


The Mayfly Genus *Acerpenna* (Insecta, Ephemeroptera, Baetidae) in Latin America

C.R. LUGO-ORTIZ and W.P. McCAFFERTY



LUGO-ORTIZ, C.R. and W.P. McCAFFERTY (1994): **The Mayfly Genus *Acerpenna* (Insecta, Ephemeroptera, Baetidae) in Latin America**
Studies on Neotropical Fauna and Environment 29, pp. 65-74.

The genus *Acerpenna* (Ephemeroptera: Baetidae), previously known from North America north of Mexico, is shown to occur extensively in Latin America, where it demonstrates considerable variability. The genus includes species with or without hindwings, with or without gills on abdominal segment 1, and with gills on abdominal segment 7 either rounded or pointed apically. *Americabaetis*, originally considered a subgenus of *Baetis* s. l. and having one nominal species described from Cuba, is synonymized with *Acerpenna*. Besides *A. naranjoi* (Kluge), n. comb., four new species of *Acerpenna* are described from Latin America: *A. boriquirensis*, n. sp., from the Greater Antilles, *A. intermedia*, n. sp., from Central America, *A. pletura*, n. sp., from Central America and Mexico, and *A. robacki*, n.sp., from South America.

C.R. Lugo-Ortiz and W.P. McCafferty, Department of Entomology, Purdue University, West Lafayette, Indiana 47907, USA.

Introduction

Waltz & McCafferty (1987) erected the genus *Acerpenna* in the family Baetidae to include *A. macdunnoughi* (Ide) (type species) and *A. pygmaea* (Hagen). Later, McCafferty & Waltz (1990) added *A. akataleptos* (McDunnough) and *A. harti* (McDunnough). All four of these species were previously classified in *Baetis* Leach and all occur in North America north of Mexico (McCafferty & Waltz, 1990). Lugo-Ortiz & McCafferty (1993) provided the first generic records of *Acerpenna* from Central America, but did not treat species.

Our examination of Ephemeroptera material from Mexico, Central and South America, and the Greater Antilles revealed the presence of undescribed species of *Acerpenna* in each of these regions. Also, it became obvious from a Russian paper on Cuban Baetidae by Kluge (1992), that *Baetis* (*Americabaetis*) *naranjoi* Kluge was another species of *Acerpenna*. Latin American *Acerpenna* expand the known variability of the genus somewhat so that the genus contains species with or without hindwings, with or without gills on abdominal segment 1, and with either rounded or apically pointed gills on abdominal segment 7. We redescribe the genus and describe four new species of *Acerpenna* from Latin America.

In the species descriptions presented we follow the Morihara & McCafferty (1979) formulae of mandibular denticulation: (a + b) or (a + 1 + b), where a =

number of distal denticles, b = number of basal denticles, and 1 = presence of a small denticle between distal and basal denticles; when a is followed by (1) it indicates the presence of a very small denticle at the base of the distal denticles. Institutions housing the material examined are as follows: the Academy of Natural Sciences of Philadelphia (ANSP); Cornell University (CU); Florida A & M University (FAMU); and the Purdue Entomological Research Collection (PERC).

Acerpenna Waltz and McCafferty

Baetis Leach, 1815: 137 (in part).

"Genus 1 nr *Pseudocloeon*" Roback, 1966: 134. New synonym.

Acerpenna Waltz & McCafferty, 1987: 669.

Baetis (*Americabaetis*) Kluge, 1992: 18. New synonym.

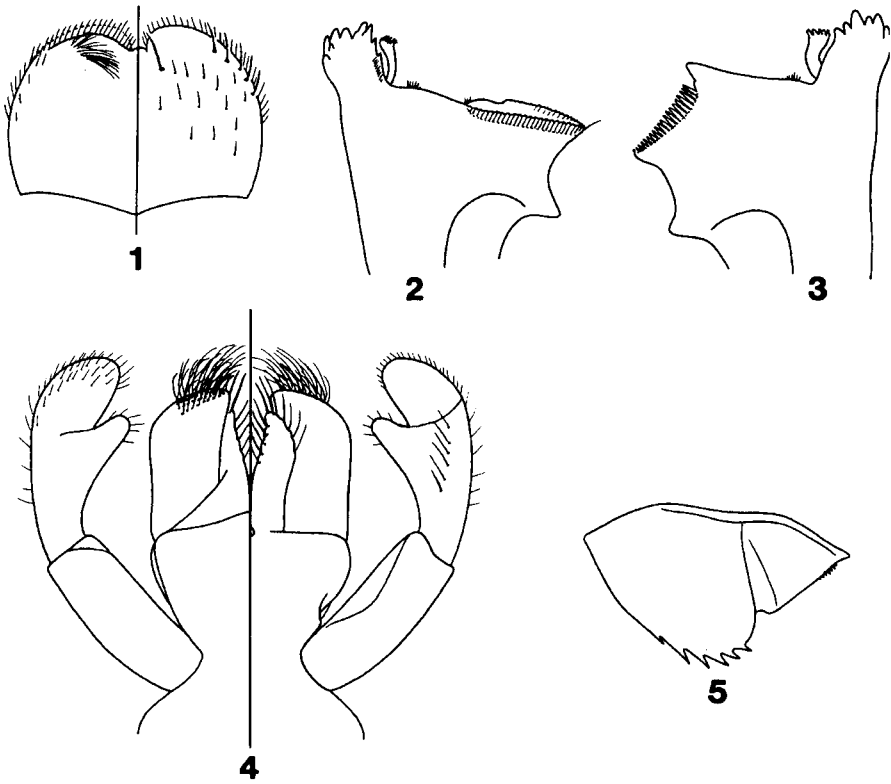
Larva: Antennal scapes rarely with robust setae. Frontal keel present (Fig. 6) or absent. Mandibles (Figs. 2-3, 8-9, 12-13) with incisors basally fused, denticles distinct; tuft of setae between prothecae and molars. Maxillary palps three segmented, subequal to galealacinia or longer. Anteromedial process of segment 2 of labial palps moderately developed (Fig. 10) or thumblike (Fig. 4). Femora without villopore, margins subparallel. Hindwingpads present or absent. Gills present or absent on abdominal segment 1; gills on abdominal segment 7 rounded or pointed apically, all other gills rounded apically. Terminal filament subequal to cerci.

Adult: Forewings with paired marginal intercalaries. Hindwings present or absent, when present with pointed coastal process and undulate anterior margin beyond coastal process [Fig. 1 (McCafferty & Morihara, 1979)]. Basal segment of male genital forceps with conical process present [Fig. 20 (McCafferty & Morihara, 1979)] or absent [Fig 3(6) (Kluge, 1992)].

Type species: *Baetis macdunnoughi* Ide, 1937: 230, by original designation.

Discussion: Waltz & McCafferty (1987) erected the genus *Acerpenna* for baetids that lacked a femoral villopore, possessed hindwings and a thumblike process on segment 2 of the labial palps, and had the terminal pair of gills apically pointed. Roback (1966) considered his Genus 1 nr *Pseudocloeon*, based on possibly as many as five Peruvian species, to be a group that lacked hindwings but that could not be placed in any known genus at that time. Kluge (1992) erected the subgenus *Americabaetis* within *Baetis* s. l. based on a Cuban species which as larva lacked a femoral villopore, did not possess hindwingpads, had a thumblike process on segment 2 of the labial palps, and lacked gills on abdominal segment 1.

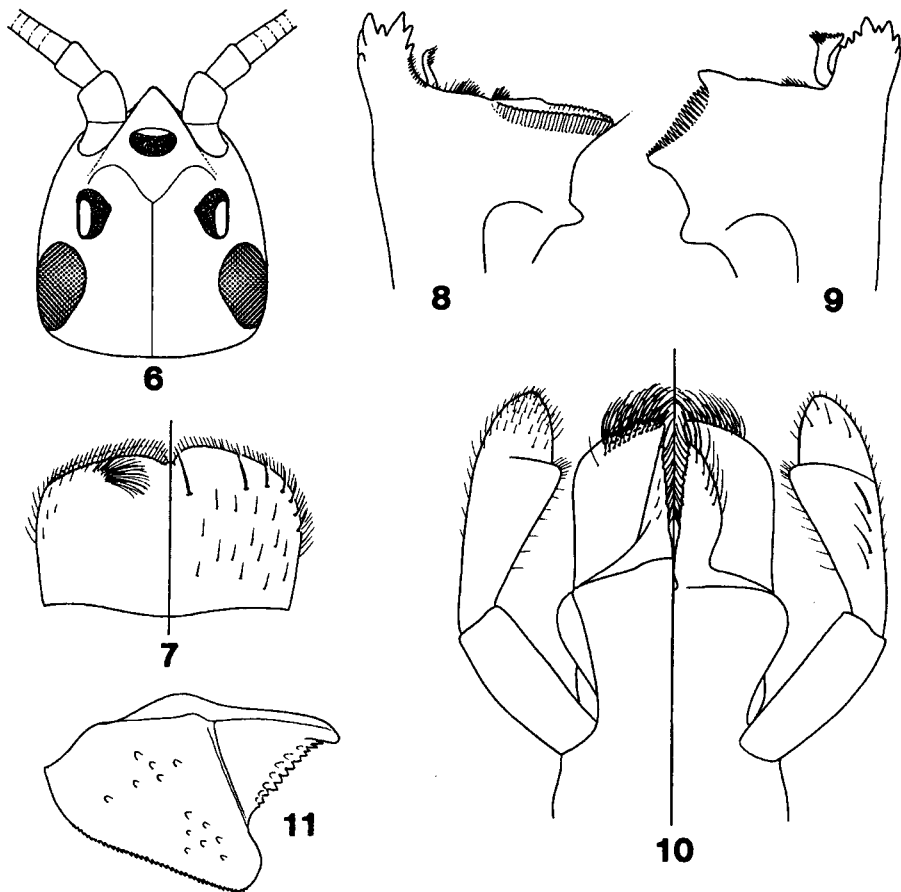
Waltz & McCafferty (1987) and McCafferty & Waltz (1990) discussed the importance of the villopore in the systematics of baetids with paired marginal intercalaries in the forewings. The presence of the villopore is apparently diagnostic of a distinct holophyletic group comprised of *Baetis*, *Acentrella* Bengtsson, *Baetiella* Uéno, *Barbaetis* Waltz & McCafferty, *Heterocloeon* McDunnough, and *Platybaetis* Müller-Liebenau. The absence of the villopore in Roback's Genus 1 nr *Pseudocloeon* and Kluge's *Americabaetis* clearly separates them from *Baetis* and the rest of this group, including *Pseudocloeon* s. l. The presence of a



Figs. 1-5. *Acerpenna boriquirensis* larva: 1, labrum (left-ventral; right-dorsal); 2, right mandible; 3, left mandible; 4, labium (left-ventral; right-dorsal); 5, paraprot.

thumblike process on segment 2 of the labial palps, on the other hand, clearly indicates the equivalency of Genus 1 nr *Pseudocloeon* and *Americabaetis* with *Acerpenna*.

As shown by McCafferty & Waltz (1990), the presence or absence of hindwings is a trivial character in many baetid lineages, being highly susceptible to convergent loss. It therefore has not constituted a reliable character to delineate baetid genera. All Latin American *Acerpenna* we have studied lacked hindwings. The presence or absence of the first gill pair is equally unreliable as a generic character. The genus *Dipheter* Waltz & McCafferty, for example, contains species with and without a first gill pair. The South American species previously considered in Genus 1 nr *Pseudocloeon* by Roback (1966) and those found in North America north of Mexico possess the first gill pair, whereas the Mexican, Central American, and Greater Antillean species lack the first pair.



Figs. 6-11. *Acerpenna intermedia* larva: 6, head (top view); 7, labrum (left-ventral; right-dorsal); 8, right mandible; 9, left mandible; 10, labium (left-ventral; right-dorsal); 11, paraproct.

Acerpenna boriquensis Lugo-Ortiz and McCafferty, new species

Material examined. Holotype: Female larva, Puerto Rico, Utuado, Utuado rd, 60.9/6, III/13/35, J.G. Needham and J. García-Díaz, deposited at CU. Paratypes: One female and four male larvae, same data and deposition as holotype.

?? *Cloeodes* sp. No. 1 Traver, 1938: 38 (in part).

Larva: Body length: 4.5-4.8 mm; caudal filaments: 2.0 mm. Head: Coloration brown, with no distinct pattern. Antennae brown, with very fine setae on scapes and pedicels. Frontal keel absent. Labrum (Fig. 1) more heavily sclerotized posteriorly, with deep anteromedial emargination; submedial setae present; sub-

marginal setae inconspicuous; numerous fine setae scattered over dorsal surface; marginal setae weakly branched. Right mandible (Fig. 2) 3 (1) + 1 + 4; short row of fine setae at base of denticles; few setae between prostheca and molars and base of molars; long seta on distal end of molars. Left mandible (Fig. 3) 3 + 3; few setae between prostheca and molars; triangular process at base of molars. Maxillae elongate; palps extending as far as galealacinia; palp segment 1 very short; segments 2 and 3 subequal and with scattered fine setae. Labium (Fig. 4) robust; palp segment 1 as long as segments 2 and 3 combined; segment 2 with thumblike projection and five or six dorsal setae; distal end of thumblike projection and segment 3 with scattered fine setae; glossae basally broad, tapering distally, with seven or eight setae on medial margin; paraglossae broad, with three rows of weakly pectinate setae at apex. Thorax: Nota yellowish brown, with no distinct pattern. Sterna yellowish brown. Hindwingpads absent. Legs yellowish brown; femora with 21-22 long setae on dorsal margin and many short setae on ventral margin; tibiae with 21-22 short setae on dorsal margin (distal seta longer than other setae) and with 14-15 short setae on ventral margin (distal two setae contiguous and longer than other setae); tarsi with 17-18 long setae on ventral margin and eight or nine short setae on dorsal margin; tarsal claws with 12 denticles. Abdomen: Color yellowish brown, with no distinct pattern. Tergal surfaces with few fine setae and angulate scale bases; posterior margins with numerous short sharp spines. Gill on segment 1 absent; gills 2-7 platelike, poorly tracheated, and with numerous marginal serrations and fine setae. Paraprocts (fig. 5) with five or six sharp marginal spines. Caudal filaments pale.

Adult: Unknown.

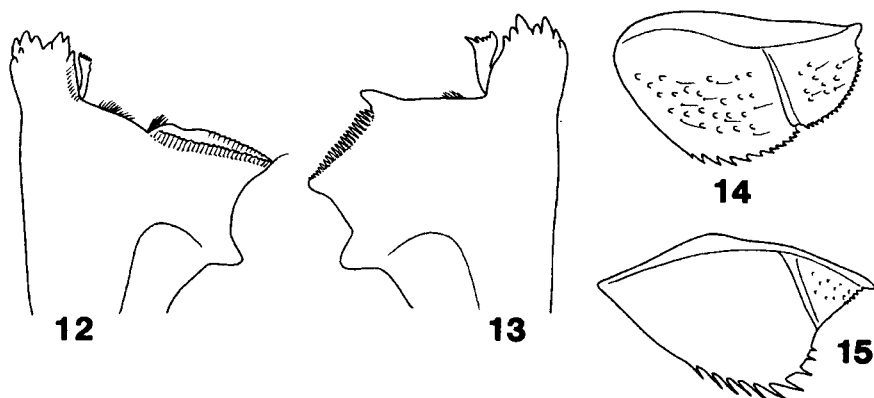
Etymology: Boriquen is a transliteration of the name given to Puerto Rico by the pre-Columbian Arawak-Taino culture of the Greater Antilles; the specific epithet is a Latinized form meaning "from Boriquen."

Discussion: Traver (1938) tentatively described and assigned some specimens collected in the mountain region of Puerto Rico to *Cloeodes* Traver. However, Traver (1938) pointed out that those specimens probably belonged to a different genus within Baetidae. Kluge (1992) suggested that those specimens probably belonged to *Americabaetis*. Our examination of that material revealed that part of those specimens are *Acerpenna boriquensis*, and the others are either *Fallceon garcianus* (Traver) or *Paracloeodes portoricensis* (Traver).

Acerpenna boriquensis can be distinguished from the other *Acerpenna* described herein by the spination of the paraprocts (Fig. 5) and the pale coloration of the caudal filaments.

***Acerpenna intermedia* Lugo-Ortiz & McCafferty, new species**

Material examined. Holotype: Male larva, Costa Rica, San José Prov., Río Parmita Chiquito, rt 12, 6.5 km SW of jct rt 2, 9.703° N/83.970° W, 1990 m, IV/10/87, Holzenthal, Hamilton, and Heyn, deposited at PERC. Paratypes: Male larva, Costa Rica, Puntarenas Prov., 10 km N of San Vito, at quarry waterfall, III/16/69, W.P. McCafferty, deposited at PERC; one female and one male larvae, same data as holotype, deposited at FAMU; one male larva, Costa Rica, San José Prov., 12 mi N of



Figs 12-15. *Acerpenna pletura* and *A. robacki* larvae: 12-14. *A. pletura*: right mandible; 13, left mandible; 14, paraproct. 15. *A. robacki*, paraproct.

San Isidro del General, Panamerican Highway, 1600 m, VII/20/62, G.G. Musser, deposited at PERC. Additional material examined: Eleven larvae, Costa Rica, Puntarenas Prov., 10 km N of San Vito, at quarry waterfall, III/16/69, W.P. McCafferty, deposited at PERC.

Larva: Body length: 6.2-6.5 mm; caudal filaments: 4.5 mm. Head (Fig. 6): Color brown, with no distinct pattern. Antennae brown, with very fine setae on scapes and pedicels. Frontal keel present. Labrum (Fig. 7) sclerotized posteriorly, with deep anteromedial emargination; submedial and three or four submarginal setae present; numerous fine setae scattered over dorsal surface; marginal setae branched. Right mandible (Fig. 8) 3 (1) + 3; short row of fine setae at base of denticles; tuft of setae between prosthema and molars and base of molars; long seta at distal end of molars. Left mandible (Fig. 9) 3 (1) + 3; tuft of setae between prosthema and molars; triangular process at base of molars. Maxillae elongate; palps extending as far as galealacinia; palp segment 1 very short; segments 2 and 3 subequal, with scattered fine setae. Labium (Fig. 10) elongate and robust; palp segments 1 and 2 subequal and long; segment 2 with moderate distal projection; segment 3 short, not quite 2/5 length of segment 2, with numerous fine setae over surface; glossae basally broad, tapering distally, with 13 - 14 setae on medial margin; paraglossae broad, with three rows of weakly pectinate setae at apex. Thorax: Nota olive brown, with no distinct pattern. Sterna pale. Hindwingpads absent. Legs olive brown, with femora basally pale; femora with 20 - 21 long setae on dorsal margin (distal two setae almost contiguous) and many short setae on ventral margin; tibiae with 15 - 17 short setae on dorsal margin and many short setae on ventral margin (four or five long setae at distal end of ventral margin); tarsi with very fine setae on dorsal margin and 16 - 18 long setae on ventral margin; tarsal claws with 12 - 13 denticles. Abdomen: Color olive brown, with no distinct pattern. Tergal surfaces with numerous fine setae and angulate scale bases; posterior margin with numerous short sharp spines. Gills on segment 1 absent; 2 - 7 platelike and somewhat elongated, with numerous marginal serrations and fine

setae, and with branched tracheation. Paraprocts (Fig. 11) with numerous minute marginal spines. Caudal filaments light brown, paler distally.

Adult: Unknown.

Etymology: The specific epithet is an allusion to the nature of the mouthparts and gills in this species, which are somewhat intermediate between those found in most typical *Acerpenna* and *Fallceon*.

Discussion: The mouthparts (Figs. 7 - 10) of *A. intermedia* appear to be somewhat intermediate between those of *Fallceon* Waltz & McCafferty and other known *Acerpenna*. The glossae and paraglossae, however, are broader than those found in *Fallceon*, and the second segment of the labial palps have a moderately developed distal projection that is absent in *Fallceon*. The combination of these characters places this species in *Acerpenna*, but the mouthparts in general may indicate a relatively plesiomorphic position of *A. intermedia* within *Acerpenna*.

In addition to mouthpart peculiarities, *A. intermedia* can be distinguished from the other species of *Acerpenna* treated herein by the spination of the paraprocts (Fig. 11) and the presence of a frontal keel (Fig. 6).

Acerpenna naranjoi (Kluge), new combination

Baetis naranjoi Kluge, 1992: 19.

Kluge (1992) described *A. naranjoi* from southeastern Cuba. We have not been able to examine this material, but from its abbreviated description it appears to differ from other Latin American *Acerpenna* treated herein by its distinctly patterned caudal filaments, which have two narrow brown bands on the cerci and a narrow brown medial band on the terminal filament [Fig. 3(7) (Kluge, 1992)]. On the basis of the few larval characters described, *A. naranjoi* might be closely related to *A. boriquirensis* and *A. pletura*. Presently, this is the only Latin American species of *Acerpenna* for which the adult is known. The male adult of *A. naranjoi* has anteriorly divergent turbinate eyes [Fig. 3 (18) (Kluge, 1992)], lacks hindwings, and does not possess a conical process in the basal segment of the genital forceps [Fig. 2 (6) (Kluge, 1992)].

Acerpenna pletura Lugo-Ortiz & McCafferty, new species

Material examined. Holotype: Male larva, Nicaragua, Presa El Clavo, IX/10/80, Sandra, deposited at PERC. Paratypes: Two male and three female larvae, same data and deposition as holotype. Additional material examined: Eight larvae, Belize, Cayo Prov., Roaring Creek, Riffle, VI/20/74, V. Resh, deposited at PERC; two larvae, Belize, Sibun River, Gracy, VI/19/74, V. Resh, deposited at PERC; one larva, Costa Rica, Guanacaste Prov., Río Tenorio at Finca La Pacífica, E of Panamerican Highway, II/8-11/69, W.P. McCafferty, deposited at PERC; two larvae, Costa Rica, Limón Prov., Río Banano, 16 km WSW of Bomba, 9.888° N/83.167° W, 150 m, III/26/87, Holzenthal, Hamilton, and Heyn, deposited at FAMU; two larvae, Honduras, Cortes Prov., Chamalech, Río Chamel, X/18/64, J.S. Packer, deposited at PERC; two larvae, Mexico, Tamaulipas Prov., Río Frío, XII/20/39, L. Berner, deposited at PERC; one larva, same locale, collector, and deposition, XII/21/39; 13 larvae,

same locale, collector, and deposition, XII/24/39; one larva, Mexico, Culinavara, I/1/48, deposited at PERC.

Larva: Body length: 4.8-5.0 mm; caudal filaments: 2.0 mm. Head: Color yellowish brown, with no distinct pattern. Antennae yellowish brown; scapes and pedicels bare. Frontal keel absent. Labrum sclerotized posteriorly, with deep anteromedial emargination; submedial setae present; submarginal setae inconspicuous; numerous fine setae scattered throughout dorsal surface; marginal setae branched. Right mandible (Fig. 12) 3 (1) + 1 + 3; short row of fine setae at base of denticles; tuft of setae between prosthema and molars and base of molars; very fine seta at distal end of molars. Left mandible (Fig. 13) 3 (1) + 1 + 3; tuft of setae between prosthema and molars (sometimes very small); triangular process at base of molars. Maxillae robust; palps extending as far as galealacinia; palp segment 1 very short; segments 2 and 3 subequal, with scattered fine setae. Labium compact and robust; palp segment 1 as long as segments 2 and 3 combined; segment 2 with thumblike projection and four or five dorsal setae; distal end of thumblike projection and segment 3 with scattered fine setae; glossae basally broad, tapering distally, shorter than paraglossae, with eight setae on medial margin and nine to ten on lateral margin; paraglossae broad, with four rows of weakly pectinate setae apically and four or six dorsal setae. Thorax: Nota yellowish brown, with no distinct pattern. Sterna yellowish brown. Hindwingpads absent. Legs yellowish brown; femora with 17 - 18 long setae on dorsal margin (distal two setae almost contiguous) and many short setae on ventral margin; tibiae with 10- 12 short setae on dorsal margin (distal seta longer than other setae) and 13 - 14 short setae on ventral margin (distal two setae longer than other setae); tarsi with 13 - 14 long setae on ventral margin and three or four short setae on dorsal margin; tarsal claws with 10 - 11 denticles. Abdomen: Color yellowish brown, with no distinct pattern. Tergal surfaces with numerous fine setae and angulate scale bases; posterior margin with numerous short sharp spines. Gill on abdominal segment 1 absent; 2 - 7 platelike, somewhat elongated, poorly tracheated, and with numerous marginal serrations and fine setae. Paraprocts (Fig. 14) with 11 - 13 sharp marginal spines. Caudal filaments yellowish brown, with broad brown band medially.

Adult: Unknown.

Etymology: The specific epithet is a Latin word meaning abundant. It is an allusion to the widespread distribution of the species in Mesoamerica.

Discussion: *Acerpenna pletura* is known from throughout much of Mexico and Central America. Some Mexican populations of this species have a dorsal white stripe along the abdomen, but no other morphological differences could be found to distinguish them as a separate species from other Mexican and Central American populations.

The spination of the paraprocts (Fig. 14) and the brown medial band of the caudal filaments distinguish *A. pletura* from all other known *Acerpenna*.

Acerpenna robacki Lugo-Ortiz & McCafferty, new species

Material examined. Holotype: Female larva, Peru, Loreto Prov., Río Rondos, nr Iquitos, S.S. Roback, IX/29/55, deposited at ANSP.

“Genus 1 nr *Pseudocloeon*” Sp. 5 Roback, 1966: 135.

Larva: Body length: 5.4 mm; caudal filaments: broken [3.0 mm, according to Roback (1966)]. Head: Coloration pale, with no distinct pattern. Antennae pale; scapes and pedicels bare. Frontal keel absent. Labrum lightly sclerotized posteriorly, with deep anteromedial emargination; submedial setae present; submarginal setae inconspicuous; numerous fine setae scattered over dorsal surface; marginal setae branched. Right mandible 3 (1) + 1 + 4; short row of fine setae at base of denticles; tuft of setae between prostheca and molars and base of molars; very fine seta at distal end of molars. Left mandible 3 (1) + 1 + 3; few setae between prostheca and molars; triangular process at base of molars. Maxillae robust; palps extending slightly beyond galealacinia; segment 1 very short, segments 2 and 3 subequal and with scattered fine setae. Labium robust and somewhat elongated; palp segment 1 as long as segments 2 and 3 combined; segment 2 with thumblike projection and six setae dorsally; distal end of thumblike projection and segment 3 with scattered fine setae; glossae broad, tapering distally, shorter than paraglossae, with six or seven setae medially and nine to ten setae laterally margins; paraglossae broad, with three rows of weakly distally pectinate setae at apex and one or two dorsal setae present. Thorax: Nota pale, with no distinct color pattern. Sterna pale. Hindwingpads absent. Legs pale; femora with 21 -22 long setae on dorsal margin (distal two setae almost contiguous) and many short setae on ventral margin; tibiae with 26 - 27 short setae on dorsal margin and many short setae on ventral margin; tarsi with six or seven short setae on ventral margin and 12 - 13 long setae on dorsal margin; tarsal claws with 12 - 13 denticles. Abdomen: Color pale, with no distinct pattern. Tergal surfaces with sparse fine setae and angulate scale bases; posterior margin with short sharp spines. Gills present on abdominal segments 1 - 7, elongated, with numerous marginal serrations and fine setae, but not tracheated. Paraprocts (Fig. 15) with 10 long slender marginal spines. Cerci [after Roback (1966)] ca 2.0 x terminal filament, with median and preapical brown bands; terminal filament with brown median band.

Adult: Unknown.

Etymology: We name the species after Selwin S. Roback, who collected it and recognized its uniqueness over 25 years ago.

Discussion: Roback (1966) described five unnamed species from the Peruvian-Amazon region but could not place them exactly to genus. Without examining Roback's material, Kluge (1992) considered it assignable to *Baetis* (*Americabaetis*). Our examination of Roback's material revealed that at least four of the five species (sp. 1, sp. 2, sp. 4, and sp. 5) are referable to *Acerpenna*. Species 3 could not be found; however, Roback's (1966) description and figures of that species indicate that it also belongs to *Acerpenna*. Unfortunately, most of Roback's

material is in poor condition. As a consequence we can redescribe and assign a name only to Sp. 5.

Acerpenna robacki can be differentiated from other known species of Latin American *Acerpenna* by the coloration of the caudal filaments and spination of the paraprocts (Fig. 15). It also differs from Mesoamerican species by retaining the first pair of gills, as do those species known from north of Mexico. In this respect, Kluge (1992) indicated that Roback's Genus 1 nr *Pseudocloeon* was identical to his *Americabaetis*; however, Roback (1966) had clearly stated in his descriptions that the larvae possessed the first gill pair.

Acknowledgments

We thank the following individuals for the loan of the material used in this study: D. Azuma (Academy of Natural Sciences of Philadelphia); J.K. Liebherr (Cornell University, Ithaca, NY); and R.W. Flowers and M.L. Pescador (Florida A & M University, Tallahassee). We also thank R.D. Waltz (Indiana Department of Natural Resources, Indianapolis) for discussing the subject, and A.V. Provonsha (Purdue University, West Lafayette, IN) for the line drawings. This paper has been assigned Purdue Experiment Station Journal No. 13834.

References

- KLUGE, N.Y. (1992): Cuban mayflies of the family Baetidae (Ephemeroptera). 2. Subgenera *Caribaetis* subgen. n. and *Americabaetis* subgen. n. of the genus *Baetis* s. 1. Zool. Zh., 4: 13-20 (in Russian).
- LUGO-ORTIZ, C.R. & W.P. MCCAFFERTY (1993): Genera of Baetidae (Ephemeroptera) from Central America. Entomol. News, 104: 193-197.
- MCCAFFERTY, W.P. & D.K. MORIHARA (1979): The male of *Baetis macdunnoughi* Ide and notes on parthenogenetic populations within *Baetis* (Ephemeroptera: Baetidae). Entomol. News., 90: 26-28.
- MCCAFFERTY, W.P. & R.D. WALTZ (1990): Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. Trans. Amer. Entomol. Soc., 116: 769-799.
- MORIHARA, D.K. & W.P. MCCAFFERTY (1979): The *Baetis* larvae of North America (Ephemeroptera: Baetidae). Trans. Amer. Entomol. Soc., 105: 139-221.
- ROBACK, S.S. (1966): The Catherwood Foundation Peruvian-Amazon Expedition. VI. Ephemeroptera nymphs. Monogr. Acad. Nat. Sci. Philadelphia., 14: 129-199.
- TRAVER, J.R. (1938): Mayflies of Puerto Rico. J. Agric. Univ. Puerto Rico., 22: 5-42.
- WALTZ, R.D. & W.P. MCCAFFERTY (1987): New genera of Baetidae previously included in *Baetis* Leach (Ephemeroptera). Ann. Entomol. Soc. Amer., 80: 667-670.