



## TAXONOMIC AND DISTRIBUTIONAL NOTES ON *PERLESTA TEAYSIA*, *P. GOLCONDA*, AND *P. SHAWNEE* (PLECOPTERA: PERLIDAE)

Scott A. Grubbs<sup>1</sup> & R. Edward DeWalt<sup>2</sup>

<sup>1</sup>Department of Biology and Center for Biodiversity Studies Western Kentucky University  
Bowling Green, Kentucky, U.S.A. 42101

E-mail: [scott.grubbs@wku.edu](mailto:scott.grubbs@wku.edu)

<sup>2</sup>Illinois Natural History Survey 1816 S. Oak Street Champaign, IL 61820 USA

E-mail: [edewalt@inhs.uiuc.edu](mailto:edewalt@inhs.uiuc.edu)

### ABSTRACT

*Perlesta napacola* DeWalt is shown to be a junior synonym of *P. teaysia* Kirchner & Kondratieff. The egg of *P. golconda* DeWalt & Stark is illustrated with scanning electron microscopy for the first time, and a significant range extension is presented and discussed for *P. shawnee* Grubbs.

**Keywords:** Plecoptera, Perlidae, *Perlesta*, *P. teaysia*, *P. napacola*, *P. golconda*, *P. shawnee*

### INTRODUCTION

The known diversity of the eastern Nearctic stonefly genus *Perlesta* continues to increase, as evidenced by the number of new species descriptions within the last 20 years. Stark (1989) recognized 12 species as distinct. New descriptions published prior to Stark's (2004) updated taxonomic treatment, plus those presented in Kondratieff et al. (2006, 2008), increased the total number of species known to 27 (Stark et al., 2008).

The difficulty of *Perlesta* taxonomy resides in that multiple life stages are typically needed to identify a known species or describe a species as new to science. Males with fully extruded aedeagi associated with females with mature eggs provide the most definitive evidence of a species identity. The intent of this paper is to use scanning electron microscopy (SEM) of *Perlesta* eggs as the central means of addressing taxonomic and distributional issues of *P. napacola* DeWalt, *P. teaysia* Kirchner & Kondratieff, *P. golconda* DeWalt & Stark, and *P. shawnee* Grubbs. Specimens were examined from the Monte L. Bean Museum, Brigham Young University, Provo, Utah (BYU), Canadian National Collection, Ottawa,

Ontario (CNC), C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado, (CSU), Illinois Natural History Survey, Champaign, Illinois (INHS), Ohio Biological Survey, Columbus, Ohio (OBS), Purdue University, West Lafayette, Indiana (PU), and Western Kentucky University, Bowling Green, Kentucky (WKU).

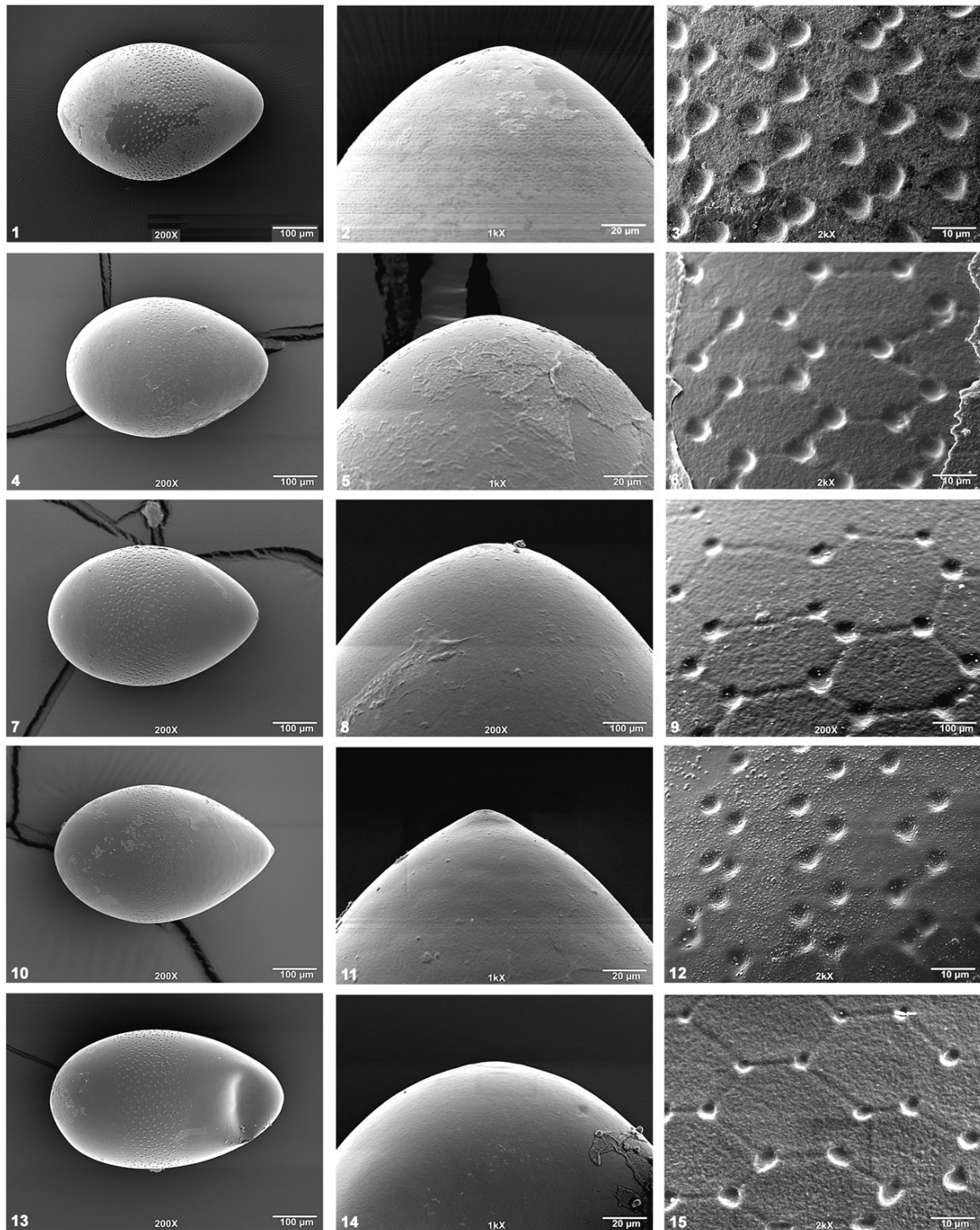
### *Perlesta teaysia* Kirchner & Kondratieff (Figs. 1-15)

*Perlesta teaysia* Kirchner & Kondratieff, 1997:290. Holotype ♂ (United States National Museum of Natural History). Reed Creek of New River, Wythe Co., Virginia, U.S.A.

*Perlesta teaysia* Stark, 2004:95

*Perlesta napacola* DeWalt, 2002:174. Holotype ♂ (Illinois Natural History Survey). Unnamed tributary of Vermilion River, Vermilion Co., Illinois, U.S.A. **New synonymy**

**Material examined.** . U.S.A., ILLINOIS: Vermillion Co., tributary to Vermillion River, 8 km SE Westville, Forest Glen Forest Preserve, 19 June 2001, R.E. DeWalt, 1 ♂ (Holotype – *P. napacola*; INHS); same but



Figs. 1–15. *Perlesta teaysia* egg SEM micrographs. 1–3: U.S.A., IL, Vermilion Co., Forest Glen Forest Preserve, 4 August 1977, 4–6: U.S.A., IN, Jackson Co., Guthrie Creek, 18 July 2000, 7–9: U.S.A., KY, Warren Co., Doty Creek, 6 July 2003, 10–12: U.S.A., MD, Allegany Co., Flintstone Creek, 4 July 1996, 13–15: U.S.A., VA, Wythe Co., Reed Creek, 24 July 2008). 1, 4, 7, 10, 13. Entire egg, 200X; 2, 5, 8, 11, 14. Anterior pole, 1000X; 3, 6, 9, 12, 15. Chorionic sculpturing, 2000X.

19 June 2001, R.E. DeWalt, 4 ♂, 7 ♀ (Paratypes – *P. napacola*; INHS); same but 6 July 2000, R.E. DeWalt, 1 ♂, 1 ♀ (Paratypes – *P. napacola*; INHS); same but 4 July 1977, D.W. Webb, 2 ♂, 10 ♀ (Paratypes – *P. napacola*; INHS). INDIANA: Brown Co., tributary to Middle Fork Salt Creek, 3 km N Stone Head, 21 June 2008, R. E. DeWalt, 1 ♂, 2 ♀ (INHS); Bear Creek, 0.7 km NNE Waycross, Yellowwood State Forest, 21 June 2006, R.E. DeWalt, 1 ♂ (INHS); Floyd Co., locality unknown, 18 July 1972, A. V. Provonsha & E. Levine, 1 ♂ (PU); Harrison Co., Buck Creek, 10 mi SE Corydon, 9 June 2000, S. A. Grubbs, 3 ♂ (WKU); Jackson Co., Guthrie Creek, Hemlock Bluffs Nature Preserve, 18 km E Bedford, 10 June 2000, S. A. Grubbs, 5 ♂, 4 ♀ (WKU); same but 18 July 2000, S. A. Grubbs, 4 ♂, 9 ♀ (WKU); Salt Creek, nr. Maumee, 22 June 2008, R.E. DeWalt, 2 ♂ (INHS); Jefferson Co., Clifty Falls State Park, 5 July 1937, collector unknown, 1 ♂, 4 ♀ (PU); Orange Co., Patoka River, Hoosier National Forest, 11 km SE Paoli, 15–19 June 2006, S.A. Grubbs, 3 ♂, 2 ♀, 9 nymphs (WKU); Owen Co., Raccoon Creek, Green Bluffs Nature Preserve, 3 km NW Freeman, 7–11 June 2006, S.A. Grubbs, 3 ♂, 6 ♀, 20 nymphs (WKU); McCormick's Creek, Spencer, 7 June 1944, W. Stehr, 2 ♂, 1 ♀ (CNC). KENTUCKY: Green Co., Upper Brush Creek, 14 km SE Buffalo, 21 July 2003, S.A. Grubbs, 2 ♂, 1 ♀ (WKU); same but 1 July 2005, S.A. Grubbs, 1 ♂ (WKU); same but 17 July 2006, S.A. Grubbs, 1 ♂, 2 ♀ (WKU); Taylor Co., Middle Pitman Creek, 5 km NW Campbellsville, 5 June 2006, S.A. Grubbs, 2 ♂ (WKU); Warren Co., Big Reedy Creek, 19 km N Richardsville, 19 June 2001, S.A. Grubbs, 1 ♂ (WKU); Doty Creek, 11 km SW Bon Ayr, 24 June 2001, S.A. Grubbs, 1 ♂ (WKU); same but 6 July 2003, S.A. Grubbs, 2 ♂, 3 ♀ (WKU). MARYLAND: Allegany Co., Fifteenmile Creek, Green Ridge State Forest, 8 km NW Little Orleans, 4 July 1996, S.A. Grubbs, 13 ♂, 14 ♀ (WKU); Flintstone Creek, Flintstone, 29 July 1996, S.A. Grubbs, 1 ♂, 3 ♀ (WKU); same but 4 July 1996, S.A. Grubbs, 18 ♂, 21 ♀ (WKU); Sideling Hill Creek, nr. Bellegrove, at light, 4 July 1996, S.A. Grubbs, 1 ♂, 1 ♀ (WKU); same but 6 August 1996, S.A. Grubbs, 1 ♂ (WKU); same but 14 July 1998, S.A. Grubbs, 1 ♂ (WKU); Town Creek, Green Ridge State Forest, 5 km NE Oldtown, 4 July 1996, S.A. Grubbs, 3 ♂ (WKU). OHIO: Ashland Co., Jerome Fork, Mohican River, C.R. 1302, 26 June 2000, E. Chapman, 2 ♂ (OBS); Lang Creek, US-250/OH-60, 5 km NNW Ashland, 6 July 1995, collector unknown, 7 ♂, 8 ♀ (OBS); Athens Co., Athens, 23 July 1997, G.

Kristsky, 5 ♂, 3 ♀ (OBS); Brown Co., Ellis Run Creek, S.R. 41, 9 July 1994, Kovarik, 3 ♂, 8 ♀ (OBS); Clermont Co., Little Indian Creek, 5 km SSW Laurel, 23 July 1997, G. Kristsky, 4 ♂, 2 ♀ (OBS); Clinton Co., Lytle Creek, nr. Todds Fork junction, 5 June 1944, W.E. Ricker, 2 ♂, 1 ♀ (BYU); Coshocton Co., Beaver Run, 2 km NW Warsaw, 14 July 2001, B. Armitage, 8 ♂, 3 ♀ (OBS); Simmons Run, 0.9 km SSW Warsaw, 26 June 2000, E.G. Chapman, 1 ♂ (OBS); Geauga Co., Stebbins Gulch, 18 June 1953, A.R. Gaufin, 1 ♂ (BYU); Greene Co., Little Miami River, Clifton Falls, 19 June 1952, A.R. Gaufin, 3 ♂ (BYU); Highland Co., Big Branch, 4 km NW New Petersburg, 26 June 1999, S. Cordas & J. Thompson, 2 ♂ (OBS); Bull Creek, C.R. 15, 1.5 km N Bridges, 26 June 1999, S. Chordas & J. Thompson, 25 ♂, 11 ♀ (OBS); Jefferson Co., Brush Creek, C.R. 72, 14 km SW East Liverpool, 26 June 2000, E.G. Chapman, 2 ♂, 5 ♀ (OBS); Logan Co., Lee Creek, T.R. 69, 25 July 1994, V. Fazio, 1 ♂, 3 ♀ (OBS); Miami Co., Spring Creek, 7 June 1953, A.R. Gaufin, 5 ♂ (BYU); Portage Co., Silver Creek, 3 km NW Garrettsville, 16 June 1953, A.R. Gaufin, 1 ♂ (BYU). Shelby Co., Tawawa Creek, 9 July 1994, Kovarik, 2 ♂, 4 ♀ (OBS); Plum Creek, at confluence with Miami River, Sidney, 28 July 1970, M.A. Tkac, 1 ♂ (OBS); Tuscarawas Co., small woodland stream, 6 July 1997, E. Chapman, 1 ♂, 18 ♀ (OBS). PENNSYLVANIA: Crawford Co., Linesville Creek, 3 km N Linesville, 1–5 July 1998, S.A. Grubbs, 3 ♂, 1 ♀ (WKU); same but 28 June 2007, S.A. Grubbs, 3 ♂, 3 ♀ (WKU); Erie Co., West Branch Conneaut Creek, 11 km NW Springboro, 27 June 2007, S.A. Grubbs, 1 ♂ (WKU). TENNESSEE: Grundy Co., Savage Creek, Rte. 399, 8 km NW Dunlap, 29 May 2003, S.A. Grubbs, 1 ♂, 1 ♀, 5 nymphs (WKU); same but 30 May 2006, S.A. Grubbs, 1 ♀, 4 nymphs (WKU). VIRGINIA: Montgomery Co., tributary to Mill Creek, Rte. 8, nymphs collected 25 June 1996, adults emerged 30 June 1996 (reared), S. Hiner, 2 ♂, 3 ♀ (CSU); Wythe Co., Reed Creek, U.S. 11 bridge, 23 July 1996, B.C. Kondratieff & R.F. Kirchner, 5 ♀, 1 nymph (Paratypes – *P. teaysia*; CSU); Stony Fork, Reed Creek, U.S. 52, 11.5 km NW Wytheville, Jefferson National Forest (JNF), 24 July 2008, S.A. Grubbs, 3 ♀ (WKU); Reed Creek, F.R. 221, 21 km WNW Wytheville, JNF, 24 July 2008, S.A. Grubbs, 1 ♀ (WKU); Reed Creek, C.R. 658, 5 km SW Wytheville, 24 July 2008, S.A. Grubbs, 2 ♀ (WKU).

**Remarks.** *Perlesta teaysia* was described from southwestern Virginia (Kirchner & Kondratieff,

1997). DeWalt (2002) described *P. napacola* from eastern Illinois, yet first reported this species as *P. nr. teaysia* in DeWalt et al. (2001). DeWalt (2002) indicated that *P. napacola* was distinct from *P. teaysia* only in the egg stage, noting that males and females of the two species were morphologically inseparable. *Perlesta teaysia* was later reported as new to Maryland (Grubbs & Stark, 2001), Pennsylvania (Grubbs & Stark, 2001) and West Virginia (Tarter & Nelson, 2006) based solely on male morphology. Stark (2004), in his key to the Perlidae of the eastern Nearctic region, separated the males of the two species only by geographic differences (i.e., Illinois vs. Virginia). Grubbs (2004) and Tarter et al. (2006) have subsequently reported *P. napacola* from Indiana and Kentucky, respectively, based on SEM work with eggs.

Eggs from multiple series of *P. teaysia* collections from western Maryland were examined recently with SEM, surprisingly revealing an identical pattern of chorionic sculpturing to *P. napacola* eggs, yet also very distinct from *P. teaysia*. This discrepancy raised a question regarding the true identity of *P. teaysia* because the Maryland location and the Virginia type locality both lay within the Ridge and Valley Physiographic Province.

Eggs from paratype females of *P. napacola* were examined with SEM and compared to eggs from Indiana, Kentucky, and Maryland. Eggs were not present in the type series of *P. teaysia*, yet gravid females were collected in July 2008 from each of three sites near the type locality. The egg shape, collar

characteristics and chorionic sculpturing pattern were identical for all eggs examined (Figs. 1–15), revealing that the egg depicted in Kirchner & Kondratieff (1997; Fig. 10) does not represent the true *P. teaysia* and that *P. napacola* must be a junior synonym. The combination of (a) a long tubular aedeagus lacking a caecum, (b) dense, separated patches of sensilla basiconica on the 10<sup>th</sup> tergum, and (c) paraprocts lacking a spine is now considered distinctive for the male of *P. teaysia*.

The egg presented in the original description belongs to an undetermined species. In addition, it should be noted that the egg shown in Stark (2004; Fig. 7.407) for *P. teaysia* also is of undetermined identity. All previously documented records of *P. napacola* from Illinois (DeWalt et al., 2001; DeWalt, 2002), Indiana (Grubbs, 2004), and Kentucky (Tarter et al., 2006) are now referable to *P. teaysia*, while the collection from Tennessee represents a new state record.

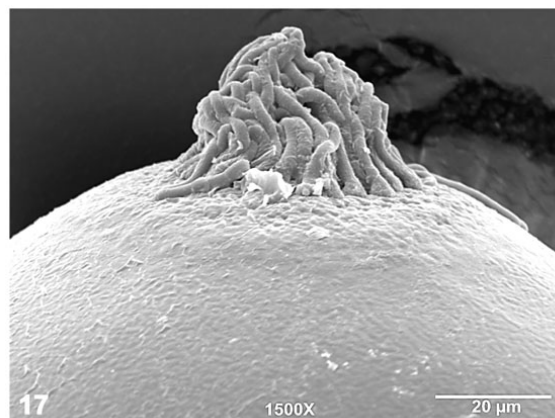
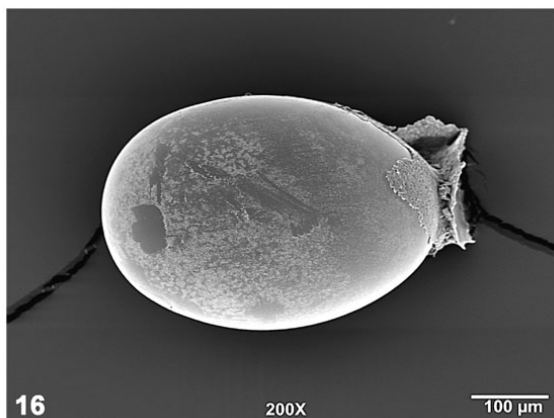
#### *Perlesta golconda* DeWalt & Stark

(Figs. 16–17)

*Perlesta golconda* DeWalt et al., 1998:315. Holotype ♂ (Illinois Natural History Survey). Ohio River, Pope Co., Illinois, U.S.A.

*Perlesta golconda* Stark, 2004:93

**Material examined.** U.S.A., ILLINOIS: Carroll Co., Savanna, at light, 20 July 1927, T.H. Frison & R.D. Glasgow, 1 ♂, 3 ♀ (INHS).



Figs. 16–17. *Perlesta golconda* egg SEM micrographs, U.S.A., IL, Carroll Co., Savanna, 20 July 1927. 16. Entire egg, 200X, 17. Anterior pole, 1500X.

**Remarks.** This species was described from the Ohio River in southeastern Illinois (DeWalt et al., 1998). The known distribution of this species has since been expanded to Iowa (Stark et al., 2008), Missouri (Stark, 2004) and Nebraska (DeWalt et al., 2001). Females from the original type series possessed eggs that were too poorly sclerotized to permit SEM work and because only line illustrations were presented, fine details of the collar and chorion could be interpreted solely from the written description (DeWalt et al., 1998; Fig. 8). Material stored at INHS that has been subsequently identified as *P. golconda* included gravid females, allowing for SEM and the first high-resolution images of the eggs of this species. Although the eggs depicted here were too fragile to clean sufficiently, they adhere easily to the original description in DeWalt et al. (1998). All eggs examined were near-symmetrically oval, the chorion was smooth to slightly granular, and the collar was raised only slightly above the anterior surface of the egg (Figs. 16–17).

*Perlesta shawnee* Grubbs  
(Figs. 18–23)

*Perlesta shawnee* Grubbs, 2005:64. Holotype ♂ (Illinois Natural History Survey). Cooper Creek, Alexander Co., Illinois, U.S.A.

*Perlesta shawnee* Stark, 2004:95

**Material examined.** U.S.A., ALABAMA: Clay Co., tributary to Cheaha Creek, Turnipseed Campground, Talladega National Forest (TNF), 11 July 2008, S.A. Grubbs, 1 ♀ (WKU); Swept Creek, F.R. 615, 20 km S Talladega, TNF, 20 June 2006, A.L. Sheldon, 1 ♂ (WKU); tributary to Swept Creek, F.R. 615, TNF, 25 May 2006, A.L. Sheldon, 1 ♀ (WKU); Cleburne Co., tributary to South Fork Terrapin Creek, F.R. 500, 8 km SE Piedmont, TNF, 11 July 2008, S.A. Grubbs, 2 ♀ (WKU); Talladega Co., Smelley Creek, C.R. 234, 15 km S Talladega, TNF, 26 May 2006, A.L. Sheldon, 1 ♂ (WKU). ILLINOIS: Pope Co., Quarrel Creek, 8 km NE Dixon Springs, 13 July 2003, S.A. Grubbs 2 ♂, 3 ♀ (Paratypes; WKU); Lusk Creek, 13 km NW Golconda, 20 May 2006, S.A. Grubbs 1 ♂ (WKU). INDIANA: Perry Co., East Deer Creek, 13 km E Tell City, Hoosier National Forest, 12 June 2003, S.A. Grubbs 1 ♂, 2 ♀ (Paratypes; WKU). NORTH CAROLINA: Cleveland Co., First Broad River, Mt. Zion Church Rd., S of New Hope, 13 July 2007, B.C. Kondratieff, R.E. Zuellig & D.R. Lenat 1 ♂, 6 ♀ (CSU). VIRGINIA:

Wythe Co., Stony Fork, Reed Creek, U.S. 52, 11.5 km NW Wytheville, Jefferson National Forest (JNF), 24 July 2008, S.A. Grubbs, 1 ♂ (WKU); Reed Creek, F.R. 221, 21 km WNW Wytheville, JNF, 24 July 2008, S.A. Grubbs, 2 ♂ (WKU); Reed Creek, C.R. 658, 5 km SW Wytheville, 24 July 2008, S.A. Grubbs, 1 ♂ (WKU).

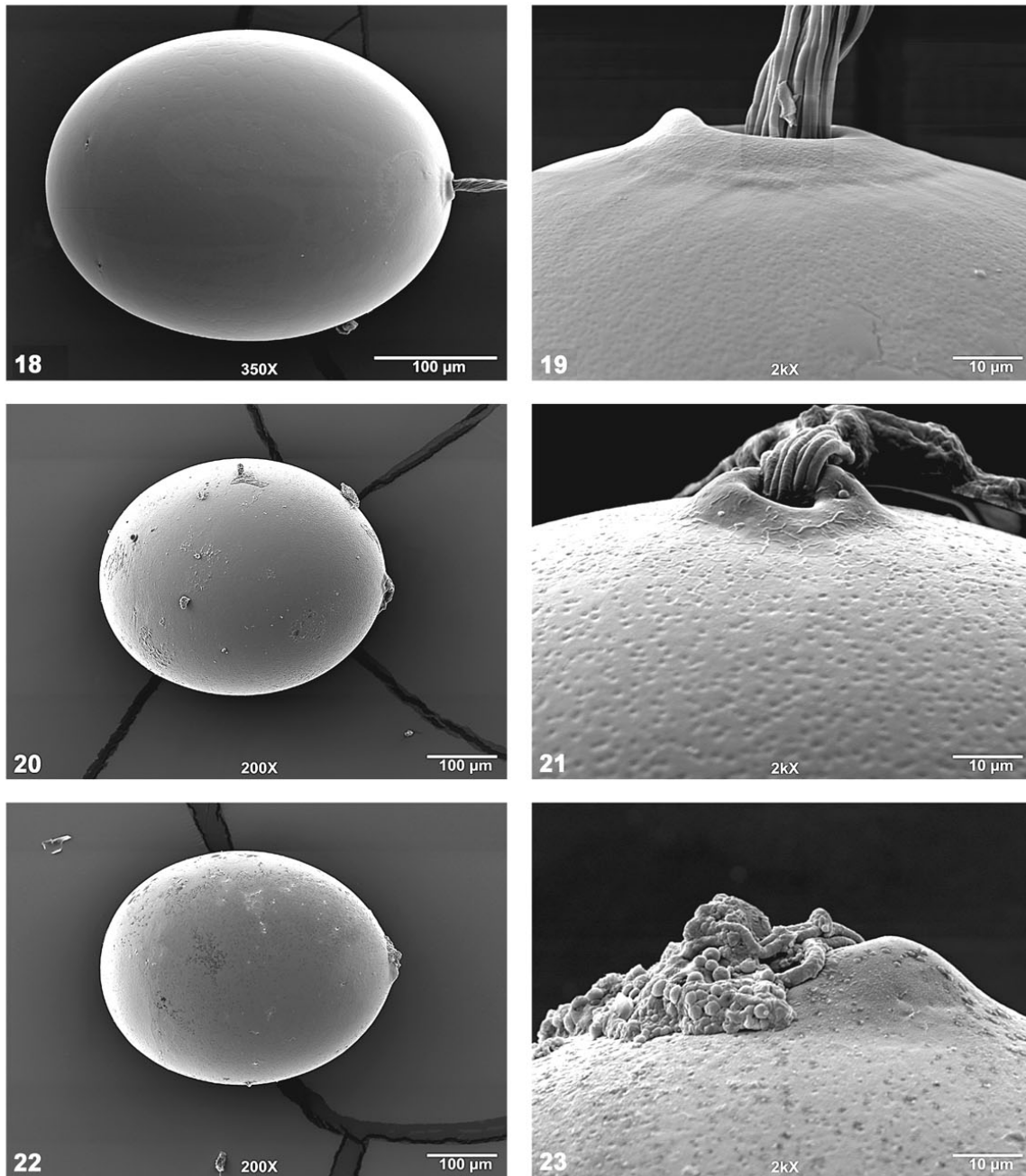
**Remarks.** This species was described from the unglaciated southern portions of Illinois and Indiana (Grubbs, 2005). The male is distinctive among *Perlesta* and readily identified by the combination of (a) a long, tubular aedeagus lacking a caecum, (b) dense separated patches of sensilla basiconica on the 10<sup>th</sup> tergum, and (c) long slender paraprocsts bearing a laterally-directed tooth. As part of a larger study addressing elevational patterns of stoneflies of the montane Talladega National Forest region of east-central Alabama, *Perlesta* specimens collected in summer 2006 included males that were tentatively identified as *P. shawnee*. Because mature eggs were not present in females, however, a definitive species designation was not applied.

Gravid females were collected in July 2008 and eggs were examined via SEM. Although eggs from the Alabama series (Fig. 19) were noticeably less pitted and smoother than from paratype females from Indiana and Illinois (Figs. 21, 23), both the overall egg shape (i.e., oval; Figs. 18, 20, 22) and collar (i.e., low, gently-rounded open pit; Figs. 19, 21, 23) were too similar to warrant a new species description.

In addition, several series of this species were also obtained recently from southwestern Virginia and western North Carolina. The occurrence of *P. shawnee* in Alabama, North Carolina and Virginia represent new state records and a significant southeastern range extension from Illinois and Indiana.

**ACKNOWLEDGEMENTS**

Paul Tinerella (Illinois Natural History Survey) and Boris Kondratieff (Colorado State University) made the paratypes of *Perlesta napacola* and *P. teaysia*, respectively, available for study. Boris Kondratieff kindly provided the North Carolina record of *P. shawnee*. Brian Armitage (Ohio Biological Survey), Shawn Clark and Richard Baumann (Brigham Young University), Arwin Provonsha (Purdue University) and Ian Smith (Canadian National Collection) either provided loans or accommodated visits to examine material onsite. John Andersland (Western Kentucky University) assisted with SEM work.



Figs. 18–23. *Perlesta shawnee* egg SEM micrographs. 18–19: U.S.A., AL, Cleburne Co., tributary to South Fork Terrapin Creek, 11 July 2008, 20–21: U.S.A., IL, Pope Co., Quarrel Creek, 13 July 2003, 22–23: U.S.A., IN, Perry Co., East Deer Creek, 12 June 2003), 18. Entire egg, 350X, 20, 22. Entire egg, 200X, 19, 21, 23. Anterior pole, 2000X.

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Received 23 September 2008, Accepted 17 October 2008, Published 29 October 2008

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