

A Revision of the Genus *Ephemerella* (Ephemeroptera: Ephemerellidae)

II. The Subgenus *Caudatella*¹

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ABSTRACT

The six known species of this subgenus include *E. (C.) orestes* from Oregon and *E. (C.) cascadia* from Oregon and northern California, both of which, like *E. (C.) edmundsi* Allen, are known only from nymphs. Adults of *E. (C.) hystrix* Traver are described for the first time. *E. (C.) heterocaudata* McDunnough (= *E. columbiella*

McD., new synonymy) is polytypic, with *E. (C.) h. californica* occurring in the Sierra Nevada mountains of central and southern California, and *E. (C.) h. circia* in west-central Oregon. Keys are given to the nymphs and to the adults so far as known, and complete synonymies and distributions are included.

Part I of this revision (Allen and Edmunds 1959) dealt with the subgenus *Timpanoga*. In the accounts that follow dealing with species of the subgenus *Caudatella*, collections made by the authors are indicated by initials, GFE and/or RKA. Abbreviations for the collections where the specimens are deposited are as follows: INHS, Illinois State Natural History Survey; UM, University of Massachusetts; VKM, personal collection of Dr. V. K. Mayo; CNC, Canadian National Collection; UU, University of Utah; OSC, Oregon State College; CAS, California Academy of Sciences. Specimens without designation are deposited in the collection of the University of Utah.

Subgenus *Caudatella* Edmunds

(*Ephemerella*) *heterocaudata*-group, McDunnough 1935: 97.
Caudatella Edmunds 1959: 546 (as subgenus); type *heterocaudata* McDunnough, by original designation.

The species of the subgenus *Caudatella* have been at various times placed in three different species groups within the genus *Ephemerella*. Traver (1935) placed *Ephemerella heterocaudata* McDunnough in the *serrata*-group and *E. hystrix* Traver in the *needhami*-group. McDunnough (1935) first noticed the relationship of *E. heterocaudata* and *E. hystrix*, and placed them together as the *heterocaudata*-group. Edmunds (1959) erected the subgenus *Caudatella* for this group of species, characterized by the terminal filament being longer than the lateral cerci in both the nymph and the adult.

As treated here, the subgenus *Caudatella* contains six species: *Ephemerella heterocaudata* McDunnough (= *columbiella* McDunnough, 1935: 97, new synonymy), *E. hystrix* Traver, *E. jacobi* McDunnough, *E. edmundsi* Allen, *E. orestes*, new species, and *E. cascadia*, new species.

McDunnough (1935) named *E. columbiella* from nymphs and adults collected in British Columbia. He distinguished these from *E. heterocaudata* on minor nymphal morphological differences, especially in the

character of the paired dorsal abdominal spines. Comparison of topotypical specimens from British Columbia with others from the known range of *E. heterocaudata* shows that the nymphs of "*E. columbiella*" fit well within the variability of *E. heterocaudata*. Reared paratype male and female imagoes, and nymphs, of "*E. columbiella*" from the Canadian National Collection were compared with *E. heterocaudata*, and as McDunnough stated, there are "no very tangible differences," between these specimens and typical *E. heterocaudata*. *Ephemerella columbiella*, therefore, is placed as a synonym of *E. heterocaudata*.

After study of material collected throughout its known range in western North America, *Ephemerella heterocaudata* is herein divided into three subspecies: *E. heterocaudata heterocaudata* McDunnough, *E. heterocaudata californica* new subspecies, and *E. heterocaudata circia* new subspecies.

The following keys will serve to distinguish the species and subspecies of the subgenus *Caudatella*. The undescribed imagoes of *E. cascadia*, *E. orestes* and *E. edmundsi* probably have ventral color markings and ratios of lateral cerci to terminal filament similar to those of the nymphal stages. If so, the unknown adults of these species may be associated with their respective nymphal stages without rearing.

IMAGOES

1. Abdominal sterna uniformly dark brown with pale lateral margins on segments 8-9; genitalia of male as in fig. 4 **jacobi**
Each abdominal sternum with either three brown longitudinal stripes or a shallow dark brown chevron (figs. 7 and 8); genitalia of male not as above 2
2. Each abdominal sternum with three brown longitudinal stripes (fig. 7); genitalia of male as in fig. 3 **heterocaudata**
Each abdominal sternum with a shallow dark brown chevron (fig. 8); genitalia of male as in fig. 2 **hystrix**

The ventral abdominal color pattern of the nymphs is diagnostic for most species included in this subgenus, but it becomes well formed only when the nymph is about half-grown. Also, the color patterns may fade out in specimens preserved in alcohol for many years. To take advantage of the use of ventral color pattern and yet not limit its utility, this key has

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been constructed so that specimens with well-marked ventral abdominal color patterns will key with ease. Well-marked specimens can be verified, and indistinctly marked specimens will key through a more difficult series of couplets starting with couplet 5. *Ephemerella edmundsi* Allen is the only species in this subgenus lacking a distinct ventral color pattern, but it is remarkably distinct morphologically.

NYPHS

1. Abdominal sterna with a conspicuous dark and light color pattern (figs. 7 to 9).....2
Abdominal sterna unicolorous or nearly so, without a contrasting dark and light pattern, or at most with only light dots or streaks laterally (fig. 10), or color pattern faded, or young nymph with color pattern not yet formed.....5
2. Each abdominal sternum dark brown with light yellow-brown lateral margins (fig. 9).....4
Each abdominal sternum marked otherwise (figs. 7 or 8).....3
3. Each abdominal sternum with a chevron-shaped dark marking (fig. 8).....**hystrix**
Each abdominal sternum with a median and paired sublateral dark stripes (fig. 7).....**heterocaudata**, 9
4. Occipital tubercles present (fig. 18).....**casadia** n. sp.
Occipital tubercles absent.....**orestes** n. sp.
5. Paired dorsal abdominal tubercles on terga 1-10 (fig. 27); labrum with a deep median notch on margin (fig. 22); tarsal claws with two rows of denticles (fig. 21); maxillary palpi wanting (fig. 20).....**edmundsi**
Paired dorsal abdominal tubercles on terga 1-9 or 2-9; labrum only slightly emarginate on margin (fig. 13); tarsal claws with a single row of denticles (figs. 15-16); maxillary palpi three-segmented (fig. 12).....6
6. Femora with only a few stout spines, and scattered hairs; tibiae and tarsi without a distinct row of hairs (fig. 16); paired dorsal abdominal tubercles long and slender (figs. 25-26).....7
Femora with spines and a distinct row of marginal hairs; tibiae and tarsi with a distinct row of hairs (fig. 15); paired dorsal abdominal tubercles short and stout (figs. 23-24).....8
7. Occipital tubercles present (fig. 18); paired dorsal abdominal tubercles long and strongly divergent apically (fig. 25).....**casadia** n. sp.
Occipital tubercles absent (fig. 17); paired dorsal abdominal tubercles shorter and only slightly divergent (fig. 26).....**hystrix**
8. Cerci less than one-third as long as terminal filament; paired dorsal abdominal tubercles as in figs. 1 or 23.....**heterocaudata**, 9
Cerci at least two-thirds as long as terminal filament; paired dorsal abdominal tubercles as in fig. 24.....**orestes** n. sp.
9. Thorax with paired, submedian, wartlike tubercles covered with dense setae (fig. 19).....**h. circia**, n. ssp.
Thorax without wartlike tubercles.....10
10. Paired dorsal abdominal tubercles on segments 1-9 (fig. 23).....**h. californica** n. ssp.
Paired dorsal abdominal tubercles on segments 2-9 only (fig. 1).....**h. heterocaudata**

Ephemerella heterocaudata McDunnough

This polytypic species was originally described from nymphs and adults collected in Yellowstone National Park, Wyoming.

The subspecies of *Ephemerella heterocaudata* may

be readily distinguished from one another in the nymphal stage by well defined morphological characters. *Ephemerella h. californica* possesses paired dorsal submedian tubercles on segment 1, which are lacking in the other two subspecies. *Ephemerella h. circia* may in turn be distinguished from *E. h. heterocaudata* as the nymphs of the former possess wartlike tubercles on the thorax, which are not present in the latter. Whether the adult stages will be as easily distinguished can be decided only after series of male adults are available for each subspecies.

Male Imago (dry).—Length: body 6-7; forewing 6.5-7.5 mm. Eyes reddish-brown. Thorax olive-brown, yellowish patch anterior to the base of the wing, containing a black line which descends to the coxa of the foreleg; lateral sutures marked with black; legs pale olive-brown; fore femora and tibia with black markings; wings hyaline with pale veins and cross veins. Abdominal terga olive-brown, anterior half of each of the first four segments with broad black bands, bands on posterior segments reduced to large semicircular dorsal patches; sterna pale olive-brown with midventral and sublateral longitudinal dark brown stripes as in fig. 7. Caudal filaments brown, lateral cerci 20%-30% as long as terminal filament. Penes with a shallow median apical depression as in fig. 3.

Female Imago (dry).—Length: 6-7; forewing 6.5-7.5 mm. Similar to male except for usual sexual differences.

Mature Nymph.—Length: 7-8; cerci 2-3; terminal filament 10-12 mm. Head brown with pale markings, roughened but without occipital tubercles; antennae brown; maxillary palpi three-segmented as in fig. 12. Thorax brown; legs brown, femora with a few marginal spines and a distinct row of marginal hairs, tibiae and tarsi with a distinct row of marginal hairs (fig. 15), tarsal claws with three to seven denticles. Abdominal terga olive-brown; anterior half of each of the first four segments with broad black bands, bands on posterior segments reduced to large semicircular dorsal patches; each tergum with a series of lateral black patches; paired dorsal abdominal tubercles on segments 1-9 or 2-9 as in figs. 1 and 23; sterna pale olive-brown with median and paired sublateral longitudinal dark brown stripes as in fig. 7. Caudal filaments light brown, darker at the joinings; lateral cerci 20% to 30% as long as terminal filament.

Ephemerella heterocaudata heterocaudata McDunnough, new status

Ephemerella heterocaudata McDunnough 1929: 170; Wallely 1930: 15, 6 figs. (nymph); Traver 1935: 603; Allen and Edmunds 1956: 87

Ephemerella columbiella McDunnough 1935: 97, 1 fig.; Traver 1935: 629. **New synonymy.**

Mature Nymph.—The nymph of this race is distinguishable by the absence of thoracic tubercles and the absence of paired, dorsal submedian tubercles on tergum one.

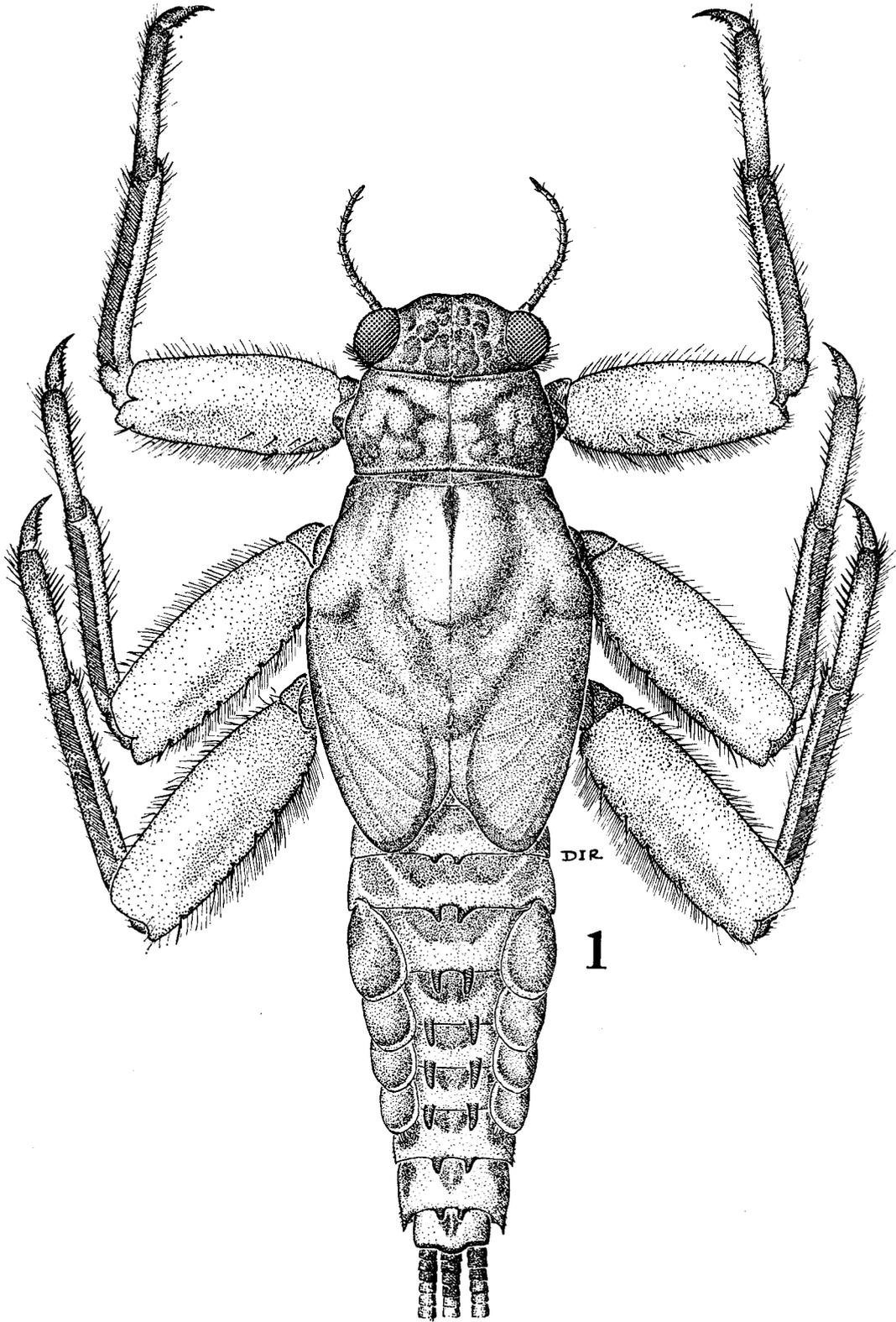


PLATE I

FIG. 1.—*Ephemera heterocaudata heterocaudata*, mature female nymph, dorsal view.

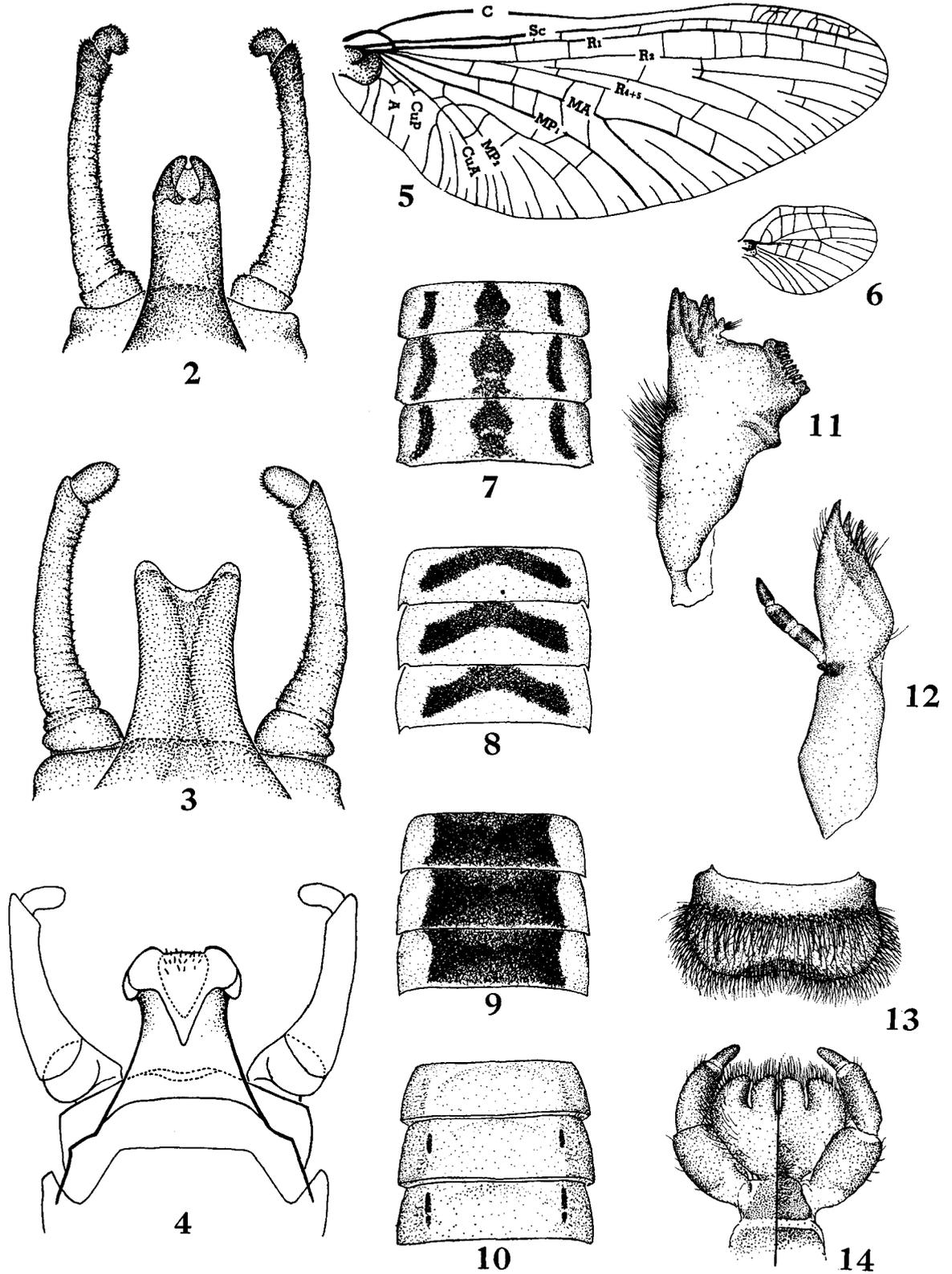


PLATE II

Type Locality.—Upper Geyser Basin, Yellowstone National Park, Wyoming.

Type.—No. 2993, Canadian National Collection, Ottawa, Canada.

DISTRIBUTION

Ephemerella h. heterocaudata is a boreal, western North American subspecies. It is known from British Columbia astrad to Oregon, northern California, central Idaho and northwestern Wyoming (figs. 28a, 28b). The authors have examined specimens from the following localities:

BRITISH COLUMBIA.—Shuswap Falls, Trepanier Creek, Peachland, 17-VIII-33, 16-VII-34, A. N. Gartrell (CNC); Shingle Creek Road, Keremeos, 3-VIII-35, A. N. Gartrell (CNC); Wilson Creek, New Denver, 21-VIII-40, V. K. Mayo (VKM). CALIFORNIA.—Siskiyou Co., Swillup Creek, 2-VII-59, RKA. IDAHO.—Custer Co., Big Lost River, Mackay, VII-48, G. F. Edmunds, Sr. OREGON.—North Butte Forest Camp, Rogue River National Forest, 12-VIII-50, C. P. Alexander (UM); Wallowa Co., French Camp, Lostine River, 18-VIII-52, GFE. WYOMING.—Firehole River, Biscuit Basin, Yellowstone National Park, 21-VI-46, GFE.

Ephemerella heterocaudata californica, new subspecies

Ephemerella heterocaudata, Day 1954: 28; Day 1956: 98.

Mature Nymph.—*Ephemerella h. californica* nymphs are distinguished from the nymphs of the other known races by possessing paired, dorsal, submedian tubercles on tergum one (fig. 23), and lacking tubercles on the thorax (fig. 19).

Holotype.—Female nymph, Chilacoot Creek, 1 mile above Bass Lake, Madera Co., California, 19-VI-59, Richard K. Allen, in collection University of Utah, Salt Lake City. Paratopotype.—1 nymph (UU). Paratypes.—CALIFORNIA.—Mariposa Co., 1 nymph, Goose Creek, Yosemite National Park, 19-VI-59, RKA (UU); Madera Co., 5 nymphs, stream 0.8 miles up road to Soquel (off California Highway 41), Sierra National Forest, 19-VI-59, RKA (UU); Los Angeles Co., 1 female subimago, East Fork San Gabriel River at Camp Bonita, 16-VI-59, RKA (UU); Nevada Co., 1 nymph, Yuba River, 2 miles W. Cisco Grove, 6-VIII-59, RKA (UU); 1 nymph, Chipmunk Creek, 2-VIII-38, P. R. Needham (INHS); 2 nymphs, South Fork Rubicon XI, 100 yards N. of Bridge, 5-VIII-38, P. R. Needham (INHS); 1 nymph, North Fork Creek above Bass Lake, 15-VI-34, V. K. Mayo (VKM).

DISTRIBUTION

Ephemerella heterocaudata californica is known from the Sierra Nevada Mountains in central California, and from a single subimago female collected in the San Gabriel Mountains in southern California (fig. 28b).

Ephemerella heterocaudata circia, new subspecies

Mature Nymph.—This race is distinguished in the nymphal stages by the presence of paired submedian wartlike tubercles, covered with setae, on the pronotum and mesonotum and a single median wart on the mesonotum.

Holotype.—Female Nymph, Umpqua River, Sawyer Rapids, 26 mi. E. Reedsport, Douglas Co., Oregon, 17-VI-58, M. L. Johnson, in collection University of Utah, Salt Lake City. Paratopotypes.—Five nymphs (UU).

TAXONOMY

Ephemerella h. circia is a Coast Range form known only from its type locality in west central Oregon. It presumably intergrades with *E. h. heterocaudata* wherever their ranges meet. Of 14 nymphs collected in the Middle Fork of the Willamette River, Lane Co., Oregon, where the Coast Range and the Cascades converge with the Klamath Mountains, 3 specimens totally lacked thoracic tubercles, and 11 specimens had varying degrees of development of these tubercles. A single nymph with reduced thoracic tubercles was also examined from the Willamette River near Walker, Lane Co., Oregon. Streams originating in this region of the Cascade Mountains flow through the Coast Ranges and empty into the Pacific Ocean. *Ephemerella h. heterocaudata* and *E. h. circia* probably meet and intergrade in many suitable streams in this area (fig. 28b).

Ephemerella hystrix Traver

(Without name), Needham 1927: 116.

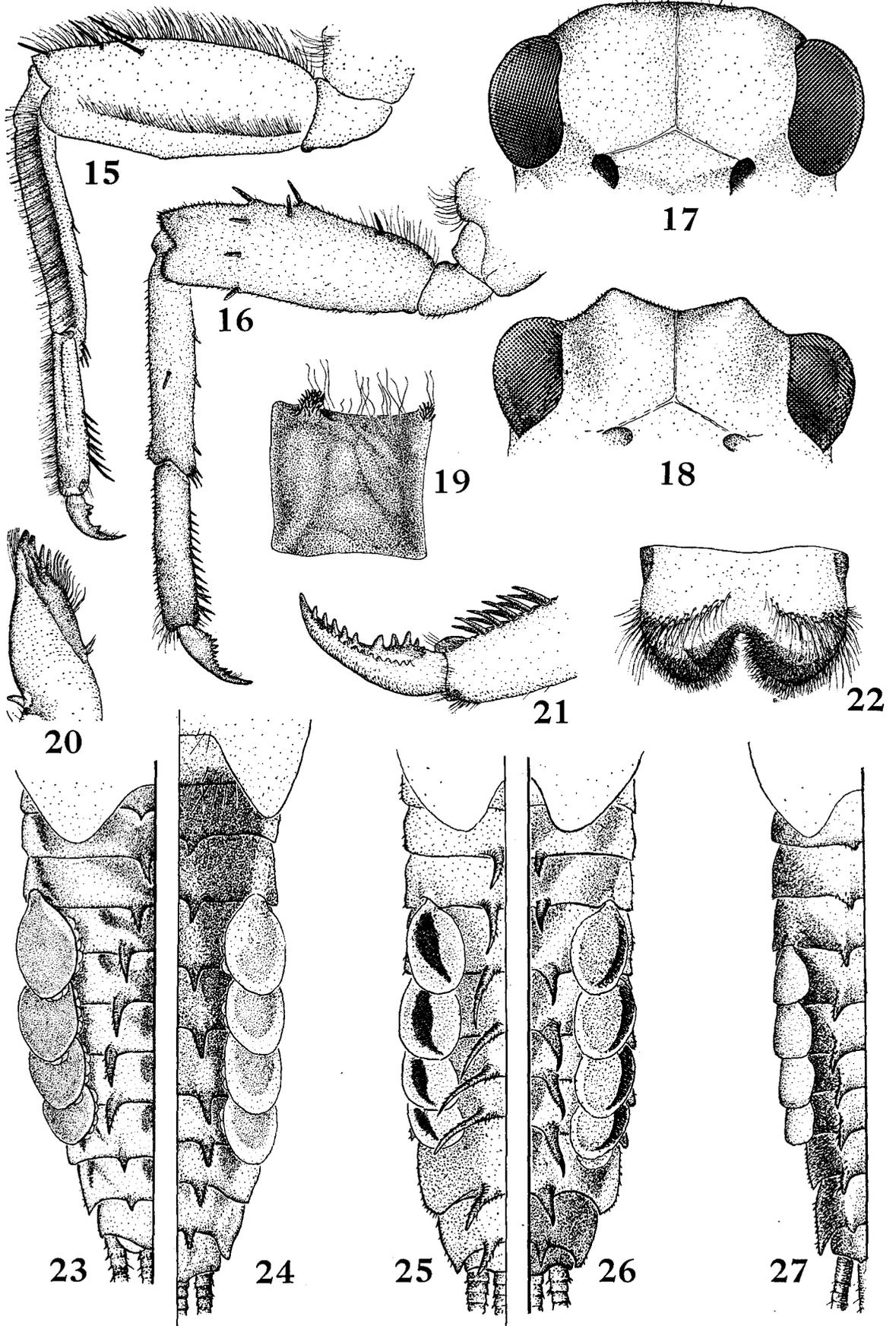
Ephemerella hystrix Traver 1934: 212; Traver 1935: 605 and 628; McDunnough 1935: 98 (redescription); Day 1954: 25 (= *spinosa* Mayo 1951; Day 1956: 98; Allen and Edmunds 1956: 87).

Ephemerella spinosa Mayo 1951: 122 (nec Morgan, 1911: 94).

This species was briefly described, but not named, by Needham (1927) from specimens collected in western Montana. Traver (1934) named and redescribed the species from these specimens.

Mayo (1951) named *Ephemerella spinosa* from specimens collected in California. Day (1954), who examined the holotypes of both *E. hystrix* and *E.*

FIG. 2.—*Ephemerella hystrix*, male genitalia, dorsal view. FIG. 3.—*E. heterocaudata*, male genitalia, dorsal view. FIG. 4.—*E. jacobi*, male genitalia, dorsal view (after McDunnough, 1939). FIGS. 5-7.—*E. heterocaudata*. fig. 5, forewing of male imago; fig. 6, hindwing of male imago; fig. 7, abdominal sterna 3-5. FIG. 8.—*E. hystrix*, abdominal sterna 3-5. FIG. 9.—*E. orestes*, abdominal sterna 3-5. FIG. 10.—*E. edmundsi*, abdominal sterna 3-5. FIGS. 11-14.—*E. heterocaudata*, nymphal mouthparts. fig. 11, left mandible; fig. 12, maxilla; fig. 13, labrum; fig. 14, labium.



spinosa, concluded that these names applied to the same species, and placed the name *E. spinosa* as a synonym.

Among *Ephemerella* specimens borrowed from the Canadian National Collection were reared adults of *E. hystrix*, which are described here for the first time.

Male Imago (dry).—Length: body 7.5-8.5; forewing 11-12 mm. Eyes reddish brown. Thorax dark reddish brown, lateral sutures and base of forewings light yellowish brown with a black lateral line which runs from the base of the forewing to the coxae of the forelegs; prosternum dark brown, nearly black, light yellowish brown near bases of legs; mesosternum dark brown medially, becoming lighter laterally; anterior half of metasternum dark brown, nearly black, posterior half yellow-brown, tibiae and distal end of femora of prothoracic legs dark brown; wings hyaline, longitudinal veins brown, crossveins pale. Abdominal terga black; segments 1 and 2 uniformly black; segments 3-9 with light oblique yellowish streaks that originate near the anterolateral corner of the tergum and extend beyond the middle, streaks broader and more pronounced on posterior segments; terga 3-8 with yellow lateral border and yellow maculae at posterolateral corners; terga 8 and 9 yellow along posterior margins; tergum 10 with yellow lateral and posterior margins; sterna 1-9 each marked with a broad dark reddish brown chevron as in fig. 8; sternum 10 dark brown, the chevron partially or entirely obscured. Caudal filaments brown, lateral cerci 65%-75% as long as terminal filament. Penes with two submedian apical lobes forming a deep median depression as in fig. 2.

Female Imago (dry).—Length: 7.5-8.5; forewing 11-12 mm. Thorax olive-brown, lighter than in male but with same yellowish lateral sutures and dark lateral line. Abdominal segments darker than in male with color pattern less distinct. Other characters as in male except for usual sexual differences.

Mature Nymph.—Length: body 9-11; cerci 6-8; terminal filament 9-11 mm. Head brown with pale markings; without occipital tubercles (fig. 17); antennae brown; maxillary palpi three-segmented. Pronotum and mesonotum brown with pale markings; legs brown, with scattered spines and hairs only, as in fig. 16; tarsal claws with 6-10 denticles. Abdominal terga brown with darker brown markings; terga 1-9 with median dark brown triangles; terga 2, 3, and 8 with dark lateral oblique dashes; tergum 9 dark brown, partially obscuring median and lateral markings; tergum 10 entirely dark brown; paired dorsal submedian tubercles on segments 2-9; tuber-

cles short with bases close together on tergum 2, tubercles longer and bases more widely separated to tergum 7; tubercles on terga 2-7 uniformly divergent; tubercles on terga 8 and 9 are less divergent, shorter and more narrowly separated than those on tergum 7 (fig. 26); sterna light brown, each with a dark brown chevron (fig. 8); sternum 9 may be dark brown, partially obscuring chevron. Caudal filaments brown, darker at joinings, lateral cerci 65% to 75% as long as terminal filament.

Type Locality.—Big Blackfoot River, Potomac, Montana.

Type.—Cornell University, Ithaca, New York.

DISTRIBUTION

Ephemerella hystrix is a boreal species known to occur in six western states and Canada. It is found in British Columbia and Montana austrad to northwestern Wyoming and central California (fig. 28a). Specimens of this species have been examined from the following localities:

BRITISH COLUMBIA.—Shingle Creek Road, Keremeos, 31-VII-35, A. N. Gartrell (CNC). California.—Shasta Co., Burney Creek, VII-53, W. C. Day; Hat Creek at Sandy Public Camp, 2 mi. N. Old Station, 3-VII-59, RKA; Inyo Co., Big Pine Creek, 25-VI-34, V. K. Mayo (VKM); Big Pine Creek (8100'), 2-VII-39, V. K. Mayo (VKM); Nevada Co., Eure Valley, 5-VII-48, W. C. Day; Eldorado Co., West Fork Carson River, 2 mi. N.E. Woodfords, 21-IX-57, GFE and RKA; Mono Co., Cottonwood Creek near Oasis Ranch, 11-VI-33, V. K. Mayo (VKM). NEVADA.—Washoe Co., Incline Creek, 2 mi. W. Mt. Rose Summit, 21-IX-57, GFE and RKA. OREGON.—Benton Co., Woods Creek near Corvallis, 24-IV-48, E. P. Hughes; Woods Creek, 24-IV-36, R. E. Reider (OSC); North Fork Alsea River, 13-V-35, "Jacobsen" (OSC); Wallowa Co., French Camp, Lostine River, 18-VIII-52, GFE. WASHINGTON.—Mason Co., Hamma Hama River, Olympic National Park, 4-IX-58, GFE and RKA. WYOMING.—Yellowstone National Park, Iron Creek, 21-VI-49, GFE; Antelope Creek, 17-VI-49, GFE; Firehole River, Old Faithful, 6-VI-42, GFE.

Ephemerella jacobi McDunnough

Ephemerella jacobi McDunnough 1939: 49, 1 fig.

This species is known only from the adult stages.

Male.—Head deep brown; eyes (dried) blackish with slight reddish tinge. Pronotum deep brown, the lateral edges pale yellowish; mesonotum deep brown, shaded with paler laterally and posteriorly, latero-

FIG. 15.—*Ephemerella heterocaudata*, right nymphal foreleg. FIGS. 16-17. *E. hystrix*. fig. 16, right nymphal foreleg; fig. 17, vertex of nymphal head, front view. FIG. 18.—*E. cascadia*, vertex of nymphal head, front view. FIG. 19. *E. h. circia*, prothorax, lateral view (anterior margin to the right). FIGS. 20-22. *E. edmundsi*. fig. 20, maxilla; fig. 21, tarsal claw of right foreleg; fig. 22, labrum. FIGS. 23-27. Subgenus *Caudatella*, half of abdominal terga of mature nymph. fig. 23, *E. h. californica*; fig. 24, *E. orestes*; fig. 25, *E. cascadia*; fig. 26, *E. hystrix*; fig. 27, *E. edmundsi*.

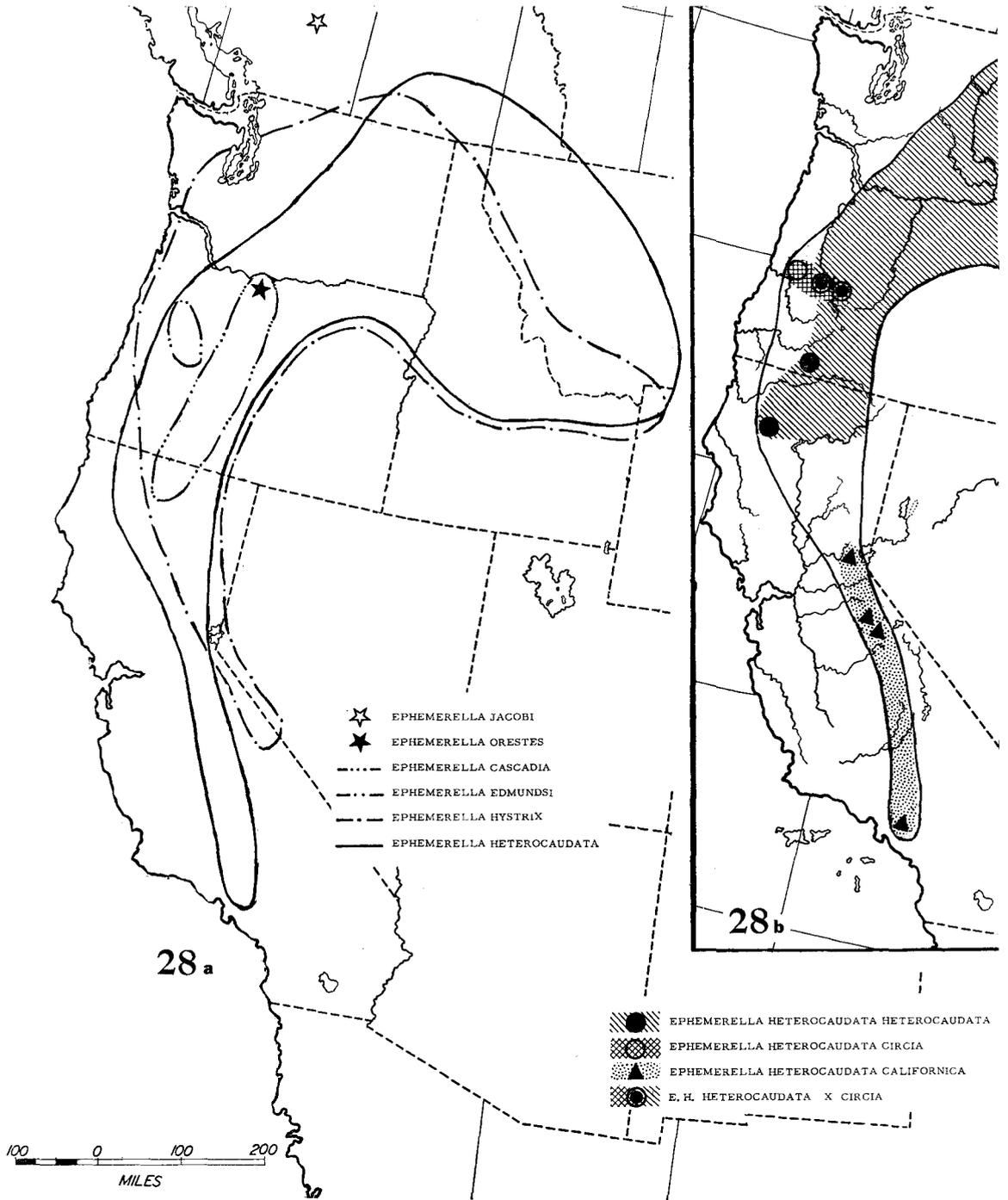


PLATE IV

FIG. 28a.—Distribution map of the species of the subgenus *Caudatella*. FIG. 28b. Distribution map of the subspecies of *Ephemera heterocaudata*.

anterior edge deep blackish; scutellum long, narrow, with palish area at base and the thin ends of the axillary cords projecting caudad beyond its apex for a considerable length (as in *tibialis* and *hystrix*). Pleura and sternum blackish, shaded with paler around bases of legs and with a large pale yellowish

area cephalad of wing-base, crossed by a black line. Metathorax and abdomen blackish, the posterior edges of abdomen paler brown, giving a slight ringed appearance. Forelegs with femora and tibiae pale smoky, the tibia long and almost twice the length of femur; tarsi dull ochreous, paler than the preceding

joints. Mid- and hindlegs dull ochreous, the femora considerably shaded with smoky. Wings narrow, hyaline, with entirely pale and inconspicuous cross-veins; longitudinal veins fine and pale brownish in costal half of wing. Tails broken. Length of forewing 10 mm. (After McDunnough 1939.)

Female Imago (dry).—Length: body 6; forewing 10 mm. Head light brown, eyes blackish. Thorax clay brown, yellowish patch anterior to base of forewing, containing a black line that descends to the coxa of the foreleg; lateral sutures marked with black; wings hyaline, veins light brown; legs dull ochreous. Abdominal terga black with posterior light margins, posterior two segments pale with lateral dark areas; sterna black, posterior two segments with pale lateral margins (caudal filaments missing).

Type Locality.—Kwieek Creek near Lytton (2500'), British Columbia.

Type.—No. 4442, Canadian National Collection, Ottawa, Canada.

DISTRIBUTION

This species is known only from the type locality in British Columbia (fig. 28a). The authors were able to examine a single paratype female imago from the Canadian National Collection.

TAXONOMY

The nymphs of both *E. cascadia* and *E. orestes* exhibit a ventral abdominal color pattern similar to *E. jacobii* imagoes and either of these nymphs may eventually prove to be the immature stage of this species.

Ephemerella cascadia, new species

Ephemerella jacobii? (in part), Allen and Edmunds 1956: 87.

Mature Nymph.—Length: body 5-7; cerci 4-5; terminal filament 6-7 mm. Head brown with pale markings; moderately developed paired submedian occipital tubercles (fig. 18); antennae light brown; maxillary palpi three-segmented. Pronotum brown, with low, rounded, paired submedian thoracic tubercles and paired, sublateral smaller tubercles near the hind margin; mesonotum brown, roughened, but without tubercles. Legs brown with scattered spines and hairs only, similar to those in fig. 16; tarsal claws with 7-10 denticles. Abdominal terga light brown with variable lateral darker markings; tergum 10 light brown; long, thin, paired dorsal submedian tubercles on segments 2-9 (fig. 25); base of tubercles on segment 2 close together, becoming more widely separated to segments 6 to 8, and closer together on segment 9; all tubercles divergent apically; tubercles on terga 2 to 4 arise at a nearly perpendicular angle with their tips directed posterolaterally; tubercles on terga 5-8 directed more laterally and less perpendicularly than any of the preceding tubercles; tubercles on tergum 9 nearly straight and directed posterolaterally; sterna dark brown with light brown lateral margins similar to those in fig. 9. Caudal

filaments brown, lateral cerci 65% to 75% as long as terminal filament.

Holotype.—Branch of Still Creek, Timberline Lodge Road, Mt. Hood, Clackamas Co., Oregon, 30-VIII-58, Richard K. Allen and George F. Edmunds, Jr., in collection of University of Utah, Salt Lake City. Paratopotypes.—3 nymphs, 27-VII-54; 31 nymphs, 30-VIII-58 (UU). Paratypes.—CALIFORNIA.—Shasta Co., 1 nymph, Kings Creek, Lassen Volcanic National Park, 3-VII-59, RKA. OREGON.—Clackamas Co., 1 nymph, Still Creek, Still Creek Forest Camp, Mt. Hood, 30-VII-58, GFE and RKA; 3 nymphs, Government Camp, Mt. Hood National Forest, 23-VII-46, H. H. Ross (INHS); Hood River Co., 6 nymphs, South Fork Iron Creek, U. S. Highway 38, Mt. Hood, 31-VIII-58, GFE and RKA; Wasco Co., 1 nymph, Clear Creek, U. S. Highway 26 near Mt. Hood, 30-VIII-58, GFE and RKA. Some paratypes are deposited in the collections of California Academy of Sciences, personal collections of J. R. Traver and W. C. Day, Canadian National Collection, Illinois Natural History Survey and the University of Florida.

Ephemerella orestes, new species

Mature Nymph.—Length: body 6-7; cerci 8-9; terminal filament 10-11 mm. Head brown without occipital tubercles; antennae brown; maxillary palpi three-segmented. Pronotum and mesonotum brown without tubercles and with irregular light brown markings. Legs brown with rows of long hairs and a few short spines similar to those in fig. 15; tarsal claws with 6-8 denticles. Abdominal terga brown, terga 1-7 dark brown laterally, lighter medially, light areas increase in width posteriorly so that terga 8-10 are nearly light brown as in fig. 24; conspicuous, paired dorsal submedian tubercles on segments 2-9, as in fig. 24, tubercles are narrowly separated on tergum 2 and become more widely separated to tergum 7; tubercles are slightly closer together on terga 8 and 9; sterna dark brown with light brown lateral margins as in fig. 9, anterolateral corners may be darkened. Caudal filaments brown, lateral cerci are 75%-85% as long as terminal filament.

Holotype.—East Fork Hood River, Mt. Hood, Clackamas Co., Oregon, 27-VIII-54, Richard K. Allen and George F. Edmunds, Jr., in collection of University of Utah, Salt Lake City. Paratype.—1 nymph, Little Zig Zag River, 3 mi. below Government Camp, Mt. Hood, Clackamas Co., Oregon, 27-VIII-54, GFE and RKA (UU).

TAXONOMY

Ephemerella orestes appears most closely related to *E. heterocaudata* McDunnough as their legs and dorsal abdominal tubercles are very similar. This new species may be readily distinguished from *E. heterocaudata* and all other known nymphs of this subgenus by the combination of its dark brown ventral abdominal color pattern and its extremely long lateral cerci. The dark brown ventral color pattern of this

species is similar to that of *E. cascadia*, but the paired occipital tubercles and the much longer abdominal spines of *E. cascadia* readily distinguish it from *E. orestes*.

Ephemerella edmundsi Allen

Ephemerella jacobii? (in part), Allen and Edmunds 1956: 87.

Ephemerella edmundsi Allen 1959: 59, 7 figs.

This species is known only from the nymphal stage.

Mature Nymph.—Length: body 7-7.5; cerci 5-6; terminal filament 8-9 mm. General color uniformly light brown. Head without occipital tubercles; labrum hairy and deeply emarginate (fig. 22); maxillae with very small palpi or palpifer (fig. 20). Legs short and thick, all segments with short heavy spines and only scattered hairs; tarsal claws with double row of denticles, anterior row with 10-14 small denticles and posterior row with 9-12 larger denticles (fig. 21). Abdomen with conspicuous, paired dorsal submedian tubercles on segments 1-10 as in fig. 27; width between bases of tubercles narrow on segment 1, gradually increasing in width to segment 5, narrowing again to segment 10, tubercles barely discernible on segment 10; sterna 4-8 with pale, sometimes obscure, brown dashes on lateral margins (fig. 10). Caudal filaments light brown, lateral cerci 55% to 65% as long as terminal filament.

Type Locality.—Woods Creek, Benton Co., Oregon.

Type.—California Academy of Sciences, San Francisco, California.

DISTRIBUTION

Ephemerella edmundsi is presumably a boreal species and is known only from a few localities in the Coast Ranges of western Oregon. The authors have examined specimens of this species from the following localities:

OREGON.—Benton Co., Woods Creek, 13-V-37, "Niot" (Holotype, CAS); Lane Co., McKenzie River, 9-III-39, "J.E.D." (UU,OSC); Fall Creek, 4-V-40, N. L. Sieg (OSC); McKenzie River, B. and K. Doris State Park, 15-VI-58, M. L. Johnson; McKenzie River, H. J. Morton State Park, 15-VII-58, M. L. Johnson.

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