*International Quarterly of Entomology (1985)* **1**, *1-7.*

# *Amercaenis:* new Nearctic genus of Caenidae (Ephemeroptera)

A. V. PROVONSHA and W. P. McCAFFERTY Department of Entomology, Purdue University, West Lafayette, Indiana, 47907, USA

ABSTRACT. A new genus, *Amercaenis,* of the family Caenidae is described and illustrated from the Great Plains area of North America. The larvae of this genus differ from *Caenis* in many respects including a well-developed third segment of the labial palpi that possesses numerous long filtering setae, and foretibiae and foretarsi that also possess long filtering setae. A keel-like ridge of the operculate gills, filtering setae, elongated labial palpi, and several other derived character states are shared with the Old World genus *Clypeocaenis,* indicating a recent common ancestry with that group. *Clypeocaenis,* however, appears relatively more highly derived on the basis of several character state differences, such as more ordered filtering setae. *Amercaenis ridens* (McDunnough) comb. n., is redescribed in detail. Adults of *Amercaenis* are not as clearly differentiated, and methods of separating them from species groups of *Caenis* are discussed.

## Introduction

The pannote mayfly family Caenidae has been represented in North America by the genera *Brachycercus* Curtis and *Caenis* Stephens. This fauna has been known primarily as adults, with only four of the 21 nominal species having been described as larvae (Traver, 1935; Allen and Murvosh, 1983; Roemhild, 1984). Dr. Tomas Soldan is presently reevaluating the generic status of *Brachycercus* spp., and the senior author is conducting a revision of North American *Caenis* spp. that will emphasize larval descriptions and keys.

A highly unusual and previously unknown larval form of Caenidae was recently discovered from the Republican and Niobrara Rivers of Nebraska. Adult material reared from these larvae in August, 1982, from the Republican River indicated that they were associated with adults of what has been called *Caenis ridens* McDunnough. Although consistent genus-differentiating characters are not present in the adults of this species (generic limits of adults in this family are weak at best), the larvae possess numerous character states that clearly separate them from the other 12 presently known world genera of Caenidae. A new genus is therefore here erected to accommodate this species. The larvae of all other North American species that have been described in the genus *Caenis* fall within the concept of that genus, based on the current revisionary study of that taxon. The new genus is thus presumably monospecific, although it demonstrates a close relationship with an Old World genus as will be discussed below.

Correspondence: Dr A.V. Provonsha, Department of Entomology, Purdue University, West Lafayette, Indiana, 47907, U.S.A.

***Amercaenis* gen. n.**

*Larva* (Fig. 1)

*Head.* Head capsule without tubercles. Labrum broadly emarginate medially, hirsute. Mandibles (Figs. 2, 3) with cluster of long setae near lateral margins. Maxillary palpi three-segmented; apex of galea-laciniae and terminal segment of palpi densely covered with long setae (Fig. 4). Labial palpi three-segmented, segment 3 twice as long as segment 2; ventral surface of glossae, paraglossae, and segments 2 and 3 of palpi densely covered with long setae as in Fig. 5.

*Thorax.* Shape robust. All legs subequal in size. Forecoxae of each leg pair nearly contiguous ventrally. Inner margin of foretibiae and foretarsi densely covered with long setae (Fig. 6).

*Abdomen.* Segments moderately flattened dorsoventrally; segments 7 and 8 fringed along posterior margin with short, posteriorly directed, trifurcate setae. Posterolateral projections prominent and not upcurved; projections on segment 9 as large or larger than those of preceding segments (Fig. 8). Gill 1 (Fig. 10) greatly reduced, subequal in length to mid length of abdominal segment 2. Gill 2 (Fig. 11) operculate, quadrate; lateral and posterior margins fringed with short bifurcate setae; dorsal surface covered with minute bifurcate setae; median fork of Y-ridge keel-like. Gills 3-6 with margins fringed.

*Adult*

*Head.* Eyes small and remote. Pedicel of antennae twice as long as scape.

*Thorax.* Prosternum triangular, twice as long as broad. Forecoxae of each leg pair nearly contiguous ventrally. Forewings (Fig. 13) broad; vein $ICuA_1$ forked with $CuA_2$ distad of $CuA_1$-CuP crossvein; posterior margin fringed with setae from base to tip of wing.

*Abdomen.* Male penes lobes membranous, fused; forceps short, flattened, densely covered with microspines as in Fig. 14.

*Eggs*

Shape ovoid. One polar cap present; polar cap hood-like, enveloping approximately one-fifth of egg. Chorion finely punctate, with single micropyle and no sperm guide.

***Amercaenis ridens* (McDunnough) comb. n.**

*Caenis ridens* McDunnough, 1931:256. Holotype ♀, Kansas, Lawrence, July, Mrs. L. W. Brown (Canadian National Collection, Ottawa) [examined]; Burks 1953:52.

*Larva* (Fig. 1)

Body 3.0-4.4 mm long. Head uniform dark brown with large pale spots. Antennae pale.

Pronotum dark brown, pale around median suture, often with paler submedian blotches; pale lateral margins subparallel. Mesonotum dark brown; large pale spots at wing bases. Thoracic sternites pale. Legs pale, unmarked; forefemora with transverse row of bifurcate setae (Fig. 6). Mid and hind femora covered with short bifurcate spurs; mid and hind tarsi each with four to six simple spurs on inner margin (Fig. 7) and one fimbriate spur on ventral surface near apex; hind tarsal claw with six or seven small denticles.

Abdomen broad (segment 5 approximately five times broader than long). Tergites generally dark brown, with 8 and 9 pale medially; posteromedian projection of tergite 2 long, spatulate in lateral view (Fig. 9). Lateral projections pale, margined with short spatulate setae; tergites 7-10 covered with short bifurcate setae. Sternites pale; light brown sublateral blotches usually present on posterior sternites; posterior margin of sternite 9 shallowly notched (Fig. 8). Operculate gills (Fig. 11) uniform brown; median fork of Y-ridge with short bifurcate setae; ventral surface with sublateral row of microtrichia. Caudal filaments pale; middle segments with long lateral setae subequal to length of segment; each segment with subterminal whirl of moderately long setae.

*Male Adult* (Fig. 12)

Body 2.0-2.8 mm long. Head pale yellowish white; occasionally with brownish black transverse stripe between lateral ocelli. Antennae pale.

Pronotum pale with blackish blotches in anterolateral area; posterior margin blackish; small black median spot usually present. Mesonotum pale yellowish white; median notal suture usually broadly bordered with blackish

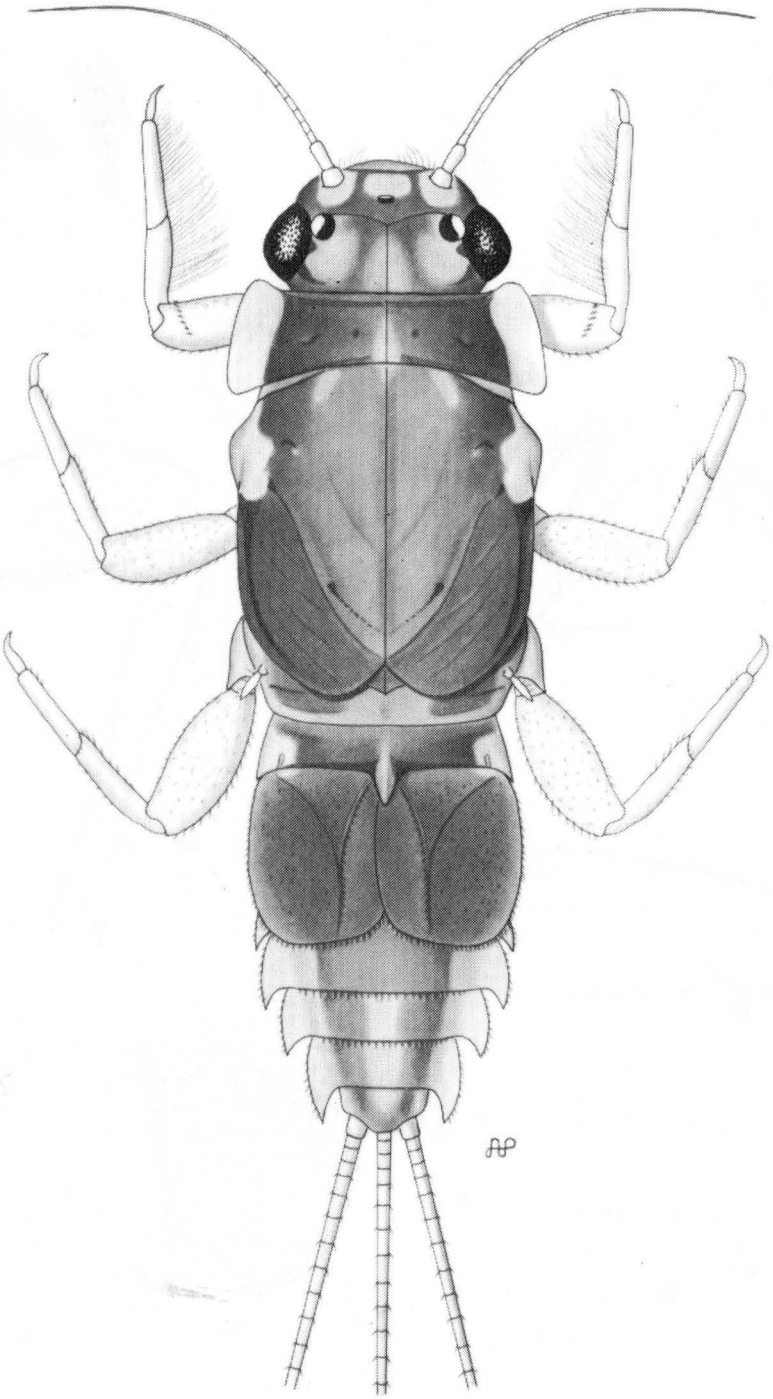
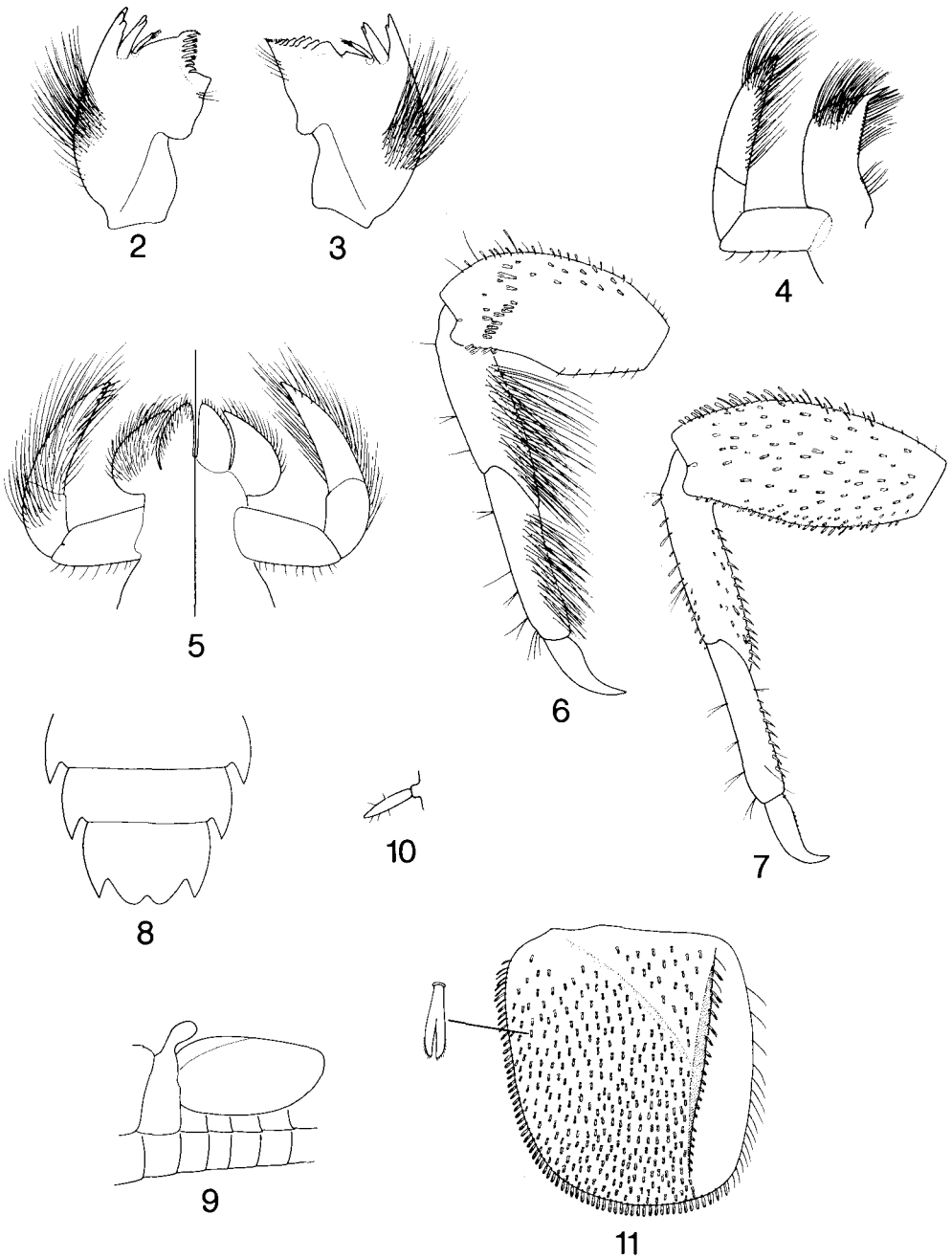


FIG. 1. *Amercaenis ridens*, larva.




FIGS. 2-11. *Amercaenis ridens,* larva. (2) left mandible; (3) right mandible; (4) maxilla; (5) labium (left, ventral; right, dorsal); (6) foreleg; (7) hind leg; (8) ventral abdominal segments 7-9; (9) lateral abdominal segments 1-7; (10) gill 1; (11) gill 2 (bifurcate seta enlarged).

brown stripe; narrow blackish, often indistinct, transverse dashes near wing bases; scutellum bordered with blackish brown. Posterior margin of metanotum narrowly black. Thoracic pleura pale yellowish white, except anteroventral area light brown. Thoracic sterna pale. Forecoxae heavily shaded with blackish; forefemora smoky; mid and hind legs pale, unmarked.

Abdomen whitish except smoky laterally on tergites 1 and 2. Tergite 2 with thin finger-like posteromedian projection. Caudal filaments pale.

*Female Adult*

Similar to male in markings. Length 3.0-4.0 mm.

*Material Examined*

*Types.* Holotype, adult female, Kansas, Douglas Co., Lawrence, July, Mrs. L. W. Brown, Canadian National Collection. Four adult female paratypes, same data as holotype.

*Non-types. Kansas:* Four larvae, Doniphan Co., Missouri R., 2 mi E 1 mi N Doniphan, 26.vi. 1979, Slater, University of Kansas (UK). Two adult males, Douglas Co., Kansas R., Eudora Bridge, 3.viii.1976, Huggins and Liechti, UK. Eight adult males, Douglas Co., Lawrence, 25.vii.1977, Liechti and Huggins, UK. 10 larvae, Douglas Co., Kansas R. at Lecompton, 28.vii.1982, Liechti, UK. 10 larvae, Jefferson Co., Kansas R. near Lecompton, 19, 20.ix.1958, S.S.R., Academy of Natural Sciences of Philadelphia (ANSP). One male adult, 13 female adults, Mitchell Co., Solomon R. below dam at Beloit, 4.viii.1977, Roth, UK. One larva, Reno Co., N Fork Ninnescah R. 3 mi S 3.2 mi E Castleton, 6.vi.1977, Liechti and Huggins, UK. 10 larvae, Shawnee Co., Kansas R., Survey 3-R near Lecompton, 17-19. ix.1958, S.S.R., ANSP. *Nebraska:* Two larvae, Cherry Co., Niobrara R., 11.vii.1977, Preuss, University of Nebraska at Lincoln. One larva, Furnas Co., Republican R., bridge S Oxford, Hwy 46, 17.vi., 9, 31.vii.1980, Decker, University of Nebraska at Omaha (UNO). 52 Male adults (five reared, with larval exuviae), 17 female adults (three reared, with larval exuviae), and 26 larvae, Furnas Co., Republican R. at Oxford, 11.viii.1982, Provonsha and Van Allen, Purdue University. One larva, Hitchcock Co., Frenchman R., first bridge S Calbertson, Hwy 17, 31.vii.1980, Decker, UNO. One larva, Red Willow Co., Republican R. bridge 1 mi S Bartley, 9.vii.1980, Decker, UNO. One larva, Webster Co., Republican R. bridge S Red Cloud, Hwy 281, 30.vii.1980, Decker, UNO.

## Biology and Ecology

*Amercaenis ridens* appears to be restricted to sandy-bottomed rivers of the Great Plains of North America. Burks' (1953) records of the species from other areas of the Midwest are based on misidentified adults. Based on collection dates of mature larvae and adults, the emergence period is in late summer and early fall.

The larvae were collected from medium to large rivers. Although found mostly in the slower, shallow reaches, they were also encountered in the main current. They are excellent swimmers and use their heavily setaceous forelegs to help propel them. They were observed to quickly cover themselves with a fine layer of sand after coming to rest on the substrate. Although feeding has not been observed, the forelegs and mouthparts strongly suggest the passive filtering of microseston.

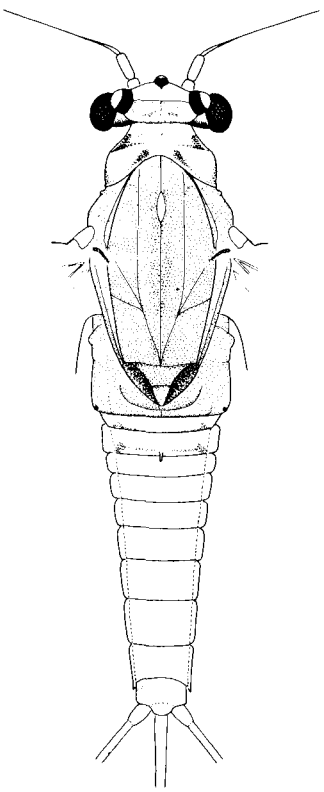
## Generic Diagnosis

There are numerous structural differences between the larvae of *Amercaenis* and *Caenis;* however, *Amercaenis* can be most easily distinguished from *Caenis* by the presence of dense, long setae on the inner margin of the foretibiae and foretarsi (Fig. 6). Only short spurs are found in this area of *Caenis* forelegs. The difference in setal development and the relative length of segment 3 of the labial palpi also obviously separates the two genera. This segment is heavily setaceous and twice as long as segment 2 (Fig. 5) in *Amercaenis* but nearly naked and subequal to or shorter than segment 2 in *Caenis*. These character states will, in fact, separate *Amercaenis* from all other caenid genera except *Clypeocaenis* Soldan, which will be discussed below.

Adults of *Caenis simulans* McDunnough and its close relatives differ from *Amercaenis* by having $CuA_1$ and $ICuA_1$ forking basad of an $ICuA_1$-CuP crossvein. Species level characteristics must be used to differentiate *Amercaenis* from *Caenis hilaris* (Say) and its close relatives. Burks (1953) described the adult of *A. ridens* and used the "hooked apices" of the male forceps as a key character. This is highly variable and shared to various degrees by many *Caenis* species including *C. hilaris*. Adults can be distinguished from the majority of *C. hilaris* by the absence of black lateral dashes on abdominal segments 7-9. Unfortunately, many light-phase *C. hilaris,* on which these black pleural dashes are obscure or absent, may be misidentified as *A. ridens*. The presence of a thin, finger-like fleshy lobe on the posteromedian margin of abdominal tergite 2 will separate *A. ridens* from *C. hilaris* and its cognates that frequently occur in the same geographic region. There are, nevertheless, other North American *Caenis* adults that also possess a small median projection on the second abdominal tergite.

## Relationships

A large number of similarities in the larvae of *Amercaenis* and the Old World genus *Clypeocaenis* appear to be synapomorphs within the family Caenidae (using other Pannota for out-group comparison) and strongly suggest, at this time, a sister relationship between these genera. These similarly derived characteristics include



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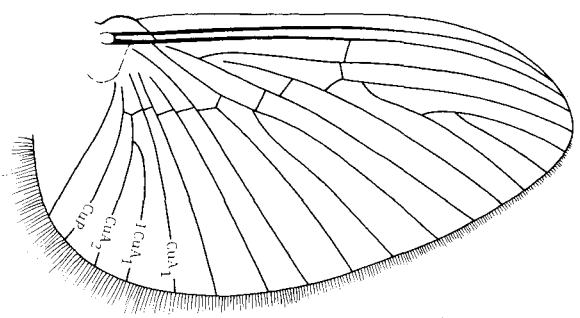


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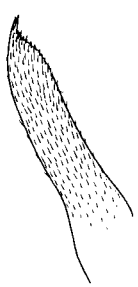

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FIGS. 12-14. *Amercaenis ridens,* adult male. (12) dorsal body; (13) forewing; (14) forcep.

increased setation on all moutparts, including filtering hairs of the palpi; minute setae on the femora, operculate gills, and abdominal cuticle; a reduced first gill; short marginal setae and keel-like ridge on the operculate gills; and short setae along the posterior margin of abdominal tergites 7 and 8. The keel-like gill ridge, presence of filtering setae on the forelegs and labia, and the elongated labial palpi are evidently unique to the two genera. The extent of minute setae has become reduced secondarily in some *Clypeocaenis* species. The exact relationship of *Amercaenis* and *Clypeocaenis* to other genera of Caenidae is difficult to hypothesize at this time due to the general lack of larval data from throughout the world; however, a *Caenis*-like ancestor appears likely.

A number of autapomorphs are found in *Clypeocaenis* that will distinguish it from the less-evolved *Amercaenis*. Thus, in *Clypeocaenis* the clypeus has developed into an oblong protrusion bearing two to four long feathered bristles (one-third to one-half the length of the antennae); in some species, toothed costae have developed on the genae between the antennae and compound eyes; the long filtering setae on the foretibiae have become differentiated into two distinct transverse rows rather than the more random situation in *Amercaenis;* in some species, the long submarginal mandibular setae also form distinct transverse rows; and in some species the lateral fork of the operculate gill Y-ridge has been totally lost.

Soldan (1983) indicated that the wing character of a "forked CuP" may prove specific for *Clypeocaenis*. This is not the case. What that worker considered as a forked CuP is in actuality $ICuA_1$ and $CuA_2$; and these latter veins share a common stem that appears to arise from a $CuA_1$-CuP crossvein. This particular arrangement is found not only in *Clypeocaenis,* but also in *Amercaenis* and many other caenid genera and probably represents the plesiomorphic condition. The marginal setae on the wing of *Clypeocaenis* extends from the base to the wing tip. Although the apical setae are much reduced in length, the marginal setae on *Americaenis* are similarly produced.

## Acknowledgments

We wish to express our thanks to Donald Azuma, Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania; Paul M. Liechti, State Biological Survey of Kansas, Lawrence, Kansas; Steele R. Lunt, University of Nebraska at Omaha, Omaha, Nebraska; and Donald W. Webb, Illinois Natural History Survey, Urbana, Illinois, for kindly loaning us specimens and to J.E.H.Martin, Biosystematic Research Institute, Ottawa, Ontario, for allowing us to examine the types of *A. ridens.* This paper is published as Purdue University Experiment Station Journal No. 10132.

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Received 3 December 1984