

First Larval Description of *Paraleptophlebia calcarica* Rowbotham and Allen (Ephemeroptera: Leptophlebiidae)

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ABSTRACT: The larva and female adult of *Paraleptophlebia calcarica* are described for the first time, based on reared and additional material from Kansas. These new records represent the first report of *P. calcarica* since its original description from Arkansas. *Paraleptophlebia calcarica* larvae may be distinguished from congeners by characters associated with the mouthparts, abdominal gills, and caudal filaments. Larvae of *P. calcarica* inhabit intermittent streams. New Kansas records are noted for *P. ontario* and *Leptophlebia intermedia*, which may cohabit with *P. calcarica*.

KEY WORDS: Ephemeroptera, *Paraleptophlebia*, mayflies, larvae

The descriptive taxonomy of North American *Paraleptophlebia* Lestage (Ephemeroptera: Leptophlebiidae) species has been poorly documented principally because many of the 39 valid nominal species (McCafferty, 1996; McCafferty and Kondratieff, 1999) have been described only as adults. One such species, *Paraleptophlebia calcarica* Rowbotham and Allen, was described based on one male adult, one male subimago, and four female subimagos collected in Logan County, Arkansas (Rowbotham and Allen, 1988). McCafferty (2001) provided clarification and correction to the orthography associated with the authors of this species. Additional records for this species have not been reported since its original description, despite subsequent study of *Paraleptophlebia* species from the Ozark-Ouachita mountain region (e.g., McCafferty *et al.*, 1997). Reared *P. calcarica* specimens reported here are the basis for the initial description of the larva and female adult provided below. Materials examined are deposited in the Purdue University Entomological Research Collection, West Lafayette, Indiana, USA [PERC], and the Snow Entomological Museum, University of Kansas, Lawrence, Kansas, USA [SEMC].

Paraleptophlebia calcarica Rowbotham and Allen, 1988

Descriptions

LARVA. (in alcohol, from penultimate and final instars, and final instar exuviae). Body length 5.4–6.9 mm. Caudal filaments length 9.5–12.1 mm.

Head capsule brown with pale spot present anterior of median ocellus, between antennal bases; dark brown maculae present between pale spot and antennal bases; pale spot present between each compound eye and lateral ocellus; black maculae present between antennal base and compound eye; pair of black, suboccipital maculae present. Antennae with scape, pedicel, and most basal flagellar segment pale to light brown; apical flagellar segments pale; sparse whorls of hairlike setae present at apex of each flagellar segment. Clypeus with pair of sublateral pale spots and single apicomedial pale spot. Labrum color brown laterally and pale medially; dorsal surface relatively evenly covered with long hairlike setae, but these setae less robust in posterolateral corners; anterior margin covered with shorter hairlike setae. Mandibles with apices not extending beyond head margin; outermost incisors length nearly 2× width at base; mola of planate mandible occupying 0.37× width of that mandible; mola of angulate mandible with length 0.5× width of that

mandible. Maxillary palpi (Fig. 1) with segments 2 and 3 subequal in length, together 1.75× length of segment 1; segment 1 with six to eight hairlike setae on outer margin; segments 2 and 3 with many long, hairlike setae, more numerous apically. Lingua of hypopharynx (Fig. 2) about two-thirds length of superlinguae, with distinct medioapical cleft. Labium (Fig. 3) with basal segment 1 subrectangular; palp segment 2 nearly two-thirds length of palp segment 3; combined length of palp segments 2 and 3 subequal to palp segment 1 length; palp segment 3 with long, hairlike setae apically and dense row of shorter setae along inner side.

Thorax brown with pale spots and scattered black maculae; prothorax with apicolateral corners pale, with black streaks extending obliquely from posterolateral corner to anterior margin, black maculae approximating pair of semicircles present on posterior margin; mesothorax with two pairs of black maculae present on anterior margin and pair of black streaks present between forewingpads. Legs pale with femur smoky brown medially, articulation between femur and tibia brown, tibia brown medially, tarsus brown basally, claw pale; numerous, minute excrescences present on brown regions of legs. Femur, tibia, and tarsus with scattered hairlike setae; femur with long, stout, bristlelike setae along dorsal margin; bristlelike setae present on ventral margin of tibia and tarsus; whorl of bristlelike setae present apically on tibia. Claw with 18–25 denticles.

Abdominal terga brown, with scattered, fine, black maculae; terga pale laterally; terga with pair of pale anteromedial longitudinal streaks and pale spot on posterior margin (Fig. 4), or with all medial pale spots coalesced (Fig. 5); variable, dark, sagittal streak often present. Sterna light brown to pale; faint, sublateral, dark maculae present; pair of pale, oblique streaks sometimes present on anterior margin; pair of pale dots sometimes present medially. Posterolateral corners of segments 8 and 9 extend into sharp projections. Segment 1 gills smaller than those on segments 2–7; all gills (Fig. 5) forked at base; tracheae without dark lateral branches. Caudal filaments pale to light brown; apex of each segment with sparse whorl of long, hairlike setae; apex of most segments also with dense whorl of short, spinelike setae present or absent on some middle segments; median filament slightly longer than cerci.

FEMALE ADULT (in alcohol). Body length 5.0–6.0 mm. Forewing length 6.0–7.0 mm. Caudal filaments length 9.0–11.0 mm.

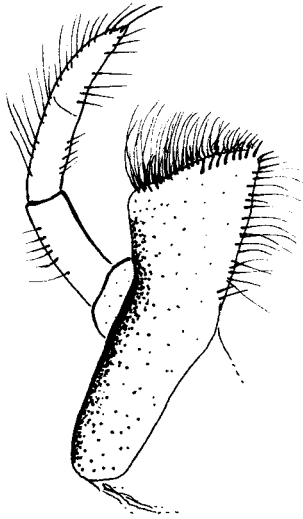
Head brown, with posterior margin pale and black maculae present around antennal bases and with pair of black maculae on occiput. Antennae pale. Compound eyes black, ocelli white with wide black ring at base; lateral ocelli larger than median ocellus.

Thorax brown, pale at wing bases; prothorax black on lateral margins and with paired, median, irregular, black maculae. Legs with femur, tibia, tarsi, and claw pale; coxa brown. Forewings hyaline with pale venation; stigmatic area clouded with white; light brown shading at base. Hindwings pale, with brown basal shading.

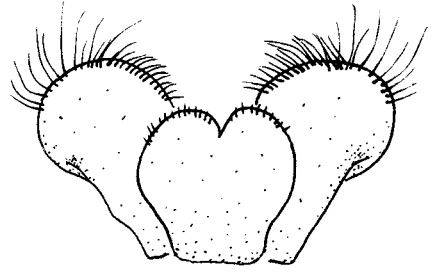
Abdominal terga brown, with lateral black streaks and irregular sublateral maculation that fades medially; terga 6–10 with black sagittal maculae; posterior margins with narrow black band. Sterna pale to light brown; subanal plate produced posteriorly, deeply cleft (Fig. 6). Caudal filaments pale.

Diagnosis

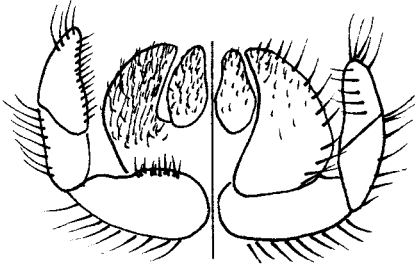
Male adults of *P. calcarica* may be distinguished from all other congeners by the shape of the penes. Each penes lobe is slender and elongate, with a slender, reflexed, mesal spur; a distinct, medial, elbow-like projection; and a small, apical hook (Robotham and Allen,



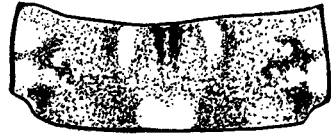
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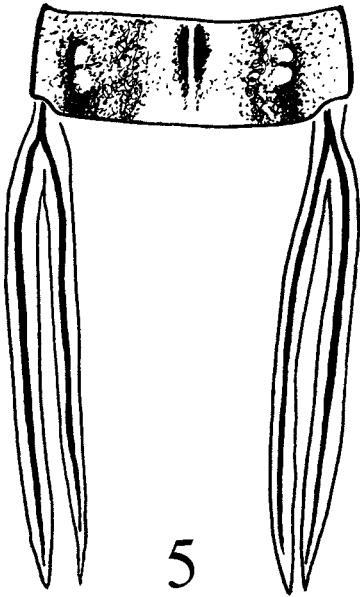
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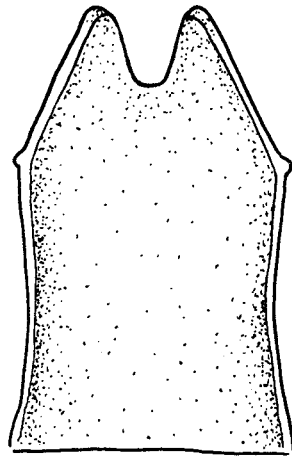
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1988: Figs. 1, 2). Robotham and Allen (1988) suggested that *P. calcarica* and *P. jeanae* Berner might be sister species, based on similarities in the adults. Male adults of the two species may be differentiated by the presence of a slender, reflexed, mesal spur on the penes lobes of *P. calcarica*, and the absence of such a spur on the penes lobes of *P. jeanae* (Berner, 1955: Figs. 1, 2; Berner, 1975: Fig. 17).

Paraleptophlebia calcarica larvae are very similar to the larvae of *P. jeanae* (Randolph and McCafferty, 1996) and *P. debilis* (Walker) (Ide, 1930; Traver, 1935: Plate 37, Figs. 2a–2f). *Paraleptophlebia calcarica* larvae are distinguishable from these latter two species by the presence of sagittal streaks on the abdominal terga and longer caudal filaments. Mature larvae of *P. calcarica* may be distinguished from all other known *Paraleptophlebia* larvae by having: the caudal filaments much longer than the body; abdominal gills forked at the base, with no dark, lateral, tracheal branches; the lingua of hypopharynx with a distinct medioapical cleft; labial palp segment 1 subrectangular; maxillary palp segments 2 and 3 subequal in length, and together 1.75 times the length of segment 1; the legs distinctly banded; and dark sagittal streaks present on at least some abdominal terga.

Paraleptophlebia calcarica was collected together with *P. ontario* (McDunnough) at one location (see below). Adults of the two species differ in the darker abdominal color of *P. ontario* and in the structure of the male genitalia. Figures of *P. ontario* male genitalia were provided by McDunnough (1926: Fig. 4), Traver (1935: Fig. 133), and Burks (1953: Fig. 207). Larvae of the two species may be separated readily, without dissection. For example, *P. calcarica* larvae usually have much more distinct banding on the legs and sagittal markings on the abdomen that are absent in *P. ontario*.

Morphological Variability

Abdominal coloration varies in both larvae and adults. The extent of the fine, black maculation on the abdominal terga varies in larvae and adults; however, it is usually most prominent in its lateral most extent. The medial, pale spots on the abdominal terga of larvae vary greatly; they may be thin and small (Fig. 4), or so large that they coalesce into a single, large, medial pale region (Fig. 5). The dark, sagittal streaks present on the abdomen of larvae and adults vary in their degree of development, but they usually are present, if only faintly visible on the most posterior abdominal segments. The sterna of some larvae have pale markings that are absent in other larvae.

Biology

Larvae of *P. calcarica* inhabit intermittent streams. The alate type material of *P. calcarica* was collected in a blacklight trap set near such a stream (Robotham and Allen, 1988). Alates have been collected from middle to late May, and occur also in early June, based on mature larvae we examined.

Remarks

The Kansas record of *P. ontario* represents the westernmost report of the species, which previously was known as far west as east central Missouri (Sarver and Kondratieff, 1997).

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Figs. 1–5. *Paraleptophlebia calcarica*, larva. 1, Maxilla. 2, Hypopharynx. 3, Labium (left: ventral view; right: dorsal view). 4, Abdominal tergum 5; color variant I. 5, Abdominal tergum 5, with gills; color variant II.

Fig. 6. *Paraleptophlebia calcarica*, female adult, Subanal plate.

Leptophlebia intermedia (Traver) also was collected with *P. calcarica* at one Kansas location (see below), which represents a new state record for the former species. Previously, only one other species of Leptophlebiidae, *Leptophlebia konza* Burian, had been reported from Kansas (Burian, 2001).

Material Examined

Paraleptophlebia calcarica: KANSAS, Chautauqua Co., Old Sedan City Lake outflow, 3 mi N, 1.8 mi W of Sedan, 18-V-1981, PM Liechti, DGH, BG Coler, one larva [SEMC]; branch of Turkey Cr, 0.05 mi E, 0.5 mi S of Chautauqua, T35S, R11E, Sec. 12, 7-VI-1982, JK Gelhaus, one female subimago [SEMC]; Linn Co., unnamed stream, 3.9 mi W, 0.7 mi S of Mound City, 8-VI-1983, PM Liechti, DGH, AB, one male adult, two female adults, four male subimagos, five female subimagos, 29 larvae [SEMC]; same data, one male adult, one female adult, five larvae [PERC]; Montgomery Co., Bluff Run, 1.8 mi N, 1.0 mi W of Dearing, 25-V-1982 (emerged 30-V-1982), PM Liechti, BG Coler, DGH, one female adult and associated exuviae, three female subimagos and associated larval exuviae, one larva [SEMC]; Wilson Co., north-south spring fed ravine, NW ¼ of SW ¼ sec. 11, T28S, R13E, ca. 37°37'30"N, 95°57'8"W, 25-V-1982, PM Liechti, DGH, BG Coler, two male adults (reared from subimagos), one female adult with associated larval and subimago exuviae, one female adult, two larvae [SEMC]; same site, 12-V-1982, PM Liechti, two larvae (dissected parts in microvial) [SEMC].

Paraleptophlebia ontario: KANSAS, Linn Co., unnamed stream, 3.9 mi W, 0.7 mi S of Mound City, 8-VI-1983, PM Liechti, DGH, AB, one male adult, one male subimago, 24 larvae [SEMC].

Leptophlebia intermedia: KANSAS, Wilson Co., north-south spring fed ravine, NW ¼ of SW ¼ sec. 11, T28S, R13E, 12-V-1982, PM Liechti, three larvae [SEMC].

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