small stout setae and occasional longer setae on outer surface; outer surface of tibia medium brown, dark brown dorsal band proximally (Fig. 7), surface with numerous small stout setae and occasional longer setae. Abdominal terga light tan; lateral and dorsal patches of bright red color coloration on segments 1-7 in fresh material. Tenth tergum weakly sclerotized medially; paraprocts weakly sclerotized, bluntly pointed apically, produced forward only to level of 10th tergum (Figs. 4, 5). Abdominal sterna light tan; 8th sternum with a small, weakly sclerotized, low vesicle extending posteriorly to anterior margin of 9th sternum, ca. 3 times as broad as long (Fig. 3). Aedeagus membranous with paired postero- and antero-dorsal rounded lobes, large antero-medial lobe, paired postero-medial finger-like lobes, paired postero-ventral rounded lobes, and large single postero-basal lobe (Fig. 6). Large postero-basal lobe and baso-median section of aedeagus covered with small, stout sharp spinulae (Figs. 6 & 6a); paired postero-ventral lobes and inner posterior margin covered with dense rows of long hair-like spinulae (Figs. 6, 6b, 6d); anterior margin above and below postero-ventral lobes with patch of stout spinulae (Figs. 6, 6c); patch of concentrated stout, thick spinulae below paired postero-median finger-like lobes (Figs. 6, 6e); paired anteromedian lobes finger-like, deflected ventrally, curved outward at tips,



Figs. 6a-f. *Isoperla jamesae*. Male aedeagus (line = 0.5 mm). 6a. Spinule pattern of postero-basal lobe. 6b. Spinule pattern of paired postero-ventral lobes and inner margin. 6c. Stout spinule patch above and below paired postero-ventral lobes. 6d. Long hair-like spinulae on paired postero-ventral lobes and posterior margin. 6e. Concentrated stout, thick spinulae below paired postero-median finger-like lobes. 6f. Paired postero-median finger-like lobes.



Figs. 6g-j, 8, 9. *Isoperla jamesae*. Male aedeagus (line = 0.5 mm). 6g. Flat scales above postero-median finger-like lobes. 6h. Posterior slender, long hair-like spines. 6i. Stout spinulae with apical long hairs above scale patch. 6j. Short stout, blunt spinulae on postero-apical area. 8. Postero-median finger-like lobes. 9. Spinule patches below postero-median finger-like lobes.



Figs. 10-13. *Isoperla jamesae*. 10. Whole egg dorsal view. 11. Whole egg lateral view. 12. Micropyle row. 13. Detail of micropyles.

medial patch of sharp stout spinulae below lobes, lateral patches of stout spatula-shaped scales lateral to medial patch (Figs. 6, 6f, 8, 9); patch of flat scales above postero-median finger-like lobes (Figs. 6, 6g); patch of concentrated stout spinulae with apical long hairs above scale patch extending from posterior margin medially to near level of paired postero-median finger-like lobes (Figs. 6, 6i), patch of slender long hair-like spinulae extending below spinulae with apical long hairs to near base of postero-ventral paired lobes (Figs. 6, 6h); concentrated patch of short stout, blunt spinulae on postero-apical area (Figs. 6, 6j).

Female. Macropterous. Body length 7.0–8.0 mm; forewing length 8.0–9.0 mm. General body coloration, head and pronotal pigmentation patterns similar to male described above, however without abdominal red coloration. Subgenital plate broadly triangular (sometimes rounded apically), 5.6 times as wide as long, produced to near posterior margin of 9th sternum (Fig. 2).

Egg. General shape nearly round, cross section concave, collar absent (Figs. 10, 11). Color light brown. Length 254 µm, width 228 µm. Chorionic surface covered with numerous small, shallow punctuations; eclosion line, hexagonal follicle cell impressions and ridges absent (Figs. 10, 11, 12). Micropyles positioned near posterior 1/3 in a row of 6-8; orifices with thickened flared ridges (Figs. 12, 13).

Etymology. This species is named in honor of Dr. Audrey James, who first recognized this species as new (James 1972).

Diagnosis. *Isoperla jamesae* males can be distinguished from other eastern congeners by the unique shape, spinule types and patterns, and unusual finger-like lobes of the aedeagus. Females can be separated from other known eastern *Isoperla* by the distinctive color pattern of the head with dark brown bands extending from the median ocellus to the frons. Due to the wide variation in the shape of subgenital plate seen among eastern *Isoperla* species in general, separation based on this character is questionable at this time. The egg is unique from other eastern *Isoperla* by having a nearly round and concave shape with no follicle cell impressions or ridges visible.

The best diagnostic species character for Nearctic *Isoperla* is the male aedeagus which needs to be fully everted to discern unique spinule patterns, arrangement of lobes, and sclerotized structures (if present). At this time it is not possible to assign *I. jamesae* to any eastern *Isoperla* species group (Szczytko and Kondratieff, in preparation). This species does, however, appear to be aligned with several eastern *Isoperla* species that have an aedeagus without sclerotized structures and a subtriangular subgenital plate.

Remarks. The type locality is a small, upland stream draining a combination of forested and agricultural lands. *Amphinemura alabama* Baumann, *A. nigritta* (Provancher), *Leuctra rickeri* James, *Alloperla caudata* Frison, and *Haploperla brevis* Banks were other stonefly species collected at the type locality with *I. jamesae*.

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REFERENCES

DeWalt, R.E., U. Neu-Becker & G. Steuber. 2009. Plecoptera species file online. Version 1.1/3.5 [17 July 2009]. http://Plecoptera.SpeciesFile.org.

James, A.M. 1972. The stoneflies (Plecoptera) of Alabama. Unpublished PhD Dissertation, Auburn University, Auburn, Alabama. 169 pp.

James, A.M. 1974. Four new species of stoneflies in North America (Plecoptera). Annals of the Entomological Society of America, 67:964–966.

Stark, B.P., R.W. Baumann, & R.E. DeWalt. 2009. Valid stonefly names for North America. Updated 19 March 2009. http://plsa.inhs.uiuc.edu/plecoptera/validnames.asp

Stark, B.P. & J.W. Lacey. 2005. Larvae of the winter stonefly genus *Allocapnia* (Plecoptera: Capniidae) in Mississippi, USA. Illiesia, 1:10–20.

Szczytko, S.W. & K.W. Stewart. 1979. The genus *Isoperla* (Plecoptera) of western North America; holomorphology and systematics, and a new stonefly genus *Cascadoperla*. Memoirs of the American Entomological Society, 32:1–120

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