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NOTES ON WESTERN SPECIES OF EPHEMEROPTERA*

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As our knowledge of the western Ephemerid fauna, particularly in its nymphal stages, increases, our conception of the individual species becomes more accurate, necessitating in some instances corrections of previous statements, and enabling us to differentiate closely allied species in various groups which heretofore had been lumped under one name. The basis for the following notes has been the rearings carried on by my assistant, Mr. A. N. Gartrell, in the Okanagan region of British Columbia in 1934.

Ephemerella flavilinea McD.

This species was originally described from a single male from Waterton Park, Alta. (1926, Can. Ent. LVIII, 188). Later, (1929, Can. Ent. LXI, 169, Pl. III, fig. 3) I gave a figure of the genitalia of the type as contrasted with those of *coloradensis* Dodds and was inclined to associate under the name a series of nymphs and adults taken at the Firehole River, Yellowstone National Park, Wyo., in late July. Following this determination Walley (1930, Can. Ent. LXII, 18, Pl. I, figs. 1a, 1b, 1c; Pl. II, figs. 3, 3a) described the Yellow-

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stone nymphs as those of *flavilinea*, figuring a full-grown one and giving certain details of structure.

Since the above notes were published we have received additional material in the shape of another male from Waterton and a small series of both sexes from the Crow's Nest Pass region, (Blairmore, Lundbreck) about 40 miles from the type locality. The Waterton specimen, evidently quite fully mature, is even ruddier in its abdominal coloration than the type and shows very clearly the ruddy spots on the coxae (mentioned in my second paper) which are only very faintly visible in the original specimen. The Crow's Nest males agree closely in all respects with the type; they appear to have been reared from subimagos and are slightly teneral, showing, therefore, less development of the ruddy shades; the females (also somewhat teneral) match up quite well with the captured females from Bozeman, Mont., from which I drew up a description of this sex (1929, *op. cit.* 169).

In 1933 I took a series of 5 males and 17 females at Seton Lake, B. C. (mostly at light) which, while considerably larger, especially in the female sex, and deeper in coloration, appeared referable to *flavilinea* on the strength of similar genitalia and pale wing-venation. Finally in 1934 Mr. Gartrell was successful in breeding a series of 1 male, 4 females, very similar to my Seton Lake series. These specimens with their nymphal skins, as well as a small series of mature nymphs from the same locality (Shingle Creek, near Penticton, B. C.) have been studied. The larger size of the British Columbia specimens is, to my mind, of no specific value, and probably due to lower altitudes and temperature conditions of the water. Further, the Penticton nymphs agree (apart from size) with two nymphs in our collection taken from small streams in the Crow's Nest Pass, an additional proof possibly that the two forms belong to the same species. On the other hand the Yellowstone Park nymphs show structural distinctions which while small are seemingly constant and make a separation from *flavilinea* apparently necessary.

The true *flavilinea* nymph is of the *coloradensis* type and very similar to Walley's figure (*op. cit.* Pl. II, fig. 3). The characteristic feature is found in the so-called "dorsal abdominal tubercles," or dorsal projections from the posterior margin of each segment; these are *much flattened* and scarcely elevated at all from the segmental plane; they are quite broad at the base, tapering sharply to a blunt, rounded apex, and are feebly granulate.

***Ephemerella lapidula* n. sp.**

Ephemerella flavilinea Walley (nec McD.) 1930, Can. Ent. LXII, 18.

Nymph.—Very close to that of *flavilinea*, differing principally in the shape of the dorsal abdominal tubercles; these are slightly longer, especially on the eighth segment, distinctly more pointed apically and *noticeably projecting upward* above the plane of the segment. In a long series of mature nymphs taken in the Firehole River, Yellowstone Park, Wyo. (July 22, 27, 28) this feature is quite constant and I therefore accord it specific value for the present. No actual breedings took place at the time but subimagos were captured as they emerged from the same spot and from these a small series of adults was secured, so that the association is fairly certain.

Male.—Scarcely separable from *flavilinea*; somewhat larger than typical Alberta specimens but smaller than British Columbia ones. The ruddy suffusion of *flavilinea* is replaced by blacker shades, especially on femora and ventral surface of abdomen. In the genitalia the terminal joint of the forceps (based on a single slide) is distinctly longer than in *flavilinea*.

Female.—Variable in the amount of ruddy suffusion on both head and abdomen; generally speaking, however, the coloration is (as in the male) somewhat deeper than found in typical *flavilinea*.

Holotype—♂, Firehole Riv., Upper Geyer Basin, Yellowstone Park, Wyo., July 29, (J. McDunnough); No. 3856 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, July 22.

Paratypes—5 ♀, same locality, July 21, 22.

Eventually this may prove to be merely a subspecies of *flavilinea*.

In the *heterocaudata* group two species have appeared in British Columbia according to our nymphal material; one is very close to *heterocaudata* and of this associations have been secured between nymph and adult; of the other only a single very striking nymph was collected.

The nymph of typical *heterocaudata* was described and figured by Walley (1930, *op. cit.* 15, Pl. I, figs. 3a-d; Pl. II, figs. 4, 4a).

***Ephemorella columbiella* n. sp.**

Nymph.—Very similar to that of *heterocaudata* in general form and maculation. Size slightly smaller; the dorsal tubercles, while of the same general blunt finger-like character, are much reduced in size, those of the gill-bearing segments being scarcely more than half the length of those in *heterocaudata* and those on segments 8-9 much reduced as compared with this latter species; the lateral setae, while showing considerable variation in length, are on the whole shorter than the normal length found in *heterocaudata*, and in consequence the middle seta is well over three times their length. The subcutaneous dark dorsal abdominal patches tend to spread out laterally along the anterior margins of the segments more so than in *heterocaudata*, and on the ventral surface the median dark band is broader and inclined to form diamond-shaped enlargements on each segment; the lateral dark stripes are also heavier.

Male.—Smaller than *heterocaudata* but with essentially the same type of abdominal maculation, this agreeing with that found in the nymph and consisting of hemispherical dark patches on anterior portion of each segment, gradually becoming reduced in size toward the caudal extremity and lacking on the last two segments; a series of dark lateral patches, tending to coalesce with the dorsal patches on anterior segments; the ground color is a light yellow brown, somewhat suffused with smoky on anterior half of abdomen; lateral edge light yellow, broadening posteriorly and tending to extend upward along the posterior edges of segments. Beneath pale yellowish with the dark median and lateral stripes reproduced from the nymphal stage. Tails smoky at base, the outer ones about two-thirds the length of the median one. Forelegs dull smoky with an amber tinge; mid and hind legs pale yellowish, the femora (especially of the mid-legs) tinged with smoky. Wings hyaline with pale venation. Length of fore wing 6 mm.

Female.—Maculation much as in male. Head pale yellowish tinged with brown and with blackish shading in central area. Outer tails shorter than in male, being less than one-half the length of the median one. Venation of forewing slightly more marked than in male.

Holotype.—♂, Trepanier Cr. Peachland, B. C., July 4, (A. N. Gartrell) (bred from nymph); No. 3857 in the Canadian National Collection, Ottawa.

Allotype.—♀, same data, July 10.

Paratypes.—5 ♂, 3 ♀, same data, July 4, 5, 7, 10, 22.

A detailed comparison of the adults with those of *heterocaudata* is difficult as we only possess one pair of this latter species (the types). Besides the somewhat larger size the male of *heterocaudata* seems to show in general more intense black coloration of the dark areas, especially on the sides of the posterior segments and on the pleura. There are, however, no very tangible differences and it is quite possible that *columbiella* will eventually prove to be merely a subspecies of *heterocaudata*, the differences being better defined in the nymph than in the adults.

I figure the male genitalia of the present species. Nymphs of this species were also taken in 1933 at Shuswap Falls, B. C., on Aug. 17; this locality is north-east of Vernon, and the later date is probably accounted for by the fact that the whole season of 1933 was a very late one in British Columbia.

***Ephemerella hystrix* Trav.**

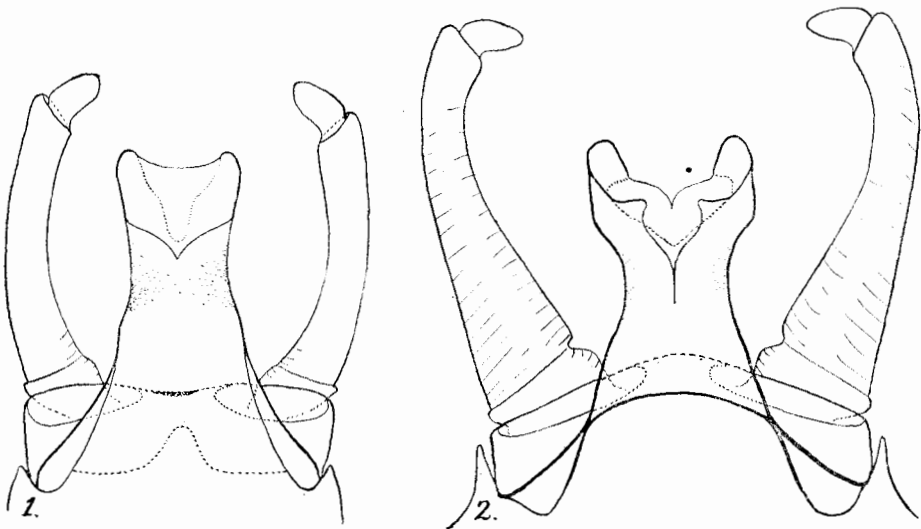
Before the appearance of Dr. Traver's paper (1934, Jour. Elisha Mitch. Sci. Soc. L, 212) I had drawn up a description of the nymph from a specimen secured on July 10 in Shingle Creek, near Keremeos, B. C., by Mr. Gartrell, with the intention of describing it as a new species. As my description supplements that of Traver's in certain respects I let it stand; I hardly think, however, when the adult is known, that it will fall in what Traver designates as the "*needhami* group"; judging by the difference in length of the tails it will probably show relationship to *heterocaudata* McD.

Nymph. Female.—Light ochre-brown. Head smooth, slightly marbled with paler on vertex; antennae pale yellowish. Prothorax considerably broader than head, roughly rectangular, outer edges gently convex; some darker lateral markings. Mesothorax broadening considerably to base of wing-pads, then gently narrowing; with slight dark median and submedian streaking. Abdomen slender; lateral posterior edges of segments drawn out to short blunt points; a double dorsal row of *long, slender, pointed* spines, bent slightly outwards and backwards situated on posterior margins of segments II-IX; those on II and III shorter and closer together; on IV-VII subequal and quite erect; on VIII and IX somewhat shorter and more flattened, all faintly spiculate apically. Gills on segments III-VII with oval, pale smoky opercula, that of VII much reduced in size. Black triangular dorsal patches based on anterior margin of each of segments I-VIII; segment IX largely black, except for a paler area around bases of spines; segment X with basal half blackish; lateral black patches on each of segments I-VIII. Ventrally light yellow-brown, crossed on segments II-VIII by broad lunate bands of black; segment IX largely blackish. Tails brown with a few short spines situated on each intersegmental area; the two outer tails are

slightly shorter than the median one, being about four-fifths its length. Legs light yellow-brown; all femora rather broad, subequal in length to tibiae, slightly marked with deeper brown on anterior surfaces and with small scattered spines on dorsal edges; tarsi tinged with blackish at distal extremities. Length of body ♂ mm.; of median tail 8 mm.

***Ephemerella hecuba* Eat.**

Mr. Gartrell was successful in rearing a small series of adults of this interesting species from nymphs taken at Faulder, near Summerland, B. C., emergence taking place October 16-18. The nymph has already been recorded from Utah by Needham (1927, Ann. Ent. Soc. Am. XX, 115) and I found it quite plentiful near Bozeman, Mont., in August, 1928. More recently a single specimen was taken in the Waterton River, Alta., and we can now record its occurrence in southern British Columbia.



Male genitalia of (1) *Ephemerella columbiella* n. sp.; (2) *Ephemerella hecuba* Eaton.

Shepherd, (1929, Can. Ent. LXI, 260) under this name gave detailed descriptions and figures of nymph and adults from Waddell Cr., Rancho del Oso, California. I doubt very much, however, whether he had the true *hecuba* before him as his nymph is stated to possess double dorsal rows of short tubercles on segments II-VII, the true *hecuba* being entirely without such; there is also considerable difference between his figure and Eaton's with respect to the lateral prolongations on the posterior segments. It might further be noted that his so-called adult male, judging particularly by the figures of fore-leg and genitalia, was probably a subimago; I know of no instance where the male fore-leg is of the same length as the other legs; in the true *hecuba* males before me the fore-leg is quite normal in character.

It seems advisable under these circumstances to present the following description of the male adult, drawn up largely from a specimen in alcohol; the nymph has already been adequately treated by both Eaton and Needham.

Male.—Head and thorax deep black-brown, the lateral edges of mesothorax tinged slightly with pale yellowish; pleura and sternum similarly black-brown

with a broad pale whitish-yellow area extending obliquely from base of forewing to base of fore-leg containing a small orange spot; similar pale areas at bases of mid and hind-legs. Abdomen dorsally smoky olive-brown with traces of a slightly ruddy median line and a series of large semi-oval ruddy brown lateral patches, which show faint shadings of pale yellowish above their dorsal edges; lateral and anterior edges of segments pale whitish-yellow. The latero-posterior angles of all segments but VIII and IX are not produced but segments V-VII show fine finger-like projections which are evidently the remains of nymphal gills; segment VII with a weak postero-lateral spine and segment IX with a much stronger one. Ventrally pale whitish-yellow, the anterior half of each segment crossed by a broad, curved band of ruddy brown. Forceps, basal plate and setae deep smoky. Forelegs long, deep smoky; tibia and combined tarsal joints sub-equal and each longer than femur. Mid and hind legs with femora largely smoky brown with a ruddy tinge and some pale yellowish shading basally; tibia dull amber; tarsi light smoky. Wings hyaline with light smoky tinge along costa; veins and crossveins moderately fine, dark smoky-brown. According to genitalia (fig. 2) the species would fall close to the typical section of *Ephemerella*, in spite of the great nymphal distinction. The shape of the penes is distinctly that of the *excrucians-invaria* group and the short terminal joint of the forceps points in the same direction. Length of body 12 mm.; of forewing 12 mm.

Genus *Ameletus*

In this genus a number of our western species are now definitely associated with their nymphs. Notes are herewith given on the early stages of certain species not yet recorded.

With the exception of *similior* McD. all the nymphs discussed belong in what might be termed the *validus* group, in which the femora are pale and show a distinct broken quadrate or oval patch centrally on the outer side. In contradistinction to these we find in the *velox* group that the femora are pale brown without any dark central patch but usually a slightly paler tinge apically; this group, to which *celer* McD., *celeroides* McD., *alticolus* McD., and *similior* McD. belong, is further distinguished by the lack of any definite dorsal patterns on the abdominal segments, the color being predominantly pale to dark brown. In the *validus* group the pattern on the dark segments consists of distinct pale oval spots and there is also a varying number of pale segments with only slight brown maculation.

Ameletus sparsatus McD.

Nymph. Male. Head sepia brown. Thorax similar in color with numerous dashes and spots of pale whitish color on both pro- and mesonotum. Abdomen dorsally with segment I brown. Segment II largely whitish with anterior margin brown, this color broadest in median section and showing two darker oblique streaks. The three segments III-V brown, with faint darker pair of submedian streaks and with distinct white markings as follows:—A pair of submedian spots above posterior margin, these spots fainter on segment V than on others, a spot in the antero-lateral corner, and the anterior half of the lateral edge. Segment VI brown, with the lateral portions broadly and triangularly white with a dark spot about middle of lateral edge. Segment VII with the anterior one-third brown from which two short submedian dashes project into

the whitish posterior two-thirds which is really a fusion medially of the white triangles of previous segment; dark lateral spot as on segment VI. *Segment VIII much as III but with pale maculation frequently reduced.* Segment IX unicolorous brown. Segment X whitish with brown streaks medially on both anterior and posterior margins. In some cases a pale median line can be traced on all segments. Ventrally segments III-VII brown with lateral edges largely whitish; a small white dot near antero-lateral corner, a white submedian patch or dash (rather variable in size) jutting from posterior margin into the dark area, becoming stronger on posterior segments and on VII extending across entire segment, separating a narrow lateral band of brown from the larger median patch. Segments VIII and IX brown with the small anterior pale dot of preceding segments. Forceps pale. Setae pale at base and apex, the entire median section black-brown. Legs pale with brown area at base of coxa, a brown central patch on outer side of femur, tibia faintly brown at base and tarsus deep brown at both base and apex; claw pale. Gills whitish with a thin blackish chitinous band *well within the dorsal margin* of gill, somewhat as in *alticolus* (1934, Can. Ent. 163, fig. d), but rather more so.

Female.—Much as in male but with tendency, especially in quite mature specimens, for the pale areas to become slightly suffused with brownish. In less mature nymphs the white spots are frequently larger than in the male.

Adults were reared from material taken at Oliver, B. C., in late May. The male genitalia are very similar to those of *acquivocus* (1934, Can. Ent. 160) but the lightly spotted forewings distinguish the species.

***Ameletus cooki* McD.**

Nymph.—Head and thorax light brown, the latter streaked and spotted, much as usual, with pale whitish, these pale areas tending to fuse laterally on pronotum and posteriorly on mesonotum and consequently considerably more extended than in *sparsatus*. Abdomen dorsally with *segments II, III and IV-VIII largely whitish*, with small brown triangular patches or dashes situated subdorsally on anterior margin, these mostly connected at their bases by a brown band of varying width, not attaining lateral edges of segments; a faint brown triangular lateral patch on III and on VIII, a narrow brown band along posterior margin extending more broadly cephalad along lateral edge and sending out small subdorsal projections which frequently join with those from the anterior margin, thus forming streaks across entire segment. *Segments IV and V only* largely brown with pale maculation much as in *sparsatus*, i. e. faint median streak, a strong oval pair of subdorsal spots and a spot in antero-lateral corner. Segment IX deep brown with faint trace of median pale line and a small pale spot in antero-lateral corner. Segment X pale, broadly suffused with pale brown in median area. Ventrally largely pale, except segments VIII and IX which are crossed by broad curved bands of brown, leaving only small pale areas antero-laterally and postero-medially. Segments III-VII with pair of small brown submedian spots near anterior margin and a lateral brown streak, faint on VI and VII; at times small faint median brown patches on posterior margins which occasionally tend to join with the pair of spots to form horseshoe-like marks. Forceps and anal plate pale. Setae pale at base and apex with a broad deep brown median area, less broad, however, than in *sparsatus*. Legs marked much as in

sparsatus with the dark patch on femur somewhat reduced at times and the dark areas on tarsus extended. Gills much as in *sparsatus* but with the dark chitinous band slightly nearer dorsal margin.

Easily distinguished from *sparsatus* by the larger number of pale segments. Adults were bred from material collected in Shingle Creek, along the Keremeos road, early in August.

Ameletus validus McD.

Nymph.—Head black-brown. Thorax rather dull clay-brown with obscure paler markings. Abdomen dorsally with segment II pale with slight brown oblique subdorsal streaks frequently joined with dark shading along anterior edge. *Segments III-VI brown with three large oval whitish patches*, one median near anterior margin and the other two lateral and posterad of the median spot; a white mark in antero-lateral corner and lateral edge marked with white; pale markings considerably reduced on segment VI. Segments VII and VIII pale with narrow brown anterior margin and a pair of fine subdorsal streaks, obsolescent at times on VIII; a small central dark lateral spot. Segment IX brown, narrowly and irregularly whitish along anterior margin. Segment X pale with faint dark median markings. Ventrally *almost entirely pale with faint brown streak* along lateral edge of segment IX. Setae with the median one paler than the outer ones, which are light brown; a faint narrow darker band across median seta near middle. Legs pale, anterior pair faintly brown-tinted; fine brown bands at bases of femora and tibiae and at apex of tarsus; two anterior femora with oval brown spot on outer side about middle. Gills large, oval, pale, faintly tra-cheated and with a thin dark chitinous band well within dorsal edge, more so than in preceding species.

The *four* dark median abdominal segments with their characteristic maculation serve to easily distinguish the species; the pale ventral abdominal surface seems also a good character. The adult is one of the latest to appear in the fall, specimens being bred in late September from nymphs secured in Shingle Cr. Penticton, B. C.

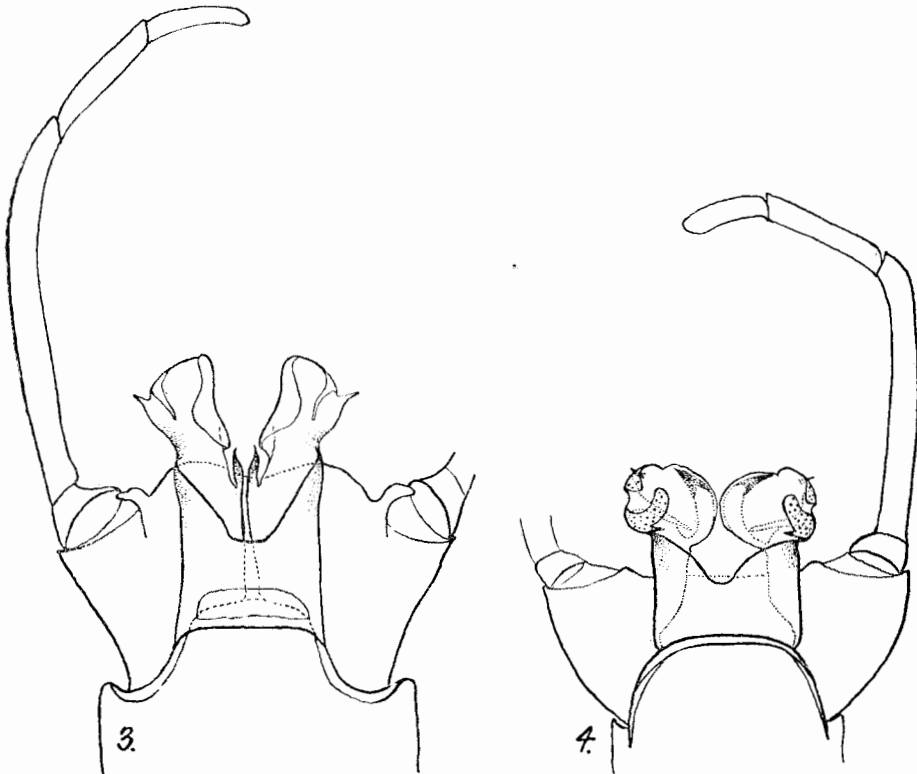
Ameletus similior McD.

Head deep brown. Thorax pale brown obscurely marked with light ochre-brown. Abdomen dorsally largely pale brown with obscure and rather variable maculation, segments IV, V and VIII considerably deeper brown, V at times with a small oval median pale spot. The maculation on the pale creamy-brown segments II, III and VI consists of the usual obscure darker subdorsal streaks which on VI may coalesce to form a median rectangular patch; on VII the posterior margin is brown sending lateral shoots upward to anterior margin, this forming dark lateral triangular patches, or at times the brown color extends over most of segments leaving only antero-lateral pale triangles; *segment VIII unicolorous deep brown with faint pale median line and small pale spot in antero-lateral corner*. *Segments IX and X pale*, the former with dark anterior margin extending downward in median line to form a small triangular patch, bisected by a faint pale line. Ventrally with segments III, IV, and VIII dark brown, others pale with faint dark lateral dashes and obscure submedian streaks uniting at times (especially on VIII) to form patches. A distinct row of median blackish ganglionic marks subcutaneously. Segment IX is practically entirely pale with

minute dark dot in antero-lateral corner. Setae pale at base, otherwise deep brown with somewhat paler apical section. Legs pale brown outwardly, paler on inner side; femora with pale streak extending backward from distal extremity; all tarsi with dark brown band apically. Gills narrowly oval, feebly tracheated, with chitinous thickening along both dorsal and ventral edges.

Apparently the most characteristic feature of the dorsal maculation is the dark eighth and the pale ninth and tenth segments. Considerable brown suffusion frequently exists which obscures the maculation as found in better-marked specimens.

Adults were bred in 1933 from nymphs collecting at 5000 ft. on Mt. Apex, near Hedley, B. C., and in 1934 from material found in Shingle Creek near Keremeos at lower altitudes.



Male genitalia of (3) *Iron dulciana* n. sp.; (4) *Heptagenia otiosa* n. sp.

***Iron dulciana* n. sp.**

Male.—Light ochreous, the thoracic tergites shaded with pale brown; pronotum edged finely with black laterally and posteriorly, mesonotum with a faint orange-brown streak at lateral edge of anterior portion; pleura pale with two small black dashes at base of forewing; there are also two similar dashes at bases of each of the two hinder pairs of legs and a brownish streak, edged posteriorly with black, ascending obliquely from coxa of foreleg to pronotum. Abdomen pale, the posterior dorsal margins bordered finely with blackish. Foreleg trochanter pale with dark apical spot, femur light amber with prominent round

black spot at middle and slight dark shading apically, tibia and tarsi pale amber, with slight black shading at apex of tibia. Mid and hindlegs somewhat paler than fore ones, both coxae with a fine black apical point on outer side, in addition to which the hind coxa shows a dark basal streak; slight black streaks on both coxae on inner upper surface; all femora with median black spot and apical black shading, tarsal claws tinged with smoky. Wings hyaline with fine, pale venation, the crossveins only distinct in apical half of wing; the basal costal crossvein tinged with black.

Female.—Similar to male in general maculation, especially the black spotting on legs and pleura; orange-brown shading at base of foreleg and at latero-anterior edge of mesonotum rather intensified. Fore femur deeper in color than in male. Head with orange-brown shading on vertex posterior to ocelli. Crossveins on wings much better defined and distinctly visible over entire area; a slight smoky shading apically in pterostigmatic area. Length of body 7 mm.; of forewing 9 mm.

Holotype—♂, Trepanier Cr., Peachland, B. C., July 3, (A. N. Gartrell); No. 3883 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, July 8.

The pale coloration together with the black spotting on pleura and base of legs should easily identify the species; the male genitalia are also quite characteristic with the latero-apical edges of the penes drawn out into sharp points.

Heptagenia otiosa n. sp.

Male.—Of a rather even dark brown coloration, very similar to that of *Rhithrogena jejuna* Eat. The anterior portion of the mesonotum is shaded with paler clay-brown and on the abdominal tergites the anterior and lateral areas are suffused with this same paler shade; there is a pale patch on pleura anterior to base of forewing. Forelegs with femora deep brown with a ruddy tinge; tibiae and tarsi slightly paler brown, the tarsi comparatively short and their entire length scarcely longer than that of the tibia. Mid and hind legs brown with a slightly darker shade at apex of each femur. Wings hyaline, the longitudinal veins fine, brown, the crossveins very fine and faint except in the outer half of wing; those of the pterostigmatic area most distinct; the costal veins beyond the bulla about 10 and not anastomosing. Length of body and forewing 7 mm.

Holotype—♂, Maupin, Ore., July 7, 1934; No. 3882 in the Canadian National Collection, Ottawa.

A small species evidently allied to *criddlei* McD. on genitalic characters. It is liable to be confused with *Rhithrogena* species but can be readily distinguished by the simple, non-anastomosing costal veins in the apical area of forewing.