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NAIDIDÆ OF CEDAR POINT, OHIO

L. B. WALTON

THE microscopic annelids constituting the family Naididæ of the subclass Oligochæta are a group which has received little attention in America. Michaelsen (:00) in his monograph of the Oligochæta recognized 42 species from various parts of the world and of that number only 6 were noted as occurring in our territory although observations made by Smith (:00) and noted in the appendix ("Zusätze und Berichtigungen") increased the number to 12. While this, taken in connection with the fact that the observations have been confined almost entirely to two localities, the one in Pennsylvania the other in Illinois, furnishes sufficient justification for a review of the Naididæ occurring at Cedar Point, Ohio, some contemplated studies of a statistical nature rendered a preliminary survey of several groups of fresh-water organisms desirable for the purpose of ascertaining which could be used most advantageously in the problems under consideration. Consequently the present paper is purely from a systematic standpoint, and although a considerable number of specimens have been fixed, stained, and mounted, and a few imbedded and sectioned, no attention beyond that necessary to differentiate the species has been given to anatomical or histological structure.

In addition to the interest attached to the study of these organisms upon the side of pure science, as outlined above, the fact that they play a rôle of decided economic importance must not be overlooked. The relation of the microscopic organisms or "plankton," accepting the definition in its broadest sense, to the

distribution of food fishes is a subject which has received increasing attention during the past twenty years. Inasmuch as the food of fishes is made up chiefly of small Crustacea, insect larvæ, minnows, etc., the existence of these being in turn dependent on microscopic forms, among which the Naids occupy an important position, it is evident that the distribution of such microscopic organisms controls to a large extent the fish supply in any given locality.

The somewhat unique location of Cedar Point with the open lake on the north and a portion of Sandusky Bay extremely rich in aquatic vegetation on the south, renders the Lake Laboratory situated there a station particularly well adapted to the study of the animal and plant life occurring in fresh water and to the investigation of the various problems of biological importance connected therewith.

The present study was carried on at the laboratory during a period of six weeks in July and August, 1905, the greater portion of the time, however, being occupied with other work. Consequently the record of species is undoubtedly far from complete, although 10 species, 7 of them new to science, are noted. The large proportion of new forms indicates the present condition in regard to the systematic study of the Naids in the United States, and while the writer has no wish to be classed as a "species maker," nevertheless it is important to lay the foundations for future biological studies by first considering those groups containing individuals resembling each other sufficiently well to be called "species."

The principal papers dealing with American Naids outside of the excellent monographs of Michaelsen (:00) and Beddard ('95), are those of Leidy ('50a, '50b, '52a, '52b, '80), Minor ('63), Reighard ('85), Cragin ('87), and Smith ('96 and :00). In addition to these, papers indispensable to the student of the group have been published by Beddard, Benham, Bourne, Bousfield, Bretschner, Michaelsen, Tauber, and Vejdovsky, that of the last author being classical in its morphological treatment of the forms. The majority of these papers are either in the library of the writer, or in the library of the department of biology of Kenyon College. Mention should here be made of the courtesies extended by the American Museum of Natural History, New York, the library

of Cornell University, and the Museum of Comparative Zoölogy of Harvard University, in the loan of literature otherwise inaccessible. I am furthermore greatly indebted to Samuel Henshaw of the Museum of Comparative Zoölogy for noting certain references.

The studies of the various species were made primarily from living specimens, all figures having been drawn with the aid of the camera lucida at the magnification noted in each instance. The most satisfactory method was that of transferring the Naid from the culture by means of a pipette to a watch-glass and subsequently to a drop of water on a slide, then placing over the drop a cover-glass the margin of which was supported by an extremely thin wooden wedge. After a time the specimens, without undue compression, would become quiet and outline drawings could be made with the camera. Specimens to be mounted were fixed with hot sublimate-alcohol (sublimate 10 g., absolute alcohol 100 cc., distilled water 100 cc., acetic acid 2 cc.), stained in borax-carminé, and eventually transferred to balsam, while those sectioned were stained in hæmatin IA (Apathy) or in iron-hæmatoxylin (Heidenhain) after fixation in cold sublimate-alcohol. The index of refraction of balsam approaches so closely the refraction of the transparent setæ that in order to study them most advantageously it was found advisable to kill the specimens by compressing them under the cover-glass and then at once to make camera lucida drawings of the setæ in the dorsal and ventral bundles.

The Naididæ are distinguished from the other families of the Oligochæta primarily by the fact that their normal method of reproduction is by means of budding, and that complete intersegmental dissepiments are present. The closely allied family *Æolosomatidæ* are without dissepiments and are usually of much smaller size. Furthermore, the presence of colored "oil drops" together with the absence of biuncinate setæ are characters which as a rule¹ will serve to distinguish these families. The *Enchytræidæ* may be separated by the absence of biuncinate setæ, while representatives of the families *Lumbriculidæ* and *Tubificidæ*

¹ Colored oil drops are absent in *Æolosoma beddardi*, *Æolosoma niveum* from North America, and two species of *Pleurophleps* occurring in Ceylon and Central America.

usually exceed 20 mm. in length, while the Naididæ on the contrary are rarely more and usually much less than 15 mm. in length.

The form and position of the setæ are the chief characters relied upon for the separation of the genera and species. These may be long and hair-like (capilliform), short and straight (needle-like), or S-shaped (sigmoid), and may terminate simply or in two hooks (biuncinate). A slight enlargement (nodulus) is usually present on all biuncinate setæ. A slight enlargement (nodulus) is usually present on all biuncinate setæ. The accompanying diagrams representing a typical Naid (Fig. 1) together with the different

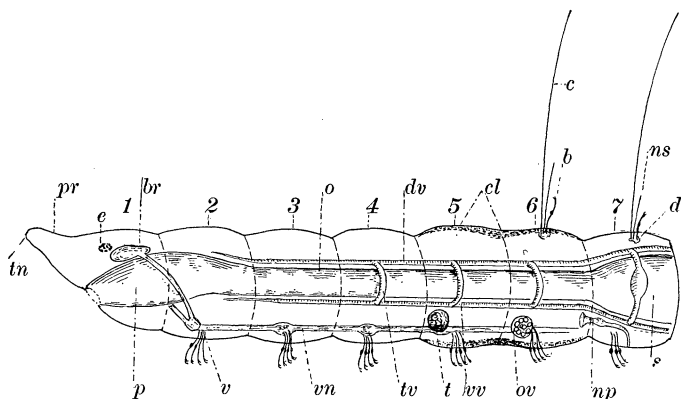


FIG. 1.— Typical Naid illustrating characters used in the tables for separating genera and species. The following abbreviations are used in this and subsequent figures. *b*, biuncinate seta; *br*, brain; *c*, capilliform seta; *cl*, clitellum; *d*, dorsal bundle of setæ; *dp*, digitiform process (see Fig. 5); *dt*, distal tooth, biuncinate seta; *dv*, dorsal blood vessel; *e*, eye; *n*, nodulus; *np*, nephridium; *ns*, needle-like seta; *o*, esophagus; *ov*, ovary; *p*, pharynx; *pr*, prostomium; *ps*, palmate seta; *pt*, proximal tooth, biuncinate seta; *s*, stomach; *sp*, spermatheca; *t*, testis; *tc*, fine teeth on capilliform seta in *Pristina*; *tn*, tentacular process; *tp*, tubular respiratory process; *tv*, transverse blood vessel; *v*, ventral bundle of setæ; *vn*, ventral nervous system; *vv*, ventral blood vessel; 1-7, seven anterior segments.

forms of setæ (Fig. 2) will prove of assistance in making clear the characters used in the synoptic table which has been slightly modified from Michaelsen (:00) who in turn adopted a large proportion of it from Vejdoovsky ('84). The reproductive organs have not been sufficiently studied to admit of a final conclusion concerning their typical arrangement. This includes all genera known up to the present time, those occurring in North America being

printed in heavier type. Since the publication of this monograph by Michaelsen one new genus (*Hæmonais*) has been founded by Bretscher, while Michaelsen (:03) has proposed the name *Vejdovskyella* for *Bohemilla*, the latter being preoccupied.

FAMILY NAIDIDÆ

1791. *Nais* [ex Ord. Mollusca, e Class. Vermes] (part) Gmelin, *Syst. Nat.*, vol. 6, p. 3120.

1895. *Naidomorpha* (e Group *Microdrili*) Beddard, *Monogr. Olig.*, p. 275.

1900. *Naididæ* Michaelsen, *Monogr. Olig.*, *Das Tierreich*, Lief. 10, p. 16.

1903. *Naididæ* Michaelsen, *Die geogr. Verbreit. d. Olig.*, p. 41.

1905. *Naididæ* Michaelsen, "Zur Kenntnis d. Naididen," *Zoologica*, vol. 18, p. 350.

Setæ aggregated together in 2 or 4 bundles on a segment. Dorsal bundles composed of capilliform, short needle-like, or sigmoid (the latter biuncinate) setæ; dorsal bundles often absent; ventral bundles composed of sigmoid biuncinate setæ. Dissepiments well developed. Brain, commissure, and ventral nerve-cord well developed, distinct from the hypodermis. Esophagus without muscular stomach. Nephridia large, occasionally entirely absent. Testes in segment 5 or 7 (rarely in segments 8 and 9). Ovaries in segments 6 and 7 (rarely in segment 10). Spermatheca in segment 5 or 7. Reproduction normally asexual by budding. Length of specimens varies from 1 to 50 mm.; usually from 2 to 10 mm.

Usually in fresh water, rarely in saline waters. One (*Amphichæta*) marine. Cosmopolitan; fifteen genera.

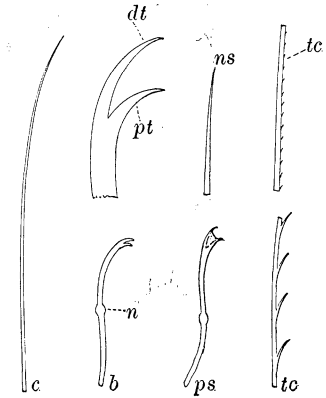


FIG. 2.—Principal types of setæ occurring in the Naididæ. For abbreviations see Fig. 1.

Synoptic Table for Separation of Described Genera

(Genera occurring in North America printed in heavy type)

- A¹. Capilliform setæ absent.
- B¹. Dorsal bundles of setæ absent.
- C¹. Ventral bundles of setæ on all segments beginning with the second. Third segment not longer than remaining segments
Schmardella.
- C². Ventral bundles of setæ absent on segment 3-5. Segment 3 extremely long **Chætogaster**.
- B². 2 dorsal and 2 ventral bundles of setæ on a segment.
- C¹. Segment 3 much longer than remaining segments. Length (of described species) not exceeding 2 mm. *Amphichæta*.
- C². Segment 3 not longer than remaining segments. Length (of described species) equal to or exceeding 5 mm.
- D¹. All setæ of dorsal bundle biuncinate *Paranais*.
- D². Some of the setæ of dorsal bundle not biuncinate **Ophidonais**.
- A². Capilliform setæ present in the dorsal bundle.
- B¹. Dorsal bundle of setæ beginning on segment 2, 5, or 6.
- C¹. Dorsal bundle of setæ beginning on segment 5 or 6.
- D¹. Posterior end developed into a tubular respiratory process containing paired gills. Usually living in tubes composed of plant fragments, etc. **Dero**.
- D². Posterior end without respiratory processes.
- E¹. Capilliform setæ of dorsal bundle with a series of prominent teeth. Dorsal bundle beginning on segment 5
Vejdovskiyella.¹
- E². Capilliform setæ without teeth. Dorsal bundle beginning on segment 6.
- F¹. Length of capilliform setæ equal to at least twice the diameter of the body.
- G¹. Capilliform setæ on all segments beginning with 6. Prostomium rounded *Macrochætina*.
- G². Capilliform setæ only on one (6) or a few (6, 7, 8) segments.
- H¹. Capilliform setæ on segments 6, 7, and 8. Prostomium developed into a tentacular process
Ripistes.
- H². Capilliform setæ only on segment 6. Prostomium not developed into a tentacular process **Slavina**.
- F². Length of capilliform setæ shorter or rarely longer than diameter of body.

¹ For *Bohemilla*, previously used as the generic name for a group of Trilobites by Barrande, (Michaelsen. :03).

- G¹. Prostomium developed into a tentacular process
Stylaria.
- G². Prostomium rounded **Nais.**
- C². Dorsal bundle of setæ beginning on segment 2.
 - D¹. Anterior capilliform setæ partly covered by filamentous gills
Branchiodrilus.
 - D². No filamentous gills present.
 - E¹. Dorsal bundle usually composed entirely of capilliform setæ. Prostomium developed into a long tentacular process **Pristina.**
 - E². Dorsal bundle composed in part of biuncinate or of short needle-like setæ. Prostomium rounded or with a short tentacular process **Naidium.**
- B². Dorsal bundle of setæ beginning on segment 12-20 *Hæmonais.*

GENUS CHÆTOGASTER K. Baer, 1827

Prostomium rudimentary, coalesced with segment 1; 2 ventral bundles of setæ on a segment, these absent on segments 1 and 3-5. Setæ uncinatæ. Pharynx large and wide. Esophagus small, not longer than pharynx; 1 pair of transverse vessels connects the dorsal and the ventral vessels. Longitudinal commissures of ventral nerve-cord more or less distinct in anterior part of body. Testes in segment 5, ovaries in segment 6, spermathecæ in segment 5.

In fresh water, free-living or parasitic on fresh-water snails. Middle and south Europe, North America.

Five species are recognized by Michaelsen and to these must be added *C. pellucidus*. Three species of Chætogaster (*C. diastrophus*, *C. diaphanus*, and *C. limnæi*) have been reported from North America, while Leidy ('52), described *C. gulosus*, so incompletely, however, that it cannot be recognized, although undoubtedly referable to the genus Chætogaster.

The following table will serve to separate all the species known at the present time: —

- A¹. Prostomium distinct, usually with a pore on anterior margin
C. diastrophus.
(Europe, N. America.)
- A². Prostomium indistinct.
 - B¹. Length of individuals not exceeding 5 mm.
 - C¹. Esophagus as long as pharynx.

- D¹. Blood vessels of pharyngeal region well developed *C. langi*.
(Europe, N. America.)
- D². Blood vessels of pharyngeal region absent or only slightly developed *C. crystallinus*.
(Europe.)
- C². Esophagus shorter than pharynx, indistinct.
 - D¹. Ventral setæ 8 to 12 in bundle, 1st postesophageal dilation of intestine covered with anastomosing network of blood vessels *C. limnæi*.
(Europe, N. America.)
 - D². Ventral setæ 6-7 in bundle, 1st postesophageal dilation of intestine surrounded by 12 or more pairs of non-anastomosing transverse blood vessels *C. pellucidus*.
(N. America.)
- B². Length of individuals 10-15 mm. *C. diaphanus*.

Chaetogaster langi Bretscher

C. langi Bretscher, *Rev. Suisse Zoöl.*, vol. 3, p. 512, fig. 1, 1896; Michael- sen, *Das Tierreich, Oligochaeta*, Berlin, p. 21, 1900.

Living specimens transparent. Prostomium blunt, indistinct. Setæ unequally bifid at distal end, 4 in a bundle. Esophagus long. Ventral ganglia glandular in form. Circulatory system with normal develop- ment in the pharyngeal region, 1 pair of trans- verse vessels (not developed as "hearts") in esophageal segment. Length 1-2 mm.

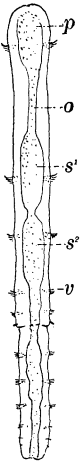


FIG. 3. — *Chaetogaster langi* Bretscher (x25). For abbreviations see Fig. 1.

Between filaments of algæ in swampy places, etc.

One specimen (Fig. 3) referable to this species was obtained early in July. There were several minor characteristics not wholly in agreement with the description of *C. langi*, but in the absence of more material it must be placed here.

Chaetogaster pellucidus n. sp.

Transparent. Prostomium indistinct. Eyes absent. Dorsal setæ absent, ventral setæ 6-7 in a bundle, biuncinate, with teeth unequal. Esophagus short, postesophageal dilation (first stomach) sur-

rounded by 12 or more pairs of non-anastomosing transverse blood vessels. Length 1.5 mm. Number of segments in an individual from 9 to 11. Budding in all specimens observed.

Sandusky Bay, Lake Erie.

A considerable number of specimens of this small *Chætogaster* were observed in cultures of aquatic plants during July and August, and a number were stained and mounted and are now in the

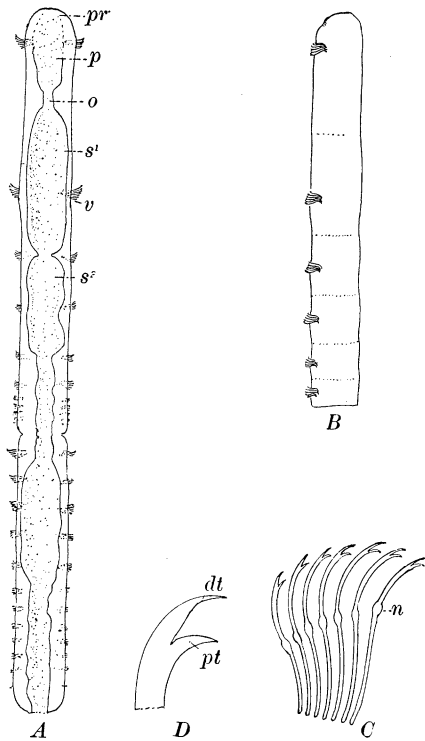


FIG. 4.—*Chatogaster pellucidus* n. sp. A. Dorsal aspect of budding individual (x25). B. Lateral aspect (x25). C. Ventral bundle of setae (x250). D. Distal portion of a single biuncinate seta showing form of distal and proximal tooth (x1000). For abbreviations see Fig. 1.

collection of the Museum at Kenyon College. All found were free living, while *C. limnæi*, to which it is most closely allied, normally occurs on or in fresh-water snails. It is possible, however, that they may have left their host as the age of the culture increased. No snails were observed in the jar.

Furthermore, Vejdovsky ('84) figures the first postesophageal dilation of *C. limnæi* as being covered with an anastomosing network of blood vessels, while in *C. pellucidus* they are plainly non-anastomosing.

Genus DERO Oken, 1815

Prostomium rounded, eyes absent. Setæ in four bundles on a segment. Ventral setæ unciniate, those of the segments 2 to 5 longer than the rest; dorsal bundle usually beginning on the 6th rarely on the 5th segment, composed of a capilliform and one or two needle-like setæ with variously formed distal ends. Posterior end developed into branchial filaments. Intestine with stomach. Blood red. Nephridia paired from 6th segment. Testes in 5th, ovaries in 6th, spermathecae in 5th segments.

Fresh water. Europe, North America, Antilles, tropical East Africa, Tonkin, Philippines; fifteen species.

Four species of *Dero* have been reported from North America: *D. obtusa*, *D. limosa*, *D. vaga*, and *D. furcata*.

Dero vaga (Leidy)

Aulophorus vagus Leidy, *Amer. Nat.*, vol. 14, p. 423, figs. 3, 4, 1880; Reighard, *Proc. Amer. Acad.*, vol. 20, p. 88, pl. 1, figs. 1-10; pl. 2, figs. 11-20; pl. 3, figs. 21-31, 1885.

Dero vaga L. Vaillant, *Hist. Nat. Annel.*, vol. 3, p. 383, 1890; Stieren, *Sitzb. Ges. Dorpat*, vol. 10, p. 107, 1893.

D. furcata Bousfield (part), *Journ. Linn. Soc. London*, vol. 20, p. 105, 1887.

D. vaga Michaelsen, *Das Tierreich, Oligochata*, p. 29, 1900.

Prostomium rounded. Ventral bundle of segments 2 to 5 with 8 to 14 long slightly curved, biuncinate setæ, with upper somewhat longer than the lower tooth. Ventral bundles of remaining segments with 4 to 7 shorter, more curved, biuncinate setæ with the upper shorter than the lower tooth. Dorsal bundle of setæ beginning on 6th segment; composed of 1 to 3 capilliform and 1 to 3 palmate setæ.

Posterior end with rudimentary branchia and two long finger-

like processes. Three pairs of hearts in segments 8, 9, and 10. Brain wider than long. Length 8 mm. or more; number of segments in an individual 24 to 35.

In slime of ditches, etc., among fresh-water plants. Massachusetts (Cambridge), Pennsylvania (Philadelphia), Illinois, Ohio (Cedar Point), and Trinidad, West Indies.

This species was extremely common at Cedar Point, particularly among cultures containing *Riccia fluitans*, the thallus of which together with statoblasts of Bryozoa, etc., it uses in the building of a protective tube by means of a viscid secretion from the body. When walking around with its tube it bears a striking resemblance to a minute caddis-fly larva.

Genus *STYLARIA* Lamarck,
1816

Prostomium developed into a tentacular process. Ventral bundles composed of biuncinate setæ; dorsal bundle composed of capilli-form setæ, beginning on 6th segment. Testes in 5th, ovaries in 6th, spermathecae in 5th segment.

Fresh water. Europe, North America; one species.

Stylaria lacustris (Linné)

Nereis lacustris Linné, *Syst.*

Nat., ed. 10, p. 654, 1758; ed. 12, vol. 2, p. 1085, 1767.

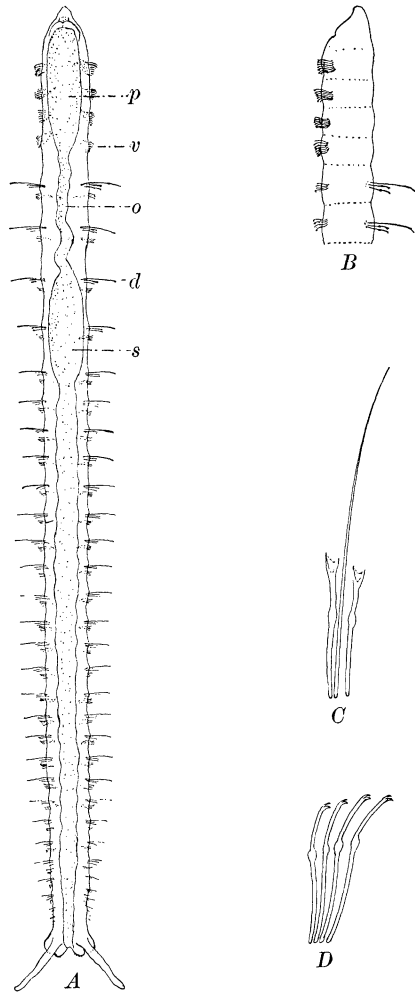


FIG. 5.—*Dero vaga* Leidy. A. Dorsal aspect (x25). B. Lateral aspect, first six segments (x25). C. Dorsal bundle of setæ (x250). D. Ventral bundle of setæ, 6th segment (x250). For abbreviations see Fig. 1.

Stylaria lacustris Johnston, *Cat. Brit. Non-paras. Worms*, p. 70, 1865; Vejdovsky, *Syst. Morphol. Olig.*, p. 30, pl. 3, fig. 27; pl. 4, figs. 1-24, 26-31, 1884.

Nais lacustris Beddard, *Monogr. Olig.*, p. 284, 1895; Michaelsen, *Das Tierreich, Oligochaeta*, p. 33, 1900.

S. paludosa, *S. fossularis* Leidy, *Proc. Acad. Nat. Sci. Phila.*, vol. 5, pp. 286, 287, 1852.

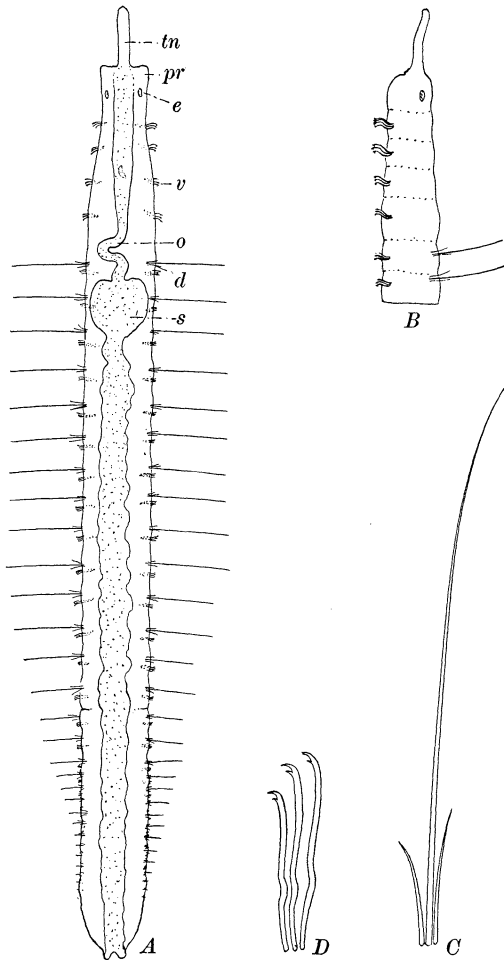


FIG. 6.—*Stylaria lacustris* (Linné). A. Dorsal aspect (x25). B. Lateral aspect, first 6 segments (x25). C. Dorsal bundle of setæ of 6th segment (x250). D. Ventral bundle of setæ, 4th segment (x250). For abbreviations see Fig. 1.

S. philadelphiana, *S. scotica* Czerniavsky, *Bull. Soc. Imp. Nat. Moscou*, vol. 55, no. 4, p. 309, 1880.

Prostomium developed into a long tentacular process. Eyes usually present. Distal teeth of ventral setæ unequal. Dorsal setæ capilliform with 1 long and 1 to 2 short in each bundle. All long setæ of each bundle approximately of the same length. Clitellum in sexually mature forms on segment 6. Male pores on 6th segment. Sperm duct in 5th, spermatheca in 5th segment. Length 10 to 15 mm. Number of segments about 25.

Europe, North America (Pennsylvania, Ohio, Illinois).

A large number of specimens were observed which must at present be referred to this species. Michaelsen notes the length of *N. lacustris* as varying between 10 and 15 mm., while the length of those found at Cedar Point was always from 4 to 5 mm. The teeth of the ventral setæ are also considerably shorter and more obtuse than illustrated in the figures of Vedjovsky ('84), Tauber, and others. Furthermore, the length of the tentacular process in those forms observed, did not exceed the length of the long capilliform setæ while Müller (1774) notes the length of the tentacular process as equivalent to ten segments of the body. The synonymy of *S. lacustris* is in a confused condition, and it is possible that careful study will establish one or more new species in the genus.

The imperfect descriptions given by Leidy ('52b) to the species described by him as *S. paludosa* and *S. fossularis*, will not permit their separation from *S. lacustris*.

Genus NAIS Müller, 1774

Prostomium rounded. Ventral bundle with biuncinate setæ. Dorsal bundle beginning on the 6th segment with capilliform and variously pointed short setæ. Testes in 5th, ovaries in 6th, spermatheca in 5th segments (in species where sex organs have been observed).

In fresh water. Europe, North America, South America, and East India; ten species.

The genus *Nais* furnishes one of the most difficult problems for the systematist attempting to define the limits of species among

the Naididæ. The following table, however, embodies the results of systematic work so far as they are known and comprises all species described up to the present time.

- A¹. Setæ of ventral bundle of segments 8 to 10 neither thicker than those of other segments nor modified by possessing blunt tips with rudimentary lower tooth.
- B¹. Eyes present.
- C¹. Ventral setæ of segments 2 to 5 much longer than those of succeeding segments. Dorsal setæ capilliform, 4 to 8 in bundle
N. obtusa.
(Europe, S. Siberia.)
- C². Ventral setæ of segments 2 to 5 not decidedly longer than those of succeeding segments.
- D¹. Transverse blood vessels simple.
- E¹. Ventral setæ of segments 2 to 5 unequally bifid at tip.
Length 1 to 1.5 mm. *N. elinguis.*
(Europe, N. America, S. America.)
- E². Ventral setæ of segments 2 to 5 equally bifid at tip.
- F¹. Number of segments in an individual approximately 10 (9 to 10), 6 to 8 ventral setæ in a bundle. Length of specimen 1.5 mm. *N. parvula.*
(N. America.)
- F². Number of segments in an individual usually 20 (18 to 22), 4 ventral setæ in a bundle. Length of specimens at least 2 mm.
- G¹. Dorsal bundles composed of 1 long capilliform and 2 short needle-like setæ. Eyes dumbbell-like in form
N. tortuosa.
(N. America.)
- G². Dorsal bundle composed of 1 long capilliform and 1 short biuncinate seta. Eyes oval, not dumbbell-like in form. Length 3.5 mm. *N. parviseta.*
(N. America.)
- D². Transverse blood vessels of segments 2 to 5 forked. Dorsal bundle with biuncinate setæ. *N. heterochaeta.*
(England.)
- B². Eyes absent.
- C¹. Proximal tooth of dorsal biuncinate setæ not longer than the distal tooth,
- D¹. Ventral bundle composed of 3 to 4 setæ. Length of individuals 3 to 3.5 mm. Colorless *N. tenuidentis.*
- D². Ventral bundle composed of 6 to 8 setæ. Length 6 to 8 mm. Color reddish *N. josinae.*
(Europe, N. America.)

- C². Proximal tooth of dorsal biuncinate setæ twice the length and twice the thickness of the distal tooth . . . *N. paraguayensis*.
(S. America.)
- A². Setæ of ventral bundle of segments 8 to 10 much thicker than those of other segments, 1 to 2 in number, tips blunt, proximal tooth rudimentary *N. bretscheri*.
(Europe.)

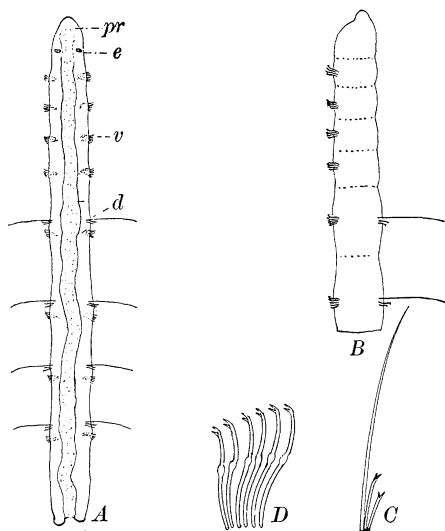


FIG. 7.—*Nais parvula* n. sp. A. Dorsal aspect (x50). B. Lateral aspect, first six segments (x50). C. Dorsal bundle of setæ of 6th segment (x250). D. Ventral bundle of setæ, 6th segment (x250). For abbreviations see Fig. 1.

Nais parvula n. sp.

Prostomium blunt, rounded. Eyes present. Digestive tract not differentiated into esophagus and stomach. Dorsal bundle beginning on segment 6, composed of 1 capilliform, subequal to diameter of body, and 2 short biuncinate setæ. Ventral bundle consisting of 6 to 7 biuncinate setæ with teeth equal. Length 1.2 mm. Number of segments in an individual 9 to 10.

Cedar Point, Sandusky, Ohio.

Several examples of this extremely small *Nais* were found in the slime accumulating at the bottom of jars containing roots of various aquatic plants obtained from Sandusky Bay. It is chiefly

remarkable by reason of its small size, and the limited number of segments composing the body. At first it seemed probable that it was an immature form but evidence to the contrary was given by budding in several specimens.

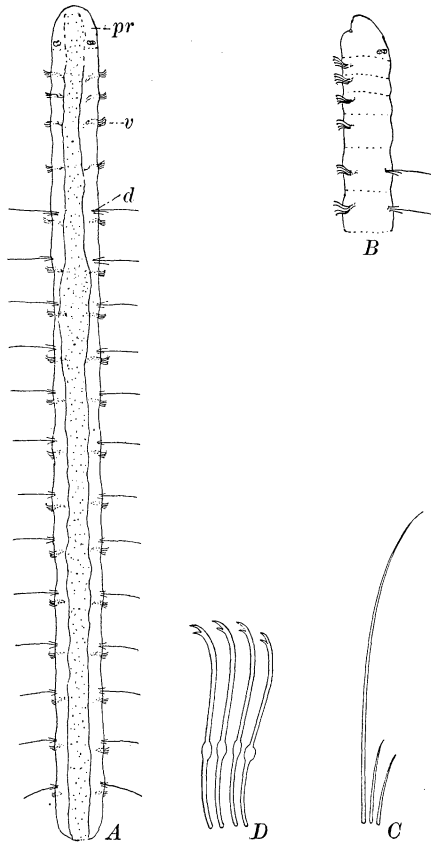


FIG. 8.— *Nais tortuosa* n. sp. A. Dorsal aspect (x50). B. Lateral aspect of first six segments (x50). C. Dorsal bundle of setæ (x250). D. Ventral bundle of setæ, 2d segment (x250). For abbreviations see Fig. 1.

***Nais tortuosa* n. sp.**

Prostomium blunt, rounded. Eyes present slightly dumbbell-shaped. Digestive tract not differentiated into esophagus nor stomach. Dorsal bundle beginning on 6th segment, composed of 1 long capilliform (180μ) and 2 short (50μ) needle-like setæ. Ven-

tral bundle consisting of 4 biuncinate setæ (110 μ) with subequal teeth. Length 2.2 mm. Number of segments in an individual 18.

Cedar Point, Sandusky, Ohio.

Two specimens belonging to this species were noted. Budding was not observed. Several Peritrichous ciliates (*Rhabdostyla* sp., length 50 μ , diameter 19 μ) were observed fixed to the anterior end of one of the individuals, the peduncle being less than 2 μ in length.

***Nais parviseta* n. sp.**

Prostomium narrow, slightly acute. Eyes present, round or slightly oval. Digestive tract differentiated into a distinct pharynx which gradually merges into an esophagus. Stomach dilation scarcely perceptible. Dorsal bundle beginning on the 6th segment, composed of 1 capilliform, subequal to diameter of body, and 1 short biuncinate seta, possessing equally developed teeth and an indistinct nodulus. Ventral bundle composed of 3 to 4 biuncinate setæ, with lower tooth considerably larger than the upper tooth. Length 3.5 mm. Number of segments in an individual 19 to 20.

Cedar Point, Sandusky, Ohio.

A very few specimens of this form were observed. Budding was noted in nearly all of the individuals examined. The characteristic differentiation of the teeth on the ventral setæ appears to be of considerable specific importance.

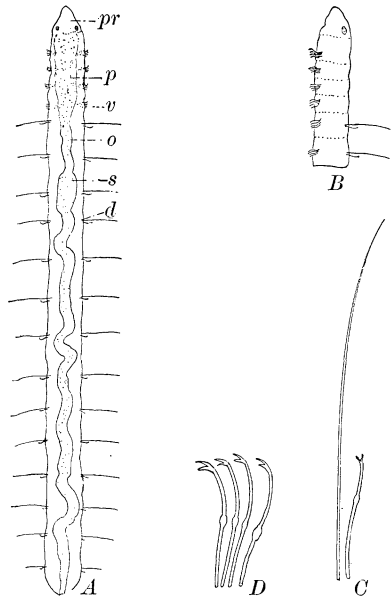


FIG. 9.—*Nais parviseta* n. sp. A. Dorsal aspect (x25). B. Lateral aspect, first six segments (x25). C. Dorsal bundle of setæ (x250). D. Ventral bundle of setæ, 4th segment (x250). For abbreviations see Fig. 1.

***Nais tenuidentis* n. sp.**

Prostomium blunt. Eyes absent. Digestive tract not differentiated into esophagus or stomach, covered with many brownish globules.

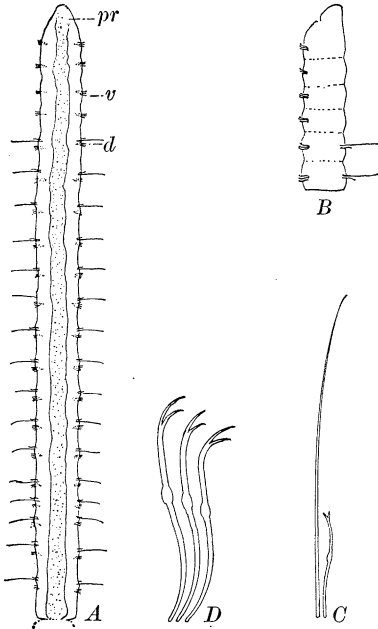


FIG. 10.—*Nais tenuidentis* n. sp. A. Dorsal aspect (x25). B. Lateral aspect, first six segments (x25). C. Dorsal bundle of setae of 7th segment (x250). D. Ventral bundle of setae, 2d segment (x250). For abbreviations see Fig. 1.

Dorsal bundle beginning on 6th segment, composed of 1 capilliform, the length ($180\ \mu$) of which is approximately one half the diameter of the body, and 1 short ($60\ \mu$) biuncinate seta possessing equally developed teeth and provided with a nodulus. Ventral bundle consisting of 4 (3 in several anterior bundles) deeply bifid setae, both teeth being exceedingly long and slender, the upper measuring $20\ \mu$ and the lower $14\ \mu$ from the base of the cleft area. Length 3 to 3.5 mm. Number of segments in an individual approximately 20. Budding observed.

Cedar Point, Sandusky, Ohio.

Only two specimens of *N. tenuidentis* were found, budding occurring in each. The extremely long and slender teeth of the ventral setae are a striking characteristic of this species.

GENUS PRISTINA Ehrenberg, 1831

Prostomium usually developed into a tentacular process. Ventral bundle composed of biuncinate setae. Dorsal bundle beginning on the 2d segment, composed of capilliform setae. Testes in 7th, ovaries in 8th, spermathecae in 7th segments (description of sexual organs based on observation of one species, *P. leidyi*).

In fresh water. Europe, North America, South America, and Java; 6 species.

The species may be separated by the following table. While it is possible that a careful study of *P. æquiseta*, *P. longiseta*, and *P. flagellum*, may show that those responsible for the descriptions have overlooked the existence of the small teeth present in *P. leidyi* and *P. serpentina*, it appears evident that the species are distinct on other grounds.

- A¹. Setæ of dorsal bundle smooth.
- B¹. Last segment not provided with finger-like processes.
- C¹. Dorsal setæ of 3d segment not decidedly longer than those of other segments; length 7 to 8 mm. *P. æquiseta*.
(Europe.)
- C². Dorsal setæ of 3d segment much longer than those of other segments *P. longiseta*.
(Europe.)
- B². Last segment provided with 3 (2 lateral and 1 median) finger-like processes projecting posteriorly *P. flagellum*.
(N. America, S. America.)
- A². Setæ of dorsal bundle provided with numerous fine but distinct teeth.
- B¹. Capilliform setæ of dorsal bundle approximately 35 μ long. Those of the 3d segment twice as long as the others *P. leidyi*.
(N. America, S. America.)
- B². Capilliform setæ of dorsal bundle approximately 300 μ long. Those of the 3d segment not longer than others.
- C¹. Teeth of ventral setæ subequal. Number of segments approximately 14 *P. serpentina*.
(N. America.)
- C². Distal teeth of ventral setæ longer than proximal teeth. Number of segments 18 to 30 *P. proboscidea*.
(S. America.)

***Pristina serpentina* n. sp.**

Prostomium developed into a long tentacular process, usually 0.2 to 0.3 mm. in length. Eyes absent. Digestive tract with stomach in the anterior part of the 8th segment. Dorsal bundle beginning on the 6th segment, composed of 2 long (300 μ), 1 medium (100 μ) capilliform setæ, and 2 to 6 short needle-like (30 μ to 50 μ) setæ. Ventral bundle composed of 5 to 6 biuncinate (60 μ to 80 μ) setæ with subequal teeth. Length 2.2 mm. Number of segments in an individual about 15.

Cedar Point, Sandusky, Ohio.

This species of *Pristina* (Fig. 11) was exceedingly abundant at Cedar Point, and on first examination was apparently to be placed near *P. aequisetæ* Bourne. Closer examination, however, dem-

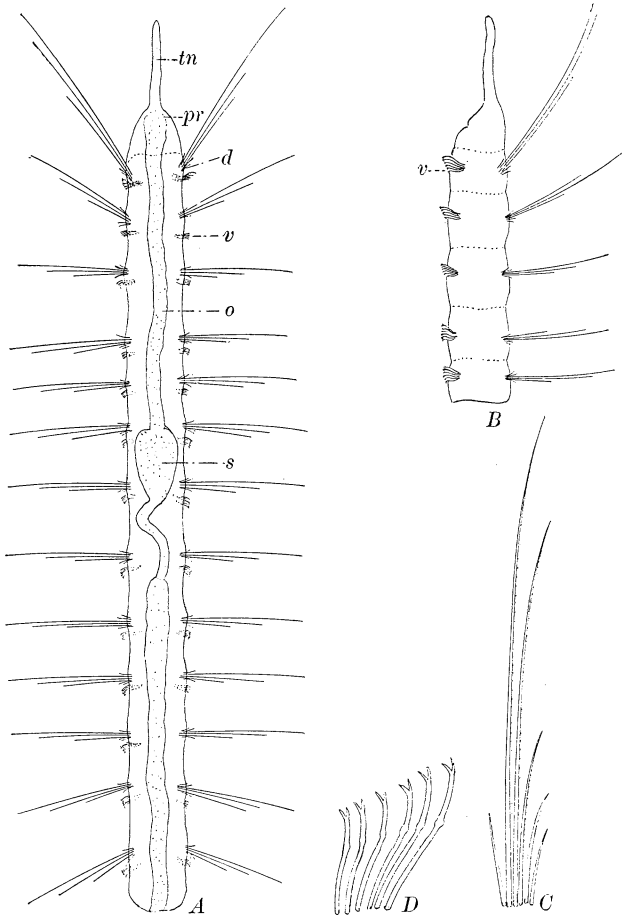


FIG. 11.—*Pristina serpentina* n. sp. A. Dorsal aspect (x50). B. Lateral aspect, first six segments (x50). C. Dorsal bundle of setæ of 7th segment (x250). D. Ventral bundle of setæ (x250). For abbreviations see Fig. 1.

onstrated the existence of fine teeth on the setæ of the dorsal bundle. The difference in the form of the distal teeth of the ventral setæ distinguishes it from *P. proboscidea* Beddard, now recognized by Michaelsen (:05) as a valid species.

Genus NAIDIUM O. Schmidt, 1847

Prostomium either rounded, pointed, or developed into a short tentacular process. Dorsal bundle beginning on the 2d segment, composed of capilliform, or needle-like, and biuncinate setæ. Ventral bundle composed of biuncinate setæ.

Fresh water. Middle Europe, East India, North America, and South America; six species.

A¹. Prostomium not developed into a tentacular process.

B¹. Number of segments composing an individual usually 15 to 30 (32 to 40, *N. luteum*). Biuncinate setæ in dorsal bundle.

C¹. Prostomium rounded or pointed, species small, not exceeding 5 mm. in length.

D¹. Number of segments in an individual 20, posterior part of brain developed into 4 pronounced lobes . . . *N. bilobatum*.
(Europe.)

D². Number of segments in an individual 15 to 16.

E¹. Capilliform setæ shorter than the diameter of the body.
Teeth of dorsal biuncinate setæ approximate . . . *N. unisetæ*.
(Europe.)

E². Capilliform setæ longer than the diameter of the body.
Teeth of dorsal biuncinate setæ remote . . . *N. osborni*.
(N. America.)

C². Prostomium slightly elongate, species large, approximately 15 mm. in length *N. luteum*.
(Europe.)

B². Number of segments in an individual 40 to 61, no biuncinate setæ in dorsal bundle *N. dadayi*.
(S. America.)

A². Prostomium developed into a short tentacular process, length of species approximating 8 mm. *N. brevisetæ*.
(East India.)

***Naidium osborni* n. sp.**

Prostomium moderately long, somewhat pointed. Eyes absent. Digestive system differentiated into pharynx (segments 1 to 3), esophagus (segments 4 to 7), and stomach (8th segment). Dorsal bundle of setæ beginning on the 2d segment, composed of 1 long capilliform (145 μ) and 1 short (50 μ) seta, the latter biuncinate

with subequal, remote teeth and an indistinct nodulus one third the distance from the tip. Ventral bundle composed of 4 biuncinate setæ with subequal teeth and a distinct nodulus midway between base and tip. Length 1.6 mm. Number of segments in an individual 15 to 16. Budding observed.

Cedar Point, Sandusky, Ohio.

Five species of *Naidium* have been described: three from central Europe, one from the East Indies, and one from South America; none, however, has been noted in North America, consequently the occurrence of a distinct species in the United States is of considerable interest. A single individual was found in the sediment of a bottle containing "reed roots" obtained at Cedar Point, Ohio, and received from Professor Osborn, September 4, 1905.

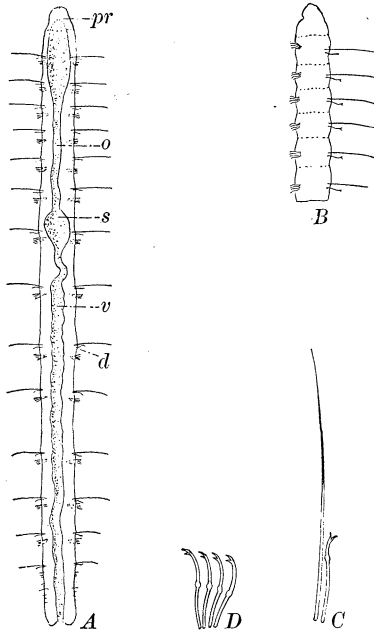


FIG. 12.—*Naidium osborni* n. sp. A. Dorsal aspect (x50). B. Lateral aspect of first six segments (x50). C. Dorsal bundle of setæ (x250). D. Ventral bundle of setæ of segment 1 (x250). For abbreviations see Fig. 1.

brevisetæ to the genus *Naidium* which thus consisted of two species, *N. luteum* and *N. brevisetæ*.

The characters which may be used for separating the two genera consist of (1) the presence as a rule of biuncinate setæ in the dorsal bundle of *Naidium*, while such setæ are absent in *Pristina*, and (2) the development of the tentacular process of the prostomium which

Schmidt (1847) founded the genus upon a single species, *N. luteum*, occurring in Europe. Beddard ('95) maintained that this species should be incorporated in the genus *Pristina* inasmuch as *Pristina brevisetæ* described by Bourne (1891) nearly bridged over the gap formerly supposed to separate the two genera. Michaelsen (:00) removed *P.*

is either absent or extremely short in *Naidium* while in *Pristina* it is long. The absence of any tentacular process in *N. osborni* suggests that until a species is found in which the process is well developed and in which the dorsal bundles contain biuncinate setæ, the genera may be considered distinct. Further studies may show other generic characters.

I take pleasure in dedicating this species to Professor Herbert Osborn, Director of the Lake Laboratory, Sandusky, Ohio.

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GAMBIER, OHIO

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