

**THE ROCKY MOUNTAIN SPECIES OF
EPEORUS (IRON) EATON
(Ephemeroptera: Heptageniidae)¹**

GEORGE F. EDMUNDS, JR. AND RICHARD K. ALLEN
University of Utah

The North American mayflies variously assigned to the genus *Iron* or the genus *Epeorus* present a perplexing problem in generic classification and this problem, as yet, has no clear solution. The type species of *Epeorus* (*E. torrentis* Eaton) and *Iron* (*I. longimanus* Eaton) appear to be as distinct in both the adult and nymphal stages as are other genera in the Heptageniidae. Lestage (1917), on the basis of nymphal characters, even placed these genera in separate subfamilies. In Europe the two types appear to retain their identity as distinct genera, but some of the New World species have uncertain generic placement. The North American species can be separated into two genera by the character of the tarsal claws in the male imago; however, the nymphal stages do not conform to this arrangement. The penes of the males of the known species are extremely diverse, and again, the groupings of the nymphal

¹The research upon which this report is based was supported by National Science Foundation Grants. Accepted for publication Nov. 12, 1963.

stages are not consistent with groupings based on the forms of the male genitalia. It is apparent that a clarification of the relationship of these species must await a general revision of the complex. *Epeorus torrentis* has a different type of penis than any of the North American species, including those assigned to *Epeorus*, and therefore we are placing *Iron* as a subgenus of *Epeorus*, including all of the species assigned by Traver (1935) to this name. The nymphs of *Ironopsis* (Traver) are so fundamentally similar to the nymphs of *Epeorus* (*Iron*) *longimanus* that we also regard it as a subgenus of *Epeorus* rather than as a distinct genus. The nymphs of *Ironodes* (Traver) are readily distinguished by the presence of dorsal abdominal tubercles, but the penes of the male imagoes are so similar to those of the subgenus *Ironopsis* that this group also seems best placed as a subgenus of *Epeorus*. This classification has been previously proposed by Burks (1953), Edmunds and Traver (1954) and Demoulin (1958); however, for a final clarification, a detailed study must be completed for the Asian species, including *Bleptus*, allies of *Iron* reported by Traver (1933a), and other Asian forms as yet undescribed.

Subgenus *Iron* (Eaton)

Iron Eaton 1833: pl. 24; Eaton 1885: 244; Needham 1905: 53, Ulmer 1920: 142; McDunnough 1924: 129; Traver 1933b: 156; Traver 1933a: 116; Spieth 1933: 331; Traver 1935: 392; Burks 1953: 194 (= *Epeorus*); Edmunds and Traver 1954: 237; Edmunds and Allen 1954: 319; Day 1956: 87; Demoulin 1958: 9; Edmunds 1962: 7.

In the Rocky Mountain area the subgenus *Iron* is represented by four species, *Epeorus longimanus* (Eaton), *E. deceptivus* (McDunnough), *E. albertae* (McDunnough), and *E. margarita* Edmunds and Allen, new species. The nymphs of all species are known and the senior author has reared all of these with the exception of *E. margarita*. The latter species has been associated with the adult stages by morphological, color, and distributional evidences. Three additional species are known from the area bordering the Pacific Ocean (British Columbia to California). *Epeorus dulciana* (McDunnough) was described from British Columbia, *E. lagunitas* (Traver) from California, and *E. hesperus* (Banks) from Washington (although the type locality may be in California, see Edmunds, 1962, viii). The nymphs of these coastal species are presently unknown. This treatment is therefore limited to the four species of the Rocky Mountain area, even though all of them, except *E. margarita*, also occur in the Pacific Coast States and British Columbia.

The following keys will serve to distinguish the adults and nymphs of the Rocky Mountain species of *Epeorus*, subgenus *Iron*.

Imagoes

1. Distal end of costal brace of forewing fuscous (Fig. 7); oblique

- black or fuscous stripes on thoracic pleurae near bases of legs; subgenital plate not produced posteriorly and lateral lobes acute (Figs. 4-5) 2
- Distal end of costal brace on forewing not darker than wing veins; without oblique dark stripes on thoracic pleurae; subgenital plate produced posteriorly and lateral lobes vestigial or blunt (Figs. 2-3) 3
2. Terga with an anteromedian macula; penes with a short lateral lobe (Fig. 5) and titillators serrate (Fig. 6) *margarita*
Terga without an anteromedian macula; penes with a long lateral lobe and titillators entire (Fig. 4) *albertae*
3. Femora without a fuscous macula near middle; penes with vestigial lateral lobes (Fig. 3) *deceptivus*
Femora with a fuscous macula; penes with blunt lateral lobes (Fig. 2) *longimanus*

Nymphs

1. Gills on abdominal segment 1 do not extend anteriorly beneath body; posterolateral spines on abdominal segments 1-7 well developed, anterior spines much longer than posterior spines (Fig. 9) 2
Gills on abdominal segment 1 extend anteriorly beneath body; posterolateral spines on abdominal segments 1-7 short, anterior and posterior spines nearly subequal (Fig. 10) 3
2. Apex of femora produced into an acute spine (Fig. 8); terga of mature nymphs with an anteromedian macula *margarita*
Apex of femora blunt (Fig. 11); terga without an anteromedian macula *albertae*
3. Femora with a fuscous macula near middle (Fig. 1); gills on segment 1 meet ventrally at midline *longimanus*
Femora without a fuscous macula; gills on segment 1 do not meet ventrally at midline *deceptivus*

Epeorus (Iron) longimanus (Eaton)

Epeorus (Colorado sp.) Eaton 1881: 26.

Epeorus longimanus Eaton 1883: pl. 23; Edmunds and Musser 1960: 116; Argyle and Edmunds, 1962: 185.

Iron longimanus Eaton 1883: pl. 24; Eaton 1885: 245; Dodds 1923: 107, fig. 21; McDunnough 1924: 129; McDunnough 1925: 221; Needham and Christenson 1927: 15; McDunnough 1929: 177; Traver 1933a: 118; Traver 1935: 406; Spieth 1938: 10 (= *proprius*); Spieth 1941: 88; Day 1956: 88; Kimmins 1960: 282.

Iron nymph No. 1 Dodds 1923: 108, Figs. 23-24.

Iron sp. Dodds and Hisaw 1924: 143, Figs. 8-9.

Iron proprius Traver 1935: 408; McDunnough 1938: 74.

Iron (Epeorus) longimanus, Day 1954: 28.

Epeorus (Iron) longimanus, Edmunds 1954: 65; Allen and Edmunds 1956: 86.

MALE IMAGO. Length: body 9-11 mm; forewing 10-12 mm. Head

yellow-brown; upper portion of eyes brown, lower portion black. Thorax yellow-brown, brown between inner and outer parapsidal furrows; mesoscutellum and metanotum brown; a pale macula anterior to mesoscutellum; pleura and pleural margins of metanotum pale; thoracic sternum yellow-brown to brown; legs yellow-brown, tarsi smoky; femora with a distinct black macula near middle; femuro-tibial joint of fore-legs brown; tarsal claws dissimilar; wings hyaline; venation light brown. Abdominal segments 2-7 semi-hyaline, 1 and 8-10 opaque; abdominal terga washed with purplish brown, distinctly darker in posterior half; terga often with a pale median stripe and dark paramedian stripes; terga with paired submedian hyaline maculae near anterior margin; middle terga with a fuscous to black diagonal streak at anterolateral corner of each segment; abdominal sterna washed with purplish brown in posterior half; paired submedian hyaline maculae often visible in purplish brown area. Male genitalia with curved titillators, blunt lateral lobes and median lobes with a shallow emargination (Fig. 2); subgenital plate with a posterior projection with an apical emargination (Fig. 2). Caudal filaments yellow-brown basally, pale distally.

FEMALE IMAGO. Length: body 9-11 mm; forewing 10-12 mm. Abdominal terga usually darker than male, often with a rosy appearance in gravid females. Apex of subanal plate with a distinct rounded emargination. Other characters as in male except for usual sexual differences.

MATURE NYMPH. Length: body 9-10 mm; caudal filaments 10-11 mm. Head pale with light to dark brown markings, often with a brown anteromedian macula, a brown line across the frons from the lateral margins to the bases of the antennae and across the ocelli and variable brown markings on the vertex (Fig. 1). Thoracic nota pale with brown markings; legs pale with brown and dark brown markings; anterior surface of femora pale with variable brown markings and with a dark brown macula and dark brown apex (Fig. 1); tarsal claws with 3-5 denticles. Abdominal terga pale with brown markings and with dark brown posterior margins; terga 1-2 often pale; terga 3-10 often brown along anterior margin and along midline; gills on segments 1 and 7 ventral; gills on segment 1 meeting at midline and apices of gills on segment 7 usually touching ventrally; gills with a broad sclerotized band extending over the outer one fourth; posterolateral spines on segments 2-7, anterior and posterior spines nearly subequal as in Fig. 9; abdominal sterna often pale. Caudal filaments pale to light brown and dark brown at apex of each segment.

Remarks. The penes of *E. longimanus* may assume unusual shapes and such a specimen was described by Traver (1935) under the name *proprius*. The nature of this change in the penes and the nomenclatural changes resulting from the awareness that such may occur have been adequately discussed by McDunnough (1938), Spieth (1938), and Bartlett (1941).

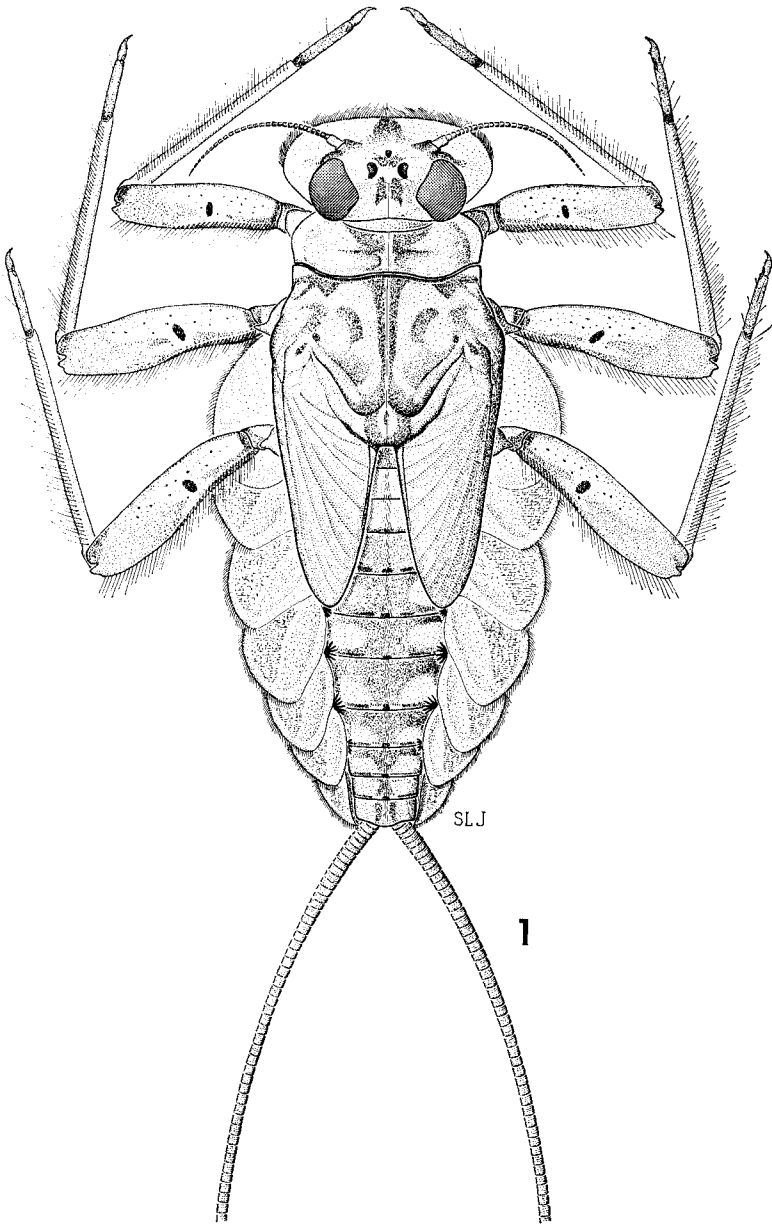


Fig. 1. *Epeorus (Iron) longimanus*, mature nymph, dorsal view.

Type Locality. Manitou, Colorado.

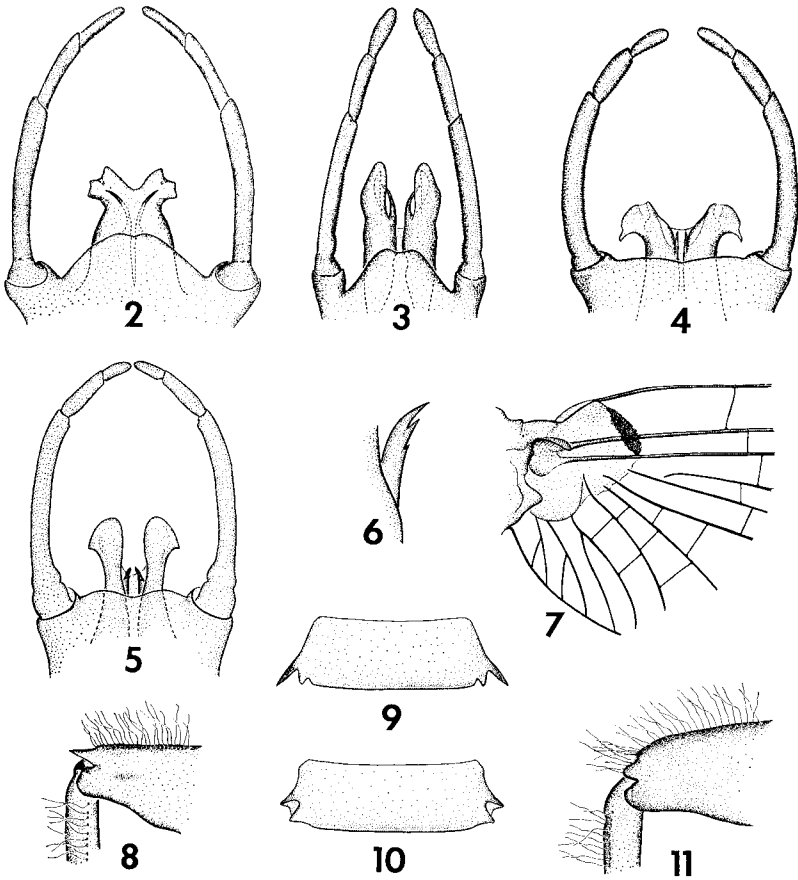
Type. British Museum (Natural History), London.

Distribution. *Epeorus longimanus* is the most widely distributed Rocky Mountain species, as it is known from Alaska, British Columbia and Alberta, and from every western state. Its austral limits are in southern California, central Arizona, and northern New Mexico (Fig. 12).

Biology. In the Rocky Mountains the nymphs of *E. longimanus* are found in the moderate to small trout streams between elevations of 5,000 to 10,500 feet. In the mountains bordering the Pacific Coast they are found at much lower elevations. The nymphs are usually found on larger rocks in moderate to rather strong currents. They are seldom found in the same stream or section of the stream as *E. albertae* (McDunnough); the latter occurs in warmer, usually larger, streams while *E. longimanus* inhabits the cooler, smaller streams and creeks. Nymphs have been collected from late April to early October.

In the nuptial flight of this species, the males gather into moderate to large swarms during the evenings or on cloudy days. At Paradise Park in the Uinta Mountains of Utah, the senior author encountered a large swarm over the stream at 5:00 P.M. The sun was covered by dark clouds and the light was reduced to 600 foot candles. Within fifteen minutes the clouds had cleared away and the swarm dispersed. Specimens were not observed again until 6:07 P.M. when two males were encountered in the shade cast by an Englemann Spruce. These males were joined by others until a small gathering had formed. The swarm was dispersed twice by short gusts of wind, but it rapidly reformed and at 6:30 it increased in size. As the amount of light in the sunlit areas was reduced to 760 foot candles a few individuals were found swarming in the unshaded area. By 6:42 the light in the unshaded area was reduced to 600 foot candles and there was no noticeable difference in the numbers of individuals per unit of stream length in the shaded and unshaded areas of the stream. By 7:15 the sun had set behind the mountains so that there was no distinction between the formerly shaded or unshaded portions of the stream. The swarming reached its greatest intensity during the short period from 7:05 to 7:20 (light intensity, about 80 foot candles), after which there was a rapid decline in the number of swarming individuals. By 7:40, when the light intensity was reduced to 20 foot candles, the swarm was completely dispersed.

At Carter Creek where it is joined by Deep Creek near the Vernal-Manila highway in the Uinta Mountains, Utah, the senior author captured approximately 200 males of this species as they swarmed over the creek. All were confined in a large net bag which was placed over the branch of a tree in such a way that the adults could rest on the branch. After 24 hours only about 15 per cent of the males had died. At the end of 48 hours an additional 30 per cent had died, and after 72 hours 35 per cent more had died. By the next morning all the specimens were dead.



Figs. 2-5. *Epeorus* (Iron), ventral view male genitalia: fig. 2, *E. longimanus*; fig. 3, *E. deceptivus*; fig. 4, *E. albertae*; fig. 5, *E. margarita*. Figs. 6-9. *Epeorus margarita*: fig. 6, titillator of penes; fig. 7, base of forewing; fig. 8, apex of forefemur; fig. 9, ventral view fourth abdominal segment. Fig. 10. *Epeorus deceptivus*, ventral view fourth abdominal segment. Fig. 11. *Epeorus albertae*, apex of forefemur.

The males are polygamous and their longevity indicates that they return the second or even third night, even if they have successfully mated on the first or second nights. The 15 per cent that died the first day may represent the three-day-old specimens; those dying the second day, the two-day-old specimens, the larger group (about 55 per cent) would then represent the newly hatched specimens. These data suggest that by using precise methods, with specimens of known time of emergence, more conclusive results could be attained.

A small series of this species collected over Cherry Creek in the Sawtooth Mountains of Idaho contains five symmetrical intersexes. One of these had a large nematode emerging from it, and it seems possible that these symmetrical intersexes may result from the parasitizing of the nymphs of genetically male specimens by nematodes.

Epeorus longimanus adults are commonly seen in the evenings over many western trout streams. Adults have been collected from late June through early August, although they seem to reach the peak of abundance during July.

Epeorus (Iron) deceptivus (McDunnough)

Iron longimanus Dodds 1923: figs. 19–20, 22; Dodds and Hisaw 1924: 144, fig. 7 (nec Eaton 1883: pl. 24).

Cinygma deceptiva McDunnough 1924: 132.

Iron deceptivus McDunnough 1929: 177; Traver 1933a: 118; Traver 1935: 399.

Epeorus (Iron) deceptivus, Edmunds 1954: 65; Allen and Edmunds 1956: 86.

MALE IMAGO. Length: body 8–9 mm; forewing 9–10 mm. Head purplish brown; upper portion of eyes gray, lower portion black. Thorax brown, paler between inner and outer parapsidal furrows; mesoscutellum and metanotum brown; a pale macula anterior to mesoscutellum; pleural membranes pale; thoracic sternum yellow-brown to brown; forelegs reddish brown, tarsi paler; femora without a macula, but with a darker area near middle; middle and hind legs often darker in basal half; tarsal claws dissimilar, wings hyaline; venation brown. Abdominal segments 1–7 semi-hyaline, 8–10 opaque; each tergum pale or yellowish anteriorly, posterior margin purplish brown gradually reducing in intensity to near middle of segment; abdominal sterna yellowish. Male genitalia with curved titillators, without lateral lobes and median lobes deeply emarginate (Fig. 3); subgenital plate with a posterior projection with an apical emargination (Fig. 3). Caudal filaments brown basally, pale distally.

FEMALE IMAGO. Length: body 8–9 mm; forewing 9–10 mm. Abdomen usually rose colored in gravid females. Apex of subanal plate with a median emargination. Other characters similar to male except for usual sexual differences.

MATURE NYMPH. Length: body 7–10 mm; caudal filaments 8–11 mm. Head pale with variable light brown markings, often with a light brown anteromedian macula, a light brown line across the frons from the lateral margins to the bases of the antennae and across the ocelli, and variable light brown markings on the vertex. Thoracic nota pale with light brown markings; legs pale with light brown markings; anterior surface of femora pale with variable light brown markings, often with a light brown macula near base and a larger light brown macula near apex; tarsal claws with 3–5 denticles. Abdominal terga yellow-brown; terga 2–9 with a brown median stripe, stripe may widen on terga 2–6 to form a triangular macula; gills on segments 1 and 7 extending only slightly beneath body; gills on segments 2–7 with a sclerotized outer

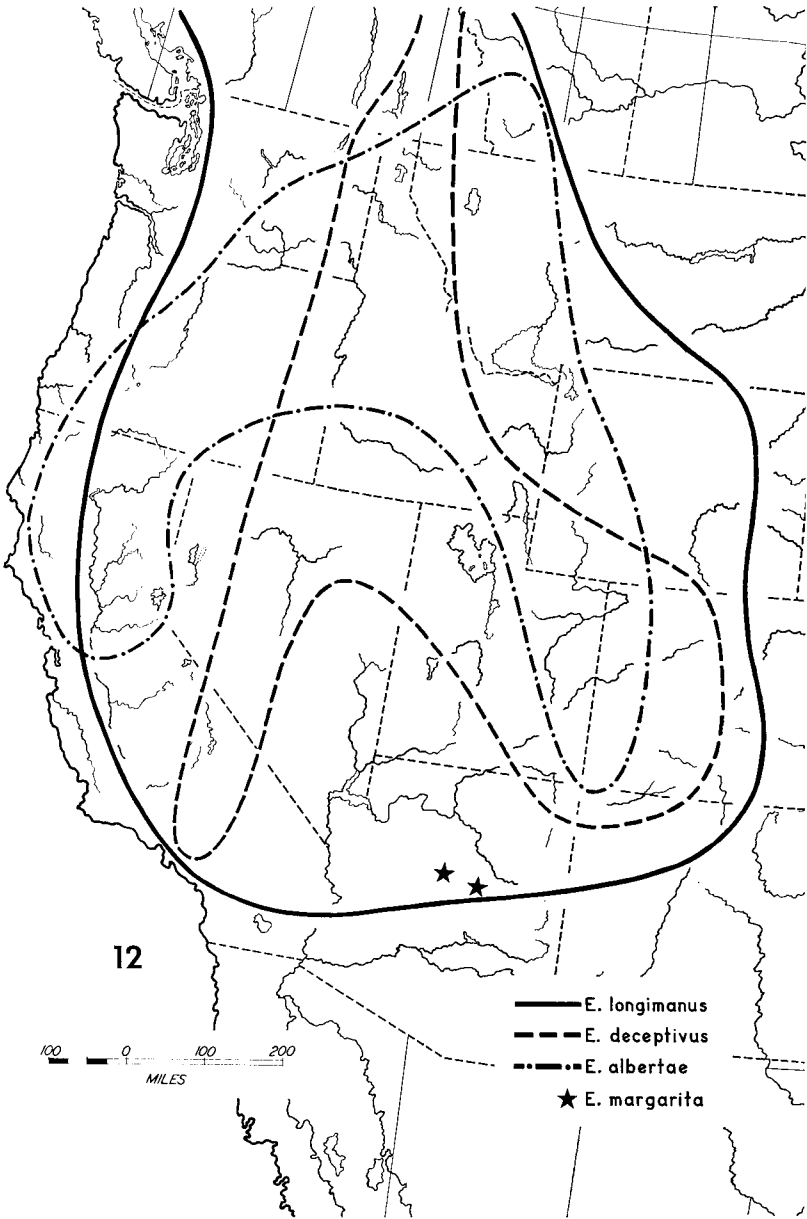


Fig. 12. Distribution map of *Epeorus longimanus*, *E. deceptivus*, *E. albertae*, and *E. margarita*.

margin; posterolateral spines on segments 2-7, anterior and posterior spines nearly subequal (Fig. 10); abdominal sterna pale with a pale stripe of yellow between midline and lateral margin. Caudal filaments yellow-brown, darker distally and pale at joinings on distal half.

Remarks. The penes of *E. deceptivus* may vary as the penes revolve, but the shape is characteristic and unlike any other species in the genus.

Type Locality. Banff, Alberta.

Type. No. 726, Canadian National Collection, Ottawa, Ontario.

Distribution. This boreal species is widely distributed in the inland mountains of western North America. It is known from southern Alberta austrad to southern California and northern New Mexico (Fig. 12). It is known from the Pacific Coast Mountains only from a single record from Barton Flats, San Bernardino Mtns., California, April 27, 1950 (no collector given), (Collection of the University of California at Los Angeles).

Biology. The nymphs of *E. deceptivus* inhabit small to medium-sized streams between elevations of 6,500 to 10,000 feet and occur in moderate current on rock and gravel bottoms. This species has been found abundantly only in American Fork Creek, Utah County, Utah, and at Wallowa River at Wallowa Lake, Wallowa County, Oregon. All other collections consist of only a few specimens. Nymphs have been collected from July to September.

The adults of *E. deceptivus* have been observed swarming with adults of the genus *Cinygmula* over a Utah stream in bright sunshine at about 4:00 PM in early September and about 5:00 PM in a distinct swarm over the Wallowa River in Oregon in late August. Adults have been collected only in late August and early September.

Epeorus (Iron) albertae (McDunnough)

Iron albertae McDunnough 1924: 129; Traver 1935: 398; Day 1956: 88.

Epeorus albertae McDunnough 1929: 177; Traver 1933a: 119; Edmunds and Musser 1960: 116; Argyle and Edmunds 1962: 185.

Epeorus sp. Needham and Christenson 1927: 15.

Iron (Epeorus) albertae McDunnough 1938: 34 (= *youngi*); Day 1954: 28.

Iron youngi Traver 1935: 412.

Epeorus (Iron) albertae, Edmunds 1954: 65; Allen and Edmunds 1956: 86.

MALE IMAGO. Length: body 9-11 mm; forewing 10-12 mm. Head light brown; eyes black. Thorax yellow-brown; pronotum margined with fuscous; area between inner parapsidal furrows black; meso- and metascutella brown to dark brown; pleurae yellow-brown with distinct fuscous markings above base of forelegs and anterior to wing base, narrow fuscous streaks above bases of middle and hind legs; thoracic sterna yellow-brown; legs pale; femora with a purplish brown apical band and a distinct fuscous macula near middle; femuro-tibial joints of forelegs brown; tarsal claws similar; wings hyaline; venation light brown; distal end of costal brace thickened, fuscous as in Fig. 7.

Abdominal segments 1-7 pale and semi-hyaline, 8-10 yellowish and opaque; abdominal terga with a distinct purplish brown to fuscous band across posterior margin; abdominal sterna pale. Male genitalia with straight titillators, short acute lateral lobes and median lobes moderately emarginate (Fig. 4); subgenital plate not projected posteriorly (Fig. 4). Caudal filaments yellow-brown basally, pale distally.

FEMALE IMAGO. Length: body 9-11 mm; forewing 10-12 mm. Abdomen usually rose colored in gravid females. Apex of subanal plate with a shallow, rounded emargination. Other characters as in male except for usual sexual differences.

MATURE NYMPH. Length: body 8-10 mm; caudal filaments 8-10 mm. Head pale with light brown markings, often with light brown anteromedian and paired antero-paramedian maculae, a light brown line across ocelli and light brown vertex. Thoracic nota light brown with variable pale markings; legs pale with light brown and dark brown markings; anterior surface of femora pale with variable light brown markings and with a dark brown macula similar to those of *E. longimanus* (Fig. 1); tarsal claws with 3-5 denticles. Abdominal terga light brown; terga 2-9 often with pale paired submedian maculae; terga 5-10 or 6-10 often with a thin dark brown median stripe; gills on segments 1 and 7 do not extend beneath body; gills on segments 2-7 with a sclerotized ridge along anterior margin; posterolateral spines on segments 2-7, anterior spines much longer than posterior spines as in Fig. 9; abdominal sterna pale; sterna 9 often with brown markings. Caudal filaments unicolorous light brown.

Remarks. McDunnough's original description of *E. albertae* omitted several important color characters, and Traver (1935) naturally assumed that these features were not present and, as a result, described the nominal *youngi*. McDunnough (1938) pointed out the omissions in his original description and synonymized *youngi* with *E. albertae*.

In some specimens of *Epeorus albertae* titillators of the penes may project laterad and the lateral lobes project anteromedially into the space between the oval penis lobes.

Type Locality. Waterton Lakes, Alberta, Canada.

Type. No. 718, Canadian National Collection, Ottawa, Ontario.

Distribution. *Epeorus albertae* is irregularly but rather widely distributed in the inland mountains of western North America. This boreal species has been collected in Alberta and austrad to central California and southeastern Colorado (Fig. 12).

Biology. The nymphs of this species are common in large rivers and is occasionally found in smaller, rather warm streams; however, they are never abundant in the latter habitat. They prefer moderate currents in streams at elevations of 4,000 to 7,000 feet where they occur on larger rocks. They are found at much lower elevations in Pacific Coast states. Edmunds and Musser (1960) noted that *E. albertae*

gradually replaced *E. longimanus* as the waters of Carter Creek warmed as they flowed toward the Green River in the Uinta Mountains of Utah. Nymphs have been collected from June to August.

The nuptial flight of *E. albertae* usually consists of single individuals or small swarms. They are usually observed flying over riffles of streams in the direct sunlight in the morning and early evening. The flight is usually steady with a minimum of vertical motion. Swarms disperse readily when disturbed by the collector's net but are not interrupted by breezes or light winds, a brisk wind being needed to disperse the swarm. Adults have been collected only in July and August.

Epeorus (Iron) margarita Edmunds and Allen, n. sp.

MALE IMAGO. Length: body 10–11 mm; forewing 10–11 mm. Head yellow-brown; eyes black. Thoracic nota yellow-brown; scutella darker; pronotum narrowly margined with fuscous; three prominent oblique fuscous stripes on pleurae, one extending from prothoracic coxa to costal articulation of forewing, one anterior to mesothoracic coxae extending to pleural wing recess, and one anterior to metathoracic coxa extending to base of hind wing; numerous other small fuscous maculae on pleuron; thoracic sterna yellow brown; legs light brown, coxae and trochanters with lateral fuscous maculae; femora with bands subapically and near middle; legs shaded with fuscous near joints; wings hyaline, often tinged lightly with brown in stigmatic area; longitudinal and cross veins yellow-brown; distal end of costal brace fuscous (Fig. 7); veins in posterior half of hind wing hyaline. Abdominal segments yellow, segments 1–7 semi-hyaline, 8–10 opaque; terga with a narrow fuscous band across anterior margin, a broad fuscous oblique band across each posterolateral corner joining to a lateral fuscous streak on pleural margin; spiracles pale, enclosed within oblique streak; anteriorly-based fuscous marking between midline and pleural margin on segments 7–9, faded or absent on other segments; a distinct median fuscous macula on anterior margins; abdominal sterna with indistinct yellow-brown ganglionic markings. Male genitalia with curved, serrate titillators (Fig. 6), very short acute lateral lobes, and median lobes deeply emarginate (Fig. 5); subgenital plate not projected posteriorly (Fig. 5). Caudal filaments brown, pale distally; joinings indistinctly darker.

FEMALE IMAGO. Length: body 10–11 mm; forewing 10–11 mm. Abdomen purplish dorsally, markings on posterior margin of each tergum diffuse. Apex of subanal plate with a shallow rounded median emargination. Other characters similar to male except for usual sexual differences.

MATURE NYMPH. Length: body 10–11 mm; caudal filaments 9–11 mm. Head pale, often with light brown U-shaped macula on frons and light brown markings on vertex. Thoracic nota pale; pronotum pale with black paired sublateral maculae on posterior margin; mesonotum pale with fuscous markings; legs pale with fuscous mark-

ings; anterior surface of femora with a large pale macula, macula extends to margin near a black macula; apices of femora produced into an acute spine (Fig. 8); tibiae pale, suffused with light brown near middle; tarsi brown; tarsal claws with four denticles. Abdominal terga yellow-brown, darker laterally and anteriorly (dark color pattern of adult present in mature or nearly mature nymphs); gills do not extend beneath body; gills on segments 2-7 with sclerotized ridge along anterior margin; posterolateral spines on segments 2-7, anterior spines much longer than posterior spines (Fig. 9); abdominal sterna pale. Caudal filaments unicolorous brown.

Holotype: Male imago. Oak Creek Canyon, Banjo Bill Forest Camp, Arizona, May 10, 1955, C. P. Alexander, in the collection of the University of Utah, Salt Lake City. *Allotype*: Female imago, Clear Creek Canyon, Arizona, June 19, 1949, D. G. Denning, in the collection of the University of Utah. Paratopotypes: 2 male imagoes, same data as holotype, 1 in the collection of the University of Massachusetts, Amherst, 1 in the collection of the University of Utah; 2 male and 2 female imagoes, June 10, 1955, 1 female in the collection of the University of Massachusetts, 2 males and 1 female in the collection of the University of Utah. Paratypes: 2 male and 1 female imagoes, Clear Creek Canyon, Arizona, June 19, 1949, D. G. Denning; 1 male and 2 female nymphs, West Fork Oak Creek Canyon, Mayhew Lodge, Arizona, June 2, 1951, J. Preece, all in the collection of the University of Utah.

Remarks. *Epeorus (Iron) margarita* may be distinguished from the other known species of the subgenus by the form of the penes and abdominal color pattern in the imagoes and by leg characters and abdominal color pattern in the nymphal stage. The nymphal and adult stages are only tentatively associated; however, they were collected in the same vicinity and the abdominal color pattern of both stages is identical. This species is named in honor of Mabel Marguerite Alexander, wife and constant field companion of Dr. C. P. Alexander who collected the holotype of this species.

Biology. The biology of this species is relatively unknown. Oak Creek is a clear canyon stream.

LITERATURE CITED

- Allen, R. K., and G. F. Edmunds, Jr. 1956. A list of the mayflies of Oregon. Proc. Utah Acad. Sci., Arts and Letters 33:85-87.
- Argyle, D. W., and G. F. Edmunds, Jr. 1962. Mayflies (Ephemeroptera) of the Curecanti Reservoir Basins. Univ. Utah Anthro. Papers 59:179-189.
- Bartlett, L. M. 1941. *Iron fraudator* Traver vs. *Iron pleuralis* Banks (Ephemera). Canad. Entomol. 75:218-219, 1 fig.
- Burks, B. D. 1953. The mayflies or Ephemeroptera of Illinois. Bull. Illinois Nat. Hist. Surv. 26 (Art. 1): 1-216.
- Day, W. C. 1954. New species and notes on California mayflies. II. (Ephemeroptera). Pan-Pacific Entomol. 30:15-29.
- . 1956. Ch. 3, Ephemeroptera, pp. 79-105. In: R. L. Usinger (ed.), Aquatic

- insects of California. Berkeley and Los Angeles: University of California Press. 508 p.
- Demoulin, G. 1958. Nouveau schema de classification des Archodonates et des Ephemeropteres. Bull. Inst. Roy. Sci. Nat. Belgium 34 (27):1-19.
- Dodds, G. S. 1923. Mayflies from Colorado, description of certain species and notes on others. Trans. Amer. Entomol. Soc. 49:93-114.
- Dodds, G. S., and F. L. Hisaw. 1924. Ecological studies of aquatic insects, I. Adaptations of mayfly nymphs to swift streams. Ecol. 5:137-148.
- Eaton, A. E. 1881. An announcement of new genera of the Ephemeridae. Entomol. Mon. Mag. 18:21-27.
- . 1883-1888. A revisional monograph of recent Ephemeridae or mayflies. Trans. Linn. Soc. London, Sec. Ser. Zool. 3:1-352.
- Edmunds, G. F., Jr. 1954. The mayflies of Utah. Proc. Utah Acad. Sci. Arts and Letters 31:64-66.
- . 1962. The type localities of the Ephemeroptera of North America north of Mexico. University of Utah Biol. Ser. 12 (5):i-viii + 1-39.
- Edmunds, G. F., Jr., and R. K. Allen. 1954. A checklist of the Ephemeroptera of North America north of Mexico. Ann. Entomol. Soc. Amer. 50:317-324.
- Edmunds, G. F., Jr., and G. G. Musser. 1960. The mayfly fauna of Green River in the Flaming Gorge Reservoir Basin of Wyoming and Utah. University of Utah Anthro. Papers, No. 48:112-123.
- Edmunds, G. F., Jr., and J. R. Traver. 1954. An outline of a reclassification of the Ephemeroptera. Proc. Entomol. Soc. Washington 56:236-240.
- Kimmins, D. E. 1960. The Ephemeroptera types of species described by A. E. Eaton, R. McLachlan, and F. Walker. Bull. British Mus. (Nat. Hist.) Entomol. 9:269-318.
- Lestage, J. A. 1917. Contribution a l'étude des Éphémères Paléarctiques. Serie I. Ann. Biol. Lacustre 8:213-457.
- McDunnough, J. 1924. New Canadian Ephemeridae with notes, II. Canad. Entomol. 56:128-133.
- . 1925. The Ephemeroptera of Covey Hill, Que. Trans. Roy. Soc. Canada 19:207-224.
- . 1929. Notes on North American Ephemeroptera with descriptions of new species, II. Canad. Entomol. 61:169-180.
- . 1938. New species of North American Ephemeroptera with critical notes. Canad. Entomol. 70:23-34.
- Needham, J. G. 1905. Ephemeroptera, pp. 17-62. In: J. G. Needham, K. J. Morton, and O. A. Johannsen, Mayflies and midges of New York. New York Mus. Bull. 86:1-352.
- Needham, J. G., and R. O. Christenson. 1927. Economic insects in some streams of northern Utah. Utah Agri. Expt. Sta. Bull. 201:1-36.
- Spieth, H. T. 1933. The phylogeny of some mayfly genera. J. New York Entomol. Soc. 31:55-86, 327-391.
- . 1938. Taxonomic studies of Ephemerida, I: Description of new North American species. Amer. Mus. Novit., No. 1002:1-11.
- . 1941. The North American types of the Rev. A. E. Eaton. Ann. Entomol. Soc. Amer. 34:87-98.
- Traver, J. R. 1933a. Heptagenine mayflies of North America. J. New York Entomol. Soc. 41:105-125.
- . 1933b. Mayflies of North Carolina. J. Elisha Mitchell Soc. 48:141-206.
- . 1935. Part II. Systematic, pp. 237-739. In: J. G. Needham, J. R. Traver, and Yin-chi Hsu, The biology of mayflies. Ithaca, N. Y.: Comstock Publishing Co. 759 p.
- Ulmer, G. 1920. Übersicht über die Gattungen der Ephemeropteren nebst Bemerkungen über einzelne Arten. Stettiner Entomol. Zeit. 81:97-144.