

## SOUTHEASTERN SPECIES OF THE MAYFLY SUBGENUS *SERRATELLA* (*EPHEMERELLA*: EPHEMERELLIDAE)<sup>1</sup>

LEWIS BERNER<sup>2</sup> AND RICHARD K. ALLEN<sup>3</sup>

Presently three species of the subgenus *Serratella* of the genus *Ephemerella* are known to occur in the southeastern United States. We are describing two new species, reporting two additional ones from this region, and discussing the other three. *Ephemerella serrata* Morgan, a boreal species, ranges southward into the Appalachian highlands of North Carolina, while the range of *E. deficiens* Morgan, reported as *Ephemerella* sp. A by Berner (1950, 1958), continues as far south as northern Florida. The range of *E. serratoides* McDunnough is also greatly increased as a result of our findings. To these records, we now add the occurrence of *E. sordida* McDunnough and *E. frisoni* McDunnough in the southeast. Both of the new species, described below, have been collected in North Carolina and Tennessee.

The subgenus *Serratella* is widely distributed in North America, occurring from coast to coast over most of the continent. Records from the central area are still scarce, probably due to unsatisfactory ecological situations for the nymphs, a stage which is dependent on flowing water. The ranges of six of the seven species reported here overlap in the southeast with the Appalachians being the common meeting ground. *Ephemerella deficiens*, the most adaptable of the species, is most widely dispersed.

The nymphs of all the species require essentially similar habitats and their behaviors are alike. All require swiftly-flowing streams, generally where there are rocks, and the nymphs live either in rock crevices or in dense mats of vegetation where they are well protected from the force of the current.

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### *Ephemerella* (*Serratella*) *carolina* n. sp.

Traver. 1932. Jour. Elisha Mitchell Sci. Soc., 47(2): 178 (*Ephemerella* sp?, No. 2).

MATURE NYMPH. Length: body 4.5-5.0 mm.; caudal filaments 1.5-2.0 mm. *Head* brown with variable darker brown markings, well-developed occipital tubercles covered with fine spicules in both male (Fig. 2) and female, maxillary palpi reduced and unsegmented (Fig. 10). *Thorax* brown

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<sup>2</sup> Department of Biology, University of Florida, Gainesville.

<sup>3</sup> Department of Zoology and Entomology, University of Utah, Salt Lake City.

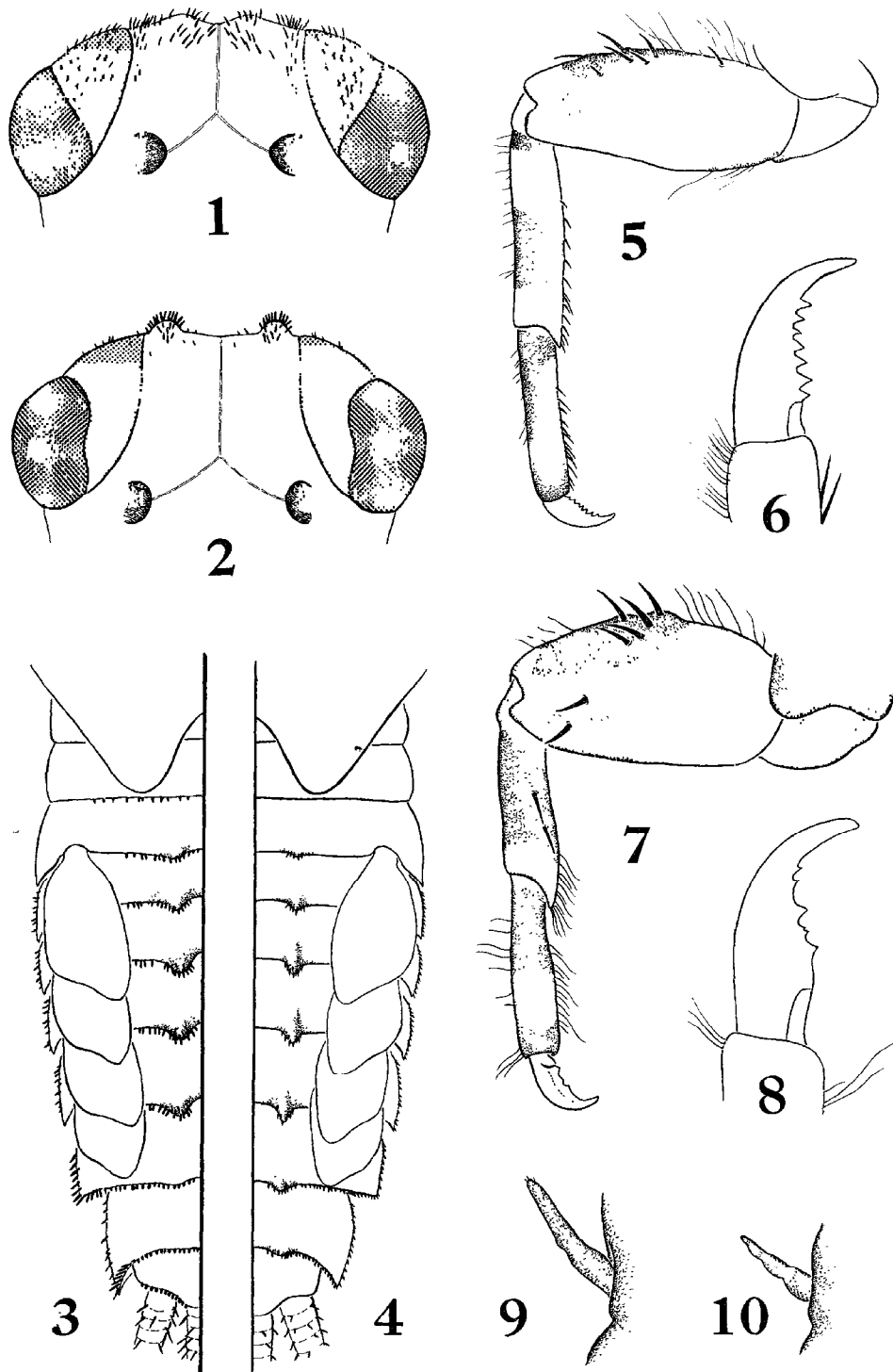


Fig. 1. *Ephemerella spiculosa*, vertex of nymphal head. Fig. 2. *E. carolina*, vertex of nymphal head. Fig. 3. *E. spiculosa*, half of abdominal terga of mature nymph. Fig. 4. *E. carolina*, half of abdominal terga of mature nymph. Figs. 5-6. *E. spiculosa*, fig. 5. right nymphal foreleg, fig. 6. tarsal claw. Figs. 7-8. *E. carolina*, fig. 7. right nymphal foreleg, fig. 8. tarsal claw. Fig. 9. *E. spiculosa*, maxillary palp. Fig. 10. *E. carolina*, maxillary palp.

with variable dark-brown and pale markings. Pronotum usually brown with a dark-brown, submedian macula, antero-lateral portion pale, enclosing a dark-brown mark; paired, submedian tubercles covered with fine spicules. Mesonotum brown with variable dark-brown and pale markings; paired, submedian tubercles, and a single posterior median tubercle all covered with fine spicules. Legs pale with brown markings; forefemora as in Fig. 7; middle and hind femora with an entire or interrupted brown, transverse band in basal third; tibiae with a variable dark-brown band near the middle; tarsi with proximal and distal bands; tarsal claws with 5-7 denticles (Fig. 8). *Abdominal terga* brown with dark-brown and pale markings; terga 4-6 usually pale while terga 7-9 are usually dark-brown to black; paired, dorsal, submedian tubercles on segments 3-9, tubercles on segments 4-8 well developed, those on segments 3 and 9 often reduced (Fig. 4); posterior margins of terga 8 and 9 only with numerous fine spicules; abdominal sterna reddish-brown, with darker, reddish-brown, lateral margins, or abdominal sterna unicolorous dark-brown. Caudal filaments pale with variable dark-brown, transverse bands.

HOLOTYPE: ♂ nymph, Buck Creek, Macon Co., N. C., Aug. 6, 1948, Lewis Berner, No. 3184.5, U. of Fla. collections.

PARATYPES: *North Carolina*: 7 ♂ and 3 ♀ nymphs, Great Smoky National Park, Oconaluftee River, July 25, 1957, L. B., 2 ♂ and 1 ♀ nymphs in collection of U. of Utah, 5 ♂ and 2 ♀ nymphs, No. 3983.0, in collection of U. of Fla.; 1 ♀ nymph, 1 mile west of Wayah Gap, Macon Co., July 29, 1957, L. B., No. 3987.3, in collection of U. of Fla.; 5 ♀ nymphs, Wayah Creek, Macon Co., Aug. 21, 1955, L. B., 2 nymphs in collection of U. of Utah, 3 nymphs, No. 3674.1, in collection of U. of Fla.; 5 ♂ and 4 ♀ nymphs, Wayah Creek, Macon Co., Aug. 17, 1960, L. B., 1 ♂ and 1 ♀ nymph in collection of U. of Utah, 4 ♂ and 3 ♀ nymphs, No. 4261.0, in collection of U. of Fla.; 1 ♀ nymph, 0.9 mi. from Hq., Coweeta Exp. Forest, Macon Co., July 30, 1957, S. and D. Mulaik, in collection of U. of Utah; 3 ♂ nymphs, Buck Creek, Macon Co., Aug. 19, 1948, L. B., No. 3187.19, in collection of U. of Fla.; 1 nymph, Paceolet River, Polk Co., July 27, 1955, L. B., No. 3764.6, in collection of U. of Fla.; 1 ♀ nymph, Indian Creek, Swain Co., Aug. 20, 1954, L. B., No. 3621.3, in collection of U. of Fla.; 1 ♀ nymph, Davidson River, June 30, 1930, in private collection of J. R. Traver, Amherst, Mass.; 3 ♀ nymphs, Smokemont, Aug. 2, 1930, H. T. Spieth, in collection of Amer. Mus. Nat. Hist.; 1 ♂ nymph, Smokemont, Aug. 3, 1930, H. T. Spieth, in collection of Amer. Mus. Nat. Hist. *Tennessee*: 1 ♂ nymph, Elkmont, Aug. 11, 1930, H. T. Spieth, in collection of Amer. Mus. Nat. Hist.

#### TAXONOMY

The nymphs of *Ephemerella carolina* appear to be most closely related to those of *E. serrata* Morgan and *E. spiculosa* n. sp. as they all possess paired, submedian, prothoracic tubercles. The nymphs of *E. carolina* may be readily distinguished from the nymphs of *E. serrata* and *E. spiculosa* and all other known species of the *Serratella* as they possess well-developed, paired, occipital tubercles (Fig. 2). The nymphs of *E. carolina* may be further distinguished from all other species of the subgenus by the number and development of the paired, submedian abdominal tubercles (Fig. 4), the development and shape of the maxillary palpi (Fig. 10), the shape,

coloration, and armature of the foreleg (Fig. 7), and the dentition of the tarsal claws (Fig. 8).

#### BIOLOGY

The nymphs of *E. carolina* seem to be restricted to streams at an altitude of not less than 2500 feet elevation. The range of the species is evidently limited as all collections are confined to North Carolina, except that of Spieth from Elkmont in the Great Smokies National Park. The rarity of the nymphs is attested by the scarcity of specimens in numerous collections from the mountainous regions of North Carolina and Tennessee, and their absence from those of South Carolina and Alabama.

Nine nymphs were collected in August, 1960, from Wayah Creek, and at this time it was a rocky-bottomed stream varying from 8-12 inches in depth and about 20 feet in width. Coarse sand was interspersed among the rocks and part of the bed was made up of this coarse material. Vegetation was sparse except for algae growing in small masses in the slowly flowing parts of the stream. Stream flow was moderate to swift, as in most mountain streams of this region, and the water was clear, colorless, and about 72°F.

Nymphs of *E. carolina* were taken from the rocks in the stream bed by use of a net held downstream while the rocks were vigorously disturbed. Nymphs probably rest on the downstream side of the rocks or in crevices where they are well protected from the current. Their movements were slow and deliberate when taken from the water and resemble those of *E. deficiens*, a closely related species. Because of the mature state of the nymphs taken at Wayah Creek, we estimate emergence of adults occurs in late August or early September.

#### *Ephemerella (Serratella) spiculosa* n. sp.

**MATURE NYMPH:** Length: body 4.0-4.6 mm.; caudal filaments 1.7-2.0 mm. *Head* brown with a dark-brown mark near each lateral ocellus; without occipital tubercles; top of head with numerous, fine spicules (Fig. 1); labrum dark-brown; maxillary palpi reduced, unsegmented, and with fine apical spicules (Fig. 9). *Thorax* with brown markings, covered with fine spicules. Prothorax with two small, submedian tubercles covered with fine spicules, suture between pronotum and mesonotum dark-brown. Mesonotum pale with brown markings, covered with fine spicules, two submedian, brown marks, two sublateral, dark-brown dots, and a dark-brown, V-shaped mark which follows the mesal margin of each wing pad. Legs pale with brown markings; forefemora marked as in Fig. 5; middle and hind femora with a brown band in basal third; tibiae with a proximal, brown mark and a median, brown band; tarsi with a proximal, brown band and a distal, brown mark; tarsal claws with 6-8 denticles (Fig. 6). *Abdominal terga* light-brown with dark-brown, nerve-like lines; terga 1-3 with two wide, submedian, dark-brown stripes; paired, dorsal, submedian tubercles on segments 3-7 covered with fine spicules; segments 2, 8, and 9 with slight undulations (Fig. 3); posterior margins of segments 8-10 with numerous, fine spicules. *Abdominal sterna* pale with brown, posterior margins; sterna 3-7 with darker-brown, sublateral marks; sternum 9 with a few, fine spicules. Caudal filaments pale with dark-brown, transverse bands.

HOLOTYPE: ♂ nymph, Horse Creek Recreation Area, Green Co., Tennessee, Aug. 3, 1956, C. D. Hynes, No. 3829.6, in collection of U. of Fla.

PARATYPES: *North Carolina*: 2 ♀ nymphs, Macon Co., Skittles Creek, July 16, 1957, C. D. Hynes, No. 3974.0, in collection of U. of Fla.

#### TAXONOMY

*Ephemerella spiculosa* is most closely related to *E. carolina* and *E. serrata* Morgan. The nymphs of all of these species have paired, submedian, prothoracic tubercles and fine spicules on the body segments. These nymphs may be readily separated as *E. carolina* has well developed occipital tubercles, *E. serrata* has small suboccipital tubercles, while the head of *E. spiculosa* lacks them. The nymphal heads of *E. carolina* and *E. serrata* have only a few scattered spicules, while the nymphal head of *E. spiculosa* is clothed with numerous fine spicules (Fig. 1). *Ephemerella spiculosa* may further be distinguished from these species and all others of the subgenus *Serratella* by the dentition of the tarsal claws (Fig. 6), the development and shape of the maxillary palpi (Fig. 9), the number and development of the paired, submedian, abdominal tubercles (Fig. 3), and the shape, coloration, and armature of the foreleg (Fig. 5).

#### BIOLOGY

A single nymph of *E. spiculosa* was taken from Horse Creek, a small stream near Greenville, Tennessee. At the time the collection was made, the stream varied from 6-12 inches in depth and 3-6 feet in width and is fairly typical of those found in the mountains of eastern Tennessee. The bottom was composed of bedrock covered with sand and contained numerous loose rocks and large boulders. During the fall of the year, the creek dries up to a series of pools, leaving the stream bed completely dry in some places (Wright and Berner, 1949). Although Dr. Mike Wright and his students collected extensively in the mountain streams of eastern Tennessee, they apparently took no specimens of *E. spiculosa* as all of their nymphs were sent to one of us (Berner) for identification and none of this species appeared in their collections.

It is likely that the nymphs of *E. spiculosa* hide in rock crevices or protected places in the stream much as do other members of the subgenus *Serratella*. Confirmation of this type of habitat is provided by the site of the second collection from North Carolina. Here the rocks from which the nymphs were collected had much moss and silt on them, yet the water was swiftly flowing.

This species, as is the case with *E. carolina*, has been found only in the mountainous areas of the Southeast. It probably requires cold, swiftly-flowing water for development.

#### *Ephemerella (Serratella) sordida* McDunnough

This species, described from Quebec by McDunnough (1925), was subsequently reported from Ontario by Ide (1930). The collections listed below extend the range of *E. sordida* through the Appalachians into Virginia, North Carolina, Tennessee, and southward into the northern Coastal Plain of Alabama.

The nymphs of *E. sordida* occurred in swiftly flowing streams varying in size from 15 feet in width and rather shallow to large rivers such as the Cahaba in Alabama. The nymphs lived in crevices or in protected places on loose rocks in the stream bed. Although generally there was moss growing on the surface of the stones, nymphs of this species apparently did not live in it.

LOCALITY RECORDS: (all specimens in University of Florida collections) *Alabama*: Perry Co., Cahaba River, May 10, 1955, C. D. Hynes, 1 nymph, No. 3710.0; Walker Co., Black Water Creek, June 14, 1954, C. D. Hynes, 25 nymphs, No. 3492.15, 10 ♂, 10 ♀ adults, No. 3492.6. *North Carolina*: Macon Co., Highlands, July 19, 1957, C. D. Hynes, 1 ♂ adult, No. 3979.0. *Tennessee*: Cumberland Co., 10.5 miles N.W. of Rhea-Cumberland Co. line, Tenn. Hwy. 68, July 27, 1956, C. D. Hynes, 1 nymph, No. 3810.6. *Virginia*: Montgomery Co., Radford Arsenal, June 3-7, 1957, R. L. Hoffman, 3 ♂, 3 ♀ adults, No. 4001.0; same data, mid-August, 1951, R. L. H., 3 ♂, 1 ♀ adults, No. 3998.2.

*Ephemerella (Serratella) frisoni* McDunnough

*Ephemerella frisoni*, previously known only from Illinois and Missouri (Burks, 1953), has been taken in the northwestern corner of Alabama. The nymphs occurred in a swiftly-flowing, large stream, varying from rather shallow to quite deep. The creek bottom was composed of bedrock with loose stones scattered over it. There was a heavy deposit of silt over the stones and many of them had vegetation attached. It was in the vegetation that the nymphs of *E. frisoni* occurred commonly. The plants grew most profusely not more than six inches below the surface, although they could be found growing well as far down as one foot. The single adult male was taken at light shortly after dark.

LOCALITY RECORDS: (all specimens in U. of Fla. collections) *Alabama*: Lauderdale Co., Cypress Creek at northern city limits of Florence, June 10, 1956, L. B. and C. D. Hynes, 1 ♂ adult, No. 3879.6, 30 nymphs, Nos. 3878.8 and 3878.13.

*Ephemerella (Serratella) serrata* Morgan

During our years of collecting in the streams of the Southeastern United States, we have not encountered *Ephemerella serrata*, although the closely related *E. carolina* has been found in many places in the Appalachian highlands. *E. serrata* is widely distributed through the eastern part of North America, having been reported by Morgan (1911) from New York and Massachusetts, Quebec by McDunnough (1931), and from Maryland, West Virginia, and three stations in the Appalachian region of North Carolina by Traver (1935).

Presently, we have adult males and females which may be either *E. serrata* or *E. carolina* but we will not be able to name them with certainty until we have an opportunity to obtain reared specimens for comparison. We are, therefore, not including these records in this paper.

*Ephemerella (Serratella) serratoides* McDunnough

*Ephemerella serratoides* is a widely distributed species ranging from Quebec, Ontario, Nova Scotia, and New Brunswick southwards as far as

southern Georgia. In the southeast, the species was found in the mountains, the piedmont, and the coastal plain.

Periods of emergence of adults show a considerable degree of variation as we have mature nymphs from Tennessee taken in April which would have emerged late that month or in early May, while specimens from northern Georgia collected in mid-August included many which would not have emerged until September. In addition, the northern Georgia collection includes half-grown nymphs which likely would have emerged the following spring. McDunnough's (1931) adult specimens were collected from mid-July to mid-August. Our earlier as well as later emergence dates are probably a reflection of the higher water temperatures in the southern streams.

The nymphs of *E. serratoides* were generally found in swiftly-flowing, rocky-bottomed streams. Many of the rocks in these streams were moss-covered on their upper surfaces and nymphs of *Ephemerella* occurred buried in these masses of vegetation. When the rocks were removed from the stream and the water allowed to drain away, the nymphs began to crawl upward and were easily detected. The mosses grew in shallow water and the nymphs, therefore, were only a few inches below the water surface. Because of the denseness of the plants, the nymphs were protected from the force of the current and could move about freely near the base of the plants where they fed. Movements were slow and deliberate as is true of all members of the subgenus *Serratella*.

The Ichawaynochaway Creek, a tributary of the Flint River in southern Georgia, is a swiftly-flowing, deep stream coursing over a limestone bed. Rocks are strewn over the bottom which is overlaid with coarse sand. Cypress trees formerly grew at the banks where collections were made but they have now been cut with only the stumps remaining. Mosses grow profusely on the upper surfaces of the rocks as well as on the submerged parts of the tree stumps and it was in these habitats that the nymphs of *E. serratoides* were found.

At the Etowah River, also in Georgia, the nymphs were found in numbers living near the bases of the riverweed, *Podostemum ceratophyllum* Michx. These specimens were collected by removing rocks to which the plant was attached, allowing the water to drain away, and watching the nymphs as they climbed about in the drying plant. The Etowah, in the region where the collections were made, is a swiftly-flowing stream, approximately 150 feet wide and shallow. The bottom is sandy with rocks scattered over it.

LOCALITY RECORDS: (all specimens in University of Florida collections)  
*Alabama*: Coosa Co., 11.8 miles s. of Coosa-Talladega County line, Hwy. 281, June 19, 1954, C. D. Hynes, 15 nymphs, No. 3504.0; Shelby Co., Davis Creek west of Montevallo, June 18, 1954, CDH, 8 nymphs, No. 3502.1  
*Georgia*: Baker Co., Ichawaynochaway Creek at Hwy. 91, May 15, 1954, L. Berner, 6 nymphs, No. 3471.0; Cherokee Co., Etowah River near Gober, June 20, 1956, CDH, 8 nymphs, No. 3902.21, June 23, 1955, CDH and LB, 50 nymphs, No. 3716.11, July 30, 1954, CDH, 6 nymphs, No. 3609.5, Aug. 18, 1956, CDH, 3 nymphs, No. 3823.3; Lumpkin Co., Chestatee River at Hwy. 52, Aug. 13, 1955, CDH and LB, 30 nymphs, No. 3714.10, Yahoola Creek near Dahlonga, July 20, 1955, CDH, 7 nymphs, No. 3762.4, Aug. 19, 1956, CDH, 2 nymphs,

No. 3824.4. Pickens Co., Hwy. 5, 1.7 miles s. of junction with Hwy. 136, June 21, 1956, CDH, nymphs, No. 3903.5. *North Carolina*: Graham Co., Santeetlah Creek, Joyce Kilmer Forest road, Aug. 18, 1954, LB, 2 nymphs, No. 3618.0; Macon Co., Franklin, July 9, 1957, CDH, 1 ♂, 8 ♀ adults, No. 3972.1, Big Creek near Highlands, Aug. 2, 1948, LB, 3 nymphs, No. 3178.1, Buck Creek, Aug. 9, 1948, LB, 1 nymph, No. 3187.18, Nantahala River, Aug. 16, 1954, LB, 25 nymphs, No. 3615.3, Aug. 21, 1954, LB, 15 nymphs, No. 3623.3, Ellijay Creek at Hwy. 90, Aug. 21, 1955, CDH and LB, 1 nymph, No. 3673.7; Polk Co., Paceolet River, July 27, 1955, CDH and LB, 15 nymphs, No. 3764.7; Randolph Co., 3.5 miles s. of Coleridge at Hwy. 22, July 5, 1955, CDH, 2 nymphs, No. 3733.9; Swain Co., Smokemont, June 25, 1957, CDH, 1 ♀ adult, No. 3961.7, Deep Creek at Bryson City, Aug. 15, 1954, LB, 25 nymphs, No. 3613.14, Cherokee, July 8, 1957, CDH, 1 ♂ adult, No. 3969.3; Transylvania Co., Hwy. 276 s. of Brevard, June 17, 1955, CDH, 2 nymphs, No. 3581.4; Union Co., Richardson Creek at Hwy. 218, July 7, 1955, CDH, 1 nymph. *South Carolina*: Greenville Co., North Saluda River at Hwy. 11, Aug. 5, 1955, CDH, 3 nymphs, No. 3856.6; Laurens Co., South Rabon Creek at Hwy. 76, June 9, 1955, CDH, 50 nymphs, 1 ♂ subimago, No. 3562.0. *Tennessee*: Franklin Co., 11.4 miles w. of Winchester, Hwy. 64, April 13, 1954, Jean Pugh, 5 nymphs, No. 3421.0; Robertson Co., 7 miles e. of Clarkesville at Hwy. 76, June 16, 1956, CDH, 1 nymph, No. 3885.7; Sevier Co., Pigeon Forge, July 24, 1957, CDH, 2 ♀ adults, No. 3981.8, Little Pigeon River, Aug. 5, 1956, CDH, 2 nymphs, No. 3833.10, Hwy. 411, 21 miles w. of junction with 25 E, Aug. 5, 1956. CDH, 1 nymph, No. 3834.7; Unicoi Co., Washington-Unicoi County line at Hwy. 107, Aug. 6, 1956, CDH, 15 nymphs, No. 3835.5.

*Ephemerella (Serratella) deficiens* Morgan

Berner. 1950. Univ. Fla. Studies, Biol. Sci. Ser., 4(4): 160 (*Ephemerella* sp. A).

The widely distributed *Ephemerella deficiens* was reported as *Ephemerella* sp. A by Berner (1950, 1958) from northwestern Florida, Georgia, and Alabama. The species ranges over a vast territory, having been reported from New York, Quebec, Ontario, New Brunswick, Nova Scotia, New Hampshire, North Carolina, Massachusetts, Michigan, West Virginia, Virginia, Alabama, Georgia, and Florida. There appears to be no correlation between the distribution of the species and the physiographic regions of eastern North America in which it occurs. Those factors limiting the distribution of *E. deficiens* are probably temperature and rate of stream flow, the nymphs requiring moderately to swiftly-flowing water.

The biology of the nymphs of this species was discussed by Berner (1950). Supplementary data confirm earlier findings. In the streams of the piedmont and the mountains, the nymphs live side by side with those of *E. serratoides* sharing identical habitats.

LOCALITY RECORDS: (all specimens in University of Florida collections unless otherwise stated) *Alabama*: Bibb Co., Cahaba River north of Centerville, May 12, 1955, C. D. Hynes, 25 nymphs, No. 3712.6, June 16, 1954, CDH, 4 nymphs, No. 3496.9, June 22, 1956, CDH, 8 nymphs, 5 ♀ adults, No. 3905.8, Shultze's Creek north of Centerville, June 17, 1954, CDH, 4 nymphs, No. 3497.0; Coosa Co., 11.8 miles s. of Coosa-Talladega Co. line, June 19, 1954,



CDH, 10 nymphs, No. 3504.10; Covington Co., 11.4 miles e. of Brooklyn, July 13, 1954, CDH, 4 nymphs, No. 3515.1; Dallas Co., 2.9 miles s. of junction of Hwy. 100 and Hwy. 43, on Hwy. 43, June 23, 1956, CDH, 1 nymph; Elmore Co., Martin Dam road, 1.9 miles s. of Red Hill, June 10, 1954, CDH and L. Berner, nymphs, No. 3477.5; Lauderdale Co., Cypress Creek at Florence, June 10, 1956, CDH and LB, 35 nymphs, No. 3878.7, July 18, 1956, CDH, 1 nymph, No. 3826.5, 5.2 miles west of turnoff to lock four, Wilson Dam, July 27, 1954, CDH, 4 nymphs, No. 3603.0; Macon Co., Uphapsee Creek north of Tuskagee, June 9, 1954, CDH and LB, nymphs, No. 3475.16; Mobile Co., 2.1 miles s. of Kushla, June 3, 1940, LB, 13 nymphs, No. 1481.4, Seabury Creek s. of Kushla, June 3, 1940, LB, 2 nymphs, No. 1482.6; Shelby Co., Davis Creek w. of Montavallo, June 18, 1954, CDH, 15 nymphs, No. 3502.0; Tusaloosa Co., Creek on Hwy. 43, 5.8 miles n. of intersection with Hwy. 171, April 15, 1956, CDH and LB, 4 nymphs, No. 3788.4, Gin Creek 12 miles n. of Tuscaloosa, May 11, 1955, 1 nymph, No. 3711.5, 15.6 miles s. of Tuscaloosa-Fayette Co. line on Hwy. 43, June 16, 1954, 6 nymphs, No. 3495.3. *Florida: (all records prior to 1951 listed by Berner, 1950, and not repeated here)* Gadsden Co., 4½ miles s. River Junction, April 4, 1953, LB, nymphs, No. 3301.5; Liberty Co., Crooked Creek 10 miles s. River Junction, March 27, 1954, LB, 1 nymph, No. 3402.2, Sweetwater Creek, May 14, 1951, LB, 6 nymphs, 3 ♀ adults, No. 3336.3. *Georgia:* Cherokee Co., Etowah River near Gober, June 23, 1955, CDH and LB, 3 nymphs, No. 3716.10, Aug. 18, 1956, CDH, 4 nymphs, No. 3823.4, Etowah River at Canton, July 30, 1954, CDH, 6 nymphs, No. 3609.4; Decatur Co., Mosquito Creek at Hwy. 97, April 5, 1953, LB, nymphs, No. 3317.2; Early Co., 1.9 miles e. of Saffold, Feb. 2, 1949, I. J. Cantrall and LB, nymphs; Fulton Co., 10 miles n. of Atlanta, April 28, 1938, LB, 1 nymph, No. 1187.1; Lumpkin Co., Chestatee River at Hwy. 52, Aug. 13, 1955, CDH and LB, 6 nymphs, No. 3714.7; Peach Co., Mossy Creek, 4 miles n. Perry, April 10, 1954, CDH and LB, 10 nymphs, No. 3406.0; Pickens Co., Hwy. 5, 1.7 miles s. of junction with Hwy. 136, June 21, 1956, CDH, nymphs, No. 3903.3; Pike Co., Flat Shoals, 6 miles w. Concord, April 21, 1933, P. W. Fattig, 2 nymphs (Emory University collections); Wilkes Co., 5 miles e. Tignall, July 14, 1955, CDH, 2 nymphs, No. 3754.6. *Mississippi:* Lauderdale Co., Don's Falls s. of Meridian, July 14, 1954, CDH, 5 nymphs, No. 3519.3; Pike Co., Tangipahoa River at Hwy. 51, Aug. 19, 1954, CDH, 2 nymphs, No. 3646.6. *North Carolina:* Davidson Co., South Fork Creek at Hwy. 150, July 6, 1955, CDH, 1 nymph; Jackson Co., Hurricane Creek, June 13, 1955, LB, 2 nymphs, No. 3538.2; Macon Co., Middle Creek, 8 miles s. of Highlands, Aug. 11, 1948, LB, 1 nymph, No. 3192.6; Swain Co., Oconoluftee River at Smokemont, May 28, 1934, T. H. Frison (Illinois Natural History Survey), June 25, 1957, CDH, 2 ♂ adults, No. 3961.6; Transylvania Co., Hwy. 276 s. of Brevard, June 17, 1955, CDH, 35 nymphs, No. 3581.6, Pisgah National Forest at Hwy. 276, July 30, 1957, CDH, 4 ♀ adults, No. 3988.0. *South Carolina:* Aiken Co., Dikes above Ellenton, no date, T. Dolan and S. S. Roback, nymphs (identified by J. R. Traver and in collection of Academy of Natural Sciences of Philadelphia); Anderson Co., Hwy. 76 n. of Anderson, June 8, 1955, CDH, 1 nymph, No. 3560.3; Edgefield Co., 6.1 miles n. of North Augusta at Hwy. 230, July 13, 1955, CDH, 1 nymph, No. 3752.6; Fairfield Co., Parr, April 19, 1955, CDH and LB, 4 nymphs, No. 3704.1; Greenville Co., Hwy. 14, 1.5 miles n. of junction

with Hwy. 29, Aug. 3, 1955, CDH, 1 nymph, North Saluda River at Hwy. 11, Aug. 5, 1955, CDH, 50 nymphs, No. 3856.4, Aug. 20, 1955, CDH, 10 nymphs No. 3865.3. *Tennessee*: Hawkins Co., 9 miles w. of Church Hill, Aug. 2, 1956, CDH, 15 nymphs, No. 3828.1; Polk Co., Hwy. 30, 1.7 miles n. of Junction with Hwy. 64, Aug. 11, 1956, CDH, 4 nymphs, No. 3817.0; Sevier Co., Gatlinburg, Fighting Creek, May 27, 1934, T. H. Frison, nymphs (in collection of Illinois Natural History Survey), Pigeon Forge, July 24, 1957, CDH, 1 ♂ adult, No. 3981.9, Little Pigeon River, Aug. 5, 1956, CDH, 2 nymphs, No. 3833.9, Hwy. 411, 21 miles w. of junction with Hwy. 25 E, Aug. 5, 1956, CDH, 3 nymphs, No. 3834.8; Unicoi Co., Hwy. 107 at Washington-Unicoi county line, Aug. 6, 1956, 1 nymph, CDH, No. 3835.6.

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