

## A CONTRIBUTION TO THE TAXONOMY OF THE TUBIFICINAE (OLIGOCHAETA: TUBIFICIDAE)

Ralph O. Brinkhurst

*Abstract.*—The former genera *Isochaeta* and *Peloscolex* are revised. Both names are rejected on the basis of inadequate description of the original type-species. *Isochaetides* is modified to include 8 species, all with bifid setae. *Varichaeta*, new genus, consists of 2 former *Isochaeta* species plus *V. pacifica*, new species, all with hair and pectinate setae and distinctive male ducts. *Peloscolex* now contains 8 unidentifiable taxa, the other species in the genus being attributed to *Tubificoides* (marine species), *Spirosperma* (8 species), *Baikalodrilus* (4 species), *Haber* (possibly as many as 9 species), and *Quistadrilus*, new genus, for *Peloscolex* sensu Holmquist, with 1 species.

---

### Introduction

Investigation of specimens from Mowich Lake, Mount Rainier, Washington collected by G. Larson in 1966 led to the tentative identification of *Isochaeta nevadana* and a species said to resemble both *Peloscolex variegatus* Leidy and *P. nikolskyi* Last. and Sol. (Brinkhurst 1979). Recent collections of large numbers of these enables them to be redescribed, but the nomenclature cannot be settled without a revision of both *Isochaeta* and *Peloscolex* sensu Brinkhurst (1971). In the course of this study other relevant material collected by Mr. M. Barbour, J. Hiltunen, K. Stimpson, and Dr. M. Loden was brought to my attention, and examination of them has added to this manuscript.

Full bibliographic citations to all species named will be found in Brinkhurst (1971) if not cited in the text.

### *Isochaeta* Pointner, 1911

*Type-species.*—*Isochaeta virulenta* Pointner, 1911.

The type-material of *I. virulenta* was traced to the University of Graz by Brinkhurst (1963), but despite subsequent work on the River Danube (in which it was first found) and other extensive studies in central Europe, the species has not been rediscovered. Hrabě (1966) reexamined the type and declared it to represent partially mature specimens of *Limnodrilus udeke-mianus* Clap. 1862. There is sufficient doubt about the existence of the species that it seems best to regard it as species dubium.

The species formerly associated with this genus now have to be reasigned.

*Isochaetides* Hrabě, 1966 (emended)

*Definition.*—Bifid setae in dorsal bundles. Vas deferens of one width, much longer than atrium, small prostate present, attached at ental end of atrium, penis sheaths thin or absent, penes usually elongate. Spermathecal setae modified, somatic setae bifid, ventrals of XI, X and XII slightly modified in one species.

*Type-species.*—*Limnodrilus baicalensis* Michaelsen, 1901 (by original definition).

*Distribution.*—W. Europe, Lake Baikal, USSR (S. Sakhalin) USA, ? Brazil. Fresh and brackish water.

*Remarks.*—The type-species of *Isochaetides* Hr. is *Limnodrilus baicalensis* Michaelsen, the types of which were recently examined by the author (Brinkhurst, in press). This species has bifid setae, modified spermathecal setae, long vasa deferentia, short atria not much wider than the former and no distinct cuticular penis sheaths. It is known from Lake Baikal, along with *I. arenarius* (Mich., 1926) which closely resembles the former. The types of both species are in the Zoological Museum of Hamburg University. A third European species, *I. michaelseni* (Last., 1937) has slightly modified genital setae in IX, X and XII but otherwise conforms to the generic type, as does the asiatic *I. suspectus* (Sok., 1964) apart from possession of distinct cuticular penis sheaths, and identifiable ejaculatory ducts.

*Tubifex lacustris* Cern., 1939 was synonymized with *I. baicalensis* by Brinkhurst (1963, 1966, 1971) on the basis of the similarity of the original descriptions, but zoogeographic considerations would support the position of Hrabě (1966) that the species are distinct but congeneric.

*I. hamatus* (Moore, 1905) is also recognized as a member of this complex, although it has not been redescribed from fresh material and the types are all immature. A species with very similar setae was described under the name *Psammoryctides curvisetosus* Br. and Cook, 1966, but was transferred to *Peloscolex* by Loden (1978). As the revision of that genus in this manuscript excludes it from *Peloscolex*, it seems more appropriate to place it here as *Isochaetides curvisetosus* (Br. and Cook, 1966) new combination. The relationship between these two North American species can only be clarified by the discovery of the latter in or adjacent to the type-locality of the former in the Acushnet River, above New Bedford, Mass., in brackish water.

Holmquist (1979) suggested that *Peloscolex freyi* Br., 1965 belongs here, and I would confirm that this be done rather than leave it in limbo as it cannot be incorporated within the redefined *Peloscolex* complex.

*Siolidrilus adetus* Marcus, 1949 was transferred to the genus by Hrabě (1967). Due to the nature of the prostate gland as originally described, and the absence of the spermatozeugmata that are characteristic of members of the Tubificinae, Brinkhurst (1971) aligned the monospecific genus with the Aulodrilinae. The prostate gland could in fact, be regarded as tubificine in nature, and it should be noted that spermatozeugmata were also said to be absent in *I. hamatus* although the specimens were thought to be only partially mature (Moore, 1905), and so the same may be true of *Siolidrilus*. The species is included here following the opinion of Hrabě (1977).

The genus now contains 9 species, most of which need redescribing.

*Isochaetides*: *adetus* (Marcus, 1949), *arenarius* (Mich., 1926), *baicalensis* (Mich., 1901), *curvisetosus* (Br. and Cook, 1966) n. comb., *freyi* (Br., 1965), n. comb., *hamatus* (Moore, 1905), *michaelseni* (Last., 1936), *suspectus* (Sok. 1964).

Four species assigned to this genus by Hrabě (1966, 1967) are excluded here primarily on the basis of differences in the male ducts, and secondarily by the nature of the setae, which are now conceded by me to exclude hair and pectinate setae in this genus as befits the original generic name. The following are listed under their original names with their present taxonomic status being indicated.

*Limnodrilus newaensis* Mich., 1903. Although transferred to *Isochaetides* by Hrabě (1966) on the basis of the lack of hair setae, the male ducts are very closely similar to those of *Tubifex tubifex* (Mull., 1774) and it has long been associated with *Tubifex* by me (e.g., Brinkhurst, 1971).

*Limnodrilus pseudogaster* Dahl, 1960. The species was redescribed by Baker (1980) who confirmed its placement in the genus *Tubificoides* Last., 1937.

*Limnodrilus neotropicus* Čern., 1939. The form of the male ducts and especially the cuticular penis sheaths, suggests that this species should be left within *Limnodrilus*. The species lacks the spiral muscles normally associated with the penes of *Limnodrilus*, and it needs redescribing. It was found in Lake Titicaca along with the poorly known *I. lacustris* already mentioned.

*Limnodrilus lastoschkini* Jar., 1948. The species was identified as *Psammoryctides deserticola* by Finogenova 1972.

Three other species were placed here by me (e.g., Brinkhurst 1971) but all three have hair setae in the dorsal bundles, and male ducts which differ from those of *Isochaetides* sensu strictu. The first, originally described as *Tubifex dojranensis* Hrabě, 1958 is now assigned to *Haber* Holmquist, 1978, as emended below. Two other species, along with a newly described species, are placed in the following new genus in which the vasa deferentia are short relative to the very long, thin atria, in contrast to the reverse in *Isochaetides*. They also possess hair and pectinate setae dorsally.

The species *I. tomilovi* Sem. and *I. koshovi* Sem. are mentioned by Se-

mernoj and Tomilov (1972) and Semernoj (1973) but I have not seen descriptions of them.

*Varichaeta*, new genus

*Holotype*.—USNM 64728.

*Paratypes*.—USNM 64729–64735.

*Etymology*.—"Varichaeta"—Hair and pectinate setae present dorsally, so setae not all alike, as in *Isochaeta*, from which 2 of the included species were derived.

*Definition*.—Tubificine oligochaetes in which the male ducts each consist of vas deferens of variable length, a long tubular atrium receiving a small prostate gland near the ental end, and true penes with distinct penis sheaths. Spermathecal setae absent/unmodified, penial setae slightly modified/absent. Hair and pectinate setae present dorsally.

*Type-species*.—*Varichaeta pacifica*, n. sp. by original designation.

*Distribution*.—Israel, U.S.A. (Nevada, California, Washington, Alaska).

*Varichaeta pacifica*, new species

Fig. 1

Worms up to 15 mm long  $\times$  0.75 mm broad. Body wall with foreign matter in grooves. Dorsal setae 5–6 or even 10 smooth, long hair setae, 5–6 or up to 8 pectinate setae anteriorly, 2–3 hairs and 2–3 bifid setae in postclitellar bundles, ventral setae up to 6 anteriorly, with upper tooth longer and thinner than the lower, 3–4 in median segments, fewer posteriorly. Ventral setae of XI 3–4 or more bifid setae, slightly wider than normal. Male ducts each with short vas deferens, long tubular atrium with broadest part entally, in region of broadly stalked attachment of moderate-sized prostate gland, thin ejaculatory duct not abruptly demarcated from atrium, penis with large folded basal section capable of erection, large retractor muscles within, tip armoured with cuticular sheath. Spermathecae each with wide vestibule, followed by fairly elongate, cuticle-lined duct and then large, wide ampulla. Spermatozeugmata moderately long.

*Type-locality*.—Mowich Lake 5000 ft., Mount Rainier, near Seattle, Washington, U.S.A. Coll. P. M. Chapman and Brinkhurst. Other localities: Toolik Lake, Alaska (68°40'N, 149°25'W) 20 km north of Brooks Range. Coll. S. C. Mozley, 1980.

*Etymology*.—*pacifica*, from the Pacific N.W. of North America.

*Varichaeta nevadana* (Brinkhurst, 1965), new combination

Fig. 2A

Very small worms. Anterior dorsal bundles with 1–3 hair setae, 1–3 pectinate setae. Anterior ventral bundles with 3–6 setae, upper teeth longer and

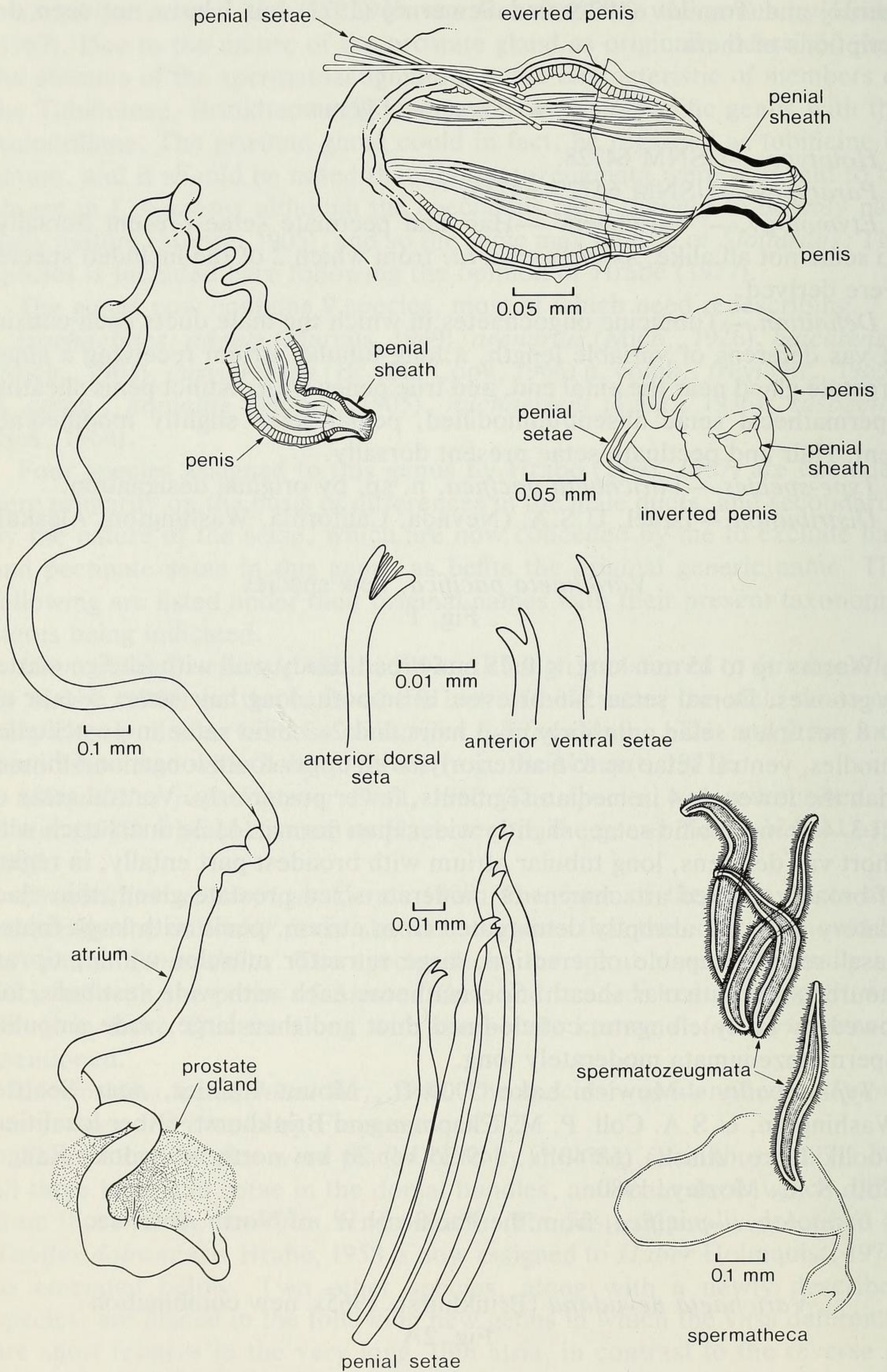


Fig. 1. *Varichaeta pacifica* (from type-series): Setae and reproductive system.

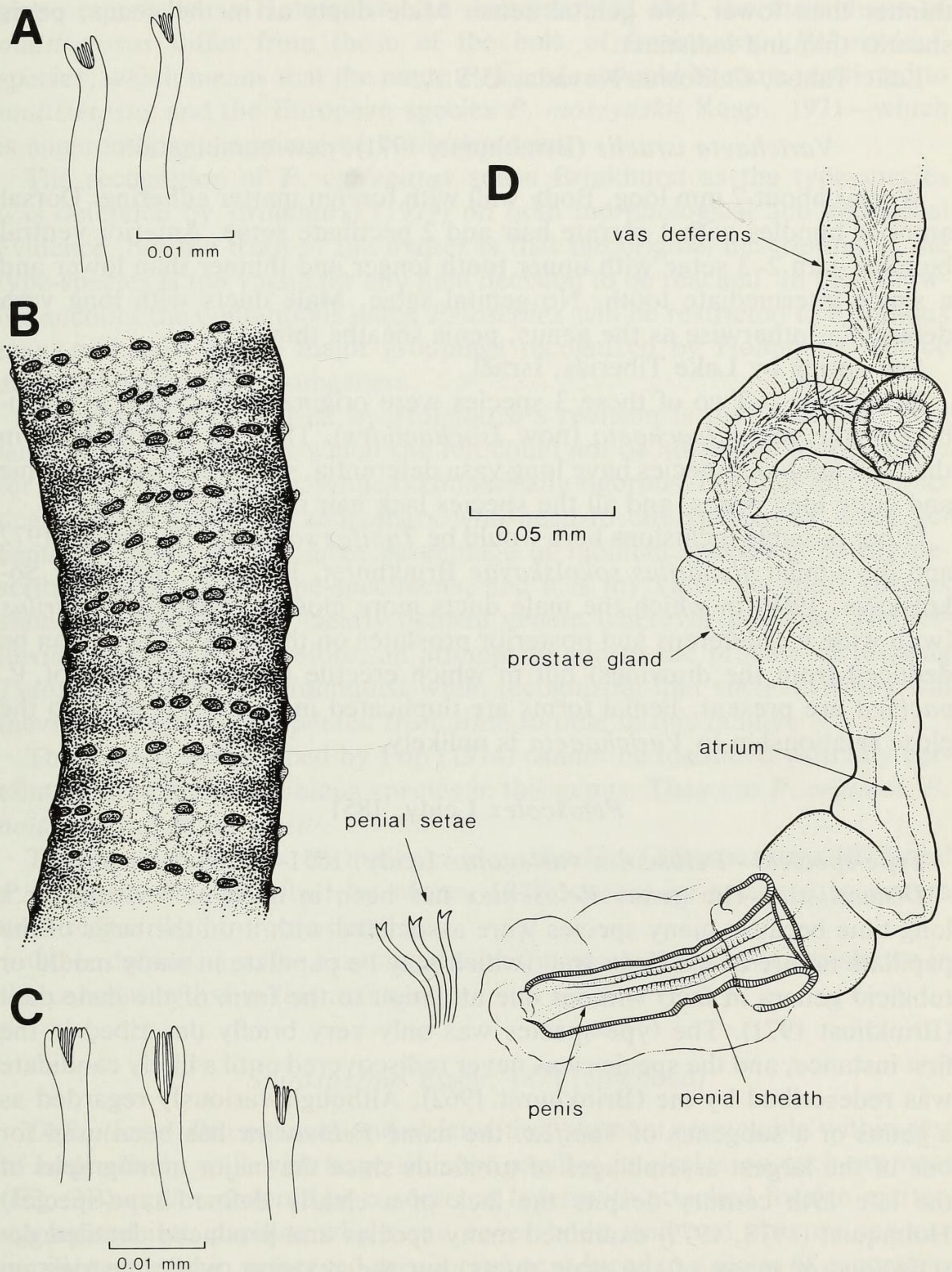


Fig. 2. A, *Varichaeta nevadana* (from type-series), anterior pectinate setae; B, *Embolocephalus velutinus*, body wall, from a photograph by Kasprzak (1976); C, *Embolocephalus beetoni* (from type-series), pectinate setae; D, *Tubifex superiorensis* (from Lake Michigan), ectal end of male duct with atrium, prostate, penis sheath and penial setae.

thinner than lower. No genital setae. Male ducts as in the genus, penis sheaths thin and indistinct.

Lake Tahoe, California/Nevada, U.S.A.

*Varichaeta israelis* (Brinkhurst, 1971), new combination

Worms about 7 mm long. Body wall with foreign matter adhering. Dorsal anterior bundles with 1 serrate hair and 2 pectinate setae. Anterior ventral bundles with 2–3 setae with upper tooth longer and thinner than lower and a single intermediate tooth. No genital setae. Male ducts with long vasa deferentia, otherwise as the genus, penis sheaths thin.

Salt spring by Lake Tiberias, Israel.

*Discussion.*—Two of these 3 species were originally described as members of the genus *Isochaeta* (now *Isochaetides*). The two genera differ in that *Isochaetides* species have long vasa deferentia, short atria, genital setae and quite long penes, and all the species lack hair and pectinate setae.

Other possible inclusions here would be *Tubifex solitarius* Semernoj, 1972 and the similar *Ilyodrilus sokolskayae* Brinkhurst, 1970 (= *I. orientalis* Sokolskaya, 1969) in which the male ducts more closely resemble *Ilyodrilus* (with wide vas deferens and posterior prostates on the atria so far as can be deduced from the drawings) but in which erectile penes like those of *V. pacifica* are present. Penial forms are duplicated in various genera, so the close relationship to *Varichaaeta* is unlikely.

*Peloscolex* Leidy, 1851

*Type-species.*—*Peloscolex variegatus* Leidy, 1851—dubious species.

*Discussion.*—The genus *Peloscolex* has been in need of revision for a long time because many species were associated with it on the basis of the papillate nature of the body wall (which may be papillate in many nauidid or tubificid genera in fact) without due attention to the form of the male duct (Brinkhurst 1971). The type-species was only very briefly described in the first instance, and the species was never rediscovered until a likely candidate was redescribed by me (Brinkhurst 1962). Although variously regarded as a genus or a subgenus of *Tubifex*, the name *Peloscolex* has been used for one of the largest assemblages of tubificids since the major monographs of the late 19th century despite the lack of a clearly defined type-species. Holmquist (1978, 1979) examined many species and produced detailed descriptions of many of the male ducts, but the revision, while clearing up many problems, created 2 difficulties. The first involves the recognition of another American species, originally described as *Embolocephalus multi-setosus* Smith, 1900, as a possible synonym of *P. variegatus*, with the new name *E. confusus* Holmquist, 1979 being attributed to *P. variegatus* sensu Brinkhurst. This would cause considerable confusion to American biolo-

gists, especially as Holmquist also demonstrated that the male ducts of *multisetosus* differ from those of the bulk of freshwater "*Peloscolex*" species, which means that the name *Peloscolex* would become restricted to *multisetosus* and the European species *P. moszynskii* Kasp., 1971—which is apparently synonymous with *multisetosus*.

The recognition of *P. variegatus* sensu Brinkhurst as the type-species was defended by Brinkhurst (1979) on both morphological and ecological evidence, but the truth of the matter is that the original description of the type-species is too vague for any final decision to be reached. In the following account the contentious name *Peloscolex* will be restricted to 8 dubious taxa, and most of the major groupings recognized by Holmquist will be accepted as genera or subgenera.

The second issue raised by Holmquist's revision is the placement of a large number of species which she felt could not be attributed to any genus for certain. This opinion, while taxonomically rigorous, is not of much practical help to ecologists and others who need to cite species by some acceptable name. A very large percentage of tubificid species is poorly described and/or lacks type-specimens, and it is my view that most species should be attributed to clearly defined genera wherever possible. The following account is, therefore, an attempt to add to the process of revising *Peloscolex* begun by Holmquist while recognizing that such revisions will inevitably need to be updated from time to time in this family.

Three species described by Pop (1974) cannot be identified with any certainty and remain as dubious species in this genus. They are *P. arganoi*, *P. boitanii*, and *P. cottarelli*.

Two Russian species, *P. malevici* (described by Cekanovskaya 1975) and *P. chukotensis* (described by Morev 1979) cannot be assigned to genera until redescribed in more detail.

Other dubious species associated with the name *Peloscolex* are shown in the concluding list in this manuscript.

#### *Spirosperma* Eisen, 1879 (emended)

*Definition.*—Prostomium and at least first segment retractable within rest of body. Body wall with large sensory papillae in circles on each segment (Fig. 2B) and/or covered by a secreted layer with attached foreign matter, aggregated into papillae which can cover body wall and obscure sensory papillae (at least in preserved specimens) or reduced to a series of concentric rings even within a single species. Hair setae broad and sabre-like in most instances, bifid or pectinate dorsal setae often with small tips or lyre-shaped tips where better developed. Ventral setae may be simple-pointed in some or all bundles, but are unusually variable in tooth development thickness and curvature even on a single specimen. Hollow spermathecal setae may

replace ventrals in X in mature specimens. Male ducts each with long vas deferens, usually separated into narrow and wide sections, atrium large, more-or-less crescentic in shape due to median attachment of large prostate glands, ejaculatory ducts variously developed, penes elongate in large sacs, with or without thin cuticular sheaths often little thicker than body-wall cuticle. Spermathecae with voluminous ampullae, often long ducts. Spermatozeugmata elongate, vermiform.

*Type-species.*—*Spirosperma ferox* Eisen, 1879.

*Distribution.*—Holarctic.

*Synonyms.*—*Embolocephalus* Randolph, 1892, *Orientodrilus* Holmquist, 1978.

The genus *Orientodrilus* was erected by Holmquist (1978) for the single species *O. nikolskyi* (Last. and Sol.), although she stated: "The genera *Embolocephalus*, *Spirosperma* and *Orientodrilus* may be closely related, considering not only the construction of their male organs but also the fact that they all have a cutaneous cover and strong head retractors. *Embolocephalus* and *Orientodrilus* on the one hand share the character of modified spermathecal setae, *Orientodrilus* and *Spirosperma* on the other hand the characters of crescent-shaped atria and long ejaculatory ducts." Such differences are incorporated within other tubificid genera and *Orientodrilus* is clearly intermediate between the other two genera proposed by Holmquist. The number of species involved is quite small. While I regard this as a single genus, the differences seem to be sufficient to merit subgeneric status for *Spirosperma* and *Embolocephalus*. The curvature of the atrium and length of vas deferens varies within both subgenera even according to the illustrations by Holmquist (1978, 1979).

*Spirosperma* (*Spirosperma*) Eisen, 1879, new subgenus

*Definition.*—*Spirosperma* species lacking simple-pointed ventral setae and modified spermathecal setae. Dorsal setae hairs and clearly pectinate setae. Body wall with or without papillae. Penis sheaths present.

*Type-species.*—*Spirosperma ferox* Eisen, 1879.

*Species list.*—

*S. (S.) ferox* (Eisen, 1879)

*E. plicatus* Randolph, 1892.

*S. papillosus* Beddard, 1895.

Europe, E. North America. Closely papillate to non-papillate. Anterior ventral setae sometimes with pectinations. Ejaculatory ducts long. Spermathecal ducts moderately long.

*S. (S.) tenuis* (Hrabě, 1931)*P. tenuis striatus* Pop, 1977.*P. scodraensis* Hrabě, 1958.

Yugoslavia (L. Ohrid, Prespa, Skadar). Ventral setae strongly recurved, thicker in *tenuis* than in *scodraensis*. Spermathecal ducts short.

*S. (S.) apapillatus* (Lastochkin and Sokolskaya, 1953)*P. a. sachalinensis* Sokolskaya, 1964.*P. kamtschaticus* Sokolskaya, 1961.

Asiatic USSR. Thin, non-papillate cutaneous covering. Ventral setae bluntly pointed, not strongly recurved. Spermathecal ducts long.

*Remarks.*—It seems better to follow Holmquist (1979) in separating *tenuis* from *apapillatus* at the same level as these are separated from *ferox*. The zoogeographic evidence then begins to suggest that subspecific rank could be applied to a near-holarctic *P. ferox* (none of these taxa being identified from western N. America yet).

The atria of *S. tenuis* (see Holmquist 1979, Fig. 13) are almost identical to those of *S. nikolskyi* (Holmquist 1978, Fig. 3) and *S. ferox* (Holmquist 1978, Fig. 2B) apart from the size of the penis (which varies within many genera, e.g. *Limnodrilus*) and so there is no basis for the separation of *Orientodrilus* (type *nikolskyi*) from *Spirosperma* (type *ferox*) according to this fundamental generic character of tubificids.

*Spirosperma (Embolocephalus)* Randolph, 1892, new rank as subgenus

*Definition.*—*Spirosperma* species with spermathecal setae present, penis sheaths absent, at least some simple-pointed ventral setae present, dorsal setae hairs and hair-like setae with small bifid to pectinate tips.

*Type-species.*—*Saenuris velutina* Grube, 1879.

*Species list.*—

*S. (E.) velutinus* (Grube, 1879)*Tubifex sarnensis* Pierantoni, 1904.*Peloscolex cernosvitovi* Hrabě, 1958.*Peloscolex fontinalis* Hrabě, 1964.

Europe. Dorsal setae bifid or pectinate. Ventral setae all simple-pointed or with strongly reduced upper tip or occasionally clearly bifid. The ventral setae vary strongly in single specimens. Spermathecal setae are present in *P. cernosvitovi* (see Holmquist 1979). The male ducts of *E. velutinus* have been described by Holmquist (1979) and Martinez-Ansemil and Giani (1980),

demonstrating the expected minor differences between specimens and/or illustrator's interpretation.

*S. (E.) nikolskyi* (Lastochkin and Sokolskaya, 1953)

Fig. 3

? *Tubifex (Peloscolex) nomurai* Yamamoto and Okada, 1940.

? *Peloscolex* sp. Yamaguchi, 1953 (= *P. yamaguchii* Brinkhurst, 1971).

*Peloscolex kurenkovi* Sokolskaya, 1961.

*Peloscolex oregonensis* Brinkhurst, 1965.

*E. alaskensis* Holmquist, 1979.

*E. confusus* Holmquist, 1979 (= *P. variegatus* sensu Brinkhurst).

*Orientodrilus nikolskyi* (L. and S.) Holmquist, 1978.

Holarctic. Dorsal setae variously pectinate, ventral setae of II–III or even IV with 1 or 2 simple-pointed setae as well as 1–2 bifid setae, the rest bifid.

*Remarks.*—*Peloscolex yamaguchii* is too poorly described to be sure of its position, but it does have spermathecal setae. In this and the older Japanese *T. nomurai* there is no mention of simple-pointed setae, but when these descriptions were published, such setae had yet to be described in any of these species, and they are a unique characteristic of these taxa. The hair setae are clearly serrate in many of these forms. The serration has not yet been seen in Great Lakes specimens. All have spermathecal setae, but only the glandular sacs were seen in *T. nomurai*.

The range of variation in the other taxa is no greater than that in the other variable species in the genus. They could be erected as subspecies if it were deemed necessary, as was done in the case of *E. stankovici* by Hrabě and others (see below).

The Mowich Lake specimens have 2–4 or sometimes 6 serrate hair setae, a similarly variable number of pectinate setae with thin tips, ventral setae of II–III a mixture of simple-pointed and bifids, usually 2 of each, sometimes 3, 1 posteriorly, bifids with upper teeth thinner and a bit longer than lower anteriorly. The ventral setae of X are modified spermathecal setae. The male ducts are long, the atria somewhat crescentic, the penes elongate with the cuticle slightly thicker than ordinary cuticle, and extending up the inside of the penis. The longer spermathecal ducts also have a cuticular lining. They have large ampullae and elongate spermatozeugmata (Fig. 3).

The serrate hair setae were observed in *P. oregonensis* by Timm and Medvedev (1972).

*S. (E.) carolinensis* (Brinkhurst, 1965)

U.S.A. (N. Carolina). Dorsal setae with minute tips, ? bifid. Ventral setae of II–VIII with 1 bifid, 1 simple-pointed seta.

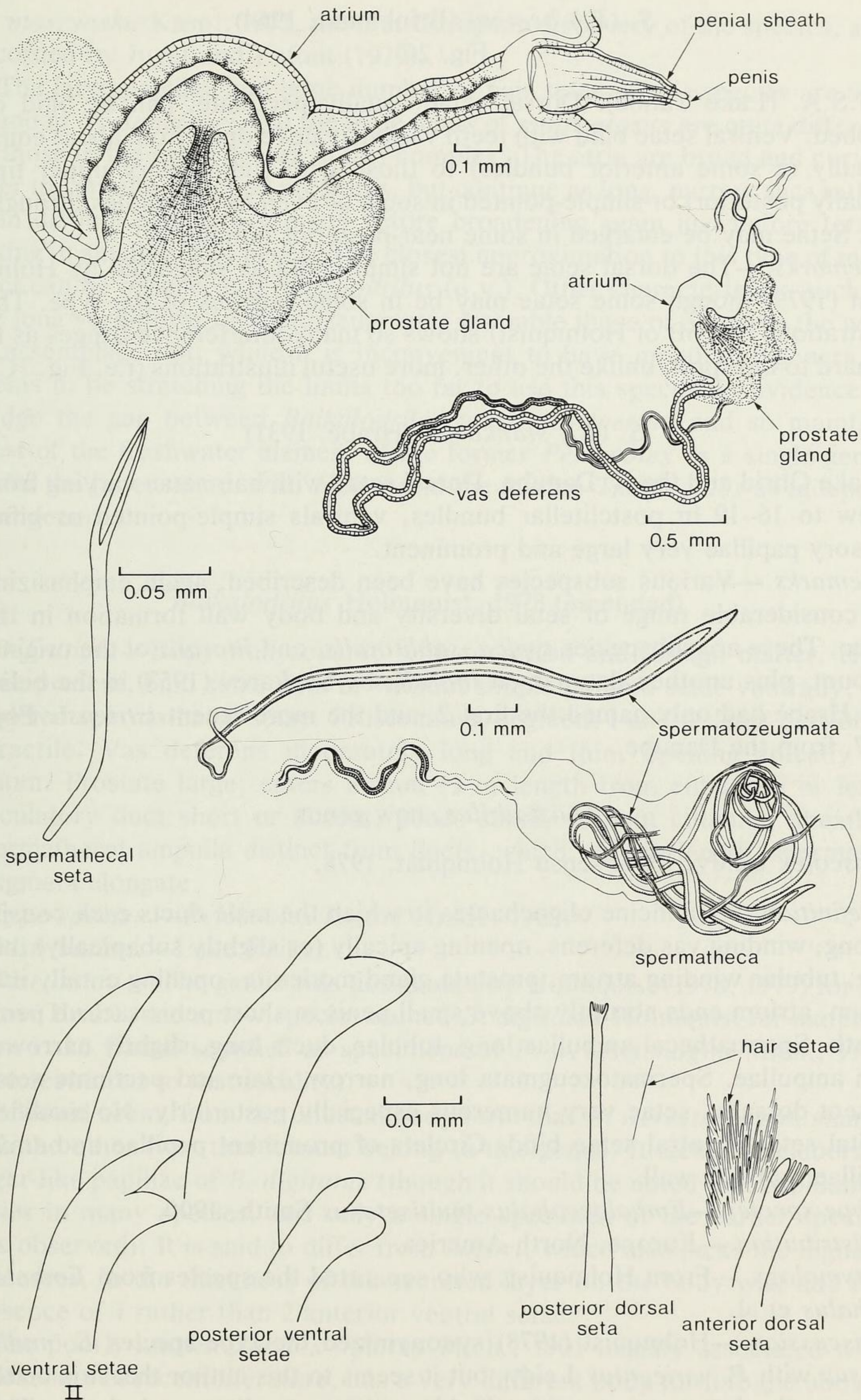


Fig. 3. *Embolocephalus nikolskyi* (from Mowich Lake), setae and reproductive structures.

*S. (E.) beetoni* (Brinkhurst, 1964)

## Fig. 2C

U.S.A. (Lake Tahoe). Dorsal setae usually pectinate, can be bifid or webbed. Ventral setae bifid with teeth variously developed from about equal (usually in some anterior bundles) to those with rudimentary upper tips (usually posterior) or simple-pointed in some or even most bundles throughout. Setae may be enlarged in some near-posterior bundles.

*Remarks.*—The dorsal setae are not simply bifid as suggested by Holmquist (1979) though some setae may be in some bundles of the type. The illustration (Fig. 6B of Holmquist) shows so many interference fringes as to be hard to interpret, unlike the other, more useful illustrations (i.e. Fig. 7C).

*S. (E.) stankovici* (Hrabě, 1931)

Lake Ohrid and the R. Danube. Dorsal setae with hair setae varying from a few to 16–19 in postclitellar bundles, ventrals simple-pointed or bifid. Sensory papillae very large and prominent.

*Remarks.*—Various subspecies have been described, again emphasizing the considerable range of setal diversity and body wall formation in the group. These are subspecies *typica*, *sublitoralis*, and *litoralis* of the original account, plus another also named *litoralis* by Sapkarev (1953) in the belief that Hrabě had only named the first 2, and the more recent *istriensis* Pop, 1977, from the Danube.

*Quistadrilus*, new genus

*Peloscolex* Leidy, 1851, sensu Holmquist, 1978.

*Definition.*—Tubificine oligochaetes in which the male ducts each consist of long, winding vas deferens, opening apically (or slightly subapically) into long, tubular winding atrium, prostate gland moderate, opening entally into atrium, atrium ends abruptly above small penis in short penis sac, no penis sheath. Spermathecal ampullae long, tubular, ducts long, slightly narrower than ampullae. Spermatozeugmata long, narrow. Hair and pectinate setae present dorsally, setae very numerous especially posteriorly. No modified genital setae, ventral setae bifid. Circlets of prominent papillae and small papillae on body wall.

*Type-species.*—*Embolocephalus multisetosus* Smith, 1900.

*Distribution.*—Europe, North America.

*Etymology.*—From Holmquist, who separated the species from *Embolocephalus* et al.

*Discussion.*—Holmquist (1978) synonymized the type-species *E. multisetosus* with *P. variegatus* Leidy, but it seems to this author that it is better to leave the latter as an unidentifiable species, as discussed above. This decision requires a new genus for one species, *E. multisetosus* (including

*P. moszynskii* Kasp., 1971, the first European discovery of the species, also recorded by Juget and Lafont (1979)).<sup>1</sup>

The large papillae and large number of hair setae of this species are also found in *S. stankovici*, but the male ducts of *multisetosus* are quite different to those in the other genera in this complex. The atria are broad and curved over the entally-attached prostates, but continue as long, narrow sacs rather than distinct ejaculatory ducts before broadening again just before terminating in small, naked penes. The closest approximation to this type of male duct can be observed in *Baikalodrilus* (q.v.). Other characteristics, such as the long vermiform spermatozuogmata, resemble those of others in the wider assemblage but, while it is inconvenient to have monotypic genera, it seems to be stretching the limits too far to use this species as evidence to bridge the gap between *Baikalodrilus* and *Spirosperma* and so maintain most of the freshwater element of the former *Peloscolex* as a single genus under the latter name, with *Haber* and the marine *Tubificoides* as independent genera.

#### *Baikalodrilus* Holmquist, 1978 (emended)

*Definition.*—Body wall covered with secretion and foreign matter. Hair setae present, bifid setae with or without simple-pointed setae ventrally, no modified spermathecal setae. Prostomium, segment I and at least part of II retractile. Vas deferens moderately long and thin, opening apically to atrium. Prostate large, enters atrium  $\frac{1}{3}$  of length from ental end or less, ejaculatory duct short or absent, penes small, without cuticular sheaths. Spermathecal ampulla distinct from ducts, which vary in length, spermatozuogmata elongate.

*Type-species.*—*Peloscolex kozovi* Hrabě, 1969.

*Distribution.*—Lake Baikal.

*Discussion.*—The genus was designated by Holmquist (1978, 1979) for *P. kozovi* Hrabě, and a new species named *B. digitatus* Holmquist for material from Lake Baikal supplied as specimens of *P. werestschagini* Mich., 1933 (also restricted to that locality).

It would seem, from the unusual body form that *P. werestschagini* shares with the other two, that it must belong to this genus. It lacks the elaborate finger-like papillae of *B. digitatus* (though it should be noted that papillation varies in many species, and only a single specimen of the earlier species was observed). It is said to differ from *kozovi*, which also lacks the digitate processes, in the thickness of the secreted layer on the body wall and the presence of 1 rather than 2 anterior ventral setae.

The poorly-known *Tubifex inflatus* Mich., 1901 usually associated with *Peloscolex* in recent literature, has a very different body form to the above,

<sup>1</sup> Now also Pfannkuche, O. 1981. Arch. Hydrobiol. (suppl.) 43:506–524, in the Elbe.

but the male ducts are not drastically different apart from the presence of a very short ejaculatory duct and a wider lumen. It seems convenient to place it here, with the other Baikal species. Examination of the types (Brinkhurst, in press) has added little to the solution of this problem, but new material from Baikal is on hand.

*Haber* Holmquist, 1978

*Definition.*—Tubificine oligochaetes in which the male ducts each consist of a long, winding vas deferens which widens abruptly before entering a relatively narrow atrium apically, prostate gland of moderate size enters medially, atrium narrows gradually to an ejaculatory duct, penis with thick basement membrane resembling cuticular penis sheath. Spermathecal and penial setae modified, in glandular sacs. Hair and pectinate setae present.

*Type-species.*—*Tubifex speciosus* Hrabě, 1931.

*Distribution.*—Balkan Lakes, Pyrenees, Britain, U.S.A. (New York), Asia (Amur River).

*Discussion.*—This genus is quite distinct and, as suggested by Holmquist (1978, 1979) contains the Balkan Lakes taxa<sup>1</sup> *speciosus* (Hr.), *zavreli* (Hr., 1942); *monfalconensis* Hr., *dojranensis* (Hr., 1958) plus the asiatic *amurensis* (Sol. and Hr., 1969), and the British *simsi* (Br., 1966).

The French species *P. pyrenaicus* Juget and Giani, 1974, and *P. turquini* Juget and Lafont, 1979 are now attributed to *Haber*. The former has spermathecal setae, penial setae in at least some specimens, hair and pectinate setae dorsally and cuticular penis sheaths of an odd form with basal folds reminiscent of those described in *Haber* species. The atria are not much wider than the vasa deferentia. The second species has much the same set of characteristics and both clearly belong here.

Finogenova (1972) demonstrated that *Ilyodrilus svirenkoi* Lastochkin is closely related to *H. speciosus*, then thought to be a *Tubifex* species.

*Haber* cf. *speciosus* Hrabě, 1931

Fig. 4

Single broken specimen, 0.15 mm wide at peristomium, small worm. Dorsal anterior setae 2–3 hairs and 3–4 pectinates with long lateral teeth and fine intermediate teeth, posteriorly 1 hair and 1 bifid seta with shorter teeth. Ventral setae anteriorly 3–7, teeth long and sharply pointed, the upper longer than the lower, 3 posteriorly with shorter teeth. Penial and spermathecal setae long, thin, hollow tipped, in glandular sacs. Cuticular basal membranes (?) in penes (resembling penis sheaths) present.

One mature specimen, coll. K. Stimpson, in a shallow riffle with swift current, large cobbles, 4.8 km upstream of railroad bridge, above Goudey Generating Station, Binghamton, Broome Co., New York, Susquehanna R., 2 August 1976. Smithsonian Institution USNM 065223.

<sup>1</sup> Subspecific or specific ranks have yet to be determined.

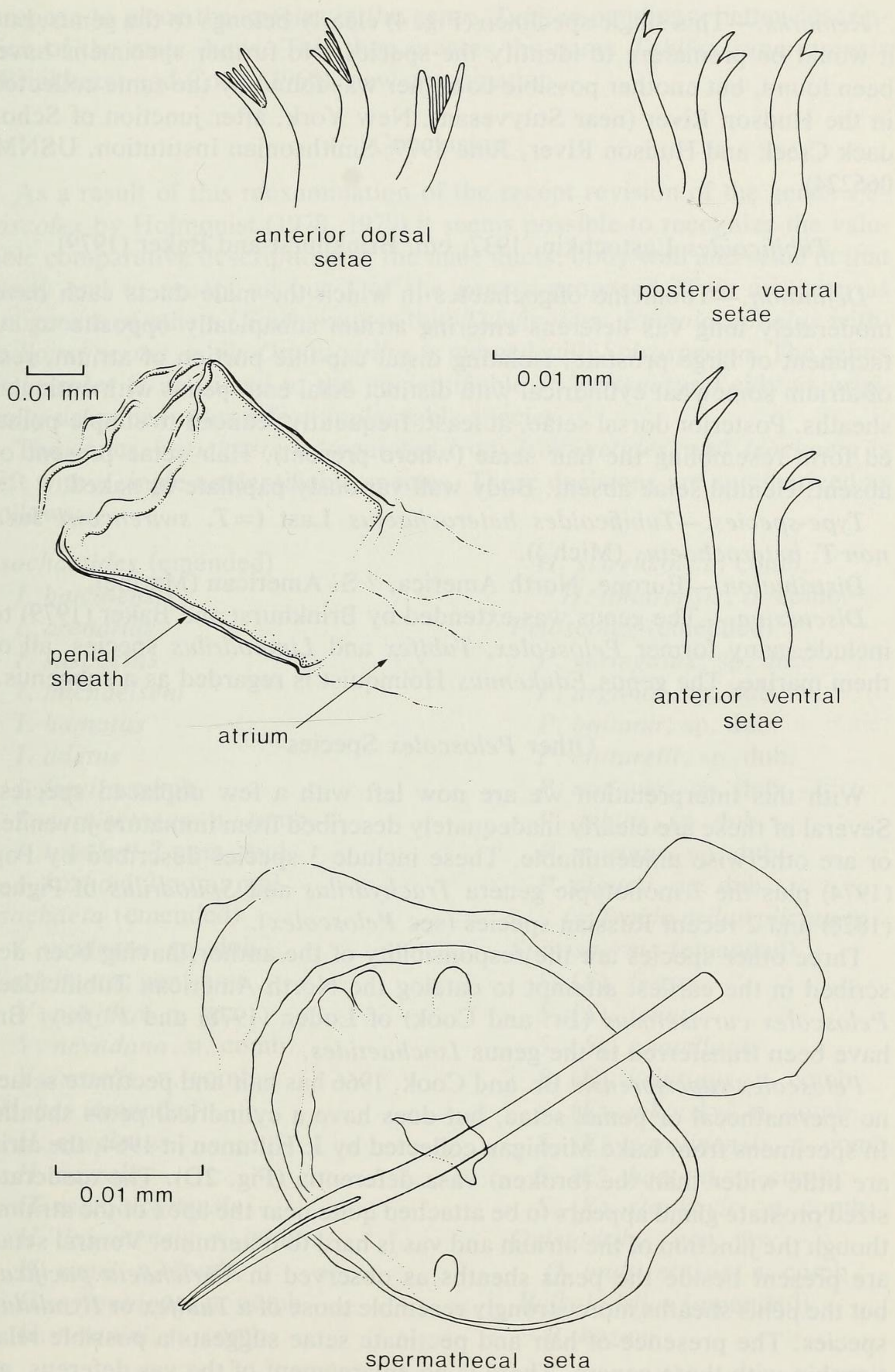


Fig. 4. *Haber ? speciosus* (from New York state), somatic and genital setae, penis sheath.

*Remarks.*—This single specimen (Fig. 4) clearly belongs to the genus, but it would be premature to identify the species. No further specimens have been found, but another possible congener was found by the same collector in the Hudson River (near Stuyvesant, New York, after junction of Scho-dack Creek and Hudson River, June 1977; Smithsonian Institution, USNM 065224).

*Tubificoides* Lastochkin, 1937, em. Brinkhurst and Baker (1979)

*Definition.*—Tubificine oligochaetes in which the male ducts each have moderately long vas deferens entering atrium subapically opposite to attachment of large prostate, isolating distal cap-like portion of atrium, rest of atrium somewhat cylindrical with distinct ectal end, penes with cuticular sheaths. Posterior dorsal setae, at least, frequently reduced to simple-pointed form resembling the hair setae (where present). Hair setae present or absent. Genital setae absent. Body wall variously papillate or naked.

*Type-species.*—*Tubificoides heterochaetus* Last (= *T. swirencowi* Jar., non *T. heterochaetus* (Mich.)).

*Distribution.*—Europe, North America, ? S. American (Marine).

*Discussion.*—The genus was extended by Brinkhurst and Baker (1979) to include many former *Peloscolex*, *Tubifex* and *Limnodrilus* species, all of them marine. The genus *Edukemius* Holmquist is regarded as a subgenus.

#### Other *Peloscolex* Species

With this interpretation we are now left with a few unplaced species. Several of these are clearly inadequately described from immature juveniles or are otherwise unidentifiable. These include 3 species described by Pop (1974) plus the 2 monotypic genera *Trachydrilus* and *Spilodrilus* of Piguet (1828) and 2 recent Russian species (see *Peloscolex*).

Three other species are the responsibility of the author, having been described in the earliest attempt to catalog the North American Tubificidae. *Peloscolex curvisetosus* (Br. and Cook) of Loden (1978) and *P. freyi* Br. have been transferred to the genus *Isochaetides*.

*Peloscolex superiorensis* Br. and Cook, 1966 has hair and pectinate setae, no spermathecal or penial setae, but does have a cylindrical penis sheath. In specimens from Lake Michigan collected by J. Hiltunen in 1964, the atria are little wider than the (broken) vasa deferentia (Fig. 2D). The moderate sized prostate gland appears to be attached quite near the apex of the atrium, though the junction of the atrium and vas is hard to determine. Ventral setae are present beside the penis sheaths as observed in *Varichaeta pacifica*, but the penis sheaths more strongly resemble those of a *Tubifex* or *Ilyodrilus* species. The presence of hair and pectinate setae suggests a possible relationship with these genera. There is no enlargement of the vas deferens, as in the latter, and the atria are too short for placement in *Varichaeta*, so I

propose to place the species in the genus *Tubifex* pending a better description of the male ducts. This then creates the name *Tubifex superiorensis* (Brinkhurst and Cook, 1966), new combination.

### Conclusion

As a result of this reexamination of the recent revision of the genus *Peloscolex* by Holmquist (1978, 1979) it seems possible to recognize the valuable comparative descriptions of the male ducts, body wall and setae in that study and to accept all but 3 of the genera proposed. Two are seen as subgenera of others (*Edukemius* within *Tubificoides*, *Embolocephalus* within *Spirosperma*, while *Orientodrilus* is merged with *Spirosperma*. The genus *Peloscolex* is restricted to the unidentifiable *P. variegatus* Leidy as originally described, plus a few unplaceable species.

The genus *Varichaeta* is separated from *Isochaetides*, and *Isochaeta* is left with a single unidentifiable species. These decisions are summarized as follows:

#### *Isochaetides* (emended)

- I. baicalensis*
- I. arenarius*
- I. suspectus*
- I. michaelsoni*
- I. hamatus*
- I. adetus*
- I. freyi* n.comb.
- I. curvisetosus*, n. comb.
- I. tomilovi* ? nom. nud.
- I. koshovi* ? nom. nud.

#### *Isochaeta* (emended)

- I. virulenta*, sp. dub.

#### *Varichaeta*, gen. nov.

- V. pacifica*, n. sp.
- V. nevadana*, n. comb.
- V. israelis*, n. comb.

#### <sup>1</sup>*Haber* (emended)

- H. speciosus*
- H. zavreli*
- H. monfalconensis*
- H. dojranensis*, n. comb.
- H. simsi*, n. comb.
- H. pyrenaicus*, n. comb.
- H. turquini*, n. comb.

- H. svirenkoi*, n. comb.

- ? *H. amurensis*, n. comb.

#### *Peloscolex* (emended)

- P. variegatus*, sp. dub.
- P. arganoi*, sp. dub.
- P. boitanii*, sp. dub.
- P. cottarelli*, sp. dub.
- P. malevici*, sp. dub.
- P. debilis*, sp. dub.
- P. marinus*, sp. dub.
- P. pigueti*, sp. dub.

(= *Trachydriulus plicatus*)

#### *Spirosperma* (emended)

- S. (S). ferox*
- S. (S). tenuis*
- S. (S). apapillatus*
- S. (E). velutinus*, n. comb.
- S. (E). nikolskyi*, n. comb.
- S. (E). carolinensis*, n. comb.
- S. (E). beetoni*, n. comb.
- S. (E). stankovici*, n. comb.

#### *Quistadrilus*, gen. nov.

- Q. multisetosus*, n. comb.

#### *Baikalodrilus* (emended)

- B. kozovi*

<sup>1</sup> Species limits to be determined.

*B. digitatus*  
*B. werestschagini*, n. comb.  
*B. inflatus*, n. comb.  
*Tubificoides* em. Brinkhurst  
 and Baker, 1979

*Tubifex*  
*T. superiorensis*, n. comb.  
*Spilodrilus*, gen. dub.  
*S. stellatus*, sp. dub.

### Acknowledgments

I am indebted to Dr. M. Loden and Messrs. M. Barbour, J. Hiltunen and K. Stimpson for loans of material and most useful discussions. Dr. P. Chapman and Ms. M. Farrell made the Mowich Lake material available following the field work. Dr. T. Timm discussed aspects of this work with me, and I acknowledge his generosity, as well as that of my students and assistants Mr. R. Baker and Ms. K. Coates. The manuscript was prepared by S. Oliver. The artwork was executed by Techni-Graphics Ltd. of Victoria, B.C.

### Literature Cited

- Baker, H. R. 1980. A redescription of *Tubificoides pseudogaster* (Dahl) (Oligochaeta, Tubificidae).—Transactions of the American Microscopical Society 99:337–342.
- , and R. O. Brinkhurst. In Press. A revision of the genus *Monopylephorus* and redefinition of the subfamilies Rhyacodrilinae and Branchiurinae (Tubificidae:Oligochaeta).—Canadian Journal of Zoology.
- Brinkhurst, R. O. 1962. A redescription of *Peloscolex variegatus* Leidy (Oligochaeta, Tubificidae) with a consideration of the diagnosis of the genus *Peloscolex*.—Internationale Revue der Gesamte Hydrobiologie 47:301–306.
- . 1963. Taxonomical studies on the Tubificidae (Annelida, Oligochaeta).—Internationale Revue der Gesamten Hydrobiologie, Systeme. Beih. 2:1–89.
- . 1966. Taxonomical studies on the Tubificidae (Annelida, Oligochaeta). Supplement.—Internationale Revue der Gesamten Hydrobiologie 51:727–742.
- . 1971. In Brinkhurst, R. O. and B. G. M. Jamieson. *Aquatic Oligochaeta of the World*; Oliver and Boyd, Edinburgh, xi + 806 pp. (Part 2. Systematics. 8. Family Tubificidae. pp. 444–625).
- . 1979. On the types in the genus *Peloscolex* Leidy (Oligochaeta: Tubificidae).—Proceedings of the Biological Society of Washington 92(4):677–681.
- . In Press. On the types of the Tubificidae (Oligochaeta) described by W. Michaelsen and others in the Zoological Museum, University of Hamburg.
- , and H. R. Baker, 1979. A review of the marine Tubificidae (Oligochaeta) of North America.—Canadian Journal of Zoology 57:1553–1569.
- Секавоская, О. В. 1975. Новые тубифичиды (Oligochaeta Tubificidae) из абиссали озера Байкал.—Труды Байкал'ской Лимнологической Станции 18:112–130.
- Finogenova, N. P. 1972. New species of Oligochaeta from the Dnieper and Bug Firth and the Black Sea and revision of some species.—Труды Зоологического Института Академии Наук СССР (Trans. Zool. Inst. USSR Acad. Sci.) 52:94–116 (In Russian).
- Holmquist, C. 1978. Revision of the genus *Peloscolex* (Oligochaeta, Tubificidae). 1. Morphological and anatomical scrutiny; with discussion on the generic level.—Zoologica Scripta 7:187–208.

- . 1979. Revision of the genus *Peloscolex* (Oligochaeta, Tubificidae). 2. Scrutiny of the species.—*Zoologica Scripta* 8:37–60.
- Hrabě, S. 1966. New or insufficiently known species of the family Tubificidae.—*Spisy Přírodovědecké Fakulty University v Brně* 470:57–77.
- . 1967. Two new species of the family Tubificidae from the Black Sea, with remarks about various species of the subfamily Tubificinae.—*Spisy Přírodovědecké Fakulty University v Brně* 485:331–356.
- Juget, J., and M. Lafont. 1979. Description de *Peloscolex turquini*, n.sp. et redescription de *Peloscolex moszynskii* Kasprzak, 1971, (Tubificidae, Oligochaeta) avec quelques remarques sur la répartition du genre *Peloscolex* dans les eaux douces Françaises.—*Bulletin de la Société Linnéenne de Lyon* 48(2):75–118.
- Kasprzak, K. 1976. Contribution to the knowledge of aquatic Oligochaeta of Italy.—*Acta Zoologica Cracoviensia* 21:331–340.
- Loden, M. S. 1978. A revision of the genus *Psammoryctides* (Oligochaeta: Tubificidae) in North America.—*Proceedings of the Biological Society of Washington* 91(1):74–84.
- Marcus, E. du Bois-Reymond. 1949. Further notes on nauidids and tubificids from Brazil.—*Comunicaciones Zoológicas del Museo de Historia Natural de Montevideo* 51:1–11 (+ 2 plates).
- Montinez-Ansemil, E., and N. Giani. 1980. Premières données sur les oligochètes aquatiques de la Péninsule Iberique.—*Annales de Limnologie* 16(1):43–54.
- Moore, J. P. 1905. Some marine oligochaeta of New England.—*Proceedings of the Academy of Natural Sciences of Philadelphia* 57:373–399 (+ 2 plates).
- Morev, A. P. 1979. A new species of the genus *Peloscolex* (Oligochaeta, Tubificidae) from water bodies of the Anadyr River basin.—*Zooloogicheskii Zhurnal* 58:755–758.
- Piguet, E. 1928. Sur quelques Oligochètes de l'Amérique du Sud et d'Europe.—*Bulletin de la Société Neuchâteloise des Sciences Naturelles N.S.* 1:78–101.
- Pop, V. 1974. Faunistische Forschungen in den Grundwassern des Nahen Ostens. XII. Oligochaeta (Annelida).—*Archiv für Hydrobiologie* 73:108–121.
- Šapkarev, J. 1953. (A new form of *Peloscolex stankovici* Hrabě (*P.s.* forma *littoralis*, n.f.), an endemic oligochaete of Lake Ohrid).—*Zbornik Radova Hidrobiol. Zav. Ohrid.* 1–6:105–114.
- Semernoj, V. P. 1973. Малоштитииковые черви (Oligochaeta) озер забайкалья. Казанский орденa трудового красного знамени государственный Университет Цменив—и. Ульянова-ленина. Каза. Нб. 1973:1–20.
- Semernoj, V. P., and A. A. Tomilov. 1972. Олигохеты (Oligochaeta) Озхубсугул (Монголия)—*Биология Внутренних Вод* 16:26–29.
- Timm, T. E., and F. S. Medvedev. 1972. Североамериканский вид рода *Peloscolex* В западной сибирии. In *Водные Малоштитииковые Черви (Материалы Второго Всес. Симп.)*: 130–133. Yaroslavl.

Ocean Ecology Laboratory, Institute of Ocean Sciences, P.O. Box 6000, Sidney, British Columbia, Canada, V8L 4B2.