Aquatic Oligochaetes Occurring in Forest Litter.—I.

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Abstract

THREE species of aquatic oligochaetes are recorded from cultures of forest litter, One is a new Naidid species. These worms are considered to constitute an indigenous ground fauna. Cysts of both Aeolosomatid species, sexual stages of one species, and a bifurcate individual of the other species are also recorded.

INTRODUCTION

IN an earlier paper (Stout, 1952), two species of Aeolosomatid worms were recorded from soil. These two species have now been identified in cultures of gorse and manuka litter, together with a new species of Naidid worm, *Pristina taita* n.sp.

The worms were identified in samples of litter and Taita hill soil taken from the western aspect of the hills overlooking the Hutt Valley on the Soil Bureau Experimental Station. This area was covered by gorse (*Ulex europeus*) and manuka (*Leptospermum scoparium*) scrub. The scrub was cut and cleared, and samples of both litter and topsoil were collected before the area was burnt and at various intervals after burning. *Pristina taita* n.sp. occurred only in the moist lower litter before the burn. The two Aeolosomatid worms occurred both in the moist litter samples before the burn and in subsequent soil samples.

It is interesting to find a Naidid worm in litter as they are usually considered strictly aquatic. The two species to which this worm is most nearly related both show similar ecological characteristics. *Pristina amphibiotica* is recorded in sphagnum of swamps and lakes not covered with water but only moistened, from the sides of an old wooden bridge in a small tarn, and in shallow bays at the depth of some decimetres in the surface layer of a sandy bottom. *P.idrensis* lives in moss-tufts which hang down into the water from the border of little woodland lakes (Sperber, 1948). Marcus (1944) recorded *Aeolosoma kashyapi,* including sexual worms, from moist leaves. The records of these worms from moss, moist leaves, soil, and now forest litter indicate that they constitute a distinct fauna inhabiting a niche perhaps subject to periodic desiccation but capable of retaining sufficient moisture for a typically aquatic microfauna. This fauna is taxonomically distinct from the fauna of permanent fresh water habitats.

To the earlier descriptions of the Aeolosomatid worms can now be added a description of their cysts, not previously recorded, a bifurcated individual of *Aeolosoma niveum,* and sexual stages of *A. kashyapi.*

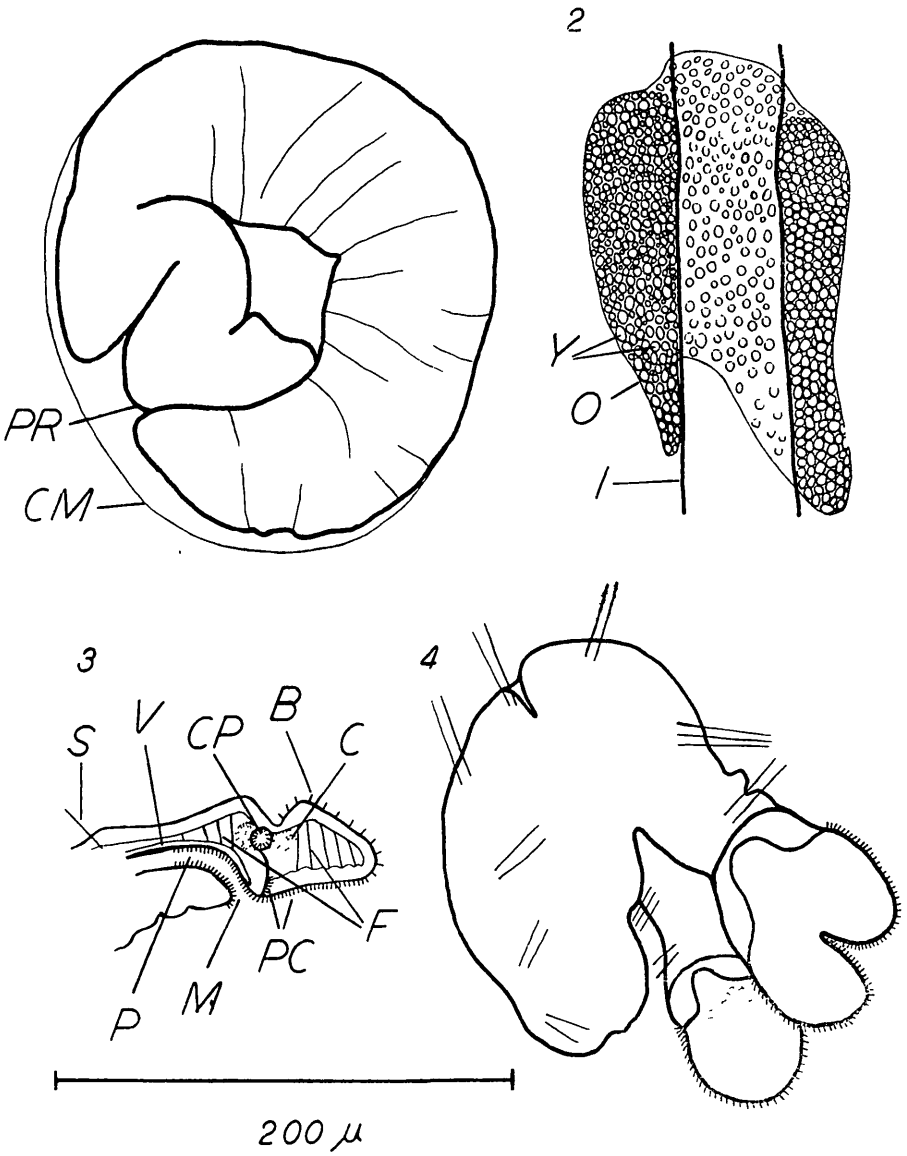
Generally living worms were studied, but worms were also fixed to obtain greater detail of the ovum in *A. kashyapi* and general morphological detail in *Pristina.* Bouin's was found to be the best fixative. With *Pristina,* worms were mounted in polyvinyl alcohol, which proved very satisfactory for defining the setae (Salmon, 1949).

Description

Family AEOLOSOMATIDAE

Aeolosoma niveum Leydig 1865. Figs. 1, 3, 4.

The present worm is similar to that previously identified as *A. niveum* (Stout, 1952). It is distinguished from *A. kashyapi* by its loosely coiled nephridia, the absence of colour glands, and the presence of ciliated pits on the prostomium. These (Fig. 3) are generally



Text-fig 1.—Fig 1—*Aeolosoma niveum* Cyst PR, prostomium: CM, cyst membrane.
Text-fig 1.—Fig. 2—*A. kashyapi* Ovum O, ovum; I, intestine; Y, yolk granules.
Text-fig. 1.—Fig. 3—*A niveum.* Lateral view of the head S, seta; V, dorsal blood vessel; CP, ciliated pit; B, dorsal bristles; C, cerebral ganglia; F, muscle fibres; PC, cilia of prostomial surface and lateral groove; M, mouth; P, pharynx.
Text-fig. 1.—Fig 4—*A. niveum.* Bifurcated monster.

similar to those of *A. aureum* (Marcus, 1944). The ciliated prostomial groove leads directly to the ciliated pit, but the cilia of the groove are partly obscured by its posterior margin which partly covers the groove.

Encystment of a worm isolated on a slide was observed. It coiled itself into a tight ring, with the flat ciliated ventral surface of the prostomium closely apposed to the inner surface of the last segment of the body (Fig. 1). A very thin cyst membrane enclosed the worm. Fracturing the cyst membrane freed the worm, which again became active on the slide. Because of its starved condition, both the worm and the cyst were very small, but otherwise it generally resembled the encysted stage of *A. hemprichii,* described by Herlant-Meewis (1950, 1951).

In the later cultures there occurred a bifurcated monster (Fig. 4). Bifurcation was at the anterior end, the body being united at the fourth—i.e., the third setigerous segment. There were six segments posterior to the bifurcation. Normally, n, the number of segments anterior to the budding zone is 7. The prostomium of one of the monster's heads showed further partial bifurcation. I did not observe the cerebral ganglia in this head, nor did I observe the functioning of the gut. The worm died after a few days. I do not know of any other record of bifurcation in Aeolosomatid worms. Usually they reproduce asexually by budding, and I have never observed sexual worms of *A. niveum.* The monster, however, must have been formed by the abnormal development of an egg (Stephenson, 1930: 543–544).

Aeolosoma kashyapi Stephenson 1923. Fig. 2.

The present worm is similar to that previously identified as *A. kashyapi* (Stout, 1952). Sexual worms were observed in June and October. In June, only the clitellum and ovum were present. In October, sperm morulae were also present. Marcus (1944: 92) found sexual worms of *A. kashyapi* in December and January. There is no indication, therefore, of a seasonal cycle.

In the living worm, the ovum, or ovocyte as it is called by Marcus, extends from just in front of the setae of the fifth segment to just behind the setae of the sixth segment. It is asymmetric, lying on the ventral and left side of the gut and closely apposed to it (Fig. 2). It is a large, flattened body, roughly oval in outline. Seen in the living worm, the ovum appears much denser between the gut and the body wall than where it is seen over, or under, the gut. However, in my worms, the ovum, filled with yolk granules, was perfectly homogeneous throughout. Only a single ovum was observed in each worm. A thickening of the body wall—the clitellum—is restricted to the left side of the body—i.e., next to the ovum. Sperm morulae, at different stages of development, were observed throughout the body cavity. No other stages of sexual development were observed. These observations are similar to those of Marcus (1944: 115), except that he shows the ovum, or ovocyte, as consisting of a dark lateral part and a lighter median part. This appearance is, as I have described, a deception. The ovum is, as shown by Aiyer (1929: 18) for *A. travancorense,* an homogeneous body.

A cyst of *A. kashyapi* was observed in the later cultures. It was about 150–170 mu in diameter and resembled very closely the cysts of *A. hemprichii* described by Herlant-Meewis (1950, 1951).

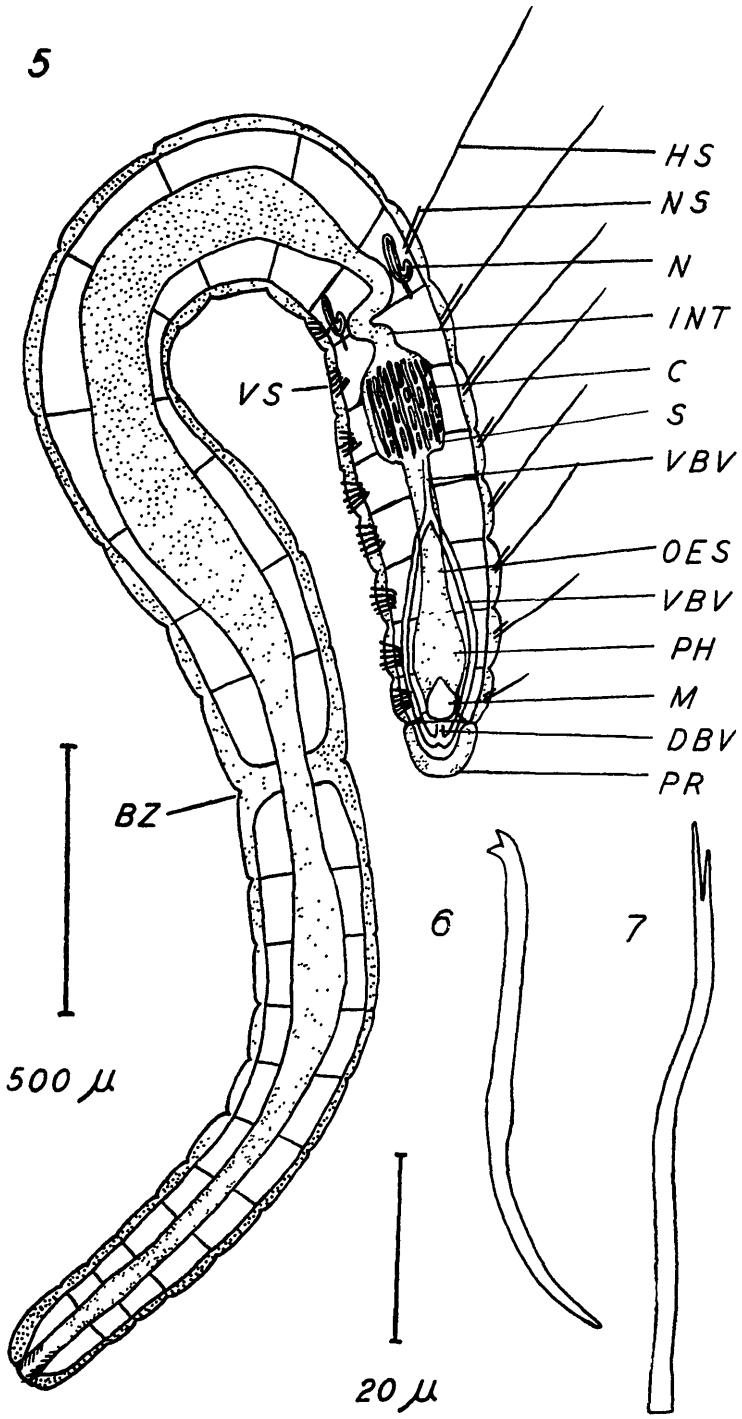
Family NAIDIDAE

Pristina taita n.sp. Figs. 5-7.

The worms are normally transparent and from 1.5 to 5 mm in length. The body wall is annulated and contains minute oil drops which, if the worm is damaged, coalesce and render it opaque. Minute bristles (8–10 mu long) occur on all segments, and are conspicuous on the prostomium and the anal segment. There are normally 22–25 segments in a worm and n is 17 The prostomium is semicircular to pyriform in outline, with no proboscis development. The peristomium is short and not distinctly separated from the succeeding segment. The first seven segments are smaller than the succeeding segments.

The setae commence on the second segment. They consist dorsally of a single unserrated hair seta and a single needle seta per bundle and ventrally of 7–2 bifid crotchets per bundle. Only once have I observed the dorsal setae of some segments doubled in number. The hair setae are simple and flexible and vary in length from 60 to 360 mu. The needle setae (Fig. 7) are slightly sickle shaped, with a bifid tip, the proximal tooth (7-8 mu) being distinctly longer than the distal (4–5 mu). They vary in length from 35 to 72 mu. The ventral setae (Fig. 6) are bifid crochets with a weakly developed nodulus about the middle of the seta. They vary in length from 30 to 64 mu. They are most numerous in the anterior segments and decrease in number posteriorly. There may be as many as 7 per bundle in II, there are generally 4–5 in the middle segments, and 2–3 in the terminal segments.

The variation in the size of the setae is very great both for a single worm and between different worms. Nor is the pattern consistent. The ventral setae may sometimes be relatively short in a worm with relatively long dorsal setae, and vice versa. Consequently little reliance



TEXT-FIG. 2.—Fig 5—*Pristina taita* n sp Semi-diagrammatic drawing. PR, prostomium; DBV, dorsal blood vessel; M, mouth; PH, pharynx; VBV, ventral blood vessel; OES, aesophagus; S, stomach; C, canals in stomach wall; INT, intestine; N, nephridium; NS, needle seta; HS, hair seta; VS, ventral seta, BZ, budding zone. Fig. 6—*Pristina taita* n.sp. Ventral seta. Fig 7—*Pristina taita* n sp. Needle seta The outline of Fig. 5 and all other figures drawn with the aid of a camera lucida.

can be placed on the specific length of the setae. However, there is one consistent feature. The dorsal setae are invariably short in the first setigerous segment and increase progressively in length to the seventh setigerous segment. They then diminish slightly with succeeding segments and are conspicuously shorter again in the terminal segments. This characteristic is specific.

The alimentary canal consists of a well developed protrusible pharynx in segments I–IV with a dorsal diverticulum II–IV; a short oesophagus V–VI; a distinct stomach VI–VII; succeeded by a narrow coiled intestine broadening in X. The stomach broadens sharply in VI, and its walls have the canals characteristic of *Pristina* (Sperber, 1948: 25). Chloragogen starts in segment IV. Both the pharynx and anus are conspicuously ciliated.

The vascular system consists of the typical contractile dorsal and non-contractile ventral vessels. The latter, however, bifurcates in V and the two branches, lying somewhat laterally, pass on either side of the pharynx and unite with the dorsal vessel in the prostomium. There are also paired commissural vessels uniting the dorsal and ventral vessels in II and IV. The dorsal vessel is attached to the oesophagus by short strands and is intimately associated with the alimentary plexus of the stomach and intestine.

The nephridia consists of a small, ciliated, diamond-headed nephrostome and an elaborate double coiled body with parallel lumina. They are paired in IX and may occur in subsequent segments, either paired or single. In the latter case the nephridia occur on alternate sides.

Pharyngeal, oesophageal, and septal glands occur in II-VI Black coelomocytes, up to 15 mu in diameter, occur in large numbers.

Budding is the only form of reproduction so far observed. Although the worm has been cultured for two years, no sexual worms have been observed. The fission zone is 17, but budding zones may develop in the anterior segments. Further, just prior to the separation of the zooids a partly developed segment, shown by the development of setae, may be intercalated posterior to 17. Generally there are only two zooids in a chain. In one instance, in a particularly vigorous culture, a chain of three zooids was observed This was 10 mm long. A clearly marked fission zone occurred at 17 in the anterior zooid, but anterior to this were five thickened zones indicative of future budding zones. The middle zooid consisted of only nine setigerous segments. The posterior zooid had a clearly marked fission zone at 17, with eight posterior segments as in the typical worm. In the well developed bud, just prior to fission, the first six setigerous segments are smaller than the succeeding segments, as in the anterior zooid, and their setae are shorter. This characteristic seems to be the expression of an underlying metabolic gradient, to which the position of the stomach may also be related (Stephenson, 1930: 597–598). This metabolic gradient seems to determine the specific form of the worm and to account for interspecific differences.

The systematics of the Naididae are treated in a recent monograph by Sperber (1948). She combines the genera *Pristina* and *Naidium* in a single genus, *Pristina*, and sub-family Pristininae, chiefly distinguished by the dorsal setae, which consist of needles and hairs and begin in II. Within this genus a major distinction is the formation of a proboscis in many species. Those without a proboscis may be separated into those with serrated and those with non-serrated hair setae. Six species lacking a proboscis and with non-serrated hair setae are listed by Sperber.

Lacking knowledge of the sexual organs, the next most valuable specific character is the position of the stomach. For reasons given above, the size of the setae is of no value and actually the variation of setal size in the present species almost wholly covers the range of these six species. The only two species which have the stomach commencing in VI are the closely related *P. amphibiotica* and *P. idrensis*. My worm differs from these two species in the position of n and of the segments in which the dorsal setae attain their maximum length, a character which, as I have pointed out, is specific. In both *P. amphibiotica* and *P. idrensis* the setae are longest in segments IV and V, as contrasted with VIII and IX in my worm An unusual character of my species is the bifurcation of the ventral blood vessel which further distinguishes it from the other two species The teeth of the needle setae of this species are longer, and the ratio of the distal tooth length to the proximal is 6/10, compared with 5/10 for *P. amphibiotica* and 8/10 for *P. idrensis*.

I have named the new species *P. taita* n.sp as it occurred in litter taken from the Soil Bureau Experimental Station at Taita. The culture of the worm is being maintained in the hope that sexual forms will eventually occur.

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