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DESCRIPTION OF THE IMAGO OF THE MOUNTAIN MIDGE *DEUTEROPHLEBIA* *COLORADENSIS* PENNAK (DIPTERA, DEUTEROPHLEBIIDAE)¹

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While collecting aquatic insects along the North St. Vrain Creek near Lyons, Colorado, early in the morning of July 19, 1948, the writer found about 200 adult male and two adult female specimens of *Deuterophlebia coloradensis* Pennak (Diptera, Deuterophlebiidae). Although the peculiar aquatic larvae and pupae are well known (Pennak, 1945) and have been taken from many western mountain streams, these were the first emerged adults to be collected. A brief account of the circumstances associated with the finding of these specimens has already been published (Pennak, 1950), and it is the purpose of this paper to describe them fully.

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Deuterophlebia coloradensis Pennak

MALE: Small, midge-like insects; average body length, 1.96 mm. General coloration dark tan to dark brown. Wings enormous; antennae very long; thorax high and broad.

Head small, transverse, and entirely hidden in dorsal view by

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the projecting, hump-like mesonotum; dorsal surface slightly convex transversely. Eyes rather small, subspherical, and without pubescence; facets all the same size. Ocelli absent. Middle lobe of clypeus with about eight large marginal hairs and about 15 large hairs on the anterior surface. Margin of entire clypeus also set with finer hairs which are especially dense laterally. Mouth parts absent, but the oral opening is present on the under side of middle lobe of clypeus. Two small pores open on surface of clypeus. Except for the eyes, the entire head is pubescent.

Antennae six-segmented, slender, and very long, averaging 9.50 mm., but first five segments together only about one-quarter longer than maximum width of head across the eyes. Scape thick, covered with hairs dorsally and pubescence ventrally. Pedicel pubescent, cup-shaped, and less than one-half as long as scape. First flagellar segment cylindrical and slightly longer than the combined length of the pedicel and scape; distal inner margin near tip with two prominences bearing about 12 bristles. Second and third flagellar segments subequal in length and together slightly shorter than the first flagellar segment; each with a prominence bearing about six bristles. Terminal segment gradually tapering, its basal portion being about as thick as the preceding segment, but the distal portion only about one-quarter as thick as the basal portion; tip spatulate and bearing a few hairs; outer side of this segment heavily sclerotized, blackish, and glabrous, but inner side poorly sclerotized, slightly and irregularly scalloped, and set with slender hairs; these hairs are abundant on the basal third and progressively less abundant on the middle third; the distal third has only a very few scattered hairs. First flagellar segment coarsely pubescent; second and third flagellar segments with progressively finer pubescence; fourth flagellar segment with an extremely fine pubescence on a small basal area about as long as the third flagellar segment.

Thorax covered with dense, pile-like pubescence. Prothorax reduced to a chitinous band fringing the occipital foramen. Mesonotum very large. Prescutum broad and extending forward over head; with a median line which extends posteriorly through the scutum and becomes indistinct near the posterior margin of the scutum. Prescutum and scutum contiguous medially but separated laterally by a suture on each side. Scutellum transverse, narrow, roughly quadrangular, and with a small anterior

median projection. Postscutellum very large and wide. Metanotum small and mostly hidden under the tergite of the first abdominal segment. Prothoracic and mesothoracic spiracles large, broadly oval, and ringed with a chitinous band.

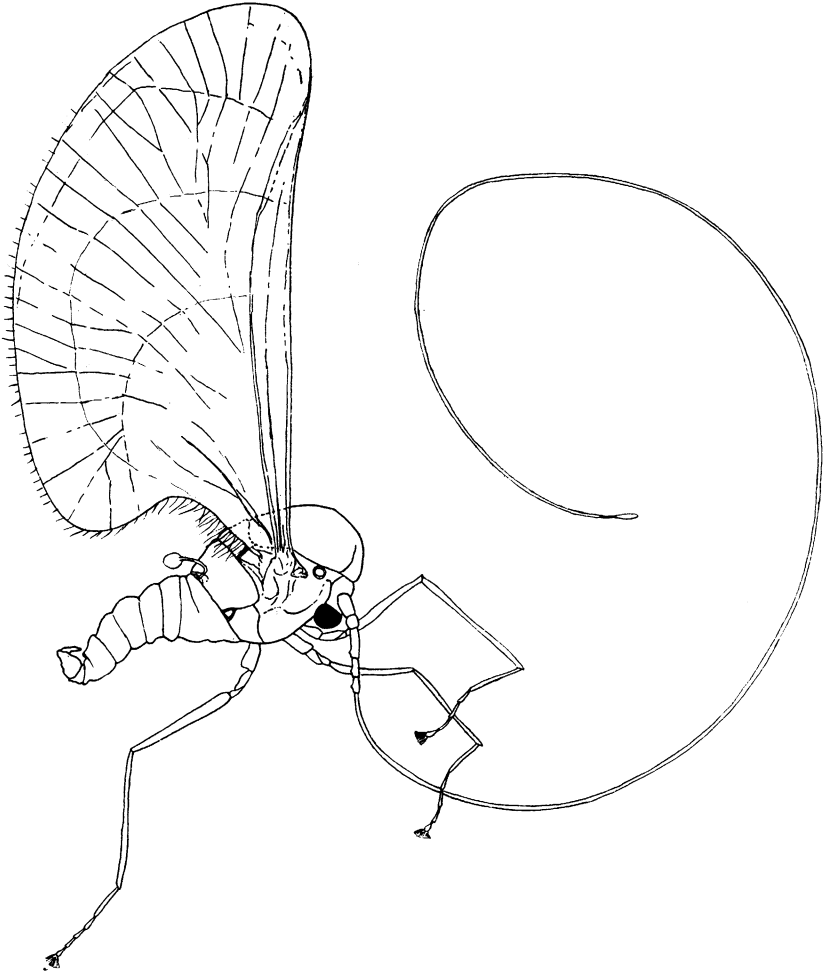


FIG. 1. Adult male *Deuterophlebia coloradensis*, $\times 22$.

Wings very large, averaging 3.77 mm. in length and 1.84 mm. in width. Anal lobe conspicuous. Veins represented by only a few vestiges. Costa almost attaining the wing apex. Subcosta terminating at about mid-length of wing. Radius obvious at

base, but R_1 and R_2 faint and terminating at costa. Media and cubitus indistinct. Base of anal pronounced. Secondary venation fan-like and highly variable, with three concentric lines indicating the manner of transverse wing folding in the pupal case. Posterior margin of wing with slender, delicate macrotrichiae which are long and dense at the base and wing angle but progressively shorter and more sparse towards the apex and absent from the distal third of the posterior margin. Wings covered with microtrichiae which are much more densely arranged on the anterior half of the wing than on the posterior half. Halteres pale, delicate, and finely pubescent; stem slender and curved dorsally.

Legs all similar. Coxa more than twice as long as wide, covered with long pubescence. Hind coxa the most robust; first coxa the slenderest. Trochanter about as long as coxa and obliquely two-segmented, the distal segment being much the smaller; pubescence of basal segment much longer than that of distal segment. Femur nearly cylindrical; entirely pubescent but the pubescence of the flexor surface and basal quarter of the segment longer than the pubescence of the rest of the segment. Tibia slender, longer than femur, and thickened distally. Basal portion of tibia covered with pubescence which grades into more sparsely arranged, long, knob-like hairs, the distal portion of the tibia being covered with the latter.

First four tarsal segments set with knobbed hairs along the flexor surface; these hairs are about as long as the width of their segments. Flexor surface of first four tarsal segments and entire fifth tarsal segment covered with very fine pubescence. Fifth tarsal segment with two bristles near the distal end. Empodium flat and irregularly subcircular, very densely set with long, yellowish, knobbed hairs and short plain hairs. Claw pubescent, slender, nearly straight, pointed, and about two-thirds of the diameter of the empodium.

Abdomen broad at base, tapering apically, and covered with pubescence. Third, fourth, and fifth segments more heavily sclerotized than the other abdominal segments. Sixth segment about half as long as fifth but slightly narrower. Seventh segment small, about half as long as sixth. Eighth segment much smaller than seventh, reduced to a mere ring. Fifth, sixth, and seventh segments each with several lateral bristles on low prominences. Abdomen without spiracles.

Ninth and tenth tergites fused into a single plate; posterior margin with two low lobes separated by a small median emargination; flattened posterior surface of each lobe pubescent and set with about eight short spines; dorsal and ventral surfaces of plate covered with less dense pubescence. Sternite and basistyles pubescent. Basistyles stout, less than twice as long as wide, slightly tapering, and concave; with about 10 short spines scattered near the dorsal margin of the concavity. Dististyles entirely pubescent, broad at the base, tapering, twisted and some-

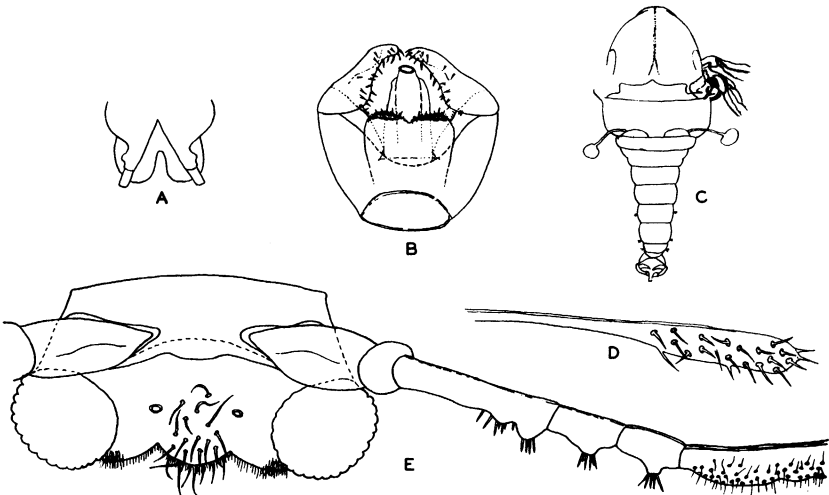


FIG. 2. Structure of *Deuterophlebia coloradensis*. A. Dorsal view of posterior end of female. B. Dorsal view of posterior end of male. C. Dorsal view of body of male, $\times 18$. D. Tip of antenna of male. E. Anterior view of head of male. (All pubescence omitted.)

what spatulate distally; outer margin sinuate; inner surface concave and supplied with numerous stout spines. Aedeagus about twice as long as wide and consisting of a tubular half cylinder fused to a long, flat plate; without pubescence.

FEMALE: Thorax lower and narrower than that of male. Abdomen wider than that of male. Coloration as in male. Body 1.60 mm. long. Head similar to that of male but smaller.

Antennae six-segmented and only .32 mm. long. Basal scape segment cylindrical and greatly narrowed at base. Distal scape segment wide and short, only one-third as long as basal scape

segment; with three bristles. First flagellar segment cylindrical and about as long as the next two segments together; with two bristles on the inner side near the tip. Last three flagellar segments all about the same length; width of each slightly more than half its length. Second and third flagellar segments each with two bristles. Distal segment with about five bristles. Scape segments and first flagellar segment very finely pubescent.

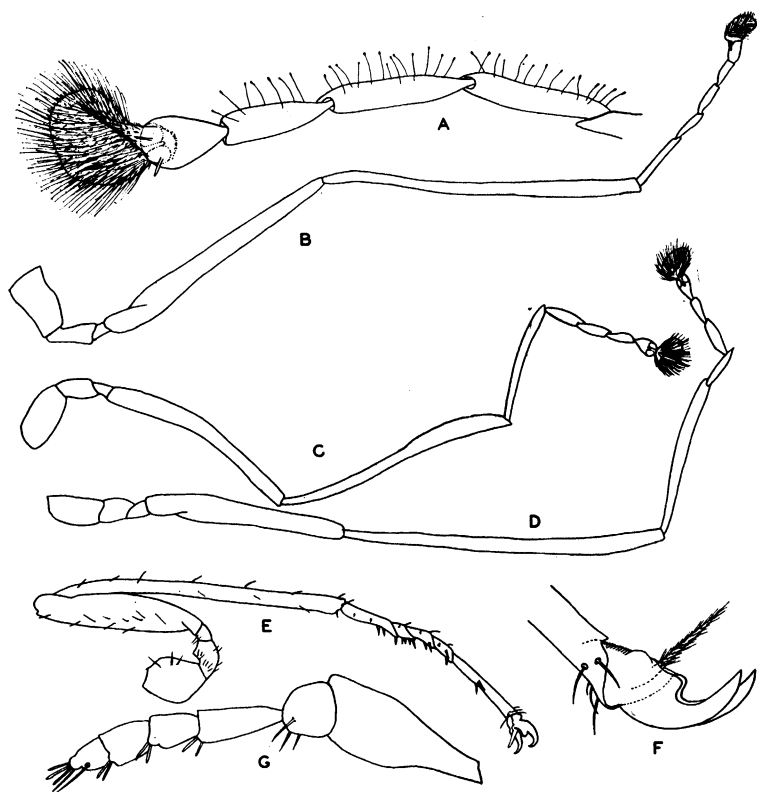


FIG. 3. Structure of appendages of *Deuterophlebia coloradensis*. A. Tip of leg of male. B. Male third leg. C. Male second leg. D. Male first leg. E. Female first leg. F. Tip of leg of female. G. Antenna of female. (All pubescence omitted.)

Thorax similar to that of male but smaller. Anal lobe of wing less pronounced than that of male. Wings much smaller than those of male; length, 2.40 mm.; width, 1.15 mm.

Legs considerably different from those of male. Coxae with

about four bristles and finely pubescent; thicker than those of male. First coxa only slightly longer than wide; third coxa about twice as long as wide. Trochanters two-segmented, much more slender than coxae, and with scattered small spines and bristles; pubescence of trochanters longer than that of coxae. Femora stout and sparsely set with bristles, especially along the extensor surface. Tibiae slender and about twice as long as femora; only slightly thickened distally; sparsely set with spine-like bristles; with a fine pubescence.

First tarsal segment slightly shorter than the next three combined. Second tarsal segment slightly shorter than the third. Third and fourth tarsal segments subequal. Second, third, and fourth segments nearly rhomboidal and articulated obliquely. Last tarsal segment about as long as the first three together. Each tarsal segment finely pubescent and with about eight spines. Claws paired, identical, stout, and curved; each with a protuberance near its base. Empodium densely setose, thin, tapering, and about two-thirds as long as claws; two small prominences at the base of the empodium, one on each side.

Abdomen broad, broadest in the middle and tapering apically; densely set with fine pubescence. Sixth and seventh segments with several lateral bristles on low prominences. Tenth tergite V-shaped at the tip, the apex of each lobe with a small cylindrical process. Subgenital plate with a large, semicircular emargination.

PLESIOTYPES: Both male and female deposited in the collections of the American Museum of Natural History. Collected from the surface of shore eddies in North St. Vrain Creek, one-tenth of a mile north of the town of Lyons, Colorado, on July 19, 1948.

DISCUSSION: Five different species of mountain midges have been adequately described in both the larval and pupal stages. Pulikovsky (1924) described larvae and pupae of *Deuteroephlebia mirabilis* Edwards from mountain streams of central Asia; this species is now known to occur generally between latitudes 34° and 46° N. and longitudes 69° and 99° E. *D. nipponica* Kitakami is widely distributed on the Japanese islands of Honshu and Kyushu. *D. tyosenensis* Kitakami has been reported only from northern Korea. *D. shasta* Wirth has been recently described from Fawn Creek, Siskiyou County, California, but it is thought to be generally distributed in mountainous areas of the Pacific coast states (Wirth, 1951). *D. coloradensis* is widely dis-

TABLE 1

SOME DIFFERENTIATING CHARACTERS OF THE ADULT MALES OF THE FOUR SPECIES OF *Deuterophlebia*

	<i>mirabilis</i>	<i>nipponica</i>	<i>coloradensis</i>	<i>shasta</i>
Total length	3.70 mm.	—	1.96 mm.	—
Wing length	5.60	4.70 mm.	3.77	3.60 mm.
Wing width	2.90	2.30	1.84	1.70
Antenna length	13.0	10.8	9.5	—
Terminal segment of antenna	Practically bare; a few fine hairs near base	Inner side set with hairs; basal portion densely set and ranging to scattered hairs on the distal third	Inner side set with hairs; basal portion densely set and ranging to scattered hairs on the distal third	Inner side set with hairs; basal portion densely set and decreasing to scattered hairs; distal third practically bare
First flagellar segment	With one or two short bristles	With about 10 bristles	With about 12 bristles, some scattered before apical clump	With five or six peg-like bristles, all in clump at inner apex
Second and third flagellar segments	With a very few fine and short hairs on dorsal surface	Without hairs on dorsal surface	Finely pubescent over most of surface; five or six bristles at inner side of apex	A few minute setae in ring around apex; five or six peg-like bristles in clump at inner side of apex; pubescence extremely fine
Thorax	Absolutely bare	Entirely glabrous	Pubescent	Pubescence visible only above 200X
Femur setation	Bare	Sparsely set with short bristles	Entirely pubescent	Pubescent, densely so at base; a few scattered coarse setae
Tibia setation	Fine, close, erect pubescence on outer two-thirds	Densely set with fine, erect, knobbed hairs mainly on flexor surface	Basal portion covered with pubescence which grades into more sparsely arranged long knobbed hairs, the distal portion being covered with the latter	Very finely pubescent; distal three-quarters with fine, erect, knobbed hairs on flexor surface, and also on outer surface of distal quarter; outer side with scattered setae

TABLE 1—*Continued*

Tarsus setation	Bare	Densely set with fine, erect, knobbed hairs mainly on flexor surface	First four segments set with knobbed hairs along flexor surface; flexor surface of first four segments and entire fifth segment covered with very fine pubescence	Same as in <i>coloradensis</i>
Wing fringe	Long and delicate fringe around anal lobe	Long and delicate fringe on most of posterior margin	Long and delicate fringe on most of posterior margin	Long and delicate around anal lobe, gradually becoming short and scanty on posterior margin
Abdominal bristles	Lateral margins of abdominal segments with groups of two or three minute bristles	Sixth and seventh segments laterally with a small tubercle with five or six short bristles, their tergites each with a coarse, transverse row of short bristles	Fifth, sixth, and seventh abdominal segments each with several lateral bristles on low prominences	Sixth and seventh abdominal segments with lateral prominences, each with five or six strong scattered spines
Aedeagus	Simple	Simple	Consisting of a tubular half cylinder fused to a long, flat plate; length about twice the width	Flat plate not apparent; length more than three times the width

tributed in Colorado mountain and foothill streams and has also been reported from Wyoming and Utah. It is possible that this species is common and generally distributed in the Rocky Mountain system. Mountain midges winter over in the early larval stages, and at least in Colorado the pupae are formed in the late spring and early summer.

Adult stages have thus far been adequately described only for *D. mirabilis*, *D. nipponica*, and *D. shasta*. Edwards (1922) originally characterized the family Deuterophlebiidae and described the male of *D. mirabilis* from two specimens found floating at the edge of a lake at the inlet of a mountain stream in Kashmir, but the female was described from specimens dissected from pupae by Brodsky (1930). Brodsky also dissected out some males and supplemented Pulikovsky's original description. Adult *D. shasta* were also described from specimens removed from pupae (Wirth, 1951). Kitakami (1938), however, described both sexes of *D. nipponica* from an abundance of emerged individuals. This worker comments on the large number of adult females and relative rarity of males, but the present writer found the reverse to be true. Possibly the majority of males and females do not emerge simultaneously.

Late morning and afternoon collecting have never yielded adult *D. coloradensis* in the type locality, and it is quite probable that they emerge at night or around dawn and flutter about feebly and briefly before dying and falling to the surface of the stream. Kitakami (1938) also collected adult mountain midges only in the hours just after dawn.

COMPARATIVE NOTES: Pulikovsky (1924) described an adult female dissected from a pupa collected in the Altai Mountains. Her description is so generalized and sketchy, however, that it cannot be used for comparison with other species. Although she assumed that it was an adult *D. mirabilis*, this assumption is probably erroneous, since the specimen was dissected from a pupa that clearly was not a *D. mirabilis* pupa.

Most of the differences between the adults of the various species are indistinct and slight. The females are especially indistinguishable, and judging from the available literature, the species can best be separated on the basis of male characters. Table 1 is therefore based on some of the more obvious differences between the four species for which males are known.

From the above data it is clear that *D. nipponica* and *D.*

coloradensis are very much alike, each being easily separable from *D. mirabilis*. Critical work requires the use of the low and high powers of the compound microscope for these small midges, and since it is difficult to tell whether or not the high powers were used for the original descriptions of *D. nipponica* and *D. mirabilis*, it is possible that some of the setation differences indicated in table 1 are erroneous.

Deuterophlebia coloradensis and *D. shasta* can be most easily differentiated by the detailed structure of the first flagellar segment of the antennae and the aedeagus.

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