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NEOCLOEON, A NEW MAYFLY GENUS
(EPHEMERIDA)*

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Slender nymphs somewhat resembling those of *Baetis* were taken in the early spring of 1929 and again in 1930, from a small spring-fed tributary of Big Alamance Creek, twelve miles south of Greensboro, N. C. These were reared into imagoes in which the hind wing was totally lacking; the intercalaries of the forewing occurred singly, and the genitalia resembled those of *Centroptilum*. Since the combination of characters of nymph and imago of these mayflies does not fit any previously-described genus, a new genus *Neocloeon* is herewith proposed, the type species to be *Neocloeon alamance*. This genus would appear to be rather close both to *Cloeon* and to *Centroptilum*.

NEOCLOEON genus nov., type species **NEOCLOEON
ALAMANCE** n. sp.

The nymphs of this genus have stream-line-form bodies of the *Baetis* type, and rather long legs. The antennæ are rarely longer than head, thorax and the first five abdominal segments in young nymphs, and do not extend beyond the second abdominal segment in mature nymphs. The claws are long, slender and sharp-pointed. The tibia is slightly longer than the tarsus, and the femur equal to twice the length of the tarsus, in the fore-leg. Gills are present on segments 1-7, all single, the tracheæ pinnately branched, but all the main branches on the inner side (see Figs. 13-17). The tails are three in number, approximately equal in length and thickness, the two outer ones with long hairs on the inner margin and short spinules out the outer margin. The lateral margins of the abdominal segments are spinose, the posterior spines being somewhat longer than the anterior ones. The maxillary palp is three-jointed. The distal end of the labial palp is much dilated at the tip, its lower angle rounded. Mouthparts in general very similar to *Centroptilum* (Figs. 2-6, 9, 11, 12).

Hind wings are lacking in the adult insect, and the intercalaries, as already mentioned, occur singly. As in *Cloeon*, the first cross vein between R and the upper branch of the radial sector is, in the main, basad of the first cross vein in the cell below. But in one wing examined, this first cross vein was distad of the first cross vein in the cell below, as in *Procloeon*.

* Contributions from the limnological laboratory of Cornell University.

Evidently this character is inconstant in *Neocloeon*, and is therefore of no use. Turbinate eyes of the male are not contiguous at any point, but approach one another at the back. The genitalia somewhat resemble those of *Centroptilum conturbatum* McD., the forceps being four-jointed. The second joint of the forceps is expanded on its inner margin into a truncate projection resembling an ax blade. The terminal joints are long and slender; the penultimate joints are swollen distally and to a lesser extent near the basal end, and curve inward. Claws are dissimilar on all legs, in both sexes. The tarsus of the foreleg of the male equals $1\frac{1}{2}$ of the tibia. First tarsal joint very short; second, twice the length of the fourth; third, $1\frac{1}{2}$ the length of the fourth. Tibia approximately $\frac{1}{2}$ the length of the femur. In the second and third legs of both sexes, the first tarsal joint is much elongated, being approximately three times the length of the second joint. The tenth sternite of the female is an irregular plate, cleft along the center line almost or entirely to the posterior margin of the ninth sternite. Laterally, each side of this plate is much narrowed near the base, then expands slightly into a sharp-pointed projection (see Fig. 7). Tails two, in male and female. Tails of male imago slightly more than twice the length of the body.

Of the nymphs of the genera related to *Neocloeon*, the following likewise have single gills: *Baetis*, *Centroptilum*, *Pseudocloeon* and *Acentrella*. The two latter lack a median tail, which at once distinguishes them from *Neocloeon*. The shape and tracheation of the gills, the mouthparts and the approximate equality of the tails, serve to separate *Neocloeon* from *Baetis*. The shape and tracheation of the gills distinguish it from *Centroptilum*.

In three other genera of this group—*Pseudocloeon*, *Cloeon*, and *Procloeon*—hind wings are lacking in the adults. In *Pseudocloeon* the intercalaries are paired, which character separates this genus from *Neocloeon*. *Cloeon* and *Procloeon*, however, have the intercalaries single, as in *Neocloeon*. These may be separated from the new genus by the type of the genitalia, the second joint of the forceps in *Neocloeon* being enlarged and expanded on the inner margin, as already stated. Further, the relative lengths of the joints of the legs differ in each of these genera from *Neocloeon*, as follows: In *Cloeon* (Eaton, p. 180) the fore tarsus of the male is nearly $\frac{1}{2}$ as long as the tibia; the joints of the hind tarsus are, in order of lessening rank, 1, 4, 3, 2. In *Neocloeon* the fore tarsus is but $1\frac{1}{2}$ as long as the tibia, the joints of the hind

tarsus ranking as 1, 2, 4, 3. Procloeon (Bengtsson, p. 219) agrees with Neocloeon in that the first joints of the middle and hind tarsi of both sexes are much elongated, being three times longer than the second joints. The latter, however, are in Procloeon three times longer than the third joint, while in Neocloeon the second joint is less than twice the length of the third joint.

NEOCLOEON ALAMANCE, n. sp.

MEASUREMENTS				
	<i>Body</i>	<i>Tails</i>	<i>Wing</i>	<i>Foreleg</i>
Male nymph (3 specimens)	5-6	Broken		
Female nymph (6 specimens)	5½-7	2½-3		
Male imago (5 specimens)	5-6	12-12½	4½-6	4-5
Female imago (5 specimens)	5½-7	Broken	5½-6	3-4

NYMPH (see Fig. 1)

Head.

Compound eyes very dark grey or black. Middle ocellus dark grey; less than half as large as lateral ones, which are ringed at base with dark grey except on upper margin. Antennæ and mouthparts whitish. Genæ and frons creamy white; vertex and occiput same, but with brown longitudinal stripes. Mouthparts much as in *Centroptilum*. Both outer and inner canines of the left mandible have four teeth, although but three are usually visible on the right mandible. The lacinia of the right mandible is a slender curved rod, while that of the left one is larger and has a comb-like projection on the edge away from the canines. A row of hairs is present on both mandibles between the lacinia and the molar surface. Labrum wider than long. End joint of maxillary palp longer than first or second, which are about equal in length. Palp slightly longer than entire body of maxilla.

Thorax.

Dorsally light yellow with brown markings. Pleura creamy; ventrally white.

Legs.

Creamy white. Claws very long and slender, longer than half the tarsus. Tarsus and tibia of second leg of equal length; femur nearly twice as long as tibia or tarsus. Third leg, tibia slightly longer than tarsus; femur 1½ as long as tarsus.

Abdomen.

Tergites light yellow marked with brown. Sternites creamy white, 5-8 with posterior border narrowly brown. Tergites and sternites with short spines fringing the posterior border of each. Lateral margins of abdominal segments spinose. Gills present on segments 1-7, all single, the tracheæ

branching pinnately, but all the main branches on the inner side. First gill more slender than others. Each gill almost straight on outer margin, widely rounded on inner margin, and cordate at base on inner side. (See Figs. 13-17.)

Tails.

Three, the middle one very slightly shorter than the outer ones. All three end in long slender filaments, which are easily broken. Outer tails fringed with hairs on inner side, and with short spines on outer side. Short spines also at some of the joinings. Bare at tips. Tails creamy white, light brown at joinings. In a young nymph, the tails are fully as long as the abdomen.

MALE IMAGO

Head.

Reddish brown. Ocelli white, ringed at base with black. Antennæ greyish tan, second joint white except at joinings. Turbinate eyes bright orange; occupy most of upper half of head (see Fig. 8.). Upper surface somewhat egg-shaped, but inner margin straight. These eyes not contiguous at any point, but closer together near back. Lower portion of compound eyes blue-black, silvery along borders.

Thorax.

Pronotum and prothoracic pleura olive-brown. Mesonotum bright red-brown; light tan on each side of and posterior to central sclerites. Mesothoracic pleura yellowish brown, creamy white between sclerites. Metanotum dark red-brown, metathoracic pleura olive-brown. Venter of thorax dark red-brown shading into olive-brown posteriorly. Creamy white at joinings of sclerites.

Legs.

Silvery white. Foreleg almost as long as body. Tarsal joints in order of decreasing length; 2, 3, 4, 5, 1. Second tarsal joint twice as long as fourth; fifth joint one-half of fourth. Femur $\frac{3}{4}$ of tibia. Tarsal joints of second leg, in order of decreasing length; 1, 4, 2, 3. Fourth joint longer than second or third. Third leg, tarsal joints are; 1, 2, 4, 3. Second and fourth joints equal in length. In second and third legs, first tarsal joint is slightly longer than all other tarsal joints together, and femur is twice the length of the tibia.

Wings.

No cross veins beyond humeral cross vein in basal half of costal cell. All veins silvery white. Wings transparent except in costal and subcostal cells, which are translucent, particularly so in the apical third. (See Fig. 18.)

Abdomen.

Tergite 1 dark olive-brown, with a small rounded silvery spot on each side in posterior lateral angle. Tergites 2-6 silvery, each with light olive-brown band parallel to posterior margin. An extension of this band on each side runs forward, forming triangular patches in each posterior lateral angle. Only in tergite 2 does the apex of this triangle reach the anterior margin.

A longitudinal stripe extends the length of each tergite on each side of the mid-dorsal line, becoming wider posteriorly. Between these two lines, two short darker parallel bars closely border the mid-dorsal line, extending from the anterior margin backward about one-third the length of the tergite. Tergite 7 dark olive-brown. A small silvery triangle in anterior lateral angle; crescent-shaped spots on each side near the pleural fold and in the center of the posterior margin.

Sternite 1 dark olive-brown, lighter near center of posterior margin. Sternites 2-7 silvery; each with white ganglionic area. Small and indistinct in 2 and 3, this area forms a wide central longitudinal streak in 6 and 7. On 2 also, a wide white band runs the length of the sternite on each side of the mid-ventral line, each starting from a round brown spot on the anterior margin. Sternite 8 opaque yellowish white, a faint brownish streak next to pleural fold. Sternite 9 opaque white in center, bordered on sides and along posterior margin with dark olive-brown; white next to pleural fold. Sternite 10 entirely white.

Abdominal segments 2-7 transparent, others opaque. On every tergite a purplish-brown streak lies parallel and near to the pleural fold, in the posterior three-fourths of each.

Genitalia.

Forceps silvery white. Penes inconspicuous. Funnel-like openings of vasa deferentia appear from the dorsal aspect as in fig. 10.

Tails.

Silvery white, opaque white at joinings. Finely pilose throughout length. Slightly more than twice the length of the body.

MALE SUBIMAGO

Very similar to imago, but darker. Tails two, only slightly longer than body.

FEMALE IMAGO

Head.

Antennae and ocelli as in male. Compound eyes dark blue-black, margined with silver. Head light red-brown.

Thorax.

Light red-brown, slightly darker on ventral surface and at posterior margins of meso- and metanotum.

Legs.

Silvery white.

Wings.

As in male, but longitudinal veins, especially C and Sc, are tinted with light brown.

Abdomen.

Tergites light orange-brown. On each, a lighter streak along mid-dorsal line, this lighter area bordered on each side with an irregular brownish band. On 4 and 5, purplish tracings show the location of the tracheae. On 6-8 are two irregular dark spots on the posterior margin, one on each side

of the mid-dorsal line. Tergite 10 has two longitudinal brown streaks on each side of the median line, and a brown posterior margin. On each tergite appear the purplish bars parallel to and near the pleural fold, as in the male. Sternites creamy, ganglionic area white. On 3-7, on the outer side of the white central area are two indistinct brownish marks in the anterior half of the sternite. 8-10 faintly flesh-colored.

FEMALE SUBIMAGO

Very similar to imago, but darker. Tails 2, equal in length to the body.

Holotype—♂ imago—Big Alamance Creek, N. C. Reared from nymph Apl. 5, 1929.

No. 1020.1 in Cornell University collection.

Allotype—♀ imago—Same as above. Reared.

No. 1020.2 in C. U. collection.

Paratypes—3 ♂ imagoes—Same as above. Reared.

No. 1020.3-1020.8 in C. U. collection.

The nymphs of these dainty little mayflies were first taken on February 17, 1929. At this time they were not mature. However, by March 7 several showed darkened wing-pads, and a male subimago emerged on March 11. On March 28, over fifty nearly-mature nymphs were taken from the same small tributary, the last of these transforming on April 15. As the season of 1930 was unusually early, nymphs of *Neocloeon* were taken in the same stream, in company with partly-grown nymphs of *Blas-turus*, on Jan. 5. The first subimago, a female, emerged on Feb. 7. A single nymph was taken from a small rapid-flowing stream near Spero, N. C., on Mch. 24, 1929. Although much collecting was done in the vicinity of Greensboro as well as elsewhere in the state, in no streams except the two mentioned were nymphs of this species found.

The nymphs were kept indoors in shallow water in Petri dishes, with diaton-covered leaves and plant stems for food. As they fed or moved about in the dish, the luminosity of their ocelli was very noticeable. In quickness of movement these nymphs resemble *Baetis*, *Callibatis* or *Ameletus*. Although many nymphs died, the water seldom seemed to be polluted, nor were the bodies of the dead nymphs often to be found. While no *Neocloeon* nymph was actually seen to feed upon the dead body of another nymph, circumstantial evidence leads to the belief that these

nymphs will take such animal food when the opportunity presents itself. Nor would this be unusual, as *Callibaetis* nymphs have been seen to eat bits of dead tadpoles, and nymphs of *Blas-turus* and *Ephemerella* have frequently been observed feeding upon other dead nymphs.

No adults of *Neocloeon* were taken in the field. Several were successfully reared to maturity indoors, although many nymphs and subimagos died. The usual time for the emergence of the subimago from the nymphal skin was between 9:30 and 11 a. m. One male, emerging from its nymphal skin about 9:45 a. m. on April 13, was seen trying unsuccessfully to complete its transformation at 4 p. m. the same day—a subimaginal period of about 6 hours. In the case of another male, 7 hours were required for this period. Until such time as many others can be reared and records kept of the exact time of their transformation, data on the length of the subimaginal period must remain very incomplete.

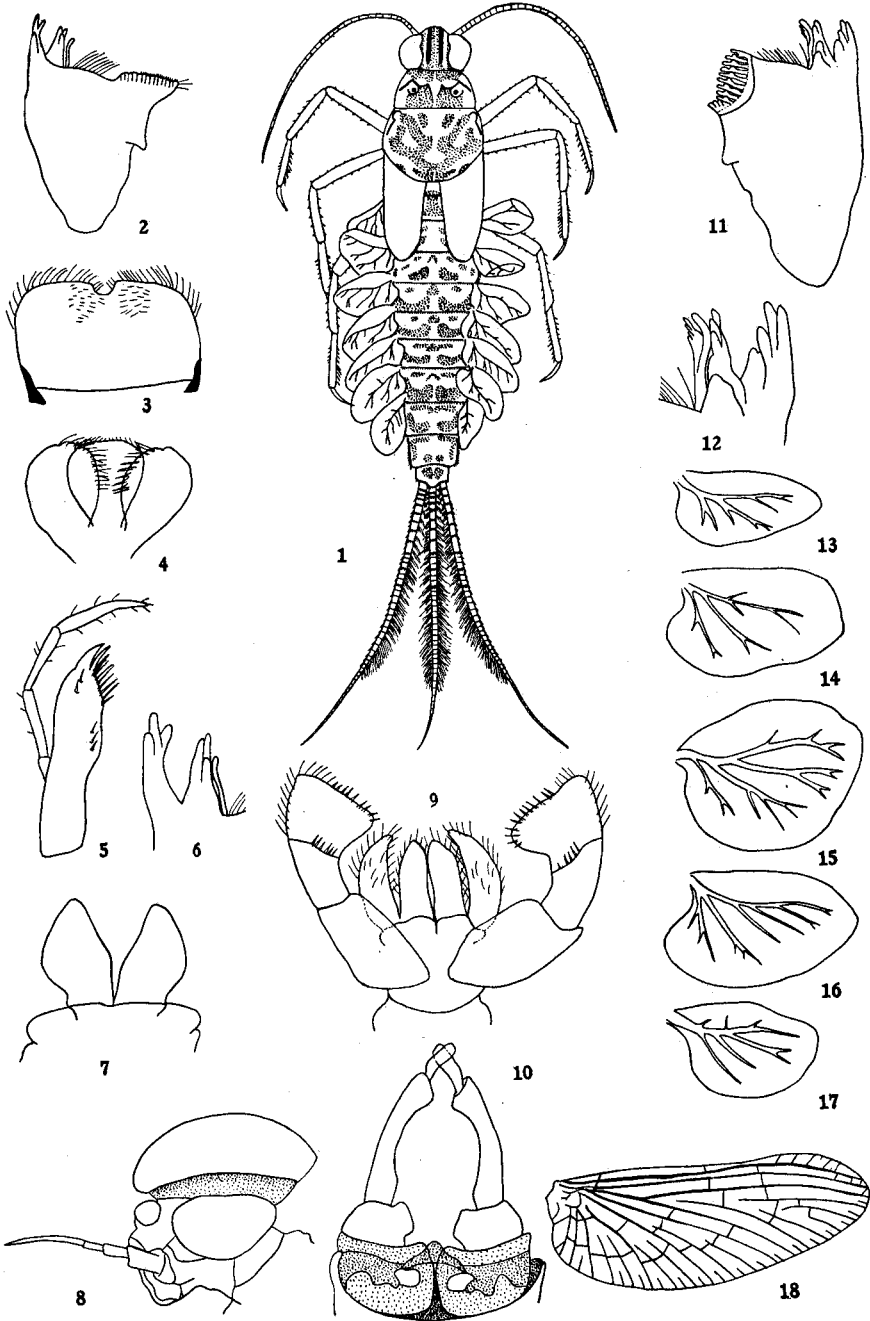
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PLATE XIV

Neoclæon alamance

- Figure 1. Nymph, not yet fully mature. Dorsal aspect.
Figure 2. Right mandible, ventral aspect.
Figure 3. Labrum.
Figure 4. Hypopharynx.
Figure 5. Right maxilla, ventral aspect.
Figure 6. Detailed sketch of canines, right mandible.
Figure 7. Tenth sternal plates of female imago, with posterior margin of ninth sternite.
Figure 8. Head of male imago, lateral aspect.
Figure 9. Labium.
Figure 10. Genitalia of male imago, dorsal aspect. Basal joint of forceps stippled lightly; chitinized structures stippled more heavily; openings of vasa deferentia unstippled.
Figure 11. Left mandible, ventral aspect.
Figure 12. Detailed sketch of canines, left mandible.
Figures 13-17. Gills from left side of body. In order, taken from segments 1, 2, 4, 5, 7.
Figure 18. Left wing of male imago.



NEOCLŒON ALAMANCE