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THE GENUS NEOEPHEMERA IN NORTH AMERICA (EPHEMEROPTERA: NEOEPHEMERIDAE)[1]

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With the discovery of a new species of *Neoephemera*, it seems advisable to review our present knowledge of all of the species of the genus and to construct keys for their separation. It is certainly likely that as our knowledge of the mayflies of North America is enlarged additional species of *Neoephemera* will be described; such a summary may, therefore, serve as a guide for future work.

McDunnough (1925) described *Neoephemera* from eight males that were collected by G. S. Walley at Laprairie, Quebec. In his paper, McDunnough gave no information relative to the phylogenetic relationship of the genus nor did he discuss conditions under which the specimens were taken. Ulmer (1933) was the first to give *Neoephemera* a family placement when he included it as one of the genera of the Ephemeridae. Subsequently, Needham, Traver, and Hsu (1935) erected a new subfamily, Neoephemerinae, to include McDunnough's genus as well as *Oreianthus*, a genus described by Traver in 1931. In this latter report, it was stated that the nymph of *Neoephemera* was unknown and that the distribution of the genus was Nearctic; *Oreianthus* was said to be Holarctic, and in the Nearctic to occur in the southeastern United States.

The description of *Oreianthus* was based on specimens collected and reared in 1929 and 1930. Traver (1931), in her description, indicated that the wing venation of the adult insect showed that it should be placed in the subfamily Ephemerinae even though the nymph, other than in size, resembles that of the genus *Caenis*. In discussing the relations of *Oreianthus* to other forms, Traver pointed out that, based on a study of illustrations, a nymph from the Garonne River in France, which was described by Joly (1870) as *Caenis maxima*, was in reality a member of her new genus. The status of Joly's nymph has still not been established with certainty by European workers nor, as far as I can determine, has the species again been recorded.

Because of similarities in appearance of the nymph of *Oreianthus* and that of *Caenis* and certain resemblances of the adults, Traver (1932) placed the former genus in the Baetinae, but indicated that the wing venation of the adult is similar to that of the Ephemerinae. In this same paper she mentioned that another species, represented only by nymphs, was at hand, and this same nymph was again reported by her in 1935 as occurring in Florida. In 1935, the genus was transferred to the family Ephemeridae, subfamily Neoephemerinae (Needham, Traver, and Hsu, 1935). The second species of *Oreianthus* was described from Florida nymphs by Traver (1937) but was not given a specific name, simply being designated as *Oreianthus* sp. No. 1.

Oreianthus was next discussed in "The Mayflies of Florida" (Berner, 1950) where it was said that phylogenetically the genus probably represented a distinct family.

Burks (1953) established the family Neoephemeridae to include the genera *Neoephemera* and *Neoephemeropsis* and at the same time synonymized *Oreianthus* with *Neoephemera*. When Ulmer (1939) described *Neoephemeropsis* from Sumatra and Java, he placed it in the family Potamanthidae and stated that it was close to *Neoephemera;* however, Burks claims that *Neoephemeropsis* almost certainly belongs in the family Neoephemeridae, a conclusion with which I am in agreement.

With the description of *Neoephemera youngi* Berner (1953), the status of Traver's *Oreianthus* sp. No. 1 was clarified. Subsequently, I have discovered a fourth species in the genus, the description of which is given below.

As presently understood, the genus in North America is distributed from southeastern Canada southward through the Appalachians to Florida and westward is known from Michigan. Nymphs and adults are rarely found in collections and records of the occurrence of the genus are sparse. The known distribution of each species will be discussed separately.

I am indebted to Dr. Henry Dietrich, Cornell University, and Dr. M. W. Sanderson, Illinois Natural History Survey, for the loan of specimens of *Neoephemera*. Mr. G. S. Walley, Division of Entomology, Ottawa, kindly provided me with a paratype of *N. bicolor*. All illustrations were prepared by Miss Esther Coogle, Staff Artist, Department of Biology, University of Florida.

Genus **Neoephemera** McDunnough

Genotype: *N. bicolor* McD., Laprairie, Quebec, July 9, 1924. No. 1292, Canadian National Collection.
Joly (1870, p. 142)—*Caenis*.
Eaton (1881, p. 196)—*Caenis*.
Eaton (1883, p. 140)—*Tricorythus* (?).
Lestage (1917, p. 373)—? *Tricorythus*.
McDunnough (1925, p. 168)—*Neoephemera*.

[1]This investigation was supported in part by a research grant, No. G-4058, from the National Institutes of Health, Public Health Service.
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Traver (1931, p. 103; 1932, p. 111)—*Oreianthus*.
Ulmer (1933, p. 199)—*Neoephemera*.
Needham, Traver, and Hsu (1935, p. 289; p. 290)—*Neoephemera; Oreianthus*.
Traver (1937, p. 34)—*Oreianthus*.
Ulmer (1939, p. 484; p. 606)—*Neoephemera; Oreianthus*.
Berner (1950, p. 98)—*Oreianthus*.
Burks (1953, p. 42)—*Oreianthus* = *Neoephemera*.
Berner (1953, p. 145)—*Neoephemera*.

Wings hyaline; fore wings with basal costal crossveins weak or vestigal; stigmatic crossveins partly anastomosed; vein M_2 curved toward vein Cu_1 near the wing base; vein A_1 with from one to three crossveins attaching it to the hind margin (figs. 19, 20). Hind wing with an acute costal projection (fig. 18). Legs normal; claws dissimilar on legs. Pleural folds of abdominal segments expanded laterally. Penis short, dome-shaped; separated by a V-shaped median cleft on apical margin. Forceps with four segments, the two distal ones short (fig. 15). Three fully developed caudal filaments in both sexes.

Nymphs (fig. 9) grossly resemble *Caenis* but have two pairs of wing pads. Head almost twice as wide as long. Second segment of antennae covered with short, plumose hairs which are also present sparsely on vertex of head; such hairs are also present on the legs and abdomen. Prothorax longer at margins than at mid line, and margins may be considerably elongated at anterolateral angles (fig. 5); lateral margins developed into thin expanded areas. Body widest at greatest width of mesothorax. Submedian paired tubercules may be present at anterior margin of pronotum and mesonotum (fig. 4); short, posteriorly-projecting median tubercule on metanotum. Legs long and spider-like; claws simple, curved (fig. 11). Abdominal segment 1 with a pair of vestigal, filamentous gills; gills of segment 2 fused to form elytroid plates covering the following four pairs (fig. 9). Prominent median spine on tergites 1 and 2; tergites 2 to 8 may have a median carina which terminates in a short spine. Lateral margins of segments 3 to 9 prolonged posteriorly into flattened processes that may be decurved (fig.4); these processes exceptionally well developed on segments 6 to 9. Three caudal filaments with rings of stiff hairs at the joints.

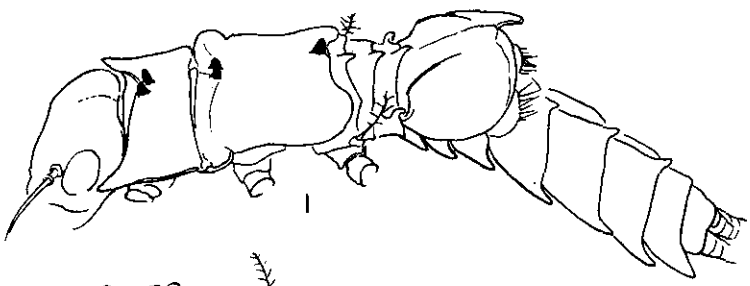
Neoephemera compressa n. sp.

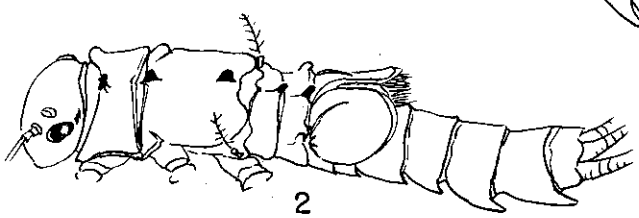
The adults of this new species can be separated from the others of the genus by size and venational characters or by color differences. *N. compressa* is distinct from the other two species in the size range in which it falls, *N. bicolor* and *N. youngi*, in the coloration of its legs and the absence of annulations on the caudal filaments. From *N. purpurea*, it may be separated by its smaller size and by the presence in the fore wing of only a single crossvein attaching A_1 to the hind margin. *N. compressa* also differs from *N. youngi* in lacking the small, dorsally-projecting, median spine on tergite 2.

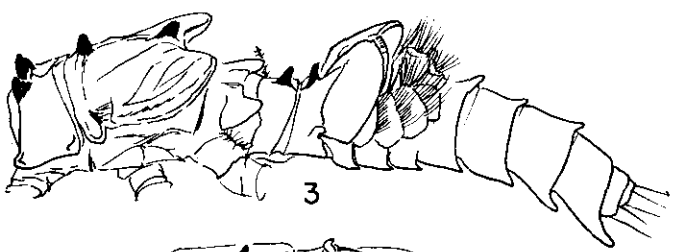
MALE HOLOTYPE: Body length 9.8 mm.; mesothoracic wings 8.6 mm.; caudal filaments incomplete.

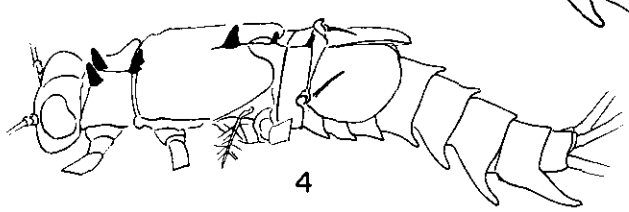
Head: Eyes large, separated by a distance equal to about one-half the width of one of the compound eyes. Vertex pale; geminate, deep-brown lines extending from posterior margin of lateral ocelli to occiput. Margin of occiput dark brown. Frontal carina brownish; dark brown marking at its distal end. Heavy brown horizontal marking below the antennae extending almost from the median carina laterally to the compound eyes. Antennae pale, marked with deep-brown, longitudinal line running length of second segment; flagellum with a slight brownish tinge. Ocelli brownish; basally with usual dark markings.

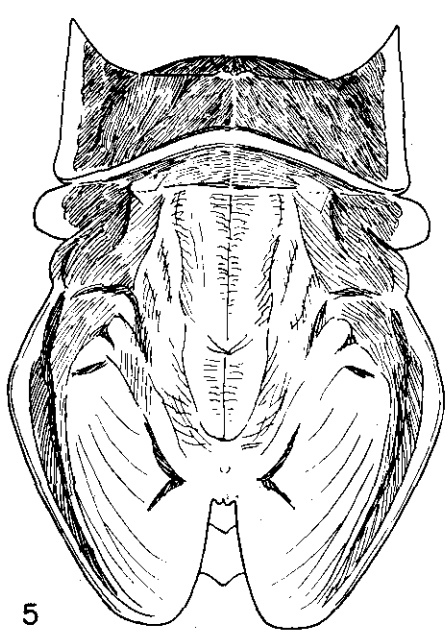
Thorax: Pronotum blackish brown around margins; very dark mid line; lateral portions slightly paler than the margins. Mesonotum much paler in color than the pronotum; blackish penciling around the margins of the scutum; scutellum pale in the median area and with blackish brown margins. Metanotum dark medially, paler laterally. Pleurae pale with dark, purplish-brown markings at the bases of the wings and legs. Sternum blackish brown but mottled with pale spots between the bases of each pair of legs; laterally brown. Prosternal tubercle blackish brown and projecting ventrally almost as far as the distal end of coxae. *Legs.* Fore coxa pale with blackish-brown spot on outer side; trochanter pale with purplish-brown penciling on outer surface; femur colored with intense purplish gray markings distally and pale in basal fifth; this basal pale area extending distally along the front margin about one-half its length; posterior margin colored deep purplish gray becoming much more extensive and covering remainder of femur. Tibia colored much the same as the femur, pale basally except for a short, longitudinal dark dash at the base; distal four-fifths purplish gray, except at the extreme end where it becomes pale once more. Tarsal segments 1 to 4 pale but washed with purplish gray, fourth dark at distal end, fifth segment much deeper in color with tendency to form a band in middle portion; claws shaded with purplish gray; first tarsal segment very short, about one-third the length of fifth, second and third equal, fourth slightly shorter than third, and fifth slightly shorter than fourth. Middle and hind legs colored very much as fore legs except for the fact that their coloration is even more intense. Pale area of femur less than that of fore femur; tibiae with a short dark dash at the base on the inner side. Tarsal segments with a tendency to form purplish rings on segments 2 to 5; fifth almost entirely purplish gray; claws as on fore legs. *Wings:* Hyaline and as

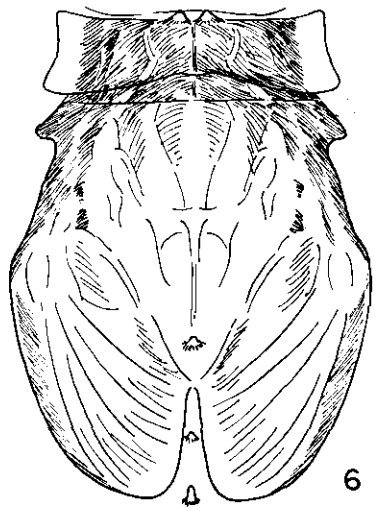


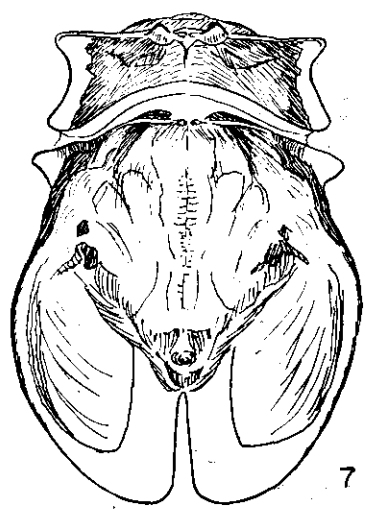


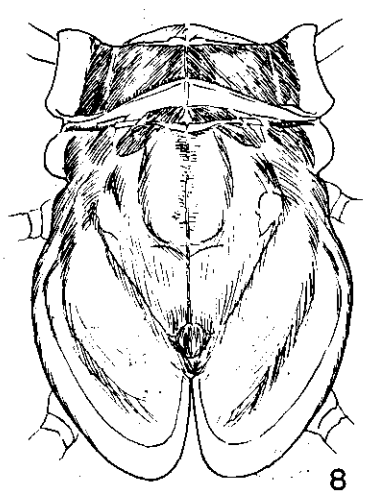












FIGS. 1–4. Oblique views of half-grown nymphs to show thoracic tubercules and abdominal spines.
1. *Neoephemera purpurea*. 2. *N. youngi*.
3. *N. bicolor*. 4. *N. compressa*.

FIGS. 5–8. Dorsal view of thorax of mature nymphs showing thoracic tubercules. 5. *N. purpurea*. 6. *N. compressa*. 7. *N. bicolor*. 8. *N. youngi*.

shown in figs. 22 and 23. All longitudinal veins pale; stigmatic area cloudy, crossveins anastomosed; single crossvein attaches A_1 to hind margin. Hind wing with a slight purplish-gray coloration at extreme base; costal projection so placed that it overlaps the anal crossvein probably providing a coupling device for the two wings when the insect is in flight.

Abdomen: Purplish brown dorsally; pale median line running the length of tergites 1 to 9; tenth completely dark. On tergite 2, the pale area expanding somewhat so that much of the median section is occupied by a pale area; on tergites 3 to 5 the median line expanding at the anterior margin into a broad pale area that runs along the anterior margin almost to the lateral line; on tergite 6 the expansion also occuring at the posterior margin and running laterally almost to the lateral border. Tergites 3 to 9 with small lateral, clear spots toward the posterior margin. Spiracular areas of segments 1 to 9 deeply colored with blackish brown. On the tergites in which the lateral margins are expanded, particularly 7 to 9, purplish brown coloration following the expansion; tenth tergite more or less uniformly colored with mottled purplish-brown; some intensification of color in the median line. Posterior margins of tergites 8 and 9 more deeply colored, pattern forming a blackish-brown band. Sternites much paler than tergites with a slight wash of purplish gray in the median area of 6 to 9 and laterally on 1 to 5. At the anteromedial line of the sternites, a deep blackish-brown mark which extends posteriorly as a streak on sternites 6 to 9; laterally on each of the sternites just below the dark marks of the spiracular areas, a deep, purplish-black mark that becomes progressively smaller posteriorly. Genitalia pale; as shown in fig. 16. Caudal filaments pale; basal segments with a slight brownish coloration.

FEMALE ALLOTYPE: Wing length 10 mm., body 9 mm. (abdomen of specimen in somewhat contracted state); caudal filaments 10 mm.

Head: Eyes widely separated. Vertex mottled; a deep, blackish-brown band on the occiput medial to the eyes runs across the head just above the median ocellus. Coloration of the head dark. Carina blackish brown in its distal portion. Coloration of head below antennae like that of male. Base of antenna pale, second segment marked as in male; flagellum brownish; tips broken in allotype.

Thorax: Marked much as in male except that mesonotum considerably darker with mid line blackish brown. Pleural and sternal markings similar to those of male. Prosternal process similar to that of male.

Legs: More intensely colored than in male with pale areas smaller than those of male. Tarsal segments appearing almost annulate in fore leg. Femora of middle and hind legs only slightly paler at the proximal end. Tibiae of middle and hind legs with small pale area basally, remainder deep purplish gray. Tarsal segments as in male, with color becoming more intense distally; first tarsal segment of middle and hind legs almost completely pale, washed with light purplish coloration.

Wings: Hyaline, some slight, purplish shading near the base; costal border with a faint purplish tinge; costa, subcosta and R_1 with purplish shadings, other longitudinal veins pale. Stigmatic veins weak and anastomosed.

Abdomen: Almost uniformly purplish brown with a faint indication of a pale median line beginning at the posterior portion of tergite 6 and running full length of 7 to 9; tergite 10 lacking this pale median line. Ventrally, sternites mottled with purplish coloration; a clear spot present at the anteromedian margin of segments 2 to 7. Lateral flanges deep purplish brown; caudal filaments washed with a purplish tinge.

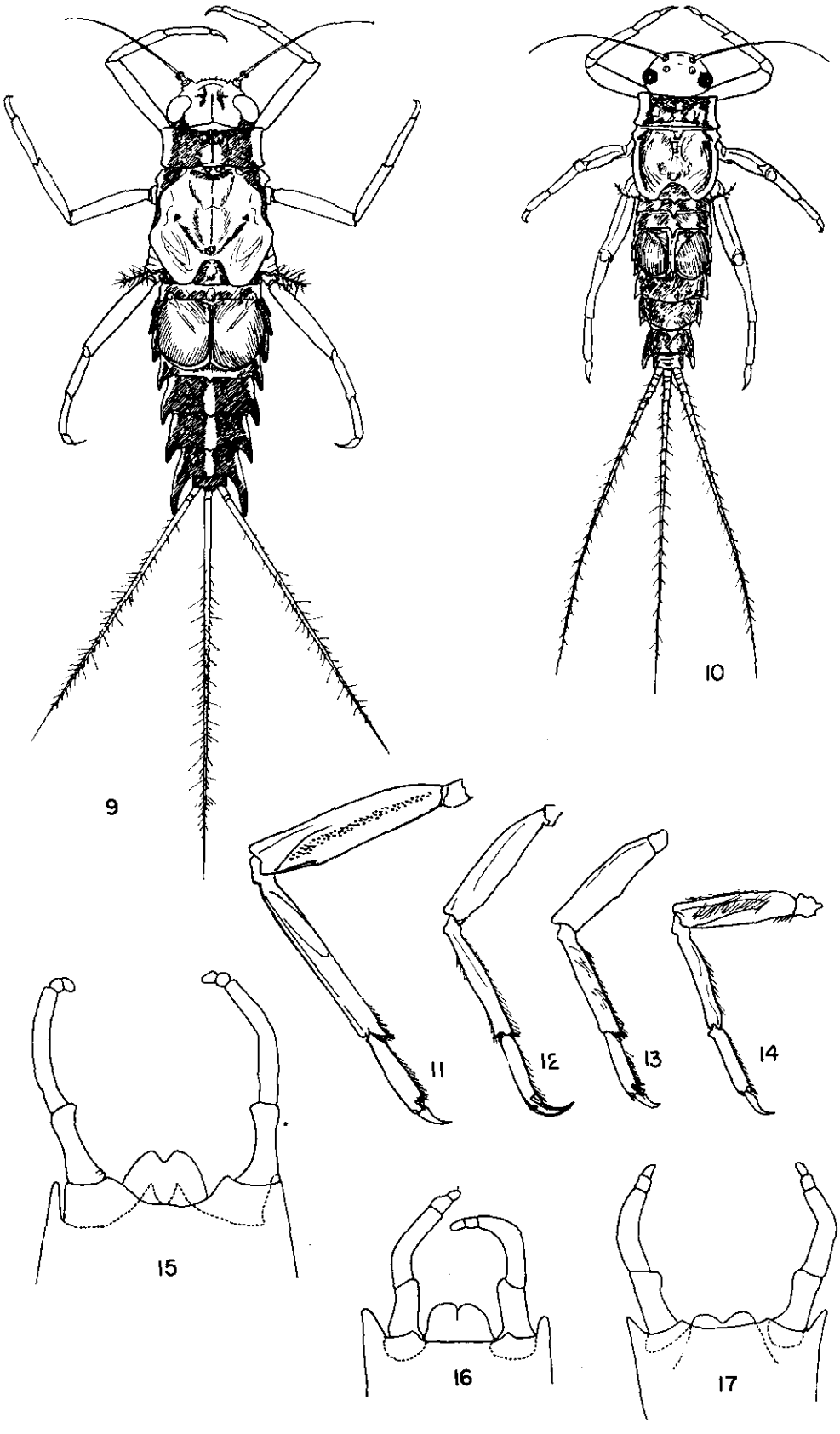
NYMPH: Body length 9 mm.; caudal filaments 8.5 mm.

Head: Vertex with numerous course hairs over the surface, some present on the medial surface of compound eyes. Hairs enlarged and frayed distally. Head crossed by purplish-brown band between the eyes; vertex brownish with two submedian clear spots; pale between ocelli. Ventrad to the antennae, between the eye and antennal base, a deep-brown band extending across the face. Basal segments of the antennae with the same type of course hairs that are present on the surface of the head; these hairs especially numerous on the second antennal segment where they give it a very rough appearance; flagellum pale and long.

Thorax: Lateral margin of pronotum as shown in fig. 6; most of the pronotum deep brown with flanges pale; pair of very prominent submedian tubercles at the anterior margin of pronotum. Mesonotum with anterolateral corners expanded into almost spine-like projections; a pair of minute submedian tubercules at anterior margin; a median spine present at the posterior margin between the wing pads. Mesonotum brownish, anterolateral corners dark brown. Metanotum completely concealed by wing pads. Sternum mottled with purplish-brown; a ventrally projecting process on the sternum between each pair of legs, prominent on the younger nymphs; on mature nymphs the projections clearly visible between the anterior and middle

EXPLANATION OF FIGURES

FIG. 9. *N. compressa*, half-grown nymph.
FIG. 10. *N. youngi*, half-grown nymph.
FIGS. 11–14. Right hind leg of mature nymphs. 11. *N. purpurea*. 12. *N. compressa*. 13. *N. youngi*. 14. *N. bicolor*.
FIGS. 15–17. Genitalia of male adults. 15. *N. purpurea*. 16. *N. compressa*. 17. *N. youngi*.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pairs of legs, but only a bump between the hind legs. A brown spot present on the sternum medial to each leg.

Legs: Covered with same type of hairs as seen on head and antennae. All segments of leg rather densely covered with these hairs, interspersed with long normal hairs on the femur and tibia. All legs long and spindly; purplish; femora more intensely colored at distal end; at the juncture of trochanter and femur, on the ventral side, a large brown spot overlapping both segments. Tarsus slightly paler at its proximal end; claw heavy and curved; pale except at tip where it becomes deep brown in color. Claws in striking contrast to the dark color of rest of the leg.

Abdomen: Abdominal segments expanded laterally into long, posterolateral projections, becoming more conspicuous on posterior segments where they are decurved. The posterior spine of each segment approximately half the length of that tergite, except that on 9 the spine equal to the length of the tergite. In older specimens the posterolateral spines clear at the outer margin and at the tip, but with purplish-brown coloration running into the posterior portion; anterolateral portion of the spines clear. The lateral margins of the segments covered with the same type of course frayed hairs present on the head. Tenth segment without postero-lateral spines. Tergites 1 and 2 with dorsally-projecting, pale median spines between the wing pads. The spine on segment 2 especially prominent and also covered with the course hairs. Tergites 6 to 8 free of gill covers, with posteriorly projecting spines at the median line; these spines much less conspicuous than those on tergites 1 and 2 and not erect. Abdomen deeply colored with purplish brown on the dorsum; ventrally paper with mottled appearance. The whole venter covered with coarse, frayed hairs. At the anterolateral margin of each of the sternites, a purplish-brown dash directed inward, the dash being less prominent but more elongate on the posterior segments and obsolescent on sternite 9. Caudal filaments approximately equal in length; brownish and with stiff, coarse hairs at the joints.

Younger nymphs are particularly striking in appearance and the name that I have given this species is derived from the pronounced dorso-ventral flattening of the thorax. The tubercules of the anteromedian margin of the pronotum are very conspicuous as is another pair at the anterior margin of the mesonotum. The single posterior tubercule of the mesonotum is also very prominent. As the nymphs mature, the thorax swells in size so that it assumes a more normal shape and the anterior tubercles are almost obliterated. The heads of younger nymphs are often completely pale except directly behind the eyes, where they are deeply colored with purplish brown. Legs of the young nymphs may also be paler basally instead of being wholly dark as in old nymphs. The posterolateral spines of the abdomen are one of the notable features of the young nymph. They also show a median line on the tergites which includes the posteromedial spines on segments 6 to 9. This light line is sometimes very pronounced. Because of the coloration of the posterolateral spines the abdomen may often appear to be banded at the margins.

Holotype: Male imago (reared), preserved in alcohol. Hamilton Co., Florida, Withlacoochee River at Georgia-Florida state line, March 14, 1954. Collected by L. Berner. In University of Florida collections.

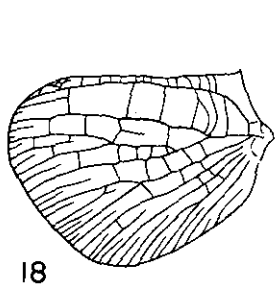
ALLOTYPE: Female imago (reared), preserved in alcohol. Same data as holotype. In University of Florida collections.

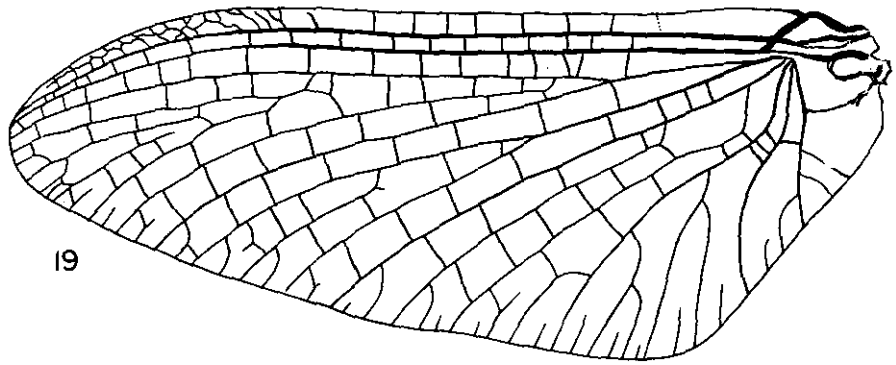
PARATYPES: 1 male subimago (partially shed); 4 females (reared). Same data as holotype. In University of Florida collections.

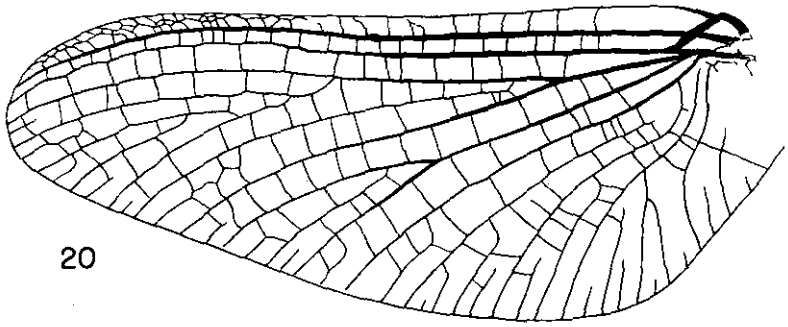
OTHER LOCALITY RECORDS: Florida, Withlacoochee River at several localities, January 28, 1954, (C. D. Hynes); Santa Fe River at Camp O'Leno State Park, October 31, 1953 (C. D. Hynes). Georgia, Ichawaynochaway Creek at Ga. Hwy. 91, November 27, 1953 (C. D. Hynes and L. Berner); Withlacoochee River, 4 miles west of Valdosta, March 13, 1954 (Hynes and Berner). All specimens in University of Florida collections.

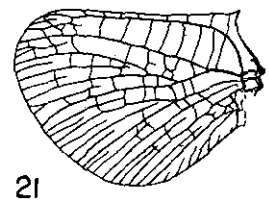
The nymphs of *N. compressa* occur in streams of slow to moderate flow. The Withlacoochee River, where the nymphs were found in some abundance, is a deep, slow-flowing stream bordered by ash, willow, cypress and black-gum trees. Where the trunks of these trees are submerged, they are usually covered by a densely growing species of moss. It was in this moss that the nymphs were found, usually after a careful examination. They are slowly moving insects which are sometimes difficult to see in the dark vegetation and it is only by removing large clumps of the plant and shaking them that the nymphs are dislodged. Many were removed by picking them from the moss after it was taken from the water. The nymphs were associated with those of *Baetisca obesa*, which were very common in the moss. Amphipods and isopods were also numerous in this association. Nymphs were often found in some abundance by running a dip net through debris anchored in flowing water.

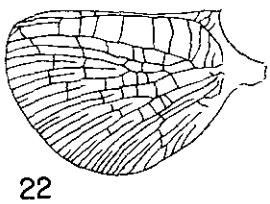
At the Ichawaynochaway Creek near Newton, Georgia, nymphs were taken by washing the submerged roots of plants which hang exposed at the banks. A few nymphs were also collected from logs which had been in the stream for a long period and had become very soft. The greatest number of nymphs from this stream were, however, taken from clumps of moss of the same species as that growing in the Withlacoochee

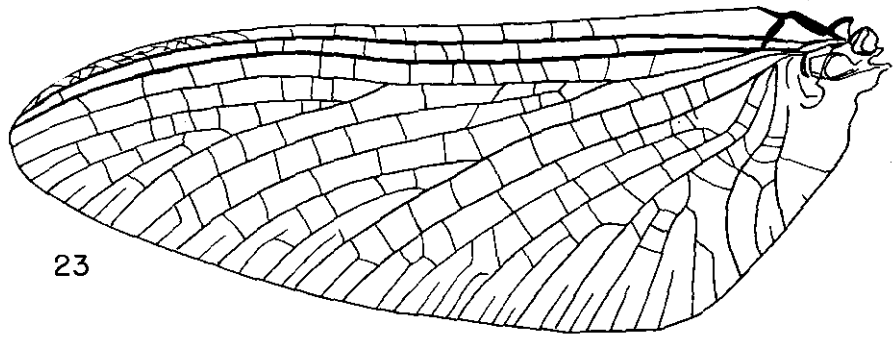


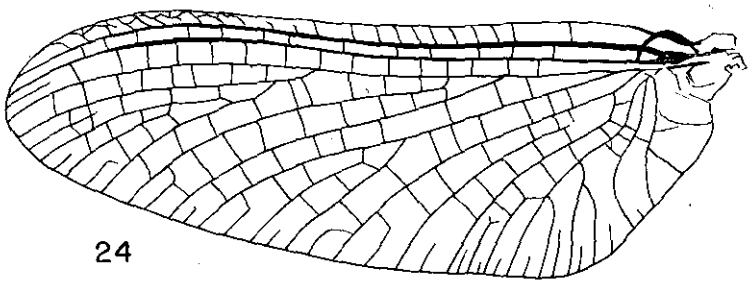


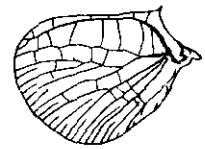












FIGS. 18–25. Wings of adults. 18–19. *N. purpurea*. 20–21. *N. bicolor*. 22–23. *N. compressa*. 24–25. *N. youngi*.

River. No nymphs were found in the swiftest part of the stream.

Adults were reared from mature nymphs collected from the Withlacoochee River in January and March. The earliest emergence occurred in late February and the latest was recorded in early April. The subimagal stage lasts approximately twenty-four hours.

My collections indicate that *N. compressa* may be a southern species restricted to streams of the Coastal Plain.

FIG. 26. The Withlacoochee River near Valdosta, Georgia, March 21, 1954. *Neoephemera compressa* nymphs were taken from the moss growing on the submerged trunks of these trees and from debris anchored in the stream.

Neoephemera purpurea (Traver)

Traver (1931, p. 103)—*Oreianthus purpureus*. Type in Cornell University Collections.
Needham, Traver, Hsu (1935, p. 291)—*Oreianthus purpureus*.
Traver (1937, p. 34)—*Oreianthus purpureus*.
Burks (1953, p. 43)—*Neoephemera purpurea*.

This species was described by Traver as *Oreianthus purpureus* in 1931. In her paper she gave a very complete description of both female imago and the nymph; however, in this earlier description one error was made which was later corrected in her 1937 report on the mayflies of the southeast. The description is entirely adequate and the 1937 correction simply makes note of the fact that she failed to mention the pair of low submedian tubercles on the anterior margin of the pronotum. Traver also pointed out that the short median tubercle on the mesonotum between the wing pads was, in the original description, in error described as being on the metanotum. The nymph is by far the largest of any of the North American species of *Neoephemera* and is readily distinguished from the others in the mature form by its size. The lateral profile of the nymph is distinctive as indicated in the drawing (fig. 1). The tubercules on the pro- and mesonotum are relatively short and inconspicuous on the mature nymph as compared with those of *bicolor* and *compressa*. On half-grown nymphs the tubercules are exaggerated but are still considerably less so than on nymphs of *N. compressa* at a comparable stage of development.

The specimens examined by Traver and reported on in publications subsequent to the original description have all represented mature nymphs. The appearance of a half-grown specimen is shown in fig. 1.

When Traver (1937) collected the nymphs of *N. purpurea* in North Carolina, she found them

usually beneath small, isolated boulders or irregularly-shaped sedimentary rocks in swift water, or under the large, flat rocks that form the main bed of the stream. Here she found only few specimens, never taking more than two or three nymphs from under a single rock. In 1948 while I was collecting in the North Fork of the French Broad River at Rosman, I found several half-grown nymphs of this species living in debris in slow-flowing water. A search of the larger rocks produced no specimens. During the summer of 1954, I again had an opportunity to collect mayflies in the mountain streams of North Carolina and at this time found nymphs of *N. purpurea* in Deep Creek and in the Nantahala River living commonly in debris caught in flowing water. Where bushes had fallen into the stream and had remained there for some time, the nymphs could be taken by dislodging the debris to which they were attached. In the Nantahala, as many as seventeen nymphs were taken at one time by gathering up clumps of exposed, clean-washed roots of vegetation in shallow water. The nymphs clung tenaciously but could be shaken or picked loose. A few nymphs were also collected by lifting large stones where the flow was swift and holding a screen downstream; however, this method of collecting was much more tedious and less productive than working in debris and roots.

Distributional records indicate that this species is confined to the swift streams of the Appalachian mountains.

Specimens examined: North Carolina, Davidson River, Pisgah Forest, (J. R. Traver), June 19, 22, 1929, C.U.[2]; June 30, 1930 (Holotype) C.U.; June 12–22, 1936, C.U.; North Fork of French Broad River at Rosman, August 19, 1948 (L. Berner) U.F.[2]; Deep Creek, Bryson City, August 12, 1954 (L. Berner) U.F.; Nantahala River, August 16, 1954 (L. Berner) U.F. Tennessee, Elkmont, October 10, 1940 (L. Giovannoli) U.F. Georgia, Neel Gap, June 8, 1945 (P. W. Fattig) I.N.H.S.[2]; Rock Creek, May 14, 1931 (P. W. Fattig), C. U.; Satolah, May 4, 1929 (J. G. Needham) C.U. Virginia, Piney River, August 1, 1953 (J. Pugh) U.F. West Virginia, Elk Garden, August 21, 1930, C. U.

Neoephemera bicolor McDunnough

McDunnough (1925, p. 168)—*Neoephemera bicolor*. Type in Canadian National Collections.
Needham, Traver, Hsu (1935, p. 289)—*N. bicolor*.

Through the courtesy of the Illinois Natural History Survey, I was privileged to study their collection of *Neoephemera*. Included in the lot of specimens was a small series of nymphs from Michigan identified by Dr. B. D. Burks as ?*Neoephemera bicolor* McD? These nymphs resembled those of *N. compressa* but differ in minor details as indicated in the key. Because of the presently known distribution of *N. bicolor*, I believe that Dr. Burks identification is correct and I am calling these specimens by that specific name.

The nymph of *N. bicolor* has never been described. I shall not detail the characteristics of the Michigan specimens as they are practically the same as those of *N. compressa* except in the following respects: the pronotal spines are more widely spaced and are slightly less prominent, and the posterolateral abdominal spines are slightly shorter and are less strongly curved ventrally. These details are shown in figs. 3, 4, 6, and 7.

Mr. G. S. Walley of the Division of Entomology, Ottawa, has kindly furnished me with a paratype and a topotype of *N. bicolor*. A comparison of these specimens with the three southern species has made it possible for me more clearly to delineate the forms in the key.

Specimens examined: Quebec, Laprairie, July 9, 1924 (G. S. Walley), paratype; July 7, 1925 (F. P. Ide). Michigan, Riffle River, Omer, May 21, 1936 (Frison and Ross)—nymphs.

There was no ecological information accompanying the nymphs of *N. bicolor* that were collected in Michigan. Because of their close resemblance to the nymphs of *N. youngi* and *compressa*, I believe that they occupy similar habitats, occurring in rivers and large streams that have a slow to moderate flow.

Neoephemera youngi Berner

Traver (1937, p. 83)—*Oreianthus* sp. No. 1.
Berner (1950, p. 99)—*Oreianthus* sp. No. 1.
Berner (1953, p. 145)—*Neoephemera youngi*. Type deposited in University of Florida Collections.

Among the specimens of *Neoephemera* in the collection of Illinois Natural History Survey, there is a single, adult male from Echeconnee Creek, Georgia, identified by Dr. B. D. Burks as *N. bicolor*. A careful examination of this specimen shows that it is in reality *N. youngi*. Apparently on the basis of this male, Dr. Burks (1953) reported that *N. bicolor* occurs in Georgia, a distribution which would have been unlikely as it is known elsewhere only from Michigan and Quebec. Further, Dr. Burks reported that *N. purpurea* occurs in Florida; intensive studies of the Ephemeroptera of this state have never produced a nymph of *purpurea* nor have I ever taken the species south of the Appalachians. It is my belief that *N. youngi* is essentially a costal plain species that may be much more widely distributed through this physiographic province than is indicated by specimens in collections.

N. youngi is closely related to *bicolor* and *compressa* and with these two species forms a clearly distinct unit of the genus *Neoephemera*. Size, venation, and characters of the immatures

[2]C. U.—Cornell University collections; U. F.—University of Florida collections; I.N.H.S.—Illinois Natural History Survey collections.

reveal this grouping very clearly as indicated in the keys to adults and nymphs.

Distribution and specimens examined: Generally distributed throughout northwest Florida from the Apalachicola River system westward. In Georgia from Decatur Co., Mosquito Creek, April 5, 1953, March 28, 1954 (L. Berner) U.F.; Town Creek, May 14, 1931 (P. W. Fattig) C.U.; Oconee River near Greensboro, April 9, 1931 (P. W. Fattig) C.U.; Upatoi Creek near Columbus, April 29, 1931 (P. W. Fattig) C.U.; Echeconnee Creek, 11 miles south of Macon, May 5, 1939 (P. W. Fattig) I.N.H.S. South Carolina, North Edisto River at Orangeburg, October 21, 1952 (H. P. Nicholson) U.F.

The habitats occupied by nymphs of *N. youngi* were discussed in some detail in "The Mayflies of Florida" (Berner, 1950) and will not be redescribed here. In many respects they are similar to those from which *N. compressa* was taken, although no *youngi* has ever been taken from moss around the trunks of submerged trees.

KEY TO NYMPHS

1. Body length (head to tails) 14–17 mm. Anterolateral projections of pronotum strongly produced (fig. 5); anterolateral projections of mesonotum prominent and rounded ..... **purpurea**
1'. Body length 8–10 mm.; anterolateral corners of pronotum only slightly elongated (fig. 6) 2
2. Posterolateral abdominal spines strongly produced (figs. 4, 9). Median spines present at posterior margins of abdominal segments 6–8 (fig. 4). Anterolateral corners of mesonotum pointed (fig. 6); pronotal submedian tubercules prominent (fig. 6) .. 3
2.' Posterolateral abdominal spines only moderately produced (fig. 2, 10). No median spines on posterior margins of abdominal segments 7 and 8 and only faintly indicated on 6 (fig. 10). Anterolateral corners of mesonotum rounded (fig. 8); pronotal submedian spines much reduced in mature nymphs (fig. 8) ..... **youngi**
3. Posterolateral abdominal spines strongly produced and curved ventrally (fig. 4). Pronotal submedian spines only slightly separated (fig. 6) ..... **compressa**
3.' Postero-lateral abdominal spines less strongly produced and less strongly curved ventrally (fig. 3). Pronotal submedian spines widely separated (fig. 7) ..... **bicolor**

KEY TO ADULTS

1. Wings 13.5 to 17 mm. in length; longitudinal veins of fore wings purplish black; two crossveins attaching A_1 to hind margin (figs. 18, 19) ..... **purpurea**
1'. Wings 8 to 10.5 mm. in length; veins, except those of costal border, pale. A single crossvein attaching A_1 to hind margin (fig. 20) 2
2. Small purplish band present in distal four-fifths of femora; tarsal segments 2 to 4 of middle and hind legs ringed with purplish-gray. Caudal filaments annulate ..... **youngi**
2'. Coloration of legs otherwise. Caudal filaments without annulations 3
3. Femora usually pale; tarsi smoky, not annulate. Each sternite with lateral black dot ..... **bicolor**
3'. Fore femur extensively colored with purplish-gray; tarsus purplish-gray, fifth segment with purplish-gray band. Other legs heavily shaded with deep purplish gray, tarsal segments annulate. Sternites with lateral black dot as well as a blackish-brown dot at anteromedial line ..... **compressa**

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