

INTRASPECIFIC VARIATION IN TAXONOMIC CHARACTERISTICS OF
THE MAYFLY *POTAMANTHUS MYOPS* (WALSH)Robert J. Lord¹ and Peter G. Meier²

ABSTRACT

Data collected from an ecological study of the mayfly *Potamanthus myops* (Walsh) in Michigan showed intraspecific variability in taxonomic characteristics that have been employed by previous investigators for species separation. Nymphal dorsal maculation patterns varied considerably within a single population. Also, the ratio of mandibular tusk length to head length increased with successive nymphal instars. Certain adult taxonomic characteristics, particularly relative male imago eye size and distance of separation, were either too poorly defined or too variable to be conclusive in species identification.

INTRODUCTION

Mayflies of the genus *Potamanthus* occur locally in scattered but concentrated populations in several larger rivers of southeastern Michigan. As a part of a larger study on the ecology, taxonomy, and life history of this group (Lord, 1975), the feasibility of developing a key to species based on nymphal characteristics was examined. There is very little information available concerning the taxonomic characteristics of *Potamanthus* nymphs, except for the recent publication by McCafferty (1975). Morgan (1913) was one of the first authors to mention that size and relative length of mandibular tusks may be a species distinguishing characteristic, while Ide (1935) attempted to differentiate nymphs on the basis of dorsal head maculation (Figure 1).

Current *Potamanthus* taxonomy, however, is based exclusively on adult characteristics. According to Walsh (1863), male imagos could be classified to species by employing eye size and the respective distance between them measured in terms of eye diameters. On this basis he described *Potamanthus* (originally *Ephemera*) *myops* and *flaveola*. Subsequently, this characteristic has been widely used by many authors in descriptions of new species (i.e. Argo, 1927; Ide, 1935; Needham, et al., 1935). However, examination of these groupings by eye size and eye separation distance shows many discrepancies, in particular within the species *Potamanthus verticis*. This species was originally described by Say (1839), as possessing large eyes separated by a distance less than or equal to one eye diameter (male imago). McDunnough (1926) suggested that *verticis* and *flaveola* were synonyms because they shared this characteristic of eye size. However, Argo (1927) put *verticis* into the *Potamanthus* group having small eyes separated by a distance of two or more eye diameters and retained *flaveola* in the large eyed group. Needham, et al. (1935) returned *verticis* to the large eyed group, but later, in their description of the new species *P. neglectus*, a species having small, widely separated eyes, they stated that *neglectus* may be a synonym of *verticis*! Burks (1953) is the only author to illustrate relative eye sizes (Figure 2) and includes *P. distinctus* in the "intermediate" eye size group.

Male imago wing length, darkening of cross veins in both sexes, and the presence of pale lateral abdominal markings were other adult taxonomic characteristics utilized for species separation by past researchers.

Both Needham, et al. (1935) and Edmunds and Allen (1957) recognize eight species of *Potamanthus* in North America, while Burks (1953) describes only four. A summary of adult taxonomic characteristics for these eight species by Edmunds and Allen (1957) is presented in Table 1.

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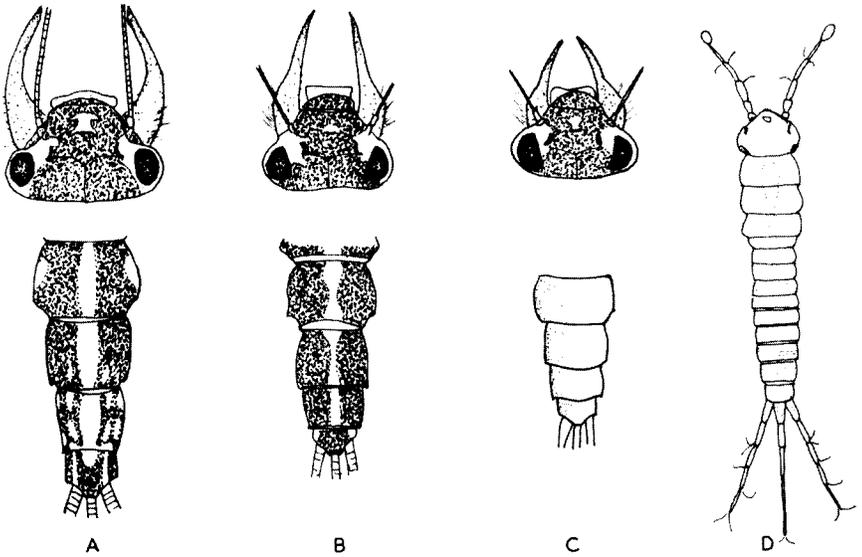


Fig. 1. Dorsal maculation of *Potamanthus* nymphs (Ide, 1935). A) *rufous*; B) *walkeri*; C) *flaveola*; and D) early instar of *flaveola*.

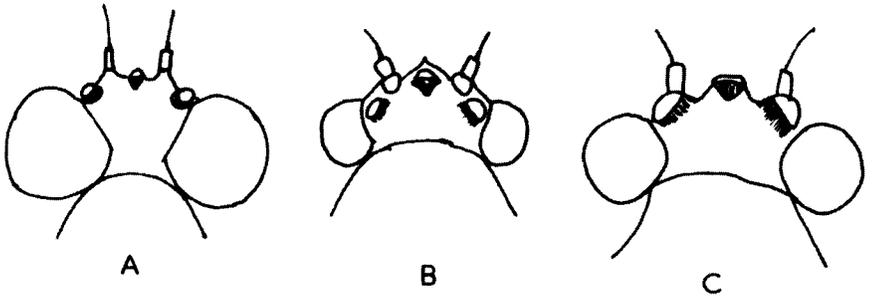


Fig. 2. Eye sizes of *Potamanthus* male imagos (Burks, 1953). A) large eyes-*verticis*; B) small eyes-*myops*; C) medium eyes-*distinctus*.

METHODS

The area of study was Michigan within a 50 mile radius of Detroit. Live material was collected and maintained from the Huron and Black Rivers. Nymphs were collected from May through July, 1975, and adults from June through August, 1975. Some nymphs from each sampling area were reared in aquaria for association of nymphs to adult. Preserved material collected in 1970 by the author was examined from the Saline and Raisin Rivers.

Table 1. Adult *Potamanthus* species characteristics (after Needham, Traver, Hsu, 1935)

Species	wing length	eye size	cross-veins		abdominal markings	distribution
	male	male	male	female		
<i>diaphanus</i>	9.5 mm	lg	hy	hy	none	NY
<i>distinctus</i>	11.0 mm	med	dk	dk	1. stripes	NY OH NC CN
<i>inequalis</i>	11.5 mm	sm	hy	?	none	NY
<i>myops</i> (= <i>medius</i>)	12.5-13.0 mm	sm	hy	hy	none*	midwest
<i>neglectus</i>	8.0- 9.0 mm	sm	dk	dk	1. spots	MD NY PA
<i>rufous</i>	13.5-14.0 mm	sm	hy	hy	1. spots	NY
<i>verticis</i> (= <i>flaveola</i>)	8.0-10.0 mm	lg	hy	dk	1. spots	midwest & northeast
<i>walkeri</i>	9.0 mm	lg	hy	dk	none	Ontario

*very pale spots in freshly killed specimens

lg = large; med = medium; sm = small; hy = hyaline; dk = darkened; 1. = lateral

RESULTS

Although only one species of *Potamanthus* was collected in the course of the study, considerable variation of taxonomic characteristics in both nymphs and adults was observed.

In the nymph, mandibular tusk length was found to increase in proportion to head length with later instars. This ratio, of head length to tusk length, changed from 1 to .63 in an early instar with 6 mm body length (excluding cerci), to 1 to 1.4 in the last instar with a 15 mm body length. Since the nymphs of several instars are present at the same time, this progressive development of tusk length with age, as illustrated in Figure 3, precludes the use of this characteristic as suggested by Morgan (1913) and others, in differentiating *Potamanthus* species at the immature level. However, McCafferty (1975) feels that the ground color of the naiad and the shape of the tusks may suffice in the separation of these species.

Dorsal head maculation was also found to be variable within a single population of nymphs of approximately the same size. Figure 4 presents some examples of head maculation differences, while Figure 5 illustrates the general maculation pattern in the last instar of *Potamanthus myops*.

Several of the generally accepted adult taxonomic characteristics also showed a degree of variation. In this *Potamanthus* species wing cross veins were found to be, without exception, hyaline in both sexes. Faint lateral abdominal markings were observed in some individuals of a given population and not in others. However, when present, these lateral abdominal markings were most prominent in the subimago stage and virtually disappeared in the adult form. Preservation of subimagos in 70% ethanol removed all traces of lateral abdominal markings as indicated by Burks. Since identification is carried out mostly from preserved specimens, the usefulness of lateral abdominal markings for differentiating *Potamanthus* imagos is questionable.

Wing lengths of male imagos showed a range of 9.46 mm to 12.54 mm with the average being 11.15 mm. This variability of wing length within one population of this local species overlaps nearly all other species presented in Table 1. Probably the most consistent taxonomic characteristic found for these populations of *Potamanthus myops* was that of eye size and respective distance of separation. This morphological feature (Figure 6), which compares most closely with Burk's illustration of *distinctus* (Figure 2),

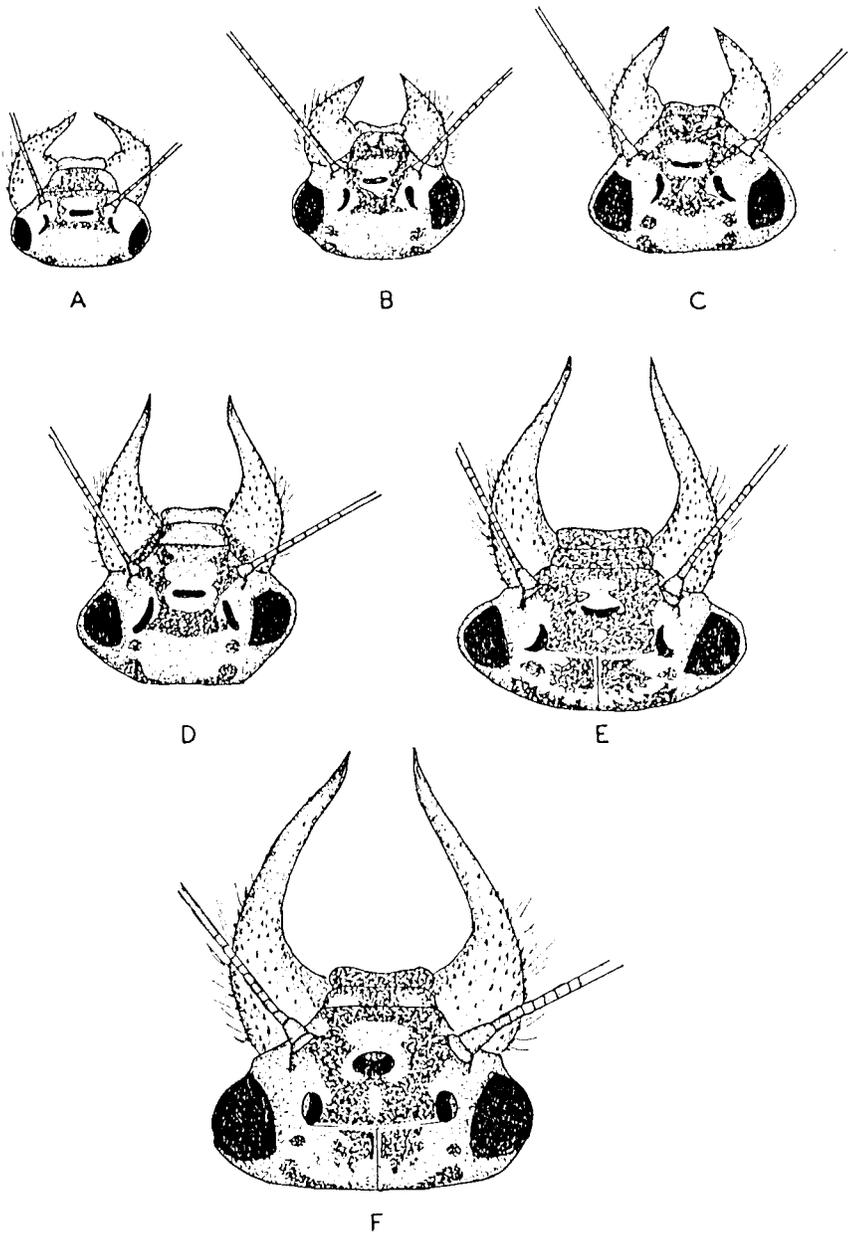


Fig. 3. Progressive increase in tusk length relative to head length of *P. myops*. Body lengths (excluding cerci), A) 6.0 mm; B) 7.5 mm; C) 9.0 mm; D) 11.0 mm; E) 13.0 mm; F) 15 mm.

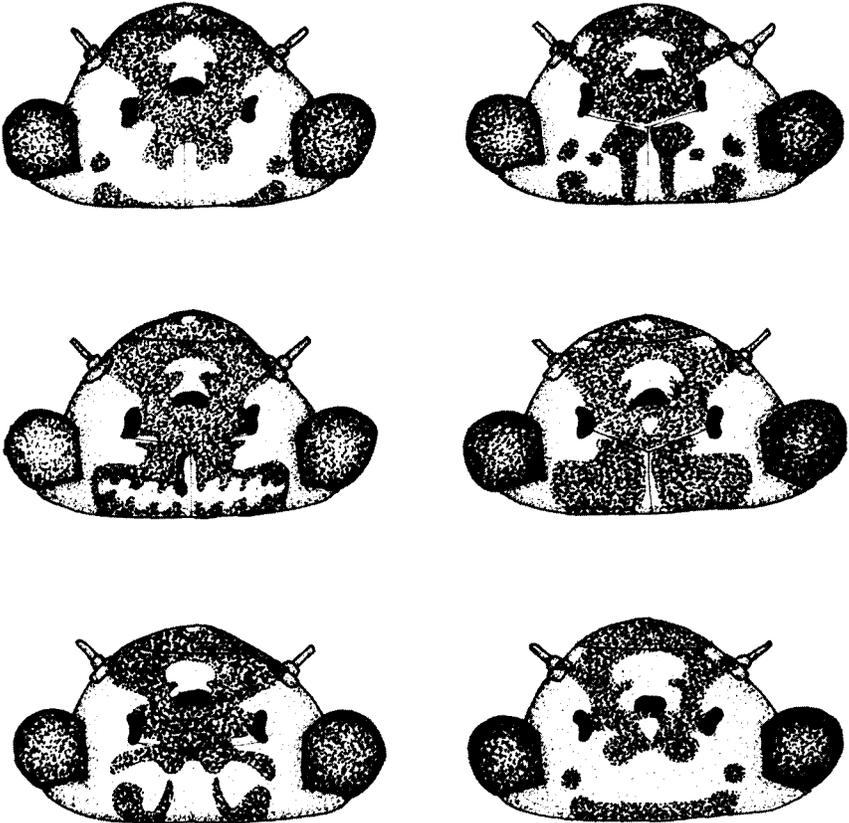


Fig. 4. Variation in dorsal head maculation of *P. myops* nymphs of a single population (scale 1:40).

would appear to place this species in the intermediate eye size group. However, measurements show that the eyes are separated by slightly more than two eye diameters fitting the definition of the small eyed *Potamanthus* group. Thus, even here some confusion exists as to the exact definition and usefulness of eye size and separation distance in differentiating *Potamanthus* species.

The populations of *Potamanthus* collected locally consisted of a single species, *myops*. This identification was based upon those characteristics described in Table 1 and the midwestern distribution of this species.

CONCLUSIONS

The nymphal characteristics of dorsal head maculation and mandibular tusk length as employed by Ide (1935) and Morgan (1913) for species separation were found to be too variable even within a single population of *Potamanthus myops* to be considered of taxonomic value. Male imago wing lengths displayed a range of variation over-lapping that

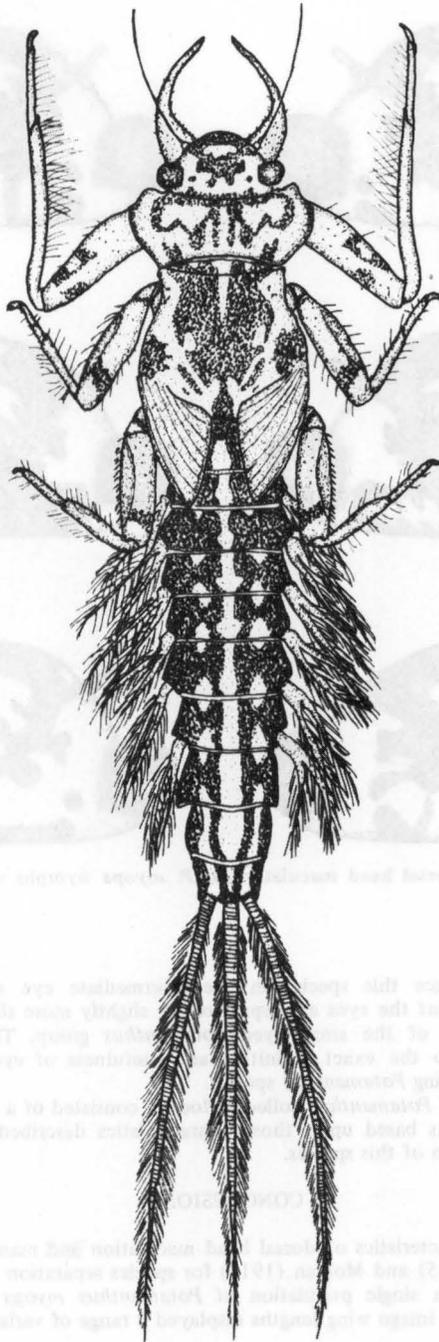


Fig. 5. *P. myops*, dorsal view of last nymphal stage (scale 1:10).

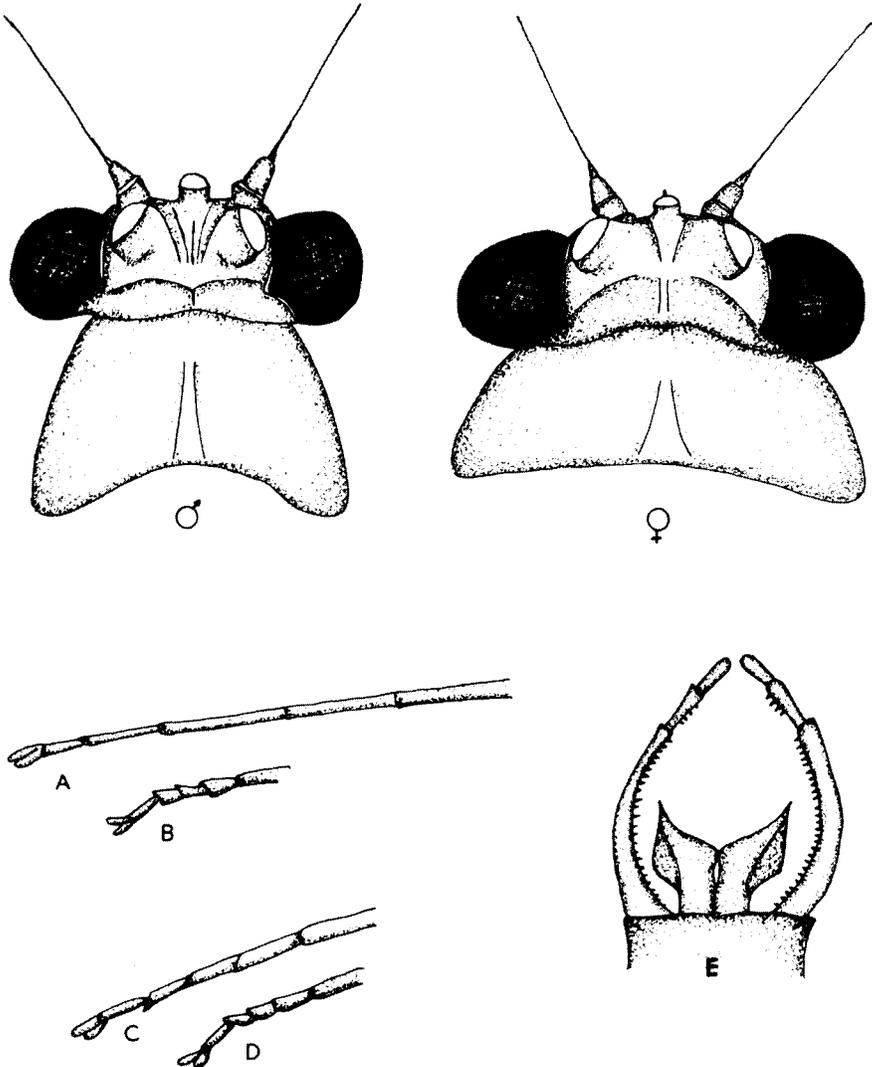


Fig. 6. *P. myops*, Dorsal view of imago heads (scale 1:40). A) and B) male fore and middle tarsi. C) and D) female fore and middle tarsi (scale 1:20). E) male genitalia, ventral aspect (scale 1:50).

of other species. Other characteristics of taxonomic value such as lateral abdominal markings occurred too infrequently and disappeared upon preservation in 70% ethanol. The primary taxonomic characteristics of eye size and distance of separation was determined to be poorly defined in past literature and probably was misused by previous authors. Thus the mayfly genus *Potamanthus* may be in need of re-examination and revision due to wide variability and inconsistent use of species distinguishing taxonomic characteristics by past authors.

LITERATURE CITED

- Argo, V. M. 1927. The North American species of the genus *Potamanthus* with a description of a new species. J. N.Y. Entomol. Soc. 35:319-325.
- Burks, B. D. 1953. The mayflies (or Ephemeroptera) of Illinois. Bull. Ill. Nat. Hist. Surv. 26.
- Edmunds, E. F. and R. K. Allen 1957. A checklist of the Ephemeroptera of North America, north of Mexico. Ann. Entomol. Soc. Amer. 50:317-24.
- Ide, F. P. 1935. Life history notes on *Ephoron*, *Potamanthus*, *Leptophlebia*, and *Blasturus* with descriptions. Can. Entomol. 67.
- Lord, R. J. 1975. *Potamanthus*: ecology, taxonomy and life history. M.S. Thesis, Water Res. Prog. Univ. of Mich.
- McCafferty, W. P. 1975. The burrowing mayflies (Ephemeroptera: Ephemeroidea) of the United States. Trans. Amer. Entomol. Soc. 101:447-504.
- McDunnough, J. 1926. Notes on North American Ephemeroptera with description of a new species. Can. Entomol. 58.
- Morgan, A. H. 1913. A contribution to the biology of mayflies. Ann. Entomol. Soc. Amer. 6:371-413.
- Needham, J. G., J. R. Traver and Y. Hsu 1935. The biology of mayflies. Comstock Pub., N.Y.
- Say, T. 1839. Descriptions of new North American neuropterous insects, and observations on some already described. Acad. Nat. Sci. Phil. 8:9-46.
- Walsh, B. D. 1863. Observations on certain N.A. Neuroptera, by H. Hagen, M.D. of Koenigsberg, Prussia; translated from the original French M.S., and published by permission of the author, with notes and descriptions of about 20 new N.A. species of Pseudoneuroptera. Proc. Entomol. Soc. Phila. 2:167-272.