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THE NORTH AMERICAN SPECIES OF THE GENUS POTAMANTHUS, WITH A DESCRIPTION OF A NEW SPECIES

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The material on which this study is based is part of the Cornell University collection and comes from Iowa, Michigan, Pennsylvania, New York, Maryland, and Tennessee. During the summer of 1926 the writer had the opportunity of making fairly regular collections in the Potomac River and some of its tributary streams in the state of Maryland and was fortunate in collecting at least three species of *Potamanthus* in the adult stage and a large number of unidentified nymphs belonging to the same genus. The members of the genus have been somewhat confused and this paper is an effort to clear up some of the taxonomic difficulties in the group. In the past there have been six species described from North America: *P. verticis* Say, originally classed as a *Baetis*, then put in *Ecdyurus* by Eaton, listed in Bank's catalogue under *Heptagenia*, and finally placed in *Potamanthus* by McDunnough in 1926; *P. flaveola* Walsh, originally described as an *Ephemera*, and listed in Bank's catalogue as a *Potamanthus*; *P. myops* Walsh, originally described as an *Ephemera* and put into *Potamanthus* by McDunnough in 1926; *P. medius* Banks, originally described as a *Potamanthus*; *P. diaphanus* Needham and *P. inequalis* Needham, originally described as species in *Potamanthus*.

The descriptions are scattered in the literature and as a whole are rather incomplete and unsatisfactory. There has been a lack of uniformity in the manner of handling and describing material; some has been used in the fresh condition; some has been pinned and dried and some has been preserved in alcohol and with forms so delicate and so lightly colored this would naturally lead to ambiguity. In the Cornell Collection all material is kept in alcohol and as specimens are studied the wings are mounted on one slide and the head, legs, genitalia and tails are mounted on another slide. If there are distinctive patterns on the abdomen or thorax these parts are cleared and mounted also.

In going over the material in the Cornell Collection there seem to be at least five distinct species represented; *verticis*, *flaveola*, *myops*, *diaphanus*, and one which will be described in this article. They fall into two groups, those in which the males have small eyes separated by a distance of more than two eye diameters, and those in which the males have large eyes, separated by a distance of but little more than one eye diameter. In the first group would be placed *verticis*, *myops*, and the one new species, while in the second group would be placed *flaveola* and *diaphanus*. The comparative size and position of the eyes is a character which has been used but once in the past, by Walsh in separating *myops*, a small-eyed species, from *flaveola*, a large-eyed species. No mention of the kind of eyes found in *verticis* is made by Say. According to his very incomplete description, the infuscated cross veins and the small size are its only distinguishing characters. In separating *verticis* from *flaveola* I took all the male specimens which showed black on the cross veins to any degree and found that they were uniformly smaller than *flaveola* and that they all had small and widely separated eyes. Since the males of *flaveola* do not have infuscated cross veins, according to Walsh's description, I have called these specimens *verticis*, and would add to Say's description the matter of the eye dimension as a very easily observed character.

Needham's type specimen of *inequalis* seems to have been lost and as a result it has not been treated in this grouping. It was separated from *diaphanus* through an apparent difference in the outline of the penes of the male, but after making careful exami-

nation of all the material at hand, it appears that there are no specific differences in the shape of the male genitalia of the species in the genus and any variation in outline might be due to differences of turgidity and muscular contraction. There is a fairly constant size variation within the genus, and in one species there is a color character associated with the genitalia, but for the lack of other characters *inequalis* should be classed as a synonym of *diaphanus*.

Banks' *medius* was described from females and the female differences have not been studied sufficiently to tell whether his species is valid or not. I have been unable to separate it on the characters he gives.

In the past the distinction between the nymphs of *Potamanthus* and *Polymitarcys* has been held to consist only of this one difference; in *Potamanthus* the tusk-like ramus on the side of the mandible is short and barely extends beyond the labrum, while in *Polymitarcys* the tusk is long and extends some distance beyond the edge of the labrum. This distinction was apparently substantiated by a single adult *Polymitarcys* which was said to have been reared from one of the long-tusked nymphs by W. E. Howard in 1904. This past summer Doctor Needham collected from the Jordan River in Utah, and the writer collected from the Potomac River in Maryland, a series of nymphs which are entirely different and resemble nothing previously collected in this country. They correspond exactly with Eaton's description of the nymph for the genus *Polymitarcys*, resembling very closely his figure of *P. virgo*, the type of the genus. An examination showed the developing wing pads to have the typical *Polymitarcys* wing venation. An examination of the wing pads of nymphs which had previously been held to be *Polymitarcys* in this country, showed that they had typical *Potamanthus* wing venation. Thus it is found that the nymphs of *Potamanthus* are entirely different from those of *Polymitarcys* and have an entirely different mode of living. The former are found on the sand and gravel at the edge of riffles where the water is not too swift, while the latter are burrowing forms which are dug up out of the sand and silt where the water is flowing slowly and the bottom is soft. They have elaborate strainers of parallel bristles

on the mouth parts and the fore legs, which would seem to act as sieves for getting the available food from the ooze and silt of the bottom. An examination of the original nymphal skin from which Howard claimed to have reared a specimen of *Polymitar-cys albus* shows it to have been a *Potamanthus* nymph, some faulty observation having been made to give rise to this error which has persisted so long. The length of the mandibular tusk of the *Potamanthus* nymph seems to vary with species. Among the nymphs in the Cornell Collection there are some with very short tusks and some with long tusks, but as far as I know there are no specimens with tusks as short as Eaton has shown in his figure for the nymph of *P. luteus*.

KEY TO THE NORTH AMERICAN SPECIES OF POTAMANTHUS

1. Eyes of the male small, separated by a distance equal to at least twice the eye diameter..... 2
 Eyes of the male large, separated by a distance equal to little more than one eye diameter..... 4
2. Species with a wing expanse of over 20 mm.; no infuscation on veins or cross veins of male or female..... 3
 Species with wing expanse of less than 20 mm.; cross veins infuscated on male and female; vertex, thorax, and the tip of anterior femur, ferruginous; vittae on sides of abdomen, tip of anterior tibia, incisures of anterior tarsus, and incisures of tails, fuscous.....*P. verticis*.
3. Species yellowish white; wing expanse of male 28-29 mm.; fore leg 9 mm.; body 15 mm.; tails 30-20-30 mm.; vertex, antennae, tip of anterior femur, tip of anterior tibia, incisures of tails, and incisures of genital forceps, ferruginous; vittae on sides of abdomen and tarsal incisures, fuscous*P. rufous* n. sp.
 Species white; expanse of male 26-27 mm.; fore leg 11 mm.; body 12-13 mm.; tails 28-20-28 mm.; tip of anterior tibia, incisures of anterior tarsus, incisures of tails, slightly ferruginous; no fuscous vittae on sides of abdomen and no coloring of the incisures of the genital forceps*P. myops*.
4. Wings an expanse of 18-22 mm.; male with no infuscation on cross veins, female with cross veins infuscated; vertex, thorax, and tip of anterior femur, ferruginous; tip of anterior tibia, incisures of anterior tarsus, incisures of tails, and vittae on sides of abdominal segments, fuscous*P. flaveola*.
 Wing expanse 20 mm.; neither male or female has infuscated cross veins; vertex, thorax, pale yellowish white; tip of anterior tibia and incisures of anterior tarsus faintly infuscated; tails white with colorless incisures*P. diaphanus*.

Potamanthus rufous new species.

Wing expanse of male 28–29 mm.; bod y15 mm.; tails 30–20–30 mm.; fore leg of male 10 mm.; eyes small, separated by a distance equal to $2\frac{1}{2}$ times the eye diameter; vertex, antennae, and thorax, ferruginous; abdomen yellowish with with fuscous spots on sides of segments; incisures of tails strongly ferruginous; tips of anterior femora and tibiae, strongly ferruginous; incisures of anterior tarsi fuscous; incisures of genital forceps ferruginous; wings hyaline with no color on veins or cross veins.

Females: wing expanse 33 mm.; body 16 mm.; tails 20 mm., middle one but little shorter than the other two; fore leg 9 mm.; eyes small, separated by a distance equal to three times the eye diameter; antennae, vertex, and thorax, ferruginous; abdomen white with fuscous dots on sides of segments; incisures of tails strongly ferruginous; anterior femora and tibiae strongly ferruginous their entire length; incisures of anterior tarsi fuscous.

The female is more strongly ferruginous than the male, slightly larger in expanse of wing and length of body, and has the eyes more widely separated. It cannot be confused with the *P. medius* described by Banks.

Described from two males and one female taken at Corning, N. Y., July 8, 1924, by C. R. Crosby, and one male taken at McLean Reservation, Tompkins Co., N. Y., July 12, 1924.

This species is the largest one in the genus and seems to be a distinct form. It is most easily recognized by its large size and the amount of reddish coloring found on the body; it is the only one examined which showed any color at the incisures of the genital forceps. The body and genitalia are found to be regularly larger than is the case in *myops*, while the front leg of the male is considerably shorter than that of *myops*. The fuscous dots on the sides of the abdomen are plainly seen, but Walsh after examining a series of specimens of *myops* made no mention of any such spots.

ANNOTATED BIBLIOGRAPHY

BANKS, NATHAN. Catalogue of the Neuropteroid insects (except Odonata) of the United States. Philadelphia, 1907.

In his catalogue Banks lists but one species in the genus *Potamanthus*, *P. flaveola* Walsh.

BANKS, NATHAN. Neuropteroid insects—notes and descriptions. Trans. Am. Ent. Soc., XXXIV, 1908, p. 259.

Banks describes the species *P. medius* from female specimen collected at electric light in July from Douglas Co., Kansas.

EATON, REV. A. E. A revisional monograph of recent ephemeridae or mayflies. Trans. Linn. Soc. of London, Second series, Vol. III, Zoology, 1888.

Eaton describes the genus, restricting it much more than Pictet had done and designates *P. luteus* Linn. as the type. He gives complete descriptions of adult and nymph of *luteus*. But he seems to have had something different from what Say had when he describes *verticis*, which he places in *Ecdyurus*, the color characters which he gives are very clearly different from what Say gave to *verticis*.

HOWARD, W. E. Mayflies and midges of New York, by James G. Needham, N. Y. State Mus. Bul. 86, Ent. 23, 1905.

Needham includes an account by Howard in which he describes a nymph from which he claims to have reared an adult *Polymitarceys albus* Say. I have examined the nymphal skin and find it to be that of a long-tusked *Potamanthus* species.

McDUNNOUGH, J. Note on North American Ephemeroptera with descriptions of new species. Can. Ent., Vol. LVIII, no. 8, 1926.

McDunnough claims that *flaveola* is a synonym of *verticis*.

MORGAN, ANNA H. Mayflies of Fall Creek. Ann. Ent. Soc. of America, Vol. IV, 1911, pp. 93-119.

Mention is made of a half grown nymph of *Potamanthus* which was observed in Fall Creek, near Ithaca, N. Y. It is described as having short tusks on the mandibles. No name is given to it.

MORGAN, ANNA H. A contribution to the biology of mayflies. Ann. Ent. Soc. of America, Vol. VI, 1913, pp. 371-413.

In this paper Miss Morgan describes the life habits of the nymphs of *Potamanthus* and *Polymitarceys* but they should both be in the genus *Potamanthus*. She figures a *Potamanthus* nymph, and the mandibular tusks are seen to be somewhat longer than the ones shown in Eaton's figure of *P. luteus*.

NEEDHAM, JAMES G. Burrowing mayflies of our larger lakes and streams. Bul. of the Bur. of Fisheries, Vol. XXXVI, 1917-18, pp. 269-292.

In this paper Dr. Needham describes the nymphs of *Potamanthus* and *Polymitarceys*, but the form he has figured as *Polymitarceys* is the long-tusked species of *Potamanthus*.

PICTET, F. J. Histoire naturelle des insectes neuroptères, 1843, Vol. II, p. 197.

Pictet describes the genus *Potamanthus* for the first time and groups a number of new and old species under it but describes no type for the genus.

SAY, THOMAS. Descriptions of new North American Neuropterous insects, and observations on some already described. Acad. Nat. Sci. of Phil., Vol. VIII, 1839, pp. 9-46.

Say describes *verticis* under the genus *Baetis*.

WALSH, BENJ. D. List of the Pseudoneuroptera of Illinois, contained in

the cabinet of the writer, with descriptions of over forty new species. Proc. Acad. Nat. Sci. of Phil., Vol. XIV, 1862, p. 377.

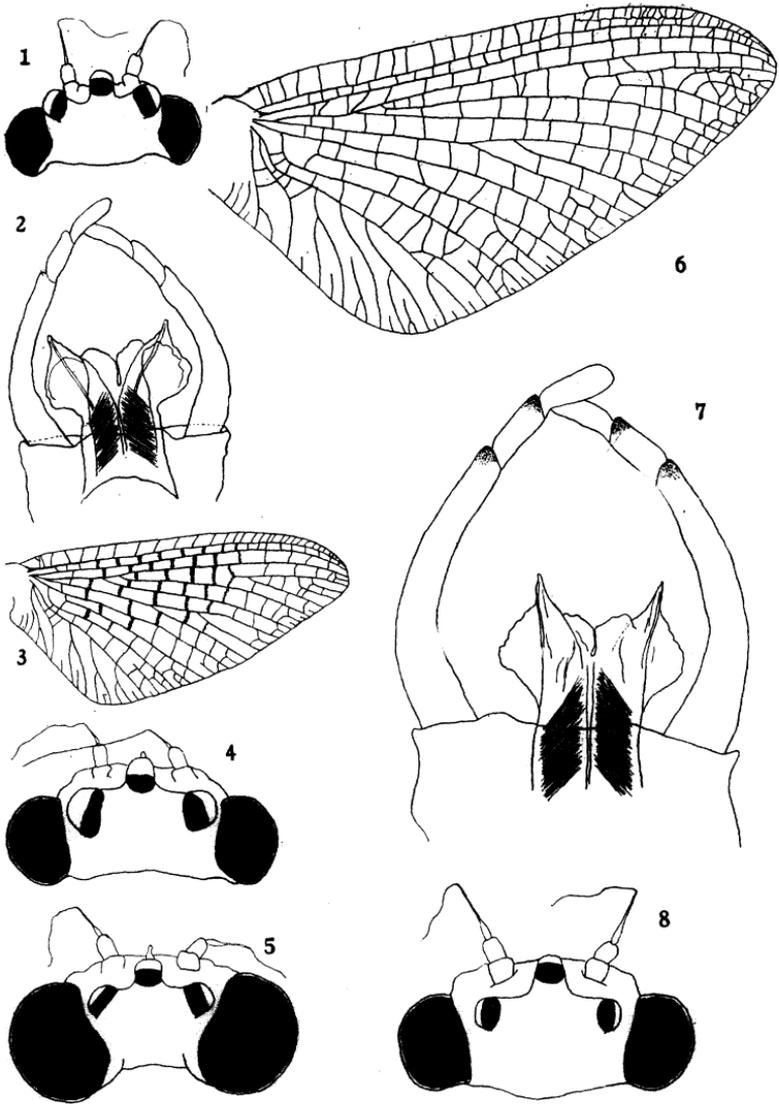
Walsh describes *flaveola* under the genus *Ephemera*.

WALSH, BENJ. D. Observations on certain North American Neuroptera, by H. Hagen, M.D., of Königsburg, Prussia; translated from the original French MS., and published by permission of the author, with notes and descriptions of about twenty new North American species of Pseudoneuroptera. Proc. Ent. Soc. of Phil., Vol. II, 1863-4, p. 207.

Walsh describes *myops* in this paper, and makes use of the comparative size of the eyes in differentiating it from *flaveola*.

PLATE XIV. ADULT STRUCTURES

- FIG. 1. Head of *Potamanthus verticis* Say, male, collected near Hagerstown, Md.
- FIG. 2. Genitalia of same.
- FIG. 3. Wing of same, shows infuscation of crossveins.
- FIG. 4. Head of *Potamanthus myops* Walsh, collected near Hagerstown, Md.
- FIG. 5. Head of *Potamanthus flaveola* Walsh, collected near Hagerstown, Md.
- FIG. 6. Wing of *Potamanthus rufous* n. sp., collected at Corning, N. Y.
- FIG. 7. Genitalia of same, shows ferruginous incisures of forceps.
- FIG. 8. Head of same.



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PLATE XV. NYMPHAL STRUCTURES

FIG. 9. Nymph of *Polymitarcys virgo* Ol. Figure copied from Eaton.

FIG. 10. Head of nymph of *Polymitarcys* sp. collected in the Potomac River, Md.

FIG. 11. Under surface of right mandible of same.

FIG. 12. Upper surface of left mandible of same.

FIG. 13. Gill of same.

FIG. 14. Gill of *Polymitarcys virgo* Ol. Figure copied from Eaton.

FIG. 15. Fore leg of *Polymitarcys* sp. collected in the Potomac River, Md.
It shows the elaborate development of bristles into strainers on the tibiae.

FIG. 16. Middle leg of same.

FIG. 17. Hind leg of same.

FIG. 18. Wing pad from same. Shows typical *Polymitarcys* venation.

FIG. 19. Plate taken from Needham's paper, "Burrowing Mayflies of our Larger Lakes and Streams." Drawings by C. H. Kennedy.

a. Nymph from above.

b. Head of same enlarged.

c. Mandible of same.

d. Maxilla of same.

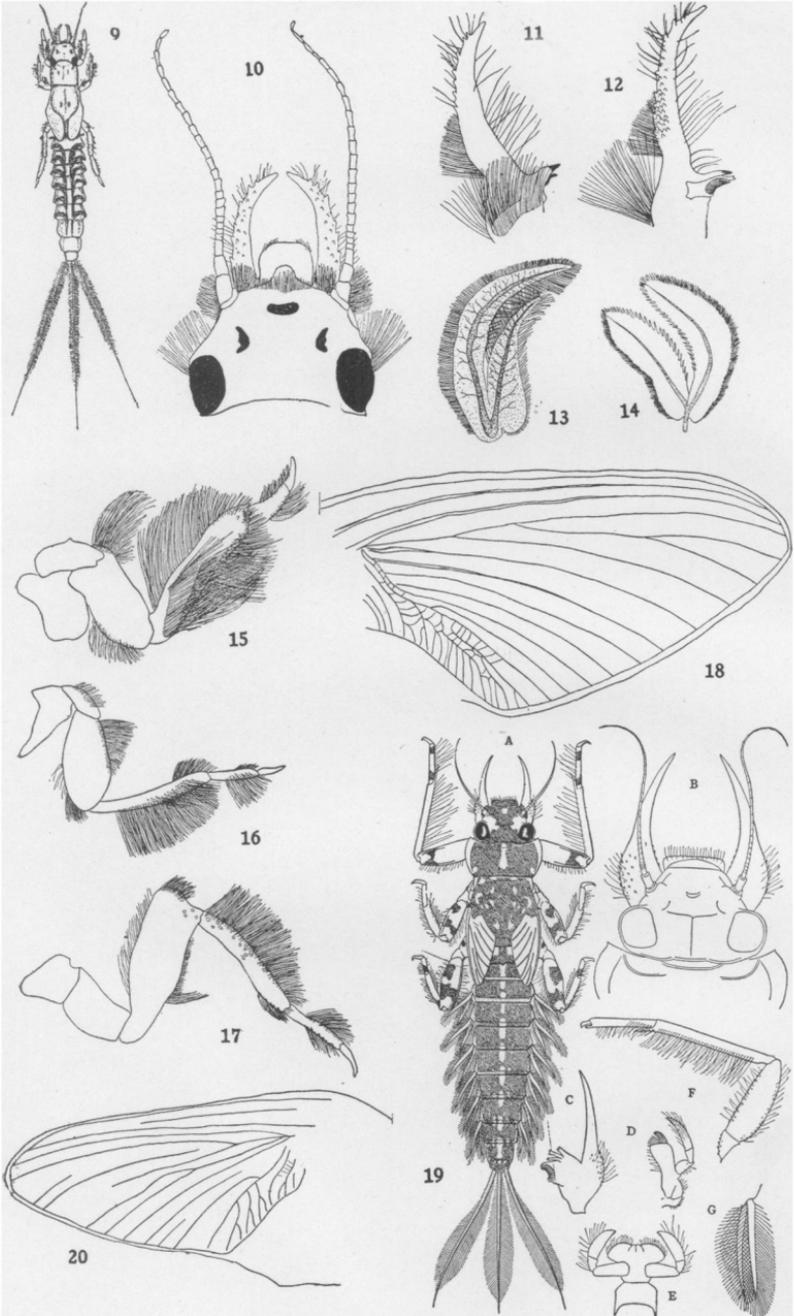
e. Labium of same.

f. Fore leg of same.

g. Gill of the second abdominal segment.

These drawings were made from the nymphal skin from which Howard said he reared an adult *Polymitarcys albus* Say, it is a typical *Potamanthus* and differs from Eaton's figure of the nymph of *Potamanthus luteus* Linn. only in the comparative length of the mandibular tusks.

FIG. 20. Wing pad nymph of *Potamanthus* sp., collected in Potomac River, Md. This nymph seemed to be identical with the one figured above, and the wing pads showed the typical *Potamanthus* venation.



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