

NEW SPECIFIC SYNONYMS AND RECORDS OF NORTH AMERICAN *CENTROPTILUM* AND *PROCLOEON* (EPHEMEROPTERA: BAETIDAE)¹

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ABSTRACT: Eight species of North American Baetidae are placed as subjective junior synonyms as follows: among *Centroptilum*, *C. album* [= *C. convexum* and *C. walshi*, n. syns.], *C. bifurcatum* [= *C. selandreorum*, n. syn.], *C. asperatum* [= *C. elsa* and *C. oreophilum*, n. syns.], among *Procloeon*, *P. ingens* [= *P. implicatum*, n. syn.], *P. rufostrigatum* [= *P. hobbsi*, n. syn.], and *P. viridoculare* [= *P. irrubrum*, n. syn.]. Eighteen USA state records for eight species of *Centroptilum* and 21 state records and one Canadian province record for eight species of *Procloeon* are included among the 17 species reviewed and the 67 new North American collection records cited. Certain previously incorrect records are reassigned.

KEYWORDS: Ephemeroptera, Baetidae, *Centroptilum*, *Procloeon*, new synonyms

A study of the North American Baetidae genera *Centroptilum* Eaton and *Procloeon* Bengtsson (sometimes referred to as long-clawed baetids) revealed a number of new specific synonyms and considerable new distributional data. This information is detailed here along with reassignments of some previously published collection records. New species descriptions and diagnoses and keys to all North American species of *Centroptilum* and *Procloeon* will be taken up elsewhere.

New data are given here for 17 species presented alphabetically. Specific synonymies for each species are given, including eight new synonyms for six of the species. A majority of the 67 new collection citations, including 19 of the 39 new state and provincial records, are based on materials from the Purdue Entomological Research Collection (PERC). Three of these 39 records are based on corrected assignments of previously published locale data. Other collections that have been the source of new records or other materials examined are Colorado State University (CSU), Cornell University (CU), Florida A & M University (FAMU), personal collections of L. S. Long (LSL), Massachusetts Audubon Society (MAS), Missouri Department of Natural Resources (MDNR), Snow Museum of Entomology (SME), personal collection of R. S. Sarver (RS), and personal collection of N. A. Wiersema (NAW).

CENTROPTILUM

Centroptilum album McDunnough

Centroptilum album McDunnough, 1926:189

Centroptilum walshi McDunnough, 1929:173, **NEW SYNONYM**

Centroptilum convexum Ide, 1930:222, **NEW SYNONYM**

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Records. MASSACHUSETTS: Franklin Co, East Branch North R, VI-23-1995 (larvae, MAS). OREGON: Lane Co, Cummins Cr nr Neptune St Park, VIII-25-1954 GF Edmunds, and Benton Co, no other data (larvae, PERC). TENNESSEE: Williamson Co, Holt Cr at Edmundson Pike, III-18-1995 (larvae, PERC).

Remarks. Examination of numerous larvae and adults throughout much of North America has demonstrated that species concepts of *C. walshi* and *C. convexum* include intergrading color variants of *C. album*. Larvae and adults that have been attributed to the above names are structurally indistinguishable. *Centroptilum album* is one of the most geographically widespread and commonly collected species of long-clawed baetids in North America.

Centroptilum asperatum Traver

Centroptilum asperatum Traver, 1935:708

Centroptilum elsa Traver, 1935:713, **NEW SYNONYM**

Centroptilum oreophilum Edmunds, 1954:1, **NEW SYNONYM**

Material Examined. *Centroptilum elsa*, HOLOTYPE: reared male adult, Wyoming: Moose, VII-30-1929, EB Knots (No. 1360.1, CU); PARATYPES: two males, same data as holotype (No. 1360.3 and 4, CU). *Centroptilum asperatum*, HOLOTYPE: male adult with subimaginal exuviae, California: Big Bear L, San Bernardino Mts, VIII-29-1932, CD Michener (No. 1359.1, CU). *Baetis* No. 1 Seemann, reared female adults, California: Cobil's Canyon, nr Claremont, Seemann (CU); larva, Napa Co, Capelle Cr at Rt 128, 2.1 mi N jet Rt 121, I-27-1994, BC Kondratieff (CSU).

Remarks. Our study indicated that the type concept of *C. elsa* represents small, pale, late summer emergents of *C. asperatum*. In addition, no reliable characteristics have been found to distinguish *C. oreophilum* from *C. elsa*. This is a strictly western North American species. It also includes Seemann's *Baetis* No. 1 taken from Riverside County, California (Seemann 1927) and the California locales cited above.

Centroptilum bifurcatum McDunnough

Centroptilum bifurcatum McDunnough, 1924:96

Centroptilum selanderorum Edmunds, 1954:2, **NEW SYNONYM**

Records. KANSAS: Douglas Co, Kansas R at Eudora Bridge, VIII-24-1978, P. Liechti (larvae, SME). KENTUCKY: Montgomery Co, Slate Cr at Cooks Branch Rd, .9 km SSW jet Ky 460 and 713, VII-19-1983, and Taylor Co, Robinson Cr, .75 km SW jet Ky 70 and 337 at Mannsville, VII-27-1983 (larvae, PERC). WASHINGTON: Benton Co, Richland, IX-18-1998, R Newell (adult, NAW).

Remarks. Initial evidence of the equivalency of *C. selanderorum* (known as adults) and *C. bifurcatum* was presented by McCafferty et al. (1993). The examination of considerable additional materials since that time has confirmed that genitalic form and coloration associated with *C. selanderorum* (Edmunds 1954) represents variability found within or between populations of the relatively widespread, mainly midwestern and western *C. bifurcatum*. The new Kansas and Kentucky records of this species extend the known midwestern range (e.g., Randolph and McCafferty 1998) south and into the fringe of the Southeast.

***Centroptilum conturbatum* McDunnough**

Centroptilum conturbatum McDunnough 1929:171

Records. ARIZONA: Yavapai Co., Spring Cr, 8 mi SW Cedona, 1 mi off US 89A, 3500', T16N, R4E, center, SW/4, V-06-1981, and Red Tank Draw, 1.5 mi E I-17 & AZ 279, on Rd # 618, E Montezuma Well Nat Mon, 3780', V-04-1981, WU Brigham, AR Brigham, MW Sanderson (larvae, PERC). COLORADO: Jackson Co, Roaring Fork R at Co Rd 5 bridge, VIII-22-1991, R Durfee, and Douglas Co, Cherry Cr, bank/bw Castlewood Canyon St Prk, VII-17-1997, A Polonsky, R Durfee (larvae, CSU).

Remarks. This species is known from central and western Canada south through the intermountain western USA.

***Centroptilum minor* McDunnough**

Cloeon minor McDunnough, 1926:190

Records. ALABAMA: Elmore Co, Sofkahatchee Cr, IX-16-1987, S Harris, and Dekalb Co, W. frk Little R at Desota St Prk, VI-22-1988, KS Fraser, and Clay Co, Cheaha Cr at For Rd 637, 2.7 mi W L Chinnabee, VI-01-1988, S Harris (male adults, CSU). MISSOURI: MARIES Co, Gasconade R nr Hwy 63 bridge, V-03-1989, S Humphrey (larvae, MDNR). NORTH CAROLINA: Randolph Co, Little Brushy Cr at St Rd 1005, V-18-1990 (larva, NAW). TEXAS: Montgomery Co, Peach Cr at US 59, N New Caney, 20° 12' 11 N, 095° 11' 07 W, IV-19-1999, and Walker Co, Sandy Cr, E Huntsville St Prk, 30° 37' 52 N, 095° 31' 15 W, II-24-1999, and Waller Co, Ponds Cr at Hwy 290, IX-17,27-1997, NA Wiersema (larvae and reared females, NAW).

Remarks. This is an eastern species that in the south extends westward to Missouri and Texas.

***Centroptilum ozarkensum* Wiersema & Burian**

Centroptilum ozarkensum Wiersema and Burian, 2000:177

Records. TENNESSEE: Cannon Co, East Fork Stones R at headwaters, VI-07-1997, and Williamson Co, Holt Cr at Edmundson Prk, III-19-1995, LS Long (larvae and exuviae, NAW).

Remarks. This species is currently known only from Missouri and Tennessee.

***Centroptilum triangulifer* McDunnough**

Cloeon triangulifer McDunnough, 1931:88

Records. ARKANSAS: Boone Co, Bear Cr at St Rd 14, V-28-1974, WP McCafferty, AV Provonsha, L Dersch (female adult, PERC). FLORIDA: Calhoun Co, Chipola R at Hwy 20, I-20-1974, PH Carlson (larva, FAMU). IOWA: Chickasaw Co, East Fork of the Wapsipinicon R 2.5 mi NE of North Washington & N of 150th St. Bridge, X-03-2002 (larvae, PERC).

Remarks. This species is found generally in the eastern half of the continent and extends westward into the Southwest as far as Oklahoma and Texas.

***Centroptilum victoriae* McDunnough**

Centroptilum victoriae McDunnough 1938:27

Records. INDIANA: La Grange Co, Pigeon Cr at 1100 E, VI-10-1974, L Dersch, D Tyler (exuvia, PERC). MICHIGAN: Marquette Co, Lower Elm Cr .25 mi SW Ives L Stone House, VII-9-11-1985, WP McCafferty, AV Provonsha, and Pine River at bridge on Huron Mtn Club Compound Rd, VI-2-5-1986, WP McCafferty (larva, PERC). VERMONT: Windhams Co, North Brook at W Edge of Wilmington, VI-20-1976, WP McCafferty, AV Provonsha, and M Minno (larvae, PERC).

Remarks. This species was first reported in name from the USA by McCafferty et al. (2002) in their inventory of Iowa mayflies. Reexamination of Maine material upon which the report of *C. semirufum* McDunnough by Burian and Gibbs (1991) was based, revealed that it was referable to *C. victoriae*. As a result, *C. semirufum* is currently known in the USA only from the state of Pennsylvania (Jacobus and McCafferty 2001). Historically, *C. victoriae* has been known primarily from central and eastern Canada.

PROCLOEON

Procloeon ingens McDunnough

Cloeon ingens McDunnough, 1923:44

Cloeon implicatum McDunnough, 1924:113, **NEW SYNONYM**

Procloeon implicatum (McDunnough), **NEW SYNONYM**

Remarks. We have found *P. implicatum* indistinguishable from *P. ingens*. Also, reexamination of material reported as *P. mendax* (Walsh) from Marquette County, Michigan, by Randolph and McCafferty (1998) showed it to be referable to *C. ingens*. This species is known from Alberta and the Yukon, east across Canada and also from a few USA states, including Colorado, Maine, and now Michigan.

Procloeon mendax Walsh

Cloeon mendax Walsh, 1862:381

Remarks. Leonard and Leonard (1962) mentioned *Cloeon* sp. from a small tributary of the Au Sable River in Crawford County, Michigan. Examination of this material and the figure of the genitalia of this species presented by Leonard and Leonard (1962), demonstrated it as referable to *P. mendax*, which otherwise is represented in Michigan only in an old report from Detroit (Wayne County) by Eaton (1887). The species has been reported infrequently from northeastern and midwestern North America.

Procloeon nelsoni Wiersema

Procloeon nelsoni Wiersema, 1999:27

Records. TENNESSEE: Rutherford Co, West Fork Stones R at Barfield, IV-22-1997, and Panther Cr at Panther Cr Rd, VI-08-1997, and Panther Cr at Walnut Grove Rd/Panther Cr Rd, IV-27-1997, and Williamson Co, unnamed trib of Mill Cr at Rock Springs Rd and Clovercroft, IV-07-1997, LS Long (larvae, female adults, some reared, LSL).

Remarks. Reexamination of the larva informally referred to as *Procloeon* sp. 3 from Texas by McCafferty and Davis (1992) revealed that it was referable to *P. nelsoni*. This species is currently known only from Texas and Tennessee.

Procloeon pennulatum Eaton

Centroptilum pennulatum Eaton, 1870:2

Centroptilum infrequens McDunnough, 1924:98

Records. ARKANSAS: Scott Co, Johnson Cr at Johnson Cr Rd nr US Hwy 71, 8 mi N Mena, VI-1-1974, WP McCafferty, AV Provonsha, L Dersch (larvae, PERC). COLORADO: Moffat Co, Yampa R at Echo Prk, Dinosaur Nat Mon, IX-03-1994, BC Kondratieff, R Durfee (reared adults, NAW). NEVADA: Elko Co, Humbolt R at Elko, VIII-29-1965, SL and JW Jensen (larva, PERC). TENNESSEE: Cannon Co, Carson Frk at Burt Burgen Rd and Todd's Cemetery, VIII-27-1997 (exuviae, NAW).

Remarks. This widespread Holarctic species was first recognized in North America by Lowen and Flannagan (1990) by way of synonymizing *C. infrequens* with it. The species is now known from all North American regions excluding the extreme southwestern USA and Mexico (see also comments under *P. rivulare*, below).

Procloeon rivulare Traver

Centroptilum rivulare Traver, 1935:716

Records. CONNECTICUT: New Haven Co, Seymour, Bladden's Brk, at Rt 67 and Skokorat Rd, VII-22-1996, SK Burian (larvae, NAW). MASSACHUSETTS: Hampshire Co, Mill R, Arcadia Sanctuary, Easthampton, VIII-01-1991 (larvae, MAS). MISSISSIPPI: Perry Co, Leaf River, 31/13/03N 87/03/47W, VII-2000 (PERC). TENNESSEE: Polk Co, Lost Cr at Lost Cr Campgr nr Ocoee R, III-5-1994, and Rutherford Co, West Fork Stones R at Barfield, IV-22-1997, LS Long (larvae, LSL). VERMONT: Windhams Co, small spring at North Brk at W edge of Wilmington, VI-20-1976, WP McCafferty, AV Provonsha, M Minno (larva, PERC). VIRGINIA: Highland Co, Back Cr at Va Hwy 84, V-05-1968 (larva, PERC).

Remarks. Reexamination of materials reported as *P. pennulatum* from North Carolina by McCafferty (1993) and New Brunswick by McCafferty and Randolph (1998) are referable to *P. rivulare*. This species is known from far eastern Canada (New Brunswick and Nova Scotia), through the Appalachian chain in the USA, and westward in Kentucky, Indiana, Mississippi, and Ohio.

Procloeon rubropictum McDunnough

Cleion rubropictum McDunnough, 1923:43

Records. MISSOURI: Bollinger Co, Little Whitewater R, IX-22-1999, and Hickory Co, Little Niagra R, IX-17-1996, and Reynolds Co, E Frk Black R, IX-21-1999, and Shannon Co, Pea Vine Hollow, V-16-2001, and St. Clair Co, Brushy Cr, IX-20-1995 (larvae, MDNR). TENNESSEE: Rutherford Co, West Fork Stones R at Barfield, IV-22-1997, and Panther Cr at Panther Cr Rd, VI-08-1997, LS Long (larvae and female adult, LSL).

Remarks. This species is relatively common throughout eastern Canada and the eastern half of North America to as far west as Oklahoma, although it has yet to be reported from any states north or south of Oklahoma.

Procloeon rufostrigatum McDunnough

Centroptilum rufostrigatum McDunnough, 1924:95

Centroptilum bistrigatum Daggy, 1945:389

Centroptilum hobbsi, Berner, 1946:77, NEW SYNONYM

Procloeon hobbsi (Berner), NEW SYNONYM

Material examined. *Centroptilum hobbsi*, PARATYPE: female adult, Florida, Alachua Co, Sante Fe R at Poe Springs (FAMU). *Procloeon* sp. 1, female adults, Texas: Blanco Co, Blanco R (PERC).

Records. MISSOURI: Adair Co., Chariton R at Hwy 6 bridge, IX-20-2001, RJ Sarver (larvae, RS); Osage Co, Maries R, VIII-21-1996, RJ Sarver (larvae, MDNR). VERMONT: Windhams Co, Whetstone Brk at Battleboro, VI-19,20-1976, WP McCafferty, AV Provonsha, M Minno (larvae, PERC).

Remarks. Berner (1946) based his description of *C. hobbsi* on a small number of adult females from northern Florida, and he included a description of presumably associated larvae. The latter are indistinguishable from the larvae of *P. rufostrigatum*. Adult paratype material of *P. hobbsi* also proved to be equivalent to *P. rufostrigatum*. The report of *P. rivulare* from central Texas by Baumgardner et al. (1997) is referable to *P. rufostrigatum*, and reexamination of material informally referred to as *Procloeon* sp. 1 from Texas by McCafferty and Davis (1992) showed that it also is referable to *P. rufrostrigatum*. This species is common in the central plains states and Manitoba, but is also known from more eastern Canada and the USA.

Procloeon simplex McDunnough

Cloeon simplex McDunnough, 1925:185

Records. MISSOURI: Maries Co., Gasconade R nr Hwy 63 bridge, V-03-1989, S Humphrey (larvae, PERC, MDNR).

Remarks. This species is known from scattered localities in the eastern half of North America.

Procloeon viridoculare Berner

Centroptilum viridocularis Berner, 1940:39

Procloeon irrubrum Lowen and Flannagan, 1992:104, NEW SYNONYM

Records. ARKANSAS: Scott Co, Mill Cr at Mill Cr picnic area, Ouachita Nat For, VI-1-1974, WP McCafferty, AV Provonsha, L Dersch (larva, PERC). KENTUCKY: Christian Co., Buck Fork Pond R, VIII-14-1980, and Knott Co, Carr Fork, VI-27-1978, WP McCafferty, AV Provonsha (larvae, PERC). INDIANA: Benton Co., Big Pine Creek, V-25-1976, and trib of Big Pine Cr, ca 5 mi NE Templeton, VIII-04-1976, AV Provonsha, M Minno, and Elkhart Co, Elkhart R, IX-5-1978, WP McCafferty, AV Provonsha, and Hendricks Co, W frk White Lick Cr, VII-20-1978, M Minno, JH Hollis, and Jasper Co., Oliver Ditch (Iroquois R), VII-26-1973, K Black, and Jefferson Co, Indian-Kentuck Cr, VI-17-1977, AV Provonsha, M Minno, AA Alabi, and LaGrange Co., Pigeon Cr IX-7-1974, AV Provonsha, and Martin Co., West Fork White River at Hindostan Falls Publ Fish Site, VII-26-1982, and Bogg's Cr, IX-8-1978, AV Provonsha, M Doub, and Tippecanoe Co., Wabash R, VI-14-1977, M Minno, D Morihara, S Yocom, and Warren Co., Kickapoo Cr, V-21-1976, M Minno, D Morihara (larvae, PERC). OKLAHOMA: Noble Co, no other data (larva, PERC).

Remarks. We found that *P. irrubrum* was indistinguishable from *P. viridoculare*. This species is common in central states such as Iowa and Texas, and southeastern states such as Florida and Alabama. It is also known from a few additional midwestern and eastern states as well as Ontario.

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