

ADDITIONS TO THE TAXONOMY OF *AMERICABAETIS* (EPHEMEROPTERA: BAETIDAE): *A. LUGOI*, N. SP., ADULT OF *A. ROBACKI*, AND KEY TO LARVAE¹

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ABSTRACT: *Americabaetis lugoi* is a distinctive new species of the small minnow mayfly family Baetidae and is described from female larvae and adults collected in Costa Rica. Extensive samples of the new species indicate that it is parthenogenetic. Larvae of *A. lugoi* share a frontal keel with certain other species of *Americabaetis*, but *A. lugoi* larvae differ from all other known species of the genus in mouthpart, paraproct, and other characteristics. Adults of *A. robacki* are described for the first time, based on reared material from Uruguay. They are diagnostically compared with *A. alphas*, the only other South American species known as an adult. A key to the larvae of all known *Americabaetis* species is provided.

Lugo-Ortiz and McCafferty (1996) gave generic status to *Americabaetis* Kluge, and in that revision reviewed or described 10 nominal species from Latin America as follows: *A. alphas* Lugo-Ortiz and McCafferty, from South America; *A. boriquirensis* (Lugo-Ortiz and McCafferty), from the Antilles; *A. intermedius* (Lugo-Ortiz and McCafferty), from Central America; *A. labiosus* Lugo-Ortiz and McCafferty, from South America; *A. longetron* Lugo-Ortiz and McCafferty, from South America; *A. maxifolium* Lugo-Ortiz and McCafferty, from South America; *A. naranjoi* (Kluge), from the Antilles; *A. pleturus* (Lugo-Ortiz and McCafferty), from Central America and North America (see also Wiersema and McCafferty [1998]); *A. robacki* (Lugo-Ortiz and McCafferty), from South America; and *A. titthion* Lugo-Ortiz and McCafferty, from South America. McCafferty (1998) indicated that the genus was clearly of South American origin.

We herein describe a new species of *Americabaetis* based on female larvae and adults discovered in Costa Rica. In addition, we give the first description of male and female adults of *A. robacki*, and provide a key to all known species based on the larval stage. We are honored to name the new species after our colleague, Carlos Lugo-Ortiz.

Americabaetis lugoi, NEW SPECIES

Larva. Size: Body length 5 mm; cerci, 3.0-3.5 mm. Antennal scapes and pedicels subequal in length, with scattered fine setae, and scales; segments of the flagella each with distal row of moderately large scales. Frontal keel present and narrow (Fig. 1). Labrum (Fig.

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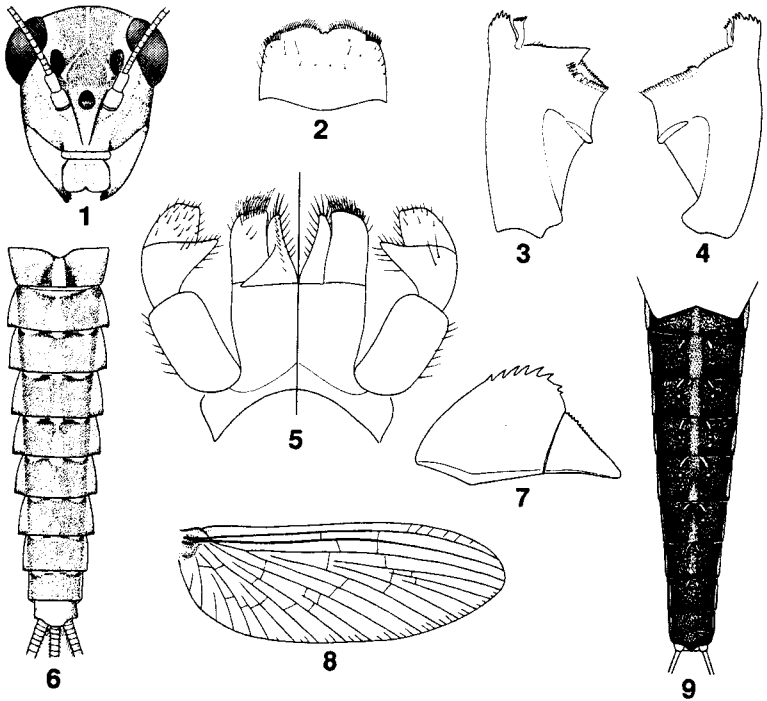
2) with anterior margin subparallel to hind margin and with median notch, prominent medial seta absent, few scattered fine setae dorsally, 6-7 bladelike submarginal setae at anterolateral corners. Right mandible (Fig. 3) with four or five denticles on outer incisor (third or fourth very small), one on middle incisor, and three on inner incisor, each incisor with vertical row of short, fine setae; prostheca stout, digitate; tuft (row) of setae present between base of incisors and mola. Left mandible (Fig. 4) with three denticles on outer incisor, one on middle incisor, and three on inner incisor; prostheca stout, digitate; scattered bristlelike setae present between base of incisors and mola. Maxillae elongate; maxillary palp two segmented, reaching apex of galealacinia; basal setae of galealacinia 5+1. Labium (Fig. 5) elongate and robust; palps with segment 1 subequal to 2 and 3 combined, segment 2 with anteriorly projecting apically setate lobe and 2-3 dorsal setae, segment 3 apically setate and with scattered fine setae on surface; glossae broad at base, tapering distally, with seven or eight setae on medial margin, and submarginal ventral row of 10-12 finer setae extending to near base; paraglossae broad, with three rows of pectinate setae at apex. Thorax: Nota yellowish-brown, without distinct pattern. Legs pale yellow-brown with numerous short bristles ventrally; femora dorsally with 18-20 blunt bristles, and distally with brown spot (seen on exuviae); tibiae with few scattered bristles dorsally, and with brown bands (seen in exuviae); tarsi with few scattered bristles dorsally; tarsal claws with 12-15 denticles.

Abdomen (Fig. 6): Color yellow-brown (ochre in alcohol) with broken dorsal median stripe; exuviae light brown with pale medial stripe dorsally; last instar with thoracic and abdominal color of subimagos and adults (see below). Terga and sterna with scales and few scattered fine setae; posterior margins of terga and sterna with sharp spines with length 1-2 times basal width. Gills platelike, poorly tracheated, with few marginal serrations, and with fine setae on anterior and posterior margins, not over 2.0 times length of respective segment. Paraprocts (Fig. 7) with 8-10 sharp spines. Caudal filaments pale, without banding; terminal filament ca. 0.8 times length of cerci.

Female adult. Body size 3.0-3.5 mm; body color brick-red to dark reddish brown, darker at intersegmental areas laterally and dorsally, medial two-thirds of sterna relatively pale, cream in some. Legs pale, yellow and contrasting strongly with dorsal body coloration; femora unmarked. Forewings (Fig. 8) with distinct dark brown stain at base of wing; apical intercostal area slightly opaque. Abdomen (Fig. 9) of some specimens dorsally with thin pale median longitudinal stripe; abdominal terga additionally with fine white lines and dots as shown in Figure 9.

Material examined. HOLOTYPE: female larva (exuviae): COSTA RICA, Guanacaste Prov., Estacion Maritza, Rio Tempisque, B.W. Sweeney, lab reared, VI-5-1992, slide-mounted in Euparal, deposited in the Purdue University Entomological Research Collection, West Lafayette, Indiana. PARATYPES: four female larvae and four adult females, same data and deposition as holotype.

Remarks. *Americabaetis lugoi* is apparently related to those *Americabaetis* species that possess a frontal keel on the head as larvae. These include *A. alphas*, *A. intermedius*, *A. longetron*, and *A. maxifolium*. Precise relationships within this grouping have not been ascertained, and those relationships are further complicated by the fact that, of this grouping, only *A. alphas* has also been described in the adult stage. *Americabaetis lugoi* larvae can easily be distinguished from all other species by characteristics given in the key below. Little can be said about adult diagnosis since it must be based entirely on female comparisons and at present only a few species of *Americabaetis* are known as



Figs. 1-6. *Americabaetis lugoi* larva. 1. Head capsule (frontal view). 2. Labrum. 3. Left mandible. 4. Right mandible. 5. Labium. 6. Abdomen (dorsal). 7. paraproct. 8-9. *A. lugoi* female adult. 8. Forewing. 9. Abdomen (dorsal).

female adults. Adults comparisons of *Americabaetis* are treated by Wiersema and McCafferty (1998).

Jackson and Sweeney (1995) discussed the known biology of *A. lugoi* (as *Acerpenna* sp.). They showed that in the laboratory, eggs had a median developmental time of 23 days, and larvae completed development in 28 days (median period). Larvae were classified as gatherers since they could successfully complete development on an algal diet. Males were not represented in a sample of 86 reared specimens, and we consider *A. lugoi* to be parthenogenetic. As such it represents the first tropical species of Baetidae that we know to be parthenogenetic. In the Western Hemisphere, certain far-northern baetid species, such as *Baetis foemina* McDunnough and *B. hudsonicus* Ide, are strictly parthenogenetic, and other species of Baetidae have been shown to be parthenogenetic in some far-northern fringe populations. These latter include *Acerpenna*

macdunnoughi (Ide), *B. bicaudatus* Dodds, and *Dipheter hageni* (Eaton) (see discussion in McCafferty and Morihara [1979]). *Americabaetis lugoi* would appear unusual in that its parthenogenesis is not associated with a cold regime. We do not know what adaptive significance parthenogenesis would be to this Costa Rican population, or if *A. lugoi* will prove to be parthenogenetic throughout its range, if indeed it occurs elsewhere.

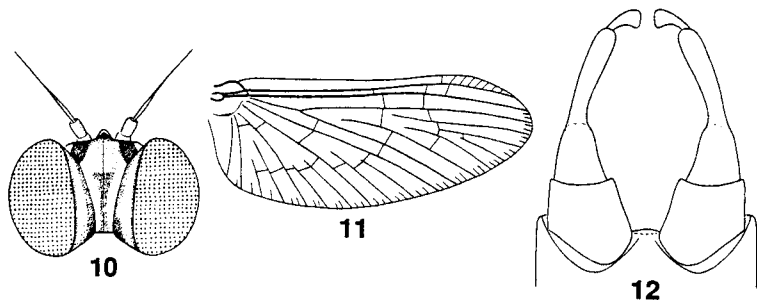
***Americabaetis robacki* (Lugo-Ortiz and McCafferty)**

Larva. Originally described by Lugo-Ortiz and McCafferty (1994) as *Acerpenna*; descriptions were slightly modified when transferred to *Americabaetis* (Lugo-Ortiz and McCafferty 1996), particularly regarding its possession of six rather than seven pairs of gills as had been incorrectly reported earlier.

Male adult (in alcohol). Body 2.5-3.0 mm long; forewings 3.3-3.5 mm long. Tubinate eyes (Fig. 10) ellipsoidal, longer than broad dorally, well separated anteriorly, but more approximate posteriorly, pale yellow dorsally and basally. Thorax medium to light brown, solid dorsally. Legs pale yellow, unmarked (fore- and midfemora dusky yellow). Forewings as in Figure 11, with base of subcosta shaded with reddish-brown, strongly opaque in intercostal area, otherwise membrane and venation colorless. Abdomen light to medium brown dorsally, tan to pale yellow ventrally; terga without distinct markings, although pigment sometimes granular, and terga with dark pencil line at posterior margin in specimens with relatively light abdomens; terga 7-10 slightly darker; sterna without markings, sterna 7-10 slightly more shaded. Male genitalia as in Figure 12. Cerci grayish white.

Female adult. Body 2.5-3.0 mm long; forewings 3.3-3.5 mm long. Coloration generally similar to male, except thorax yellow-brown; forewings lacking basal shading of subcosta and lacking strongly opaque intercostal area; and posterior terga brownish gray.

Material examined. URUGUAY: one male subimago and exuviae, Depto Maldonado, Arroyo de la Quinta, II-10-1984, N482, M. Gillies; one female adult and exuviae, same data as previous, II-15-1984, N335; 34 larvae, same data as previous, I-9-1984, N443-476; one female subimago and exuviae, Depto Maldonado, Branch of R. Maldonado Abra del Perdonnastas, I-15-1984, N334, M. Gillies; one female adult and exuviae, Depto Maldonado, Laguna del Sauce, I-1-1984, N336, M. Gillies; one male adult and exuviae, same data as



Figs. 10-12. *Americabaetis robacki* male adult: 10. Eyes (dorsal). 11. Forewing. 12. Genitalia (ventral).

previous, N401; five adult males, one adult female, same data as previous, by dam, XII-15-1983, N351-357. All material deposited at Purdue Entomological Research Collection, West Lafayette, Indiana. In addition, *A. alphas* material cited by Lugo-Ortiz and McCafferty (1996) was re-examined for comparative purposes.

Remarks. The only other South American *Americabaetis* known in the adult stage is *A. alphas*. *Americabaetis robacki* and *A. alphas* adults are quite similar; however, males of *A. alphas* have a distinctive dorsal pattern on the abdominal terga, with terga 2-6 being unpigmented in a posterior band that gradually expands anteriorly towards the middle. Both sexes of *A. alphas* tend to be lighter colored than *A. robacki* and somewhat smaller in size. The turbinate eyes of *A. alphas* are uniformly separated from each other, whereas those of *A. robacki* are much closer posteriorly than they are anteriorly. Also, the intercostal area of the male wings is even more opaque in *A. alphas*. For a more complete comparison of known adults of *Americabaetis*, see Wiersema and McCafferty (1998).

Key to *Americabaetis* larvae

- | | | |
|----|--|-------------------------|
| 1 | Frontal keel present (Fig. 1) | 2 |
| 1' | Frontal keel absent | 6 |
| 2 | Second segment of labial palp not developed mediolaterally (Fig. 10 [Lugo-Ortiz and McCafferty 1994]); paraproct with numerous minute marginal spines (Fig. 11 [Lugo-Ortiz and McCafferty 1994]) | <i>A. intermedius</i> |
| 2' | Second segment of labial palp developed mediolaterally (Figs. 5; 4 [Lugo-Ortiz and McCafferty 1994]; Figs. 6, 21, 31, 40, 50 [Lugo-Ortiz and McCafferty 1996]); paraprocts without numerous minute marginal spines | 3 |
| 3 | Gills (Figs. 43, 44 [Lugo-Ortiz and McCafferty 1996]) 2.5-3.0 times length of respective tergum, with margins sparsely serrate | <i>A. maxifolium</i> |
| 3' | Gills (Figs. 11, 12, 33, 34 [Lugo-Ortiz and McCafferty 1996]) 1.5-2.0 times length of respective tergum, with margins densely or sparsely serrate | 4 |
| 4 | Paraprocts with 6-7 elongate, sharp spines; abdominal terga either with distinctive white areas on 1, 4, and 7 (males) (Fig. 7 [Lugo-Ortiz and McCafferty 1996]) or white laterally on 2-8 (females) | <i>A. alphas</i> |
| 4' | Paraprocts with 8-13 spines; abdominal terga either nondescript or with median stripe (Fig. 6) | 5 |
| 5 | Paraprocts with 8-10 irregular, sharp, marginal spines (Fig. 7); dorsal margin of femora with 18-20 blunt bristles | <i>A. lugoi</i> |
| 5' | Paraprocts with 11-13 slender spines increasing in length distally (Fig. 35 [Lugo-Ortiz and McCafferty 1996]); dorsal margin of femora with 22-25 long, acute setae | <i>A. longetron</i> |
| 6 | Labial palp segment 2 (Figs. 21, 50 [Lugo-Ortiz and McCafferty 1996]) narrow-elongate and weakly developed mediolaterally | 7 |
| 6' | Labial palp segment 2 (Fig. 4 [Lugo-Ortiz and McCafferty 1994]) not as above | 8 |
| 7 | Meso- and metasternum (Fig. 51 [Lugo-Ortiz and McCafferty 1996]) with paired setose protuberances | <i>A. tithion</i> |
| 7' | Meso- and metasternum without paired setose protuberances | <i>A. labiosus</i> |
| 8 | Caudal filaments without dark bands; paraprocts with 5-6 spines (Fig. 5 [Lugo-Ortiz and McCafferty 1994]) | <i>A. boriquirensis</i> |

- 8' Caudal filaments variously banded; paraprocts variable 9
 9 Cerci with single dark broad band medially; paraproct with 11- 13 spines followed by numerous minute serrations (Fig. 14 [Lugo-Ortiz and McCafferty 1994]); Central and North American *A. pleturus*
 9' Cerci with both median and subapical banding; paraprocts not as above; South American and Antillean 10
 10 Labial palp segment 2 with six dorsal setae; South American *A. robacki*
 10' Labial palp segment 2 with four dorsal setae; Cuban *A. naranjoi*

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