NEW SPECIES OF WINTER STONEFLIES, GENUS *ALLOCAPNIA* (PLECOPTERA, CAPNIIDAE)

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ABSTRACT.—Six new species of winter stoneflies from the temperate deciduous forest area of eastern North America belonging to the genus *Allocapnia* are described as follows (with the states of occurrence indicated): *A. pechumani* (N.Y.), *A. tennessa* (Tenn.), *A. frisoni* (N.Y., Pa., W. Va.), *A. petioides* (Ark., Okla.), *A. mabri* (Okla.), and *A. ohioensis* (Ind., Ky., Ohio). Diagnostic characters of the male genitalia are illustrated for each species.

One of the most intriguing genera of insects in eastern North America is the stonefly genus *Allocapnia*. The aquatic nymphs mature in very late autumn and early winter, and the adults emerge, mate, and lay their eggs from late November to late March, sometimes being active into early April in the northern part of their range. The genus is known only from the area occupied by the temperate deciduous forest and its northern ecotone area with the boreal coniferous forest.

Because of the restricted ranges of certain species in this genus, we think that these little stoneflies contribute valuable information to an understanding of faunal movements and dispersals associated with the glacial events of the Pleistocene. In the accumulation of material furthering these studies, several species new to science have been discovered, and six of them are described in this paper.

Unless otherwise specified, the types of all species described herein are deposited in the collection of the Illinois Natural History Survey, with a duplicate set of paratypes deposited in the Canadian National Museum.

SYSTEMATIC DESCRIPTIONS

The following new species of *Allocapnia* are small, dark members of the family Capniidae remarkably similar in superficial appearance and general characteristics to species already described. The diagnostic differences between these species are found in the shape of a few sclerites and processes at the terminal end of the body, associated with genitalic structures. Information concerning related species may be found in the detailed studies of Frison (1935, 1942), Hanson (1942), and Ricker (1952).

Allocapnia pechumani, new species

Male.—Length 5 mm. Color dark brown to blackish, the cerci and venter light brown, the wing veins medium brown and the membrane slightly smoky. General structure typical for genus. Wings reaching only to fourth tergite. Genitalia typical of the *A. forbesi* group, Figure 1 *A, B, C*. Process of seventh tergite high, conical from lateral view, its apex cleft to form distinct lateral lobes, Figure 1 *B*. Process of eighth tergite high, its apex cleft to form a pair of wide lobes, Figure 1 *C*. Upper supra-anal process with short, sagittate apical segment.

Female.—Length of head and body 6 mm. Color and general structure similar to male. Wings extending slightly

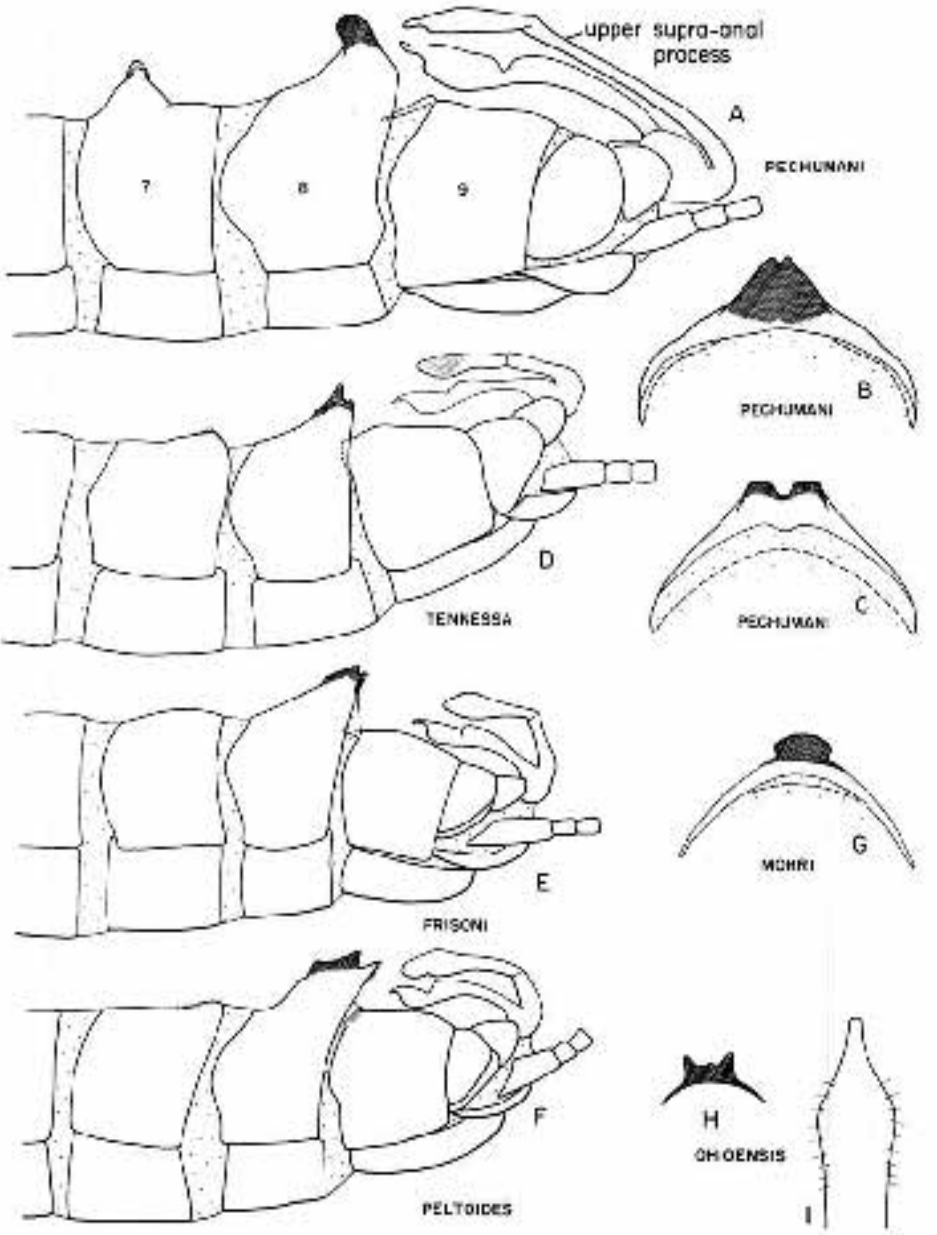

FIGURE 1.—Male genitalic structures of *Allocapnia* species. *A, D, E, F,* lateral aspect; *B,* seventh tergite, posterior aspect; *C, G, H,* eighth tergite, posterior aspect; I, tip of lower supra-anal process, dorsal aspect.

beyond the tip of the abdomen. Genital segments indistinguishable from those of *A. maria* Hanson (Ricker, 1952, Figure 116).

Holotype male, *allotype* female, and 11 male and female *paratypes*.—Starkville, Herkimer County, New York, Otsquago Creek, March 27, 1960, K. R. Chadwick. *Paratypes* — NEW YORK: Albany County, Trout Pond Creek, near Hicks Pond, Rensselaerville, April 6, 1963, L. L. Pechuman, two males; Cayuga County, Paines Creek at Route 90, Aurora, March 28, 1963, L. L. Pechuman, twelve males and four females; Greene County, tributary of West Kill, near Spruceton March 31, 1963, L. W. All, one female; Schenectady County, small stream three miles south of junction of Route 30 and Route 159, March 19, 1957, P. H. Freytag, four males; Schuyler County, tributary of Tanghannock Creek, one-tenth mile south of Mecklenburg, March 5, 1963, L. L. Pechuman, nine males and eight females; Tompkins County, Willow Creek, corner of Kraft and DuBois Roads, Ithaca, March 24, 1963, L. W. All, three males and one female. Tompkins County, Willow Creek waterfalls, five and seven-tenths miles north of Ithaca, Route 84, March 24, 1963, L. W. All, three males and one female; Tompkins County, Danby Creek, junction of Route 96 and Van Etten Road, Danby, March 29, 1963, L. W. All, 12 males and 20 females; Tompkins County, Buttermilk Falls State Park, Ithaca, March 16, 1963, L. L. Pechuman, eight males; Esperance, April 11, 1937, H. H. Ross, one male; Fredonia, April 15, 1931, H. H. Ross, six males; Ithaca, Beebe Lake, March 17, 1950, S. E. Neff, one male; Ithaca, Beebe Lake, March 26, 1950, B. Lund, one female; Starkville, Otsquago Creek, March 27, 1960, K. R. Chadwick, ten females and three males. Deposited in the collections of the Illinois Natural History Survey, the Canadian National Museum, Cornell University, and the collection of P. H. Freytag, Columbus, Ohio.

This species is most closely related to *A. forbesi* Frison but differs in having the process of the seventh tergite cleft and occupying the middle or the front half of the tergite. From *A. maria* Hanson this species differs in the wide lobes of the process of the eighth tergite.

Allocapnia tennessa, new species

Male.—Length, color, and general structure similar to the preceding. Wings absent. Cerci, Figure 1 *D*, having upper supra-anal process short, its apical segment as long as basal segment. Seventh tergite without a raised sclerous process. Process of eighth tergite moderately low, its lateral aspect pointed at tip and forming a sharp angle with the posterior portion of the segment, its posterior aspect evenly arcuate, almost exactly as in Figure 1 *G*.

Female.—Length 7 mm, color and general structure similar to male. Wings of allotype reaching almost to tip of abdomen, in paratypes varying from short (reaching only to fourth tergite) to long (extending slightly beyond tip of abdomen). Seventh and eighth sternites with their mesal area fused; eighth, ninth, and tenth tergites completely and heavily sclerotized.

Holotype male, *allotype* female, and 4 male and female *paratypes*.—Three miles north of Fayetteville, Tennessee, January 27, 1958, H. H. and J. A. Ross. *Paratypes*—TENNESSEE: Triune, January 27, 1958, H. H. and J. A. Ross, eight males; two miles south of Shelbyville, January 27, 1958, H. H. and J. A. Ross, two females; five miles northwest of Shelbyville, on U.S. Alternate 41, January 26, 1958, H. H. and J. A. Ross, two males and one female; Rutherford County, Overall Creek, near south of Allisona, January 18, 1968, H. H. and J. A. Ross, two females; Marshall County, East Rock Creek, five miles north of Lewisburg, January 18, 1968, H. H. and J. A. Ross, one male; Maury County, ten miles west of Columbia, February 11, 1962, Ross and Ross, one female; Maury County, Duck River, February 11, 1962, Ross and Ross, four males and two females.

This species is a close relative only of *A. vivipara* Claassen, differing from that species in the short basal segment of the upper supra-anal process, and the less extensive fusion of the female seventh and eighth sterna.

Allocapnia frisoni, new species

Male.—Length, color and general structure similar to the preceding. Wings reaching sixth segment. Seventh

tergite having no sclerous process. Eighth tergite, Figure 1 *E*, rising gradually posteriorly, the lateral aspect of its dorsal process appearing as a flat sloping area that is somewhat shield-shaped from dorsal view; below the tip of the process there is on each side a short, small, prominent projection bearing fine hairs. Both arms of supra-anal process short, the upper one having the apical and basal segments about equal in length.

Female.—Length 6 mm, color and general structure similar to male. Wings extending beyond apex of abdomen. Seventh and eighth sternites not fused, the mesal area of the posterior margin of the eighth sternite having a wedge-shaped shining area, indistinguishable at present from illustrations of *A. granulata* (Claassen) (Frison, 1935, Fig. 220).

Holotype male, *allotype* female, and 7 male and female *paratypes*.—Evansville, West Virginia, March 16, 1945, Frison et al. *Paratypes*.—NEW YORK: Cayuga County, Little Creek at Route 90, Aurora, March 23, 1963, L. L. Pechuman, one male and one female; Tompkins County, Ludlowville, Salmon Creek at bridge, Salmon Creek Road, January 19, 1963, L. L. Pechuman, two females and six males; Tompkins County, Ludlowville, Locke Creek at Salmon Creek Road, January 19, 1963, L. L. Pechuman, nine males and six females; Tompkins County, Ludlowville, Locke Creek at Gulf and Holden Road, January 19, 1963, L. L. Pechuman, one female; Tompkins County, Myers, Salmon Creek at bridge, January 19, 1963, L. L. Pechuman, one male; Tompkins County, Salmon Creek at Bridge, Myers, February 20, 1963, L. L. Pechuman, one male; Church Creek, near Lindley, March 14, 1963, L. L. Pechuman, one female; OHIO: Ash Cave, March 6, 1938, T. H. Frison, five males and six females; rock riffle, Athens, March 5, 1942, W. E. Stehr, two males; PENNSYLVANIA: small creek three miles west of Duncansville, March 10, 1958, P. H. Freytag and J. Dukes, two males and one female; WEST VIRGINIA: Horse Creek, Jacger, February 2, 1936, J. Addair, five males and three females; Horse Creek, Jacger, January 1, 1936, J. Addair, five males and six females; Buffalo Creek, Macomber, March 4, 1959, H. H. and J. A. Ross, one male. Deposited in the collections of the Illinois Natural History Survey, the Canadian National Museum, Cornell University, and the collection of P. H. Freytag, Columbus, Ohio.

The small, setose processes below the process of the eighth tergite indicate that of the described species of *Allocapnia* this species is most closely related to *A. granulata*. From this species *A. frisoni* differs in the flat and somewhat shield-shaped area which represents the rugose dorsal process of the eighth tergite of the male.

Allocapnia peltoides, new species

Male.—Distinguished from the preceding species only in characters of the genital segments, as follows, Figure 1 *F*: dorsal process of eighth tergite larger, its lateral aspect with the tips of the rugose area more anterior to the small haired processes than in *A. frisoni*, the dorsal aspect forming a larger shield; dorsal aspect of the upper supra-anal process almost uniform in width, not tapering at the base as in *A. frisoni*.

Female.—Indistinguishable at present from that of *A. frisoni*.

Holotype male, *allotype* female, and 1 male *paratype*.—Polk Creek, Leflore Co., Poteau, Oklahoma, Feb. 10, 1961, Ross & Ross. *Paratypes*.—ARKANSAS: Mill Creek, Scott Co., Feb. 10, 1959, Ross & Stannard, 1 male, 1 female; OKLAHOMA: 4 miles south of Lewisville, Haskel Co., Feb. 10, 1961, Ross & Ross, 1 male.

This species forms with *A. frisoni* a pair of sister species of unusual interest. It is logical to suppose that the parent of the two must have dispersed between the Appalachian region and the Ouachita region, then become separated into two isolated populations. The eastern population evolved into *A. frisoni*, the western one into *A. peltoides*.

Allocapnia mohri, new species

Male.—Length 4.5 mm. Color and general structure similar to preceding. Lateral aspect of genitalic structures as in illustrations of *A. recta* Claassen (Frison, 1935, Fig. 221). Seventh tergite without dorsal processes. Process

of eighth tergite, Figure 1 *G*, moderately low, its lateral aspect gently sloping, its posterior aspect wide, arcuate, with hardly any suggestion of a shoulder at the base. Upper supra-anal process short, wide, and thin, almost foliaceous.

Female.—Indistinguishable from that of *A. recta* (Claassen) as illustrated by Frison (1935, Fig. 213).

Holotype male, *allotype* female, and 70 male and female *paratypes*. Two miles south of Summit, Leflore County, Oklahoma, Feb. 11, 1961, Ross & Ross.

In Frison's (1935) key this species will run to *recta* (Claassen), of which it is an extremely close relative. From *A. recta*, *A. mohri* differs in the wide and arcuate apex of the process of the eighth tergite. In *A. recta* the posterior aspect of this process is much narrower and shouldered at the base.

Allocapnia ohioensis, new species

Male.—Length 6 mm. Color and general structure similar to preceding. Wings reaching fifth segment. Process of seventh tergite prominent but much smaller than that of eighth, with a suggestion of the tridentate condition. Process of eighth tergite, Fig. 1 *H*, fairly high and abrupt, posterior aspect tridentate, the middle tooth much lower than the pair of lateral teeth. Apex of lower supra-anal process, Fig. 1 *I*, tapering fairly gradually into the wider base, the tip somewhat triangular.

Female.—Seventh and eighth sternites fused, apical margin of eighth produced into a wide shiny area, projecting only a small distance beyond the lateral edge of the apical margin.

Holotype male, *allotype* female, and 10 male and 4 female *paratypes*.—Tributary of Hocking River, Coolville, Ohio, March 16, 1940, Frison et al. *Paratypes*.—INDIANA: Bryant's Creek, six miles south of Martinsville, March 25-26, 1950, W. E. Ricker, one male and three females; Center Creek, two miles south of Brooklyn, March 28, 1950, W. E. Ricker, one female; creek two miles south of Brooklyn, on Road 67, February 9, 1950, W. E. Ricker, three males; 10-Dead Creek, four miles north of Bloomington, January 5, 1950, W. E. Ricker, one male; creek northwest of Medora, February 11, 1938, T. H. Frison and C. D. Mohr, twenty-three males; Kentucky: Catlettsburg, March 10, 1959, H. H. and J. A. Ross, one male; stream northwest of Olive Hill, on Route 59 March 14, 1962, P. H. Freytag and A. B. Kunkel, one male and one female; Morehead, March 11, 1959, H. H. and J. A. Ross, thirteen males; OHIO: Ash Cave, March 6, 1938, T. H. Frison, twenty-five females and twenty-four males; Athens, Margaret Creek, March 6, 1935, T. H. Frison, one male Road 125, nine miles east of Blue Creek, March 19, 1960, W. E. Ricker, six males; Carbondale, March 6, 1938, T. H. Frison, two males; tributary of Hocking River, Coolville, March 16, 1940, T. H. Frison, thirteen males and three females; Mount Pleasant, March 6, 1938, T. H. Frison, one female; northern branch of Sunfish Creek below Pixe Lake, January 2, 1960, P. H. Freytag, twenty-two males and ten females; Turkey Creek west of Portsmouth, March 19, 1950, W. E. Ricker, one male. Some paratypes deposited in the collection of Dr. Paul Freytag, Columbus, Ohio.

This species is remarkably close to *A. indianae* Ricker, which differs from *A. ohioensis* in having a narrow and tongue-like apex of the lower supra-anal process and in having the mesal tooth of the process of the eighth tergite as high as the lateral ones. Ricker segregated many of the above paratypes from the paratype series of *A. indianae*.

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