

**Article IV.—AFRICAN STONE-FLIES AND MAY-FLIES
COLLECTED BY THE AMERICAN MUSEUM
CONGO EXPEDITION¹**

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PLATE V

The few specimens of the above-named groups collected by the Congo Expedition have proved of very great interest and are described herewith.

PLECOPTERA

Two, or possibly three, species of stone-flies of the genus *Neoperla* were taken by Messrs. Lang and Chapin at Faradje, Belgian Congo, 29° 40' E., 3° 40' N. The African species of this genus are inadequately described. The first to be made known was Newman's *N. spio* from Sierra Leone (Newman, 1839, p. 86). Six others are briefly characterized in an analytical key by Klapalek (1909 *b*, p. 218), four of them as new species, without any description other than diagnostic characters (some of which are mere color characters), without measurement, and without more specific designation of localities. Two species of the Congo Expedition collection are represented by both sexes and, in both, are so strongly marked that it seems possible to identify them with two that are named in Klapalek's key. These two are more fully characterized herewith. The third, somewhat larger, form (possible species) is represented by a single female in bad condition, and is specifically unidentifiable.

NEOPERLA Needham

Pseudoperla BANKS, 1892, Trans. Amer. Ent. Soc., XIX, p. 332 (preoccupied).

Neoperla NEEDHAM, 1905, Proc. Ent. Soc. Washington, p. 108. Klapalek, 1909, Wien. Entom. Zeitg., XXVIII, p. 216.

Ochthopetina ENDERLEIN, 1909, Entom. Zeitg. Stettin, LXX, p. 324.

This genus includes all the African Plecoptera and is also found in America, India, Indomalaya, and Japan. It is the dominant genus of stone-flies in the tropics of the world.

Since so little is known of the African Plecoptera the following list of species described from the Ethiopian region may prove useful. The years and pages refer to the appended bibliography.

¹Scientific Results of the Congo Expedition. Entomology, No. 5.

Neoperla africana Klapalek, 1909 *a*, p. 56.—Cameroon (Johann Albrechtshöhe, Kribi); German East Africa (Ukami, Langenburg)

Neoperla camerunensis (Enderlein), 1909 *a*, p. 343.—Cameroon (Barombi); Belgian Congo (Kitobola).

Neoperla conradti (Enderlein), 1909 *a*, p. 335.—Cameroon (Barombi).

Neoperla didita (Enderlein), 1909 *a*, p. 345.—Cameroon (Barombi).

Neoperla dubia Klapalek, 1909 *b*, p. 218.—Africa; Belgian Congo (Faradje).

Neoperla excisa Klapalek, 1909 *b*, p. 218.—Africa; Belgian Congo (Faradje).

Neoperla laticollis Klapalek, 1909 *b*, p. 218.—Africa.

Neoperla leroiana Klapalek, 1911, p. 103.—Anglo-Egyptian Sudan (Redjaf).

Neoperla nigricauda Klapalek, 1909 *a*, p. 218.—Africa.

Neoperla sjöstedti Klapalek, 1909 *a*, p. 55.—Mt. Kilimanjaro (Kibonoto, 1300–1900 m.); Mt. Ruwenzori (western slope, at 2000 m.).

Neoperla spio (Newman), 1839, p. 86.—Sierra Leone.

Neoperla tenera (Navás), 1915, p. 4.—Abyssinia (Endessa, Haut Aouache).

Neoperla transvaalensis (Enderlein), 1909 *b*, p. 402.—Transvaal (Zoutpansberg).

***Neoperla excisa* Klapalek**

Plate V, Figures 13, 15 and 17

Length to wing tips 12 mm. Expanse 21 mm. in male. Color uniformly dull yellowish over body, wings, and appendages, the tips of the last hardly darker in color, the veins of the fore wings brownish. Ocelli large, close-set, these being separated by a space that is less than half the diameter of one of them.

The distinctive characters of this species lie almost wholly in the secondary sexual characters. In the male, segment ten of the abdomen is divided on the mid-dorsal line, and the two anteriorly directed dorsal horns are slender, nearly smooth, approximated in their basal half and divergent toward the tips. Between the bases of these horns, the free, flaplike, inner ends of the divided dorsum are thickly studded with minute, roundish, brown, button-like, chitinous nodules, covering the convex upper surface, one hundred or more on each flap. On the dorsum of the eighth segment a conic-triangular, brown, heavily chitinized process arises under the tips of the paired horns, and like them is directed forward. The tip of this median process is directed toward a shallow notch in the emarginate chitinized apical ring of abdominal segment seven, and beside the emargination and beneath the tip of the process are a few larger and darker chitinous nodules.

The female is similar to the male in coloration, slightly larger in size, and bears no well-marked external sex characteristics, the apical margin of the eighth abdominal segment on the ventral side is slightly emarginate toward the median line and more strongly chitinized over a minute and very shallow median concavity in this margin. The shell of the ovarian egg is marked by about eight to twelve straight, low longitudinal ridges that divide the surface into areas like the staves on a barrel, that extend over four-fifths the length of the egg, but that do not reach either the shell aperture at the micropyle or the more pointed opposite end.

One male and one female. Faradje, Belgian Congo.

Neoperla dubia Klapalek

Plate V, Figures 12, 14 and 16

Length to tip of wings 13 mm. Expanse 23 mm. in male. Color brownish, becoming yellowish below and on bases of all appendages. Legs yellowish, suffused with brown on knees externally and on tarsi beyond the basal segment. Both fore and hind wings smoky yellowish brown with dark brown veins.

Like the preceding species the critical diagnostic characters are found in the genitalia. The horns on the dorsally cleft tenth abdominal segment are slender and parallel beyond their converging bases. Like the horns, the internal flaps between their bases are bare. The dorsum of the ninth segment is somewhat saddle-shaped, with a raised, broadly rounded area each side, that is studded with some forty to fifty setigerous punctures, bearing long divaricate bristles. At the rear of the seventh segment rises a long flattened conical process that is directed backward. Its tridentate tip lies between the tips of the paired horns.

In the female the apical margin of the eighth abdominal segment is slightly produced in the mid-ventral line, in a minute, roundish, scale-like flap covering the genital aperture, and the tip of this scale-like portion shows a more or less evident median apical emargination.

The lower portion of the oviduct is densely clothed within by minute conic prickles, whose points are directed outward. This chitin-lined portion is coiled several turns, and has a length equal to that of several abdominal segments.

The shell of the egg of this species shows some thirty to forty very oblique longitudinal striæ, spirally wound about it, and reaching to its obtuse ends.

Several specimens of both sexes from Faradje, Belgian Congo.

PLECOPTERA RECORDED FROM THE BELGIAN CONGO

Perlidae**NEOPERLA** Needham

Neoperla camerunensis (Enderlein).—Lower Congo (Kitobola).

Neoperla dubia Klapalek. See above.

Neoperla excisa Klapalek. See above.

Neoperla sjöstedti Klapalek.—Western slope of Mt. Ruwenzori, at 2000 m.

Klapalek has also described three nymphs of Perlidae taken in the Belgian Congo (forest 90 kilom. west of the southern shore of Lake Albert Edward) and Lestage has described and figured three additional species of nymphs from the Maba River, near Mlonda (western shore of Tanganyika). All these are undetermined species of *Neoperla*.

BIBLIOGRAPHY OF AFRICAN PLECOPTERA

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 1909 *b.* Vorläufiger Bericht über exotische Plecopteren. Wien. Entom. Zeitg., XXVIII, pp. 215-232.
 1911. *Neoperla leroiana* n. sp. Wien. Entom. Zeitg., XXX, pp. 103-104.
 1912. Plecoptera. Wiss. Ergebn. Deutsch. Zentr. Afr. Exp. (1907-08), III, pp. 447-452.
- LESTAGE, J. A. 1917. Deuxième contribution à l'étude des larves des Éphémères et Perlides du Congo Belge. Rev. Zoolog. Afric., V, pp. 134-140.
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 1915. Neurópteros nuevos o poco conocidos, IV. Mem. Ac. Cienc. Barcelona, (3) XI, No. 23, pp. 1-28.
- NEWMAN, E. 1839. On the synonymy of the *Perlites*, together with brief characters of the old, and of a few new species. Mag. Nat. Hist., N.S., III, pp. 84-90.

EPHEMERIDA

A single male adult May-fly appeared among the pinned specimens brought from the Belgian Congo by Messrs. Lang and Chapin. However, when a dilapidated and crumpled specimen of the stone-fly *Neoperla excisa* was boiled for study, two additional minute specimens of another May-fly were loosened from some place of concealment underneath the stone-fly, and floated freely away from it in the water. These, thus softened, were fit for study, and upon examination proved to be apparently a nymph and a male imago of the same species. They represent a new genus, as well—one closely allied to the cosmopolitan genus *Cænis*. This is one of the smallest of May-flies. The other pinned specimen is one of the largest of May-flies. It is the fine species for which Navás proposed the generic name *Eatonica*. Its generic position has been discussed by Eaton, Navás, Ulmer and Lestage without much agreement. Lestage has summarized the evidence in the Revue Zoologique Africaine, VI, 1918, pp. 82 to 89, and we follow him in calling this species *Pentagenia schoutedeni*. The nymphs of all the genera in question are much more strongly characterized than are the adults; but the nymph of this species is as yet unknown. Both this species and the new one are herewith described and illustrated.

Pentagenia schoutedeni (Navás)

Plate V, Figures 1 and 2

Length about 17 mm., tails 40 mm. additional. Expanse of wings 30 mm.

Color brownish, darker on dorsum and on all carinæ, paler beneath. Fore and middle legs are lacking from the single specimen; the single hind leg present is pale and concolorous, as are the setæ. The middle tail, in the male, aborted to a few-segmented rudiment. Claws very dissimilar, one of each tarsus being broadly

flabellate; the other, sharply uncinatè. Venation as shown in Plate V, figure 1. Wings opalescent and iridescent; fore wings strongly marked with a broad costal band of brown. All veins tinged with a deeper shade of purplish brown, the transverse veins about the base of both wings and a few others near the middle of the hind wings more broadly margined with the same color.

Forceps of the male strong, the elongate middle segment curved almost in a semicircle, the single small terminal joint twice as long as wide. Penes separated at tip in less than half their length, in a V-shaped notch; each bearing a low subterminal obtuse hook just below the aperture of the recurved sperm duct.

One male. Faradje, Belgian Congo. Lestage reports this species as being distributed throughout equatorial Africa.

CÆNOPSIS, new genus

Allied to *Cænis*. Tails three, middle one longest. Forceps of the male at least three-jointed, the third joint very long and flexible. Claws dissimilar, one sharply hooked, one blunt. Terminal tarsal segment as long as the three basal segments. Wings two. Venation as shown in Plate V, figure 3, differing from *Cænis* in better preservation of typical forks and in a wider band of cross-veins.

Cænopsis fugitans, new species

Plate V, Figures 3 to 11

Length 4 mm., tails 9 mm. (middle one 10 mm.) additional. Expanse of wings 10 mm.

Color blackish, with pale setæ and whitish wings. Head blackish, paler in rear, antennæ pale. Thorax and abdomen black, the latter with sooty black patches on sides of segments one to eight and on mid-dorsum of segments nine and ten. Tibiæ each with a minute sooty patch just below the knee joint. Wings with smoky costal band that is darkest along the subcostal vein. Male forceps wholly pale, basal segment not longer than wide; middle segment five times as long, cylindric, end segment longer than all the basal parts collectively, tapering and flexible in its terminal portion. Penes fused into a single pyriform organ except at tip where a median cleft remains, and surrounded beneath by a V-shaped ring of chitin at the apex of the tenth abdominal segment, the arms of the V reaching laterally to the base of the forceps each side. Fore tibia of the male three to four times as long as the other tibiæ.

One specimen found as detailed above, with its nymph. Faradje, Belgian Congo.

Nymph.—Length about 7 mm., antennæ 2 mm., setæ broken, perhaps a little longer than the antennæ, width 2 mm. Color apparently greenish black. Body depressed, rather smooth with short legs and thin lateral edges to abdomen.

Head small and rather compact, with small rounded eyes capping its lateral angles. Mouth-parts as shown in Plate V, figures 8 to 11. Prothorax wider than the head with thin flaring anterolateral angles.

Abdomen with a conspicuous mid-dorsal hook on the second abdominal segment and with thin flat lateral spines on segments four to nine, the series on each side curving outward like a segment of a circular saw. Gills on segments one and three

to seven, those of segment one simple tapering filaments set erect upon a pedunculate base, those on segment three elytriod and covering the others to rear, those of segments four to seven, thin, flat translucent, whitish plates, obliquely oval in form, the margins fringed with long, forking, respiratory filaments.

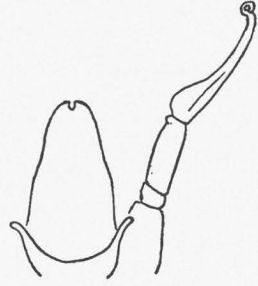
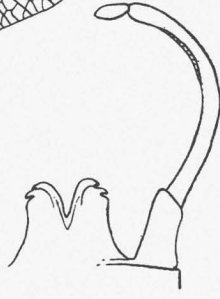
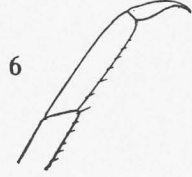
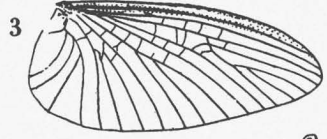
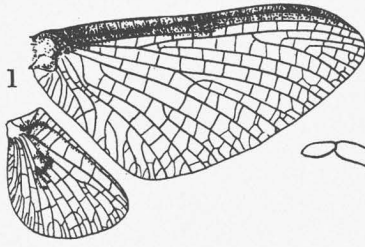
One nymph, taken with the adult from the body of the stone-fly *Neoperla excisa*, as noted above.

A complete summary of what has hitherto been published concerning African May-flies will be found in a paper by J. A. Lestage entitled: "Les Éphémères d'Afrique: Notes critiques sur les espèces connues" in *Revue Zoologique Africaine*, VI, 1918, pp. 65-114.

PLATE V

Congo May-flies and Stone-flies.

- Fig. 1. Wings of *Pentagenia schoutedeni* (Navás), male.
- Fig. 2. Forceps and penes of the same.
- Fig. 3. Wing of *Cænopsis fugitans*, new species, male.
- Fig. 4. Forceps and penes of the same.
- Fig. 5. Nymph of *Cænopsis fugitans*.
- Fig. 6. Hind foot of same.
- Fig. 7. Gill of first abdominal segment of same.
- Fig. 8. Mandible of same.
- Fig. 9. Maxilla of same.
- Fig. 10. Hypopharynx of same.
- Fig. 11. Labium of same.
- Fig. 12. *Neoperla dubia* Klapalek, mid-dorsal aspect of rear segments of the abdomen in the male.
- Fig. 13. *Neoperla excisa* Klapalek, showing corresponding parts.
- Fig. 14. Egg-shell of *Neoperla dubia*, showing spiral striations.
- Fig. 15. Egg-shell of *Neoperla excisa*, showing longitudinal ridges.
- Fig. 16. *Neoperla dubia*, aspect of the eighth ventral segment of the female, showing lamina.
- Fig. 17. *Neoperla excisa*, showing the retuse corresponding border.



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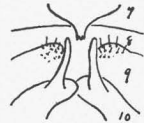
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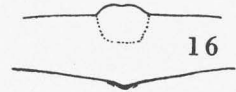
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