

A Review of the Mayfly Genus *Cinygmula* McDunnough (Ephemeroptera: Heptageniidae) in Colorado

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ABSTRACT: Ten species of the heptagenine mayfly genus *Cinygmula* are recognized in North America. Two of these species were originally described from Colorado, *C. mimus* (Eaton) and *C. ramaleyi* (Dodds). Additionally, *C. par* (Eaton) and *C. tarda* (McDunnough) have been reported from the state. The purpose of this paper is to provide comparable descriptions of the adult males of the four species known from Colorado, providing illustrations of the male penes.

KEY WORDS: Mayfly, *Cinygmula*, Colorado

McDunnough (1933) proposed the genus *Cinygmula*, designating *C. ramaleyi* (Dodds) from Colorado as the type. At least ten species are currently recognized in North America, with *C. subaequalis* (Banks) being restricted to Eastern North America (Edmunds *et al.*, 1976). Two species were originally described from Colorado, *C. mimus* (Eaton) and *C. ramaleyi*; and Dodds (1923) reported *C. par* (Eaton) under the name of *C. mimus*. Durfee and Kondratieff (1997) recorded *C. tarda* (McDunnough) from the state.

Adult male descriptions are available for all the North American species of *Cinygmula* (Traver, 1935; Jensen, 1966). The purpose of this paper is to facilitate the identifications of four species known from Colorado by providing comparable descriptions of the adult males and providing new figures of the penes.

Methods and Materials

The material listed below is deposited in the C. P. Gillette Museum of Arthropod Diversity, Colorado State University. Type material was examined from the Natural History Museum, London (BMNH) and the Canadian National Collection of Insects (CNCI). All specimens were scored for morphological features and color patterns observable under light microscopy up to 1000 \times . Illustrations of the penes were drawn from original photomicrographs taken with a Nikon MF-15 camera through a Nikon Diaplot inverted microscope. Wing measurements were taken from ten males from at least five different populations using a calibrated ocular micrometer and given to the nearest 0.10 mm. Some of the morphological terminology follows Bednarik and McCafferty (1979).

Cinygmula mimus (Eaton)

Cinygma mimus Eaton, 1885:249. Type locality, Colorado. Lectotype ♂ (BMNH), examined. Spieth, 1941:89.

Cinygma mimus, McDunnough, 1924:131.

Cinygmula mimus, McDunnough, 1933:75.

Cinygmula mimus, Traver, 1935:389.

Wing length: 10–11.5 mm.

Head: Light brown to reddish brown; ocellar bases black; antennae pale; compound eyes contiguous.

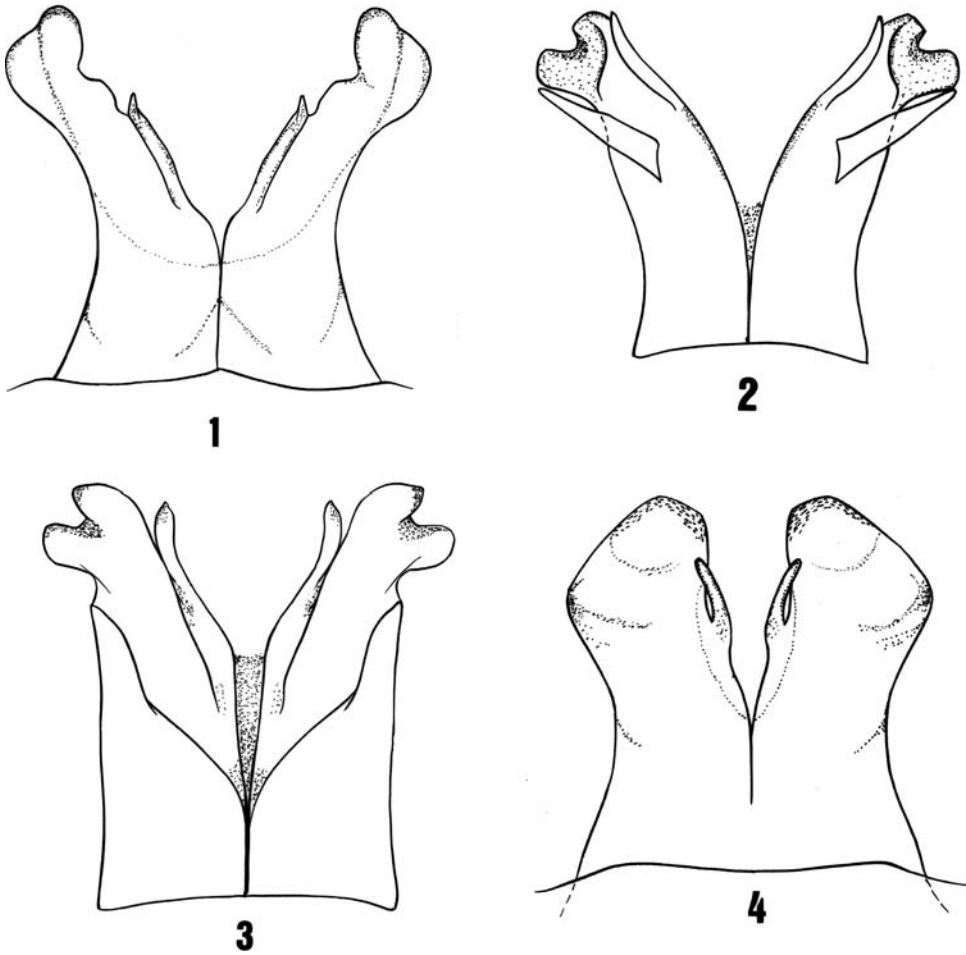


Fig. 1-4. Male penes, ventral view. 1. *Cinygmula mimus*, 2. *Cinygmula par*, 3. *Cinygmula ramaleyi*, 4. *Cinygmula tarda*.

Thorax: Thorax light brown to chestnut-brown; paler at wing bases and pleura. Legs light yellow-brown, tarsal joints brown, claws brownish. Fore- and hindwing membrane ranging from hyaline, lightly, to darkly tinted with yellowish-brown, forewing membrane darker at crossveins; longitudinal veins darker yellow-brown; crossveins often more reddish in color.

Abdomen: Abdominal terga 1-6 ranging from partially purplish brown to largely purple brown, terga 7-10 yellowish brown. Sterna pale. Caudal filaments yellowish brown to brown.

Genitalia: Penes fused at base diverging apically, each lobe with acute median spine as Fig. 1.

Material examined: COLORADO: Jackson Co., Michigan River below Lake Agnes, 28 July 1991, B. Kondratieff, R. Durfee, & B. Painter, 12 ♂; Jackson Co., Michigan River below Lake Agnes off Route 14, 29 July 1991, B. Kondratieff & R. Durfee, 8 ♂, 20 ♀ reared; Jackson Co., Michigan River, CO Rt. 14, 21 June 1992, B. Kondratieff & M. Kippenhan, 33 ♂; Jackson Co., Michigan River below Lake Agnes Rd., 15 July 1995,

S. Fitzgerald & A. Foley, 31 ♂, 2 ♀; Rio Grande Co., Beaver Creek at Upper Beaver Creek campground, 24 July 1993, B. Brooks, 2 ♂; Larimer Co., Buckhorn Creek 20 miles north of Masonville, 31 May 1986, B. Kondratieff & R. Durfee, 1 ♂; Larimer Co., Buckhorn Creek 15 miles west of Masonville, 28 May 1991, R. Durfee, 3 ♂, 5 ♀ (reared); Larimer Co., Skin Gulch at Stove Prairie Road, 8 May 1993, B. Kondratieff & R. Durfee, 2 ♂; Grand Co., North Fork Colorado River, Rocky Mountain National Park, 0.4 km upstream of bridge, Windy River Ranch, 30 June 1982, R. Rader, 13 ♂; Grand Co., Colorado River, 2.3 km below Granby, 7 July 1983, R. Rader, 1 ♂; Garfield Co., Grizzly Creek, I-70 rest stop, 2 July 1996, B. Kondratieff, 1 ♂; Archuleta Co., Beaver Creek, Beaver Meadow Springs, San Juan National Forest, 19 October 1994, O. Cundiff, 1 ♂; Douglas Co., Strontia Springs, 30 September 1927, E. J. Osler, 57 ♂. MONTANA: Gallatin Co., Grayling Creek, 9 miles NW of Yellowstone, 9 June 1987, B. Kondratieff, 3 ♂. NEVADA: White Pine Co., Upper Lehman Creek, Great Basin National Park, 22 June 1999, P. Opler, 1 ♂. WYOMING: Park Co., Yellowstone River, Cascade Picnic Area, 30 July 1986, M. Vivoda, 1 ♂; Teton Co., Devils Falls, 19 July 1989, H. R. Lawson, 4 ♂; Carbon Co., Swarming Deed Creek at Forest Road 101, Medicine Bow National Forest, 18 July 1997, B. Kondratieff & R. Durfee, 23 ♂, 2 ♀.

Diagnosis: The entire diverging lobes of the penes, in combination with a median spine (Fig. 1) easily distinguishes this species from all other Colorado *Cinygmula* male imagoes.

Remarks: McDunnough (1924) previously illustrated the penes of *C. mimus*. However, this illustration does not clearly indicate the median spine present in the Lectotype and present in all material examined from Colorado. The male penes of *C. mimus* are very similar to the Pacific northwestern *C. reticulata* McDunnough (McDunnough, 1934; Traver, 1935; Jensen, 1966). Edmunds (1952) indicated that there appears to be at least one undescribed species close to *C. mimus*. Additionally, Jensen (1966) alluded to the variability of *C. mimus* male imagoes, including color variation and wing length. Examination of material throughout the reported range of *C. mimus* is necessary to resolve species distinctions.

Cinygmula par (Eaton)

Cinygma par Eaton, 1885:249. Type locality: Arizona. Lectotype ♂ (BMNH), examined, Spieth, 1941:89.

Cynigma (sic) *mimus* Eaton, Dodds, 1923:106.

Cinygma confusa McDunnough, 1924:131. Holotype ♂, Moraine Lake, Alberta (CNCI), syn. Jacobus and McCafferty, 2002:147.

Cinygmula par, McDunnough, 1933:75.

Cinygmula confusa, McDunnough, 1933:75.

Cinygmula confusa, Traver, 1935:387.

Cinygmula par, Traver, 1935:389.

Wing length: 8–11 mm.

Head: Reddish brown with purplish brown at sutures and at bases of ocelli; antennae pale; compound eyes separated by a distance equal to or less than the width of lateral ocellus.

Thorax: Light brown to reddish-brown, scutellum often reddish brown to purplish brown; purple at all sutures, wing and leg bases. Foreleg brown, mid- and hind legs pale. Wings hyaline, tinted usually with brown, darker at bases and stigmatic area. Venation brown.

Abdomen: Terga semi-hyaline with purple-brown shading; sterna pale. Caudal filaments brown.

Genitalia: Penes long, diverging from base. Each pene with a deep apical notch, large lateral and smaller median spines as Fig. 2.

Material examined: COLORADO: Larimer Co., Rawah Wilderness outlet creek, Twin Crater Lakes, 11,000' elevation, 17 September 1995, S. Fitzgerald & A. Foley, 6 ♂, 1 ♀; Larimer Co., South Fork Poudre River headwaters, 22 September 2002, D. Finn, 8 ♂; Larimer Co., South Fork Poudre River Headwaters, 22 September 2002, D. Finn, 1 ♂, 2 ♀; Hinsdale Co., Silver Creek at Silver Creek Trail 2 miles from trailhead, 12,000' elevation, 5 September 1993, B. Kondratieff & R. Durfee, 2 ♂, 1 ♀ (reared); Hinsdale Co., Silver Creek at Silver Creek Trail, 12,000' elevation, 10 September 1993, T. Eckberg & S. Fitzgerald, 4 ♂; Hinsdale Co., West Lost Trail Creek, 11,500' elevation, 18 August 1997, Simonson & Ellingson. 8 ♂; Summit Co., Creek in Avalanche Chute West Side Peak, 2 September 1995, S. Fitzgerald & A. Foley, 1 ♂; Summit Co., Copper Mountain Resort, 11,000' elevation, 3 September 1995, S. Fitzgerald & A. Foley, 6 ♂. WYOMING: Fremont Co., Golden Lakes Middle Fork, Bull Lake, 6 August 1996, J. Ptacek, 1 ♂.

Diagnosis: The male penes of *C. par* are similar to *C. ramaleyi*, but are distinguished by the presence of both lateral and median spines (Fig. 2).

Remarks: The pigmentation of the wing membrane of this species is highly variable and consistent with the observation made by Edmunds (1952). *Cinygmula par* is often a common species of smaller streams at elevations 3350–3658 m of the Colorado Rockies.

Cinygmula ramaleyi (Dodds)

Ecdyurus ramaleyi Dodds, 1923, 49:101. Type locality: Tolland, (Gilpin Co.) Colorado (Academy of Natural Sciences, Philadelphia), not examined.

Iron tollandi Dodds, 1923, 49:109. Type locality, South Boulder Valley, (Gilpin Co.?) Colorado (ANSP), not examined. Syn. McDunnough 1928, 60:9, 239.

Cinygma ramaleyi, McDunnough, 1924:132.

Cinygma ramaleyi, McDunnough, 1928:239 (= *Iron tollandi*)

Cinygma ramaleyi, McDunnough, 1929:178.

Cinygmula ramaleyi, McDunnough, 1933:75.

Cinygmula ramaleyi, Traver, 1935:390.

Wing length: 8–11 mm.

Head: Red-brown, purplish brown at sutures and at bases of ocelli, antennae pale; compound eyes separated by a distance equal to or less than the width of lateral ocellus.

Thorax: Reddish brown, purple at sutures. Forewings usually tinted with amber, stigmatic area gray-white; hindwings hyaline. Forelegs smoky brown, mid- and hind legs white.

Abdomen: Terga hyaline, posterior margins of terga 1–7 with broad, reddish-brown transverse bands, darker posteriorly. Caudal filaments dark red-smoky-brown.

Genitalia: Penes fused at base diverging apically. Each pene with apical notch and long incurving spine as in Fig. 3.

Material examined: COLORADO: Grand Co., Colorado River, Windy River Ranch, 28 July 1986, R. Rader, 1 ♂; Grand Co., Tonahutu Creek, Big Meadows RMNP, 2 August 1988, B. Kondratieff, 1 ♂; Grand Co., East St. Louis Creek, above diversion Fraser Exp. Forest, 26 September 1998, H. Rhodes, 1 ♂; Boulder Co., South Fork Middle Boulder River at Hessie, Roosevelt NF, 12 September 1998, B. Kondratieff, 2 ♂; Boulder Co.,

Tributary to Jasper Creek, Indian Peak Wilderness 12 September 1998, B. Kondratieff, 1 ♂; Larimer Co., Poudre River, 10,160' elevation, 19 August 1976, A. Shoutis, 1 ♂, 1 ♀; Larimer Co., Corral Creek Trailhead, Longdraw Road, 3 October 1993, A. Williams, 5 ♂, 1 ♀; Jackson Co., Michigan River below Lake Agnes off Route 14, 28 July 1991, R. Durfee & B. Kondratieff, 1 ♂; Pueblo Co., Spring, 2 miles NW Rye, 27 September 1986, M. Vivoda, 2 ♂; Lake Co., East Fork of Arkansas, 2 miles below Climax, 15 September 1990, D. Rees, 10 ♂, 1 ♀; Hinsdale Co., West Lost Trail Creek, 11,500' elevation, 18 August 1997, Simonson & Ellingson, 10 ♂. UTAH: Uintah Co., Green River at Cub County Road, Dinosaur NM, 22 August 1991, B. Kondratieff, 1 ♂.

Diagnosis: The long, deeply emarginate penes in combination with the long median spines (Fig. 3) easily distinguish this species.

Remarks: In Colorado, *C. ramaleyi* usually occurs in high gradient streams of higher elevations (2400–3350 m).

Cinygmula tarda (McDunnough)

Cinygma tarda McDunnough, 1929:178. Holotype ♂, Banff, Alberta (CNCI), examined.

Cinygmula tarda, McDunnough, 1933:75.

Cinygmula tarda, Traver, 1935:391.

Wing length: 8.5 mm.

Head: Light brown, reddish or purplish shading near eyes; antennae pale; compound eyes separated by a distance equal to or less than the width of lateral ocellus.

Thorax: Rusty brown, darker brown at sutures; yellowish-brown ochre shading on mesonotum and scutellum. Wings hyaline except for white stained stigmatic area, longitudinal veins darker at base; legs pale brown.

Abdomen: Abdominal segments 2–7 hyaline, posterior margins shaded red-brown, segments 8–10 opaque. Caudal filaments white.

Genitalia: Penes broad, not divergent at base. Each pene lobe broadly truncate with rounded medial margin and short median spine as Fig. 4.

Material examined: COLORADO: Park Co., South Fork South Platte River, Knight-Inter SWA, Hwy. 285, 13 August 1996, B. Kondratieff, 1 ♂.

Diagnosis: The simple, short truncate penes (Fig. 4) easily distinguish this species.

Remarks: Durfee and Kondratieff (1997) first reported this species from Colorado where it has only been collected from a single locality. It has been previously collected from Alberta and Montana (McDunnough, 1929), Idaho (Jensen, 1966), and Utah (Edmunds, 1954).

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