Tasmanian Earthworms

by

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"*All the fertile areas of this planet have at least once passed through the bodies of earthworms*." - Charles Darwin (1881)

PREFACE

This work is dedicated to the great guiding lights of earthworm study, Wilhelm Michaelsen (1860-1937), John Stephenson (1871-1933), and Ken Lee (1927-) who have set standards of intellect, endeavour and integrity that we followers should hope

to emulate. I appreciate the support and encouragement along the way of friends and colleagues in Australia and overseas, including John Buckerfield and Dr Ken Lee in Adelaide, Dr John Hickman in Tasmania, Dr Chris Glasby in NT, Drs Geoff Read and Gregor Yeates in NZ, Mary Applehof in USA and Dr Stephanie Greshon in the UK. The efforts of the collectors of the worms are also acknowledged - where possible I have named species in honour of these contributors. I also thank the Director and staff who have helped at the Queen Victoria Museum, Launceston especially Dr Brian Smith the curator of zoology, and at the Tasmania Museum, Hobart, the Museum of Victoria, Melbourne, the Australian Museum, Sydney and the Museum of Natural History, London. Peer review was by two anonymous and two independent scientists who are thanked for their critical appraisal of earlier drafts. It would be remiss not also to give recognition to the subjects of this study, the worms themselves, that have been sacrificed for the sake of furthering our knowledge and understanding of these important yet modest and often neglected animals.

Intermittent funding for about two years laboratory work at the Queen Victoria Museum was provided by the Plomley Foundation, and by a National Estates Grant. Most field work in Tasmania and essential visits to inspect type material held in other institutions were self-funded. Subsequent funds for the production of a computer guide to the fauna, was awarded to me by ABRS, Canberra in November 1998, but due to other commitments I was unable to take this up until early 2000. Tasmanian Parks and Wildlife Service provided $4,000 for my Lake Pedder survey [actually $5,000 but some monies went missing...] under an endangered species fund of the World Heritage Area program, and Forestry Tasmania gave a small grant for work on material from their Warra Long-Term Ecological Research (LTER) site.

I started work on Tasmanian material briefly in 1991 and 1993, but most of the taxonomic effort was completed in the three years following relocation to Launceston, in 1995-1998. Laboratory work at the Queen Victoria Museum, or more correctly at the spirit store annex - the Launceston Council's Roads Depot Compound across the railroad tracks at Rocherlea on the outskirts of town, was interspersed with field work in Tasmania and on Macquarie Island, and essential visits to inspect type material held in the Tasmanian Museum, the Museum of Victoria, the Australian Museum, and the Natural History Museum, London.

My studies of Australia's native and exotic earthworms at species, genus and family levels, were extended by the Tasmanian work, which also gave the opportunity to compare the relationships between the fauna of Tasmania and those found on the mainland and elsewhere in the World. Due to errors and omissions in some earlier work, which had not been critically reviewed nor to my knowledge much utilized in the intervening period, it was necessary to completely revise descriptions based on previous type material. Unraveling the mysteries of some taxa has been an involved and laborious process, nevertheless the current revision is written without prejudice, and as a scientific contribution should be without fear of censure. Published works cannot be ignored and the taxonomist is obliged to take into consideration previous work, however speculative it is, and has a duty to make corrections to the mistakes of others, and to their own earlier mistakes. Revisionary work has been an essential prerequisite for this study, but has effectively doubled the time and effort (and personal expense) required, considerably impeding progress. And, while I have been as thorough and conscientious as possible with the material available, to the extent of re-surveying type localites and re-checking the characters of specimens, sometimes as many as three or four times, it is still possible that oversights and omissions remain. Although unintentional, these are entirely the responsibility of the author. This is the nature of human endeavour. It is also the nature of Nature: the great number of specimens inspected during the course of this study meant that several species complexes and ecotypes were encountered that presented apparent continua of characteristics. At the same time, many gaps in the series were recognized of intermediate forms that were either not located or have become extinct. Some of the toughest decisions were when determining interspecific boundaries - drawing the line between where one species ended, and another began. Frequent anomalies were also found that collapsed the prototype houses of cards and forced several systematics rethinks, but always the questions were: are these specimens likely to be part of an exclusive interbreeding species, and are these species related with a common ancestry by characters universally present (synapomorphies) so that they belong to the same genus, and family, group? [Subspecies are usually regarded as morphologically distinct, potentially or actually interbreeding conspecific populations, whereas a species can be defined as a reproductively isolated, interbreeding population (Sims, 1983: 472)]. In most cases species are separated only where they differ on at least one

significant morphological point (autapomorphy), preferably there are two or more points of difference. However, characters that seemed reliable in one population, were less so in another, and almost always an exception was found to an otherwise well formed morphological group. Here the problem is partly the arbitrariness enforced by working from the anatomy of preserved specimens, assumed to be representative, that only ever partially reflect the full spectrum of behaviour and ecology that, in reality, defines a species. I strongly advocate combining field work and laboratory studies on ecology and ethology, as well as experimental investigation of interbreeding ability, with taxonomic determination in order to build a more complete picture. In reverse order, I now present a taxonomic guide to the known earthworms of Tasmania in the hope that it will stimulate and assist ecologists and other researchers working in the field to identify the species they encounter and attempt to better understand.

This monograph is titled simply "Tasmanian Earthworms", although it could be called "Preliminary Notes on Tasmanian Earthworms Part II", or perhaps "Earthworms of Tasmania (and Puerto Rico!)". Spencer's (1895: 34) statement: "There must be very many yet undiscovered [Tasmanian species], especially in the well-watered valleys on the west coast of the island" probably remains as true today, despite the results of the current study. While the diversity in Tasmania is unprecedented and remarkable for the small size of this island State, it must also be realized that there is still considerable work to build a complete inventory, and phlylogeny, of the earthworm fauna. The possibilities arising from molecular analyses may yet reveal an even greater understanding of the fauna, in either case depending on the reliability of the initial morphological descriptions. Important and exciting research into areas such as these are unfortunately beyond the scope and resources of the present study. But to the current and future generations of Tasmanian worm workers who take up the challenge, and quoting (slightly out of context) the Clown from Shakespear's *Anthony and Cleopatra*: "I wish you all joy of the worm".

R.J.B., Canberra
13th December 2000.

Note: This work was issued according to Article 8 of ICZN (1999) in order to provide a public and permanent record. In compliance with this Article, identical versions of the current monograph on CD read-only disk have been lodged at the Queen Victoria Museum, Launceston; Museum of Victoria, Melbourne; Australian Museum, Sydney; Museum of Natural History, London; the Smithsonian Institution, Washington; and Te Papa, Wellington, NZ. A copy of the work was sent to the *Zoological Record*, BIOSIS, UK. Further copies may be obtained on request from the author or via:
The Librarian, Queen Victoria Museum, Wellington Street, LAUNCESTON, Tasmania, 7250.
A Delta interactive key to Tasmanian endemic species that complements the current work will be available shortly, available for distribution via ABRS, Canberra, or from the author.

[A December, 2008 version differs only in correction of three typing errors with an updated checklist available here - www.annelida.net/earthworm/Tasmanian%20Earthworms/Tassie%20Earthworms.pdf .
This December, 2020 version has original figures attached at end of text. Note: *Tokea orthstichon* (Schmarda, 1861), listed in *Megascolides*, is now confirmed from New Zealand but, like *H. pedderensis*, is extinct; see - http://nh.kanagawa-museum.jp/files/data/pdf/bulletin/48/bull48_61_68_blakemore.pdf .
Ironically, just one year after completing this study I moved to Tokyo and started research on PCR species barcoding such that I would no longer attempt taxonomy without such molecular support, nor work up material collected by others. Twenty years on from this endeavour, several friends and colleagues have sadly passed but, as to the status of Tasmania's earthworms, we do not know as there has been few, if any, follow up studies. Perhaps, as the extinction/climate/human health crises intensify, people may eventually realize that the best & only solution is in healthy soils and a mutual richness in the unique soil fauna.

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CONTENTS

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Abstract

Earthworms known from Tasmania now number 228 species in 38 genera belonging to 4 families as described herein. Prior to 1997 approximately 55 species were known, while in the three years to 2000 this had been almost doubled to 95 species comprising: 69 natives, 1 neo-endemic, 23 exotics and 2 translocated mainland species. The current account makes new combinations and adds 136 new native taxa to nearly triple the total of endemics to 202 species in 24 genera. This biodiversity compares with total of approximately 48 species from Britain and Ireland, 74 from Japan, 160 from North America, 174 from Myanmar, 180 from France, 192 from New Zealand, 350 from the Indian subcontinent, and ca. 350 from mainland Australia. Previously known species are fully revised, some are placed in synonymy, a few are restored, and two neotypes are designated for *Cryptodrilus polynephricus* Spencer, 1895 and *Perionychella richea* (Spencer, 1895). Determinations are made of the earliest reported species from Tasmania *viz. Megascolides orthostichon* (Schmarda, 1861), this the first earthworm described from Australasia, and of the 'giant' *Vesiculodrilus tasmanianus* (Fletcher, 1887). A new species is added to *Pontodrilus* Perrier, 1874 and an argument is made for its Australian endemicity. One native species, *Hypolimnus pedderensis*, is believed extinct and, if so, is the first known instance of loss of an earthworm from the list of world fauna.

Although several genera are common to both Tasmania and continental Australia, particularly Victoria and southern NSW, no endemic earthworm at the species level is know to have a natural distribution that crosses the Bass Strait. Speciation of earthworms in Tasmania is assumed to be a consequence of the diversity of habitats afforded by its geological and climatic history and its present topography, combined with a lack of competition from exotics nor, until recent times, much human interference. Exotic and introduced species are not treated in detail in the present work, although the first Australian record of *Lumbricus terrestris* Linnaeus, 1758 is noted. All 24 Tasmanian genera are reviewed as many Tasmanian species, both new and known, are permissible in the 'classical' genera *Megascolides* McCoy, 1878, *Notoscolex* Fletcher 1886, *Anisochaeta* Beddard, 1890, *Diporochaeta* Beddard, 1890, and *Perionychella* Michaelsen, 1907, or in the recently restored *Vesiculodrilus*. Seven new genera are proposed based on morphological and behavioural characteristics, these are *Aceeca*; *Amphimiximus*; *Anisogaster*, *Caecadrilus*;

Provescus, *Scolecoidea*, and *Tassiedrilus* gen. novae. Several species are discovered to have previously unknown features, for example six pairs of spermathecae in *Vesiculodrilus duodecithecatus* sp. nov., double spermathecal entries in *Hickmaniella classica* sp. nov., alternating nephridial bladders in *Aceeca dee* gen. et sp. nov., multiple spermathecae in *Amphimiximus* spp. nov., and multiple intestinal caeca for *Caecadrilus* spp. nov.

All 18 megadrile Oligochaeta families of the World are reviewed and revised in order to place Tasmanian, and Australasian, genera in the context of the extraneous fauna. The long anticipated 'missing-link' of Octochaetidae in Australia is newly determined, eg. *Octochaetus ambrosensis* (Blakemore, 1997). No endemic Acanthodrilidae nor Octochaetidae occur in Tasmania as are found on both the North and South Islands of New Zealand and in northern Australia. Tasmania's earthworms all belong in the Megascolecidae s. strict. The family Exxidae fam. nov. is proposed in order to remove a "troublesome" and 'puzzling' element, the genus *Exxus* Gates, 1959 that complied with the Octochaetidae except that its pairs of prostates had the apomorphic racemose state, and which was placed by disparate authors in either a restricted Megascolecidae or an expanded Acanthodrilidae, although it actually complied with neither. Presumed to be an Australian genus, the present study concludes that it is most likely from Central America (possibly around Puerto Rico). The revised classification presented here, like most previous ones, owes much to the 'Classical System' originally devised by Michaelsen (1900, 1907, 1921, 1929), presented in its final form by Stephenson (1930), and modified by Lee (1959), Gates (1959, 1972), and Sims (1966, 1980, 1982).

INTRODUCTION

Background

Earthworms are amongst the most ancient of terrestrial animal groups, their ancestors possibly emerging in the pre-Cambrian some 600-700 million years ago (Glaessner et al., 1969; Bengston & Zhao, 1997). They are ubiquitous in all but the driest of regions and the present day world distribution of almost 4000 described species in 18 families have been explained in terms of Wegener's hypothesis of continental drift (Michaelsen, 1922; Lee, 1985; 1994; Sims, 1980). Because they play a vital role in the formation and maintenance of fertile soils, earthworms are of paramount importance to primary production. Charles Darwin (1837; 1881) was one of the first scientists to give credence to the conventional wisdom from earlier civilizations about the beneficial effects of earthworms on soils and plant growth, and thus on human survival. Recently there has been a resurgence in interest in earthworms, driven by environmental and economic concerns, particularly the need to appreciate and utilize their function in sustainable agriculture, horticulture and forestry, and to understand and exploit their potential for restoring damaged soils and for recycling of organic 'wastes' (Blakemore, 1981; 1991; 1994a; 1995b; 1997c; 2000d; Blakemore & Temple-Smith, 1996; Lee, 1985; Sims & Gerard, 1985; Edwards & Bohlen, 1996). One of the first steps to this understanding is to reliably identify which species are involved and to determine their regional distributions (Blakemore, 1999).

Tasmania is an island state of 6,850,000 ha to the south-east of continental Australia, approximately the same size as Ireland or Sri Lanka but with a much lower population leaving much of the central plateau and west coast, designated as National Parks, uninhabited and pristine. Situated in the Southern Ocean, the current climate is cool temperate with mean annual rainfall ranging from 500-3600 mm and distinct seasons influenced locally by coastal or montane topography. Mountains were not formed until mid Tertiary (20-40 million ybp) and until the breakup of Gondwanaland in the early Tertiary, the climate is believed to have been warm and wet, followed by cooling as Australia was isolated which resulted in glaciation on much of western Tasmania in the Pleistocene. Oscillations in sea level have caused land bridges to mainland Australia to be established periodically, the last as recently as the Quaternary, 8,000-15,000 year ago. Geologically Tasmania is formed from two main blocks: an older Pre-Cambrian quartzite block in the west and a younger dolerite

block in the east. Soils derived from these tend to be less fertile in the west and more complex in the north and east. Vegetation types range from temperate rainforest (mainly in the west but with relicts in north-east and south-east), wet and dry sclerophyll forests, sedgelands (button grass plains), open grasslands, alpine herbfields, feldmark and bogs, coastal heath, and wetlands, with fields, forests and gardens variously cultivated and managed. (Geological, climatic, and vegetation information from Greenslade, 1985). The environment and biology of Subantarctic Macquarie Island is described by Selkirk *et al.* (1990).

This study concerns Tasmanian earthworms, primarily the endemic fauna although exotics and introduced species are also reported. Earthworms are here taken to mean the larger, mainly terrestrial, megadriles (superorder Megadrili) of the class Oligochaeta. The smaller and mainly aquatic microdriles (superorder Microdrili) are treated by Brinkhurst and Fulton (1979), and Pinder and Brinkhurst (1994). For this group approximately 22 endemic species are recognized (several of these currently undescribed) plus 14 species shared with mainland Australia of which about 5 are cosmopolitan, an additional two or three species are found on Macquarie Island. [Two other Tasmanian microdrile species have been found by the author with character unlike any known in existing genera from Australia (A. Pinder, pers. comm.). It is proposed to submit these specimens to Adrian Pinder in WA for description]. Enchytraids ('pot worms') of the family Enchytraeidae tend to fall between studies of the other groups, and although they occur in Tasmania (pers. obs.) have not been much studied, apart from three species reported from Macquarie Island by Lee (1968).

The earliest formal reports of Tasmanian earthworms were *Hypogaeon orthostichon* Schmarda, 1861, the first oligochaete species to be described from Australasia, and the 'giant' *Megascolides tasmanianus* Fletcher, 1887, (these two species are described under *Megascolides orthostichon* and *Vesiculodrilus tasmanianus*). The first substantial treatment of the Tasmanian fauna was by Spencer (1895, based on a paper read to a meeting of the Victorian Royal Zoological Society on 8th March, 1894) where he described a total of 19 species, including Fletcher's *V. tasmanianus*. Subsequently, Cognetti de Martiis (1910), Michaelsen (1910) and Stephenson (1924) each described a single species from Tasmania. In 1974, Jamieson published a monograph on Tasmanian earthworms based mainly on collections of Dr J.L. Hickman, that also revisited some of these species and added new taxa to give a

total of forty-seven species in ten genera (six of these genera the products of his own creation). An additional twenty-two endemic species and five genera were newly described by Blakemore (1997a, 1998, 2000b).

Spencer (1895) deliberately excluded species that had clearly been introduced from foreign countries, while Jamieson (1974) ignored exotic species but unintentionally described one, *Rhododrilus littoralis*, which is a junior synonym of *Rhododrilus kermadecensis* Benham, 1905. Only seven or eight exotic earthworms had been recognized from Tasmania prior to a status report by Blakemore (1999) that listed up to 66 exotic species in eight families from Australia, including 24 from Tasmania, one a probable neo-endemic on Macquarie Island. Two other species recently recognized in Tasmanian material collected by the author are probable exotics for which no corresponding accounts have as yet been found in the literature. A further two native species translocated from mainland Australia, *Anisochaeta dorsalis* (Fletcher, 1887) and *A. sebastianus* (Blakemore, 1997), were mentioned by Blakemore (2000a and 2000b). These two particular species were considered to be introduced rather than endemic because:

1. They were only found in disturbed garden soils - transportation of pot plants being a well known mode of transfer of attendant soil fauna including earthworms (Stephenson, 1930; Gates, 1972; Lee, 1987b)
2. The specimens agree exactly with their earlier taxonomic descriptions.
3. They appear related but distinct from Tasmanian natives in the same genus.
4. While most members of their genus have restricted ranges, these two plus a few others are known to have acquired unusually widespread distributions that may be partly accounted for by fluvial or human-mediated transportation (Blakemore, 2000a: 39).

Biology and Ecology of Earthworms

Accounts of oligochaete biology, morphology, and terminology are found in Stephenson (1930), Lee (1959), Gates (1972), Reynolds (1977), and Sims & Gerard (1985). Apart from an unpublished PhD thesis by Blakemore (1994a), that treats both natives and exotic species introduced from around the world, no introductory reference nor comprehensive study of Australian earthworms is currently available (cf. Pinder and Brinkhurst, 1994, for aquatic microdriles). Therefore, some instruction on

the subject is required for the benefit of students and ecologists intending to enter this field of study and for the practical application of the findings from the current work.

The biological Cycle-of-Life is reproduction, survival, dispersal, and ultimately the death of individuals or the extinction of species. The comparative anatomy of phenotypic expression is used by morphological taxonomists (cf. genetic products used by molecular analysts and behavioural traits used by ethnological ecologists). Some understanding of functional anatomy is required for a better appreciation of variability and comparability, this in turn relates to the evolutionary history and ecology of the organism. In earthworm systematics, most importance is given to the reproductive organs as these are not only prominent and expensive for the individual to maintain, they are also the most conservative - less affected by environmental influence through time. Thus the number and positioning of the testis, the openings of the male pores, the form of the prostates, the ovaries and their means of shedding eggs, and the thickness of the cells forming the clitellum, assume primary importance in earthworm systematics; while the spermathecae that store sperm are also of interest. [Sims, (1980, 1982) presented a classification of earthworms incorporating morphology of the ovaries as initially proposed by Gates (1976)]. Digestive and excretive physiology are important, but are probably more adaptive, influenced by environmental and climatic factors such as pedology and prevalent soil moisture. The "well known dependence of the conformation of the alimentary tract on food and environment" (Stephenson, 1930: 720) means that the degree of development of gizzards, calciferous glands, and of the intestine often take secondary rank. Similarly, the nephridia that remove waste products from the coelom and serve for osmo-regulation have traditionally been accorded some systematic importance, especially the division between plesiomorphic ('primitive') holoic and apomorphic ('derived') meroic nephridial states. [Nephridial terminology follows Gates (1972) who avoided unnecessarily long terms such as 'holonephridial' and 'meronephridial' that have the same meaning as holoic and meroic, thus avoiding tautologies such as "megameronephridial nephridia"]. Finer distinctions of the nephridial systems have been found to be unreliable characters for higher classification, or of uncertain systematic significance, and are believed to be 'adaptive' (eg. see Easton, 1979: 9, 17-20; Sims, 1980: 105; 1982: 284). The nervous and vascular systems are sometimes credited with significance at higher than the species level (eg. by Gates, 1972), while

the respiratory system, which in terrestrial species at least is simple gaseous exchange through the epidermis, is not utilized at all. Those characters that are perhaps most adaptive, or rather those most subject to immediate environmental influence, and therefore of lesser interest are the superficial external features of the worm such as the colouration, and, because worms are soft-bodied, their precise biometry. However, setal arrangements are important, especially the development from plesiomorphic lumbricine (8 setae per segment) to apomorphic perichaetine (more than 8 setae) states, these being indicative of phylogeny as well as ecological strategy. An intermediate stage, that seems particularly common in Australian species, is the 'anisochaetine' state where there are 8 setae in the anterior that increase in number posteriorly, as found in some members of *Anisochaeta*. External genital markings that serve for recognition, attachment, and alignment during mating, are often highly specific characteristics. Although of vital importance, characteristic behaviours are rarely taken into consideration in systematics, not least because relatively little is known on this subject, especially for cryptofauna such as earthworms that, due to their subterranean, and crepuscular or nocturnal activities, elude ready observation. The ecological strategies and activities of earthworms, were used by Lee (1959, 1985, 1987a) to define three broad ecological categories: litter, topsoil and subsoil dwellers; as these three classes of habitat tend to favour particular combinations of morphological and phenological characters (Fig. 1). Lee (1985) and Edwards & Bohlen (1996) provide comprehensive reviews and discussion on the ecology of earthworms and their relationship with soils and land use.

Earthworm Morphology and Reproduction

The basic morphology of an earthworm is a tube, the digestive system, within a tube, the muscular body. The body wall consists of a diaphanous yet resilient cuticle, an epidermis, muscular layers, and a peritoneal lining. The space between these two tubes is the body cavity, the **coelom**, compartmentalized and filled with fluid that acts as a hydrostatic skeleton. Free floating cells within the coelom perform various functions and are called **coelomocytes**. The body is annular, formed of segments (technically called **somites** or **metameres**) that are most specialized in the anterior, divided internally by the **septa** (singular, septum) that correspond to the external furrows. Intestinal segments are iterations without much modification towards the tail.

Due to the earthworm's subterranean habitat and its need to build and maintain burrows, there are rarely external appendages and only subtle variations in superficial form prevail. Eye spots and jaws are absent. Apart from their variations in size, body shape, and position of external pores and markings, most worms look alike. In order to identify them, it is therefore essential in most cases to perform some degree of dissection of specimens so that the nature of their internal organization can be revealed. Some patience and skill is required, but it is only through practice that earthworms can be differentiated by relating their internal anatomy to consistent external features.

Earthworms are promiscuous, polygamous, hermaphrodites (i.e., with both male and female organs). Their reproductive strategy involves mate recognition, mutual exchange of sperm, and the shedding of eggs within a protective and/or nutritive cocoon formed at the clitellum. Although there are variations within some groups, particularly where spermatophores are exchanged or there is direct fertilization of eggs, mating, or **amphimixis**, is most often by two individuals going "nose-to-tail" with the male pores of one lining up, successively, with the spermathecal pores of another. Sperm from the concopulant is stored in the spermathecae. The **clitellum** is a girdle-like thickening of the epidermis in the anterior or mid-body which detaches and, as it moves forwards, receives eggs (from the female pores) that are fertilized by a partner's sperm (from the spermathecae or from spermatophores) to form embryos within the shed cocoon. Development and hatching of the young worms is without a larval stage and, apart from the positioning of the cocoons, is without parental care. Some species, particularly the most successful peregrines, have parthenogenic morphs that produce viable offspring without mating, but often retain most of their reproductive anatomy or at least the rudiments, and can ideally be traced to their ancestral diploid and bi-parental populations from which they have been isolated. Nevertheless parthenogenesis imposes several "systematist's nightmares", as has been discussed at length by Gates (1972: 16-19) who said "Just how many 'species' were erected on individuals of more of less degraded morphs has not been determined, but the number certainly is greater than several".

METHODS OF STUDY

Characters to Look for

External Features and Biometry. Body shape, size, pigmentation, number of segments, secondary annulations, and the extent and development of the clitellum in mature specimens are recorded, but these all tend to vary intraspecifically and depending on the methods of preservation, thus are of limited use for identification. Amputees and regenerates are also fairly common. The clitellum can be annular, or saddle-shaped, but sometimes it only appears saddle-shaped due to intrusion or occlusion by genital markings. Reduction of the first segment, or presence of a dorsal canal, can be of specific note. The shape and position of the **clitellum**, the glandular girdle that is sloughed off to form the **cocoon**, is often recorded but its exact extent varies according to the reproductive state of the specimen, and it is therefore of limited systematic use (although the cocoons themselves may be identified to species).

Prostomium *(plural, prostomia).* A prehensile flap over the mouth that is an important organ used to sense the environment and to grip the substrate, its specific characterization is useful. There are four main types, **zygolobous** (rare), **prolobous**, **epilobous**, and **tanylobous**, with intermediate forms between the last three (Fig. 2). In some non-native taxa the worm appears to have swallowed its own head or the prostomium is replaced by a protrusible proboscis. The first 'segment' that supports the prostomium and the mouth is called the **peristomium** (cf. the last 'segment' that supports the anus and is called the **periproct**, **pygidium**, or **pygomere**). The peristomium often bears furrows that are extensions from the prostomium and may also have a ventral cleft that probably allows for stretching, however secondary wrinkling, especially in older specimens, can obscure these. Occasionally the pharynx is everted during preservation which can hamper recognition of the prostomium.

Dorsal pores. These allow secretion of coelomic fluid to lubricate and moisten the body surface and to provide protection from predators and parasites. Their level of development and commencement are indicative of whether the species is of aquatic origin (where they are superfluous), or whether the worm needs to generate increased hydrostatic pressure in the anterior for pushing through a compact substrate (where

having pores in the anterior would be a disadvantage). Dorsal pores may also be reduced or completely eliminated where exonephric nephridial adaptations, such as bladders or multiple nephropores, replace their function for surface moisture regulation, or where parasite entry through dorsal pores (eg. of nematodes) is problematical. Although the location of the first dorsal pore may be subject to slight individual variation, it often has definite interspecific limits.

***Setae** (singular, seta).* Small sigmoid bristles, the basic state is **lumbricine**, with 8 setae per segment often in pairs and in longitudinal series in all except for the first and the ultimate 'segments' (the peristomium and the pygomere), that are asetose and support openings of the mouth and anus, respectively. Occasionally they are reduced or absent from the anterior, and ventral setae are usually deleted from segment 18 near the male pores or are replaced by penial setae. Any increase in numbers of setae in any part of the body above eight is the **perichaetine** state (Fig. 3). In several perichaetine species there is transition in setal numbers along the body, those that have 8 setae in the anterior increasing in numbers posteriorly are classed as **anisochaetine** (eg. as found in parts of Australian *Anisochaeta* and Puerto Rican *Borgesia* James, 1991). Specimens that have lost their tails through autotomy or physical trauma are difficult to identify and, if it is suspected that they are anisochaetine, more material will need to be collected. Setal ratios (for lumbricine worms) are of questionable systematic use as these vary intraspecifically, depending on the state of the individual or on its method of preservation, and on the technique used to measure and calculate these ratios which differ from one worker to the next; thus separate taxa are often reported with the same setal ratios, and vice versa. However, the setae provide useful reference points for location of external pores and markings.

The microsopic sculpturing reported for the **penial setae** (i.e., modified setae sometimes occuring near the prostatic pores that are often enlarged and with hooked, curved, bifid or otherwise ornamented tips) are also of debatable value as they vary individually, even within a bundle, are damaged or worn by age and use, and may be similar if not the same in several species (Gates, 1972: 23). Where present, the reliance on penial setal detail for specific characterization requires that these are elucidated for all specimens under consideration (which is not always the case, cf.

Jamieson, 1974: 211), and is also impracticable for the majority of field workers who lack ready access to high-powered or scanning electrode microscopes. What is of interest, and is particularly evident in the presentation of the author's figures - where a specimen's penial setae and spermathcae are shown *in situ* and to the same scale, is that there is often a corresponding relationship between the length of the penial setae, when present, and the depth of the spermathecal diverticula. This would tend to support the function of the penial setae for scraping out and disrupting any spermatozoa and fluids already in the spermathecae from previous copulation (Visa Nuutinen, pers. comm.). Such action would be of selective advantage to the worm concerned, as it would thus favour its own sperm for fertilization of the partner's eggs. There are exceptions, but it is interesting to note that most of those species described in Blakemore (2000c) that lack of have reduced penial setae also have duplicated or multiloculate spermathecal diverticula, reinforcing the relationship between penial setae and spermathecae. Penial setae may also assist in locking two individuals together, provide stimulation, and act as conduits for the motile sperm to enter the diverticula. **Genital setae** occur on tumescences, those that are modified in the region of the spermathecal pores (eg in *Diplotrema*) are called **spermathecal** or **copulatory setae** (these three terms are interchangeable in some accounts).

External pores (Fig. 4). The segmental position and relation to setal lines of the **nephropores** (most obvious in holoic species where they are often intersegmental and visible in lateral series, although they may also alternate with or without regularity), **spermathecal pores** (usually ventro-lateral and intersegmental), **female pore(s)** (usually on 14) and **male pore(s)** (usually on 18) are recorded. The male pores are often superficial on small mounds or papillae called **porophores** (a term more correctly used to describe eversions of copulatory pouches but also applicable to any structure that bears a pore), or they may be inside furrows, copulatory pouches, or in some families they are on penes. For obvious reasons, in most species the longitudinal position of the male pores usually corresponds to that of the spermathecal pores.

Male pore arrangements are called **acanthdrilin(e)** where they are on 18 separate from the pores of two pairs of prostates on 17 and 19; **megascolecin(e)** where male and prostatic pores are combined on 18 (or its homeotic equivalent if anterior

segments are reduced); **microscolecin(e)** where male and prostatic pores are generally on 17; and **balantin(e)** where male and prostatic pores are generally on 19.

Genital markings. Variously arranged external sucker-like discs, pits, grooves, or tumid pads, sometimes associated with internal glands. Those in the anterior, at least in some cases, perhaps represent responses in the individual to attachment by the concopulant, as they frequently correspond, in inverse relation, to the positioning of the 'true' markings found around the male pores. There is often a correlation between the number and position of the spermathecal pores, that require progressive charging with sperm, and of the form and arrangements of genital markings around the male field. Consequently, genital markings, even allowing for interspecific variability, are of great value for identification. In exotic lumbricid species, and some other families, the genital pads are called **tubercula pubertatis**.

Septa *(singular, septum)*. Internal partitions that separate adjacent segments, these are usually delicate but may be thickened and muscular between anterior segments. Septa are perforated by sphinctered apertures, and are often deflected by larger organs that may also traverse several septa. The degree of development of the septa, and whether they are distended, adpressed, or even deleted in some segments, should be noted.

Spermathecae (*singular, spermatheca*), (Fig. 5). These are separate from the female pores in most families and usually consist of a large sac, the **ampulla** (plural, ampullae) on a duct that exits at the spermathecal pore and supports a smaller appendage, the **diverticulum** (plural, diverticula) often on a short stalk and with a dilated terminal bulb. Diverticula are **clavate** ('club-shaped'), **sessile** (without stalk), and/or **multiloculate** (with numerous chambers rather than just a simple bulb). The diverticulum stores spermatozoa arranged in clusters with the tails aligned so that they diffract light and are iridescent. The ampulla is believed to contain nutritive solutions for maintenance and subsequent delivery of the sperm, probably this is received as a product from the prostatic glands of the partner. A question related to this is who 'owns' the spermathecae? Although internal, they open to the exterior and receive and store genetic and other copulatory material from another individual that would

presumably be foreign to the body and subject to reaction and rejection. The spermathecae then, can be viewed as invaginations into the body cavity that are essentially external to the body and perhaps actually 'belong' to the other partner(s). The variations in shape and positioning of the spermathecae may be the result of a continual compromise between preserving and enhancing the survival of one's own sperm that is transferred to a mate, and an attempt to disrupt any remnants of a third party's sperm that may already be stored in the spermathecae, (see also the remarks concerning **penial setae** above). This is expressed as morphological variations, possibly supported by physiological secretions, and, as noted above, often correlated with the degree of development of the penial setae. Other modifications may avoid cross-fertilization or help discourage entry of pathogens or parasites (for example, the nematodes that are sometimes found in the spermathecae). Multiloculate spermathecal diverticula are another manifestation that possibly represent one method of reducing disruption by penial setae, or perhaps more efficient storage of sperm. For these and possibly other reasons, the number, position and shape of the spermathecae although varying slightly within and between specimens are sufficiently constant to be especially useful for identification. In megadriles, the original arrangement is thought to comprise two pairs opening at 7/8 and 8/9, (Gates, 1972) but there may be as many as six or seven pairs, as few as one pair, they may be unpaired, or the spermathecae may be multiple per segment.

Male organs. Testes are small paired organs sometimes enclosed in testis sacs, often surrounded by opaque seminal fluid or mucus, and are detectable mostly by the bright iridescence of their associated sperm funnels. These duct via the **vasa deferentia** (singular, vas deferens) to exit at the male pores (after uniting with the prostatic ducts in megascolecids). In their basic state, they are **holandric**: i.e., paired in segments 10 and 11. Sometimes only a single pair is retained in segment 10 (**proandric**) or in segment 11 (**metandric**). Associated with the testes are **seminal vesicles**, storage sacs where spermatozoa develop, these are usually large paired outgrowths from the septa into the segments adjacent to the testes, often in 9 and 12, but other variations are of specific note.

Female organs. Ovaries are almost invariably **metagynous**, paired in segment 13 (or its homeotic equivalent in specimens that have deletion or duplication of anterior segments), they appear as sheets of egg strings along with the oviducts that exit at the female pore(s) in segment 14. **Ovisacs** that store ripening eggs, if present, are paired in segment 14 as outgrowths attached to the anterior septum.

Prostates, (Fig. 6). These distinct male reproductive organs occur in several families. Consisting of a gland and a duct, the gland is of three main forms: its basic state is **tubular**- elongate with a smooth surface and, when sectioned, with a simple unbranched central canal; **tubuloracemose** - where external nodulation and indentations have developed and are connected by small side branches to the central duct internally, the shape of the gland is still elongate but is often flattened; and **racemose** (like a 'bunch of grapes') where the gland is composed of a composite cluster with varying degrees of nodulation and a ramifying canal system, especially obvious where these ductlets branch externally to the glandular parts. The prostate glands provide exudates that help in delivery of sperm to the partner during copulation, and probably charge their ampullae with nutrient solutions, (there appears to be a correlation between the size of the prostates and the combined volume of spermathecal ampullae). In megascolecids, each type of gland connects to the male pores by a muscular **prostatic duct** that receives sperm from the testis via the vasa deferentia, often near the junction with the gland although this is not always obvious. Families are distinguished partly on the degree of prostate development, and the Ocnerodrilidae, Acanthodrilidae, Ocnerodrilidae and Exxidae have either an acanthodriline, microscolecine, or balantine arrangement, while the Megascolecidae have a megascolecine arrangement. An important distinction for generic (and family) separation is whether the prostates are tubular, or non- tubular. In general, when regarding tubular prostates, the question to ask is whether they resemble the form of those found in the undisputedly more primitive families (eg. Ocnerodrilidae; Acanthodrilidae), and in the primitive genera of Megascolecidae (eg. *Pontodrilus*, *Plutellus*, *Sebastianus*). Some specimens, particularly those that attain large size by surviving for several seasons, appear to have particularly thick tubular glands as the columnar gland-cells regenerate from the periphery, and these may be easily confused with tubuloracemose prostates (see Blakemore, 2000c: 199). There are also

gradations in non-tubular glands, with tubuloracemose glands perhaps becoming more racemose as the specimen ages. It is also possible that the method of preservation or maceration of specimens may distort superficial determination of prostate form.

Nephridial systems, (Fig. 7). These exctetory organs have two main states: **holoic** where in each segment there are a single pair of large **holonephridia** ('meganephridia' in earlier terminology), and **meroic** (literally 'divided') where there are is an apomorphic increase in number in any segment, usually in the anterior and often with a reduction in size of these **meronephridia** ('plectonephridia' in some earlier works) that sometimes occur in hundreds in 'forests'. (The terms 'macroic' and 'microic' are substituted for holoic and meroic in some more recent treatments). The first few sets of nephridia in both holoic and meroic specimens may be modified as pharyngeal **tufted nephridia** ('peptonephridia' of earlier works) that open into the anterior of the gut and function as 'salivary glands'. Nephridia may be 'open', where they duct to the exterior (**exonephry**) or to the intestine (**enteronephry**), or 'closed' where they have blind ducts in the coelom. Both holoic and meroic nephridia may attain **vesicles** (bladder-like dilations of the terminal ducts) that aid moisture regulation. Presence or absence of preseptal nephridial funnels (**nephrostomes**) for both holoic and meroic nephridia in caudal segments has been accorded some importance under some taxonomic schemes but detection of these, even where they are present, is often extremely difficult especially where they are micro-meroic, and, when they are absent, the search will be futile. Meroic species may retain or develop a pair of large (**megameroic**) nephridia in addition to smaller (**micromeroic**) tubules, or their nephridia may be intertwined in the anterior, and they may thus be mistakenly classed as holoic. It is important therefore to accurately determine whether there is just a single pair of holoic nephridia in the anterior segments, or whether additional meroic tubules are present and demonstrable by their separate nephrostomes and/or multiple bladders, in either case ignoring pharyngeal tufts.

Anterior digestive system. The mouth opens immediately to the **pharynx**, the front of which often has an eversible pad, followed after a few segments by the **oesophagus** that usually has a muscular **gizzard** at its anterior end, may be variously modified with calciferous glands during its course, and usually terminates in a pre-intestinal valve.

Calciferous glands ('chyle-sacs' or the Glands of Morren in earlier literature), is a catch-all term for oesophageal structures that vary from lateral pouches, barely modified with internal lamellae or rugae, to complex extra-mural organs, that serve various functions but, despite the name, do not necessarily contain calcium carbonate. In most Australian native earthworms the oesophageal gizzard is well developed in or near segment 5. In some taxa there are multiple gizzards, but the gizzard may also be reduced, vestigial, or apparently lacking. Oesophageal (and/or intestinal gizzards where present) may be preceded by a dilated crop, the **proventriculus**.

Vascular system. This is a closed system with a contractile **dorsal vessel** (sometimes doubled) carrying blood to the anterior and connected by lateral trunks to **ventral vessels**. There may be a **supra-oesophageal** vessel on the oesophagus, and, usually in post-oesophageal segments, a **sub-neural** vessel below the ventral nerve cord. Vessels and delicate trunks are sometimes difficult to detect unless they are filled with blood, and are easily damaged or broken during dissection. The extent of the dorsal vessel, and whether it is doubled, is recorded, as are any developments of supra-oesophageal vessel. The number and position of the paired **hearts** are noted, these contractile and valved lateral vessels are usually preceded in the anterior by smaller non-contractile pseudo-hearts called **commissurals**. Last hearts are usually found in segments 12 or 13. Strictly, the hearts are classed as 'lateral' if they connect dorsal and ventral vessels only, 'oesophageal' if connecting supra-oesphageal and ventral vessels, and 'latero-oesphageal' if they join all three (Gates, 1972).

Nervous system. The **ventral nerve cord** runs for the length of the body, bifurcating under the pharynx via circum-pharangeal connective trunks that reunite to form the bilobed, anterio-dorsal **cerebral ganglion** in segment 2 or 3. The nervous system is found to be particularly well developed in some native species.

Posterior digestive system. The **intestine** is usually thinner walled, less vascularized, and wider than the oesophagus, and may also develop lateral pouches (**caeca**, singular, caecum) towards its anterior that probably maintain cultures of gut microflora or symbiotic protozoa. The internal surface area of the intestine is sometimes increased by a dorsal infolding called the **typhlosole** that may be simple

lamellar, T-shaped, V-shaped, or variously convoluted. **Intestinal gizzards** occur in some families and are found relatively frequently in Tasmanian taxa - they are single, or multiple and moniliform. Gut contents (**ingesta**) give an indication of habitat and ecological strategy, this material is processed as it passes through oesophagus and intestine and is voided as earthworm 'casts' or 'castings'.

Other internal features. The presence of peculiar internal organs should be noted, such as **pseudovesicles** (resembling seminal vesicles but in an unusual location), copulatory glands associated with genital markings, muscularized tendons, 'lymph glands' on the intestine, or parasitic artefacts that are particularly evident where the worm is infected with protozoans or nematodes. For accounts of internal parasites see Stephenson, (1930), Gates, (1972), Lee, (1985), Yeates *et al.* (1998).

Collection

Worms are best obtained by digging and hand sorting on a plastic sheet, although various vermifuge solutions or mechanical methods of collection may be used. Use of hazardous chemicals and electrical methods are not recommended. They are most abundant in moist soil with lush vegetation, but may also be obtained at depth from dryer soils, under rocks or logs, and from water courses. The depth of activity in the soil should be recorded, but for quantitative studies the abundance and total biomass are by convention always calculated per square metre (m^{-2}). Date, location and habitat notes should be taken and any particular behavioural responses recorded. Collection permits are required for survey of National Parks and State Reserves, some native species are protected by legislation in Australia, and ethical codes of conduct apply to the care and use of animals for scientific purposes. Representative specimens are washed before being placed in a tray or dish of water and, over several minutes, alcohol is added to gradually anaesthetize the worms without causing severe reaction. When a specimen is fully relaxed and no longer responds, it is damped off on tissue to remove any mucus and straightened out for preservation. It can be fixed by immersion overnight in 4% formaldehyde (i.e., a 10% solution of concentrated commercial formalin) - if layed flat or hung by the tail threaded with cotton it will ideally maintain an elongate shape, and then transferred to preservative. For molecular analysis, or to avoid the use of toxic formaldehyde, the specimen may be

placed directly into preservative. The most reliable solution is 80% ethanol (but methanol may be substituted): any lower concentration will result in the specimen becoming macerated with time, any higher and it becomes brittle. Alcohols are flammable and carriage by mail or aircraft is regulated. It is important to have a sufficiently large sample jar, with airtight lid, to hold the specimen without dilution and to clearly label the sample. The label is written in permanent ink on resilient paper or card that is added to the jar so that it can be read through the glass, or the specimen itself can be tagged. Only marking the lids will invite mistakes later. It is mandatory to deposit taxonomic type material in recognized institutions (ICZN, 1999) and is good practice to also lodge voucher specimens from any agro-ecological study.

Inspection

Live specimens may be observed in the laboratory for their activities, behavioural responses, and reactions to stimuli. After their biometry is taken, specimens are examined externally under a stereoscopic microscope with an adjustable light source to record the position of setae and external markings and pores. Functional dorsal pores can be determined by applying slight pressure and watching for fluid exuding, and such traction can also reveal the location of other intersegmental pores. For preserved specimens, it is sometimes necessary to remove the cuticle to determine the position of pores. Where the reproductive pores and nephropores are still not visible, they can to be checked with reference the internal position of the organs, although these may enter the body wall at some distance from their exit points. Dissection is by dorsal incision using a scalpel blade from the anterior just below the peristomium and following beside the line of the dorsal pores through the clitellum, sometimes it is easier to cut forwards from the midbody. The specimen is teased open, pinned with fine entomological pins on a tray with black paraffin wax base, and immersed with liquid (water or ethanol) to prevent desiccation. It helps counting if the pins are put through certain segments, such as 5, 10, 15, and 20. Internally the position of the ovaries – almost invariably in segment 13, serves as a useful reference point to confirm segmentation. A needle and forceps (or fine tweezers) are useful for counting and probing, and sharp-pointed scissors can be used to cut cuticle, muscles, and thick septa. Good visibility is maintained if the dissection is flushed frequently using a syringe. The form, development and position of the internal organs should be

noted, each time without preconceptions as to where or how they should occur. Record just what is seen. Spermathecae are often buried under the blood vessels and guts, and need to be teased out, their ampullae may also be checked for nematodes. Prostates can be sectioned to inspect their central lumen and possible side-branches. The intestine should be incised to determine typhlosole development and gut contents.

It is convenient to use a manilla folder to sketch the external appearance and internal organs of the animal on one folio, preferably using a *camera lucida* attachment to the microscope, and to record the corresponding internal organization on the other folio. Either you can list the morphology under the headings above, or work sequentially from segment to segment starting from the anterior and record and sketch the structures. It is a good policy to have only one jar open on the bench at a time to avoid the confusion of mixed samples.

Conventions and Abbreviations

Two conventions are followed when describing earthworm regarding their segmental counts and setal designations. Following Michaelsen (1900), segments are counted from the anterior starting from the peristomium (i.e., the mouth bearing segment that lacks setae) using the normal and more familiar Arabic numerals to avoid the confusion inherent in use of Roman numerals. [Female pores are on 14 and in megascolecids the male pores are on 18, unless counts are reduced by suppression of anterior segments]. Intersegments and furrows are designated by a slash (eg. 1/2), variations are shown by a comma, and range by a dash (eg. 3,4-5 meaning "segments 3 or 4 to 5"). Setae, counted from the ventral-most on each side, have lower case letters (eg. a b c d) and in perichaetine species the dorsal-most setae are designated z, the penultimate y, and so on; setal lines refer to longitudinal setal series, sometimes pairs of setae are written without a space (eg. ab lines).

In the current account, right- and left-hand-side are rhs and lhs, respectively, from the observer's point of view (thus in some of the sketches the position of the organs that were viewed dorsally are reversed when compared to the ventral view of the specimen). All new material examined by the author is fixed and preserved in 80% ethanol and lodged in the Queen Victoria Museum, Launceston (QVM with registration numbers beginning 14:); in the Tasmanian Museum, Hobart (registrations TM:K); and in the National Earthworm Collection of the CSIRO Division of

Entomology, Canberra (ANIC:). Earlier material is lodged in the Musem of Victoria, Melbourne (MOV:, formerly NMV:); the Australian Museum, Sydney (with registration beginning AM:W); and the Museum of Natural History London (BM:). [Specimens housed in private collections are not governed by the regulations of ICZN (1999)]. Type material are designated H - holotype, P - paratypes, N - neotype, and L - lectotype. Australian states and territories have their usual abbreviations. Localities are given as standard AGM grid-references (eastings and northings) obtained from 1:25,000 or 1:100,000 map series, or were obtained from handheld GPS, and are set off by quotes when from sample data, or they are derived from map or gazetteer. An outline map of Tasmanian regions is shown in Fig. 8. Dorsal dissections were performed under magnification, specimens being pinned on a wax tray containing ethanol and sketched in the author's usual style using a *camera lucida*. For most lumbricine species, the setal ratios on one side of segment 12 are included in the figures. When present the clitellum is shaded, and other structures of taxonomic significance are shown *in situ* (Fig. 9 is annotated). All scale bars are 1mm. Notes on Distribution and Habitat follow each species' description - these are intended (along with the morphology and gut contents) to give some indication of ecological strategy and species associations, as well as to assist fieldworkers locate further material.

Systematics and Comparison of Previous Classifications

Taxonomic nomenclature is governed, at least up to family level, by an International Code of Zoological Nomenclature (ICZN, 1999). Under the Code, the type-genus is defined by the unique character states found in the type-species, or more correctly the type-specimen of the type-species, and other species that share these characters are included, again relating to the conditions found in their unique type-specimens. As species are the essential building blocks of taxonomy, the systematics process is from the 'bottom up', rather than from the 'top down'.

Using computer techniques based on principals propounded by Hennig (1950), Lee (1970) attempted a classification that largely confirmed the conclusion of Mayr (1968) that numerical methods are likely to contribute to taxonomy when combined with the philosophy of evolutionary taxonomy. The results of Lee's computer analysis tended to support those previously established on phylogenetic grounds alone and using fewer 'key' characters. As stated by Lee (190), practical taxonomy attempts to fulfil three requirements:

1. To assign exclusive names to species.
2. To establish an hierarchy of taxa above the species level that can be described in mutually exclusive terms so that they may be placed and ranked by the specialist and non-specialist.
3. To show the evolutionary and biogeographic relationships between taxa.

These first two requirements (which were the primary objectives of the current study) are often incompatible with the third. Nevertheless, it is necessary to consider higher classification, for which species are the basic elements of construction, to better understand the relationships between different groups.

The most recent comprehensive world-wide family-level treatment of the megadrile Oligochaeta is that presented by Sims (1980, 1982), which appears to have been widely accepted (see Parker, 1982: 50-61; Easton, 1980: 35; Easton, 1984: 111; Sims and Gerard, 1985: 41; etc.). Sims' system built on his earlier computer analysis (Sims, 1966) as well as the prodigious contributions, spanning a period of almost 60 years, of Gates (eg. Gates, 1925; 1959; 1972; 1982). Yet, most subsequent phylogenetic works owe much to Michaelsen's influence (see Lee, 1994), and to the 'Classical System' - defined by Gates (1972) as that devised and presented by

Michaelsen (1900) in *Das Tiereich*, and expressed in its final form by Stephenson (1930) in "The Oligochaeta". Although Michaelsen (1921, 1929) had revised his earlier classification, Stephenson (1930) reverted to that of the Tierreich, and therefore 1900 is the date that heralded a period of structure and stability to earthworm systematics. In the last 40 years, the details of the arrangement and components of the families, particularly the composition of the Megascolecidae, has been the subject of much debate and controversy. Much of this being what Gates (1959: 252) termed "reshuffling based on the literature".

Lee (1959) recognized Stephenson's definitions of families and divided the Megascolecidae into two subfamilies: the Acanthodrilinae (including the Octochaetinae) with an 'acanthodriline' form of male and prostatic pores, and the Megascolecinae with the 'megascolecine' arrangement i.e., one pair of male and prostatic pores combined on 18 (and either tubular or 'non-tubular' prostates). Gates (1959, 1972, 1976) was a constant critic of the classical system, rejected Lee's system, and proposed a revised scheme in partial agreement with Michaelsen (1921, 1929) that was presented in a refined form by Sims (1980, 1982). Gates only allowed 'truly' racemose prostates in the Megascolecidae and all other excluded species - "with tubular glands, regardless of presence or absence of lateral branches from the axial lumen", went into the (holoic) Acanthodrilidae and (meroic) Octochaetidae. Jamieson (1971 and subsequently) devised yet another scheme, largely ignoring different forms of prostate, based instead on a syllogism that allowed a relatively few actually instances of detailed descriptions of nephridial arrangements to account for placement of whole groups (eg. see Easton, 1979: 17; James, 1991: 337). Because the finer nephridial details of most species described from around the world are not known, and because determination of such details would now be difficult, if not impossible, to obtain (see Gates, 1959: 252; 1972: 24; Easton, 1979: 9), Jamieson's scheme was impractical, did little to provide clarity, and was also found to have gross morphological groupings that were not mutually exclusive (Blakemore, 1994a: 225-231). The better part of Jamieson's scheme still owed much to the classical system (Lee, 1994: 12), despite the claim (eg Jamieson, 1974: 207) that the "taxonomy employed by Stephenson is now largely obsolete". Jamieson (1971: 77) only really critiqued Gates' flawed scheme and later (eg. Jamieson, 1988) largely ignored Sims' version of it, failing to recognize the strength and validity of the classical system.

The main advantage of Gates' scheme, following on from Michaelsen (1921) and as presented by Sims (1980), was the pragmatic elevation of the Ocnerodrilidae, Acanthodrilidae, Octochaetidae, and Megascolecidae to family rank. However one exceptional and "troublesome" species, *Exxus wyensis* Gates, 1959, disrupted an otherwise workable templet. This meroic species with an acanthodriline arrangement of male and prostatic pores complied with the Octochaetidae but, because it had racemose prostates, Gates (1959: 258) allowed it to introduce the acanthodriline state into his redefinition of the Megascolecidae, whereas Jamieson (1971) allowed it to introduce racemose prostates into his redefinition of the Acanthodrilidae.

There is a pressing need to review family-level systematics of megadriles in order to correctly place Tasmanian genera in the context of the World fauna, to resolve uncertainties about synonymy and higher level taxonomy of Australian earthworms (Abbott, 1994: 117; Blakemore, 2000c), and to simplify disparate classification schemes inherited without clear consensus. The scheme proposed by Jamieson (1971 and subsequently) has not been generally tested for Tasmanian taxa prior to the current study, but has been criticised and rejected in whole or part by several other workers around the world (eg. Reynolds & Cook, 1976; Edwards & Lofty; 1977; Easton, 1979: 9, 17-20; Sims, 1980; 1982a; 1982b; Easton, 1984; Sims & Gerard, 1985; Fender & McKey-Fender, 1990; Reynolds & Cook, 1993; and, because they recognized the family Acanthodrilidae, presumably by Dyne & Wallace, 1994: 61), due partly to its being based on negative (i.e., absent) or on seemingly adaptive ultrastructural characteristics of the nephridial system which Jamieson (1974: 211) admitted were difficult to demonstrate and Easton (1979: 17) showed to be hampered by the paucity of available information for most species, and due partly to biogeographical anomalies (Sims, 1980: 105; 1982: 284). Inconsistencies in Jamieson's (1971) scheme have also been found, for example, by James (1991: 339), Blakemore (1994; 1997; 2000), and Dyne (1997: 144, 155).

Easton (1979: 20) stated: "Until new taxonomic criteria can be recognized, or evidence conflicting with the results of the phenetic study become available, it is intended to revert to the older classification of Megascolecoid earthworms proposed by Gates ...". In later studies of Oriental, Australian, and Oceanian earthworms, Easton (1980; 1982; 1984) adopted Sims' (1980; 1982) classification, as did Sims and Gerard (1985) for their study of European earthworms. In order to place North

American worms, Fender and McKey-Fender (1990: 369), lamenting that "The family-level classification of the megascolecid earthworms is in chaos", rejected both Gates' and Jamieson's schemes and had to devise their own classification. [For an overview of the dispute over family-level classification, these authors refer us to Gates (1959), Jamieson (1971), and Sims (1980)]. Whereas Blakemore (1994a: 225-234; 1999: 182) adopted Sims' system for treatment of exotic and some neo-endemic taxa, Blakemore (1997; 2000) was forced to revert to Michaelsen's earlier system for consideration of Australian natives, clearly an unsatisfactory situation. Recently, Lee et al. (in press) have been obliged to follow a similar course in a revision of NZ taxa.

Most previous taxonomic schemes make a distinction, if at all, between racemose prostates and 'non-racemose' prostates (i.e., tubular or tubuloracemose). For example, Sims (1980) in following Gates' lead allowed only 'non-racemose' prostates in his division of the Acanthodrilidae and Octochaetidae, that were further separated on holoic or meroic nephridia respectively. In the current author's view (endorsing that of Michaelsen, 1907), it makes more sense phylogenetically and tautologically to draw the dividing line between plesiomorphic tubular prostates and apomorphic non-tubular prostates (i.e., tubuloracemose to racemose). Similarly with setae, these are plesiomorpic lumbricine or apomorphic non-lumbricine (i.e., anisochaetine to perichaetine). Furthermore, any increase in nephridia anywhere in the body, excluding pharyngeal tufted nephridia, from the plesiomorphic holic state (i.e., one pair per segment), produces the apomorphic meroic state (i.e., more than one pair per segment). It is possible that sub-categories of 'non-holoic' nephridia may also be determined, but this is not necessary for the practical purposes of the current work.

Thus, in the author's present system (eg. Blakemore, 1994a: 228; 1994b: 30; 1997b: 1786; 2000b: 2; 2000c: 188), any derivation from the plesiomorphic states of tubular prostates, lumbricine setae and holonephridia (with the exception of tufted pharyngeal nephridia) are considered apomorphies (as per Jamieson, 1988: 371-372). This is consistent with Stephenson (1930: 213, 245, 836-837) and with Michaelsen (1907: 160), whose primary separation of genera was based on: "Prostaten schlauchförmig, mit einfachem, unverzweigtem Kanal" (prostates tubular, with simple unbranched duct) or "Prostaten mit verzweigtem Kanalsystem" (prostates with branched system of ducts); secondarily on nephridia that were either holoic or

"wenigstens im Vorderkörper" (at least in the fore-body) meroic; and finally setal arrangements that were lumbricine or "wenigstens am Mittel- und Hinterkörper" (at least in mid- and hind-body) perichaetine. However, this is contrary to the contentious views of Jamieson expressed thusly: (Jamieson, 1971: 79) "The form of the prostates has been eliminated from consideration" and (Jamieson, 1974: 218) that "Variation in form of the prostates from tubular to racemose is considered unimportant" and further (Jamieson, 1974: 219) "*Perionychella* has been extended to include forms with eight setae" and (Jamieson, 1977: 279) "perichaetine, a condition now known to be of little significance". Michaelsen's final distinctions for generic separation, as supported and endorsed herein, referred to details of the alimentary system and the arrangement of the openings of the reproductive organs.

Based on the above premises, a revised and simplified family-level system is proposed, modified from those of Lee (1959), Gates (1959), and Sims (1980; 1982), and yet still owing much to the Classical System for the classification of megadrile earthworms. The synopses of Acanthodrilidae and Megascolecidae proposed below are almost identical to those of Lee (1959: 32), only raised from sub-family to family rank and with the Ocnerodrilidae and Octochaetidae (and Exxidae) separated off.

SYSTEMATICS RESULTS

Classification

Phylum ANNELIDA (segmented worms)

Subphylum or superclass CLITELLATA (annelids with a clitellum)

Class OLIGOCHAETA (worms with few setae, cf. mainly marine polychaetes)

Order HAPLOTAXIDA (variously divided by different authors into mainly small, aquatic microdriles and often larger, mostly terrestrial or limnic/littoral megadrile earthworm groups).

[Note: the ICZN (1999) Code mainly regulates names of taxa in the family group and below, excluding hypothetical concepts at these and higher levels].

Stephenson (1930: 719) considered it "unnecessary from the point of view of convenience" to consider the interposition of grades between Order and Family, so he "dispensed with groups above the level of family in his great monograph" (Sims, 1980: 104).

The following key to Families is adapted from the works of Michaelsen (1900; 1907: 160; 1921); Stephenson (1930); Lee (1959); Gates (1972: 31-32); Easton (1980: 35-37); Sims (1980: 106-107); Pinder and Brinkhurst, (1994: 21-26); and from Blakemore, (1994a: 225-569; 1997; 2000). Because divisions are made on apomorphies (i.e., derived character states), this system although greatly simplified, may represent actual phylogenetic assemblages (extant, expected, or extinct).

Key to the Families of Earthworms

1 Clitellum usually formed from a single layer of cells in the region of the male pores; macrolecithal, i.e., eggs large, yolky 2

Clitelum more than one cell thick with small, microlecithal eggs 4

(Suborder Lumbricina also classed as Megadrili, the megadrile earthworms).

2 Testes and male funnels, not intraseptal; male pores, one or two pairs 3

Testes and male funnels, intraseptal; male pores, one (rarely two) pair(s) ..... **Moniligastridae**

(Suborder Moniligastrida but usually included in considerations of the megadriles).

3 Male pores two pairs ..... **Haplotaxidae**
(Suborder Haplotaxida usually classed with the Microdrili; cosmopolitan distribution; aquatic, typically predatory).

Male pores one pair (spermathecae in 5 opening near 4/5) ..... **Enchytraidae**
(small white 'pot worms'; usually excluded from considerations of the megadriles and often included with the Microdrili; cosmopolitan distribution but uncommon in tropics; littoral, aquatic or terrestrial and frequently in moist forest soils).

4 (2) Prostatic glands, or 'prostate-like' bursae, discharging through or near male pores or on adjacent segments 5

Prostatic glands absent ('prostate-like' bursae, when present, not associated with the male pores) 13

5 (4) Male pores posterior to segment 16 6

Male pores on or anterior to segment 16 11

6 Last hearts in 11 (prostates tubular, calciferous glands or 'diverticula' typically in 9 or 9-10, or intramural spaces in some of 8-10) ..... **Ocnerodrilidae**
(tropical America, S Africa; India; about 21 genera, a few species introduced elsewhere; often aquatic).

Last hearts posterior to segment 11 (calciferous glands present or absent) 7

7 Male pores on 18 opening separately from pores of two pairs of prostates in 17 and 19, or male and prostatic pores combined or separate on 17 or 19 8

Male pores on 18 (or homeotic equivalent) combined with pores of a single pair of prostates, or on 17 and emerging from ducts of 'euprostates' 10

8 Holoic (prostates tubular) ..... **Acanthodrilidae**

Meroic (prostates tubular or non-tubular) 9

9 Prostates tubular ..... **Octochaetidae**

Prostates non-tubular (i.e., racemose or tubuloracemose) ..... **Exxidae fam. nov.** (Neotropical: Central America or Caribbean, no longer considered 'Australasian'; four known species in two genera). [Note: this family name is formed in accordance with Articles 11.7, 29, 35, 55.3, 63 of the Code (ICZN, 1999) from the type-genus *Exxus* Gates, 1959].

10 (6) Male pores on 18, spermathecae present in pre-testicular segments (prostates tubular to racemose, nephridia holoic or non-holoic, setae lumbricine to perichaetine) ..... **Megascolecidae**

Male pores on 17, spermathecae absent from pre-testicular segments ('euprostates' present, holoic, lumbricine) ..... **Eudrilidae** (tropical Africa south of the Sahara; about 45 genera, one species introduced to other tropical areas).

11 (5) Male pores on 13 (cf Lumbricidae; lateral line present) ..... **Biwadrilidae** (Japan, aquatic or limnic; monotypic).

Male pores on 15 or 16, (lateral line absent) 12

12 Body quadrangular (male pores on porophores) ..... **Criodrilidae** (southwestern Palaearctic: Europe, Middle East, introduced into USA; only 1 or 2 species, mainly aquatic).

Body cylindrical (male pores in copulatory pouches) ..... **Kynotidae** (Malagasian: Madagascar; 12 species in primary forests).

13 (4) Oesophageal gizzard(s) or dilations present in pre-testicular segments 14

Oesophageal gizzards or dilations absent from pre-testicular segments 18

14 Extra-mural calciferous glands present 15

Extra-mural calciferous glands absent 16

15 Gizzard in 6 (supra-oesophageal vessel present) ..... **Glossoscolecidae**
(Neotropical: Central, S. America, Caribbean; 200 species, a few species distributed and circumtropical in forest soils or near coast).

Gizzard in 7 (supra-oesophageal vessel absent) ..... **Microchaetidae**
(S. African; 33 species in primary grasslands). [Note: the genus *Tritogenia* Kinberg, 1867 is meroic rather than holoic so possibly requires separation].

16 (14) Body quadrangular in section, at least in hind-body (supra-oesophageal vessel present) ..... **Almidae**
(tropical equatorial; 40 species, aquatic, amphibious, or limicolous).

Body cylindrical (supra-oesophageal vessel absent) 17

17 Male pores paired on 15 (two or three gizzards each restricted to a single segment) ..... **Hormogastridae**
(Mediterranean, 4 species).

Male pores paired on 22 (one gizzard, or two gizzards each occupying two segments) ..... **Ailoscolecidae**
(Pyrenees and southeast USA, two monotypic genera). [Note: Sims, (1980: 108) puts American Komarekionidae Gates, 1974 in synonymy].

18 (13) Testes two pairs in 10 and 11 (intestinal gizzards, when present, in some or all of 17-20) 19

Testes ten pairs in segments 12-21 (intestinal dilations in 21-24) .... **Lutodrilidae**
(southeast USA; riverine or limicolous; monotypic).

19 Intestinal gizzards (and calciferous glands) absent ..... **Sparganophilidae**
(Nearctic, Neotropical: North and Central America, introduced into Europe; three species, aquatic).

Intestinal gizzards present (calciferous glands present, male pores usually on 15 but some parthenogenic morphs of *Eiseniella tetraedra* have male pores exceptionally on 11 or more usually on 13) ..... **Lumbricidae**
(Holarctic; many species widely distributed; terrestrial).

Revised Australasian families and families of exotic species reported from Australia (all other families are mostly as described by Gates, 1972 and Sims, 1980). (* marks endemic Australasian families (also found elsewhere), although Exxidae is doubtful).

1. **Moniligastridae** – defined by its intraseptal testes and male funnels; macrolecithal eggs providing their own yolk [but Gates (1972: 31, 238) questions whether the clitellum is always one cell thick], unlike true megadriles that have microlecithal eggs which gain nutrients via secretions from a more glandular clitellum. A pair (or two pairs in *Desmogaster* Rosa, 1890) of male pores behind spermathecal pores but in front of the female pores; lumbricine; vesiculate holoic; multiple intestinal gizzards. This large Oriental family which may rival the Oriental Megascolecidae for number of species is found in natural and cultivated soils and jungles in India, southeast Asia west of Wallace's Line, southern and central China, Taiwan, Japan, Korea and eastern Siberia, ?East Africa; a few species are peregrine transported around the world, the most common of these, *Drawida barwelli* (Beddard, 1886), also occurs in Australia as initially collected and described by Blakemore (1994a, 1999) on a farm in Queensland.

2. **Ocnerodrilidae** – male pores on 17 or 18 (rarely 19 or 20), one to three pairs of prostatic pores from tubular prostates between 16-21; lumbricine; holoic; spermathecal pores pretesticular; one or two oesophageal gizzards present; intestinal gizzards absent; calciferous glands or 'ocnerodrilid diverticula' extramural in 9 or 9-10 (or intramural spaces in some of 8-10). Last hearts in 9. This relatively primitive family is distributed in tropical America, Africa, India; about 21 genera with a few peregrine species mainly in tropical areas and often associated with freshwater. Four such species have been reported from Australia by Blakemore (1999), two of these: *Eukerria saltensis* (Beddard, 1895) and *Ocnerodrilus occidentalis* Eisen, 1878 from Tasmania (the latter species from drainage pipes in my backyard at Invermay in Launceston!).

3. **Acanthodrilidae** * – male pores usually paired on 18 and pores of tubular prostates paired on both 17 and 19, or paired on 17 or 19 separate or combined with a single

pair of prostatic pores on the same segment (i.e., not united on 18 as in the Megascolecidae), sometimes pores midventral, (eg. in *Lavellodrilus* Fragoso, 1988); lumbricine, holoic. Oesophageal gizzard(s) present, or rudimentary, or absent; calciferous glands commonly present (but not arranged as in the Ocnerodrilidae), or absent; intestinal gizzards absent; spermathecae diverticulate. Distribution: Americas, Africa, Asia, Australasia, Oceania, islands of the Southern Ocean (presumably including Antarctica in past geological times). The family is well represented in New Zealand distributed on both north and south Islands although dominant in the southern parts (Lee, 1959; 1994), where the endemic genus *Rhododrilus* is particularly common. *Acanthodrilus* Perrier, 1872 and *Microscolex* Rosa, 1887 occur in the Pacific and Southern Oceans. The only wholly Australian acanthodrilid is *Diplotrema*, phyletically an ancient genus (cf. the megascolecid *Pontodrilus*), that is closely related to genera found on Gondwanan fragments as well as North American parts of Pangea (eg. *Diplocardia* Garman, 1888). [James (1990) provisionally placed two Mexican species in *Diplotrema*, but these and other Mexican earthworms variously placed in *Notiodrilus* and *Eodrilus* require clarification]. The present day distribution of *Diplotrema* is restricted to northern Australia (Qld, NT, north-west WA and northern NSW), where species are found in rainforest, woodland, grassland, cultivated soils, and a few moisture retaining refugia in arid areas (Blakemore, 1994a; 1997b; and in prep.). No native acanthodrilids are known from Tasmania.

Six exotic species are presently recorded from Australia (Blakemore, 1994a: 296-297; Blakemore, 1999), four of these from Tasmania: *Rhododrilus kermadecensis* Benham, 1905, *Microscolex dubius*, and its sibling species *M. phosphoreus* (Dugès, 1837) - (these latter two new records by the current author were found in the drain of a carpark at Rocherlea), plus the probable neo-endemic *M. macquariensis* (Beddard, 1896) on Macquarie Island from whence it was recently re-sampled by the current author. This species is closely related to congeneric species on other sub-Antarctic islands, the genus originating from southern South America (Lee, 1968; 1994), and would have had to undergone speciation in the 11,000 years since the island emerged or since its last glaciation (or possibly it colonized from other islands from which it has not yet been reported or that are now submerged). Although *Microscolex dubius* (Fletcher, 1887) was first described from Sydney, Mulwala (in soil brought from

Melbourne), and Adelaide (Fletcher, 1887a: 381), the homeland of this genus is in South America and it is not endemic to Australasia.

Species found on the mainland, such as *Rhododrilus queenslandicus* Michaelsen, 1916 on Cape York Peninsula, were believed to be the result of either introduction and subsequent naturalization from New Zealand, or possibly relict fauna of ancestral stock shared with other regions and now isolated (Blakemore, 1994a: 297). Possible modes of transportation and initial introduction of exotics are by oceanic rafting of euryhaline ('salt water tolerant') species, by carriage on birds' feet, or incidental to human migrations (Stephenson, 1930), where the occurrence of certain species in Australia may predate the arrival of European settlers, reflecting earlier undocumented commerce with south-east Asia and Indo-Pacific Islands (Blakemore, 1999: 185). At least eight kinds of earthworms, including *Rhododrilus edulis* Benham, 1904, were a prized dish formerly used in Maori feasts (Stephenson, 1930: 657). Although it is probable that *Rhododrilus* was initially rafted to Australia via ocean currents, it is remotely possible that specimens were carried by boat from New Zealand along with the root-stock of plants, or as a food source in its own right.

4. **Octochaetidae** * – as Acanthodrilidae but meroic (rarely with two pairs of male pores and prostatic pores on 17 and 19). Some past authors believed this family to be a derived grade rather than a clade, meriting only sub-family rank in the Acanthodrilidae. Distribution: Australia, New Zealand, India into Myanmar, Indian Ocean, Madagascar, Africa, tropical America, with *Dichogaster* spp. especially introduced into other regions. Australia species provisionally placed in *Diplotrema* that actually have meroic nephridia, such as *Diplotrema (?) ambrosensis* Blakemore, 1997b, belong in this group as mooted by Blakemore (1994a; 1997b: 1788, 1792). A later paper by Dyne (1997) appears to have overlooked such species when he erected *Neodiplotrema* for meroic 'diplotremas' in Queensland, but this genus is herein considered a junior synonym of the prior New Zealand genus *Octochaetus* Beddard, 1892 – the type-genus of the family. The Indian *Octochaetoides* Michaelsen, 1922 and *Octochaetona* Gates,1962 are similar to *Octochaetus* which is itself similar, if not indistinguishable apart from geographical location, to the African genus *Monogaster* Michaelsen, 1920 (see Lee, 1959: 104).

It has for some time been anticipated that Australia, intermediate within this wide distributional range, would also have endemic representatives (eg. Michaelsen, 1909 as quoted by Lee, 1959: 26). The long anticipated 'missing link' of ocotchaetids in Australia, appears under the current system of classification to have arrived in the form of *Octochaetus ambrosensis* (Blakemore, 1997) **syn. nov.**. Also of *O. minutus* (Jamieson & Dyne, 1986) **syn. nov.**, and *O. tumidus* (Dyne, 1997) **syn. nov.**. [Note: there appear to be some inconsistencies in the stated registrations of specimens of the latter species and the actual deposited material that was conscientiously curated and registered by Blakemore (1995a). For example, Dyne, (1997: 149) has no P2, two P10's, the Holotype designated by Dyne (1997) is included under the same registration as several Paratypes, and several other Paratypes appear to be missing and/or mixed. Another species in this paper has primary types that are not registered in any recognized institution (cf. ICZN, 1999, Recommendations 10A, 16C, 16D, 73, 72E). A further species based on nine aclitellate specimens, *O. deminutionis* (Dyne, 1997) **syn. nov.**, also has the Holotype included under the same registration as the Paratypes, this species has the microscolecine reduction of male pores to segment 17 but still qualifies it for inclusion in Octochaetidae]. The form of the prostates were not described for a second proposed Queensland genus, considerably impeding comparison of meroic balantine *Torresiella* Dyne, 1997, but if we assume they are tubular, then this too would belong in the Octochaetidae.

Although none are yet known from Tasmania, seven exotic octochaetids were reported for Australia by Blakemore (1994a; 1999), including *Octochaetona beatrix* (Beddard, 1902) recorded for the first time at two widely separate locations in Queensland, both sites agricultural. Despite the current revision of the interpretation of Octochaetidae, no argument is put forward for considering the peregrine *O. beatrix* and its sibling species *O. surensis* Michaelsen, 1910 to be species endemic to Australia.

5. **Exxidae (*?)** – as Octochaetidae but with non-tubular (i.e., tubuloracemose to racemose) prostates, (and with two or three oesophageal gizzards). The type-genus *Exxus* Gates, 1959 comprises monotypic *Exxus wyensis* Gates, 1959, that has *typus amissus* (Reynolds and Cook, 1976: 190) although Gates (1959: 231) deposited sections in the Museum of Comparative Zoology at Harvard College. [Note: I can

find no etymology for this name, but suspect it is Gate's little pun on species 'X' from location 'Y']. The genus *Neotrigaster* James, 1991 is also included. Distribution: Puerto Rico, Central America, (doubtfully Australasia, but see Note below). Gates (1959) described *Exxus wyensis* from a dozen macerated specimens "secured by an anonymous collector at an unknown site", that had two gizzards in 5-6; absence of calciferous glands (and typhlosole?); spermathecae with diverticula sessile on the duct; and with genital setae (in 8 & 9) and penial setae (in 17 & 19). Although the provenance was unknown, Gates (1959: 253) assumed it to be Australasian (and his strict polarization of families caused him to place it in his concept of Megascolecidae). Jamieson (1971: 81) marked it as a possible Australian genus (and because his scheme fails to differentiate between forms of prostates, he placed this genus within his concept of the Acanthodrilidae that included the Octochaetidae). No species agreeing with the generic definition are known from Australia nor New Zealand, and this species has until now been a puzzling enigma. It is most unlikely that this species does originate from Australasia, although it is somewhat similar morphologically, were it not for the racemose prostates and doubled gizzards, to some *Octochaetus* species from New Zealand and, at least, to *Octochaetus ambrosensis* (Blakemore, 1997b) from Rockhampton, Queensland. Its homeland is most probably in Central America or the Caribbean: in Puerto Rico, Mexico, Cuba or the Virgin Islands. More pieces of the 'puzzle' are provided by several acanthodriline or octochaetine genera recently described from this region by James (1991; 1993) that, although they have tubular prostates, have many similar features including multiple oesophageal gizzards (eg. *Zapatadrilus* James, 1991; *Protozapotecia* James, 1993).

Further support for the deductions above is gained from the one other genus included in the family Exxidae, *Neotrigaster* James, 1991 from Puerto Rico, as the type-species *Neotrigaster rufa* (Gates, 1954), re-described on new material by James (1991: 348) with racemose prostates in 17 and 19, differs substantially from *Exxus* only by having three gizzards in 5-7. Of the other two species included in *Neotrigaster* by James (1991) only *N. complutensis* (Borges & Moreno, 1991) belongs in this family (the third species, *Trigaster yukiyui* Borges & Moreno, 1991, with tubular prostates probably requires returning to its original genus in the family Octochaetidae).

[Note: in a recent paper in which there is an erroneous claim that *Diplotrema* Spencer, 1900 is an "Emendation", Jamieson (1997) describes *Diplotrema sheltingai* with "tubuloracemose prostates" that "appear racemose" but, from the evidence provided, they appear to the current author to be mere thickly tubular. Moreover, Jamieson (1997: 244) was unable to adequately characterize the holoic nephridia of the inadequately preserved specimens believing them to be possibly meroic and thereby meriting inclusion in *Neodiplotrema* Dyne, 1996 [sic], (now *Octochaetus*), and although Jamieson (1997: 244) questioned the validity of *Neodiplotrema*, later Jamieson (1997: 269) found its separation "convenient". Correct characterization and placement of this species is presumably the responsibility of subsequent workers].

6. **Megascolecidae** * – male pores united with prostatic pores, paired or unpaired (eg *Fletcherodrilus* Michealsen, 1891) commonly on 18 (rarely on 19 or 20). Prostates tubular to racemose, holoic or meroic, lumbricine to perichaetine. Dorsal pores present or absent. Oesophageal gizzard(s) present; calciferous glands present or absent; intestinal gizzard(s) and caecae sometimes present, or absent. Spermathecae single, paired, or multiple; diverticulate (or rarely with intramural sperm chambers). A large family with well in excess of 1,000 named species. Distribution: Australasia: Australia, New Zealand; India; Asia and Pacific Oceania; (possibly including Antarctica in past geological times); North and Central America; many species peregrine, particularly some of the 600+ species of Oriental pheretimoids. This family is dominant in Australia (including Tasmania) and is well represented in New Zealand where it is most prevalent in the north of the North Island (Lee, 1959; 1994:17).

Megascolecidae s. strict. remains the largest of megadrile groupings. It has been re-shuffled into various super- and sub-ordinate ranks in various combinations by disparate authors at different times. It is theoretically possible to create subdivision based on transitional, intermediate or adaptive states between holoic and meroic but as mentioned above, since these nephridial states are unlikely ever to be determined for all meroic species, this course is impractical. However, under the present revision it would be entirely possible to made sub-divisions between the generally known prostate, nephridial and setal states: genera having combinations of tubular prostates, holoic nephridia, and lumbricine setae being phyletically the most 'primitive' and ancient. This revision of families places Australasian genera such as *Pontodrilus*,

Plutellus, and *Sebastianus*, and the North American *Argilophilus*, as rather primitive members of the Megascolecidae, while *Diporochaeta* and *Perionychella* are more derived. (New Zealand's *Rhododrilus*, Australian *Diplotrema*, and North American *Diplocardia* remain in the Acanthodrilidae). The genera *Megascolides* McCoy 1878 and *Celeriella* Gates, 1958, are herein transferred to the Megascolecidae from the Octochaetidae, as their male and prostatic pores are combined on 18. *Celeriella* is an Indian genus that provisionally receives the residue of species from Australia and New Zealand that were formerly part of *Spenceriella*, after removal of the type-species of the latter genus to *Anisochaeta* (see Blakemore, 2000a and remarks under *Anisochaeta* below). More advanced megascolecid genera are Indian *Megascolex* Templeton, 1844 s, strict. (see Blakemore, 1997b, 2000a), and *Lampito* Kinberg, 1866 s. strict., Australian *Anisochaeta*, and Oriental pheretimoids such as *Amynthas* Kinberg, 1867 (see Sims & Easton, 1972; Easton, 1979). Most, but not all, Australian genera belong in the Megascolecidae, as do all known endemic Tasmanian earthworms.

Twenty exotic species are currently recorded from Australia - three of these are also found in Tasmania plus two megascolecids introduced from the mainland (see Exotic species sections of the current work); the genus *Begemius* Easton, 1982, endemic to New Guinea, has neoendemic species in north-eastern Australia (Blakemore, 1999). Initial mode of introduction of this genus may be similar to those mentioned for the exotic Acanthodrilidae above.

7. **Eudrilidae** – Neotropical family with approximately 500 species endemic to tropical Africa. One species widely transported, *Eudrilus eugeniae* (Kinberg, 1867), "the African Nightcrawler", that was described and first confirmed from Australia by Blakemore (1994a; 1999). Cocoons had been imported from Canada as stock for a worm-farming operation in Queensland, and this species is now distributed to other sub-tropical regions although it was recently identified as far south as a worm farm at Menai in Sydney (pers. obs.). It is unlikely to survive in Tasmania's cool temperate climate unless it is maintained in heated worm beds.

8. **Glossoscolecidae** – Neotropical family with approximately 200 endemic species in tropical America and West Indies. One species widely distributed around the world, the cosmopolitan *Pontoscolex corethrurus* (Müller, 1856) which, because it is found

mainly in coastal regions of the tropics, is probably euryhaline (at least in the cocoon?). This species has been reported from Australia, as described by Blakemore, (1994a, 1999), and has recently been discovered as far south as the Royal Botanic Gardens in Sydney's Farm Cove (pers. obs.).

9. **Lumbricidae** – Holarctic family with nearly 400 named species (Easton, 1983), endemic in North America, Europe, Siberia; north-east Asia. Twenty-five lumbricids are now reported as introductions into Australia (Blakemore, 1999), with approximately 16 of these from Tasmania, including the first Australian record of *Lumbricus terrestris* Linnaeus, 1758 (which I discovered in my backyard in Invermay!).

Summary of Key Characters after Revised Classification of Megascolecidae s. lato.

Family OCNERODRILIDAE - Male pores on 17 or 18 (rarely 19 or 20), one to three pairs of prostatic pores from tubular prostates between 16-21. Lumbricine. Holoic. One or two oesophageal gizzards present; intestinal gizzards absent; calciferous glands or 'ocnerodrilid diverticula' extramural in 9 or 9-10 (or intramural spaces in some of 8-10). Spermathecal pores pretesticular. Last hearts in 9.

Family ACANTHODRILIDAE - Male pores usually paired on 18 and pores of tubular prostates paired on both 17 and 19, or paired on 17 or 19 separate or combined with a single pair of tubular prostatic pores on the same segment (i.e., not united on 18 as in the Megascolecidae). Lumbricine. Holoic. Oesophageal gizzard(s) present, or rudimentary, or absent; calciferous glands commonly present (but not arranged as in the Ocnerodrilidae), or absent; intestinal gizzards absent. Spermathecae usually diverticulate. Last hearts in 12 or 13.

Family OCTOCHAETIDAE – as Acanthodrilidae, but meroic.

Family EXXIDAE – as Octochaetidae, but with non-tubular prostates.

Family MEGASCOLECIDAE – Male pores united with prostatic pores on 18 (or homeotic equivalent). Prostates tubular to racemose. Holoic or meroic. Lumbricine to perichaetine. Dorsal pores present or absent. Oesophageal

gizzard(s) present; calciferous glands present or absent; intestinal gizzard(s) and caecae sometimes present, or absent. Spermathecae single, paired, or multiple; diverticulate (or sperm chambers intramural). Last hearts 12 or 13.

Systematic results: Tasmanian taxa

Tasmanian genera are reviewed as many Tasmanian species, both new and known, are permissible in the 'classical' genera *Diporochaeta* Beddard, 1890, *Perionychella* Michaelsen, 1907, *Megascolides* McCoy, 1878, and *Anisochaeta* Beddard, 1890 or in the recently restored *Vesiculodrilus* (see Blakemore 2000b,c). Jamieson (1974: 216) had expanded the definition of Michaelsen's *Perionychella* to include lumbricine or perichaetine species with tubular, tubuloracemose or racemose prostates, although this was contradicted almost immediately by Jamieson (1974: 260, 265). Nevertheless, this "very profound emendation of the genus after a long period of suppression [sic]" (Jamieson, 1974: 220) had the effect of superceding definitions of both *Diporochaeta* and *Vesiculodrilus*, amongst other prior genera. When Jamieson (1976: 4) next transferred *Perionychella en mass* to *Diporochaeta*, the definition of Beddard's genus (only in Queensland?) was extended to include these states:

> "Setae eight or more per segment...tubular or tubuloracemose (rarely racemose?) prostates...holonephridia with or without bladders".

This expanded definition encompassed several prior genera including, but not confined to: *Vesiculodrilus*, *Woodwardiella*, *Perionychella*, and *Graliophilus*. As the actual definition of *Diporochaeta*, based on the states found in the type-species, is now restored to the original (i.e., for species with perichaetine setae, tubular prostates and holoic nephridia), most of these other genera are similarly restored (Blakemore, 2000b,c). For reasons that are not entirely clear, Jamieson (1974: 266) further expanded the defintion of Fletcher's *Cryptodrilus* to include species with "tubular, tubuloracemose, or racemose" prostates - this never part of this genus' definition as having tubular prostates would qualify for the prior genus *Megascolides*. Following Blakemore (2000b,c) *Cryptodrilus* is retained for species with non-tubular prostates that are meroic and found to have nephridial bladders, avesiculate species go into *Notoscolex* or where they lack dorsal pores, to *Aporodrilus* Blakemore, 2000c.

Megascolides has its normal definition - for lumbricine, meroic species with tubular prostates (Blakemore, 1997a; 2000c).

Earthworms from Tasmania are now known to number 228 native and exotic species in 38 genera belonging to 4 families as described herein. Prior to 1997 approximately 55 species were known, while in the three years to 2000 studies by the author almost doubled this number to 95 species comprising: 69 endemics, 1 neo-endemic, 23 exotics (in 14 genera) and 2 translocated mainland species. The current account makes new combinations and adds 136 new native taxa to almost triple the endemics to 202 species and sub-species in 24 genera. This biodiversity compares with approximately 48 species from Britain and Ireland, 74 from Japan, 160 from North America, 174 (in 23 genera) from Myanmar, 180 from France, 192 (in 34 genera) from New Zealand, 350 from the Indian subcontinent, and ca. 350 (in ca. 33 genera) from mainland Australia - the total fauna of which is anticipated to ultimately yield at least three times as many species (Blakemore, 1999, and in prep.), particularly when only about a dozen are known from huge areas like the Northern Territory.

Although several genera are common to both Tasmania and continental Australia, particularly Victoria and southern NSW, no earthworms at the species level are know to have natural distributions that cross the Bass Strait (cf. Jamieson, 1974: 326; see also the Remarks following the re-description of *Anisochaeta tasmanica* below). Neither is it to be expected that earthworm migrations across previous land bridges (the last as recently 8,000-15,000 year ago) were commonplace, given the present-day often highly restricted distribution of endemic species in both Victoria and Tasmania. For example, no survey has revealed species native to either of these regions to have even State-wide distributions, despite the lack of appreciable topographical or ecological barriers, and most are often highly endemic - confined to just one or two specific locations. Invasion of exotics, particularly lumbricid and megascolecids earthworms, is a recent event mostly occurring in the 200 years since the arrival of European and other settlers. Speciation of earthworms in Tasmania is therefore assumed to be a consequence of the great diversity of habitats afforded by its geological and climatic history and its present topography, combined with a lack of competition from exotics nor, until very recent times, much human interference.

In the following account, discussion is confined to remarks accompanying generic and specific descriptions. A fully-illustrated, interactive electronic key to the species and genera of Tasmania has been produced to accompany the present work, which is available on CD from the author or via Australian Biological Resource Survey in Canberra. The Regulation Table to Tasmanian endemic genera below serves as an entry point to the species; the genera *Pontodrilus* through to *Megascolides* have tubular prostates, while *Zacharius* though to *Anisogaster* have prostates that are non-tubular.

Regulation Table of Characters of Tasmanian Genera - Family MEGASCOLECIDAE s. strict. (* endemic genera not yet known elsewhere).

Genus	Prostates	Nephridia	Setae	Other Characteristics
1. *Pontodrilus*	Tubular	Holoic avesiculate	8	Nephridia absent from anterior segments
2. *Graliophilus*	Tubular	Holoic avesiculate	8	Nephridial bladders absent
3. *Vesiculodrilus*	Tubular	Holoic vesiculate	8	Nephridial bladders present
4. *Amphimiximus* *	Tubular	Holoic vesiculate	8	Multiple spermathecae
5. *Diporochaeta*	Tubular	Holoic a/vesiculate	>8	Classical genus
6. *Provescus* *	Tubular	Holoic avesiculate	>8	Doubled oesophageal gizzards
7. *Megascolides*	Tubular	Meroic a/vesiculate	8	Classical genus
8. *Zacharius*	Tubulo-racemose	Holoic a/vesiculate	8	Simple holoic, with or without bladders
9. *Woodwardiella*	Racemose	Holoic avesiculate	8	Holoic nephridial tufts (possibly meroic?)
10. *Perionychella*	Tubulo-/racemose	Holoic a/vesiculate	>8	Classical genus
11. *Tassiedrilus* *	Tubulo-racemose	Holoic avesiculate	>8	Multiple intestinal gizzards
12. *Hypolimnus* *	Tubulo-racemose	Holoic vesiculate	>8	Multiple oesophageal gizzards
13. *Notoscolex*	Tubulo-/racemose	Meroic avesiculate	8	Classical genus, (dorsal pores present)
14. *Nexogaster* *	Racemose	Meroic avesiculate	8	Multiple intestinal gizzards, dorsal pores present
15. *Cryptodrilus*	Tubulo-/racemose	Meroic vesiculate	8	Nephridial bladders, (dorsal pores absent)
16. *Aporodrilus *?*	Tubulo-racemose	Meroic avesiculate	8	No bladders, dorsal pores absent
17. *Gastrodrilus* *	Tubulo-racemose	Meroic avesiculate	8	Multiple intestinal gizzards, dorsal pores absent
18. *Caecadrilus* *	Tubulo-racemose	Meroic avesiculate	8	Intestinal caeca (Flinders Island)
19. *Anisochaeta*	Tubulo-/racemose	Meroic a/vesiculate	>8	Classical genus
20. *Aceeca* *	Tubulo-racemose	Meroic vesiculate	>8	Dorsal pores absent, alternating bladders
21. *Scolecoidea* *	Tubulo-/racemose	Meroic avesiculate	>>8	Hyersetose, paired spermathecal diverticula
22. *Hickmaniella* *	Tubulo-racemose	Meroic avesiculate	>8	Single intestinal gizzard in 19-20
23. *Retrovescus* *	Tubulo-racemose	Meroic avesiculate	>8	Multiple intestinal gizzards, penial setae
24. *Anisogaster* *	Racemose	Meroic avesiculate	>8	Multiple intestinal gizzards + typhlosole

[Note only two forms of prostates: tubular and “non-tubular”, two forms of nephridia: holoic and “non-holoic”, and two forms of setae: lumbricine and “non-lumbricine” together form the basis of this new classification]

Pontodrilus Perrier, 1874

Pontodrilus Perrier, 1874: 1582; Beddard, 1895: 468; Michaelsen, 1900: 179, 1910: 83; Stephenson, 1930: 833-834; Jackson, 1931: 93; Lee, 1959: 335; Gates, 1972: 47.

Plutellus (Pontodrilus); Michaelsen, 1922: 22; 1928: 116.

Diagnosis Setae lumbricine (i.e., eight per segment). Dorsal pores absent. Female pores paired on 14. Male pores paired on 18 combined with pores of tubular prostates. Gizzard rudimentary in 5 or absent; extramural calciferous glands absent; typhlosole absent. Nephridia avesiculate holoic, lacking in pre-clitellar segments. Spermathecae two or four pairs with clavate or multiloculate diverticula. Penial setae absent or present.

Type-species *Lumbricus litoralis* Grube, 1855, (syn. *Pontodrilus marionis* Perrier, 1874), originally found on shoreline of Mediterranean at Villafranca, Nizza, and Marseilles, in southern France, (for full synonymy, see Easton, 1984: 114).

Other included species *Pontodrilus lacustris* (Benham, 1903) from NZ, *P. agnesae* Stephenson, 1915 from Sri Lanka, P. *sinensis* Chen & Zhifang, 1977 from China, and *P. primoris* sp. nov. - the first record of an endemic *Pontrodrilus* from Tasmania.

Distribution Circummundane – on shorelines in the tropics and warmer parts of continents and islands in the Atlantic, Pacific and Indian Oceans, from the Mediterranean, South China, and Red Seas; lacustrine in NZ; terrestrial in Sri Lanka and China. For Australia, Jackson (1931) reported *P. litoralis* (as varieties of *P. albanyensis* Michaelsen, 1907 and *P. bermudensis* Beddard, 1891) from WA, while Easton (1984: 115) had further records from Torres Strait to Port Kembla; this species is also known from Christmas Island (see Blakemore, 1999), and Blakemore (unpublished) has described *P. litoralis* from Apple Tree Bay and Botany Bay, NSW (specimens ANIC:RB.98.2.60, AM:W24571, AM:W197309).

Remarks *Pontodrilus* is ascribed to the family Megascolecidae rather than Acanthodrilidae where it had been placed by some earlier authors. This genus, characterized by a lack of nephridia in anterior segments, was last reviewed by Lee (1959) who recognized five species: the littoral *Pontodrilus litoralis* Grube,1855, *P. bermudensis* Beddard, 1891, and *P matsushimensis* Iizuka, 1898, as well as lacustrine *P. lacustris* (Benham, 1903) free-swimming in Lake Wakatipu, New Zealand at

depths of 100-400m, and terrestrial *P. agnesae* Stephenson, 1915 from Sri Lanka. Easton (1984) revised the species, placing all three littoral species in synonymy of *P. litoralis* and remarking that the other species, plus *P. sinensis*, are sometimes (erroneously) placed in the allied genus *Plutellus* by some authors. Although the non-littoral species may be transferable to new genera, none would comply with *Plutellus* following revision of this genus (see Blakemore, 1994). Easton (1984) stated:

> "*Pontodrilus lacustris*, which has been recorded from lacustrine habitats, may be distinguished from *P. litoralis* by having 4 pairs of spermathecae and penial setae; *P. agnesae*, from terrestrial habitats, can be distinguished by the presence of penial setae. *P. sinensis* is either terrestrial or lacustrine - the original description lacks detail but the type locality is 250 km from the coast - and can be distinguished from *P. litoralis* by possessing seta b (? and a) on xviii and four pairs of seminal vesicles in ix-xii. The relationship between the 4 species of *Pontodrilus* are unknown."

The origin of *Pontodrilus* is undetermined although Gates (1972: 47) guessed it to be in the region of Australia-New Zealand. Two distinct species are known from the latter country, one is lacustrine, the other - the cosmopolitan *P. litoralis*, is littoral and is shared with many other parts of the world including Australia. Having a second littoral species from Tasmania puts Australia, with its huge and often tropical coastline, in contention for the provenance of the genus.

Little is known of the life histories nor possible means of distribution of the species. It may be speculated that the cocoons of *P. litoralis*, like other life stages, are euryhaline and are dispersed by ocean currents (Stephenson, 1930: 662; Lee, 1969: 351-353; Lee, 1985: 66). Easton's synonymy of divers forms under *P. litoralis* suggests that either there is frequent global recruitment of this species, the mechanisms of which are difficult to explain, or that despite being highly variable intraspecifically it has remarkably conservative morphology, or possibly that this synonymy is too broad. Gates (1972: 48) stated that "Absence of geographic variation does suggest that transportation may have been recent", although a converse view, especially when *Pontodrilus* is more correctly placed in Megascolecidae, is of rather primitive species that may have precursors close to the original forms of this family, living in a constant littoral habitat. Stephenson (1930: 834) thought "the terrestrial and limnic species of the genus may owe their origin to the survival and modification

in a new environment of colonies accidentally transported from the shore". Extension of these ideas raises interesting possibilities for the origins of the family Megascolecidae, especially as these relate to zoogeography and the separation of the continents through geological time.

Pontodrilus primoris sp. nov.

Fig. 9.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K1285, Ansons Bay beach, NE Tasmania, ca. FQ 034 541, 23.iii.1978, Coll: Dr P.R. Last of CSIRO, "ex I.S.R. Ichthyological collection", "in sand", (mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Body: with quadrangular tail and four plates at pygomere. Length: 120 mm. Width: ca. 4 mm. Segments: 118 with much secondary annulation. Colour: unpigmented. Prostomium: epilobous. Clitellum: not developed although body constricted in 14-17. Dorsal pores: absent. Nephropores: at anterior of segments in b lines, small in 9,10-11, larger from 12. Setae: small, 8 per segment in regular rows; ab absent from 18. Spermathecal pores: 7/8 and 8/9 in b lines. Female pores: paired on 14 anterio-median to setae a. Male pores: paired superficial in position of deleted b setae on 18. Genital markings: none developed in anterior although faint paired pore-like structures seen in ab or just median of a lines in 4/5-7/8 (possibly artefactual or due to loose cuticle); widely paired discs in ab lines in 18/19 and 19/20 with weak furrows intervening between each set of discs.

INTERNAL ANATOMY

Septa: 5/6-13/14 increasingly thickened, thereafter membranous. Gizzard: absent (pharynx in 4-7 is same thickness without modification). Oesophagus: not especially dilated. Nephridia: avesiculate holoic; absent from anterior as no nephridia nor other structures seen in 5-13 (although nephropores appear from 9,10), in 14-20 nephridial tubules associated with yellow discoid fatty body increasingly developed, each with tortuous loop connected by mesentery and exiting to nephropore; from 20 nephridia are simple holoic. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts increasingly developed in 9-13; supra-oesophageal weak in

12-14. Spermathecae: paired in 8 and 9 with small saccular ampulla tapering to duct that is occupied on one side by thick, bifid or sessile multiloculate diverticulum, at least one of which has spermatozoal iridescence. Male organs: holandric, non-iridescent testis sheets in 10 and 11, paired posterior sperm-funnels present; paired seminal vesicles racemose in 11 and 12 anteriorly. Ovaries: small, palmate in 13, individual eggs not visible but oviducts present; small paired ovisacs in 14 anteriorly. Prostates: tubular coiled in 18 with duct, ca. 1 mm long, and as thick as gland but not muscular; penial setae absent. Intestine: origin in ½15; typhlosole absent; gut entirely filled with beach sand - mainly mineral quartz.

REMARKS

Pontodrilus primoris differs from Easton's (1984: 114) characterization of the permissible variability of *Pontodrilus litoralis* (Grube, 1855), and its synonymous species, on these points:

1/. Size and setal counts are at extreme range of 32-120 mm by 2-4 mm and 78-120.

2/. Clitellum possibly weakly developed in 14-17 (cf. annular in 13-17,18).

3/. Setal ratios differ substantially (cf. Easton, aa:ab:bc:cd:dd:U = 11:4:10:9:25:82).

4/. Female pores not in setal b lines.

5/. Genital markings not single, median in several of furrows 11/12-16/17 and/or (18/)19/20/21.

6/. Nephropores in b lines from 9,10 rather than in ab lines from 13,14 and not deleted on 14 where the female pores occur.

Specimens of *P. litoralis* described by the author from Apple Tree Bay and Botany Bay, NSW differ slightly from Easton's diagnosis, but conform closely to Gates' (1974: 47-48) precis of *Pontodrilus bermudensis* (now in the synonymy of *P. litoralis*), as the female pores are closer to setal a lines, the clitellum is saddle-shaped, male pores are laterally bordered by clefts, marking are midventral in 12/13 and 19/20, and the spermathecal diverticula are clavate and longer than the ampullae. Jackson (1931) describes *P. albayensis* (now also in the synonymy of *P. litoralis*), from W.A. that has "small oval papillae between the setal lines a and b in furrow 18/19 and two unpaired ventral-median spindle-shaped papillae in furrows 17/18 and 18/19", but these specimens also have clavate spermathecal diverticula. Compared to both these species, subsequently synonymized in *P. litoralis* by Easton (1984), the unique features of *P. primoris* appear to be the genital markings widely paired in 18/19 and

19/20 in ab, the sessile bifid or multiloculate spermathecal diverticula, and lack of muscularization of either oesophagus or prostate ducts.

Because only a single, preserved specimen is available, it is not known whether *P. primoris* displays the bright bioluminescence as is found in *P. litoralis*. Having genital markings and spermathecal iridescence suggests that this species is amphimixic rather than parthenogenic. Further investigation is required to determine the abundance, distribution, ecology, and habits of this species.

ETYMOLOGY primoris, Latin - 'first, foremost' referring to the first *Pontodrilus* recorded from Tasmania, collected by Dr Last.

DISTRIBUTION AND HABITAT

Ansons Bay, NE Tasmania, in beach sand - this habitat and the sand contents of the gut suggest that this worm's diet consists of microscopic algae, and interstitial microfaunae. It is not recorded whether this specimen was collected above the high water mark, and if so whether there was an accumulation of organic debris, nor the level and salinity of the local water table.

Graliophilus Jamieson, 1971

Graliophilus Jamieson, 1971: 472; 1974: 259.

Diagnosis: Setae 8 per segment. Combined male pores and pores from tubular prostates paired on 18. Nephridia avesiculate holoic discharging in series, sometimes replaced in anterior segments by tufted pharyngeal nephridia. Calciferous glands and intestinal typhlosole present or absent. Spermathecae five or fewer pairs each with one or more simple diverticula.

Etymology apparently an anagram of the North American genus *Argilophilus* Eisen.

Type species *Graliophilus georgei* Jamieson, 1971 from WA.

Distribution south-western WA, SA (Kangaroo Is.), southern NSW, Tasmania, (Victoria?). In Tasmania the genus is mainly confined to the Central and N/NE districts, with single (doubtful?) records from SE and King Island.

Included species Indeterminate as the nephridial states of several earlier described species, especially from Victoria, have yet to be determined (cf. *Vesiculodrilus*). Five species are described from WA, one from SA (*Graliophilus inconstans* (Jamieson) **syn. nov.**), two from NSW, and one from Tasmania with a further three previously described species with uncertain nephridial status. An additional four Tasmanian species are newly described below.

Remarks *Graliophilus* is one of several genera that were subsumed by Jamieson's (1976) expanded definition of *Diporochaeta*, but which appears to have been restored in a later paper where, for unexplained reasons, Jamieson (1994: 177) has 'tubuloracemose' prostates in his data matrix for *Graliophilus georgei*, the type-species of this genus, despite it being described by Jamieson (1971: 473, 477, 500) with tubular prostates, as confirmed by Jamieson (1974: 259). Thereby the findings from this cladistic analysis are invalidated (see also Blakemore, 1998: 660). (In the same data matrix Jamieson, 1994: 177 made similar errors for the prostates of several other species, including the type-species of *Diporochaeta*, and of his genus *Hiatidrilus* that is, nevertheless, possibly a junior synonym of *Graliophilus* as mooted by Blakemore, 2000c: 193). It is here assumed that *Graliophilus georgei* has tubular prostates. If it did in fact have non-tubular prostates then this genus may be synonymous with a revised *Woodwardiella* Stephenson, 1925, or take priority from

Zacharius, and included species that do have tubular prostates would need to be transferred to another available genus.

Despite the reservations mentioned above, this genus is restored with the diagnosis and distribution based on those of Jamieson (1974: 259-260) except that species with five pairs of spermathecae are again permitted, and SA is now included in its range. Jamieson, (1974: 260) had "unequivocally" placed his *Graliophilus montiskosciuskoi*, a lumbricine species with five pairs of spermathecae, in *Perionychella* - despite this latter genus being reserved for perichaetine species with non-tubular prostates, but this species is now restored to its original genus. The range includes Kangaroo Island SA, because Jamieson described a highly variable species from there as *Perionychella (P.) inconstans* which, nevertheless, appears to comply with the diagnosis above.

Related genera with the relatively primitive characteristics of tubular prostates, holoic nephridia and lumbricine setae are: *Sebastianus* Blakemore, 1997 that differs on current knowledge primarily by having extramural calciferous glands on long stalks in segments 11 and 12; and, with the acqusition of nephridial bladders, *Plutellus* where the nephropores have regular alternation, or *Vesiculodrilus* were they are in more regular series.

Graliophilus adsiduus sp. nov.

Fig. 10.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1777, Mt Arthur, N Tasmania, EQ 255 317, 630 m, 17.v.1991, R. Mesibov, from rainforest worms found along creek, (mature, dissected and sketched).

PARATYPES: (P1) 14:1122, Mt Victoria Forest Reserve, N Tasmania, EQ 662 225, 720 m, 22.vi.1992, R.D. D'Orazio, wet sclerophyll to rainforest, (mature, dissected); (P2) 14:3064, same details as (P1), (mature, posterior-amputee); (P3-4) 14:3063, same details as (H), (two subadults that superficially agree).

EXTERNAL FEATURES

Body: stout with distinctive spade-shaped tail that is faintly canaliculate dorsally. Lengths mm: (H) 95, (P1) 156, (P2) 100+, (P3) 95, (P4) 90. Width: ca. 3.5 mm. Segments: (H) 122, (P1) 136, (P3 and P4) 145. Colour: dark brown pigmentation dorsally and laterally to setal c lines, ventrum and setal auriolae pale, clitellum buff. Prostomium: open epi-tanylobous, dorsally furrowed to 2/3. Clitellum: ½13-16 and just encroaching on 17. Dorsal pores: from 3/4 (or 2/3 in P4). Setae: 8 throughout; c, d and sometimes b irregular on tail. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired on 14. Male pores: in setal a lines on small papillae. Genital markings: mid-ventral circular pads in 10/11-12/13 (H) or only in 12/13 (P1 and P2); small paired discs in b lines conjoined by tumescent pads in 17/18 and 18/19, larger, more closely paired discs in a lines in 19/20 and 20/21 (H, P1-2).

INTERNAL ANATOMY

Septa: 7/8-13/14 with some thickening, 11/12 thickest. Gizzard: in 5 small but muscular. Oesophagus: somewhat dilated in all of 9-16 but especially so in 14 and 15 where it is internally lamellate possibly forming calciferous glands. Nephridia: avesiculate holoic in c lines; not tufted anteriorly. Vascularization: dorsal blood vessel single, large hearts 10-12; supra-oesophageal vessel only noted in 14 and 15. Spermathecae: five pairs in 5-9, ampullae taper to ducts each with small, ectal diverticulum. Male organs: holandric, testes iridescent in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: palmate in 13. Prostates: tubular with anterior loop in 17-21; penial setae present (ca. 1mm long, in P1 these have flared, curved and bifid tips). Intestine: from 17; typhlosole absent; gut contains organic matter.

REMARKS

Graliophilus adsiduus with five pairs of spermathecae is similar to *G. benlomondi* and *G. praestringor*, however the distribution of the intersegmental genital markings, especially those mid-ventrally in the anterior in *G. adsiduus*, appear to distinguish these taxa. *Graliophilus adsiduus* is also remarkable close morphologically to *Diporochaeta kershawi* except for its lumbricine setae throughout.

ETYMOLOGY: adsiduus, Latin - "continual", for the lumbricine setae throughout.

DISTRIBUTION AND HABITAT

N Tasmania: Mt Arthur from rainforest along creek, and Mt Victoria Forest Reserve in wet sclerophyll.

Graliophilus ? bassanus (Spencer, 1895), comb. nov.

Fig. 11

Megascolides bassanus Spencer, 1895: 46-47, figs. 34-36; Jensz & Smith, 1969: 99.

Plutellus bassanus ; Michaelsen, 1900: 169.

Perionychella (subgenus?) bassana ; Jamieson, 1974: 253-255.

MATERIAL

TYPES: not present in MOV, presumed lost (Jensz and Smith, 1969: 99).

SPECIMENS: none found.

This description is taken from Spencer's original.

EXTERNAL FEATURES

Length: 85 mm. Width: ca. 3 mm. Segments: ? Colour: ? Prostomium: prolobous. Clitellum: distinct, annular on anterior half of 14 then saddle-shaped extending to ab in ½14-19. Dorsal pores: from 4/5(?). Setae: 8 throughout; cd twice as wide as ab. Nephropores: in c lines (Spencer adds an exclamation mark at this for some reason). Spermathecal pores: in 7/8 and 8/9 in ab (incorrectly located in fig 34 in 6/7 and 7/8 - fig 36 shows spermathecae in 8 and 9). Female pores: paired on 14. Male pores: on papillae on 18 in a. Genital markings: median ventral patch on 17 and 18, that on 17 larger than that on 18 between the male pores; paired papillae on 19 in setal a lines conjoined by median ridge.

INTERNAL ANATOMY

Gizzard: in 5. Oesophagus: dilated in 13 and 14, not calciferous; "swollen out" in front of intestine. Nephridia: holoic, large with nephrostomes. Vascularization: dorsal blood vessel single; hearts (and commisurals) 8-13; no continuous supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9, ampulla saccular, diverticulum simple less than half length of ampulla. Male organs: holandric, funnels in 10 and 11; seminal vesicles racemose anteriorly in 10, 11 and 12. Ovaries: in 13. Prostates: tubular, small and coiled in 18; penial setae not noted. Intestine: from 19; typhlosole not noted.

REMARKS

The prostates are described as "small and coiled" and figured as tubes that fold back on themselves, therefore they are assumed to be tubular. It is not known whether the large nephridia have bladders or not (Spencer's exclamation mark may indicate that the nephropores are large and obvious). On the assumption that it lacks bladders,

it is attributed to *Graliophilus* rather than *Vesiculodrilus*, although it is unusual in either genus to have a saddle-shaped clitellum (cf. *G. tripapilatus*) or a prolobous prostomium; further material is required for full characterization at which time it may be transferred to *Vesiculodrilus* or some other genus. It is believed that Spencer placed this species in *Megascolides*, a meroic genus, only because the clitellum covered more than four segments which at that time partially defined this genus.

DISTRIBUTION AND HABITAT

King Island in Bass Straits.

Graliophilus benlomondi sp. nov.

Fig. 12.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3599, village at summit of Ben Lomond, NE Tasmania, 41°35'S.147°40'E, ca EQ 568 005, 1,500 m, 23,iii,1997, Rob Blakemore, Adrian Pinder and Richard Marchant, from moist clay-loam beside creek, (mature, dissected and figured).

PARATYPES: all same details as H, ANIC:RB.97.3.7 (P1), (mature, dissected); TM:K1546 (P2), (mature, dissected); 14:3600 (P3), (mature dissected); ANIC:RB.97.3.8 (P4), (mature); TM:K1547 (P5), (mature); 14:3600 (P6-P9), (one mature, one aclitellate mature and two subadults, one a posterior regenerate).

EXTERNAL FEATURES

Lengths mm: (H) 65, (Ps) 50-75. Width: ca. 2 mm. Segments: (H) 93, (P1) 98, (P2) 90. Colour: anterior dorsum to ca. 25 and last 16 segments of tail puce, first seven segments iridescent, rest of body pale unpigmented with faint dark dorsal line; clitellum orange. Prostomium: open epilobous. Clitellum: ½13,14-16. Dorsal pores: reduced or minute and difficult to see, not found till 10/11 in H, commencing from 4/5-9/10 in some paratypes where detected by mucal ejecta, (or, in P2, by nematode tail protruding from 8/9); occluded on clitellum. Setae: 8 throughout in regular rows. Nephropores: minute in c lines. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired on 14 in common field. Male pores: on 18 on small mounds in ab lines. Genital markings: small mid-ventral discs posteriorly in 7-9 (H, P2-3, P6, P8-9), or 8 and 9 (P1, P4-5, P7); paired discs in a lines in 16/17 (not P6), wider in ab lines in 17/18 and 18/19 where tumid pads intervene; in a lines in 19/20 (not P3, P6), and paired (in H) or analogue (P2, P5) in 20/21.

INTERNAL ANATOMY

Septa: 7/8-12/13 only slightly thickened. Gizzard: weak in 5. Oesophagus: not especially dilated, darkened in 7-17. Nephridia: avesiculate holoic exiting in c lines with large pre-septal funnels in b lines; not tufted. Vascularization: dorsal blood vessel single but broad, hearts 10-12 with connectives to supra-oesophageal vessel that runs 6,7-13. Spermathecae: five pairs in 5-9, ampullae ovoid tapering to short ducts, each with medium sized ectal diverticulum. Male organs: holandric, testes iridescent in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: in 13

as clusters of large egg strings; small paired ovisacs in 14. Prostates: tubular in 17-22; penial setae present. Intestine: from ½17 with neither typhlosole nor intestinal gizzards; gut contains fibrous organic matter and gritty soil.

REMARKS

Graliophilus benlomondi is characterized by its medium size (50-75 mm), epilobous prostomium, minute dorsal pores, five pairs of spermathecae, and the distributions of the genital markings. Dorsal pores are similarly reduced in *G. tripapillatus* and this adaptation, more usually found in aquatic species, is possibly partly a defence against nematodes, one of which was seen protruding from the dorsal pore in specimen P2 of *G. benlomondi*.

ETYMOLOGY: after type-locality.

DISTRIBUTION AND HABITAT

N Tasmania: Ben Lomond mountain, from summit in moist clayey loam soil.

Graliophilus cooperi sp. nov.

Fig. 13.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:959, Rowallan, Dublin Plain (dry sclerophyll, on Private Property), DP 385 833, 575 m., 6.x.1992, M. Cooper and R.D. D'Orazio, dry sclerophyll, (mature, dissected and drawn).

PARATYPES: (P1) ANIC:RB.96.11.13, same collection details as H, (mature, dissected); (P2) 14:1776, same collection details as H, (mature, dissected); (P3) 14:3578 (ex 14:414), Lake Rowallan, Mersey White Water Forest Reserve, DP 351 808, 445 m, 6.x.1992, R.D.D. and M.C., dry sclerophyll with low dense heath , (mature dissected); (P4) 14:3582 (ex 14:419), same details as H, (mature that agrees externally).

SPECIMENS: 14:967, Mole Creek, DP 443 876, Devil's Gullet State Reserve, DP 443 876, 1140 m, 5.x.1992, R.D.D. and M.C., mountain plateau grassland, (seven mature specimens, one dissected); 14:977, Mole Creek, DP 443 876, Lake MacKenzie Rd., DP 362 942, 540m, 5.x.1992, R.D.D. and M.C., wet sclerophyll, (six mature specimens, one dissected)

EXTERNAL FEATURES

Lengths mm: (H) 65, (P1) 55, (P2) 50. Width: ca. 2.5 mm. Segments: (H) 128, (P1) 127, (P2) 123. Colour: anterior dorsum light brown, clitellum buff, remainder of body pale. Prostomium: tapering open epilobous. Clitellum: 14-17, annular. Dorsal pores: from 4/5. Setae: 8 per segment in regular rows, cd move more dorsally in tail and become slightly irregular. Nephropores: in d lines, at least after clitellum (in H, P3) Spermathecal pores: in 7/8/9 in a lines. Female pores: widely paired on 14 just in front of setae a. Male pores: small superficial pores on 18 in setal a lines. Genital markings: paired, elongate pads centred close to a lines and obscuring intersegmental furrow in 13/14; paired elongate pads within tumid discs on either side of male pores on 18 (H-P1 have additional faint mid-ventral disc between male pores, and some Mole Creek specimens have two pairs of markings either side of male pores). All type specimens except (P3) have deep, longitudinal cleft below ventral setal arc on 14.

INTERNAL ANATOMY

Gizzard: muscular barrel in 5. Oesophagus: dilated in 12-17, not calciferous; gut narrows in 18 and 19, appearing valvular but is also compressed by prostates.

Nephridia: avesiculate holoic, nephridial tubules in c lines sending ducts to d lines; not tufted. Vascularization: hearts in 10-12; supra-oesophageal vessel weakly developed. Spermathecae: two pairs in 8 and 9; saccular ampulla on long duct which has dilated spongy bulb ectally and iridescent clavate diverticulum as long as duct. Male organs: holandric, testes and funnels in 10 and 11 in mucus; seminal vesicles paired racemose, small in 9, larger in 12. Ovaries: numerous egg strings in 13; ovisacs weakly developed in 14. Prostates: tubular 18-19, much coiled; penial setae present ca. 1 mm long. Intestine: dilated from 20; typhlosole absent; gut contains dark, gritty soil.

REMARKS

Unique characters of *Graliophilus cooperi* are two pairs of distinctively shaped spermathecae, the elongate genital markings in 13/14 and in 18, nephropores in d lines, and the posterior commencement of the atyphlosolate intestine in 20 (cf. *G. bassanus* in 19). The Mole Creek specimens agree externally and internally with the above description, the largest is 80mm long, others are 60-65 mm, but they were not all as thoroughly inspected.

ETYMOLOGY: after the collector.

DISTRIBUTION AND HABITAT

N Tasmania: Lake Rowallan and Mole Creek, from dry or wet sclerophyll and mountain grassland.

Graliophilus ? decathecus (Michaelsen, 1910) comb. nov.

Fig. 14.

Plutellus decatheca Michaelsen, 1910: 81-83, figs. XIV-XVI.

Perionychella (subgenus?) decatheca ; Jamieson, 1974: 255.

(Non *Plutellus decathecatus* Altman, 1936).

MATERIAL

TYPES: missing (from Hamburg Museum?), (Reynolds & Cook, 1976: 93).

SPECIMENS: none known.

This description from Michaelsen (1910) is based on a single mature specimen.

EXTERNAL FEATURES

Body: with secondary annulation in the fore-body and dorsal canal throughout body to the prostomium. Length: 100 mm. Width: 6-10 mm. Segments: 164. Colour: light golden-grey or unpigmented. Prostomium: closed epilobous, short but broad. Clitellum: annular 14-18. Dorsal pores: from 4/5. Setae: 8 throughout widely spaced, in the hind-body the dorsal setae move closer together. Nephropores: ? Spermathecal pores: in 4/5-8/9 in a lines. Female pores: in furrow on 14. Male pores: on 18 on papillae in ab. Genital markings: paired transverse papillae from just lateral of b and extending almost to mid-ventrum postsetally in 17 and 19-21, those in 17 much larger than the others.

INTERNAL ANATOMY

Septa: 5/6 delicate, 6/7-15/16 thickened, especially 9/10-11/12. Gizzard: large in 5. Oesophagus: slightly dilated and vascular in 14 and 15, not calciferous. Nephridia: holoic; bladders not noted. Vascularization: dorsal blood vessel single; last heart 13; supra-oesophageal vessel not noted. Spermathecae: five pairs, ampulla saccular, diverticulum small, simple. Male organs: holandric, testes and funnels in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13. Prostates: tubular in 18; penial setae ca. 1.2 mm long, almost straight with small hook at tips. Intestine: origin ?; typhlosole not noted.

REMARKS

Since nephridial details are unavailable and type material is lost it is not possible to adequately characterize this species, nor even to confirm it in *Graliophilus* rather than *Vesiculodrilus*. Michaelsen considered his species close to *Vesiculodrilus insularis* (Spencer, 1895), and it also resembles parts of the *V. mortoni* species

complex and is especially similar to *V. prospectus*, however it differs from these other taxa on the description of its segmental markings. Unless further material is located, it must be considered a rather dubious species.

DISTRIBUTION AND HABITAT

From the vicinity of Hobart.

Graliophilus ellisii (Spencer, 1895) comb. nov.

Fig. 15.

Cryptodrilus ellisii Spencer, 1895: 42-43, figs. 22-24; Jensz & Smith, 1969: 87.

Plutellus ellisi ; Michaelsen, 1900: 172.

Perionychella (subgenus?) ellisi ; Jamieson, 1974: 257.

MATERIAL EXAMINED

SYNTYPES:MOV:F40032 (previously NMV:G32), labeled in Spencer's hand, "C sp 9T." and "Dee Bridge in damp soil on log, Jan/[18]93", (six specimens in poor condition, dried and brittle and yielding little useful information; two were aclitellate; four were previously dissected, probably by Spencer). Note: Jamieson (1974: 257) erroneously stated that G32 consisted of only four syntypes.

MOV:F40033 (previously NMV:G33) labeled "C. sp 10T", "C. ellisii", and "Dee Bridge T. Jan/[18]93", this jar had contained five specimens which are now lost (Jensz & Smith, 1969:).

SPECIMENS: none found despite searches of type-locality by the current author. The following description is from Spencer (1895) and from inspection of syntypes.

EXTERNAL FEATURES

Body: small with mid-dorsal canal. Lengths mm: 25-35 (dried syntypes ca. 20 mm). Width: ca. 3 mm. Segments: ? Colour: dorsum dark puce before clitellum, brown behind this and dull flesh colour at posterior; ventrum lighter; clitellum pale. Prostomium: epilobous, dorsally furrowed. Clitellum: annular ½13,14-16. Dorsal pores: 5/6. Setae: 8 throughout; setal ratio ab<bc:cd:dd. Nephropores: ? Spermathecal pores: in 6/7-8/9 in b lines. Female pores: paired on 14. Male pores: on papillae on 18 in or just ventral of b lines. Genital markings: paired markings, presetal in 10 and 11 in ab lines; paired in 17/18 and 18/19 in ab lines; paired presetal in 20 and 21 in ab lines.

INTERNAL ANATOMY

Gizzard: in 5. Oesophagus: dilated in 14 and 15 forming paired calciferous glands. Nephridia: holoic, nephridial bladders not found (nor noted by Spencer). Vascularization: dorsal vessel single; last hearts in 12; supra-oesophageal vessel not noted. Spermathecae: three pairs in 7-9, diverticulum simple and small compared to the saccular ampulla. Male organs: holandric, testes and funnels in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13; large ovisacs in 14. Prostates:

tubular, coiled in 17-20; penial setae not noted. Intestine: from 17; typhlosole not noted.

REMARKS

Graliophilus ellisii is a small species with three pairs of spermathecae in 7-9 exiting in b lines, it is somewhat reminiscent of *Vesiculodrilus symmetricus* and *V. tunnackensis*. Syntypes in MOV are in poor condition, and although holonephridia are present, nephridial bladders were not demonstrable (pers. obs.) therefore this species is placed in *Graliophilus* rather than *Vesiculodrilus*. One syntype specimen appeared to have a ventral peristomial cleft but this was not seen in others.

DISTRIBUTION AND HABITAT

Central Tasmania: Dee Bridge, "under logs and stones".

Graliophilus praestringor sp. nov

Fig. 16.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:852, Dazzler Range, Tattersall Road, N Tasmania, EQ 773 359, 440 m, 29.vi.1992, R.D. D'Orazio and A. Mitchell, wet sclerophyll, (aclitellate mature, dissected and figured).

PARATYPES: (P1) 14:1120, Dazzler Range, Kerrisons Road, EQ 755 376, 415 m, 29.vi.1992, R.D. D'Orazio and A. Mitchell, wet scleropyll, (posterior regenerate from 85, dissected and drawn); (P2) 14:3075, same details as P1, (aclitellate, mature, posterior amputee); (P3) 14:3076, same details as P1, (subadult); (P4) 14:3077, same details as P1, (mature); (P5-P6) 14:1119, Dazzler Range, Kerrisons Road, EQ 756 389, 510 m, 29.vi.1992, R.D. D'Orazio and A. Mitchell, rainforest, (one subadult and one juvenile); (P7-P8) 14:739, Dalgarth Forest Reserve, Wallaby Creek, N Tasmania, EQ 734 329, 30.vi.1992, R.D. D'Orazio, rainforest, (four specimens, one subadult and one juvenile that superfically agree, plus two immatures); (P9-11) 14:1114, Sideling Range, EQ 344 354, 555 m, 15.vi.1992, R.D. D'Orazio and M. Cooper, logged rainforest, (three matures).

SPECIMENS: (S1) 14:3092, Mt Arthur, N. Tasmania EQ 255 317, 630 m, 17.v.1991, R. Mesibov, (mature, dissected and figured); 14:1730, Mt Arthur, EQ 246-310, 750 m, 1991, R. Mesibov, (six specimens, one previously dissected); 14:3096, Mt Arthur, 21.iii.1984, R.H. Green, (two matures and an immature); 14:2350, Mt Arthur, in rainforest, 16.ii.1972, J. Simmons, labeled "*Perionychella hobartensis* det. G. Dyne", (four matures and one immature).

EXTERNAL FEATURES

Body: robust, tail club-shaped often with weak dorsal canal. Lengths mm: (H) 150, other complete mature paratypes range 200-255. Width: 3.5-6.8 mm. Segments: (H) 140, (P1) 111+, (P3) 145. Colour: claret dorsum and flanks to setal c lines where abrupt change to pale colour, intersegments and setae pale; clitellum buff. Prostomium: tanylobous, deeply furrowed to first intersegment and weakly continued to 2/3. Clitellum: ½13-½17 (P1 and P4). Dorsal pores: from 4/5. Setae: 8 throughout, cd irregular posteriorly. Nephropores: not found (possibly small in c lines). Spermathecal pores: 4/5-8/9 in a lines often with slight markings. Female pores: paired on 14. Male pores: paired on 18 on papillae in ab. Genital markings:

slight paired markings almost as continuation of the spermathecal pore lines in 9/10 in a lines (eg. in H, P1-4, P7, P9-11), sometimes weakly repeated in 10/11 (eg. in H); paired circular pads in 16/17-18/19 approximately in line with the male pores and each faintly linked by tumid isthmus, but this whole field generally tumid; extra rhs analogue or paired markings in 19/20 (in P1, P9-11).

INTERNAL ANATOMY

Septa: 7/8-14/15 thickening. Gizzard: in 5 barrel-shaped but compressible. Oesophagus: dilated and vascularized in 9-16, insufficient to be considered calciferous. Nephridia: avesiculate holoic in c lines, not tufted anteriorly. Vascularization: dorsal blood vessel single, large hearts 10-12; supra-oesophageal vessel 7,9-12,13. Spermathecae: five pairs in 5-9, ampulla tapers to duct with small, ectal diverticulum. Male organs: holandric, testes iridescent and invested in mucus in 10 and 11; seminal vesicles paired, racemose in 9 and lingular in 12. Ovaries: palmate in 13. Prostates: tubular in 17-21; penial setae long (up to ca . 1.5 mm). Intestine: from 17; typhlosole absent; gut empty or with organic matter.

REMARKS

Graliophilus praestringor is morphologically close to *Graliophilus adsiduus*, it differs mainly in the distribution of genital markings around the male field including an extra pair in 16/17, those in 17/18/19 barely wider than male pores, and lack of markings in (19/)20/21, plus lack of mid-ventral markings in the anterior. The dorsal pore commencement one segment posteriorly and the less developed calciferous glands in 14-15 are possibly additional distinctions.

The Mt Arthur specimens (size range 120-160 mm) agree with the above description, including dorsal pores from 4/5. Some lack the anterior markings in line with the spermathecal pores while not gaining mid-ventral markings of sympatric *G. adsiduus*, however, the markings around the male fields are somewhat intermediate to those of *Graliophilus praestringor* and *G. adsiduus*. These specimens are possibly part of a complex with these other taxa, but more work is required to determine their taxonomic affinities.

ETYMOLOGY: praestringor, Latin noun - 'dazzler', for the type range.

DISTRIBUTION AND HABITAT

N Tasmania: Dazzler and Sideling Ranges, (Mt Arthur), from wet sclerophyll or rainforest soils.

Graliophilus tripapillatus (Jamieson, 1974) comb. nov.

Fig. 17.

Graliophilus (?) tripapillatus Jamieson, 1974: 261-263; Figs. 17, 32A; Plate 1.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K313, Tarraleah, 42°20'S.146°25'E, 27.v.1954, J.L. Hickman, "over pipeline", (dissected entire specimen, redrawn here).

PARATYPES: (P2-6) TM:K314-318, same collection details as H, (none previously dissected, only P3 dissected here); (P1, 7-9) BM(NH):1973.2.1-4, same details as (H), (not located in Museum); (P10-12) AM:W5203-5205, same collection details as (H), (not inspected).

SPECIMENS: none found despite searches of type-locality by the current author.

EXTERNAL FEATURES

Lengths mm: (H) 58, (P3) 61. Width: ca. 3 mm. Segments: (H) 134. Colour: unpigmented, uniform buff in alcohol, clitellum darker. Prostomium: tapering closed epilobous. Clitellum: ½13-½18, mostly saddle-shaped but annular anteriorly in 14. Dorsal pores: not visible in anterior, minute in posterior. Setae: 8 per segment in regular rows. Nephropores: small in c lines. Spermathecal pores: in 6/7/8/9 just median of a lines. Female pores: widely paired on 14 in front of setae a. Male pores: on minute papillae on 18 in ab. Genital markings: elongate pads extending as far as b lines encroaching to equators of adjacent segments and increasing in size posteriorly, mid-ventral in 15/16 (in H and P1 only) and/or in 16/17 and 19/20; smaller mid-ventral pads in aa in 17/18 and 18/19 bordering the male pores.

INTERNAL ANATOMY

Gizzard: large in 5, displaced to 6. Oesophagus: not especially dilated. Nephridia: avesiculate holoic in c lines, ducts in midbody are long and thin. Vascularization: hearts in 10-12 connected to supra-oesophageal vessel in 8-13. Spermathecae: three pairs in 7-9; saccular ampulla tapering without distinct duct, with small, iridescent diverticulum. Male organs: holandric, testes and funnels in 10 and 11 in mucus; small seminal vesicles racemose in 9 and 12. Ovaries: large in 13 with pair of pseudovesicles; ovisacs in 14. Prostates: much coiled tubular in 18-20; penial setae small. Intestine: from 18 with large typhlosole developing from 19,20; gut contains organic material.

REMARKS

Minor additions to Jamieson (1974) are the colouration, presence of small dorsal pores in the posterior, pseudovesicles in 13, and the gut contents. This species is diagnosed by the genital field, with its arrangement of five or four genital markings, and the clitellum saddle-shaped where it is suppressed by these markings.

DISTRIBUTION AND HABITAT

Central Tasmania: Tarraleah, found over hydroelectric channels or "pipeline".

Vesiculodrilus Jamieson, 1973

Vesiculodrilus Jamieson, 1973: 224; Blakemore, 2000b: 3; 2000c:193.

Perionychella (*Vesiculodrilus*) (part.); Jamieson, 1974: 221.

Pinguidrilus Jamieson, 1974: 263.

Diagnosis Size range 33-610 mm. Setae lumbricine (i.e., eight per segment). Male pores on 18 combined with pores of tubular prostates. Gizzard in 5 (or 6). Extramural calciferous glands absent (annular or pouched glands sometimes present). Intestinal typhlosole present or absent. Nephridia vesiculate holoic (i.e., one pair per segment with terminal dilations of the ducts forming large bladders); nephropores in a single row on each side near c lines or irregular in c lines and above. Spermathecae six or fewer pairs each with single, uniloculate diverticulum. Penial setae present or absent.

Type-species *Cryptodrilus frenchi* Spencer, 1892 from Victoria (as redescribed by Blakemore, 2000c:193-195).

Distribution Victoria, southern New South Wales, and Tasmania (all regions).

Included species Three NSW species, all from Mt. Kosciuszko region, are *Vesiculodrilus nivalis* Blakemore, 2000c, *Vesiculodrilus purpureus* Jamieson, 1973 [probably a junior synonym of *V. victoriae* (Spencer, 1892)], and *Vesiculodrilus vallis* Blakemore, 2000c. Of the Victorian species included in *Vesiculodrilus* by Jamieson (1973: 225), *Megascolides tisdalli* and *M. volvens*, both of Spencer, 1900, have setae reputedly increasing beyond 8 per segment (i.e., perichaetine) which would place them in *Diporochaeta*. Similarly, several perichaetine species from Tasmania, Victoria and Queensland listed under *Perionychella (Vesiculodrilus)* by Jamieson (1974a: 222) are excluded from *Vesiculodrilus* as defined above. Complete lists of species are currently precluded by lack of information on nephridial states from some earlier descriptions and checking of Victorian species, with five or fewer pairs of spermathecae, for presence or absence of nephridial bladders is beyond the scope of the present work. Nine species were previously known from Tasmania and a further 43 taxa are added below to bring the total to 52 taxa, making this the dominant genus in Tasmania.

Remarks *Vesiculodrilus* is restored to its original generic rank to signify its morphological (and zoogeographical) homogeneity, for the most recent discussion of this genus see Blakemore (2000c). For taxonomic "convenience", Jamieson

(1974:218) retained *Vesiculodrilus* as a subgenus of *Perionychella*, a prior genus which he stated had been "suppressed" for nearly sixty years, but both genera (along with several others) were later subsumed when Jamieson (1976b) greatly expanded his definition of *Diporochaeta*. Characteristics of holonephry, lumbricine setae and tubular prostates are all pleisiomorphic states that *Vesiculodrilus* shares with *Graliophilus* and its probable junior synonym *Hiatidrilus*, and with *Fletcherodrilus*, *Plutellus*, and *Sebastianus* - indicating the relatively primitive nature of these genera. Acquisition of nephridial vesicles in *Vesiculodrilus* , *Fletcherodrilus* and *Plutellus* is probably apomorphic and the latter genus, which is confined to central coastal NSW, is further distinguished by regular alternation of nephropores and extramural calciferous glands (see Blakemore, 1994a,b; 2000c). *Fletcherodrilus* typically has unpaired male and spermathecal pores (this genus, incorrectly cited, first as "gen. nov." then as an Emended name, was nevertheless retained by Jamieson (1994:178) "at least for convenience"). Avesiculate *Sebastianus* has autapomorphic extramural calciferous glands in segments 11 and 12. Species with holonephridia with or without bladders but attaining greater than eight setae (the perichaetine condition) are assigned to *Diporochaeta* s. strict. if they have tubular prostates, or to *Perionychella* s. strict. where their prostates are other than tubular (ie., tubuloracemose or racemose).

The generic definition is revised slightly to allow nephropores in sinuous, but not regularly alternating, series as are found in *V. apris*, and in *V. tasmanianus* following the author's discovery of spermathecal diverticula in the lectotype - and all other specimens of this species, thereby removing justification for the monotypic genus *Pinguidrilus* (see Blakemore, 2000b,c). Moreover, the definition now allows species with six or fewer pairs of spermathecae since *V. duodecithecatus* has six pairs.

Vesiculodrilus albus sp. nov

Fig. 18.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3293, near Scottsdale, ca. 41°10'S.147°35'E, NE Tasmania, dug from Forestry Tasmania "Cuckoo" soil pit, 25.i.1996, R.J. and S.A.McI. Blakemore, (mature, dissected and figured).

PARATYPES: (P1-11) 14:3294, same details as H, (five specimens agree externally with H, the other specimens are slightly smaller, average size about 50 mm, but they also agree).

EXTERNAL FEATURES

Length mm: (H) 70. Width: 2.5 mm. Segments: (H) 114. Colour: white unpigmented almost albino, but with darker extremities and mid-dorsal line; clitellum cream. Prostomium: tapering closed epilobous; no peristomial notch. Clitellum: 13-16. Dorsal pores: from 1/2 or 2/3. Nephropores: in c lines. Setae: 8 throughout. Spermathecal pores: 6/7-8/9 in a lines. Female pore: single on 14. Male pores: on 18 on small papillae in ab. Genital markings: in 16/17, 19/20 and 20/21 - three pairs of discs centred in a lines; in 17/18 and 18/19 - two pairs of conjoined discs centred in b lines.

INTERNAL ANATOMY

Gizzard: compact, muscular in 5. Oesophagus: increasingly dilated in 14-16 (lamellate but doubtfully calciferous). Nephridia: vesiculate holoic in c lines, bladders slightly elongate. Vascularization: large hearts 10-12; supra-oesphageal in 8-13. Spermathecae: three pairs in 7-9, spherical ampulla tapers to medium-sized clavate diverticulum; no distinct duct. Male organs: holandric, iridescent testis and funnels in mucus in 10 and 11; racemose seminal vesicles in 9 and 12. Ovaries: in 13. Prostates: tubular in 18-22; penial setae not found. Intestine: from 18; typhlosole absent.

REMARKS

A previously described Tasmanian species with three pairs of spermathecae in 7-9 is *Vesiculodrilus tunnackensis*, for which Jamieson (1974:253) states "As in all Tasmanian species of the genus, the genital markings of this species are distinctive". By this criterion *V. albus* is also distinct, especially in its lack of anterior genital markings. A further species similar to *Vesiculodrilus albus* that typically lacks

anterior genital markings is *Vesiculodrilus mesibovi* which is differentiated under that species' account. Externally, *Vesiculodrilus albus* resembles *V. dendrophagus* that also has a single female pore, differing principally by one fewer pairs of spermathecae, lack of appreciable spermathecal ducts, and its intestinal origin before 19. Sexathecal species from the same region include *Diporochaeta hellyeri*, *D. iseo*, *D. monogyna*, and *D. montisarthuri*, all of which obtain additional setae in the midbody, amongst other differences.

ETYMOLOGY: albus, Latin - white, for the colouration.

DISTRIBUTION AND HABITAT

N Tasmania: near Scottsdale in forest soil, found with *Diporochaeta iseo* sp. nov.

Vesiculodrilus ansoni sp. nov.

Fig. 19.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:2031, Ansons River Reserve, Ansons Bay, NE Tasmania, FQ 034 541, 40m, 12.i.1994, R.D. D'Orazio and D.E. Soccol, (mature, posterior amputee near tail, dissected and drawn).

PARATYPE: (P) 14:3108, same collection details as H, (sub-adult, dissected; sample also contains three unregistered tails).

EXTERNAL FEATURES

Body: stout. Lengths mm: (H) 150+, (P) 130. Width: ca. 16 mm. Segments: (H) 113+, (P) 176. Colour: unpigmented in alcohol, clitellum buff. Prostomium: pro-epilobous, dorsally furrowed to first intersegment. Clitellum: weakly marked in 14-19, intruding on 20 dorsally. Dorsal pores: vestigial in 4/5, open from 5/6. Setae: eight throughout; d lines becoming increasingly irregular. Nephropores: alternate irregularly between c or d lines and above. Spermathecal pores: in 4/5-6/7 closely paired median in aa. Female pores: widely paired just anterior to setae a. Male pores: closely paired just median to setal a lines on small prominent mounds. Genital markings: elongate rimmed pads in 14/15-20/21, i.e., seven of, extending laterally to b lines but narrower around male pores where setae converge, (markings present but rudimentary in P).

INTERNAL ANATOMY

Ventral nerve cord: large, ca. 2 mm wide in anterior. Septa: 9/10-12/13 thickened. Gizzard: large and strong in 5 but displaced to occupy 6-9, preceded by large crop. Oesophagus: increasingly dilated 8-15, especially 12-14 where it may be calciferous; valvular in 16. Nephridia: vesiculate holoic, bladders large and elongate in anterior to around clitellum, become more flask-like in mid-body with long ducts that open to irregular nephropores. Vascularization: hearts 10-13 with connectives to supra-oesophageal in 9-13; small vessels from dorsal blood vessel applied to oesophagus in 14 and 15. Spermathecae: three pairs in 5-7 converging under the ventral nerve cord, ampulla saccular tapering; diverticula small, inseminated in anterior two pairs only. Male organs: testes iridescent in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: in 13; ovisacs vestigial on anterior septum in 14. Prostates: tubular in 18, with coiled ducts; penial setae not found. Intestine: from

anterior of 17; spiraling; typhlosole absent; gut contains woody organic matter and dark soil.

REMARKS

Within *Vesiculodrilus* the body dimensions, distribution of genital markings, extent of the clitellum, and irregularity of nephropores of *V. ansoni* are reminiscent of *V. tasmanianus*. However, *V. ansoni* has only three closely paired spermathecal pores mid-ventrally in 4/5-6/7 compared to five spermathecal pores in setal a lines in *V. tasmanianus*. It is most unusual amongst the known species in Tasmania to have spermathecal pores thus anteriorly placed when so few in number. *V. ansoni* is particularly close to *V. apris*, and these may well be ecotypes or species in transition, separated on three or two pairs of spermathecae, respectively, and on slight differences in intestinal details and genital markings. Common to both these species is the greatly enlarged ventral nerve cord in the anterior that probably indicates heightened sensitivity.

ETYMOLOGY: after the type-locality.

DISTRIBUTION AND HABITAT

NE coastal Tasmania: Ansons River Reserve, Ansons Bay, from "dry sclerophyll, Blackwood, dogwood, musk on banks".

Vesiculodrilus apris sp. nov.

Fig. 20.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0284, Wild Pig Hill, EQ 489 962, near Ansons Bay, NE Tasmania, 160m, 28.vii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (mature, posterior amputee at segment 60 - drawn and dissected).

PARATYPES: (P1) ANIC:RB.96.12.16, same collection details as H, (mature, dissected); (P2) TM:K1538, same collection details as H, (mature, dissected); (P3) 14:3103, same details as H, (mature, dissected); (P4) 14:3128, same details as H, (sub-adult, dissected); (P5) 14:3104, same details as H, (immature, dissected); (P6-7) 14:2030, Ansons River Reserve, Ansons Bay, FQ 034 541, 40m, 12.i.1994, R.D. D'Orazio and D.E. Soccol, (two specimens - P6, sub-adult, dissected, P7, damaged mature); (P8-10) 14:3113, Ansons Bay, May 1988, E. Collins, (three specimens - P8, mature, dissected, P9-10 sub-adults, P9 dissected); (P11) 14:3147, Ansons Bay, 20.xi.1993, Mrs Collins, (macerated sub-adult); (P12) 14:2339, Swimcart Beach, Binalong Bay, FQ 070 346, 2.x.1978, R.H. Green, (aclitellate mature, dissected).

EXTERNAL FEATURES

Body: stout. Lengths mm: range 125-240; 230 (P1), 170 (P2), 160 (P3), 125 (P4); 150 (P6), 210 (P8), 175 (P9-10); 240 (P12). Width: ca. 16 mm. Segments: 168 (P1), 161 (P3). Colour: unpigmented in alcohol, clitellum grey. Prostomium: pro-epilobous appearing tanylobous due to peristomial furrowing, deep mid-dorsal furrow to 1/2. Clitellum: ½13,14-20 (i.e., seven+ segments), tumid and appearing saddle-shaped due to ventral genital markings and lack of furrows dorsally. Dorsal pores: from 4/5 (or 5/6 in P8 and P12). Setae: eight throughout; d lines becoming increasingly irregular from about 10. Nephropores: irregular, either in c lines or between d and mid-dorsum. Spermathecal pores: in 4/5 and 5/6 closely paired median in aa (slightly wider in a lines in P12). Female pores: paired just anterior to a setae. Male pores: closely paired almost apposed just median to setal a lines on small prominent mounds. Genital markings: elongate rimmed pads in 14/15,15/16-20/21 extending laterally to b lines but narrower around male pores where setae converge (i.e., six or seven sets, those in 14/15 rudimentary or lacking in H, P1, P2 and P4).

INTERNAL ANATOMY

Ventral nerve cord: very large in anterior, ca .3.5 mm wide in 9 (except in Swimcart Beach specimen). Septa: 4/5 distended by gizzard, 5/6-13/14 thickening, 9/10-12/13 thickest, 16/17/18 adpressed by intestine. Gizzard: large and muscular with flimsy proventriculus entirely in 5. Oesophagus: increasingly dilated in 9-13 with internal lamellae, 14-15 more contracted; valvular in 16-½17. Nephridia: vesiculate, holoic from 2, bladders large and convoluted in anterior, ducts open to irregular nephropores. Vascularization: dorsal blood vessel single; commissurals in 9, huge hearts in 10-13 with connectives to supra-oesophageal vessel in 8,9-13. Spermathecae: two pairs in 5 and 6 converging under the enormous ventral nerve cord; ampulla saccular with small iridescent diverticulum. Male organs: testes iridescent in 10 and 11; seminal vesicles paired, racemose in 9 (large) and 12 (smaller). Ovaries: in 13 as sheets of egg strings; ovisacs vestigial on anterior septum in 14. Prostates: tubular in 18, with coiled ducts; penial setae not found. Intestine: origin ½17 but sometimes not reaching full width until 18 (eg. in P6 and P8); spiraling; typhlosole absent; gut contains soil with quartz grains (some up to 4 mm across) and dark or woody organic matter.

ETYMOLOGY: aper, apris Latin – 'of wild boar', from the Wild Pig type-locality.

REMARKS

Vesiculodrilus apris is similar to *V. ansoni* but with only two pairs of spermathecal pores anteriorly in 4/5/6, and an intestinal origin slightly further posteriorly in ½17.

DISTRIBUTION AND HABITAT

NE coastal Tasmania: Wild Pig Hill, Ansons Bay from dry sclerophyll and Swimcart Beach.

Vesiculodrilus bithecatus (Jamieson, 1974) comb. nov.

Fig. 21.

Perionychella (Vesiculodrilus) bithecata Jamieson, 1974: 233-234, figs. 8A, 16H, Plate 93.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K264, Hellyer Gorge, NE Tasmania, 145°35'E.41°41'S, 28.v.1954, J.L. Hickman, (mature specimen, previously dissected, reinspected and figured).

PARATYPES: (P1) BM:1972:8:1, same details as H, (mature specimen, undissected); (P2-3) AM:5186-7, same details as H, (not examined).

EXTERNAL FEATURES

Lengths mm: (H) 40, (P1) 30. Width: ca. 1.5 mm. Segments: (H) 96, (P1) 98. Colour: uniform buff in alcohol, clitellum darker. Prostomium: widely open epilobous. Clitellum: ½13-¾16. Dorsal pores: from 4/5. Setae: 8 widely paired throughout in regular rows. Nephropores: large in c lines. Spermathecal pores: in 6/7 in b lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab. Genital markings: paired, presetal in setal a lines in 7, 8, and 17 with analogue on 19rhs (in H); or analogue on 6lhs postsetally in ab lines and paired presetal in a lines in 19 (in P1); two laterally elongate pads the width of the male pores at the anterior and posterior borders of 18 (in H and P1) with wider pair of discs in b lines in 17/18 (in P1).

INTERNAL ANATOMY

Gizzard: small but muscular in 5 below pharyngeal mass. Oesophagus: dilated 8-13, and in 14 and 15 lamellate and forming calciferous glands. Nephridia: vesiculate holoic in c lines, bladders subspherical. Vascularization: hearts 10-12; supra-oesophageal vessel weak. Spermathecae: large pair in 7 but encroaching to 8 or 9; flat, saccular ampulla marked from thick duct bearing short clavate diverticulum ectally with iridescent termination. Male organs: holandric, testes and funnels iridescent in 10 and 11; seminal vesicles in 9 and 12. Ovaries: large, racemose in 13. Prostates: tubular, looping forward in 17-21; penial setae present. Intestine: origin 16 but compact in 17-19 to accommodate prostates; no typhlosole; gut contains pellets of organic matter.

REMARKS

Differences from Jamieson's account are the lesser extent of the clitellum (shown in his fig 8A to occupy all of segment 13), the presence of calciferous glands in 14 and 15, and the intestinal origin in 16 rather than 17. *Vesiculodrilus bithecatus* is similar to *V. santaclairis* in having a single pair of spermathecae pores but differs in having them in line with b setae rather than a setae; and in the distribution of genital markings, even though slight variations appear permissible in *V. bithecatus* (i.e., paired in some of 6, 7, 8, 17 and 19).

DISTRIBUTION AND HABITAT

NW Tasmania: Hellyer Gorge, found with *Diporochaeta hellyeri*.

Vesiculodrilus borealis Blakemore, 2000

Fig. 22, Fig. 23.

Vesiculodrilus borealis Blakemore, 2000b:5-7, figs. 1-2.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3478, Sprent Basin, Lake Pedder, SW Tasmania, ca. 42°55'S.146°10'E, 417600 5263100, 310 m, 9.iv.1996, R.J. Blakemore, in loam under Ti-tree/Banksia, (mature specimen, dissected and figured).

PARATYPES: (P1) 14:3471, same details as H, (mature, dissected and figured); (P2) 14:3479, same details as H, (mature, posterior amputee); (P3) 14:3480, same details as H, (mature, posterior amputee, dissected); (P4) 14:3486, Bell Basin, Lake Pedder, 419600 5259700, 310 m, 9.iv.1996, R.J. Blakemore, in loam (mature, dissected); (P5) 14:3487, same details as (P4), (mature); (P6-8) 14:3488, same details as (P4), (three matures, one a posterior amputee, dissected); (P9-11) 14:3489, same details as (P4), (two matures, one a posterior amputee plus an immature and an unregistered tail); (P12-15) 14:3500, same details as (H), (three subadults - two posterior amputees, and an immature); (P16-18) 14:3472, same location as H, (two subadults and an immature plus three unregistered tails); (P19-20) 14:1261, Tram Road Picnic area, Wynyard, NW Tasmania, 389200 5457200, 34m, 19.iv.1993, R.D. D'Orazio and D.E. Soccol, (two mature specimens, both dissected).

SPECIMENS: 14:414, Lake Rowallan, N Tasmania, White Water Forest Reserve, DP 3577 808, 445m, 6.x.1992, R.D. D'Orazio and M. Cooper, (nineteen specimens, four matures and seven immatures agree superficially); 14:415, Lake Rowallan, Fish River Road, DP 365 749, 720m, 6.x.1992, R.D. D'Orazio and M. Cooper, (fifteen specimens, seven matures and five immatures, one mature posterior-regenerate dissected, plus immature of different species); 14:418, Mt Roland, NE Tasmania, Short Spur Road, DQ 446 088, 240 m, 24.ix.1992, R.D. D'Orazio and M. Gittus, (thirteen specimens that agree superficially, except one 14:3581 which is abnormal with an aborted anterior segment, three dissected); 14:465, Mt Roland, Lienna Road, N Tasmania, DQ 399 406, 455m, 24.xi.1992, R.D. D'Orazio and M. Gittus, (four specimens that agree superficially); 14:413, Mole Creek, Arm River Forest Reserve, N. Tasmania, DP 332 839, 460 m, 5.x.1992, R.D. D'Orazio and M. Cooper, (five specimens that agree superficially); 14: 968, Mole Creek, Snake Creek Road, N. Tasmania, DP 391 895, 590 m, 5.x.1992, R.D. D'Orazio and M. Cooper, (six mature

specimens that agree superficially); 14: 419, Lake Rowallan, White Water Forest Reserve, DP 385 833, 575m, 6.x.1992, R.D. D'Orazio and M. Cooper, (two specimens that agree superficially).

EXTERNAL FEATURES

Body slightly flattened dorso-ventrally, first segment sometimes compressed, tail blunt. Lengths mm: range: 30-60 mm, (H) 60, (P1) 45, (P4) 45, (P5) 45, (P6-7) 30-40, (P10) 40, (P19-20) ca. 40, (immatures, ca. 30-40 mm). Width: ca. 1.5 mm. Segments: (H) 138, (P1) 128, (P19-20) 91. Colour: anterior and dorsum light brown or puce with darker mid-dorsal line, ventrum pale, clitellum pale; or white throughout (P19-20, bleached in alcohol?). Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: from 2/3 (rudimentary in 1/2?). Setae: 8 in regular rows although c and d migrate dorsally in posterior (so that dd = cd) and some d setae are irregular in the tail, but no setae added. Nephropores: in c lines. Spermathecal pores: 6/7/8/9 just lateral of setal a lines (diverging slightly). Female pores: paired on 14. Male pores: paired on small porophores in ab but closer to a lines. Genital markings: single mid-ventral, postsetal discs in some of 6-10 (H, P3, P9-10, P19-20); or paired pre-setal below spermathecal pores in 7,8-9 (P1, P2, P5-7, P17), or paired mid-ventral pre-setal in 7-9 (P4, P8); mid-ventral discs in most specimens in 16/17; tumid pads in all specimens in aa in 17/18 and 18/19, paired discs wider than male pores in b lines in 17/18 (H, P8, P9-10) and 18/19 (all mature specimens except P4, P19-20); a midvental disc in 19/20 (H, P9); (no paired genital markings in 19/20 nor 20/21).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: large, barrel-shaped in 5. Oesophagus: pale and smooth walled (but not muscular) in 6 and 7; increasingly vascularised and dilated in 8-15, especially 14 and 15; narrowing and valve-like in 16. Nephridia: vesiculate holoic in c lines; bladders elongate in the anterior but broader after the clitellum (becoming ocarina-shaped or perhaps diverticulate); not tufted anteriorly. Vascularization: hearts in 10-12 with connection to weak supra-oesophageal vessel in (8-)10-12,½13. Spermathecae: three pairs in 7-9, saccular ampulla tapering to duct with simple diverticulum ectally. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles large, racemose in 9 and 12. Ovaries: large, palmate in 13; small ovisacs sometimes noted in 14.

Prostates: tubular 18-19; short penial setae present. Intestine: origin 17; no typhlosole; gut contains organic soil material.

REMARKS

This species is similar to *Vesiculodrilus tunnackensis* and *V. ventralis* in having three pairs of spermathecal pores in setal a lines. However, *V. tunnackensis* differs in having first dorsal pores from 4/5, the clitellum extending to 12/13, apparently having only subspherical nephridial bladders, and in the arrangement of the genital markings: in addition to glandular pads in 17/18 and 18/19, *V. tunnackensis* has markings pre-setal near the spermathecal pores in 7-9, and widely paired in ab in 19/20 and 20/21. This latter arrangement is not met in *V. borealis*, plus the anterior markings are often mid-ventral, and paired discs frequently border the pads in 17/18 and 18/19.

ETYMOLOGY "borealis" for its predominantly northern distribution.

DISTRIBUTION AND HABITAT

Found at the northern end of Lake Pedder, SW Tasmania, under litter and in loam under Ti-tree (*Leptospermum* sp.) and Banksia spp., and at Wynyard, NW Tasmania. Additional specimens from NW and N Tasmania have also been identified at Lake Rowallan, Mt Roland and Mole Creek.

Vesiculodrilus bronte sp. nov.

Fig. 24.

Perionychella (Vesiculodrilus) hobartensis (part.); Jamieson, 1974: 241-245.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K293, Marlborough Highway, near Bronte, 146°30'E.42°10'S, 26.v.1954, J.L. Hickman, (mature specimen, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Body: without dorsal canaliculation, tapering tail flat and quadrangular. Length: 65 mm. Width: 3 mm. Segments: 111. Colour: uniform buff in alcohol; clitellum orange. Prostomium: open epilobous; no ventral cleft. Clitellum: ½13-½17. Dorsal pores: small in 4/5, larger from 5/6. Setae: 8 in regular rows throughout. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired on 14 in common white field. Male pores: on small papillae on 18 in ab surrounded by creases. Genital markings: paired discs in 16/17 in ab.

INTERNAL ANATOMY

Gizzard: slightly muscular in 5 but same width as pharynx in 4. Oesophagus: not especially dilated. Nephridia: vesiculate holoic, bladders elongate discharging in c lines. Vascularization: hearts 10-12; supra-oesophageal vessel weak in 7-14. Spermathecae: five pairs in 5-9, ampulla spherical on tapering duct with club-shaped diverticulum about same length as duct. Male organs: holandric, iridescent testes in 10 and 11 in mucus; seminal vesicles large racemose in 9 and 12. Ovaries: in 13 as sheets; ovisacs absent. Prostates: very long, tubular and undulating in 18-27; penial setae not found. Intestine: origin in 17; typhlosole absent; gut contains only mucus.

REMARKS

Vesiculodrilus bronte is similar to the sympatric *V. insularis* (Spencer, 1895), and both species lack genital markings in 17/18 that are characteristic of *V. hobartensis*. Its differences from *V. insularis* are: lack of prostomial cleft, lack of oesophageal dilations and penial setae, intestinal origin in 17, and its distinctive club-shaped spermathecae.

ETYMOLOGY: after the type-locality.

DISTRIBUTION AND HABITAT

Marlborough Highway, near Bronte in Central Tasmania.

Vesiculodrilus brunyi sp. nov.

Fig. 25.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3707, McCracken Creek, Missionary Road, Bruny Island, SE Tasmania, EN 294 244, 20m., R.D. D'Orazio and M. Cooper, dry sclerophyll, (mature, drawn and dissected).

PARATYPES: all with same details as H, 14:3708 (P1), (mature, dissected); 14:3709 (P2), (mature dissected); 14:3710 (P3-4), (two matures that agree externally); 14:1698 (P5-11), (three aclitellate matures, one dissected, plus four juveniles that agree superficially).

EXTERNAL FEATURES

Body: with faint dorsal canaliculation from mid-body. Lengths mm: 260 (H), 190 (P1), 210 (P2), 240 (P3), 190 (P4), 150-160 (P5-7), ca. 110 (juveniles P8-11). Width: ca. 4 mm. Segments: 178 (H), 175 (P1), 179 (P2). Colour: anterior dorsum brown, rest of body light brown, clitellum buff. Prostomium: mostly open epilobous but faintly closed and appears tanylobous (eg. in H). Clitellum: ½13-½17,17. Dorsal pores: vestigial in 4/5, open from 5/6. Setae: 8 in regular series. Nephropores: large at anterior of segments in c lines. Spermathecal pores: at posterior edge of segments near 5/6/7/8/9 in setal a lines. Female pores: widely paired in 14. Male pores: on small papillae in ab lines on 18. Genital markings: paired elongate anterior to and involving spermathecal pores in 5-9, often merging mid-ventrally; paired elongate markings in and median to a lines postsetally on 16; widely paired ellipses lateral of b lines with intervening tumid pad posteriorly in 17; similar tumid pad median to male pores posteriorly on 18; large paired elongate markings wider than ab lines at posterior of 19 and encroaching on 19/20; small marking on 15rhs posterio-median to seta a (P2 only). Juvenile specimens (P8-11) have markings rudimentary or undeveloped.

INTERNAL ANATOMY

Septa: 8/9,9/10-12/13 thickest. Gizzard: in 5 large muscular barrel-shaped with anterior flange and crop, displaced to occupy 7-9. Oesophagus: thin walled but dilated in 8-½17, more vascular in 13-½17, not calciferous. Nephridia: vesiculate holoic with small preseptal funnels in a lines; bladders elongate, especially after clitellum, exiting in c lines. Vascularization: dorsal blood vessel single; hearts large

10-12; supra-oesophageal vessel 9-12. Spermathecae: four pairs in 6-9, saccular ampulla tapers to duct with small clavate inseminated diverticulum ectally. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles large racemose anteriorly in 11 and 12, (P2 has small pseudovesicles in 13). Ovaries: large in 13 comprising several egg-strings; ovisacs absent. Prostates: tubular in 18-19 (surface sometimes slightly incised); very small (ca. 0.2 mm long) penial setae present. Intestine: origin appears to be from 18/19 in (H) but is ½18 in (P2, P5) typhlosole absent; gut contains coarse organic matter.

REMARKS

Vesiculodrilus brunyi is differentiated from other species having four pairs of spermathecae in 5/6-8/9, by being holandric but with seminal vesicles in 11 and 12, and on the distinctive arrangement of its genital markings especially those in the anterior. Additionally, the prostomium appears epi-tanylobous in some specimens of this large species.

ETYMOLOGY: after the type-locality.

DISTRIBUTION AND HABITAT

Bruny Island, dry sclerophyll.

Vesiculodrilus bufalus sp. nov.

Fig. 26.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:2072, Buffalo Brook, Avoca, E Tasmania, EP 492 791, 320 m, 19.x.1993, R.D. D'Orazio, dry sclerophyll woodland, (mature specimen, drawn and dissected).

PARATYPES: all same collection data as H, 14:3148, (P1), (clitellate, posterior amputee, dissected); 14:3149, (P2), (clitellate, inspected); 14:3150 (P3), (clitellate, inspected); 14:3151 (P4), (aclitellate, posterior amputee, inspected); 14:3152 (P5), (juvenile, inspected).

EXTERNAL FEATURES

Body shape: dorso-ventrally flattened giving a wide body which tapers abruptly at tail; dorsally canaliculate throughout. Lengths mm: 105 (H), 95+ (P1 and P4), 95 (P2-3), 80 (P5). Width: ca. 10 mm. Segments: 115 (H), 117 (P2), 113 (P3). Colour: dorsum light brown pigment, clitellum paler buff. Prostomium: closed epilobous, deeply furrowed dorsally to 2/3. Clitellum: 13-17 but slightly impinges on adjacent segments. Dorsal pores: from 3/4. Setae: 8 in regular series. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in setal a lines. Female pores: paired anteriomedian to setae a. Male pores: approximately in setal a lines on small papillae interconnected by narrow isthmus. Genital markings: elongate, often sunken pads between setae aa in 15/16-18/19 (i.e., four sets, seen in all specimens), those of 17/18 and 18/19 more defined.

INTERNAL ANATOMY

Septa: 5/6-8/9 flimsy and displaced dorsally by gizzard, 9/10-11/12 adpressed to form testis sacs. Gizzard: in 5 large, muscular barrel with anterior flange and proceeded in 4 by proventriculus and in 3 by large pharyngeal mass. Oesophagus: contracted in 6-10 by gizzard, from 10-14 only slightly dilated and vascular, in 15 much expanded and internally lamellate forming single large calciferous gland. Nephridia: vesiculate holoic with small preseptal funnels; the large, elongate bladders exiting in c lines. Vascularization: dorsal blood vessel doubled in 6-15,16,17; hearts in 10-13 increasingly enlarged; supra-oesophageal vessel not noted. Spermathecae: five pairs in 5-9, large saccular ampullae demarcated from ducts, each with clavate, inseminated diverticulum. Male organs: holandric, iridescent testes and funnels in 10

and 11 contained (along with seminal vesicles, hearts, and nephridia) in testis sacs formed by septa; seminal vesicles small and tongue-like in 10, large coralline in 11 and free in 12 (i.e., 3 pairs in 10-12). Ovaries: as sheets, high on septum in 13. Prostates: tightly coiled, tubular and confined to 18; penial setae not found. Intestine: origin 18; no typhlosole; gut filled with soil, grits and organic matter including fine root hairs.

REMARKS

Vesiculodrilus bufalus has testis sacs formed by septa 9/10-11/12, seminal vesicles in 10-12, a double or bifid dorsal blood vessel in ca. 6-16, a calciferous gland in 15, and four elongate genital markings in 15/16-18/19. It is morphologically similar to *Vesiculodrilus glandiferus* in several of these characteristics, and in other respect it superficially resembles sympatric *V. fictilis*. Differences in *V. bufalus* are the last hearts in 13, seminal vesicles in 10, and the form and distribution of the genital markings.

ETYMOLOGY bufalus (Latin) -"wild ox" - for the Buffalo Brook type locality.

DISTRIBUTION AND HABITAT

E Tasmania: Buffalo Brook, Avoca from dry sclerophyll woodland, found with *V. fictilis*.

Vesiculodrilus canaliculatus sp. nov

Fig. 27.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3786, Maweena south of Wynyard, NW Tasmania, DELP Sheet 8315 130465, 290 m, "Maweena Soil Sequence, Site 18 [or 8?] #6 Deep", 13.ix.1993, QVM collection from Forestry Tasmania (M. Laffan?), (mature, damaged in midbody but complete, dissected and drawn).

PARATYPE: (P) 14:3787, same details as H, (mature, dissected).

EXTERNAL FEATURES

Body: robust and dorsally canaliculate. Lengths mm: (H) 230; (P) 235. Width: ca. 8 mm. Segments: (H) 167, (P) 183. Colour: unpigmented in alcohol, clitellum buff. Prostomium: closed epilobous, furrowed. Clitellum: ½13-17. Dorsal pores: from 5/6. Setae: 8 throughout. Nephropores: in c lines. Spermathecal pores: 4/5-6/7 in setal a lines. Female pores: paired on 14. Male pores: on paired papillae in ab and replacing these setae on compressed segment 18. Genital markings: small in 17, 19 and 20 postsetal and centered on setal a lines but just reaching b lines, those in 17 and 19 almost occlude the male papillae.

INTERNAL ANATOMY

Gizzard: in 5 large and tapering posteriorly. Oesophagus: dilated and vascularized in 12-15 but not calciferous. Nephridia: vesiculate holoic exiting in c lines, bladders elongate and doubled over in anterior; not tufted anteriorly. Vascularization: dorsal blood vessel single, large hearts 10-12; supra-oesophageal vessel 9-12,13. Spermathecae: three pairs in 5-7, large saccular ampulla tapers to duct and disproportionately small diverticulum. Male organs: metandric, iridescent testis found only in 11; paired, racemose seminal vesicles found only in 12. Ovaries: as small egg sheets in 13. Prostates: tubular in 18-22; penial setae not found. Intestine: from 17; typhlosole absent; gut contains soil and much mucus (especially in P1).

REMARKS

Vesiculodrilus canaliculatus has three pairs of spermathcal pores in 4/5-6/7, rather than 6/7-8/9 as in other sexathecal species of the genus, it is also characterized by its large size, dorsal canaliculation, the distribution of genital markings, and metandry.

ETYMOLOGY for the dorsal canaliculus.

DISTRIBUTION AND HABITAT

Maweena is a Forestry Tasmania site south of Wynyard in NW Tasmania near Meunna and ca. 5km south of Preolenna at end of rail line. Soil details of this wet eucalypt forest site recorded by M. Laffan of Forestry Tasmania are xanthozem with sandy loams over sandy clay loams and clays, with pH 4.9 @ 14-26 cm.

Vesiculodrilus culminis sp. nov

Fig. 28.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3631, near summit of Ben Lomond, NE Tasmania, 41°35'S.147°40'E, ca EQ 568 005, 1,500 m, 23,iii,1997, Rob Blakemore, Adrian Pinder and Richard Marchant, from moist clay-loam beside creek, (mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Body: slender. Length mm: 48. Width: ca. 1 mm. Segments: 107. Colour: anterior dorsum delicate pink, clitellum cream, rest of body pale. Prostomium: open epilobous; peristomium ventrally notched. Clitellum: ½13-16. Dorsal pores: small from 2/3. Nephropores: in c lines from 2. Setae: small, 8 throughout in regular rows. Spermathecal pores: 6/7-8/9 in mid-ab lines. Female pores: paired on 14 in darker field. Male pores: on 18 on small mounds close to b lines. Genital markings: paired discs presetally below spermathecal pores on 7-9 and in setal a lines in 16/17; discs in b lines in 17/18 and 18/19rhs with tumid furrow in bb.

INTERNAL ANATOMY

Septa: none especially thick. Gizzard: weak, almost vestigial in 5. Oesophagus: vascularized in 8-14, dilated in 13-15 with internal lamellae thus possibly forming three sets of calciferous glands; valvular in 16-½17. Nephridia: vesiculate holoic, bladders sub-spherical in c lines. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; commissurals in 4-9, hearts 10-12 with connection to supra-oesophageal vessel that runs 7-12. Spermathecae: three pairs in 7-9, saccular ampulla on short duct with small bulbous diverticulum. Male organs: holandric, iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles in 9 and 12. Ovaries: as sheets in 13; ovisacs small pair in 14. Prostates: tubular in 17-20; fine penial setae present. Intestine: from ½17; no typhlosole nor gizzards; gut contains organic matter and mineral soil.

REMARKS

Vesiculodrilus culminis is especially similar to *V. gracilis*, differentiated primarily on genital markings distribution: anterior markings tend to be mid-ventral in *V. gracilis* and those in 17/18/10 are paired but median in ab, rather than wider than

male pores as in *V. culminis*. In addition, *V. culminis* possesses a ventrally cleft peristomium, the male pores are slightly more lateral in b lines, and it has more developed calciferous glands.

ETYMOLOGY culminis, Latin – of the summit.

DISTRIBUTION AND HABITAT

NE Tasmania: summit of Ben Lomond, in moist loamy soil near creek; same locality as *Graliophilus benlomondi* and *Diporochaeta iseo*.

Vesiculodrilus cuneatus sp. nov

Fig. 29.

Perionychella (Vesiculodrilus) mortoni (part.); Jamieson, 1974: 247-250.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3255, Tasmanian Forestry site TSF 078, South Springfield, NE Tasmania, EQ 388 287, 560 m, 24.iv.1992, QVM collection, labeled "TSF 78 Sp 2 or Sideling Sp 3", (mature, dissected and drawn).

PARATYPES: (P1) 14:3256 same details as (H), (mature, dissected); (P2-P4) TM:K405, Mt Arthur east side, 15.x.1971, A.J. Dartnall and R.C. Kershaw, (P2, a complete mature, P3 a mature posterior amputee, P4, a subadult, previously dissected); (P5) 14:156, Mt Victoria, 720 m, EQ 662 225, 22.vi.1992, R.D. D'Orazio, (mature).

EXTERNAL FEATURES

Length mm: (H) 140, (P1) 135, (P2) 130, (P3) 155. Width: 5.5 mm. Segments: (H) ca. 170, (P1) 179, (P2) 166, (P5) 167. Colour: pale unpigmented, clitellum cream. Prostomium: tapering tanylobous. Clitellum: ½13-17. Dorsal pores: from 4/5 (possibly minute in 3/4). Setae: 8 throughout, ab converging then diverging around male pores, after clitellum setal line c migrates slightly dorsally with respect to nephorpores which are in c anteriorly. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired. Male pores: superficial in b lines on compressed segment 18. Genital markings: paired just median to level of male pores in ab lines in 17/18, no genial pad present between these markings; paired discs postsetal wholly in ab in 19 and 20.

INTERNAL ANATOMY

Septa 5/6-12/13 increasingly thickened. Gizzard: large, muscular in 5, occupying 6-8. Oesophagus: dilated in 14-16, lamellate as calciferous glands in 14 and 15 (H and P2). Nephridia: vesiculate holoic in c lines, not tufted anteriorly, bladders elongate bent. Vascularization: hearts 10-12, supraoesophageal vessel 9-13. Spermathecae: five pairs in 5-9, saccular ampulla clearly marked from shorter duct with small clavate diverticulum ectally. Male organs: holandric, iridescent testis and mucus in 10 and 11, racemose seminal vesicles anteriorly in 9, posteriorly in 12 and 13, those in 13 possibly 'pseudovesicles' but as large as those in 12. Ovaries: palmate in 13. Prostates: tubular to 22-27,28, penial setae not found. Intestine: from 17; low

dorsal ridge (not typhlosole) from 19 (H and P2) or 22 (P1); gut contains woody organic matter.

REMARKS

Vesiculodrilus cuneatus is anatomically close to *Vesiculodrilus fictilis* (which itself is similar in some respects to *Vesiculodrilus mortoni* (Spencer, 1895)). The present species differs in not having genital markings in 18/19 and in having additional genital markings in 20. Jamieson included specimens of this species in his wide redefinition of *V. mortoni* where, however, there is a midventral pad in 17/18 and the genital markings in 17 are wider than in successive markings - the opposite to *V. cuneatus* where the paired markings in 17/18 are median to the male pores . The presence of calciferous glands in 14-15 and seminal vesicles in 13 are additional differences, moreover *V. cuneatus* lacks diverticula on the nephridial bladders as are usually found in *V. mortoni*, and its tapering tanylobous prostomium is particularly distinctive.

ETYMOLOGY cuneatus, Latin - 'in the form of a wedge', referring to the distinctive shape of the prostomium.

DISTRIBUTION AND HABITAT

NE Tasmania: South Springfield, Mt Arthur from wet sclerophyll forest; and Mt Victoria, *V. fonsager* is sympatric at the former site.

Vesiculodrilus cygnus sp. nov.

Fig. 30.

MATERIAL EXAMINED

HOLOTYPE: 14:0352 (H), Royal George, West Swan River, Lake Leake, E Tasmania, EP 790 605, 540 m, "9.5Km from Meetus Falls turn off until bridge", 10.viii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (mature, drawn and dissected).

PARATYPES: seven specimens all from one sample: 14:1721 (P1), Aspley Myrtle Forest, E Tasmania, EP 932 719, 450 m., 5.viii.1992, R.D. D'Orazio and M. Cooper, rainforest, (mature, dissected); 14:3690 (P2), (mature dissected); 14:3691 (P3), (mature); 14:3692 (P4), (mature); 14:3693 (P5), (mature); 14:3694 (P6), (aclitellate mature); 14:3695, (P7), (an immature specimen, length - 20mm).

EXTERNAL FEATURES

Lengths mm: 160 (H), 200 (P1), 160 (P2), 90-115 (P3-P6). Width: ca. 5 mm. Segments: 166 (H), 160 (P1). Colour: dorsum dark red-grey to c lines, ventrum pale, clitellum peach. Prostomium: closed epilobous, furrowed dorsally to 2/3; peristomium also grooved ventrally. Clitellum: ½13-17. Dorsal pores: from 4/5, sometimes vestigial in 3/4. Setae: 8 in regular series. Nephropores: in c lines. Spermathecal pores: 4/5/6/7/8 in, or just lateral to, setal a lines. Female pores: paired anteriomedian to setae a in common dumbbell-shaped field. Male pores: on 18 on small papillae approximately in setal b lines and interconnected by thin elongate median pad. Genital markings: small discs just anterior to spermathecal pores in 4-7, often joined by an arc of papillae; small discs just below setae b on 16 (all specimens except P3); large elongate sucker-like pads centred in a lines on 17 (all specimens); narrow pad wholly between the male pores on 18; paired discs median and just below setae a on 19 (in P2 and P3 only); in most specimens, mid-ventrum in 19/20 is tumid.

INTERNAL ANATOMY

Septa: 7/8-12/13 increasingly thickened. Gizzard: in 5 large, solid, barrel-shaped with anterior flange and crop. Oesophagus: moniliform in 7-12 but not especially enlarged, 13-15 increasingly dilated, not calciferous. Nephridia: vesiculate holoic with small preseptal funnels; large, elongate and folded bladders exiting in c lines. Vascularization: dorsal blood vessel single; commissurals in 6-9, hearts 10-12; supra-oesophageal vessel weak 8-12. Spermathecae: four pairs in 5-8, large saccular

ampullae taper to ducts, each bearing small, clavate, inseminated diverticulum. Male organs: metandric, iridescent testes and funnels in 11 only invested in mucus, seminal vesicles large pair in 12 only. Ovaries: large in 13; ovisacs not found. Prostates: tubular in 18-22,25 (only the duct in 18 in H); very small penial setae present (ca. 0.5 mm long). Intestine: origin 17; from about 20 low dorsal ridge insufficiently developed to be considered true typhlosole; gut contains woody organic matter and few grits (some ca. 2 mm diameter) plus soil.

REMARKS

Vesiculodrilus cygnus has a dorsally furrowed peristomium, four pairs of spermathecae in 4/5/6/7/8 in a lines, and is metandric with long tubular prostates. It is similar to *V. oeconomicus* and *V. quadruparus*, distinguished from these taxa by having an arc of markings between the spermathecal pores, its paired markings on 16 are in b lines and on 17 centred in a lines, while markings in 19 and 20 are typically wanting. Moreover, the male pores appear to be wider, closer to b lines rather than a lines as in these other taxa.

ETYMOLOGY cygnus, Latin – swan, for the river locality.

DISTRIBUTION AND HABITAT

E Tasmania: Royal George, near Swan River, from dry sclerophyll, and Aspley Myrtle Forest, from rainforest.

Vesiculodrilus dendrophagus sp. nov

Fig. 31.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3267, Scout Hut, Forester River, NE Tasmania, EQ575 544, 40 m, 10.x.1990, QVM collection, ex litter, (mature posterior amputee, dissected and drawn).

PARATYPES: all with same collection details as (H), 14:3268 (P1), (mature, dissected); 14:3269 (P2), (subadult, posterior-amputee, dissected); 14:3270 (P3), (mature); 14:3271 (P4), (mature, posterior-amputee); 14:3272 (P5), (mature); 14:3273 (P6), (mature).

SPECIMENS: 14:3266, from the same sample, (10 specimens that agree superficially).

EXTERNAL FEATURES

Lengths mm: range 60-75; (H) 65+, (P1) 75, (P3) 60, (P5) 70, (P6) 65. Width: ca. 2 mm. Segments: (P1 and P3) 125. Colour: unpigmented in alcohol, clitellum cream. Prostomium: open epilobous but with faint lines to first intersegment, therefore tanylobous; slight ventral peristomial notch. Clitellum: ½13-16. Dorsal pores: from 2/3. Nephropores: not found. Setae: 8 throughout. Spermathecal pores: 5/6/7/8/9 in a lines. Female pore: single on 14. Male pores: on 18 on papillae in ab and replacing these setae. Genital markings: in 16/17, 19/20 and 20/21 - pairs of discs centred in a lines; in 17/18 - paired conjoined discs centred in b; in 18/19 similar pair of discs slightly wider apart. Markings in 16/17 (in P3 and P4) and 20/21 (in P2, P3 and P4) sometimes not developed. Therefore, markings consistently in 17/18, 18/19 and 19/20 only.

INTERNAL ANATOMY

Gizzard: small, muscular in 5. Oesophagus: dilated and lamellate in 15-16, possibly calciferous. Nephridia: vesiculate holoic in c lines, not tufted anteriorly, bladders slightly elongate. Vascularization: large hearts 10-12, supra-oesophageal vessel in 8-16. Spermathecae: four pairs in 6-9, spherical ampulla clearly marked from longer duct which has medium size clavate diverticulum ectally. Male organs: holandric, iridescent testis in mucus in 10 and 11, racemose seminal vesicles in 9 and 12. Ovaries: in 13. Prostates: tubular in 18-19,20; penial setae not found. Intestine:

from 19 (H) or 20 (P1 and P2); typhlosole absent; gut contains wood, some soil, and mica grains.

REMARKS

Unique combination of characters in *Vesiculodrilus dendrophagus* are its four pairs of spermathecae, a single female pore, and intestinal origin in 19 or 20. The only other species with spermathecal pores in 5/6-8/9 in or near a lines and such posterior intestinal origin is *V. brunyi* that has seminal vesicles in 11 and 12 rather than 9 and 12, amongst other differences. *V. dendrophagus* is superficially similar to *V. hobartensis*, and to *V. albus* which also has a single female pore, but these differ in having five and three pairs of spermathecae, respectively.

ETYMOLOGY dendro-phagus, from Greek, "wood-eating" - for the gut contents.

DISTRIBUTION AND HABITAT

NE Tasmania: Forester River, ex litter, found with *V. pennyae*.

Vesiculodrilus duodecithecatus sp. nov.

Fig. 32.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3769, Mt Barrow, N Tasmania, EQ 353 212, 750m, 16.vi.1992, R.D. D'Orazio and M. Cooper, "MT.B2", rainforest, (mature specimen, drawn and dissected).

PARATYPES: all same collection data as H, ANIC:RB:98.1.21 (P1), (aclitellate mature, dissected); TM:K1580 (P2), (aclitellate mature, dissected); 14:3770 (P3), (immature specimen lacking genital markings, dissected).

EXTERNAL FEATURES

Body squarish after clitellum with dorsalo-ventrally flattened tail. Lengths mm: 240 (H), 150 (P1), 120 (P2), 100 (P3). Width: ca. 5 mm. Segments: 213 (H), 235 (P1), 246 (P2), 236 (P3). Colour: pale unpigmented in alcohol, clitellum buff. Prostomium: looks tanylobous in all specimens, possibly open epilobous as peristomium deeply furrowed obscuring exact form. Clitellum: ½13-17 (-½18 dorsally, deeply furrowed and slightly damaged in H). Dorsal pores: small from 4/5 (all specimens). Setae: 8 in regular series. Nephropores: in c lines (seen after clitellum). Spermathecal pores: 4/5-9/10 in setal a lines. Female pores: widely paired anteriomedian to setae a. Male pores: approximately in setal ab lines on small papillae in 18. Genital markings: elongate, sunken pads with tumid borders between bb lines in 10/11 and 11/12; similar pads in 15/16 (in P1 only), 16/17, 19/20, 20/21 and 21/22 (H, P1-2), and in 22/23 (H, very weakly and P1); narrower tumid pads in aa lines in 17/18 and 18/19 on male field obscuring furrows (all specimens).

INTERNAL ANATOMY

Ventral nerve cord: large in anterior, broadly extending almost to line of spermathecae. Septa: 5/6 thin to base of gizzard, 6/7-10/11 increasingly thick, thereafter thin. Gizzard: in 5 muscular barrel with anterior flange. Oesophagus: especially dilated in 13-17, with internal lamellae but insufficient to be considered calciferous; valvular in 18. Nephridia: vesiculate holoic with large elongate bladders exiting in c lines, and small preseptal funnels. Vascularization: dorsal blood vessel single; hearts in 10-12 with connections to surpra-oesophageal vessel that runs 9-13,14. Spermathecae: six pairs in 5-10, saccular ampulla on tapering duct, with clavate, inseminated diverticulum as long as duct, (in H, 6-7rhs have weak

supernumerary diverticula). Male organs: metandric, iridescent testes and funnels in 11 only; seminal vesicles large pair in anterior of 12 only. Ovaries: large pair as sheets in 13; small pair of ovisacs in 14; (in P1 the egg strings from 13 pass through septum to 14). Prostates: thickly tubular in 18-19; small penial setae present. Intestine: origin 19; no typhlosole; gut contains colloidal soil and organic fragments.

REMARKS

Vesiculodrilus duodecithecatus is unique in the genus, and differs from all known Australian megascolecids, by having six pairs of spermathecae, (some exotic plutelloid species, however, have six or even seven pairs of spermathecae). It is exceedingly unusual to find spermathecae in segment 10 and it is perhaps relevant that the testis are absent from this segment (metandry).

ETYMOLOGY for the twelve spermathecae.

DISTRIBUTION AND HABITAT

N Tasmania: Mt Barrow, from rainforest.

Vesiculodrilus emu sp. nov.

Fig. 33.

Perionychella (Vesiculodrilus) hobartensis (part.); Jamieson, 1974: 241-245.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K287, Emu River, Fern Glade, Burnie, 24.viii.1954, J.L. Hickman, (mature specimen, previously dissected, here redescribed and figured).

PARATYPES: none found despite resurvey by the current author; (specimen K288, with the same collection details and also included in the description of *V. hobartensis* by Jamieson, is in fact an immature *Notoscolex* sp.).

EXTERNAL FEATURES

Body: tapering without dorsal canaliculation. Length mm: 60. Width: 2.6 mm. Segments: 102. Colour: uniform buff in alcohol, clitellum orange. Prostomium: open epilobous. Clitellum: 14-16. Dorsal pores: from 4/5. Setae: 8 throughout in regular rows. Nephropores: in c lines. Spermathecal pores: 4/5-7/8 just lateral of setal a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab. Genital markings: three paired discs in 16/17-18/19 in ab, centred just lateral of a lines, (pale patches, possibly artefacts, surround aa on 20 and 21).

INTERNAL ANATOMY

Gizzard: weakly muscular in 5 in pharyngeal mass. Oesophagus: not especially dilated. Nephridia: vesiculate holoic in c lines. Vascularization: hearts 10-12; supra-oesophageal vessel 7-12, larger in the last three segments and associated with the hearts. Spermathecae: four pairs in 5-8, ampulla spherical, separated from tapering duct with clavate diverticulum just longer than the duct. Male organs: holandric, iridescent testes in 10 and 11; seminal vesicles racemose in 9 and, larger, in 12. Ovaries: palmate in 13. Prostates: tubular, coiled in 18-23; penial setae seen externally but not detectable internally (possibly broken off and previously removed?). Intestine: origin 16; no typhlosole; gut contains woody organic matter and mucus.

REMARKS

Vesiculodrilus emu is characterised by four pairs of spermathecae in 4/5/6/7/8, holandry, and, unlike *V. parattah*, by genital markings in 16/17-18/19. It is somewhat similar to *V. borealis* which, however, has only three pairs of spermathecae. Jamieson (1974) had included this specimen under his wide redefinition of *V. hobartensis* that actually has five pairs of spermathecae, and in his table (p 242) he had listed specimen

TM:K288 from Fern Glade as having genital markings, however this is an immature *Notoscolex* sp. that lacks any markings and if Jamieson meant TM:K287 then the table is also incorrect for the distribution of markings for this specimen. Penial setae were seen externally but not found internally, possibly they were removed as Jamieson had described them for this specimen.

ETYMOLOGY for the Emu River type locality.

DISTRIBUTION AND HABITAT

Emu River, Fern Glade, Burnie, N Tasmania, the same locality (and collection details) as specimens of *Perionychella richea*, *Notoscolex bidiverticulatus*, and *Anisochaeta burniensis*.

Vesiculodrilus fictilis sp. nov

Fig. 34.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:2062, Buffalo Brook, Avoca, E Tasmania, EP 492 791, 320 m, 19.x.1993, R. D. D'Orazio, dry sclerophyll woodland, (mature specimen dissected and drawn).

PARATYPES: (P1-3) 14:2066, same details as H, (P1- mature, dissected; P2, mature; P3, subadult).

EXTERNAL FEATURES

Body: stout, tapering gradually, waisted below clitellum. Lengths mm: (H) 110, (P1) 100, (P2) 115, (P3) 85. Width: ca. 7 mm. Segments: (H and P2) 170, (P1) 172. Colour: pale pinky porcelain, clitellum cream. Prostomium: pro-epilobous, deeply furrowed to first intersegment. Clitellum: ½13-17. Dorsal pores: rudimentary in 2/3/4, pronounced from 4/5. Nephropores: in c lines in anterior. Setae: 8 throughout in straight series but after clitellum setal line c migrates slightly dorsally with respect to nephorpores. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired. Male pores: on papillae in ab on compressed segment 18. Genital markings: small paired, postsetal in 17 just lateral of setae a; faint in 18 median to male pores; larger in 19 centered just below setae a but extending to b lines.

INTERNAL ANATOMY

Gizzard: large, muscular in 5. Oesophagus: dilated and lamellate in 14-16 but not calciferous. Nephridia: vesiculate holoic, bladders elongate exiting in c lines, but slightly displaced after clitellum; not tufted anteriorly. Vascularization: hearts 10-12, supraoesophageal vessel 11-16. Spermathecae: five pairs in 5-9, flattened or saccular ampulla clearly marked from shorter duct with small clavate diverticulum ectally. Male organs: holandric, iridescent testis and mucus in 10 and 11, racemose seminal vesicles in 9 and 12. Ovaries: rosettes in 13. Prostates: tubular in 18-23 (H) or 18-20 (P1), penial setae not found. Intestine: from 17; typhlosole from 23; gut contains organic remains.

REMARKS

Vesiculodrilus fictilis is comparable with *V. mortoni* (Spencer, 1895) that differs in having a tanylobous peristomium, elongate markings in 17, 19 and 20 with a midventral tumid patch between the two genital marking on 17, and by having

intestinal origin in 18 rather than 17 as here. *Vesiculodrilus fictilis* is a pale lumbricine worm that is characterised by five pairs of spermathecae, a pro-epilobous prostomium with deep dorsal peristomial furrow, and genital markings as described; it differs from *V. mathinna*, which occurs nearby, principally by having seminal vesicles in segments 9 and 12, rather than in 11 and 12.

ETYMOLOGY fictilis, Latin - clay or earthen, for the colouration.

DISTRIBUTION AND HABITAT

Buffalo Brook, Avoca from dry sclerophyll woodland, found with *V. bufalus*.

Vesiculodrilus fingal sp. nov.

Fig. 35.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:828, Fingal, Valley Road, E Tasmania, EP 894 836, 760 m, 3.viii.1992, R.D. D'Orazio and M. Cooper, unlogged dry sclerophyll forest, (mature, dissected and drawn)

PARATYPES: same details as (H), 14:3061 (P1), (mature, dissected); 14:3062 (P2), (mature, inspected).

EXTERNAL FEATURES

Body: small, tapering, without dorsal canaliculation. Lengths mm: (H) 37, (P1) 35, (P2) 38. Widths: ca. 1.5 mm. Segments: (H) 90, (P1) 89, (P2) 95. Colour: anterior and dorsum light reddy brown with faintly darker dorsal line, ventrum pale, clitellum buff. Prostomium: open epilobous; peristomium with weak ventral cleft. Clitellum: ½13-16. Dorsal pores: from 4/5 (rudimentary in 3/4). Setae: 8 throughout in regular rows except converge ventrally around male pores. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in a lines. Female pores: on 14 anterior to setae a. Male pores: on small papillae on 18 in ab. Genital markings: small markings near spermathecal pores in 8 and 9 (in H); paired discs in a or a and b lines in 16/17, in ab in 17/18 and 18/19 on either side of male pores; larger discs in ab in 19/20 and 20/21.

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: absent or vestigial, segment 5 the same width as the oesophagus. Oesophagus: increasingly dilated and lamellate in 13-15, probably calciferous in 14 and 15. Nephridia: vesiculate holoic in c lines, bladders elongate or J-shaped. Vascularization: hearts 10-12; supra-oesophageal vessel from 9. Spermathecae: five pairs in 5-9, ampulla saccular, ectal diverticulum clavate on duct. Male organs: holandric, testis and funnels in mucus in 10 and 11; seminal vesicles weak in 9 and 12 (in P1, not well developed). Ovaries: in 13. Prostates: tubular, 18-25; penial setae not found. Intestine: from 17; typhlosole not found to ca. 35; gut contains organic matter. Note: in (H) a dipteran larva, possibly parasitic, was found in segment 26 and is placed in a phial with this specimen.

REMARKS

Vesiculodrilus fingal is morphologically similar to *V. hobartensis* and *V. insularis*. It differs from the former species principally in its smaller size, lack of

dorsal canaliculization, having additional paired genital markings in 20/21, and in the form of the spermathecae which have ectal diverticula. *V. insularis* has a well developed gizzard, unlike *V. fingal* and genital markings confined to 16/17.

ETYMOLOGY named after the type locality.

DISTRIBUTION AND HABITAT

E Tasmania: Fingal, from dry sclerophyll.

Vesiculodrilus fonsager sp. nov

Fig. 36.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3054, South Springfield, NE Tasmania, EQ 388 287, 560 m, 3.vi.1992, R.D. D'Orazio, rainforest, (dissected and drawn).

PARATYPES: all with same locality as (H), 14:3055 (P1), (aclitellate mature, dissected); 14:1736 (P2), (mature); 14:3056 (P3), (mature); 14:3257-3258 (P4-5), ditto but collection date 24.iv.1992, (two matures, both dissected, one sketched; these specimens seemed slightly macerated).

EXTERNAL FEATURES

Body: long and slender. Lengths mm: mean 141.7 (n=6); (H) 145; (P1) 105; (P2) 145; (P3) 135; (P4) 160; (P5) 160. Width: ca. 2.5 mm. Segments: mean 144.7 (n=6): (H) 155; (P1) 124; (P2) 148; (P3) 161; (P4) 130; (P5)150. Colour: unpigmented in alcohol, clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16 (or ½13-½17 in P2). Dorsal pores: rudimentary in 1/2, developed from 2/3. Setae: 8 throughout. Nephropores: lateral in c lines. Spermathecal pores: 6/7-8/9 in a lines. Female pores: paired on 14. Male pores: paired on 18 on papillae in ab but apposed. Genital markings: midventral pads in 11 and 12, each usually with tetrad of sucker-like discs but sometimes with three or five discs (in P4-5); similar pads with only two discs midventral in 16/17; 19/20 and 20/21 (and in 21/22 in P2); paired discs in 17/18 and 18/19 joined by furrow and wider than male pores (all specimens, P4-5 have a pair of faint papillae within this furrow); ventral setae in 19-21 are on tumescences in some specimens.

INTERNAL ANATOMY

Septa: 7/8-14/15 slightly thickened. Gizzard: in 5 barrel-shaped but not strongly muscular. Oesophagus: dilated and vascularized in 7-16 but not calciferous, contracted in 17-18 to accommodate prostates. Nephridia: vesiculate holoic in c lines, not tufted anteriorly although septal glands are present, bladders elongate or sub-rounded. Vascularization: dorsal blood vessel single, large hearts 10-12; supra-oesophageal vessel 9-12. Spermathecae: three pairs in 7-9, saccular ampullae with equally long ducts that have slightly longer, ectal diverticula. Male organs: holandric, testes and funnels iridescent and invested in mucus in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: small in 13; ovisacs sometimes seen in 14.

Prostates: tubular in 18 (tightly coiled and more incised in P4 and P5); penial setae not seen. Intestine: from 20 (H) or 19 (P4); typhlosole absent; gut contains organic matter (H) or reddish soil and some quartz grains (P4).

REMARKS

The distribution of the distinctive genital markings, especially those in 11 and 12, and posterior intestinal origin in 19 or 20, distinguish *Vesiculodrilus fonsager* from other species with three pairs of spermathecae in setal a lines in 6/7-8/9.

ETYMOLOGY fonsager Latin - 'springfield', derived for the type locality.

DISTRIBUTION AND HABITAT

NE Tasmania: South Springfield, collected from rainforest.

Vesiculodrilus glandiferus glandiferus (Jamieson, 1974), comb. et subsp. nov.

Figs. 37.

Perionychella (Vesiculodrilus) glandifera Jamieson, 1974: 237-238, figs. 10A-B [segments miscounted], 15D (p. 254), 16L-M (p. 256).

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K283, St Helens, 41°20'S.146°10'E, on road to Launceston via Scottsdale between 94 and 96 mileposts, 26.viii.1953, L.J. Hickman, (mature, dissected).

PARATYPE: (P) BM:1972:8:9, St. Columba Falls, 41°20'S.147°55'E, 17.iv.1954, J.L. Hickman, (aclitellate specimen, dissected).

SPECIMENS: 14:3120, Coffee Court, Binalong Bay, 1.ix.1993, T. Wodnaugh, (mature specimen, dissected and figured); 14:2334, St. Helens, Binalong Bay Rd., FQ 095 322, 5.xi.1978, T. Hume, (mature specimen, dissected); 14:3153, St. Helens, Binalong Bay Rd., 5.xi.1978, T. Hume, (mature specimen); 14:1665, Moorina, Frome Road, NE Tasmania, EQ 762 443, 420 m, 21.vii.1992, R.D.D'Orazio and M. Cooper, (three mature specimens, dissected and one sketched).

EXTERNAL FEATURES

Body: stout and broad but flaccid, faintly canaliculate dorsally. Lengths mm: 85-125 (cf. 73-75 Jamieson). Width: ca. 9.5 mm. Segments: 96-99. Colour: unpigmented, almost translucent, clitellum buff. Prostomium: pro-epilobous (cf. broadly tanylobous, Jamieson), deeply furrowed dorsally to 2/3. Clitellum: ½13-17. Dorsal pores: from 4/5. Setae: 8 in regular series. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in setal a lines. Female pores: paired on 14. Male pores: approximately in setal a lines on small papillae. Genital markings: large, paired sucker-like disks often with central pores, in 17/18 and 18/19 in mid-bc or just lateral to b line, between each pair, and almost connecting them, elongate pad obscures intersegmental furrows.

INTERNAL ANATOMY

Septa: 4/5-8/9 thin and displaced dorsally by gizzard, 9/10-11/12 adpressed to form testis sacs. Gizzard: in 5 large and muscular with anterior flange. Oesophagus: contracted in 6-10 by gizzard; single, large calciferous gland in 15 internally lamellate. Nephridia: vesiculate holoic with large, elongate bladders that after clitellum acquire small diverticulum at the bend before they exit in c lines; tufted in 2 in some

specimens. Vascularization: dorsal blood vessel doubled in 8,9-17,18 (in 9,10-23 in two Moorina specimens); hearts in 10-12 (in some Moorina specimens pair of small lateral vessels branch in 13 but these are not hearts); supra-oesophageal vessel not developed. Spermathecae: five pairs in 5-9, large saccular ampullae taper to ducts, each with clavate diverticulum as long as the duct. Male organs: holandric, iridescent testes and funnels in 10 and 11 contained (along with hearts and nephridia) in testis sacs formed by septa; seminal vesicles large racemose within testis sac in 11, and free in 12. Ovaries: in 13. Prostates: tightly coiled, tubular and confined to 18; penial setae not found. Intestine: origin 17 (Moorina specimens) or 18 (Binalong Bay specimens), (cf. ½17 in P and posterior of 17 in H, Jamieson); no typhlosole; gut filled with organic matter, fine soil and quartz grits. Note: ventral nerve cord is large in the anterior in some specimens.

REMARKS

The present redescription largely confirms and augments the type description which was based on only two specimens. Extended in the current account are the range of body size, and the extent of the bifurcation of the dorsal blood vessel which is 9-23 or more in some specimens; differences in setal ratios were found between the specimens (that serve to demonstrate their limited taxonomic use). *V. glandiferus* was believed unique amongst the Tasmanian species of the genus in the bifid dorsal vessel, however this feature has been found (by the present author) in *Perionychella irregularis* (Spencer, 1895), in *V. bufalus*, and in *V. gryps*. These latter two species are clearly closest to *V. glandiferus* and to its subspecies *V. g. pyengana*, both morphologically and geographically (see these species' descriptions). The geographic distribution of *V. glandiferus* is also extended in the current account.

DISTRIBUTION AND HABITAT

St. Helens district, in the catchment of Georges River, to Binalong Bay; and Moorina.

Vesiculodrilus glandiferus pyengana subsp. nov.

Figs. 38.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3286, Pyengana, St. Columba Falls, ca. 41°20'S.147°55'E, EQ 800 280, 24.i.1996, S.A.McI. Blakemore, collected on walking track in rainforest near the Falls (mature, dissected).

HOLOTYPES: none.

EXTERNAL FEATURES

Body: stout, circular in section. Length mm: 75. Width: ca. 10 mm. Segments: 95. Colour: in life, anterior to clitellum pink, dorsum brown-pink rest of body light grey; clitellum orange. Prostomium: prolobous, deeply furrowed dorsally to 2/3. Clitellum: ½13-17. Dorsal pores: small in 3/4, open from 4/5. Setae: 8 in regular series, except around the male pores where they converge. Nephropores: lateral in c lines throughout. Spermathecal pores: in 4/5-8/9 just median to setal a lines. Female pores: paired on 14. Male pores: approximately in setal a lines on small papillae, setae on 18 retained. Genital markings: pair of large ovoid discs in ab in 16/17 almost contiguous ventrally; two pairs of sucker-like disks in 17/18 and 18/19 lateral to b lines and linked by furrow that obscures intersegment.

INTERNAL ANATOMY

Septa: all flimsy, 9/10-11/12 adpressed to form testis sacs (septum 10/11 is possibly perforated since fluid communication appears possible between segments 10 and 11). Gizzard: large in 5 but displaced to occupy 6-9. Oesophagus: single, large calciferous gland in 15 internally lamellate. Nephridia: vesiculate holoic with bent elongate bladders that from clitellum acquire small diverticulum at the bend. Vascularization: dorsal blood vessel doubled from before 13 onto intestine to at least segment 40; hearts possibly in 10-12 but obscured by other structures. Spermathecae: five pairs in 5-9, saccular ampullae taper to ducts with clavate diverticula as long or longer than ducts. Male organs: holandric, iridescent testes and funnels in 10 and 11 contained (along with hearts and nephridia) in testis sacs formed by septa; seminal vesicles within testis sac in 11, and very large in 12. Ovaries: in 13. Prostates: thickly tubular and confined to 18; penial setae not found. Intestine: origin 17; typhlosole not found; gut filled with woody organic matter.

REMARKS

Vesiculodrilus pyengana varies from the nominal subspecies on its extra pair of genital markings in 16/17, retention of ventral setae on 18, and a greater extent of dorsal blood vessel bifurcation, which continues well onto the intestine. It is given subspecific status until the level of reproductive isolation of the subspecies is determined.

ETYMOLOGY for the type locality.

DISTRIBUTION AND HABITAT

Pyengana, St. Columba Falls, from rainforest. This specimen was found wandering on the surface during a shower along with specimens of *Vesiculodrilus tasmanianus* (Fletcher, 1887). The early the following morning numerous large worms were seen stranded on the sides of the road at Weldborough Pass, these observations may indicate that both species are subject to periodic "mass migrations", at least during rainy times.

Vesiculodrilus gracilis sp. nov

Fig. 39.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0115, Pelion Valley, C Tasmania, DP 209 660, 940 m, rainforest, 12.ii.1992, QVM collection, (mature, figured and dissected).

PARATYPES: (P1) 14:3546, Pelion Gap, C Tasmania, DP 217 364, 1120 m, 12.ii.1992, QVM, (mature, dissected); (P2-3) 14:0112, same details as P1, (two juveniles, both dissected that also agree superficially; sample contains an immature of a different species); (P4) 14:3548, Pelion Valley, Frog Flats, C Tasmania, DP 196 368, 875 m, rainforest, 13.ii.1992, QVM, (mature, dissected).

EXTERNAL FEATURES

Body: slender. Lengths mm: 85 (H), 60 (P1), 40 (P2-3), 40 (P4). Width: ca. 1.5 mm. Segments: (H) 108. Colour: anterior dorsum puce, rest of body pale; clitellum buff. Prostomium: epilobous, not notched. Clitellum: ½13,14-16. Dorsal pores: from 2/3 (small), larger from 3/4. Nephropores: in c lines. Setae: small, 8 throughout in regular rows but some rows slightly irregular on tip of tail. Spermathecal pores: 6/7-8/9 in mid-ab lines. Female pores: paired on 14. Male pores: on 18 close to b lines on small mounds in ab with crescent furrows laterally. Genital markings: mid-ventral discs postsetal in 7-9 (H, P2-4) or 8-9 (P1) and in 16 (P1) and/or 17 (H, P1, P4); widely paired discs in 17/18 and 18/19, just medial of male pores in ab lines (all matures).

INTERNAL ANATOMY

Gizzard: weak, almost vestigial in 5. Oesophagus: dilated slightly in 14-16 (not calciferous). Nephridia: vesiculate holoic, bladders large sub-spherical in c lines, smaller after clitellum; not tufted anteriorly. Vascularization: hearts 10-12 connected to supra-oesophageal vessel that passes from 8-13. Spermathecae: three pairs in 7-9, saccular ampulla tapers to short duct with small clavate diverticulum. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles small in 9 and 12. Ovaries: in 13; ovisacs small pair in 14. Prostates: tubular in 17-20; fine penial setae present. Intestine: from ½17; no typhlosole; gut contains organic soil.

REMARKS

Vesiculodrilus gracilis is characterized by its distribution of genital markings and a weak gizzard. Morphologically, it it similar to *V. symmetricus*, but this species has spermathecal pores slightly wider in 6/7/8/9 in b lines.

ETYMOLOGY gracilis, Latin - slender.

DISTRIBUTION AND HABITAT

Pelion Valley, Central Tasmania, from rainforest soil.

Vesiculodrilus gryps sp. nov.

Figs. 40.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3734, Griffin Forest Reserve, Mathinna, E Tasmania, EQ 687 088, 23.vi.1992, R.D. D'Orazio and M. Cooper, gully at edge of pines, (mature, dissected and figured).

PARATYPES: all with same details as H, 14:3735 (P1-3), (three mature specimens, two aclitellates P1 and P3 dissected).

EXTERNAL FEATURES

Body: stout but flaccid, dorso-ventrally flattened, first segment compressed and deeply furrowed. Lengths mm: (H) 80, (P1-3) 68-70. Width: ca. 7 mm. Segments: (H) 99, (P1) 107. Colour: unpigmented, almost translucent, clitellum buff. Prostomium: prolobous dorsally furrowed. Clitellum: ½13-17. Dorsal pores: 3/4 or 4/5. Setae: 8 in regular series. Nephropores: large in c lines. Spermathecal pores: mostly 5/6-8/9 in setal a lines, (H and P1 are anomalous: H has pores paired in 5/6, on rhs only in 6/7-9/10, but absent from 8/9; P1 has pores paired in 5/6-8/9 plus single in 4/5lhs). Female pores: paired on 14. Male pores: approximately in setal a lines on small papillae in ab. Genital markings: in 17/18 and 18/19 elongate pad which obliterates intersegmental furrow.

INTERNAL ANATOMY

Septa: 4/5-8/9 flimsy, 9/10-11/12 adpressed to form testis sacs. Gizzard: in 5 large with anterior crop, displaced to occupy 7-10. Oesophagus: with large, annular calciferous gland in 15. Nephridia: vesiculate holoic with large, elongate bladders; tufted in anterior in 2-4. Vascularization: dorsal blood vessel doubled from 10 or 12 (at least, in H, P1) or from 5 (P3); hearts in 10-12; supra-oesophageal vessel not noted. Spermathecae: usually four pairs in 6-9 (H and P1 are anomalous: H has spermathecae paired in 6, but on lhs only in 7-9 with that in 9 ducting to 9/10; P1 has spermathecae in 5-9 on rhs and 6-9 on lhs), large saccular ampullae taper to ducts, each with long, clavate diverticulum. Male organs: holandric, weakly developed testes and funnels in 10 and 11 contained in testis sacs formed by septa; seminal vesicles small within testis sac in 11, and free in 12. Ovaries: in 13; ovisacs absent. Prostates: tubular, confined to 18; penial setae not found. Intestine: origin 17; no typhlosole; gut filled with organic matter.

REMARKS

Vesiculodrilus gryps differs from *V. glandiferus* by lacking paired spermathecae in 4/5: there are usually only four pairs of spermathecae but some specimens are anomalous as noted in the description, perhaps indicating a species in transition. In addition, *V. gryps* while retaining pads in 17/18 and 18/19, lacks the large paired discs in that are characteristic of *V. glandiferus*, furthermore, the spermathecal diverticula tend to be relatively longer

ETYMOLOGY gryps, Latin - griffin, for the type locality.

DISTRIBUTION AND HABITAT

Griffin Forest Reserve, Mathinna, E Tasmania, from wet sclerophyll in gully at edge of pines.

Vesiculodrilus hobartensis (Spencer, 1895) comb. nov.

Fig. 41.

Cryptodrilus hobartensis Spencer, 1895: 37-38, figs. 10-12; Jensz & Smith, 1969: 88.

Plutellus hobartensis; Michaelsen, 1900: 175-176.

Megascolides hobartensis; Sweet, 1900: 111-112.

Perionychella (Vesiculodrilus) hobartensis (part.); Jamieson, 1974: 241-245; figs 11A-F [some misidentified]; 15A-B [p. 254 with incorrect scalebars]; 16P-R.

Diporochaeta hobartensis; Jamieson, 1994: 175.

MATERIAL EXAMINED

LECTOTYPE: MOV:F40050 (previously NMV:G50), "Parattah, Tasmania. January 1893." "C. sp 5 Parattah Jan/93" [in Spencer's hand], ca. 42°20'S.147°25'E, collected by W. Baldwin Spencer, (this specimen, a previously undissected posterior-amputee 28+ mm long, was designated a lectotype of *Cryptodrilus hobartensis* by Jensz & Smith (1969: 88); Jamieson (1974) found it to be a parthenogenic morph that lacked seminal vesicles, had prostate ducts but no glands, lacked penial setae, and had abnormal spermathecae and genital markings. It is currently in reasonable condition but has suffered some damage from dissection and has had several spermathecae detached and left loose in its body cavity (pers. obs.)). In view of its gross morphological differences from Spencer's description it is debatable whether or not this previously undissected specimen would have qualified as a syntype, even though it was in a jar labeled the same as the type series, and it should perhaps be requested of the Commission to set aside this parthenogenic morph lectotype in favour of a neotype, such as 14:3502, under Article 75.5 of ICZN (1999).

PARALECTOTYPES: NMV:G49, "*Cryptodrilus hobartensis* Mt Wellington, A. Morton, July/[18]92.", "C. sp5. T. (cf. sp4)" [in Spencer's hand], ca. 42°55'S.147°15'E, collected by Mr A. Morton of the Tasmanian Museum, (ten dried specimens plus fragments consisting of one previously dissected mature, two undissected matures, one ca. 44 mm long, and seven subadults, one ca. 75 mm long; all these specimens were dried and brittle yielding little useful information); NMV:G51, Parattah, February, 1893, (originally four complete specimens, one partly dissected, in fair condition but dried according to Jensz & Smith (1969: 88) now not locatable in MOV, Dr T. Stranks (pers. comm.)). Note: Whereas Jensz & Smith (1969: 88) list G49 as having eight specimens and five fragments, and G51 as having

four specimens, Jamieson (1974: 243) failed to mention G49 yet stated that G51 had only two paralectotypes. It is therefore possible that these samples have been intermixed as G49 now has ten specimens plus fragments, and G51 is not locatable. Jamieson (1974), although synonymising *Vesiculodrilus insularis* with *V. hobartensis*, failed to mention the lectotype of *V. insularis* (NMV:G39) which has the same collection details as G51. Note: under Article 73.2.2 of ICZN (1999), paralectotypes have no name-bearing function after designation of a lectotype and do not regain status as syntypes if the lectotype is lost or destroyed.

SPECIMENS: 14:3502, Mt Wellington, ca. 42°55'S.147°15'E, 21.ii.1996, R.J. Blakemore, (a mature specimen, dissected and drawn, sample also contains two immatures that agree superficially); 14:3510, Tunnack (close to Parattah type-locality), ca. 42°25'S.147°30'E, 21.ii.1996, R.J. Blakemore, and 27.ii.1996, R.J. Blakemore and J. Hirth, (four mature specimens, two dissected); TM:K299, Tunnack, 18.viii.1954, J.L. Hickman, under logs and stones damp conditions, (one mature with tip missing, previously dissected, redrawn; one subadult, undissected; sample includes a posterior portion and an immature of a different species); TM:K300-301, Collin's Vale near Hobart, 147°05'E.42°50'S, 8-9.ix.1955, J.L. Hickman, in myrtle forest, (two mature specimens, one dissected); TM:K302, Mt Wellington, Bett's Vale, 147°15'E.42°55'S, 4.iii.1954, J.L. Hickman, under stones at creek, (small specimen, 50 mm long, dissected); TM:K304, Lenah Valley, Newtown Falls, 147°20'E.42°50'S, 24.vi.1957, L.J. Hickman, (two mature specimens, one dissected); TM:K305, Mt Nelson, Sandy Bay, 147°20'E.42°50'S, 11.ix.1953, J.L. Hickman, (mature specimen, previously partially dissected, here fully dissected and sketched); TM:K306, Risdon, 147°20'E.42°50'S, 26.vi.1947, V.V. Hickman, (mature, previously dissected); BM:1972:8:15-17, East Risdon, 14.viii.1954, J.L. Hickman, from under stones on hill and in valley, (mature specimen, undissected; plus two subadults); TM:K307, same details as K306, (dissected mature and two subadults); TM:K308, Tinderbox, 147°20'E.43°05'S, 4.viii.1957, J.L. Hickman, under fallen eucalyptus leaves, (mature specimen, dissected); 14:780, Lizard Hill, Tasman Peninsula, 7.ix.1992, R.D. D'Orazio, Eucalypt forest with wet understorey, (eight matures, one dissected, and six subadults); 14:3067-3068, same details as 14:780, (two smaller matures, one dissected); 14:821, Brookerana Reserve, E Tasmania, EP 709 193, 590 m.,

11.viii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (seven large matures, one dissected).

Because of some confusion over the definition of this species, Spencer's original account will be presented followed by additional information from inspection of type material and new specimens.

EXTERNAL AND INTERNAL ANATOMY - from Spencer (1895).

Body long and narrow. Length mm: ca. 75. Width: ca. 3 mm. Colour: dorsum purple with a dark dorsal line, clitellum lighter, ventrum pale. Prostomium: epilobous. Clitellum: ¼13-16,¼17. Dorsal pores: from 4/5. Setae: distinct, 8 throughout in regular rows; ab narrower than cd; d setae are near to the dorsal surface. Spermathecal pores: five pairs in 4/5-8/9 in a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab. Genital markings: four pairs of elliptical discs in 16/17-19/20 in ab.

Gizzard: in 5. Oesophagus: calciferous glands in 12-15. Nephridia: holoic. Vascularization: last hearts in 12. Spermathecae: five pairs in 5-9; diverticulum simple and not more than half the length of ampulla. Male organs: testes in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13. Prostates: widely tubular, coiled in 18-24. Intestine: from 17.

EXTERNAL FEATURES - expanded definition from reinspecition of lectotype and new material. Body: tapering with fine dorsal canaliculation (seen in F40050 and G49 and most other specimens, except those from Lizard Hill). Length range (mm): usually 70-100; (two specimens, 14:3067-3068 from Lizard Hill are smaller, 45-60 mm, but otherwise agree; Brookerana specimens are all just over 100 mm, and one Tunnack specimen in 14:3510 is 130 mm long). Widths: 2-4 mm. Segments: 103-134. Colour: anterior and dorsum dark puce with darker dorsal line, clitellum buff, ventrum pale (pigment maybe bleached out to uniform buff in older museum specimens). Prostomium: open epilobous with dorsal furrow; peristomium ventrally cleft (in F40050 and G49 and most other specimens). Clitellum: ½13-16,¼17. Dorsal pores: from 4/5 but larger in 5/6. Setae: 8 throughout in regular rows. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab. Genital markings: two to four pairs of eye-like discs in 16/17-19/20 centred in a lines but extending towards b lines, the latter one of two pairs occasionally wanting or analogous, (eg. K299, K306-308, one

Tunnack specimen in 14:3510, and Lizard Hill and Brookerana specimens; in lectotype only those in 16/17 and 17/18 are well developed, those in 18/19 are rudimentary, and they are lacking from 19/20); markings are in 16/17 and 18/19 only in 14:3067-3068 from Lizard Hill.

INTERNAL ANATOMY

Gizzard: weakly muscular in 5, the same width as the oesophagus (in F40050 and all other inspected specimens). Oesophagus: dilated in 12-15, especially 14 and 15, with weak internal striations (barely sufficient to be considered calciferous). Nephridia: vesiculate holoic from segment 2, bladders elongate, J-shaped discharging in c lines (in F40050 and all inspected specimens). Vascularization: hearts 10-12; supra-oesophageal vessel weakly or well developed in 9-12,13. Spermathecae: five pairs in 5-9 with characteristic shape, thin duct extends from pore to junction of almost equally long diverticulum and saccular ampulla. Male organs: holandric. Ovaries: in 13; ovisacs absent. Prostates: tubular, usually in 18-24,25; long, thin penial setae seen in some specimens (eg. Tunnack and Lizard Hill, specimens), but not found in others (eg. lectotype, Hobart and Mt Wellington specimens). Intestine: origin 17 although there may be some modification of texture and colour in 16; no typhlosole; gut contains dark organic soil. Note: nematodes found the coelom in specimen K299 and in 14:3502 in the nephridial bladders, coelom and gut are placed in a phials in these sample jars.

REMARKS

Spencer was emphatic that *Vesiculodrilus hobartensis* was pigmented, epilobous, had five pairs of spermathecae with the diverticulum simple and not more than half the length of the ampulla opening in a lines in 4/5-8/9, and genital markings between 16/17-19/20 in ab. Spencer (1895: 36-37) used the characteristics given in the table below to separate his *Cryptodrilus* (= *Vesiculodrilus*) *mortoni* and *C.* (= *V.) hobartensis*:

Table of the characters Spencer used to separate *V .mortoni* and *V. hobartensis*.

Character	*V. mortoni*	*V. hobartensis*
Length (converted to mm)	65-75	75
Width (converted to mm)	6	3

Pigmentation	Whitish/flesh coloured	Dark – dorsum puce with dark median line, ventrum pale, setae distinct
Prostomium	Tanylobous	Epilobous
Genital markings	In 17/18-19/20	In 16/17-19/20
Body shape	Stout - broad in comparison to its length	Long and narrow

There was an unfortunate transposition in Spencer (1895: 38), which may have confused subsequent workers, where for *Cryptodrilus (=Vesiculodrilus) hobartensis* he stated :

> "In internal anatomy this worm [*Cryptodrilus hobartensis*] is almost identical with *C. mortoni*, but the two are perfectly distinct in external appearance. The worm in question [*C. mortoni*] is a whitish stout form, whilst *C. mortoni* [obviously a mistake as he meant *C. hobartensis*] is darkly coloured with conspicuous setae, and is long and narrow."

Examination of Spencer's type material, although dried, showed that the lectotype (F 40050) and a paralectotype (from G49, one probably dissected by Spencer) were small and thin, had mid-ventral peristomial clefts and were faintly dorsally canaliculate. Non-type material listed above agrees tolerably with Spencer's account and with each other to be considered conspecific with *V. hobartensis*, especially those specimens from Tunnack (close to the Parattah type-locality) and Mt Wellington, Hobart. The distinctive spermathecae were omitted or overlooked in earlier descriptions but appear to be characteristic of this species. This feature along with the ventral peristomial cleft and vestigial gizzard are constant for all new material included here. Dorsal canaliculization although present in type material and other specimens was absent from all the Lizard Hill specimens.

Jamieson (1974) failed to mention pigmentation in any of his descriptions, but claimed to have "considerably augmented" Spencer's description of *V. hobartensis* - expanding the definition so much that it included many variants as well as several species and genera (including K288, an immature *Notoscolex* sp., and six specimens in K298 which were actually *Notoscolex campestris* (Spencer, 1895), (pers. obs.)). Museum specimens cited under *V. hobartensis* by Jamieson (1974) are now

redistributed to more precisely fit Spencer's original description and to form more cohesive taxa (resulting in more precise distributions) thus:

K287, unpigmented with 4 pairs of spermathecae from Burnie - *Vesiculodrilus emu*;

K289 and K290, from Great Lake - *V. insularis* (Spencer, 1895);

K291 and K292 unpigmented specimens from Goulds' Country Lottah - *V. mathinna*;

K293, from Bronte - *V. bronte*;

K294-K298 with four pairs of spermathecae (but only the remaining three of nine specimens of this last sample that are not *Notoscolex campestris*) from Parattah - *Vesiculodrilus parattah*;

K303 with genital pores in b setal lines from Mt Wellington- *V. lateralis*.

Although Jamieson (1973) listed *Cryptodrilus insularis* Spencer, 1895 separately from *Cryptodrilus hobartensis* in the new genus *Vesiculodrilus*, he later (Jamieson, 1974) considered it to be a junior synonym. No evidence was offered to support this decision, consequently these two similar species are retained, as was Spencer's original intent, and are redescribed separately herein.

DISTRIBUTION AND HABITAT

Designation of a lectotype makes Parratah the type locality under Article 73.2.3 of ICZN (1999), Spencer gives the habitat as "Parratah and Mount Wellington", other locations and habitats are given under 'Material examined' above.

Vesiculodrilus inornatus sp. nov

Fig. 42.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0021, edge of Melaleuca Lagoon, Melaleuca, SW Tasmania, DM 321 921, L.F. McGowan, 4.iii.1992, in leaf litter, (mature, figured and dissected).

PARATYPES: (P1-2) 14:3788, same details as H, (P1, mature, dissected; P2 subadult, inspected).

EXTERNAL FEATURES

Lengths mm: (H) 40, (P1) 30, (P2) 25. Width: ca. 1.5 mm. Segments: (H) 101, (P1) 100, (P2) 98. Colour: anterior dorsum and tip of tail dark brown; ventrum pale unpigmented, mid-dorsal line and longitudinal setal lines markedly darker; clitellum buff.. Prostomium: open epilobous, not notched. Clitellum: from anterior third of 13-16. Dorsal pores: from 2/3 (small), larger from 3/4. Nephropores: just ventral of c lines in anterior (from 3), aligned with c lines after clitellum. Setae: small, 8 throughout in regular rows but d lines move slightly more dorsal progressively to tail. Spermathecal pores: 5/6-8/9 just lateral of a lines (diverging slightly). Female pores: paired on 14. Male pores: superficial just lateral of a lines on 18 (setae b, or at least follicles, retained on 18). Genital markings: laterally elongate pads in 17/18 and 18/19 mostly in aa.

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: compact, muscular in 5. Oesophagus: dilated slightly in 15 (not calciferous); narrow in 16. Nephridia: vesiculate holoic, bladders small spherical in c lines; not tufted anteriorly. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-12; supra-oesophageal vessel weak in 10-11 (H) or 10-12 (P1). Spermathecae: four pairs in 6-9, saccular ampulla tapers to short duct with small, clavate diverticulum. Male organs: holandric, iridescent testes and funnels in 10 and 11 invested in mucus; racemose seminal vesicles small in 9 and larger (bi-lobed?) in 12. Ovaries: in 13; ovisacs small pair in 14. Prostates: tubular in 18-19; fine penial setae converge with duct. Intestine: from 17; no typhlosole to about 40; gut contains organic debris.

REMARKS

Vesiculodrilus inornatus is distinguished by having four pairs of spermathecae in 4/5-8/9 just lateral of a lines, genital markings reduced to simple pads in 17/18 and 18/19, and retention of setae b on 18. It is morphologically similar to *V. dendrophagus*, but the latter species has a single female pore, different arrangements of genital markings, spermathecae with long ducts, intestinal origin in 19 or 20, and apparently lacks penial setae. It is also close to *V. octothecatus* and sympatric *V. melaleuteus*, but differs in lack of paired genital markings (in anterior and in 18/19 or 19/20), and spermathecae in setal a lines rather than ab or b lines.

ETYMOLOGY inornatus, Latin - 'unadorned', for the reduced genital markings.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania from leaf litter.

Vesiculodrilus insularis (Spencer, 1895) comb. nov.

Fig. 43.

Cryptodrilus insularis Spencer, 1895: 41-42, Figs. 19, 20, 21.

Plutellus insularis; Michaelsen, 1900: 176.

Megascolides insularis; Sweet, 1900: 111, fig. 16.

Vesiculodrilus insularis; Jamieson, 1973: 225.

Perionychella (Vesiculodrilus) hobartensis (part.); Jamieson, 1974: 241-245.

(Non *Cryptodrilus insularis* Rosa, 1891, now in synonymy of *Pontodrilus litoralis*)

MATERIAL EXAMINED

LECTOTYPE: MOV:F40039 (previously NMV:G39), "Parattah, Feb/[18]93." "C sp 8. T." [in Spencer's hand], ca. 42°20'S.147°25'E, collected by W. Baldwin Spencer, (an immature specimen which was complete and undissected when designated by Jensz and Smith (1969) but is now halved at segment 30, has had the anterior half dissected with many of the internal organs removed and missing from the jar - this specimen consequently yields little additional information and is inadequate for illustration).

SPECIMENS: 14:3511, Tunnack (near Parattah type locality), 21.ii.1996, R.J. Blakemore, and 27.ii.1996, R.J. Blakemore and J. Hirth, in woodland soil, (combined sample of fourteen specimens, mostly mature, three dissected one drawn); TM:K289, Great Lake, 146°45'E.41°55'S, 26.v.1954, J.L. Hickman, near stones around base of gum tree, slopes of lake, (mature specimen, undissected); TM:K290, same details as K289, (mature, dissected and sketched).

EXTERNAL FEATURES

Body: thin tapering, without dorsal canaliculation (lectotype and all other specimens). Length mm: 25-50 (Spencer), 50-80 (new material). Width: 2-3 mm. Segments: 131 (lectotype), 110-123 (new material). Colour: dorsum puce, paler in the posterior with a faint dorsal line, flanks pinkish and ventrum pale, clitellum buff. Prostomium: epilobous; peristomium ventrally cleft (lectotype and new material). Clitellum: ½13-½17. Dorsal pores: from 5/6 (Spencer) or 4/5 (new material). Setae: 8 per segment, in regular rows save an odd one or two at posterior; setae ab converge around male pores (Spencer). Nephropores: in c lines. Spermathecal pores: 4/5/6/7/8/9 in a lines, two posterior pairs most obvious. Female pores: paired on 14.

Male pores: on 18 on small papillae in ab. Genital markings: paired discs in 16/17 in ab; (Great Lake specimens have an extra pair, or analogue, in 15/16 in a lines).

INTERNAL ANATOMY

Gizzard: moderately muscular in 5. Oesophagus: increasingly vascularized and dilated in 13-15 with internal lamellae, contracting in 16 (cf. no true calciferous glands present - Spencer); oesophageal valve in 16 (Great Lake specimen) or 17 (Tunnack specimens). Nephridia: vesiculate holoic from segment 2, bladders elongate, J-shaped discharging in c lines. Vascularization: hearts 10-12; supra-oesophageal vessel weak in 9-12. Spermathecae: five pairs in 5-9, ampulla spherical tapering to duct with clavate diverticulum about half length of the ampulla. Male organs: holandric, iridescent testes in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13; ovisacs small in 14 or absent. Prostates: very long, tubular and coiled in most or all of 18-30; thin penial setae present. Intestine: origin in 18 (Tunnack specimens), 17 (Great Lake specimen) or 16 (Spencer); typhlosole absent; gut contains organic matter.

REMARKS

Spencer rarely mentioned the presence or absence of nephridial bladders, however, as Jamieson (1973: 225) included *Cryptodrilus insularis* in his new genus *Vesiculodrilus* it is assumed he had inspected the now damaged type material to determine that this species is vesiculate. New material included in the above account differs from the type description in three important characters: dorsal pores in 4/5 (rather then 5/6); oesophagus dilated in 13-15; and intestinal origin in 17 or 18 (rather than 16). In other respects there is sufficient general agreement, especially in the external appearance, in the spermathecae and in the long prostates. The ventrally cleft prostomium is constant for all material examined. *V. insularis* is similar to the sympatric *V. parattah* which has only 4 pairs of spermathecae, to *V. bronte* which is differentiated under that species account, and to *V. hobartensis*. Whereas Jamieson (1974) considered *Cryptodrilus insularis* Spencer, 1895 a junior synonym of *Vesiculodrilus hobartensis* (Spencer, 1895) he offered no evidence to support this, consequently these two species are retained and are differentiated on these points:

1/. Genital markings in 16/17 or 15/16/17 in *V. insularis* cf. 16/17-18/19 in *V. hobartensis*.

2/. Shape of spermathecae: in *V. hobartensis* they have long ducts after diverticula.

3/. Prostates extend to 27-30 in *V. insularis*, generally less in *V. hobartensis*.

4/. *V. hobartensis* typically has dorsal canaliculation.

DISTRIBUTION AND HABITAT

Parratah, under logs (Spencer, 1895); Tunnack in woodland soil, and Great Lake under stones.

Vesiculodrilus lateralis sp. nov.

Fig. 44.

Perionychella (Vesiculodrilus) hobartensis (part.); Jamieson, 1974: 241-245.

MATERIAL EXAMINED

HOLOTYPE: 14:3503, Mt. Wellington, ca. 42°55'S.147°15'E, 21.ii.1996, R.J. Blakemore, in soil and litter in gullies, (mature, probably posterior regenerate as pygium setose, dissected and drawn).

PARATYPES: (P1) 14:3504, same details as H, (mature, undissected); (P2) 14:3505, same details as H, (mature, dissected); (P3) 14:3506, same details as H, (mature, undissected); (P4) TM:K303, Mt Wellington, Shoobridge Bend Track, ca. 42°55'S.147°15'E, 580 m, 19.viii.1971, E. Bradbury, in loam and clay in Eucalypt-fern woodland, (mature specimen, dissected).

EXTERNAL FEATURES

Body: narrow tapering, without dorsal canaliculation. Lengths mm: (H) 44+, (P1) 50, (P2-3) 40. Width: ca. 2 mm. Segments: (H) 51+, (P1) 88, (P2) 72, (P3) 84, (P4) 40. Colour: anterior and dorsum puce, ventrum pale, clitellum buff. Prostomium: open epilobous; peristomium with weak ventral cleft. Clitellum: ½13-16. Dorsal pores: from 5/6, vestigial in 4/5. Setae: 8 throughout in regular rows. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in b lines. Female pores: on 14. Male pores: on 18 in b lines on small papillae. Genital markings: paired discs in a lines in 16/17, in ab in 17/18 and 19/20.

INTERNAL ANATOMY

Gizzard: vestigial in 5, same width as oesophagus. Oesophagus: slightly dilated in 14-15. Nephridia: vesiculate holoic in c lines, bladders elongate. Vascularization: hearts 10-12; supra-oesophageal vessel not noted. Spermathecae: five pairs in 5-9, ampulla saccular to junction with long thin diverticulum on equally long, thin duct. Male organs: holandric, testes and funnels iridescent in mucus in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13. Prostates: tubular, 18-27; short penial setae present. Intestine: origin in 16 (in H) but appearing valvular in 16 and wider in 17 (in P2), thus origin is possibly near 16/17; no typhlosole; gut contains sandy soil.

REMARKS

Vesiculodrilus lateralis is sympatric with and similar to *V. hobartensis*, it differs principally in having the spermathecal and male pores more lateral in line with b setae. Other differences are the lack of dorsal calaliculation, the position of the first dorsal pore and possibly the lack of markings in 18/19.

ETYMOLOGY lateralis, for the lateral spermathecal pores.

DISTRIBUTION AND HABITAT

Mt Wellington, Hobart, in soil and litter in gullies.

Vesiculodrilus lepidus sp. nov

Fig. 45.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1753, Sideling Range, N Tasmania, 550 m., EQ 344 354, 15.vi.1992, R.D. D'Orazio, rainforest, (mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 130. Width: ca. 2.5 mm. Segments: 130. Colour: anterior and dorsum puce with darker mid-dorsal line throughout, ventrum pale, silvery setal lines being well marked giving distinct striped appearance; clitellum buff. Prostomium: epilobous, peristomium not cleft. Clitellum: ½13-16. Dorsal pores: vestigial in 3/4 open from 4/5. Nephropores: at anterior of segments in c lines. Setae: 8 throughout in regular rows although d lines move slightly more dorsal towards tail. Spermathecal pores: 5/6/7/8/9 in ab lines but closer to b lines. Female pores: paired on 14. Male pores: on low papillae in ab on 18. Genital markings: small paired discs median to spermathecal pores anteriorly in 8 and 9, latter pair repeated with further postsetal pair in ab lines on 9; paired discs in ab lines but closer to a lines in 16/17; elongate tumid pads on either side of male field extending almost to b lines in 17/18 and 18/19.

INTERNAL ANATOMY

Gizzard: weak in 5. Oesophagus: dilated slightly in 12-15, narrow and valvular in 16. Nephridia: vesiculate holoic, bladders spherical; not tufted in anterior. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-12 from weak supra-oesophageal vessel in 9-12. Spermathecae: four pairs in 6-9, saccular ampulla tapers to short duct with medium-sized clavate diverticulum. Male organs: holandric, iridescent testes in mucus in 10 and 11, racemose seminal vesicles in 9 and 12. Ovaries: compact in 13. Prostates: tubular in 18; long and fine penial setae present. Intestine: from 17; typhlosole absent; gut filled with organic matter.

REMARKS

Vesiculodrilus lepidus is morphologically similar to *V. octothecatus* in having four pairs of spermathecae exiting in 5/6-8/9 in ab, it differs by having paired genital markings in 16/17 and lacking a pair in 18/19. Also similar is *V. mesibovi* which occurs in the same region but has only three pairs of spermathecae, amongst other differences.

ETYMOLOGY lepidus, Latin - 'graceful or neat', for the distinctively arranged markings.

DISTRIBUTION AND HABITAT

Sideling Range, N Tasmania, from rainforest on 'Sideling' soil type on Mathinna Sandstone, soil pit dug by Mike Laffan, Forestry Tasmania.

Vesiculodrilus lilliputensis sp. nov.

Fig. 46.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:221, Weldborough, NE Tasmania, 1.8 km along Emu Road, EQ 781 408, 540 m, 21.vii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll to rainforest, (mature specimen, dissected and drawn).

PARATYPES: (P1) ANIC:RB.97.2.2, same collection details as H, (mature, dissected); (P) TM:K1540, same details as H, (weakly-clitellate mature, dissected); (P3) 14:3132, same details as H, (mature); (P4) 14:3133, same details as H, (aclitellate mature); (P5-10) 14:3112, "16 km beyond Derby on road to Weldborough [ca. EQ 750 400,], 15.x.1985, Mrs Holmes", "...Small worms were above clay beneath about 2" of compost layer", (six macerated specimens, four matures of 65-100 mm, and two juveniles, one mature dissected); (P11) 14:3142, same details as P5-10, (immature, dissected).

EXTERNAL FEATURES

Lengths mm: range 80-100 (mean 91 mm ±6.6, n=5); 90 (H), 95 (P1), 100 (P2), 90 (P3), 80 (P4), immature specimen, 50 mm. Width: ca. 7.5 mm. Segments: 142 (H), 140 (P1); immature specimen, 135. Colour: unpigmented grey in alcohol, clitellum buff. Prostomium: furrowed, weakly closed epi-tanylobous. Clitellum: ½13-17,½18. Dorsal pores: 4/5 vestigial, perforate from 5/6. Setae: eight throughout in regular rows. Nephropores: in c lines. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired on 14. Male pores: on 18 in ab lines on slightly raised mounds (small dark tips of setae seen protruding in P2, setae ab retained on 18 in P5). Genital markings: elongate pads in 14/15-21/22/23/24, wider than b setae, but only extending as far as mid-ab in 17/18/19; (ten markings in H and P1, nine in P2-3, eight in P4).

INTERNAL ANATOMY

Septa: 9/10-12/13 some thickening. Gizzard: in 5, large and muscular preceded by proventriculus. Oesophagus: moniliform 6-14, wider in 15,16; valvular in 16; not calciferous. Nephridia: vesiculate, holoic from 2, bladders elongate with nephropores in c lines. Vascularization: hearts 10-12 from supra-oesophageal vessel in 9-12. Spermathecae: five pairs in 5-9, each with elongate ampulla and small iridescent diverticulum, (in H and P2 both ampullae occur on the same side in segment 8, one being deflected under the ventral nerve cord). Male organs: testes

iridescent in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: small palmate in 13; ovisacs absent. Prostates: thickly tubular, blocky, confined to 18; modified penial setae not found (although in P2, P3, P5 prostatic ducts enter body wall in b lines and small black setae a and b are retained). Intestine: from 17, spiraling; typhlosole absent; gut contains soil and organic matter or woody material.

REMARKS

Vesiculodrilus lilliputensis is superficially similar to *Vesiculodrilus tasmanianus*, especially in the appearance and distribution of the genital markings, however, it differs in its smaller mean size (91 mm *vs.* 260 mm), fewer segments and less extensive clitellum. In addition, *Vesiculodrilus lilliputensis* has last hearts in 12 (cf. in 13 in *V. tasmanianus*), intestinal origin in 17 (cf. in 18, or posterior of 17, in *V. tasmanianus*), nephropores are in a regular series, and setae d are in straight lines. Despite these differences, the closest relationship of *V. lilliputensis* is probably with *V. tasmanianus*, the distribution of their genital markings, at least, serving to separate them from other known *Vesiculodrilus* spp. with five pairs of spermathecae.

ETYMOLOGY reference to island in Swift's 'Gulliver's Travels', putatively Van Diemen's Land (= Tasmania), where the inhabitants were small.

DISTRIBUTION AND HABITAT

Between Weldborough and Derby, where this small species is sympatric with the much larger *V. tasmanianus*, from woodland or under 'compost'.

Vesiculodrilus marian sp. nov.

Fig. 47.

MATERIAL EXAMINED

HOLOTYPE: 14:3316, Maria Island, SE Tasmania, Bishop & Clerk Mountain, QVM collection, (mature, posterior amputee, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Body: stout, dorso-ventrally flattened after clitellum, finely dorsally canaliculate from segment 7. Length mm: 95+. Width: ca. 13 mm. Segments: 90+. Colour: unpigmented, pale in ethanol; clitellum grey. Prostomium: prolobous barely impinging on peristomium; unfurrowed Clitellum: 14-17 obscuring furrow 17/18 dorsally. Dorsal pores: from 5/6. Setae: 8 in regular rows, except converge around male pores. Nephropores: in c line but migrating just ventral of this from 15 for remainder of body. Spermathecal pores: at posterior of segments near 4/5/6/7/8/9 in setal a lines. Female pores: paired on 14. Male pores: superficial in ab on 18, dark tips of penial setae visible nearby. Genital markings: none in anterior; paired elongate pads wider than b lines postsetally in 17 almost overwhelming male pores and obscuring intersegmental furrow; no midventral pad in 17/18 but faint pad median to male pores on 18; three pairs of ellipsoid markings postsetally in ab lines in 19, 20 and 21 but encroaching on adjacent segment.

INTERNAL ANATOMY

Septa: 9/10-13/14 much thickened. Gizzard: large muscular barrel in 5 but displaced to position of 7-9. Oesophagus: dilated in 9-16, white and internally ruggose in 13-16 forming annular calciferous glands in these latter four segments; narrow and valvular at 16/17. Nephridia: vesiculate holoic, large bladders elongate and J-shaped in anterior segments, in clitellar segments developing pouched diverticulum at bend, in intestinal segments bladder much elongated. Vascularization: hearts 10-13 with connectives to supra-oesophageal vessel. Spermathecae: five pairs in 5-9, ampulla saccular on shorter duct with medium sized clavate diverticulum ectally (irregularly enlarged on 9lhs). Male organs: holandric, iridescent testes in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: fan-shaped in 13; no ovisacs in 14. Prostates: from 18, tubular and interlocking dorsally in 17-21; small penial setae present. Intestine: origin 17; no typhlosole; gut contains red soil.

REMARKS

Vesiculodrilus marian is similar to subspecies of *V. mortoni* (Spencer, 1895), to *V. fictilis*, and to *V. prospectus* having elongate nephridial bladders and nephropores migrating ventral of c setal lines in the mid-body. Its distinctive characters are its proportionally larger size (despite amputation), an unfurrowed prolobous prostomium, dorsal pores from 5/6, last hearts in 13, and intestinal origin in 17. Moreover, it lacks a mid-ventral pad in 17 (although a faint pad is median in 18), and has paired markings in 17 and 19-21.

ETYMOLOGY named after the type locality.

DISTRIBUTION AND HABITAT

Maria Island, SE Tasmania.

Vesiculodrilus maritimus sp. nov.

Fig. 48.

Perionychella (Vesiculodrilus) mortoni (part.); Jamieson, 1974: 247-250.

MATERIAL EXAMINED

HOLOTYPE: TM:K419, Eastern Slope of Hobart Domain, ca. 42°50'S.147°20'E, 14.viii.1954, J.L. Hickman, (a previously undissected mature specimen, dissected and sketched).

PARATYPES: (P1) TM:K402, Domain, Hobart, August 1954, J.L. Hickman, (a previously undissected specimen); (P2) TM:K416, Sandy Bay, Hobart, September 1954, J.L. Hickman, (a previously undissected specimen - a second immature specimen in this sample was a *Cryptodrilus* sp.).

EXTERNAL FEATURES

Body: slightly flattened, faint dorsal canaliculation posteriorly. Lengths mm: 165 (H), 145 (P1), 140 (P2); average 150.0 mm. Width: ca. 6 mm. Segments: (H and P1) 216. Colour: uniform grey in alcohol, clitellum buff. Prostomium: epilobous (faintly tanylobous in P2), deeply furrowed to 2/3. Clitellum: ½13-17. Dorsal pores: 4/5. Setae: 8 throughout in regular rows but converging on either side of male pores. Nephropores: in c lines throughout (i.e., not migrating ventrally after the clitellum). Spermathecal pores: 4/5-8/9 in setal a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in b, with intervening ridge. Genital markings: paired or elongate pads between the spermathecal pores in 4/5,5/6-8/9; paired elongate pads postsetal from lateral of b line and almost converging ventrally in 17 and 19-20 and (in H only) in 21.

INTERNAL ANATOMY

Gizzard: muscular barrel in 5. Oesophagus: dilated in 14-16, not calciferous. Nephridia: vesiculate holoic, bladders elongate discharging in c lines, doubled over in the anterior then forming small diverticulum on the bend which becomes elongate in and after clitellar segments. Vascularization: hearts 10-12 from supra-oesophageal vessel which runs 7,8-13,15. Spermathecae: five pairs in 5-9, ampulla saccular tapering to duct with small diverticulum. Male organs: holandric, iridescent testes in 10 and 11 in mucus; seminal vesicles racemose in 9 and 12. Ovaries: large in 13; small ovisacs in 14. Prostates: tubular in 18-26 (H) or 18-27 (P1); penial setae not

found (possibly minute as tips seen externally in P1). Intestine: origin 18; no typhlosole; gut contents organic soil.

REMARKS

Vesiculodrilus maritimus differs from subspecies of *V. mortoni* (Spencer, 1895) by its larger biometry (length 165 mm, segments 216), the lack of a mid-ventral genital pad in 17, its nephropores remaining in setal c lines rather than migrating ventrally after the clitellum, and in the greater extent of the prostates. The anterior genital markings and distinctively furrowed prostomium also serve to distinguish *V. maritimus* from *V. marian*.

ETYMOLOGY maritimus, Latin - 'coastal', for the habitat.

DISTRIBUTION AND HABITAT

The Domain and Sandy Bay, both coastal localities of Hobart.

Vesiculodrilus mathinna sp. nov.

Fig. 49.

Perionychella (Vesiculodrilus) hobartensis (part.); Jamieson, 1974: 241-245.

MATERIAL EXAMINED

HOLOTYPE: (H,) 14:1473, Evercreech Forest Reserve, Mathinna, NE Tasmania, 41°29'S.147°53'E, EQ 821 175, 640m, 23,vi.1992, R.D. D'Orazio, (mature, dissected, sketched).

PARATYPES: (P1) ANIC:RB.00.1.4, same details as H, (mature that agrees exactly externally, sample includes seven large immatures, 14:3728, that superficially agree); (P2) TM:K291, Goulds' Country, near Lottah, NE Tasmania, 41°15'S.148°05'E, 16.iv.1954, Dr J.L. Hickman, (mature specimen, previously dissected, here re-inspected and sketched); (P3) TM:K292, same collection details as P2, (mature, only partially dissected previously, here more fully described).

EXTERNAL FEATURES

Body: moderately stout and rounded without dorsal canaliculation, tail blunt. Lengths mm: (H) 80, (P1) 75, (P2) 65, (P3) 75. Width: ca. 3.5-4.5 mm. Segments: (H) 137, (P2) 151, (P3) 165. Colour: unpigmented or light brown in alcohol; clitellum buff. Prostomium: slightly epilobous, closed, dorsally furrowed to 2/3. Clitellum: ½13-16. Dorsal pores: minute in 3/4, open from 4/5. Setae: small, 8 throughout in regular rows. Nephropores: in c lines in anterior but move slightly more slightly ventral after clitellum. Spermathecal pores: small in 4/5-8/9 in a lines with small lateral marks either side. Female pores: widely paired on 14 in paler field. Male pores: on 18 near b lines on small raised papillae that replace ab setae and are conjoined by low ridge. Genital markings: small puckers adjacent to spermathecal pores possibly artefactual; small paired discs postsetally in ab but closer to a lines posteriorly on 17, 19, 20, former pair conjoined by dark median patch that encroaches on 17/18, latter two pairs converge slightly.

INTERNAL ANATOMY

Septum: 5/6 thin and distended to base of gizzard. Gizzard: large in 5, displaced to occupy 7-8. Oesophagus: dilated in 9-15, not calciferous. Nephridia: vesiculate holoic, bladders elongate Z- or J-shaped dilations of ducts, exiting laterally; not tufted anteriorly. Vascularization: hearts 10-12 with connective to supraoesophageal vessel in 8-12. Spermathecae: five pairs in 5-9, tapered ampulla on

duct with small clavate diverticulum ectally. Male organs: holandric, iridescent testis and funnels in 10 and 11; seminal vesicles absent from 9, paired in 11 and larger in 12. Ovaries: palmate and often gravid in 13; no ovisacs in 14. Prostates: tubular, although slightly flattened and weakly incised, in 18-24,25; penial setae present in H (not found in P2, previously removed?). Intestine: from 17; no typhlosole but low dorsal ridge present from ca. 19; gut contains woody material, soil and quartz grits.

REMARKS

Characteristics of *Vesiculodrilus mathinna* are the dorsally furrowed prostomium and peristomium, five pairs of spermathecae, elongate nephridial bladders, a strong gizzard, and, especially, seminal vesicles in 11 and 12 rather than the more usual 9 and 12. The only previously described species with this arrangement is *V. glandiferus*. Although Jamieson (1974) included these Goulds' Country specimens under his wide redescription of Spencer's *V. hobartensis*, they are in fact closer to *V. mortoni* and in any case they are clearly distinct from either taxon as characterized herein.

ETYMOLOGY after the type-locality.

DISTRIBUTION AND HABITAT

NE Tasmania: Evercreech Forest Reserve, from wet sclerophyll, and Goulds' Country near Lottah, from "fireplace near creek".

Vesiculodrilus melaleuteus sp. nov

Fig. 50.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0013, Melaleuca, Half-woody Hill, SW Tasmania, DM 338 889, 80 m, 5.iii.1992, Louise F. McGowan, in wet forest, (mature, dissected and sketched).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 47. Width: ca. 2 mm. Segments: 94. Colour: dark brown pigment dorsally to b lines, ventrum, intersegments and setal auriolae yellow; clitellum buff. Prostomium: open epilobous, not notched. Clitellum: 14-16 and encroaching one third into adjacent segments. Dorsal pores: from 4/5. Nephropores: not found. Setae: 8 throughout. Spermathecal pores: 5/6-8/9 just lateral of b lines. Female pores: paired on 14. Male pores: on 18 on pican-shaped mounds in ab lines. Genital markings: paired postsetal discs in ab in 7 and 8; paired discs in ab in 19/20; male pores incorporated in paired elongate mounds on 18 in ab.

INTERNAL ANATOMY

Gizzard: weakly muscular in 5 but not much larger than oesophagus in 6-7. Oesophagus: not especially dilated; narrows in 16. Nephridia: vesiculate holoic exiting in c lines; flattened, subspherical bladders in anterior (seen from 6), become elongate V-shaped from 13; anterior tufting not noted. Vascularization: dorsal blood vessel single; hearts 10-12; supra-oesophageal vessel not found. Spermathecae: four pairs in 6-9, ovoid ampulla on short duct with medium-sized clavate diverticulum ectally with flat iridescent bulb. Male organs: holandric, iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles in 9 and 12. Ovaries: as sheets (ova not seen) plus oviducts in 13; large paired ovisacs in 14 (contain large ova). Prostates: tubular, slightly flattened in 18-19; penial setae not found. Intestine: from ½17; no typhlosole; gut void. Note: small nematodes were found in anterior nephridial bladders.

REMARKS

Vesiculodrilus melaleuteus is distinguished by its dark pigmentation with yellow intersegmental bands; its elongate nephridial bladders; and its distinctive genital markings and male field all of which serve to separate it from other octothecal vesiculodrilids.

ETYMOLOGY from the dark/yellow pigmentation.

DISTRIBUTION AND HABITAT

Melaleuca (Half Woody Hill), SW Tasmania, in wet forest, sympatric with *V. inornatus* and *V. pulchellus.*

Vesiculodrilus mesibovi sp. nov.

Fig. 51.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1725, Mt Arthur, N Tasmania, EQ 246 310, 750 m, 19.v.1991, R. Mesibov, wet sclerophyll, (mature, dissected and drawn)

PARATYPE: (P) 14:3978, Upper Castra, NW Tasmania, DQ 304 274, 285 m, 19.i.1994, R.D. D'Orazio and D. Soccol, (mature posterior amputee, dissected).

EXTERNAL FEATURES

Length mm: 85. Width: ca. 2 mm. Segments: 111. Colour: faint dorsal pigmentation with darker mid-dorsal line, clitellum buff. Prostomium: open epilobous. Clitellum: 13-16. Dorsal pores: from 2/3. Setae: 8 throughout. Spermathecal pores: 6/7/8/9 in setal a lines. Female pores: paired on 14. Male pores: in ab on small papillae on 18 replacing setae ab. Genital markings: absent from anterior; large paired discs midventral in aa lines in 16/17, wider in b lines in 17/18 and 18/19 with large flat pads intervening between the latter discs.

INTERNAL ANATOMY

Gizzard: in 5 moderately muscular and preceded by a proventriculus in 4. Oesophagus: dilated in 14 and 15 as calciferous glands. Nephridia: vesiculate holoic from segment 2, bladders gourd-like discharging in c lines. Vascularization: hearts 10-12; supra-oesophageal vessel not noted. Spermathecae: three pairs in 7, 8 and 9, ampulla spherical demarcated from shorter duct with medium-sized, iridescent diverticulum. Male organs: holandric, iridescent testes in 10 and 11 concealed in mucus; small seminal vesicles in 9 and 12. Ovaries: large in 13. Prostates: tubular in 18-20 looping forward into 17; penial setae not found. Intestine: origin 17; no typhlosole; gut contains soil and woody material.

REMARKS

Vesiculodrilus mesibovi, a medium-sized worm with three pairs of spermathecae and genital markings in 16/17-18/19, is similar to *V. albus* but this species differs by having a single female pore, additional markings in 19/20/21, and intestinal origin in 18. *Vesiculodrilus borealis*, *V. tunnackensis* and *V. ventralis*, are also similar, and *V. tunnackensis* and *V. borealis* have oesophageal dilations in 14 and 15, the main differences are that these three species all have anterior genital markings in some of 6-10. The geographic distribution of *V. mesibovi* is intermediate between

these other species. The paratype (P) differs from H in having darker dorsal pigmentation; first dorsal pore from 4/5, the mid-ventral genital marking in 16/17 replaced by a pair of discs in setal a lines and nephridial bladders that are laterally elongate, but in other respects it agrees with H and is, on balance, considered conspecific.

ETYMOLOGY named after the collector, Dr Bob Mesibov.

DISTRIBUTION AND HABITAT

Mt Arthur, N Tasmania in wet sclerophyll, and Castra, NW Tasmania.

Vesiculodrilus metandris sp. nov.

Fig. 52.

Perionychella (Vesiculodrilus) mortoni (part.); Jamieson, 1974: 247-250.

MATERIAL EXAMINED

HOLOTYPE: TM:K414, Eaglehawk Neck, ca. 43°00'S.147°55'E, 13.v.1954, J.L. Hickman, (a previously undissected mature specimen - listed under *P.(V.) mortoni* by Jamieson (1974: 148, 450), here dissected and sketched).

PARATYPES: none (a second specimen in this sample is a damaged *Cryptodrilus* sp.).

EXTERNAL FEATURES

Body: dorso-laterally flattened, tail blunt, faint canaliculation posteriorly. Length mm: 95. Width: ca. 6.6 mm. Segments: 130. Colour: uniform buff in alcohol, clitellum paler. Prostomium: tanylobous. Clitellum: ½13-½17. Dorsal pores: from 4/5. Setae: 8 throughout in regular rows but converging on either side of male pores. Nephropores: in c lines but migrating slightly ventral of this after 14/15. Spermathecal pores: at posterior margins of segments near 4/5-8/9 in setal a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab, conjoined with faint elongate trough. Genital markings: arching papillae in 5/6-8/9 between the spermathecal pores; midventral pads in aa anteriorly and posteriorly in 18; pairs of ellipsoid markings extending from b towards the mid-ventral line in 19/20-21/22; ventral setae on 17 are on tumescences.

INTERNAL ANATOMY

Gizzard: muscular barrel in 5 preceded by large proventriculus. Oesophagus: dilated in 9-16 but not calciferous. Nephridia: vesiculate holoic from segment 2, bladders elongate discharging in c lines with an elongate diverticulum which develops just before clitellum. Vascularization: hearts 10-12 from supra-oesophageal vessel which extends 9-13. Spermathecae: five pairs in 5-9, ampulla saccular tapering to duct with small diverticulum. Male organs: metandric, funnels in 10 not iridescent, iridescent testes and funnels in mucus in 11; seminal vesicles, large and racemose in 12 only. Ovaries: small in 13. Prostates: tubular confined to 18; penial setae not found. Intestine: origin 18; no typhlosole; gut contains organic soil.

REMARKS

Vesiculodrilus metandris differs from subspecies of *V. mortoni* (Spencer, 1895) because it is metandric, lacks genital markings in 17 or 17/18, and has its prostates confined to 18. The original description of *V. mortoni* was of an holandric species with testes and "ciliated rosettes" (= funnels) in 10 and 11 and "sperm sacs" (= seminal vesicles) only in 12, and whereas *V. metandis* actually has seminal vesicles only in 12 it differs on these other points.

DISTRIBUTION AND HABITAT

Eaglehawk Neck, SE Tasmania.

Vesiculodrilus mortoni montis subsp. nov.

Fig. 53.

Perionychella (Vesiculodrilus) mortoni (part.); Jamieson, 1974:247-250, figs12B (p. 244), 15E-G (p. 254), 16T (p. 256).

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K413, Mt Wellington, ca. 42°55'S.147°15'E, 27.x.1955, J.L. Hickman, (a previously undissected mature specimen, here dissected and drawn).

PARATYPES: (P1-P21) 14:3312-3315, Shoobridge Bend, Mt Wellington, ca. 42°55'S.147°15'E, 21.ii.1996, R.J. Blakemore, (twenty-one specimens, P1-P3, i.e., 14:3312-3314, dissected; all other specimens in 14:3315 were inspected - including three posterior amputees, three aclitellates and three immatures); (P22-P26) TM:K404, Waterworks Rd. Hobart, 17.viii.1954, J.L. Hickman, (five specimens none previously dissected, only one, P22, fully mature, dissected); (P27-P30) TM:K407, Collinsvale, 8-9.xi.1955, J.L. Hickman, (four specimens, one a posterior amputee, plus a tail); (P31) TM:K417, Mt Wellington, April 1952, W. Radford, (an undissected mature specimen); (P32-33) TM:K415, labeled by Jamieson as "Fern Glade, Emu River, Burnie, 24.viii.1954, J.L. Hickman" but most likely from Fern Tree, near Mt Wellington, Hobart, (three specimens, one found to be a *Cryptodrilus* sp., the other two matures, one previously dissected, and one, P33, here dissected and sketched - both agree externally and internally).

SPECIMENS: MOV:F40041 (previously NMV:G41), labeled "Mt Wellington, July 1892 A. Morton, C sp 3", a second label in Spencer's hand states "*C. polynephricus* 2 or 3 specimens", - this specimen was incorrectly designated a lectotype of *Cryptodrilus polynephricus* Spencer, 1895 by Jensz and Smith (1969: 90), as it was later stated to be a specimen of "*Perionychella (Vesiculodrilus) mortoni*" by Jamieson (1974: 286); although Jensz and Smith (1969) described this as 'a dissected entire specimen', it was found be the current author to be dissected but only in the posterior, therefore it is not clear how Jamieson (1974) could state categorically that it was *V. mortoni*, neither did he list it under his material examined for this taxon, (a mature specimen, previously undissected in the anterior, here dissected and shown to actually belong to *Vesiculodrilus mortoni* subspp.); TM:K408, Newton Falls, Lenah Valley, 24.vi.1957, J.L. Hickman, (21 mature and 2 immature specimens, one previously dissected, one other dissected here); BM:1972:8:26-30, Lenah Valley,

Newtown Falls, 24.vi.1947, J.L. Hickman, (five specimens, none dissected); BM(NH) 1972:8:18-25, Shoobridge Bend track (Mt Wellington ca. 42°55'S.147°15'E), 19.viii.1971, E.A. Bradbury, (eight specimens, inadequately preserved, macerated and in rather poor condition, some dissected).

EXTERNAL FEATURES

Body: dorso-laterally flattened behind clitellum, tail blunt, faint canaliculation sometimes seen in the caudal region. Lengths mm: range 58-160, average about 90: (H) 85, (P1) 100, (P2) 80, (P3) 58, (ten specimens of 14:3315) 65-100, (P22, P32-33) 80, (K407) 75-80, (K408) 90-160, (K417) 90, (F40041) 95. Width: ca. 6 mm. Segments: range 103-166: (H) 110, (P1) 129, (P2) 103, (P3) 112, (P33) 147, (the longest from K408) 166, (K417) 132, (F40041) 140. Colour: faint pink tinge to anterior and posterior on pale background in life; uniform grey in alcohol, clitellum grey-buff. Prostomium: tanylobous not tapering. Clitellum: 13,½13-½17,17. Dorsal pores: from 4/5. Setae: 8 throughout in regular rows but converging on either side of male pores; and cd moving slightly more dorsally after midbody. Nephropores: in c lines but migrating ventral of this from 14 for remaining length of the body. Spermathecal pores: at posterior margins of segments near 4/5-8/9 in or just lateral to setal a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab, conjoined with faint elongate trough. Genital markings: paired, rounded or elongate pads often present between spermathecal pores in 4/5,5/6-8/9; paired ellipsoid discs in ab postsetally in 17; midventral pad in aa in 17/18; pairs of ellipsoid markings extending from just lateral of b setae towards the mid-ventral line postsetally in 19, 20, often in 21 and sometimes in 22.

INTERNAL ANATOMY

Septa: 4/5-7/8 flimsy and displaced posteriorly, 8/9-13/14 only slightly thickened. Gizzard: muscular barrel in 5 but displaced to occupy position of 7-8. Oesophagus: dilated in 8,9-16, especially in 13,14-16, internally rugose but not calciferous. Nephridia: vesiculate holoic from segment 2, bladders elongate discharging in or near c lines, elongate diverticulum develops on bladders just before clitellum and becomes more elongate afterwards. Vascularization: hearts 10-12 from supra-oesophageal vessel that runs from 8-13. Spermathecae: five pairs in 5-9, ampulla shape varies from spherical to flattened rectangular or conical, tapering or clearly demarcated from duct with small ectal diverticulum (P1 had a single

anomalous spermatheca on lhs in 9 with small paired diverticula). Male organs: holandric, iridescent testes in 10 and 11 in mucus; seminal vesicles, large and racemose in 9 and 12. Ovaries: large in 13; small ovisacs sometimes in 14. Prostates: tubular in 17,18-21,22,23; small penial setae occasionally seen (but not in H). Intestine: origin 18 (but septum 17/18 pushed forwards by prostates) preceded by distinct valve in 17; no typhlosole; gut contains colloidal organic soil and, especially in gizzard and in the first four segments of intestine, sand grains.

REMARKS

Although *Vesiculodrilus mortoni montis* has clear affinity with the nominal subspecies- both have a tanylobous prostomium and a genital pad in 17/18 - none of the above specimens conform to Spencer's original description of *V. mortoni*, neither are they considered sufficiently distinct to justify other than sub-specific status. *V. mortoni montis* differs from *V. mortoni mortoni* principally in its larger size range (usually between 75-160 mm) and the form of its genital markings: paired markings in 17 tending to be rounded and not much, if at all, wider than those in successive segments; and paired in 19-21,22, rather than in 19, 20/21 and 21/22. In addition, *V. m. montis* tends to have paired markings between the spermathecal pores, although sometimes they are elongate. Subspecific separation is also warranted by inconsistencies in previous descriptions of *Vesiculodrilus mortoni mortoni*, as are discussed under that taxon's account. Characters serving to separate specimens of the *V. mortoni* 'species complex' in SE Tasmania are given in the following table:

Table of characteristics of V. mortoni species complex.

Taxon	*V. marian*	*V. maritimus*	*V. metandris*	*V. m. montis*	*V. m. mortoni*
Length mm	90+	165	95	60-160	50-75
Width mm	13	6	6	6	6
Segments	90+	216	130	100-166	121
Prostomium	Prolobous	Epilobous	Tanylobous	Tanylobous	Tanylobous
GM in 17	Y	Y	N	Y	Y
Pad in 17/18	N	N	N	Y	Y
GM in 20,21	Y	Y	N	Y	N
GM 20/21/22	N	N	Y	N	Y
Sem. vesicles	9&12	9&12	12	9&12	9&12

Prostates	18-21	18-26,27	18	18-20,22,23	18-21,22
Penial setae	Y	N	N	Y or N	Y or N
Intestine	17	18	18	18	18

GM - paired genital markings, Y - yes, N - not present.

ETYMOLOGY named for the mountain habitat at Mt Wellington.

DISTRIBUTION AND HABITAT

Mount Wellington, Collinsvale, Lenah Valley and Waterworks Rd. - all in Hobart, many of these samples were reported as collected from under stones. Specimens, TM:K415 (P32-33) that Jamieson (1974:248) claimed were from "Fern Glade, Burnie" are most probably from "Fern Tree, Hobart", thus this locality is excluded from the species' distribution.

Vesiculodrilus mortoni mortoni (Spencer, 1895), comb. nov.

Fig. 54.

Cryptodrilus mortoni Spencer, 1895: 36-37, figs 7-9; Jensz & Smith, 1969: 88.

Plutellus mortoni; Michaelsen, 1900: 176.

Woodwardiella mortoni ; Jamieson, 1970: 104,105.

Perionychella (Vesiculodrilus) mortoni (part.); Jamieson, 1974: 247-250.

Diporochaeta mortoni; Jamieson, 1994: 158, 175, 177.

Diporochaeta (=Perionychella) mortoni; Jamieson, 1994: 179.

MATERIAL EXAMINED

SYNTYPE: MOV:F40083 (formerly NMV:G83), labeled "*Cryptodrilus mortoni*, Tasmania A. Morton 1892" and "C. sp 4. T. 1892 A.M." [in Spencer's hand], (mature specimen, previously dissected, 50 mm long and coiled, refractory and darkened in alcohol yielding little useful information). Between February and August, 1892, Mr A. Morton of the Tasmanian Museum collected much material that was described by Spencer (1895) all of it from Mt Wellington, it is therefore probable that this specimen is from this location. Only one syntype was recognized by Jensz & Smith (1969:88), and this constitutes the single name-bearing type of the taxon under Article 73.2 of ICZN (1999) as no other type material is know (but see MOV:F40041 listed under *V. mortoni montis*).

SPECIMEN: TM:K418, Mt Wellington, ca. 42°55'S.147°15'E, 13.i.1954, J.L. Hickman, (a previously undissected mature specimen, from the type locality and conforming to Spencer's description on most points, here dissected and figured).

EXTERNAL FEATURES - The following account is taken from Spencer (1895), from reinspection of the syntype, and from inspection of specimen K418.

Body "flesh colour, and broad in comparison to its length" and "a whitish stout form" (Spencer, 1895 pp: 36 and 38); in specimen K418 body is rounded, tapers gradually after clitellum and has faint post-clitellar dorsal canaliculation. Lengths mm: 50+ (coiled syntype), 58 (K418), (cf. 63-75, Spencer). Width: 5.8 mm (K418), (cf. ca. 6 mm, Spencer). Segments: (both syntype and K418) 121. Colour: unpigmented, clitellum buff. Prostomium: tanylobous (Spencer and K418). Clitellum: faint in 13, tumid in 14-17 but interrupted ventrally in 17 (cf. 14-17, Spencer). Dorsal pores: from 4/5. Setae: 8 throughout in regular rows but converging about six segments on either side of male pores. Nephropores: in c lines but migrating

slightly ventral of this from the mid-clitellum (K418). Spermathecal pores: 4/5-8/9 in setal a lines. Female pores: paired on 14. Male pores: on small papillae on 18 near setal a lines. Genital markings: (of K418) faint elongate pads between the spermathecal pores in 5/6-8/9 (possibly artefacts of copulation); paired elongate sucker-like pads postsetally in 17 extnding from a to well lateral of b lines, adjacent to mid-ventral tumid pad in aa; pairs of markings more ventral than those in 17, mostly centred in a lines and extending inwards near to mid-ventral line postestally in 19, and less wide in 20/21 and, weaker, in 21/22.

INTERNAL ANATOMY

Gizzard: muscular barrel in 5. Oesophagus: dilated and white in 13-16, not calciferous (cf. Spencer, true calciferous glands in 13-16). Nephridia: (K418) vesiculate holoic from segment 2, bladders elongate discharging in c lines with elongate diverticulum. Vascularization: hearts 10-12 increasing in size; supra-oesophageal vessel not noted. Spermathecae: five pairs in 5-9, ampulla blunt, flattened sacs tapering to duct with simple diverticulum less than half length of ampulla. Male organs: holandric, iridescent testes in 10 and 11; racemose seminal vesicles paired, small in 9 and larger in 12 (in K418, cf. Spencer, in 12 only). Ovaries: large in 13; small ovisacs in 14. Prostates: tubular in 18-21,22; penial setae seen in syntype but not K:418. Intestine: origin 18; no typhlosole.

REMARKS

The syntype of *Vesiculodrilus mortoni* (Spencer, 1895) is in poor condition therefore Spencer's description cannot be unequivocably confirmed from it. No specimens have subsequently been found from either locality that correspond exactly with Spencer's account. A single specimen, TM:K418 from the type locality of Mt Wellington comes closest to Spencer's description and illustrations, agreeing on each point except for the extent of the clitellum, the presence of seminal vesicles in segement 9 (as would normally be expected) and the distribution of the posterior genital markings which are in 19, 20/21 and 21/22. Spencer had these latter markings in both his text and figure in 18/19 and 19/20 but it is possible he miscounted segment 18 (which is compressed and overwhelmed by segment 17 in specimen K418). Spencer (1895) also miscounted the spermathecal pores in the text as between 5/6-9/10 but these were more plausibly shown in his figure in 4/5-8/9. Additional characters from the new material described here are the elongate and diverticulate

nephridial bladders exiting in setal line c in the anterior but that migrate just ventral of this on and after the clitellum, and ventral setae converging around the male pores.

Features which distinguish *V. mortoni mortoni* from its sympatric subspecies, *V. mortoni montis* and other similar species (eg. *V. fictilis*, *V. maritimus*, *V. mathinna*, *V. metandris*, *V. prospectus*, and *V. cuneatus*) are body length less than 75 mm and a set of three elongate markings near 17/18: a mid-ventral pad in 17/18 in aa, and a pair of elongate markings postsetally in 17, that are manifestly wider than successive markings (see figure of specimen K418 and Spencer's fig 16). Successive markings are paired and elongate postsetally in 19, and in 20/21 and 21/22 (cf. Spencer in 18/19 and 19/20), centred in setal a line on each side.

Jamieson (1974), when redescribing *Vesiculodrilus mortoni*, made no mention whatsoever of the syntype, and allowed a size range of 56-212 mm, segmental counts of 113-274, prostomium epilobous or tanylobous, presence or absence of nephridial bladders, and other morphological variations wider than normally acceptable for specific (or indeed for generic) separation. Reinspection of museum specimens cited under *P.(V.) mortoni* by Jamieson (1974) has required much revision and redistribution to more taxonomically cohesive taxa, thus:

TM:K402 and K419 from Hobart Domain and TM:K416 from Sandy Bay - now in *V. maritimus* sp. nov.

TM:K414 from Eaglehawk Neck, sample contains two specimens, (see specimen 2 under TM:K414 below) - now in *V. metandris* sp. nov.

BM:1972:8:18-25 from Mt Wellington, Hobart; BM:1972:8:26-30 from Lenah Valley, Hobart; TM:K404 from Waterworks Rd, Hobart; TM:K407 from Collinsvale, Hobart; TM:K408 from Lenah Valley; TM:K413 and TM:K417 from Mt Wellington; and TM:K415 supposedly from "Fern Glade, Burnie" but most probably from Fern Tree, Hobart as this same calamitous error was made by Jamieson, 1974 in his redescription of *Cryptodrilus polynephricus*, the sample contains three specimens, (see specimen 3 under TM:K415 below) - now in *V. mortoni montis* subsp. nov.

TM:K405 from Mt Arthur - now in *Vesiculodrilus cuneatus* sp. nov.

Tasmanian Museum specimens that were also incorrectly identified by Jamieson (1974) as "*Perionychella (Vesiculodrilus) mortoni*" are: TM:K97 labeled simply "Tasmania" - two previously undissected specimens, externally similar to *V.*

maritimus but the nephridial bladders appear adiverticulate and nephropores remain in c lines - I refrain from describing them further as there are insufficient collection and location details; TM:K414 (specimen 2) from Eaglehawk Neck - a single damaged specimen, 212 mm long, that is in fact a *Cryptodrilus* sp, possibly *C. polynephricus*; TM:K415 (specimen 3) supposedly from "Fern Glade, Burnie" but probably from Fern Tree, Hobart - previously undissected specimen in very poor condition that is a *Cryptodrilus* sp.; TM:K416 (specimen 2) from Sandy Bay - a previously undissected subadult, 210 mm long, that is also a *Cryptodrilus* sp.

Further samples placed by Jamieson in his *P.(V.). mortoni* that are not traceable and consequently have uncertain affinities (eg. TM:K403 and K409-412?) include those specimens from St Columba Falls collected 17.iv.1954 by J.L. Hickman that were stated (Jamieson, 1974: 248) to lack diverticula of the nephridial bladders and are therefore excluded from *V. mortoni* as defined here (but perhaps they are similar to K97 from "Tasmania" noted above). Moreover, Jamieson (1974: 223) failed to elaborate on a footnote of an "avesiculate morph of *P.(V.) mortoni*" that, if found, would belong in a different genus (or perhaps he was refering to one of the several other species of other genera that he included under this taxon?).

DISTRIBUTION AND HABITAT

The syntype confers type locality, which is probably Mt Wellington, whereas Spencer gives the habitats as "Dee Bridge and Mount Wellington, Tasmania. Under logs and stones". Collecting trips by the current author to both Dee Bridge and Mt Wellington localities failed to rediscover this species although the subspecies, *V. mortoni montis* was located at the latter site along with *V. hobartensis*, *V. lateralis* and *Cryptodrilus polynephricus* Spencer, 1895.

Vesiculodrilus narcissus

Fig. 55.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:831, Barren Rock Falls Reserve, SE Tasmania, EN 208 867, 350 m, 18.viii.1992, R.D. D'Orazio and M. Cooper,dry sclerophyll, (drawn and dissected).

PARATYPE: (P1) 14:3138, same collection data as H, (mature, dissected); (P2) 14:3317, Tunnack, ca. 42°25'S.147°30'E, 21.ii.1996, R.J. Blakemore, moist soil beside track, (mature, dissected).

EXTERNAL FEATURES

Body: faintly dorsally canaliculate. Lengths mm: (H) 150, (P1) 110, (P2) 100. Width: ca. 6 mm. Segments: (H) 140, (P1) 134, (P2) 130. Anterior dorsum puce with dark dorsal line, clitellum buff. Prostomium: epilobous, furrowed. Clitellum: ½13,14-17,½18. Dorsal pores: 4/5 imperforate, 5/6 perforate. Setae: 8 in regular series. Nephropores: in c lines. Spermathecal pores: 4/5/6/7/8/9 in setal a lines. Female pores: paired just anteriomedian to a setae. Male pores: paired in ab on small papillae. Genital markings: paired, postsetal and just anterior to spermathecal pores in 4-8 (H, P1) or 5-8 (P2); paired, postsetal and intersegmental in line with male pores but conjoined in 19-23 (H, P1) or 19-22 (P2); slight midventral pad between the male pores.

INTERNAL ANATOMY

Septa: 7/8-12/13 increasingly thickened. Gizzard: in 5 large with proventriculus. Oesophagus: dilated in from 8 or 9 to 12 or 15, not calciferous. Nephridia: holoic with elongate bladders that on and after clitellum develop lateral extension. Vascularization: hearts 10-12; supra-oesophageal vessel 9-12 (the hearts of 11 and 12 arise from this). Spermathecae: five pairs in 5-9, irregular saccular ampulla clearly demarcated from duct with small ectal diverticulum. Male organs: metandric, iridescent testes and funnels in 11 only, invested in mucus; seminal vesicles large, coralline pair in 12 only. Ovaries: small in 13. Prostates: confined to 18, tubular; no penial setae found. Intestine: origin 18, no typhlosole, gut contents fine soil with quartz grits.

REMARKS

Vesiculodrilus narcissus is reminiscent of *V. metandris*, both species are have five pairs of spermathecae and are metandric with prostates largely confined to 18, it differs in the distribution of its genital markings (i.e., with four or five, postsetal pairs near the spermathecal pores that are mirrored in 19-22,23).

ETYMOLOGY named Narcissus for the distinctive genital markings: those in the anterior are a reflection of those in the posterior.

DISTRIBUTION AND HABITAT

Barren Rock Falls in dry sclerophyll and Tunnack, SE Tasmania.

Vesiculodrilus octothecatus sp. nov

Fig. 56.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3299, Mt Barrow, N Tasmania, EQ 353 212, 750 m, R.D. D'Orazio, M. Cooper, and Paul, rainforest, (mature, dissected and sketched).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: (H) 85. Width: 2.5 mm. Segments: 120. Colour: dark brown; ventrum slightly paler, setal lines show through; clitellum buff. Prostomium: open epilobous; peristomium with ventral notch. Clitellum: ½13-16. Dorsal pores: from 3/4. Nephropores: in c lines. Setae: 8 throughout. Spermathecal pores: 5/6/7/8/9 in mid-ab lines. Female pores: paired on 14. Male pores: on small papillae in ab on 18 between pair of deep mid-ventral troughs in aa one before and one after papillae. Genital markings: small paired discs median to spermathecal pores presetal in 7-9; laterally elongate pads in 17/18 and 18/19 in aa; the last pad conjoining paired sizeable discs in b in 18/19.

INTERNAL ANATOMY

Gizzard: weak in 5. Oesophagus: dilated in 13 (slightly), 14 and 15, possibly calciferous. Nephridia: vesiculate holoic, bladders ovoid becomming pear-shaped after clitellum, not bilobed. Vascularization: dorsal blood vessel single to pharynx; hearts 10-12; supra-oesophageal vessel 6-13. Spermathecae: four pairs in 6-9 increasingly large, saccular ampulla tapers to short duct with medium-sized clavate diverticulum. Male organs: holandric, iridescent testes in 10 and 11, racemose seminal vesicles in 9 and larger in 12. Ovaries: large in 13. Prostates: tubular in 18-19; small penial setae present. Intestine: from 17; no typhlosole.

REMARKS

Vesiculodrilus octothecatus is distinguished by having four pairs of spermathecae in 5/6/7/8/9 in mid-ab lines, genital markings as pads obscuring the intersegmental furrows in aa in 17/18 and 18/19 with a pair of discs in b lines at the terminals of the latter pad. *V. octothecatus* is morphologically similar to *V. inornatus* and *V. dendrophagus*, it differs from both these species at noted under their respective descriptions.

DISTRIBUTION AND HABITAT

Mt Barrow, N Tasmania, rainforest.

Vesiculodrilus oeconomicus sp. nov.

Fig. 57.

MATERIAL EXAMINED

HOLOTYPE: 14:0740 (H), Wallaby Creek, Dalgarth Forest Reserve, N Tasmania, DQ 734 329, 30.vi.1992, R.D. D'Orazio, rainforest, (mature, drawn and dissected).

PARATYPES: all with same collection details as (H), 14:3069 (P1), (mature, dissected); 14:3070 (P2), (mature, dissected); 14:3071 (P3), (mature, dissected); 14:3072 (P4), (mature, dissected); 14:3073 (P5), (mature, dissected); 14:3074 (P6-15), (ten specimens, one mature posterior amputee (P6) plus two subadults and seven juveniles).

EXTERNAL FEATURES

Body: stout, not spade-shaped in posterior, slightly dorsally canaliculate. Lengths mm: 150 (H), 145 (P1), 135 (P2), 115-130 (P3-P5). Width: ca. 5.5 mm. Segments: 156 (H), 149 (P1), 155 (P2). Colour: dorsum dark red-brick in anterior to c lines, pinker in posterior, ventrum pale, clitellum darker. Prostomium: closed epilobous, furrowed dorsally to 2/3. Clitellum: ½13-17. Dorsal pores: vestigial in 3/4, open from 4/5. Setae: 8 in regular series. Nephropores: in c lines. Spermathecal pores: 4/5/6/7/8 in setal a lines. Female pores: paired anteriomedian to a setae in common dumbbell-shaped field. Male pores: approximately in setal a lines on small papillae in ab that are interconnected on 18 by a thin elongate median pad. Genital markings: small paired markings median to aa posteriorly on 16 and on 17, and mid-ventral on 19 (all specimens), plus weaker pair in 20 posteriorly (H, P3, P5 and P6 only). Segments 16-21 are slightly tumid ventrally.

INTERNAL ANATOMY

Septa: 5/6-13/14 increasingly thickened. Gizzard: large solid in 5. Oesophagus: increasingly dilated 6-15, especially 14-15, but not calciferous, valvular in 16. Nephridia: vesiculate holoic from 2 with large, elongate and folded bladders exiting in c lines. Vascularization: dorsal blood vessel single; commissurals in 6-9, hearts 10-12; supra-oesophageal vessel seen intermittently in 8-13. Spermathecae: four pairs in 5-8, large saccular ampulla tapers to duct with disproportionately small, clavate, inseminated diverticulum ectally. Male organs: metandric, iridescent testes and funnels in 11 only in mucus, seminal vesicles large racemose pair in 12 only. Ovaries: in 13; ovisacs not found. Prostates: tubular in 18-24; very small penial setae

present (ca. 0.5 mm long). Intestine: origin 17; from about 18 low dorsal ridge emulates typhlosole but is insufficiently developed and is not detectable in posterior; gut contains organic matter.

REMARKS

Vesiculodrilus oeconomicus has a dorsally furrowed peristomium, four pairs of spermathecae in setal a lines in 4/5/6/7/8, and is metandric with extensive tubular prostates. It is comparable with *V. cygnus* and *V. quadruparus*, although it can be distinguished by its genital markings confined to the mid-ventrum: median to a setal lines in 16, 17, 19 and, occasionally, in 20.

ETYMOLOGY named for its small and 'economical' spermathecal diverticula.

DISTRIBUTION AND HABITAT

Dalgarth Forest Reserve, N Tasmania, from rainforest.

Vesiculodrilus parattah sp. nov.

Fig. 58.

Perionychella (Vesiculodrilus) hobartensis (part); Jamieson, 1974: 241-245.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3507, Parattah, SE Tasmania, ca. 42°20'S.147°25'E, 21.ii.1996, R.J. Blakemore, over fence in open eucalypt woodland, (mature dissected and sketched).

PARATYPES: (P1) TM:K294, Parattah, ca. 42°20'S.147°25'E, 18.viii.1954, Prof. V.V.Hickman and Dr J.L. Hickman, "under moss, in earth at base of cliff, also in earth along sides of logs", (mature specimen, previously dissected, here reinspected and sketched); (P2) TM:K295, same details as P1 (posterior amputee, dissected); (P3) TM:K296, same details as P1, (mature, dissected); (P4) TM:K297, same details as P1, (anterior amputee, not previously dissected); (P5) 14:3508, same details as H, (mature, undissected).

SPECIMENS: 14:3509, same details as H, (32 specimens in various life stages, some slightly damaged); TM: K298, same details as P1, (one subadult and two immature specimens; 6 other specimens in this batch are actually *Notoscolex campestris* (Spencer, 1895)).

EXTERNAL FEATURES

Body: tapering, without canaliculation, tail flat and quadrangular. Length mm: (H) 70 (P1) 55, (P3) 62, other specimens up to 85 mm. Width: ca. 2.3 mm. Segments: (H) 95, (P1) 117, (P3) 122. Colour: uniform buff in alcohol, clitellum orange. Prostomium: open epilobous, peristomium ventrally cleft. Clitellum: ½13-16. Dorsal pores: from 4/5. Setae: 8 throughout in regular rows, converging slightly around male pores. Nephropores: in c lines. Spermathecal pores: 4/5-7/8 in a lines. Female pores: widely paired on 14. Male pores: on small papillae on 18 in ab. Genital markings: paired in 16/17 in ab lines (H and most specimens); additional pair (or analogue) in ab lines in 15/16 (in P1 and several other specimens).

INTERNAL ANATOMY

Gizzard: small and weakly muscular in 5 concealed in pharyngeal mass. Oesophagus: increasingly dilated in 10-15, not calciferous. Nephridia: vesiculate holoic in c lines, bladders elongate. Vascularization: hearts 10-12; supra-oesophageal vessel weak 10-12. Spermathecae: four pairs in 5-8; saccular ampulla marked from

thin duct bearing short digitiform diverticulum ectally with iridescent termination. Male organs: holandric, testes and funnels iridescent in mucus in 10 and 11; seminal vesicles large, racemose in 9 and 12. Ovaries: small in 13. Prostates: tubular, long and folded in 18-29,30,31; fine penial setae present (not found in P1 - previously removed?). Intestine: origin 17; no typhlosole; gut contains soil, organic matter and quartz grains.

REMARKS

Vesiculodrilus parattah is superficially similar to the sympatric *Vesiculodrilus insularis* (Spencer, 1895), especially the genital markings in 16/17 and the remarkably long prostates, it, principally differs in having only four pairs of spermathecae, first dorsal pore in 4/5 and intestinal origin in 17. *V. parattah* is separated from *V. emu*, also with four pairs of spermathecae, as it lacks genital markings around the male pores, has spermathecae of a distinctive shape, and has intestinal origin in 17 rather than 16.

ETYMOLOGY: after type-locality.

DISTRIBUTION AND HABITAT

Parattah, SE Tasmania, under open woodland also under moss, in earth at base of cliff and in earth along sides of logs.

Vesiculodrilus pennyae sp. nov

Fig. 59.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3274, Scout Hut, Forester River, NE Tasmania, EQ575 544, 40 m, 10.x.1990, QVM collection, ex litter, (mature specimen, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 45. Width: 1.4 mm. Segments: 83. Colour: unpigmented in alcohol, clitellum cream. Prostomium: open epilobous. Clitellum: 14-16. Dorsal pores: from 4/5. Setae: 8 throughout. Spermathecal pores: 7/8/9 just ventral of b lines. Female pores: paired on 14. Male pores: on 18 on papillae in ab and replacing these setae. Genital markings: small pair of discs postsetal in setal a lines on 9; similar pair on 17 and 18, this latter pair continuous with male pores and further pair of presetal discs that have additional midventral marking between them.

INTERNAL ANATOMY

Gizzard: in 5, as compressible barrel within pharyngeal mass. Oesophagus: dilated and lamellate in 14-16. Nephridia: vesiculate holoic in c lines, not tufted anteriorly, bladders sub-spherical. Vascularization: large hearts 10-12. Spermathecae: two pairs in 8 and 9 the latter pair larger, saccular ampulla tapers to duct with medium sized clavate diverticulum. Male organs: holandric, iridescent testis and mucus in 10 and 11, racemose seminal vesicles in 9 and 12. Ovaries: in 13. Prostates: tubular in 18-23; no penial setae. Intestine: from 17; typhlosole absent; intestinal gizzards not noted; gut contains wood, some soil and quartz grains.

REMARKS

Vesiculodrilus pennyae is characterized by its two pairs of spermathecae in 7/8/9 (cf. *V. apris* has two pairs in 4/5/6), and by the distribution of its genital markings around the male field.

ETYMOLOGY: named for Pauline Penny of Department of Conservation, Wellington, NZ.

DISTRIBUTION AND HABITAT

Forester River, NE Tasmania, ex litter, found with *V. dendrophagus*.

Vesiculodrilus pollex sp. nov

Fig. 60.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3781, Crotty, Kelly Basin Rd at Allan's Creek, Darwin, W Tasmania, CP 857 228, "UGR 8013", 17.iii.1973, QVM collection, (mature specimen, dissected and drawn).

PARATYPE: (P) ANIC:RB.98.1.26, same details as H, (mature, posterior regenerate at 86, dissected).

EXTERNAL FEATURES

Lengths mm: (H) 65, (P) 60. Width: 3.5 mm. Segments: (H) 118, (P) 103. Colour: unpigmented in alcohol with blue iridescence in anterior, clitellum cream. Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: small or vestigal in 2/3, small in 3/4, open from 4/5. Setae: 8 throughout in regular rows except d sinuous in last few tail segments. Nephropores: in c lines. Spermathecal pores: at anterior margin of segment in 6/7/8/9 in b lines. Female pores: paired on 14. Male pores: on 18 on papillae in b lines, setae ab replaced. Genital markings: tumid, elongate furrow in 17/18 terminating in crimped discs in b lines (H, P), plus pair of flat discs medial to aa lines posteriorly on 18 (P only).

INTERNAL ANATOMY

Gizzard: in 5 compact muscular but compressible. Oesophagus: narrow in 6-11, widening in 12-13, dilated in 14-15 with internal lamellae appearing as calciferous glands, valvular in 16. Nephridia: vesiculate holoic in c lines, not tufted anteriorly, bladders elongate. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4, hearts 10-12 from weak supra-oesophageal vessel in 8-12. Spermathecae: three pairs in 7-9, saccular ampulla on wide duct with thick clavate diverticulum. Male organs: holandric, testis and funnels in 10 and 11, only the latter pair iridescent in H; racemose seminal vesicles small in 9 and larger racemose in 12. Ovaries: palmate in 13 along with oviducts; ovisacs large paired in 14. Prostates: tubular in 18-20; small penial setae present. Intestine: from 17; typhlosole absent; intestinal gizzards absent; gut contains organic soil. Note: nematodes from ventral blood vessel, and parasitic sacs on lhs in 9 and 10 of H, placed in phials in sample jar.

REMARKS

Vesiculodrilus pollex is characterized by its three pairs of spermathecae in 6/7/8/9 in b lines, and by its genital markings that are restricted to those in 17/18 and 18. It is similar to *V. recessus*, as is discussed under that species' account.

ETYMOLOGY: pollex, Latin - thumb, for the shape of the spermathecal diverticulum that sticks out like a sore thumb.

DISTRIBUTION AND HABITAT

Crotty, W Tasmania, from same sample as *Provescus crottyi*.

Vesiculodrilus prospectus sp. nov

Fig. 61.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:664, Colebrook, Coal River Gorge Nature Reserve, SE Tasmania, EN 325 965, 310m, 17.viii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll in gully, (mature, dissected and figured).

PARATYPE: (P) 14:3143, same collection details as H, (subadult that agrees externally and internally).

EXTERNAL FEATURES

Body: stout with blunt tail and faint dorsal canaliculation. Length mm: (H) 110, (P) 65. Width: 11 mm. Segments: (H) 142. Colour: brown dorsal pigmentation to lateral c lines especially anteriorly and caudally, faded in midbody; ventrum pale; clitellum reddish. Prostomium: closed epilobous with dorsal furrow to first intersegment. Clitellum: 14-17,½18. Dorsal pores: from 4/5 (minute in 3/4). Nephropores: in c lines in anterior but from 14 moving just ventral of this. Setae: 8 throughout, ab converging then diverging around male pores. Spermathecal pores: in 4/5-8/9 in a lines marked by small papillae. Female pores: widely paired on 14. Male pores: in ab on compressed segment 18. Genital markings: paired elongate pads on greatly swollen mounds in 17/18 which overwhelm, but are lateral to, male pores; paired postsetal wholly in ab in 19-21 progressively decreasing in size posteriorly. In subadult (P) markings correspond but are rudimentary.

INTERNAL ANATOMY

Septa 9/10-13/14 thickened. Gizzard: large, muscular in 5, occupying 6-8 and preceded by a long curved pharynx and proventriculus. Oesophagus: dilated and vascularized in 9-14, more swollen and paler in 15 but not calciferous. Nephridia: vesiculate holoic in c lines, not tufted anteriorly, bladders elongate bent but, by 14, forming small diverticulum at the bend which becomes more pronounced after this. Vascularization: hearts 10-13 with connection to supra-oesophageal vessel that runs 9-13. Spermathecae: five pairs in 5-9, saccular ampulla on short duct with small clavate diverticulum. Male organs: holandric, iridescent testis and funnels in 10 and 11, racemose seminal vesicles in 9 and 12. Ovaries: fan-shaped in 13. Prostates: tubular and compressed in 18; penial setae not found. Intestine: from 18; no typhlosole; gut contains organic soil and quartz.

REMARKS

Vesiculodrilus prospectus is possibly part of the *V. mortoni* species complex, having nephropores migrating ventrally after the clitellum and possessing diverticula on the nephridial bladders, but it differs by having an furrowed epilobous peristomium, lack of a mid-ventral pad in 17/18, and having last hearts in 13. Last hearts in 13 are also found in *V. marian*, however in that species the first dorsal pore is in 5/6, the intestine is from segment 17 rather than 18, and the prostates extend beyond segment 18. This species is similar to *Graliophilus? decathecus* (Michaelsen, 1910), especially with regards size, genital markings and last heart in 13. However, Michaelsen did not record presence or absence of nephridial bladders and type material is lost, therefore the taxonomic status of this latter species is uncertain.

ETYMOLOGY: prospectus, Latin – 'prospect', that which is to be expected.

DISTRIBUTION AND HABITAT

Coal River Gorge Nature Reserve, this river arises in the mountains around Tunnack and after Richmond flows into Pitt Water. Found in dry sclerophyll woodland in gully.

Vesiculodrilus pulchellus sp. nov.

Fig. 62.

MATERIAL EXAMINED

HOLOTYPE: (H), 14:0015, Melaleuca SW Tasmania, Half-woody Hill, DM 338-889, 80 m, wet forest, 5.iii.1992, Louise F. McGowan, wet forest, (mature specimen, figured and dissected).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: (H) 23. Width: 1 mm. Segments: (H) 98. Anterior dorsum puce with dark mid-dorsal line, clitellum speckled. Prostomium: open epilobous. Clitellum: weak in 14-16. Dorsal pores: from 2/3. Setae: 8 in regular series. Nephropores: in c lines. Spermathecal pores: 5/6/7/8 just median to b setal lines. Female pores: paired anteriomedian to a setae. Male pores: paired just median of b lines within small papillae. Genital markings: single, midventral in 6-8 as central disks with paler 'butterfly wings'; in 17/18 and 18/19 are tumid conjoined bands with infolded centres in ab lines.

INTERNAL ANATOMY

Septa: none thickened. Gizzard: compact in 5 hardly modified from pharynx in 4. Oesophagus: dilated in 14 and 15 to form annular calciferous glands having numerous internal lamellae. Nephridia: vesiculate holoic with elongate to sub-spherical bladders. Vascularization: hearts 10-12 from supra-oesophageal vessel in 6-12. Spermathecae: three pairs in 6-8, saccular ampulla tapers to duct with small ectal diverticulum. Male organs: holandric, iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles racemose in 9 and 12. Ovaries: small with few egg strings in 13; ovisacs small in 14. Prostates: tubular in 18-19 on short duct; penial setae also short. Intestine: origin 17, no typhlosole to about 30; gut void except for white mucus.

REMARKS

Vesiculodrilus pulchellus is unique in the genus in having three pairs of spermathecae in 6-8 that open laterally in b lines in 5/6/7/8; the form and distributions of the genital markings are also characteristic.

ETYMOLOGY: pulchellus, Latin - 'pretty, little' worm.

DISTRIBUTION AND HABITAT

Half-woody Hill, Melaleuca, SW Tasmania in wet forest soil found with *V. melaleuteus*.

Vesiculodrilus quadruparus sp. nov.

Fig. 63.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1715, Dazzler Range, Kerrisons Road, N Tasmania, EQ 755 376, 415 m., 29.vi.1992, R.D. D'Orazio and A. Mitchell, wet sclerophyll, (mature, dissected and figured).

PARATYPE: (P) 14:1123, same details as H, (mature, dissected).

EXTERNAL FEATURES

Body faintly canaliculate dorsally. Lengths mm: 170 (H), 200 (P). Width: ca. 5.5 mm. Segments: 142 (H), 128 (P). Colour: dorsum dark brown blending to pale ventrum, with dark mid-dorsal line; clitellum buff. Prostomium: closed epilobous, deeply furrowed dorsally to 1/2. Clitellum: ½13-17, interrupted ventrally by markings. Dorsal pores: from 4/5. Setae: 8 in regular rows throughout. Nephropores: in c lines. Spermathecal pores: 4/5/6/7/8 in or just lateral to setal a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab replacing these setae, infolded in (H), connected by anterior lateral ridge in (P). Genital markings: single faint mid-ventral marking on 9 (H only); faint paired markings in 15/16 in ab (H only); paired discs at posterior of segments, on 16 in ab lines and on 17 in mid b-c, plus paired mid-ventral in aa on 19 (H, P1) and 20 (H only). Ventral region tumid in 18-24 (H) or 19-21 (P).

INTERNAL ANATOMY

Septa: 9/10-13/14 thickened. Gizzard: muscular, barrel-shaped in 5 but displaced to occupy 6,7-8; in (H) preceded by exceptionally long pharynx. Oesophagus: not differentiated. Nephridia: vesiculate holoic, elongate and bent bladders exit in c lines; compact tufts seen in 3-4. Vascularization: dorsal blood vessel single; hearts 10-12; supra-oesophageal vessel 7,8-12,13. Spermathecae: four pairs in 5-8, elongate saccular ampulla tapers to duct with small clavate diverticulum from exit. Male organs: metandric, iridescent testes and funnels in mucus in 11 only, seminal vesicles paired racemose in 12 only. Ovaries: large with many egg-strings in 13; pseudovesicles anteriorly in 13, small ovisacs in 14. Prostates: tubular in 18-22; small penial setae present. Intestine: origin in 17, expands suddenly and is thin walled; from 19 low dorsal ridge emulates a typhlosole but is rudimentary; gut contains woody organic matter, soil and mucus.

REMARKS

Vesiculodrilus quadruparus is morphologically similar to *V. cygnus* and *V. oeconomicus*. These three taxa are separated mainly on the distributions of the genital markings: in *V. quadruparus* they are paired in ab on 16 and wider in mid-bc on 17, while in *V. cygnus* they are in or median of b lines in 16 and 17, and in *V. oeconomicus* they are paired median to aa in 16 and 17. Moreover, male pores are in ab, b and a lines, respectively and all three taxa have variation in markings median to aa setae on 19 and 20. The long pharynx is similar to that found in *V. prospectus*.

ETYMOLOGY for the four pairs of spermathecae and genital markings.

DISTRIBUTION AND HABITAT

Dazzler Range, N Tasmania, from rainforest, same site as *Graliophilus praestringor*.

Vesiculodrilus recessus sp. nov

Fig. 64.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1762, Retreat, N Tasmania, EQ 144 481, R.D. D'Orazio, dry sclerophyll, Forestry Tasmania, TSF 61 site, (aclitellate mature specimen, dissected and drawn).

PARATYPE: none.

EXTERNAL FEATURES

Length mm: 33. Width: ca. 1 mm. Segments:84. Colour: unpigmented yellow in alcohol with faint mid-dorsal line. Prostomium: open epilobous. Clitellum: undeveloped. Dorsal pores: small from 3/4. Setae: 8 throughout in regular rows. Nephropores: in c lines. Spermathecal pores: at anterior margin of segment in 6/7/8/9 just lateral of b lines. Female pores: paired on 14. Male pores: on 18 on papillae just lateral of b lines. Genital markings: small papillae below spermathecal pores; ellipsoid markings in 17/18 and 18/19 in ab but latter pair slightly more extensively developed.

INTERNAL ANATOMY

Septa: all thin. Gizzard: compact muscular in 5. Oesophagus: dilated in 14-15 (not calciferous); valvular in 16-½17. Nephridia: vesiculate holoic in c lines, not tufted anteriorly, bladders saccular. Vascularization: dorsal blood vessel single, hearts 10-12 from weak supra-oesophageal vessel in 10-17. Spermathecae: three pairs in 7-9, elongate ampulla on short duct with small clavate diverticulum. Male organs: holandric, testis and iridescent funnels in 10 and 11, seminal vesicles small in 9 and larger in 12. Ovaries: compact in 13 with oviducts; small ovisacs in 14. Prostates: tubular in 18-19; small penial setae present. Intestine: from ½17; typhlosole and intestinal gizzards absent; gut contains loamy soil.

REMARKS

Vesiculodrilus recessus is comparable with *V. pollex*, both are small worms with spermathecae, in 6/7/8/9 in b lines, male pores near b lines, and similar genital markings. However, the pores in *V. recessus* are slightly wider and markings are paired in 17/18 and 18/19. Moreover, the nephridial bladders in *V. recessus* are saccular, while those in *V. pollex* are elongate, and the respective shapes of the spermathecae also differ.

ETYMOLOGY: recessus, Latin – retreat or secluded spot, for the type-locality.

DISTRIBUTION AND HABITAT

Retreat, N Tasmania, dry sclerophyll.

Vesiculodrilus santaclairis sp. nov.

Fig. 65.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3307, Mt. Olympus, at Echo Point, Lake St Clair, C Tasmania, ca. 42°05'S.146°10'E, 13.x.1995, R.J. Blakemore, in beech forest, (mature posterior amputee, dissected and drawn).

PARATYPES: (P1) 14:3308, same details as H, (mature); (P2) 14:3309, same details as H (mature, posterior amputee); (P3) 14:3310, same details as H, (mature).

EXTERNAL FEATURES

Length mm: (P1) 35, (P3) 38. Width: ca. 1 mm. Segments: (P1) 84. Colour: anterior dorsum puce, the remainder of body unpigmented except for dark mid-dorsal line, clitellum pale. Prostomium: widely open epilobous. Clitellum: ½13-16. Dorsal pores: from 3/4. Setae: 8 throughout in regular rows. Nephropores: in c line. Spermathecal pores: 6/7 in setal a lines. Female pores: paired on 14. Male pores: on small papillae on 18 in ab. Genital markings: midventral, paired postsetal in 6 (sometimes faint), paired presetal in 7; paired postsetal discs in ab in 17/18 (and on rhs in 18/19 in P3); midvental pads in aa in 17/18 and 18/19 seen in all specimens.

INTERNAL ANATOMY

Gizzard: weak in 5. Oesophagus: dilated and white in 15 only, not calciferous. Nephridia: vesiculate holoic in c line, bladders small and spherical. Vascularization: hearts 10-12; supra-oesophageal vessel weak 8-12. Spermathecae: single pair in 7; large saccular ampulla tapers to duct bearing short iridescent diverticulum ectally. Male organs: holandric, testes and funnels iridescent in mucus in 10 and 11; seminal vesicles in 9 and 12. Ovaries: in 13. Prostates: tubular, looping forward in 17-20; small penial setae present. Intestine: origin 17; no typhlosole; gut contains organic matter.

REMARKS

Vesiculodrilus santaclairis is bithecal and thus similar to *Vesiculodrilus bithecatus*, but is distinguished by having spermathecal pores in line with setae a, in the the form and distribution of the genital markings, in not having calciferous glands in 14 and 15, and in the intestinal origin which is in 17 (cf. 16 in *Vesiculodrilus bithecatus*).

ETYMOLOGY: named for the type locality.

DISTRIBUTION AND HABITAT

Mt Olympus, Lake St Clair in beech (*Notofagus*) forest; also found at Pelion Valley (pers. obs), in ranforest, under leaf litter and in rich topsoil.

Vesiculodrilus symmetricus sp. nov

Fig. 66.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3551, Mt Oakleigh, Pelion Valley, C Tasmania, DP 209 370, 870 m, edge of wet forest, 10.ii.1992, QVM collection, (mature, missing tip of tail, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: (H) 45+. Width: ca. 1.5 mm. Segments: (H) 81+. Colour: anterior dorsum puce, clitellum buff. Prostomium: open epilobous. Clitellum: 14-16. Dorsal pores: small from 2/3. Setae: 8 throughout to cut. Spermathecal pores: in 6/7/8/9 in b lines. Nephropores: in c lines. Female pores: paired on 14. Male pores: on 18 near b lines on papillae in ab, setae ab replaced. Genital markings: paired presetal discs in ab in 10, 11, 17, and 19; paired elongate markings in 17/18 and 18/19 centred in a lines.

INTERNAL ANATOMY

Gizzard: in 5 moderately muscular. Oesophagus: slightly dilated in 13-16. Nephridia: vesiculate holoic in c lines, not tufted anteriorly, bladders sub-spherical. Vascularization: hearts 10-12 from supra-oesophageal vessel in 8-12. Spermathecae: three pairs in 7-9, saccular ampulla tapers to exit where met by clavate diverticulum. Male organs: holandric, testis and funnels in 10 and 11 but only the latter pair iridescent; racemose seminal vesicles in 9 and 12. Ovaries: in 13; small ovisacs in 14. Prostates: tubular in 17-19; penial setae present. Intestine: from 17; typhlosole absent; gut contains organic soil.

REMARKS

Vesiculodrilus symmetricus is characterized by its three pairs of spermathecae in 6/7/8/9 in b lines, and by its genital markings which are paired in 10,11, 17 and 19, and in 17/18/19. It superficially resembles *V. gracilis*, as noted under that species' account, and is also morphologically similar to *V. pollex* and *Graliophilus ? ellisii* that differ, at least, in the respective distributions of genital markings and commencement of dorsal pores.

ETYMOLOGY: symmetricus - for the almost symmetrical arrangement of markings

DISTRIBUTION AND HABITAT

Mt Oakleigh, Pelion Valley from whence V. *gracilis* and *V. santaclairis* were also procured.

Vesiculodrilus tasmanianus (Fletcher, 1887), comb. nov.

Fig. 67, Fig. 68.

Notoscolex tasmanianus Fletcher, 1887b: 607-611.

Megascolides tasmanianus; Spencer, 1895: 33-34.

Plutellus tasmanianus; Michaelsen, 1900: 175; Michaelsen, 1907b: 159.

Pinguidrilus tasmanianus; Jamieson, 1974: 263-265, figs. (mislabeled "*tasmanicus*") 25B (p.294), 32B (p.325) [not located on maps].

MATERIAL EXAMINED

LECTOTYPE: (designated by Jamieson, 1974) MOV:F42112 (previously NMV:G2112), labeled "*Megascolides tasmanicus* (sic) Fl[etcher] Jar 2 [or Jan 2nd?] from MUZD [Melbourne University Zoology Department]", Fletcher gives the type locality as Thomas's Plains, NE Tasmania, (mature specimen in five or more fragments, the anterior in reasonable condition although partly damaged by previous dissection with some organs removed and missing from jar, re-inspected here).

PARALECTOTYPES: Australian Museum: W.1263-1271, W.1476, (those specimens of this Fletcher Collection series that I had the chance to view were in rather poor condition, most broken in pieces). [Note: a letter from Elizabeth Pope, Curator of Worms, to the Director of the Australian Museum dated 18.iii.1970 requested that specimen W.1264 (at least) be "written off" as it had disintegrated - approval for this by the Trustees was signed on 21.iv.1970].

SPECIMENS: 14:3105, Weldborough, EQ 756 395, 2.ix.1990, R. Mesibov, from base of eucalypt, (weakly clitellate mature specimen, dissected and illustrated here); 14:3109 "No. 3401 Giant Earthworm. From Weldborough. Donor - Mr J. McCrackan, April 13th, 1909", (mature specimen); 14:2335, Frome Dam, Moorina, ca. EQ 760 440, 18.ix.1974, C. Taylor, "On the surface", (mature specimen); 14:3114 (previously QVM:1963:18:1), "nr. Pipers Heads [N Tasmania?], 12.ii.1963, R. Woolhouse, *Pinguidrilus tasmanianus*, Det: Jamieson, 1973", (mature specimen, dissected); 14:3122, Weldborough, EQ 756 395, 2.ix.1990, R. Mesibov, from base of eucalypt, (mature specimen); 14:1590, Tom's Gully, FQ 900 218, 320m, 27.vii.1992, R. D. D'Orazio & M. Cooper, in wet sclerophyll forest, (mature posterior-amputee, dissected); 14:3115, Binalong Bay, 768 255, 1.ix.1993, T. Woolnaught, (mature, dissected); 14:3119-3120, same details as 14:3115, (two mature specimens, one damaged); 14:0893, Mt Cameron nr. Pioneer, EQ 886 483, 175 m, 20.vii.1992, R.D.

D'Orazio and M. Cooper, (three immature specimens agreeing with this species, two dissected); 14:0842, Hogarth Rd., NE Tasmania, EQ 521 356, 7.vii.1992, R.D. D'Orazio, (four immature specimens, two possibly this species); 14:3140, "16 km beyond Derby on road to Weldborough, [ca. EQ 750 400], 15.x.1985, Mrs Holmes", "*Pinguidrilus tasmanianus*, Prep: T. Scarbourough; Det: G.R. Dyne"; "Found 1½ mls [ca. 2.4 km] off the road in claybank in gravelly country in wet forest. Large worms were deep in clay in burrows...", (mature in two halves, dissected and drawn); 14:3141, same collection details as 14:3140, (damaged sub-adult, 155 mm); 14:3144, same collection details as 14:3140, (cocoon, ca. 17.5 x 30 mm, figured); 14:3110, same collection details as 14:3140 additionally "Kept alive for 11 days", (five specimens - three matures, one a posterior-amputee, a sub-adult and an immature); 14:3573, same details as 14:3110, (mature posterior amputee, dissected, plus two tails); 14:3287, St Columba Falls, EQ 800 280, 24.i.1996, S.A.McI. and R.J. Blakemore, collected on surface of track in rain in wet sclerophyll forest, (weakly clitellate mature); ANIC:RB.97.3.9, same collection details as 14:3287, (mature, dissected); ANIC:RB.97.2.1, just north-west of Weldborough, ca. EQ735 405, 14.i.1997, Sean Blake, collected when forest trail roadbuilding, (mature); TM:K1539, same collection details as ANIC:RB.97.2.1, (mature); 14:3574, Binalong Bay, FQ 080 320, 26.i.1997, Ian Bell, (mature, dissected).

EXTERNAL FEATURES

Body robust, segments 1-12 thick, wide and tapering to the mouth; posterior segments thinner and more annulated, sometimes with faint dorsal canaliculation. Lengths: contracted preserved specimens, range 180-330 mm (mean 260 mm ±44.8 for 12 mature specimens), (cf. 200-250 mm and up to 610 mm in life, Fletcher); immatures 80-100 mm. Width: 12.0-27.5 mm. Segments: range 164-212 (mean 187±19.1, n=6), (cf. about 200, Fletcher); immature specimen of 100 mm had 194 segments. Colour: in life, pink anteriorly with orange clitellum, remainder of the body blue-grey; in alcohol, uniform grey or pale with clitellum darker slate grey sometimes lighter hue. Prostomium: wide and open or tapering closed epilobous, with faint dorsal furrow. Clitellum: ½13,14-21,22,½23 (cf. ½13-22 Fletcher), i.e., extending for seven to nine segments. Dorsal pores: from 4/5 or more usually 5/6 (seen in specimens from coastal region and other locations), or small from 7/8 (in specimens 14:3109 and 3122 from Weldborough), or minute and undetectable in the anterior but

visible immediately before and then continuous after the clitellum (all other Welborough specimens), (cf. 10/11 Jamieson; 12/13 Fletcher). Setae: eight throughout, relatively small and sometimes difficult to see; converging in the region of male pores; d lines in irregularly sinuous series especially posteriorly, not so marked in immatures; (setal ratio from Fletcher, aa:ab:bc:cd = 2:1:2:1.5-4). Nephropores: irregular in c lines or in d lines or above, especially after clitellum, (in Binalong specimens mostly in straight series in c lines). Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired. Male pores: in ab lines, on slightly raised mounds. Genital markings: pale, elongate and smooth pads in 14/15,15/16-21/22,22/23,23/24 extending just lateral of setae b lines although the first and those either side of the male pores may be narrower, (i.e, seven to ten markings, cf. seven or eight Fletcher, and lectotype; of twenty mature specimens examined here, two had seven markings, nine had eight markings, eight had nine markings, and one had ten markings, commencing always in 14/15 except for ANIC:RB.97.3.9 from St Columba Falls where they are in 15/16-22/23).

INTERNAL ANATOMY

Septa: 4/5/6/7 thin and distended by gizzard, 8/9-13/14 thickened, massively in 10/11-12/13, anterior septa transversed and dorsally displaced by large tendons. Gizzard: entirely in 5 (as Fletcher; cf. in 5 and 6 Jamieson), large and muscular preceded by wide proventriculus also in 5. Oesophagus: dilated but thin walled in 9,10-13; vascularized with numerous internal ruggae in 14-15,16 (cf. "globularly dilated in 8-16, especially last two or three of these... probably functioning as calciferous glands", Fletcher); extramural calciferous glands absent. Nephridia: holoic, vesiculate, bladders elongate flask-shaped with thin ducts discharging to nephropores, often irregularly in c lines and more dorsally. Vascularization: dorsal blood vessel single, large hearts 10-13; supra-oesophageal vessel, 9-13. Spermathecae: five pairs in 5-9, ampullae elongate with small iridescent diverticula seen in lectotype for those spermathecae remaining, and in all dissected specimens, (cf. adiverticulate Fletcher, Jamieson). Male organs: testes iridescent in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: paired in 13 as minute clusters of egg-stings; small pseudovesicles sometimes present anteriorly in 13 and 14. Prostates: tubular but often with minute surface lobulations, tortuous but mostly confined to 18 (in lectotype, rhs prostate removed and missing from jar); penial setae

absent. Intestine: from 18, where it attains full width or sometimes from posterior of 17, most of 17 is narrow oesophageal valve, (cf. from about 19 Fletcher, or 19 Jamieson); much convoluted and spiraling in contracted specimens; typhlosole absent; gut filled with clay or organic soils, occasional large grits and sometimes fibrous root material.

REMARKS

The above description concurs with Fletcher's original (with which Jamieson's also closely agreed), except where noted. Spermathecal diverticula are recorded for the first time and are confirmed from inspection of the Museum of Victoria lectotype. These diverticula are partially embedded in the thick body wall, which may explain why they were not found by Fletcher nor by Jamieson. Spermathecal diverticula are a feature of Australian megascolecids serving to store the sperm of concopulants, their presence in this species removes justification for the monotypic genus *Pinguidrilus*. Possession of tubular prostates (albeit sometimes flattened and with minute surface lobulations), lumbricine setae, and vesiculate holonephridia qualify this species in *Vesiculodrilus*. The irregular distribution of the nephropores, possibly an adaptation due to large size and necessity to maintain body surface moisture, is found in several other genera, particularly in large species. Variations in size and distribution of genital markings are derived from the additional material inspected during the present study. Other characters found to be at odds with earlier descriptions are the position of the gizzard in 5 (rather than 5-6, Jamieson, 1974) and intestine commencing in 18, or in posterior of 17, (rather than 19). There appears to be some variation in location of first dorsal pores: in some specimens these are obvious from 4/5 or 5/6, whereas in others (especially those from Welborough populations) they are usually undetectable in pre-clitellar segments.

Despite having several character states differing from the above description in his input data matrix for *V. tasmanianus* (including prostate type as tubular-tubuloracemose contrary to the generic diagnosis of Jamieson, 1974: 263), the computations of Jamieson (1994) showed *V. tasmanianus* to group with other *Vesiculodrilus* spp. included in his cladistic analysis. These species were V. *victoriae* (Spencer, 1892) and *V. mortoni* (Spencer, 1895), (perichaetine *Diporochaeta kershawi* (Jamieson, 1974) also formed part of this group but it was erroneously characterized as "lumbricin" in the data matrix in Jamieson, 1994: 177). Although not commented

on by Jamieson (1994), this 'grouping' perhaps adds further justification for resurrection of the genus *Vesiculodrilus*.

The size range of *V. tasmanianus* is comparable with the "giant" Victorian species *Megascolides australis* McCoy, 1878 that may attain a length of 3060 mm although the average is about 1000 mm (Van Praagh, 1992), and with *Notoscolex grandis* Fletcher, 1886 from Burrrawang, NSW that measures 760-1060 mm. Fletcher (1887b) described living specimens of *V. tasmanianus* of over 610 mm long and while this is shorter than *M. australis* or *N. grandis*, these three species are of equivalent width. A cocoon, recorded and illustrated for the first time, was obtained with specimens from Weldborough and is commensurate with the clitellum.

DISTRIBUTION AND HABITAT

North-east Tasmania - the original "large and fine" specimens from Thomas's Plains were investigated by Mr Bernard Shaw, Inspector of Police, and were sent to Fletcher (and to Spencer) by Mr Alexander Morton, curator of the Tasmanian Museum, Hobart. After much researching, I found a reference for Thomas's Plains as an historical name for Weldborough (ca. EQ 756 395); this pers. comm. from Mr Stephen Cleaves, of Department of Environment and Land Management, Hobart, who informed me that on Page 26 of "Centenary of Portland" there is a reference to a survey at the end of April, 1875 at Thomas's Plains, an area of 1,000 acres - now Weldborough.

Specimens in the current study are from the the vicinity of the type locality of Weldborough through to the Bay of Fires. A single specimen is recorded from near Pipers Heads which is on the north coast. Specimens dug during forest trail building operations were found at about 1-1.5 m depth, but some burrows were as deep as 5 m (Sean Blake, Forestry Tasmania, Scottsdale, pers. comm.). An interesting observation by the author is that the St Columba Falls specimens collected in 1996 were found wandering on the surface during the daytime in rain, and numerous large worms were seen on road surfaces early the following morning (see also account of *Vesiculodrilus glandiferus pyengana*). Derby Road specimens were coincident at this site with *V. lilliputensis* sp. nov.

Vesiculodrilus tunnackensis (Jamieson, 1974), comb. nov.

Fig. 69.

Perionychella (Vesiculodrilus) tunnackensis Jamieson, 1974: 253, figs. 14, 16X.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K312, Tunnack, ca. 42°25'S.147°30'E, under logs and stones, damp conditions, 18.viii.1954, J.L. Hickman, (previously dissected specimen, redescribed and redrawn).

PARATYPE: (P) BM:1972:8:32, "Tunnack, Aug 1954, V.V. Hickman and J.L. Hickman, under logs and stones", (mature, previously dissected).

SPECIMEN: (S1) 14:3667, Brookerana Reserve, E. Tasmania, EP 709 193, 590 m., 11.viii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, dissected).

EXTERNAL FEATURES

Lengths mm: (H, P) 33, (S1) 54. Width: ca. 1-1.4 mm. Segments: (H) 82, (S1) 80. Colour: unpigmented or uniform buff in alcohol with faint darker mid-dorsal line in anterior. Prostomium: open epilobous. Clitellum: ½13,13-16. Dorsal pores: small and difficult to determine in anterior, small markings seen from 2/3, in type material destroyed by dissection (from 4/5, Jamieson). Setae: 8 throughout in regular rows. Nephropores: obvious in c lines. Spermathecal pores: 6/7/8/9 in setal a lines. Female pores: paired on 14. Male pores: in ab lines on small papillae on 18. Genital markings: discs just posterior to spermathecal pores anteriorly in 7-9, paired or analogous; large ventral pads on either side of and as wide as male pores in 17/18 and 18/19; paired markings in ab lines in 19/20 (H, P) or weak in a lines (S1) and in 20/21 (H only).

INTERNAL ANATOMY

Gizzard: in 5 as slight muscular swelling of oesophagus. Oesophagus: dilated in 13,14-15 (calciferous?). Nephridia: vesiculate holoic from segment 2, bladders subspherical discharging in c lines. Vascularization: hearts 10-12; supra-oesophageal vessel weak 7-12 (S1). Spermathecae: three pairs in 7, 8 and 9 (in H, 9rhs had been removed and was missing from jar), ampulla spherical same length as duct, with equally long, iridescent diverticulum. Male organs: holandric, iridescent testes in 10 and 11, seminal vesicles racemose in 9 and 12. Ovaries: large in 13; small paired ovisacs in 14. Prostates: tubular in 18-21 but also looping forward; penial setae present (removed from H). Intestine: origin 17; no typhlosole; gut full of organic soil.

REMARKS

The above description confirms and considewably augments the type description. Jamieson (1974: 253) stated that "As in all Tasmanian species of the genus, the genital markings of this species are distinctive." However some variation exists and consistent markings are those near the spermathecal pores and the lateral ridges flanking the male pores in 17/18 and 18/19. Superficially, this species is almost identical to *Cryptodrilus ellisii* Spencer, 1895 but Spencer did not record presence or absence of nephridial bladders and, although type material is now in poor condition, examination of the deteriorated syntypes of *C. ellisii* in the present study failed to detect nephridial vesicles and it was therefore provisionally placed in *Graliophilus*. The only other major differences between these two species are that Spencer described dorsal pores from 5/6 and, perhaps more significantly, spermathecal pores in b line.

DISTRIBUTION AND HABITAT

Tunnack, and Brookerana Reserve under wet sclerophyll.

Vesiculodrilus ventralis Blakemore, 2000

Fig. 70, Fig. 71.

Vesiculodrilus ventralis Blakemore, 2000b:7-8, fig 3.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3336, Bonnet Bay, Lake Pedder, SW Tasmania ca. 42°55'S.146°10'E, 431150 5248260, 310 m, 12.iv.1996, R.J. Blakemore, M. Driessen and M. Anderson, under rocks on hillslope above creek, (mature specimen, dissected and figured).

PARATYPES: (P1) 14:3337, same collection details as H, (mature specimen, dissected); (P2) 14:3464, Mt Cawthorne, Lake Pedder, 427897 5249337, 310 m, 12.iv.1996, R.J. Blakemore, M. Driessen and M. Anderson, in sand and debris on beach, (mature posterior amputee, dissected); (P3) 14:3446, Maria Creek, Lake Pedder, 442000 5250600, 310 m, 11.iv.1996, R.J. Blakemore, along creek in sand/roots, (aclitellate mature, possibly an amputee as pygomere setose, dissected); (P4) 14:3447, same details as P3, (immature that argees externally); (P5-6) 14:1858, Maydena, SE Tasmania, Mueller Road, site 3, DN 542 598, 540 m, 12.x.1993, R.D. D'Orazio and D.E. Soccol, from moorland swamp, (mature posterior amputee and complete mature, both dissected, plus two unregistered tails).

SPECIMEN: 14:3362 (S1), Mt. Solitary, Lake Pedder, 438800 5244500, 310 m, 11.iv.1996, R.J. Blakemore, (damaged mature specimen that is possibly the same species, see Remarks below).

EXTERNAL FEATURES

Slender body, tapering to tail. Lengths mm: (H) 75, (P1) 50, (P3) 58, (P6) 40, (P4 immature, 30 mm). Width: ca. 1.5 mm. Segments: (H) 116, (P1) 118, (P3) 90, (P4) 85, (P6) 113. Colour: anterior and dorsum dark brown, ventrum pale, clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: from 2/3 (small), from 3/4 on larger. Setae: 8 in regular rows although dorsal setae migrate more dorsally in posterior. (Note: an odd supernumerary seta occasionally found in the posterior of H, P6). Nephropores: in c lines. Spermathecal pores: 6/7/8/9 in setal a lines (not diverging). Female pores: paired on 14. Male pores: paired on small porophores in ab. Genital markings: mid-ventral, presetal discs in 7-9 (H, P5, P6) or 7 only (P1, S1), 8-9 (P2); or absent (P3); tumid pads in all specimens in aa in 17/18 and 18/19, in (P1) there is an analogue of a disk wider than male pores in 17/18 on lhs;

paired discs mid-ventral in aa in 16/17 (H, P3) and/or 19/20 (H, P3, P5, P6) and an analogue in 20/21 (in H only).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: small and weakly muscular in 5. Oesophagus: pale and smooth walled but not muscular in 6 and 7; vascularised but only slightly dilated in 8-15; narrowing and valve-like in 16. Nephridia: vesiculate holoic in c lines; the bladders subspherical in the anterior but broadening after the clitellum; not tufted anteriorly. Vascularization: hearts in 10-12 from well developed supra-oesophageal vessel in 6,7-13. Spermathecae: three pairs in 7-9, elongate ampulla distinct from short duct with simple diverticulum ectally. Male organs: holandric, iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles racemose in 9 and 12. Ovaries: compact in 13. Prostates: tubular in 18, throwing loop forward into 17 and extending to 20,21; short penial setae present. Intestine: origin ½17; no typhlosole but low dorsal ridge present (from about 26); gut contains, organic soil and grits.

REMARKS

Differences of *Vesiculodrilus ventralis* from *V. borealis* are an often darker colour, smaller gizzard, the greater extent of the tubular prostates and, especially, the differences in distribution of genital markings as described above and as shown in the respective illustrations. The spermathecal pores also tend to be closer to setal a lines, rather than just lateral to this. Paired, pre-setal markings in 7-9 are noted in some specimens, nevertheless, this species remains distinct from *V. tunnackensis* for reasons similar to those given for *V. borealis*. Widely paired markings are lacking from 18/19 (as found in *V. borealis*), and from 19/20-20/21 (except the solitary Mt. Solitary specimen that also has a mid-ventral pad in 7).

ETYMOLOGY "ventralis" for the mid-ventral genital markings.

DISTRIBUTION AND HABITAT

Apparently widely distributed at the southern end of Lake Pedder under rocks and in sand/roots along creeks and shoreline, and at Maydena SE Tasmania from moorland swamp.

Vesiculodrilus zeehan sp. nov.

Fig. 72.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1533, Heemskirk Rd, Zeehan, W. Tasmania, CP 568 669, 185 m, 27.vii.1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (mature specimen with tip of tail missing, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 40+. Width: ca. 1.8 mm. Segments: 90+. Colour: only the anterior dorsum is dark brown, further back the prostates are visible through the body wall; clitellum buff. Prostomium: open epilobous. Clitellum: 14-16. Dorsal pores: from 3/4. Setae: 8 throughout. Nephropores: in c lines. Spermathecal pores: 6/7-9/10 near b lines. Female pores: paired on 14. Male pores: on small papillae on 18 near b. Genital markings: four midventral unpaired discs posteriorly in 7-10; discs in a line on 16/17lhs, and paired posteriorly in b lines on 17, and in a lines on 19.

INTERNAL ANATOMY

Gizzard: weak in 5. Oesophagus: dilated and lamellate in 14 and 15 (calciferous?). Nephridia: vesiculate holoic from segment 2, bladders subspherical discharging in c lines. Vascularization: hearts 10-12; supra-oesophageal vessel only seen in 10. Spermathecae: four pairs in 7-10, ampulla spherical tapering to duct with medium sized, clavate diverticulum. Male organs: metandric, iridescent testes in 11, seminal vesicles racemose in 10 and 12. Ovaries: in 13. Prostates: tubular in 18-21 looping forward to 17; penial setae not found. Intestine: origin 17; no typhlosole; gut contains soil.

REMARKS

Vesiculodrilus zeehan is distinct in having four pairs of spermathecae with the last pair, along with a pair of seminal vesicles, in segment 10. Initially it was believed that this was an abnormal specimen although no trace of damage nor regeneration was detected in the anterior, and moreover, *V. duodecithecatus* is now known which although it has six pairs of spermathecae, also has the last pair in 10 and, interestingly, is similarly metandric.

ETYMOLOGY after the type locality (named after one of Tasman's Dutch ships).

DISTRIBUTION AND HABITAT

W Tasmania: Zeehan, from wet sclerophyll, same locality as *Anisochaeta zeehan*.

Amphimiximus gen. nov.

Diagnosis Small size, 35-42 mm. Setae lumbricine (i.e., eight per segment). Dorsal pores present thoughout. Male pores on 18 combined with pores of tubular prostates. Gizzard in 5; extramural calciferous glands absent; typhlosole absent. Nephridia vesiculate holoic (i.e., one pair per segment with terminal dilations of the ducts forming large bladders); nephropores in series on each side near c setal lines. *Polythecate*: monodiverticulate spermathecae, sometimes vestigial, duplicated on each side to give two (or three) at each locus.

Type-species *Amphimiximus stumpyi* sp. nov.

Etymology for the complex coupling required to charge the multiple spermathecae.

Distribution coastal NE and N Tasmania.

Remarks Morphologically, only the multiplication of spermathecae differentiates this genus from *Vesiculodrilus.* This polythecate condition is met elsewhere in 'advanced' megascolecids, eg in some members of the genera *Amynthas* and *Polypheretima* (see Blakemore, 1997e). This is the first record for this condition in an Australian native species and, moreover, in a species which retains more 'primitive' character states (of tubular prostates, holoic nephridia, and lumbricine setae).

Amphimiximus delicans sp. nov.

Fig. 73.

MATERIAL EXAMINED

HOLOTYPE: QVM:14:3733, Baldocks Cave State Forest Reserve, Mole Creek, N Tasmania, DP 444 958, 430 m, 1.ix.1992, R.D. D'Orazio, "travelled 6 km along South Mole Creek Road", wet sclerophyll/rainforest, (mature, dissected and figured; an odd specimen ex 14:0378).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: (H) 35. Width: ca. 1.5 mm. Segments: (H) 106. Colour: pale unpigmented in alcohol. Prostomium: open epilobous. Clitellum: not developed. Dorsal pores: small from 1/2. Nephropores: at anterior of segment in c lines. Setae: 8 per segment in regular rows. Spermathecal pores: in a and b lines in 8/9. Female pore: single on 14. Male pores: ill-defined, paired in ab lines on broad pads on 18. Genital markings: paired discs just posterior to b setae on 8 and anterior to b setae on 9; similar discs in ab lines in 17/18 and 18/19 both sets median to large lateral pads; ventrum in 19-22 pale and slightly tumid.

INTERNAL ANATOMY

Gizzard: muscular pod-shaped in 5. Oesophagus: increasingly dilated and vascularized in 14-17, not calciferous. Nephridia: vesiculate holoic, bladders elongate; anterior tufting not noted. Vascularization: last hearts in 12. Spermathecae: primary spermathecae in 9 in a lines, saccular ampulla with long duct and diverticulum of same length; supernumerary spermathecae vestigial in b lines. Male organs: holandric, iridescent testes in mucus in 10 and 11; seminal vesicles in 11 and 12 (absent from 9). Ovaries: in 13; ovisacs possibly small in 14. Prostates: tubular in 18-19; small penial setae present. Intestine: from 18; typhlosole not noted; gut contains organic soil. Note: a dipteran larva was found in gut (in phial).

ETYMOLOGY delicans, Latin - 'delightful', for the appearance of this worm.

REMARKS

Amphimiximus delicans differs from *Am. stupyi* in its spermathecae in a single segment (9) rather than over three segments (7-9), in its single female pore, and in the distribution of its genital markings. However, similarity between these two taxa extend to dorsal pores commencing from 1/2 and seminal vesicles in 11 and 12.

DISTRIBUTION AND HABITAT

Baldocks Cave State Forest Reserve, from wet sclerophyll/rainforest.

Amphimiximus stumpyi sp. nov.

Fig. 74, Fig. 75.

MATERIAL EXAMINED

HOLOTYPE: QVM:14:2027, Stumpys Bay, Mt William National Park, Gladstone, NE Tasmania, FQ 029 739, 10m, 12.i.1994, R.D. D'Orazio and D.E. Soccol, dry sclerophyll, (mature, bisected, dissected and figured). (Note: this sample contains a phial with spermathecae removed from H, plus a small damaged specimen of a different species).

PARATYPES: ANIC:RB.97.5.11 (P1), same details as H, (mature aclitellate, possible posterior-amputee, dissected and figured); TM:K1557 (P2), same details as H, (sub-adult, dissected); QVM:14:2027 (P3), same details as H (sub-adult, dissected).

EXTERNAL FEATURES

Body: tail square in section with corners at mid-dorsum and mid-ventrum and laterally in line with c setae. Lengths mm: (H) 42, (P1) 40+, (P2) 40, (P3) 38. Width: ca. 1.5 mm. Segments: (H) 138, (P1) 98+, (P2) 131, (P3) 129. Colour: white, unpigmented. Prostomium: epilobous. Clitellum: 14-16 and part of 13 (H). Dorsal pores: from 1/2. Nephropores: at anterior of segment in c lines from 2 or 3. Setae: 8 per segment in regular rows except for last few segments where c and d are irregular. Spermathecal pores: not clearly distinguished in (H, P3); in (P1-2) seen in both a and b lines in 6/7/8/9. Female pores: paired on 14. Male pores: paired lateral to b lines in deep furrow in (H); in b lines below elongate ridge in (P1). Genital markings: paired just posterior to spermathecal pores in 7-9 in (H, P1 and P3); single mid-ventral in 6-7 in (P1) or 10-11 and 17, 19 and 20 in (H); widely paired just lateral of b lines in 16/17, 17/18, 19/20 and 20/21 in (H); or paired in a lines in 16/17 with thick ridge in b lines in 17/18 and 18/19 plus paired markings lateral of b lines in 19/20/21 in (P1), only the ridges around male pores developed in (P2-3).

INTERNAL ANATOMY

Gizzard: large muscular in 5, displaced to occupying 6-7. Oesophagus: dilated 8-13,14 but not calciferous; narrow in 13,14-17 to valve. Nephridia: vesiculate holoic, bladders elongate; not tufted in anterior. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-12; supra-oesophageal well developed in 8-12 (seen in P1 only). Spermathecae: (see figures) in (H) vestigial in b lines in 7, one large and one smaller ancillary spermatheca on each side in ab in 8 and 9, with third

smaller spermatheca in 9 lhs; in (P1) and (P2) with two spermathecae apparently in a and b lines in each of 7-9; in (P3) small and detectable only in 8 and 9 in b and just lateral to b lines (i.e., not in a lines); both larger primary and smaller ancillary spermathecae are easily detached and have spermatozoal iridescence in their single clavate diverticula. Male organs: holandric, iridescent testes in mucus in 10 and 11; seminal vesicles in 11 and 12 (absent from 9). Ovaries: in 13; ovisacs not found. Prostates: tubular in 18-19; penial setae (or at least their sheathes) present. Intestine: from 18; typhlosole absent but wide dorsal ridge from 23; gut contains mucus and some soil and quartz particles.

ETYMOLOGY for the type-locality.

REMARKS

Some variation in the distributions of the abundant genital markings and in the position of the multiple spermathecae appear permissible in *Amphimiximus stumpyi* which is, nevertheless, unique in both of these features.

DISTRIBUTION AND HABITAT

Stumpys Bay, Mt William National Park, NE Tasmania, from dry sclerophyll.

Diporochaeta Beddard, 1890

Aporochaeta (laps. cal.) Beddard, 1890: 55

Diporochaeta Beddard, 1890: 56; Michaelsen, 1900: 199-200; 1907b: 160, 161; Stephenson, 1923: 315; 1930: 840; Lee, 1959: 262-263; Gates, 1959: 254; Jamieson, 1974: 220; Blakemore, 2000b: 3.

Perionyx (part.); Michaelsen; 1916: 46, 53; (subgen. *Diporochaeta* part.), Michaelsen, 1923: 229.

Perionychella (part.); Jamieson, 1974: 216-223.

Diporochaeta (part.); Jamieson, 1976b: 4-7.

Terriswalkerius (part. – not type or other species with non-tubular prostates) Jamieson , 1994: 158-159.

Diagnosis Setae more than eight per segment, at least in the mid- or hind-body. Dorsal pores absent or present. Male pores paired, combined with pores of tubular prostates on 18. Gizzard in 5 or 6; extramural calciferous glands and typhlosole present or absent. Nephridia holoic (with or without bladders), often tufted in anterior segments. Spermathecae five or fewer pairs; diverticula uniloculate.

Type species *Perichaeta intermedia* Beddard, 1889 (syn. *P. novaezealandiae* Beddard 1890) from New Zealand.

Distribution Victoria, Tasmania, southern New South Wales, New Zealand, Queensland, ?India.

Included species

At its most restrictive diagnosis, only the New Zealand type-species was allowed (Jamieson, 1974: 220), while its most permissive diagnosis included approximately 77-78 Australian species (Jamieson 1976: 3; 1994:157), subsequently reduced to only about 60 species (Jamieson, 1994:157). Most of these Australian species are now more correctly returned to *Graliophilus*, *Vesiculodrilus*, and *Perionychella* (see the remarks following these genera herein). From New Zealand, 10 species are known in addition to the type-species (Lee, 1959; Lee *et al.*, in press). A full list of the Australian species is beyond the scope of the present study, however, 17 taxa are now known from Tasmania, including 13 new species.

Remarks

The generic diagnosis reverts to 'classical' concept of *Diporochaeta* established by Michaelsen (1900) and adopted by Stephenson (1930) and Lee (1959), modified only

to allow presence or absence of a typhlosole. The 'classical' definition was based on Beddard's original thus:

> Tubular prostates, holonephridia and, at least in the mid- and hindbody, more than 8 setae per segment.

A greatly expanded diagnosis of *Diporochaeta* by Jamieson (1976b: 4) allowed:

> Tubular or tubuloracemose or racemose prostates, last hearts in 12 or 13, holonephridia with or without bladders, setae 8 or more per segment, gizzard in 5 or 6 (well developed to vestigial), typhlosole absent or rudimentary; calciferous glands and penial setae absent or present and spermathecae with single, paired or composite diverticula.

The wide heterogeneity of this latter definition encompassed prior definitions of *Perionychella* and *Vesiculodrilus*, as well as several less closely related genera, and is indicative of an artificial congeries in urgent need of re-examination. Jamieson has subsequently made some adjustments, but *Diporochaeta* remains, after Jamieson (1994: 157), "a paraphyletic and polyphyletic entity requiring further resolution". Combined with consideration of evolutionary relationships, one of the aims of practical taxonomy (as stated by Jamieson, 1974: 218) is that of 'convenience'. The relationships of many genera await detailed phylogenetic testing by molecular analysis of their constituent members, either case depending entirely on the reliability of morphological descriptions of species. Jamieson (1974: 218) asserted that "Tasmanian fauna provides the key to revision of *Diporochaeta* in Australia, and to the relationships of *Vesiculodrilus*". The present study adds to this revision, attempting to decide the fates of genera, under the taxonomic principles of priority, as a preliminary to further species descriptions.

Although, Beddard (1890) tentatively included only one other species in the genus, *Diporochaeta bakeri* (Fletcher, 1887b) from Victoria, it is only certain that the type-species (as with several other New Zealand and Australian congeners) has vesiculate holonephridia. Initially and temporarily restricting the genus to only the type-species (Jamieson, 1974:220), Jamieson's (1976: 3) greatly expanded definition brought the generic total for Australia to 77 named species, but in his most recent systematic offering (Jamieson, 1994: 157), the number of Austraslian species of *Diporochaeta* was reduced to 60. However, in this 'cladistic analysis' Jamieson (1994: 177) input the prostate type of the type-species as "tubuloracemose" (rather

than "tubular" as originally described and as confirmed by Jamieson, 1976a: 40, fig 1B; 1988: 370-375) resulting, indeed, in the separation of *D. intermedia* from the other *Diporochaeta* species included in his analysis. Although the type species of *Vesiculodrilus* was not tested, Jamieson (1994) considered the resulting phylogram to be not inconsistent with separate generic status for *Perionychella*.

Full revision of *Diporochaeta* is beyond the scope of the present work, save for its differentiation from other genera under consideration here (see discussions under *Graliophilus*, *Vesiculodrilus*, and *Perionychella*).

Diporochaeta ateramnis sp. nov.

Fig. 76.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1309, Black River Reserve near Sisters Beach, NW Tasmania, 150 m, CQ 655 603, 150m, 20.iv.1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (mature, dissected and drawn).

PARATYPE: (P) 14:3311, same collection details as H, (slightly damaged mature, dissected).

EXTERNAL FEATURES

Body: dorso-ventrally flattened caudally. Lengths mm: (H) 82, (P) 60. Width: ca. 2.5 mm. Segments: (H) 125. Colour: light brown dorsal pigmentation with darker mid-dorsal line; clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: from 3/4. Setae: 12 on 12, 14 on 20, and 16 posteriorly in straight rows. Nephropores: in c lines anteriorly, in d lines on 20, and in e lines posteriorly due to added setae. Spermathecal pores: 6/7/8/9 in or near b lines. Female pores: paired on 14. Male pores: in b lines on papillae. Genital markings: paired discs just below spermathecal pores in 7, 8 and 9; faint mid-ventral disc in 16/17 (in H only); large mid-ventral pads anteriorly in 18 and 19 in aa (H, P); paired, postsetal in ab in 17 and 18 (H, P); paired presetal discs on 19 in ab (in P only).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: moderately muscular but compressible in 5 in pharyngeal mass. Oesophagus: dilated 8-13, 14 and 15 large and white but not deemed calciferous. Nephridia: vesiculate holoic from segment 2 in c lines; bladders sub-spherical in the anterior, becoming bilobed by 17, the lobe more elongate further posteriorly. Vascularization: dorsal blood vessel single, hearts 10-12; supra-oesophageal vessel 8-13. Spermathecae: three pairs in 7-9; thick waisted ampulla on small duct with medium sized, iridescent diverticulum. Male organs: metandric, iridescent testes in 11 only; seminal vesicles large and racemose in 12 only. Ovaries: in 13. Prostates: tubular in 18-20 (H) or 17-21 (P); penial setae long and fine. Intestine: origin 17; no typhlosole; gut contains fine siliceous sand and some organic material.

REMARKS

Diporochaeta ateramnis is similar to *D. hellyeri* with three pairs of spermathecae, metandry, and elongate nephridial bladders. These two taxa are separable on their distributions of genital markings, the mid-ventral pads in 18 and 19 in *D. ateramnis* are particularly distinctive.

ETYMOLOGY: ateramnis, Latin - "black river", for the locality.

DISTRIBUTION AND HABITAT

Black River Reserve, NW Tasmania, from wet sclerophyll.

Diporochaeta coccyx sp. nov.

Fig. 77.

MATERIAL EXAMINED

HOLOTYPE: (H), 14:1025, Cuckoo Falls, Legerwood, NE Tasmania, EQ 516 342, 415 m, 7.vii.1992, R.D. D'Orazio, rainforest 200 m along track to falls, (mature, dissected and sketched).

PARATYPES: (P1) ANIC:RB.98.1.8, same details as H, (mature, dissected); (P2) TM:K1563, same details as H, (mature, dissected).

EXTERNAL FEATURES

Lengths mm: 170 (H), 110 (P1), 105 (P2). Width: ca. 2 mm. Segments: 140 (H), 145 (P1). Colour: unpigmented in alcohol; clitellum buff. Prostomium: open epilobous. Clitellum: ½13,14-16. Dorsal pores: from 2/3. Setae: anisochaetine, 8 in anterior, from mid-body c seta are sometimes displaced and extra seta added, then d seta are similarly altered, so that by tail have ca. 12 setae per segment with all but ab lines irregular. Nephropores: in c lines in anterior, lateral in posterior where setae displaced. Spermathecal pores: 5/6/7/8/9 in ab setal lines. Female pore: single, midventral on 14. Male pores: on prominent mounds in ab lines replacing ab setae on 18. Genital markings: small discs paired just median of spermathecal pores in 6-9 (H, P1-2), plus mid-ventral markings postsetally in 5-9 (P2 only); paired conjoined markings in 16/17 centred in a lines, in 17/18 and18/19 wider than b lines, and in 19/20 in a lines (H, P1-2).

INTERNAL ANATOMY

Septa: 9/10-11/12 slightly thickened. Gizzard: large muscular barrel in 5. Oesophagus: most dilated and vascularized in 16 with internal lamellae, possibly calciferous; narrow in 17-19,20. Nephridia: vesiculate holoic, bladders elongate in anterior, ocarina-shaped in posterior. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-12 from supra-oesophageal vessel in 8-12,13. Spermathecae: four pairs in 6-9, those in 6 reduced in paratypes; saccular ampulla on tapering duct with clavate diverticulum. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles paired racemose in 9 and 12. Ovaries: in 13; ovisacs not noted. Prostates: smooth walled, thickly tubular in 18-19 (anterior loops appear fused in H but are more defined tubular in paratypes although no central canal was detected in section); small penial setae present. Intestine: origin

difficult to discern appears to vary from ½19 (P2), 20 (P1), or 21 (H); typhlosole absent; gut contains organic debris.

REMARKS

Diporochaeta coccyx is characterized by four pairs of spermathecae, a single female pore, and distinctive genital markings in both spermathecal and male fields. It principally differs from *D. monogyna* by four rather than three pairs of spermathecae, and a different arrangement of genital markings. The anterior spermathecae are vestigial in the paratypes, the prostates often appear almost tubuloracemose, and the intestinal origin varies, thus it is possible that these specimens represent a species in transition.

ETYMOLOGY: *coccyx*, Latin - Cuckoo, for the locality.

DISTRIBUTION AND HABITAT

Cuckoo Falls, NE Tasmania, from rainforest, found with *D. monogyna*.

Diporochaeta diadema Blakemore, 2000

Fig. 78.

Diporochaeta diadema Blakemore, 2000b:8-10, fig 4.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3495, Coronets, Lake Pedder shoreline, SW Tasmania ca. 42°55'S.146°10'E, 437900 5248800, 310 m, 11.iv.1996, R.J. Blakemore, in litter under eucalypts beside creek, (mature complete, dissected, figured).

PARATYPES: 14:3496 (P1), same details as H, (mature posterior amputee, dissected and figured); (P2) 14:3497, same details as H, (mature, posterior regenerate); (P3) 14:3498, same details as H, except under leaves on lake's edge, (mature, posterior amputee, dissected); (P4-11) 14:3462, same details as (P3), (eight specimens: three mature, posterior amputees, five immatures, one a posterior regenerate plus an unregistered tail); (P12-13) 14:3499, same details as (P3), (two subadults, both complete); (P14-20) 14:3463, same details as (H), (seven specimens: one mature tail regenerate; two subadults, one posterior amputee; one juvenile; and three immature posterior amputees).

EXTERNAL FEATURES

Body circular in section, tail blunt. Lengths mm: (H) 45, (P1) 40+, (P2) 30+, (P12) 45, (P13) 40, (P12-13) 45-40, (P14) 25+, (P15) 40, (immatures, ca. 25-35 mm). Width: ca. 1.5 mm. Segments: (H) 97, (P1) 99+, (P2) 85+ (posterior regenerate from 72), (P3) 54+, (P12-13) 100-104, (P14) 40+25 (regenerated), (P15) 108. Colour: anterior and dorsum light lilac-brown with darker mid-dorsal line, ventrum pale, clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: from 2/3. Setae: anisochaetine, 8 setae in regular rows in the anterior; d line migrates more dorsally in the posterior and becomes sinuous and in the tail (i.e., from segment 50 (H), 85 (P1), 71 (P2), 72 (P12), 90 (P14), 80 (P15), and in all complete immatures) setae are added irregularly between c and d (and sometimes between a and b too) to give 10 or more setae per segment. Nephropores: in c lines in the anterior. Spermathecal pores: 6/7/8/9 just lateral of setal a lines (diverging slightly). Female pores: paired on 14. Male pores: paired on small porophores in ab. Genital markings: paired (sometimes analogue), postsetal discs in a lines in some of 7-9: in 7-9 (P4), 7-8 (H, P2), 8rhs and 9lhs (P14), 9 only (P13), 9lhs (P1, P15-16), or absent (P3, P5, P12); mid-ventral elongate pads in aa in 17/18 and 18/19 (all specimens), rarely with

terminal discs in ab (P14 only); sometimes paired eye-like discs in 16/17 (P1, P13) and/or 19/20 (P1, P6, P12-13, P15-16).

INTERNAL ANATOMY

Septa: not especially thick in anterior. Gizzard: flask-shaped in 5. Oesophagus: pale and smooth walled (but not muscular) in 6 and 7; increasingly vascularised and dilated in 8-15; narrowing and valve-like in 16. Nephridia: vesiculate holoic in c lines; the bladders elongate in the anterior, becoming bilobed after the clitellum; not tufted anteriorly. Vascularization: hearts in 10-12 from weak supra-oesophageal vessel in 9-12. Spermathecae: three pairs in 7-9, saccular ampulla on distinct duct with simple diverticulum ectally. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles racemose in 9 (small) and 12 (large). Ovaries: palmate in 13; small ovisacs sometimes in 14. Prostates: tubular 17-20; fine penial setae present. Intestine: origin ½17; no typhlosole but low dorsal ridge seen; gut often contains organic sandy soil.

REMARKS

Diporochaeta diadema is comparable to *D. monogyna*, *D. hellyeri* and *D. montisarthuri* as all these species have three pairs of spermathecal pores and add setae posteriorly. However, *D. monogyna* has a single female pore and the latter two species have spermathecae in b lines rather than in a or ab lines, moreover, the arrangements of genital markings differ.

ETYMOLOGY diadema, Latin - for the "Coronets" location.

DISTRIBUTION AND HABITAT

Apparently restricted: found only on shoreline under Coronet Range east of Lake Pedder, in litter.

Diporochaeta gordoni Blakemore, 2000

Fig. 79.

Diporochaeta gordoni Blakemore, 2000b:10-11, fig 5.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3385, laneway off Island Road, Lake Gordon south, SW Tasmania, 438800 5258900, 310 m, 14.iv.1996, R.J. Blakemore, under myrtle/Huon pine forest litter and beside creek on shoreline, (mature specimen, missing tip of tail, dissected and figured).

PARATYPES: all same details as (H): (P1) 14:3386, (mature, posterior-amputee, dissected); (P2) 14:3387, (mature dissected); (P3) 14:3388, (mature, dissected); (P4) 14:3389, (mature, posterior-amputee); (P5) 14:3390, (mature); (P6) 14:3391, (mature); (P7) 14:3392, (aclitellate mature); (P8) 14: 3393, (mature); (P9) 14:3394, (clitellate, posterior-amputee); (P10) 14:3395, (aclitellate mature); (P11) 14:3396, (aclitellate mature); (P12-14) 14:3397, (aclitellate mature, posterior-amputee and two immatures plus several unregistered tail portions).

EXTERNAL FEATURES

Caudal regions, near where extra setae are added, often thin and pale (in complete, unregenerated, specimens). Lengths mm: (H) 70+, (P2) 75, (P3) 62, (P5) 45, (P6) 42. Width: ca. 1.5 mm. Segments: (H) 108+, (P2) 123, (P3) 109, (P5) 100, (P6) 114. Colour: anterior and dorsum brown with darker mid-dorsal line, ventrum and posterior pale, clitellum buff. Prostomium: open epilobous. Clitellum: ¼13,½13-16. Dorsal pores: (1/2 non-functional?), functional from 2/3. Setae: anisochaetine, 8 on 12 and 20 in regular rows; add setae between ab, bc or in and above cd on tail suddenly (i.e., from 98 in H, 75 in P2, 87 in P3, 89 in P6) or gradually (in P5 from segment 50) to give 14-18 setae per segment. Nephropores: in c lines in anterior and in d or e in posterior. Spermathecal pores: 7/8/9 just lateral of setal a lines. Female pores: paired on 14. Male pores: paired on small porophores in ab but nearer a line. Genital markings: weak presetal, mid-ventral discs in some or all of 6-9 (mostly in 7-9); in all specimens, elongate pads in aa in 17/18 and 18/19.

INTERNAL ANATOMY

Gizzard: muscular, flask or barrel-shaped in 5. Oesophagus: smooth and internally lamellate in 6-½7, but not muscular; thereafter vascularized to 15 or 16 where it narrows and becomes valvular with thickened wall. Nephridia: vesiculate

holoic in c lines in anterior; bladders spherical, large and flattened. Vascularization: hearts 10-12 from supra-oesophageal vessel in 8-13. Spermathecae: two pairs in 8 and 9, subspherical ampulla with medium sized diverticulum from duct. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: branching in 13; ovisacs in 14. Prostates: tubular 18-20; short penial setae present. Intestine: origin ½17; no typhlosole; gut contains mainly organic matter.

REMARKS

Apart from *Diporochaeta gordoni*, the only known Tasmanian species of the genus having two pairs of spermathecae is *Diporochaeta moroea* (Spencer, 1895). However, this latter species is larger with more setae in the anterior, has different genital markings, dorsal pores from 3/4, and, significantly, lacks nephridial bladders (pers. obs. from inspection of type specimen in Museum of Victoria, NMV: G292).

DISTRIBUTION AND HABITAT

Possibly restricted: Lake Gordon south, under myrtle beech *Nothofagus cunninghami* /Huon pine *Lagarostrobos franklinii* litter on shoreline.

Diporochaeta hellyeri (Jamieson, 1974) comb. nov.

Fig. 80.

Perionychella (Vesiculodrilus) hellyeri Jamieson, 1974: 238-241, Figs. 9B (p. 235), 16N, O (p. 256).

MATERIAL EXAMINED

HOLOTYPE: TM: K284, Hellyer Gorge, 41°20'S.147°35'E, 28.v.1954, J.L. Hickman, (previously dissected specimen, here redescribed and redrawn);

PARATYPES: (P1-P2) BM(NH): 1972.8.10-11, same locality (two matures, both previously dissected, here reinspected); AM: W5192-5193 (P3-4), same locality as H, (specimens not inspected).

SPECIMENS: none - two specimens from Mt Arthur (TM:K284-286) included in the type description are now attributed to *Diporochaeta iseo*.

EXTERNAL FEATURES

Lengths mm: 53(H) - 60. Width: ca. 2.5 mm. Segments: 94-104. Colour: body uniform buff in alcohol, clitellum darker. Prostomium: open epilobous, almost tanylobous (peristomium not ventrally cleft). Clitellum: ½13-16. Dorsal pores: from 4/5. Setae: anisochaetine, 8 anteriorly, increasing to ca. 20-24 posteriorly where they are in irregular rows. Nephropores: in c lines in anterior. Spermathecal pores: in 6/7/8/9 just median of b lines. Female pores: paired on 14. Male pores: paired on transversely conjoined papillae on 18 in b. Genital markings: (H) faint markings in 6-8 just median to spermathecal pores or (P1) presetal in b lines in 9 and 10; mid-ventral tumid patches just in front of setal arc in aa on 17 (H, P3, on lhs in P2) and/or 18 (H, P1-4) boss-like with central depression containing small paired pores; in all mature specimens, paired eye-like markings in b in 17/18 connected by elongate trough; no markings in 18/19 (confirmation of Jamieson).

INTERNAL ANATOMY

Gizzard: small, almost vestigial in 5 in pharyngeal mass and preceded by proventriculus. Oesophagus: dilated in 14 and 15 appearing to form calciferous glands. Nephridia: vesiculate holoic, bladders elongate (H) or ocarina-shaped (P1, P2). Vascularization: last hearts 12; supra-oesophageal vessel well developed in 8-13. Spermathecae: three pairs in 7-9, ampulla saccular on very short duct with simple diverticulum. Male organs: incipiently metandric, funnels in 10 present in H but not iridescent, iridescent in 11 (all specimens); seminal vesicles small in 9 (H) or absent

(P1-2), and very large in 12. Ovaries: palmate in 13; ovisacs present (in H, P1). Prostates: blocky, tubular zig-zagging in 18-20,21, no muscular duct found; penial setae not found (cf. Jamieson where they were reported for paratypes). Intestine: origin 17; no typhlosole; gut contains organic matter and mucus.

REMARKS

Augmented in the present account of *Diporochaeta hellyeri* are the prostomium being almost tanylobous and the presence of markings near the spermathecal pores. Although Jamieson (1974) described penial setae of the paratypes, he made no mention for the holotype; no penial setae were found during reinspection of the holotype although it is possible they were removed. Two specimens from Mt Arthur, TM:K285-286, included with the original type description, are found to differ substantially from the holotype and are consequently removed to *Diporochaeta iseo* sp. nov.. Jamieson (1974: 241) considered *D. hellyeri* to be close morphologically to his *D. montisarthuri* but to be "readily distinguished from it by the presence of postcitellar genital markings in *aa* [boss-like in 18]." This characteristic, along with its incipient metandry, also separates *D. hellyeri* from *D. iseo*.

DISTRIBUTION AND HABITAT

Hellyer Gorge, NW Tasmania (not from Mt Arthur in NE Tasmania).

Diporochaeta iseo sp. nov.

Fig. 81, Fig. 82.

Perionychella (Vesiculodrilus) hellyeri (part.) Jamieson, 1974: 238-241.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3295, near Scottsdale, ca. 41°10'S.147°35'E, NE Tasmania, in Forestry Tasmania "Cuckoo" soil pit, 25.i.1996, R.J. and S.A.McI. Blakemore, (mature, dissected and figured).

PARATYPES: (P1) 14:3296, same details as (H), (posterior amputee, dissected); (P2) 14:2018, Winnaleah, Banca Road, NE Tasmania, 11.i.1994, R.D. D'Orazio and D.E.Soccol, dry sclerophyll, (mature, dissected and figured); (P3-4) 14:3099, Tombstone Creek Reserve, NE Tasmania, EQ577 163, 640 m, 25.vi.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll along Esk Forest Road, (two mature posterior amputees, undissected); (P5) 14:1467, same details as (P3-4), (mature dissected and figured); (P6) 14:3100, same details as (P3-4), (mature dissected and figured); (P7) 14:3198, same details as (P3-4), (mature dissected and figured); (P8-11 14:3630, summit of Ben Lomond, , NE Tasmania, 41°35'S.147°40'E, ca EQ 568 005, 1,500 m23.iii.1997, R.J. Blakemore, , in alpine heath at edge of a sink hole, (three matures, dissected, one figured one posterior regenerate, plus an immature specimen); (P12) TM:K285, Mt Arthur, 41°15'S.147°20'E, 3.iii.1971, A.J. and J.A. Dartnall, in rainforest, (small posterior amputee, previously undissected - included as 'Material examined', but not designated paratype, in Jamieson's description of *Diporochaeta hellyeri*, here dissected and figured); (P13) TM: K286, same details as (P12 K286) (much damaged and coiled posterior amputee that is of little use except to confirm external characters like setal counts); (P14) 14:1443, Griffin Forest Reserve, NE Tasmania, EQ 687 088, 23.vi.1992, R.D. D'Orazio, wet sclerophyll gully at edge of pines, (mature dissected and sketched); (P15) ANIC:RB.98.1.27, same details as P14, (mature, dissected); (P16) 14:3782, same details as P14, (anomalous mature with two anterior segments deleted, dissected)

EXTERNAL FEATURES

Tail flattened and tapering. Lengths mm: range 30-66; (H) 50, (P1, P5) 47, (P6) 45, (P7) 55, (P8) 66, (P9) 48, (P10) 30, (P11 immature) 35, (P14-16) 38-58. Widths: ca. 1.8-2.5 mm. Segments: (H) 101, (P2) 98, (P5) 94, (P6) 96, (P7) 95, (P8) 114, (P9) 96, (P14-15) 90-115. Colour: in life, snout and tail pink, anterior dorsum

puce or, in alcohol, dark, with darker dorsal line continuing length of body, ventrum pale, clitellum lighter of buff. Prostomium: open epilobous; peristomium ventrally cleft. Clitellum: ½13-16. Dorsal pores: (sometimes vestigial in 2/3), open from 3/4. Setae: 8-12 anteriorly with an odd one or two added between c and d especially after the clitellum or only on tail segments giving 10-14 setae posteriorly (eg. in H, P2, P5, P7 there are 8 setae in anterior and 10 on last 10-15 segments; P3-4, P6, P8, P14 have 10 on segment 12 increasing up to 14 on tail; P15 has 12 setae throughout). Nephropores: in c lines in anterior. Spermathecal pores: in 6/7/8/9 in, or just ventral of, b lines. Female pores: widely paired on 14. Male pores: paired on papillae on 18 in b, often transversely conjoined by tumid ridge. Genital markings: faint paired markings in (P2-4) below spermathecal pores in 7-9, or (P5, P14) mid-ventral in 6-8, or (P6) below setae a in 6-8, or (P7) in 5-9 just median of b lines, or (P12, P15) presetally in 7-9 just median of a lines; (all specimens) two pairs of lip-like markings in ab lines in 17/18 and 18/19, the interval between each pair puckered; plus paired sucker-like discs median to a lines in 18 on anterior, or (P5-6) posterior edge, of the male pore ridge; additional postclitellar markings are found in (P6) below a setae on 17, and in (P7) two pairs of discs presetally in ab lines in 17 and 19.

INTERNAL ANATOMY

Septa: all thin or 7/8/9 slightly thickened. Gizzard: small but muscular in 5. Oesophagus: dilated in 13-16, forming lamellar calciferous glands in 14 and 15, valvular in 16. Nephridia: vesiculate holoic, bladders elongate or waisted in the anterior; bilobed after about 14. Vascularization: dorsal blood vessel single, hearts 10-12, supra-oesophageal vessel 10-13. Spermathecae: three pairs in 7-9, ampulla saccular, often waisted, on very short short duct with simple diverticulum. Male organs: holandric, testes and funnels iridescent in mucus in 10 and 11; seminal vesicles large, racemose in 9 and 12. Ovaries: palmate in 13; small ovisacs sometimes seen in 14. Prostates: thickly tubular in 18-20,21 often throwing loop into 17, with flaccid duct; small penial setae present. Intestine: origin abrupt in mid-17; no typhlosole; gut contains mainly organic matter.

REMARKS

Characteristics *Diporochaeta iseo* shares with *D. montisarthuri* and *D. hellyeri*, both of Jamieson (1974), and with *D. ateramnis*, are setae that increase beyond 8 per segment in the mid- or hind-body, three pairs of spermathecae near b lines in 6/7/8/9,

calciferous glands developed in 14-15, elongate or bilobed nephridial bladders, and intestinal origins in 17. However, *D. iseo* and *D. montisarthuri* are holandric, rather than incipiently metandric like *D. ateramnis* and *D. hellyeri*. Moreover, distinguishing characters of *D. iseo* are that the setae increase from 8-12 per segment in the anterior to only 10-14 per segment posteriorly (rather than up to 16-20), the peristomium is ventrally cleft, and genital markings are in 17/18 and 18/19 (as in *D. montisarthuri*) but also ventrally in 18 (as in *D. ateramnis* and *D. hellyeri*) - although these latter differ in appearance and are not boss-like. In addition to these consistent markings, some additional marking in the anterior and posterior appear in the paratypes included in the above description. Tasmanian Museum specimens K285 and K286, here designated paratypes (P12-P13) of *D. iseo*, were originally listed under *D. hellyeri* by Jamieson (1974), they differ from this species on the points mentioned above.

ETYMOLOGY: '*inter septentriones et orientam*' - for the NE distribution (acronym).

DISTRIBUTION AND HABITAT

Diporochaeta iseo is widely distributed in NE Tasmania, occurring at Scottsdale, Mt Arthur, Winnalea, Tombstone Creek, Griffin F.R., and on the summit of Ben Lomond.

Diporochaeta kershawi (Jamieson, 1974)

Fig. 83a., Fig. 83b.

Perionychella (Perionychella) kershawi Jamieson, 1974: 229-230, Figs. 5B (p. 224), 16E (p. 256).

Diporochaeta kershawi; Jamieson, 1994: 175-177.

MATERIAL EXAMINED

HOLOTYPE: (H monotypic) TM:K262, under a rotting log near the old Breiseis Tin Mine dam, Derby, NE Tasmania, 41°10'S.147°50'E, 19.ix.1971, R.C. Kershaw, (previously dissected specimen that was already partially macerated, here redescribed and redrawn).

SPECIMENS: 14:1115, Emu Rd., Weldborough, NE Tasmania, EQ 781-408, 540 m, 21.vii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll to rainforest, (mature specimen, dissected and drawn); 14:3065, same details as 14:1115, (three mature specimens); 14:895, Frome Road, Moorina, NE Tasmania, EQ 762 443, 420 m, 21.vii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (three mature specimens, one a posterior amputee).

The Holotype is redescribed and augmented with information from new material.

EXTERNAL FEATURES

Body large; tail spade-shaped. Length mm: (H) 170; range, 115-190 (mean of seven specimens, 131.8 mm). Width: ca. 7 mm. Segments: (H) 119; range 134-150 (four other specimens). Colour: dark red-brown pigmentation dorsally and laterally to c setal lines with pale setal auriolae and darker mid-dorsal line, ventrum pale; clitellum buff. Prostomium: epilobous with mid-dorsal furrow, the furrow continuous to 1/2 or more usually to 2/3. Clitellum: ½13-½17 (cf. Jamieson 'XIII-XVII' but shown ½13-17 in his Fig. 5B). Dorsal pores: from 4/5. Setae: anisochaetine, 8 anteriorly, ca. 12-20 in midbody with other than ab lines irregular, and ca. 20 on tail with other than a lines irregular. Nephropores: in c lines in anterior. Spermathecal pores: 4/5/6/7/8/9 in a lines. Female pores: paired on 14. Male pores: in a lines on small raised papillae on 18. Genital markings: midventral circular lenses in aa in 11/12 (H only) and 12/13 (H and three of seven other specimens); small paired discs in, or just lateral of, b lines conjoined by tumescence in 17/18 and second set slightly narrower in 18/19 (H and all specimens); larger (except in H), more closely paired

conjoined discs in a lines in 19/20 (all) and (in only three of seven specimens) in 20/21 also.

INTERNAL ANATOMY

Septa: 7/8-15/16 with some thickening. Gizzard: in 5 large but compressible (in H) or compact. Oesophagus: dilated in 8,9-15, vascularized in 14 and 15 but not calciferous (indeterminable in H where gut is macerated after 13). Nephridia: avesiculate holoic, in anterior in 2,3-9 low clusters with numerous loops attach to the body wall anteriorly in bc, simple paired holonephridia in c lines after clitellum. Vascularization: dorsal blood vessel single, large hearts 10-12 from supra-oesophageal vessel in 8-12, this traced to 15 in one specimen. Spermathecae: five pairs in 5-9; flaccid gourd-like ampulla tapers to duct with single small, ectal diverticulum. Male organs: holandric, testes iridescent in mucus in 10 and 11; seminal vesicles paired, racemose or lingular in 9 and 12. Ovaries: 13, palmate (indeterminable in H). Prostates: tubular in 17-23,24; longish penial setae present. Intestine: indeterminate in holotype due to maceration (cf. 17, Jamieson), from 18 in Weldborough specimen; no typhlosole; gut filled with woody material (H) or organic matter.

REMARKS

This redescription confirms and considerably augments the type description - which was based on a single, macerated specimen. Differences and additions to the type description are the colour, the prostomium epilobous rather than tanylobous, the distributions of genital markings, the anterior nephridia in coiled clusters in the anterior rather that tufts, and the intestinal origin is in 18 in one specimen (it is indeterminate in the macerated holotype although stated to be in 17 by Jamieson). Nephridial bladders were not found, neither were the "terminal dilations of the ducts of the anterior tufts" confirmed, therefore this species is avesiculate holoic.

Having perichaetine setae (i.e., more than 8 per segment, at least in mid- or hindbody), holonephridia regardless of presence or absence of bladders, and tubular prostates qualifies it for inclusion in *Diporochaeta*. This species has transition from 8 setae anteriorly to ca. 20 setae posteriorly and is separated from the wholly perichaetine species, *D. soccoli* by this and by other differences. *Diporochaeta kershawi* is also similar to *D. stronach*, that differs notably only in the distribution of

its genital markings and vesiculate nephridia. Morphologically it resembles the wholly lumbricine *G. adsiduus* and *Graliophilus praestingor*.

Jamieson (1994) included this species, as *Diporochaeta kershawi*, in a cladistic analysis. In the data matrix he erroneously recorded this species as 'lumbricin', and had the first full clitellar segment as 13 rather than 14 as shown in Jamieson 1974: fig. 5B, the resulting cladogram is therefore highly unreliable.

DISTRIBUTION AND HABITAT

Type locality Derby, new material is from Weldborough and Moorina which are in the same region.

Diporochaeta lacustris Blakemore, 2000

Fig. 84.

Diporochaeta lacustris Blakemore, 2000b: 11-12, fig 6.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3431, Maria Creek, Lake Pedder west, SW Tasmania ca. 42°55'S.146°10'E, ca. 441700 5251000, 310m, 11.iv.1996, R.J. Blakemore, in wet soil along creek, (mature specimen, dissected and figured, fig. 6).

PARATYPES: (P1) 14:3442, same details as (H), (mature, posterior amputee, dissected); (P2) 14:3443, Cripps Point, Lake Pedder east, 429000 5242900, 310 m, 12.iv.1996, M. Anderson, under button grass near creek, (mature, posterior amputee, dissected); (P3) 14:3444, same details as (P2), (mature, complete, dissected, plus eight unregistered tails); (P4-15) 14:3433, same details as (H), (twelve specimens: ten matures - three posterior amputees, and two subadults - one posterior amputee); (P16-20) 14:3435, same details as (H), except in sand in creek bed, (five complete matures and an unregistered tail).

EXTERNAL FEATURES

Lengths mm: (H) 110, (P1) 105, (P2) 75+, (P3) 80, (P4-9) 75-110, (P16-20) 65-90. Width: ca. 2 mm. Segments: (H) 146, (P2) 78+, (P3) 137. Colour: anterior and dorsum puce with darker mid-dorsal line, ventrum yellow, tail pale, clitellum buff. Prostomium: open epilobous, faintly furrowed. Clitellum: ½13-16. Dorsal pores: from 2/3 (1/2 rudimentary - but see Remarks below). Setae: anisochaetine, 8 anteriorly in regular rows (although d line moves more dorsally in posterior), increasing to 10-12 or more per segment in tail (eg. from segment 96 in H, 69 in P2, 61 in P3). Nephropores: in c lines in anterior. Spermathecal pores: 5/6/7/8/9 just lateral of setal a lines (diverging slightly). Female pores: paired on 14. Male pores: paired on small porophores in ab, (setae b, or follicles, retained). Genital markings: paired or analogue postsetal discs in a lines in 8 or 9 thus: 8rhs (P2), 9lhs (H, P19-20), 9rhs (P10), or paired in 9 (P1, P5-6, P8, P14-15), or absent (P3-4, P7, P9, P11-13, P16-18); tumid pads in aa in 17/18 and 18/19 in all mature specimens; paired or analogue eye-like discs in a lines in 19/20 (in all specimens, except P3).

INTERNAL ANATOMY

Gizzard: barrel-shaped, muscular in 5. Oesophagus: smooth and pale in 6 and 7, vascularised and increasingly dilated in 8-15, valvular in 16. Nephridia: vesiculate

holoic in c lines; not tufted anteriorly, bladders bilobed or elongate. Vascularization: hearts in 10-12 from weak supra-oesophageal vessel in 8,10-12,13. Spermathecae: four pairs in 6-9, saccular ampulla distinct from short duct with simple diverticulum ectally. Male organs: holandric, iridescent funnels in mucus in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13; small pair of ovisacs in 14. Prostates: tubular 17-20,21; penial setae present. Intestine: origin 17; no typhlosole; gut contents colloidal soil.

REMARKS

Diporochaeta lacustris has paired female pores and spermathecae in 5/67/8/9 near a lines, as do *D. rubertumula* and *D. setosa*, but these species are separated mainly on the distributions of their genital markings and setal arrangements. *D. lacustris* differs from *D. rubertumula* by having genital markings that are widely paired or analogue in the anterior in 8 and/or 9 (where present) rather than mid-ventral, plus penial setae; both differ from *D. setosa* in having only eight setae in the anterior. All three species are also morphologically similar to sympatric species that have only three pairs of spermathecae: *D. diadema* and *V. ventralis*, the latter also differing generically in having plesiomorphic lumbricine state throughout. Specimen P3 has yellow pigment, a dorsal gutter in the posterior half of the body, plus its dorsal pores, which although present from 2/3 appear non-functional until 20/21 to about 50/51, and, in these respects, superficially resembles *H. pedderensis*.

ETYMOLOGY "lacustris" of the lake.

DISTRIBUTION AND HABITAT

Maria Creek on the west shore and Cripps Point on the east shore of southern Lake Pedder, mainly in wet sand along creeks and under button grass (*Gymnoschaenus sphaerocephalus*).

Diporochaeta monogyna sp. nov.

Fig. 85.

MATERIAL EXAMINED

HOLOTYPE: (H), 14:1026, Hogarth Road, Legerwood, NE Tasmania, EQ 521 356, 290 m, 7.vii.1992, R.D. D'Orazio, rainforest, (mature, dissected, figured).

PARATYPES: (P1) ANIC:RB.98.1.9, same details as H, (mature, slightly macerated in mid-body, dissected); (P2) TM:K1564, same details as H, (mature, slightly macerated in mid-body, dissected); (P3) 14:3739, Cuckoo Falls, NE Tasmania, EQ 516 342, 415 m, 7.vii.1992, R.D. D'Orazio, rainforest, (mature, dissected and sketched).

EXTERNAL FEATURES

Lengths mm: 180 (H), 250 (P1), 230 (P2), 125 (P3). Width: ca. 2 mm. Segments: 190 (H), 170 (P3). Colour: unpigmented in alcohol; clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: vestigial in 1/2, open from 2/3. Setae: anisochaetine, 8 in anterior and mid-body, posteriorly, from ca. 150, sudden and slight shift of c setae and seta added irregularly in position of bc, then others added irregularly in cd to give 12-14 per segment on tail. Nephropores: large in c lines. Spermathecal pores: 6/7/8/9 in a setal lines. Female pore: single, midventral on 14. Male pores: on small mounds in a lines replacing setae ab on 18. Genital markings: small discs paired, sometimes analogous, in ab lines presetally in 7-10 (H, P1) or 8-10 (P2) or 7-9 (P3), and postsetally in 8,9 (H); paired conjoined markings in 16/17 in ab lines, in 17/18 and18/19 wider than b lines, and in 19/20 and 20/21 tapering closer to a lines.

INTERNAL ANATOMY

Septa: 7/8-11/12 thickening. Gizzard: in 5 muscular conical. Oesophagus: dilated and vascularized in 16-18, probably not calciferous; valvular in 18/19. Nephridia: vesiculate holoic, bladders elongate in anterior, oblong in posterior. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-12 from supra-oesophageal vessel in 7-13. Spermathecae: three pairs in 7-9, saccular ampulla on tapering duct with clavate diverticulum; ampullae in P1 about twice as long as in other specimens, some diverticula in P3 are also long. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles paired racemose in 9 and 12. Ovaries: paired delicate sheets in 13; paired ovisacs in 14.

Prostates: tubular in 18; small penial setae present. Intestine: origin 19 (or 18 in P3); typhlosole absent; gut contains soil, organic matter, quartz and mica particles.

REMARKS

Diporochaeta monogyna is characterized by three pairs of spermathecae, a single female pore, and distinctive genital markings in both spermathecal and male fields. A similar and sympatric species is *D. coccyx* that differs by its four pairs of spermathecae and slightly different arrangement of genital markings.

ETYMOLOGY: 'monogyna' for the single female pore.

DISTRIBUTION AND HABITAT

Hogarth Road and Cuckoo Falls, Legerwood, NE Tasmania, from rainforest.

Diporochaeta montisarthuri (Jamieson, 1974), comb. nov.

Fig. 86.

Perionychella (Vesiculodrilus) montisarthuri Jamieson, 1974: 246-247, Figs, 12A (p. 244), 15H (p. 254), 16S (p. 256).

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K309, 41°15'S.147°20'E, Mt Arthur, east side from rainforest, 15.x.1971, A.J. Dartnall and R.C. Kershaw, (mature specimen previously dissected ventrally, here reinspected and refigured).

SPECIMENS: none.

EXTERNAL FEATURES

Body dorso-ventrally flattened. Length mm: (H) 75. Width: ca. 2.5 mm. Segments: 85. Colour: anterior and dorsum brown with darker mid-dorsal line, paler in the mid-body; ventrum pale; clitellum buff.. Prostomium: open epilobous (it is not possible to determine whether the peristomium is ventrally cleft as the anterior has been dissected, however Jamieson makes no mention of it being so). Clitellum: ½13-16 (cf. Jamieson, 1974: fig 5A). Dorsal pores: small in 2/3, larger from 3/4. Setae: anisochaetine, 8 anteriorly with odd one or two added in mid-body; 14 or 16 setae on tail. Nephropores: in line with setae c (in anterior). Spermathecal pores: in 6/7/8/9 (cf. Jamieson, 1974: fig 12A where they are erroneously shown in 6/7-9/10), in or just ventral of b. Female pores: widely paired on 14 anteriomedian to setae a (cf. Jamieson, 1974: fig 12A where they are erroneously shown on 13). Male pores: on small, low papillae on 18 in ab. Genital markings: pair of low ovoid markings in 17/18 and 18/19, slightly wider than the male porophores.

INTERNAL ANATOMY

Gizzard: small but muscular in 5. Oesophagus: dilated in 13-15 forming lamellar calciferous glands in 14 and 15. Nephridia: vesiculate holoic, bladders subspherical in anterior becoming bilobed after about 14. Vascularization: hearts 10-12; supra-oesophageal vessel 9-13. Spermathecae: three pairs in 7-9, ampulla heart-shaped with simple diverticulum, duct negligible. Male organs: holandric, testes and funnels iridescent in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: palmate in 13. Prostates: tubular 17-21 with flaccid duct; penial setae small. Intestine: origin ½17; no typhlosole; gut contains organic matter.

REMARKS

This re-description considerably augments the type description: noted for the first time are dorsal pores from 2/3, body shape and pigmentation, and, moreover, confusion over the positioning of the spermathecal pores, female pores and the extent of the clitellum (due to conflicts in Jamieson's description and illustrations) are now resolved.

Jamieson (1974) stated that *Diporochaeta montisarthuri* was morphologically close to *D. hellyeri* , although this was perhaps true only for those specimens included in the latter description which are found in the current account to actually be specimens of *D. iseo*. There are similarities between *D. iseo* and *D. montisarthuri*, especially three pairs of spermathecae and bilobed nephridial bladders, however these two taxa are separable because *D. montisarthuri* is not metandric, has different forms of genital markings in 17/18 and 18/19, and lacks any markings in 18.

DISTRIBUTION AND HABITAT

From the east side of Mt Arthur, NE Tasmania, in rainforest.

Diporochaeta moroea (Spencer, 1895)

Fig. 87.

Perichaeta morœa Spencer, 1895: 49, Figs. 40-42; Jensz & Smith, 1969: 107.

Diporochaeta moroea; Michaelsen, 1900: 207.

Perionychella (subgenus?) moroea; Jamieson, 1974: 257-258.

MATERIAL EXAMINED

LECTOTYPE: MOV:F40292 (previously NMV:G292), labelled "P[erichaeta]. sp2. T[asmania]", collected Lake St Clair, [ca. 42°05'S.146°10'E], Jan. 1893, (by W. Baldwin Spencer?), (aclitellate mature, missing the tip of its tail, previously dissected with part of the gut removed, reinspected here).

This specimen is herein designated a lectotype, under the article 74 of ICZN (1999).

SPECIMENS: none found despite resurvey by the author.

Description from Spencer (1895) and from re-inspection of lectotype.

EXTERNAL FEATURES

Length mm: 90+ (cf. 100 Spencer). Width: ca. 5 mm. Segments: 141+. Colour: uniform buff in alcohol. Prostomium: closed epilobous. Clitellum: not developed. Dorsal pores: from 3/4. Setae: numerous throughout, 22-36 in anterior, 40-42 in posterior; dorsal and ventral gaps small. Nephropores: lateral in line with i or j in midbody. Spermathecal pores: in 7/8 and 8/9 in c (cf. in ab, Spencer). Female pores: paired on 14. Male pores: on papillae on 18 in cd, connected by median, mid-ventral ridge, no setae intervene between male pores (cf. Spencer, fig 40 which appears to have setae a and b between). Genital markings: paired elliptical markings in ac lines in 19/20 (confirmation, incorrectly shown in 18/19 in Spencer's fig 40).

INTERNAL ANATOMY

Gizzard: compact and muscular in 5. Oesophagus: not especially dilated. Nephridia: avesiculate holoic, approximately in line with setae c in anterior. Vascularization: dorsal vessel single; commissurals 5,6-11, large hearts in 10-12; supra-oesophageal vessel present. Spermathecae: two pairs in 8 and 9; saccular ampulla tapers to duct with simple diverticulum extending to about the middle of the ampulla. Male organs: holandric, testes and funnels in 10 and 11; seminal vesicles large and racemose in 9 and 12. Ovaries: in 13 with oviducts. Prostates: tubular in 17-20 (the rhs prostate is removed from lectotype); penial setae not found (removed?).

Intestine: from 17 (Spencer - not determinable in the dissected lectotype as gut removed); typhlosole not noted.

REMARKS

The above redescription confirms Spencer's account, recording for the first time the tubular prostates which, combined with perichaetine setae and (avesiculate) holonephridia, places this species in the genus *Diporochaeta*, as correctly determined by Michaelsen (1900). Contrary to Jamieson (1974:258) where it was claimed that the syntype (NMV:G292) was "in a very refractory condition and yields no useful information", this syntype, now a lectotype, is actually in good condition although the prior removal of the gut inhibits confirmation of the alimentary tract.

DISTRIBUTION AND HABITAT

Lake St. Clair region where Spencer camped out for some four weeks in the early part of 1893.

Diporochaeta pulvilla sp. nov.

Fig. 88.

MATERIAL EXAMINED

HOLOTYPE: (H), 14:2836, Birchs Inlet, W Tasmania, CN 753 878, Spero map 7912, 10 m, 16.x.1993, Jane Griffith, (mature with tip of tail missing, dissected, figured).

PARATYPE: (P) 14:3640, same details as H, (an immature that superficially agrees, slightly macerated in mid-body, dissected and agrees internally except for undeveloped sex organs).

EXTERNAL FEATURES

Body: anterior segments to 8 becoming increasingly enlarged, then reducing in size to about 13 after which become more uniform, then (in P) very thin in posterior. Lengths mm: 65+ (H), 50 (P). Width: ca. 6.5 mm. Segments: 83+ (H), 240! (P). Colour: pale unpigmented with several dark spots irregularly on anterior segments, these concentrated above genital markings equatorial on 19-21 (see figure). Prostomium: prolobous or, if epilobous, barely impinging. Clitellum: weakly marked, extent not determinable (but see dorsal pores). Dorsal pores: vestigial in 10/11, open in 11/12, absent from 13/14-16/17 (clitellar segments?), present for remainder of body. Setae: small and difficult to see in anterior, ca. 16-20 on 12 and 20, ca. 18-20 in posterior segments in mostly regular rows with tendency to pairing. Nephropores: not found (lateral?). Spermathecal pores: weakly marked in 7/8/9 in ab setal lines. Female pores: widely paired just anteriomedian to setae a. Male pores: minute on small pads approximately in ab lines on 18. Genital markings: (H) large elongate mounds with pair of slightly formed pads wider than male pores in 15/16; similar padded mounds, reducing in size, in 19/20-21/22 (i.e., total of four pads).

INTERNAL ANATOMY

Septa: 5/6-10/11,11/12 markedly thickened. Gizzard: in 5 large muscular barrel with anterior flange, displaced to occupy ½6-7, preceded by narrow thin-walled pharynx as long as gizzard but bent into S-shape. Oesophagus: increasingly dilated in 10-16 with internal ruggae but not calciferous; valvular in 17-18. Nephridia: avesiculate holoic from (at least) 4, tubules enlarged on and just after clitellar region then more flattened and ducts enter body wall laterally; no tufting detected in anterior; large pre-septal funnels present. Vascularization: dorsal blood vessel single onto

pharyngeal mass; hearts 10-13 from supra-oesophageal vessel 8-13. Spermathecae: two pairs in 8 and 9, elongate, flat and bent over ampulla on slightly shorter duct with small knob-like diverticulum ectally. Male organs: metandric, iridescent testes and funnels free in 11 only; seminal vesicles paired racemose on anterior septum of 12 only. Ovaries: as several strings in 13; small paired ovisacs on anterior septum of 14. Prostates: tubular in 18, glandular part yellowy, duct flaccid and ensheaved in mesentery from body wall; no penial setae found. Intestine: origin 19; 19-23 distended and wrinkled but not muscular; distinct low lamellar typhlosole commences from 34; gut contents from 24 on filled with homogenous dark soil that contains organic fragments and grits.

ETYMOLOGY: pulvillus, Latin - loosely relating to 'pads', for the genital markings.

REMARKS

Diporochaeta pulvilla is characterized by its prolobous prostomium, the posterior commencement of dorsal pores, distinctive genital markings and spermathecae, its last hearts in segment 13, presence of a typhlosole, and by metandy. This combination of features is sufficient to distinguish this species from other members of the genus.

DISTRIBUTION AND HABITAT

Birchs Inlet, W Tasmania from rainforest.

Diporochaeta rubertumula Blakemore, 2000

Fig. 89.

Diporochaeta rubertumula Blakemore, 2000b:13-14, fig 7.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3410, Red Knoll Lookout, south Lake Pedder, SW Tasmania ca. 42°55'S.146°10'E, 440600 5234600, 400m, 8.iv.1996, QVM, (mature, possibly a posterior amputee as the body appears truncated, dissected and figured).

PARATYPES: all with same collection details as (H): (P1) 14:3411, (mature, posterior amputee, dissected); (P2) 14:3412, (mature, the last 24 segments are abruptly pale and thinner, possibly a posterior regenerate although this may also be a normal characteristic); (P3) 14:3413, (mature, posterior amputee, dissected); (P4) 14:3414, (mature, posterior amputee); (P5) 14:3415, (mature, complete); (P6) 14:3416, (mature, aclitellate); (P7) 14:3417, (aclitellate, posterior amputee); (P8-9) 14:3418, (two specimens both aclitellate, posterior amputees, plus 14 unregistered tails and bits).

EXTERNAL FEATURES

Body tapering abruptly at tail which is often unpigmented (eg. H, P2, P6). Lengths mm: (H) 65 (+?), (P2) 48, (P6) 50. Width: ca. 2 mm. Segments: (H) 106, (P2) 93, (P6) 105. Colour: anterior and dorsum puce with darker mid-dorsal line, ventrum pale, clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: from 2/3 (1/2 rudimentary). Setae: anisochaetine, 8 anteriorly in regular rows (although d line moves more dorsally in posterior), increasing to 10-12 or more per segment in tail (eg. from segment 96 in H, 70 in P2, 80 in P6). Nephropores: in c lines in anterior. Spermathecal pores: 5/6/7/8/9 just lateral of setal a lines (not diverging). Female pores: paired on 14. Male pores: paired on small porophores in ab (setae b, or follicles, retained). Genital markings: single, mid-ventral post-setal discs in some or all of 6-9: in 6-9 (P1); 7-8 (H, P2, P4-5, P7); or only in 7 (P8) or in 8 (P3); single mid-ventral pre-setal disc also in 8 or 9 (in H, P1-2, P4-5), or closely paired discs in 8 in aa (in P9 only), or absent (P6); tumid pads in aa in 17/18 and 18/19 in all mature specimens; eye-like discs in a lines in 19/20 (in H, P1, P3, P6-9) and sometimes an analogue in 20/21 (in H, P1).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: flask-shaped, weakly muscular in 5. Oesophagus: smooth and pale in 6 and 7, vascularized and increasingly dilated in 8-15, valvular in 16. Nephridia: vesiculate holoic in c lines; not tufted anteriorly, bladders subspherical. Vascularization: hearts in 10-12 from supra-oesophageal vessel in 9-13. Spermathecae: four pairs in 6-9, saccular ampulla distinct from short duct with simple diverticulum ectally. Male organs: holandric, iridescent funnels in mucus in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13; small pair of ovisacs in 14. Prostates: tubular 17-20,21; penial setae not found. Intestine: origin 17; no typhlosole but low dorsal ridge from about 22; gut contents, organic soil.

ETYMOLOGY "rubertumula" for the Red Knoll location.

REMARKS

The main distinction of *D. rubertumula* from *D. lacustris* is in the distibution of genital markings, these being mid-ventral in the anterior rather than paired (or absent). Apparent lack of penial setae (in dissected specimens) is an additional distinction.

DISTRIBUTION AND HABITAT

Red Knoll Lookout, southern Lake Pedder.

Diporochaeta setosa Blakemore, 2000

Fig. 90.

Diporochaeta setosa Blakemore, 2000b:13-14, fig 8.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3382, Stillwater under Hermit, Lake Pedder east, SW Tasmania ca. 42°55'S.146°10'E, 428200 5258200, 310 m, 14.iv.1996, R.J. Blakemore, in sandy soil on shoreline, (mature specimen, dissected and figured).

PARATYPES: (P1) 14:3459, Mt Cawthorne, 427897 5249337, 310m, 12.iv.1996, R.J. Blakemore and M. Driessen, in beach sand and muddy soil, (mature, dissected); (P2) 14:3442, Cripps Point, 429000 5242900, 310 m, 12.iv.1996, M. Anderson, under button grass near creek, (mature, posterior amputee, dissected and figured); (P3) 14:3422, Bell Basin, 419600 5259700, 310 m, 9.iv.1996, R.J. Blakemore, under button grass, (single mature specimen in 2 halves); (P4) 14:3383, same details as (H), (mature specimen, damaged in anterior, dissected); (P5-6) 14:3460, same details as (P1), (two mature posterior amputees, plus two unregistered tails); (P7) 14:3465, same details as (P1), (mature posterior amputee); (P8) 14:3338, Bonnet Bay, 431150 5248260, 310 m, 12.iv.1996, R.J. Blakemore, M. Driessen, M. Anderson, under stones on hillslope, (mature, dissected).

EXTERNAL FEATURES

Lengths mm: (H, P1) 65, (P3) 50, (P4) 63, (P8) 80. Width: ca. 2 mm. Segments: (H) 116, (P1) 110, (P3) 121, (P4) 112, (P8) 92. Colour: anterior and dorsum dark brown, ventrum and tail pale, clitellum buff. Prostomium: open epilobous, faintly furrowed. Clitellum: ½13-16. Dorsal pores: from 2/3 (1/2 rudimentary). Setae: 10 (P2, P8) or more often 12 throughout in regular rows, may add setae in tail (eg. last 25 segments in P1). Nephropores: large in c lines (decasetose specimens) or d lines (duodecasetose specimens). Spermathecal pores: 5/6-8/9 diverging from just lateral of setal a lines in 5/6 to just median of b lines in 8/9. Female pores: paired on 14. Male pores: paired on small porophores in b. Genital markings: paired, or analogue, postsetal discs in (or median to) a lines in some or all of 6-9, or absent (from P3-4, P6, P7); tumid pads in bb in 17/18 and 18/19 in all mature specimens (with paired, or analogous, discs in bc lines in 17/18 (P1, P3, P6, P8) and/or in a or b lines in 18/19 (H, P2-3); paired eye-like discs in a line in 16/17 (H, P7-8) and/or 19/20 (H, P2-3, P7) or an analogue (P4-5, P8).

INTERNAL ANATOMY

Gizzard: small, barrel-shaped in 5. Oesophagus: smooth and pale in 6 and 7 (internally lamellate but not muscular), vascularised 8-15, valvular in 15,16. Nephridia: vesiculate holoic in d lines; not tufted anteriorly, bladders round, elongate, bilobed or ocarina-shaped. Vascularization: hearts in 10-12 from weak supra-oesophageal vessel in ½7-13. Spermathecae: four pairs in 6-9, saccular ampulla tapering to short duct with simple diverticulum ectally. Male organs: holandric, iridescent funnels in mucus in 10 and 11; seminal vesicles large, racemose in 9 and 12. Ovaries: large in 13; small pair of ovisacs in 14. Prostates: tubular 17,18-19,20,21; small penial setae present. Intestine: origin 17,½17; no typhlosole (may have low dorsal ridge); gut contains organic, gritty soil.

REMARKS

Diporochaeta setosa differs from *D. rubertumula* and *D. lacustris* primarily in having 10-12 setae in the anterior (rather than 8), secondly in the diverging spermathecal pores, and thirdly in the variation of its genital markings.

ETYMOLOGY "setosa" having (more) setae.

DISTRIBUTION AND HABITAT

Widely distributed around Lake Pedder shorelines, in beach sand or along creeks and under button grass (*Gymnoschaenus sphaerocephalus*) or rocks.

Diporochaeta soccoli sp.nov.

Fig. 91.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1933, Banca Rd., Winnaleah, NE Tasmania, EQ 670 596, 180 m, 19[11?].i.1994, R.D. D'Orazio and D.E. Soccol, dry sclerophyll, (complete mature, figured and dissected, sample also contained a tail portion).

PARATYPES: (P1) 14:3093, same details as H, (mature posterior amputee, dissected); (P2) 14:3094, same details as H, (mature, posterior amputee).

EXTERNAL FEATURES

Length mm: (H) 125 (P2) 95+. Width: ca. 70 mm. Segments: (H) 149. Colour: dark brown pigmentation dorsally and laterally to c setal lines with darker dorsal line, pale ventrum, clitellum buff; setal auriolae pale. Prostomium: open epilobous, dorsally furrowed to 2/3. Clitellum: (H) ½13-16, (P1-2) ½13-½16. Dorsal pores: from 5/6 or 6/7. Setae: 9-10 on segment 12, 16-20 on segment 20, and 22-32 posteriorly; there is a wide dorsal gap anteriorly which tapers posteriorly but setae d are in approximately straight series. Nephropores: in c lines in anterior from 2. Spermathecal pores: 4/5/6/7/8/9 in a lines. Female pores: paired. Male pores: in ab lines on small raised papillae. Genital markings: widely paired eye-like pores in ab in 16/17, continuous elongate marking extending almost to c lines in 17/18; paired but linked markings in ab in 18/19 and in a in 19/20.

INTERNAL ANATOMY

Septa: 6/7-12/13 thickening. Gizzard: small in 5, same width as oesopahgus but slightly muscular. Oesophagus: dilated and vascularized in 9-15, not calciferous. Nephridia: avesiculate holoic in c lines, tufted clusters anteriorly, simple holonephridia after clitellum (ducts flattened but not dilated as bladders). Vascularization: dorsal blood vessel single, commissurals in 5-9; hearts 10-12; supra-oesophageal vessel 9-12. Spermathecae: five pairs in 5-9, spherical ampulla on long duct with small, ectal diverticulum. Male organs: holandric, testes iridescent in 10 and 11; seminal vesicles paired, in 9 and 12. Ovaries: small in 13. Prostates: tubular in 18-19,20; penial setae present. Intestine: from 17; no typhlosole; gut contains mucus.

ETYMOLOGY: for the collector.

REMARKS

Diporochaeta soccoli differs from *D. kershawi* principally by having greater than 8 setae throughout, rather than a transition from 8 to many posteriorly, and genital markings absent from pre-clitellar segments (i.e. 11/12 and/or 12/13), but with an additional pair in 16/17. It is compared with *D. stronach* under that species' description.

DISTRIBUTION AND HABITAT

Winnaleah, in the same region as *D. kershawi* distribution, from dry sclerophyll.

Diporochaeta stronach sp. nov.

Fig. 92.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3292, collected near Scottsdale ca. 41°10'S.147°30'E on road to Derby, NE Tasmania, EQ 510 362, ca. 420 m, in Forestry Tasmania "Stronach" soil under wet forest litter, 25.i.1996, R.J. and S.A.McI. Blakemore, (complete mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 120. Width: ca. 6 mm. Segments:112. Colour: dark brown dorsum to c setal lines with darker mid-dorsal line, ventrum pale, clitellum yellow. Prostomium: epilobous, mid-dorsally furrowed to 1/2. Clitellum: ½13-16,½17. Dorsal pores: from 4/5. Setae: anisochaetine, 8 anteriorly, increasing irregularly in midbody to give ca. 30 on tail. Nephropores: in c line anteriorly. Spermathecal pores: 4/5-8/9 in a lines. Female pores: paired on 14. Male pores: superficial in a lines. Genital markings: large paired discs in b lines within tumescence meeting ventrally in 17/18; smaller paired discs in a lines in 19/20 (no markings in 18/19).

INTERNAL ANATOMY

Gizzard: small in 5. Oesophagus: dilated in 9-15, not calciferous. Nephridia: holoic in c lines with ducts dilated to form elongate tubular bladders; anterior tufting not noted. Vascularization: last hearts in 12. Spermathecae: five pairs in 5-9; saccular ampulla tapers to duct with small, ectal diverticulum. Male organs: holandric, testes iridescent in mucus in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: in 13. Prostates: tubular in 18-20; penial setae not noted. Intestine: from 17; typhlosole not noted.

ETYMOLOGY: for the soil-type of habitat.

REMARKS

Diporochaeta stronach is similar to and almost sympatric with *D. kershawi* and *D. soccoli*, differing mainly in the distribution of its genital markings which are absent from the anterior and from 18/19, although present in 17/18 and 19/20. Other slight differences are the position of the first dorsal pore, the setae are increased in the tail, the dilated nephridial ducts found in and after the clitellar segments that make this

species vesiculate holoic, and an absence of penial setae. More material is required to determine the full variation and relationship of these taxa.

DISTRIBUTION AND HABITAT

Scottsdale, found in Forestry Tasmania "Stronach" site that has yellow earth/podzolic topsoil formed on granite, under litter in wet forest (pH 5.9).

Diporochaeta sucta sp. nov.

Fig. 93.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3587, Christmas Hills, west of Smithton, NW Tasmania, CQ 309 667, 60 m, 6.xii.1990, R. Mesibov, (mature, posterior amputee, dissected figured).

PARATYPE: (P1) 14:3746, same details as H, (mature, dissected); (P2) 14:3747, same details as H, (mature, posterior amputee).

EXTERNAL FEATURES

Length mm: 140 (P1). Width: ca. 4 mm. Segments: 148 (P1). Colour: unpigmented, clitellum buff. Prostomium: closed (H, P2) or open (P1) epilobous. Clitellum: ½14-17, or 14-16 (P1). Dorsal pores: from 4/5. Setae: 16 on segment 12, ca. 22 on 20, and 20-22 further posteriorly; series apart from ab highly irregular. Nephropores: not found (lateral?). Spermathecal pores: 7/8/9 in ab near b setal lines. Female pores: widely paired just anterior to a setae. Male pores: protruding on mounds approximately in b lines on 18. Genital markings: large midventral sucker-like markings wider than bb lines in 12/13, in bb lines in 13/14; and (in H and P2) in bb in 16/17, wider than bb in 19/20, 20/21, and (P1 only) in 21/22.

INTERNAL ANATOMY

Septa: 8/9-12/13 slightly thickened. Gizzard: in 5 large muscular barrel. Oesophagus: not especially dilated. Nephridia: avesiculate holoic, single preseptal funnels found in post clitellar segments ducting laterally to body wall; not tufted in anterior. Vascularization: dorsal blood vessel single; hearts 10-13, weak supra-oesophageal vessel seen in 9-13. Spermathecae: two pairs in 8 and 9, elongate ampulla on slightly shorter duct with clavate diverticulum at junction that is embedded in anterior septum. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose in 9 (on lhs only in H) and 12. Ovaries: small pair in 13; small paired ovisacs on anterior septum of 14. Prostates: in 18 coiled tubular; penial setae present. Intestine: origin 19, no typhlosole, gut contains soil and woody particles.

ETYMOLOGY: suctus, Latin - loosely relating to 'suckers', for the genital markings.

REMARKS

Two pairs of spermathecae in 7/8/9 in ab or b lines, and the distinctive sucker-like genital markings on either side of the clitellum characterize *Diporochaeta sucta*, and differentiate it from other species of the genus in Tasmania, although it comes closest to the metandric *D. pulvilla*.

DISTRIBUTION AND HABITAT

Christmas Hills, NW Tasmania, "sand pocket of myrtle, sassafras and leatherwood rainforest in gully amid wet sclerophyll surrounds, clay", found with several other megascolecids and a single microdrile that was passed to Adrian Pinder to identify.

Provescus gen. nov.

Diagnosis: Setae perichaetine (twelve per segment). Dorsal pores present. Female pores paired on 14. Male pores from tubular prostates paired on 18. Oesophageal gizzards doubled in 5 and 6; calciferous glands, typhlosole, intestinal caeca and intestinal gizzards absent. Nephridia avesiculate holoic, not tufted anteriorly. Spermathecae five pairs with single, clavate diverticula. Penial setae present.

Type-species *Provescus crottyi* gen. et sp. nov., monotypic.

Distribution Crotty, Darwin, W Tasmania.

Etymology 'Provescus' Latin - 'forward eating' for the doubled oesophageal gizzards. Masculine.

Remarks

Provescus is distinguished from *Diporochaeta* by having apomorphic doubling of oesophageal gizzards in 5 and 6. Doubled or tripled gizzards in 5-7 is characteristic of mainland genera *Digaster* Perrier, 1872, *Didymogaster* Fletcher, 1886 and *Perrisogaster* Fletcher, 1887; however, these three mainland Australian genera have non-tubular prostates and are lumbricine and meroic (see Blakemore, 1997b; 2000c). *Provescus* differs from the Lake Pedder genus *Hypolimnus* Blakemore, 2000b on its tubular prostates, lack of nephridial bladders and presence of dorsal pores from the anterior.

Provescus crottyi gen. et sp. nov.

Fig. 94.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3780, Crotty, Kelly Basin Road at Allen's Creek, Darwin, W Tasmania, U.G.R. 8013.856228, (CP 856 228, ca. 42°5'S.145°33'E), 17.iii.1973, QVM collection, (mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Body: small and slender. Length mm: 45. Width: ca. 2.5 mm. Segments: 115. Colour: pale unpigmented in alcohol, clitellum cream. Prostomium: open epilobous. Clitellum: 14-17. Dorsal pores: from 4/5 or 5/6. Nephropores: not found. Setae: 12 per segment in regular rows in anterior but adding supernumerary seta in some tail segments and slightly more irregular. Spermathecal pores: not externally visible, found to be in 4/5/6/7/8/9 in ab lines closer to a lines from internal examination. Female pores: widely paired on 14 anterior to setae a. Male pores: on small mounds in ab lines on 18. Genital markings: paired, lenticular pads posteriorly in 6-9 not wider than b-b; lenticular depressions possibly with paired pads in 15/16-21/22 not wider than b-b; intervening mid-ventral white patches in 19-23.

INTERNAL ANATOMY

Septa: 10/11/12 slightly thickened; septal glands surround gizzard and extend to 9. Gizzards: elongate muscular in 5 and bulbous in 6, waisted where septum 5/6 attaches. Oesophagus: not especially dilated but with internal lamellae to 19, valvular in 20. Nephridia: avesiculate holoic with convoluted lateral tubes, thick in anterior to 20 then thin, sending thin duct to c lines; funnels not found; not tufted anteriorly. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts large in 10-12; supra-oesophageal vessel in weak in 10,11-12. Spermathecae: five pairs in 5-9; spherical ampulla on thin duct with clavate diverticulum ectally. Male organs: holandric, testis iridescent in 10 and 11; paired, racemose seminal vesicles in 9 and 12; pseudovesicle in 13lhs. Ovaries: large in 13 each consisting of ca. six egg strings; ovisacs paired in 14. Prostates: tubular in 18; small penial setae present. Intestine: from 21; typhlosole, gizzards absent; gut contains dark organic soil.

REMARKS

Apart from the doubled gizzards, *Provescus crottyi* is distinctive in its small size, arrangement of genital markings, and intestinal origin deferred to 21. *Anisochaeta corinna* and *A. zeehan* from the same region have a gizzard that is waisted or duplicated but not doubled.

DISTRIBUTION AND HABITAT

Crotty-Darwin, W Tasmania is towards Franklin-Lower Gordon Wild Rivers National Park; found with *Vesiculodrilus pollex*.

Megascolides M'Coy

Megascolides M'Coy, 1878: 21; Michaelsen, 1900: 182; 1907: 160-161; Stephenson, 1930: 835; Lee, 1959: 284-285; Blakemore, 1997a: 1689-1690; 2000c: 197-198.

Dinephrus Spencer, 1900: 33.

Austrohoplochaetella Jamieson, 1971: 490.

Pseudocryptodrilus Jamieson, 1972: 172.

[Note: under Article 12 of ICZN (1999), the genus-group name *Dinephrus* proposed by Spencer (1900) with type-species *Megascolides diaphanus* Spencer, 1900 is deemed to be available; therefore, Jamieson's *Pseudocryptodrilus* with the same designated type-species is a Junior Objective Synonym of this genus, which is itself in the synonymy of *Megascolides*].

Diagnosis Setae 8 per segment. Clitellum typically developed over at least four segments. Male pores from tubular prostates paired on 18 (or 17 where first segment suppressed). An oesophageal gizzard in 5 or 6 (or 7?). Nephridia meroic, at least in the fore-body, avesiculate or vesiculate, sometimes tufted anteriorly. Spermathecae one or more pairs, each with a clavate diverticulum. Typhlosole and calciferous glands present or absent; intestinal caeca absent. Penial setae present or absent.

[Note: according to ICZN (1999: 36) a compound genus-group name ending in the suffix *-ides* is to be treated as a masculine unless the author has stated otherwise, and the species name should agree in gender].

Type-species *Megascolides australis* M'Coy, 1878, (synonyms: *Notoscolex gippslandicus* Fletcher, 1887; *Lumbricus australis* Vaillant, 1889) from Gippsland, Victoria. (Syntypes, AM:W1253-1262).

Distribution Victoria, New South Wales, Tasmania, Western Australia, New Zealand (confined to the north of North Island). Widespread in Tasmania except for Central Plateau and offshore islands from whence it is currently unknown.

Included species

Megascolides australis M'Coy, 1878, from Gippsland, Victoria

Megascolides bagomaraglensis Blakemore, 2000c, from NSW;

Megascolides diaphanus Spencer, 1900, from Victoria;

Megascolides kendricki (Jamieson, 1971), from WA;

Megascolides maestus Blakemore, 1997a, from Tasmania;

Megascolides nokanenaensis Michaelsen, 1907, from WA;

Megascolides orthostichon (Schmarda, 1861), from Mt Wellington - there has been some debate as to whether this is Mt Wellington in New Zealand, or in Tasmania (see below).

Megascolides tenuis (Fletcher, 1889), from NSW.

Fifteen additional species from Tasmania are described below and *Pseudocryptodrilus acanthodriloides* Jamieson, 1974 is herein transferred from *Megascolides* to *Notoscolex.*

Eleven species are known from New Zealand (Lee *et al.*, in press) after removal of those listed in Lee (1959) with tubuloracemose prostates (previously attributed to *Tokea*) to *Notoscolex.*

Remarks The most recent discussions of this genus are found in Blakemore (1997a, 2000c) where the above synonymies are discussed. Spencer (1900: 33) had earlier proposed the genus *Dinephrus* for species that have only two nephridia per side, such as his *Megascolides diaphanus* (see Blakemore, 2000c: 198) that was also made the type-species of Jamieson's objectively synonymous genus *Pseudocryptodrilus*; however this species can be accommodated in *Megascolides* as defined above.

It is perhaps significant that all the species from Tasmania attributed to *Megascolides* in this work have only two pairs of spermathecae in 7/8/9, several have a reduced number of nephridial tubules in each segment, and most have long, convoluted prostate glands. Two new species that lack long prostates are *Megascolides cataractus* and *M. sanctorum* that, along with *M. xanthus*, are further distinguished within the genus by nephridial bladders, as are found also in *M. tenuis* (Fletcher, 1889) from Braidwood, NSW. Such vesiculate species, especially those that lack dorsal pores, may have affinities with *Cryptodrilus* that, nevertheless, is defined for species with non-tubular prostates.

Indian species of *Megascolides* were transferred to *Scolioscolides*, *Barogaster* and *Travoscolides* by Gates (1940). North American species of *Megascolides* were transferred to *Driloleirus* by Fender and McKey-Fender (1990).

Megascolides cataractus sp. nov.

Fig. 95.

MATERIAL EXAMINED

HOLOTYPE: 14:1442, Hardings Falls Forest Reserve, E Tasmania, EP 914 663, 260 m, 5.viii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (mature specimen, dissected and figured).

PARATYPE: (P) ANIC:RB.00.1.11, same details as (H), (mature, posterior amputee, dissected; a tail in sample does not belong to specimen).

EXTERNAL FEATURES

First segment reduced and barely differentiated from second. Length mm: 80 (H). Width: ca. 3 mm. Segments: 157 (H). Colour: unpigmented in alcohol. Prostomium: tanylobous. Clitellum: annular ½13,14-17. Dorsal pores: in (H) not present until 18/19 and then small but persist to tail, in (P), rudimentary from 12/13 but more pronounced from 18/19. Setae: 8 in regular rows, small except on tail. Nephropores: often seen in line with setae at anterior of segments, i.e., ca. 8 per segment; variably those in c setal lines 'jump' slightly more laterally to bc or c lines (eg in H commencing from 14-16, in P from 19lhs or 22rhs). Spermathecal pores: in 7/8/9 in a lines. Female pores: paired on 14. Male pores: paired in ab on large but flat porophores. Genital markings: (both specimens) paired pads with irregular centres fill ventral aspect of 10 in ab lines; pads containing two or more central papillae ventrally in 17 and in 19; in 18 paired small papillae just above and outside male pores.

INTERNAL ANATOMY

Gizzard: muscular with anterior rim in 5. Oesophagus: in 13-15,16 dilated and internally lamellate, possibly sufficient to be classed as calciferous in 14 and 15; contracts in 17. Nephridia: vesiculate meroic from 4, with ca. four sets of tubules per side each with small spherical bladders approximately in line with setae; nephridial tufts in 2-3. Vascularization: large hearts 10-12 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9, ampulla elongate tapering to duct with clavate diverticulum ectally. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11, racemose seminal vesicles small in 9 and in 12. Ovaries: in 13; ovisacs not noted. Prostates: compact but thickly tubular in 18; vestigial penial setae present. Intestine: origin 18; typhlosole develops from 22; gut contains reddish soil plus (H) has what looks like an earthworm cuticle as well as gut nematodes (put in phial).

REMARKS

Megascolides cataractus is distinct in the genus in Tasmania in its combination of tanylobous prostomium, small dorsal pores commencing from (12/13 or) 18/19; the distinctive arrangement of the genital markings in 10 and 17-19, last hearts in 12, and, especially, its nephridial bladders (which are found also in *M. tenuis* (Fletcher, 1889) from Braidwood, NSW, and in *M. sanctorum* and *M. xanthus* spp. nov. - both of which have similar morphology and distribution to the current species).

ETYMOLOGY: cataracta, Latin – 'waterfall', for the type locality.

DISTRIBUTION AND HABITAT

Hardings Falls Forest Reserve, in dry sclerophyll.

Megascolides catenastagnis sp. nov.

Fig. 96.

MATERIAL EXAMINED

HOLOTYPE: 14:670 (H), 5.2 km along "E" Road, Piccaninny Creek bridge, Chain of Lagoons, E Tasmania, FQ 029 847, 310 m, 4/5.viii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, tail missing, dissected and figured).

PARATYPES: ANIC:RB.98.1.28 (P), same details as H, (mature, tip of tail missing, dissected).

EXTERNAL FEATURES

First segment reduced. Lengths mm: 105+ (H), 120+ (P). Width: ca. 3 mm. Segments: 88+ (H), 156+ (P). Colour: pale unpigmented in alcohol, opaque in anterior with many small dark equatorial dots; clitellum cream. Prostomium: open epilobous on reduced first segment. Clitellum: ½13-18. Dorsal pores: from 12/13 weakly retained on clitellum. Nephropores: not found. Setae: 8 per segment in regular rows (to cuts). Spermathecal pores: in 7/8/9 in setal a lines. Female pores: widely paired on 14. Male pores: difficult to locate, perhaps superficial in b lines on wide pads in ab replacing these setae, on 18 but closer to 18/19. Genital markings: paired pads in ab in 17/18; male field tumid encompassing 18/19; narrow elongate pad in bb in 19/20.

INTERNAL ANATOMY

Septa: 5/6-9/10 increasingly thick. Gizzard: large muscular in 5 preceded by crop. Oesophagus: dilated and vascularized with internal lamellae in 12-14 forming annular calciferous glands; valvular in 15-16. Nephridia: avesiculate meroic, tufted clusters in 3-5; then reduce forming ca. eight to ten discrete tubules per side after clitellum, mostly equatorial but ventral two or three near anterior septum. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts in 10-12 increasingly large with connection to supra-oesophageal vessel which is weak in 10-11 and large and doubled in 12-14. Spermathecae: two pairs in 8 and 9; flat saccular ampulla on short duct with small diverticulum that is bifid or three chambered. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles flat in 9 and elongate in 12. Ovaries: sheet-like in 13; small paired ovisacs in 14. Prostates: tubular in 18; penial setae absent. Intestine: origin in 17; deep T-shaped typhlosole commences in 24; intestinal gizzards absent; gut contains finely mixed soil.

REMARKS

Other known species that are similar to *Megascolides catenastagnis* being holandric and typhlosolate, are *M. cataractus*, and *M. tener*. These three species differ in their prostomia, commencement of dorsal pores, presence or absence of nephridial bladders, seminal vesicles, presence or absence of penial setae, last heart positions, and characteristic genital markings. *Megascolides fontis* and *M. laffani* are also similar but are both metandric.

ETYMOLOGY: 'cantena-stagnis', Latin - for the 'Chain of Lagoons' type-locality.

DISTRIBUTION AND HABITAT

Piccaninny Creek, Chain of Lagoons, E Tasmania, from wet sclerophyll.

Megascolides croesus sp. nov.

Fig. 97.

MATERIAL EXAMINED

HOLOTYPE: 14:0380 (H), Mole Creek, Croesus Cave State Reserve, N Tasmania, DP 352 966, 300m, 2.ix.1992, R.D. D'Orazio, wet sclerophyll, (mature, dissected and figured).

PARATYPES: 14:3696 (P1), same details as H, (mature, dissected); 14:3697 (P2), same details as H, (mature, dissected); 14:3698 (P3), same details as H (mature); 14:3699 (P4), same details as H (mature); 14:3700 (P5), same details as H, (mature); 14:3701 (P6-P12), same details as H, (seven mature specimens).

EXTERNAL FEATURES

Lengths mm: 75 (H, P2), 92 (P1), 95 (P3), 85 (P4, P5), 40-70 (P6-P12). Width: ca. 2.5 mm. Segments: 99 (H), 113 (P1), 108 (P2). Colour: unpigmented almost silvery; clitellum cream. Prostomium: tanylobous; peristomium ventrally cleft (all specimens). Clitellum: ½13,14-16,½17. Dorsal pores: from 5/6 (in 4/5 in P2-3; in 5/6 in P5), present on clitellum. Nephropores: not found. Setae: 8 in regular rows. Spermathecal pores: in 7/8/9 near a lines. Female pores: paired on 14. Male pores: on low mounds in ab lines on 18. Genital markings: paired discs anterio-median to setae a on 10 and 11(in all specimens except in P9 in 11 only and none in P10 and P12); small discs in a lines (only in P5, and lhs in P3); ill-defined tumid mid-ventral areas in bb in 17/18 and 18/19; paired conjoined discs in ab in 19/20 (H, P1-P5, P7).

INTERNAL ANATOMY

Septa: 9/10-11/12 slightly thickened. Gizzard: muscular conical in 5 with anterior flange and preceded by crop. Oesophagus: increasingly dilated and vascularized in 8-15; valvular in 16-½17. Nephridia: avesiculate meroic, with ca. four overlying convoluted sets of tubules seen in clitellar segments, post-clitellum with three or four per side, one approximately in c lines the others in b lines; funnels not found; flat clusters ventrally in 3-4. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-12 from weak supra-oesophageal vessel 8,9-12. Spermathecae: two pairs in 8 and 9 (although ampullae often in anterior segments), large elongate ampulla tapers to duct with much longer thin diverticulum from near exit. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles large racemose in 9 and 12. Ovaries: large in 13; small pseudo-vesicles

anteriorly in 13 and in 14. Prostates: tubular coiled in 18-19; exceptionally long penial setae run from 18-24 in sheaves that extend to segment 26. Intestine: origin in ½17; low lamellar typhlosole develops from 20; gut contains organic matter and soil particles.

REMARKS

Megascolides croesus is similar to *M. tortuosus*, both having similar markings, tanylobous prostomia, and intestinal typhlosoles. Distinguishing characteristics of *M. croesus* are the segmental genital markings in 10 and 11 in most specimens, dorsal pores from 4/5/6, pseudovesicles in 13, and the exceptionally long spermathecal diverticula with correspondingly long penial setae.

ETYMOLOGY: for the type-locality, Croesus was a king of Lydia, famed for his wealth.

DISTRIBUTION AND HABITAT

Croesus Cave State Reserve, N Tasmania, wet sclerophyll.

Megascolides fontis sp. nov.

Fig. 98.

MATERIAL EXAMINED

HOLOTYPE: 14:1714 (H), Four Springs Forest Park (owned by Forest Resources, it was logged in 1972), DQ 863-199, 180 m., 24.viii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Some anterior segments expanded but with much secondary annulation. Length mm: 170. Width: ca. 3 mm. Segments: 213. Colour: unpigmented white in alcohol with small dots near setae in anterior and tail segments; clitellum cream. Prostomium: small, open epilobous. Clitellum: ½13-17. Dorsal pores: from 10/11, obvious on clitellum. Nephropores: not found (correspond to segmental dots?). Setae: small, 8 per segment in regular rows. Spermathecal pores: in 7/8/9 in a setal lines. Female pores: closely paired on 14. Male pores: on small mounds in ab lines compressed by genital pads on 18. Genital markings: tumid mid-ventral pads in 10/11/12/13; elongate tumid pads with rows of small apical papillae obscuring furrows and setae mid-ventrally in 17/18 and 18/19 extending on either side of male pores.

INTERNAL ANATOMY

Septa: 5/6-11/12 thick and displaced posteriorly. Gizzard: large muscular in 5 preceded by crop and displaced to correspond with segment 7. Oesophagus: increasingly dilated and vascularized in 9-13, not interpreted as calciferous glands; narrow and valvular in 15-16. Nephridia: avesiculate meroic, clusters ventrally in 2-3; then forming six discrete tubules on ventrum plus three on posterior septum on each side; in intestinal segments four or five smaller tubules per side on body wall evenly spread laterally; funnels not found, ducts extend laterally to enter body wall. Vascularization: dorsal blood vessel single; commissurals in 8-9; hearts in 10-12 from supra-oesophageal vessel in 9-13. Spermathecae: two pairs in 8 and 9; compact conical ampulla on longer thin duct with, at mid-length, small ectally directed diverticulum; tendon attaches end of duct to septum. Male organs: metandric, iridescent testes and funnels in 11 only; seminal vesicles racemose in 12 only. Ovaries: small in 13; small paired ovisacs in 14. Prostates: coiled tubular in 18-19;

quite long penial setae present in 18-19. Intestine: origin in 17; typhlosole absent but low dorsal ridge commences in 24 (traced to 35); intestinal gizzards absent; gut contains loamy organic soil with grits and plant seeds.

REMARKS

Distinctive features of *Megascolides fontis* are metandry, posterior commencement of dorsal pores (both characteristics also found in *M. laffani*), and the distinctive shape and arrangement of the genital markings and spermathecae. The prostates are much coiled.

ETYMOLOGY: fontis, Latin – 'of the Springs', for the type-locality.

DISTRIBUTION AND HABITAT

Four Springs Forest Park, dry sclerophyll.

Megascolides improbus sp. nov.

Fig. 99.

MATERIAL EXAMINED

HOLOTYPE: 14:0014 (H), Melaleuca, SW Tasmanian, Half-woody Hill, DM 338-889, 80m in wet forest, 5.iii.1992, Louise F. McGowan, (mature, dissected and drawn).

PARATYPES: ANIC:RB.97.4.4 (P1), same sample as (H), (aclitellate mature, dissected); TM:K1553 (P2), same details as (H), (mature, dissected); 14:3639, (P3-4), same details as (H), (two aclitellates, P3 dissected, P4 abnormal); 14:0047 (P5-6), Melaleuca, SW Tasmania, edge of Melaleuca lagoon, DM 321-921, 0-1m in leaf litter, 4.iii.1992, L.F. McGowan, (P5 mature, dissected, P6 abnormal subadult dissected); 14:3642 (P7-8), "Melaleuca, L.F.M.", (two specimens, P7 posterior amputee, dissected and P8 mature undissected).

EXTERNAL FEATURES

Length mm: 40 (P5), 45 (H, P2-P4), 50 (P1), 65 (P8). Width: ca. 2.5 mm. Segments: 108 (H, P5), 113 (P1), 112 (P2), 104 (P3), 120 (P8). Colour: unpigmented although anterior with mid-dorsal line; clitellum cream. Prostomium: epilobous. Clitellum: ½13-½17. Dorsal pores: as dark dot in 3/4, open from 4/5. Nephropores: (in H) seen in some anterior segments anteriorly in d lines (at least). Setae: 8 in regular rows. Spermathecal pores: in 7/8/9 in a lines. Female pores: paired on 14. Male pores: superficial in ab lines. Genital markings: paired discs in aa in 9/10 (normal mature specimens); weak in aa in 17/18 and 18/19 (H); paired discs in ab in 20/21 (or absent from 18/19 and in rhs only in 19/20, P5, P7-8). (Specimens (P4) and (P6) are abnormal having respectively two or one segment deleted, thus reducing normal external and internal counts by these amounts).

INTERNAL ANATOMY

Anterior segments filled with mucus which obscures some features. Septa: none especially thickened. Gizzard: compact muscular barrel in 5. Oesophagus: slightly dilated 15-16; valvular in 17-½18. Nephridia: avesiculate meroic, two sets of tubules per side, at least in some anterior segments, in b and c lines sending ducts to mid bc and to d lines; only single funnel found in b line in some segments; in mid-body nephridia appear either interlinked or single on each side; not tufted anteriorly. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-12; weak

supra-oesophageal vessel seen in 12 only. Spermathecae: two pairs in 8 and 9; flattened ampulla from equally long duct with medium length diverticulum extending just beyond base of ampulla. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose in 9 (in H only and then surrounded in mucus and attached to spermathecae in 9) or paired in 12 only (P1-3), or in 11 and 12 (P5, P7). Ovaries: fan-shaped in 13; ovisacs not found. Prostates: tubular 18-20; penial setae 18-23,24. Intestine: origin in ½18 (H, P1, P5, P7); typhlosole absent; intestinal gizzards absent; gut contains mucus and organic matter.

REMARKS

Megascolides improbus is similar to *Megascolides umbonis* but it lacks the paired genital markings in 17/18 and the characteristic central boss-like marking on segment 18. The remaining genital markings are similar as are the shape of the prostates and length of the penial setae. Differences are the intestinal origin in 18 rather than 19, the frequent lack of seminal vesicles in 9, and the relative lengths of the spermathecal diverticula.

ETYMOLOGY: improbus, Latin – 'rascally', for its small size.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania, wet forest or leaf litter.

Megascolides intestinalis sp. nov.

Fig. 100.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:962, Lake Rowallan, 1.7 km along Dublin Road from Little Fisher River Road, N. Tasmania, DP 381 825, 590 m, 6.x.1992, R. D'Orazio and M. Cooper, rainforest from banks of creek, (mature posterior amputee, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 40+ (posterior amputee). Width: ca. 2.5 mm. Segments: 60+. Colour: unpigmented in alcohol, clitellum buff. Prostomium: open epilobous. Clitellum: 14-17, interrupted ventrally in 17 by markings. Dorsal pores: from 3/4. Setae: 8 in regular rows to amputation. Spermathecal pores: 7/8/9 near a lines. Female pores: widely paired. Male pores: in a lines on paired papillae in ab replacing these setae. Genital markings: paired markings in 17/18 and 18/19 centred in a lines on papillae in ab and reaching to male papillae; elongate midventral marking on 18 between the male pores extends to 18/19.

INTERNAL ANATOMY

Gizzard: moderately muscular in 5. Oesophagus: dilated, vascularized and deeply ruggose in 12-17 but not calciferous; from 18-20 more dilated and paler with thick soft walls and internally lamellate thus resembling annular calciferous glands. Nephridia: avesiculate meroic with approximately two or three nephridia per side but these intertwinded and therefore having spurious appearance of holonephridia; the presence of several nephrostomes per side in mid-body demonstrates their true meroic nature; not tufted anteriorly although there is much mucus. Vascularization: hearts 10-12; supra-oesophageal vessel 10-15. Spermathecae: two pairs in 8 and 9; flattened, spade like ampulla clearly demarcated from duct which bears small clavate diverticulum. Male organs: holandric, testis iridescent in 10 and 11; paired, racemose seminal vesicles in 9 and 12. Ovaries: as long egg strings in 13. Prostates: tubular in 18-19; short penial setae present. Intestine: commences in 21 from intestinal valve in 20/21; typhlosole absent; gut contains dark soil and woody organic matter.

REMARKS

Although a posterior amputee, this species is apparently lumbricine, meroic, with tubular prostates therefore it qualifies in *Megascolides*. *M. intestinalis* is unique in the genus known from Tasmania in having oesophageal dilations in 18-20 and intestinal origin deferred until 21, but is otherwise similar to *M. oppidanus* . The genital markings are also distinctive and are reminiscent of those found in paratypes of *Notoscolex acanthodriloides* but the current species has an additional and distinctive mid-ventral marking on 18.

ETYMOLOGY: referring to the delayed onset of the intestine.

DISTRIBUTION AND HABITAT

Lake Rowallan region, in rainforest along creek banks.

Megascolides jotaylorae sp. nov.

Fig. 101.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1653, 3.5km along Peters Road, Georges Bay, E Tasmania, EQ 939 445, 170 m, 28.vii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature posterior amputee, figured and dissected).

PARATYPES: (P1) ANIC:RB.98.1.13, same details as H, (complete mature, dissected); (P2) TM:K1567, same details as H, (mature, dissected); (P3) 14:3743, Peters Road, NE Tasmania, EQ 939 446 (slightly different grid-reference), 170 m, 28.vii.92, R.D. D'Orazio and M. Cooper, (mature, dissected); (P4) ANIC:RB:98:1:14, same details as P3, (mature); (P5) TM:K1568, same details as P3, (mature); (P6) 14:3744, same details as P3, (subadult); (P7-10) 14:1652, Wild Pig Hill, NE Tasmania, EQ 489 962, 160 m, 28.vii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (three matures and one juvenile, one mature dissected); (P11-14) 14:3745, same details as P6-9, (four matures).

SPECIMENS: 14:1654, Badger Marsh, NE Tasmania, EQ 975 368, 120 m, 27.vii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (four mature specimens that superficially agree, one dissected agrees internally); 14:1651, Pioneer, Mt Cameron Water Race Reserve, NE Tasmania, EQ 8866 483, 175 m, 20.vii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (six mature specimens that superficially agree, one dissected agrees internally too).

EXTERNAL FEATURES

Body: first segment often reduced, only the Holotype has an exceptionally swollen clitellum. Lengths mm: (H) 100+, (P1) 230, (P2) 90+, (P3) 175, (P4) 135, (P7-14) 140-190. Width: anterior ca. 8 mm. Segments: (P1) 257. Unpigmented buff in alcohol with several random dark dots in the anterior; clitellum darker. Prostomium: obscured as first segment much furrowed and retracted in H and some other specimens, appears to be pro-epilobous in others (that of P1 figured). Clitellum: 13-18 (H, P1, P7). Dorsal pores: reduced, not found until after clitellum and then minute (in H, P2), or from 13/14 (P6), or 14/15/16 (P1, P3). Setae: 8 per segment, small and difficult to detect in anterior, after this in regular rows to tail. Nephropores: not found. Spermathecal pores: paired in 7/8-8/9 in ab lines perhaps nearer to a. Female pores: paired anteriomedian to a on 14 in groove. Male pores: superficial near

ab lines on 18. Genital markings: tumid patch between spermathecal pores in 8/9; midventral pad within tumid rim in 12/13, similar pads in 17/18-22/23 with the whole of bb in this region raised. H and P1-5 are the same although in less mature specimens some markings are weaker, and last set may be wanting.

INTERNAL ANATOMY

Septa: 5/6-9/10 slightly thickened. Gizzard: muscular barrel in 5 (in H contains several quartz grain "crop stones", some as wide as 1mm). Oesophagus: with three pairs of large extramural calciferous glands in 15-17, that attach by thin ducts laterally and spread both dorsally and ventrally around oesophagus, each with two rows of lamellae separated by fissure. Nephridia: vesiculate meroic from 3-6, ca. twenty large equatorial tubules per side at base of anterior septa, from 7 suddenly move ventrally forming string of ca. six to ten sets of tubules per side on posterior septa, from 13-14 revert to evenly spread equatorial bands which reduce in size after clitellum. Vascularization: dorsal blood vessel single, commissurals large in 7-9, hearts in 10-12, calciferous glands each supplied by large vessels from dorsal vessel. Spermathecae: two pairs in 8 and 9, ampulla saccular on long thin duct with minute iridescent diverticulum that has tendon attaching it to anterior septum. Male organs: metandric, testes and iridescent funnels in 11 only; large seminal vesicles paired, racemose in 12 only. Ovaries: small in 13 each comprising four egg strings; ovisacs in 14, easily detached. Prostates: tubular folded in 18 on thin duct; penial setae present. Intestine: from 18 (H) or 19 (P1), or 18/19 (P2-3); typhlosole absent; intestinal gizzards absent; gut contains soil, organic debris, with few quartz grits.

REMARKS

Megascolides jotaylorae is an interesting species with a unique set of features, such as the reduced first segment and dorsal pores, metandry, extramural calciferous glands in 15-17, the distinctive shape of the spermathecae, and the arrangement of genital markings. Specimens from Badger Marsh and Pioneer agree with the above description, as do other inadequately labeled specimens from farmland at Rushy Lagoon in the same region.

ETYMOLOGY: after Dr Jo Taylor of MOV who has greatly assisted and encouraged the program.

DISTRIBUTION AND HABITAT

Peters Road, Wild Pig Hill, Badger Marsh, Pioneer/Mt Cameron Reserve, E and NE Tasmania, from wet and dry sclerophyll; and from farm at Rushy Lagoon, NE Tasmania.

Megascolides laffani sp. nov.

Fig. 102.

MATERIAL EXAMINED

HOLOTYPE: 14:3501 (H), Railton, ca. 41°20'S.146°26'E, NW Tasmania, 10.vi.1996, M. Laffan, Forestry Tasmania site, (mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Body: robust with deep dorsal canal after clitellum, squarish in cross-section, anterior segments wide, much narrower in posterior (with slight damage). Length mm: 190. Width: ca. 8 mm. Segments: 233. Colour: unpigmented but with small yellow dots near setae; clitellum grey. Prostomium: small, tanylobous with mid-dorsal furrow on wrinkled peristomium. Clitellum: 13-17 with some encroachment onto adjacent segments. Dorsal pores: 10/11, larger in 11/12, occluded on clitellum, thereafter gaping often in deep dorsal gutter. Nephropores: not found. Setae: small and difficult to detect, 8 per segment, diverge slightly after clitellum. Spermathecal pores: in 8-9 on prominent mounds at anterior of segments in ab lines. Female pores: paired on 14. Male pores: superficial in ab lines on 18. Genital markings: four elongate tumid pads extending beyond b lines in 17/18-20/21.

INTERNAL ANATOMY

Septa: 4/5-10/11 increasingly thickened. Gizzard: massive muscular barrel in 5. Oesophagus: thin walled and vascularized in 7-9, smooth and yellow externally with many internal rugae in 10-15, not construed as calciferous glands. Nephridia: avesiculate meroic, diffuse, perhaps slightly tufted in anterior, (eg. in 7 and 9 avesiculate but flattened cluster of tubules approximately in line wth ventral setae plus few remote tubules on posterior septa), from clitellum spread laterally to form equatorial parietal bands with about ten discrete tubules per side, none enlarged; funnels not found. Vascularization: dorsal blood vessel not noted; hearts increasing in size in (9?),10-13 from weak supra-oesophageal vessel in 9-13. Spermathecae: two pairs in 8 and 9; saccular or conical ampulla on thick duct with small almost sessile and perhaps bifid diverticulum towards exit. Male organs: metandric, iridescent testes and funnels in 11 only; seminal vesicles racemose in 12 only. Ovaries: small palmate in 13; ovisacs not found. Prostates: coiled tubular 18-19; short penial setae present, ca.

1mm long. Intestine: origin in 18; typhlosole and intestinal gizzards absent; gizzard full of soil, gut contains only mucus.

REMARKS

Megascolides laffani is a large species that appears unique in the genus in Tasmania due to its prominent spermathecal pores in ab lines, elongate genital markings, last hearts in 13, metandry, and the distinctive shape of the spermathecae. Known species that come closest are perhaps *M. fontis* and *M. jotaylorae*.

ETYMOLOGY: after the collector.

DISTRIBUTION AND HABITAT

Railton, NW Tasmania, (no other information available from Forestry Tasmania).

Megascolides maestus Blakemore, 1997

Fig. 103.

Megascolides maestus Blakemore, 1997a:1704-1707, fig. 8.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3327, Dismal Swamp Nature Reserve, NW Tasmania, 40°59'S 144°51'E, 8.ix.1987, QVM, (complete mature, dissected and figured).

PARATYPES: (P1) ANIC:RB.96.12.1, Dismal Swamp, approximately 400m along eastern reserve track, 3.xii.1996, R.J. Blakemore, (complete mature, dissected); (P2) TM:K1531, same details as P1, (mature in two halves, dissected); (P3) 14:3570, Dismal Swamp, gully west of turn off beside Bass Highway, 40°58'S 144°51'E, 3.xii.1996, R.J. Blakemore, (mature, caudal tip missing).

EXTERNAL FEATURES

Lengths mm: ca 35. Width: 1.6 mm. Segments: 99-105. Colour: unpigmented, small yellow dots near setae c on anterior segments; clitellum pale yellow. Prostomium: open epilobous. Clitellum: ½13-½17,17. Dorsal pores: small in 4/5, larger from 5/6. Nephropores: not found. Setae: 8 throughout in regular series. Spermathecal pores: 7/8-8/9 in b lines. Female pores: paired in 14. Male pores: superficial in ab on 18. Genital markings: paired discs anterior to setae a on 10; pairs of discs in ab obscuring median intersegmental furrow in 17/18, and slightly narrower in 19/20-21/22 (three pairs in H; the last pair not developed in P1; only the first pair in P2-3, plus rhs analogue in 20/21 in P2).

INTERNAL ANATOMY

Septa: thin. Gizzard: compact muscular in 5 (displaced to appear in 6). Oesophagus: narrow except for white dilated annulations in 14 and 15 that are probably calciferous glands (in H, P2, not as developed in P1). Nephridia: avesiculate meroic; two per side approximately in b and d lines, intertwined and appearing holoic but separable with care; not tufted. Vascularization: hearts 10-12; supra-oesophageal vessel seen in 9-12. Spermathecae: two pairs in 8 and 9; elongate saccular ampulla on thin duct with long and iridescent, digitiform diverticulum ectally. Male organs: holandric, iridescent testes in 10 and 11 in mucus; racemose seminal vesicles in 9 and 12. Ovaries: in 13; ovisacs absent. Prostates: tubular, coiled in 18-20, duct short; long penial setae in 18-23. Intestine: from 17 (septum 16/17 anteriorly displaced);

gizzards absent although intestinal wall slightly thickened in 18-23; typhlosole absent; gut contains yellow soil, woody particles and some quartz grits.

REMARKS

Megascolides maestus is the only member of the genus in Tasmania currently known to have spermathecal pores in b lines. Its small size and characteristic paired markings, especially those in 10, are also distinctive.

DISTRIBUTION AND HABITAT

Dismal Swamp Nature Reserve, sympatric with *Hickmaniella opisthogaster*, *Anisochaeta simpsonorum*, and *Notoscolex pilus* and some other natives and exotic lumbricids.

Megascolides oppidanus sp. nov.

Fig. 104.

MATERIAL EXAMINED

HOLOTYPE: 14:1403 (H), Queenstown, W Tasmania, CP 787 315, 35m, 10.viii.1993, R.D. D'Orazio and D.E. Soccol, sampled from Cool Temperate Rainforest at side of car park along Mt Jukes Road leading to John Butters Power Station located, (mature, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Body: anterior flattened. Length mm: 90. Width: ca. 4 mm. Segments: 148. Colour: unpigmented; clitellum white. Prostomium: small open epilobous. Clitellum: ½13-½17. Dorsal pores: rudimentary in 3/4, open from 4/5. Nephropores: not found. Setae: 8 in regular rows. Spermathecal pores: in 7/8/9 near a lines. Female pores: paired on 14. Male pores: superficial in mid-ab lines. Genital markings: offset pad with two faint discs on lhs in 10/11; two elongate pads each with three lateral discs in 19/20 and 20/21 in bb.

INTERNAL ANATOMY

Septa: 9/10-12/13 slightly thickened. Gizzard: muscular spherical in 5. Oesophagus: slightly dilated 16-17, narrow and valvular in 18-19. Nephridia: avesiculate meroic, two sets of tubules per side converging in b lines, at least after clitellum; anterior tufting not noted. Vascularization: dorsal blood vessel not noted; hearts 10-12 from weak supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9; elongate spherical ampullae taper to ducts with long, sometimes stalked and flattened diverticula near exits, iridescent for most of length. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: large in 13; ovisacs not found. Prostates: tubular in 18; moderately long penial setae in 18. Intestine: origin in 20; typhlosole absent; gut contains soil.

REMARKS

Distinctive characters *M. oppidanus* are its elongate genital markings and spermathecae, plus the posterior commencement of the intestine in 20 (cg. 21 in *M. intestinalis*). It is comparable with *M. umbonis* that has intestinal origin in 19 and longer penial setae.

ETYMOLOGY: oppidanus, Latin - 'townsman', for the Queenstown locality.

DISTRIBUTION AND HABITAT

Queenstown, W. Tasmania from Cool Temperate Rainforest.

Megascolides orthostichon (Schmarda, 1861)

Fig. 105.

Hypogaeon orthostichon Schmarda, 1861: 12, Plate 18, fig. 159.

Lumbricus orthostichon; Hutton, 1883: 586; Fletcher, 1886a: 524.

? Hypogaeon orthostichon; Beddard, 1891: 278.

"Hypogaeon orthostichon"; Beddard, 1892a: 129; Benham, 1949: 350.

Megascolides orthostichon; Beddard, 1892a: 130; Beddard, 1895: 496; Michaelsen, 1907: 161; Lee, 1959: 349; Lee, 1962: 175-176, figs. 11, 12 [possibly a different species].

Notoscolex orthostichon; Michaelsen, 1900: 189.

TYPE MATERIAL: Hamburg Museum:8615, listed by Reynolds & Cook (1976: 148), although Beddard (1892a) inspected type material in the Vienna Museum, dissecting one specimen, and Beddard (1895: 496) later noted "I had only the type of Schmarda, which it was necessary to respect."

OTHER MATERIAL: BM:1904:10:5:488/490, non-type material, of unknown provenance from the British Museum Beddard Collection, (two clitellate matures, one entire and one dissected along the dorsal mid-line, plus three aclitellate specimens); these specimens were inspected by Lee (1962), but whether they were the correct taxon is uncertain, and as they are not type material they have no name-bearing function.

The following description is from Beddard (1892a), Michaelsen (1900), and Lee (1959), cf. Lee (1962); Ludwig K. Schmarda did not describe internal characters.

EXTERNAL FEATURES

Length mm: 80 (Schmarda, Beddard), 36 (Lee, 1962). Width: 3.5-4 mm. Segments: 65 (Beddard), 64-66 (Lee, 1962). Colour: dark brown in alcohol, (Schmarda said dark red, which may have been the colour of fresh specimens). Prostomium: tanylobous (Lee, 1962). Clitellum: annular 14-17 (Beddard) or ½13,14-17 (Lee, 1962). Dorsal pores: not recorded. Nephropores: not recorded. Setae: in eight equidistant rows (Beddard). Spermathecal pores: in 7/8/9, or at anterior margins of 8 and 9 (Lee, 1962), [possibly in setal a lines as for the male pores?]. Female pores: paired on 14. Male pores: on 18 in a lines (Beddard). Genital markings: no genital papillae developed in the neighbourhood of the male pores nor anywhere else upon the body (Beddard), or tumid bands in 14/15 in aa and on 18 in bb (Lee, 1962).

INTERNAL ANATOMY

Septa: none thickened (Lee, 1962). Gizzard: in 5 (Beddard). Oesophagus: glandular in 13 (Lee, 1962). Nephridia: "diffuse", i.e., meroic, with numerous tubules. Vascularization: dorsal blood vessel unpaired, hearts in 10-12 (Lee, 1962). Spermathecae: two pairs in 8 and 9; each has small diverticulum, pyriform in shape, like the ampulla. Male organs: holandric, testis in 10 and 11; seminal vesicles in 10, 11 and 12 (Beddard) or in 11 and 12 (Lee, 1962). Ovaries: in 13; ovisacs in 14 (Beddard). Prostates: tubular, both gland and duct are short (Beddard) or long, extending from 18-26 (Lee, 1962); penial setae absent (Beddard). Intestine: from 16 (Lee, 1962); typhlosole unrecorded.

REMARKS

Lee (1959: 349) listed this species as *incertae sedis* because Schmarda's description was insufficient for identification, nevertheless he relied on the subsequent descriptions of Beddard (1892a; 1895) and Michaelsen (1900) for characterization. Lee (1962: 175-176) later described Beddard Collection material deposited in the British Museum and believed to be of *Megascolides orthostichon*, although it differed somewhat from the earlier accounts (as noted in the description above) and more closely resembled *Megascolides kirki* (Benham, 1904) from North Auckland; (Lee, 1959:315 had also noted that Ude (1905) thought that his *Megascolides unipapillatus* might be identical with Schmarda's species). Most of the New Zealand specimens deposited in the British Museum by Beddard in 1904 had been sent to him between 1885-1896, and it is possible, therefore, that the material inspected by Lee (1962) was of a species different from *M. orthostichon*. Thus, as the type material has not been traced, there still remains much uncertainty about the characterization of this species. Distinctive features are perhaps the red pigmentation, small size, and locations of seminal vesicles.

New Zealand has ca. 11 known species of *Megascolides*, confined to the north of the North Island and some northern coastal islands, while Tasmania is more speciose with 16 species now known, in addition to *M. orthostichon*, but with none close to matching Beddard's (1892a) characterization of *M. orthostichon*. Collection of new material has been elusive to date, but only this would confirm Mt Wellington as the type-locality, assuming the species still exists in nature.

DISTRIBUTION AND HABITAT

The type-locality given by Schmarda was "Mt Wellington, New Zealand" and perhaps location of Schmarda's ship's log would provide more information, but Lee (1959: 349; 1962: 176) remarks that there has always been doubt as to whether this species was actually collected from New Zealand or whether it might have been from Tasmania. Although there is a Mt Wellington near Auckland, it is now considered that the correct locality is Mt Wellington, Hobart. The main support for this argument is given by Fletcher (1886a: 534) who, in the opening paper of his series of reports on Australian earthworms, states:

> "Up to the present time only three species of earthworms have been described from Australia, with a fourth (*Lumbricus orthostichon*, Schmarda) from Tasmania. This last was originally described as from New Zealand, but this locality, on the authority of Captain Hutton, is incorrect."

Assuming the information from Captain F.W. Hutton, curator of Otago Museum, that was provided to Fletcher (1886a) was reliable, this species would thus represent the first earthworm formally described from Australasia, and specifically from Tasmania.

Megascolides salmo sp. nov.

Fig. 106.

MATERIAL EXAMINED

HOLOTYPE: 14:3595 (ex 14:1606), Salmon River, NW Tasmania, CQ 199 534, 50 m., 17.v.1993, R.D. D'Orazio and D.E. Soccol, sampled where Salmon River crosses Salmon River Road, wet sclerophyll, (mature, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 65. Width: ca. 2.5 mm. Segments: 128. Colour: unpigmented in alcohol; clitellum cream. Prostomium: open epilobous. Clitellum: ½13-½17. Dorsal pores: small in 4/5, from 5/6 larger. Nephropores: not found. Setae: 8 in regular rows. Spermathecal pores: in 7/8/9 in a lines. Female pores: paired on 14. Male pores: superficial in ab lines on raised mid-ventral band on 18. Genital markings: none in anterior; in 17/18 large paired discs in ab lines; three sets of paired discs in 19/20/21/22 centred near a lines .

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: large muscular barrel in 5 but displaced to correspond to segments 6-8. Oesophagus: dilated as annular calciferous glands in 14-15; narrow and valvular in 16. Nephridia: avesiculate meroic, small and difficult to determine in most segments; in anterior, two or three sets of tubules per side (slightly tufted in 3-4); seen in some post clitellar segments are two nephridia per side that send ducts to b and d lines. Vascularization: dorsal blood vessel single; hearts in 10-12 from supra-oesophageal vessel that runs 8-12. Spermathecae: two pairs in 8 and 9; conical ampulla on thin duct with equally long iridescent diverticulum from near exit. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: as long egg-strings in 13; no ovisacs found. Prostates: tubular in 18-19; long penial setae extend from 18-21. Intestine: origin in ½17; lamellar typhlosole develops from 19; gut contains mucus.

REMARKS

Megascolides salmo is similar to *M. maestus* on almost each described character, it differs however in its lack of genital markings in 10, having spermathecal pores in setal a lines rather than in b lines, and by the development of a typhlosole.

Another similar species is *M. tortuosus*, but this species has anterior markings in 11 and is tanylobous.

ETYMOLOGY: salmo, Latin – 'salmon', for the type-locality.

DISTRIBUTION AND HABITAT

Salmon River, NW Tasmania, found in dry sclerophyll along with *Retrovescus simplex* Blakemore, 1998.

Megascolides sanctorum sp. nov.

Fig. 107.

MATERIAL EXAMINED

HOLOTYPE: 14:1656, St Patricks Head State Reserve, Irish Town Road, E Tasmania, FP 026 988, 430 m, 4.viii.1992, R.D. D'Orazio and M. Cooper, sampled from dry sclerophyll recovering from fire, location details: "Enter gravel road opposite road to Lower GermanTown Rd. once the wire gate has been crossed go 100m and turn right along track which enters bush; travel 4.5km along this track until at the base of hill", (mature posterior amputee, dissected and figured).

PARATYPE: (P1) ANIC:RB.98.1.12, same details as H, (mature, missing tip of tail, dissected); (P2) 14:1655, St Marys Pass State Reserve, Lower German Town Road, E. Tasmania, FP 002 989, 220 m, R.D. D'Orazio and M. Cooper, wet sclerophyll, location details: "Stopped at bridge 1.3km from sealed road", (complete mature, dissected); (P3) TM:K1566, same details as (P2), (mature, dissected); (P4-11) 14:1655, same sample as P2), (eight matures that superficially agree).

EXTERNAL FEATURES

First segment slightly reduced, especially in (P2). Length mm: 180+ (P1), 230 (P2), 170 (P3). Width: ca. 4 mm. Segments: ca. 240 (P1), 262 (P2). Colour: uniform buff in alcohol. Prostomium: tanylobous. Clitellum: annular ½13,-18. Dorsal pores: none, but after clitellum the mid-dorsal body wall is thin to give spurious appearance of pores. Setae: 8 in regular rows. Nephropores: from 2, just before setae on each side but, from 13, supernumerary pores appear in mid-bc and from 14, nephropores in b lines are deleted, and from 18, those in c lines also deleted to give pores in a, bc, and d lines for the remainder of body (in H). Spermathecal pores: 7/8/9 in a lines. Female pores: widely paired on 14 near to nephropores. Male pores: paired in longitudinal slits in 18 on low pads in ab. Genital markings: large paired pads the width of segment 11 with hollow centres in ab; smaller markings on 17 and 19; two sets of markings above and below male pores laterally on 18.

INTERNAL ANATOMY

Gizzard: compact muscular in 5. Oesophagus: increasingly dilated in 14-16 with internal rugae, but not really forming calciferous glands; valvular in 17 (in H). Nephridia: vesiculate meroic small spherical bladders corresponding with nephropores, i.e., four per side in anterior in line with setae, after clitellum three per side in a, mid-

bc and d lines; nephridial tufts not noted. Vascularization: dorsal blood vessel large, single; hearts 10-12; supra-oesophageal vessel 10-13. Spermathecae: two pairs in 8 and 9, conical ampulla on long, concertinaed duct with small ectal diverticulum (that is slightly bifid in P2). Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11, seminal vesicles large, paired in 9 and in 12. Ovaries: fan-shaped in 13; ovisacs in 14. Prostates: compact but thickly tubular in 18; penial setae absent. Intestine: origin 18 (H) or 17 (P1); deep, lamellar typhlosole develops from 23; gut contains mucus and organic soil.

Note: nematodes were not found in nephridial bladders of H, as in *M. xanthus*.

REMARKS

Megascolides sanctorum is similar to *M. cataractus* in having nephridial bladders and a typhlosole, but differs on its lack of dorsal pores; the distinctive arrangements of the nephropores and its genital markings in 11 and 17-19. *Megascolides xanthus* also has nephridial bladders, and a similar distribution of nephropores, but the spermathecae are mid-ventral, amongst other differences.

ETYMOLOGY: sanctorum, L - "of saints" for the St Patrick's Head and St Mary's Pass localities.

DISTRIBUTION AND HABITAT

St Patrick's Head and St Mary's Pass reserves, E Tasmania, from dry or wet sclerophyll.

Megascolides tener sp. nov.

Fig. 108.

MATERIAL EXAMINED

HOLOTYPE: 14:3650 (H), Warra, Forestry Tasmania LTER site, ca. 43°04'S.146°40'E, SE Tasmania, 6.viii.1997, Forestry Tasmania/ANU collection, "site 3, steep coup", wet sclerophyll, (mature, dissected and figured).

PARATYPES: ANIC:RB.97.5.2 (P1), same details as (H), (mature, dissected); TM:K1554 (P2), same details as H, (mature, dissected); 14:3651 (P3 - P7), same details as (H), (two matures, one subadult and one immature that all superficially agree).

EXTERNAL FEATURES

Body: stout with much secondary annulation. Lengths mm: 120 (H), 130 (P1), 140 (P2), 125 (P3), 95 (P4), 70 (P5), 55 (P6), 30 (P7). Width: ca. 5-6 mm. Segments: ca. 216 (H), ca. 250 (P1). Colour: in life, grey with slight superficial rusty or pink colour; in alcohol more uniform grey with numerous small dark dots especially on equators in anterior segments; clitellum mauve. Prostomium: closed epilobous. Clitellum: ½13,13-18, interrupted ventrally by genital markings. Dorsal pores: small and almost undetectable, (in H and P1) not found till after clitellum i.e., from 18/19, but seen in 14/15 (in P3 and P5). Nephropores: not found (related to dots on segments?). Setae: 8 per segment, minute and difficult to detect in anterior, in mostly regular rows in posterior except cd slightly irregular. Spermathecal pores: in 7/8/9 near a lines possibly in ab. Female pores: paired on 14. Male pores: on small mounds in ab lines on 18. Genital markings: ventral area around 8/9 stippled pink in life (disappears on preservation); from ½17-½19 correspondingly swollen and pink with delicately convoluted white patterns around male pores.

INTERNAL ANATOMY

Septa: increasingly thickened 5/6-12/13. Gizzard: very large muscular barrel in 5 but displaced to occupy 6-7, preceded in 4 by crop. Oesophagus: 7-14 vascularized and with numerous longitudinal rugae internally, possibly not calciferous but highly modified; valvular in 16-½17. Nephridia: tufted in 3-4,5 then avesiculate meroic, with ca. six to ten sets of tubules per side equatorially. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts in 10-13 from supra-oesophageal vessel that runs 7-13. Spermathecae: two pairs in 8 and 9 overlying one

another in their segments; large dilated ampulla tapers to long thin duct with diverticulum budding near junction (i.e. far from exit). Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles absent from 9, finely racemose anteriorly in 11 and 12. Ovaries: delicate, fan-shaped in 13; ovisacs not found in H, small in P1. Prostates: convoluted tubular in 18; penial setae not found. Intestine: origin in ½17; deep lamellar typhlosole develops from about 24; gut contains compressed fine yellow soil.

REMARKS

Distinctive combination of characters of *Megascolides tener* are the genital markings in 17-19, tanylobous prostomium, very long spermathecal ducts, absence of seminal vesicles from 9, and the presence of a deep typhlosole.

ETYMOLOGY: tener, Latin - 'tender, delicate', for the pink markings on 17-19.

DISTRIBUTION AND HABITAT

The Warra LTER site is a 15,900 ha area which lies between the Huon and Weld Rivers, approximately 60 km west south-west of Hobart. The site is geologically diverse but dominated by Jurassic dolerite, most of the area is wet *Eucalyptus obliqua* forest. The site was designated in 1995 as part of the international Long Term Ecological Research (LTER) program to foster monitoring in Tasmanian forests, and to facilitate the development and demonstration of sustainable forest management practices. The western portion of the site is part of the Tasmanian Wilderness World Heritage Area and is managed primarily for conservation values by the Department of Environment and Land Management. The eastern portion is State forest managed by Forestry Tasmania for multiple-uses including sustainable timber harvesting. *Aporodrilus warrai* sp. nov. is found at the same site.

Megascolides tortuosus sp. nov.

Fig. 109.

MATERIAL EXAMINED

HOLOTYPE: 14:3524 (H ex 14:709), Mt Roland, NW Tasmania, Belstone Road to Minnow Creek, DQ 429 078, 300 m, 24.xi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll forest, (mature, dissected and figured).

PARATYPES: 14:709 (P1-2), same details as (H), (two matures, inspected); 14:3526 (P3-4 ex 14:706), Mt Roland, Union Bridge Rd., DQ 446 088, 240 m., R.D. D'Orazio and M. Gittus, "Travelled 7.2km passed Mersey River bridge to road along pines, stopped on short spur road", wet sclerophyll, (two matures, one dissected).

EXTERNAL FEATURES

Body: coiled on preservation and penial setae protrude, first segment reduced. Length mm: 115 (H), 85 (P1), 80 (P2), 60 (P3), 65 (P4). Width: ca. 3.5 mm. Segments: 173 (H). Colour: unpigmented in alcohol; clitellum cream. Prostomium: tanylobous, peristomium ventrally cleft (in P3-4). Clitellum: ½13-½17. Dorsal pores: from 3/4. Nephropores: not found. Setae: 8 in mostly regular rows except cd slightly irregular in posterior. Spermathecal pores: in 7/8/9 near a lines. Female pores: widely paired on 14. Male pores: on small mounds in ab lines on 18. Genital markings: (most developed in H) paired presetal discs within tumid pad that occupies anterior ventrum of 11; two or three sets of large paired discs in ab within conjoined tumid pads in 17/18, 19/20 and (in H, P1-2) in 20/21.

INTERNAL ANATOMY

Septa: not noted. Gizzard: elongate muscular in 5. Oesophagus: dilated as annular calciferous glands in 14-15. Nephridia: avesiculate meroic, two or three sets of tubules per side with long thin and convoluted ducts approximately in line with setae ab and c, those in ab lines possibly composed of two intertwined tubules; anterior tufting not noted. Vascularization: dorsal blood vessel not noted; hearts large in 10-12 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9; narrow, elongate ampulla tapers to duct with equally long diverticulum that is iridescent for most of its length. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: palmate in 13; ovisacs not found. Prostates: tortuously coiled tubular in 18; long penial setae 18-22,23.

Intestine: origin in 17; low lamellar typhlosole develops from 19-20; gut contains organic soil.

REMARKS

Distinctive characteristics of *M. tortuosus* are the genital markings in 11; tanylobous prostomium; elongate spermathecal diverticula, penial setae and nephridial tubules; and presence of a typhlosole. Differences from *M. croesus* are given under that species account.

ETYMOLOGY: tortuosus, Latin - winding, for the coiled prostates.

DISTRIBUTION AND HABITAT

Mt Roland, NW Tasmania, wet sclerophyll.

Megascolides umbonis sp. nov.

Fig. 110.

MATERIAL EXAMINED

HOLOTYPE: 14:0026 (H), Melaleuca, SW Tasmania, DM 328 904, 5.iii.1992, Louise F. McGowan, under button grass on SW Track, (mature, dissected and drawn).

PARATYPES: 14:0026 (P1), same sample as (H), (mature, dissected); 14:0027 (P2-12), same details as (H), (P2, mature dissected; P3 mature posterior regenerate; P4 mature; P5, aclitellate mature; P6-P7, subadults; P8-P12 immatures, P12 a posterior regenerate after 30; sample also contains an immature *Aporodrilus* specimen); 14:0024, same details as (H), (weakly clitellate mature, posterior regenerate after segment 80, dissected; sample also contains two *Aporodrilus* sub-adults).

EXTERNAL FEATURES

Body: slightly flattened after clitellum. Lengths mm: range 73-95; 90 (H, P4), 73 (P1), 95 (P2-3), 80 (P5, P13). Width: ca. 2.5 mm. Segments: 147 (H), 152 (P1), 130 (P12), 146 (P13). Colour: unpigmented yellowy in alcohol, small dark pigment spots on each segment from 2 laterally, immediately posterior to c setae to segment 35-38 (in aclitellate P5-6 spots are near both setae b and d but not c on 14-16) then just anterior to c setae and, on tail, just ventral of c setae; clitellum cream. Prostomium: epilobous. Clitellum: ½13,14-16,½17. Dorsal pores: from 4/5 (vestigial in 3/4 in P2-5). Nephropores: not found. Setae: 8 in regular rows. Spermathecal pores: in 7/8/9 in setal a lines. Female pores: paired (or single mid-ventral in P13) on 14. Male pores: on small mounds in ab lines in 18. Genital markings: paired discs in aa in 9/10 (H, P1, rhs only P2, P3 lhs only P4-6, slightly wider apart in P13); paired discs in ab in 17/18 (H, P4-8, rhs only in P13); mid-ventral 'boss' on 18 (H, P1, P3-4, P6, P13); paired discs in ab lines in 19/20 (H, P1-7, nearer a lines in P13) and paired in a lines in 20/21 (H rhs only, P2-5, P6 rhs, P13), (P9-P12 are immatures without markings).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: moderately muscular barrel in 5. Oesophagus: not especially dilated (or slightly in 14-16 in P13); valvular in 17-18. Nephridia: avesiculate meroic, two (sometimes three?) sets of tubules per side converging approximately in b lines and sending ducts laterally to above d lines; funnels not found; not tufted anteriorly. Vascularization: dorsal blood vessel single

onto pharyngeal mass; hearts 10-12; weak supra-oesophageal vessel 6-13. Spermathecae: two pairs in 8 and 9; elongate ampulla tapers to duct with large flat diverticulum just longer than ampulla. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: as large sheets in 13; small pair ovisacs in 14. Prostates: tubular 18-19 (more thickly tubular in P13) coiled with central lumen; penial setae 18-24. Intestine: origin in 19 (or ½19 in P13) expanding to full width in 20; typhlosole absent; intestinal gizzards absent; gut contains organic matter.

REMARKS

Unique characters of *Megascolides umbonis* are the distribution of genital markings, typically with a central disc on segment 18 between the male pores, the thickly elongate spermathecal diverticula, the intestinal origin in 19, and long penial setae. Three specimens (P3 and P12-13) were posterior regenerates. Differences from *M. maestus* include the spermathecal pores in a lines rather than b lines, and lack of calciferous glands; and differencs from *M. salmo* are the genital markings in 9/10 and 18, and the lack of a typhlosole.

ETYMOLOGY: umbonis, Latin – 'boss (of a shield)', for the central, boss-like marking on 18.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania from button grass, *Gymnoschaenus sphaerocephalus*.

Megascolides xanthus sp. nov.

Fig. 111.

MATERIAL EXAMINED

HOLOTYPE: 14:3104 (H ex 14:3102), Scamander Forest Reserve, E Tasmania, FQ 015 123, 100 m, 27.vii.92, R.D. D'Orazio and M. Cooper, "Travelled 10.8km from Tasman Highway and stopped along Pitts Road", wet sclerophyll, (mature posterior amputee, figured and dissected).

PARATYPES: ANIC:RB.98.1.11 (P1), same details as (H), (complete mature, dissected); TM:K1565 (P2), same details as (H), (mature, dissected); 14:3731 (P3-4), Baldocks Cave State Reserve, N Tasmania, DP 444 958, 430 m. 1.ix.1992, R.D. D'Orazio, "Travelled 6kms along South Mole Creek Road", wet sclerophyll/rainforest, (two matures, both dissected); ANIC:RB.98.1.10 (P5), Toms Gully, NE Tasmania, FQ 900 218, 320 m, 27.vii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, sketched and dissected); 14: 286 (P6-8), Trafalgar Flats, NE Tasmania, EQ 875 178, 300 m, 29.vii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (two matures and one juvenile that agree superficially, plus a tail); 14:1022 (P9), Evercreech Forest Reserve, EQ 812 162, 350 m, R.D. D'Orazio, 23.vi.1992, wet sclerophyll, (aclitellate mature posterior amputee, dissected).

SPECIMENS: 14:280, same details as (H), (twelve matures, four aclitellate matures and five juveniles that superficially agree, some of these specimens are easily broken in the mid-body); 14:0378, same details as (P3-4), (five matures plus four immatures); 14:281, same details as (P5), (five matures that agree externally). 14:1021, same details as (P5), (five matures that agree externally).

(Note: although the first segment is suppressed, all segmental counts in the description below are increased by one, to allow comparison with other species).

EXTERNAL FEATURES

Body: first segment suppressed and continuous with segment 2; after clitellum segments narrow. Lengths mm: (H) 73+, (P1) 85, (P2) 70, (P3-4) 120, (P5) 160. Width: ca. 3 mm. Segments: (H) 126+, (P1) 204, (P3) 164, (P4) 227, (P5) 281. Unpigmented in alcohol, transparent after clitellum; clitellum buff. Prostomium: proepilobous on segment 2. Clitellum: 14-17. Dorsal pores: absent. Setae: 8 throughout; ventral pairs converge either side of male pores. Nephropores: obvious at anterior of segments and in line with setae from 2 (i.e., four pairs per segement in

anterior); on and after clitellum those in b and c lines are replaced by single pore in mid-bc (in midbody in H; from 15rhs and 17lhs in P3; from 13lhs and 14rhs in P5). Spermathecal pores: midventral closely apposed pairs in 7/8/9. Female pores: paired anteriomedian to a on 14. Male pores: midventral, closely paired on common mound that encroaches on 18/19. Genital markings: paired disks with tumid rims in ab lines in 17/18 (not in P2), 18/19 (P3-5, P9), 19/20 and 20/21 (all mature specimens), and 21/22 (P3-5, P9), these latter markings diverge from male pores.

INTERNAL ANATOMY

Septa: 5/6-11/12 slightly thickened. Gizzard: in 5, elongate muscular with anterior flange and displaced to occupy two segment lengths. Oesophagus: increasingly dilated and vascularized in 10-14, but insufficiently developed into calciferous glands; narrow, valvular in 15 (and 16 in P3-5). Nephridia: vesiculate meroic, four pairs per segment in anterior with elongate bladders in line with setae from 2, on or sometime after clitellum the bladders become smaller sub-rounded and those in b and c lines are replaced by single nephridium that exits in mid-bc, giving only three pairs per segment; preseptal funnels not found; pharyngeal tufted neprhridia absent. Vascularization: dorsal blood vessel single continuous onto pharynx in 3,4, hearts 10-12, supra-oesophageal 9,10-13. Spermathecae: two pairs in 8 and 9 (ampullae sometimes displaced into preceding segment), spherical ampullae taper to long ducts which converge under ventral nerve cord, each have small iridescent diverticulum near exit. Male organs: holandric, testes and funnels iridescent and invested in mucus in 10 and 11; seminal vesicles paired, racemose in 9 and 12. Ovaries: small in 13; ovisacs absent. Prostates: tubular folded in 18 with ducts that converge under ventral nerve cord; delicate penial setae present. Intestine: from 16 (or 17 in P3-5, P9); typhlosole absent; spiraling gut contains organic matter and soil with few grits.

[Note: several thread-like nematodes filling nephridial bladders in anterior in H and posterior in P1 and P9 are placed in phials in these specimens' jars; other nematodes found in dorsal blood vessel and commissurals in 9 in (P5) are in a phial in this specimen's jar].

REMARKS

Megascolides xanthus has vesiculate nephridia (as do *M. cataractus* and *M. sanctorum*). Unique characters are the suppression of the first segment, lack of dorsal

pores, and the close apposition of the spermathecal and male pores. The distribution of the genital markings, the shape of the spermathecae, and posterior reduction of nephridia, are further distinctions. Slight variation in genital markings in some specimens from different localities are noted, and intestinal origin appears to vary from 16 to 17 in some populations that, nevertheless, agree on other given characters.

ETYMOLOGY: after the type-locality, Xanthus - River of Troy identified with Scamander.

DISTRIBUTION AND HABITAT

Widely distributed: Scamander, Baldocks Cave, Toms Gully, Trafalgar Flats - in E, NE and N Tasmania, often from wet sclerophyll/rainforest.

Zacharius Blakemore, 1997

Zacharius Blakemore, 1997b: 1811-1812.

Diagnosis Size small. Setae, eight per segment throughout. Male pores from tubuloracemose prostates paired on 18; penial setae absent or present. Gizzard in 5; calciferous glands absent; typhlosole absent. Nephridia holoic, avesiculate or vesiculate, in lateral series; not tufted in the anterior. Spermathecae, two or more pairs, with single, clavate diverticula.

Type-species *Zacharius zacharyi* Blakemore, 1997b: 1812-1815, fig 8, from Woodburn Island, NSW.

Distribution Northern NSW, Tasmania.

Remarks Rather than create a new genus to accommodate Tasmanian material, the generic diagnosis of *Zacharius* is amended slightly to allow more than two pairs of spermathecae, and the presence of penial setae and of nephridial bladders (as found in *Z. weldboroughi*). The distributional range is now extended to Tasmania where the two species described below comply with the diagnosis above.

The establishment of this genus has an involved history: First mooted in an unpublished PhD thesis, Blakemore (1994a), the formal description was submitted to an Australian journal early in 1994 but the manuscript was rejected about nine months later, due to an unfavourable referee's report. Simultaneously, Jamieson (1994) published his first taxonomic paper for many years that happened to cover similar taxa and included a new genus *Hiatidrilus*. The manuscript was revised to accommodate the genera proposed by Jamieson (1994) and resubmitted to a Queensland journal whence, after a similar delay, it was again rejected due to an anonymous and hostile referee's report (the rejection letter from the editor, Mr P. Jell, was sent the same week that a second paper by Jamieson was accepted there). Jamieson (1995) again covered a similar range of taxa and forced further revisions of the manuscript that was submitted to an International journal, accepted, and finally published in modified form in Blakemore (1997b).

[Note: under the ICZN Code of Ethics, zoologists and editors should not publish a new name if they have reason to believe that the taxon has already been recognized by another person who intends to establish it].

Genera possibly related to *Zacharius* are: *Woodwardiella* that differs by having prostates that are racemose rather than tubuloracemose, and, on current

information, tufted holonephridia beyond the pharynx, and *Perionychella* that differs by having perichaetine setae. *Diporochaeta* is perichaetine with tubular prostates, while lumbricine *Hiatidrilus*, which is diagnosed to allow either tubular or tubuloracemose prostates (although the former occur in the type-species) was differentiated by its paired spermathecal diverticula even though this character is not normally given generic importance. Lumbricine, holoic, *Simsia* Jamieson, 1972 is also diagnosed with either tubular or tubuloracemose prostates, but the type-species appears to have the tubular form, and it is characterized by multiloculate spermathecal diverticula (another rather dubious characteristic).

Zacharius evansi (Jamieson, 1974) comb. nov.

Fig. 112.

Perionychella (Vesiculodrilus) evansi Jamieson, 1974: 236-237, Figs. 9A, 15C, 16K.

MATERIAL EXAMINED

HOLOTYPE: TM:K282 (H), Lake St. Clair, 146°10'E.42°05'S, Feb. 1941, J.W. Evans, "9065", (mature, previously dissected and in two pieces - the internal organs had been removed and discarded at segment 15 and only the lhs prostate was present; what remains of the specimen is redescribed and refigured).

PARATYPE: BM(NH): 1972:8:8 (P), same locality, Tasmanian Biological Survey: J20, Feb. 1941, (mature specimen damaged anteriorly, cut at mid-clitellum and also partially destroyed by dissection).

SPECIMENS: none found despite searches of the type locality by the current author.

EXTERNAL FEATURES

Length mm: (H) 50. Width: ca. 2.5 mm. Segments: 102. Colour: uniform buff in alcohol, clitellum darker. Prostomium: closed epilobous. Clitellum: ½13-17. Dorsal pores: from 3/4. Setae: 8 in longitudinal rows throughout. Nephropores: obvious in c lines. Spermathecal pores: in 7/8 and 8/9 in a lines. Female pores: paired on 14. Male pores: on small papillae in 18 in a. Genital markings: mid-ventral patches presetally in 7-8 and (in H) 9, and 18 and 19 in aa; paired discs in b in 18/19.

INTERNAL ANATOMY

Gizzard: muscular barrel-shaped in 5. Oesophagus: dilated in 14 and 15, not calciferous (Jamieson). Nephridia: vesiculate holoic, bladders subspherical, sometimes bilobed. Vascularization: last hearts 12; supra-oesophageal vessel well developed. Spermathecae: two pairs in 8 and 9, ampulla spherical on short duct with long clavate diverticulum. Male organs: holandric, testes in 10 and 11; small seminal vesicles in 9 and 12. Ovaries: in 13; ovisacs in 14. Prostate: elongate tubuloracemose minutely lobulated extending through 17-20,21; penial setae present (Jamieson), but not found in holotype - possibly removed?. Intestine: origin 16, typhlosole absent (Jamieson).

REMARKS

Allowing for the subsequent damage to specimens, the above account largely agrees with the type description. The prostrates were described as "appearing

racemose...but resolvable into a compressed and minutely lobulated tubular form", here construed as tubuloracemose. The two pairs of spermathecae and the distribution of genital markings were used to diagnose this species. A morphologically similar species is *Vesiculodrilus pennyae* that, however, has tubular prostates, spermathecae in b lines, and more developed calciferous glands, amongst other differences.

DISTRIBUTION AND HABITAT

Lake St Clair, Central Tasmania.

Zacharius weldboroughi (Jamieson, 1974) comb. nov.

Fig. 113.

Perionychella (Perionychella) weldboroughi Jamieson, 1974: 230-232, Figs. 7A, 16F.

Diporochaeta weldboroughi; Jamieson, 1976: 11 (repeating Jamieson, 1974: 260); Jamieson, 1994: 158 (repeating Jamieson, 1976: 11).

MATERIAL EXAMINED

HOLOTYPE: TM:K263 (H, monotypic), 1.6 miles (2.5 km) from eastern end of Weldborough Pass, NE Tasmania, ca. 147°55'E.41°10'S, 26.viii.1953, J.L. Hickman, (mature, previously dissected, refigured).

SPECIMENS: none found despite searches of the locality by the current author.

EXTERNAL FEATURES

Length mm: 47. Width: ca. 1.5 mm. Segments: 71. Colour: unpigmented in alcohol; clitellum buff. Prostomium: open epilobous, tapering but not quite tanylobous; peristomium with faint ventral groove. Clitellum: 13-16. Dorsal pores: from 4/5. Nephropores: in c lines. Setae: 8 throughout in regular rows. Spermathecal pores: 4/5-8/9 in or just lateral of setal a lines. Female pores: paired on 14. Male pores: near b lines on small raised papillae in ab replacing these setae, conjoined by low ridge. Genital markings: segments 6-9 ventrally tumid; markings small paired discs in common field in aa in 17/18; slightly larger midventral disc in 18/19 between male pores.

INTERNAL ANATOMY

Gizzard: moderate in 5. Oesophagus: greatly dilated in 13-15, not calciferous. Nephridia: simple avesiculate holoic, funnels not found; not tufted anteriorly. Vascularization: hearts 10-12 (those in 12 damaged by dissection), supraoesophageal vessel not noted. Spermathecae: five pairs in 5-9, tapered ampulla on short duct with long diverticulum ectally that has zig-zag stalk. Male organs: holandric, iridescent testis in 10 and 11; large, racemose seminal vesicles in 9 and 12. Ovaries: palmate in 13; small ovisacs in 14. Prostates: tubuloracemose 18-21; penial setae small. Intestine: from 17; no typhlosole; gut void.

REMARKS

The above redescription of *Zacharius weldboroughi* adds these characters to the type description: lack of pigment, epilobous peristomium, tortuous spermathecal diverticula, and prostates tubuloracemose rather than "flattened, somewhat incised,

tubular". Jamieson (1974) remarked "The midventral genital marking in 18/19 diagnoses this species". A morphologically similar species is *Graliophilus benlomondi* that has a different arrangement of markings, reduced dorsal pores, tubular prostates, and shorter spermathecal diverticula.

DISTRIBUTION AND HABITAT

Weldborough Pass, NE Tasmania.

Woodwardiella Stephenson, 1925.

Woodwardia Michaelsen, 1907b: 161-162. (Nom. preocc.).

Woodwardiella Stephenson, 1925: 888; Stephenson, 1930: 834; Jackson, 1931: 101; Jamieson, 1970: 101; Jamieson, 1974: 265.

Pseudoperichaeta Jamieson, 1970: 133-134. **Syn. nov.**

Diagnosis Setae eight per segment. Male pores from racemose prostates paired on 18. Gizzard in 5 (or nearby?); extramural calciferous glands absent; typhlosole weak or absent. Nephridia avesiculate holoic but often with numerous coils, replaced in the anterior segments with tufted nephridia. Spermathecae two or more pairs opening near setal a lines, the last in 8/9; diverticula uniloculate.

Type species *Woodwardia callichaeta* Michaelsen, 1907b from southern Western Australia.

Distribution southern Western Australia, Victoria, Tasmania.

Remarks The name *Woodwardiella* was substituted by Stephenson (1925) for *Woodwardia* that was pre-occupied (in Mollusca and Insecta) and therefore unavailable. Many of Michaelsen's original species were from south-western Australia, most others from eastern Australia are now reassigned to *Heteroporodrilus* (see Blakemore, 1994a,b; 2000c). Two of the species from Victoria, *Vesiculodrilus gippslandicus* (Spencer, 1892) and *Graliophilus punctatus* (Spencer, 1900), were possibly inadvertently included by Michaelsen as the prostates of both species, although appearing racemose, were described as "coiled tubular" by Spencer (this requires confirmation by inspection of all type material listed by Jensz and Smith, 1969). Only one Tasmanian species was transferred to the genus by Michaelsen (1907b) (cf. Jamieson, 1974: 265-266), *Woodwardiella tesselatus* (Spencer, 1895) but if this species is in fact found to be meroic, as suggested below, it would then qualify for inclusion in *Notoscolex*.

Michaelsen's one remaining species, *Woodwardiella smithi* (Fletcher, 1890) from Victoria, (which, like the type-species, has dorsal setal translocation) was erected as type-species of the monotypic genus *Pseudoperichaeta* by Jamieson (1970). The dorsal setal translocation used to define this genus was presumably invalidated in Jamieson's expansions both of *Perionychella* s. Jamieson (1974:216) and of *Diporochaeta* s. Jamieson (1976b) that, ignoring setal variations (and form of prostates), also subsumed those characters serving to distinguish *Woodwardiella*. As

discussed in the introduction, setal ratios are notoriously unreliable characteristics. Herein *Woodwardiella smithi* is included in the prior genus *Woodwardiella* as originally defined and as diagnosed above and, thereby, *Pseudoperichaeta* becomes a junior synonym.

The genus *Graliophilus*, which Jamieson (1971a: 500) described as "relatively primitive in its holonephry, lubricine setae and tubular prostates", is also predominantly from Western Australia and is primarily distinguished from *Woodwardiella* by its possession of tubular prostates. Jamieson's expansions of *Diporochaeta* subsumed those characters which define *Graliophilus* (as for *Woodwardiella*) and "rendered even more uncertain" the distinction of this genus (Jamieson, 1976: 9). Previously, Jamieson (1974: 265) had only tentatively retained *Woodwardiella*, differentiating it from *Perionychella* s. Jamieson (1974) and from *Graliophilus* by its attainment of racemose prostates. This seems to be inconsistent with his earlier statements firstly, (Jamieson, 1974: 216) that *Perionychella* s. Jamieson has "tubular, tubuloracemose or racemose prostates", secondly, (Jamieson, 1974: 218) that "variation in form of the prostates from tubular to racemose is considered unimportant" and thirdly (Jamieson, 1974: 219) that "The fact that in the present work *Perionychella* has been extended to include forms with eight setae per segment removes all justification for separating *Woodwardiella*". In a later paper, Jamieson (1994) briefly reconsidered *Woodwardiella* and *Graliophilus* but, inexplicably, input the prostates of the type species, *G. georgei* Jamieson, 1971b, as tubuloracemose in his data matrix - conflicting with the original generic and species descriptions and with Jamieson (1974:259, 265), where it is stated "Tubular prostates are all that is certainly known to distinguish *Graliophilus* from the older *Woodwardiella*". Nevertheless, Jamieson (1994) concluded that the resulting phylogram was not inconsistent with the generic status of these two genera.

In the current revision, the characters that distinguish *Perionychella* from these two genera are that the setae increase beyond the pleisiomorphic eight per segment and, whereas species in *Perionychella* may have tubuloracemose or racemose prostates, in *Woodwardiella* only those with racemose prostates qualify, and in *Graliophilus* (on current information) only those with tubular prostates.

Two new species are added in the present account: a distinctive feature shared by *W. tiki* and *W. vandiemensis* spp. nov. are the convoluted holonephridial tufts, as

opposed to pharyngeal nephridial tufts. Tufted nephridia are given in the generic definition, but they are usually confined to the anterior segments. In both these species this tufting continues for much, if not the whole length, of the body and may be construed as a form of nephridia transitional between holonephridia and meronephridia. Stephenson (1925: 890; 1930) presents arguments for regarding such 'tufted nephridia' in *Woodwardiella*, as well as in several other species from different genera, as holoic. There remains some uncertainty about the nephridial situation in Western Australian species, including the inadequately known type-species *W. callichaeta*, a syntype of which was re-described by Jamieson (1970) with tufted holonephridia similar to those found here. If further investigation determines these non-pharyngeal tufted nephridia to be meroic derivations from true holonephridia, then generic revisions and reallocation of species would be required. All oriental species that were at one time placed in *Woodwardiella* have subsequently been removed on the grounds of their actually being meroic (Gates, 1960).

Woodwardiella tesselatus (Spencer, 1895)

Fig. 114.

Cryptodrilus tesselatus Spencer, 1895: 40-41, figs. 16-18; Jensz & Smith, 1969: 91.

Plutellus tessellatus ; Michaelsen, 1900: 170-171 (incorrect subsequent spelling of *tesselatus*).

Woodwardia tessellatus ; Michaelsen, 1907: 162.

Woodwardiella ? tessellatus; Jamieson, 1974: 266.

Cryptodrilus tesselatus (sic) Spencer, 1896 [sic]; Jamieson, 1974: 266.

Woodwardiella ? tesselatus (sic); Jamieson, 1974:266.

[Note: under ICZN (1999) Articles 32 and 33.5, the name "tesselatus" is preserved as the correct original spelling and is not considered an inadvertent error of transliteration or latinization by Spencer as he titled his figures 16-18 with the same spelling].

MATERIAL EXAMINED

TYPES: Not present in MOV and presumed lost (Jensz & Smith, 1969).

SPECIMENS: none found despite surveys of the type-locality by the current author.

The following description is taken from Spencer's original.

EXTERNAL FEATURES

Body: with mid-dorsal line that runs forward onto the prostomium. Length mm: in alcohol 25 mm. Width: ?. Segments: ca. 65. Colour: strongly marked both when alive and in sprits; purplish with setae on small white elevations which give it a distinct chequered appearance. Prostomium: pro-epilobous; peristomium with mid-ventral cleft. Clitellum: tumid, 13-17 with mid-ventral continuation including parts of 18 and 19 so far dorsal as b lines. Dorsal pores: from 5/6. Setae: eight per segment with dorsal row very irregular and obscure in some segments, c lines also irregular in final six segments. Nephropores: not discernible. Spermathecal pores: in 7/8/9 in ab lines. Female pores: paired on 14. Male pores: paired on 18 on small papillae in ab lines. Genital markings: two pairs of small elliptical marks in ab lines in 12/13 and 13/14.

INTERNAL ANATOMY

Septa: ? Gizzard: in 5. Oesophagus: no true calciferous glands present. Nephridia: holoic. Vascularization: dorsal blood vessel single; last heart in 12; supra-intestinal vessel present (?). Spermathecae: two pairs in 8 and 9, diverticulum simple

and less than half length of ampulla. Male organs: testes and funnels in 10 and 11; paired seminal vesicles racemose on anterior septum of 12 only. Ovaries: in 13; ovisacs not noted. Prostates: small, flattened [racemose?] in 18; penial setae not noted. Intestine: origin 17; typhlosole not noted.

REMARKS

The types of *Woodwardiella tesselatus* are missing and it has not subsequently been found in nature to confirm its definition. If the nephridia were in fact meroic, it would then qualify for inclusion in *Notoscolex*. Two new species that appear superficially similar are *Notoscolex pardus*, and *Anisochaeta clavi*.

ETYMOLOGY tessellatus, Latin adjective - mosaic; and tessellation is chequering.

DISTRIBUTION AND HABITAT

Mount Olympus, Lake St. Clair, C Tasmania, "in damp soil under logs and amongst decaying leaves in Beech Forest" (*Notofagus cunninghami*).

Woodwardiella tiki sp. nov.

Fig. 115.

MATERIAL EXAMINED

HOLOTYPE: 14:3106 (H), Weldborough, EQ 756 395, NE Tasmania, 2.ix.1990, R. Mesibov, from base of eucalypt, (weakly clitellate mature specimen, drawn and dissected).

PARATYPES: ANIC:RB.97.2.3 (P1), same collection details as H, (weakly clitellate mature); TM:K1541 (P2), Sideling, EQ 350 310, 14.xii.1983, M. Jessup "In wet forest", (aclitellate mature, dissected); 14:3123 (P3), Sideling Range, NE Tasmania, 11.viii.1991, QVM, (aclitellate mature posterior amputee, dissected); 14:1046 (P4), same details as P3, (aclitellate mature, dissected); 14:3577 (P5), Sideling Range, 26.vi.1993, QVM, (mature, damaged around clitellar region, dissected); 14:3124 (P6), South Springfield, NE Tasmania, EQ 388 287, 560 m, 3.vi.1992, R.D. D'Orazio, rainforest, (slightly damaged sub-adult, dissected).

EXTERNAL FEATURES

Body: robust with faint dorsal canaliculation for most of length; first segment furrowed and reduced. Lengths mm: range 210-245; (H) 240, (P1) 225, (P2) 245, (P4) 240, (P5) 210, (P6) 220. Width: ca. 17 mm. Segments: (H) 167, (P1) 163. Colour: uniform pale straw colour in alcohol. Prostomium: tapering epi-tanylobous, with faint dorsal furrow. Clitellum: weakly marked in H and P1 in 14-18,19 (i.e., 5 or 6 segments). Dorsal pores: from 4/5 in all specimens. Setae: eight throughout in regular series, small and black. Nephropores: from segment 2, shortly before d lines at anterior of segments (seen in most segments of all specimens although P6 is anomalous as the pores are in mid c-d). Spermathecal pores: 7/8-8/9 just lateral of setae a lines. Female pores: paired anterio-median to a lines. Male pores: widely paired just median to b lines on small papillae. Genital markings: widely paired, eye-like pads approximately in ab lines in 14/15-16/17 (H, P1, P3-4), first and last pairs sometimes weak, plus ill-defined elongate pair in the anterior of 18 in ab (all specimens) plus widely paired in ab lines in anterior of 19 (H, P1 rhs, P2-3, P4 lhs, P6) and in 19/20 (H, P1, P2, P4-5); i.e., when fully developed, with five or six pairs of markings.

INTERNAL ANATOMY

Septa: 8/9-14/15 with some thickening. Gizzard: large and aubergine-shaped in 5 (septum 5/6 is distended to the base of gizzard), displaced posteriorly. Oesophagus: dilated in 8-13 with internal rugae, less dilated and paler in 14-17. Nephridia: avesiculate holoic; tufted pairs in anterior from segment 2 or 3 as large convoluted clusters of ten or more coiled tubules (that can be teased out with care but are inseparable) branching laterally and converging at anterior septum in ab lines to single common duct; exiting via composite duct composed of ca. eight thin tubules extending more laterally and entering body wall near d lines; in midbody from about segment 20, nephridial tufts reduce in size and number; in caudal segments nephridia more compact with fewer tubules; pre-septal nephrostomes not found in any segment. Vascularization: hearts 10-12 from supra-oesophageal vessel in 8-15. Spermathecae: two pairs in 8 and 9 partly embedded in thick body wall, ampulla large and flat with small iridescent diverticulum (that is slightly spade-shaped in P2). Male organs: testes and funnels invested in mucus in 10 and 11; seminal vesicles paired, racemose anteriorly in 11 and 12, filling this last segment (absent from 9). Ovaries: in 13 as small sheets of egg strings; ovisacs absent. Prostates: racemose in 18 (glandular part blocky with no central canal), duct short, straight; penial setae not found. Intestine: origin 18; typhlosole absent; gut contains fine soil with many quartz grits.

REMARKS

Woodwardiella tiki is unlike other known Tasmanian species with regard to its distribution of genital markings. Its closest relationships are with *W. vandiemensis* sp. nov. which is differentiated by having three pairs of spermathecae and genital markings confined to 17/18/19. One sub-adult specimen (P6) is included in *W. tiki* because, despite having markings only developed in 17/18/19 and anomalous distribution of nephropores, it has only two pairs of spermathecae. Further material of this variant is required to determine its full relationships.

ETYMOLOGY for the markings, reminiscent of Maori tiki designs.

DISTRIBUTION AND HABITAT

North-east Tasmania; from Weldborough where it is sympatric with both *Vesiculodrilus tasmanianus* and *V. lilliputensis* , to west of Scottsdale where *W. vandiemensis* occurs; from rainforest.

Woodwardiella vandiemensis sp. nov.

Fig. 116.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3289, Scottsdale, NE Tasmania, 41°10'S.147°30'E, ca. EQ 450 400, ca. 325 m, 25.i.1996, S.A.McI. & R.J. Blakemore, from pit dug in 'Stronach' granitic soil in wet sclerophyll forest, (weakly clitellate mature, drawn and dissected).

PARATYPES: (P1) 14:3116, Scottsdale, 41°10'S.147°30'E, EQ 503 382, 3.x.1994, QVM, (aclitellate mature specimen in two halves at segment 100, dissected); (P2) ANIC:RB.97.2.4, same collection details as P1, (sub-adult with anterior damaged, dissected); (P3) TM:K1542, same collection details as P1, (sub-adult, dissected); (P4-10) 14:3290, same collection details as H, (three sub-adults, one dissected and four immatures, one dissected).

EXTERNAL FEATURES

Body: stout with faint dorsal canaliculation. Lengths mm: range 180-225; (H) 220, (P1) 225, (P2) 220, (P3) 180, immatures 110-160. Width: 16-20 mm. Segments: (H) 161, (P1) 168, (P2) 163. Colour: in life, unpigmented with pink extremities and grey clitellum; in alcohol, uniform straw colour. Prostomium: weakly closed epi-tanylobous with dorsal furrow. Clitellum: weak in 14-19? (H). Dorsal pores: from 4/5. Setae: eight in regular series but small and difficult to see. Nephropores: in anterior in mid- cd lines near anterior margins of segments, slightly irregular but migrating closer to c lines in midbody (seen in all specimens). Spermathecal pores: minute in 6/7-8/9 near setae a lines. Female pores: paired well median of a lines. Male pores: paired just median to b lines on small papillae; in P2, setae a follicles retained on 18. Genital markings: paired crescentic pads in 17/18 and 18/19 on either side of male pores extending from median of a lines to just lateral of b lines; flat pads border the male pores anteriorly (in H); faint puckered patches seen in 7-9 between spermathecal pores (H, P1).

INTERNAL ANATOMY

Septa: 5/6-8/9 flimsy and displaced by gizzard, 9/10-15/16 thickened. Gizzard: large, muscular in 5 with large proventriculus. Oesophagus: dilated in 9-13 with internal rugae, 14-16 with thicker walls, not calciferous. Nephridia: avesiculate holoic, large tufts fill segments 2 and 3, thereafter as smaller paired clusters of numerous coiled tubules that converge to common duct on anterior septum

approximately in b lines; become more elongate in clitellar region and reducing in size posteriorly; pre-septal nephrostomes not found. Vascularization: commissurals 8 and 9, hearts increasingly large in 10-12 from supra-oesophageal in 8-12. Spermathecae: three pairs in 7-9, increasing in size posteriorly with large spherical ampullae clearly demarcated from duct, each with small diverticulum with slightly bifid, iridescent bulb. Male organs: testes and funnels in 10 and 11 invested in mucus; paired seminal vesicles racemose on anterior septa in 11 and 12. Ovaries: small sheets of egg-strings in 13; ovisacs not noted. Prostates: compact, racemose in 18, duct short; penial setae not found. Intestine: origin 18, spiraling; typhlosole absent; gut contains soil, organic matter and large quartz grits. In H and P4, segment 12 filled with blood engorged "liver-like" structure that surrounds the hearts (possibly embolisms).

REMARKS

Woodwardiella vandiemensis is morphologically similar to *W. tiki*, they are differentiated on the basis of spermathecae (three pairs and two pairs, respectively), on the distribution of genital markings and on the nephropores being more dorsal near d lines in *W. tiki*.

ETYMOLOGY 'from Van Diemen's land'.

DISTRIBUTION AND HABITAT

Scottsdale, north-east Tasmania, from forest soil, dug at depths of ca. 1 m. *Woodwardiella vandiemensis* is sympatric with *W. tiki* at the western boundary of its known range.

Perionychella Michaelsen, 1907

Perionychella Michaelsen, 1907b: 160, 163; Blakemore, 2000b: 3-4.

Perionyx (part.); Michaelsen, 1900: 207; 1916: 7; 1923: 232; Stephenson, 1930: 841; Lee, 1959: 318-319; Gates, 1959: 254.

Perionychella (part.); Jamieson, 1974: 216-223.

Terrisswalkeris Jamieson, 1994: 158. **Syn. nov.**

Diagnosis Setae more than eight per segment, at least in the mid- or hind-body. Male pores from tubuloracemose or racemose prostates paired on 18. Gizzard in 5 (or 6?); extramural calciferous glands absent; typhlosole absent. Nephridia holoic with or without bladders, often tufted in anterior segments. Spermathecae five or fewer pairs, diverticula clavate, uniloculate.

[Note: under the recommendations of ICZN (1999: 35) a genus-group name ending in Latin dininutive suffix *-ella*, is to be treated as feminine].

Type species *Perichaeta dendyi* Spencer, 1893 from Victoria.

Note: The type material of *Perichaeta dendyi* was listed as missing from the NMV by Jensz & Smith (1969:104), however Jamieson (1974: 220) claimed to have inspected a "Syntype (?)", AM:W.1294, in the Australian Museum. If this is a syntype, it is possible that some others of Spencer's missing types, including those collected from Tasmania, may be located there. While acknowledging *Perichaeta dendyi* as type-species of *Perionychella*, Jamieson (1974) failed to list this species as belonging to either of the subspecies he established in the same paper. In a later paper, Jamieson (1994), input characters of *P. dendyi* that were for a species with racemose prostates and avesiculate holonephridia. The prostates of *Perionychella dendyi* were originally described as "flattened bodies", that were classed as racemose by Sweet (1900: 133) and by Jamieson (1994:177), but were stated to be tubuloracemose by Michaelsen (1907a: 12) as concurred with by Jamieson (1974: 217, 265), (from examination of a syntype?).

Distribution Victoria, Tasmania, New South Wales, Queensland; New Zealand.

Included species

In New Zealand, one species is known from Mt Egemont in the North Island, and three species occur on subantarctic Auckland Island, (these latter possibly belonging in a separate genus as they have a reduced or absent gizzard). Whereas Jamieson (1974) listed about 66 Australian species in this genus, only about half of these

actually belonged here and many are quite correctly transferred back to *Diporochaeta*, while several other species have subsequently been confirmed in the genus *Vesiculodrilus* (see Remarks after the description of this genus). A full list of Australian species is beyond the scope of the present study, but eight species are now recorded from Tasmania, including four new taxa, described below.

Remarks *Perionychella* is restored, after being variously "supressed" (sic - Jamieson, 1974; 1976, although 'Suppression' is in fact an act of the ICZN), for holonephric (vesciulate or avesiculate), lumbricine species with non-tubular (ie., tubuloracemose to racemose) prostates. Combining such a variation in non-tubular prostate form is justified as the present author endorses the tautology that derivation from a pleisiomorphic character, in this case tubular prostates, is an apomorphy. The "very profound emendation" of *Perionychella* by Jamieson (1974), ignoring variations in setae and prostates and therefore encompassing not only *Diporochaeta*, a prior genus, but also several other genera, was superseded when Jamieson (1976b) reassigned *Perionychella* s. Jamieson (1974) *en masse* to *Diporochaeta* s. Jamieson (1976b). Later, Jamieson (1994) removed Queensland components including *Perichaeta canaliculata* Fletcher, 1887a (although Jamieson appears not to have inspected the Australian Museum type specimens, this species has vesiculate holonephridia and, according to Michaelsen, and Jamieson (1994:177), tubuloracemose prostates), making this the type-species of his newly erected *Terrisswalkerius*, albeit included species with tubular prostates would comply with *Diporochaeta*. His cladistic analysis suggested separate generic status for *Perionychella*, but Jamieson (1994) had erroneously input the prostate form of the type species of *Diporochaeta* as "tubuloracemose" rather than tubular, and he also failed to redefine the residue of *Diporochaeta*. Herein, *Perionychella* is re-constituted separately from *Diporochaeta*, both having characteristics and distributions close to their original 'classical' definitions. *Terrisswalkerius* is placed in synonymy as the type-species, *Perichaeta canaliculata*, and other included species with tubuloracemose prostates, comply with the diagnosis above (those that have tubular prostates can be returned to *Diporochaeta*). The genus *Perionyx* was restricted to Oriental species by Gates (1960; 1972).

Perionychella dilwynnia (Spencer, 1895)

Fig. 117.

Perichaeta dilwynnia Spencer, 1895:50-51, figs. 46-48; Jensz & Smith, 1969: 104.

Diporochaeta dilwynnia ; Michaelsen, 1900:204.

Perionychella (Vesiculodrilus) dilwynnia ; Jamieson, 1974: 234-236, figs. 8B (p. 232), 16J (p. 256).

Perionychella (Vesiculodrilus) obliquae (?part.) Jamieson, 1974: 250-251, Figs, 13B, 16V.

Perionychella dilwynnia; Blakemore, 2000b: 15-16, fig. 9.

MATERIAL EXAMINED

TYPE MATERIAL: Not present in NMV, presumed lost (Jensz & Smith, 1969: 104). No new material has been located from the Dee Bridge type-locality, despite collection efforts by the author.

SPECIMENS: (S1) 14:3335, Bell Basin, Lake Pedder north, 310 m, 28.iii.1996, A. Osborne and N. Forteath, (mature specimen, dissected and figured); (S2) 14:3469, Sprent Basin, Lake Pedder north, 417600 5263100, 310 m, 9.iv.1996, R.J. Blakemore, under Ti-tree on edge of lake, (mature, posterior amputee, dissected); (S3) 14:3470, same details as (S1), (aclitellate mature); TM:K266-274, BM:1972:8:4-7, Tarraleah, central Tasmania, 146°25'E.42°20'S., 27.v.1954, J.L. Hickman, over pipeline, (twelve mature specimens and a tail portion); AM:W5202 (ex-specimen of *Perionychella obliquae* not designated type material although forming part of the type description), Port Davey, Kelly's Basin, 43°20'S.145°55'E, Jan 1940, Tasmanian Biological Survey J17, C.D. King, (mature, posterior amputee, previously dissected with spermatheca removed and missing from jar, re-inspected here).

EXTERNAL FEATURES

Body: paddle-shaped anterior, body tapers to flattened tail. Lengths mm: (S1) 62, (S3) 45, cf. 50 (Spencer), other specimens 50-70 mm.. Width: 2.5-3.0 mm. Segments: (S1) 120, (S3) 113, other specimens 104-118. Colour: anterior gunmetal grey, dorsum brown, ventrum yellow, clitellum buff. Prostomium: epilobous, almost tanylobous, faintly furrowed; some specimens have ventral cleft. Clitellum: ½13-½17. Dorsal pores: from 4/5. Setae: 14-16 on 12 almost evenly spaced, rows regular to midbody then become intercalated, increasing to 24-30 in posterior third of body where the dorsalmost setae move more dorsally (Spencer has 12-26 setae).

Nephropores: lateral (in d or e lines). Spermathecal pores: 4/5-8/9 in mid-ab lines. Female pores: paired on 14. Male pores: paired on low mounds on 18 in ab. Genital markings: unpaired, mid-ventral discs, in posterior of some segments in 6-8; elongate pad in aa anteriorly on 18; paired eye-like markings in a or ab lines in (16/17, 18/19?), 19/20 and 20/21.

INTERNAL ANATOMY

Gizzard: slender, muscular in 5. Oesophagus: increasingly dilated in 6-14,15, not calciferous; contracted with thicker wall in 15 and/or 16. Nephridia: vesiculate holoic in c lines, the ducts translucent but only slightly dilated as elongate bladders exiting approximately in e lines in anterior; not tufted anteriorly. Vascularization: hearts in 10-12 with connectives to well developed supra-oesophageal vessel in 7,8-12,13. Spermathecae: five pairs in 5-9, ampulla tapers to duct with simple diverticulum ectally. Male organs: holandric, testes and funnels in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: palmate with many large egg strings in 13; ovisacs not found. Prostates: tubuloracemose reflexed in 17,18-20; small penial setae present. Intestine: origin 17; no typhlosole to ca. 45; gut contains organic remains.

REMARKS

These small specimens agree tolerably with Spencer's original account, differences are that the prostomium extends for more than half of the first segment, genital markings occur mid-ventrally in the anterior and the posterior markings are in 19/20 and 20/21 (not 18/19 and 19/20 as stated by Spencer). Also, seminal vesicles were found in 9 as well as 12, the more usual holandric locations. Spencer (1895: 51) describes the prostates as "wide, tubular with racemose surfaces extending through segments 17-20" while Jamieson (1974: 234) has them as "depressed, lobulated tubular, with compressed coils in XVII-XX", i.e., tubuloracemose, thereby qualifying inclusion in *Perionychella*.

Distinctive characters of *Perionychella dilwynnia* are the five pairs of spermathecal pores in ab lines, numerous setae, tubuloracemose prostates and a genital pad preceding the male pores (which possibly corresponds with the anterior sucker-like markings in concopulants). The ventrally cleft peristomium in the Tarraleah specimens (described but not illustrated in Jamieson, 1974 fig. 8B) was not reported by Spencer, neither was it seen in the Lake Pedder specimens. Spencer described his species as 'meganephric' (i.e., holoic) but did not mention presence or

absence of bladders. Spencer's figure 45 has the female pores closer than his description: "just ventral of and anterior to, the innermost setae" (as in the specimens here). Jamieson's specimens (as here) had wide female pores and genital markings in 19/20 and 20/21; two of Jamieson's specimens also had seminal vesicles in 9, ovisacs in 14, and slender penial setae. Differences between the present account and Jamieson's account are the gizzard is not "almost rudimentary", and the nephridial bladders are not "wide, tortuous tubular".

The Port Davey specimen (AM:W5202) has a pad in 18, spermathecal pores in ab lines and appears to agree internally, but differs from the above description by having 22 setae in the anterior and additional weak markings in ab in 16/17. These differences do not appear sufficient for recognition of a distinct species, especially as only one (now damaged) specimen is available, and a larger series from this locality is needed for full characterization.

In *Perionychella*, a similar species is *P. richea* (Spencer, 1895), but this apparently differs in having more setae, spermathecal pores closer to or in setal a lines, lacks the mid-ventral pad in 18 and genital markings in the anterior, and while nephridial ducts are sometimes tubular, they are not always classed as bladders as in *P. dilwynnia*.

DISTRIBUTION AND HABITAT

Widespread in Central to SW Tasmania: Dee Bridge (Spencer), around Tarraleah (Hickman), and Lake Pedder where it was found under Ti-tree (*Leptospermum* spp.) litter in woodland on the lake's edge. Possibly also from Port Davey.

Perionychella eruca *sp.* nov.

Fig. 118.

MATERIAL EXAMINED

HOLOTYPE: 14:2837 (H), Birchs Inlet, SW Tasmania, CN 753 878, 16.x.1993, J. Griffith, rainforest, (mature dissected, figured).

PARATYPES: 14:3539 (P1-3), same details as H, (three specimens, one mature, one aclitellate mature and one immature, all dissected).

EXTERNAL FEATURES

Body: ventrum infolded from 14-23. Lengths mm: (H) 95, (P1, P2) 80, (P3) 45. Width: ca. 4.5 mm. Segments: (H) 156, (P1) 105, (P2) 148. Colour: unpigmented white in alcohol; clitellum pale. Prostomium: open epilobous, tapering almost to furrow. Clitellum: ½13-½18, setae and dorsal pores retained. Dorsal pores: from 4/5 (although vestigial pore possibly in 3/4 in H). Nephropores: not found. Setae: small and difficult to see, ca. 20 per segment, variations 18-22. Spermathecal pores: 7/8/9 in ab lines. Female pores: widely paired on 14. Male pores: on flat discs in ab on 18 with tips of penial setae visible, male pores within tumid field from ½17-18. Genital markings: wide lip-like intersegmental pads extending to bb lines in 10/11 (H only), and/or 11/12 (H and P1); similar pads in 18/19-20/21 (H-P2) and possibly weak in 21/22 (H only).

INTERNAL ANATOMY

Septa: 9/10-13/14 with slight thickening. Gizzard: large muscular barrel in 5 but displaced to occupy 7-9. Oesophagus: dilated slightly in 12,13-14 (H) or 14-16 (P1-2), internally rugose but not calciferous. Nephridia: avesiculate holoic (difficult to determine due to mucus: only one set of much-coiled, rounded tubules determined per side in pre-clitellar segments, after clitellum tubules flattened and spread laterally); not tufted in anterior; funnels not found. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-13, supra-oesophageal vessel weak 10-13. Spermathecae: two pairs in 8 and 9, conical ampulla on greatly dilated duct with moderately long stalked diverticulum that has iridescent bulb. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; small saccular seminal vesicles ventrally in 9, larger amorphous vesicles in 11 and 12 where there is also much mucus. Ovaries: small in 13; ovisacs absent. Prostates: tubuloracemose, folded in 18; penial setae small, stout. Intestine: origin 18, from 18-21 dilated and thin walled without any

muscular sheen, from 22 thicker walled and more yellowy; no intestinal gizzards present; typhlosole absent; gut contains woody organic matter and occasional sandy grits.

REMARKS

Distinctive characters of *Perionychella eruca* are the elongate lip-like markings, last hearts in 13, and two pairs of spermathecae that have markedly bulbous ducts. Seminal vesicles appear in 9, 11-12 but are obscured by mucus and fatty deposits that also attach to the nephridia. It is compared to *P. variegata* under that species' account.

ETYMOLOGY: eruca, Latin – 'caterpillar', which the genital markings resemble slightly.

DISTRIBUTION AND HABITAT

Birchs Inlet, Melaleuca SW Tasmania, from rainforest; found with *Tassiedrilus griffithae*.

Perionychella irregularis (Spencer, 1895) comb. nov.

Fig. 119.

Perichaeta irregularis Spencer, 1895: 53-54, figs 52-54; Jensz and Smith, 1969: 106.

Diporochaeta irregularis; Michaelsen, 1900: 206.

Perionychella (Perionychella) irregularis; Jamieson, 1974: 228-229, Fig. 6C (and 16G - a figure of a spermatheca from segment 9 removed from the lectotype).

MATERIAL EXAMINED

LECTOTYPE: NMV: G288 labeled "King River, Tasmania. Coll: C.G. Officer, Jan. 1894 - TYPE" and "Peri sp X 15 King R[iver] T[asmania] Mr C. G. Officer Jan/[18]94", (ca. 42°10'S.145°40'E), (mature specimen in good condition but previously dissected, only in the anterior, and with spermathecae in segment 9 now removed and missing from the jar). Lectotype designation by Jensz & Smith (1969: 106).

PARALECTOTYPES: none.

OTHER MATERIAL: 14:3537, Pelion Valley, Forth River NW side, DP 173 674, 725 m, 13.ii.1992, QVM, rainforest, (mature, dissected and drawn); 14:3538, same details as 14:3537, (mature and sub-adult, both dissected).

EXTERNAL FEATURES

Length mm: 90 (lectotype) - 130. Width: ca. 5 mm. Segments: 74 (lectotype) - 124. Colour: anterior dark grey, dorsum reddy brown to flanks; ventrum pale; clitellum brick red (not ventrally). Prostomium: open epilobous, furrowed. Clitellum: 13-17,½18, not tumid only faintly marked dorsally and laterally. Dorsal pores: small in 3/4 (from 4/5, Spencer). Setae: ca. 26-28 on 12, increasing up to ca. 40 posteriorly, dorsal gap slight. Nephropores: lateral in f-g (in h-i, Spencer). Spermathecal pores: small in 6/7-8/9 in d-e (or diverging from c to e lines, Spencer). Female pores: minute, paired on 14. Male pores: on small papillae in 18 in bc; no setae intervene although figured thus in Spencer (1895: fig. 52). Genital markings: paired or analogous markings, posteriorly in some of 7-9 (in new material); two pairs of elliptical patches centred in bc in 19/20 and 20/21 (in lectotype and all other specimens except sub-adult 14:3539 where in 19/20 only).

INTERNAL ANATOMY

Gizzard: moderately muscular in 5, septum 5/6 distended so that it appears in 6. Oesophagus: dilated and vascularized in 9-10 and 13-15,16, not calciferous.

Nephridia: avesiculate holoic, the coils flattened. Vascularization: dorsal blood vessel doubled bifurcating in 14-17 (in lectotype), single but often looped in other specimens; hearts in 10-12; supra-oesophageal vessel weak in 8-12. Spermathecae: three pairs in 7-9, ampulla spherical on a narrow duct with small clavate diverticulum; Spencer reported special blood vessels on the surfaces of ampullae. Male organs: holandric, testes elongate iridescent in 10 and 11; seminal vesicles elongate racemose, small on posterior septa in 9 and 10, large on anterior septa in 11 and 12 (i.e. 4 pairs although those in 11 sometimes undeveloped); small paired pseudovesicles in 13. Ovaries: small in 13, small ovisacs in 14. Prostates: tubuloracemose coiling through 17,18-21,22, muscular duct long and tortuous; penial setae not found. Intestine: origin 17; no typhlosole; gut contains organic matter.

REMARKS

The position of the gizzard in *Perionychella irregularis* was stated by Spencer (1895) to be in segment 6, but was illustrated in 5, as here. He also described and illustrated the genital markings in 18/19 and 19/20 while in the lectotype they are in 19/20 and 20/21. Moreover, Spencer (1895: fig 52) and Jamieson (1974: fig 6c) incorrectly figure spermathecal pores in 7/8/9/10 and in 5/6/7/8, respectively - the correct location is 6/7/8/9. Jamieson (1974: 228-229) was also lax in missing the lectotype's doubled dorsal blood vessel (describing it as "single, continuous onto the pharynx"), and in describing the tubuloracemose prostates as resolvable "into a tubular form". Having tubular prostates would qualify this species for inclusion in *Diporochaeta* rather than *Perionychella* where it actually belongs. Jamieson believed this species to be close to his *P. hickmani* – now in *P. richea*, and to his *P. capensis* – now in the genus *Retrovesus* Blakemore, 1997. Similar species, differing mainly by having only two pairs of spermathecae, are *Perionychella eruca* and *P. variegata*, while sexathecal *P. lacustris* is differentiated under this species' account.

DISTRIBUTION AND HABITAT

King River Valley and Pelion Valley, in NW and C Tasmania. Spencer (1895: 33) stated that earthworms were obtained along the King River Valley "amongst the western mountain ranges", this puts the type-locality approximately 42°10'S.145°40'E.

Perionychella lacustris (Stephenson, 1924), comb. nov.

Fig. 120.

Perionyx lacustris Stephenson, 1924: 546-547.

Perionychella (Vesiculodrilus) lacustris ; Jamieson, 1974: 245-246, figs, 1 [mislabeled *P.(P.) lacustris*], 7B (p. 231), 16I (p. 256).

TYPE MATERIAL (not examined here): Syntypes BM(NH): 1924.10.21.1-5, obtained at the Great Lake, Tasmania (ca. 41°55'S.146°45'E), in September, 1914 by Prof. Dendy, found under stones in water at the margin of the lake, (Stephenson received fourteen specimens - not all mature, - all much softened, and several in two pieces; he dissected one of the deposited specimens and Jamieson dissected another).

MATERIAL EXAMINED

SPECIMENS: TM: K265, Lyell Highway, 5 miles from Bronte towards Hobart, 42°15'S.146°35'E, 24.v.1954, J.L. Hickman, (mature, posterior amputee with regeneration of last three segments, previously dissected with some organs loose in the body cavity, here reinspected and figured); BM(NH): 1972:8:2, same details as TM:K265, (specimen now desiccated and yielding little useful information).

Description based on Stephenson (1924) augmented by information from other material.

EXTERNAL FEATURES

Body: slightly depressed dorso-ventrally (Stephenson). Length mm: 45-50 (Stephenson), 55+ (K265). Width: ca. 2.5-3.0 mm. Segments: 107 (Stephenson), 68+ (K265). Colour: red and brilliantly iridescent in life; faintly pigmented dorsally in alcohol; clitellum buff.. Prostomium: tapering epilobous, not quite tanylobous. Clitellum: 14-16 (Stephenson) or ½13-½17 (K256). Dorsal pores: from 4/5. Setae: small and difficult to see, ca. 12-22 on 12, 14-22 on 20. Nephropores: in line with setae d (in anterior). Spermathecal pores: in 6/7-8/9 in bc. Female pores: paired on 14. Male pores: on papillae on 18 in bc. Genital markings: midventral, postsetal pads in 7 and 8; widely paired discs in 16/17, and 18/19 in ab; paired eye-like discs on the tumid anterior of 18 but incorporating intersegment 17/18 just preceding male papillae; in K256 segments 17 and 19 have swollen mounds on each side at a-c. The markings in the anterior and in 16/17 are sometimes wanting (Stephenson).

Note: Stephenson (1924:547) remarked on fine crystalline needles on the surface of his specimens that were probably salts from the preservatives.

INTERNAL ANATOMY

Septa: thin with "septal glands" on each side in 6 and 7. Gizzard: vestigial (mislocated in 6 by Stephenson), or weakly muscular in 5 but displaced dorsally (in K256). Oesophagus: not appreciably dilated or slightly dilated only in 14 and 15, calciferous glands absent. Nephridia: holoic, avesiculate in type material with ducts only slightly thickened (Stephenson), or avesiculate in 2-7 then becoming vesiculate with very flimsy subspherical bladders (K256). Vascularization: hearts 10-12 connected to supra-oesophageal vessel which runs from 8-12. Spermathecae: three pairs in 7-9, ampulla ovoid or heart-shaped with short but distinct duct and clavate diverticulum ectally. Male organs: holandric, testes and iridescent funnels free but in coagulum (what I call mucus) in 10 and 11; seminal vesicles racemose in 9 and, larger, in 12. Ovaries: saccular in 13. Prostates: tubuloracemose in 18-20, bulging forwards into 17; penial setae absent (Stephenson) or present but thin and delicate (in K256). Intestine: origin about 18 (Stephenson) or ½17 (K256); typhlosole absent.

REMARKS

The only major difference from the type-description in the Bronte specimen is the development of flimsy nephridial bladders which were not visible in the type-material, nevertheless, both states are permissible in *Perionychella*, and agreement on other points suggests conspecificity. The genital markings in the region of the male and spermathecal pores on the new material examined here encompass the slight range of variations Stephenson found in different specimens. The only other Tasmanian *Perionychella* currently known with three pairs of spermathecae is Spencer's *P. irregularis*, that has seminal vesicles in 9-12 and a different arrangement of genital markings.

DISTRIBUTION AND HABITAT

From Great Lake, Central Tasmania, found under stones in water margin, and near Bronte in the same region.

Perionychella myrtea *sp.* nov.

Fig. 121.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3091, Lake Rowallan, C Tasmania, ca. 41°44'S.146°14'E, Lake Bill track, 9.ix.1992, QVM, in myrtle-grove, (aclitellate mature, dissected, figured).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 130. Width: ca. 6 mm. Segments: 150. Colour: dark anterior dorsum and mid-dorsal line; ventrum and setal auriolae pale. Prostomium: open epilobous, with faint furrows. Clitellum: not developed. Dorsal pores: from 2/3. Nephropores: not found. Setae: 20-24 anteriorly, 28-32 posteriorly. Spermathecal pores: minute in 5/6/7/8/9 in b lines. Female pores: minute, paired on 14. Male pores: on 18 in b lines on mounds in a-c replacing setae ab. Genital markings: eye-like paired markings in 17/18 in bb lines and wider in 19/20 in ab lines.

INTERNAL ANATOMY

Septa: 7/8-13/14 with slight thickening. Gizzard: solid and thick in 5. Oesophagus: slightly dilated in 6-16, not calciferous. Nephridia: avesiculate holoic in b(?) lines; not tufted in anterior; funnels not found. Vascularization: hearts 10-12. Spermathecae: four pairs in 6-9, conical ampulla tapering to duct with clavate diverticulum (not inseminated). Male organs: holandric, testes and funnels not iridescent in 10, larger and iridescent in 11; seminal vesicles racemose in 9, 10 and 12. Ovaries: in 13. Prostates: tubuloracemose, folded in 18-19; penial setae not found. Intestine: from 18; typhlosole absent; gut void.

REMARKS

Monotypic *Perionychella myrtea* is distinguished from other species in the genus in Tasmania by its four pairs of spermathecae, lack of calciferous glands, and possible incipient metandry. The holotype although large is not fully mature.

ETYMOLOGY: myrteus, Latin – 'of myrtles', for the habitat.

DISTRIBUTION AND HABITAT

Lake Rowallan, Central Tasmania, from a grove of myrtle, found with *P. richea*.

Perionychella richea (Spencer, 1895) comb. nov.

Fig. 122, Fig. 123.

Perichaeta richea Spencer, 1895: 49-50, figs. 43-45; Michaelsen, 1900: 204; Jensz & Smith, 1969: 107.

Perichaeta richae (sic); Jamieson, 1974: 223.

Perionychella (subgenus?) richea ; Jamieson, 1974: 258-259, (Note: Jamieson (1974: 258) in his synonymy for *Perichaeta richea* appears to have confused this species with both of Spencer's *P. dilwynnia* and *P. scolecoidea*).

Perionychella (Perionychella) hickmani Jamieson, 1974: 226-228, figs. 1 (mislabelled *P.(V.) hickmani*), 6A,B, 16C,D. **Syn. nov.**

Perionychella (Vesiculodrilus) obliquae Jamieson, 1974: 250-251, Figs, 13A, 16U. **Syn. nov.**

MATERIAL EXAMINED

SYNTYPES: not present in the NMV and presumed lost (Jensz & Smith, 1969: 107).

NEOTYPE: 14:3300 (N), Lake St Clair, 42º05'S.146º10'E, Mt Olympus, near Echo Point, 13.x.1995, R.J. Blakemore, in beech forest litter, (mature, with tip of tail damaged, dissected and figured).

Note: In the interest of nomenclatural stability, this freshly collected specimen from the original type-locality is here designated a neotype, under ICZN (1999) Article 75, as no type-material is known to exist and, for reasons given below, the specimen is considered consistent with the taxon described by Spencer.

SPECIMENS: ANIC:RB.00.1.19, same details as 14:3300, (mature, agreeing superficially); 14:3301, same details as 14:3300, (mature, dissected); 14:3302, same details as 14:3300, (four matures, two dissected, and a tail); 14:3303, same details as 14:3300, (five matures, one dissected, plus one subadult and one immature); 14:3540, Lake Bill Track from Lake Rowallan, C Tasmania, ca. 41º44'S.146º14'E, 9.ix.1991, QVM, in myrtle grove, (mature, figured and dissected); 14:3541, 3542, same details as 14:3540, (one mature and one subadult, both dissected, plus an immature of a different species); 14:3083,3084, same details as 14:3540, (two matures, both dissected, one figured); 14:608, Cradle Mountain Road, NW Tasmania, CP 949 986, 670 m, 16.vi.1993, R.D. D'Orazio and D. E. Soccol, peat swamp, (six matures, one dissected, one anterior amputee, plus a subadult of a different species); 14:0102,

Pelion Valley, 420900 5366000, Feb, 1992, QVM, (clitellate mature, from batch of 45 specimens agreeing with *P. richea*, this one an anterior regenerate from segment 6, having only three replacement head segments, dissected); 14:583, Julius River Forest Reserve, Smithton, NW Tasmania, CQ 345 421, 110 m, 18.v.1993. R. D. D'Orazio and D. Soccol, cool temperate rainforest, (seven specimens, one mature dissected and drawn); 14:974, Mole Creek, Lake McKenzie Rd., N Tasmania, DP 373 924, 700 m, 5.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll/rainforest at Martha Creek, (mature specimen, dissected and drawn); 14:711, Nietta, NW Tasmania, Jean Brook Forest Reserve, DQ 193 116, 525 m, 25.xi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll over creek, (16 specimens, 12 mature); 14:1996, Castra, NW Tasmania, DQ 304 274, 285 m, 19.i.1994, R.D. D'Orazio and D. Soccol, (three specimens); 14:1997, Castra, same details, (five specimens plus two tails); 14:1999, Castra, DQ 228 224, 480 m, 19.i.1994, R.D. D'Orazoi and D.E. Soccol, (four matures); 14:2001, Castra, same details, (three specimens, one mature); 14:2008, Castra, Gaunts Rd., DQ 228 213, 485 m, 19.i.1994, R.D. D'Orazio and D. Soccol, (eight specimens); 14:2009, Castra, same details, (six specimens);

TM:K260 (ex-holotype of *Perionychella hickmani*), Fern Glade, Emu River, Burnie, N. Tasmania, 41°05'S. 145°55'E, 24.viii.1954, J.L. Hickman, (mature, previously dissected, re-inspected and refigured); BMNH:1972:8:12 (ex-P1 of *Perionychella hickmani*), Hellyer Gorge, 41°20'S.145°35'E, 28.v.1954, J.L. Hickman, (mature, dissected, re-inspected); TM:K261 (ex-P2 of *Perionychella hickmani*), Parrawe, 41°20'S. 145°35'E, 25.viii.1954, J.L. Hickman, (partially dissected); BM:1972:8:13 (ex-P3 of *Perionychella hickmani*), Lake St Clair, 42°05'S. 146°20'E, Feb 1941, (aclitellate mature, in two bits, previously dissected with some spermathecae removed and missing from jar, re-inspected); BM:1972:8:14 (ex-P4 of *Perionychella hickmani*), same details, (aclitellate, in two halves but undissected);

TM:K301 (ex-holotype of *Perionychella obliquae*), 2 miles inland, south of Interview River, NW Tasmania, 41°35'E.144°55'S, 31.xii.1953, W. Jackson, (mature specimen damaged by previous dissection with intestine removed, redrawn); BMNH:1972:8:31 (ex-paratype of *Perionychella obliquae*), same details, (large mature posterior-amputee, macerated and damaged by dissection with several internal organs removed and missing from jar, re-inspected). Note: the Port Davey, SW Tasmania, specimen attributed to *P. obliquae* is no longer considered conspecific (see Remarks below).

EXTERNAL FEATURES

Body: with segment 18 around the male pores often compressed. Lengths mm: (N) 70, range 60-130 (cf. Spencer, 75). Width: ca. 3-5 mm. Segments: (N) 78, range 78-125. Colour: anterior and dorsum dark red-brown to flanks, mid-dorsal line darker due partly to setal gap; ventrum pale; clitellum puce. Prostomium: open epilobous " about one-half dovetailed into the peristomium" (Spencer). Clitellum: annular 14-17 (ditto Spencer), or ½13-½17 (eg. in ANIC:RB:00.1.19, 14:3540, K260, K310, 14:583). Dorsal pores: rudimentary in 3/4 (as Spencer), or open from 4/5. Setae: numerous, 24 in anterior, 28-34 in posterior, 40-45 or more on tip of tail (cf. Spencer 24 in front of clitellum, 48 in midbody). Nephropores: lateral in g-h in anterior. Spermathecal pores: in 4/5-8/9 in or near a lines (ditto Spencer). Female pores: paired on 14. Male pores: on papillae on 18 in ab. Genital markings: none in anterior or slight near spermathecal pores in some of 7-9, (eg. 14:608, 14:583); very weakly marked and easily overlooked on either side of male pores in 17/18 and 18/19 (eg. in 14:3540) or small paired lenticular in ab in some or all of 16/17-20/21 (eg. in neotype, ANIC:RB.00.1.19, 14:3541, TM:K260 ex- holotype *P. hickmani*, TM:K261, TM:K310 ex- holotype *P. obliquae*, BM:1972:8.3:1); sometimes only those in 16/17 and 17/18 present or with extra markings in 21/22 (eg. BM:1972:8:12-13, 14:3302 specimens); none developed in some subadults (eg. from Pelion Valley, and BMNH:1972:8:14 ex-P4 *P. hickmani* from Lake St. Clair); (cf. Spencer, accessory copulatory structures - none developed).

INTERNAL ANATOMY

Septa: 2/3-4/5 thin, 5/6-13/14 slightly thicker, septum 17/18 sometimes deflected forwards by prostates. Gizzard: small onion-shaped in 5, (cf. Spencer, in segments 3 and 4 - but shown in 4 in his fig 44). Oesophagus: slightly dilated in 13,14-15,16 (cf. Spencer, white and swollen in 11 and 12), not calciferous. Nephridia: simple holoic, with thin convoluted ducts (neotype and most specimens), ducts sometimes slightly thickened or dilated (eg. 14:3301, TH:K260, and in some Smithton and NW coastal specimens, in 14:583 the dilations of the ducts switch on and off in mid-body in the same specimen). Vascularization: dorsal vessel single; hearts in 10-12 (cf. Spencer, 9-12); supra-oesophageal vessel in 7-12 (cf Spencer, 9-12). Spermathecae: five pairs in 5-9; saccular ampulla with small clavate diverticulum on base of duct. Male organs: holandric, testes and funnels in 10 and 11;

seminal vesicles racemose in 9 and 12. Ovaries: in 13; small ovisacs in 14 (ditto Spencer). Prostates: coiled tubuloracemose in 17,18-19 often forming open rosette (cf. Spencer, widely tubular in 17-19, shown in fig. 45 with open circular outline); small penial setae present (neotype and most other specimens), or not found (Spencer rarely commented on presence or absence of these setae). Intestine: from ½17 (neotype and most specimens), variation 17-18, (cf. Spencer, 17); typhlosole absent; gut mostly contains organic soil.

REMARKS

While agreeing on most points, notable differences of the neotype from Spencer's original are the gizzard in its more usual location of 5 rather than 3-4, the presence of genital markings, and oesophageal dilations in 13-15 rather than 11-12 that, nevertheless, do not form calciferous glands. The gizzard in Spencer's specimen was probably anomalous (N.B., 14:0102 from Pelion Valley is a mature anterior regenerate, 70 mm long with genital markings weak in 16/17 and 17/18, complying with the above description and having its regrown gizzard in segment "3"), and the marking and alimentary differences appear as acceptable variations for this taxon. Support for this argument is found in the figured specimen (14:3540) from near Lake Rowallan which agrees with Spencer's account on most points (except for its gizzard in 5), and also with the neotype (except for its reduced markings). It is not possible to morphologically separate the other material included under this taxon above, despite varying degrees of genital marking development, dilations of nephridial ducts, and presence or absence of penial setae. Prostate form is interpreted as tubuloracemose, although in some specimens it superficially resembles a blocky or thickly tubular form, and it is usually found coiled in 17,18-19 with an almost circular outline.

Only the small genital markings in 16/17/18 sustantially separated *Perionychella hickmani* from the previously described *P. richea* (Spencer, 1895) - disregarding Spencer's anomalous and obvious mislocation of the gizzard, yet Jamieson (1974: 226, 228) had only cursorily differentiated *P. hickmani* by comparison with his *P. capensis* that is now in the genus *Retrovescus* (see Blakemore, 1998). Re-inspection of types of *Perionychella hickmani*, including the two specimens from Lake St Clair that had reduced or absent markings and spermathecal pores closer to a lines, located the intestinal origin in 17, not 18, and confirm agreement with *P. richea* as described above. Jamieson's *Perionychella*

(Perionychella) hickmani was almost identical to his *Perionychella (Vesiculodrilus) obliquae*, separated only because the former species was originally described as having "tubular" nephridial ducts, while the latter had "bladders long, tubular or somewhat dilated", a rather fine distinction, albeit both vesiculate and avesiculate conditions are permitted in *Perionychella* as currently defined. In TK:K260, the nephridial ducts in the anterior are thick, resembling bladders. Reinspection of the holotype and paratype of *P. obliquae* revealed nephidial bladders as only slight, filmsy dilations of the ducts, spermathecae closer to setal a lines, and gizzard moderate rather than vestigial in 5. (The Port Davey non-type specimen of *P. obliquae*, however, was found on re-inspection to also lack distinct "bladders", but to have spermathecal pores in ab lines as well as a mid-ventral marking in 18 - placing it in the domain of *P. dilwynnia*). With nephridia similar to those in the ex- holotype of *P. hickmani*, both *P. obliquae* ex-type-specimens have additional genital markings in 19/20 and 20/21, as are also found in *Perionychella richea*, not least in the neotype, but not in other specimens that do have bladder-like nephridial ducts (eg. 14:583 specimens from Smithton). Prostates were described as "not tubular (holotype) or depressed tubular, zig-zag in 17-19" for *P. hickmani*, and as "depressed tubular, somewhat lobulated.. in 17-19" in *P. obliquae*. It is here confirmed that the nephridia and tubuloracemose prostates are equivalent in both taxa, therefore *P. obliquae* is a junior synonym of *P. hickmani* and, as a consequence of the overall similarities in these and in other respects, both are here synonymised under Spencer's prior *Perionychella richea*.

A species similar to *Perionychella richea* is *Perionychella dilwynnia* (Spencer, 1895) that may be distinguished by its slightly smaller size, fewer setae, spermathecal pores in 4/5-8/9 slightly wider in ab lines, and by a mid-ventral pad above the male pores on 18 as well as paired markings in 18/19/20.

DISTRIBUTION AND HABITAT

Widely distributed in Central and NW Tasmania, in wet sclerophyll/rainforest and swampy soils. The type-locality is Mt Olympus, Lake St. Clair; also known from Lake Rowallan, Pelion Valley, Cradle Mountain Road, Hellyer Gorge, Burnie (Fern Glade - this record is considered correct because of the date, cf. Jamieson's records of *Vesiculodrilus mortoni* and *Cryptodrilus polynephricus*), Castra, Parrawe, Smithton and from Interview River from *Obliqua*-forest. Spencer collected material of this species and *Woodwardiella tesselatus* under logs in a beech (*Notofagus cunninghami*)

forest; the neotype comes from the same habitat and was collected at Mt Olympus along with specimens of *Scolecoidea scolecoidea* (Spencer), *Vesiculodrilus santaclaris* and *Aporodrilus olympus* spp. nov.

Perionychella strzeleckii *sp.* nov.

Fig. 124.

MATERIAL EXAMINED

HOLOTYPE: 14:3754 (H), Flinders Island, Mt Strzelecki National Park, ER 925 485, 500 m, 2.xi.1992, QVM, (clitellate mature, dissected, figured).

PARATYPES: all with same details as H, ANIC:RB.98.1.17 (P1), (mature, dissected); TM:K1570 (P2), (mature, dissected); 14:3755 (P3), (mature, dissected); 14:3756 (P4), (mature, dissected; 14:3757 (P5), (mature).

EXTERNAL FEATURES

Body: robust. Lengths mm: (H) 215 (Ps) 180-185. Width: ca. 8.5 mm. Segments: (H) 252. Colour: unpigmented in alcohol with random dark dots equatorially; clitellum buff. Prostomium: epi-tanylobous, i.e., closed epilobous but with faint tapering extensions to intersegment. Clitellum: ½13-17. Dorsal pores: vestigial in 3/4, open from 4/5. Nephropores: not found. Setae: small and difficult to detect, perhaps five per side in anterior and 6-8 per side posteriorly giving segmental counts of 10-16, with other than ab in irregular rows. Spermathecal pores: in 5/6/7/8/9 in a setal lines. Female pores: large paired on 14. Male pores: on mounds in ab replacing these setae on 18. Genital markings: large round discs centred in b lines posteriorly in 10 and anteriorly in 11; much smaller pair anteriorly in 18; elongate pads midventral in 18/19, widely paired in 19/20-21/22 (H, Ps same).

INTERNAL ANATOMY

Septa: 5/6 thin to top of gizzard, 6/7-11/12 thickened. Gizzard: muscular flask in 6 (only in P3 can septum 5/6 be traced half-way down gizzard), preceded by crop. Oesophagus: annular calciferous glands in 15-16; valvular in 17. Nephridia: avesiculate holoic as convoluted tubules in anterior segments to ca. 14, thereafter as thick coiled tubules connected laterally to body wall by mesentery; not tufted in anterior; funnels not found despite thorough inspection. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-12 with connections to supra-oesophageal vessel in 9,10-12; calciferous glands and intestine in 18-25 highly vascularized. Spermathecae: four stumpy pairs in 6-9, round ampulla on thick duct with short diverticulum. Male organs: metandric, testes and funnels iridescent in 11 only; seminal vesicles large racemose in 12 only. Ovaries: composed of several long fine egg-strings, with oviducts in 13; large paired ovisacs in 14. Prostates:

tubuloracemose, folded in 18-17; penial setae present. Intestine: from 18, from 18-25,26 intestinal walls hardened but thin and not muscular; typhlosole absent but low dorsal ridge present from ca. 26; caeca absent; gut contains mucus and dark organic soil with quartz grits.

ETYMOLOGY: for the locality.

REMARKS

Perionychella strzeleckii is highly distinctive with its genital markings, four pairs of stumpy spermathecae, gizzard in 6, calciferous glands in 15-16, and its metandry.

DISTRIBUTION AND HABITAT

Mt Strzelecki National Park, Flinders Island.

Perionychella variegata Blakemore, 2000

Fig. 125.

Perionychella variegata Blakemore, 2000b: 17, fig 10.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3340, Sprent Basin, north Lake Pedder, 417600 5263100, 310 m, 9.iv.1996, R.J. Blakemore, in loam in Banksia/Ti-tree scrub on edge of lake, (mature specimen, dissected and figured).

PARATYPE: (P1) 14:3341, same details as H (posterior amputee, dissected); 14:3485, same details as H, (an immature, agreeing superficially).

SPECIMENS: 14:0074-0077 from Pelion Valley, Central Tasmania, QVM, (several mature and subadult specimens that comply with this taxon).

EXTERNAL FEATURES

Length mm: (H) 115. Width: ca. 5 mm. Segments: (H) 120. Colour: anterior and dorsum iridescent dark brown to flanks, ventrum yellow, clitellum brick-red (not ventrally). Prostomium: open epilobous, faint dorsal furrow. Clitellum: 13,14-17 (saddle-shaped, not pronounced). Dorsal pores: (rudimentary in 2/3) small in 3/4, more distinct from 4/5. Setae: longitudinal series not quite regular, 32-40 in anterior increasing up to ca. 42 in posterior, dorsal gap less than ventral gap. Nephropores: lateral in h-j ,k or f-g lines. Spermathecal pores: 7/8/9 between c or d lines. Female pores: minute, paired on 14 anterio-median to setae a (one pore slightly off-centre in H). Male pores: paired on low mounds in c (no setae between male pores , follicles possibly retained). Genital markings: paired just ventral of spermathecal pores posteriorly in 8; paired in b lines in 19/20.

INTERNAL ANATOMY

Gizzard: large and muscular in 5 but occupying 7-8. Oesophagus: dilated in 9-15, not calciferous. Nephridia: avesiculate holoic; not tufted anteriorly. Vascularization: dorsal blood vessel single; hearts in 10-12 from supra-oesophageal vessel in 9-12. Spermathecae: two pairs in 8 and 9, subspherical ampulla on short duct with simple diverticulum ectally. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose small in posterior of 9 and 10 and anterior of 11 and 12 (i.e., four pairs, although parasitic artefacts obscure some of these). Ovaries: palmate in 13; no ovisacs. Prostates: flat, tubuloracemose 17-

20,22; penial setae not found. Intestine: origin 17; no typhlosole; gut contains, woody material. Specimens infested with *Monocystis* sp. protozoan parasites.

REMARKS

Perionychella variegata is morphologically similar to *P. irregularis* (Spencer, 1895) and both are sympatric at Pelion Valley (pers. obs.). The major differences in *P variegata* are two rather than three pairs of spermathecae, and genital markings in 19/20 rather than 19/20/21. Another similar species is *P. eruca* that differs in its more ventral spermathecal pores, last hearts in 13, intestinal origin in 18 and the arrangement of its genital markings.

ETYMOLOGY: "variegata" for its variegated colouration.

DISTRIBUTION AND HABITAT

Lake Pedder in loam under Banksia/Ti-tree; Pelion Valley, Central Tasmania.

Tassiedrilus gen. nov.

Diagnosis Setae more than eight per segment. Dorsal pores present. Male pores from tubuloracemose prostates paired on 18. Oesophageal gizzard and intestinal gizzards in 5 and 20,21-24; extramural calciferous glands absent; typhlosole absent. Nephridia holoic without bladders, not tufted. Spermathecae two pairs, diverticula clavate, uniloculate.

Type species *Tassiedrilus griffithae* gen. et sp. nov., monotypic.

Etymology 'Tasmanian worm', (Tassie is the diminutive for this state). Masculine.

Distribution SW Tasmania.

Remarks *Tassiedrilus* is unique in being perichaetine, holoic with tubuloracemose prostates and having 'opisthogastric' intestinal gizzards. Were it not for these gizzards, the genus would comply with *Perionychella*, its possible precursor. *Retrovescus* is a similar genus from NW Tasmania that, however, is meroic.

Tassiedrilus griffithae gen. et sp. nov.

Fig. 126.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3641, Birchs Inlet, S.W. Tasmania, CN 753 878, 16.x.1993, J. Griffith, (mature dissected, figured).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 30. Width: ca. 1.5 mm. Segments: ca. 118. Colour: pale unpigmented. Prostomium: open epilobous. Clitellum: ½13-½17. Dorsal pores: from 5/6. Nephropores: not found. Setae: ca. 30 on 12, 26 or more on 20, and ca. 30 on tail. Spermathecal pores: 7/8/9 just lateral of setal a lines. Female pores: widely paired on 14. Male pores: on small discs in a-bc on 18. Genital markings: small paired discs presetal in a-c lines in 9 and 10; similar discs in a-b,c lines in 19/20 and 20/21.

INTERNAL ANATOMY

Septa: none thickened. Gizzards: weakly muscular and compact in 5 not much larger than pharynx in 4; intestinal gizzards in 20,21-24. Oesophagus: dilated slightly in 14-15, not calciferous; valvular in 16. Nephridia: avesiculate holoic – only one pair of simple lateral tubules found per segment despite re-checking; anterior tufting not noted; funnels not found. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-12, supra-oesophageal vessel not found. Spermathecae: two pairs in 8 and 9, conical ampulla on short duct with short, bulbous diverticulum occupying most of duct. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles in 9 and 12. Ovaries: small in 13 with oviducts; small paired ovisacs in 14. Prostates: tubuloracemose, S-shaped in 18-19; long penial setae present. Intestine: origin 17, dilated and thin walled in 17-19, strongly walled with muscular sheen in 20,21-24, these moniliform gizzards are smooth walled internally; typhlosole absent; gut contains organic material.

REMARKS

Tassiedrilus griffithae is remarkably similar to *Retrovescus mesibovi* (and initially I thought this small specimen was an allopatric anomaly). The only significant differences between these two species are that *T. griffithae* is holoic while *R. mesibovi* is meroic (just), lacks ovisacs, has intestinal gizzards in 20-26, and an

additional genial marking in 17. In order to confirm the differences, I re-checked as thoroughly as possible the nephridial and intestinal states in both species. As their descriptions are based on single specimens, further material is required to determine the permissible range of variations of these taxa.

ETYMOLOGY: named after the collector, Jane Griffith.

DISTRIBUTION AND HABITAT

Birchs Inlet, Melaleuca SW Tasmania, found in rainforest with *Perionchella eruca*.

Hypolimnus Blakemore, 2000

Hypolimnus Blakemore, 2000b: 4.

Diagnosis Setae more than eight per segment. Dorsal pores present but reduced (to midbody). Male pores from tubuloracemose prostates paired on 18. Multiple oesophageal gizzards in 5-6,½7; extramural calciferous glands absent; typhlosole absent. Nephridia vesiculate holoic. Spermathecae four pairs; diverticula single, uniloculate.

Type species *Perionychella (Vesiculodrilus) pedderensis* Jamieson, 1974: 251.

Etymology 'hypolimnus' Greek, - beneath the lake. Masculine.

Distribution Lake Pedder, Tasmania.

Remarks *Hypolimnus* is defined principally on the autapomorphic multiplication of oesophageal gizzards, that are apparently unique to this perichaetine, holoic megascolecid. The reduced dorsal pores are another feature of this genus. Were it not for these gizzards, the monotypic type-species would comply with *Perionychella* as defined above. Multiple gizzards in some or all of of 5-7 are found in *Digaster* Perrier, 1872, *Didymogaster* Fletcher, 1886 and *Perrisogaster* Fletcher, 1887; however, these three mainland Australian genera are lumbricine and meroic (see Blakemore, 1997b; 2000c). *Provescus* shares several characters with *Hypolimnus*, including multiple oesophageal gizzards, but this genus has dorsal pores from the anterior, tubular prostates, and lacks nephridial bladders.

Hypolimnus pedderensis (Jamieson, 1974)

Fig. 127.

Perionychella (Vesiculodrilus) pedderensis Jamieson, 1974: 251, figs. 12C (p. 244), 16W (p. 256).

Perionychella pedderensis; Dyne, 1991: 2, fig. 1.

Diporochaeta pedderensis; Driessen, 1999: 333, fig. 2.

Hypolimnus pedderensis; Blakemore, 2000b:18-20, fig 11.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K311, Lake Pedder, 146°12'E. 42°57'S, 25.ii.1971, P. Tyler, labelled thus: "Collected by Dr Peter Tyler on main beach of Lake Pedder, near where Maria Creek came to the lake. Dr P. Tyler pers. comm. 15.ii.1991, R.H. Green" - "sorted from interstitial fauna" (complete mature specimen, coiled and slightly damaged, previously dissected in the anterior only, re-inspected, re-figured). (Note: the type specimen was in good condition when last inspected by the author, but has subsequently been handled and re-figured by an artist in Driessen, 1999)

EXTERNAL FEATURES

Body tapering to tail, coiled with broad dorsal gutter in hindbody (possibly due to emaciation or preservation). Length mm: 50. Width: 1.5 mm. Segments: 129. Colour: anterior and dorsum faint brown pigmentation, yellowed in alcohol, clitellum buff. Prostomium: open epilobous (previously sectioned so furrowing not discernible). Clitellum: ½13-17 (damaged on lhs in 16). Dorsal pores: absent from anterior, present in midbody from 39/40 for about 35 segments (detected by mucal ejecta). Setae: 10 on 12 increasing to 24 in posterior with one or two extra setae caudally to give up to 28 per segment, in mostly regular series. Nephropores: lateral in straight series in c lines in anterior and d lines in posterior. Spermathecal pores: 5/6/7/8/9, diverging from just lateral of a lines, to mid-ab, to just median of b lines. Female pores: paired on 14. Male pores: paired on slight mounds in mid-ab lines on 18 with protruding penial seta, setae b retained. Genital markings: small, paired markings just anterio-median of spermathecal pores in 8; elongate pads in 17/18 and 18/19 as wide as male pores, extending to mid-ab; paired eye-like markings in ab in 19/20 and analogue in 20/21lhs.

INTERNAL ANATOMY

Septa delicate except for 11/12/13. Gizzards: muscular in 5, 6 and part of 7 (i.e., 2½ segments), smooth with muscular sheen externally, an anterior rim in 5 and a larger posterior rim in 6 that continues into 7, waisted at 5/6; previously sectioned and showing muscular body wall and deep longitudinal lamellae internally. Oesophagus: dilated in 8-13 but not calciferous, narrow in 14-16. Nephridia: vesiculate holoic with small, thickened, spherical bladders apparent only from segment 5; not tufted anteriorly, nephridia reduced in size before segment 12. Vascularization: dorsal blood vessel single, widened on intestine; hearts 10-12, supra-oesophageal vessel developed in 8-13. Spermathecae: four pairs in 6-9, sub-spherical or heart-shaped ampulla on short duct with simple diverticulum ectally, 8lhs slightly bifid, (Note: 8rhs and 9rhs had previously been removed and were loose in body cavity). Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles racemose in 9 and, larger, in 12. Ovaries: palmate in 13; large paired ovisacs present on anterior septum in 14. Prostates: tubuloracemose 18-19,20, surface slightly lobular with weak central canal on section; penial seta seen externally but not found internally (partially removed previously?). Intestine: origin 17; no typhlosole but low dorsal ridge present; gut contains mucus and several large quartzite grains (some of 0.8 mm diameter).

REMARKS

Dyne (1991: 2-3) inspected this holotype but concluded only that: "The type specimen of *P. pedderensis* in the Tasmanian Museum was re-examined to confirm the morphological characteristics recorded by Jamieson (1974)", he did however note that the original description erroneously attributed the collection to a Mr D Tyler. The current author's redescription considerably augmented the original account, with the following characters differing from the type description, or recorded for the first time:

1. Gizzards in 5-½7 (cf. "Gizzard moderate, in VI.").
2. Dorsal pores present, but confined to the mid-body (cf. "absent").
3. Nephropores lateral in c-d lines (cf. "?").
4. Clitellum ½13-16 (cf. "XIII-XVI" and as in Jamieson, 1974: fig. 12C).
5. Nephridia reduced before segment 12 (cf. "appearing rudimentary to VII").
6. Prostates tubuloracemose (cf. "thickly tubular").
7. Presence of a supra-oesophageal vessel (cf. "Suboesophageal").
8. Divergence of spermathecal pores to just median to b in 8/9 (cf. figs).

9. Correct locations of spermathecal pores and setae (cf. Jamieson, 1974: fig. 12C).
10. Absence of genital marking in 20/21rhs setal a line (described but not shown in Jamieson, 1974: fig. 12C).

According to Jamieson's description, this species would have been permissible in *Diporochaeta*, rather than *Perionychella*, for which it would qualify on the basis of its tubuloracemose prostates. The presence of multiple oesophageal gizzards (and reduced dorsal pores) warrant its placement in a new genus. Doubled or tripled oesophageal gizzards are a characteristic of several mainland genera (i.e., *Digaster*, *Perrisogaster*, *Didymogaster*), but these genera are lumbricine and meroic, whereas *Hypolimnus* is perichaetine and holoic. The Tasmanian genus *Provescus* shares several characters with *Hypolimnus*, including multiple oesophageal gizzards, but this genus has dorsal pores from the anterior, tubular prostates, and lacks nephridial bladders.

Results of a detailed taxonomic survey initiated and conducted by the author (Blakemore, 1996, 2000c) found several sympatric species that were morphologically close to *Hypolimnus pedderensis* (perhaps indicating a common ancestry), most notably those having some modification of the oesophagus in segments 6 and 7. For example, *Vesiculodrilus ventralis*, *Diporochaeta diadema*, *D. gordoni* and *D. rubertumula*, *D. lacustris* and *D. setosa*, were similar and one specimen of *D. lacustris* also had most of its dorsal pores occluded. However, none of these other species had such development of gizzards, and the question remains of whether the single specimen of *H. pedderensis* is an aberrant individual with regard to its dorsal pores. Unfortunately, this will probably remain the subject of speculation as the intensive survey of the new shoreline of Lake Pedder, including recently formed beaches in the region of Maria Creek, failed to locate any specimens corresponding with *H. pedderensis*, even allowing for the errors of the original account.

Furthermore, no additional material remained in the sample in which *H. pedderensis* was originally contained, apart from several immature tubificids - 14:3476, labeled "Lake Pedder, S.E. Tasmania, 15.ii.1971, P.A. Tyler from interstitial fauna", and a Zoology Dept. Univ. of Qld. label [in Jamieson's hand?]: "Loc. 45 - Enchytraeids" (22 specimens, shrivelled and brittle, apparently immatures).

DISTRIBUTION AND HABITAT

Known only from a single specimen collected from the original (now submerged) beach of east Lake Pedder, interstitial (in sand). Likely to be extinct. An intensive and extensive taxonomic survey of the locality by the current author (Blakemore, 1996; 2000b) found no trace of this species. An earlier survey funded by Tasmanian Parks and Wildlife by Dyne (1991) conducted between 28/2/1991-2/3/1991 reached similar conclusions but can hardly be considered extensive as two specimens were collected from only two sites, neither of which agreed with the type description.

Notoscolex Fletcher, 1886

Notoscolex Fletcher, 1886: 546; Michaelsen, 1900: 187, 1907: 160-162; Stephenson, 1930: 836; Lee, 1959: 317; Gates, 1959: 254; Jamieson, 1973: 235, 239; Blakemore, 1997a: 1688-1689; 2000b: 4; 2000c: 216.

Tokea Benham, 1904: 240.

Pseudonotoscolex Jamieson, 1971: 496.

Oreoscolex Jamieson, 1973: 238; 1974: 302.

Diagnosis: Setae 8 per segment. Dorsal pores typically present, at least in the posterior, or absent. Male pores from racemose or tubuloracemose prostates paired on 18. An oesophageal gizzard in 5 or 6 (or not developed, eg. in *N. pardus*). Nephridia meroic, at least in the fore-body, avesiculate, sometimes tufted. Spermathecae two to four pairs, or unpaired, typically with multiloculate sessile, or with one or more clavate diverticula. Typhlosole typically absent, or present; extramural calciferous glands typically present, or absent; intestinal caeca and gizzards absent. Penial setae typically present, or absent.

Type-species *Notoscolex camdenensis* Fletcher, 1886 from Burrawang, NSW. (Syntypes, MOV: G170).

Etymology Greek, "southern worm".

Distribution New South Wales, Victoria, Tasmania, southern Western Australia, southern Queensland, New Zealand, (?India), [Gates (1972: 132, 136) questions whether any south Indian species belong in this genus and has suggested that several of these, at least, be included in *Lennoscolex* Gates, 1960].

Included species No attempt can be made here to fully list nor revise this large genus that comprises more than 45 previously named Australian species, including those returned from *Pseudonotoscolex* and *Oreoscolex* but excluding those subsequently transferred to *Cryptodrilus* and *Aporodrilus*. Eleven species are known from New Zealand, confined to the north of the North Island (Lee *et al.*, in press), most of which were at some time placed in the genus *Tokea*. This latter genus was made junior synonym of *Notoscolex* following Michaelsen (1916 as stated by Stephenson, 1930: 837), (cf. Lee, 1959). Thirteen species were previously described from Tasmania, two of these are placed in synonymy (*Notoscolex dinephrus* Blakemore, 2000b under *N. pilus* Blakemore, 1997a and *N. sexathecatus* (Jamieson,

1974) under *N. officeri* (Spencer, 1895)), eleven new species are added bringing the generic total in this State to 22 species.

Remarks

The above definition is based on the 'classical' definitions of Michaelsen (1907) and Stephenson (1930), as supported by Blakemore (1997a, 2000c) where the above synonymies are discussed. *Oreoscolex* was defined for species with unpaired spermathecae, which now seems unlikely to be of more than specific value (see Gates, 1972: 132), and this genus was therefore placed in the synonymy of the prior genus *Notoscolex* by Blakemore (2000c). Jamieson (1974: 266, 302) had expanded his definitions of both *Cryptodrilus* and *Oreoscolex* so that they were not mutually exclusive and, moreover, subsumed the characters of the prior genera *Megascolides* and *Notoscolex*. Under the present revision, only the demonstrable attainment of nephridial bladders serves to separate *Cryptodrilus* from the prior genus *Notoscolex*. In the Tasmanian fauna there is an apparent morphological (and geographical) distinction in species that comply with the above diagnosis and those, lacking dorsal pores, that conform to *Aporodrilus*.

Notoscolex acanthodriloides (Jamieson, 1974), comb. nov.

Fig. 128.

Pseudocryptodrilus acanthodriloides Jamieson, 1974: 298-299; figs. 26A, B, 32S.

Megascolides acanthodriloides; Blakemore, 1997: 1706: 2000c: 197.

MATERIAL

HOLOTYPE: TM:K355 (H), Great Lake, Central Highlands, 41°55'S.146°45'E, 26.v.1954, J.L. Hickman, (mature, previously dissected with rhs spermathecae and rhs prostate removed and missing from jar, here re-inspected and re-sketched).

PARATYPES: TM:K356 (P2), same details as H, (aclitellate, previously dissected); TM:K357 (P3), same details as H, (aclitellate, dissected); TM:K358 (P4), same details as H, (aclitellate, undissected); TM:K359 (P5), same details as H, (aclitellate, undissected); BM: 1973:2:31-33 (P1, 11, 13), same details as H, (not found in Natural History Museum, London, Miranda Lowe pers. com.); AM:W5320-5321 (P7, 12), same details as H, (not inspected).

EXTERNAL FEATURES

Body flattened after clitellum, ventrum in region of spermathecal pores puckered in bb. Lengths mm: 65-70. Width: ca. 3 mm. Segments: 126-127. Colour: uniform buff in alcohol. Prostomium: epilobous, faintly closed and with slight mid-dorsal furrow to first intersegment (cf. "epitanylobous", Jamieson). Clitellum: ½13-17. Dorsal pores: from 4/5. Nephropores: sporadically visible in a, b and d lines. Setae: 8 in regular rows but d lines irregular on last ten segments (in H). Spermathecal pores: at anterior margins of 8 and 9 just lateral of a lines. Female pores: widely paired on 14. Male pores: in a lines. Genital markings: paired elongate pads in ab extending from setal lines of 18-19; additional pair often present in ab in 17/18 (eg. in P2).

INTERNAL ANATOMY

Gizzard: large in 5 with anterior flange. Oesophagus: dilated in 15-16, possibly forming rudimentary calciferous pouches; valvular in 17. Nephridia: avesiculate meroic, two (sometimes three?) tubules per side approximately in a and b lines; single nephridium per side in last twelve segments (in H); tufted anteriorly in 2-4. Vascularization: hearts 10-12 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9; heart-shaped ampulla on short duct with small clavate diverticulum. Male organs: holandric, testis in 10 and 11; seminal vesicles in 9 and 12. Ovaries: in

13; small ovisacs in 14. Prostates: in 18-19 described by Jamieson as "flattened, tubular, tortuous", here construed as tubuloracemose because the surface is lobulated and no central canal was found in section (on lhs in H as rhs prostate removed, also in P2-3); penial setae slender, 0.6 mm long (removed from H, present in P3). Intestine: from 18; typhlosole absent; gut contains organic matter.

REMARKS

Following Blakemore (1997a), *Pseudocryptodrilus* with type species *Megascolides diaphanus* Spencer, 1900 is synonymized under *Megascolides*, but having non-tubular prostates qualifies *Notoscolex acanthodriloides* for inclusion in *Notoscolex*. The current account considerable augments the original description, despite the damaged holotype, eg. determination of epilobous peristomium. Although the prostates of *N. acanthodriloides* were described by Jamieson (1974: 296,299) as "depressed tubular" or "flattened, tubular", the lobulated, glandular surface and lack of characteristic central canal when that of the holotype was sectioned confirms the prostate form as tubuloracemose. The prostates of the paratypes are thicker, more lobulated and even more convincingly tubuloracemose. The elongate markings of *N. acanthodriloides* are similar to those found in *Notoscolex bidiverticulatus*, *N. liffey*, and *N. penguini*.

DISTRIBUTION AND HABITAT

Shore under decaying gum leaves Great Lake (Hickman).

Notoscolex bidiverticulatus (Jamieson, 1974), comb. nov.

Fig. 129.

Oreoscolex bidiverticulatus Jamieson, 1974: 305-307, figs. 27A, 32J (p.325).

Notoscolex bidiverticulatus; Blakemore, 1997a: 1706.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K362, Fern Glade, Emu River, Burnie, 24.viii.1954, J.L. Hickman, (mature, mutilated by previously dissection with rhs spermatheca and lhs prostate removed and missing from jar, here re-inspected and re-figured).

PARATYPE: BM:1973:2:35 (P1), same details as H, (not located in British Museum, per. obs.).

EXTERNAL FEATURES

Lengths: 106 (P) -145 (H) mm. Widths: 4-5 mm. Segments: 120 (H) -141 (P). Colour: uniform buff in alcohol, clitellum paler. Prostomium: open epilobous. Clitellum: ½13-17. Dorsal pores: from 4/5. Nephropores: not found. Setae: 8 throughout. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14. Male pores: on small papillae in a lines on 18. Genital markings: two elongate pads (tubercula pubertatis) in ab lines from ½17-½19.

INTERNAL ANATOMY

Gizzard: large in 5. Oesophagus: large sessile calciferous glands paired in 15 and 16. Nephridia: avesiculate meroic, tufted anteriorly in 2-5 (cf. 2-7 Jamieson), then reducing in size especially after the clitellum, where they are in intermittent bands associated with anterior septa but funnels not found even at highest (X 64) magnification. Vascularization: hearts 10-13; supra-oesophageal vessel 7-14. Spermathecae: two pairs in 8 and 9, saccular ampulla tapers to thin duct with diverticula single bifid, or paired but converging ectally on same side of duct; (in H 8rhs single bifid, 9lhs and, from fig32J, 9rhs paired; P was described with one diverticulum). Male organs: holandric, testis in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: in 13; small ovisacs paired in 14. Prostate: tightly-coiled and thickly tubuloracemose in 18 (lhs prostate removed and missing from jar, cf. "racemose" Jamieson); penial setae ca. 1mm long stated as present (but removed from H). Intestine: from 17 (cf. 18 Jamieson); deep typhlosole from 23 (cf. continued to 19, Jamieson).

REMARKS

The current account considerable augments the original description, despite the damaged holotype. Differences from, and additions to, the type description are: colouration, prostate resolvable into tubuloracemose rather than racemose, intestinal origin in 17 rather than 18, typhlosole from 23 rather than 19, the lack of obvious preseptal nephridial funnels, and full descriptions of the spermathecae. Jamieson's remarks that "intraspecific variation from one to two diverticula on a spermatheca is highly unusual in the Oligochaeta but there is no doubt that the holotype and paratype are conspecific" is contraindicated by this variation occurring within a single specimen - the holoype. When all the spermathecae of specimens are actually checked, this phenomenon is found quite regularly (eg. see accounts of *Heteroporodrilus* spp in Blakemore, 1994; 2000; and of *Caecadrilus* below), and further demonstrates the advantage of the current author's style of illustration. *Notoscolex bidiverticulatus* is similar to *N. penguini* that also has spermathecae with either one or two diverticula occurring within the same specimen, as is discussed under that species' account.

DISTRIBUTION AND HABITAT

The "Fern Glade, Burnie" locality would have to be taken with some reservation as Jamieson had erroneously given this data for some of his other specimens, eg. *Cryptodrilus polynephricus*, that were actually collected by Prof. J.L. Hickman from Fern Tree, Hobart. Re-survey of the Fern Glade site by the author failed to locate further material of this species there, however a remarkably similar species - *Notoscolex penguini*, occurs nearby and, by association, it is therefore possible that Burnie is the correct locality.

Notoscolex campestris (Spencer, 1895)

Fig. 130.

Crytodrilus campestris Spencer, 1895: 39, figs. 13-15; Jensz & Smith, 1969: 86.

Notoscolex campestris ; Michaelsen, 1900: 192; 1910: 102.

Oreoscolex campestris ; Jamieson, 1974: 307-309, figs. 28A [segments misnumbered], 32K.

MATERIAL EXAMINED

SYNTYPES: NMV: G48, Parattah, SE Tasmania, collected by W.B. Spencer, February, 1893, in damp earth under logs, (one dissected entire worm, four complete specimens and one fragment, all in poor, shriveled condition yielding little useful information).

SPECIMENS: TM:K298, Parattah, 147°25'E.42°20'S., 18.viii.1954, V.V. and J.L. Hickman, under moss, in earth at base of cliff, also in earth along edges of logs, (nine specimens, six specimens here attributed to *N. campestris*, the largest of which is figured and dissected for the present description, plus three immatures probably of a *Vesiculodrilus* sp.; all these specimens were apparently included by Jamieson (1974: 243) under his wide characterization of *Vesiculodrilus hobartensis* (Spencer, 1895)); TM:K363-367, same details, (five specimens inspected by Jamieson); BM:1973:2:36-41, same details, (six specimens); AM:W5324-5328, same details, (five specimens, not re-inspected here).

EXTERNAL FEATURES

Lengths: 50-75 mm (Spencer), other material 80-90 mm. Width: ca. 2.5 mm. Segments: ca. 100. Colour: "when alive whitish with pink clitellum, the same colour retained, only duller, in spirits" (Spencer). Prostomium: small, epilobous, faintly furrowed. Clitellum: 13-17. Dorsal pores: from 3/4 (Spencer), or 4/5. Nephropores: not visible. Setae: 8 throughout, cd almost dorsal and the interval dd narrowing posteriorly. Spermathecal pores: 7/8/9 in or just lateral of a lines. Female pores: paired on 14. Male pores: near to a lines on low papillae in ab on 18. Genital markings: large circular patches, paired in ab (figured presetally by Spencer) in 17 and in ab in 18/19 and 19/20 (Spencer); or paired discs in ab in 17/18, and in some of 18/19,19/20-21/22,22/23 in new material.

INTERNAL ANATOMY

Septa: 5/6 flimsy to base of gizzard. Gizzard: huge in 5 but sometimes appearing to be in 6, displaced and occupying 6-10. Oesophagus: dilated in 12-14; not calciferous (Spencer) or appearing calciferous in some specimens (eg. in 12-13 in TM:K298); constricted and valvular in 15. Nephridia: large tufted nephridia present in segment 4, otherwise avesiculate meroic as compact clusters in anterior, reduced in posterior to about two or three per side. Vascularization: dorsal blood vessel single; hearts 10-12; supra-oesophageal vessel 7-14. Spermathecae: two pairs in 8 and 9; saccular ampulla tapers to duct with sessile or short-stalked, multiloculate diverticulum described by Spencer as "rosette-shaped". Male organs: holandric, testis in 10 and 11; racemose seminal vesicles in 9 and 12. Ovaries: in 13; ovisacs small in 14 (not recorded by Spencer). Prostates: small, flattened tubuloracemose or racemose in 18; short penial setae present (not recorded by Spencer). Intestine: from 16 (confirmation of Spencer); large T-shaped typhlosole from 19 (not recorded by Spencer); gut often contains organic soil and quartz grits.

REMARKS

Additions to the type description of *Notoscolex campestris* are the huge gizzard; the presence of small ovisacs in 14; small penial setae in 18, and a well-developed typhlosole from 19. The range of the genital markings has also been extended and differs slightly from Spencer's account, although agreement on other points suggests conspecificity. Spencer described and figured the prostates as "small and flattened", i.e. tubuloracemose or racemose, while Jamieson construed them as "originating from a tubular type".

DISTRIBUTION AND HABITAT

Parattah, SE Tasmania, in damp earth under logs; although collected from there by Hickman in the 1950's, specimens were not relocated at the type-locality during surveys by the author.

Notoscolex dorazioi sp. nov.

Fig. 131.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1491, Dalgarth Forest Reserve, N Tasmania, EQ 722 325, 30.vi.1992, R.D. D'Orazio, wet sclerophyll, (mature, dissected and drawn).

PARATYPES: (P1, P4) ANIC RB.97.5.9, Champion Reserve, NW Tasmania, 3 km along Pumping Station Road Forth, DQ 372 372, 40 m, R.D. D'Orazio and M. Cooper, wet sclerophyll, (two matures, one dissected); (P2, P5) TM:K1555, same details as P1, (two matures, one dissected); (P6) 14:810, same details as P1, (mature, sketched and dissected); (P7) 14:3655, same details as P1, (mature, sketched and dissected); (P8) 14:3057, same collection details as H, (dissected); (P9-14) 14:3058, same collection details as H, (one mature and four sub-adults); (P15) 14:886, Lower Wilmot, NW Tasmania, 5km from bridge at ALMA SRA towards Lower Wilmot, DQ 346 277, 240 m, 31.viii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, sketched and dissected); (P16) 14:709, Mt Roland, Minnow Creek, N Tasmania, Belstone Road until Minnow Creek, DQ 429 078, 300 m, 24.xi.1992, R.D.D. and M. Gittus, wet sclerophyll forest, (mature, sketched and dissected). dissected); (P17) 14:3523, same details as P16, (mature, dissected).

SPECIMENS: all superficially agree, 14:1495, same collection details as H, (six subadult or immature specimens); 14:3656, same details as P1, (18 subadult or immature specimens); 14:886, same details as P15, (six matures and two immatures); 14:1461, Dazzler Range, N Tasmania, EQ 764 349, 330 m, 29.vi.1992, R.D.D'Orazio and A. Mitchell, poor remnant rainforest, (seven matures, one dissected, and five immatures); 14:1466, Dazzler Range, EQ 756 389, 510 m, 29.vi.1992, R.D.D'Orazio and A. Mitchell, rainforest, (three matures, one dissected, and two immatures); 14:469, Lake Paloona Road, NW Tasmania, DQ 373 298, 75 m, 25.xi.1992, R.D.D'Orazio and M. Gittus, dry sclerophyll, (twelve matures and subadults, one dissected, and four immatures); 14:458, Mt Roland, Sheffield, DQ 406 115, 390 m, 23.xi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll, (mature, not well preserved, dissected); 14:164, Dazzler Range, EQ 755 376, 415 m, 29.vi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll, (three immatures); 14:3525 + 14:706, Mt Roland, Short Spur Rd., DQ 446 088, 240 m, 24.xi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll, (mature, dissected, plus twelve matures and two immatures); 14:371, Eugenena, Arboretum

Nature Trail, NW Tasmania, DQ 414 357, 50 m, 26.viii.1992, R.D.D. and M.C., wet sclerophyll, (two aclitellate matures, both sketched and dissected - while agreeing superficially, both have annular calciferous glands most developed in segment 15, and one has a few supernumerary setae on two tail segments).

EXTERNAL FEATURES

First intersegment sometimes weak. Lengths mm: (H) 70, (P1) 80,(P2) 85, (P6) 110, other matures 60-110 mm. Width: ca. 4 mm. Segments: (H, P2, P7) 100; (P1) 112; (P6) 140, (P8) 118. Colour: uniform pale in alcohol. Prostomium: epilobous often with extensions of furrows almost to first intersegment, or faintly tanylobous where especially when first intersegment weak. Clitellum: not marked in H, in ½13-17 in clitellate matures. Dorsal pores: rudimentary in 3/4, larger from 4/5. Setae: 8 throughout, in slightly irregular series posteriorly. Nephropores: sometimes seen faintly in a lines. Spermathecal pores: 7/8/9 just lateral of setal a lines. Female pores: paired on 14, (or single in P17, possibly anomalous). Male pores: paired in ab lines on low papillae. Genital markings: pair of small papillae or elongate pads median to spermathecal pores in 8/9 (eg. in H, P1, P6, P8, P15-16); closely paired or single discs midventral just in front of setal arc in aa variously in some of 7-11, or absent; elongate bands composed of several small papillae in bb in 16/17 and/or 19/20, and in 20/21 and, sometimes 21/22; elongate pads sometimes with small papillae or paired markings on either side of male pores in 17/18 and 18/19. INTERNAL ANATOMY

Septa: 8/9-12/13 with slight thickening, thin septum 5/6 runs to the top of the gizzard, 6/7 to its base. Gizzard: solid in 6, preceded by a proventriculus. Oesophagus: dilated and internally lamellate in 14 and 15, sufficiently developed to be considered calciferous glands in most specimens. Nephridia: avesiculate meroic, ca. three or four small, spiral clumps per side, discrete but interconnected, the innermost not especially enlarged; not tufted anteriorly; no funnels nor ureters seen in posterior. Vascularization: hearts 10-12; supra-oesophageal vessel 9-12,13. Spermathecae: two pairs in 8 and 9, saccular ampulla on shorter duct with small clavate diverticulum on duct. Male organs: holandric iridescent testes and funnels in 10 and 11; seminal vesicles absent from 9, in 10 (H only, possibly parasitic artefacts?), and racemose in 11 and 12 on the anterior septa. Ovaries: palmate in 13; ovisacs not found in H, small in some other specimens. Prostates: in 18 racemose with almost circular outline around small flaccid duct; penial setae not found. Intestine: origin 17 (in H) or ½17-

18 in some other specimens; thin lamellar typhlosole from 19,20 soon becomes deep and substantial; gut contains plant remains and woody material and often shining mica/quartz grains, or reddy clay in Arboretum specimens.

REMARKS

Unique characters of *N. dorazio* are an often weak first intersegment, the gizzard in 6, calciferous glands in 14-15, seminal vesicles in 11 & 12, and an intestinal typhlosole. The shape of the spermathecae and seminal vesicle arrangement are reminiscent of *N. simsoni* Spencer, 1895. However, *N. dorazio* lacks the elongate markings in 10/11/12 and has extra markings in some of 16/17-20/21, as well as last hearts in 12, rather than 13. Considerable variation in the distributions of genital markings, in specimens that are otherwise inseparable, appears permissible in *N. dorazioi* and, characteristically, the intersegmental markings are often composed of numerous small papillae.

ETYMOLOGY: in recognition of the collector, Rob D'Orazio who has assiduously collected many of the samples used in the present study.

DISTRIBUTION AND HABITAT

N/NW Tasmania: Dalgarth Forest Reserve, Champion Reserve, Lower Wilmot, Mt Roland, also found at Dazzler Range and Eugenana, often in wet sclerophyll forest.

Notoscolex duplex sp. nov

Fig. 132.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:358, Coal River Gorge Nature Reserve, 6km along Rhydaston Rd, SE Tasmania, EN 325 965, 310 m, 17.viii.1992, R.D. D'Orazio and M. Cooper, sampled from dry sclerophyll gully, (mature specimen, dissected and drawn).

PARATYPES: (P1) 14:1713, Spinning Gum Forest Reserve, SE Tasmania, EN 393 950, 460 m, 17.viii.1992, R.D.D and M.C., (mature, sketched and dissected); (P2) 14:3678, same details as P1, (mature, dissected); (P3) 14:3679, same details as P1, (mature, dissected); (P4-8) 14:3680, same details as P1, (five matures); (P9) 14:3666, Tooms White Gum Reserve, EP 701 226, 600 m, 11.viii.1992, R.D.D. and M.C., remnant rainforest, (mature dissected); (P10-12) 14:3686-3688, same details as P9, (mature, dissecte, a juvenile and an immature); (P13) 14:356, Brookerana Reserve, EP 709 193, 590 m, 11.viii.1992, R.D.D and M.C., wet sclerophyll, (mature, dissected); (P14) 14:3685, same details as P13, (mature, dissected).

EXTERNAL FEATURES

Lengths mm: range 70-210, (H) 70, (P1) 185; (2-8) 110-210, (P9) 80, (P13-14) 90. Width: ca. 3-4 mm. Segments: (H) 120, (P1) 143, (P2) 147, (P13-14) 110-115. Colour: uniform yellow tinge in alcohol with several dark equatorial dots in anterior; clitellum buff. Prostomium: open epilobous, often tapering. Clitellum: 14-17 but impinges onto adjacent segments. Dorsal pores: small in 3/4 open from 4/5. Nephropores: not found. Setae: 8 throughout but immediately after clitellum c and d move more dorsally and d is close to mid-dorsum. Spermathecal pores: 7/8/9 in setal a lines. Female pores: paired on 14. Male pores: on 18 in a on small papillae in ab. Genital markings: paired discs in ab in 17/18; wide tumid pad in bb in 19/20; extra pad weak on rhs in 15/16 in P1.

INTERNAL ANATOMY

Septa: none especially thickened, septum 5/6 thin to base of gizzard. Gizzard: large and muscular in 5 preceded by proventriculus. Oesophagus: dilated in 10-13, narrow in 14-15. Nephridia: avesiculate meroic, flattened ventral clusters of numerous tubules in anterior, form bands of ca. 8-12 discrete tubules per side after clitellum; (in H, but not in P1) tufted in the anterior in 2-4. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-12 from supra-oesophageal

vessel in 10-12,13,14. Spermathecae: two pairs in 8 and 9; elongate ampulla on longer duct with sessile, multiloculate diverticulum as crescent near exit of duct. Male organs: holandric, testis iridescent in 10 and 11 in mucus; seminal vesicles in 9 and 12; pseudovesicles may also occur in 13-14 (eg, in P1). Ovaries: compact in 13; small ovisacs in 14. Prostates: flattened tubuloracemose or racemose in 18; penial setae present. Intestine: from 16 (H, P2) or ½16 (P1), dilated and vascularized in 16-17,18 but thin walled and not muscular (this modification is considered to be intestinal rather than oesophageal); deep T-shaped typhlosole develops from 18 (H) or 19 (P1); gut contains organic matter and sand grains, or fine red soil in Tooms Reserve specimens.

REMARKS

The distinctive elongate pad in 19/20 in *Notoscolex duplex* is similar to that in *N. wellingtonensis*, but it is distinguished by an additional pair of markings in 17/18. The migrating d setae and T-shaped typhlosole are also found in *N. campestris* that differs on its paired rather than elongate markings in 19/20. These three species occur in the same region; *N. duplex* is also sympatric with *N. triplex*.

ETYMOLOGY duplex, Latin – 'double', for the two sets of spermathecae (cf. *N. triplex*).

DISTRIBUTION AND HABITAT

Coal River, and adjacent Reserves, SE Tasmania in dry or wet sclerophyll.

Notoscolex geevestoni sp. nov.

Fig. 133.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1720, Geeveston, South Weld Rd., 6 kms passed Tahune Forest Reserve, SE Tasmania, DN 755 347, 235 m., 13.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, macerated in midbody, dissected and figured).

PARATYPES: (P1) ANIC:RB.00.1.14, same details as (H), (mature dissected); (P2) 14:3712, same details as (H), (mature, posterior amputee, dissected); (P3-7) 14:3713, same details as (H), (five specimens, four matures, P6 aclitellate, plus one juvenile that superficially agrees); (P8) 14:0426, same details as (H), (four specimens, one aclitellate mature, dissected, plus three juveniles two of which superficially agree).

EXTERNAL FEATURES

Body slightly laterally flattened to tail. Lengths mm: (H) ca. 200, (P1) 210, (P3-P6) 120-150, (P7, juvenile) 100, (P8) 100. Width: ca. 3 mm. Segments: (H) ca. 200, (P1) 218, (P8) 217. Colour: unpigmented in alcohol with small dots near setae in anterior segments; clitellum buff. Prostomium: small, open epilobous. Clitellum: weak ventrally, 13-17 just overlaps adjacent segments. Dorsal pores: absent from anterior, only occur between last 30 segments of tail (in H at least). Nephropores: not found (slight indentations in b and d lines sometimes seen). Setae: small, 8 per segment in regular rows. Spermathecal pores: in 7/8/9 in setal a lines. Female pores: widely paired anterior to setae a on 14. Male pores: on small mounds in ab lines. Genital markings: large paired discs within tumid patches in b lines in 10/11 (all mature specimens), plus on rhs in 9/10 (P5); smaller paired discs in ab lines in 16/17 (P4), 17/18 (H, P1-5, P8) and 18/19 (P2-P5) or 19/20 (P1, P3lhs, P4).

INTERNAL ANATOMY

Septa: 9/10/11 slightly thickened. Gizzard: muscular barrel in 5 preceded by crop. Oesophagus: increasingly dilated and vascularized in 8-15, but not considered calciferous; valvular near 15/16. Nephridia: avesiculate meroic, about five tubules per side attached anterior to setal follicles: two in b lines, one in c, and one in d, plus one above d lines; after clitellum reduce in size and about three per side, funnels and tufting not found. Vascularization: dorsal blood vessel single; hearts in 10-12 from supra-oesophageal vessel in 10-12. Spermathecae: two pairs in 8 and 9, conical ampulla on thin duct with medium sized diverticulum ectally. Male organs: holandric,

iridescent testes and funnels in 10 and 11; seminal vesicles racemose anteriorly in 11 and 12. Ovaries: small in 13; small paired ovisacs in 14. Prostates: in 18-19, elongate with slight surface lobulation and, in section, large central canal that has small side canalicules, interpreted as (just) tubuloracemose rather than tubular; duct muscular, joined near junction by vasa deferentia; penial setae present up to 1mm long. Intestine: origin posteriorly in 16; typhlosole absent; intestinal gizzards absent; gut contains fine yellow soil. Note: ventral nerve cord in H has thick longitudinal muscle fibres on either side in anterior.

REMARKS

Distinctive features of *Notoscolex geevestoni* are the markings in 10/11 (seen in all specimens) and seminal vesicles in 11 and 12, cf. *N. huoni* in 9 & 12. The reduced dorsal pores in these two species are also characteristic of *N. index*, (*N. leai*?), and *N. longus* that differ with regard to their shapes of spermathecae, seminal vesicles and typhlosoles.

ETYMOLOGY: for the type-locality.

DISTRIBUTION AND HABITAT

Geeveston, SE Tasmania, in wet sclerophyll, found with *Notoscolex huoni*.

Notoscolex gogensis sp. nov

Fig. 134.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3776, Gog Range, N Tasmania, DQ 560 055, 230 m, 16.xii.1991(?), R.M. (Bob Mesibov) and T.S. (Tammy Scarborough), wet sclerophyll on flowline, (mature missing tail, sketched and dissected).

PARATYPES: none.

EXTERNAL FEATURES

First segment weakly defined, almost suppressed. Length mm: (H) 53+. Width: ca. 2.5 mm. Segments: 94+. Colour: pale in alcohol with only slight coloration of segmental equators; clitellum cream. Prostomium: tanylobous. Clitellum: 13-17. Dorsal pores: from 3/4. Nephropores: not found. Setae: 8 through to cut. Spermathecal pores: paired at anterior of segments near 7/8/9 in a lines. Female pores: paired on 14 in patch. Male pores: on 18 in a on large protuberant mounds in ab on 18. Genital markings: mid-ventral pad in aa in 17/18 and 18/19; large paired disks in aa in 19/20 with rhs analogues in 20/21 and 21/22.

INTERNAL ANATOMY

Septa: thin. Gizzard: in 5, displaced to occupy 7-8. Oesophagus: dilated in 15-16, internally lamellate and forming annular calciferous glands; valvular in 18. Nephridia: avesiculate meroic, after clitellum clusters of ca. three tubules per side: two in ab lines, and one in mid-bc that extends to d lines; not tufted in anterior. Vascularization: dorsal blood vessel single onto pharyngeal mass in 3; hearts 10-12 from supra-oesophageal vessel in 8-12. Spermathecae: two pairs in 8 and 9; saccular ampulla on duct with clavate diverticulum mid-length. Male organs: holandric, testis small, iridescent in 10 and 11; seminal vesicles in 11 and 12. Ovaries: palmate in 13; small paired ovisacs in 14. Prostates: flattened, bilobed tubuloracemose or racemose in 18 on thick duct; penial setae not found. Intestine: from 18; deep lamellar typhlosole develops from 23; gut contains organic soil and debris.

ETYMOLOGY for the type-locality.

REMARKS

Notoscolex gogensis appears distinct in the genus in Tasmania by its combination of tanylobous prostomium, prominent male pore mounds, the distribution of its genital markings, and its calciferous glands in 15-16. Because there is only one

specimen, and this is missing the tail, it is not certain that the setae do not increase caudally, although this species has close morphological affinities with other members of *Notoscolex*. It is especially similar to *N. dorazio*, with seminal vesicles in 11 & 12m but differs by having calciferous glands and typholosole displaced further posteriorly, and paired rather than papillated genital markings.

DISTRIBUTION AND HABITAT

Gog Range, N Tasmania, from wet sclerophyll forest on flowline.

Notoscolex huoni sp. nov.

Fig. 135.

MATER,AL EXAMINED

HOLOTYPE: (H) 14:3605, Geeveston, South Weld Road 6km passed Tahune Forest Reserve, SE Tasmania, DN 755 347, 235 m., 13.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, dissected and figured).

PARATYPE: (P) ANIC:RB.00.1.15, same details as (H), (mature dissected).

EXTERNAL FEATURES

Lengths mm: (H) 62, (P) 60. Width: ca. 2 mm. Segments: (H) 130, (P) 136. Colour: white unpigmented in alcohol with small dots near equators of anterior segments; clitellum cream. Prostomium: small, open epilobous. Clitellum: weak ventrally where markings impinge, ½13-17. Dorsal pores: absent from anterior, only occur between final six segments of tail (in H), not found in P. Nephropores: not found. Setae: 8 per segment in regular rows, d setae soon move more dorsally to give almost equal intervals between all setae. Spermathecal pores: in 7/8/9 in setal a lines. Female pores: widely paired on 14. Male pores: on 18 near to b lines and lateral to protruding setae on low mounds in ab. Genital markings: large paired discs with white centres filling ab lines in 10/11 (P) and/or 11/12 (H), elliptical disks mostly with white centres near a lines but some extending almost to b lines in 14/15/16/17 and 19/20/21 (H,P), plus weak pair of sunken, elongate pads in 17/18 in ab in H.

INTERNAL ANATOMY

Septa: none thickened. Gizzard: muscular cone in 5. Oesophagus: not especially dilated; valvular in 15. Nephridia: avesiculate meroic, in anterior about nine tubules per side attached near setal follicles: five in a lines, two in b lines, one each in c and d; after clitellum reduce in size and number to about six per side, in 3-6 nephridial clusters possibly form tufts, sending composite ducts forward in a lines; funnels not found.. Vascularization: dorsal blood vessel single; hearts in 10-12 from supra-oesophageal vessel in 8-12. Spermathecae: two pairs in 8 and 9, sub-spherical ampulla on compressed duct with medium sized diverticulum on its mid-length. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles saccular in 9 and 12. Ovaries: in 13; ovisacs absent. Prostates: tubuloracemose in 18 (H) or 18-19 (P); small dark penial setae present but same size as regular setae. Intestine: origin in 16; typhlosole absent but low ridge occurs from 31,32; intestinal gizzards

absent although intestinal wall is thin and smooth in 16-27,28; gut contains organic soil.

REMARKS

Notoscolex huoni specimens were from the same samples as *N. geevestoni*, and although both species have reduced dorsal pores, they can be differentiated on the body size, arrangement of genital markings and seminal vesicles which are in 9 & 12 or 11 & 12, respectively. *N. longus* differs, at least, by having intestinal origin after 17 and a typhlosole. *Notoscolex huoni* superficially resembles some species in *Cryptodrilus* and *Aporodrilus* but is separated from these on its lack of nephridial bladders and presence of dorsal pores. Dorsal pores are only just present in H, and were not found in P, that agrees in all other respects suggesting either that this is a species in transition, or possibly that the paratype is a posterior regenerate.

ETYMOLOGY: for the Huon Valley type-locality.

DISTRIBUTION AND HABITAT

Geeveston, SE Tasmania, from wet sclerophyll.

Notoscolex index sp. nov

Fig. 136.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:629, Geeveston, SE Tasmania, 1.65km along Peppers Road to site, DN 857 252, 260 m, 12.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, dissected and drawn).

PARATYPE:(P) ANIC:RB.00.1.16, same details as H, (mature, disected);

SPECIMEN: 14:3060, same details as H, (an immature).

EXTERNAL FEATURES

Length mm: (H, P) 115. Width: 3 mm. Segments: (H, P) 147-146. Colour: unpigmented in alcohol, clitellum buff. Prostomium: tanylobous. Clitellum: ½13-17, appears saddle shaped due to raised pale ventral area. Dorsal pores: absent from anterior but are minute and just visible in posterior. Nephropores: not found. Setae: 8 in regular rows throughout. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14. Male pores: in small longitudinal slits in a lines. Genital markings: large paired discs on mounds in ab in 10/11 and 11/12; trio of smaller discs in longitudinal series in 17/18, 18/19 and just lateral of male pores on 18, (H and P same).

INTERNAL ANATOMY

Septal glands: in 4-5. Septa: 10/11-12/13 slightly thickened, septum 5/6 to top of gizzard, 6/7 to its base. Gizzard: solid, appearing in 6 due to position of septa, preceded by a crop. Oesophagus: dilated and lamellate 8-13, contracted in 14-15, not calciferous. Nephridia: avesiculate meroic, numerous but largest ones appear to be associated with setae on each side, after clitellum these are much reduced in size; funnels not found; not tufted anteriorly but denser. Vascularization: hearts 10-12; supra-oesophageal vessel only noted in 12. Spermathecae: two pairs in 8 and 9; large spherical ampulla on long duct with long diverticular appendage from its base from which small iridescent and bifid diverticulum hangs. Male organs: holandric, testis and funnels iridescent in 10 and 11; small, racemose seminal vesicles in 9 and 12. Ovaries: in 13. Prostates: large flattened tubuloracemose in 18-21; penial setae observed externally but not located internally. Intestine: from 16; typhlosole from 21 soon becoming substantial; gut void.

REMARKS

Notoscolex index is characterized by its reduced dorsal pores, gizzard in 6 and seminal vesicles in 9 & 12 (cf. *N. dorazio*). The distribution of genital markings and the spermathecae with elongate, finger-like appendages of unknown function, clearly distinguish this species.

ETYMOLOGY index, Latin – 'forefinger or witness', for the long finger-like diverticular appendage.

DISTRIBUTION AND HABITAT

Geeveston, SW Tasmania, same locality as *N. geevestonis* and *N. huoni*, from wet sclerophyll.

Notoscolex irregularis (Spencer, 1895)

Fig. 137.

Cryptodrilus irregularis Spencer, 1895: 34-35, figs. 1-3; Jensz & Smith, 1969: 88.

Notoscolex irregularis; Michaelsen, 1900: 191.

Oreoscolex irregularis; Jamieson, 1974: 309-310, figs. 28C [only partly figured and segments misnumbered], 32L.

MATERIAL EXAMINED

LECTOTYPE: NMV: G46, labeled: "Crypto. Sp 1. Tasm. C. irregularis" and "Table Cape, Tasmania Jan/[18]92" (a previously dissected and mature specimen designated by Jensz and Smith and stated to be in reasonable condition, now damaged around the male field and with several internal organs removed and missing from jar).

PARALECTOTYPES: none, although Jensz and Smith state the type description suggests that more were found.

SPECIMENS: 14:1259, Sisters Beach, Tram Rd. picnic area, CQ 892-572, 34 m, 19.iv.1993, R.D. D'Orazio and D.E. Soccol, (mature posterior regenerate, dissected and sketched); TM: K368-369, Table Cape, 24.viii.1954, J.L. Hickman, (two specimens); BM(NH): 1973:2:42, same details as TM: K368-369, (large mature, undissected).

EXTERNAL FEATURES

Lengths mm: (lectotype) 145, (cf. 150 mm Spencer), other specimens up to 195. Width: ca. 4 mm. Segments: 120-136. Colour: dorsum dark grey with reddish mid-dorsal line, clitellum slate grey. Prostomium: open epilobous. Clitellum: ½13-17,½18. Dorsal pores: from 4/5. Setae: eight throughout; after 14, rows apart from a lines become irregular and in caudal segments they are almost equally spaced but alternate between segments. Nephropores: not discernible. Spermathecal pores: at anterior margin of segments 8 and 9, minute, closely paired in mid-ventrum (in lectotype, etc., cf. "in a lines", Spencer, "not demonstrable externally", Jamieson). Female pores: widely paired on 14. Male pores: on 18 minute, closely paired, mid-ventral within roundish tumid patch (cf. "very close together or fused so as to form a single one", Spencer). Genital markings: oval median marking in 20/21 in aa in mature specimens (cf. none noted by Spencer).

INTERNAL ANATOMY

Gizzard: muscular, compact in 5. Oesophagus: dilated 8-15, that in 13 most strongly developed but not calciferous. Nephridia: avesiculate meroic, tufted in anterior to 9 becoming equatorial bands from 14 and reducing in size posteriorly; no funnels nor ureters seen. Vascularization: dorsal vessel single; hearts 10-12; supra-oesophageal vessel 8-12. Spermathecae: two pairs in 8 and 9, ampullae saccular tapering to ducts which converge to enter body wall, clavate diverticula about as long as duct. Male organs: holandric iridescent testes and funnels in 10 and 11; seminal vesicles paired or analogue in 9 and larger in 12, (cf. 12 only, Spencer). Ovaries: in 13. Prostates: flattened tubuloracemose in 18 with flaccid duct that enters body wall under ventral nerve cord; penial setae not found. Intestine: origin ½17 (or 18 Spencer); typhlosole absent; gut contains organic soil and litter fragments.

REMARKS

The spermathecal pores in lectotype and other specimens of *Notoscolex irregularis* are mid-ventral and closely paired, not in setal a lines as stated by Spencer; other differences from the type description are noted in the above account. Jamieson diagnosed his *N. peculiaris* on its median male pores, and on other 'peculiarities', that are similar to those found in *N. irregularis*. Although Jamieson did not see the lectotype of *N. irregularis*, nor locate the spermathecal pores in either species, his *N. peculiaris* is remarkably similar morphologically - differing notably on its arrangement of genital markings.

DISTRIBUTION AND HABITAT

North coastal Tasmania: Table Cape found under logs (Spencer), and from Sisters Beach in soil litter layer.

Notoscolex leai Michaelsen, 1910

Fig. 138.

Notoscolex leai Michaelsen, 1910: 99-102, figs. 18, 19.

Oreoscolex leai; Jamieson, 1974: 310-311.

MATERIAL EXAMINED

TYPES: missing from Hamburg Museum (Reynolds & Cook, 1976: 126).

SPECIMENS: none found.

The following description taken from Michaelsen's original.

EXTERNAL FEATURES

Length mm: 310. Width: 7-12 mm. Segments: 452 (but setae indistinct and posterior segments much annulated). Colour: brown in alcohol. Prostomium: broadly pro-epilobous. Clitellum: insunk midventrally, but not saddle-shaped, ½13-19. Dorsal pores: not reported. Nephropores: not reported. Setae: eight in regular rows except in posterior; ab narrowing around male pores. Spermathecal pores: in 7/8 and 8/9 in line with male pores (in ab lines?). Female pores: paired on 14. Male pores: on small papillae in ab on 18. Genital markings: elongate pads ventral in bb in 15/16-18/19.

INTERNAL ANATOMY

Septa: 5/6 delicate, 6/7-112/13 thickened. Gizzard: large, muscular in 5. Oesophagus: not especially dilated. Nephridia: meroic, numerous tubules; aggregated ventrally in the anterior. Vascularization: dorsal vessel simple; last hearts 12; supra-oesophageal vessel not noted. Spermathecae: two pairs in 8 and 9; elongate ampulla with multiloculate diverticulum with four or five sperm chambers sessile on short duct. Male organs: holandric, testis in 10 and 11; seminal vesicles in 12 only. Prostates: tubuloracemose; long penial setae present. Intestine: Michaelsen does not record the origin, only that it spirals at least from its start to segment 24; he didn't record typhlosole presence or absence, although his two previous *Notoscolex* species in the same paper were both described without typhlosoles.

REMARKS

Michaelsen stated that *Notoscolex leai* appeared intermediate to Spencer's *N. campestris* and *N. wellingtonensis*, both of which have dorsal pores and multiloculate spermathecal diverticula, and that it was distinguished on the order and form of the genital markings, clitellum, and setae. It's most distinctive features are is high

segmental counts and seminal vesicles only in segment 12, but its large size, markings and morphology are reminiscent of both *Notoscolex longus* and *Aporodrilus urethrae*. If it actually lacks dorsal pores, it would belong to the latter genus.

DISTRIBUTION AND HABITAT

Michaelsen's specimens were obtained from a Dr A.M. Lea from around Hobart but since no similar forms have been found in this region it is also possible that, as with *N. simsoni*, this locality is mistaken.

Notoscolex liffeyi sp. nov.

Fig. 139.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0170, Liffey Forest Reserve, N. Tasmania, DP 763 827, 920 m., 2.vii.1992, R.D. D'Orazio and L.F. McGowan, rainforest, (mature, posterior amputee, dissected and figured).

PARATYPES: (P1) 14:3702, same details as H, (mature, dissected); (P2) 14:3703, same details as H, (mature, dissected); (P3-4) 14:3704, same details as H, (two aclitellate matures).

EXTERNAL FEATURES

Lengths mm: 85+ (H), 165 (P1), 160 (P2), 110 (P3), 70+ (P4). Width: ca. 3 mm. Segments: 166 (P1), 152 (P2), 152 (P3). Colour: unpigmented in alcohol; clitellum cream. Prostomium: open or weakly closed epilobous. Clitellum: 14-17. Dorsal pores: from 4/5 (vestigial in 2/3/4). Nephropores: not found. Setae: 8 in regular rows. Spermathecal pores: in 7/8/9 in a lines. Female pores: widely paired anterior to a setae on 14. Male pores: on small mounds in ab lines within tumid area on 18. Genital markings: none in anterior; wide mid-ventral sunken pad extending to b lines in 14/15 (all specimens) also ill-defined pad mid-ventrally in 15/16 (in H); mid-ventral boss median to male pores and paired elongate pads in b lines in 18/19 extending to level of male pores on 18 (all specimens).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: large, muscular cone in 5 preceded by crop and displaced to occupy 7-8. Oesophagus: increasingly dilated and vascularized in 12-16, possibly forming annular calciferous gland in this latter segment; valvular in 17-½18. Nephridia: avesiculate meroic, two or three sets of tubules per side approximately in b and c lines but interconnected with mesentery that extends to d setal follicle and gives spurious appearance of elongate bladder; not tufted anteriorly. Vascularization: dorsal blood vessel single; hearts small in 10-12; supra-oesophageal vessel in 9-12. Spermathecae: two pairs in 8 and 9; conical ampulla tapers to duct with medium sized clavate diverticulum near exit. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles racemose in 9 and 12; small pseudo-vesicles anteriorly in 13. Ovaries: as several egg-strings in 13; small paired ovisacs in 14. Prostates: in 18-19 coiled, slightly incised,

tubuloracemose, (no central lumen found in section in H and only small central canals in P1-2); small penial setae present in 18. Intestine: origin ½18; typhlosole absent; intestinal gizzards absent; gut contains gritty grey soil.

ETYMOLOGY: for the type-locality.

REMARKS

Notoscolex liffeyi is similar to *N. acanthodriloides* and *N. pilus*, differentiated at least on the genital markings for which especially those in 14/15 appear characteristic. The prostates are classed as tubuloracemose because the surface of the gland is finely incised and the central canal, where present, is small.

ETYMOLOGY: for the type-locality.

DISTRIBUTION AND HABITAT

Liffey Forest, NW Tasmania, from rainforest.

Notoscolex longus (Jamieson, 1974), comb. nov.

Fig. 140.

Oreoscolex longus Jamieson, 1974: 311-313, figs. 27B (p. 304), 32N,O (p. 325).

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K370, Cox's Bight, 146°15E.43°30'S, Nov.1938 and Jun. 1939, C.D. King, Tasmanian Biological Survey, (mature, damaged by previous dissection, re-figured and re-inspected).

PARATYPES: (P1, P5) BM: 1973:2:43-44, same details as H, (P1 subadult, dissected); (P2) TM:K371, same details as H, (aclitellate, previously undissected); (P3) TM:K372, same details as H, (aclitellate, undissected); (P4) TM:K373, same details as H, (clitellate, dissected); (P6) AM:W5329, same details as H, (not inspected).

EXTERNAL FEATURES

Lengths mm: 160-330. Width: 5-6 mm. Segments: 210-231. Colour: brown, clitellum darker. Prostomium: closed epilobous. Clitellum: saddle-shaped, ½13-18 (cf. annular, 13-18 Jamieson, fig. 27B). Dorsal pores: indistinct, the first visible from 19/20-21/22. Nephropores: not seen. Setae: 8 in regular rows. Spermathecal pores: 7/8 and 8/9 in a lines. Female pores: paired on 14. Male pores: on papillae in ab on 18. Genital markings: small pads in ab in 9/10 (in H and most other specimens except P1); median pads in bb in 12/13-15/16 (in P1 only); large oval pads (often conjoined) in ab in 16/17, 19/20 and 20/21 (in H, P1 and most other specimens).

INTERNAL ANATOMY

Septa: 5/6-6/7 delicate and displaced by gizzard, 9/10-13/14 with some thickening. Gizzard: large, muscular in 5 but displaced to occupy 8-9. Oesophagus: dilated in 9-13 but not calciferous. Nephridia: avesiculate meroic, indistinct anteriorly, about three or four small equatorial bands seen from segment 5, the ventralmost larger. Vascularization: last hearts 12; supra-oesophageal vessel to 13. Spermathecae: two pairs in 8 and 9; saccular ampulla with wide clavate diverticulum which occludes duct. Male organs: holandric, testis in 10 and 11; seminal vesicles small in 11 and 12 (in H, not developed in P1). Ovaries: in 13; ovisacs in 14. Prostates: tubuloracemose, 18-20; long penial setae present. Intestine: origin 17 (H) or 18 (P1-2, P4); some intestinal modification in 17,18-22, smooth walled and vascularised but insufficiently muscular to be construed as gizzards; deep but thin typhlosole from 24.

REMARKS

In *Notoscolex longus* the genital markings are supposed to be distinctive but, as noted above, there are some differences in the distributions of these in the immature paratype (P1) compared to the other type material. This species is anatomically similar to *Aporodrilus urethrae*, especially in the shape of the spermathecae, however the presence of dorsal pores, albeit they commence posteriorly, serves to differentiate *N. longus*.

DISTRIBUTION AND HABITAT

Cox's Bight, SW Tasmania.

Notoscolex officeri (Spencer, 1895)

Fig. 141, Fig. 142.

Cryptodrilus officeri Spencer, 1895: 44-45, Figs. 28-30; Jensz & Smith, 1969: 90.

Trinephrus officeri; Michaelsen, 1900: 186-187.

Notoscolex officeri; Michaelsen, 1907: 162.

Cryptodrilus ? officeri; Jamieson, 1974: 280-282.

Oreoscolex sexthecatus Jamieson, 1974: 315-317, figs. 29A, 32P,Q. **Syn. nov.**

MATERIAL EXAMINED

TYPES: NMV: G80, King River Valley, January 1894, C.S. Officer, recorded on MOV catalogue card as having four specimens that are not now in jar and are presumed lost (Jensz & Smith, 1969: 90).

Note: despite new material described here, I refrain from designating a neotype as none were obtained from the King River type-locality.

SPECIMENS: (S1-3) 14:1283, Cradle Mountain Road, just passed Hellyer Mine road to where creek crosses highway, CP 949 986, 670 m, 16.vi.1993, R.D. D'Orazio and D. Soccol, peat swamp, (three mature specimens having same distribution of genital markings, one dissected and figured); (S4-6) 14: 3260, same details 14:1283, (three mature specimens, one dissected and drawn, one a posterior amputee also dissected); (S7-8) 14:3259, same details as 14:1283, (two mature specimen, one a posterior amputee, the other dissected and drawn); (S9) 14: 0055, Pelion Valley, 417700 5367500, QVM, (one mature, dissected and figured); (S10-14) 14:1271, Cradle Mountain Rd., CP 901 976, 680 m, 16.vi.1993, R.D. D'Orazio and D.E. Soccol, cool temperate rainforest, (mature, dissected; plus one subadult and three immatures); 14:1278, Cradle Mountain Rd., CP 970 989, 610 m, 15.vi.1993, R.D. D'Orazio and D.E. Soccol, cool temperate rainforest, (two immatures that superficially agree); 14:1272, Cradle Mountain Rd., CP 901 976, 680 m, 16.vi.1993, R.D. D'Orazio and D.E. Soccol, (three immatures that superficially agree); 14:2523, Waratah, NW Tasmania, CQ 702 064, 680 m, 22.ix.1990, R. Mesibov, (subadult specimen, dissected and sketched);

(S15) TM:K378 (*Oreoscolex sexthecatus* ex-Holotype), Lake St Clair, R.W. Kerr, Feb. 1941, (weakly clitellate, posterior amputee at about segment 27, macerated, heavily parasitized, and much damaged by previous dissection with spermatheca, prostates, and intestine removed and several of these organs missing from jar).

EXTERNAL FEATURES

Body dorso-laterally flattened in posterior. Length mm: 60-80 (cf. 45 Spencer). Width: ca. 7 mm. Segments: 88-92. Colour: violet dorsum to c lines, with darker mid-dorsal line, ventrum pale, clitellum buff. Prostomium: open epilobous or faintly tanylobous. Clitellum: ½13,14-17,½18, interrupted ventrally by genital markings. Dorsal pores: small in 4/5, larger from 5/6. Nephropores: occasionally seen in c lines. Setae: eight in regular rows in anterior but soon d becomes irregular, then c and, posteriorly, b also irregular (an odd supernumerary seta is sometimes added in posterior segments). Spermathecal pores: 6/7/8/9 just lateral of b lines. Female pores: paired on 14. Male pores: on large raised porophores in ab. Genital markings: large, paired sucker-like discs near ab lines (centred in either a, ab, or b lines) on clitellum in 13/14 (S15 only), 14/15 (S9, S15), 15/16, 16/17, and 19/20, often with transverse pads in bb on either side of the male pores in 17/18 and 18/19 (in most mature specimens). Some specimens (eg. S1-3) have paired sucker-like discs presetally in ab lines just below the spermathecal pores in 8 and 9, or paired mid-ventral presetal pores in common field in 8 and 9 (eg. in S4-6), or sucker-like discs postsetal in ab in 8 (eg. in S9). Common to most specimens are paired markings in 15/16/17 and 19/20, while those that lack preclitellar genital markings (eg. S7-8, 10) agree exactly with Spencer's description.

INTERNAL ANATOMY

Monocystis sp. infestations frequently noted in most, if not all specimens, and sometimes flimsy translucent sacs on ventrum in anterior segments are seen that may be empty parasite sacs. Septa: weak but just traceable before 8/9, thereafter thickening to 12/13. Gizzard: in 5 large muscular barrel with anterior flange occupying two or three segment lengths and displacing septa 5/6/7, preceded by thin-walled proventriculus. Oesophagus: dilated in 8-15 and lamellate in 14-15, but not calciferous. Nephridia: avesiculate meroic, tufted in the anterior, tubules becoming elongate before reducing in posterior, two to four per side approximately in setal lines but irregular except for those in a lines (which are, nevertheless, not enlarged); funnels not found. Vascularization: dorsal blood vessel single; hearts 10-12; supra-oesophageal vessel 9,10-12. Spermathecae: three pairs in 7-9, flattened oval ampulla on equal length duct that is swollen and bulbous ectally near where joined by iridescent multiple clavate and/or bifid or multiloculate diverticula described by

Spencer as "a group of little finger-like processes", (diverticula vary from clavate to multiloculate within the same specimen, eg. in S4, S9, S15). Male organs: holandric, testis iridescent in 10 and 11 in mucus; paired racemose seminal vesicles in 9 and 12; paired pseudovesicles (possibly parasitic artefacts?) present in 13 in some specimens. Ovaries: extensive, palmate in 13; small ovisacs in 14. Prostates: flattened, tubuloracemose in 18, duct flaccid; penial setae present, over 1 mm long. Intestine: from 17, spiraling; typhlosole absent; gut contains organic matter and dark soil.

REMARKS

Cryptodrilus officeri is characterized by three pairs of spermathecae in 6/7/8 opening near b setal lines (cf. a lines in *N. triplex*). Additions to Spencer's description are an open epilobous prostomium, extra genital markings, and the presence of penial setae; close agreement otherwise on most features described by Spencer indicates that the material above is conspecific. Having paired markings in 15/16/17 and 19/20, at least, helps to define the species, but additional markings are permissible. Spermathecal diverticula vary from clavate or bifid to multilocute within some specimens and parasitic artefacts are sometimes additionally present on the spermathecae, (eg. in S15), but it is probable that the original form is clavate - as noted in immature and subadult specimens, becoming multiloculate only after use in mature specimens, (cf. *N. salutigerulus* vs. *N. simsoni*).

Re-inspection of what remains of Jamieson's monotypic *Oreoscolex sexthecatus* - based on a damaged anterior portion found also to be heavily parasitized - shows that it complies with the above account (Jamieson had misinterpreted the true position of dorsal pores and spermathecae), and it is therefore placed in synonymy. Apparently Jamieson (1974: 316) put this specimen in *Oreoscolex*, rather than some other genus under his scheme, on the basis of a "posterior fragment" which happened to be contained in the same sample, although Jamieson (1974: 282) had conceded that of *Cryptodrilus officeri* was "reminiscent" of his inadequately described *O. sexthecatus*.

DISTRIBUTION AND HABITAT

Central, NW and W Tasmania: Cradle Mountain, Pelion Valley, Lake St Clair, Waratah, from swampy or rainforest soils, and King River Valley (Spencer's type locality) "amongst the western mountain ranges".

Notoscolex pardus sp. nov

Fig. 143.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1414, Queenstown, just entered Franklin-Gordon Wild Rivers National Park, W Tasmania, CP 860 213, 200 m, 10.viii.1993, R.D. D'Orazio and D. Soccol, wet sclerophyll on slope, (mature specimen, dissected and drawn).

PARATYPES: (P1) 14:3261, same details as H, (mature dissected); (P2) 14:3262, same details as H, (mature).

EXTERNAL FEATURES

Body short and straight with faint dorsal canaliculation. Length mm: (H) 30, (P1-2) 25. Width: 2.3 mm. Segments: (H) 70, (P1) 66, (P2) 67. Colour: dark chocolate brown dorsum, lighter ventrally, with large, pale setal auriolae giving distinct spotted appearance; clitellum dark except ventrally where genital markings impinge. Prostomium: open epilobous, furrowed to 2/3; peristomium ventrally cleft. Clitellum: 13-17. Dorsal pores: from 4/5. Nephropores: not found. Setae: 8 throughout, d soon becomes irregular, other setae are in series except at the caudal extremity. Spermathecal pores: 7/8/9 in ab lines. Female pore: single, midventral on 14. Male pores: on raised porophores in ab but closer to b on 18. Genital markings: paired closely apposed discs in aa in 10/11 (P1) or 12/13 (in H, P2), and in 14/15 (all specimens); on either side of male pore in 17/18 and 18/19 are another pair of discs in a lines within generally tumid area that exends from 17-19 over whole ventral surface. In (P2) the markings on the clitellum are wider apart near a lines.

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: absent or rudimentary as the oesophagus appears undeveloped in 5. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, approximately two per side in a and d lines (intertwined and easily mistaken for holonephridia); larger but not tufted in the anterior, much reduced in the posterior. Vascularization: dorsal blood vessel single; hearts 10-12; supra-oesophageal vessel not noted. Spermathecae: two pairs in 8 and 9; small spherical ampulla on longer duct with single clavate diverticulum. Male organs: holandric, testis iridescent in 10 and 11 concealed in mucus; seminal vesicles not found in 9, small in 12. Ovaries: in 13. Prostates: tubuloracemose in 18; penial setae absent. Intestine: from 16 with chloragogen cells on dorsum; typhlosole absent.

ETYMOLOGY pardus, Latin - leopard, for the spotted markings.

REMARKS

Distinguishing features of *Notoscolex pardus* are the small size, the distinct genital markings and setal patterns, the single female pore, and the lack of a gizzard. This species is superficially similar to perichaetine *Anisochaeta clavi* from Lake Pedder, and also remarkably close to *Woodwardiella tesselatus* (Spencer 1895) - major differences are that Spencer's species reputedly has holonephridia, genital markings only in 12/13 and 13/14 in ab, paired female pores, intestinal origin in 17, and a gizzard in 5. Spencer's figure 16 shows some modification around the male pores that are possibly analogous to the markings found here. Meronephridia in the present species are intertwined and may easily be mistaken for holonephridia (cf. Spencer's *Scolecoidea scolecoidea*), so location of new material of *W. tesselatus* from the type locality at Lake St. Clair is required to determine the true relationship between Spencer's species and the current species.

DISTRIBUTION AND HABITAT

Queenstown, W Tasmania, from wet sclerophyll.

Notoscolex peculiaris (Jamieson, 1974), comb. nov.

Fig. 144.

Oreoscolex peculiaris Jamieson, 1974: 313-315, figs. 28B (p. 306), 32M (p. 325).

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K374, Mt Wellington, Shoobridge Bend Track, 147°15'E.42°55'S, 19.viii.1971, B. Jamieson and E.A. Bradbury, 580 m, in loam and clay in eucalypt - fern woodland, (macerated mature, much damaged by previous dissection).

PARATYPES: (P1) BM: 1973:2:45, same details as H, (macerated and damaged by dissection); (P2) TM:K375, same details as H, (mature, posterior regenerate, undissected); (P3) BM:1973:2:46, same details as H, (macerated, only dissected in posterior); (P6) TM:K376, same details as H, (aclitellate, damaged in mid-body, undissected); (P7) TM:K377, same details as H, (mature, damaged in mid-body, undissected); AM:W5330 (P4), same details as H, (not inspected).

SPECIMENS: 14:3522, Mt Wellington, Shoobridge Bend Track, 147°15'E.42°55'S., 21.ii.1996, R.J. Blakemore, from wet forest soil, (16 specimens, seven matures - two dissected, three subadults and six immatures that superficially agree).

EXTERNAL FEATURES

Body squat. Length mm: 46-60. Width: ca. 6 mm. Segments: 125-155. Colour: in life, unpigmented, transparent with ventral nerve cord clearly visible through body wall, some specimens have superficial darker pigmentation, clitellum yellow; in alcohol uniform buff. Prostomium: open or faintly closed epilobous. Clitellum: ½13,13-17. Dorsal pores: from 5/6, or 4/5 (in P2 - pers. obs.). Nephropores: not seen. Setae: eight converging around male pores; c and d irregular around clitellum; b, c and d irregular posteriorly. Spermathecal pores: closely paired, mid-ventral in 7/8 and 8/9 (cf. in a lines, Jamieson). Female pores: paired on 14. Male pores: paired in 18 median to a lines and median to paired indistinct mounds within large oblong glandular pad which includes whole ventral surface of 17-19; two pairs of faint disc are included in pad at anterior and posterior margins of 18 lateral to male pores. The mounds on either side of male pores are more pronounced in P6-7.

INTERNAL ANATOMY

Gizzard: large in 5 with anterior flange. Oesophagus: dilated 8-14, especially in 10-12 but not calciferous. Nephridia: avesiculate meroic, tufted anteriorly in 3-7, reducing in size to 14, from 15 forming equatorial bands of discrete tubules. Vascularization: hearts 10-12; supra-oesophageal vessel to 14. Spermathecae: two pairs in 8 and 9; saccular ampulla tapers to duct with disproportionately small clavate diverticulum. Male organs: holandric, testis in 10 and 11; seminal vesicles in 9 (absent from P1), and 12. Ovaries: in 13; ovisacs absent. Prostates: tubuloracemose in 18; penial setae present. Intestine: from 16 (cf. 17 Jamieson), gut spirals in 19-21 with some modification but not muscular; typhlosole absent; gut contains very fine soil and numerous sand grains.

REMARKS

The present account considerably augments the type description. Differences of *Notoscolex peculiaris* from Jamieson's account are the prostomium not tanylobous; first dorsal pore from 4/5 or 5/6, not 6/7; c and d setal lines irregular around the clitellar region; spermathecal pores that are mid-ventral rather than in a lines; and intestinal origin is in 16 rather than 17. These last two attributes are especially important changes to the type description. New material provides much better characterization of this species as the type series specimens are poorly preserved and most are damaged in some way or other. It is closest morphologically and comparable with *N. irregularis*.

DISTRIBUTION AND HABITAT

Mt Wellington, in forest-fern woodland soil.

Notoscolex penguini sp. nov.

Fig. 145.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1985, Penguin, N Tasmania, DQ 188 445, 75 m, 20.i.1994, R.D. D'Orazio and D.E. Soccol, (mature specimen, figures and dissected).

PARATYPES: (P1) 14:3263, same details as H, (mature posterior amputee, dissected); (P2) 14:3264, same details as H, (mature posterior amputee, dissected).

EXTERNAL FEATURES

Body with deep dorsal canaliculus after clitellum. Length mm: (H) 130, (P1) 100+, (P2) 50+. Width: ca. 6 mm. Segments: (H) 210, (P1) 143+. Colour: uniform pale to white, clitellum cream. Prostomium: small, open epilobous. Clitellum: weakly developed in 13-17. Dorsal pores: small in 3/4 large and obvious from 4/5. Nephropores: seen in b lines in posterior. Setae: 8 throughout, cd irregular in posterior. Spermathecal pores: 7/8/9 in b lines (all specimens). Female pores: paired on 14, closely in H, wider in P1. Male pores: on 18 in b on papillae. Genital markings: two large glandular depressions extend lengthwise from ½17-½19, almost meeting ventrally and extending laterally to mid-bc, encircling each male pore.

INTERNAL ANATOMY

Body filled with much mucus. Septa: 5/6 flimsy to base of gizzard, then increasingly thickened to 12/13. Gizzard: round and muscular in 5 preceded by large crop. Oesophagus: large, extramural sessile calciferous glands paired in 15 and 16. Nephridia: avesiculate meroic, tufted anteriorly to 4,5 then as small coils, after clitellum mostly in b lines but intermittently in c and/or d lines; funnels not found. Vascularization: dorsal vessel single; hearts 10-13; supra-oesophageal vessel 7-17, large in 14-17 over the calciferous glands. Spermathecae: two pairs in 8 and 9; saccular ampulla tapers to duct with one, two or three diverticula; (in H single except 9rhs paired; in P1 all paired; in P2 paired except 9lhs has three diverticula). Male organs: holandric, testis in 10 and 11 iridescent and invested in mucus; racemose seminal vesicles small in 9, larger in 12. Ovaries: in 13 as large egg strings; ovisacs not found. Prostates: appearing racemose in 18; small penial setae present. Intestine: from 17; typhlosole absent but low dorsal ridge present from ca. 30.

Note: nematodes found in dorsal blood vessel in P1 removed and placed in phial in sample jar.

REMARKS

Notoscolex penguini while remarkably similar morphologically to *N. bidiverticulatus* differs by having its spermathecal and male pores in b lines rather than in a lines, a dorsal canal, and by lacking of a typhlosole. The spermathecal diverticula, when paired are opposed, rather than pyriform as in *N. bidiverticulatus*. The large genital markings surrounding the male field, the occasionally bidiverticulate spermathecae, and the presence of calciferous glands in 15 and 16, are characteristic for both species.

ETYMOLOGY for the type-locality.

DISTRIBUTION AND HABITAT

Penguin, northern coastal Tasmania.

Notoscolex pilus Blakemore, 1997

Fig. 146, Fig. 147, Fig. 148.

Notoscolex pilus Blakemore, 1997a: 1701-1704, figs 6 & 7.

Notoscolex dinephrus Blakemore, 2000b: 20-21, fig 12. **Syn. nov.**

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3325, Dismal Swamp Nature Reserve, NW Tasmania, 40 59'S.144°51'E, 8.ix.1987, QVM, (mature, dissected and figured).

PARATYPES: (P1) ANIC:RB.96.11.8, same collection data as H, (mature, dissected); (P2) TM:K1530, Belmont Rd, Waratah, NW Tasmania, 41°23'S 145°32'E, 31.v.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (mature, dissected); (P3) 14:3326, same details as P2, (mature); (P4) 14:3566, same details as P2, (weakly clitellate mature, possibly posterior regenerate, dissected; plus an unregistered immature that superficially agrees); (P5) 14:2524, Wombat Hill near Waratah, NW Tasmania, 41°29'S 145°27'E, 22.ix.1990, R. Mesibov, (mature, dissected); (P6) ANIC:RB.96.11.14, same details as P5, (mature); (P7) ANIC:RB.96.11.15, same details as P5, (mature, dissected); (P8) TM:K1533, same details (mature); (P9), same details (mature, dissected); (P10) 14:3567, same details as P5, (mature); (P11) 14:3568, same details as P5, (sub-adult); (P12) 14:3569, same details as P5, (sub-adult); (P13) 14:0111, Frog Flats, Pelion Valley, NW Tasmania, 41°48'S.146°02'E, 13.ii.1992, QVM, (mature, dissected and figured); (P14) 14:0124, near Old Pelion Hut, Pelion Valley, NW Tasmania, 41°48'S.146°03'E, 12.ii.1992, QVM, (mature).

SPECIMENS: (S1) 14:3352 (ex-H of *N. dinephrus*), Sprent Basin, Lake Pedder north, DN 175 633, 310 m, 9.iv.1996, R.J. Blakemore, Banksia/Ti-tree on edge of lake, (mature, dissected and figured); (S2) 14:3481 (ex-P1 of *N. dinephrus*), same details as S1, (subadult, dissected); (S3) 14:3482 (ex-P2 of *N. dinephrus*), same details as S1, (aclitellate posterior amputee); (S4) 14:3490 (ex-P3 of *N. dinephrus*), Bell Basin, Lake Pedder north, DN 406 346, 310 m, 9.iv.1996, R.J. Blakemore, under Ti-tree, (mature, complete but damaged in the midbody);

(S5) 14:0028: Melaleuca, South Coast Track, DM 328 904, 10m, 5.iii.1992, Louise F. McGowan, from button grass, (mature, dissected and sketched); (S6) 14:2833, Birchs Inlet, W Tasmania, CN 751 878, 10 m, 17.x.1993, P. Swiatkouski, rainforest hand collected, (mature dissected, figured); (S7) 14:3643, same details as S6, (mature, dissected); (S8) 14:3644, same details S6, (abnormal mature with extra pair of

spermathecae and all pores and organs displaced posteriorly by one segment count possibly due to heteromorphic regeneration of anterior segments).

EXTERNAL FEATURES

Lengths mm: range 30-55. Width: ca. 2-3 mm. Segments: 84-116. Colour: unpigmented or delicate lilac in life, with yellow tinge in alcohol; clitellum yellowish. Prostomium: open epilobous (faint ventral cleft on peristomium in some specimens). Clitellum: ½13-16,½17. Dorsal pores: small in 4/5, or from 5/6. Nephropores: not found or in a or d lines. Setae: 8 throughout in regular series (sometimes slightly irregular in tail). Spermathecal pores: 7/8-8/9 in a lines. Female pores: paired. Male pores: paired on small mounds in ab; tips of penial setae may protrude. Genital markings: faint paired or mid-ventral presetal discs in some of 7-10 (H, P4-12, S1-4); or mid-ventral in 13 (P5, P8-9, P12), or in 17 (H, P1, P12), or absent from anterior (S5-8); paired discs in 17/18 (P2, P12-14, S1-6) and 18/19 (P5, S6) in ab lines; paired eye-like markings within tumid pads in ab in 19/20 (P3, P5-7, P11-12, S1, S3-4) and often slightly more ventral in 20/21 (H, P2, P8-10, P13-14, S5), and sometimes in 21/22 (P1).

INTERNAL ANATOMY

Septa: thin. Gizzard: muscular in 5 but posteriorly displaced. Oesophagus: white, dilated and lamellate in 14 and 15 forming annular calciferous glands (weakly in S5). Nephridia: avesiculate meroic, two per side in ca. a and c or b and d lines, intertwined but separable with care in fore-body, (spuriously appearing as holonephridia in hind-body); not tufted anteriorly. Vascularization: hearts 10-12; supra-oesophageal vessel weak in 6,7,8,9-12,13. Spermathecae: two pairs in 8 and 9; elongate ampulla on short duct with digitiform diverticulum often as long as ampulla ectally (iridescent). Male organs: holandric, iridescent testes in 10 and 11 in seminal coagulum; racemose seminal vesicles in 9 and 12. Ovaries: large in 13; ovisacs absent. Prostates: flattened tubuloracemose in 18-20,21,22; duct external to the glandular part for most of its length (in H and P1) or bilobed (racemose? in P1 only); long, curving penial setae ensheathed in 18-22,23. Intestine: from 17 but septum 16/17 often displaced forwards; intestinal gizzards absent; typhlosole absent but low dorsal ridge sometimes present; gut contains gritty, yellow soil, or woody organic matter and quartz grits.

REMARKS

Notoscolex pilus is characterized by its small size, spermathecal pores in 7/8/9 in a lines, calciferous development in 14-15, two sets of nephridial tubules per side, flattened tubuloracemose (or racemose?) prostates, and long spermathecal diverticula and penial setae. *Notoscolex dinephrus* is placed in synonymy as specimens from Melaleuca and Birchs Inlet were identified that had characters, especially their genital markings, which bridged the differences between this taxon and the prior *N. pilus*. Some variations in the arrangements of genital markings appear in different populations of *N. pilus* (and mature S7 has no markings), perhaps representing ecotypes, but all conform on other morphological characteristics to the diagnosis above.

DISTRIBUTION AND HABITAT

Widespread: Dismal Swamp Nature Reserve, Waratah and Pelion Valley in NW and Central Tasmania; north Lake Pedder, SW Tasmania, in organic soil under *Banksia* spp. and Ti-tree (*Leptospermum* spp.) scrub, Birchs Inlet W Tasmania from rainforest, and Melaleuca, SW Tasmania, from button grass.

Notoscolex salutigerulus sp. nov.

Fig. 149.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3773, Gog Range, DQ 461 058, 530 m, R.M. and T.S. (Bob Mesibov and Tammy Scarborough?), wet sclerophyll, (mature, possibly posterior regenerate as last eight segments narrower, figured and dissected).

PARATYPES: (P1) 14:3777, Montagu Swamp, Montagu, CQ 287 547, 30 m, 28.xii.1990, R. Mesibov, (mature, dissected); (P2-4) 14:3778, Christmas Hills, NW Tasmania, CQ 309 667, 60 m, 6.xii.1990, R. Mesibov, (two matures, one dissected, plus one subadult).

EXTERNAL FEATURES

Body: slightly dorso-ventrally flattened. Lengths mm: (H) 60, (P1) 62, (P2-3) 80-70. Width: ca. 4 mm. Segments: (H) 99, (P1) 97. Colour: anterior and dorsum dark chestnut brown to c lines with darker mid-dorsal line, ventrum pale, clitellum buff. Prostomium: open epilobous, mid-dorsally furrowed in P1. Clitellum: (H) 14-17, (P1) 13-½18. Dorsal pores: from 2/3. Setae: eight throughout, but after clitellum setae d lines are irregular wandering more dorsally then more ventrally (in H), or irregular only on tail (P1-4). Nephropores: not found. Spermathecal pores: 7/8/9 in setal a lines. Female pores: widely paired on 14. Male pores: paired in setal a lines with penial setal follicles on low papillae. Genital markings: elongate with numerous internal papillae in bb in 10/11 (H), or 11/12 (P1, P2), or none anteriorly (in P3-4); two pairs of elliptical patches centred in b lines in 19/20 and ab lines in 20/21 (all matures); weak analogue in ab in 21/22lhs (in H).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: compact muscular in 5. Oesophagus: dilated 13-15, not calciferous; valvular in 16-17. Nephridia: avesiculate meroic, about eight to ten small spiral clumps per segment in line with setae plus extra set in bc lines; not tufted anteriorly; no funnels found; (Note: in H, *Monocystis* sp. in sacs were found near some nephridia). Vascularization: dorsal vessel single onto pharyngeal mass in 3; hearts 10-13. Spermathecae: two pairs in 8 and 9, ampulla saccular on bulbous duct, diverticulum manicate, multiloculate; (Montague swamp and Christmas Hills specimens have multiloculate diverticula and folded lobes on ampullae). Male organs: holandric, testes and iridescent funnels in mucus in 10 and

11; seminal vesicles paired on the anterior septa, small or vestigial in 10 (H and P3), larger in 11 and 12. Ovaries: palmate in 13; small ovisacs in 14. Prostates: racemose in 18, on thin duct; short penial setae present. Intestine: origin 18; no typhlosole; gut contains dark organic matter.

Note: clusters of small nematodes found under the lhs prostate gland in H are placed in a phial in the sample jar.

REMARKS

Significant differences of *Notoscolex salutigerulus* from Spencer's *N. simsoni* are the multilocuate spermathecal diverticula - rather than clavate or bifid in mature specimens, shorter penial setae, and less obvious nephropores. Spermathecal diverticula are characteristically manicate, but the ampullae are either smooth or lobed. As with *N. simsoni*, anterior genital markings are in 10/11 or 11/12, and parasitic sacs near some nephridia may be erroneously mistaken for bladders.

ETYMOLOGY salutigerulus, Latin - "carrying greetings", for the manicate diverticula.

DISTRIBUTION AND HABITAT

Gog Range, Montagu Swamp and Christmas Hills, in NW Tasmania, from wet sclerophyll.

Notoscolex simsoni (Spencer, 1895)

Fig. 150.

Megascolides simsoni Spencer, 1895: 45-46, Figs. 31-33; Jensz & Smith, 1969: 101-102.

Trinephrus simsoni ; Michaelsen, 1900: 186.

Notoscolex simsoni ; Michaelsen, 1907: 162; 1910: 97-99.

Cryptodrilus simsoni ; Jamieson, 1974: 294-296, Figs 19C (p 273), 25A (p 294), 31N, O (p. 323), Table 11.

MATERIAL EXAMINED

LECTOTYPE: (L) MOV:F40182 (previously NMV:G182), labelled: "Megascolides simsoni Launceston Tas Coll. A. Simson 1892"; "Mega Simsoni (=C. sp 2. Tas)"; "Crypto. Sp 2. Tasm.", and "Aug Simson Launceston 2/92", (posterior amputee in good condition but dissected, presumably by Jamieson as Jensz and Smith (1969: 101) state it was an entire undissected specimen).

PARALECTOTYPES: none present in MOV.

SPECIMENS: 14:1300, Blackwell Rd., NW Tasmania, CQ 790 352, 250m, 19.iv.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (mature, dissected); 14:3779, Urks Loop track, N Tasmania, DP 367 975, 560 m, 16.ix.1992, R.D. D'Orazio, wet sclerophyll, (mature specimen, dissected, plus one perichaetine specimen of another species); 14:3653, Birralee, N Tasmania, DQ 840 175, 4.ix.1994, QVM, (eight specimens, three matures, two subadults, one juvenile and one immatures - one damaged mature dissected); ANIC:RB.97.5.8, Birralee, N. Tasmania, DQ 837 161, 4.ix.1994, QVM, , rough pasture (mature, dissected); TM: K352-354 (Jamieson's specimens 1-3), Fern Dene, Ironcliff Road near Penguin, 13.x.1954, collector unknown, (one mature posterior amputee tagged "1", previously undissected; one mature tagged "2", dissected; one mature tagged "3", undissected); BM(NH): 1973:2:29-30 (Jamieson's specimens 5 and 8), same details as TM: K352-354, (two matures, one a posterior amputee, dissected).

EXTERNAL FEATURES

Body: slightly dorso-ventrally flattened. Lengths mm: (lectotype) 45+ (45 mm Spencer) other complete mature specimens 70-90 mm. Width: ca. 3 mm (Spencer). Segments: 95+, 123-130. Colour: recent material bright puce dorsum and flanks to c lines, ventrum yellow-grey, clitellum beige; in alcohol uniform buff. Prostomium:

epilobous, dorsally furrowed to intersegment 1/2. Clitellum: ½13-17,½18 (lectotype), or 13-18 (Spencer) or 14-17 (Michaelsen). Dorsal pores: from 2/3 but ejecta only seen from 3/4 or 4/5 (4/5? Spencer; 2/3 Michaelsen). Setae: eight throughout, c and d in slightly irregular series from mid-body posteriorly. Nephropores: in anterior obvious in front of setae, but also sometimes seen in mid-ab and above d lines ("present immediately in front of each seta, though occasionally not visible, in the clitellar region apparently more than eight", Spencer). Spermathecal pores: 7/8/9 in setal a lines. Female pores: widely paired on 14. Male pores: paired in a lines on small papillae. Genital markings: elongate with numerous internal papillae in bb in 10/11 (lectotype, Urks Loop and Birralee matures, and one Penguin specimen) or 11/12 (other Penguin specimens, Blackwell Rd specimen); faint markings paired in ab in 17/18 and/or 18/19 with small pads between them (lectotype and some other specimens); two pairs of white elliptical patches centred in b lines in 19/20 and ab lines in 20/21 (Spencer and Michaelsen only mention the latter two pairs of genital markings); weak pad sometimes seen mid-ventrally in 21/22.

INTERNAL ANATOMY

Oesophageal glands in 5-7 (at least, in lectotype). Gizzard: compact muscular in 5. Oesophagus: dilated 9-15,16, not calciferous. Nephridia: avesiculate meroic, about eight small spiral clumps per segment in line with setae, the ventral most appear slightly more coiled and elongate; not tufted anteriorly; no funnels nor ureters seen in posterior. Vascularization: dorsal vessel single; hearts 10-13 from weak supra-oesophageal vessel in 7,8-13. Spermathecae: two pairs in 8 and 9, ampulla saccular on thin duct, diverticulum small, simple (although one diverticulum in lectotype and those in 14:1300 are slightly bifid). Male organs: holandric, testes and iridescent funnels in mucus in 10 and 11; large seminal vesicles paired in 11 and 12 on the anterior septa, extra small pair seen anteriorly in 10 in one Biralee specimen. Ovaries: palmate in 13; ovisacs not found, or in 14 in Birralee specimen. Prostates: racemose in 18, overwhelming the thin duct; long penial setae present. Intestine: origin 18 or ½18 (cf. 19, Spencer); no typhlosole though low ridge present from about 26; gut contains organic soil.

REMARKS

Slight differences from Spencer's description of *Notoscolex simsoni* are the lesser extent of the clitellum and greater distribution of genital markings, and

intestinal origin in 18 rather than 19. Genital markings either in 10/11 or 11/12 appear acceptable variations as there is agreement on other points. Parasitic *Monocystis* sp. cells were noted in some specimens (eg. lectotype, TM:K352, 14:1300), as are also found in *N. officeri* and *N. salutigerulus* specimens, both on septa and on nephridia, and these may easily be mistaken for nephridial bladders. Spencer (1895: 46) described "sac-like structures" behind the clitellar region dorsal to rows of coiled tubes that correspond apparently in position of the nephropores. No nephridial bladders were found in the current account, if found they would qualify this species for inclusion in *Cryptodrilus* rather than *Notoscolex*.

DISTRIBUTION AND HABITAT

Emu Bay and Launceston (Spencer), also from Blackwell Rd., Penguin, and Birralee in NW and N Tasmania. On the information given, Michaelsen's specimens comply with the above account, but their Hobart location is far from the known range and is possibly erroneous.

Notoscolex triplex sp. nov.

Fig. 151.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:802, Tooms White Gum Reserve, E Tasmania, 31.5km along McKays Road, EP 701 226, 600 m, 11.viii.1992, R.D. D'Orazio and M. Cooper, rainforest, (mature, dissected and drawn).

PARATYPE: (P) 14:3689, same details as H, (aclitellate mature, dissected).

EXTERNAL FEATURES

Length mm: (H) 135, (P) 80. Width: ca. 3.5 mm. Segments: (H) 132, (P) 115. Colour: unpigmented in alcohol with several dark equatorial dots in anterior; clitellum cream. Prostomium: open epilobous, tapering. Clitellum: ½13-½18. Dorsal pores: small in 3/4 open from 4/5. Nephropores: not found. Setae: 8 throughout but c and d move more dorsally in posterior. Spermathecal pores: 6/7/8/9 in a lines. Female pores: paired on 14. Male pores: in a on 18 on small papillae. Genital markings: paired discs in ab in 17/18; wide tumid pad in bb in 19/20.

INTERNAL ANATOMY

Septa: 7/8-11/12 slightly thickened. Gizzard: large and muscular in 5 preceded by large proventriculus. Oesophagus: dilated in 10-14, narrow in 15. Nephridia: avesiculate meroic, clusters of ca. 8-10 tubules become smaller and spread laterally in intestinal segments; not tufted in anterior. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-12 from supra-oesophageal vessel in 8-14. Spermathecae: three pairs in 7-9; elongate ampulla on curved duct with sessile, multiloculate diverticulum above narrower exit; in H 7 and in P 7lhs are heteromorphic (in H 7lhs and P 7lhs lack diverticula, while in H 7rhs has two). Male organs: holandric, testis iridescent in 10 and 11 in mucus; seminal vesicles in 9 and 12. Ovaries: compact in 13; small ovisacs in 14; pseudovesicles in 13-14. Prostates: flattened racemose in 18; penial setae present. Intestine: from 16, dilated and vascularized in 16-18 but not muscular; deep T-shaped typhlosole develops from 19; gut contains organic soil.

REMARKS

Notoscolex triplex is morphologically similar to *N. duplex* apart from its extra pair of spermathecae in 7 that, nevertheless, are often heteromorphic and are perhaps indicative of a species in transition. The only other *Notoscolex* species known to have

three pairs of spermathecae is *N. officeri* in which, however, the pores are in b setal lines, and a typhlosole is lacking.

ETYMOLOGY triplex, Latin – 'triple', for the three sets of spermathecae.

DISTRIBUTION AND HABITAT

Tooms White Gum Reserve, E Tasmania, sympatric with *N. duplex*.

Notoscolex wellingtonensis (Spencer, 1895)

Fig. 152.

Cryptodrilus wellingtonensis Spencer, 1895: 43-44, Figs. 25-27; Jensz & Smith, 1969: 92-93.

Notoscolex wellingtonensis; Michaelsen, 1900: 192-193; 1910: 102.

Oreoscolex wellingtonensis; (part.) Jamieson, 1974: 317-318, Figs 29B [segments miscounted], 32R.

MATERIAL EXAMINED

LECTOTYPE: NMV: G75, labeled in Spencer's hand: "Hobart from A. Morton Esq. Aug/92", "C. sp 11 T.", in the jar is a metal tag (from Tasmanian Museum?) "TM S1048", (a previously dissected specimen in poor condition, coiled, hardened and providing little information).

Note: because of its poor condition, Jensz and Smith (1969) recorded this specimen as a syntype rather than a lectotype; however, as no other syntypes are known they are deemed to have actually designated it as the lectotype under Article 74.6 of ICZN (1999). Jamieson's (1974:318) "topotypic" designation has no regulation under ICZN.

SPECIMENS: TM: K379, Domain, Hobart, 14.viii.1954, J.L. Hickman, (Jamieson's specimen 1, previously dissected mature); AM:W5331, same collection data as TM: K379 (Jamieson's specimen 2, not re-inspected here).

[Note: BM(NH):1973:2:47 (Jamieson's specimen 3), from Kelly's Basin, Port Davey is a large, dissected mature that differs substantially from Spencer's species - its genital markings consist of two elongate bands in 12/13 and 20/21 that are wider than bb, and its spermathecal diverticula are small and clavate rather than sessile multiloculate; in these respects it fails to conform to the type description, is probably a new species, and the Port Davey distribution for *N. wellingtonensis* can therefore be disregarded].

EXTERNAL FEATURES

Lengths mm: ca. 75+ (lectotype), (100 mm Spencer), 130 (TM:K379). Width: ca. 6 mm (Spencer). Segments: 138 (TM:K379). Colour: darkened in alcohol. Prostomium: epilobous. Clitellum: 14-17,½18 (Spencer). Dorsal pores: 3/4 (Spencer). Setae: eight throughout, but dorsal setae sometimes obscure. Nephropores: not discernible. Spermathecal pores: 7/8/9 in ab lines (Spencer), or closer to a lines. Female pores: paired on 14. Male pores: paired on papillae on 18 in

ab within tumid band. Genital markings: wide intersegmental marking in 19/20 in bb with wide borders in adjacent segments (as Spencer, 1895, fig. 25).

INTERNAL ANATOMY

Gizzard: large in 5, displaced posteriorly. Oesophagus: dilated 9-14, especially swollen and white in 9, not calciferous. Nephridia: avesiculate meroic, numerous and small in each segment; tufted anteriorly. Vascularization: dorsal vessel single; hearts 9,10-12 connected with the supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9, ampulla saccular, diverticulum multiloculate, rosette-shaped sessile on duct. Male organs: holandric iridescent testes and funnels in 10 and 11; seminal vesicles in 9 and 12. Ovaries: in 13. Prostates: racemose in 18; penial setae present. Intestine: origin 16; typhlosole from 24; gut contains organic soil.

REMARKS

Two pairs of multiloculate spermathecae and an elongate genital marking in 19/20 characterize *Notoscolex wellingtonensis*. It is superficially similar to *Anisochaeta alba* sp. nov. which, however, has perichaetine setae.

DISTRIBUTION AND HABITAT

The type description specifies Mt Wellington as the locality, while Spencer's label refers to Hobart; not relocated, despite 'topotypic' surveys by the author. Port Davey is no longer considered a valid locality (see note under Material Examined above).

Nexogaster Blakemore, 1997

Nexogaster Blakemore, 1997a: 1686-1687.

Diagnosis Setae 8 per segment. Dorsal pores present. Male pores from racemose prostates paired on 18. An oesophageal gizzard in 5 and moniliform intestinal gizzards in the region of 22-27 (i.e., four to six of). Nephridia meroic, avesiculate, not tufted anteriorly. Spermathecae two pairs, spermathecal diverticula single, clavate but may be internally bifid. Calciferous glands and intestinal caeca absent, typhlosole present. Penial setae present or absent.

Etymology: transliteration of Latin 'nexus' or 'necto-' and 'gaster' - for the gizzards in connected series.

[Note: under the recommendations of ICZN (1999: 35) a genus-group name ending in *-gaster*, is to be treated as feminine].

Type-species: *Nexogaster sexies* Blakemore, 1997a: 1686-1687.

Other species: *Nexogaster quaterni* sp. nov.

Distribution: NW Tasmania.

Remarks

Nexogaster is distinguished by the possession of an oesophageal gizzard in segment 5 and moniliform intestinal gizzards in 22,23-26,27. The generic diagnosis is modified to allow presence or absence of penial setae, as these are not found in *N. quaterni*.

The monotypic genus *Pleionogaster* Michaelsen, 1892 from the Philippines (and doubtfully from Moluccas), while having intestinal gizzards in 26-28,29, differs principally by being perichaetine, vesiculate meroic and having an oesophageal gizzard in segment 8 (Easton, 1979). Its similarity in other respects supports a close relationship between Australian and Oriental megascolecids. Multiple intestinal gizzards are also found in the primitive and distantly related, Oriental family Moniligastridae. Were it not for the intestinal gizzards, species included in *Nexogaster* would comply with *Notoscolex*, indeed several *Notoscolex* species are superficially similar. Other Tasmanian genera with multiple intestinal gizzards are *Tassiedrilus* (that is holoic and may be derived from *Perionychella*), *Gastrodrilus* (that is similar to *Nexogaster*, but has neither dorsal pores nor a typhlosole, and may be derived from *Aporodrilus*), and *Anisogaster* and *Retrovescus*. The latter two

genera are anisochaetine or perichaetine, and meroic and both may thus be derived from *Anisochaeta*.

Nexogaster quaterni sp. nov.

Fig. 153.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0560, Yolla, Blackwell Road, NW Tasmania, CQ 790 352, 250 m, 9.iv.1993, R.D. D'Orazio and D.E. Soccol, sampled 5.5 km along road in rainforest, (mature, dissected and figured).

PARATYPES: (P1) ANIC:RB.00.1.22, same details as H, (mature, dissected); (P2) 14:3716, same details as H, (mature posterior regenerate in last 17 segments, disected); (P3) 14:3717, same details as H, (mature); (P4) 14:3718, same details as H, (mature); (P5) 14:3719, same details as H, (mature); (P6-11) 14:0561, Yolla, Blackwell Road, Wynyard, NW Tasmania, CQ 786 351, 250 m, 9.iv.1993, R.D. D'Orazio and D.E. Soccol, samples a further 1.5 km along road (i.e., 7 km) in rainforest, (four matures and two juveniles, one mature dissected); (P12-18) 14:1061, Hellyer Gorge Reserve, NW Tasmania, CQ 836 294, 310 m, 31.v.1993, R.D. D'Orazio and D.E. Soccol, (seven matures, one dissected).

EXTERNAL FEATURES

Body: often laterally flattened, first segment not reduced. Lengths mm: range 80-110; (H) 105, (P1-7) 80-85, (P12-17) 80-110. Width: ca 3 mm. Segments: range 110-140; (H) 132, (P1) 110, (P5) 120, (P12) 140. Colour: pale unpigmented in alcohol, small yellow dots laterally near setae in anterior and tail; clitellum buff. Prostomium: open epilobous. Clitellum: ½13-17. Dorsal pores: from 4/5 (occluded on clitellum). Nephropores: not found. Setae: 8 in regular rows except d, then c, then b, slightly irregular on tail. Spermathecal pores: 7/8/9 just ventral of a lines. Female pores: paired on 14. Male pores: in a lines on small mounds in ab within circular male field on 18. Genital markings: large, mid-ventral sucker-like discs in 12/13 (H, P3-4, P12, P13) and in 19/20 (H, P1-12, P14-18).

INTERNAL ANATOMY

Septa: 5/6-10/11/12 increasingly thick. Gizzards: compact oesophageal gizzard in 5; intestinal gizzards smooth, muscular and moniliform in 22-25 (in H and P1), i.e., four of. Oesophagus: slightly dilated but not calciferous in 14-16, valvular in 17-½18. Nephridia: avesiculate meroic, clusters of three or four tubules per side lateral of a and b and in c-d lines, these latter large; all smaller after clitellum; not tufted anteriorly; funnels not found. Vascularization: dorsal blood vessel single;

hearts 10-12 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9; saccular ampulla on tapering duct with clavate but slightly bifid diverticulum ectally (H, P1). Male organs: holandric, iridescent testes in 10 and 11; racemose seminal vesicles small in 9 and larger in 12. Ovaries: large, paired, almost filling segment 13; vestigial ovisacs in 14. Prostates: racemose in 18 with gland sometimes folded on itself, and duct long, curving; penial setae absent. Intestine: origin in ½18, dilated and thin-walled to 21; muscular intestinal gizzards in 22-25, transitional in 26,27; large T-shaped typhlosole develops from 27,28; gut contains organic soil, mucus and quartz grits.

REMARKS

Nexogaster quaterni differs from *Nexogaster sexies* by having unpaired genital markings, on the shape of the spermathecae which have slightly bifid diverticula, on the shape of the prostates, lack of penial setae, and intestinal gizzards in series of four only. Externally, *N. quaterni* is similar to both *Anisochaeta zeehani* and *A. corinna*, perhaps indicative of common origins, although these two species have perichaetine setae.

ETYMOLOGY *quaterni* , Latin – 'four of' , alluding to the four intestinal gizzards.

DISTRIBUTION AND HABITAT

NW Tasmania: Yolla-Wynyard, in rainforest, and Hellyer Gorge.

Nexogaster sexies Blakemore, 1997

Fig. 154.

Nexogaster sexies Blakemore, 1997a: 1698-1701, fig. 5.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3320, Marrawah, N.W. Tasmania, 41°01'S 144 44'E, 7th September 1987, "Killara" property , S. Pilkington, (mature, dissected and figured).

PARATYPES: (P1) ANIC:RB.96.11.9, same details as H, (mature, dissected); (P2) TM:K1529, same details as H, (mature); (P3) ANIC:RB.96.11.10, same details as H, (mature, aclitellate); (P4), 14:3324, same details as H, (mature specimen, dissected); (P5) 14:3571, New Paddock at "Killara", 24th June 1993, R.J. Blakemore, J. Buckerfield, S. Pilkington, (mature specimen); (P6) ANIC:RB.96.12.2, same details as P5, (mature, dissected); (P7), TM:K1534, same details as P5, (mature).

EXTERNAL FEATURES

Body: slender, often dorso-ventrally flattened, first segment not reduced. Lengths mm: range 60-90; (P6-7) 90, (H, P2 and P5) 80, (P1) 75, (P3) 65, (P4) 60. Width: ca 3.3 mm. Segments: (H) 132, (P1) 128. Colour: unpigmented in alcohol, small yellow dots laterally near c setae; clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16,½17. Dorsal pores: small in 4/5, larger from 5/6. Nephropores: not found. Setae: 8 in regular rows (except in some specimens setae are slightly irregular at the caudal extremity and, seen in H, occasional odd or duplicated seta added); P1 has several dark speckles ventrally on 18 and 19. Spermathecal pores: 7/8-8/9 in setal a lines. Female pores: paired. Male pores: paired on small mounds in ab. Genital markings: large, paired sucker-like discs in 10/11 and sometimes also in 11/12 (in H, P3, P6-7) centred in a lines; similar disks in 17/18 and some of 18/19-20/21 in ab (markings absent from 18/19 in P1, P4 and P7; absent from 20/21 in P2, P5 and P7); i.e., consistently occurring only in 10/11, 17/18 and 19/20.

INTERNAL ANATOMY

Gizzards: muscular oesophageal gizzard in 5; intestinal gizzards also present. Oesophagus: slightly dilated but not calciferous in 14-15,16. Nephridia: avesiculate meroic, clusters of four or five tubules per side centred around bc and easily broken up on dissection; larger in clitellar region, becoming smaller after this; not tufted anteriorly; funnels not found. Vascularization: hearts 10-12; supra-oesophageal vessel 9-12. Spermathecae: two pairs in 8 and 9; saccular ampulla with large, wholly

iridescent, clavate diverticulum on duct ectally. Male organs: holandric, iridescent testes in 10 and 11; racemose seminal vesicles paired in 9 and 12. Ovaries: large in 13. Prostates: racemose in 17-19,20; long, curving penial setae present. Intestine: from 18, dilated and thin-walled in 18-21,22; smooth, muscular and moniliform gizzards in 22-27 (in H and P1) or 23-27 (P4) or 22-26 (P6), i.e., five or six of; moderately deep typhlosole after intestinal gizzards from 28; gut contains organic matter or dark soil and many quartz grits.

REMARKS

Despite one or two supernumerary setae on a few tail segments in H (not seen in other specimens), these are not sustained and consequently the lumbricine state is retained. *Nexogaster sexies*, is nevertheless comparable to *Anisogaster* species that have anisochaetine setae, also differing on their multiloculate spermathecal diverticula.

DISTRIBUTION AND HABITAT

NW Tasmania: Marrawah, on a farm property. Specimens were collected following cultivation of indigenous swampy heath vegetation, and after sowing to pasture.

Cryptodrilus Fletcher, 1886

Cryptodrilus Fletcher, 1886a: 570; Beddard, 1895: 483; Jamieson, 1972b: 154; Blakemore, 1997a: 1687; 2000c: 213.

Trinephrus Beddard, 1895: 483.

Cryptodrilus (part.); Jamieson, 1974: 266.

Diagnosis: Setae 8 per segment. Dorsal pores present or absent. Male pores from tubuloracemose or racemose prostates paired on 18 (or homeotic equivalent, eg. 17 in *C. mediocris* that has first segment suppressed). An oesophageal gizzard in 5. Nephridia vesiculate meroic, with multiple bladders in at least some segments of body. Spermathecae two (or three) pairs, with one or more clavate diverticula. Extramural calciferous glands and caeca absent; intramural calciferous glands and typhlosole absent or present. Penial setae present or absent.

Type-species *Cryptodrilus rusticus* Fletcher, 1886: 570-573, from Burrawang, NSW. (Syntypes, AM:W1389).

Distribution New South Wales, Victoria, Tasmania.

Included species

Cryptodrilus dubius Spencer, 1892: 136-137, figs. 13-15, 67, from Victoria, probably Croanjingolong, East Gippsland. (Lectotype NMV:G35).

Cryptodrilus fastigatus Fletcher, 1889, from Burrawang, Illawarra, Bega-Bombala, and Mt Kosciuszko, NSW. (Types AM:W.1308, see Blakemore, 2000c).

Cryptodrilus mediocris Fletcher, 1889: 1544-1546, from Newington, near Parramatta, NSW. (Syntypes AM:W.1313).

Cryptodrilus naroomai Blakemore, 2000c: 215-216, fig 16, from Narooma, NSW. (Holotype: AM:W24454, paratypes AM and ANIC).

Cryptodrilus polynephricus Spencer, 1895: 35-36, figs. 4-6, from Mt. Wellington and Parattah, Tasmania. (Neotype, QVM 14: 3512, newly designated below).

Cryptodrilus rusticus Fletcher, 1886, from Burrawang, NSW. (Lectytype, AM:W.1389).

Three additional taxa from Tasmania are described below.

Remarks Even though Jamieson (1972b:154) had stated that the prostates of *Cryptodrilus* were non-tubular, Jamieson (1972b:155) made a major lapse when he diagnosed "tubular to racemose prostates", an error repeated in Jamieson (1974: 266-267). *Crytptodrilus* was in fact never defined by tubular prostates, and species with

this character state belong in *Megascolides*. What differentiates *Cryptodrilus* from the prior genus *Notoscolex* is the demonstrable presence of nephridial bladders. The status of several species previously attributed to *Cryptodrilus* is uncertain as the presence or absence of nephridial bladders has not been satisfactorily determined and they therefore remain to *Notoscolex*.

Dorsal pores are present in the type species, *Crytodrilus rusticus*, and in other mainland Australian congeners, including *Cryptodrilus fastigatus* Fletcher, 1889, the type-species of Beddard's *Trinephrus*; however, all known Tasmanian species lack dorsal pores. These Tasmanian species form a cohesive assemblage that are closely similar to species of *Aporodrilus*, the only difference being that nephridial bladders are not manifest in the latter genus. It is possible that Tasmanian species should be united with *Aporodrilus*, separate from the mainland species of *Cryptodrilus* that have dorsal pores. Aquatic species often lack doral pores which, presumably, are also superfluous in moist habitats. In the case of *Cryptodrilus* and *Aporodrilus* it is possible that their multiple nephropores provides sufficient body surface moisture for respiration, lubrication, and defence, and having nephridial bladders helps to regulate this, making dorsal pores redundant. Occlusion of dorsal pores may have further adaptive advantage in preserving body moisture and discouraging entry of nematodes and other parasites.

Cryptodrilus polynephricus Spencer, 1895

Fig. 155.

Cryptodrilus polynephricus Spencer, 1895: 35-36, figs. 4-6; Jamieson, 1972b: 169-172, figs. 6D and 7E, 7F, 7G; Blakemore, 2000c: 213.

Trinephrus polynephricus : Michaelsen, 1900: 185-186.

Megascolides polynephricus ; Michaelsen, 1907: 161.

Cryptodrilus polynephricus polynephricus (part.) ; Jamieson, 1974: 282-288, figs. 21A, 22, 24A, 31H.

Perionychella (Vesiculodrilus) mortoni (part.); Jamieson, 1974: 248.

(Non *Cryptodrilus polynephricus urethrae* Jamieson, 1974: 288-291; see *Aporodrilus urethrae* sp. nov.).

[Non *Cryptodrilus polynephricus polynephricus* ad *urethrae* Jamieson, 1974: 291-293, figs. 21B, 24B, 31I; under Article 1.3.4 of ICZN (1999) intrasubspecific entities, such as this "morph", are excluded from the provisions of the Code].

MATERIAL EXAMINED

NEOTYPE: QVM 14:3512, Mt Wellington, 147°15'E.42°55'S, Shoobridge Bend Track, 21.ii.1996, R.J. Blakemore, under rocks and leaf litter, (mature specimen, dissected and figured).

This specimen is herein designated neotype under Article 75 of ICZN (1999) in order to clarify the taxonomic status of *Cryptodrilus polynephricus* - it is consistent with Spencer's original description, with Jamieson's characterization of an incompletely mature paralectotype, and is from the type locality.

[Note: From specimens not previously recognized as types, Jensz & Smith (1969: 90) had designated MOV:F40041 (previously NMV:G41) as lectotype, but this mature specimen, 95mm long with 140 segments and previously undissected in the anterior (which, despite this, was claimed by Jamieson (1974: 286) to be "*Perionychella (Vesiculodrilus) mortoni*"), has on inspection by the present author been demonstrated to be in fact a subspecies of *Vesiculodrilus mortoni* and, as it could not be a syntype of *Cryptodrilus polynephricus*, it loses its status as lectotype under Article 74.2 of ICZN. Dr B.J. Smith has agreed that this specimen's invalid designation was inadvertent, and, although the sample jar had labels stating "Mt Wellington, July 1892 A. Morton, C sp 3", and, in Spencer's hand, "C. sp. 3. T." and "*C. polynephricus* 2 or 3 specimens", it has clearly at some stage been misplaced].

PARALECTOTYPES (designations by Jensz & Smith, 1969: 90): MOV:G1436, four complete specimens from Mt Wellington, July 1892, A. Morton, formerly included with NMV:G41, for which the museum register lists lodgment of five specimens - one, now F40041, was separated off by Jensz and Smith (1969) with details given for MOV:F40041 above. The four remaining paralectotypes, listed in reasonable condition, were initially described by Jamieson (1972b:170) as aclitellate without genital markings; however, only three "incompletely mature" specimens were redescribed by Jamieson (1974: 286, 288), at least one of which had by this time acquired "normal" markings. In November, 1995, none of these specimens were traceable in MOV, and were later found to be on outstanding loan to Queensland University (T. Stranks, MOV Curator of Invertebrates, pers. comm. 3.vi.1996).

MOV: G40, an entire specimen dissected (presumably by Spencer), now in badly dried condition and of little use for study, with two Spencer labels: "C sp 3 T. - Parattah Feb./'92". (ca. 147°25'E.42°20'S) and "C sp 3 T. (Mt Wellington) AM/'92" (147°15'E.42°55'S).

[Taxonomic note: as paralectotypes do not regain their status as syntypes if the lectotype is lost and they have no name-bearing status (under Articles 73.2.2, 74F of ICZN, 1999), this specimen would have been eligible for designation as neotype although its poor state of preservation compelled giving preference to fresh material].

SPECIMENS: (Note: apart from the author's fresh material from Mt Wellington, several of the specimens listed here are in poor state and cannot be unequivocably identified with *C. polynephricus*, they are listed nevertheless since several formed a part of Jamieson's descriptions and have not yet been shown to belong to other taxa).

14:3513, Mt Wellington, 147°15'E.42°55'S, Shoobridge Bend Track, 21.ii.1996, R.J. Blakemore, same details as neotype, (17 specimens that superficially agree, including several immatures, one dissected to confirm internal anatomy); 14:3086, Lake Rowallan, C Tasmania, ca. 41°44'S.146°14'E, Lake Bill track, 9.ix.1992, QVM, in myrtle-grove, (clitellate mature, dissected and sketched); BM:1973:2:11-14 (Jamieson's specimens 1-4), Fern Tree, Hobart, 147°15'E.42°55'S, 17.viii.1954, Dr J.L. Hickman, in fern glade under logs, (four specimens. Note: the original label in this jar in Hickman's hand states "**Fern Glade, Fern Tree, 17/8/54, under logs. J.L.H.**", a second typed label added by Jamieson has "**Fern Glade, Emu R., Burnie. Under logs. J.L. Hickman. 17.V.1954. Ident: B.G.M. Jamieson**" - this latter

location and date are erroneous; a further Jamieson label says "*C. p. p.* with bladders and ureter", pers. obs.); BM:1973:2:15-16 (Jamieson's specimens 5-6), Tarraleah, 146°25'E.42°20'S, 27.v.1954, Dr J.L. Hickman, over pipeline [referring to the hydroelectric channels], (two mature specimens, undissected; Note: there is an inconsistency in these registrations as the next sample, 14:1926, that was donated to QVM contains the same Jamieson specimen numbers); 14:1926, Tarraleah, over pipeline, 146°25'E.42°20'S, 27.v.1954, Dr J.L. Hickman, labeled "Specs 5,6. Ident: BJ", (only one specimen in the jar, a mature tagged "6", dissected); 14:1967 (formerly Jamieson's T39-40, specimens 12-13), Mt Wellington, Hobart, 147°15'E.42°55'S, 27.x.1955, Dr J.L. Hickman, (two mature specimens, one previously dissected in the anterior only and with some internal organs removed and missing from jar, the other sectioned only in the tail; as Jamieson based his description on specimen 12, it is surprising that it was not dissected caudally); (Note: Jamieson's specimens 16 and 17, BM:1973:2:17-18, "from the top of Mt Wellington under stones, JLH, 13.xi.1954", are smaller specimens with genital markings in 10/11,11/12 in setal a lines and are not here considered conspecific); 14:1969, (formerly BJ: 41-42?, Jamieson's specimens 10-11, tagged "*ad urethrae*"), Collinsvale near Hobart, 147°15'E.42°50'S, 9.xi.1955, Dr J.L. Hickman, in myrtle forest, (two matures, dissected); BM:1973:2:19 (Jamieson's specimen 24), Waterworks Rd, Hobart, 147°20'E.42°50'S, 17.viii.1954, Dr J.L. Hickman, under stones, (mature, dissected; Note: this is the same date that Dr J.L.Hickman collected specimens from Fern Tree, Hobart, see BM:1973:2:11-14 above); TM:K334 (Jamieson's specimen 37), Lenah Valley, Hobart, 147°10'E.42°50'S, 31.viii.1953, Dr J.L. Hickman, under stones on banks of New Town Creek, (one mature specimen, previously dissected in the anterior only, here fully dissected and described, plus an unregistered, undissected, subadult); TM:K339 (Jamieson's specimen 43) and K340 (Jamieson's specimen 42), tagged "*ad urethrae*", Florentine Valley, 146°25'E.42°35'S, 7.iii.1956, Mr. J.M. Gilbert, surface soil under litter in *Eucalyptus regnans* forest under stones, (two matures, one previously undissected apart from a nick in the tail, both redescribed here); TM:K414 (Jamieson's "*Perionychella (Vesiculodrilus) mortoni*"), from Eaglehawk Neck, 147°55'E.43°00'S, 13.v.1954, Dr J.L. Hickman, (sample contained two specimens: specimen "1" is now in *Vesiculodrilus metandris* sp. nov., specimen "2" is a single damaged specimen, 212 mm long, that is possibly *C. polynephricus*); TM:K415

(Jamieson's "*Perionychella (Vesiculodrilus) mortoni*"), supposedly from "Fern Glade, Burnie" but most probably from Fern Tree, Hobart as a similar calamitous error was also made for specimens BM:1973:2:11-14 of *C. polynephricus* noted above, (sample contains two specimens: specimen "1" is now in *V. mortoni montis* subsp. nov., specimen "2" a previously undissected specimen in poor condition that is possibly *C. polynephricus*); TM:K416 (Jamieson's "*Perionychella (Vesiculodrilus) mortoni*"), from Sandy Bay, Hobart, (a previously undissected subadult, 210 mm long, that is possibly *C. polynephricus*); BM:1973:2:20-23 (Jamieson's specimen 46), Tyenna River (formerly Russell River), 146°40'E.42°45'S, 16.ii.1939, Tasmanian Biological Survey, J12, C.D. King, labeled "Only specimen 46 (BMNH 1975.2.20) is positively C. p.p. ad urethrae B.Jamieson", (four macerated specimens that provided little useful information).

EXTERNAL FEATURES (from Spencer, description of neotype, and from other material which complies sufficiently).

Body: moderately stout, circular with blunt tail that is sometimes dorsally canaliculate. Lengths mm: neotype 150; lectotypes 85-135; specimens range ca. 80 (K339) - 212 (K414), (cf. 120-150, Spencer). Width: ca. 5-6 mm (6 mm, Spencer). Segments: neotype 122, range ca. 120-180. Colour: brown in alcohol, fresh material yellowy with dark grey-brown dorsum; clitellum buff. Prostomium: open epilobous sometimes secondarily closed by lateral crease. Clitellum: ½13,13-17, often weak ventrally where genital markings impinge (Spencer: "when fully formed complete occupying 13-17. When not fully formed it is weak ventrally and more saddle-shaped"). Dorsal pores: absent. Setae: 8 in regular series. Nephropores: sporadically visible, minute, ca. 10 per segment posteriorly, mainly in setal lines plus one between cd. Spermathecal pores: 7/8/9 just lateral of setal a lines. Female pores: paired on 14. Male pores: paired in ab on very small papillae. Genital markings: characteristically with two or three pairs of elliptical tumid patches posteriorly in 9 and 10 centred in or near b lines, and (less often) in 11 slightly move ventral; further pairs sometimes posteriorly in 19 and 20 in ab (these latter figured but not described by Spencer); other paired markings are found posteriorly in some or all of 14-22, typically 15-21, sometimes overlapping intersegment in or near a lines but often diverging slightly around the male pores (observations from neotype and non-type material).

INTERNAL ANATOMY

Gizzard: large flask-shaped in segment 5 but displaced to occupy 8-9. Oesophagus: not especially dilated or with some dilation in 10-13, ('no true calciferous glands, Spencer). Nephridia: vesiculate meroic, five (Spencer) or six or seven nephridia per side with small spherical bladders in line with and between setae, (specimens from Florentine Valley and one from Collinsvale have bladders only in posterior segments, pers. obs.); tufted in anterior three or four segments; funnels not discernible (confirmation of Spencer), [so called 'ureters' were found only in Florentime Valley specimens and there were more like funnels to the succeeding segment rather than continuous ducts]. Vascularization: dorsal vessel single, commissurals 4-8, larger hearts in 9,10-13 arising from supra-oesophageal vessel which runs from 8,9-13 (confirmation of Spencer). Spermathecae: two pairs in 8 and 9, diverticulum thickly clavate about one-quarter the total length. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles large racemose, paired in 9 and 12 (confirmation of Spencer). Ovaries: in 13; ovisacs absent or rudimentary. Prostates: large and flat, blocky tubuloracemose extending through 18-20,21; penial setae present. Intestine: origin ½16 (in neotype, cf. 17 Spencer); typhlosole absent, but low dorsal ridge may sometimes be present; gut often contains fine soil and woody organic matter.

REMARKS

Michaelsen (1907) placed *C. polynephricus* in *Megascolides* based on Spencer's description of the prostates as 'tubular'. The prostates are in fact tubuloracemose (as was stated by Jamieson, 1974: 282). *Aporodrilus albertisii* (Cognetti de Martiis, 1910) is a possible junior synonym, as discussed under this species' account.

The above account is consistent with Spencer's original and with the internal anatomy from Jamieson's (1972, 1974) inspection of an aclitellate paralectotype that had nephridial bladders. A notable difference from previous accounts is the intestinal origin is in ½16 rather than 17 (Spencer) or 16 (Jamieson). Information on anatomical variations is based on more recently collected specimens, including some from the type locality, that conform sufficiently with the original definition and with the paralectotypes described by Jamieson. However, there are some inconsistencies in Jamieson's descriptions of the external features of the four paralectotypes as he stated (1972b: 170) "accessory genital markings undeveloped", yet Jamieson (1974: 288) has

"in the [three remaining?] paralectotypes of which, though they are incompletely mature, one has rudiments of a normal field, with genital markings in IX and X".

Jamieson's (1974) characteristation of *C. polynephricus* was based on a number of specimens (in the absence of adequate type material?) and encompassed at least two distinct species (see *Aporodrilus urethrae*). Jamieson (1974:248) also appears to have included some characters from *Cryptodrilus polynephricus* in his expanded definition of *Vesiculodrilus mortoni* (Spencer, 1895), and vice versa. Jamieson's anatomical variation was therefore wider than would normally be acceptable within a single species. Jamieson's concept of *Cryptodrilus polynephricus*, now mostly revised, had these character variations:

> Length 98-330 mm; prostomium epilobous to tanylobous; genital markings: in 9-11, sometimes absent [Jamieson's location of these markings was highly contradictory and confused, especially with reference to his figures, eg., p. 282 "in ab or medial of a"; vs. p. 284 "lateral of the line of spermathecal pores", i.e., lateral of a; vs. p. 288 "with centres in a ... in 9/10 and 10/11 and ... 11/12"; whereas Spencer actually had these markings in 9-11 in b lines]; female pores paired or unpaired; last hearts in 13 or 12; typhlosole absent or present; nephridial bladders absent or present; seminal vesicles in 9 and 12, or 11 and 12 or 9, 11 and 12; prostates racemose to tubuloracemose; spermathecal diverticulum with or without a basal swelling.

Whereas Jamieson (1974) recognized two subspecies: *C. p. polynephricus* and *C. p. urethrae* (as well as several morphological intermediate forms) these are herein redefined and given separated specific, and generic, status (see *Aporodrilus urethrae*). The diagnosis of *Cryptodrilus polynephricus* s. strict. is:

> Length 80-212 mm; prostomium epilobous; genital markings characteristically in 9-10,11 close to b lines; additional paired markings posteriorly in some of 14,15-21,22 nearer to a lines; female pores paired; last hearts in 13; typhlosole absent; nephridial bladders present, at least posteriorly, numbering 4 to 7 per side; seminal vesicles in 9 and 12 only; prostates large, blocky tubuloracemose extending through several segments; penial setae present; spermathecal diverticula stout but relatively short.

DISTRIBUTION AND HABITAT

SE and Central Tasmania: localities given by Spencer were Mt Wellington, Hobart and Parattah, the former becomes the type-locality from the neotype, the latter locality has not been confirmed despite surveys by the current author. Specimens have also been identified from Tarraleah, Florentine Valley, and Tyenna River near Central Lakes region and, possibly, from Eaglehawk Neck. Location of this species at Fern Glade near Burnie in northern Tasmania by Jamieson (1974) is incorrect - these specimens were in fact from Fern Tree, an Hobart suburb near Mt Wellington.

Cryptodrilus ramosus sp. nov.

MATERIAL EXAMINED

See sub-species.

EXTERNAL FEATURES

Lengths mm: 35-75. Width: ca. 2.5 mm. Segments: 98-153. Colour: unpigmented white or with faint pigmentation; clitellum cream. Prostomium: open epilobous but sometimes appears almost tanylobous, furrowed; peristomium furrowed ventrally also. Clitellum: annular ½13-17. Dorsal pores: absent. Setae: 8 in regular rows. Nephropores: not found but some dots near some setae in anterior noted. Spermathecal pores: 7/8/9 just lateral of a lines. Female pores: paired on 14. Male pores: paired on 18 in ab on small papillae. Genital markings: paired pads with small disc at centre in ab on 9-10,11 posteriorly just crossing furrows; small paired markings median to a lines but diverging around male pores in 14/15,15/16-19/20,20/21.

INTERNAL ANATOMY

Septa: thin. Gizzard: large muscular barrel in 5 but displaced to occupy 7-8. Oesophagus: not especially dilated; valvular in 15. Nephridia: vesiculate meroic, tubules approximately in line with setae and most or some with small bladder; tufts in 2-3,4; preseptal funnels found only in a lines. Vascularization: hearts 10-12,13 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9, ampulla saccular tapering to duct, diverticulum clavate on duct. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11, elongate racemose seminal vesicles in 9 and 12. Ovaries: in 13; ovisacs not noted. Prostates: flattened, folded, tubuloracemose in 18-19,20; vestigial penial setae present. Intestine: origin near anterior of 16; low but definate lamellar typhlosole present or absent; gut contains gritty soil.

ETYMOLOGY: ramosus, L. - branching off, for the separation of the species.

REMARKS

Cryptodrilus ramosus is similar to *C. polynephricus* but has lighter colour, smaller size, anterior genital markings are slightly more ventral, there are fewer nephridial bladders, penial setae are reduced, and, in variants, last hearts in 12 or a low typhlosole. Two sub-species are proposed as defined below.

DISTRIBUTION AND HABITAT

See sub-species.

Cryptodrilus ramosus copiafluvis subsp. nov.

Fig. 156.

MATERIAL EXAMINED

HOLOTYPE: 14:3657, Plenty River, Uxbridge, sampled where river crosses beneath road, SE Tasmania, DN 885 549, 470 m., 11.x.1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (mature specimen, dissected and figured).

PARATYPES: ANIC:RB.97.5.10 (P1), same details, (mature, aclitellate, possibly posterior regenerate, dissected); TM: K1556 (P2), same details, (mature, aclitellate, dissected); 14:1850 (P3), same details, (mature, dissected).

EXTERNAL FEATURES

Lengths mm: 65 (H), 50-55 (P1-2), 75 (P3). Width: ca. 2.5 mm. Segments: 138 (H), 106 (P1), 98 (P2), 153 (P3). Colour: unpigmented white in alcohol but with faint equatorial dark band in 7,8-10,11; clitellum cream. Genital markings: paired pads with small disc at centre in ab in 9 and 10 and (in P1-3) in 11 posteriorly and crossing furrow; small paired markings median to a lines but diverging around male pores in 14/15-19/20,20/21.

INTERNAL ANATOMY

Nephridia: vesiculate meroic, tubules approximately in line with setae each (always?) with small bladder, difficult to discern in anterior where they are partly embedded in body wall and lay close to setal sheathes, more clearly defined after clitellum; tufts in 2-3,4; preseptal funnels only found in a lines. Vascularization: hearts 10-13 (in H and P3 heart in 13 on rhs only) from supra-oesophageal vessel. Intestine: origin near anterior of 16; low but definate lamellar typhlosole develops from 30; gut contains gritty soil.

REMARKS

Cryptodrilus ramosus copiafluvis differs from *C. polynephricus* on its lighter colour, more ventral anterior genital markings, reduced penial setae, and presence of a low typhlosole.

ETYMOLOGY: copiafluvis, L. - of Plenty River, for the type locality.

DISTRIBUTION AND HABITAT

Plenty River, Uxbridge, S Tasmania in wet sclerophyll.

Cryptodrilus ramosus monsagris subsp. nov.

MATERIAL EXAMINED

HOLOTYPE: 14:1862, Mt Field National Park, SE Tasmania, DN 764 747, 200 m., 13.x.1993, R.D. D'Orazio and D.E. Soccol, walked the length of Russell Falls Trail sampling in 3 spots from wet sclerophyll/rainforest, (mature specimen, dissected).

PARATYPES: (P1-2) ANIC:RB.00.1.10, same details, (mature, posterior amputee @ 48, dissected, plus a juvenile, dissected).

EXTERNAL FEATURES (agreeing with *C. ramosus copiafluvis* except on points below)

Lengths mm: 45 (H), 35 (P2). Colour: faint anterior and posterior pigmentation. Genital markings: as in *C. r. copiafluvis* except not in 11 (H, P1) nor 14/15 (H), (P2 has no markings).

INTERNAL ANATOMY

Nephridia: vesiculate meroic, tubules approximately in line with setae, only some have small bladders. Vascularization: hearts 10-12 (all specimens). Intestine: origin 16, typhlosole absent but low ridge present (all specimens).

REMARKS

Cryptodrilus ramosus monsagris is separated from *C. r. copiafluvis* on the points given in the diagnosis above. This sub-species lacks a typhlosole, but still differs from *C. polynephricus* on its smaller size and its last hearts in 12 rather than 13, (this latter condition is possibly inchoate in *C. r. copiafluvius*).

ETYMOLOGY: monsagris, L. - of Mount Field, for the type locality.

DISTRIBUTION AND HABITAT

SE Tasmania: Mt Field National Park, Russell Falls Trail from wet sclerophyll/rainforest.

Cryptodrilus spenceri sp. nov.

Fig. 157.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3517, Tunnack, SE Tasmania, 147°30'E.42°25'S, 21.ii.1996, R.J. Blakemore, in woodland soil, (mature specimen, dissected and drawn).

PARATYPES: (P1) 14:3518, same details, (mature, posterior regenerate, dissected); (P2) 14:3519, same details, (aclitellate mature, undissected); (P3) 14:3520, same details, (aclitellate mature, slightly damaged, dissected); (P4-8) 14:3521, same details, (five immature specimens agreeing superficially).

EXTERNAL FEATURES

Lengths mm: 130 (H), 120 (P2), 110 (P1, P3). Width: ca. 4.5 mm. Segments: 153 (H). Colour: anterior and dorsum, light chocolate brown; clitellum grey. Prostomium: epilobous, closed by lateral furrow. Clitellum: annular though weaker ventrally, ½13,-17. Dorsal pores: absent. Setae: 8 in regular rows. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14. Male pores: paired on 18 in ab. Genital markings: paired pads postsetally in 9-11 in ab lines but converging; elongate pads postsetally in 17 and 18 centred in a lines (same for all matures).

INTERNAL ANATOMY

Gizzard: large, flask-shaped with anterior rim in 5 but displaced posteriorly to occupy 7-8. Oesophagus: not especially dilated. Nephridia: vesiculate meroic, in anterior to segment 9 ventral clusters of tubules converge to common duct that passes forwards on either side, then with several discrete, equatorial and avesiculate tubules approximately in line with setae; from around 15, small nephridial bladders appear intermittently but after clitellum they are consistently found just anterior to setae (i.e., four per side). Vascularization: hearts 10-13 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9, ampulla subspherical, diverticulum clavate. Male organs: holandric iridescent testes and funnels in 10 and 11, racemose seminal vesicles in 9 and 12. Ovaries: in 13; ovisacs absent. Prostates: large, flattened tubuloracemose in 18-21,22; penial setae ca 1mm long present. Intestine: origin ½16; typhlosole absent although there is a low dorsal ridge; gut contains organic soil.

REMARKS

Cryptodrilus spenceri shares most characters with *C. polynephricus* s. strict. and is found close to Spencer's Parattah type locality, although no new material of *C. polynephricus* has been located here and the remaining type material that is possibly from this locality, NMV: G40, is too deteriorated to check its identity. *C. spenceri* differs from the type description and re-description herein of *C. polynephricus*, principally in its fewer nephridial bladders and on its distribution of genital markings which are more median and closer to a lines in the anterior and in 17 and 18 only (cf. more extensive posteriorly in *C. polynephricus*). This distribution of markings is reminiscent of some specimens of *Aporodrilus enteronephricus* and *A. urethrae* - both of which lack nephridial bladders, amongst other differences.

ETYMOLOGY: patronym for Professor Sir W. Baldwin Spencer who did much of the early systematics work on Australian, and Tasmanian, earthworms..

DISTRIBUTION AND HABITAT

SE Tasmania: Tunnack, in woodland soil.

Aporodrilus Blakemore, 2000

Aporodrilus Blakemore, 2000b: 4-5.

Diagnosis: Setae eight per segment. Dorsal pores absent throughout. Male pores from tubuloracemose prostates paired on 18. Female pores paired or single. Oesophageal gizzard large in 5. Nephridia meroic, at least in the fore-body, avesiculate. Spermathecae two pairs, with clavate (or multiloculate but not sessile) diverticula. Intestine commencing in 16, or rarely 17; typhlosole absent; extramural calciferous glands absent; intestinal caeca and gizzards absent. Penial setae present or absent.

Type-species *Aporodrilus dombrovskisi* Blakemore, 2000, from Lake Pedder.

Distribution Tasmania: mainly SE, SW and Central with two species (*A. monogynus* and *A. urethrae*) widespread including N and NW.

Remarks *Aporodrilus* is separated from *Notoscolex* principally on its lack of dorsal pores, on its typically tubuloracemose prostates, and its intestinal origin in 16 (or 17). *Cryptodrilus* as defined by Jamieson, 1974 included species with tubular prostates - this never part of previous definitions - and species with or without nephridial bladders (despite Jamieson, 1972b having shown that the type species of *Cryptodrilus* had bladders), and with or without dorsal pores. Following Jamieson (1972b), *Cryptodrilus* is restricted to species with multiple nephridial bladders in a segment (Jamieson, 1974: 268 revised his earlier view and emended the definition of *Cryptodrilus* to include avesiculate species, a decision not supported here). Lack of nephridial bladders separates species of *Notoscolex* from *Cryptodrilus*; further lack of dorsal pores separates species of *Aporodrilus* from *Notoscolex*.

Aporodrilus ? albertisii (Cognetti de Martiis, 1910)

Fig. 158.

Megascolides Albertisii Cognetti de Martiis, 1910: 329-331, Figs. 3-6.

Notoscolex albertsi [sic] ; Jamieson, 1971: 73, 78.

Cryptodrilus albertisi ; Jamieson, 1974: 270-271.

TYPES: a single sub-adult collected from Mt Wellington, Feb., 1878 by Sig. Enrico D'Albertis and Dott. Odouardo Beccari, (this type specimen not located according to Reynolds & Cook, (1976: 67)).

SPECIMENS: none found.

EXTERNAL FEATURES (from type description).

Length mm: 68. Width: 4 mm. Segments: 107. Colour: "cenerognolo-bianchiccio", greyish-whitish. Prostomium: tanylobous or closed epilobous. Clitellum: not developed. Dorsal pores: absent the whole length of body. Setae: 8 closely paired, behind 18 setal lines, with the exception of a, displaced dorsally. Nephropores: not recorded. Spermathecal pores: 7/8/9 just lateral of setal a lines. Female pores: paired anteriorly on 14, midway between setal a lines and the ventral midline. Male pores: 'not externally visible'. Genital markings: three pairs of whitish, slightly tumid papillae posteriorly in 9-11 in b lines; no mention was made of other markings.

INTERNAL ANATOMY

Septa: 9/10-14/15 slightly thickened. Gizzard: extending from mid-5 to mid-6. Oesophagus: 'not bearing calciferous glands'. Nephridia: 'diffuse' [i.e., meroic], from approximately 30, those of the most ventral pair, in b lines, are much larger than others. Vascularization: hearts in 9-13. Spermathecae: two pairs in 8 and 9, ampulla transversely compressed with slightly lobulated margin with stout duct of equal length into which, close to external pore, opens digitiform diverticulum. Male organs: holandric, testes and funnels in 10 and 11; seminal vesicles small in 9 larger in 12, non-racemose. Ovaries: in 13. Prostates: paired in 18-20, the glandular part oblong, flattened, with corrugated surface [i.e., tubuloracemose]; the S-shaped muscular duct penetrating the parietes, apparently, in b lines; penial setae present 0.8 mm long. Intestine: origin in 16; typhlosole not recorded.

REMARKS

Cognetti de Martiis' account was based on an aclitellate specimen, was not fully figured, and, as no new material corresponding to his description has been located, there is some uncertainty concerning its identity. This species is *incertae sedis* because no mention was made of the presence of nephridial bladders, but is attributed to *Aporodrilus* due to its stated lack of dorsal pores. However, despite its smaller body dimensions, the genital markings are reminiscent of those of *Cryptodrilus polynephricus* for which *Aporodrilus albertisii* may actually be a junior synonym, and it is probable that Cognetti de Martiis was unaware of this prior species described by Spencer from Mt Wellington.

DISTRIBUTION AND HABITAT

Type-locality, Mt Wellington, Hobart Town.

Aporodrilus avesiculatus (Jamieson, 1974)

Fig. 159, Fig. 160.

Cryptodrilus avesiculatus Jamieson, 1974: 271-273, Fig. 18B [segments misnumbered], 31A (p. 322).

Aporodrilus avesiculatus; Blakemore, 2000b: 4.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K319 Kelly's Basin, Port Davey, SW Tasmania, 145°53'E.43°17'S, Tasmanian Biological Survey J17 Mr C.D. King, Jan 1940, (mature specimen in rather poor condition, previously dissected, with spermatheca removed and missing from jar).

PARATYPES: (P1) BM:1973:2:5, same details as H, (mature, dissected); (P2) TM:K320, same details as H, (undissected in anterior); (P3) TM:K321, New Harbour, SW Tasmania, 146°10'E.43°31'S, C. Davis, no date, (from original label, cf. Jamieson, 1974: 273 "146°70'E.43°30'S", "Mr C.D. King"), tagged "P3", (undissected in anterior); (P4) TM:K322, same details as P3, tagged "P4", (mature, undissected; Note: these two specimens were mixed between the labeled jars, but since they were tagged , the correct specimens are in the correct jars as stated here); (P5) AM:W5206, same details as P3-4, (mature, posterior amputee, previously dissected, re-inspected here); (P6) AM:W5207, same details as P3-4, (mature, damaged, undissected).

SPECIMENS: (S1-3) 14:3101, Melaleuca, Celery Top Island, SW Tasmania, DM 309 977, 4.iii.1992, L.F. McGowan, in rainforest, (three specimens, one mature dissected and sketched, one mature posterior regenerate, one subadult); (S4) 14:3636, Melaleuca, Half-woody Hill, DM 338 889, 5.iii.1992, L.F. McGowan, in wet forest, (mature posterior-amputee, dissected and figured); (S5-10) 14:0043, Melaleuca, Celery Top Island, DM 309 977, 4.iii.1992, L.F. McGowan, in rainforest, (six specimens, three matures one dissected and figured, one subadult, and two immatures that superficially agree); (S11-18) 14:0044, Melaleuca, Half-woody Hill, DM 338 889, 5.iii.1992, L.F. McGowan, in wet forest, (eight specimens, five matures, one dissected, two subadults, one immature); (S19-31) 14:0045, Melaleuca, DM 339 889, 80m, 5.iii.1992, L.F. McGowan, base of Eucalypt, (thirteen specimens, ten matures and three subadults); (S32) 14:0042, , Melaleuca, nr. Half-woody Hill, DM 339 909, 1.iii.1992, L.F. McGowan, in low scrub, (immature); (S33) 14:3646 (ex 14:1914), Cox Bight, 146°15'E.43°30'S, DM 386 851, "Cox's Bight TBS Nov. 1935 Jb8 and

June 1939 J9, C.D. King", labeled on UQ paper "Not *O. longus* from 18/1", tagged "3", (previously dissected mature, one of three specimens, the others are placed in *Gastrodrilus kingi* sp. nov.).

EXTERNAL FEATURES

Lengths mm: range 70-160; (H) 80, (P1) 70, (P2-3, S1) 95, (P4) 75, (S5) 160, (S6) 100, (S11-31) 90-110. Width: ca. 4 mm. Segments: range 95-126. Colour: (old material) uniform buff in alcohol, (fresh material) dorsum to flanks dark brown, ventrum and intersegmental furrows pale, dark dorsal line giving a distinctive "tiger stripe" appearance; clitellum buff to dark grey. Prostomium: open epilobous, sometimes with lateral furrow (eg. S1, S4, S5). Clitellum: ½13,14-17 (appearing more saddle-shaped in S5, S6-7, S12, S14-15, S19-28). Dorsal pores: absent. Setae: 8 in regular series. Nephropores: in S1, S4 in post-clitellar segments small irregular pores seen equatorially near b, mid bc and between d and mid-dorsum. Spermathecal pores: 7/8/9 just lateral of setal a lines, often surrounded by faint auriolae. Female pores: paired on 14. Male pores: paired on small papillae, median to b lines. Genital markings: faint markings in 7/8/9 near to spermathecal pores sometimes present (eg. in P1, P4-6, S1, S4); discs often paired (but not in P3-4) or analogue (S5 lhs) in ab lines posteriorly on 9; sometimes small paired or analogue ventral of setae a posteriorly in 16/17 (S5 rhs) and 17/18 (H, P2 rhs, S5, S11 rhs, S22 lhs, S27 lhs); paired sucker-like, median to a setal lines and almost connected midventrally in 18/19,19/20 (H, P1-6, all mature Ss, except S33) and in 20/21 too (in P3, S1, S2, S5 rhs, S11, S14 rhs, S21-22, S25).

INTERNAL ANATOMY

Septa: 10/11-13/14 slightly thickening. Gizzard: barrel-shaped and muscular, filling segment 5. Oesophagus: increasingly dilated 7-13 (not calciferous); narrow, valvular in 14-15. Nephridia: avesiculate meroic, four (sometimes only two or three?) per side approximately in line with setae, the median-most only slightly, if at all, larger in posterior; no funnels nor ureters seen, tufts noted in H, S1, S4 in segments 2-3,4. Vascularization: dorsal blood vessel single in new material; hearts 10-12 from weak supra-oesophageal vessel in 8-12,13. Spermathecae: two pairs in 8 and 9 (in H 9lhs removed and missing from jar), ampulla on solid sometimes bent duct with, midlength, small round knob-like diverticulum. Male organs: holandric iridescent testes and funnels in 10 and 11 invested in mucus; seminal vesicles small, paired

posteriorly in 9 and 12, also in 10 (H?, P1, S1, S4-5, S11), and anteriorly in 11 (in H rhs, P1, P3, S1, S4-5, S11, S33). Ovaries: palmate in 13; small ovisacs in 14 (in H, S4). Prostates: tubuloracemose in 18-20; penial setae present. Intestine: origin 16; no typhlosole; no intestinal gizzards; gut contains organic matter.

REMARKS

This redescription considerably augments the type description; differences and additions are that the post-clitellar genital markings are mostly median to a lines (not in a lines); small seminal vesicles are also present in 10 and 11 (in H and several other specimens), small ovisacs were found (in H), and the extent of the supra-oesophageal vessel is noted. *Aporodrilus avesiculatus* is closely similar to *A. brunyensis*, *A. enteronephricus*, and *A. urethrae*. Its arrangement of genital markings and the knob-like shape of the spermathecal diverticula are distinctive, furthermore, it differs from *A. brunyensis* by having paired female pores; and from *A. enteronephricus* by lacking a typhlosole. Separation from *A. urethrae* is made in remarks following that species' account below.

DISTRIBUTION AND HABITAT

SW coastal Tasmania: Port Davey, New Harbour, Melaleuca, and Cox Bight, often in rainforest.

Aporodrilus brunyensis (Jamieson, 1974)

Fig. 161.

Cryptodrilus brunyensis Jamieson, 1974: 273-275, Fig. 19A, 31B, C (p. 322).

Aporodrilus brunyensis; Blakemore, 2000b: 4.

MATERIAL EXAMINED

HOLOTYPE: TM:K323 (H), Bruny Island, 147°,15'E.43°22'S, 10.iv.1971, Mr A.J. Dartnall, from rainforest at summit of Mt Mangana, (mature, dissected and drawn, penial setae possibly removed).

PARATYPE: BM: 1973:2:6 (P), same details as H, (mature, dissected with some spermathecae removed and missing from the jar, penial setae possibly also removed).

EXTERNAL FEATURES

Lengths mm: (H) 50, (P) 65. Width: ca. 4 mm. Segments: 83-124. Colour: faint dark brown pigment in anterior; clitellum buff. Prostomium: open epilobous. Clitellum: ½13-½17. Dorsal pores: absent. Setae: 8 in regular series, b setae on 9 appear slightly enlarged. Nephropores: not found. Spermathecal pores: 7/8/9 just lateral of setal a lines surrounded by faint auriolae. Female pore: single on 14. Male pores: paired near a on small mounds on 18 in ab lines; tips of penial setae visible. Genital markings: paired in ab lines in 17/18; paired almost contiguous midventrally in aa in 19/20 and 20/21.

INTERNAL ANATOMY

Gizzard: muscular barrel in 5. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, about four tubules per side after clitellum; no funnels nor ureters seen although the median nephridia in the tail region discharge via duct into successive segments; tufted in 2-5. Vascularization: hearts 10-12 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9, ampulla as long as duct with elongate diverticulum midlength. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles small in 11, large in 12. Ovaries: palmate in 13; no ovisacs. Prostates: tubuloracemose in 18-20; penial setae appear small, but Jamieson stated length as 1.9 mm so possibly they have been removed from H. Intestine: origin 16; lamellar typhlosole develops from 17; gut contains organic matter.

REMARKS

This redescription considerably augments the type description; differences and additions are the true extent of the clitellum (cf. 13-17), b setae in 9 on tumid mounds,

and details of the nephridial system. The characteristics of *Aporodrilus brunyensis* of a single female pore, a well developed typhlosole, and last hearts in 13 are found in *A. monogynus* but the genital markings, at least, differ (eg. none in 18/19), and having seminal vesicles in 11 and 12 is similar to *A. hartzi* and *A. semisilvus*, which are differentiated below.

DISTRIBUTION AND HABITAT

SE Tasmania: Mt Mangana, Bruny Island, from rainforest.

Aporodrilus dombrovskisi Blakemore, 2000

Fig. 162.

Aporodrilus dombrovskisi Blakemore, 2000b: 21-22, fig 13.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3351, Sprent Basin, Lake Pedder north, DN 175 633, 310 m, 310 m, 9.iv.1996, R.J. Blakemore, in Ti-tree litter on edge of lake, (a mature specimen, dissected and figured).

PARATYPES: (P1) 14:3406, same details as (H), (mature, dissected); (P2) 14:3424, same details as (H), (mature posterior amputee, dissected); (P3) 14:3425, Scott's Peak, Huon Campsite, Lake Pedder south, DN 433 345, 320 m, 8.iv.1996, QVM, in peaty layer over clay in rainforest, (mature, dissected); (P4) 14:3426, same details as (P3), (mature, posterior amputee); (P5-6) 14:3427, same details as (P3), (two immatures, one dissected); (P7) 14:3440, Maria Creek, Lake Pedder, 442300 5250500, 315 m, 11.iv.1996, R.J. Blakemore, in Smithton peppermint *Eucalyptus nitida* woodland litter, (mature anterior amputee plus an unregistered tail); (P8-9) 14:3483, Bell Basin, Lake Pedder north, 419600 5259700, 310 m, 9.iv.1996, R.J. Blakemore, in Ti-tree litter, (two mature specimens).

EXTERNAL FEATURES

Tail rounded not tapering. Lengths mm: (H) 120, (P1) 110, (P3) 100, (P8-9) ca. 73, (P5-6 immatures) ca. 65. Width: ca. 4.5 mm. Segments: (H) 128, (P1) 143, (P3) 133. Colour: light brown dorsum to lateral c lines anteriorly but recedes to faintly pigmented spine in dd posteriorly; ventrum pale; clitellum buff. Prostomium: open or closed epilobous, sometimes appearing almost tanylobous. Clitellum: 13,½13,14-½17,17, saddle-shaped (only weakly developed ventrally in aa). Dorsal pores: absent. Setae: 8 in regular rows, ab (or at least their pores) retained on 18. Nephropores: not seen. Spermathecal pores: 7/8/9 in setal b lines. Female pores: paired on 14. Male pores: paired just lateral to b setae which are retained. Genital markings: nine or ten pairs of small discs in 9/10,10/11-18/19, in line with spermathecal pores but converging to setal a lines in 14/15 or 15/16 then diverging; usually with pairs of larger pads in a lines in 19/20 and, often in 20/21 and 21/22 also, but here more convergent.

INTERNAL ANATOMY

Gizzard: large, flask-shaped in 5 displaced to occupy 7-8. Oesophagus: vascularized in 12-13, not calciferous. Nephridia: avesiculate meroic; larger but not tufted anteriorly; approximately three to five, or more, clusters of tubules per side, equatorial but associated with anterior septa; none especially enlarged; funnels not found. Vascularization: hearts in (9?),10-12; supra-oesophageal vessel in 8-13. Spermathecae: two pairs in 8 and 9, ampulla ovoid with a thick, iridescent diverticulum preceded by a distinctive ectal diverticula appendage of unknown function. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles racemose in 9 and 12. Ovaries: palmate in 13, no ovisacs seen. Prostates: flattened, tubuloracemose 17-23,24; enlarged penial setae absent. Intestine: origin 16; no typhlosole to 35; gut contains, organic soil and woody material; no intestinal gizzards.

REMARKS

Distinctive characters of *Aporodrilus dombrovskisi*, compared to other members of the genus, are the linear arrangement of genital markings, the unusual spermathecal appendages, and the retention of setae ab on 18 ventral to the male pores.

ETYMOLOGY in tribute to the late Peter Dombrovskis, wilderness photographer.

DISTRIBUTION AND HABITAT

SW Tasmania; known only from Lake Pedder, but widespread around the shoreline, mainly in woodland litter, loam, in peaty layer over clay in rainforest.

Aporodrilus doveri sp. nov.

Fig. 163.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3771, Dover, 4.4km from Adamson Rd/Creekton Rd intersection to Creekton Rivulet, SE Tasmania, DN 922 983, 110 m, 20.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, dissected).

PARATYPE: (P) ANIC.RB.98.1.22, same details as H, (aclitellate mature, dissected).

EXTERNAL FEATURES

Body robust. Lengths mm: (H) 190, (P) 185. Width: ca. 10 mm. Segments: (H) 175, (P) 168. Colour: pale unpigmented in alcohol with few intersegmental dark dots in anterior; clitellum darker. Prostomium: open epilobous. Clitellum: ½13-17. Dorsal pores: absent. Setae: 8 in regular rows. Nephropores: not found. Spermathecal pores: minute 7/8/9 just lateral of setal a lines. Female pore: paired on 14. Male pores: paired superficial on 18 in ab lines. Genital markings: paired elongate pads from mid-ventrum to b lines in 10/11 and smaller in 17/18; possibly with faint paired markings in posterior 18 (H, P same).

INTERNAL ANATOMY

Septa: 6/7-12/13 increasingly thickened, septum 5/6 thin to base of gizzard. Gizzard: muscular barrel in 5 preceded by proventriculus displaced to occupy 7-8. Oesophagus: only slightly dilated in 9-13. Nephridia: avesiculate meroic, simple discrete tubules, about ten to twelve per side, connected by mesentery after clitellum; no funnel nor ureters seen; tufted nephridia absent. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-13 from weak supra-oesophageal vessel in 9-13. Spermathecae: two pairs in 8 and 9, ampulla long conical on thin duct giving appearance of mushroom, small diverticulum ectally. Male organs: holandric iridescent testes and funnels in 10 and 11; seminal vesicles small, spherical in 9, saccular or racemose anteriorly in 11 and 12. Ovaries: as delicate sheets of monofilaments in 13; no ovisacs in 14 (in H) or small in (P). Prostates: flattened tubuloracemose in 18; penial setae present, ca 4 mm long. Intestine: origin suddenly in 16; typhlosole not found; gizzards and caeca, absent; gut contains organic soil and fibrous root material.

REMARKS

Aporodrilus doveri is a comparable with *A. urethrae* having large size, paired female pores, seminal vesicles in 9, 11 and 12, and lack of a typhlosole. *A. doveri* is distinct in the shape of its spermathecae with diverticula which are elongate clavate and not cashew-like, its prominent genital markings in 10/11 only, and its pale colouration.

ETYMOLOGY for the Dover locality.

DISTRIBUTION AND HABITAT

SE Tasmania: Creekton Rivulet that opens to Port Esperance near Dover, wet sclerophyll.

Aporodrilus enteronephricus (Jamieson, 1974)

Fig. 164.

Cryptodrilus enteronephricus Jamieson, 1974: 277-280, Fig. 2, 20, 31E-G (p. 322).

Aporodrilus enteronephricus; Blakemore, 2000b: 4.

MATERIAL EXAMINED

HOLOTYPE: TM:K325 (H), Dee Bridge, C Tasmania, Lyell Highway, 146°38'E.42°24'S., 24.v.1954, Dr J.L. Hickman, (mature, previously dissected with spermatheca missing, re-inspected and sketched).

PARATYPES: (P1) BM:1973:2:9, Marlborough Highway, C. Tasmania, (near Bronte), 146°30'E.42°10'S., 26.v.1954, Dr J.L. Hickman, (mature, dissected); (P3) BM:1973.2.10, Lyell Highway, 5 miles from Bronte towards Hobart, 146°35'E.42°15'S., 24.v.1954, Dr J.L. Hickman, (mature, dissected with internal organs removed and missing from jar); (P6) TM:K326, same details as P1, (mature, dissected, sample also contains four unregistered immatures); (P7) TM:K327, same details as P1, (mature, undissected); (P8) TM:K328, same details as P1, (subadult, undissected); (P9) TM: K329, same details as P1, (subadult posterior amputee, undissected); (P10) TM:K330, same details as P1, (mature, dissected).

NON-TYPE SPECIMENS: QVM:14:1928 (formerly BJ: T28-32, "P11-15"), Tarraleah over pipeline, 146°25'E.42°20'S, 27.v.1954, Dr J.L. Hickman, (five specimens, two dissected); 14:3265, Pump House Point, Lake St Clair, 146°15'E.42°05'S., 140 m, 12.x.1995, R.J. Blakemore, from base of an eucalypt, (two specimens, one mature dissected, and an immature).

MATERIAL NOT EXAMINED: (P4-5) AM:W5211-5212, Tarraleah, Lyell Highway, 146°25'E.42°20'S, Dr J.L. Hickman, 22.v.1954.

EXTERNAL FEATURES

Lengths mm: (H) 120, (P1) 110, (P3) 60, (P6) 120, (14:3265) 130. Width: ca. 4 mm. Segments: (H) 162. Colour: uniform brown in alcohol. Prostomium: open epilobous with small parallel grooves; peristomium ventrally cleft (H). Clitellum: often appears saddle-shaped due to mid-ventral genital markings, ½13,14-17,½18. Dorsal pores: absent. Setae: 8 in regular series but diverge slightly either side of male pores, becoming almost equidistant in tail (eg. in P3). Nephropores: not found. Spermathecal pores: 7/8/9 just lateral of setal a lines. Female pores: paired on 14. Male pores: paired in ab, small penial setae protrude. Genital markings: paired pads

near a lines postsetally in 9 and 10 near intersegments (in P4-5 in 10 only); markings on clitellum in some or all of 14/15-17/18, mostly mid-ventral but diverging posteriorly to form paired discs in ab lines; small paired discs in ab lines in 18/19 and often 19/20 (eg. H), and in 20/21 too (in P3 and P10).

INTERNAL ANATOMY

Gizzard: large, muscular in 5. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, several tubules (ca. four to seven) per side approximately in line with, and between, setae; tufted in the anterior otherwise none especially enlarged except in the last 30 segments where the enlarged median ventral nephridia send ducts to the surface of intestine (sometimes difficult to discern). Vascularization: hearts 10-13 (or 10-12 in P3-5) from supra-oesophageal vessel in 8-13. Spermathecae: two pairs in 8 and 9, small ampulla on thick duct with on its mid-length short clavate diverticulum that is slightly bifid in H 9lhs. Male organs: holandric, iridescent testes and funnels in 10 and 11 in mucus, racemose seminal vesicles small in 9 and 10, larger in 12. Ovaries: large in 13; ovisacs rudimentary in 14. Prostates: large, flattened tubuloracemose in 18-22; penial setae present. Intestine: origin 16, deep typhlosole develops from 16 (P3), 17 (P1), or 18 (H); gut contains mucus and dark organic soil.

REMARKS

Aporodrilus enteronephricus is separated from the superficially similar *Aporodrilus urethrae* on its well developed typhlosole (as also found in *A. brunyensis*) and seminal vesicles in 9, 10 & 12 (rather than 9 & 12). The last hearts are typically in 13 but are in 12 in some specimens (eg. in P3-5).

DISTRIBUTION AND HABITAT

Dee Bridge, Bronte, Tarraleah and Lake St Clair in Central Tasmania.

Aporodrilus fuscus sp. nov.

MATERIAL EXAMINED

See sub-species.

EXTERNAL FEATURES

Lengths mm: 75-180. Width: ca. 4 mm. Segments: 110-156. Colour: light to dark brown dorsally sometimes with brilliant iridescence; clitellum buff. Prostomium: open epilobous to tanylobous. Clitellum: saddle-shaped ½13,14-17. Dorsal pores: absent. Setae: 8 per segment in regular rows. Nephropores: at least four per segment seen in post-clitellar segments, just anterior to setal arc but irregular, most often near setae b and c and above d. Spermathecal pores: paired in 7/8/9 either median to or in setal a lines. Female pores: paired on 14. Male pores: closely apposed in common bi-lobed field median in aa; tips of penial setae visible. Genital markings: widely paired vertical discs lateral of b setal lines in 10/11; sucker-like discs in 15/16 and/or 16/17 in ab; more ventrally paired in ab lines in some of 19/20-21/22.

INTERNAL ANATOMY

Septa: none or 9/10-12/13 slightly thickened. Gizzard: large, muscular barrel in 5 displaced to occupy 6,7-8,9. Oesophagus: only slightly dilated in 12-14. Nephridia: avesiculate meroic, four or five sets of tubules per side close to each seta and mid-way between d and mid-dorsum; not tufted in anterior; no funnels nor ureters found. Vascularization: dorsal blood vessel single; hearts 10-12; supra-oesophageal vessel 9,10,11-13. Spermathecae: two pairs in 8 and 9, sub-spherical ampulla on equally long duct that has longer diverticulum ectally. Male organs: holandric iridescent testes and funnels free in 10 and 11; seminal vesicles racemose rosettes in 9 and elongate in 12. Ovaries: compact in 13; no ovisacs found in 14. Prostates: tortuous tubuloracemose in 18-20; long penial setae present. Intestine: origin 16; intestinal gizzards absent; typhlosole absent; gut contains colloidal organic soil/matter.

REMARKS

Aporodrilus fuscus differs from *A. avesiculatus* and *A. semisilvus* by having spermathecal pores in or median to setal a lines, and genital markings widely paired in 10/11 and absent from 18/19. It is divided into two sub-species as described below. A similar and sympatric species is *Aporodrilus melaleucus* sp. nov. which is differentiated under that species' account.

ETYMOLOGY: fuscus = brown, for the colouration.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania, from rainforest of low scrub.

Aporodrilus fuscus fuscus sub-sp. nov.

Fig. 165.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0030, Half-woody Hill, Melaleuca SW Tasmania, DM 339 889, 80 m, 5.iii.1992, L.F. McGowan, base of eucalypt, (mature specimen figured and dissected).

PARATYPES: (P1) ANIC:RB.97.3.10, same details as H, (mature dissected); (P2) TM:K1548, same details as H, (mature specimen, abnormal as several midbody segments fused or half duplicated, dissected); (P3) 14:3633, same details as H, (mature, dissected); (P4) ANIC:RB.97.3.11, same details as H, (mature); (P5) TM:K1549, same details as H, (mature); (P6-7) 14:3632, same details as H, (three matures, two aclitellate); (P9-P14) 14:0029, Celery Top Island, Melaleuca DM 309 977, 4.iii.1992, L.F. McGowan, rainforest, (four matures and two subadults); (P15-P19) 14:0032, Half-woody Hill, Melaleuca SW Tasmania, DM 338 889, 5.iii.1992, L.F. McGowan, wet forest, (three slightly damaged matures, one dissected, and two subadults plus two fragments); (P20-22) 14:0046, same details as H, (three subadults, one dissected).

EXTERNAL FEATURES

Lengths mm: (H, P3-5) 110, (P1) 150, (P2, P6) 120, (P9, P11) 130, (P16-19) 95-120+, other matures ca. 100, (P20-22) 75-80. Width: ca. 4 mm. Segments: (H) 110, (P1) 156, (P2) 133. Colour: light to dark brown dorsally, with irregular dark dots in anterior setal arcs; clitellum buff. Prostomium: open epilobous, not quite tanylobous. Clitellum: saddle-shaped ½13-17 dorsally. Dorsal pores: absent. Setae: 8 per segment in regular rows. Nephropores: at least four per segment seen in post-clitellar segments, just anterior to setal arc but irregular, most often near setae b and c and above d. Spermathecal pores: paired in 7/8/9 median of setal a lines, sometimes within auriolae that meet mid-ventrally. Female pores: paired on 14. Male pores: closely apposed in common bi-lobed field median in aa; tips of penial setae visible. Genital markings: (all mature specimens) widely paired discs lateral of b setal lines in 10/11; in ab lines in 15/16 and 16/17; more ventrally paired in ab lines in 19/20 and 20/21; (P3, P16-17) have additional pair or analogue in 21/22; (P11) has analogue on 14/15rhs.

INTERNAL ANATOMY

Septa: 9/10-12/13 slightly thickened. Gizzard: large, muscular barrel in 5 (septum 5/6 goes to base) but displaced to occupy 7-9. Oesophagus: only slightly dilated in 12-14. Nephridia: avesiculate meroic, four or five sets of tubules per side close to each seta and mid-way between d and mid-dorsum; not tufted in anterior; no funnels nor ureters seen. Vascularization: dorsal blood vessel single (heavily infested with nematodes in H, P1 and P15); hearts 10-12; supra-oesophageal vessel 9,10-13. Spermathecae: two pairs in 8 and 9, tubular ampulla on equally long duct that has longer diverticulum ectally (compressed and zig-zaging in P15). Male organs: holandric iridescent testes and funnels free in 10 and 11; seminal vesicles racemose rosettes in 9 and elongate in 12. Ovaries: compact in 13; no ovisacs found (except in P15). Prostates: tortuous tubuloracemose in 18-20; long penial setae present. Intestine: origin 16; intestinal gizzards absent; no typhlosole found to ca. 40; gut contains colloidal organic soil.

REMARKS

Aporodrilus fuscus fuscus has an epilobous peristomium, spermathecal pores more median than in *A. f. violaceus*, and is perhaps slightly smaller.

ETYMOLOGY: fuscus = brown, for the colouration.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania, from Eucalypt and rainforest soil.

Aporodrilus fuscus violaceus subsp. nov.

Fig. 166.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0031, near Half-woody Hill, Melaleuca SW Tasmania, DM 339 909, 15 m, 1.iii.1992, L.F. McGowan, low scrub, (mature specimen figured and dissected).

PARATYPES: (P1) ANIC:RB.97.4.2, same details as H, (mature dissected); (P2) TM:K1550, same details as H, (mature specimen, tail missing, dissected); (P3) 14:3637, same details as H, (mature); (P4) ANIC:RB.97.4.3, same details as H, (mature posterior amputee); (P5) TM:K1551, same details as H, (mature); (P6-10) 14:3638, same details as H, (two matures, one subadult and two immatures).

EXTERNAL FEATURES

Only characters differing substantially from nominal subspecies are given.

Lengths mm: (H, P1) 160, (P3, P5) 170, (P6) 180 (P2, P4) 140+. Width: ca. 4 mm. Segments: (H) 110, (P1) 154, (P3) 146. Colour: darkly pigmented with violet iridescence except for markings; clitellum slate. Prostomium: tapering tanylobous.

Spermathecal pores: paired in 7/8/9 in or just median to a setal lines. Genital markings: large, widely paired discs lateral of b setal lines in 10/11 (all mature specimens except P4 where they are in 9/10rhs and 10/11lhs) and paired or analogue in ab lines in 16/17 (in H, P3, P5-6 only); more ventrally paired discs in ab lines in 19/20 and 21/22.

REMARKS

Aporodrilus fuscus violaceus differs from the nominal subspecies by the features given above and as shown in the figures. Its elevation to species rank would depend on the degree of reproductive isolation of the respective populations of this species and *A. melaleucus*.

ETYMOLOGY: violaceus – 'violet', for the iridescence.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania, from low scrub.

Aporodrilus hartzi sp. nov.

Fig. 167.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3783, Geeveston, SE Tasmania, Keoghs Creek, Keoghs Road, DN 828 218, 180 m, 14.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, dissected).

SPECIMENS: 14:0657, same details as H, (seven specimens that are superficially similar but are insufficiently diagnosed for inclusion as paratypes).

EXTERNAL FEATURES

Length mm: (H) 85. Width: ca. 3 mm. Segments: 125. Colour: pale unpigmented in alcohol but some discoloration in anterior and few mainly intersegmental dark dots; clitellum buff. Prostomium: open epilobous but faintly furrowed to appear tanylobous. Clitellum: ½13-17. Dorsal pores: absent. Setae: 8 in regular rows. Nephropores: not found. Spermathecal pores: 7/8/9 just lateral of setal a lines surrounded by faint auriolae. Female pore: single on 14. Male pores: paired on small mounds on 18 in ab lines. Genital markings: elongate pads in bb lines in 19/20 and 20/21.

INTERNAL ANATOMY

Septa: none especially thickened, septum 5/6 to top of gizzard, 6/7 to base. Gizzard: muscular barrel in 6 preceded by proventriculus in 5. Oesophagus: slightly dilated in 12-14, valvular in 15. Nephridia: avesiculate meroic, about four tubules per side after clitellum near setae with large nephridium overlying that in a line with pre-septal funnel on each side; no ureters seen; tufted nephridial clusters in 4-5. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4; hearts 10-12 from weak supra-oesophageal vessel in 9-12; in 13 are coiled vessels on either side of oesophagus but these are not connected to dorsal blood vessels. Spermathecae: two pairs in 8 and, larger, in 9, ampulla as long as duct with digitiform diverticulum on its mid-length. Male organs: holandric iridescent testes and funnels in 10 in mucus with protozoan parasites, obscured by mucus in 11; seminal vesicles small, lingular anteriorly in 11 and 12. Ovaries: sheets in 13; no ovisacs in 14. Prostates: flattened tubuloracemose in 18-22; penial setae present. Intestine: origin in 16; deep lamellar typhlosole develops from 18; gizzards absent; gut contains organic matter.

REMARKS

Aporodrilus hartzi is comparable with *A. brunyensis* and *A. semisilvus*, all three have single female pores, seminal vesicles in 11 and 12, a well developed typhlosole, and, moreover, the spermathecae are very similar in shape with those in 8 smaller than those in 9. *A. hartzi* is distinct in having a gizzard in 6 and elongate markings in 19/20/21.

ETYMOLOGY for the Hartz Mountains, source of creeks at Geeveston.

DISTRIBUTION AND HABITAT

Keoghs Creek, Geeveston near Hartz Mountains National Park, from wet sclerophyll forest.

Aporodrilus melaleucus sp. nov.

Fig. 168.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3634, Half-woody Hill, Melaleuca SW Tasmania, DM 339 889, 80 m, 5.iii.1992, L.F. McGowan, base of eucalypt, (mature specimen figured and dissected).

PARATYPES: (P1) ANIC:RB.97.4.1, Half-woody Hill, Melaleuca SW Tasmania, DM 338-889, 5.iii.1992, L.F. McGowan, wet forest, (mature, dissected); (P2) 14:3635, same details as (P1), (mature posterior amputee, dissected); (P3) TM:K1552, same details as (H), (mature, dissected).

EXTERNAL FEATURES

Lengths mm: (H, P3) 100, (P1) 135. Width: ca. 3 mm. Segments: (H) 135, (P1) 112, (P3) 131. Colour: pale unpigmented in alcohol or with slight brown tinge; clitellum not much differentiated. Prostomium: open epilobous. Clitellum: 14-17 weaker ventrally. Dorsal pores: absent. Setae: 8 per segment in regular rows. Nephropores: anterior to most setae in post-clitellar segments. Spermathecal pores: paired in 7/8/9 in setal a lines. Female pores: paired on 14. Male pores: paired on slightly raised mounds in ab. Genital markings: paired lateral discs median of setal b lines in 10/11, conjoined discs median of b lines in 16/17, in 19/20 and (in H and P3 only) in 20/21. No markings are present in 18/19.

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: large, muscular barrel in 5 but appears to be in 5-6 (septum 5/6 goes to base). Oesophagus: only slightly dilated in 11,12-13; valvular in 15. Nephridia: avesiculate meroic, approximately four tubules per side close to setae; not tufted in anterior; no funnels nor ureters seen. Vascularization: dorsal blood vessel single; hearts 10-12; supra-oesophageal vessel 9,10-13. Spermathecae: two pairs in 8 and 9, saccular ampulla on equally long duct that has longer diverticulum ectally. Male organs: holandric iridescent testes and funnels free in 10 and 11; seminal vesicles saccular in 9 and racemose in 12. Ovaries: small in 13; no ovisacs found in 14. Prostates: tortuous tubuloracemose in 18-19,20; penial setae present. Intestine: origin 16; intestinal gizzards absent; typhlosole absent; gut contains colloidal organic soil.

REMARKS

Aporodrilus melaleucus is morphologically similar to *A. fuscus* but apparently differs by having spermathecal and male pores wider in a lines. Moreover, the markings in 10/11 and around the male field are laterally elongate and more ventral.

ETYMOLOGY: Melaleucus, noun, for the type-locality.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania, from Eucalypt or rainforest.

Aporodrilus monogynus Blakemore, 2000

Fig. 169.

Aporodrilus monogynus Blakemore, 2000b: 23-24, figs. 14, 15.

Cryptodrilus polynephricus urethrae (part.); Jamieson, 1974: 288-291, figs 23A, 24C, 31K-L.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3331, Island Road, Lake Gordon south, 438800 5258900, 310 m, 14.iv.1996, R.J. Blakemore, in humus of Huon pine forest, (mature posterior amputee, dissected and figured).

PARATYPES: (P1) 14:3437, Maria Creek, Lake Pedder, 442000 5250600, 310 m, 11.iv.1996, R.J. Blakemore, in litter under *Eucalyptus nitida* woodland, (mature, dissected and figured); (P2) 14:3398, same details as H, (mature lacking tail); (P3) 14:3399, same details as H, (mature, dissected); (P4) 14:3400, same details as H, (mature); (P5) 14:3401, same details as H, (subadult); (P6) 14:3402, same details as H, (immature plus two unregistered tails); (P7) 14:3428, Bonnet Bay, Lake Pedder, 431150 5248260, 310 m, 12.iv.1996, R.J. Blakemore, M. Driessen, M. Anderson, Ti-tree along creek, (mature, dissected plus several unregistered immatures and bits); (P8-9) 14:3438, same location as P1, (two matures); (P10-13) 14:3439, same location as P1, (four immatures); (P14) 14:3458, same details as P7, (mature).

SPECIMENS: BM(NH):1973:2:24 (ex-P1 *A. urethrae*) , Arve Valley (not "Arne"), SE Tasmania, 146°50'E.43°05'S., 10 mls [16 km] from Geeveston (not "Greeveston"), 11.xi.1955, J.L. Hickman, (mature, dissected); TM:K343 (ex-P3 of *A. urethrae*), Arve Valley, 16 km from Geeveston, 146°50'E.43°05'S, 11.xi.1955, J.L. Hickman, labeled "P3", (mature, previously dissected, but only after clitellum); TM:K344 (ex-P4 of *A. urethrae*), same details as K343, labeled "P4", (mature, undissected); TM:K345 (ex-P5 of *A. urethrae*), same details as K343, labeled "P5", (mature, undissected); TM:K346 (ex-P22 of *A. urethrae*), same details as K343, "P22", (mature, dissected); TM:K347 (ex-P23 of *A. urethrae*), same details as K343, "P23", (aclitellate mature, undissected); TM:K348 (ex-P24 of *A. urethrae*), same details as K343, "P24", (mature, undissected); TM:K349 (ex-P25 of *A. urethrae*), same details as K343, "P25", (mature, undissected); TM: unregistered, same details as K343, possibly the missing "P26", (mature, undissected);

14:409, Mole Creek, N Tasmania, DP 362 942, 540 m, 5.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (two matures, one dissected); 14:1678, Fairy Glade State Reserve, N Tasmania, DP 766 883, 740 m, 2.vii.1992, R.D. D'Orazio and L.F. McGowan, rainforest, (mature); 14:1706, Mt. Roland, N Tasmania, DQ 446 089, 240 m, 24.xi.1992, R.D. D'Orazion and M. Gittus, wet sclerophyll, (three matures and one subadult); 14:1707, Liffey Forest Reserve, N Tasmania, DP 762 827, 920 m, 2.vii.1992, R.D. D'Orazio and L.F. McGowan, rainforest, (four matures; plus one posterior amputee, dissected has paired female pores and = *A. urethrae*); 14:1709, Lake Barrington, NW Tasmania, DQ 325 133, 370 m., 25.xi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll, (three matures; plus one subadult and a mature of *A. urethrae* and one subadult of a different species).

MATERIAL NOT EXAMINED

AM:W5313 (ex-P8 of *A. urethrae*), Florentine, 4.viii.1955, J.M. Gilbert, rainforest soil, "P8", (this specimen is figured in Jamieson, 1974: fig 23A with a single female pore); AM:W5317 (ex-P12 of *A. urethrae*), Florentine Valley, 14-19?.viii.1955, J.M. Gilbert, under pieces of wood and bark, "P12", (this specimen is stated by Jamieson, 1974:290 to have a single female pore).

EXTERNAL FEATURES

Body long with tail blunt and dorsally furrowed. Lengths mm: normal range 110-200; (H) 80+, (P1) 200, (P3) 180, (P4) 150, (P7) 170, (P8-9) 140, (P14) 180. Width: ca. 7 mm. Segments: (P1) 132, (P3) 134. Colour: brown or yellowy dorsum to lateral line anteriorly but recedes to a faintly pigmented spine posteriorly, tail also dark, clitellum tan. Prostomium: closed epilobous or just faintly epi-tanylobous. Clitellum: ½13,14-½17,17. Dorsal pores: absent. Setae: 8 in regular rows, small in the anterior. Nephropores: not seen. Spermathecal pores: 7/8/9 in setal a line. Female pore: always single, midvental on 14. Male pores: paired in ab, near to penial setae. Genital markings: pairs of pale, shallow discs in line with spermathecal pores, postsetally in some or all of 7-9 often present (sometimes lacking); pairs of larger discs in a lines, but extending towards mid-ventral line, in 10/11 and/or 11/12 and 12/13; two pairs of discs in 17/18 and 18/19 just median to male pore lines; sometimes additional paired discs (or an analogue as in H) median to a lines in 19/20, and 20/21. All TM and BM specimens agree with the above range of sizes and genital marking variations and all have single female pore.

INTERNAL ANATOMY

Septa: delicate, none especially thick. Gizzard: solid, barrel-shaped in 5 but displaced posteriorly to 7-8. Oesophagus: not especially dilated. Nephridia: avesiculate meroic; not tufted anteriorly but larger and flattened in 1-6; about five-ten per side, equatorial, none especially enlarged; funnels not found; in tail segments about four or five small tubules per side, only the innermost having pre-septal funnel and sometimes sending duct to the succeeding segment. Vascularization: hearts in 10-13 with connections to supra-oesophageal vessel in 9-13. Spermathecae: two pairs in 8 and 9, ampulla elongate and with small cashew-shaped diverticulum. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles racemose, small or rudimentary in 9, larger in 11 and 12 on anterior septa. Ovaries: palmate in 13; ovisacs not found in 14. Prostates: tubuloracemose 18-19,20; penial setae present. Intestine: origin 16 (in H where it is deflected as far forwards as 13), ½16 (P1); no typhlosole; gut contents, yellow soil, woody organic matter and a few grits.

REMARKS

These specimens would formerly have been part of a *Cryptodrilus polynephricus* Spencer, 1895 complex of Jamieson (1974), fitting within the wide range of variation permissible in his *Cryptodrilus polynephricus urethrae* sub-species. However, specimens referred to *Aporodrilus monogynus* are differentiated by a single female pore, genital markings within the range of variation given above, and lack of a typhlosole. They are, nontheless, morphologically similar to, and often sympatric with, the holotype and remainder of specimens of *C. polynephricus urethrae* (here designated *Aporodrilus urethrae* comb. nov.), differentiated mainly by their paired female pores and rudimentary typhlosole.

There are several inconsistencies in Jamieson's account and figures of specimens of his "*Cryptodrilus polynephricus urethrae*". Regarding possession of single or paired female pores: the single female pore in his specimens P5, P22, P23, P24 and P25 are not noted. Moreover; accounts of the distributions of genital markings are sometimes confused, for example, Jamieson (1974:290) lists specimen "P8" as not having genital markings in 17/18 and as having genital markings in 20/21 and 21/22, the opposite to his fig. 23 of this specimen. (Jamieson's specimen P26, which is constantly referred to, is unregistered). Jamieson (1974) was also

contradictory on the presence or absence of a typhlosole (which on page 289 is stated to be absent or rudimentary in "paratype 1 and holotype, respectively"; while on page 290 it states "a typhlosole is absent or rudimentary in the holotype and paratype, respectively"). In actuality, the typhlosole is very rudimentary in *A. urethrae* (i.e., "H"), but absent from *A. monogynus* (i.e., "P1").

On further re-inspection of the types of *A. urethrae*, and in view of the subsequent intraspecific variation of single or paired female pores found in other taxa, eg. *Aporodrilus nubigenus* and some *Anisochaeta* spp. (see Blakemore, 2000a: 38), it is also possible that *A. monogynus* merits only sub-specific status from *A. urethrae*. Specific status is maintained pending further research on intraspecific variability of this character.

ETYMOLOGY "monogynus" for the single female pore.

DISTRIBUTION AND HABITAT

Widespread in Central, SW, N and NW Tasmania: Lake Gordon, Lake Pedder, Arve (and Florentine) Valleys, Mole Creek, Fairy Glade, Liffey Forest, Lake Barrington, and Mt Roland, from litter and humus in forest soils.

Aporodrilus nubigenus sp. nov.

Fig. 170.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3514, Mt Wellington, Shoobridge Bend Track, 147°15'E.42°55'S , 580 m, 21.ii.1996, R.J. Blakemore, (mature specimen, dissected and drawn).

PARATYPES: (P1) ANIC:RB.00.1.17, same details as (H), (mature, dissected); (P2) 14:3516, same details as (H), (mature with tip of tail missing, dissected).

EXTERNAL FEATURES

Lengths mm: (H, P1) 170, (P2) 160+. Width: ca. 4 mm. Segments: (H) 118, (P2) 146+. Colour: body dark yellow with dark grey dorsum (brown in P2); clitellum grey. Prostomium: open epilobous. Clitellum: saddle-shaped ½13,-17. Dorsal pores: absent. Setae: 8 in regular rows. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14 (H, P1), or single (in P2). Male pores: paired in ab. Genital markings: paired pads in b lines postsetally in 9 (P1, P2 rhs), 10 (H, P1-2) and 11 (H, narrower in P2); mid-clitellar markings in some or all of 14/15,-16/17 in or median to a lines; paired markings wider than male pores in 17/18 and 18/19; elongate ventral markings in or median to a lines in 19/20/21.

INTERNAL ANATOMY

Gizzard: large, flask-shaped in 5 but displaced posteriorly. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, several discrete, equatorial tubules per side; in anterior to 9 ventral clusters of tubules converge to common duct that passes to anterior segment. Vascularization: hearts 10-13 from supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9, ampulla heart-shaped, diverticulum clavate. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus, racemose seminal vesicles in 9 and 12. Ovaries: large in 13; ovisacs absent. Prostates: large, flattened tubuloracemose in 18-21; penial setae present. Intestine: origin 16; typhlosole absent but a low dorsal ridge present from 25; gut contains woody organic matter.

REMARKS

Aporodrilus nubigenus is morphologically similar to *A. avesiculatus*, *A. enteronephricus* and *A. urethrae*. It differs by being more darkly pigmented, having seminal vesicles in 9 and 12 only (cf. in 11 in *A. avesiculatus* and *A. urethrae*, and in

10 in *A. enteronephricus*) and in the distinctive shapes of the spermathecae. Further differences are, from *A. avesiculatus* the last hearts in 13 (rather than 12) and distribution of genial markings; and, from *A. enteronephricus* the lack of a typhlosole (the genital markings are, however, similar). Specimen (P2) has a single female pore but otherwise complies with the other two specimens. *A. nubigenus* is morphologically close to *Cryptodrilus polynephricus* - yet these specimens appeared markedly different in samples that contained this latter species which has nephridial bladders from the anterior. *A. albertisii* is another sympatric species that was described with markings in 9-11 (only?) and last hearts in 13, but no mention was made of presence or absence of nephridial bladders.

ETYMOLOGY: nubigenus, L. - 'cloud-born', for its mountain home.

DISTRIBUTION AND HABITAT

Mt Wellington, from woodland and gully litter, found along with specimens of *Cryptodrilus polynephricus*, *Vesiculodrilus hobartensis* and *V. mortoni*.

Aporodrilus olympus sp. nov.

Fig. 171.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3304, Mt Olympus, Lake St Clair, 13.x.1995, R.J. Blakemore, beech forest, (mature, dissected and drawn).

PARATYPES: (P1) ANIC:RB.00.1.13, same collection data as H, (mature, undissected); (P2) 14:3306, same collection data as H, (mature, dissected).

EXTERNAL FEATURES

Lengths mm: (H) 70, (P1 and P2) 65. Width: ca. 4.5 mm. Segments: (H) 116. Colour: pink-grey with faint mid-segmental banding in the anterior otherwise unpigmented; clitellum white. Prostomium: open epilobous. Clitellum: saddle-shaped, ½13-½18. Dorsal pores: none. Nephropores: none found. Setae: 8 throughout. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14. Male pores: superficial near a on 18, penial setae often protrude. Genital markings: paired flat white discs in b lines in 10/11; paired ellipsoid marks in ab in 16/17 and fainter in 19/20 and (in H only) in 20/21 also.

INTERNAL ANATOMY

Gizzard: elongate muscular in 5, occupying 7-8. Oesophagus: not especially dilated except perhaps in 13. Nephridia: avesiculate meroic as clusters of about three or four tubules in line approximately in line with setae, larger in the anterior segments, funnels not found. Vascularization: hearts 10-12 from supra-oesophageal vessel in 8-13. Spermathecae: two pairs in 8 and 9; ampulla demarcated from duct, diverticulum on duct with long, spiraling stalk as thick as the duct, the last few coils smaller with spermazoal iridescence. Male organs: holandric, iridescent testis in 10 and 11 in mucus; racemose seminal vesicles in 9 and 12. Ovaries: compact in 13. Prostates: tubuloracemose in 18-24; exceptionally long penial setal sheaves extend from 18-30 (18-33 in P2 with muscular attachment to body wall in 37), penial setae in bundles of about 8-9 per side. Intestine: origin 16; no typhlosole.

REMARKS

Aporodrilus olympus is distinctive in its long, spiraling diverticula and the correspondingly long penial setae. These setae, most likely function for scraping out and disrupting spermatozoa of previous concopulants as well as providing conduit for recharging the diverticula, are taken to surprising lengths in this species.

ETYMOLOGY: after the type locality, Mt Olympus.

DISTRIBUTION AND HABITAT

Mt Olympus, Lake St. Clair, from *Notofagus cunninghami* beech forest.

Aporodrilus rubicundus Blakemore, 2000

Fig. 172.

Aporodrilus rubicundus Blakemore, 2000b: 25-26, figs. 16, 17.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3342, Coronets, Lake Pedder east, 437900 5248800, 310 m, 11.iv.1996, R.J. Blakemore, in Banksia/Ti-tree woodland on lake edge, (a mature specimen, in 2 halves, dissected and figured).

PARATYPES: (P1) 14:3339, Sprent Basin, Lake Pedder, 417600 5263100, 310 m, 9.iv.1996, R.J. Blakemore, in Banksia/Ti-tree on lake edge, (mature, dissected); (P2) 14:3347, Bell Basin, Lake Pedder, 310 m, 6.iv.1996, A. Osborne and N. Forteath, (mature); (P3) 14:3343, same details as (H), (subadult); (P4) 14:3344, same details as (H), (juvenile); (P5-6) 14:3345, same details as (H), (two immatures); (P7-8) 14:3419, Ti Tree Cove, Lake Pedder, 445500 5235400, 310 m, 8.iv.1996, QVM, in matted roots and litter on lake's edge, (two matures, one dissected); (P9) 14:3421, same details as (P7-8), (a subadult, plus an unregistered tail); (P10) 14:3420, same details as (P7-8), (aclitellate mature, dissected and figured).

EXTERNAL FEATURES

Tail club-shaped. Lengths mm: (H) total 120, (P1) 120, (P2) 85, (P3) 80, (P4) 75, (P5-P6) 50, (P7) 130, (P9) 110, (P10) 135. Width: ca. 5 mm. Segments: (H) total 134, (P1) 130, (P2) 108, (P3) 88, (P5) 124, (P6) 101, (P7) 122, (P10) 122. Colour: bright red dorsum with blue cuticle iridescence to lateral c lines anteriorly (pre-clitellar segments paler), to only dd posteriorly; ventrum pale; clitellum orange. Prostomium: open or faintly closed epilobous, furrowed. Clitellum: 13,14-17, saddle-shaped. Dorsal pores: absent. Setae: 8 in regular rows, distinct as white dots. Nephropores: white intersegmental dots in c and d lines (at least). Spermathecal pores: 7/8/9 in setal a lines with pale anterior rims. Female pores: widely paired on 14. Male pores: paired in b lines near to penial setae. Genital markings: paired in line with spermathecal pores posteriorly in 9,10-11,12; sometimes paired (or an analogue) median to aa in 15/16 or 16/17; paired in line with male pores (in several specimens) in 17/18 and (in most specimens) in 18/19 followed by pairs of eye-like markings in some or all of 19/20-21/22, median to a setal lines.

INTERNAL ANATOMY

Septa: delicate. Gizzard: muscular, barrel-shaped with anterior flange in 5. Oesophagus: dilated, vascularized, and internally rugose in 8-13, but not calciferous. Nephridia: avesiculate meroic; enlarged as tufted nephridia in 3; thereafter about 3 or 5 clumps of tubules per side, equatorial approximately in line with setae plus one more dorsal; none especially enlarged; funnels not found. Vascularization: hearts in 10-12 from supra-oesophageal vessel in 8-12,13. Spermathecae: two pairs in 8 and 9, duct thick, ampulla ovoid with a stubby or multilocular (cauliform), diverticulum at junction. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles small, racemose in 9 (and 11 in P1?), lingular in 12. Ovaries: palmate in 13. Prostates: tubuloracemose, tortuous in 17,18-20,21; penial setae present. Intestine: origin 16; no typhlosole; gut contents organic soil and woody material.

REMARKS

Aporodrilus rubicundus differs from *A. avesiculatus* in having genital markings in 18/19 lateral of male pores; from *A. enteronephricus* in not having a deep typhlosole; and from *A. urethrae* in not having last hearts in 13. Other distinctive characters of *A. rubicundus* are the bright red colour, saddle-shaped clitellum and the shape of the spermathecal diverticula.

ETYMOLOGY "rubicundus" for the red colouration.

DISTRIBUTION AND HABITAT

Widespread around Lake Pedder, apparently allopatric with *A. monogynus*, in organic soil under *Banksia* and *Leptospermum* spp. scrub.

Aporodrilus semisilvus sp. nov.

Fig. 173.

MATERIAL EXAMINED

HOLOTYPE: 14:0023, Half-woody Hill, Melaleuca, SW Tasmania, DM 339 889, 80 m, 5.iii.1992, L.F. McGowan, base of eucalypt, (aclitellate mature specimen figured and dissected).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 110. Width: ca. 4 mm. Segments: 110. Colour: anterior and tip of tail with slight brown pigment, otherwise pale in alcohol. Prostomium: open epilobous. Clitellum: not developed. Dorsal pores: absent. Setae: 8 per segment, mostly in regular series but in midbody b, c and sometimes d irregular from one segment to next, also sometimes odd seta deleted; by tail, setae become evenly spaced. Nephropores: not found. Spermathecal pores: 7/8/9 just lateral of setal a lines. Female pore: single, midventral on 14. Male pores: paired on flat papillae in ab lines with tips of penial setae visible. Genital markings: paired discs median to setal a lines in 9/10 and 17/18, latter pair within common tumid pad that extends to b lines; widely paired discs in 18/19 centred in b lines.

INTERNAL ANATOMY

Septa: thin, 5/6 can be traced to base of gizzard. Gizzard: large in 5, muscular barrel-shaped occupying 8-½9. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, five or six discrete sets of tubules per side, converging in 3,4-6 to perhaps form tufts in anterior, but from 7 spread laterally on equator, reducing in size after male pore region; no funnels nor ureters seen. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-12 from well developed supra-oesophageal vessel in 9-13. Spermathecae: two pairs in 8 and 9, small spherical ampulla on equally wide duct that has long digitiform diverticulum on its mid-length. Male organs: holandric iridescent testes and funnels in 10 and 11 in mucus; seminal vesicles elongate pairs anteriorly in 11 and 12. Ovaries: fan-shaped in 13; small ovisacs in 14. Prostates: flattened tubuloracemose in 18-22; stout, straight penial setae impinge to 20. Intestine: origin suddenly in 17 forcing septum into 16; lamellar typhlosole develops immediately and becomes deep by 20; no intestinal gizzards; gut contains organic matter.

ETYMOLOGY: semi-silvus Latin - "half-woody" for the type locality.

REMARKS

Aporodrilus semisilvus differs from *A. avesiculatus* by its lack of seminal vesicles in 9, and by having a single female pore and a typhlosole, and from *A. brunyensis*, *A. enteronephricus* and *A. hartzi* (that have both these latter characters) on its arrangement of its genital markings, small spermathecal ampullae, intestinal origin in 17, and the more extensive prostates.

DISTRIBUTION AND HABITAT

Melaleuca, SW Tasmania, from base of Eucalypt.

Aporodrilus urethrae (Jamieson, 1974) comb. nov.

Fig. 174.

Cryptodrilus polynephricus urethrae Jamieson, 1974: 288-291. figs. 21C, 23B, 31J, M.

(Non *Cryptodrilus polynephricus polynephricus* ad *urethrae* Jamieson, 1974: 291-293, figs. 21B, 24B, 31I, = *Cryptodrilus polynephricus*).

Aporodrilus urethrae; Blakemore, 2000b: 4.

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K341, ANM (a forestry company, not "Arne") Road, Styx River Bridge, near Maydena, SW Tasmania, 146°35'E.42°50'S., 24.ix.1958, Mr Don Frankcombe (not "Frankombe"), labeled "Anm Road. E[ast] side of Styx River bridge approx. 1000' [300 m] into rainforest", (mature specimen, previously dissected with some internal organs removed and missing from jar).

PARATYPES: (P6) BM:1973:2:25, Florentine Valley, SW Tasmania, 146°25'E.42°35'S., 7.iii.1956, Mr J.M. Gilbert, surface soil under litter in *E. regnans* forest, under stones, (dissected and damaged specimen); (P7) TM: K350, Florentine, 146°25'E.42°35'S., 21.vii.1955, Mr J.M. Gilbert, (poor specimen that is macerated and dissected); (P16-17) BM:1973:2:26-28, Maydena, SW Tasmania, 146°40'E.42°45'S., 15.x.1960, J.L. Hickman, (two macerated specimens that provide little useful information plus an unregistered juvenile); (P21) TM: K351, Snowy Range, 146°40'E.43°00'S., 19.i.1939, Tasmanian Biological Survey: J18, Mr C.D. King, 3,300 m, (specimen in poor condition tagged "P21", plus two other unregistered specimens also in poor condition which may or may not be the same species);

TYPE-MATERIAL NOT EXAMINED: (P2) TM:K342, same details as (H), (specimen not found in Tasmanian Museum – Liz Turner, curator of invertebrates pers. comm.); (P9) AM:W5314, Florentine, 4.viii.1955, Mr J.M. Gilbert, rainforest soil, (specimen stated by Jamieson, 1974:291 to have last hearts in 12 rather than 13); (P10-11) AM:W5315-5316, Florentine Valley, 14-19?.viii.1955, Mr J.M. Gilbert, under pieces of wood and bark.

SPECIMENS: QVM: 14:3090, Lake Rowallan, C Tasmania, 46°12'E.41°45'S., 9.ix.1992, QVM, from myrtle grove, (mature posterior amputee, dissected and drawn); 14:1707, Liffey Forest Reserve, N Tasmania, DP 762 827, 920 m, 2.vii.1992, R.D. D'Orazio and L.F. McGowan, wet sclerophyll, (mature posterior amputee,

dissected, plus three matures with single female pore = *A. monogynus*); 14:1709, Lake Barrington, NW Tasmania, DQ 325 133, 370 m., 25.xi.1992, R.D. D'Orazio and M. Gittus, rainforest, (one subadult and one mature, plus four matures of *A. monogynus* and one subadult of a different species).

EXTERNAL FEATURES

Lengths mm: (H) 320, range of other specimens, 140-220. Width: 6-12 mm. Segments: (H) 181; range of other specimens, 133-180. Colour: uniform buff or with yellow tinge in alcohol, clitellum darker; fresh material has light brown anterior and tail with only slightly pigmented dorsal "spine", pale ventrum and tan clitellum. Prostomium: tapering, open epilobous, sometimes appearing closed and faintly tanylobous. Clitellum: ½13,14-17. Dorsal pores: absent. Setae: 8 in regular series. Nephropores: minute, numerous in and between setal lines. Spermathecal pores: 7/8/9 just lateral of setal line a. Female pores: on 14, closely paired (eg. in H) or more widely paired. Male pores: paired in ab on low papillae (appear as pale crescents in combination with adjacent genial markings). Genital markings: pale shallow discs on either side of spermathecal pores in some of 7-9 (sometimes present); paired (or analogue) elliptical tumid patches in, or median to, a lines in some or all of 9/10-12/13; round or elongate paired markings just median to level of male pores in 17/18, 18/19 (typically present); paired discs also in 19/20 and 20/21 or (rarely) 22/23. Most common arrangement is some of 9/10-11/12 and in 17/18-18/19.

INTERNAL ANATOMY

Septa: 7/8/9-12/13 increasingly thick. Gizzard: large muscular in segment 5 but displaced posteriorly, preceded in 4 by proventiculus. Oesophagus: slightly dilated 8-13,14, not calciferous. Nephridia: avesiculate meroic, tufted anteriorly (in ca. 2-4), thereafter five or more nephridia per side decreasing in size and number posteriorly except for the innermost which is enlarged, has preseptal funnel and connection to adjacent two or three nephridia sending composite duct to the posterior septum approximately in line with setal a lines. Vascularization: hearts in 10-13 from supra-oesophageal vessel in 8-13. (Note: Jamieson, 1974: 291, stated that P9 from Florentine Valley has last hearts in 12, but this has not been confirmed here). Spermathecae: two pairs in 8 and 9, ampulla elongate, ectal diverticulum cashew-shaped and about half length of ampulla. Male organs: holandric iridescent testes and funnels in 10 and 11; seminal vesicles racemose, small, often rudimentary in 9, larger

on anterior septum in 11 (often concealed in mucus) and 12. Ovaries: palmate in 13; no ovisacs. Prostates: tubuloracemose 18-19,20; penial setae present. Intestine: origin 16 but deflected anteriorly; no typhlosole although low dorsal ridge sometimes present (eg. in H from ca. 20 but dissipates by ca. 30); gut contains organic soil and woody material.

REMARKS

Aporodrilus urethrae is elevated to specific rank and distinguished from the superficially similar *Cryptodrilus polynephricus* on these characters: its lack of nephridial bladders; a smaller, reflexed tubuloracemose prostate and cashew-shaped spermathecal diverticula; an additional pair of seminal vesicles in 11; and also by the anterior genital markings between 9-13 in or near a lines (rather than in or near b lines). There is considerable variation in this species with regard to seminal vesicles (typically in 9, 11 and 12 although the anterior pairs may be rudimentary), and distribution of genital markings. Female pores may be widely or closely paired - specimens with a single female pore have been separated off to *A. monogynus*.

There was some confusion of the differentiation of *Cryptodrilus polynephricus urethrae* from *C. polynephricus polynephricus* in Jamieson (1974). On page 286, he states: "*C. polynephricus polynephricus* is distinguishable from *C. p. urethrae* ... in location of the anterior genital markings, or at least those in IX, significantly lateral of the spermathecal pores." and again on page 291 he reiterates: "The location of the preclitellar genital markings approximately in line with or median to the spermathecal pores...distinguish [*C. p. urethrae*] from [*C. p. polynephricus*]." and "*C. polynephricus urethrae* is recognized for specimens which have anterior genital markings in or median to the spermathecal lines..". Yet Jamieson (1974: pages 284 and 288) had previously stated that: "Some individuals [? specimens 12-17 of *C. p. polynephricus*] lacking markings in IX and with those in X and XI in or median to a." and "Specimens 14-17..and specimens 24 and 25...lacking genital markings in IX, and having those in X and XI further median than is ususal.". Moreover, Jamieson (1974 fig. 21B) shows specimen 44 of *C. p.p. ad urethrae* [= *C. polynephricus*] with genital markings in 9 and 10 in line with the spermathecal pores; Jamieson (1974, fig. 22B) shows specimen 24 of *C. p. polynephricus* with no markings in 9 and with those in 10 and 11 in line with or median to the spermathecal pores; and Jamieson (1974, fig. 23B) shows a two specimens of "*C. p. urethrae*": one without markings in 9, and the

other with markings in 9 and 10 lateral of the spermathecal pores. The confusion of the presence or absence of a typhlosole is resolved as rudimentary in the holotype of *A. urethrae*, and absent from "P1" - now transferred to *A. monogynus* (see remarks following this species' account). Finally, Jamieson (1974: 290) conceded that "Anatomical variation in this subspecies in some systems exceeds what would normally be expected with a species", but on the next page stated "morphological similarity, which exceeds that between most species,...are taken for the time being to indicate that they are subspecies."

Aporodrilus urethrae is typically a large species (up to 320 mm), that possibly requires further resolution, but is similar to *A. avesiculatus* and *A. enteronephricus* which differ primarily in the distributions of genital markings and in the shapes of spermathecae, the latter species is further differentiated by its well developed typhlosole.

DISTRIBUTION AND HABITAT

Widespread in SW, Central, and N Tasmania: eg. Arve and Florentine Valley, Russell River, Snowy Mts., Lake Rowallan, Liffey Forest and Lake Barrington, often in rainforest soils under litter.

Aporodrilus warrai sp. nov.

Fig. 175.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3652 Warra, Forestry Tasmania LTER site, ca. 43°04'S.146°40'E, SE Tasmania, 8.viii.1997, Forestry Tasmania/ANU collection, "Control plot Pit 7 0-15cm", wet sclerophyll, (mature, dissected and figured).

PARATYPES: (P1) ANIC:RB.97.5.3, same details as H, (mature, dissected).

Note: specimens preserved in 80% ethanol only (no formalin used) therefore can be used for molecular analysis; original sample also contained a third specimen possibly of a similar small species but material insufficient for full description.

EXTERNAL FEATURES

Lengths mm: (H) 44, (P) 40. Width: ca. 3 mm. Segments: (H) 88, (P) 111. Colour: slight pigmentation in anterior and posterior extremities and along mid-dorsal line in d-d; clitellum buff. Prostomium: open epilobous. Clitellum: ½13-½17. Dorsal pores: absent. Setae: 8 per segment in regular rows. Nephropores: possibly detected on clitellum between bc and above d lines. Spermathecal pores: paired in 7/8/9 just lateral of setal a lines. Female pores: single on 14. Male pores: superficial on 18 in ab replacing these setae. Genital markings: paired tumid discs with pore-like centres in line with spermathecal pores in 9/10/11/12, paired discs median to a lines in 12/13 (in P only), in 16/17, median to b lines in 17/18/19, and (in H only) median to a lines in 19/20, those in 17/18 have two pairs of papillae just lateral to b lines.

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: large, muscular barrel in 5 but occupies 6-9. Oesophagus: dilated in 9-15 but not calciferous. Nephridia: avesiculate meroic, approximately six tubules per side, the innermost two interlinked; not tufted in anterior; no funnels nor ureters seen. Vascularization: dorsal blood vessel single onto pharyngeal mass; hearts 10-12; supra-oesophageal vessel not noted. Spermathecae: two pairs in 8 and 9, saccular ampulla on equally long duct that has equally long diverticulum toward the junction of ampulla and duct. Male organs: holandric iridescent testes and funnels free in 10 and 11; seminal vesicles large and saccular in 9 and elongate in 12. Ovaries: sheet-like in 13; ovisacs not found in 14. Prostates: flattened tubuloracemose in 18-21; penial setae present ca. 0.5mm long.

Intestine: origin 16; intestinal gizzards and typhlosole absent; gut contains organic soil, plant matter and grits.

REMARKS

Aporodrilus warrai has a single female pore, seminal vesicles in 9 & 12, and lacks a typhlosole. It is comparable with *A. nubigenus* that has these same characteristics but differs in its arrangement of genital markings and its last hearts in 13. The shape of the spermathecae, with those in 8 markedly smaller than those in 9, are reminiscent of the spermathecae found in *A. brunyensis*, *A. hartzi*, *A. nubigenus*, *A. semisilvus*, and in *Notoscolex huoni*.

ETYMOLOGY: for the type-locality.

DISTRIBUTION AND HABITAT

SW Tasmania, Warra LTER site which is mainly wet *Eucalyptus obliqua* forest, found with *Megascolides tener* (see habitat details for this species).

Gastrodrilus Blakemore, 2000

Gastrodrilus Blakemore, 2000b: 5.

Diagnosis: Setae eight per segment. Dorsal pores absent. Male pores from tubuloracemose prostates paired on 18. Female pores paired. Oesophageal gizzard weak in 5; intestinal gizzards moniliform in most of 20-32 (eg 20,22,23,24-28,29,30,31,32; i.e., seven to ten of). Nephridia avesiculate meroic. Spermathecae two pairs, with clavate diverticula. Intestine commencing in 16 or 17; typhlosole absent; extramural calciferous glands absent; intestinal caeca absent. Penial setae present.

Type-species *Gastrodrilus driesseni* Blakemore, 2000.

Other included species

Cryptodrilus dartnalli Jamieson, 1974.

Gastrodrilus iosem sp. nov.

Gastrodrilus kingi sp. nov.

Distribution Lake Pedder, Melaleuca, New harbour, and Cox Bight, SW Tasmania.

Remarks *Gastrodrilus* is separated from *Nexogaster* Blakemore, 1997a which has five or six gizzards, through its lack of dorsal pores, lack of typhlosole and the form of the prostates. In *Nexogaster* the prostates are racemose (rather than tubuloracemose as in *Gastrodrilus*) and it is probable that this latter genus shares ancestry with *Notoscolex*, its intestinal gizzards being apomorphic. Similarly, *Gastrodrilus* may be related to *Aporodrilus* (i.e., lacking dorsal pores) or derived from a cryptodrilid that has lost nephridial bladders. In either case, the intestinal gizzards numbering between 7 or 10 are a remarkable and unique development. Other meroic genera with moniliform intestinal gizzards are *Retrovescus* and *Anisogaster*, however, these are both perichaetine (unlike *Gastrodrilus*) and may therefore be derived from *Anisochaeta*.

Gastrodrilus dartnalli (Jamieson, 1974) comb. nov.

Fig. 176.

Cryptodrilus dartnalli Jamieson, 1974: 275-277, figs. 2 [mislocated on map], 19B (p. 273), 31D (p. 322).

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K220, Melaleuca Inlet, Port Davey, 146°10'E.43°23'S, Dec. 1967, A.J. Dartnall, (aclitellate, posterior amputee in poor, macerated, condition, previously dissected with internal organs removed and missing from jar, re-inspected, re-figured).

PARATYPES: (P1) TM:K324, same details as H, tagged "2", (mature, macerated in mid-body, previously undissected in anterior but sectioned after clitellar region with prostate removed and missing from jar); (P2-3) BM:1973:2:7-8, New Harbour, SW Tasmania, 146°10'E.43°30'S, 17.i.1938, C.Davis [not 146°70'E (sic) nor "Mr C.D. King", as stated by Jamieson], (both specimens were of similar external appearance, only one had been dissected and was somewhat damaged internally with internal organs removed and missing from jar, but it clearly had intestinal gizzards in ca. 22-31); (P4-6) AM:W5208-5210, same details as (P2-3), tagged "P4-6", (three matures, only one clitellate, none previously dissected; clitellate specimen here dissected and found to have gizzards in 23-32).

SPECIMENS: ("P7-8") 14:1913 (previously BJ: T26-27), labeled "New Harbour, S.W. Tasmania, 27/1/38 C. Davis" (original label), i.e., same details as (P2-3), and "*C(?) dartnalli*" [on University of Queensland tag], "P2[7?]-8" [on Australian Museum tag], (both specimens darkened and rather brittle in alcohol, one clitellate and previously dissected, the other aclitellate and dissected here); (S1) ANIC:RB.00.1.20 (ex:14:0040 *G. iosem* sample), Melaleuca, South Coast Track, DM 328 904, SW Tasmania, 5.iii.1992, L.F. McGowan, under button grass, (mature, 130 mm long, dissected).

EXTERNAL FEATURES

Lengths mm: range 90-130, (H, posterior amputee) 90+, (P1) 110, (P2) 110, ("P7 -P8") 100-120, (S1) 130. Width: ca. 3.5 mm. Segments: (P2) 143, ("P7-8") both 188. Colour: uniform buff in alcohol, possibly pigmented; clitellum slightly darker. Prostomium: tapering open epilobous, sometimes closed by lateral furrow. Clitellum: (P1, P2-3, P6, "P8", S1) ½13,14,-17,½18 slightly saddle-shaped (in P2-3, S1). Dorsal

pores: absent. Setae: 8, smaller after clitellum, in regular series (to cut in H) but becoming more evenly spaced in posterior. Nephropores: not found in type-material. Spermathecal pores: obvious in 7/8/9 in setal a lines. Female pores: widely paired on 14 anterior to setae a. Male pores: paired in a lines on small mounds in ab, penial setae protrude in P1. Genital markings: very weak mid-ventral pad or only slight discolouration in aa in 10/11 (in P1, "P7-8"); paired discs centered in b in 17/18 joined by smooth pad within generally tumid and sunken male field that includes weaker smooth pad in 18/19 below male pores (H, P1-3, P4-6, "P7-8", S1).

INTERNAL ANATOMY

Gizzards: compact, muscular barrel in 5, not much modified from proventriculus in 4 (which may also have slight muscular sheen), intestinal gizzards also present. Oesophagus: only slightly dilated in 7-13,14, contracted in 14-15,16. Nephridia: avesiculate meroic, three or four tubules per side often in line with setae; none enlarged; no funnels nor ureters seen; not tufted in anterior. Vascularization: hearts 10-13 from well developed supra-oesophageal vessel in 7,8-13,14. Spermathecae: two pairs in 8 and 9, ovoid ampulla on thin duct with long digitiform diverticulum ectally that is however not longer than ampulla (spermathecae of H previously damaged or removed and missing from jar). Male organs: holandric iridescent testes and funnels in 10 and 11 (invested in mucus), seminal vesicles racemose in 9 and 12. Ovaries: in 13; no ovisacs seen in 14. Prostates: S-shaped tubuloracemose in 18-19 (in P1, lhs prostate previously removed and missing from jar); small penial setae present. Intestine: origin 17; intestinal gizzards obvious, moniliform in 22,23-30,31,32 i.e., eight to ten of (in P2-3, P6, "P7-8", S1), just discernible in (P1), and indeterminate in (H) due to maceration and damage by previous dissections; adjacent intestine sometimes transitional; typhlosole absent; gut contains organic soil and grits.

REMARKS

The present description considerably augments the original description, based on H and P2, that was grossly inadequate, possibly due partly to the poor condition of the type material especially the specimen designated the holotype. However, all of the available type material re-inspected here had tubuloracemose prostates, rather than tubular, in itself a significant departure from the original definition. Moreover, the obvious presence of intestinal gizzards, not least in P1-2 and "P8" that were

previously dissected, were overlooked in the original description. Although not positively confirmed from the holotype due to its highly macerated state, intestinal gizzards were clearly demonstrable in all other paratypes inspected. As the paratypes and new material agree with the holotype on most other points, they are here considered to be conspecific.

It is not clear why Jamieson (1974: 277) considered this species to have close affinities with *Notoscolex simsoni* (Spencer, 1895). The affinities of *Gastrodrilus dartnalli* are with *G. iosem* and *G. kingi*, they differ principally in distributions of genital markings, lengths of spermathecal diverticula, and intestinal origins. All three species differ from *G. driesseni*, the type species of the genus, which has last hearts in 12 rather than 13, and intestinal origin in ½16 rather than ½17-17.

DISTRIBUTION AND HABITAT

Melaleuca Inlet, Port Davey and New Harbour, SW Tasmania.

Gastrodrilus driesseni Blakemore, 2000

Fig. 177.

Gastrodrilus driesseni Blakemore, 2000b: 26-28, fig. 18.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3332, Cripps Point, Lake Pedder, SW Tasmania, 429000 5242900, 310 m, 12.iv.1996, M. Driessen, creek bank under trees, (mature specimen, dissected and figured).

PARATYPES: (P1) 14:3333, same details as H, (mature, dissected); (P2) 14:3334, same details as H, (mature specimen); (P3) 14:3346, Coronets, Lake Pedder shore at 437900 5248800, 310 m, R.J. Blakemore, 11.iv.1996, under button grass on shoreline, (mature posterior-amputee); (P4) 14:3348, Scotts Peak, Lake Pedder south, 444300 5234300, 310 m, 17.iv.1996, R.J. Blakemore, from creek opposite hut in sandbars, (mature specimen, dissected); (P5) 14:3349, same details as P4, (mature specimen); (P6) 14:3350, same details as P4, (six immature specimens, one dissected); (P7) 14:3356, Mt Solitary, Lake Pedder, 438000 5244500, 310 m, 11.iv.1996, R.J. Blakemore, in button grass at 20-30 cm depth and from loose pebbles and debris on shore, (mature specimen, dissected); (P8) 14:3357, same details as P7, (mature specimen); (P9) 14:3358, same details as P7, (mature, dissected); (P10) 14:3359, same details as P7, (two anterior portions of matures, one dissected); (P11) 14:3360, same details as P7, (immature specimen); (P12-18) 14:3405, Coronets, Lake Pedder, 437900 5248800, 310 m, 11.iv.1996, R.J. Blakemore, under button grass on lake edge, (seven specimens: two mature posterior amputees, three subadults, two immatures and an unregistered tail); (P19) 14:3407, Sprent Basin, Lake Pedder north, 417600 5263100, 310 m, 9.iv.1996, R.J. Blakemore, under Ti-tree litter, (mature posterior amputee); (P20) 14:3408, same details as P19, (mature posterior amuptee, dissected); (P21) 14:3409, same details as P19, (complete subadult); (P22-23) 14:3457, same details as P19, (four mature specimens, one dissected); (P24) 14:3363, Stillwater below Hermit, Lake Pedder east, 428200 5258200, 310 m, 14.iv.1996, R.J. Blakemore, under stones on shoreline, (mature, dissected); (P25) 14:3364, same details as P24, (four mature specimens, one tail-less, plus a tail); (P26) 14:3404, Bell Basin, Lake Pedder north, 310 m, 7.iv.1996, N. Forteath and A. Osborne, under Huon pines, (mature specimen, dissected); (P27) 14:3423, same details as P19, (mature posterior amputee plus two immatures); (P28) 14:3429, same details as P19 but under

button grass, (mature); (P29) 14:3430, Maria Creek west, Lake Pedder, 441700 5251000, 310 m, 11.iv.1996, R.J. Blakemore, in sand in creek bed, (mature specimen); (P30) 14:3434, same details as P29, (six immatures); (P31) 14:3422, Sprent Basin, Lake Pedder, 417600 5263100, 310 m, 9.iv.1996, R.J. Blakemore, under Ti-tree on edge of lake, (damaged subadult); (P32-36) 14:3484, same details as P31, (five specimens, one mature posterior amputee, dissected; one juvenile posterior amputee, three immatures and an unregistered tail); 14:3361, same details as P7, (a cocoon, figured).

EXTERNAL FEATURES

Lengths mm: range 95-155; (H) 130; (P1) 155; (P2-P9) 95-145. Width: ca. 4 mm. Segments: (H) 110; (P4) 133; (P7) 104; (P11) 147, (P26) 105. Colour: pale unpigmented or with yellow tinge; clitellum buff. Prostomium: open epilobous (sometimes appearing closed). Clitellum: ½13-¾17,17. Dorsal pores: absent. Setae: 8 in regular series. Nephropores: sometimes seen in a, c, mid-cd, and dorsal of d. Spermathecal pores: 7/8/9 in, or just lateral to, a lines. Female pores: widely paired 14. Male pores: paired on 18 near b lines and lateral of protruding penial setae, on low mounds. Genital markings: conjoined pair of pads in aa in 13/14 anterior to the female pores (in Stillwater and some Bell Basin specimens), an elongate pad with faint discs between aa in 16/17 (absent in all Mt. Solitary and Stillwater specimens and some Coronets and Bell Basin specimens); in most specimens - paired discs (shaped like parentheses in Mt. Solitary specimens) just wider than male pores in 17/18; common to all matures - paired discs in b lines in 18/19 and paired, elongate and convergent discs mid-ventral in 19/20 within tumid pads, often repeated in 20/21 too.

INTERNAL ANATOMY

Septa delicate, none especially thick. Gizzards: small, weak or vestigial in 5; large, moniliform intestinal gizzards from 22 to 28-31 (i.e., 7-10 of). Oesophagus: dilated but not calciferous in 10-13. Nephridia: avesiculate meroic; few in number, not tufted anteriorly; three or four simple tubules converge in b lines, other tubules are often in c and/or d lines too; funnels not seen. Vascularization: large hearts in 10-12, smaller vessels in 9 (and sometimes 13); supra-oesophageal vessel in 7-13. Spermathecae: two pairs in 8 and 9, ampulla spherical or bulb-shaped; diverticulum clavate longer than duct (in Mt Solitary, Stillwater and Bell Basin specimens,

extending beyond middle of ampulla). Male organs: holandric iridescent funnels in mucus in 10 and 11; seminal vesicles small, vestigial or absent from 9, large and racemose in 12. Ovaries: palmate in 13. Prostates: tubuloracemose, reflexed in 18, pink in colour; short penial setae present. Intestine: origin ½16, dark and dilated in ½16-21 then, from 22, replaced by smooth, moniliform, gizzards numbering between 7 and 10 (22-28 H, P4, P19, P24; 22-29,30,31 P1, P10, P26); no typhlosole although a low dorsal ridge present from 30 or 31 after the intestine recommences; gut contents colloidal soil, dark or woody organic matter and, usually, many white quartzite grits.

REMARKS

Gastrodrilus driesseni may be differentiated from *Aprodrilus dartnalli*, by its genital field, last hearts in 12, and intestinal origin in ½16. The numerous grits occurring in the gut probably assist comminution of food as it passes through the muscular gizzards.

Yellow cocoons were sometimes found with the specimens. A cocoon from Mt. Solitary is illustrated and is attributed to *G. driesseni*, as, apart from this species, only a much smaller *Vesiculodrilus* species (*V. ventralis*?) was found at this site.

ETYMOLOGY for Dr M. Driessen of Tasmanian Parks & Wildlife Service.

DISTRIBUTION AND HABITAT

SW Tasmania: common and widespread around shoreline of Lake Pedder, in moist or waterlogged peaty or sandy-loam soils under button grass (*Gymnoschaenus sphaerocephalus*), humus under Ti-tree (*Leptospermum* spp.) woodland, or in sand at the water's edge.

Gastrodrilus iosem sp. nov.

Fig. 178.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0040, Melaleuca, SW Tasmania, South Coast Track, DM 328 904, 5.iii.1992, L.F. McGowan, under button grass, (mature, in two halves, dissected and figured). (Note; other specimen, ANIC:RB.00.1.20, removed to *G. dartnalli*).

PARATYPES: (P1) ANIC:RB.00.1.21, Melaleuca, Wilson's Tin Mine, DM 320 913, 10.iii.1992, collector: Wilson, under button grass, (mature, dissected); (P2-3) 14:0041, same details as P1, (two matures, one dissected).

SPECIMENS: (S1-2) 14:2096, labelled "Coll. C. King Loc. New Harbour SW Tas", "*Cryptodrilus* sp in *simsoni* group (no bladders)" and "Probably *Cryptodrilus dartnalli* Ident: BJ" [on University of Queensland tags], (two matures that are darkend in alcohol, in poor condition, one dissected and agrees internally); 14:0025, Melaleuca, South Coast Track, SW Tasmania, DM 328-904, button grass, 5.iii.1992, L.F. McGowan, (five subadults about 100 mm long, one dissected and agrees internally).

EXTERNAL FEATURES

Lengths mm: range, 140-180; (H in total) 180, (P1) 170, (P2) 150, (P3) 140, (S1) 140. Width: ca. 3.5 mm. Segments: (H) 188. Colour: burnished brown, clitellum beige. Prostomium: tapering open epilobous. Clitellum: distinctly saddle-shaped (greatly infolded in H) ½13-½18. Dorsal pores: absent. Setae: 8, smaller after clitellum, in regular series but more evenly spaced in posterior. Nephropores: irregularly equatorial one or two near setae b and c and sometimes also near a and d. Spermathecal pores: obvious in 7/8/9 in a lines. Female pores: widely paired on 14 anterior to a setae. Male pores: paired in setal a lines on small mounds in ab, penial setae protrude in H. Genital markings: tumid pads in bb in 10/11 (in P1, P3) and 11/12 (in H, P2, S1-2) often with several small intersegmental papillae; large discs centered in b lines in 17/18 conjoined by a smooth pad within sunken male field that includes weaker smooth pad in 18/19 below male pores (H, P1-P3, S1-2).

INTERNAL ANATOMY

Septa: 7/8-12/13 slightly thickened. Gizzards: weakly muscular barrel in 5, not much modified from proventriculus in 4, intestinal gizzards also present. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, three or four

tubules per side often in line with setae although b sometimes has two and that at d extends more dorsally; none enlarged, smaller after clitellum; no funnels nor ureters seen; not tufted in anterior. Vascularization: dorsal blood vessel single; commissurals in 6-9, hearts 10-13 from well-developed supra-oesophageal vessel in 8-13. Spermathecae: two pairs in 8 and 9, large ovoid ampulla on thin duct with medium-length digitiform diverticulum ectally. Male organs: holandric iridescent testes and funnels in 10 and 11 (invested in mucus), seminal vesicles small, saccular in 9 and 12. Ovaries: compact in 13; no ovisacs in 14 but slight septal intrusion from 13 seen. Prostates: S-shaped tubuloracemose in 18-19; small penial setae present. Intestine: origin ½17; flaccid and thin walled to 21; intestinal gizzards, obvious moniliform in 22-31 (H) or 24-31 (P1) i.e., eight to ten of, adjacent intestine sometimes transitional; typhlosole absent; gut contents anterior to intestinal gizzards - loose organic colloids and fragment with quartz grits, after passage through gizzards - compressed homogenous 'mulch'.

ETYMOLOGY '*inter occosum solis et meridiem*' - from the SW location (acronym).

REMARKS

Gastrodrilus iosem is morphlogically similar to the inadequately described *G. dartnalli*, differing principally in distributions of genital markings which are well developed mid-ventrally in 10/11/12, as well as paired in 17/18. It is also slightly larger in size and has intestinal origin in ½17, rather than 17. Spermathecal diverticula and penial setae are of disproportionate lengths, cf. *G. kingi*.

DISTRIBUTION AND HABITAT

Melaleuca under button grass, and New Harbour, SW Tasmania.

Gastrodrilus kingi sp. nov.

Fig. 179.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1914, Cox Bight, SW Tasmania, 146°15'E.43°30'S, Tasmanian Biological Survey, November 1938 JG8 and June 1938 J9, C.D. King, (mature dissected, figured).

PARATYPE: (P) ANIC:RB.00.1.22, same details as H, (mature, dissected).

EXTERNAL FEATURES

Lengths mm: (H) 145, (P) 160. Width: ca. 3.5 mm. Segments: (H) 204, (P) 207. Colour: uniform brown in alcohol but looks to have darker pigmentation on setal equators where one or two dots occur near to b, c and d setae, clitellum darker. Prostomium: tapering epilobous. Clitellum: weak in 14-17. Dorsal pores: absent. Setae: 8 in regular rows but more evenly spaced in posterior. Nephropores: not found. Spermathecal pores: small in 7/8/9 in a lines. Female pores: widely paired on 14 anterior to a setae. Male pores: paired in setal a lines on small mounds in b-b. Genital markings: weakly tumid pads in aa in 10/11 and 11/12 (H); large discs centered in a lines in 17/18 and 18/19 (H, P).

INTERNAL ANATOMY

Septa: 5/6-12/13 slightly thickened. Gizzards: weakly muscular barrel in 5, not much modified from pharynx in 4, intestinal gizzards also present. Oesophagus: slightly dilated in 7-13, narrow in 14-16. Nephridia: avesiculate meroic, ca. four tubules per side near setae with ducts to body wall in a, b c and d or above; not tufted in anterior. Vascularization: dorsal blood vessel single; commissurals in 5-9, hearts 10-13 from well-developed supra-oesophageal vessel in 7-13. Spermathecae: two pairs in 8 and 9, conical ampulla on long duct with diverticulum as long or longer than ampulla. Male organs: holandric iridescent testes and funnels in 10 and 11, seminal vesicles large, saccular in 9 and 12. Ovaries: small in 13; small ovisacs in 14. Prostates: S-shaped tubuloracemose in 18-19; long penial setae present. Intestine: origin ½17; slightly modified to 19; intestinal gizzards in 20-28 (H) or 22-31 (P1), adjacent intestine sometimes transitional; typhlosole absent but low dorsal ridge from 35; gut contains homogenous grey soil and quartz grits.

REMARKS

Gastrodrilus kingi differs from *G. iosem* and *G. dartnalli* by having markings paired in 17/18 and in 18/19, and by having longer spermathecal ampullae and correspondingly long penial setae.

ETYMOLOGY after collector.

DISTRIBUTION AND HABITAT

Cox Bight, SW Tasmania, in same sample was a specimen of *Anisochaeta avesiculatus*; *Notoscolex longus* has the same type-locality.

Caecadrilus gen. nov.

Diagnosis Setae eight per segment. Dorsal pores present but restricted to tail intersegments, or absent. Male pores from tubuloracemose prostates paired on 18. Gizzard in 5; annular calciferous glands absent or present; typhlosole present; *intestinal caeca present*, two pairs in 22-23. Dorsal blood vessel doubled, at least in some segments. Nephridia avesiculate meroic, not tufted. Spermathecae two pairs, diverticula single or paired, clavate, bifid or multiloculate. Penial setae present.

Type species *Caecadrilus strzelecki* gen. et sp. nov..

Other species

Caecadrilus flindersi sp. nov.

Caecadrilus walkersi sp. nov.

Etymology 'Caecate worm' - for the unique twin pairs of intestinal caeca.

Distribution Flinders Island NE of Tasmania.

Remarks The unique feature of *Caecadrilus* is the presence of two pairs of intestinal caeca. Trilobed, prolobous prostomia, doubled dorsal blood vessels, and numerous (ca. 40-60) discrete nephridial tubules per segment are other characteristics of the included species. Were it not for caeca, the genus being lumbricine and meroic with tubuloracemose prostates would be similar to *Notoscolex* or *Aporodrilus* Intestinal caeca probably function for the maintenance of cultures of gut symbionts and, while common in several exotic megascolecids (eg. members of some pheretimoid genera, see Easton, 1972; 1982; Blakemore, 1997c; 1999), they have not been previously discovered in an Australasian Oligochaeta. Having two pairs of caeca, rather than the more usual single pair, is an additional distinction, although in northwestern North America the genus *Toutellus* Fender & McKey-Fender, 1990 has multiple intestinal caeca (see McKey-Fender, Fender & Marshall, 1994).

Caecadrilus flindersi sp. nov.

Fig. 180.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3761, Flinders Island, Brougham Sugar Loaf, NE Tasmania, ER 666 845, xi.1992, QVM, (mature missing tip of tail, dissected, figured).

PARATYPES: (P1) 14:3762, same details as H, (mature, dissected); (P2) ANIC:RB.98.1.19, same details as H, (mature, dissected); (P3) TM:K1572, same details as H, (mature, dissected); (P4) 14:3763, same details as H, (aclitellate mature missing tip of tail, dissected).

EXTERNAL FEATURES

Body robust. Lengths mm: (H) 130+, (P1-2) 170, (P3) 175, (P4) 150+. Width: ca. 7 mm. Segments: (P1) 155, (P2) 200. Colour: dark brown in alcohol with paler ventrum and markings, circle of dark dots seen at posterior of anterior segments, clitellum darker. Prostomium: prolobous, broad with three lobes. Clitellum: 13-18. Dorsal pores: absent or not found in H, present in last few intersegments in P1. Nephropores: not found. Setae: small, dark and difficult to detect in anterior, thereafter 8 in regular rows ventrally disposed. Spermathecal pores: 6/7/8/9 in a-b lines. Female pores: widely paired on 14. Male pores: in wide slits on mounds in ab on 18. Genital markings: mid-ventral pads in b-b in 10/11 and 11/12 (or 9/10/11 in P2); widely paired sucker-like discs in c-d lines in 17/18 and 18/19; wide tumid pads slightly reducing in width posteriorly, mostly in c-c lines, in 19/20 - 21/22.

INTERNAL ANATOMY

Septa: 5/6 thin to base of gizzard, 6/7-11/12 increasingly thickened. Gizzard: muscular in 5. Oesophagus: dilated in 10-13 and less so in 14, vascularized with internal lamellae and forming annular calciferous glands in these segments; narrow in 15-16, valvular in 17. Nephridia: avesiculate meroic, numerous (ca. 20-30 per side) discrete tubules scattered on body wall, larger in anterior but not tufted; funnels not found. Vascularization: dorsal blood vessel doubled in 6-21,22; hearts increasingly large in 10-13 from well developed supraoesophageal vessel. Spermathecae: three increasingly large pairs in 7-9, large saccular ampulla on stout duct with disproportionately small diverticulum on its mid-length; in H 7rhs diverticulum is bifid; in P1 9 diverticula are paired opposed, and one on 9 lhs is bifid; in P2 9rhs, diverticula are paired. Male organs: holandric, iridescent testes and funnels free in 10

and 11; seminal vesicles small in 11, larger in 12. Ovaries: large but composed of several delicate egg-strings in 13; vestigial ovisacs in 14. Prostates: tubuloracemose, blocky in 18; relatively short penial setae present, ca. 1 mm long. Intestine: origin 18, pushing septum 17/18 forwards; two lateral pairs of caeca in 22 and 23; deep lamellar typhlosole develops from 22; gut contains dark soil and organic matter, some specimens have grits in 18.

Note: on and after 17/18, septal bodies were found similar to those described for *C. strzelecki*.

REMARKS

Caecadrilus flindersi is distinguished from *C. strzelecki*, the type-species of the genus, on the two sets of anterior markings in 9/10-11/12, the spermathecae vary in form and the prostates have slightly different shape, and, perhaps most significantly, calciferous glands are developed.

ETYMOLOGY: named after the island locality.

DISTRIBUTION AND HABITAT

Sugar Loaf, Flinders Island.

Caecadrilus strzelecki gen. et sp. nov.

Fig. 181.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3758, Flinders Island, Mt Strzelecki, NE Tasmania, ER 925 485, 500 m, 2.xi.1992, QVM, (mature missing tip of tail, dissected, figured).

PARATYPES: (P1) ANIC:RB.98.1.18, same details as H, (mature, dissected); (P2) TM:K1571, Flinders Island, Mt Strzelecki near summit, NE Tasmania, ER 925 485, 1.xi.1992, QVM, (mature, dissected); (P3-5) 14:3759, same details as H, (three matures); (P6-8) 14:3760, same details as H, (one aclitellate mature, one subadult, dissected, and a juvenile that agrees superficially).

EXTERNAL FEATURES

Body robust. Lengths mm: range 190-320, (H) 290+, (P1) 320, (P2) 310, (P3) 280, (P4) 270, (P5) 235, (P6-7) 190-195, (P8) 140. Width: ca. 15 mm. Segments: (H) 138+, (P1) 218. Colour: uniform brown in alcohol, clitellum dark grey; subadult specimens paler. Prostomium: prolobous, broad with three lobes the middle one furrowed. Clitellum: 13-18½19. Dorsal pores: absent or not found in H; in P1 only present between last few segments of tail as wide slits. Nephropores: not found. Setae: small and difficult to detect in anterior, thereafter 8 in regular ventral rows throughout. Spermathecal pores: 6/7/8/9 just lateral of setal a lines. Female pores: widely paired on 14. Male pores: on small mounds in ab on 18. Genital markings: mid-ventral pad in b-b in 10/11; paired elongate pads in a-c lines in 17/18 and 18/19; tumid pads reducing in width posteriorly, in c-c to a-a lines, in 19/20 - 21/22 (H, P1) or 19/20-20/21 (P2, P6).

INTERNAL ANATOMY

Septa: 5/6 thin to base of gizzard, 6/7-12/13 increasingly thickened. Gizzard: huge, muscular cone in 5 but displaced to 6-½9, preceded by proventriculum that occupies 5. Oesophagus: not especially modified. Nephridia: avesiculate meroic, seen from 7 - small, discrete tubules scattered on body wall, perhaps more dense ventrally, ca. 20-30 per side per segment (see also Note below on parasites); anterior tufting not noted; funnels not found. Vascularization: dorsal blood vessel doubled thus - single to 5 where it loops on either side of crop and gizzard to complex networks of capillaries, in 6 long and single with posterior branch, in 7 loops above branching point at posterior but has shorter connective to both base ends of loop

(preventing expansion of loop), from 8 to intestine divided loops join at septa, from 19,20 (in H) or 22,23 (P1) wide but undivided on intestine; hearts increasingly large in 10-13 from well developed supraoesophageal vessel. Spermathecae: three increasingly large pairs in 7-9, saccular ampulla on long tapering duct with disproportionately small clavate, bifid, or short-stalked multiloculate diverticulum; in P2 9lhs diverticula are paired opposed clavate. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles in large, paired racemose in 11 and 12; small pair of pseudovesicles anteriorly in 13. Ovaries: large but delicate in 13; small paired ovisacs in 14. Prostates: tubuloracemose, S-shaped in 18; short penial setae present, just over 1 mm long. Intestine: origin 18, pushing septum 17/18 forwards; thin and tough walled in 18-19 but intestinal gizzards absent; two lateral pairs of caeca in 22 and 23; deep lamellar typhlosole develops from 22; gut contains dark organic soil and woody particles. (When caecum 23lhs in H was opened up it was void, simple wide opening sac; in P1 23lhs is filled with mucus).

Note: nematode and protozoan parasites were noted in body and, in all dissected specimens, septa from 17/18 had suspended tubular, fatty growths that were possibly parasitic although they may represent some form of modified nephridia.

REMARKS

Caecadrilus strzelecki is the type-species of this unusual genus, known only from Flinders Island.

ETYMOLOGY: named after type locality.

DISTRIBUTION AND HABITAT

Mt Strzelecki, Flinders Island.

Caecadrilus walkersi sp. nov.

Fig. 182.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3764, Flinders Island, Walkers Lookout, NE Tasmania, ER 921 653, 410 m, 4.xi.1992, QVM, (mature, dissected, figured).

PARATYPES: (P1) ANIC:RB.98.1.20, same details as H, (aclitellate mature, dissected); (P2) TM:K1579, same details as H, (mature missing tip of tail, dissected); (P3) 14:3765, same details as H, (mature missing tip of tail, dissected); (P4) 14:3766, Flinders Island, Walkers Lookout, NE Tasmania, ER 918 653, 350 m, 4.xi.1992, QVM, (mature missing tip of tail, dissected, figured); (P5) 14:3767, same details as P4, (mature); (P6-10) 14:3768, same details as H, (five matures).

.EXTERNAL FEATURES

Body robust. Lengths mm: (H) 220, (P1)225, (P2) 170+, (P3) 190+, (P4) 170+, (P5) 210. Width: ca. 6 mm. Segments: (H) ca. 278, (P12) 228. Colour: pale in alcohol, few dark dots seen at posterior of anterior segments, clitellum darker. Prostomium: prolobous, broad with three lobes. Clitellum: ½13-½18. Dorsal pores: absent from anterior, only present between last 50 segments of tail (in H at least). Nephropores: not found. Setae: small and difficult to detect in anterior, 8 in regular rows ventrally disposed. Spermathecal pores: 6/7/8/9 in a-b lines, perhaps closer to a lines. Female pores: widely paired on 14. Male pores: in wide slits on mounds in ab on 18. Genital markings: mid-ventral pad in b-b in 10/11 (H, P1) or 10/11 and 11/12 (P2-5); widely paired pad in dd in 16/17 (seen in all specimens); widely paired sucker-like discs centred in cd lines in 17/18 and 18/19; wide tumid pads slightly reducing in width posteriorly, in d-d to b-b lines, in 19/20-22/23,23/24.

INTERNAL ANATOMY

Septa: 5/6 thin to base of gizzard, 6/7-11/12 increasingly thickened. Gizzard: muscular, spherical in 5 displaced posteriorly and preceded by crop with narrow valve pharyngeal valve between crop and gizzard. Oesophagus: dark, dilated and vascularized in 11-14 with internal lamellae and forming annular calciferous glands in these segments; narrow in 15-16, valvular in 17. Nephridia: avesiculate meroic, numerous (ca. 25 per side) discrete tubules scattered on body wall; tufting not noted; funnels not found. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4, doubled in 7-17,18; hearts 10-13 from supraoesophageal vessel in 9-13.

Spermathecae: three increasingly large pairs in 7-9, large saccular ampulla on tapering duct with disproportionately small, bifid, diverticulum midlength. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles small in 11, larger in 12. Ovaries: composed of several delicate egg-strings in 13; ovisacs absent or vestigial (in P4) in 14. Prostates: tubuloracemose, flattened in 18, when sectioned with wide central canal and small side branches; short penial setae present about 1 mm long. Intestine: origin 18; two lateral pairs of caeca in 22 and 23 that each send tendons to dorsal body wall; deep T-shaped typhlosole develops from 22; gut contains colloidal soil.

Note: septal bodies as seen in other species also present, but with regular disposition and therefore probably not parasitic, but rather fat bodies or nephridial apparata.

REMARKS

Caecadrilus walkersi is distinguished from *C. strzelecki* and *C. flindersi* on its additional elongate genital markings in 16/17, and extra markings in most of 21/22-23/24.

ETYMOLOGY: named after the locality.

DISTRIBUTION AND HABITAT

Walkers Lookout, Flinders Island.

Anisochaeta Beddard, 1890.

Megascolex (part.); Beddard, 1890: 56; 1895: 381; Michaelsen, 1900: 212; 1907: 163; Stephenson, 1930: 837; Jamieson, 1974: 318.

Perichaeta (part.); Beddard, 1890: 56.

Anisochaeta Beddard, 1890: 56; Blakemore, 1997a: 1685; b: 1822; 2000a: 2; b: 5.

Trichaeta Spencer, 1900: 30.

Spenceriella Michaelsen, 1907: 160.

Gemascolex Edmonds and Jamieson, 1973: 23.

Propheretima Jamieson, 1975, 589; Blakemore, 1997a: 1686; 1997b: 1839; 2000a: 38.

Syn. nov.

Diagnosis: Anisochaetine or perichaetine (i.e., setae 8 per segment in the anterior, increasing posteriorly, or more than 8 throughout). Female pores, single or paired on 14. Male pores from tubuloracemose or racemose prostates paired on 18. Dorsal pores present, or absent (eg. in *A. mawbanna* sp. nov.). An oesophageal gizzard in 5 or 6 (large and almost divided in two in *A. zeehan*, or not developed, eg. in *A. clavi*). Nephridia meroic, at least in the fore-body, avesiculate or vesiculate, often tufted in the anterior. Spermathecae one or more pairs (sometimes unpaired), with one or more diverticula that are clavate, bifid, or sometimes multiloculate (eg. in *A. alba*, *A.brevis*, *A. floris*, *A. isla*, and *A. portusarturi*). Calciferous glands and typhlosole present or absent; intestinal caeca and gizzards absent. Penial setae present or absent. Segmental and intersegmental genital markings usually present but sometimes reduced or absent (eg. *A. sebastiani*).

Type-species *Perichaeta coxii* Fletcher, 1886: 565-659; Fletcher, 1889: 1554.

Distribution Australia, all states (Beddard, 1890, Blakemore, 2000a), and New Zealand (Lee, 1959; Lee et. al, in press); some species distributed (see Blakemore & Elton, 1994; Blakemore, 2000a).

Included species In New Zealand, three species transferred from *Megascolex* are known from the north island and one from Norfolk Island (Blakemore, 1997a,b). In Australia, approximately 117 known species have been described: 10 from SA, 21 from Vict., 50 from NSW, 14 from WA, 18 from Qld, with 4 previously described from Tasmania. Some species' natural distributions cross State boundaries and some have been widely translocated (see Blakemore & Elton, 1994; Blakemore, 1997a,c;

2000a,b). An additional 20 species from Tasmania are described below bringing the generic total to approximately 137 species, making this the largest genus in Australia.

Remarks The most recent revisions of this genus are by Blakemore (1997a,b; 2000a,b), where the above synonymies are discussed. *Perichaeta* has long been subsumed (see Stephenson, 1930), and formal separation from *Megascolex* was proposed by Blakemore (1997a,b). Monotypic *Trichaeta*, established by Spencer (1900) for his Victorian *Trichaeta australis* (now *Anisochaeta trichaeta* Blakemore, 2000b - renamed due to junior secondary homonymy of *Anisochaeta australis* (Fletcher, 1886)), was placed in synonymy of *Megascolex* by Michaelsen, 1907 and is now included under *Anisochaeta*.

Spenceriella was synonymized following supposed discovery of non-tubular prostates in the type species, *Diporochaeta notabilis* Spencer, 1900, (see, Blakemore, 1997b: 1823), [however, recent evidence suggests this needs to be re-evaluated on better preserved material as the prostates of this species may in fact be tubular]. On current information, the residue of species from *Spenceriella* that, unlike the type-species, are reported to have tubular prostates, eg. *Diporochaeta maplestoni* Spencer, 1900 and *Diporochaeta hoggii* Spencer, 1893 (see Remarks under the description of *Anisochaeta tasmanica* below), appear to comply with the generic definition of the Indian genus *Celeriella* Gates, 1958. This genus from the Palni Hills, with type-species *Spenceriella duodecimalis* Michaelsen, 1907, is described in Gates (1972: 277) and accommodates perichaetine, meroic species with tubular prostates. Transfer of Australian species (and the four New Zealand species with tubular prostates that were formerly placed in *Spenceriella* in Lee, 1959) to this Indian genus would probably be a temporary taxonomic 'convenience', pending further review of constituent species.

The synonymy of *Propheretima*, a genus based on one first proposed by G. Dyne (unpublished Qld University PhD thesis, 1984: 375-376), was advocated by Blakemore (1997a: 1686; 1997b: 1838-1839; 2000a: 38). As this genus, defined with a type-species that is a probable junior synonym of *Anisochaeta newcombei* (Beddard, 1887) (see Blakemore, 1997b: 1843), complies with the diagnosis above, it is now placed in synonymy in the prior genus *Anisochaeta*.

The character combinations separating currently monotypic Tasmanian genera *Aceeca* and *Scolecoidea* from *Anisochaeta* are given in remarks following definition of these two genera below.

Anisochaeta alba sp. nov

Fig. 183.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1688, Tasman Peninsula, Balts Road, (ca. 2.5 km along?), SE Tasmania, 8.ix.1992, R.D. D'Orazio, wet sclerophyll with rainforest species, (mature, dissected and drawn).

PARATYPES: (P1) TM:K1566, same details as H, (mature dissected); (P2) ANIC:RB.98.1.16, same details, (mature dissected); (P3) 14:3752, same details, (mature); (P4-P7) 14:3753, same details, (two matures and two juveniles that agree superficially).

EXTERNAL FEATURES

Body: with squarish tail. Length mm: (H) 210, (P1) 220, (P2) 180, (P3) 205, (P4) 230, (P5-7) 130-180. Width: ca. 4 mm. Segments: (H) 222. Colour: white, unpigmented in alcohol with dark dots in the anterior; clitellum not well marked. Prostomium: prolobous or pro-epilobous, on much furrowed peristomium. Clitellum: weakly marked as tumid and smooth surface in ½13,14-17,18 in H, absent from paratypes. Dorsal pores: small from 10/11. Setae: not found on anterior ten segments in H, small 8 per segments where seen in anterior, in mid-body in regular rows with cd moving dorsally, on last 50 segments of tail get sudden increase to 16-20 in irregular rows. Nephropores: not found. Spermathecal pores: 7/8/9 mid-ventral, apposed. Female pores: paired on 14 in groove. Male pores: mid-ventral on 18 on small pair of apposed papillae replacing setae ab. Genital markings: large tumid pads with paired or elongate white centres in 17/18, 18/19, 19/20 and (in H only) in 20/21, tumescences continuous forming solid ventral block.

INTERNAL ANATOMY

Septa: 6/7-12/13 with some thickening. Gizzard: muscular barrel in 5 with anterior crop. Oesophagus: vascularized in 10-14 but not dilated as calciferous glands; valvular in 15-16. Nephridia: avesiculate meroic with thick equatorial forests of numerous tubules in 3-7, less dense after this. Vascularization: dorsal blood vessel single, hearts 10-13 from supra-oesophageal vessel which runs 9-14. Spermathecae: two pairs in 8 and 9; elongate ampullae on long ducts that converge midventrally under ventral nerve cord, diverticula, small clavate or bifid, or short-stalked multiloculate (in H). Male organs: holandric, iridescent testis and funnels in 10 and

11; seminal vesicles large in 9 and 12. Ovaries: fine bushy in 13; ovisacs vestigial in 14. Prostates: tubuloracemose in 18; long unsheathed penial setae present. Intestine: from 17; deep T-shaped typhlosole from 26; intestinal gizzards absent although some non-muscular thickening noted in 17-18; gut contains fine soil.

REMARKS

Anisochaeta alba is part of a species group from the south-east characterized by few setae in the anterior, two pairs of spermathecae, band-like genital markings, penial setae, an intestinal typhlosole, and often with multiloculate diverticula and calciferous glands. *A. alba* is distinguished from *A. brevis*, *A. floris*, *A. isla*, and *A. portusarturi* by the apposed spermathecal and male pores and in the distribution of its genital markings. *Notoscolex wellingtonensis* (Spencer, 1895) has several similar characters to members of this *Anisochaeta* group but is lumbricine (Spencer also had difficulty confirming dorsal setae for this species), nevertheless it may be indicative of a possible precursor.

ETYMOLOGY: albus, Latin - white, for the pale colouration.

DISTRIBUTION AND HABITAT

Tasman Peninsula, SE Tasmania, wet sclerophyll with rainforest.

Anisochaeta andrea sp. nov

Fig. 184.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3533, "Peartree Cottage" at 100, Esplanade, Middleton, SE Tasmania, 147°15'E.43°14'S, 10.xi.1996, Rob Blakemore, Andrea Kitto, Bruce Kemp and Clive Crossley, under grass on slope below stand of native woodland, (dissected and drawn).

PARATYPES: all with same details as H, (P1) ANIC:RB.96.11.11, (mature, dissected); (P2) TM:K1583, (mature, dissected); (P3) 14:3534, (mature, dissected); (P4) ANIC:RB.96.11.12, (mature); (P5) TM:K999, (mature); (P6), 14:3535, (subadult, this sample also contains 6 damaged mature specimens, one of which was dissected).

EXTERNAL FEATURES

Much secondary annulation after clitellum. Length mm: (H) 110, (P1-5) 110-130. Width: ca. 3 mm. Segments: (H) 195, (P1) 176. Colour: in life unpigmented with dorsal blood vessel clearly showing through cuticle, clitellum orange; in alcohol pale, small yellow dots visible on each segment laterally. Prostomium: epilobous, narrowly tapering. Clitellum: saddle-shaped, ½13-17. Dorsal pores: small, from 7/8 (H), or 6/7 (P1, P4) or 8/9 (P2). Setae: small, dark, 8 in anterior and mid-body in regular rows; becoming irregular in posterior and increasing to 12 in some tail segments. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14. Male pores: superficial, paired on 18 in ab. Genital markings: weakly tumid bands near spermathecal pores in 7/8-8/9 in aa; more developed in 9/10 in bb (all specimens); wider with lateral or elongate, paired centres in 15/16 (H, P3-4), 16/17, and in 19/20 (all specimens), 20/21 (H, P2-4) and 21/22 (H); in addition there are weak elongate pads on either side of male pores in 17/18/19.

INTERNAL ANATOMY

Septa: 7/8-9/10 slightly thickened. Gizzard: muscular barrel with anterior flange in 5, proventriculus in 4. Oesophagus: large tri-lobed, extramural calciferous glands in 11-13 open to oesophagus laterally by common duct in 12, near to 12/13. Nephridia: pharyngeal tufts in 2-5; then avesiculate meroic clusters of four or five intertwined tubules approximately in b, plus single lateral nephridium which extends towards mid-dorsum. Vascularization: hearts 10-12 from supra-oesophageal vessel in 9-13; calciferous glands highly vascularized. Spermathecae: two pairs in 8 and 9;

heart-shaped ampulla on long duct with simple clavate diverticulum ectally (in P1, 8lhs abnormally small). Male organs: holandric, iridescent testis and funnels in 10 and 11; small, racemose seminal vesicles in 9 and 12. Ovaries: palmate in 13; small ovisacs in 14. Prostates: tubuloracemose in 18-19; penial setae present anterior to duct. Intestine: attains full width in 17 although septum 16/17 deflected anteriorly and some intestinal modification posteriorly in 16 (origin perhaps better described as 16/17); typhlosole develops immediately becoming wide and deep by 20; gut contains soil and quartz grains (pH?).

REMARKS

Unique combination of characters that differentiate *Anisochaeta andrea* are the saddle-shaped clitellum (due to markings impinging), the distribution of the elongate genital markings, presence of an intestinal typhlosole and, especially, the paired tri-lobed calciferous glands in 11-13. Another Tasmanian species with extramural calciferous glands is *A. tasmanicus*; however, in this species they are in 10-11 and each enters the oesophagus separately rather than via a combined duct.

ETYMOLOGY: Andrea - a girl's name.

DISTRIBUTION AND HABITAT

Middleton, SE Tasmania on D'Entrecasteaux Channel, under grass in paddock near woodland. Found at the same site were exotic lumbricids *Apporectodea trapezoides*, *A. caliginosa*, *Lumbricus rubellus* and, in compost, *Eisenia fetida* (all specimens in 14:3536).

Anisochaeta brevis sp. nov

Fig. 185.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0992, Dover, SE Tasmania, along Esperance River Rd. until the first bridge, DN 899 082, 140m, 19.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, tip of tail missing, dissected and drawn).

PARATYPES: (P1) 14:3669, same details as H, (mature dissected); (P2) 14:3671, Dover, 0.5km along Riawunna Rd to site from Blue Gum Saddle intersection, DN 906-162, 225m, 19.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, dissected); (P3) 14:3672, same details as P2, (mature, dissected); (P4) 14:3670, same details as H, (subadult, dissected); (P5-P8) 14:1705, Dover, 400m down Stubbs Link Road, DN 962 077, 155m, 21.x.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (four matures, two dissected).

SPECIMEN: 14:1703, same details as P2-3, (mature anterior-amputee @ 5, 210 long with 222 segments, dissected, possibly aberrant as agrees internally except intestinal origin in ½17 rather than 19).

EXTERNAL FEATURES

Body: flaccid with much secondary annulation. Lengths mm: (H) 120, (P1) 100, (P2) 180, (P3) 140, (P5-8) 100-170. Width: ca. 3 mm. Segments: (H) 168+, (P1) 189, (P3-4) ca. 200. Colour: white unpigmented in alcohol with random dark dots; clitellum cream. Prostomium: small epilobous with faint dorsal furrow. Clitellum: ½13-½18. Dorsal pores: from 4/5. Setae: small 8 on 12 and 20 in regular rows, adding setae in posterior third of body irregularly to give ca. 22-30 on tail segments. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pores: widely paired on 14. Male pores: on small papillae in a lines on 18. Genital markings: ventral intersegmental pads with thickly tumid rims as wide as reproductive pores in 7/8/9/10, 16/18/19, and 19/20 (H); paratypes mostly agree but some have markings on one side only in 18/19, or extras in 15/16, or lack those in 19/20 (eg. P2-3, P5-8).

INTERNAL ANATOMY

Septa: 6/7-9/10 slightly thickened. Gizzard: muscular barrel in 5. Oesophagus: pinched off in 13-16 but hollow and not considered calciferous glands; valvular in 17-18. Nephridia: avesiculate meroic with ventral clusters in 4 that separate to give ca. six or eight discrete tubules per side further back; not tufted

anteriorly. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4, hearts 10-12; weak supra-oesophageal vessel in 13. Spermathecae: two pairs in 8 and 9; saccular ampulla on longer duct with sessile multiloculate rosette diverticula ectally. Male organs: holandric, iridescent testis and funnels free in 10 and 11; seminal vesicles compact in 9 and 12. Ovaries: small palmate in 13; small, paired ovisacs in 14. Prostates: tubuloracemose in 18 with short muscular duct; penial setae present ca. 0.7 mm long. Intestine: from 19; typhlosole deep T-shaped from 20; intestinal gizzards absent; gut contains fine yellow soil.

Note: several dissected specimens have coelom filled with mucus and some nematodes were found (eg. in P3).

REMARKS

Anisochaeta brevis lacks the extramural calciferous glands of *A. andrea*, and is separated from *A. isla* and some other members of the genus, by its fewer setae in the anterior, last hearts in 12, and the posterior commencement of intestine in 19. Its genital marking distributions and rosette diverticula are additional characteristics.

ETYMOLOGY: brevis, Latin - short, for the spermathecal diverticula.

DISTRIBUTION AND HABITAT

Dover, SE Tasmania, from wet sclerophyll.

Anisochaeta burniensis (Jamieson, 1974), comb. nov.

Fig. 186.

Megascolex burniensis Jamieson, 1974: 319-321, figs. 30B, 32F.

MATERIAL EXAMINED

HOLOTYPE: TM:380, Fern Glade, Emu River, Burnie, N Tasmania, 145°55'E.41°05'S, 24.viii.1954, J.L. Hickman, (mature, dissected).

PARATYPES: none

SPECIMENS: none, despite searches of the type-locality by the current author.

EXTERNAL FEATURES

Length mm: 62. Width: 4 mm. Segments: 92. Colour: uniform buff in alcohol. Prostomium: tanylobous. Clitellum: ½13,14-17. Dorsal pores: from 4/5. Setae: 12 on 12, 24-30 caudally. Nephropores: not seen. Spermathecal pores: paired in 7/8 and 8/9 just lateral of a lines. Female pores: widely paired on 14. Male pores: paired on small raised papillae in ab on 18. Genital markings: three pairs of small eye-like markings, one pair presetal just median of a lines on 17, the other two pairs in ab in 17/18 and 18/19; similar analogues presetal in a lines on 19 and in 19/20; larger pads on either side of male pores presetal in 18 and 19.

INTERNAL ANATOMY

Gizzard: large in 5. Oesophagus: dilated in 8-13 but not calciferous. Nephridia: avesiculate meroic, tufted anteriorly especially in 2, thereafter with two or three large nephridia per side (and possibly some smaller intervening nephridia). Vascularization: hearts in 10-13; supra-oesophageal vessel in 8-13,14. Spermathecae: two pairs in 8 and 9; saccular ampulla tapers to duct with a clavate diverticulum on particularly long and thin stalk. Male organs: holandric, iridescent testes and funnels in 10 and 11; seminal vesicles paired, racemose in 11 and 12. Ovaries: in 13; ovisacs not found. Prostates: flat and solid, racemose (or tubuloracemose?) in 18; penial setae absent. Intestine: origin 17; typhlosole absent; gut contains organic soil.

REMARKS

The above re-description largely agrees with the original, a difference being the long stalks to the spermathecal diverticula (Jamieson, 1974: fig. 32F illustrates 9rhs spermatheca which is now missing from the holotype). The genital markings appear distinctive in this species, although lack of material precludes assessment of variations in these.

DISTRIBUTION AND HABITAT

Burnie, N Tasmania; same collection details as *Notoscolex bidiverticulatus*. (Note: this location is considered correct, cf. *Cryptodrilus polynephricus*).

Anisochaeta cethana *sp. nov.*

Fig. 187.

MATERIAL EXAMINED

Holotype: 14:0680 (H), Mt Roland, 1.4km along Cockatoo Road to dense wet patch of forest, N Tasmania, DQ 304 051, 640m, 24.xi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll, (mature with tip of tail missing, dissected and sketched).

PARATYPES: ANIC:RB.98.1.5 (P1 ex 708), Mt Roland, Minnow Creek, NW Tasmania, DQ 429 078, 300m, 24.xi.1992, R.D. D'Orazio and M. Gittus, (mature, dissected and sketched); TM:K1562 (P2), same details as P1, (mature dissected).

EXTERNAL FEATURES

Lengths mm: 110+ (H), 65 (P1), 62 (P2). Segments: 99+ (H), 83, (P1 and P2). Colour: burnished gold brown in alcohol with small dark dots scattered on equators of anterior segments; clitellum yellow/buff. Prostomium: open epilobous. Clitellum: ½13-17. Dorsal pores: from 4/5. Setae: 12-14 on 12, ca. 16 on 20 and increasing to 16-20 posteriorly. Nephropores: not seen. Spermathecal pores: paired in 7/8-8/9 just median to setal a lines. Female pores: paired anteriomedial to setae a. Male pores: paired near setal a lines within tumid area. Genital markings: paired pads in ab lines in 11/12, and conjoined in 17/18, 18/19, 19/20 narrowing posteriorly; some ventral modification of 20/21 also (H, P1).

INTERNAL ANATOMY

Septa: none especially thickened. Gizzard: large muscular barrel in 5 with anterior flange and displaced to occupy position of 7-9. Oesophagus: dilated and internally lamellate in 14-15, but not calciferous. Nephridia: avesiculate meroic, ventral clusters in 2-6 become flattened and spread out, as discrete lateral tubules in intestinal segments; not tufted anteriorly; funnels not found. Vascularization: dorsal blood vessel single in the anterior but doubled, reuniting at septa, from 17 (H), 15 (P1) or 14 (P2) and on intestine; hearts in 10-12; weak supra-oesophageal in 10,11-12,13. Spermathecae: two pairs in 8 and 9; ampulla saccular on longer duct with clavate diverticulum from middle of duct, in H diverticula are paired in 8 and bifid in 9. Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles paired racemose in 12 (absent from 9 in H and vestigial in 9 in P1). Ovaries: in 13; vestigial ovisacs in 14 9P1). Prostates: in 18, racemose, folded on long duct; penial setae not found. Intestine: origin ½18 (H, P1) or 18 (P2); deep typhlosole

developing from 22 (H) or 20 (P1, P2); intestinal gizzards absent; gut contains fine soil, organic matter and quartz grits.

REMARKS

Anisochaeta cethana is a variant of *A. simpsonorum* distinguished by a slight increase in setae, extra genital markings, a tendancy to doubled or bifid diverticula; lack of seminal vesicles in 9 and, most importantly, a doubled dorsal blood vessel that is not found in *A. simpsonorum.* Perhaps one function of a doubled vessel is to counter clogging by nematodes, as seen in some specimens of *A. simpsonorum.*

ETYMOLOGY: Cethana, noun, after the map region of the type-locality.

DISTRIBUTION AND HABITAT

Mt Roland, N Tasmania, wet sclerophyll.

Anisochaeta clavi Blakemore, 2000

Fig. 188.

Anisochaeta clavi Blakemore, 2000b: 28-29, fig 19.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3468, Sprent Basin, Lake Pedder north, 417600 5263100, 310 m, 9.iv.1996, R.J. Blakemore, under Ti-tree litter at edge of the lake (mature specimen, dissected and figured).

PARATYPES: none.

EXTERNAL FEATURES

Pharynx everted and cuticle detached intersegmentally, especially in anterior (due to preservation?), body tapers to tail. Length mm: 35. Width: ca. 2 mm. Segments: 75. Colour: shades of brown, darker dorsally, setal lines paler appearing to form stripes, clitellum beige. Prostomium: open epilobous, not furrowed; peristomium not cleft. Clitellum: saddle-shaped, ½13-½17. Dorsal pores: from 6/7. Setae: 22 on 12 and 20, increasing to ca. 30 posteriorly, mostly in straight lines but some irregularities. Nephropores: not obvious, possibly in bc and gh on clitellum. Spermathecal pores: 7/8/9 in b lines. Female pore: single, mid-ventral on 14. Male pores: paired on low mounds near b. Genital markings: paired discs in b in 16/17; analogue on lhs in a in 17/18; paired in b in 18/19.

INTERNAL ANATOMY

Gizzard: vestigial, not muscular and same width as oesophagus in 5. Oesophagus: increasingly dilated and internally lamellate in 6-13, narrows in 14 to form valve in 15. Nephridia: avesiculate meroic, two nephridia per side per segment, the innermost has preseptal funnel and discharges in about c line, other nephridium appears to collect from first nephridium (which it overlays) and exits via long duct in about h line. Vascularization: hearts in 10-12 with connectives to supra-oesophageal vessel that runs 9-12. Spermathecae: two pairs in 8 and 9, ampulla spherical, diverticulum small with stalk bent to terminal bulb. Male organs: holandric, testes and funnels iridescent in mucus in 10 and 11; seminal vesicles absent from 9, racemose in 12. Ovaries: with many egg strings in 13, funnels converge in body wall; no ovisacs. Prostates: tubuloracemose, confined to 18; no penial setae seen. Intestine: origin 16; no typhlosole; gut contains organic matter.

REMARKS

Anisochaeta clavi has distinctive colouration and setal patterns, small size, and characteristics of vestigial gizzard, two pairs of nephridia per segment, single female pore, saddle-shaped clitellum and seminal vesicles in 12 only. It shares several of these features with *Notoscolex pardus* sp. nov. which, however, has only 8 setae per segment and racemose prostates, and with *Woodwardiella tesellatus* (Spencer, 1895) that is holoic.

ETYMOLOGY: clavi, Latin - with stripes.

DISTRIBUTION AND HABITAT

Possibly rare, only one specimen found at north Lake Pedder, in humus in woodland on shoreline.

Anisochata corinna sp. nov.

Fig. 189.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3050 (ex 14:1051), Corinna, W Tasmania, Little Hunter Creek, 600m along from Timbs Creek, first area of forest Corinna Road enters into, CP 445 910, 200 m, 2.vi.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (mature, dissected and sketched).

PARATYPES: (P1) 14:3727, same details as H, (mature, dissected); (P2) 14:3725, same details as H, (mature, posterior amputee, dissected); (P3) 14:3726, same details as H, (mature, posterior amputee).

EXTERNAL FEATURES

Lengths mm: 140 (H), 120 (P1). Width: ca. 3.5 mm. Segments: 196 (H and P1). Colour: pale grey, clitellum faintly marked. Prostomium: tanylobous. Clitellum: ½13-17. Dorsal pores: from 4/5. Setae: 36-48 in anterior, 38-48 posteriorly. Nephropores: not found. Spermathecal pores: two pairs in 7/8 and 8/9in setal a lines. Female pores: paired just anterior to setae a on 14. Male pores: closely paired in a lines on 18 on raised papillae in common field within tumid mid-ventral area. Genital markings: elongate or circular mid-ventral pads with tumid margins as wide as male pores that impinge into adjacent segments in 19/20.

INTERNAL ANATOMY

Septa: 7/8-11/12 slightly thickened. Gizzard: in 5 very solid appearing doubled due to waist and occupying two segments but wholly contained between septa 4/5 and 5/6. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, clusters of two or three tubules per side; tufting not noted. Vascularization: dorsal blood vessel single; hearts in 10-13; supra-oesophageal not noted. Spermathecae: two pairs in 8 and 9; ampulla attaches to long thin duct with small, knob-like diverticulum near junction. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: small in 13; no ovisacs. Prostates: in 18 racemose rosettes with thin duct widening greatly at exit; penial setae not found. Intestine: origin 19 (H) or ½18 (P1) or posterior of 18 (P2); deep typhlosole developing from 24 (H, P1); gut contains light soil and plant remains.

REMARKS

Features of *Anisochaeta corinna* are the large number of setae (typically 36-48), spermathecal pores in a lines in 7/8/9, genital markings in 19/20, last hearts in 13, the distinctive shape of the spermathecae, and the ectal enlargement of the prostate duct. In several of these characters it closely resembles *A. zeehan*. The large, almost doubled, gizzard in 5 is remarkable and unusual in Tasmanian species (but see *Provescus crottyi*), although it is reminiscent of the doubled (or tripled) gizzards of *Digaster* on the mainland of Australia. This oesophageal development is most likely analogous to the intestinal gizzards that occur with some frequency in Tasmanian genera, serving the same purpose for comminution of soil and organic matter ingested.

ETYMOLOGY: after the type-locality.

DISTRIBUTION AND HABITAT

Corinna Road, rainforest, sympatric with *A. zeehan.*

Anisochaeta floris sp. nov

Fig. 190.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0945, Bruny Island, SE Tasmania, Gravel Reserve No. 0133, EN 290 287, 60m, 28.ix.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Body: round, tail blunt. Length mm: 160. Width: ca. 5 mm. Segments: 117. Colour: unpigmented in alcohol; clitellum grey. Prostomium: epilobous, tapering. Clitellum: annular, 14-17 although ½13-½18 also tumid. Dorsal pores: small, from 4/5. Setae: small and difficult to determine, 8 in close pairs in anterior, adding setae irregularly in mid-body to give ca. 24 on tail. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14 in dark patch. Male pores: in a lines on small papillae surrounded by florets within tumid patch on 18. Genital markings: paired slots in ab and almost uniting ventrally in 20/21.

INTERNAL ANATOMY

Septa: 9/10-11/12 slightly thickened. Gizzard: muscular barrel in 5 displaced to occupy 8-9. Oesophagus: large lateral pouches in 10-13 have internal rugae and are possibly sufficiently developed to be considered calciferous glands. Nephridia: pharyngeal tufts in 2-5; then avesiculate meroic clusters in line with ventral setae; abruptly from 15 become smaller and more extensive laterally as equatorial bands of small tubules; medianmost not enlarged, funnels not found. Vascularization: hearts 10-12 from supra-oesophageal vessel in 10-13. Spermathecae: two pairs in 8 and 9; saccular ampulla on equally long duct, sessile multiloculate diverticulum ectally (8lhs ampulla displaced into anterior segment). Male organs: holandric, iridescent testis and funnels in 10 and 11 in mucus; small, racemose seminal vesicles as floret in 9 and larger in 12. Ovaries: palmate in 13; small ovisacs in 14. Prostates: tubuloracemose in 18; small penial setae present anterior to duct. Intestine: from 16; deep lamellar typhlosole from 23; gut contains colloidal organic matter and plant remains.

REMARKS

Anisochaeta floris is distinguished by its two pairs of spermathecae in 8 and 9 with multiloculate diverticula florets, lack of extramural calciferous glands, intestinal

origin in 16 and the presence of a typhlosole. There are only 8 setae per segment in the anterior, increasing in the posterior and thereby qualifying this species for *Anisochaeta*, rather than *Notoscolex*, in which, however there are two species at least that have similar morphology to *A. floris*, including rosette-shaped diverticula: *Notoscolex campestris* (Spencer, 1895) and *Notoscolex wellingtonensis* (Spencer, 1895).

ETYMOLOGY: floris, Latin - floral, refering to appearance of male pores and diverticula.

DISTRIBUTION AND HABITAT

Bruny Island, wet sclerophyll.

Anisochaeta greeni sp. nov.

Fig. 191.

Megascolex montisarthuri (part.), Jamieson, 1974: 321-323.

MATERIAL EXAMINED

HOLOTYPE: 14:3668 (H), Lilydale - Mt Arthur, EQ 180 311, 190m, 13.xii.1972, R.H. Green, (mature dissected and figured).

PARATYPES: TM:K382 (P1), Mt Arthur, N Tasmania, 41°15'S.147°20'E, 15.x.1971, A.J. Dartnall, and R.C. Kershaw, from east side of mountain, (undissected mature); TM:K383 (P2), same details as P1 (an undissected mature); 14:3668 (P3), Mt Arthur, EQ 180 311, 190m, 13.xii.1972, R.H. Green, (aclitellate mature); BM:1973:2:48-52 (P4-P8), Mt Arthur, 41°15'S.147°20'E, 15.x.1971, A.J. Dartnall, and R.C. Kershaw, from east side of mountain (P4 and P5 dissected).

SPECIMENS: TK:K384-394, same details as P1, (not inspected here); AM:W5332-5338, same details as P1, (not inspected here); 14:0494, Mt Arthur, EQ 231 303, 990 m, 1991, R. Mesibov, subalpine rainforest, (mature, dissected); 14:3004, same details 14:0494, (mature); 14:3005 same details 14:0494, (mature); 14:3006, same details 14:0494, (mature); 14:1030, same details 14:0494, (5 matures, 1 subadult, 1 immature); 14:0495, Mt Arthur, EQ 246 310, 750 m, 1991, R. Mesibov, wet sclerophyll, (3 subadults); 14:0490, Mt Arthur, EQ255 317, 630 m, 1991, R. Mesibov, rainforest along creek, (4 matures); 14:0496, Mt Arthur, EQ239 281, 840 m, 1991, R. Mesibov, wet sclerophyll, (6 matures).

EXTERNAL FEATURES

Body: stout, slightly flattened with tail segments narrowing, first segment not suppressed. Lengths mm: 58 (H), 110 (P1), 90 (P2), 105 (P4). Width: ca. 4 mm. Segments: 115 (H), 123 (P4). Colour: uniform buff in alcohol. Prostomium: open epilobous. Clitellum: ½13-16. Dorsal pores: from 4/5. Setae: 12 on 12, 16 on 20, and 20 or more posteriorly with lines becoming irregular. Nephropores: not seen. Spermathecal pores: two pairs in 7/8 and 8/9 just median to setal a lines. Female pores: paired anterio-median to setae a on 14. Male pores: closely paired slits median of a lines on 18. Genital markings: elongate depressed inter-segmental pads with numerous ocelli-like markings in bb in 9/10, 16/17 and in 19/20; in 17/18 and 18/19 on either side of male pores are smooth pads in generally tumid area; (some Mt Arthur specimens lack markings in 9/10 and/or have markings in 20/21 rather than in 18/19).

INTERNAL ANATOMY

Septa: thin. Gizzard: large muscular cone, preceded by crop in 5 but displaced rearwards to occupy 7-9. Oesophagus: dilated in 9-14, enlarged as annular calciferous gland in 15-16 (15 only in H), narrow in 16,17. Nephridia: avesiculate meroic, tufted anteriorly in 3-4 then spread laterally to give ca. ten discrete tubules per side, none especially enlarged in posterior. Vascularization: dorsal blood vessel single onto pharynx in 4; hearts 10-12; supra-oesophageal vessel weak 10-11,12. Spermathecae: two pairs in 8 and 9; elongate saccular ampulla on short duct with clavate diverticulum about as long as duct. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles paired and racemose, small in 11, larger in 12. Ovaries: in 13; no ovisacs in 14. Prostates: racemose with short duct in 18; penial setae not found. Intestine: origin ½17; large and folded lamellar typhlosole develops from 20; intestinal gizzards absent; gut contains mucus, soil and organic debris.

REMARKS

Anisochaeta greeni resembles *Anisochaeta montisarthuri s. strict.* with closely paired spermathecal pores, distinctive markings in 16/17 and 19/20, calciferous glands in 15-16, and a deep typhlosole. However, it is separated on the basis of its undiminished first segment, epilobous prostomium, fewer setae, plus additional markings in 9/10 that may, however, be absent from some specimens (some of which have extra markings in 20/21).

ETYMOLOGY: named after the collector Bob Green, for many years QVM curator.

DISTRIBUTION AND HABITAT

N Tasmania: Lilydale, Mt Arthur in rainforest or wet sclerophyll.

Anisochaeta isla sp. nov

Fig. 192.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0943, Bruny Island, South Bruny Range, SE Tasmania, 9.5 kms along Lockleys Road from Adventure Bay, EM 251 909, 350m, 29.ix.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll regrowth, (mature, posterior amputee, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: (H) 80+. Width: ca. 4 mm. Segments: (H) 87+. Colour: uniform buff in alcohol with few dark dots in the anterior; clitellum slightly darker. Prostomium: closed epilobous. Clitellum: weakly marked ½13-17. Dorsal pores: from 9/10. Setae: 14 on 12, 16 on 20 and 18 posteriorly. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines or ab lines. Female pores: paired on 14 in groove. Male pores: near b lines on small papillae on 18. Genital markings: tumid between spermathecae on 8/9; and weakly marked tumid pads in bb in 17/18/19/20/21.

INTERNAL ANATOMY

Septa: 6/7-12/13 increasingly thick. Gizzard: muscular cone in 5. Oesophagus: dilated and vascularized in 8-15 (not considered calciferous glands), valvular in 16. Nephridia: pharyngeal tufts in 3-4; then avesiculate meroic clusters of numerous tubules, ca. ten or more per side after clitellum some sending ducts to body wall near anterior septa; medianmost not enlarged, funnels not found. Vascularization: large hearts 10-13 from supra-oesophageal vessel in 9-13. Spermathecae: two pairs in 8 and 9; saccular ampulla on long, twisted duct with short-stalked multiloculate diverticulum ectally. Male organs: holandric, iridescent testis and funnels in 10 and 11; seminal vesicles small, flat in 9 and racemose in 12. Ovaries: large palmate in 13; no ovisacs in 14. Prostates: tubuloracemose in 18; long penial setae present. Intestine: from 17; deep lamellar typhlosole from 23; intestinal gizzards absent; gut contains yellow soil and organic matter.

REMARKS

Anisochaeta isla is similar to *A. floris* in its multiloculate diverticula and typhlosole, it differs in the greater number of setae, in the later commencement of its dorsal pores, its last hearts in 13, intestinal origin in 17, and in the shape of the

spermathecae. The genital markings are ill-defined tumid pads at intersegments around the male field.

ETYMOLOGY: referring to the island locality.

DISTRIBUTION AND HABITAT

Bruny Island, Adventure Bay, wet sclerophyll regrowth.

Anisochaeta magna sp. nov

Fig. 193.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1602 Smithton, Roger River Forest Reserve along Buffs Road, NW Tasmania, CQ 331 524, 50 m, 17.v.1993, R. D'Orazio and D.E. Soccol, wet sclerophyll, (mature, posterior-amputee, dissected and drawn).

PARATYPES: (P1-3) 14:3040, same collection details as (H), (three sub-adults, all posterior-amputees, P3 dissected, plus a tail portion).

EXTERNAL FEATURES

Body robust. Length mm: (H) 110+ (posterior amputee), (P1) 140+, 120+ (P2) and 70+ (P3). Width: ca. 8 mm. Segments: uncounted in posterior-amputees. Colour: dark brown dorsum, clitellum yet darker. Prostomium: epi-tanylobous with deep dorsal furrow to first intersegment. Clitellum: ½13-19 (possibly just pigmentation in 18-19) annular but interrupted ventrally by pale genital markings. Dorsal pores: from 6/7 (or 7/8 in P1 and P3). Setae: ca. 30 on 12 increasing to ca. 36 after clitellum, interrupted ventrally and posteriorly. Nephropores: not seen. Spermathecal pores: 7/8/9 near a lines in deep caverns with puckered edges. Female pores: widely paired on 14. Male pores: on paired papillae in ab on 18, setae a or b possibly retained. Genital markings: paired in ab lines in 15/16 (in P1 and P2), in 16/17 (H, P1-P3), 17/18 and 18/19 (in all five specimens) and in 19/20 (in P3 and S1); there are small additional mounds lateral to male pores.

INTERNAL ANATOMY

Septa: 8/9-14/15 thickening, 7/8 and 8/9 adpressed. Gizzard: muscular in 5. Oesophagus: dilation not noted; calciferous gland absent. Nephridia: avesiculate meroic, tufted anteriorly, reducing in size afterwards; numerous on each side and appearing suspended from septa but funnels not found. Vascularization: hearts 10-12; supra-oesophageal vessel not noted. Spermathecae: two pairs in 8 and, larger, in 9; spherical ampulla clearly demarcated from duct with on its mid-length, small, multiloculate, rosette-like diverticulum. Male organs: holandric, testis in 10 and 11 in mucus; small paired seminal vesicles found in 12 only (none found in P3 sub-adult). Ovaries: in 13; ovisacs not noted. Prostates: racemose, elongate folded in 18; penial setae not found. Intestine: commences from 18; typhlosole absent; gut contains woody organic material, soil and large grits.

REMARKS

Characteristics of *Anisochaeta magna* are its robust size; two pairs of multiloculate spermathecae in 8 and 9; seminal vesicles only in 12; the distribution of the genital markings around the male field; and the posterior commencement of the dorsal pores in 6/7 or 7/8 (cf. *A. mawbanna*).

ETYMOLOGY: magna, Latin - big for its large size.

DISTRIBUTION AND HABITAT

Roger River Reserve, Smithton, NW Tasmania, wet sclerophyll.

Anisochaeta martha sp. nov.

Fig. 194.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:0397, Mole Creek, Martha Creek, Mersey Forest Road, N Tasmania, DP 352 922, 400m, R.D. D'Orazio, rainforest with very shaley soil, (mature, tip of tail missing, dissected and drawn).

PARATYPES: (P1) ANIC:RB.98.1.23, Mt Careless State Forest, along Saxon's Creek, N Tasmania, DQ 802 283, 420 m, 24.viii.1992, R.D. D'Orazio and M. Cooper, rainforest, (mature dissected); (P2) TM:K1581, same details as P1, (mature, dissected); (P3-4) 14:0472, same details as P1, (two matures that agree superficially); (P5-7) 14:1130, Moorina, Liffey Forest Reserve, 763 827, 920 m, 2.vii.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (three matures, one dissected); (P8-10) 14:1137, Fairy Glade Reserve, N Tasmania, DP 766 883, 740m, R.D. D'Orazio and L.F. McGowan, rainforest, (three matures, one dissected); (P11) 14:1140, Mole Creek, 7.6km along Lake MacKenzie Road and onto Snake Creek Road going left at every junction, DP 391 896, 590m, 5.x.1992, R.D. D'Orazio and M. Cooper, rainforest, (mature dissected); (P12) 14:1132, Lower Wilmot, Ingram Creek, Wilmot Road, NW Tasmania, DQ 346 277, 240m, 31.viii.1992, R.D. D'Orazio and M. Cooper, wet sclerophyll, (mature dissected); (P13-14) 14:1133, Paradise, Minnow Creek along Union Bridge Rd on right, NW Tasmania, DQ 447 806, 260m, 26.viii.1992, R.D. D'Orazio and M. Cooper, rainforest, (two matures, one dissected); (P15) 14:1138, Railton, Redwater Creek, DQ487 195, 200m, 25.viii.1992, R.D. D'Orazio and M. Cooper, rainforest, (mature dissected); (P16-17) 14:1131, Blackwood Creek, Weston's Rivulet, 892 758, 375m, 16.vii.1992, R.D. D'Orazio and M. Cooper, rainforest, (two matures, one dissected); (P18-19) 14: 0377, Needles, Chugleigh, Lobster Falls track, N Tasmania, DQ 608 008, 360m, 1.ix.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (two matures, one dissected, sample also contains three immatures); (P20-24) 14:0171, Liffey Falls Reserve, 813 845, 530m, 2.vii.1992, R.D. D'Orazio and L.F. McGowan, wet sclerophyll, (two matures, one dissected, and four juveniles); (P25-33) 14:172, 14:1135, 14:1136, Fairy Glade Reserve, same details as P8-10, (nine matures that agree superficially); (P34) 14:1134, Mt Careless State Forest, same details as P1-4, (mature); (P35) ANIC:RB.98.1.24, Gog Range, DQ 461 058, 530m, 16.xii.1991, R. Mesibov and Tammy S., wet sclerophyll, (mature, dissected);

(P36) TM:K1582, same details as P35, (mature); (P37) 14:3772, same details as P35, (mature); (P38-39) 14:3775, Gog Range, DQ 560 055, 230 m, R.M. and T.S., wet sclerophyll on flowline, (two specimens); (P40-42), 14:3775, Gog Range, DQ 557 055, 260 m, dry sclerophyll, R.M. and T.S., (three specimens, one dissected); (P43-47) 14:1139, Mt Roland, Sheffield, NW Tasmania, DQ 381 126, 235m, 23.xi.1992, R.D. D'Orazio and M. Cooper, dry sclerophyll, (four matures, one dissected, plus one juvenile); (P48) 14:2014, Castra, Gaunts Road, NW Tasmaia, 485 m, DQ 228 213, 19.i.1994, R.D. D'Orazio and M. Cooper, (mature, dissected and sketched).

EXTERNAL FEATURES

Body: quadrangular, flattened especially in tail. Lengths mm: range of matures 135-280 mm; (H) 185, (P1-2) 150, (P3) 155, (P4) 140, (P48) 170. Width: ca. 3 mm. Segments: range 80-160; (H, P35) 160, (P1) 155, (P40) 80, (P48) 157. Colour: pale unpigmented in alcohol with pink mid-dorsal line and faint brown dorsum; clitellum buff. Prostomium: closed epilobous with mid-dorsal furrow. Clitellum: ½13-½18. Dorsal pores: from 5/6. Setae: ca. 28 on 12, ca. 32 on 20, ca. 36 or more on tail. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pore: single on 14. Male pores: on low papillae in ab lines on 18. Genital markings: large intersegmental pad (paired in P48) with thickly tumid rims in 10/11 as wide as spermathecal pores and encompassing setal arcs of adjacent segments; paired braces wider than male pores in 17/18 and rounder in 18/19 in common tumid field; weak marking in aa in 19/20 in some specimens.

INTERNAL ANATOMY

Septa: 5/6 thin to base of gizzard, 9/10-12/13 slightly thickened. Gizzard: muscular barrel in 5 preceded by crop. Oesophagus: not especially dilated; valvular in 16-17. Nephridia: avesiculate meroic, dense forests of tubules in 3-5, then become more dispersed with ca. twelve tubules in approximately three ranks per side; not tufted anteriorly. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4, hearts 10-13 from weak supra-oesophageal vessel in 8-13,14. Spermathecae: two pairs in 8 and 9; bulbous ampulla on bulbous duct (H-P2, P16, P18, P20, P35, P40, P43, P48) or elongate (P5, P11-13, P15) with clavate, often bifid diverticulum ectally. Male organs: holandric, iridescent testis and funnels free in 10 and 11; seminal vesicles absent from 9, saccular in 11 and 12. Ovaries: as mass of egg strings in 13; small paired ovisacs in 14. Prostates: tubuloracemose in 18 with short muscular duct;

penial setae present. Intestine: from ½17; typhlosole deep lamellar from 21 (or 22 in some specimens); intestinal gizzards absent; gut contains organic soil and woody matter.

Note: in H, P1, P2, and P35, at least, many small protozoans were found in anterior of intestine in clumps and may possibly be gut symbionts.

REMARKS

Anisochaeta martha is distinguished by its single female pore, the bulbous spermathecae, seminal vesicles in 11 and 12 but not in 9, last hearts in 13, intestinal origin in or near ½17, a typhlosole, and the arrangement of the genital markings in 10/11 and around the male field. Castra specimen P48 differs slightly as its genital marking in 10/11 has closely paired discs, there are ca. 50 setae on the tail and the prostates are blocky.

ETYMOLOGY: for the type-locality.

DISTRIBUTION AND HABITAT

N and NW Tasmania: Martha Creek, Mt Careless, Liffey Forest Reserve, Fairy Glade Reserve, Mole Creek, Lower Wilmot, Paradise, Railton, Blackwood Creek, Chugleigh, Gog Range, Mt Roland, and Castra, mostly from rainforest or wet or dry sclerophyll.

Anisochaeta mawbanna sp. nov

Fig. 195.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:2264, Black River off Mawbanna Road, NW Tasmania, "Down near yabby burrow, log track near old sawmill", 17.iii.1975, P.S., T.W., P.F.; [second label states "Monkmana Light T.tree, 15.iii.1975, T.W., P.F., P.S."], (mature, dissected).

PARATYPES: none.

EXTERNAL FEATURES

Body stout with faint dorsal canal on tail, contracted and coiled on preservation. Length mm: 340. Width: ca. 11 mm. Segments: 188. Colour: light brown in alcohol, clitellum buff. Prostomium: epilobous with deep dorsal furrow to first intersegment. Clitellum: ½13-17, dorsally at least. Dorsal pores: not found (probably absent but possibly minute and missed due to contraction of segments). Setae: ca. 32 on 12, ca. 24 on 20, increasing to ca. 32-36 posteriorly. Nephropores: not seen. Spermathecal pores: on papillae on 7/8/9 in ab, tumid between. Female pores: minute, paired on 14. Male pores: superficial in ab on elongate tumid pad in 18, setae a (and b?) retained. Genital markings: slight pucker marks precede the spermathecal intervals in 7 and 8; widely paired discs in ab lines in 17/18, 18/19 and 19/20; slightly tumid pad precedes the male pore interval in 18.

INTERNAL ANATOMY

Septa: 5/6/7 distended and displaced, 10/11-16/17 slightly thickened. Gizzard: large muscular barrel with anterior flange in 5. Oesophagus: dilated in 9-14, white in 10 and 15, but not forming calciferous glands. Nephridia: avesiculate meroic, tufted clusters in 2-3,4, reducing in size aftwards as numerous equatorial clusters, most noticeable in ca bc lines; funnels not found. Vascularization: huge hearts in 10-12; supra-oesophageal vessel 9-13. Spermathecae: two pairs in 8 and, larger, in 9; spherical ampulla on thick muscular duct with small, multiloculate, mace-like diverticulum near junction. Male organs: holandric, testis in 10 and 11 in mucus; paired racemose seminal vesicles anteriorly in 11 and 12, absent from 9. Ovaries: not noted (in 13). Prostates: tubuloracemose, folded in 18; penial setae not found. Intestine: commences from 18, wide; typhlosole absent; gut contains leaves, soil and organic matter.

REMARKS

Characteristics of *Anisochaeta mawbanna* are its large size; the distribution of the genital markings around the male field; two pairs of multiloculate spermathecae in 8 and 9; and, differentiating it from *A. magna*, seminal vesicles in 11 & 12, and the absence (or reduction) of dorsal pores.

ETYMOLOGY: for the type-locality.

DISTRIBUTION AND HABITAT

Black River, Mawbanna, NW Tasmania, near yabby burrow.

Anisochaeta metandris sp. nov

Fig. 196.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1702, Port Arthur, Mt Arthur, Tasman Peninsula 3.7km from A9, SE Tasmania, EN 654 204, 375m, 8.ix.1992, R.D. D'Orazio, wet sclerophyll, (mature, dissected and drawn).

PARATYPES: (P1) 14:3676, same details as H, (mature dissected); (P2) 14:3677, same details as H, (mature dissected).

EXTERNAL FEATURES

Lengths mm: (H) 190, (P1) 185, (P2) 175. Width: ca. 3.5 mm. Segments: (H) 246, (P1) ca. 230. Colour: pale unpigmented in alcohol with random dark dots; clitellum cream. Prostomium: small epilobous. Clitellum: ½13-½18,18. Dorsal pores: small from 10/11 (P1) or 11/12 (H, P2). Setae: 8 on 12 and 20 in regular rows, adding setae in latter half of body irregularly to give ca. 28 on tail segments. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14. Male pores: superficial in a lines on 18 on summits of large raised mounds that have lateral braces. Genital markings: ventral inter-segmental pads with thickly tumid rims as wide as spermathecal pores in 10/11, 11/12 and 12/13; smaller markings in 13/14 (rhs analogue in ab in H); and in 17/18, 18/19, 19/20, and (in P1) 20/21.

INTERNAL ANATOMY

Septa: 5/6-10/11 with some thickening. Gizzard: large barrel-shaped in 5 with crop in 4. Oesophagus: 11-14 pinched off and internally lamellate possibly forming four pairs of pouched calciferous glands; valvular in 15. Nephridia: avesiculate meroic with ventral clusters in 4-12 that separate as ca. ten discrete tubules per side further back. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4, hearts 10-12 from supra-oesophageal vessel in 9-14. Spermathecae: two pairs in 8 and 9; saccular ampulla on equally long duct with sessile multiloculate diverticulum mid-length. Male organs: incipiently metandric, funnels vestigial in 10 and testis and funnels iridescent in 11; seminal vesicles vestigial in 9 and racemose in 12. Ovaries: and oviducts in 13; small paired ovisacs in 14. Prostates: tubuloracemose in 18 with tortuous muscular duct; long penial setae present. Intestine: from 16; typhlosole deep T-shaped from 23; intestinal gizzards absent; gut contains gritty soil.

REMARKS

Anisochaeta metandris is comparable to sympatric *A. proandris*, differing in its tendancy to metandry, in the distribution of genital markings, and on the shape of the spermathecae.

ETYMOLOGY: for metandry.

DISTRIBUTION AND HABITAT

Port Arthur, Mt Arthur, Tasman Peninsula, SE Tasmania, wet sclerophyll.

Anisochaeta montisarthuri (Jamieson, 1974) **comb. nov.**

Fig. 197.

Megascolex montisarthuri Jamieson, 1974: 321-323; Figs. 30A, 32G.

MATERIAL EXAMINED

HOLOTYPE: TM:K381 (H), Weldborough Pass, NE Tasmania, 41°10'S.147°55'E, 26.viii.1953, J.L. Hickman, 1.6 miles from eastern end of pass, (mature specimen, dissected).

PARATYPE: none.

SPECIMENS: none.

EXTERNAL FEATURES

Body: first segment notably reduced, almost suppressed (not noted by Jamieson). Length mm: 95. Width: ca. 4 mm. Segments: 125. Colour: unpigmented in alcohol; clitellum buff. Prostomium: tanylobous, dorsally furrowed. Clitellum: ½13-17. Dorsal pores: small from 4/5. Setae: 18 on 12, increasing to ca. 24 in posterior where setal lines are irregular. Nephropores: not found. Spermathecal pores: two pairs in 7/8 and 8/9 close to anterior margin of their segments, mid-ventral closely paired on small apposed mounds. Female pores: paired anterio-median to setae a on 14. Male pores: closely paired on small apposed mounds within mid-ventral tumid area from 17/18-18/19 that converge either side of the male pores. Genital markings: elongate tumid rims with depressed centres and numerous ocelli-like markings in 16/17 and in 19/20, this last set slightly larger.

INTERNAL ANATOMY

Septa: 5/6 thin to base of gizzard. Gizzard: large flask-shaped in 5 but displaced to appear in 6. Oesophagus: two annular calciferous glands with internal lamellae in 15-16. Nephridia: avesiculate meroic; tufted anteriorly in 2-3. Vascularization: hearts 10-12; supra-oesophageal vessel weak. Spermathecae: two pairs in 8 and 9 but with ampullae in preceding segment (in H, 9rhs spermatheca removed and missing from jar); saccular ampulla tapers to duct with a clavate diverticulum about as long as the duct. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles paired and racemose, small in 11 and larger in 12. Ovaries: large, palmate in 13; small ovisacs in 14 (not recorded by Jamieson). Prostates: racemose with short duct in 18; penial setae absent. Intestine: origin 18; typhlosole increasing in size from 21; gut contents not noted.

REMARKS

Jamieson's original description permitted variation exceeding that normally acceptable for a species, and confused the Weldborough type-locality of the holotype (having the same collection details as Jamieson's monotypic *Perionychella weldboroughi*) with that of the remaining 25 paratypes from Mt Arthur (having the same collection data as Jamieson's monotypic *Perionychella montisarthuri*). Herein, these latter 'paratype' specimens, which differ morphologically from the holotype, are separated off to *Anisochaeta greeni* sp. nov., leaving *A. montisarthuri* with a rather unfortunate name.

Based on re-inspection of the holotype, the characters that distinguish *Anisochaeta montisarthuri s. strict.* are:

1/. the first segment is greatly reduced, hardly differentiated from segment 2;

2/. the prostomium is tanylobous with a dorsal furrow, rather than epilobous;

3/. the first dorsal pore is in 4/5;

4/. the spermathecal pores (in 7/8/9) and male pores are closely apposed;

5/. setae increase from 18 in the anterior to ca. 24 in the posterior;

6/. distinctive genital markings are present in 16/17 and 19/20, but absent from 9/10 or 20/21;

7/. the clitellum extends ½13-17;

8/. annular calciferous glands are present in 15-16, but absent from 14 or 17;

9/. spermathecal ampullae are (always?) displaced into the preceding segment;

10/. seminal vesicles are present in 11 and 12, but absent from 9 or 10;

11/. small ovisacs are present in 14.

DISTRIBUTION AND HABITAT

NE Tasmania: Weldborough Pass, that Jamieson (1974: 323) confused with Mt Arthur (Mt Arthur is no longer considered a type-locality).

Anisochaeta portusarturi sp. nov

Fig. 198.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1127, Port Arthur, Tasman Peninsula, Mt Arthur 3.7km from A9, SE Tasmania, EN 654 204, 8.ix.1992, R.D. D'Orazio, wet sclerophyll, (mature, dissected and drawn).

PARATYPES: (P1) 14:1129, same details as H, (mature dissected); (P2) ANIC:RB.98.1.15, same details, (mature, tail missing, dissected); (P3) TM:K1569, same details, (aclitellate mature); (P4-P6) 14:1125, same details, (two subasults and one immature that agree superficially); (P7-10) 14:1126, same details, (one subadult and three juveniles that agree superficially).

EXTERNAL FEATURES

Body: with squarish tail. Length mm: (H, P1) 340, (P2) 240+, (P3) 330. Width: ca. 5 mm. Segments: (H) 256. Colour: uniform buff in alcohol with random dark dots, some specimens have slight dark pigmentation in setal arcs; clitellum buff. Prostomium: small pro-epilobous, on furrowed peristomium. Clitellum: tumid 13-19 (H), ½13-½19 (P1-2). Dorsal pores: small from 10/11 or 11/12. Setae: 8 per segment in anterior in regular rows, add setae after clitellum to give ca. 12 per segment increasing to ca. 28-30 on tail with irregular distribution. Nephropores: not found. Spermathecal pores: 7/8/9 in a lines. Female pores: paired on 14 in groove. Male pores: superficial on 18 in a lines. Genital markings: large tumid pads with paired or elongate white centres in 17/18, 18/19 and 19/20 contiguous mid-ventrally.

INTERNAL ANATOMY

Septa: 6/7-11/12 with some thickening. Gizzard: muscular barrel in 5. Oesophagus: increasingly dilated in 8-16, not calciferous; valvular in 17. Nephridia: avesiculate meroic with ventral clusters that spread laterally after 5,6 form discrete equatorial tubules. Vascularization: dorsal blood vessel single, hearts 10-12 from well developed supra-oesophageal vessel. Spermathecae: two pairs in 8 and 9; elongate ampulla with terminal teat, on tapering duct with small clavate diverticulum. Male organs: holandric, iridescent testis and funnels in 10 and 11; seminal vesicles large in 9 and 12. Ovaries: fan-shaped in 13; ovisacs small in 14. Prostates: tubuloracemose in 18; short penial setae present. Intestine: from 18; deep T-shaped typhlosole from

24; intestinal gizzards absent although has some thickening in 17-18; gut contains fine flocculated soil or (P3) woody debris.

REMARKS

Anisochaeta portusarturi differs from sympatric *A. alba* by its wider spermathecal and male pores, last hearts in 12, intestinal origin in 18 and spermathecae with distinctive shape and uniloculate diverticula; and from *A. metandris* and *A. proandris* by its holandry.

ETYMOLOGY: for the locality.

DISTRIBUTION AND HABITAT

Port Arthur, Tasman Peninsula, SE Tasmania, wet sclerophyll, found with *A. metandris*.

Anisochaeta proandris sp. nov

Fig. 199.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1704, Tasman Peninsula, Long Bay Creek, Fortescue Road 600m beyond Coronation Rd junction on the right, SE Tasmania, EN 708 269, 8.ix.1992, R.D. D'Orazio, wet sclerophyll, (mature, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Body: with much secondary annulation. Length mm: 175. Width: ca. 3.5 mm. Segments: 210. Colour: white unpigmented in alcohol with random dark dots; clitellum buff. Prostomium: small epilobous, on furrowed peristomium. Clitellum: 13-18. Dorsal pores: from 9/10, occluded on clitellum. Setae: 8 on 12 and 20, small in regular rows to tail where become irregular and add setae to give 12 on the final 15 segments. Nephropores: not found. Spermathecal pores: 7/8/9 near a lines. Female pores: paired on 14 in large dark patch. Male pores: on small papillae on 18 in ab lines. Genital markings: ventral intersegmental pads with thickly tumid rims as figured in 17/18 (paired), 18/19-20/21 (in sets of three), 21/22-23/24 (elongate and contiguous).

INTERNAL ANATOMY

Septa: 5/6-10/11 with some thickening. Gizzard: muscular barrel in 5 with anterior flange and crop in 4. Oesophagus: increasingly dilated by degrees in 7-14, especially in the last three or four segments, pinched off and internally lamellate possibly forming pouched calciferous glands; valvular in 16. Nephridia: avesiculate meroic with ventral clusters in 3-4 that separate as ca. six discrete tubules per side further back. Vascularization: dorsal blood vessel single onto pharyngeal mass in 4, hearts 10-12 from well developed supra-oesophageal vessel in 10-12. Spermathecae: two pairs in 8 and 9; saccular ampulla on equally long duct with sessile multiloculate diverticulum. Male organs: proandric, iridescent testis and funnels in 10 only; seminal vesicles compact pair in 9 only. Ovaries: in 13; ovisacs absent. Prostates: tubuloracemose in 18 with long thin, non-muscular duct; long penial setae present. Intestine: from 17; typhlosole V-shaped in 21 them becomes T-shaped; intestinal gizzards absent; gut contains sandy soil.

REMARKS

Anisochaeta proandris is unusual in its proandry (testis in 10 only) (cf. *A. metandris*). Other distinctive features are the distribution of the genital markings and the shape of the spermathecae and the weak prostates. *Anisochaeta floris*, *A. proandris*, *A. portisarturi* and *A. brevis* have intestinal origins in 16, 17, 18 and 19, respectively.

ETYMOLOGY: for proandry.

DISTRIBUTION AND HABITAT

Port Arthur, Tasman Peninsula, SE Tasmania, wet sclerophyll.

Anisochaeta scottsdalei sp. nov.

Fig. 200.

MATERIAL EXAMINED

HOLOTYPE: 14:3291 (H), Scottsdale, NE Tasmania, EQ 503 382 (ca. 41°10'S.147°30'E), ca. 325 m, wet sclerophyll in "Stronach" soil, 25.i.1996, S.A.McI. & R.J. Blakemore, (mature dissected and figured).

PARATYPES: none

EXTERNAL FEATURES

Length mm: 70. Width: ca. 4.5 mm. Segments: 113. Colour: faint dorsal pigmentation, otherwise white; clitellum yellow. Prostomium: widely tanylobous, not furrowed. Clitellum: 14-17. Dorsal pores: weak in 3/4, open from 4/5. Setae: ca. 32 on 12, and ca. 30 on 20, rows irregular further posteriorly. Nephropores: not seen. Spermathecal pores: two pairs in 7/8 and 8/9 median to setal a lines. Female pores: paired anteriomedian to setae a on 14. Male pores: paired median of a lines on 18, setae ab suppressed. Genital markings: elongate depressed intersegmental pads with numerous ocelli-like markings in cc in 16/17 and in 19/20, plus a weak marking in 20/21; in 17/18 and 18/19 on either side of male pores are smooth pads in generally tumid area.

INTERNAL ANATOMY

Septa: 9/10-12/14 slightly thickened. Gizzard: large muscular in 5 but diplaced rearwards. Oesophagus: enlarged as annular calciferous gland in 16. Nephridia: avesiculate meroic, in nephridial clusters that tare larger in the anterior. Vascularization: hearts 10-13; supra-oesophageal vessel 9-13. Spermathecae: two pairs in 8 and 9; saccular ampulla on short duct with clavate, sometimes multiloculate, diverticulum about as long as duct. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles paired and racemose on anterior septa in 11 and 12. Ovaries: in 13; small paired ovisacs in 14. Prostates: racemose with short duct in 18; penial setae not found. Intestine: origin ½17; large lamellar typhlosole develops from 21; intestinal gizzards absent; gut contents not noted.

REMARKS

Anisochaeta scottsdalei, appears intermediate to *Anisochaeta montisarthuri* and *A. greeni* (both morphologically and geographically), all three species have two pairs of spermathecae, and seminal vesicles in 11 and 12. *A. scottsdalei* has a

tendancy to reduction of the first segment and a tanylobous prostomium, as in *A. montisarthuri*, but the spermathecal pores, although closely paired, are not apposed in *A. scottsdalei*. Moreover, it lacks the markings in 9/10 typically found in *A. greeni*. From both taxa it differs by a greater number of setae, especially in the anterior; by its calciferous gland in 16, rather than 15-16; and, most distinctively, its last heart in 13 rather than 12, and its intestine from 17 rather than 18-19.

ETYMOLOGY: after the type-locality.

DISTRIBUTION AND HABITAT

Scottsdale from "Stronach" soil type, same locality as *Diporochaeta stronach*.

Anisochaeta simpsonorum Blakemore, 1997

Fig. 201.

Anisochaeta simpsonorum Blakemore, 1997: 1695-1698, figs. 3, 4.

MATERIAL EXAMINED

Holotype: QVM:14:3275 (H), Dismal Swamp Nature Reserve, NW Tasmania, 40 59'S 144 51'E, 8.ix.1987, QVM, (mature, posterior amputee, dissected and figured).

PARATYPES: ANIC:RB.96.11.6 (P1), Walking Track off Bass Highway, near Dismal Swamp, 40°57'S 144 49'E, 24.vi.1993, J.C. Buckerfield & R.J. Blakemore, (mature, posterior amputee, dissected and figured); TM:K1526-1528 (P2-4), Belmont Rd., Waratah, NW Tasmania, 41°23'S 145 32'E, 31.v.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (three matures, P2 dissected and figured); ANIC:RB.96.11.7 (P5-P8), same details P2-4, (four matures); QVM:14:1075 (P9-11), same details P2-4, (three matures, P11 dissected, plus 3 unregistered juveniles); QVM:14:3529 (P12), "Killara" property, Marrawah, N.W. Tasmania, 41°01'S 144 44'E, 7.ix.1987, S. Pilkington, (mature); QVM:14:3530 (P13), Wombat Hill near Waratah, NW Tasmania, 41°29'S 145°27'E, 22nd September 1990, R. Mesibov, (mature, posterior amputee, dissected); ANIC:RB.96.12.3-5 (P14-16), 1.5 Km along forest track in Crown land east of "Killara" property, Marrawah, 41°01'S 144 44'E, 4.xii.1996, R.J. Blakemore, (three matures, one dissected); TM:K1535-1537 (P17-19), same details P14-16, (three matures, one dissected); QVM:14:3572 (P20), same details P14-16, (1 mature, dissected; sample also contains 9 sub-adult and immature specimens that superficially agree); QVM:14:3052 (P21), Little Hunter Creek, Corinna Rd., W Tasmania, 41°36'S 145 08'E, CP 445 910, 200m, 2.vi.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (mature, dissected, separated off 14:1052 which contained 18 specimens); QVM:14:1048 (P22), Corinna, Pieman River State Reserve, NW Tasmania, CP 403 875, 40m, 41°39'S 145 05'E, 2.vi.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (mature, dissected).

SPECIMENS: 14:1055, Belmont Road, Waratah, NW Tasmania, CQ 769 174, 390 m, 31.v.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (aclitellate mature dissected); 14:3053, same details as 14:1055, (six subadults that superficially agree); 14:1058, Tullah, Huskisson River, Lower Pieman Road, NW Tasmania, CP 703 785, 160 m, 1.vi.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (fourteen specimens, two dissected agree internally); 14:1060, Waratah, Heazlewood River, Mount Cleveland Road, NW Tasmania, CQ 618 109, 210 m, 31.vi.1993, R.D. D'Orazio and D.E.

Soccol, (ten specimens, one dissected); 14:2293, Balfour, Franklands Plain, NW Tasmania, CQ 239 402, 160 m, 20.xii.1990, R. Mesibov, (mature posterior amputee, dissected).

EXTERNAL FEATURES

Lengths mm: range 60-115; (P2-3) 93, (P5-12) 80-90, (P14-20) 60-80, (P21-22) 90-115, (H and P1 are 50+ and 55+ mm, respectively). Segments: (P2) 136, (P3) 140 (P21) 124, (P22) 114. Colour: pale, unpigmented or with a yellow tinge, clitellum orange/buff. Prostomium: open epilobous. Clitellum: ½13-17. Dorsal pores: from 4/5. Setae: 12 throughout in mostly regular rows except for some irregularities in cd lines posteriorly (H and P1 to cuts, and in other specimens). Nephropores: not seen. Spermathecal pores: in 7/8-8/9 near a setal lines. Female pores: paired anteriomedial to setae a. Male pores: paired near a setal lines on small raised papillae within rimmed, mid-ventral tumid area. Genital markings: paired pads centred in b lines and extending slightly beyond ab lines in 11/12; (12/13 infolded ventrally in several specimens); smaller pads paired (or analogue) in ab lines in 16/17, sometimes absent; elongate trough in bb or aa in 19/20 surrounded by tumid area extending to setal arcs of 19-20; paired or single darkened patches in aa in 20/21. Markings are consistently in 11/12 and 19/20, however, P10-13 and P21-22 have aberrant markings: in P10 and P12 they are asymmetrical (in some of 11/12/13,16/17 and 18/19/20/21), while P11, P13, P21-22 have elongate troughs in bb in 11/12 (and in aa in 16/17 in P11, P21-22) and in aa in 19/20 (P11, P13, P21-22).

INTERNAL ANATOMY

Septa: thin in anterior, 9/10-12/13,13/14 only slightly thickened. Gizzard: in 5, muscular and barrel-shaped with anterior flange, displaced posteriorly. Oesophagus: dilated and internally lamellate in 10-16, especially 15-16, but not calciferous. Nephridia: avesiculate meroic, ca. two or three small clusters of tubules per side becoming laterally connected bands in midbody; not tufted anteriorly; funnels not found. Vascularization: dorsal blood vessel single (H, and dissected paratypes and specimens); hearts in 10-12; supra-oesophageal vessel in 8,9-12,13. Spermathecae: two pairs in 8 and 9; ampulla saccular on longer duct with clavate diverticulum from middle of duct (iridescent bulb sometimes bifid or multiloculate). Male organs: holandric, iridescent testes and funnels in mucus in 10 and 11; seminal vesicles paired (sometimes rudimentary), saccular in 9 and racemose in 12. Ovaries: large in 13;

small ovisacs paired in 14. Prostates: in 18, racemose, bilobed but appear as rosettes; ducts sinuous, wide at base; penial setae not found. Intestine: origin 18 (appears to be 17 in some specimens where septum 17/18 deflected anteriorly); darker and more dilated from 19; deep typhlosole develops from 20; intestinal gizzards absent; gut contains soil, some organic matter and quartz grits.

REMARKS

This species is morphologically differentiated from *Anisochaeta greeni*, *A. montisarthuri* and *A. scottsdalei* by its fewer numbers of setae, the positions of the genital markings, the wider spermathecal and male pores, the lack of calciferous glands, and the presence of seminal vesicles in segment 9. Some specimens in the new material included above have slight variations in genital markings and one, 14:2293 from Franklands Plain, is aberrant in having the gizzard in 6 rather than 5, but otherwise agreeing internally. This specimen, as well as several others, also had numerous nematodes distending its single dorsal blood vessel.

ETMOLOGY: named after the Simpsons a popular TV cartoon show that it resembles.

DISTRIBUTION AND HABITAT

NW Tasmania, in rainforest or wet sclerophyll forest soils. Samples from the Bass Highway, Belmont Rd. and Dismal Swamp sites also contained specimens of *Hickmaniella opisthogaster*.

Anisochaeta stumpysinensis sp. nov.

Fig. 202.

MATERIAL EXAMINED

HOLOTYPES: 14:1941 (H), Stumpys Bay, Mt. William National Park, Gladstone, 3.6kms from NP2 turning down to Stumpys Bay and to camp site 3, NE Tasmania, FQ 029 739, 10m, R.D. D'Orazio and D.E. Soccol, dry sclerophyll, (mature, dissected and figured).

PARATYPES: ANIC:RB.98.1.25 (P1), Cape Naturaliste, NE Tasmania, 14.viii.1991, QVM, creek and heath, (mature, tip of tail missing, dissected); 14:1941 (P2), same details as H, (juvenile, dissected).

EXTERNAL FEATURES

Lengths mm: 50 (H), 75+ (P1), 40 (juvenile P2). Width: ca. 2.5 mm. Segments: 101 (H), 92+ (P1), 90 (P2). Colour: dorsum dusky brown tinge darker spine, anterior darker still with blue iridescence, ventrum and setal aureolae paler; clitellum buff. Prostomium: open epilobous; peristomium ventrally cleft. Clitellum: most of 13-16 and impinging on 17 (H), 14-17 (P1). Dorsal pores: vestigial in 2/3, open from 3/4. Setae: 18-20 anteriorly, up to 30 on tail. Nephropores: not found. Spermathecal pores: 4/5-8/9 in ab. Female pores: closely paired on 14 within dark patch. Male pores: on papillae on 18 in ab. Genital markings: presetal, mid-ventral discs on 6, paired discs on 7-11, initially closely paired then separating to become widest in ac lines in 10 and slightly converged in 11 (9lhs analogue in H; absent from 9 in P1); presetal, elongate in aa on 17; conjoined but paired markings in 19-22; male pores bordered laterally by large tumid crescents on 18.

INTERNAL ANATOMY

Gizzard: weakly muscular barrel in 5. Oesophagus: three pairs of extramural calciferous glands attaching to the oesophagus laterally in 10-12. Nephridia: avesiculate meroic; small and numerous in equatorial bands approximately in line with each seta; anterior tufting not noted. Vascularization: dorsal vessel single onto pharyngeal mass in 4; hearts 10-12 connected with supra-oesophageal vessel in 10-12,13. Spermathecae: five pairs in 5-9; ampulla saccular, diverticular stalk as long as sac with swollen iridescent bulb. Male organs: holandric iridescent testes and funnels in 10 and 11; seminal vesicles racemose in 9 and larger in 12. Ovaries: large in 13; ovisacs present in 14. Prostates: flattened racemose in 18 or 18-19, not bilobed but

gland constricted where divided by septum 18/19; penial setae absent. Intestine: origin in 15; typhlosole absent; gut contains organic soil with woody remains.

REMARKS

Anisochaeta stumpysinensis is similar to *A. tasmanica* (Spencer, 1895), both have five pairs of spermathecae and three pairs of calciferous glands in 10-12. Notable differences are that the genital markings in *A. stupysinensis* tend to be paired, rather than mid-ventral, the crescents bordering the male pores are distinctive; the prostates are not as clearly bilobed; and the spermathecal diverticula are not longer than the ampullae.

ETYMOLOGY: for the type-locality.

DISTRIBUTION AND HABITAT

NE Tasmania: Mt William NP, Stumpys Bay from dry sclerophyll, and Cape Naturaliste.

Anisochaeta tamara sp. nov.

Fig. 203.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3028, Retreat, N Tasmania, EQ 451 160, TSF 64, 2.v.1992, R.D. D'Orazio, dry sclerophyll, (mature, dissected).

PARATYPES: (P1) 14:3029, same details as H, (mature); (P2) 14:3030, same details as H, (mature); (P3-P5) 14:3031, same details as H, (matures).

SPECIMENS: 14:3032, same details as H, (three matures and two immatures that superficially agree); 14:3033, Retreat, N Tasmania, EQ 464 290, TSF 60, 2.v.1992, R.D. D'Orazio, dry sclerophyll, (three matures and one subadult); 4:3034, ditto 14:3033, (two matures and two juveniles); 14:3035, ditto 14:3033, (one mature and two immatures)

EXTERNAL FEATURES

Body: circular, post-clitellum segments become tri-annular; last 16 segments decrease in size and gain dorsal canal. Lengths mm: (H) 285, (P1) 240, (P2) 210+, (P3-P5 mean ca. 200). Width: ca. 5 mm. Segments: (H) 131. Colour: darkly pigmented; clitellum buff. Prostomium: closed epilobous. Clitellum: 14-17. Dorsal pores: from 4/5 (H) or 5/6 (Ps). Setae: 12 on 12, and up to 16 irregularly in posterior. Nephropores: not seen. Spermathecal pores: three pairs in 6/7/8/9 mid-ventral, closely apposed. Female pores: paired anteriomedian to setae a. Male pores: closely paired on small papillae within tumid midventral area; setae, or at least pores, retained on 18. Genital markings: elongate continuous intersegmental markings with several central ocelli-like markings in 9/10, 16/17, 19/20, 20/21; extra markings in 20/21 and those in 19/20 sometimes paired in ab in non-type specimens; on either side of male pores are glandular areas that obscure adjacent intersegmental furrows ventrally.

INTERNAL ANATOMY

Septa: 7/8-12/13 thickening. Gizzard: strong in 5. Oesophagus: not especially dilated until 15 where it forms a large annular calciferous gland. Nephridia: avesiculate meroic, nephridia forming dense parietal forests, not tufted anteriorly, none especially enlarged caudally. Vascularization: hearts in 10-12; supra-oesophageal vessel in 11-14. Spermathecae: three pairs in 6-8; ampulla tapers to duct with small diverticulum near junction. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles racemose in 11 and 12 only. Ovaries:

small, palmate in 13. Prostates: in 18 racemose rosettes with thick duct; penial setal absent but sheaths of retained setae found. Intestine: origin 17; low typhlosole developing from ca. 24; gut contains humic matter and plant root material.

REMARKS

Anisochaeta tamara is similar to *A. montisarthuri*, especially the form of the genital markings, the presence of last heart in 12, a calciferous gland in 15, seminal vesicles in 11 and 12, and mid-ventral spermathecal pores (cf. also *Anisochaeta corinna* and *A. zeehan*). It differs most notably in the extra pair of spermathecae which also vary slightly in form, the fewer setae in posterior segments, and possibly the retention of setae on 18.

ETYMOLOGY: for the North Tamar region.

DISTRIBUTION AND HABITAT

Retreat, N Tasmania from dry sclerophyl; the same locality as *Vesiculodrilus recessus*.

Anisochaeta tasmanica (Spencer, 1895) **comb. nov.**

Fig. 204.

Perichaeta tasmanica Spencer, 1895: 47-48, Figs. 37-39.

Megascolex tasmanicus ; Michaelsen, 1900: 217.

Megascolex tasmanicus ; Jamieson, 1974: 324-326, figs 30C, 32H, I [Note: Jamieson's Specimen 1 was previously undissected, therefore it is not known whence his figured spermathecae came].

MATERIAL EXAMINED

SYNTYPES: NMV: F40289 (previously G289), labeled [in Spencer' hand], "Peri sp1. Tas", Emu Bay, Jan, 1892 (five specimens: one previously dissected in two halves, one entire dissected, and three previously undissected matures specimens - in reasonable condition but hardened in alcohol, plus one tail).

SPECIMENS: TM: K395 (S1), Table Cape, 24.viii.1954, J.L. Hickman, (previously undissected specimen, here dissected and figured); 14:2871 (S2-5), Christmas Hills, NW Tasmania, CQ 309 667, 60m ,6.xii.1990, R. Mesibov, (four specimens: 3 matures, one dissected here, and an immature that superficially agrees).

EXTERNAL FEATURES

Lengths mm: 60-80 (syntypes and specimens), (cf. 60-90, Spencer). Width: ca. 3-3.5 mm. Segments: ca. 90. Colour: dorsum and flanks dark chocolate brown, but setal auriolae pale to give appearance of dark median dorsal line, ventrum pale; clitellum buff; sprit specimens bleached uniform buff. Prostomium: open epilobous but almost tanylobous; peristomium ventrally cleft (Spencer, confirmation). Clitellum: ½13,14-½17,17 (syntypes and specimens), (cf. 13-17 Spencer, Jamieson). Dorsal pores: small in 3/4, open from 4/5. Setae: 16-22 anteriorly, 24-30 after clitellum. Nephropores: not discernible. Spermathecal pores: 4/5-8/9 in ab nearer to a lines (Spencer, confirmation). Female pores: on 14 within elliptical rim. Male pores: on small papillae on 18 in ab. Genital markings: presetal, mid-ventral, elliptical discs on 9,10-12 in aa and 19,20-23 wider than aa seen in all three mature syntypes (cf. on 9-11 and 19-22, Spencer); additional markings in 13 and 17 seen in some specimens, plus the ventral markings in 20-23 often laterally bordered by faint paired markings.

INTERNAL ANATOMY

Gizzard: moderately muscular but not large in 5. Oesophagus: slightly dilated in 9-13 with three pairs of extramural calciferous glands attaching to the oesophagus

by short ducts laterally at the posterior of 10-12. Nephridia: avesiculate meroic; small and numerous in equatorial bands; tufted anteriorly to 4 or 5 (Spencer, confirmation). Vascularization: dorsal vessel single; hearts 10-12 connected with well developed supra-oesophageal vessel in 9-13 that also supplies the calciferous glands. Spermathecae: five pairs in 5-9, ampulla saccular, diverticular stalk considerably longer than sac with swollen iridescent bulb. Male organs: holandric iridescent testes and funnels in 10 and 11; seminal vesicles racemose in 9 and 12. Ovaries: large in 13; ovisacs present in 14. Prostates: racemose in 18 or 18-19, folded, lingular in syntype, or bilobed (Spencer, confirmation); penial setae absent but some muscle fibres sometimes overlie gland. Intestine: attains full width in 16 but has slight modification in posterior of 15, perhaps better described as 15/16 (cf. 18 Spencer); typhlosole absent (cf. Jamieson); gut contains organic soil.

Note: Specimen K395 was found to be heavily infested with nematodes in its anterior coelom, specimens of unusual form with narrow waists in their midsections were taken from about segment 5, while more regular nematoid specimens were collected from segment 14. Both sets are placed in phials in the sample jar.

REMARKS

Distinctive characters of *A. tasmanica* are the five pairs of spermathecae, three pairs of extramural calciferous glands, and the distribution of its genital markings. Differences from Spencer (1895) in the current account are the intestinal origin in 15 or 16, rather than 18, and slight variations in the distributions of genital markings.

Although apparently not inspecting type material of either taxon, Jamieson (1974: 326) questioned whether *Anisochaeta tasmanica* was distinct from Spencer's prior Victorian *Perichaeta hoggii* Spencer, 1893. However, these species were known to differ not least in their arrangements of genital markings. Moreover, the lectotype (MOV: F40199) of the latter species from Mt Macedon was found on re-inspection by the current author to have prostates that are tubular, rather than bilobed racemose, amongst other differences. (This species that is perichaetine, meroic with tubular prostates thus qualifies for inclusion in *Celeriella* Gates, 1959 as noted in the Remarks under the generic definition of *Anisochaeta* above). Consequently, Jamieson's speculation, that "it would constitute the only known case of a megscolecid species shared between Tasmania and the mainland", can be discounted.

DISTRIBUTION AND HABITAT

Emu Bay, N Tasmania and King Island in Bass Straits (Spencer, 1895). Spencer's specimens from King Island have not been traced (and perhaps he combined them in the same sample jar), therefore their taxonomic status is uncertain. New material is from Table Cape and Christmas Hills, NW Tasmania, the latter locality details were from "small pocket of myrtle, sassafras and leatherwood rainforest in gully amid wet sclerophyll surrounds on clay".

Anisochaeta vincula sp. nov

Fig. 205.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3658, Detention Hills, NW Tasmania, QVM, collection from "Paddock on forest edge" [no other information], (mature, tail missing, dissected and sketched).

PARATYPES: (P) 14:3659, same details as H, (mature, dissected).

EXTERNAL FEATURES

Body: stylus shaped. Length mm: (H) 56+, (P) 65. Width: ca. 4 mm. Segments: (H) 100+, (P) 185. Colour: pale unpigmented in alcohol; clitellum orange. Prostomium: tapering tanylobous; not ventrally cleft. Clitellum: ½13-17. Dorsal pores: from 4/5. Setae: small dark, ca. 40 in anterior, ca. 30 on 12, and on 20, fewer posteriorly due to reduced ventral setae density. Nephropores: not found. Spermathecal pores: 7/8/9 in ab but closer to a lines. Female pores: widely paired on 14 in furrow. Male pores: on papillae in ab lines on 18. Genital markings: large intersegmental pads with thickly tumid rims as wide as spermathecal pores in 8/9, 9/10, and 10/11; slight modification of 15 and 16 midventrally similar to furrow on 14; large widely paired discs with smaller intervening discs on posterior annulus of 17 in common tumid field with male pores; elongate tumid pads in 19/20, 20/21 and 21/22 united in common tumid field, (H and P same).

INTERNAL ANATOMY

Gizzard: large muscular barrel in 5 preceded by crop. Oesophagus: dilated with internal lamellae in 14 and 15 (possibly forming calciferous glands); valvular in 16. Nephridia: avesiculate meroic, approximately three or five tubules per side, smaller after clitellum and intermittently seen; not tufted anteriorly. Vascularization: dorsal blood vessel single, hearts 10-12; large lateral vessels branch under gut in 13 from ventral vessel. Spermathecae: two pairs in 8 and 9; elongate ampulla on shorter duct with clavate diverticulum ectally. Male organs: holandric, iridescent testis and funnels free in 10 and 11; seminal vesicles small in 9, larger in 12. Ovaries: large sets of egg-strings in 13; small paired ovisacs in 14. Prostates: expanding tubuloracemose or racemose in 18 with short duct; short penial setae present. Intestine: from 17; dilated with smooth thin walls in 17-29 but not muscular, narrower and thicker walled

after 30; typhlosole absent; intestinal gizzards absent; gut contains organic soil, quartz grits and woody matter.

Note: in 19-21 laterally are large muscle fibres incorporated in yellow glandular mass that extend to mid-dorsum, corresponding with large external genital pads in this region.

REMARKS

Anisochaeta vincula is distinguished by its epi-tanylobous prostomium, setae decreasing posteriorly, two pairs of elongate spermathecae, last hearts in 12, lack of calciferous glands, intestinal origin in 17, lack of a typhlosole, and the arrangement of the genital markings near the spermathecal and male fields. It differs from sympatric *A. simposnorum* on several of these points (cf. also *A. cethana*). The large mucles fibres internally in the position of the posterior markings possibly flex during amphimixis.

ETYMOLOGY: vincula, Latin - detention (imprisonment), after the type-locality.

DISTRIBUTION AND HABITAT

Detention Hills, NW Tasmania (Detention Peak is part of the Dip Range between Burnie and Smithton), from paddock on forest edge.

Anisochaeta zeehan sp. nov.

Fig. 206, Fig. 207.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1551, Zeehan, 4 km along Granville Harbour Road, W Tasmania, CP 379 689, 27.vii.1993, D'Orazio and D.E.Soccol, coastal heath, (mature, dissected, and sketched).

PARATYPES: (P1) 14:3037, Pieman River State Reserve, NW Tasmania, CP 403 875, 40 m, 2.vi.1993, R.D. D'Orazio and D.E.Soccol, rainforest, (mature damaged posteriorly, dissected and drawn); (P2) 14:3036, same details as P1, (posterior amputee, dissected); (P3) 14:3038, same details as P1, (aclitellate mature); (P4) 14:1051, Corinna, W Tasmania, Little Hunter Creek, 600m along from Timbs Creek, first area of forest Corinna Road enters into, CP 445 910, 200 m, 2.vi.1993, R.D. D'Orazio and D.E.Soccol, rainforest, (mature dissected and sketched).

SPECIMENS: 14:1549, 14:3039, same sample as H, (posterior amputee plus four matures and one juvenile); 14:1561+1562, Henty River, CP 561 460, 50 m, 28.vii.1993, R.D. D'Orazio and D.E.Soccol, swamp, (thirteen mixed specimens + five matures); 14:603, 14:3041, Pieman River State Reserve, NW Tasmania, CP 403 875, 40 m, 2.vi.1993, R.D. D'Orazio and D.E.Soccol, (six mature specimens that agree externally plus three immature specimens); 14:3049, 14:3050, 14:3051, 14:1052, 14:3723 and 14:3724, Corinna Rd., NW Tasmania, CP 445 910, 200 m, 2.vi.1993, R.D. D'Orazio and D.E.Soccol, (twenty seven specimens that agree superficially, two dissected agree internally).

EXTERNAL FEATURES

Lengths mm: 170 (H), 120+ (P1), 145 (P3), 125 (P4). Width: ca. 3.5 mm. Segments: 140 (H), 164 (P3), 145 (P4). Colour: dusky or darkly pigmented, small dark spots seen near setal arcs of anterior segments; clitellum buff. Prostomium: tanylobous, or epi-tanylobous. Clitellum: ½13-17. Dorsal pores: from 4/5. Setae: small, dark, 36-40 in anterior and posterior (H, P1-3) or 25-32 (P4). Nephropores: not seen. Spermathecal pores: two pairs in 7/8 and 8/9 midventral and closely apposed. Female pores: paired anteriomedian to setae a on 14. Male pores: closely paired on small midventral papillae within depressed male field which fills 18. Genital markings: large circular pads extending to adjacent setal arcs in 11/12 (H, P4), and in 19/20 (in all mature specimens). Most specimens agree externally although some

from Corinna Road have slightly fewer setae (24-36) and one or two have additional markings in 13/14 or 16/17.

INTERNAL ANATOMY

Septa: 7/8/9-11/12/13 slightly thickened, then thinning. Gizzard: in 5 very solid appearing doubled or at least waisted, displaced to occupy two segment lengths but thin septum 5/6 traced, with difficulty, to base of gizzard. Oesophagus: not especially dilated but has some internal rugae. Nephridia: avesiculate meroic, several (two to four) large nephridia per side the median-most not particularly enlarged, not tufted anteriorly. Vascularization: dorsal blood vessel single; hearts in 10-13; supra-oesophageal noted in 8,9-13,14. Spermathecae: two pairs in 8 and 9 (in P2 the spermathecae are slightly irregular occurring in 7lhs and 8 rhs but paired in 9); ampulla attaches to thin duct with small, often bifid, diverticulum near junction. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles paired, racemose small in 9 and larger in 12. Ovaries: small in 13; ovisacs not found. Prostates: in 18 racemose rosettes, almost bipartite with thin duct widening greatly at exit; penial setae not found. Intestine: origin ½18; deep typhlosole developing from ca. 22, lamellar in most specimens but Y-shaped in P2; intestinal caeca and intestinal gizzards absent; gut contains dark organic matter and soil with few quartz grits.

REMARKS

Anisochaeta zeehan is a variation of *A. corinna* with a similarly large gizzard but distinguished by the closely apposed spermathecal and male pores, the slightly lower setal counts of 36-40, anterior genital markings often in 11/12, and possibly the slightly more anterior commencement of intestine and typhlosole. The gizzard almost divided in two is reminiscent of the gizzards developments found in *Hypolimnus pedderensis* and in *Provescus crottyi*. Doubled gizzards in 5-7 is characteristic of mainland genera *Digaster* Perrier, 1872 and *Didymogaster* Fletcher, 1886 and these mainland Australian genera are similarly meroic and have non-tubular prostates but are lumbricine, unlike *A. zeehan*.

ETYMOLOGY: after the type-locality.

DISTRIBUTION AND HABITAT

W Tasmania: Zeehan, Pieman River State Reserve, Granville Harbour Road, Henty River, and Corinna Road, from coastal heath, swamp and rainforest.

Aceeca gen. nov.

Diagnosis: Setae ten per segment, i.e., perichaetine. Dorsal pores absent. Female pores paired on 14. Male pores from tubuloracemose prostates paired on 18. Oesophageal gizzard in 5. Nephridia meroic, three per side, vesiculate with nephropores in alternate setal lines on each side. Spermathecae two pairs with clavate diverticula. Calciferous glands absent, typhlosole present; intestinal caeca and gizzards absent. Penial setae absent.

Type-species *Aceeca dee* gen. et sp. nov., (monotypic).

Distribution Dee Bridge, Central Tasmania.

Etymology for the nephropores alternating in a-c-e setal lines on each side (feminine).

Remarks *Aceeca* is distinguished from *Cryptodrilus* by having more than 8 setae, and from *Anisochaeta* by having nephropores in alternate setal lines at the anterior of segments. Nephridia reduced to a few per side, and with prominent nephropores in setal lines, is more characteristic of some Tasmanian members of *Cryptodrilus* and *Megascolides*, both of which have only 8 setae, and prostates that are tubuloracemose and tubular, respectively. The alternating nephropores are similar to those described by Spencer (1892: 137) in his *Cryptodrilus dubius* from Victoria and in *Cryptodrilus fastigatus* Fletcher, 1889 from NSW (see Blakemore, 2000c) that Beddard (1895) made type-species of his genus *Trinephrus*, a genus with only 8 setae that was subsequently placed in the synonymy of *Cryptodrilus*. The vesiculate meroic condition is sometimes found in some mainland members of *Anisochaeta* (as demonstrated by Blakemore, 2000a). Although this latter genus tends to a greater number of nephridia and of setae, the Victorian *Anisochaeta trichaeta* Blakemore, 2000a (renamed due to junior secondary homonymy for *Trichaeta australis* Spencer 1900) was type of monotypic *Tricheta*, a genus with only 12 setae that was subsequently placed in synonymy (eg. by Michaelsen, 1907a) and is now under *Anisochaeta* (eg. Blakemore, 2000a). However, it is probable that the affinities of *Aceeca* are closer to the some Tasmanian members of *Megascolides* or perhaps *Cryptodrilus*, separated on its apomorphic acquisition of tubuloracemose prostates and perichaetine setae respectively.

Aceeca dee gen. et sp. nov.

Fig. 208.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3606, near Dee Bridge, 12.x.1995, R.J. Blakemore, (mature, dissected and drawn - separated off from numerous other specimens).

PARATYPES: (P1) ANIC:RB.00.1.18, same details as H, (mature, dissected).

EXTERNAL FEATURES

Body slender with first segment reduced. Lengths mm: (H) 110, (P1) 100. Width: ca. 2.5 mm. Segments: (H) 148, (P1) 174. Colour: unpigmented in alcohol, clitellum pink. Prostomium: tanylobous, faintly furrowed. Clitellum: ½13-17. Dorsal pores: not found. Nephropores: anteriorly in segments in a, c and e lines. Setae: 10 in regular rows throughout. Spermathecal pores: 7/8/9 in a lines. Female pores: widely paired on 14. Male pores: small in a lines near 18/19, almost occluded by large discs on 18. Genital markings: paired postsetal on 10 and 11 in ab and a lines, respectively; another pair on 17 in ab lines with faint midventral disc in 17/18; large pair of sucker-like discs on 18 in ab and filling the segment; on 19-22 three postsetal discs within generally tumid areas that reduce in width posteriorly from b-b to a-a lines. Specimen (P1) has triad discs in 16/17 in aa and another triad postsetally in 17, otherwise it agrees with (H).

INTERNAL ANATOMY

Gizzard: substantial, muscular in 5. Oesophagus: vascularized but not dilated in in 9-14, contracted and yellow in 15 forming valve. Nephridia: vesiculate meroic with three nephrida per side, bladders spherical; not tufted anteriorly. Vascularization: dorsal blood vessel single; hearts 10-12 increasingly large and connecting to supra-oesophageal vessel that runs 9-14. Spermathecae: two pairs in 8 and 9; large spherical ampulla on small duct which bears small clavate diverticulum on its mid-length. Male organs: holandric, testis iridescent in 10 and 11; paired, racemose seminal vesicles in 9 and 12. Ovaries: in 13; ovisacs in 14. Prostates: tubuloracemose in 18-19,20; penial setae not found. Intestine: from 16; typhlosole from 18; gut void.

REMARKS

Aceeca dee with its nephridial bladders and obvious nephropores, resembles *Megascolides cataractus*, *M. sanctorum*, and *M. xanthus*, especially the latter two

species that lack dorsal pores. However, *A. dee* is perichaetine with 10 setae per segment, rather than lumbricine, and has prostates that are tubuloracemose, rather than tubular.

ETYMOLOGY after the type-locality.

DISTRIBUTION AND HABITAT

Dee Bridge, Central Tasmania.

Scolecoidea gen. nov.

Diagnosis

Perichaetine, exceptionally setose with up to 100 setae per segment in the anterior, reducing to ca. 60+ on the tail; setae sometimes retained ventrally between male pores. Male pores from short tubuloracemose prostates paired on 18. Dorsal pores present. Large oesophageal gizzard in 5, intestinal gizzards absent. Nephridia avesiculate meroic (with ca. two to six tubules per side having preseptal funnels bunched ventrally and extending laterally), tufted anteriorly. Spermathecae two pairs, spermathecal diverticula small, paired clavate often with several internal chambers. Calciferous glands, typhlosole and intestinal caeca absent. Penial setae absent.

Type-species: *Perichaeta scolecoidea* Spencer, 1895, monotypic.

Distribution: Mainly Western/North-western, Tasmania.

Etymology: named after the type species.

Remarks

Spencer (1895) misinterpreted the bunched meronephridia of *Scolecoidea scolecoidea* as meganephridia although he did note that there were a large number of coiled tubules in the anterior, and he further remarked that is has not the slightest resemblance externally to a typical "perichaete" worm. Having tubuloracemose prostates, numerous setae and meronephridia would qualify a species in *Aceeca* or *Anisochaeta*. Unlike *Aceeca*, *Scolecoidea* is defined with dorsal pores present and nephridial bladders absent. *Scolecoidea scolecoidea* is elevated to generic rank compared to species from *Anisochaeta* on the basis of its numerous and continuous setae that, nevertheless, decrease posteriorly (rather than increase), the bunched meronephridia, its paired often multiloculate spermathecal diverticula, and for its characteristic behaviour, first noted by Spencer. When collected in the field, this species displays excessive contraction to give a stumpy body (often retained on preservation), but if live specimens are placed back on the ground they stretch out to assume a more usual elongate vermiform.

Another Tasmanian genus that is most morphologically similar to *Scolecoidea*, including being highly setose with setae reducing posteriorly, and with multiloculate spermathecae, is *Hickmaniella*. Indeed specimens may easily be confused in the field as they display the same excessive contraction when collected, however, dissection reveals the intestinal gizzard in *Hickmaniella* and the paired diverticula in *Scolecoidea*.

These two genera also have, in *H. gogi* and *H. opisthogaster* at least, overlapping distribution in the north-west.

Scolecoidea scolecoidea (Spencer, 1895) comb. nov.

Fig. 209a, Fig. 209b.

Perichaeta scolecoidea Spencer, 1895: 51-52, Figs. 49-51; Jensz and Smith, 1969: 108.

Diporochaeta scolecoidea ; Michaelsen, 1900: 207; Jamieson, 1994: 175.

Perionychella (subgenus?) scolecoidea ; Jamieson, 1974: 259.

MATERIAL EXAMINED

LECTOTYPE: NMV:G290, labeled "*Perichaeta scolecoidea* King River, Tasmania. Coll. C.G. Officer Jan 1894" and "Peri spX.14 King R.T. C.G. Officer Jan/94", approximately 145°40'E.42°10'S, ca. CP 880 320, (previously dissected entire aclitellate specimen in reasonable condition but refractory and unsuitable for illustration).

PARALECTOTYPES: NMV:G1422, labeled "King River, Tasmania. Coll. C.G. Officer Jan. 1894. Paratypes PRSV1 1895 Removed from G290. Paratype", (two specimens in reasonable condition but rather brittle, one complete and one previously dissected).

SPECIMENS: 14:0072, Pelion Valley, Pelion Gap, DP 217 649, ca. 146°02'E.41°48'S, 31.i.1992, D. Baker, (weakly-clitellate mature 50 mm, dissected); 14:0073, Pelion Valley, Mt Doris (Davis?) track, 31.i.1992, collected by Tasmanian Parks and Wildlife Service trackworkers, (D. Baker?), (weakly clitellate mature 57 mm long, dissected and drawn); ANIC:RB.00.1.3, Walls of Jerusalem, ca. DP 440 700, (31.i.1992?), collector David Baker (Tas.P.W.S.), (two aclitellate matures 55-60 mm); 14:3576, Mt Olympus, Lake St Clair, ca. DP 260 470, 13.x.1995, R.J. Blakemore, (sub-adult 35 mm, dissected, plus two immatures); 14:1435, Queenstown, Nelson River Bridge, CP 954 377, 330 m, 11.viii.1993, R.D. D'Orazio and D.E. Soccol, cool temperate rainforest, (two aclitellate sub-adults, 40 mm, one dissected, and an immature); 14:1852, Maydeena, 3.2km along Mueller Road to creek, just south of Mt Field National Park, SE Tasmania, 520 m, DN 625 610, , 12.x.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (mature, 45 mm., dissected and sketched).

EXTERNAL FEATURES

Body: described by Spencer as "a minute annulated sausage" and with "a short stumpy nature"; in life and when undisturbed the worm has normal earthworm shape but body contracts when handled and on preservation to resemble a jellybean (pers.

obs.). Colour: unpigmented, yellow in alcohol; clitellum, when developed, beige. Lengths mm: 28 (Spencer), 30-70 (new material). Width: ca. 6 mm (Spencer), range 5-8 mm. Segments: 77 (Spencer), 72-80 (new material). Prostomium: closed epilobous or weakly tanylobous, furrowed dorsally. Clitellum: when present weakly marked in ½13,14-17,½18 (tumid in ½13-18 in Mueller Rd. specimen). Dorsal pores: from 3/4. Setae: minute and numerous, ca. 90-100 per segment in anterior reducing to 60-80 posteriorly, forming continuous ring with only indistinct dorsal and ventral gaps. Nephropores: not usually visible (in Queenstown specimens, possibly near mid-dorsum in anterior, in Mueller Rd. specimen possibly appear as irregular intersegmental pores, especially noticeable on clitellum). Spermathecal pores: in 7/8 and 8/9 in line with setae c or d. Female pores: on 14 just in front of b setae, sometimes preceded by faint pale patch. Male pores: on minute papillae on 18 in c-e lines within slightly tumid pad that extends to f or g lines; intervening setae occluded (lectotype), or some retained between the male pores (as Spencer, fig. 49). Genital markings: (seen in lectotype, paralectotypes and some mature specimens) elongate pads extending between setae e-f setal lines in 19/20 (as illustrated by Spencer, 1895: fig. 49), repeated in 20/21 (in the Mueller Rd. specimen); more often markings not developed, (markings in the type material in 13/14/15 claimed by Jamieson, 1974 were not found).

INTERNAL ANATOMY

Septa: in anterior displaced by gizzard, 9/10-12/13 slightly thickened, from 15/16 on membranous. Gizzard: large, muscular with anterior flange in 5, preceded by large proventriculus, displaced to occupy segments 6-8. Oesophagus: dilated 9-15, not calciferous; narrow, valvular in 16-½17. Nephridia: avesiculate meroic, tufted in segments 2-3 thereafter consisting of discrete flattened tubules that extend laterally on each side and give the spurious appearance of holonephridia; from two or three up to five sets of tubules are detectable on each side, only the lateral-most is appreciably larger its duct projecting laterally entering body wall towards mid-dorsum (nephridia lie just anterior to - but are not connected with - equatorial duct formed by a looped over mesentary attached to the body wall that extends from mid-ventrum to mid-dorsum on each side); nephridia have small pre-septal funnels close to each other on either side of ventral nerve cord (this arrangement easier to determine after clitellum where there are fewer tendons and blood vessels ventrally). Vascularization: dorsal

blood vessel single; large hearts in 10-12; supra-oesophageal vessel in 8,9-12,13. Spermathecae: two pairs in 8 and 9; saccular, sometimes elongate ampulla with small opposed diverticula at base of ampulla and in front of short duct; diverticula either simple uniloculate or multi-loculate - at greatest development forming chain of four or more iridescent chambers across dorsal aspect of ampulla. Male organs: holandric, testes and iridescent funnels in 10 and 11 (only funnels seen in dissected lectotype); seminal vesicles racemose in 12 (Spencer) or on anterior septa in 11 and 12 (all other dissected material). Ovaries: small in 13; ovisacs absent. Prostates: small, flattened and tubuloracemose confined to 18; penial setae not found. Intestine: spiraling from 18 (Spencer) or ½17 (other dissected material); typhlosole and intestinal gizzards absent; gut contains fine soil and colloidal material.

REMARKS

Differences from Spencer (1895) are intestinal origin in ½17 rather than 18,and seminal vesicles in 11 as well as in 12, and, of particular importance, avesiculate meronephridia. Spencer stated that this species was "meganephric" (i.e., holoic) but the actual meronephridia, although apparently not connected, are flattened and lie alongside each other and give the spurious appearance of holonephridia. Jamieson (1994:175) placed this species in *Diporocheata*, an holoic genus that actually has tubular prostates, but admitted that "*D. scolecoidea* ..differs significantly in being strongly perichaetine and in having racemose prostates".

DISTRIBUTION AND HABITAT

Spencer (1895: 33, 52) stated that Mr Officer collected the specimens under logs along the King River Valley "amongst the western mountain ranges" and had reported that it was very abundant. The range now includes Pelion Valley, Lake St Clair, Walls of Jerusalem and Queenstown in Central, NW and W Tasmania; plus a single specimen from Maydeena, just south of Mt Field National Park in SW Tasmania.

Hickmaniella Jamieson, 1974

Hickmaniella Jamieson, 1974: 300; Blakemore, 1997a: 1684-1685.

Diagnosis

Perichaetine, i.e., setae numerous per segment. Male pores from tubuloracemose prostates paired on 18. An oesophageal gizzard in 5 and an intestinal gizzard in ½18,19-20. Nephridia meroic (with ca. two to six tubules per side), avesiculate, not tufted anteriorly. Spermathecae one or two pairs, spermathecal diverticula clavate but with several internal chambers (eg. *H. gogi*) or multiloculate but not sessile; in one unique species the spermathcae have dual pores (*H. classica* sp. nov.). Calciferous glands, typhlosole and intestinal caeca absent. Penial setae present. Note: under the recommendations of ICZN (1999: 35) a genus-group name ending in -*ella*, is to be treated as feminine.

Type-species: *Hickmaniella opisthogaster* Jamieson, 1974.

Other included species

Hickmaniella classica sp. nov.

Hickmaniella faba sp. nov.

Hickmaniella gogi Blakemore, 1997a: 1690-1692, fig. 1.

Hickmaniella noda sp. nov.

Distribution: North, north-western Tasmania.

Remarks

The generic definition was amended by Blakemore (1997a) to note that the intestinal gizzard is in 19 and 20 (cf. 19 or 20, Jamieson) and to accommodate a new species having only one pair of spermathecae. The definition if further amended here to note clavate diverticula (eg. in *H. gogi* holotype), intestinal gizzard sometimes in ½18-20 (eg. in *H. noda* paratypes), and double entry to spermathecal pores (in *H. classica*). Intestinal gizzards, or opisthogastry, previously thought rare in the Megascolecidae, appears with some frequency in Tasmania. The genus *Hickmaniella* is perichaetine with tubuloracemose prostates, and a single intestinal gizzard in 18-20, whereas *Retrovescus* Blakemore, 1998 has multiple intestinal gizzards in 20-26; *Nexogaster* Blakemore, 1997 differs by being lumbricine, with racemose prostates, multiple intestinal gizzards in 22-27, and a typhlosole is present; cf. *Gastrodrilus* and *Anisogaster* gen. novae.

A possible precursors to *Hickmaniella* is *Scolecoidea* gen. nov. the two genera resemble each other morphologically except for the reduced oesophageal gizzard and acquisition of an intestinal gizzard in *Hickmaniella*, which perhaps is analogous to the especially large muscular oesophageal gizzard in *Scolecoidea*. The intestine in both genera often spirals, possibly to allow for extension.

Hickmaniella classica sp. nov.

Fig. 210.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:1297, Mawbanna, Alarm River, 3.8kms along Newhaven Rd until river ran along road, NW Tasmania, CQ 706 632, 90 m, 20.iv.1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (mature, dissected).

PARATYPE: (P) ANIC:RB.00.1.1, same details as H, (mature, dissected).

EXTERNAL FEATURES

Body stout, first segment reduced. Lengths mm: (H) 55, (P) 64. Width: ca. 4.5 mm. Segments: (H, P) 84. Colour: unpigmented; clitellum buff. Prostomium: tanylobous. Clitellum: 13,½13-½17,17. Dorsal pores: small in 3/4, open from 4/5. Nephropores: not found. Setae: ca. 42-44 on 12, ca. 40 posteriorly. Spermathecal pores: double entry, in 7/8/9 and anteriorly in 8 and 9 in ab lines but closer to a lines. Female pores: paired on 14 anterio-median to a setae. Male pores: paired on 18 on prominent mounds centred in ab; two sets of penial setal pores on either side. Genital markings: large tumid pads in 10/11, (weak in 15/16 in P), 16/17, 19/20 (in H only), and in 20/21.

INTERNAL ANATOMY

Septa: 9/10-11/12 slightly thickened forming pericardic testis sacs. Gizzards: small, weakly muscular oesophageal gizzard in 5; intestinal gizzard large and muscular in 19-20. Oesophagus: not especially dilated, narrow in 16-17. Nephridia: avesiculate meroic, two to four sets of tubules per side equatorially connected by mesentery; funnels not found. Vascularization: dorsal blood vessel single; hearts 10-12 with connectives to supra-oesophageal vessel in 9-12. Spermathecae: two pairs in 8 and 9; saccular ampulla on longer duct that bends and forms bulb before entering body wall, multiloculate, iridescent, diverticulum attaches by ductlet above bend in main duct and has separate duct to external intersegmental pore. Male organs: holandric, testes and funnels iridescent in testis sacs formed from septa in 10 and 11; seminal vesicles as vestigial sacs in 9 and 12 (slightly more developed in 12 in P). Ovaries: long, palmate in 13; no ovisacs in 14. Prostates: tubuloracemose with short, flaccid duct in 18; penial setae ca. 1.5-2 mm long present on either side of duct in sheaves attached by muscle fibres to body wall dorsally. Intestine: from 18, dilated in

18 and 21 on either side of gizzard in 19-20, intestine spirals from 22; typhlosole absent; gut contains organic soil.

REMARKS

A unique character, not known elsewhere in the Oligochaeta, is the separate openings of the spermathecae - one for the diverticulum and one for the duct. The function of this more complex arrangement is not apparent, although it is noted that the penial setae occur on either side of the prostatic duct corresponding to the positions of the dual spermathecal pores. It is perhaps also relevant that the seminal vesicles, usually functioning for storage of mature sperm, were reduced. Unfortunately, I was unable to trace the vasa deferentia from the testis, and failed to check for nematodes in the spermathecal ampullae.

I refrain from establishing a new genus on this single character as, in other respects, *Hickmaniella classica* complies with the generic definition, being separated at the specific level by the distribution of its genital markings and other features.

ETYMOLOGY: classicum, Latin – 'battle-alarm', after the Alarm River locality.

DISTRIBUTION AND HABITAT

Alarm River, NW Tasmania,wet sclerophyll.

Hickmaniella faba sp. nov.

Fig. 211.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3729, Christmas Hills, Smithton, NW Tasmania, CQ 309 667, 60 m, 6.xii. 1990, R. Mesibov, (mature, dissected, figured).

PARATYPES: (P1) ANIC:RB.98.1.6, same details as H, (mature, dissected); (P2) TM:K1563, same details as H, (mature, dissected); (P3) 14:3730, same details as H, (mature, dissected); (P4) ANIC:RB.98.1.7, same details as H, (mature, dissected).

SPECIMENS: 14:2873, original sample with same details as H, (ten matures and three immatures, possibly belonging to this taxon or some other *Hickmaniella* species as have similar body shape but none inspected in any detail, one dissected had nematodes in its spermathecae).

EXTERNAL FEATURES

Body short and squat, shaped like a jelly-bean, first segment not reduced. Lengths mm: (H, P3) 45, (P1) 42, (P2) 42, (P4) 38. Width: ca. 5 mm. Segments: (H) 69, (P1) 89, (P2) 83. Colour: unpigmented; clitellum buff. Prostomium: open epilobous. Clitellum: ½13-16,½17. Dorsal pores: small in 2/3, open from 3/4. Nephropores: not found. Setae: ca. 60 on 12, ca. 40-44 posteriorly. Spermathecal pores: in 7/8/9 in ab lines. Female pores: paired on 14 anterior to a setae. Male pores: paired on 18 on prominent mid-ventral mounds within sunken field; tips of large penial setae protrude. Genital markings: large tumid pads in 10/11 and 20/21.

INTERNAL ANATOMY

Septa: 5/6-12/13 thickening. Gizzards: large, compressible oesophageal gizzard in 5; intestinal gizzard large and muscular in 19-20. Oesophagus: narrow in 12-17. Nephridia: avesiculate meroic, four or five sets of tubules per side equatorially; funnels not found. Vascularization: dorsal blood vessel single onto pharyngeal mass in 3,4; hearts 10-13 with connectives to well developed supra-oesophageal vessel in 11-14. Spermathecae: two pairs in 8 and 9; saccular ampulla on long bulbus duct with clavate, multilocular diverticulum, ectal and embedded in body wall; in P1 the duct has blind ductlet from duct to body wall. Male organs: metandric, testes and funnels iridescent in 11 only; seminal vesicles large, racemose in 12 only. Ovaries: small in 13; no ovisacs in 14. Prostates: tubuloracemose, folded once in 18 with weak duct; penial setae stout and straight, ca. 1-1.5 mm long. Intestine: from

½18, dilated in 18 and 21 on either side of gizzard in 19-20, intestine spirals from 22; typhlosole absent; gut contains organic soil and quartz grits.

Note: small nematodes were found in the spermathecal ampullae.

REMARKS

Distinctive characters of *Hickmaniella faba* are the large genital pads in 10/11 and 20/21, last hearts in 13, and metandry. The secondary duct seen with some spermathecae are perhaps precursory to the dual openings of *H .classica*, which it closely resembles.

ETYMOLOGY: faba, Latin – bean, for the appearance of the contracted worm.

DISTRIBUTION AND HABITAT

Christmas Hills, NW Tasmania.

Hickmaniella gogi Blakemore, 1997

Fig. 212.

Hickmaniella gogi Blakemore, 1997a: 1690-1692, fig. 1.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3328, Gog Range, N. Tasmania, DQ 534 056, ca. 41 29'S.146°27'E, 27.viii.1991, QVM, other collection details not available, (mature, dissected and figured).

PARATYPES: (P1) ANIC:RB.96.11.1, same details as H, (mature, dissected); (P2) ANIC:RB.96.11.2, same details as H, (immature); (P3) 14:3319, same details as H, (immature, dissected); (P4) TM:K1523, Lake Rowallan, 6.2km along Little Fisher River Road until bridge, NW Tasmania, DP 419 824, ca. 41°42'S.146°18'E, 650 m, 6.x.1992, R.D. D'Orazio and M. Cooper, rainforest along river banks, (mature, dissected and figured); (P5-9) 14:0416, details same as P4, (five matures, one aclitellate); (P10-14) 14:0417, Lake Rowallan, 1.7km along Dublin Road from Little Fisher River Road junction, DP 381 825, ca. 41°42'S.146°15'E, 590 m, 6.x.1992, R.D. D'Orazio and M. Cooper, rainforest along creek, (five specimens - two clitellate, one aclitellate, two immature); (P15) 14:3532, Pelion Valley, Pelion Gap, NW Tasmania, 41°52'S 146°03'E, 31.i.1992, D. Baker, (mature, dissected); (P16-18) ANIC:RB.96.11.3, Mole Creek, 1.6km along Snake Creek Road going left, NW Tasmania, DP 391 895, ca. 41 37'S 146°16'E, 590 m, .x.1992, R.D. D'Orazio and M. Cooper, rainforest, (one mature and two sub-adults, one dissected); (P19-21) 14:0970, same details P16-18, (one mature and two sub-adults); (P22-23) TM:K1524-1525, Gowrie Park, O'Neils Road just over bridge at Gowrie Park, NW Tasmania, 41°26'S 146°14'E, , 23..xi.1992, R.D. D'Orazio and M. Gittus, wet sclerophyll, (one mature and one sub-adult, dissected); (P24-25) 14:0679, same details P22-23 (two sub-adults).

EXTERNAL FEATURES

Body stout hardly tapering to tail, first segment compressed. Length mm: (H) 75, (P1) 70, (P4) 60. Width: ca 7 mm. Segments: (H) 98, (P1) 97, (P2) 91, (P3) 70, (P4) 103. Colour: unpigmented in alcohol, clitellum buff. Prostomium: tapering epilobous, faintly furrowed dorsally. Clitellum: weak in ½13,14-17 (H, P1) or tumid in ½13,14-17,½18 (most other matures). Dorsal pores: rudimentary in 2/3, open from 3/4. Nephropores: not found. Setae: numerous, 40-48 per segment, ventral couples ab in regular rows other rows sinuous; dorsal setal gap ca ½aa. Spermathecal pores:

paired in 8/9 in a or ab lines within tumid area. Female pores: widely paired on 14. Male pores: paired near a lines on 18 on flat, irregular pads with two or three penial setae protruding. Genital markings: median troughs in bb in 10/11 (P10-12) or 13/14 and/or 16/17 (P1, P4-P9, P16-22); two pairs of ill-defined hollow disks joined by median troughs in 17/18 and 18/19 wider apart than the male pores (H, P1 and all other matures); elongate, depressed pads in bb in 19/20 same width as male pores (H, P1 and all matures except P10-15, P22).

INTERNAL ANATOMY

Septa: 7/8-12/13 thickened, 9/10/11/12 peripherally adpressed in H (as pericardiac testis-sacs). Gizzards: muscular but compressible oesophageal gizzard in 5; large muscular intestinal gizzard in 19-20 and perhaps part of 21 also modified; externally with lateral bands of muscle fibres, internally with longitudinal striations, wall ca 0.5 mm thick (thicker than that of oesophageal gizzard). Oesophagus: not especially dilated. Nephridia: avesiculate meroic, five or six tubules per side equatorially connected by mesentery; larger anteriorly but not tufted; funnels not found. Vascularization: dorsal blood vessel single; hearts 10-12 with connectives to supra-oesophageal vessel in 7-14. Spermathecae: one pair in 9; ampulla saccular (smooth in H, P1; irregular in outline in some other matures) on thick duct bearing small clavate diverticulum with numerous iridescent chambers internally (H) or short-stalked multilocuate diverticula (eg. P4). Male organs: holandric, iridescent testes in mucus in 10 and 11; small racemose seminal vesicles in 9 and 12. Ovaries: compact in 13. Prostates: tubuloracemose in 18, gland folded over itself; overlain by straight penial setal, ca. 2-2.3 mm long in sheaves with tendons that attach to gland. Intestine: from 18, dilated and thin-walled on either side of gizzard in 18 and in 21, spiraling from 22; typhlosole absent; gut contains soil with numerous quartz grits and sand.

REMARKS

Specific differences that separate *Hickmaniella gogi* from other members of the genus one rather than two pairs of spermathecae, the position of first dorsal pores, and the form and arrangement of the genital markings.

DISTRIBUTION AND HABITAT

Gog Range, Lake Rowallan, Pelion Gap, Mt. Roland and Mole Creek in N/NW Tasmania, in rainforest and wet sclerophyll often along creeks.

Hickmaniella noda sp. nov.

Fig. 213.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:2303, Christmas Hills, Smithton, NW Tasmania, CQ 341 702, 20 m, 7.xii. 1990, R. Mesibov, "Swamp forest. Myrtle, Sassafras, Blackwood, Tea tree", (mature, dissected, figured).

PARATYPES: (P1) ANIC:RB.00.1.2, Frankland River track, CQ 251 313 - CQ 250 302, 110-220 m, , 18.xii.1990, R. Mesibov, from "Gallery forest alluvium through wet sclerophyll peaty sand" (mature, dissected); (P2-4) 14:3592, Roger River west, Montagu Swamp, CQ 287 547, 30 m, 29.xii.1990, R. Mesibov, "sclerophyll/T-tree swamp", (two subadults with weak markings, both dissected, plus an immature).

EXTERNAL FEATURES

Body stumpy, first segment reduced. Lengths mm: (H) 50, (P1) 43, (P2-3) 33. Width: up to 8 mm. Segments: (H, P1) 74. Colour: unpigmented, clitellum buff. Prostomium: small open epilobous. Clitellum: 13-17. Dorsal pores: from 3/4. Nephropores: not found. Setae: ca. 60 on 12, ca. 46 posteriorly; ventral gap wider than dorsal gap. Spermathecal pores: in 7/8/9 near ab lines. Female pores: paired on 14 anterior to a setae. Male pores: paired on 18 on prominent mounds approximately in ab. Genital markings: faint paired markings in 9/10 in ca. b-e; pale wide raised patch ventrally in 16/17; widely paired discs in 18/19, and weaker in 19/20.

INTERNAL ANATOMY

Ventral nerve cord large. Septa: 7/8-11/12 thickening. Gizzards: compact muscular oesophageal gizzard in 5; intestinal gizzard large and muscular in 19-20 (or ½18-20 in P1-3). Oesophagus: dilated in 7-9, narrow in 14-½17. Nephridia: avesiculate meroic, tufted in 2-4; three or four sets of tubules per side equatorially connected by mesentery; funnels not found. Vascularization: dorsal blood vessel single; hearts 10-13 with connectives to well developed supra-oesophageal vessel in 9-½14. Spermathecae: two pairs in 8 and 9; saccular ampulla on long duct, twisted and bulbus in middle where short-stalked multiloculate diverticulum attaches. Male organs: holandric, testes and funnels iridescent in 10 and 11; seminal vesicles in 9 (saccular) and 12 (lingular). Ovaries: compact in 13; no ovisacs in 14. Prostates: tubuloracemose, folded once in 18; penial setae ca. 5 mm long in sheaves attaching near mid-dorsum. Intestine: from ½17, dilated in ½17-18 and 21 on either side of

gizzard in 19-20, intestine spirals from 22; typhlosole not found; gut contains rich organic matter and silt.

ETYMOLOGY: nodus, Latin - knob or girdle, for the stumpy body and pronounced clitellum.

REMARKS

Hickmaniella noda differs from *H. faba* and *H. opisthogaster* on its genital markings in 16/17 and 18/19; intestinal origin in ½17; on the shape of its spermathecae, and the long penial setae.

DISTRIBUTION AND HABITAT

Christmas Hills, Frankland River, and Montagu Swamp, NW Tasmania, from swamp forests or gallery forest on peaty sand.

Hickmaniella opisthogaster Jamieson, 1974

Fig. 214.

Hickmaniella opisthogaster Jamieson, 1974: 301-302, figs. 18A (p. 270), 32C, D (p. 325), Pl. 64-66; Blakemore, 1997a: 1693-1695, fig. 2 (p. 1694).

MATERIAL EXAMINED

HOLOTYPE: (H) TM:K360, Parrawe, 41°18'S.145°35'E, 25.viii.1954, J.L. Hickman, (mature, previously dissected, re-inspected).

PARATYPES: (P1) BM:1973.2.34, same details as H (mature, dissected, inspected); (P2) TM:K361, same details as H, (immature, previously undissected, here dissected to confirm intestinal gizzard); (P3-4) AM: W5322-5323, Table Cape, 40°57'S 145°43'E, 24.viii.1954, J.L. Hickman (not inspected here).

SPECIMENS: 14:1619, Stephens Rivulet, Balfour Track Forest Reserve, NW Tasmania, CQ 279 439, 50 m, 18.v..1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (mature, dissected and sketched, sample also contains an immature); 14:1616, Bond Tier South, Dismal Swamp, NW Tasmania, CQ 193 626. 60 m, 19.v.1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (five specimens, one immature); ANIC:RB.96.11.4, same details, (six matures, one dissected); 14:1260, Tram Road Picnic Area, Calder, NW Tasmania, 41°02'S.145°41'E, 19.iv.1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (seven specimens); 14:1080, Hellyer Gorge Reserve, NW Tasmania, 41°17'S 145°37'E, 31.v.1993, R.D. D'Orazio and D.E. Soccol, (one mature and one immature); 14:1074; Belmont Road, Waratah, NW Tasmania, 41°23'S 145°32'E, 31.v.1993, R.D. D'Orazio and D.E. Soccol, rainforest, (three matures); 14:562, West Calder Road, Calder, NW Tasmania, 41°05'S 145°37'E, 19th April 1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (one specimen); 14:1613, Trowutta Caves State Reserve, Smithton, NW Tasmania, 41°04'S 145°06'E, 17.v.1993, R.D. D'Orazio and D.E. Soccol, cool temperate rainforest, (one mature, dissected); 14:3277, Walking Track off Bass Highway, near Dismal Swamp, 40°57'S 144 49'E, 24.vi.1993, J.C. Buckerfield and R.J. Blakemore, (two matures); ANIC:RB.96.11.5, same details (two matures, one dissected); QVM:14:3554, Fern Glade Reserve, Burnie, NW Tasmania, 41°05'S 145 55'E, 3.xii,1996, R.J. Blakemore, from banks of Emu River, (three matures, one dissected).

EXTERNAL FEATURES

Body short and robust, first segment compressed. Lengths mm: 45-70. Width: ca 5-5.5 mm. Segments: 80-90. Colour: unpigmented, clitellum buff. Prostomium: epilobous, or weakly furrowed to appear tanylobous (H). Clitellum: ½13-½17 (often appears saddle-shaped when markings impinge). Dorsal pores: from 4/5 (rudimentary in 3/4 in some specimens). Nephropores: not found. Setae: 40-50 per segment; ventral gap wide, dorsal gap less so. Spermathecal pores: in 7/8/9 in a or ab lines. Female pores: paired on 14. Male pores: paired on 18 on prominent mounds, just wider than setal gap. Genital markings: large, paired (or analogue) glandular mounds in 11/12 and, variously, in 10/11, 14/15-16/17 and 19/20-22/23, slightly wider than male and spermathecal pores.

INTERNAL ANATOMY

Ventral nerve cord large. Septa: 6/7-12/13 thickening. Gizzards: large spherical but weakly muscular oesophageal gizzard in 5; intestinal gizzard large and muscular in 19-20. Oesophagus: not especially dilated. Nephridia: avesiculate meroic, three or four per side equatorially as small, convoluted masses; not tufted anteriorly; funnels not found. Vascularization: hearts 10-12; supra-oesophageal vessel moderately developed in 7-13, large in 14-17. Spermathecae: two pairs in 8 and 9 (9rhs removed from H and missing from jar); saccular ampulla on short duct, diverticulum clavate with numerous internal chambers (sometimes rosette-like but not sessile). Male organs: holandric, testes and funnels in 10 and 11 iridescent and invested in mucus; racemose seminal vesicles in 9 and 12. Ovaries: in 13. Prostates: tubuloracemose, folded once in 18; penial setae present, ca. 1.6-2.2 mm long. Intestine: from 18, dilated and thin-walled in 18 and 21,22 on either side of gizzard in 19-20, intestine spirals from 22; typhlosole absent; gut contains soil.

REMARKS

This account confirms and considerably augments the type description. Morphological features recorded by the current author are the compressed first segment, epilobous prostomium, lack of pigmentation, lesser extent of the clitellum, variations in the distribution of genital markings, the large ventral nerve cord and the intestinal gizzard in 19 and 20 (rather than 19 or 20 according to Jamieson, 1974) with intestinal dilations on either side in 18 and 21. The distributional range is also expanded although, in view of the new species subsequently discovered by the author, only the dissected specimens are positively confirmed for this taxon.

DISTRIBUTION AND HABITAT

North-western Tasmania from a north-south line from Burnie-Waratah, westwards to Balfour and Marrawah, including Parrawe, Hellyer Gorge, Wynyard, Smithton. Found mainly in wet sclerophyll and rainforest soils.

Retrovescus Blakemore, 1998

Retrovescus Blakemore, 1998: 655.

Diagnosis Setae perichaetine, 22-36 per segment. Dorsal pores present. Combined male pores and pores of tubuloracemose prostates paired on 18. Oesophageal gizzard weak in 5 and moniliform intestinal gizzards in 20-24,25,26 (i.e., over 5-7 segments) often with some muscular modification of 19 also. Holandric. Extramural calciferous glands absent. Nephridia avesiculate meroic, two sets of tubules per side in some segments (sometimes one or three per side), not tufted anteriorly. Last hearts in 12. Spermathecae two pairs in 8 and 9, spermathecal diverticulum clavate, often longer than ampulla. Intestinal origin 17, typhlosole absent, intestinal caeca absent. Long penial setae present.

Type-species: *Retrovescus plomleyi* Blakemore, 1998

Other included species:

Retrovescus capensis (Jamieson, 1974)

Retrovescus mesibovi Blakemore ,1998

Retrovescus simplex Blakemore, 1998

Distribution: North-west Tasmania.

Remarks

Retrovescus is distinguished from other described megascolecid genera by the combination of these apomorphic characters: perichaetine setae, tubuloracemose prostates, meroic nephridia (but with at most only 2 or rarely 3 sets of tubules per side in some segments) and by opisthogastry (in this case, multiple intestinal gizzards in the region of 20-25). Other distinctive features are uniloculate, often elongate, spermathecal diverticula, slender penial setae and lack of a typhlosole (cf. *Anisogaster*). It is the acquisition of intestinal gizzards that clearly separates *Retrovescus* from the prior Australian genus *Anisochaeta* Beddard, 1890 (as newly restored by Blakemore, 1997a; 1997b, 2000a). Opisthogastric genera that are also restricted in their distributions within Tasmania are: *Hickmaniella* Jamieson, 1974 (that, after Blakemore, 1997a, has only a single intestinal gizzard in 18,19-20), *Tassiedrilus* that is holoic, *Nexogaster* Blakemore 1997a and *Gastrodrilus* Blakemore, 2000c that are lumbricine, and *Anisogaster* that has moniliform intestinal gizzards in the region of 22-27, but differs by having anisochaetine setae plus a well-developed intestinal typhlosole.

Retrovescus capensis (Jamieson, 1974)

Fig. 215.

Perionychella (Perionychella) capensis Jamieson, 1974: 225-226, figs. 1, 5A, 16A,B.

Diporochaeta capensis ; Jamieson, 1994: 175-177.

Retrovescus capensis; Blakemore, 1998: 658-660, fig. 2.

MATERIAL EXAMINED

HOLOTYPE: (H) TM: K259, Table Cape, north-west Tasmania, CQ 740 770, 40°57'S.145°44'E., 24.viii.1954, J.L. Hickman, (previously dissected, redrawn).

PARATYPE: (P) BM: 1972:8:3, same details as H, (posterior amputee, previously dissected).

OTHER MATERIAL: none found (despite current author's resurvey of type-locality and inspection of much other material collected from the region).

EXTERNAL FEATURES

Length mm: 48 (H). Width: 2.5 mm. Segments: 109 (H). Colour: uniform buff in alcohol, clitellum slightly darker. Prostomium: open epilobous. Clitellum: ½13-¾17. Dorsal pores: from 5/6 (or possibly in 4/5 in H but damaged by previous dissection). Nephropores: not found (cf. Jamieson). Setae: 22-24 on 12 and ca. 30-32 posteriorly, a and b darkened and slightly enlarged; penial setae protrude from male pores (on rhs). Spermathecal pores: 7/8 and 8/9 in b-c (H) or c (P) lines. Female pores: paired anterio-median to a setae. Male pores: in b lines on low ridges. Genital markings: paired, pore-like markings within tumid mounds in 17/18 and 19/20 (or lhs only in P), centred in mid-ab and setal a lines, respectively.

INTERNAL ANATOMY

Gizzards: weak in 5, preceded in 4 by large crop; intestinal gizzards in region of 20-25 (H and P, pers. obs.). Oesophagus: dilated in 6-15, especially 14 and 15 where internal lamellae suggest calciferous glands. Nephridia: avesiculate meroic, two sets of simple tubules per side that overlie one another seen in mid-body (difficult to discern in anterior), ducts exit in ca. d and h-k lines on each side; one or two (or sometimes three) preseptal funnels detectable per side; anterior tufting not found. Vascularisation: dorsal blood vessel single; hearts 10-12, supra-oesophageal vessel 8-13. Spermathecae: two pairs in 8 and 9 (in H lhs 9 removed and missing from jar), saccular ampulla tapers to pore, the diverticular stalk longer than ampulla with iridescent bulb. Male organs: holandric, testes and iridescent funnels in mucus in 10

and 11; racemose seminal vesicles large in 9 and 12. Ovaries: large in 13; ovisacs absent (H) or small in 14 (P). Prostates: tongue-shaped tubuloracemose confined to 18 (in H rhs gland detached on gut), duct very short and flaccid; long penial setae present. Intestine: oesophageal valve in 16, origin in 17; moniliform intestinal gizzards with thick, smooth walls and obvious silvery sheen in 20-25 (H) or 20-24 (P); some muscular modification of 19 and 26 (H) or 25 (P) also; after 26 low dorsal ridge insufficiently developed to be considered typhlosole-like; gut contains mucus and organic debris.

REMARKS

Major differences from Jamieson's (1974) account of the same material are the intestinal origin in 17 (rather than ½16), presence of intestinal gizzards, nephridia that are meroic rather than holoic and absence of a true typhlosole. Jamieson (1974: Fig 5A cf. p. 225) is inconsistent in his figured and described position of the spermathecal pores and appears to have confused the dome-shaped genital markings in 17/18 for male porophores.

Jamieson (1974: 226, 228) considered his *Perionychella (P.) hickmani* to be "morphologically the closest species to *P. (P.) capensis*" (despite it having five pairs of short-stalked spermathecae), and he further remarked that it "is also unique in the genus in Tasmania in possessing a typhlosole-like dorsal thickening of the intestinal wall" (which, nevertheless, he also reported from his *P.(P.) weldboroughi* Jamieson, 1974:231), "and in the location of the first dorsal pore in 5/6" (also found in *P. (?) ellisii* (Spencer, 1895)). These remarks are equally redundant following the redescription above. Jamieson (1974: 258) later entertained the possibility that *R. capensis* was a junior synonym of *Diporochaeta moroea* (Spencer, 1895). Contrary to Jamieson (1974: 258) where he states "The single type-specimen (NMV: G292) is in a very refractory condition and yields no useful information" this specimen of *Diporochaeta moroea* lodged in the Museum of Victoria is entirely adequate and does yield useful information (pers. obs.). Even allowing for discrepancies in Jamieson's account, *Retrovescus capensis* has several unique characters (apart from its intestinal gizzards and meronephry) that separate it from *D. moroea* including genital markings in 17/18, non-tubular prostates, long penial setae and particularly long spermathecal diverticula.

Jamieson (1994) included *R. capensis* (as *Diporochaeta capensis*) in a cladistic analysis of various, otherwise holoic, megascolecids; the mutually relational results and conclusions are necessarily invalidated by the current redescription of this species.

DISTRIBUTION AND HABITAT

Known only from Table Cape, NW Tasmania.

Retrovescus mesibovi Blakemore, 1998

Fig. 216.

Retrovescus mesibovi Blakemore, 1998: 660-662, fig. 3.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3591, Christmas Hills, north-west Tasmania, CQ 309 667, 40°55'S.144°59'E., 60 m, 6.xii.1990, R. Mesibov, (mature, dissected and drawn).

PARATYPES: none.

EXTERNAL FEATURES

Length mm: 60. Width: 2.0 mm. Segments: 155. Colour: unpigmented, clitellum yellow. Prostomium: open epilobous. Clitellum: ½13-½17. Dorsal pores: from 5/6. Nephropores: not found. Setae: small and dark, 24 on 12, ca. 28-32 posteriorly. Spermathecal pores: 7/8 and 8/9 just lateral of a lines. Female pores: paired anterio-median to setae a. Male pores: near a lines on low porophores. Genital markings: small circular discs within larger tumid pads, on lhs in 9 and paired in 10 just anterior to and lateral of b lines; single, presetal and mid-ventral in 17; paired in ab lines in 19/20-21/22 (rhs analogue in 20/21 slightly offset).

INTERNAL ANATOMY

Gizzards: compact, weak in 5 (pharynx narrow in 4); intestinal gizzards in 20-26. Oesophagus: dilated in 13-15 (14 and 15 surrounded by mucus). Nephridia: avesiculate meroic, two sets of simple tubules with preseptal funnels per side seen in 7, on 22rhs, 42rhs and at least two other more posterior segments; difficult to discern in anterior due to tendons, mucus and vascularisation but only one nephridium per side found in 8 and 13 and several other segments examined; ducts exit in ca. f-g lines or further dorsally; anterior tufting not found. Vascularisation: dorsal blood vessel single; hearts 10-12 from supra-oesophageal vessel in 7-13. Spermathecae: two pairs in 8 and 9, saccular ampulla tapers to duct; iridescent diverticulum bulbous, shorter than ampulla. Male organs: holandric, testes and iridescent funnels in 10 and 11; racemose seminal vesicles in 9 (lhs vestigial) and 12. Ovaries: large palmate in 13; ovisacs not found. Prostates: flattened tubuloracemose in 18-19, duct partly visible in gland; long penial setae present 18-19,20. Intestine: oesophagus narrows in 16, origin in 17; smooth, thick-walled intestinal gizzards in 20-26; typhlosole absent; gut contains fine soil and grits.

REMARKS

Retrovescus mesibovi is distinguished from other described species in the genus by its spermathecal and male pores being more median (near setal a lines), in the distinctive form and distribution of its genital markings, in the apparent extent of the intestinal gizzards over seven segments (20-26) and in its unusually blunt spermathecal diverticula. A remarkably similar species is *Tassiedrilus griffithae*.

DISTRIBUTION AND HABITAT

Christmas Hills, west of Smithton in north-west Tasmania, from "a small pocket of myrtle, sassafras and leatherwood rainforest in a gully amid wet sclerophyll surrounds, in clay" (R. Mesibov). Found in association with specimens of *Anisochaeta tasmanica* (Spencer, 1895), new species of the genera *Megascolides*, *Diporochaeta*, *Hickmaniella faba* and *H. noda*, with the type species of the genus, *Retrovescus plomleyi*, and with a single haplotaxid.

Retrovescus plomleyi Blakemore, 1998

Fig. 217.

Retrovescus plomleyi Blakemore, 1998: 656-658, fig. 1.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3588, Christmas Hills, north-west Tasmania, CQ 309 667, 40°55'S.144°59'E., 60 m, 6.xii.1990, R. Mesibov, (mature, dissected and drawn).

PARATYPES: all with same collection details as (H), ANIC:RB.97.2.5 (P1), (mature, dissected); TM:K1543 (P2), (mature, dissected); 14:3589 (P3), (mature); TM:K1544 (P4), (mature); ANIC:RB.97.2.6 (P5), (mature); 14:3590 (P6-16), (11 specimens: 9 matures - 2 posterior amputees, P6 dissected - plus 2 sub-adults).

EXTERNAL FEATURES

Lengths mm: 77 (H), 70 (P1, P3, P4), 60 (P2), 90 (P5). Width: ca. 3.0 mm. Segments: 140 (H). Colour: unpigmented, clitellum yellow. Prostomium: open epilobous. Clitellum: ½13,14-16,½17. Dorsal pores: small in 6/7, larger from 7/8. Nephropores: not found. Setae: small and dark, 28 on 12, ca. 30-36 posteriorly. Spermathecal pores: 7/8 and 8/9 just median of c lines. Female pores: paired anterio-median to setae a. Male pores: in b lines on low porophores; tips of fine penial setae protrude. Genital markings: small white discs (sometimes doubled) within weakly tumid pads presetal in a-c lines on 8 (H-P6), 9 (H-P6, rhs only P4) and more median in ab on 19 (H-P6, rhs only P1, P4, lhs only P6); of 17 specimens (including sub-adults) eight have markings in all three segments, four have markings in 8 and 9 only, one has markings in 8 only, four have markings in 9 only.

INTERNAL ANATOMY

Gizzards: weak in 5; intestinal gizzards in 20-24. Oesophagus: slightly dilated in 7-13, marginally more dilated in 14-15. Nephridia: avesiculate meroic, two sets of simple tubules overlying one another per side (a third smaller nephridium seen in some segments), ducts exit in ca. c-d and j-k lines; not tufted anteriorly. Vascularisation: dorsal blood vessel single; hearts 10-12 from supra-oesophageal vessel in 7-13. Spermathecae: two pairs in 8 and 9, saccular ampulla on short duct with ectal diverticulum longer than ampulla. Male organs: holandric, testes and iridescent funnels in mucus in 10 and 11; paired racemose seminal vesicles small in 9 (almost vestigial in H, on rhs only in P2) and large 12. Ovaries: palmate with several egg-strings in 13; ovisacs vestigial on anterior septum of 14. Prostates:

tubuloracemose in 18, gland flat and leaf-shaped, duct visible as mid-rib; fine, silvery penial setae in sheaves extending 18-21. Intestine: oesophagus valvular in 16, origin in 17; smooth, thick-walled intestinal gizzards with muscular sheen in 20-24, with slight muscular modification of 19 and 25 also; typhlosole absent but low dorsal ridge present from 25; gut contains soil. Nematodes and gregarines frequently seen in body cavities.

REMARKS

Designated the type species of the genus, *Retrovescus plomleyi* is distinguished from other species of the genus by the presence of paired genital markings in some, or all, of segments 8, 9 and 19 and the more posterior commencement of its dorsal pores in 6/7.

DISTRIBUTION AND HABITAT

From Christmas Hills west of Smithton in NW Tasmania, found in the same habitat as *Retrovescus mesibovi*.

Retrovescus simplex Blakemore, 1998

Fig. 218.

Retrovescus simplex Blakemore, 1998: 662-664, fig. 4.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3564, Salmon River, north-west Tasmania, CQ 200 534, 41°03'S.144°50'E., 4.xii.1996, R.J. Blakemore, from silt beside creek, (mature, dissected and drawn).

PARATYPES: (P1) ANIC:RB.97.2.7, same collection details as H (slightly damaged mature, dissected); (P2) TM:K1545, same collection details as H (mature, dissected); (P3-5) 14:3593, same collection details as H (two matures, one slightly desiccated, plus an aclitellate sub-adult); (P6-7)14:3594 (ex 14:1606), Salmon River, north-west Tasmania CQ 199 534, 50 m, 17.v.1993, R.D. D'Orazio and D.E. Soccol, wet sclerophyll, (sub-adult, dissected, plus an immature).

EXTERNAL FEATURES

Body: circular with last few segments smooth and flask-shaped. Lengths mm: 35 (H, P3), 38 (P1, P2), 30 (P5), 45 (P6). Width: ca. 2.5 mm. Segments: 88 (H, tail regenerate?), 130 (P1), 121 (P3), 104 (P5), 100 (P6). Colour: unpigmented, pink with gut visible through cuticle in life, white in alcohol, clitellum white. Prostomium: open epilobous. Clitellum: ½13-½17. Dorsal pores: small in 5/6, larger from 6/7. Nephropores: not found. Setae: small and dark and irregular, ca. 22-28 on 12 (in H, 14/lhs:8/rhs; in P1, 12/lhs:14/rhs; in P2, 28 on 12), ca. 28-30+ posteriorly, setae deleted or duplicated on some segments. Spermathecal pores: 7/8 and 8/9 just lateral of b lines (H, P1) or c lines (P2-P6). Female pores: paired anterio-median to a setae. Male pores: lateral of b lines on low porophores; tips of fine penial setae protrude. Genital markings: absent or weakly represented by small pale discs in 17/18 in ab lines (in H, P2, P5).

INTERNAL ANATOMY

Gizzards: weak in 5; intestinal gizzards in 20-24. Oesophagus: dilated and vascular in 8,9-½15, narrow in ½15-½17. Nephridia: avesiculate meroic, two sets of simple tubules overlying one another per side can be carefully teased apart, ducts exit in ca. e and j-k lines (in P1 and P2, in intestinal region only lateral nephridium persists in most segments, although two sets are present on each side in anterior, in P6 a third nephridium is sometimes present in intestinal region); not tufted anteriorly and only

rudimentary in segments 3-5. Vascularisation: dorsal blood vessel single; hearts 10-12 from supra-oesophageal vessel in 8,9-13,½14. Spermathecae: two pairs in 8 and 9, saccular ampulla on short duct with ectal diverticulum iridescent and longer than ampulla (spermathecae often enveloped in mucus). Male organs: holandric, testes and iridescent funnels in 10 and 11; racemose seminal vesicles paired in 9 and 12. Ovaries: as several long egg-strings in 13; ovisacs not found (in mucus in H) or small (P1, P2) on anterior septum of 14. Prostates: flattened tubuloracemose in 18-20, duct short, flaccid; thin penial setae present extending 18-21,22. Intestine: abrupt origin in ½17; smooth, thick-walled intestinal gizzards with muscular sheen in 20-24; typhlosole absent but low dorsal ridge present from 25; gut contains silty soil.

REMARKS

Slight variations in location of spermathecae in *Retrovescus simplex* may be due to the irregularities of setae as noted in several specimens. This species is distinguished from others in the genus by its lack of appreciable genital markings (in mature, clitellate specimens). It is similar to *R. mesibovi* in the reduction of nephridia to only one per side in some intestinal segments.

DISTRIBUTION AND HABITATS

From embankment of Salmon River, in State Forest land in north-west Tasmania, found in fluvial silt beside river near bridge on forestry road in association with *Megascolides salmo* sp. nov..

Anisogaster gen. nov.

Diagnosis

Setae more than 8 per segment, at least in the hind-body. Dorsal pores present. Male pores from racemose prostates paired on 18. A weak oesophageal gizzard in 5 and moniliform intestinal gizzards in the region of 22-27. Nephridia meroic, avesiculate, not tufted anteriorly. Spermathecae two pairs, spermathecal diverticula clavate often with several internal chambers (i.e., multiloculate but not sessile). Calciferous glands and caeca absent, typhlosole present. Penial setae absent.

Etymology: *aniso-gaster*, Greek transliteration into Latin – 'uneven gizzard(s)'

Note: under the recommendations of ICZN (1999: 35) a genus-group name ending in -*gaster*, is to be treated as feminine.

Type-species: *Anisogaster quini* sp. nov.

Other included species

Anisogaster remora sp. nov.

Distribution: Central, northern Tasmania towards Cradle Mountain.

Remarks

Anisogaster resembles *Nexogaster* Blakemore, 1997 and *Retrovescus* Blakemore, 1998 in possessing an oesophageal gizzard in segment 5 and moniliform intestinal gizzards. However, *Nexogaster* is lumbricine (8 setae) throughout, while *Retrovescus* has 22-36 setae per segment and intestinal gizzards are in the region of 20-26, rather than 22-27. Other characteristic combinations in *Anisogaster*, that perhaps singly would be of only specific significance, are the multiloculate spermathecal diverticula (cf. clavate in *Nexogaster* and *Retrovescus*), the presence of a typhlosole (cf. present in *Nexogaster*, absent from *Retrovescus*), and the lack of penial setae (cf. present in *Nexogaster* and in *Retrovescus*).

Anisogaster quini sp. nov.

Fig. 219.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3048, Cradle Mountain, 4.1kms along Beecroft Road to river, N Tasmania, CP 995 034, 680 m, 16.vi.1993, R.D. D'Orazio and D.E. Soccol, peat swamp, (mature, dissected and drawn).

PARATYPES: (P1) ANIC:RB.98.1.2, same details as H, (posterior amputee, dissected and drawn); (P2) TM:K.1559, same details as H, (mature, dissected); (P3-4) 14:3044-5, same details as H, (mature, posterior amputee, and mature, posterior regenerate?); (P5) ANIC:RB.98.1.3, same details as H, (aclitellate mature); (P6) TM:K1561, same details as H, (aclitellate mature); (P7-16) 14:3722, 14:1282, Cradle Mt Road, just passed Hellyer Mine road to where creek crosses highway, N Tasmania, CP 994 986, 670 m, 16.vi.1993, R.D. D'Orazio and D.E. Soccol, peat swamp, (ten mostly mature specimens, five dissected).

SPECIMENS: 14:607, same details as H, (two juveniles).

EXTERNAL FEATURES

Lengths mm: 110 (H), 95+ (P1), 125 (P2), 100+ (P3), 100 (P4), 90 (P5), 100-140 (P7-11). Width: ca. 4 mm. Segments: 153 (H), 144 (P2), 100 (P4). Colour: pale unpigmented with dark dots near setae in some segments; clitellum buff. Prostomium: open epilobous. Clitellum: ½13,14-17. Dorsal pores: from 4/5. Setae: 8 on 12 and 20 in regular rows, add setae between cd or above d in mid-body to give 10 per segment and have ca. 12 posteriorly with other than ab in slightly irregular series. Nephropores: not seen. Spermathecal pores: two pairs in 7/8 and 8/9 in setal a lines. Female pores: paired anteriomedian to setae a in groove. Male pores: paired on small papillae in ab on 18 within raised mid-ventral pad which fills 18. Genital markings: unpaired pad within tumid rim in 19/20 extending b-b and encroaching to equators of adjacent segments (H, P1-P16); one specimen (P1 only) has similar pad in 14/15, and one specimen (14:3722) has additional marking in 20/21.

INTERNAL ANATOMY

Septa: 6/7-11/12 slightly thickened, then thinning. Gizzards: very weak walled in 5, almost vestigial; plus intestinal gizzards in 22-26. Oesophagus: slightly dilated in 7-16, but not calciferous; valvular in 17. Nephridia: avesiculate meroic, several (two to four) tubules per side approximately in line with setae; median-most not enlarged; not tufted. Vascularization: dorsal blood vessel single; commissurals in 6,7-9, hearts in 10-13 (or 10-12 in five dissected specimens of 14:1282 and 14:3722); supra-oesophageal vessel weak 9-13. Spermathecae: two pairs in 8 and 9; heart-shaped ampulla on equally long thick duct with bifid or multilocular diverticulum near exit. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles paired, large racemose anteriorly in 11 and 12. Ovaries: large, palmate in 13;

small paired ovisacs in 14, (H anomalous as 13lhs ovaries displaced into 14, but both oviducts in 13 as usual, and an extra ovisac in 15lhs). Prostates: racemose rosettes with short duct in 18; penial setae not found. Intestine: origin ½18; muscular intestinal gizzards in 22-26, with some modification of 27 (H and all dissected specimens); deep lamellar typhlosole developing from ca. 30; gut contents dark organic matter and quartz grains.

REMARKS

Specific characters of *Anisogaster quini* are last hearts in 13 in most specimens (except local variants as noted above), and seminal vesicles in 11 & 12.

ETYMOLOGY: quini, Latin adjective - five each, for the intestinal gizzards.

DISTRIBUTION AND HABITAT

Cradle Mountain Road, N Tasmania, from peat swamp.

Anisogaster remora sp. nov.

Fig. 220.

MATERIAL EXAMINED

HOLOTYPE: (H) 14:3046, Cradle Mountain, 4.1kms along Beecroft Road to river, NW Tasmania, CP 995 034, 680 m, 16.vi.1993, R.D. D'Orazio and D.E. Soccol, peat swamp, (mature, dissected and drawn).

PARATYPES: (P1) 14:3047, same details as H, (mature, dissected); (P2) ANIC:RB.98.1.4, same details as H, (mature, posterior amputee, dissected); (P3) TM:K.1560, same details as H, (mature, posterior amputee); (P4) 14:3721, same details as H, (aclitellate mature, dissected).

EXTERNAL FEATURES

Lengths mm: 125 (H), 115 (P1), 65+ (P2), 60+ (P3), 110 (P4). Width: ca. 4 mm. Segments: 153 (H), 144 (P2), 100 (P4). Colour: pale unpigmented; clitellum buff. Prostomium: open epilobous. Clitellum: ½13,14-17. Dorsal pores: from 4/5. Setae: 8 on 12 and 20 in regular rows, adding setae to give ca. 14 posteriorly with other than ab in irregular series. Nephropores: not seen. Spermathecal pores: two pairs in 7/8 and 8/9 in setal a lines. Female pores: paired anteriomedian to setae a in groove. Male pores: paired on small papillae in ab on 18 within raised mid-ventral pad which fills 18. Genital markings: on clitellum as midventral sucker-like pads within tumid rims in aa in 14/15 and 15/16 (H, P1, P2, P3), and/or 16/17 (H, P4); weak pad also in 17/18 (P1) and posteriorly on 20 (H, P2).

INTERNAL ANATOMY

Septa: 6/7-12/13 slightly thickened. Gizzards: very weak walled in 5, almost vestigial; plus intestinal gizzards in 22-27. Oesophagus: slightly dilated in 15-16, but not calciferous; valvular in 17. Nephridia: avesiculate meroic, several (three or four) tubules per side approximately in line with setae; median-most not enlarged; not tufted. Vascularization: dorsal blood vessel single; hearts in 10-13. Spermathecae: two pairs in 8 and 9; heart-shaped ampulla on tapering duct with clavate but multilocular diverticulum near exit. Male organs: holandric, iridescent testes and funnels free in 10 and 11; seminal vesicles paired anteriorly in 11 and 12. Ovaries: large, palmate in 13; small pseudovesicles in 13; vestigial ovisacs in 14. Prostates: racemose rosettes with long duct in 18; penial setae not found. Intestine: origin ½18;

muscular intestinal gizzards in 22-27; deep lamellar typhlosole developing from 30; gut contents soil and organic matter.

REMARKS

Anisogaster remora is a sympatric variant of *A. quini* having genital markings on the clitellum in some of 14/15-16/17 (but absent from 19/20).

ETYMOLOGY: the epithet 'remora' is for the sucker-like pads on the clitellum.

DISTRIBUTION AND HABITAT

Cradle Mountain Road, NW Tasmania, peat swamp; (also found at Pelion Valley, pers. obs.).

Exotic and Introduced Species

Only brief accounts will be presented here. Detailed references to the species and nomenclature can be found in other publications, such as Gates (1972), Sims (1983), Easton ,(1983), and Sims & Gerard, (1985). Considerations of common peregrine species are found in Stephenson (1930), Gates (1942, 1972) and Lee (1987b), and the issue of interactions between native and introduced worms is discussed in these references and in Lee, (1961; 1985) and Kalisz & Wood (1995). Current lists of exotics occurring in Australia (including Tasmania) are provided by Blakemore (1994a; 1997d; 1999) where 66 species are listed. If neoendemics are included this total is raised to at least 78 species (Blakemore, in prep.). Descriptions are pending of at least two other species recently recognized in Tasmanian material collected by the author that are probable exotics and for which no corresponding accounts have as yet been found in the literature.

Exotic earthworms can be common and abundant, especially in disturbed sites. For example, the following eight species were found by the author at the council depot at Rocherlea: *Aporrectodea caliginosa*, *A. trapezoides*, *Eisenia rosea*, *Octolasion cyaneum* (these four species were wandering on the asphalt carpark, at least 20 m from their possible source, following overnight rain on a September morning in 1997, (see Blakemore, 1999: 185)), plus *Lumbricus rubellus*, *Microscolex dubius*, *M. phosphoreus*, and *Anisochaeta dorsalis*.

An interesting project may be to survey the exotic species at Adventure Bay, Bruny Island as this is where Captain William Bligh planted the first apple rootstock in Tasmania (with its associated soil fauna?). This location was also visited by early explorers such as Captains James Cook, Flinders, Bass, Furneaux and Baudin.

Many of the more common exotic species recorded from Tasmania also formed part of an unpublished agronomic PhD thesis (Blakemore, 1994a; 1997) that fully describes and illustrates 75 earthworm species, most now lodged in Canberra (Blakemore, 1995a). The author retains copyright in this thesis, and intends to extend it to produce a guide to all the exotic earthworms found in Australasia (expected to be in the order of 100+ species), but this project is currently stalled, due not to lack of need nor interest, but rather to lack of funds.

LUMBRICIDAE

Many specimens of this family are held in various museum and agricultural institute collections around the State. References to these species are given in Blakemore (1999).

[Taxonomic note: the type-species of the genus *Aporrectodea* Örley, 1885 is *Aporrectodea trapezoides* (Dugès, 1828), acceptance of this as a valid species and name, rather than a phenotypic morph and therefore a junior synonym of *Aporrectodea caliginosa* (Savigny, 1826) (as was proposed by Zicsi, 1982; Sims, 1983; Easton, 1983; Sims & Gerard, 1985), displaces *A. caliginosa* as type-species. The genus *Nicodrilus* Bouché, 1872 with type-species *Enterion terrestre* Savigny, 1826 (= *Allolobophora giardi* Ribaucourt, 1901) is assumed to remain in synonymy of *Aporrectodea*].

Allolobophora chlorotica (Savigny, 1826)

Unregistered QVM sample, collected by Hobart Field Naturalists Society, 4-5.x.1995, in dark soil, (two specimens, dissected and figured). Many other specimens are in the QVM collection.

Aporrectodea caliginosa (Savigny, 1826)

14:3449, from Strathgordon, Lake Pedder, 13.iv.1996, R.J. Blakemore, in garden soil, (mature dissected and figured, see Blakemore, 2000c: 31-32 for description). Many other specimens are held in the QVM collection. Widely distributed in Tasmania. Easily confused with *A. limicola* (Michaelsen, 1890), *A. caliginosa* is a species-complex with the following morphs being recognized as separate species or sub-species by some authors (cf. *A. trapezoides*, *A. attemsi*), (see Sims & Gerard, 1985: 56-57, 61; Easton, 1983; Blakemore, 1999):

A. caliginosa caliginosa (syn. *A. turgida* (Eisen, 1874))

A. tuberculata (Eisen, 1874), [non *A. tuberculata* (Cernosvitov, 1935)].

A. caliginosa alternisetosa (Bouché, 1972)

A. caliginosa obscuricola (Cernosvitov, 1936)

Aporrectodea longa (Ude, 1885)

Abundant in Tasmania, many samples in QVM collection, also reported from every Australian State (see Blakemore, 1994a; 1997d; 1999). The author was involved in collection this and other lumbricid species from Woolnorth, NW Tasmania in 1993. This species may easily be confused with *A. norcturna* morphs of *A. trapezoides* and with the French species *A. giardi* (Ribaucourt, 1901) (see Sims & Gerard, 1985: 64). A French sub-species is *A. longa ripicola* (Bouché, 1972).

Aporrectodea trapezoides (Dugès, 1828)

Widely distributed in Tasmania and Australia, particularly in more tropical regions (see, Blakemore, 1999). This is considered part of an *A. caliginosa* species-complex, by some authors (eg. Easton, 1983; Sims & Gerard, 1985; cf. Gates, 1972: Reynolds, 1977). The following morphs being recognized as separate species or sub-species (cf. *A. caliginosa*), (see Easton, 1983; Sims & Gerard, 1985: 57):

A. trapezoides trapezoides

A. trapezoides nocturna (Evans, 1948)

A. trapezoides meridionalis (Bouché, 1972)

Dendrobaena attemsi (Michaelsen, 1902)

A report of this species from Tasmania, made by non-specialists, is unconfirmed as no authoritative source was cited and voucher specimens are not available (see Blakemore, 1999). Sims and Gerard (1985: 68) note that this species, which can easily be confused with parts of the *A. caliginosa* species-complex and with *A. limicola*, is "rare" - known only from a single record in Britain. A sub-species is *D. attemsi decipiens* (Michaelsen, 1910).

Dendrodrilus rubidus rubidus (Savigny, 1826)

14:3661, Ben Nevis, RS0440, Evandale, vi/vii.1997, collector Jim Young, from farm property, (mature, dissected and figured, from same sample as 14:3660 of *Eisenia hortensis*). Identity checked against BM: 1976.13.669-720, from Marion Islands, Indian Ocean, Van Zinderen, "Det: E.G. Easton", (several specimens loaned from the Museum of Natural History, London). Currently unregistered material lodged at QVM were collected from Biggles track, Brothers Point to Green Gorge, Macquarie Island, 20.xi.1997, R.J. Blakemore, (several specimens, that agree with earlier

descriptions). Other specimens, 14:3599, from Overland track to Bauer Bay, Macquarie Island, 30.xii.1996, C. Crossley, B. Kemp, (several specimens, one mature, figured and dissected) appear to be either ***D. rubidus subrubicundus*** (Eisen, 1874) or ***D. r. tenuis*** (Eisen, 1874), (correct determination is pending). A further subspecies *D. r. norvegicus* Eisen, 1874) has been reported from Kerguelen Islands (Bouché, 1982; Frenot, 1992).

D. rubidus tenuis (Eisen, 1874)

Listed by Lee (1968:159) as *Bimastus tenuis* (Eisen), from Macquarie Island , with collection data: Station 81, 3.vii.1930, B.A.N.Z.A.R.E., (four clitellate specimens).
[Taxonomic note: following Easton (1980: 40), *Bimastus* was corrected to its original orthography as *Bimastos*, and *B. tenuis* was placed within the synonymy of *D. rubida*, which itself was transferred from *Dendrobaena* to *Dendrodrilus*.]

Eisenia fetida (Savigny, 1826)

Possibly occuring in mixed populations with its variant, ***Eisenia fetida andrei*** Bouché, 1972. Several specimens were obtained from the same sample as 14:3660 *Eisenia hortensis*; also identified at worm farms in Lauceston, Perth and Hobart. Molecular analysis is required for specific separation of *E. fetida* and *E. andrei* as their morphological variances overlap (see Sims & Gerard, 1985; cf. Eaton, 1983: 480). This species is the most commonly used in vermicomposting and vermicultural operations around the world (Blakemore, 1995b).

Eisenia hortensis (Michaelsen, 1890)

14:3660, Ben Nevis, RS0440, Evandale, vi/vii.1997, collector Jim Young, from farm property, (mature, dissected and figured). This is the first confirmation of this species from Australia (see Blakemore, 1999). This taxon is placed in *Dendrobaena* by some authorities (eg. Easton, 1983: 478), and is another species claimed by vermiculturalists.

Eisenia rosea (Savigny, 1826)

Frequently found in disturbed habitats in Tasmania, (see Blakemore, 1994a; 1999). Several specimens lodged in QVM collection including samples from Rocherlea and

Invermay. This species is placed in *Aporrectodea* by some authorities (eg. Easton, 1983: 477; Sims & Gerard, 1985; cf. Gates, 1972), but an argument for its retention in *Eisenia* as in Michaelsen (1900) was made by Blakemore (1994a: 250-251) based on the position of its dorsal and spermathecal pores, and the uncertain systematic importance of colouration. Gates (1974) provides four pages of synonymies for this taxon (see also Easton, 1983: 477).

Eiseniella tetraedra (Savigny, 1826)

14:3451, from Lake Pedder, described by Blakemore (2000b: 33). Several other specimens from Tasmania are lodged in QVM collection. This species is often associated with moist habitats.

Lumbricus castaneus (Savigny, 1826)

Occasionally found in Tasmania, (pers. obs.). Specimens are lodged in QVM collection. This species is often found in habitats high in organic matter.

Lumbricus eiseni Levinsen, 1884

14:3452, Strathgordon, Lake Pedder, 13.iv.1996, R.J. Blakemore, from garden soil (mature dissected, described by Blakemore, 2000b: 33-34). This was the first record of this species from Australia.

Lumbricus rubellus Hoffmeister, 1843

Same sample as 14:3660 of *Eisenia hortensis* from Ben Nevis, (single specimens). Frequently found in Tasmania, further material from around the State is held in QVM collection (see also Blakemore, 1999). Frequently found under stones or logs and other moisture retaining habitats.

Lumbricus terrestris Linnaeus, 1758

Fig. 221.

Lumbricus terrestris (part.) Linnaeus, 1758, Syst. Nat. 10th edn.: 647.

Enterion herculeum Savigny, 1826, Mém. Acad. Sci. Inst. France 5: 180.

Lumbricus herculeus , Dugès, 1837, Ann. Sci. Nat., ser 2,8: 17,21.

Lumbricus agricola Hoffmeister, 1842, Verm. Lumbric., p. 24.

Lumbricus infelix Kinberg, 1867, Öfv. Vet.-Akad. Förh. Stockholm 23: 98.

? Lumbricus americanus E. Perrier, 1872, Nouv. Arch. Mus. Paris, 8: 44.

Lumbricus studeri Ribaucourt, 1896, Rev. Suisse Zool., 4: 5.

Lumbricus terrestris, Michaelsen, 1900, Tierreich, 10: 511.

MATERIAL EXAMINED

QVM: 14: 3648, Invermay, Launceston, N. Tasmania, 29.vi.1997, R.J. Blakemore, found escaping over soil surface of suburban garden when digging to 1 m depth in black clay, (mature, complete specimen; fixed in 10% formalin, preserved in 80% ethanol). [Note: neotype in British Museum not inspected. This is listed by Reynolds & Cook (1976: 18), as BMNH:1973:1:1, the original type-locality is unknown although Gates (1972: 114) argues this has to be Sweden].

EXTERNAL FEATURES

Body: fairly stout; in life, posterior third assumes flattened spade-like shape when agitated. Length mm: 200 (preserved), (250 in life), (cf., size to 350 mm, Gates 1972). Width: ca. 12 mm. Segments: 136. Colour: anterior dorsum gunmetal grey to d setal lines with blue iridescence, retained as dark mid-dorsal line to posterior; ventrum pale (pink in life); clitellum buff (yellowy in life). Prostomium: tanylobous. Clitellum: 32-37, saddle-shaped mostly to bb lines. Dorsal pores: 7/8 small, from 8/9 larger. Setae: 8 per segment, closely paired in regular rows. Nephropores: large at anterior margin of segment just lateral level of b setal lines on many segments (eg. on right-hand side on 11-15, 20, 22-25, 28, 30-36, 39-44, etc.), irregularly alternating to between d and mid-dorsum (eg. on rhs seen in dorsal position on 3-7, 9, 17-19, 21, 26-27, 29, 33-34, 37-39, 44-45), (note: it is not known why in some segments the pores appear to be in both positions on one side). Spermathecal pores: in 9/10/11 in cd nearer to c lines. Female pores: paired just lateral of b setae on 14. Male pores: towards lateral extremity of equatorial slits within tumid lips between a and c setal lines confined to 15; distinct mound tract (formed by parallel seminal grooves?) extends from male pores (or female pores?) to clitellum between bc line on both sides. Genital markings: ventral setal couples within slightly tumid pads, especially 8,9-11, 25, 31-32 and 37-38; tubercula pubertatis as elongate smooth pads just median of c lines in 33-36.

INTERNAL ANATOMY

Details of the internal anatomy of this species, the "typical earthworm", are readily available in zoology text books (eg. see Sims and Gerard, 1985: figs. 4, 6). Dissection was not attempted here in order to avoid excessive damage to the single available specimen.

REMARKS

The above description agrees with that of Sims and Gerard (1985: 106-108, figs. 1, 37 and 38), who for internal anatomy only remark on the septa and seminal vesicles, and also with descriptions by Gates (1972: 118-123) and Lee (1959: 365-368). Many competent references note that other species have frequently been confused with *L. terrestris* in the past, possibly due partly to its inaccurate characterization in school texts as "the common earthworm" [an expression rejected for this species, which is common in neither its distribution, morphology nor behaviour, by several authorities - including Stephenson, (1930) in a preface to his great monograph]. Gates (1972: 123) remarks that "A belief that almost any earthworm is *Lumbricus terrestris* is not entirely restricted to high-school graduates who have had an elementary course in biology (*cf.* Stephenson, 1930: p. xi). The species used in a recent electron-microscope study of sperm cytology was said to be *L. terrestris* but actually was *Allolobophora* [=*Aporrectodea*] *tuberculata*".

A species that has, until relatively recently, been continually confused with *L. terrestris* is *Aporrectodea longa* (Ude). The distribution of this latter species given by Sims and Gerard (1985: 64) includes "Australia (including Tasmania)". *A. longa* has been frequently reported from every State in Australia (see Blakemore, 1994a; 1997d: 607, 1999). For example, Wood (1974) recorded this species as *Allolobophora terrestris* f. *longa* (Ude) from Kosciuszko National Park. Gates (1972: 75-76), who had earlier shown that this latter name is illegitimate, went on the state that "*A. longa* is not known to have been sold or used for bait in North America but the species may have occasionally been mistaken for [*L.*] *terrestris*, unless anglers are more careful than university professors".

L. terrestris is the primary species used in the fishing bait industry in North America, most stock is collected from Canadian lawns and golf courses at night and shipped to various outlets, some as far away as Europe (pers. obs. in Herefordshire, UK).

The characteristic spade-shaped tail is believed to enhance gripping of the burrow walls, as its foraging behaviour is to anchor the tail in the mouth of the burrow to drag leaves and twigs back down for feeding. The burrow may extend to 3 m depth, and the entrance is often indicated by a small midden of pebbles and twigs as well as a plug of leaves, feathers, etc. (Gates, 1972; Sims and Gerard, 1985). Several such middens were also present in my garden, plugged mainly with oak leaves (it is assumed that these were windblown as the nearest oak tree was about 1 km away!). This worm is usually described as being nocturnally active (eg. Linnaeus, 1758: 647, "*adscendit noctu*"), its above ground wandering and copulation earning it the common name in North America of the "Canadian Nightcrawler" (or in French Canada, "Ver nocture rampant"). However, its dark pigmentation indicates a need for protection from sunlight and the present specimen was rapidly escaping over the soil surface in daytime. This escape response was probably elicited by my digging, perhaps being reminiscent of that by predatory European moles (*Talpa* spp.) for which this species is a favourite food. Such an escape response is exploited by predatory birds like lapwings (*Vanellus* spp.) that mimic the vibrations by stamping on the soil surface (Darwin, 1881: 28), as well as by anglers searching for bait.

Nuutinen & Butt (1997) have described in detail the mating behaviours of this species. Moreover, it was one of several lumbricids studied at an organic farm in Suffolk, UK (Blakemore, 1981; 2000d).

DISTRIBUTIONS AND HABITAT

According to Sims and Gerard (1985: 108): "Holarctic and temperate regions of South America, Australia, New Zealand, several temperate oceanic and other southern islands" and "In many undisturbed, terrestrial habitats, most numerous in grasslands (including lawns) and orchards, less common in woodland, arable soil and river banks. Found in alkaline soils of pH 6.2-10.0; especially abundant in clay".

For New Zealand, Lee (1959: 367-368) regarded this species "quite common in garden soils in Auckland, Hamilton, and probably in other nearby towns". However, the record of this species from "Australia" in Sims and Gerard (1985) is unauthenticated although they do cite Gates (1972) in their references and Gates (1972: 119) list this species in Australia, again without reference. The only earlier report that I can find is by Jamieson (1965: 40) where, after explaining how "essential" it was not to confuse species, stated: "The British "Common Earthworm",

Lumbricus terrestris, has been found to flourish in Australian earthworm farms and is of value". Reynolds (1977: 7 and 101) explains how *L. terrestris*, although routinely collected at night for fishing bait and study in North America, cannot be commercially cultured economically because of its long life cycle, low reproductive rate, and large spatial requirements. It appears therefore that Jamieson's report of this species in Australian worm farms is highly dubious. Furthermore, since subsequent investigations by the current author have failed to unearth any reference material of *L. terrestris* in any of the major collection in Australia, this earlier claim is most likely erroneous. The current record is therefore the first confirmation of *Lumbricus terrestris* from Australia (see also Blakemore, 1997c). Several other specimens were found at the Invermay site, but I saw no reason to kill them, and released them back into my garden.

***Octolasion cyaneum* (Savigny, 1826)**

14:3450, Strathgordon, Lake Pedder, 13.iv.1996, R.J. Blakemore, from garden soil (mature dissected, described by Blakemore, 2000b: 33-34). Widely distributed in Tasmania, several specimens are lodged in the QVM collection. A similar species is *Octolasion tyrtaeum* (Savigny, 1826).

OCNERODRILIDAE

***Ocnerodrilus occidentalis* Eisen, 1878**

Material examined: 14:3647, Invermay, Launceston, 30.vi.1997, R.J. Blakemore, from stormwater pipe blocked by roots, found tangled in wet roots with many tubificids, (two damaged specimens, both dissected). The distinctive 'ocnerodrilid diverticula' were paired in segment 9. However, these specimens had two pairs of spermathecae in segments 8 and 9, rather than the typical bithecal arrangement and are thus probably morphs of this 'species' (see Gates, 1972 for discussion of synonymy). This species is recorded from watercourses and moist habitats around theworld, it was first described by Eisen from irrigation lines at his vinyard in Fresno, Ca. (Gates, 1972).

***Eukerria saltensis* (Beddard, 1895)**

This species was identified in Tasmanian samples currently unregistered in the QVM collection in November, 1995, (see Blakemore, 1999). Often found in moist habitats.

ACANTHODRILIDAE

***Microscolex dubius* (Fletcher, 1887)**

Found in drain at carpark, Rocherlea, N. Tasmania, 8.vi.1996, R.J. Blakemore, (several specimens, one dissected to confirm identity). Material deposited in QVM collection. This species is similar to *M. phosphoreus* and may be a parthenogenic morph; it does not however give a phosphoresce response (pers. obs.).

***Microscolex macquariensis* (Beddard, 1896)**

Specimens were recently collected from Subantarctic Macquarie Island by the author in 1997/8 as part of an ecological study of invertebrates (eg. 14:3714 consisting of 8 specimens). This new material has been fully described, figured, and compared with type-material loaned from the Museum of Natural History, London. Unfortunately, funds are not currently available for publication of the findings from this study. This species is classed as a neo-endemic as discussed in Blakemore (1999), (see also introductory remarks to the current work). Lee (1959: 101-3) describes *M. macquariensis* as a New Zealand species, but transfer of political control of Macquarie Island away from NZ add this species to the Tasmanian list (Lee et al. in press). Lee (1968: 1994) discusses the affinities of this species with other *Microscolex* in the southern lands and possible modes of transportation. For *M. macquariensis* initial introduction via carriage on the feet of birds (eg. *Diomedea exulans* the Wandering Albatross) is possible, although oceanic rafting is the more probable as much debris still washes up from South America, including a tree stump with its root bolus at Bauer Bay (pers. obs. in 1997).

***Microscolex phosphoreus* (Dugès, 1837)**

14:0018, 0036, Melaleuca, SW Tasmania, 3.ii.1993, D. King, garden 319 927, (eight specimens, one dissected). Also found in drain at carpark, Rocherlea, N. Tasmania, 8.vi.1996, R.J. Blakemore, (seven specimens, collected after dark when they were seen to phosphoresce when disturbed, one dissected to confirm identity). Material deposited in QVM collection.

***Rhododrilus kermadecensis* Benham, 1905**

Rhododrilus littoralis Jamieson, 1974 **syn. nov.**

14:3473-3474, Swan Bay, River Tamar, N. Tasmania, 31.v.1996, R.J. Blakemore, from mud flat behind sedges and under driftwood, in high numbers, (two mature specimens, dissected and figured). Other specimens of this species are lodged in the TM and QVM collections. The type locality is Raoul, Kermadec Islands (Lee, 1953; 1959).

MEGASCOLECIDAE

***Perionyx excavatus* Perrier, 1872**

Found at a worm farm at Perth, N Tasmania (pers. obs. - specimens not registered). This species, originating from Indian, was first confirmed from wormfarms in Australia by Blakemore (1994a; 1995b)

***Amynthas corticis* (Kinberg, 1867)**

Found in garden soils and wormfarms in Tasmania (pers. obs.). Specimens of this Oriental species with cosmopolitan distribution are lodged in the QVM collection. This species is fully described in Blakemore (1994a).

***Anisochaeta dorsalis* (Fletcher, 1887)**

A translocated native species, introduced from Victoria (see Blakemore, 1999 and introductory remarks for the present work). Specimens examined include 14:3455, Strathgordon Village, Lake Pedder, 13.iv.1996, R.J. Blakemore, (9 specimens: 4 matures, one a posterior amputee, one dissected, plus 4 immatures and a cocoon); 14:3453, St Marys Hotel, W. Tasmania, 3.vii.1993, R.D. Dorazio and M. Cooper, (two mature specimens); 14: 3454, from "Devonport Field Naturalists", 9.vii.1991, (two mature specimens dissected and identified by RJB in 1991, the first record of a Victorian earthworm in Tasmania). Blakemore (2000b: 29-31) gives full descriptions of these specimens. Other specimens have been found wandering over the soil surface at Rocherlea, Launceston and in other several other urban gardens in the north and south of the State (pers. obs.).

***Anisochaeta sebastianus* (Blakemore, 1997b)**

This species, named for my young son, is also a translocated native that has been identified from Queensland and NSW as well as Tasmania, always in garden soils, (see Blakemore, 1994; 1997b; 2000a). Material examined is 14:3475, from Gorge Cottage, Launceston, 22.xii.1995, R. J. Blakemore, gatekeeper's cottage garden, (mature P1 specimen, dissected and sketched).

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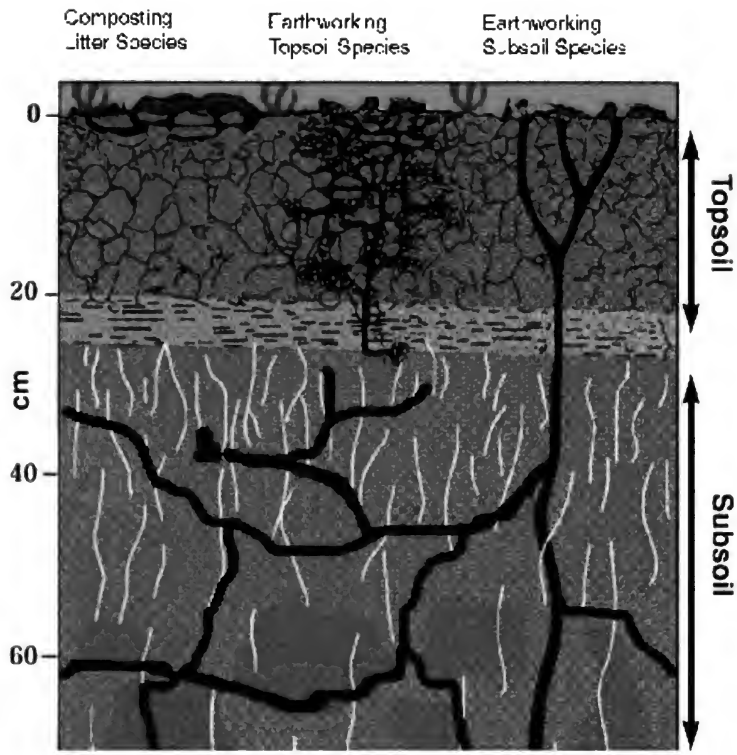


Fig 1. Ecological strategies of earthworms from Lee (1959). (Figure modified Lee, Blakemore, & Fraser, 2001).

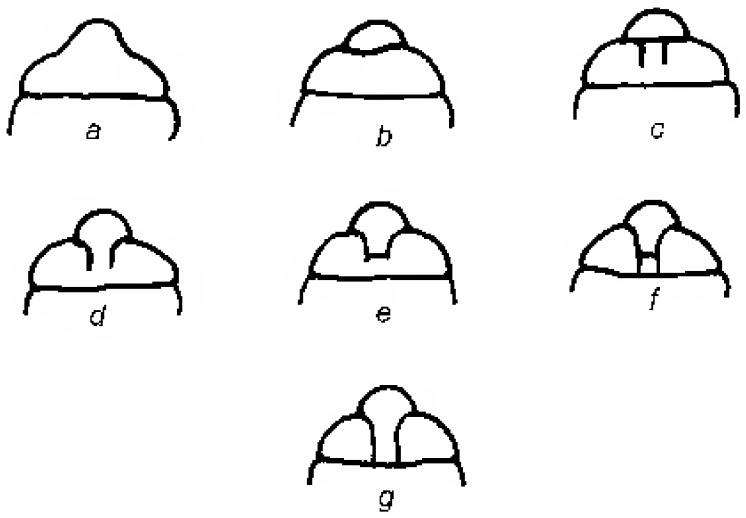


Fig 2. Dorsal views of various forms of prostimium: *a*, zygolobous; *b*, prolobous; *c*, pro-epilobous; *d*, open epilobous; *e*, closed epilobous; *f*, epi-tanylobous; *g*, tanylobous.

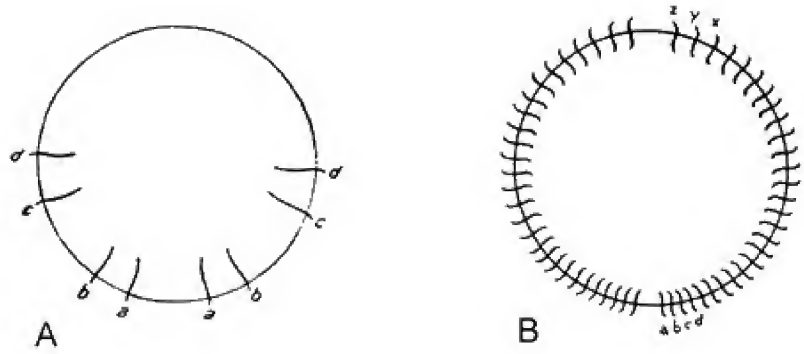


Fig. 3.

Setal arrangements in section: A, lumbricine; B, perichaetine; where the worm has 8 setae anteriorly increasing towards the tail it is anisochaetine. Setae are designated a b c d etc. from ventralmost on each side, and also z y x etc. from the dorsal-most in perichaetine specimens. (After Stephenson, 1930).

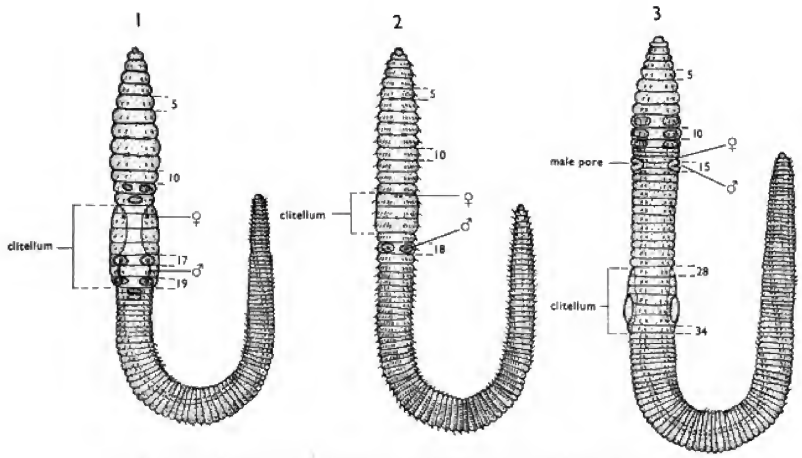


Fig. 4. Examples of typical earthworm arrangements:
1. an acanthodrilid (eg. ACANTHODRILIDAE)
2. a megascolecid (MEGASCOLECIDAE)
3. a lumbricid (LUMBRICIDAE)
(Figure modified from Lee, Blakemore & Fraser (2001) after Lee (1959)).

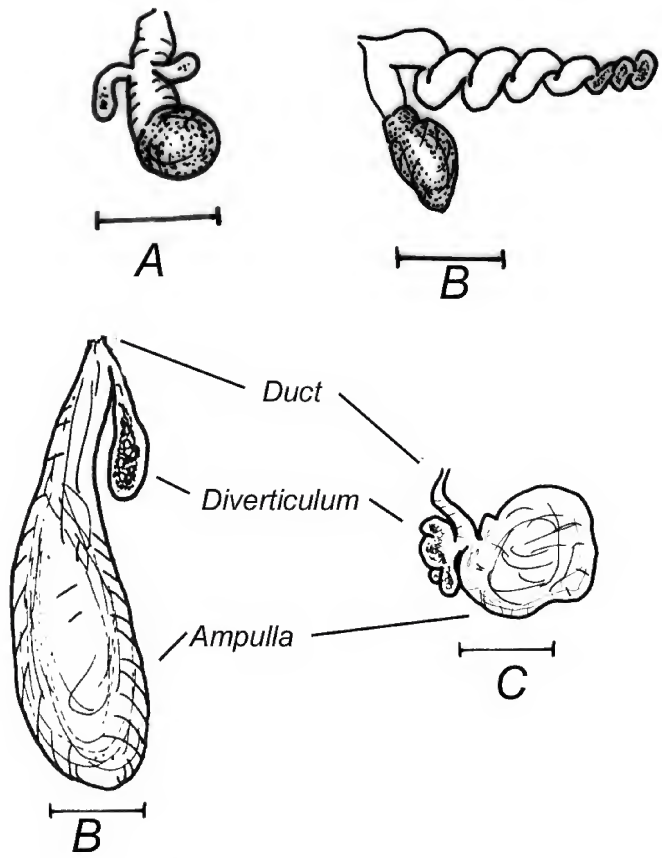


Fig. 5. Spermathecae.

A. Double diverticula.
B. Clavate (club shaped).
C. Multiloculate.

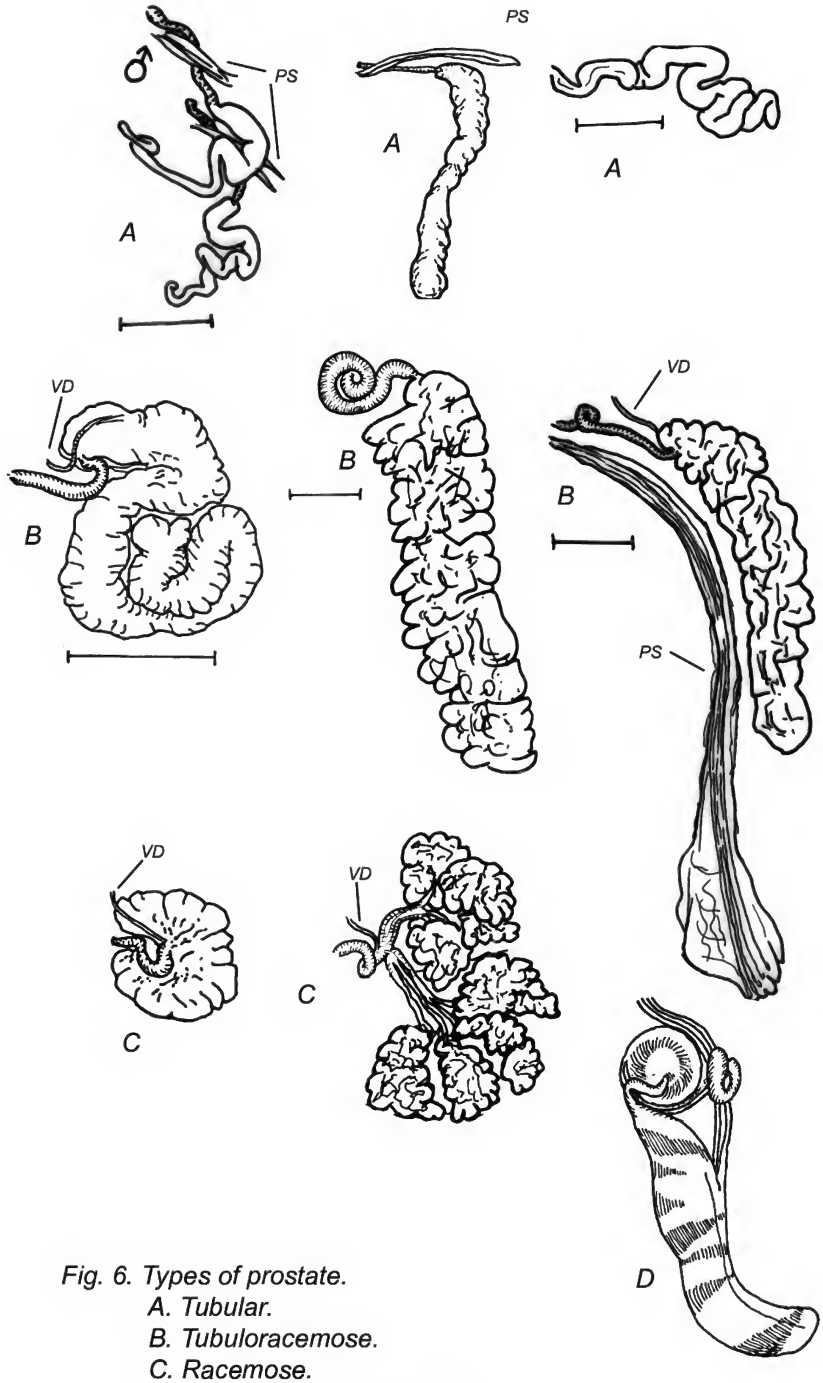


Fig. 6. Types of prostate.
A. Tubular.
B. Tubuloracemose.
C. Racemose.
D. Euprostates (Eudrilidae).
(PS - penial setae; VD - vasa deferentia).

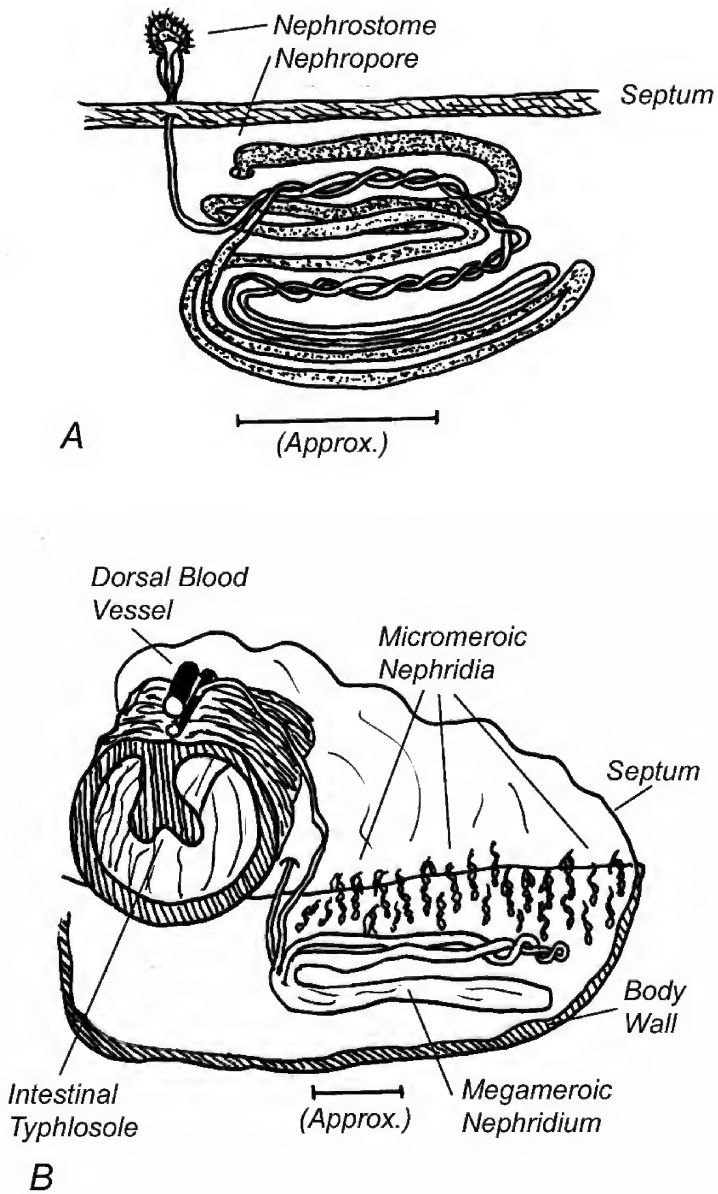


Fig. 7. Types of Nephridia:
A. Holoic, an holonephridium (after Benham).
B. Meroic, meronephridia (diagramatic after Bahl).

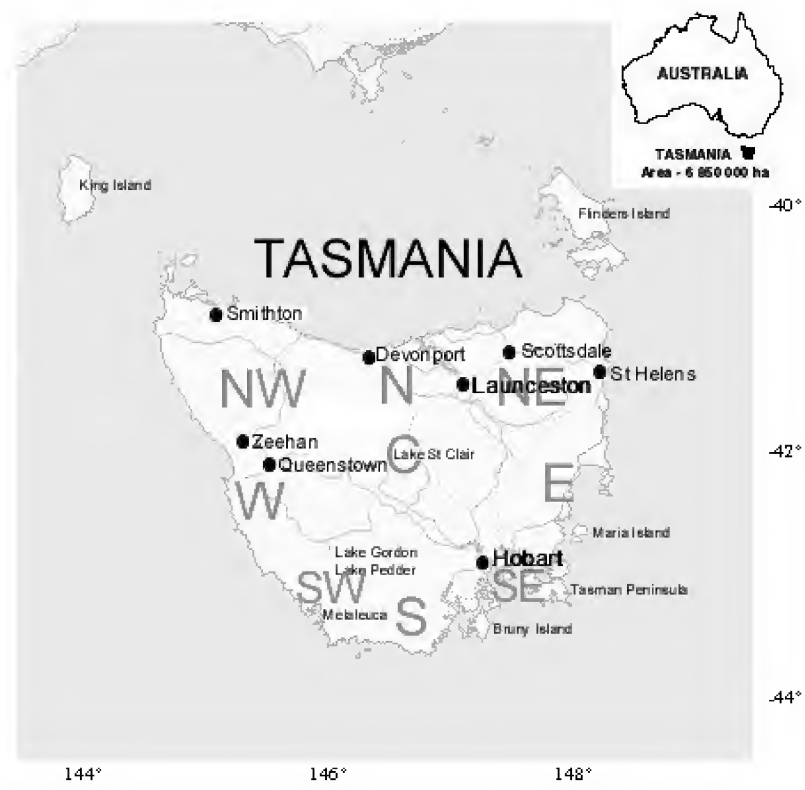


Fig. 8. Map of Tassie.

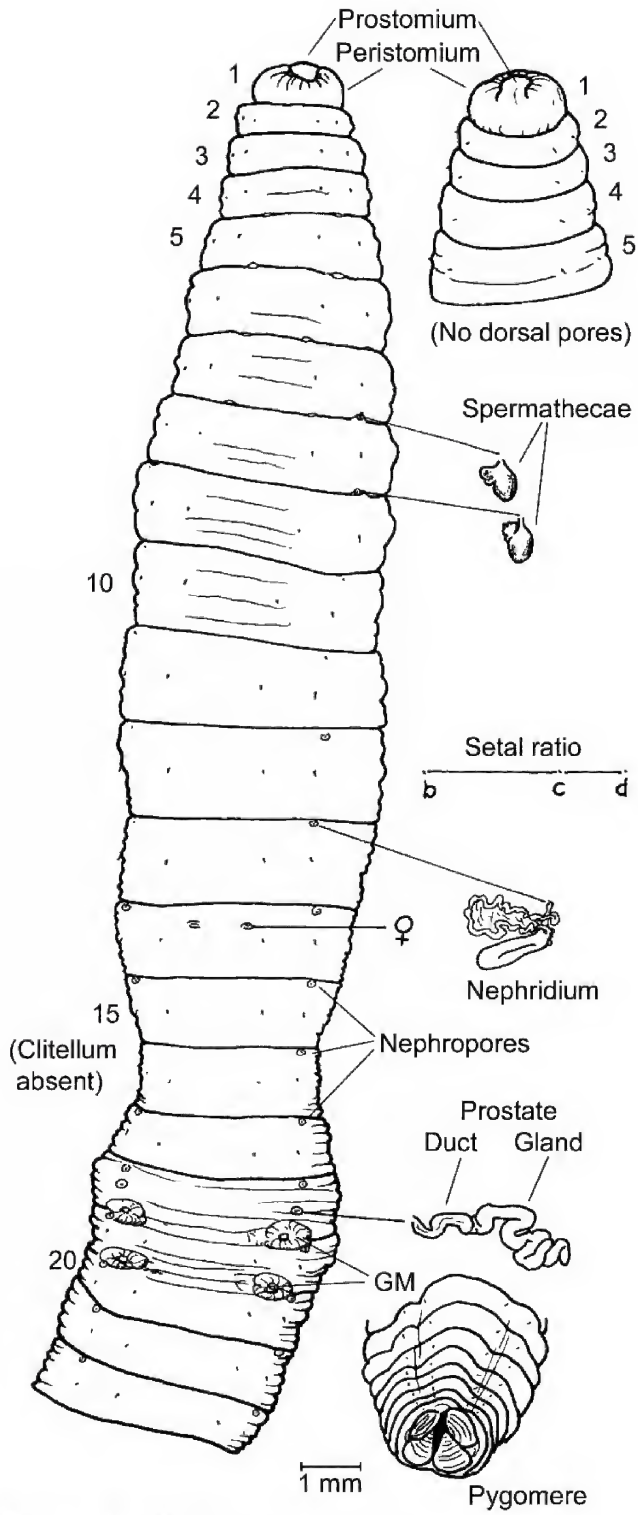


Fig. 9. *Pontodrilus primoris H.*

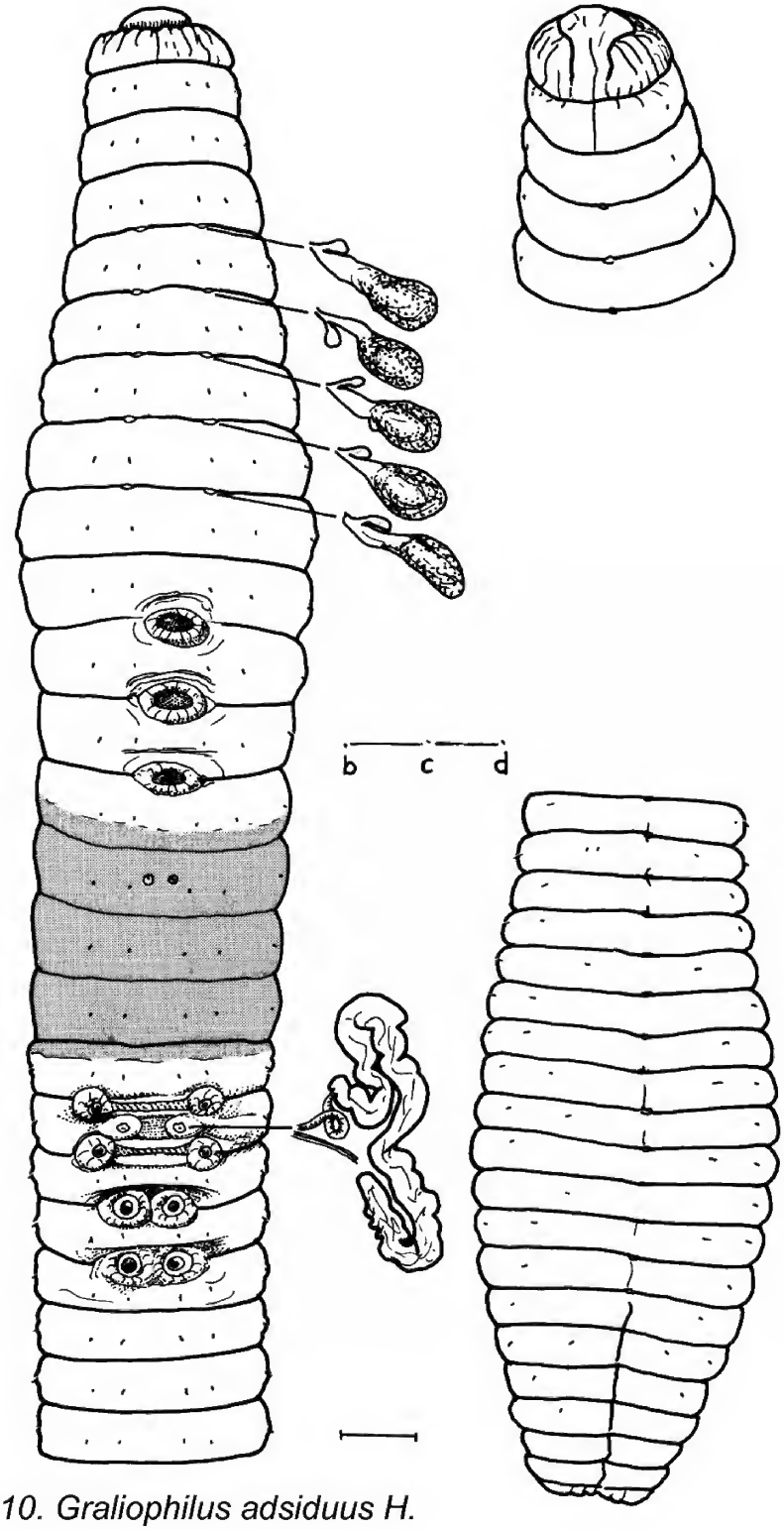


Fig. 10. Graliophilus adsiduus H.

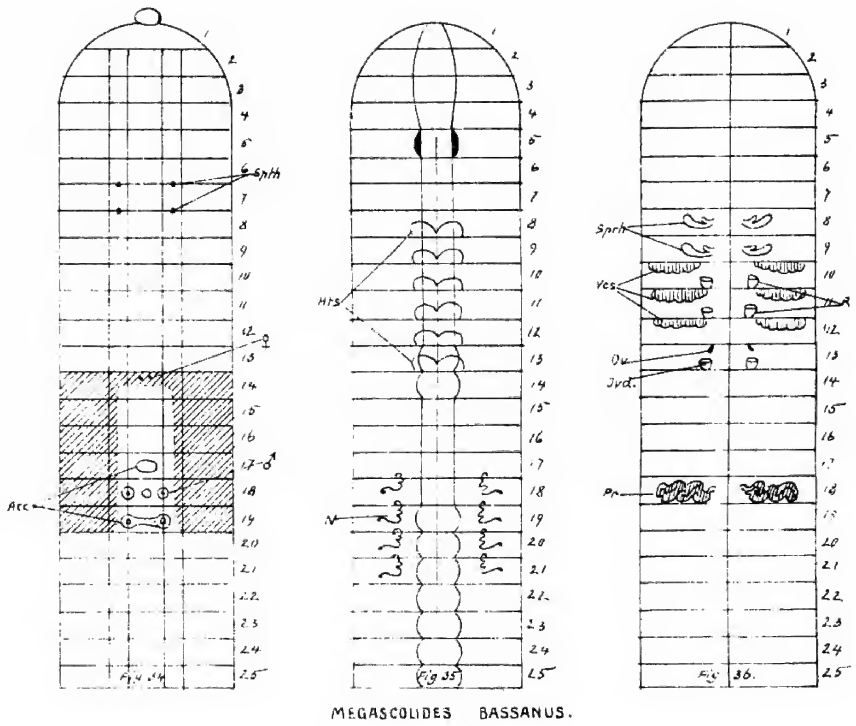


Fig. 11. Graliophilus ? bassanus (Spencer, 1895), after Spencer (1895).

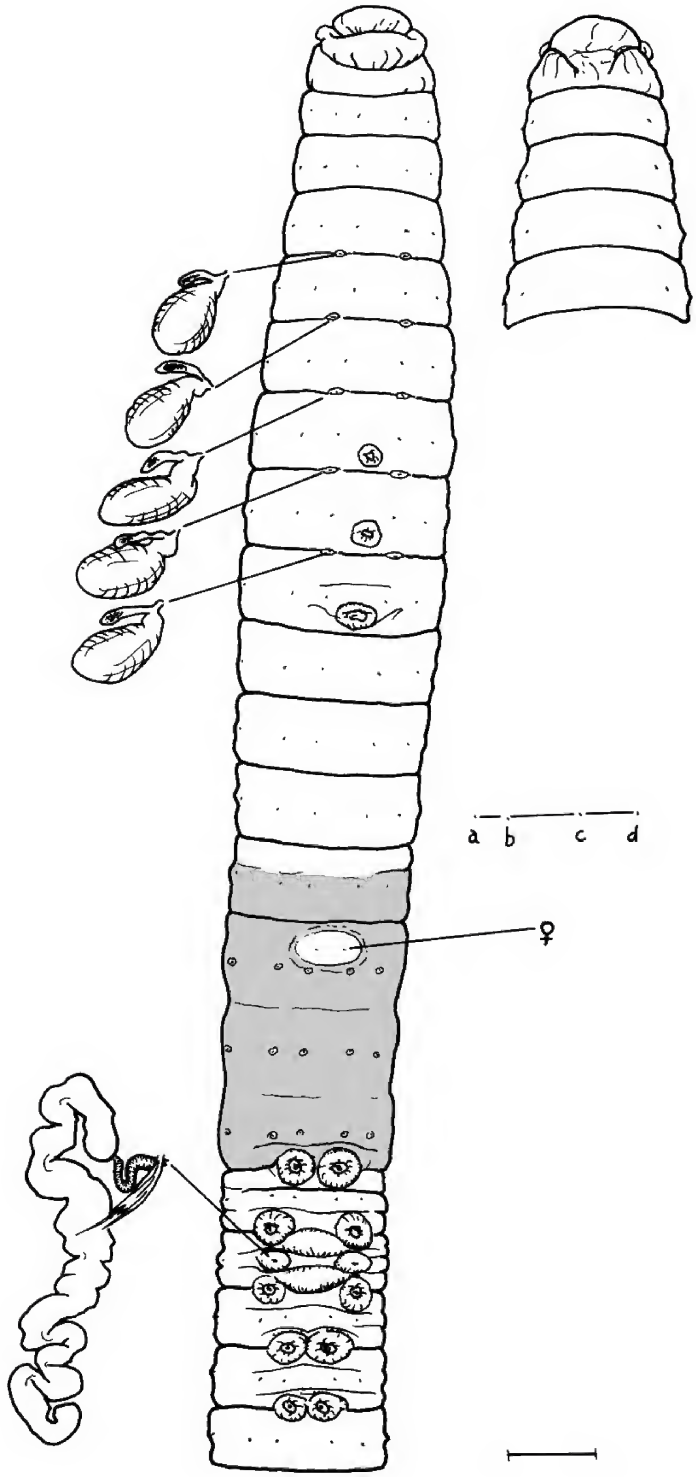


Fig. 12. Graliophilus benlomondi H.

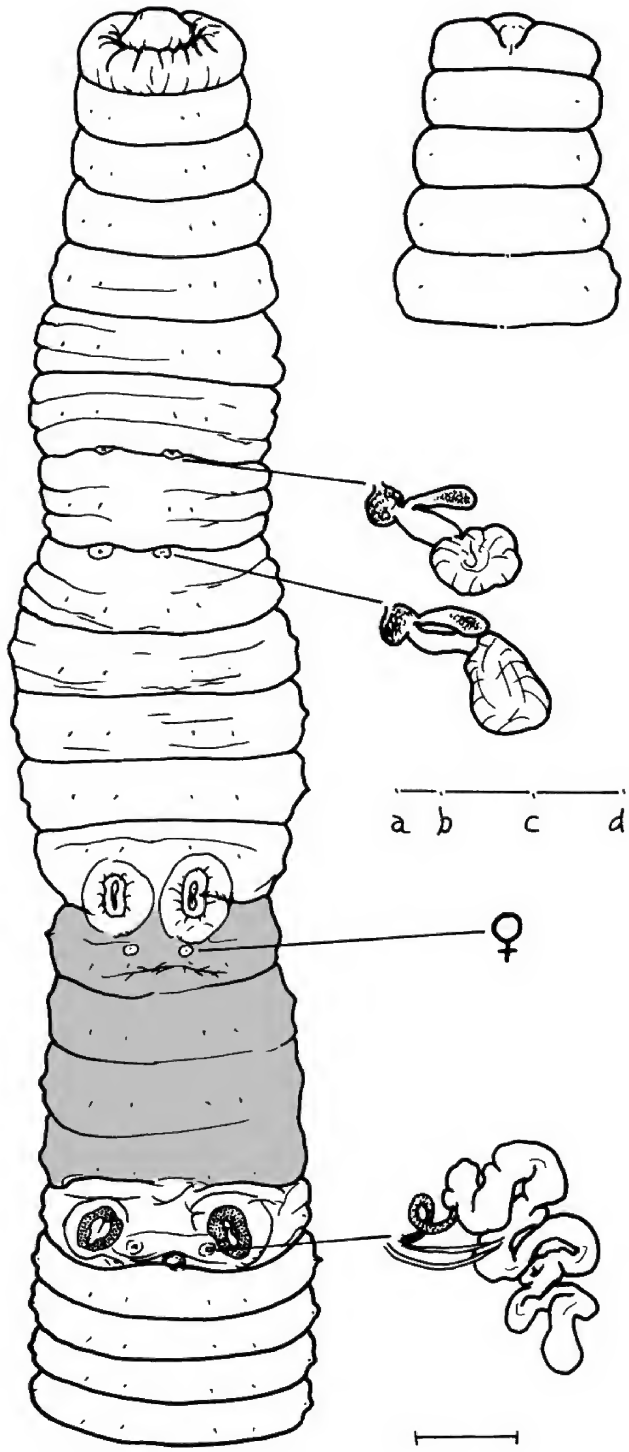


Fig. 13. Graliophilus cooperi H.

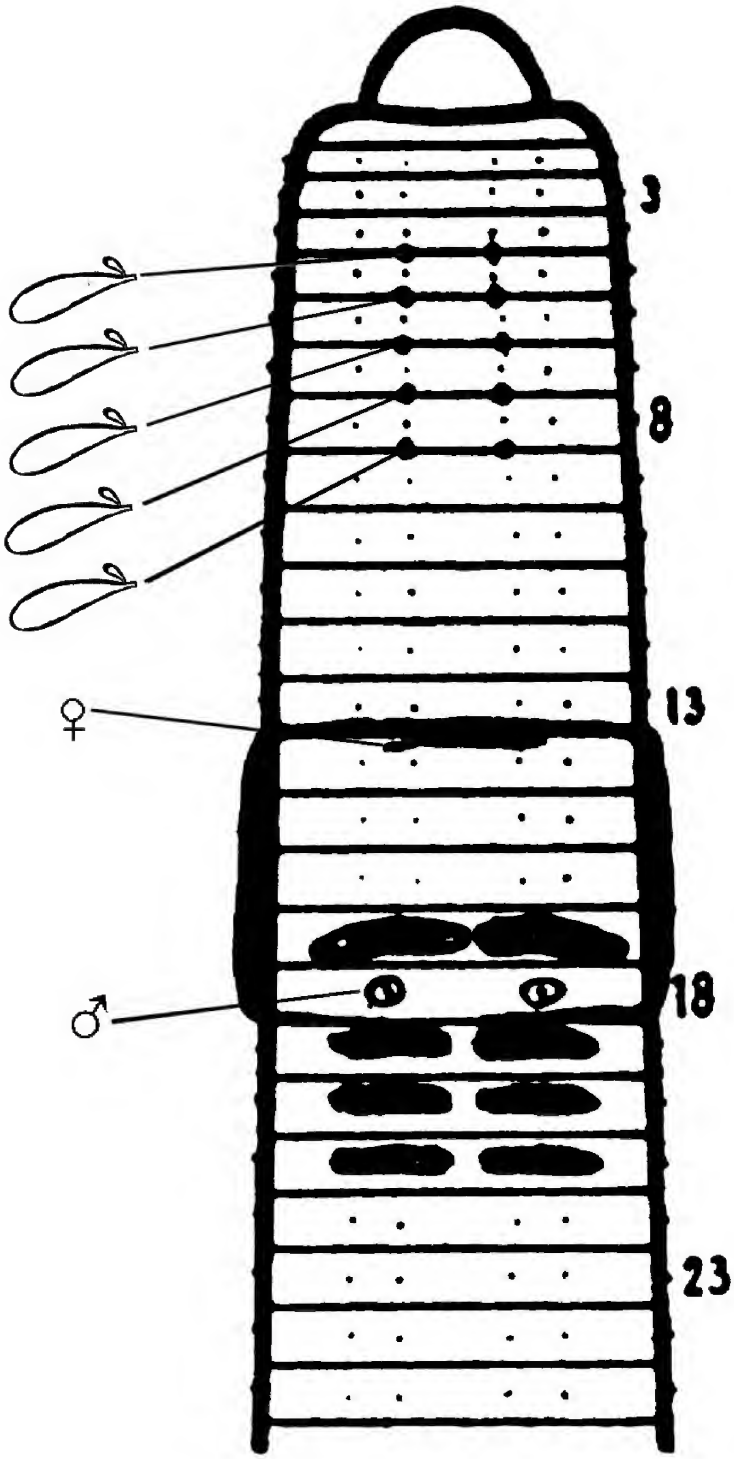


Fig. 14. Graliophilus ? decathecus (Michaelsen, 1910).

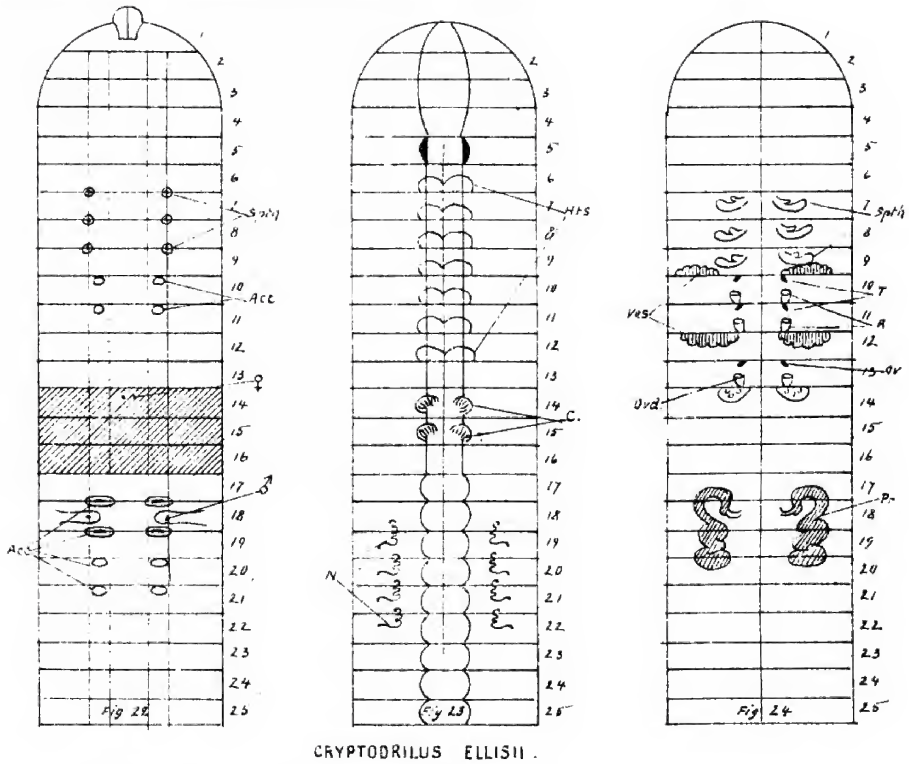


Fig. 15. Graliophilus ellisii (Spencer, 1895),(after Spencer, 1895).

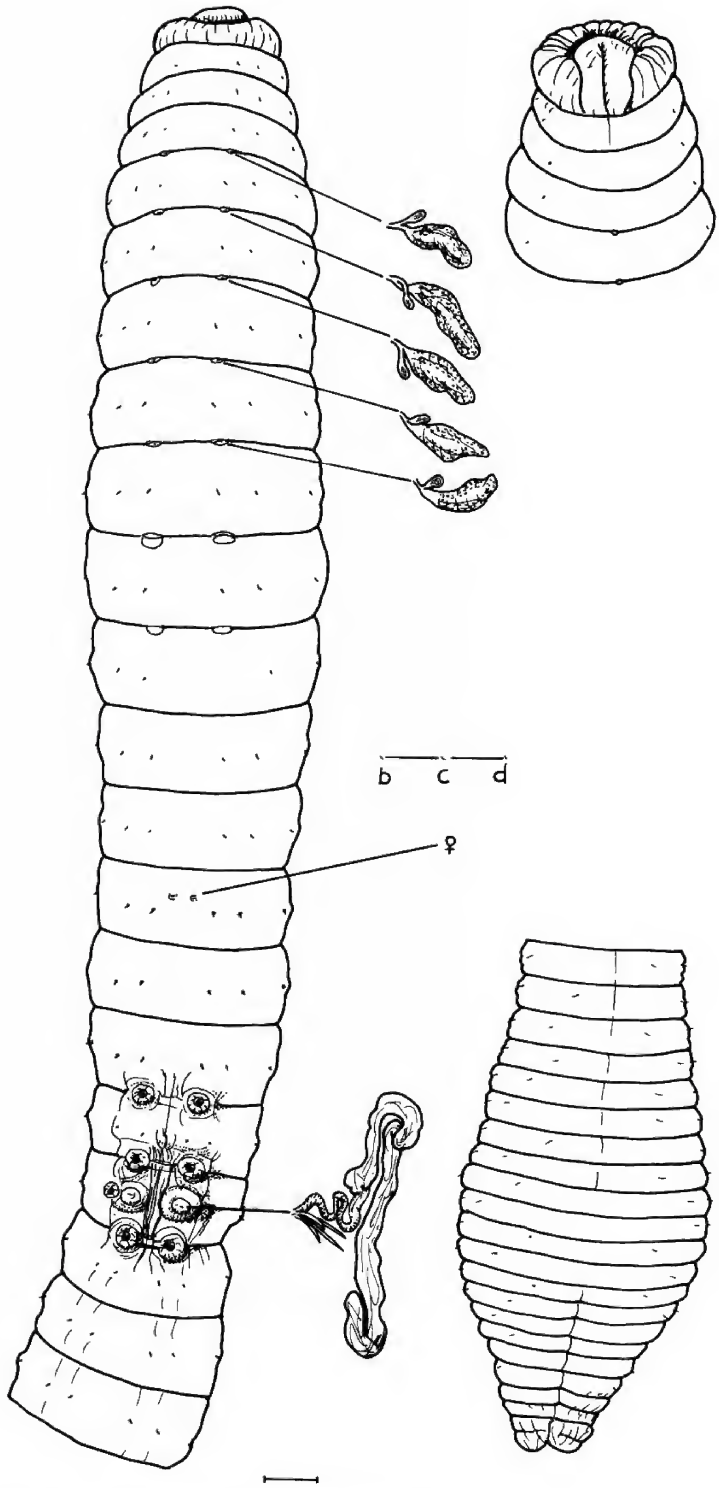


Fig. 16. Graliophilus praestringor, H.

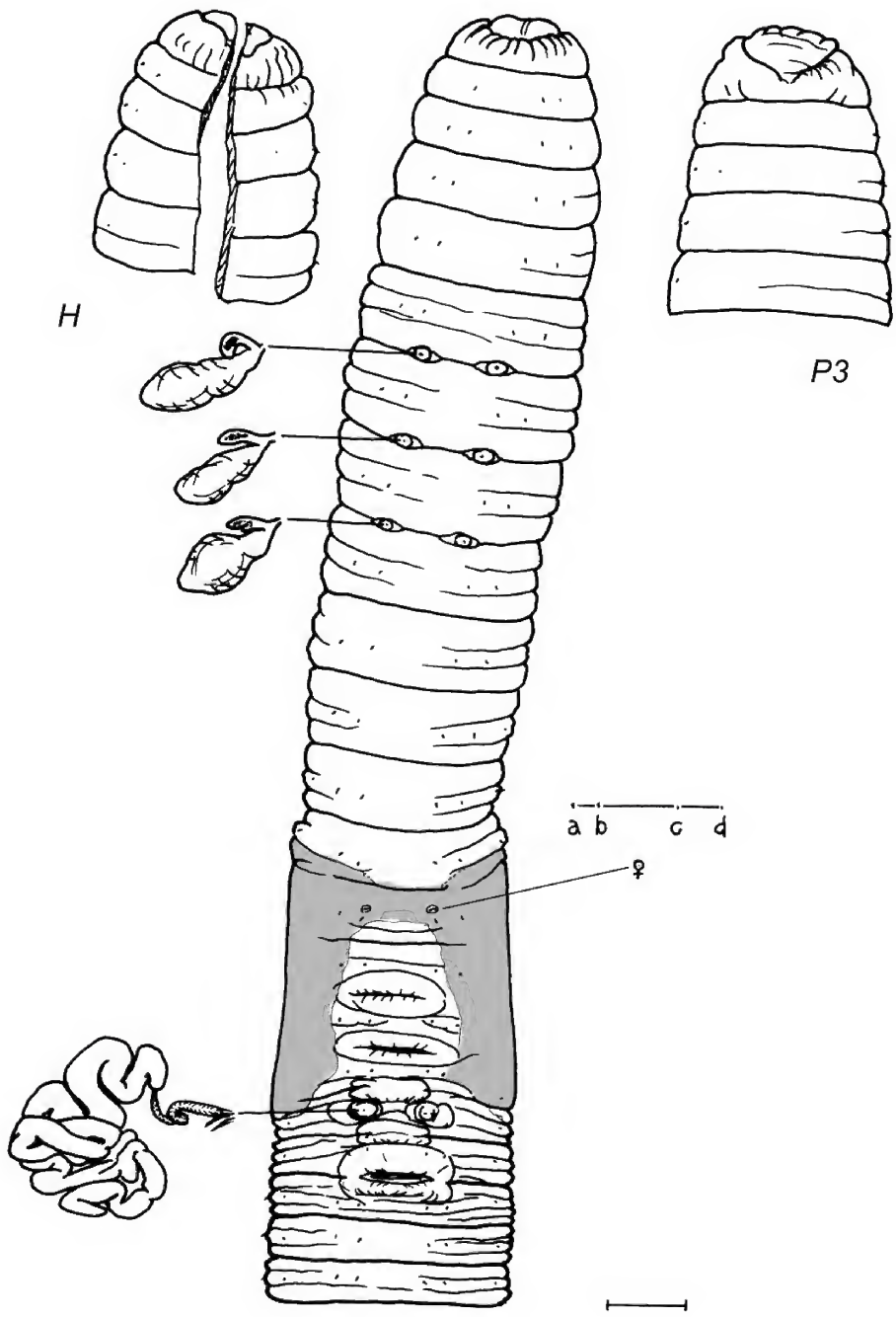


Fig. 17. Graliophilus tripapillatus (Jamieson, 1974), H.

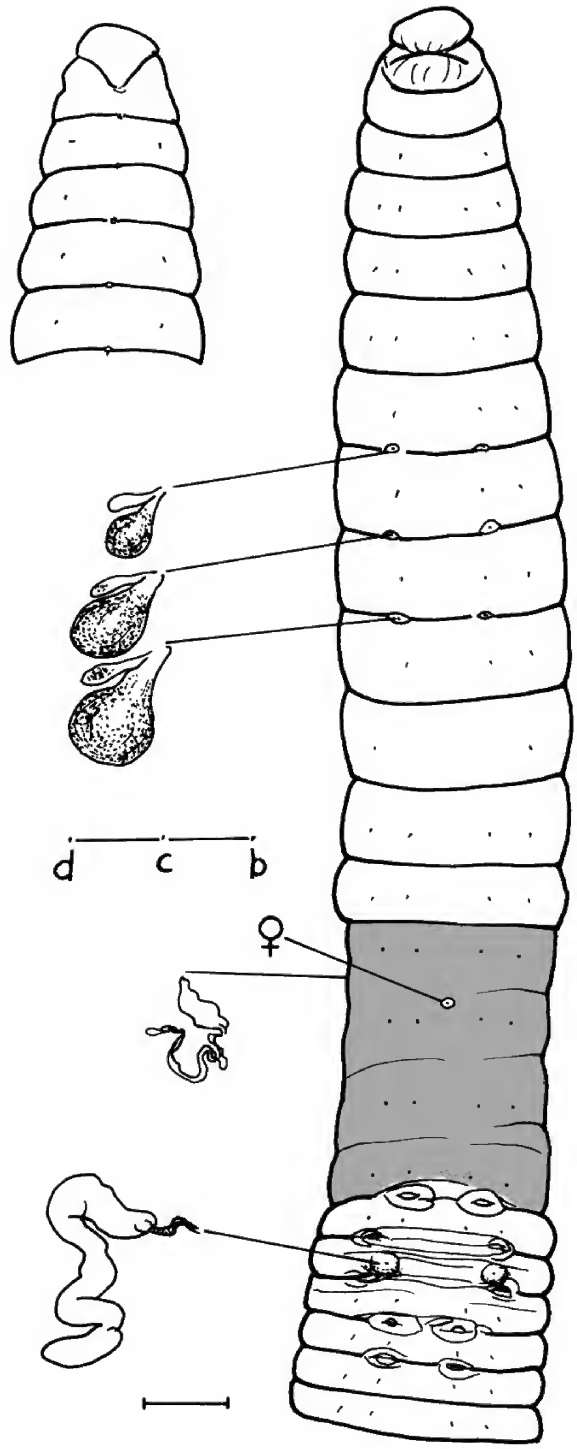


Fig. 18. Vesiculodrilus albus, H.

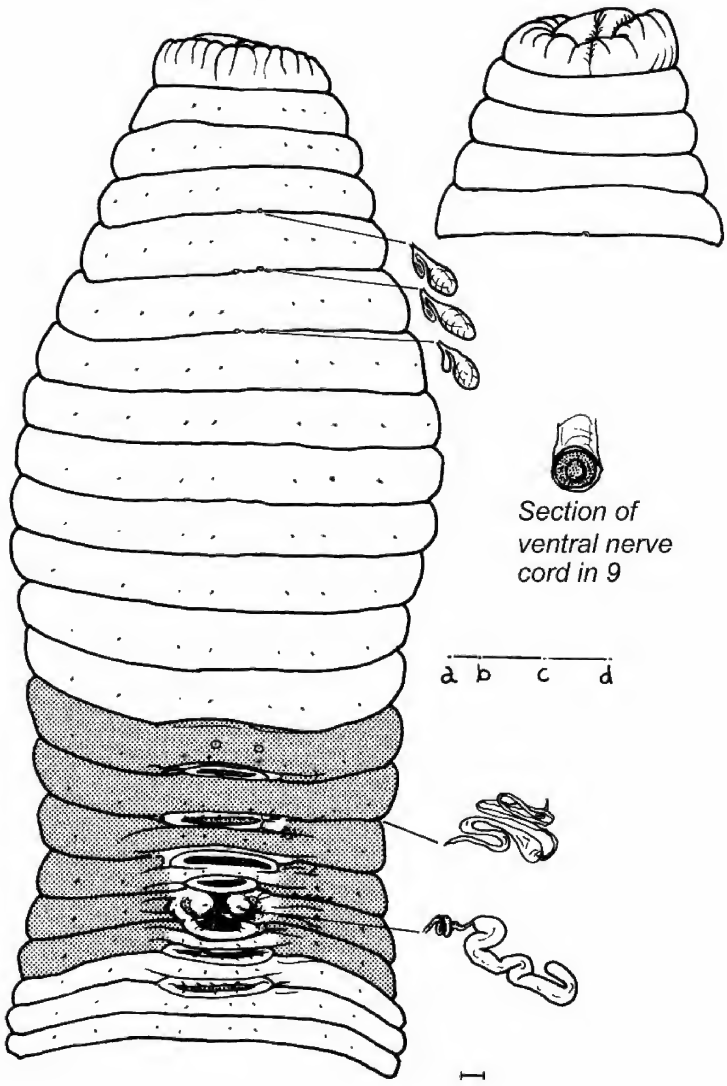


Fig. 19. Vesiculodrilus ansoni, H.

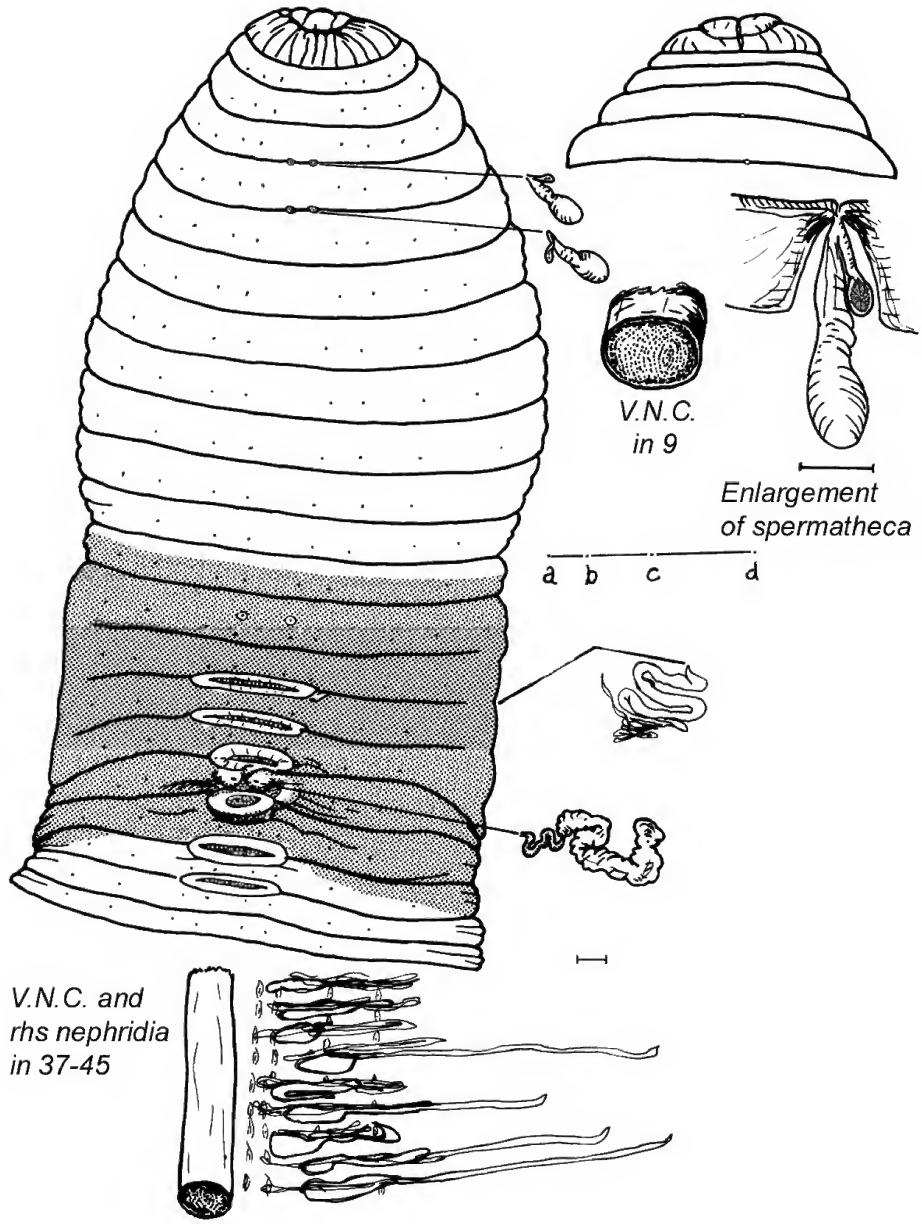


Fig. 20. Vesiculodrilus apris, H.

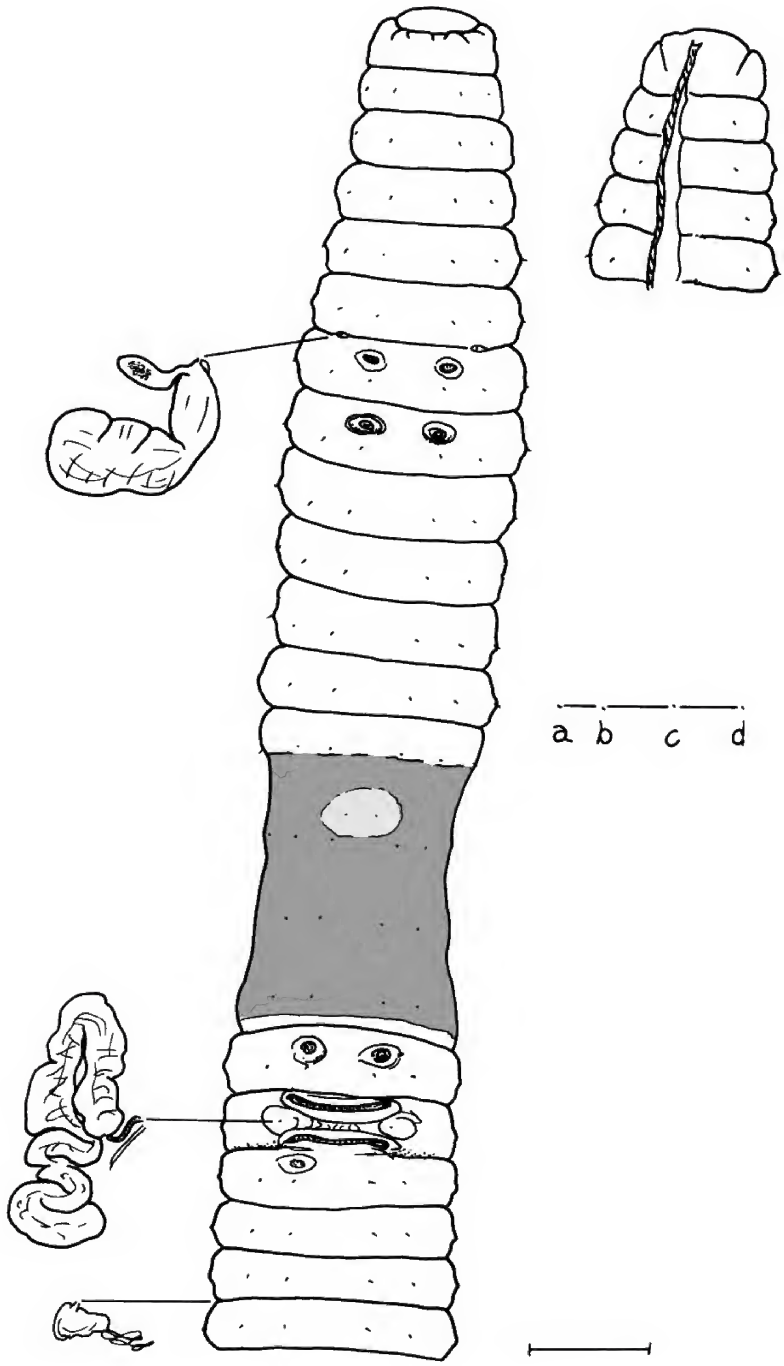


Fig. 21. Vesiculodrilus bithecatus (Jamieson, 1974), H.

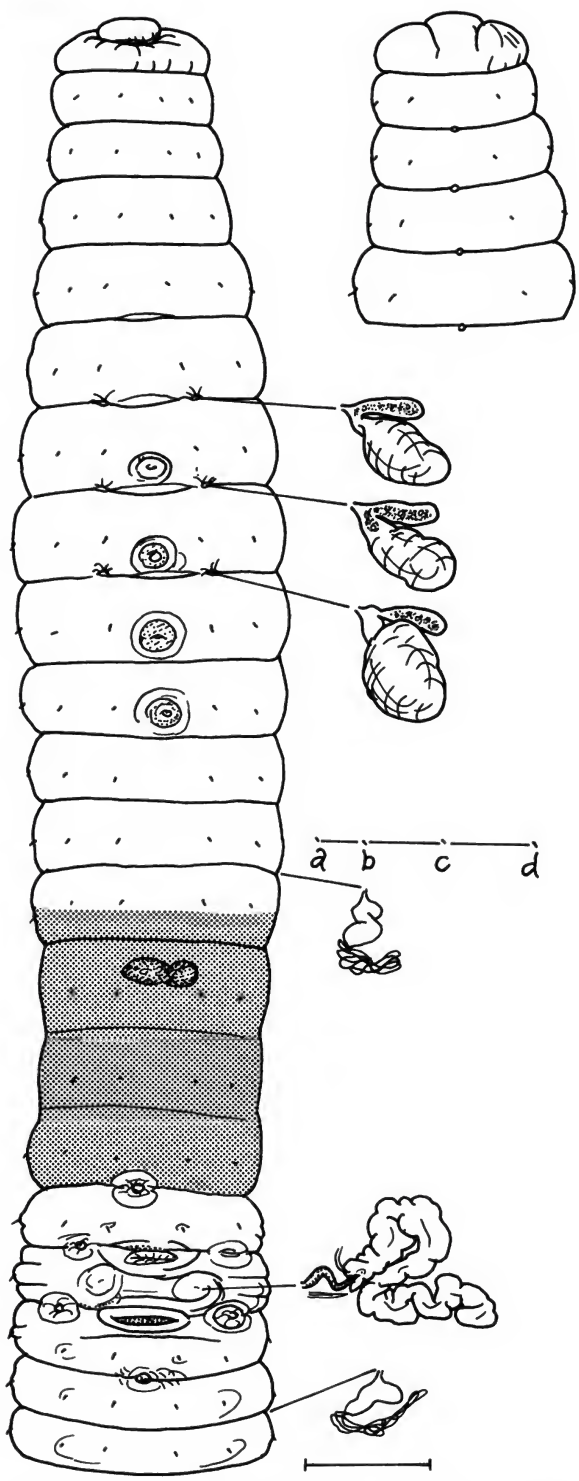


Fig. 22. Vesiculodrilus borealis Blakemore, 2000, H.

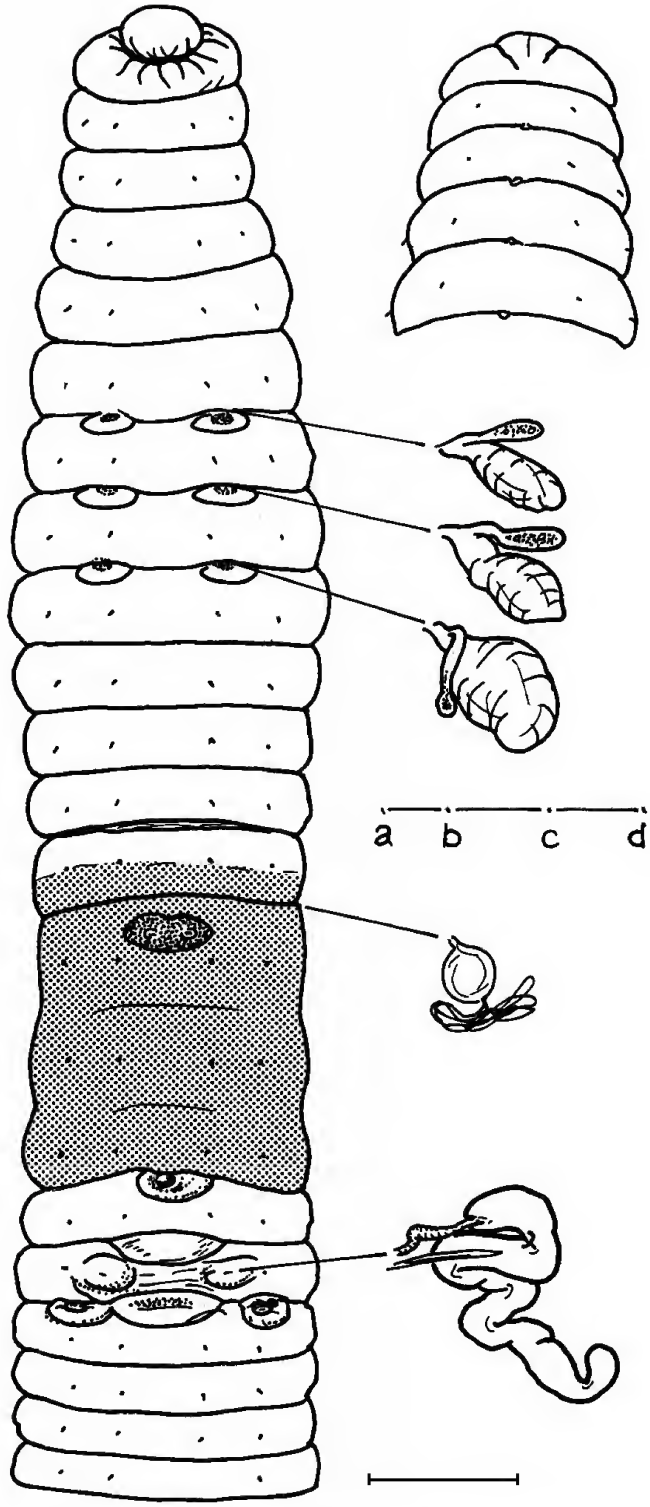


Fig. 23. Vesiculodrilus borealis Blakemore, 2000, P1.

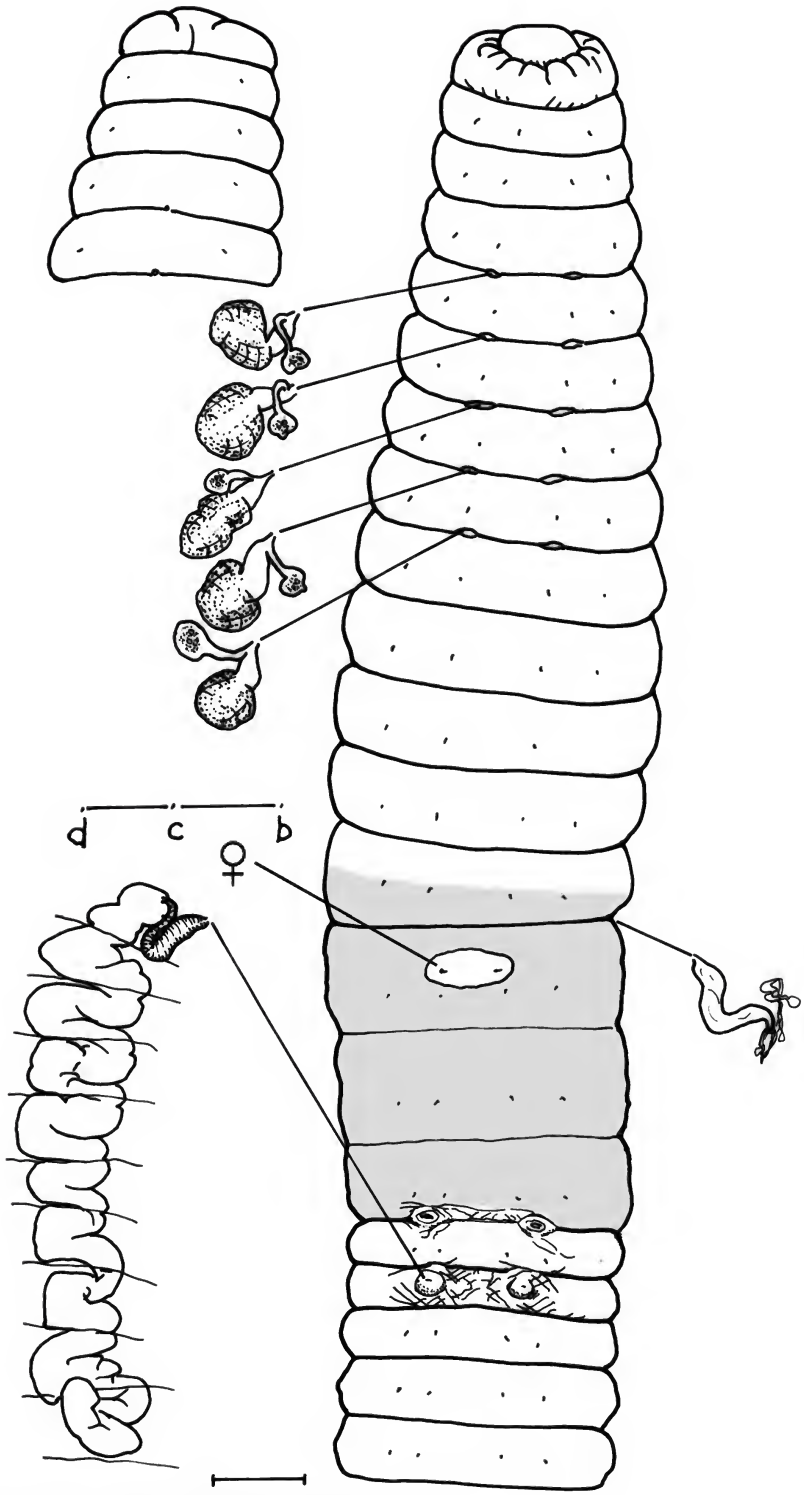


Fig. 24. Vesiculodrilus bronte, H.

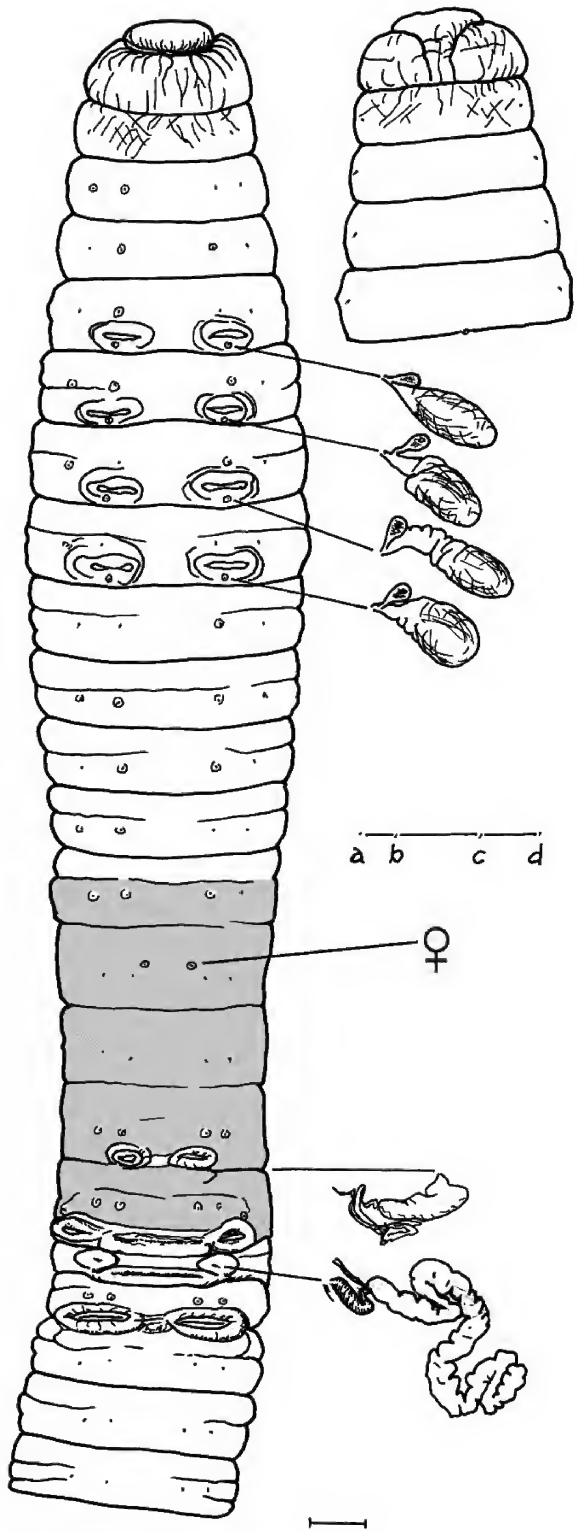


Fig. 25. Vesiculodrilus brunyi, H.

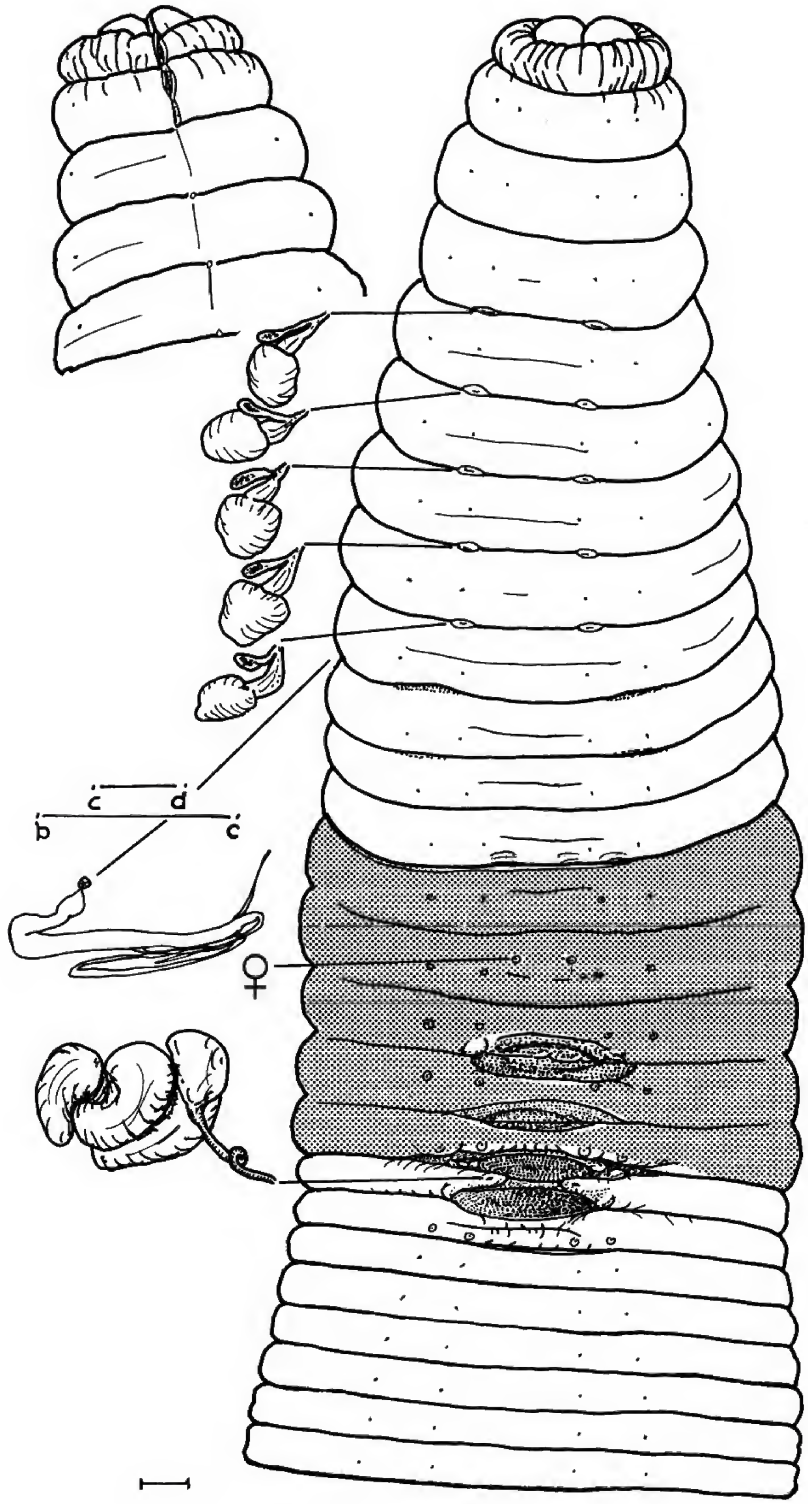


Fig. 26. Vesiculodrilus bufalus, H.

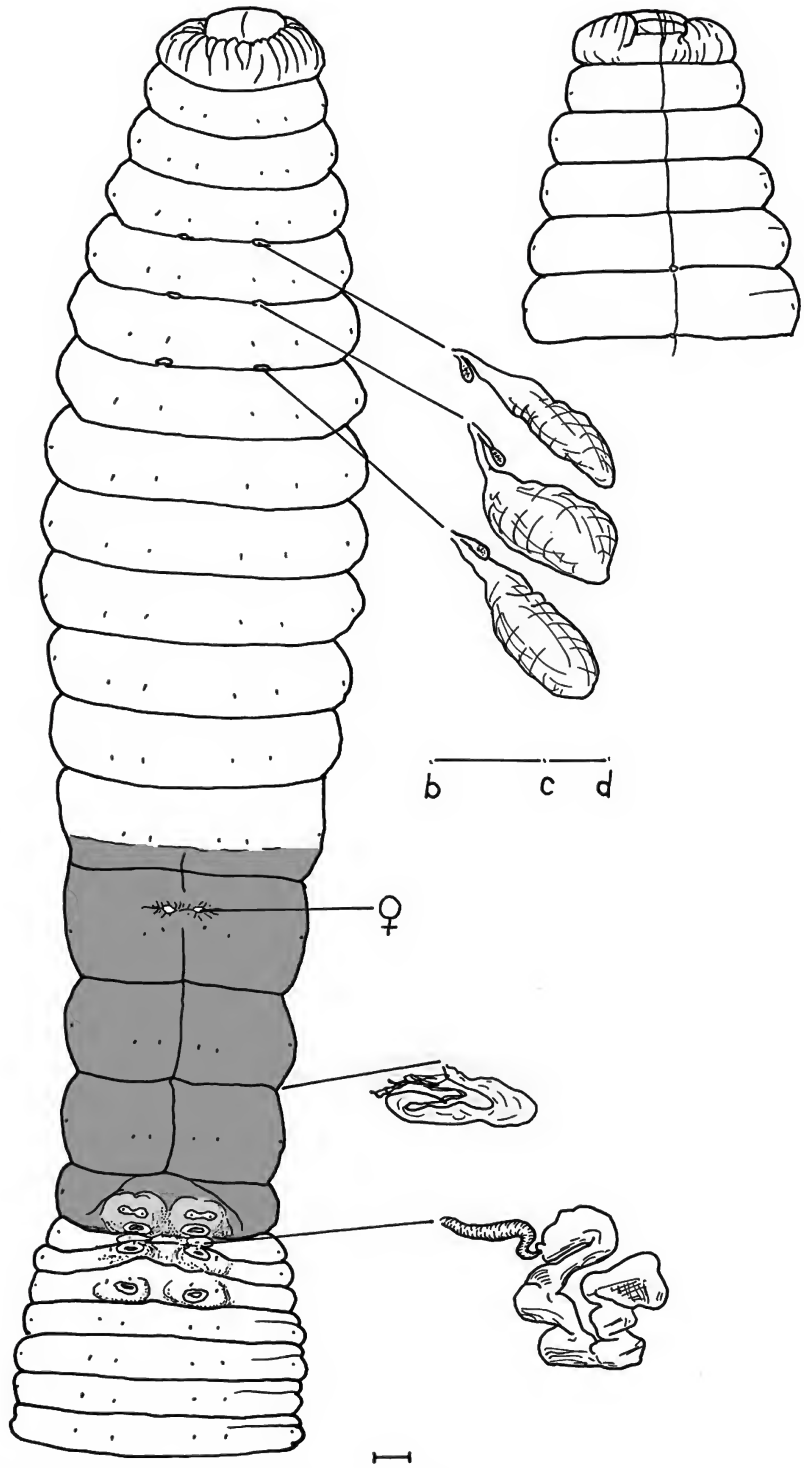


Fig. 27. Vesiculodrilus canaliculatus, H.

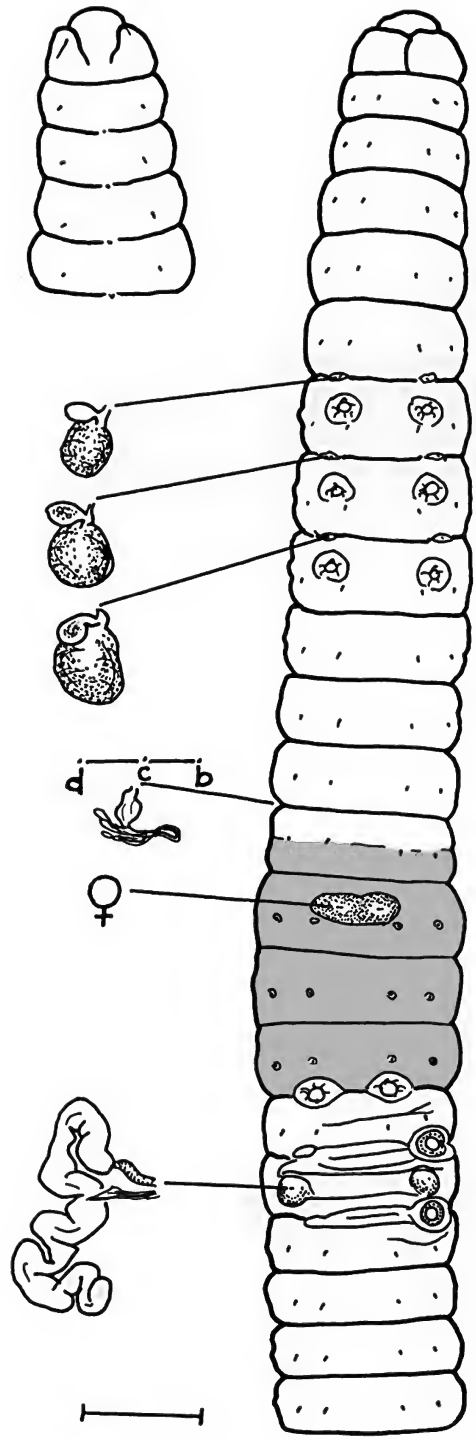


Fig. 28. Vesiculodrilus culminis, H.

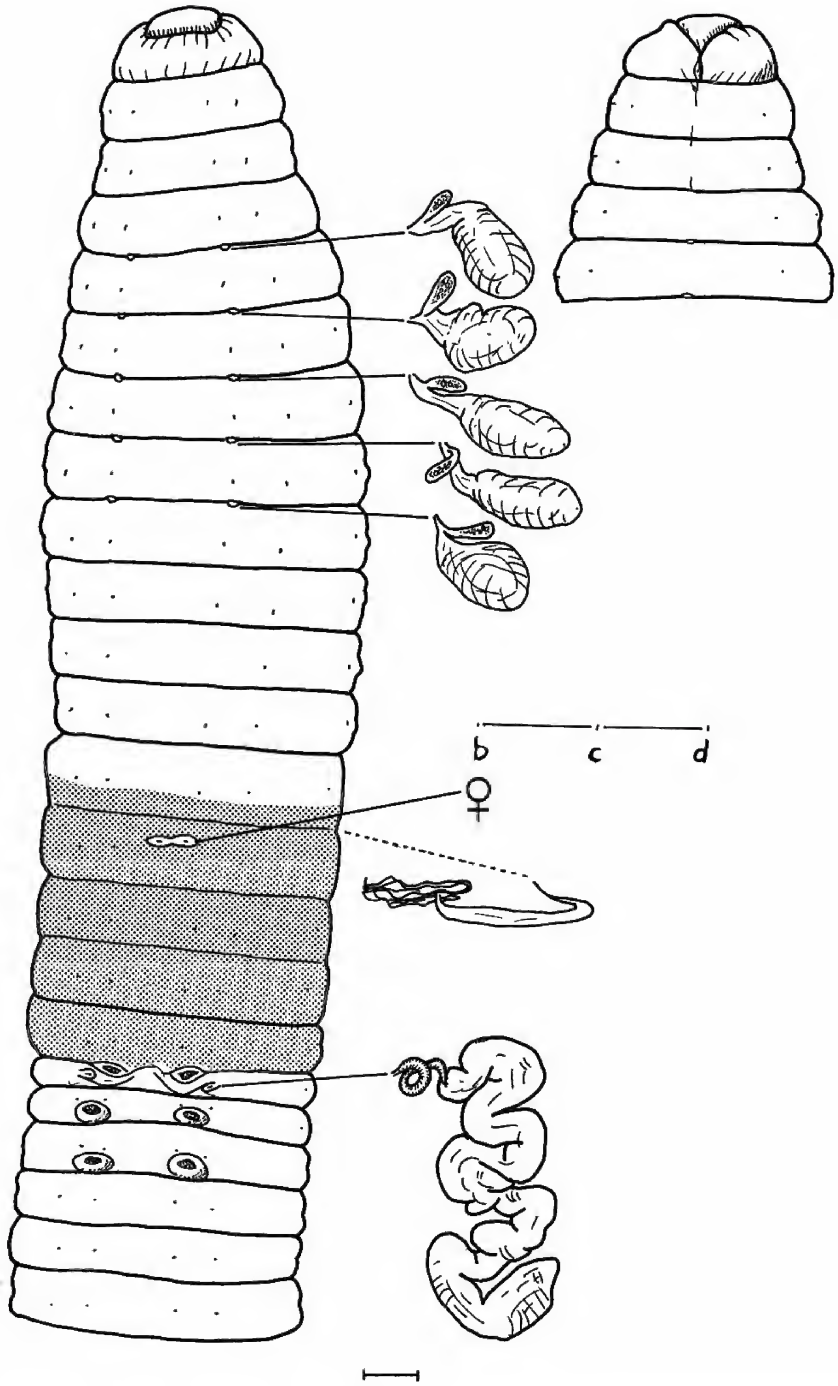


Fig. 29. Vesiculodrilus cuneatus, H.

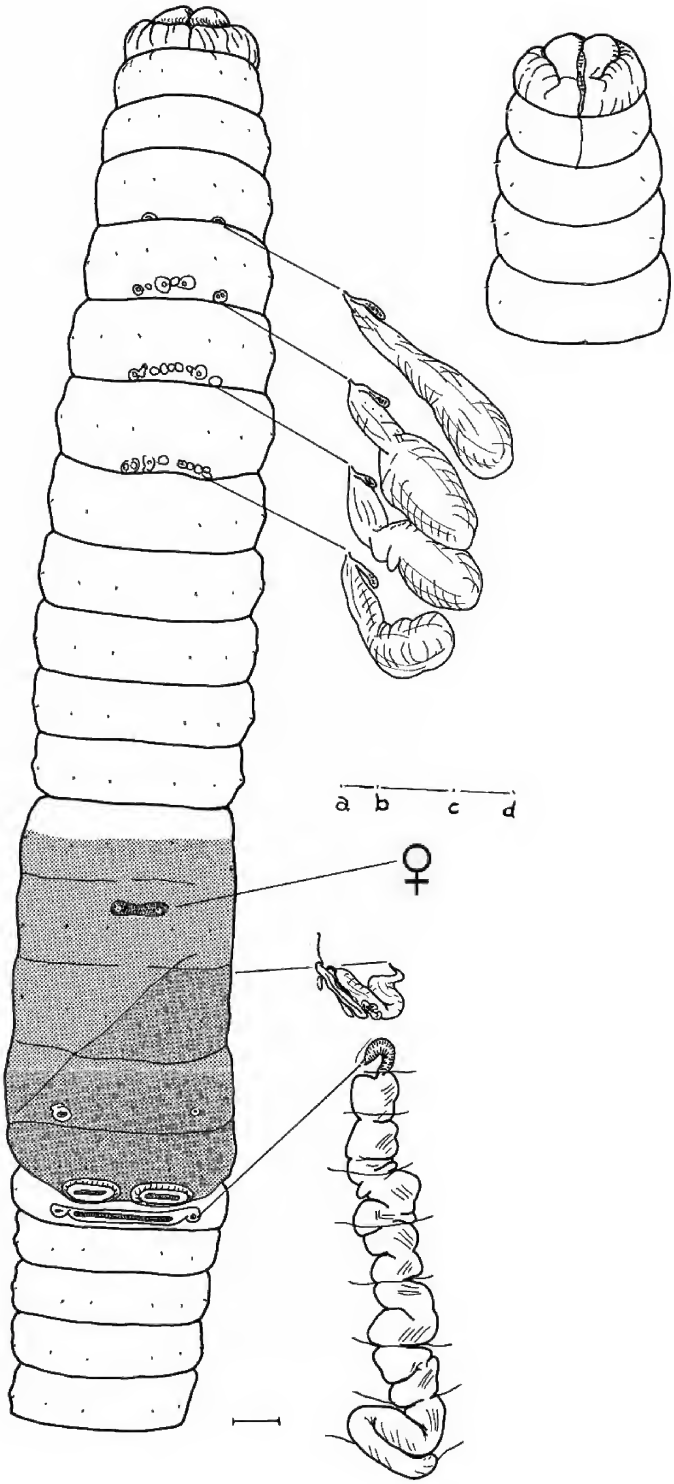


Fig. 30. Vesiculodrilus cygnus, H.

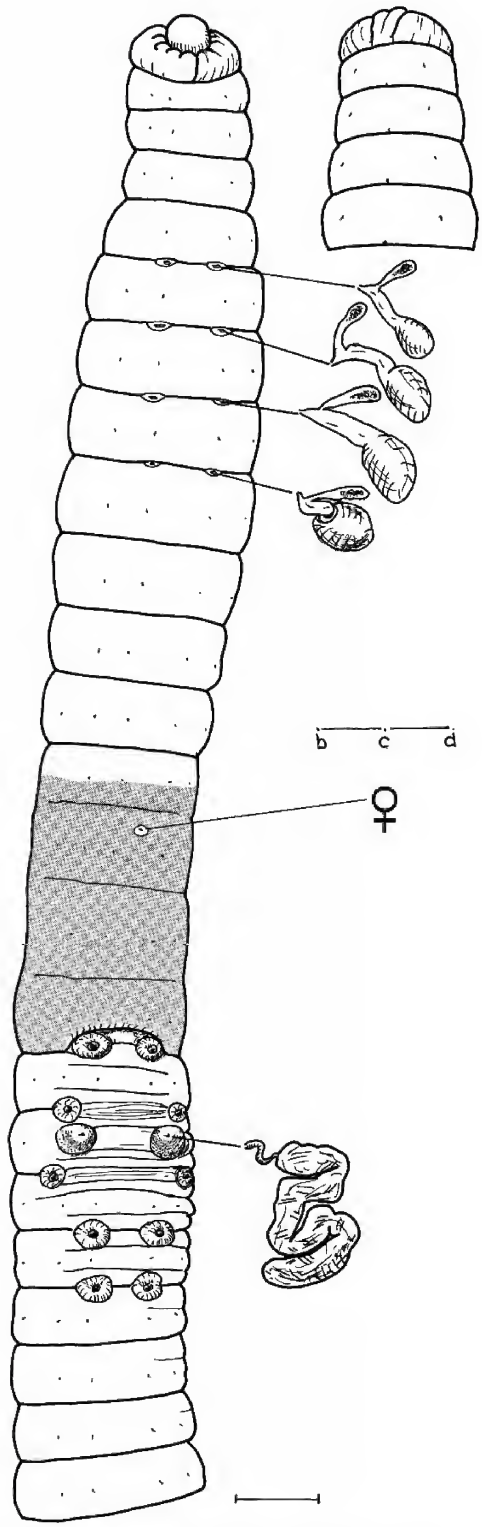


Fig. 31. Vesiculodrilus dendrophagus, H.

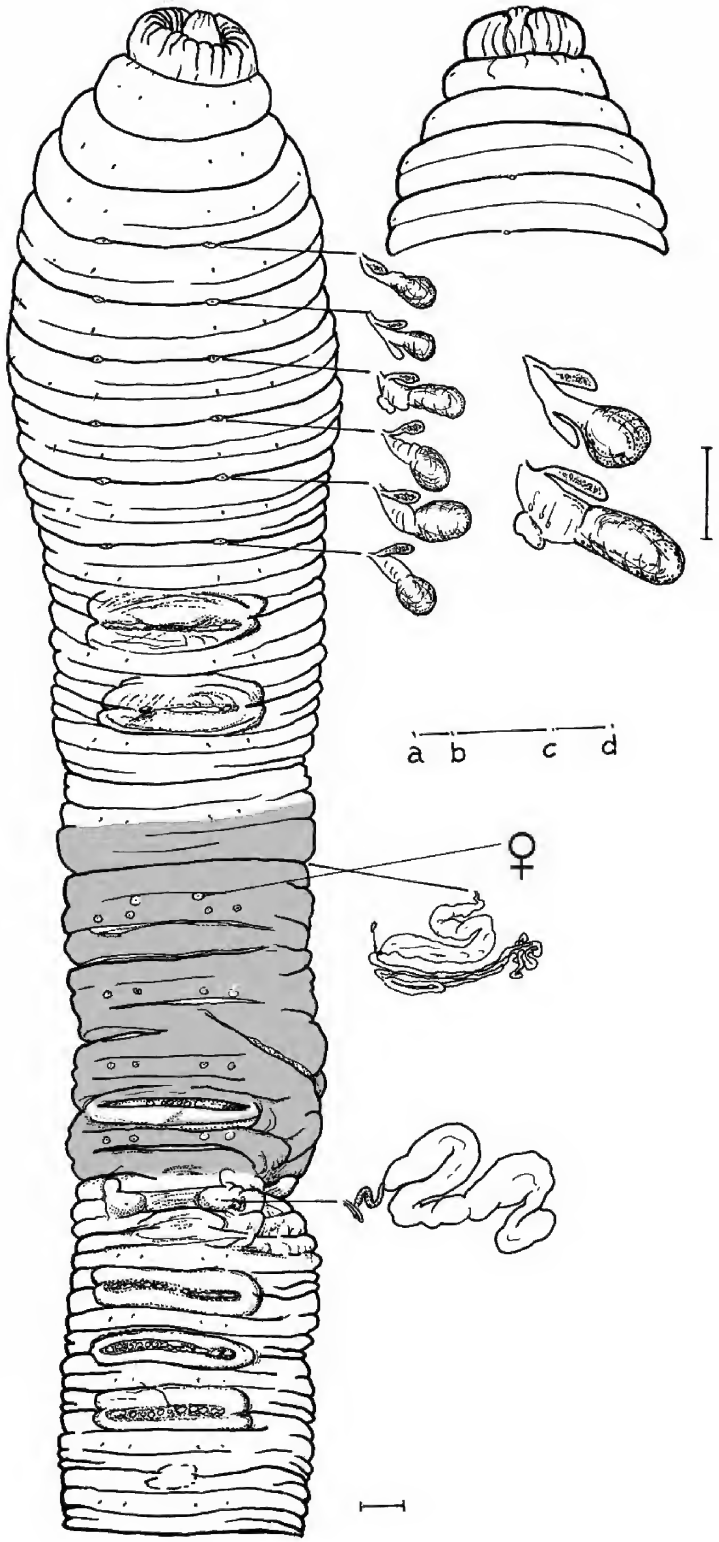


Fig. 32. Vesiculodrilus duodecithecatus, H.

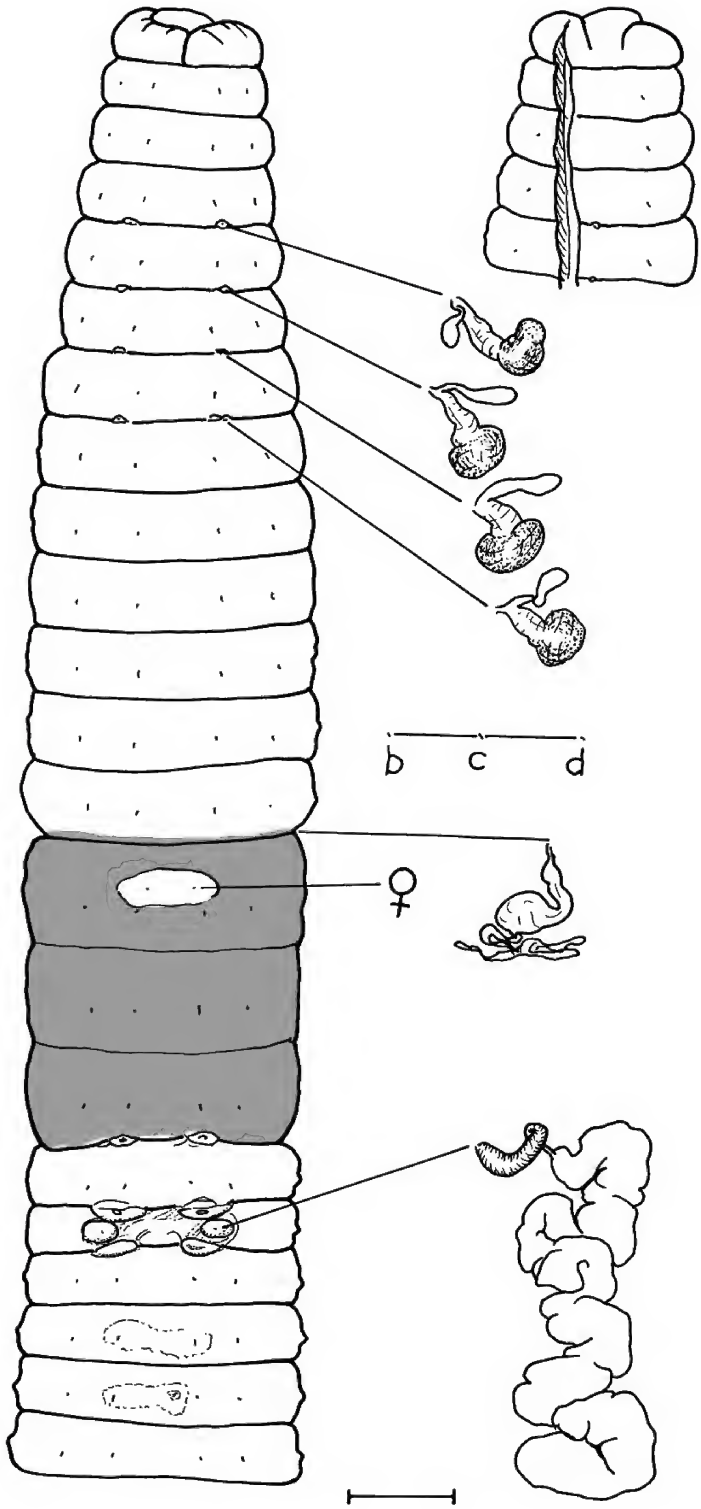


Fig. 33. Vesiculodrilus emu, H.

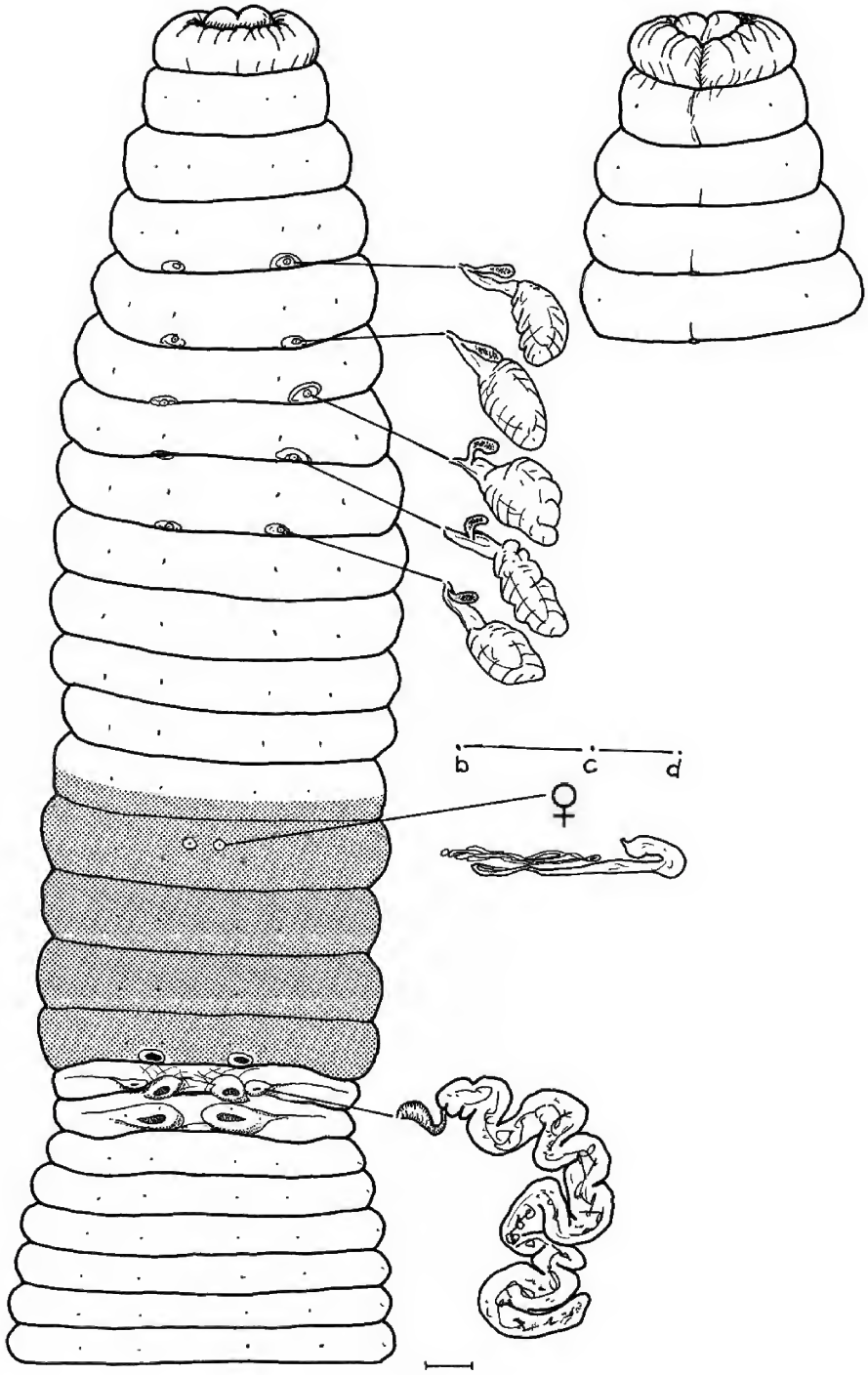


Fig. 34. Vesiculodrilus fictilis, H.

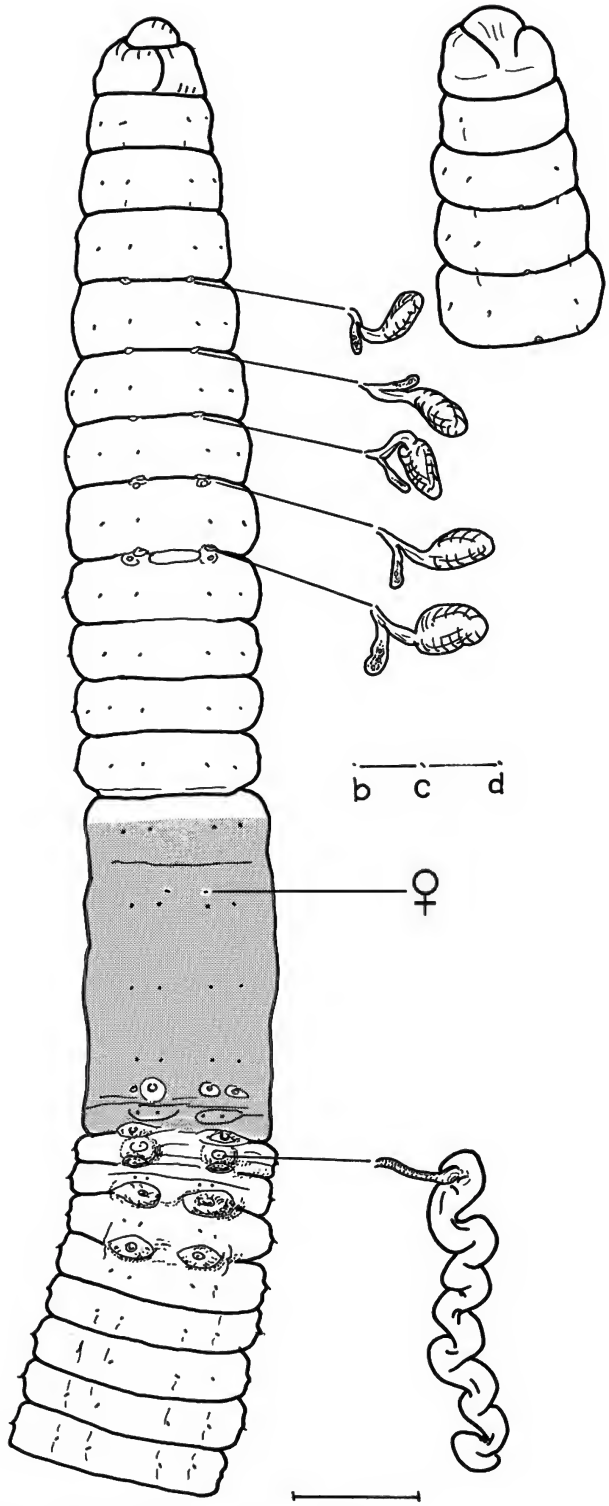


Fig. 35. Vesiculodrilus fingal, H.

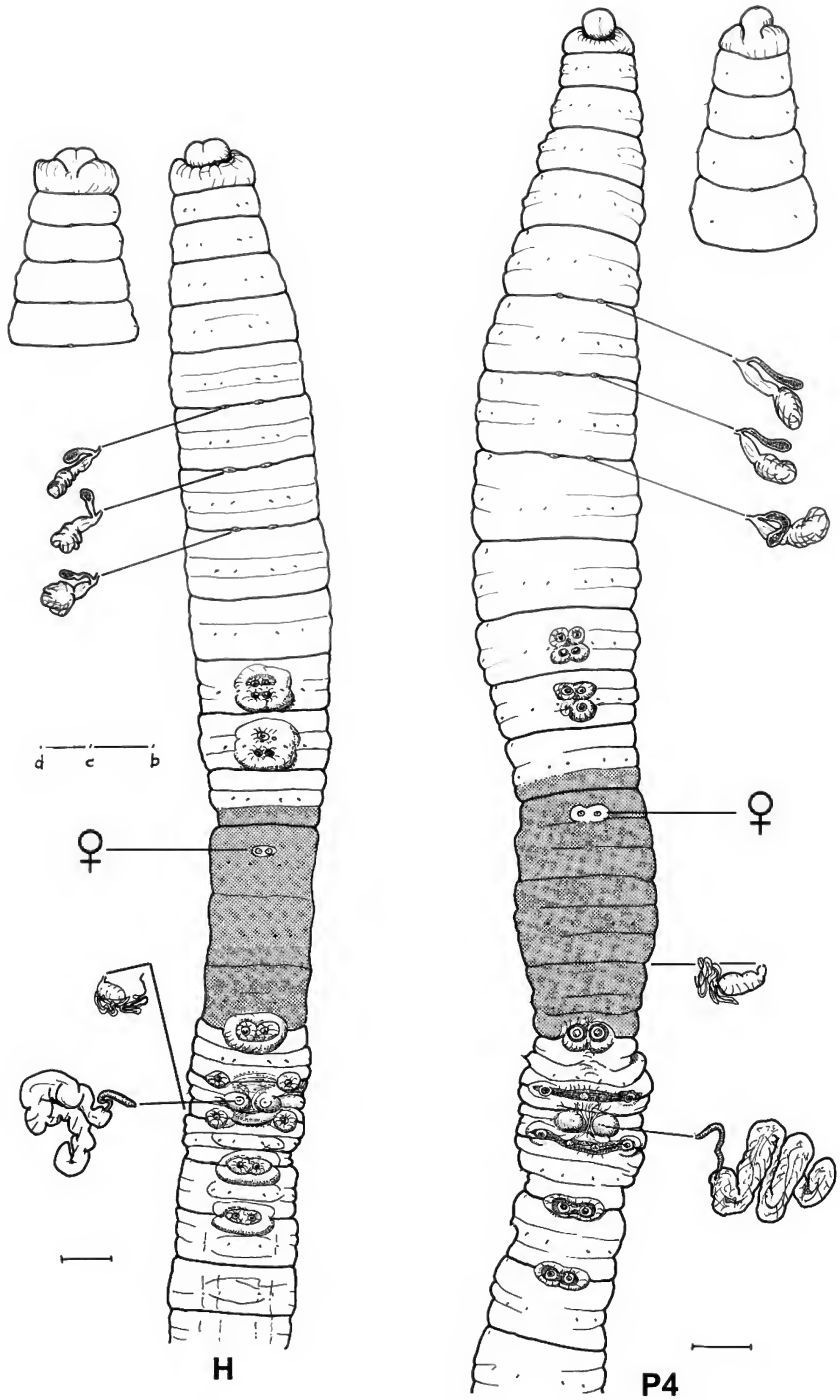


Fig. 36. Vesiculodrilus fonsager, H, P4.

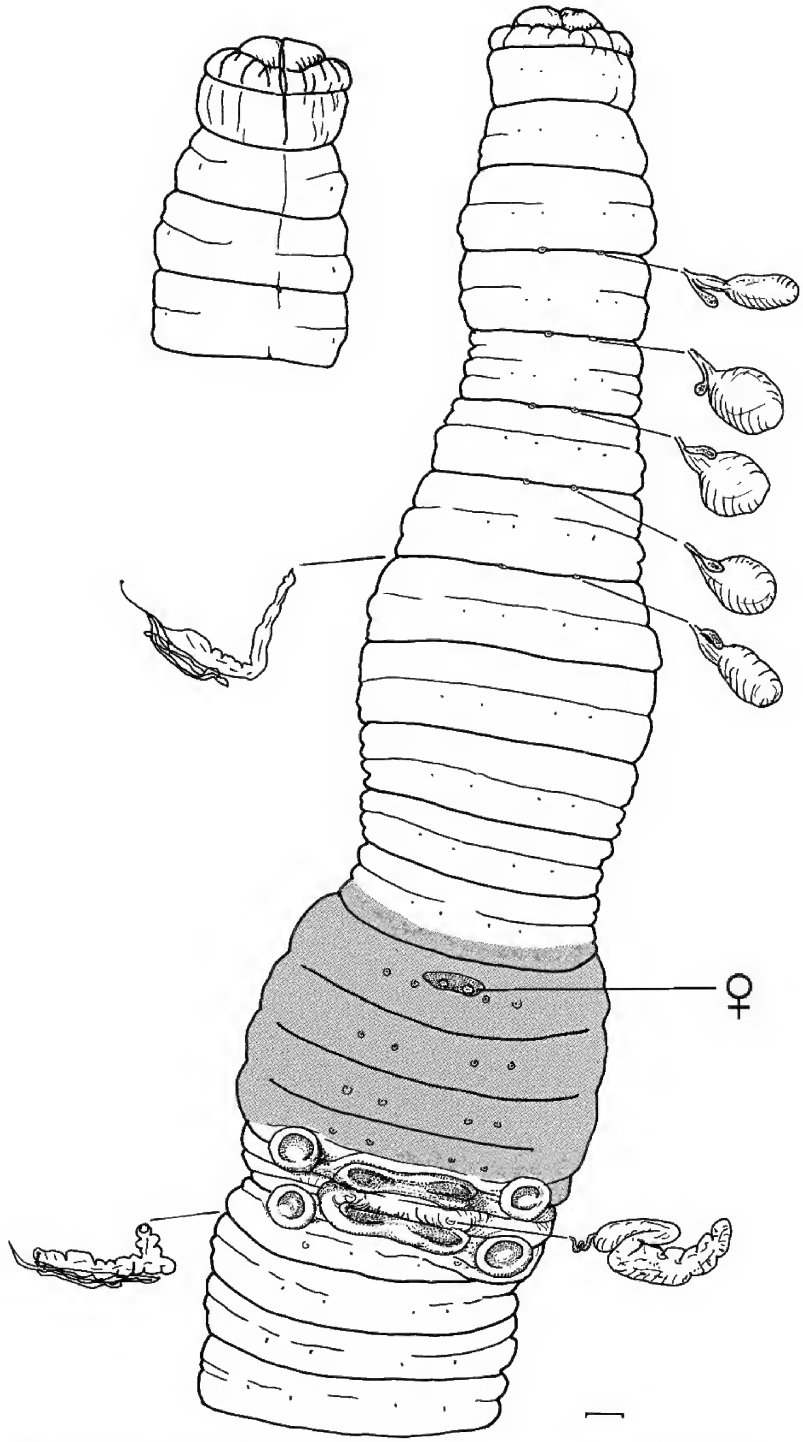
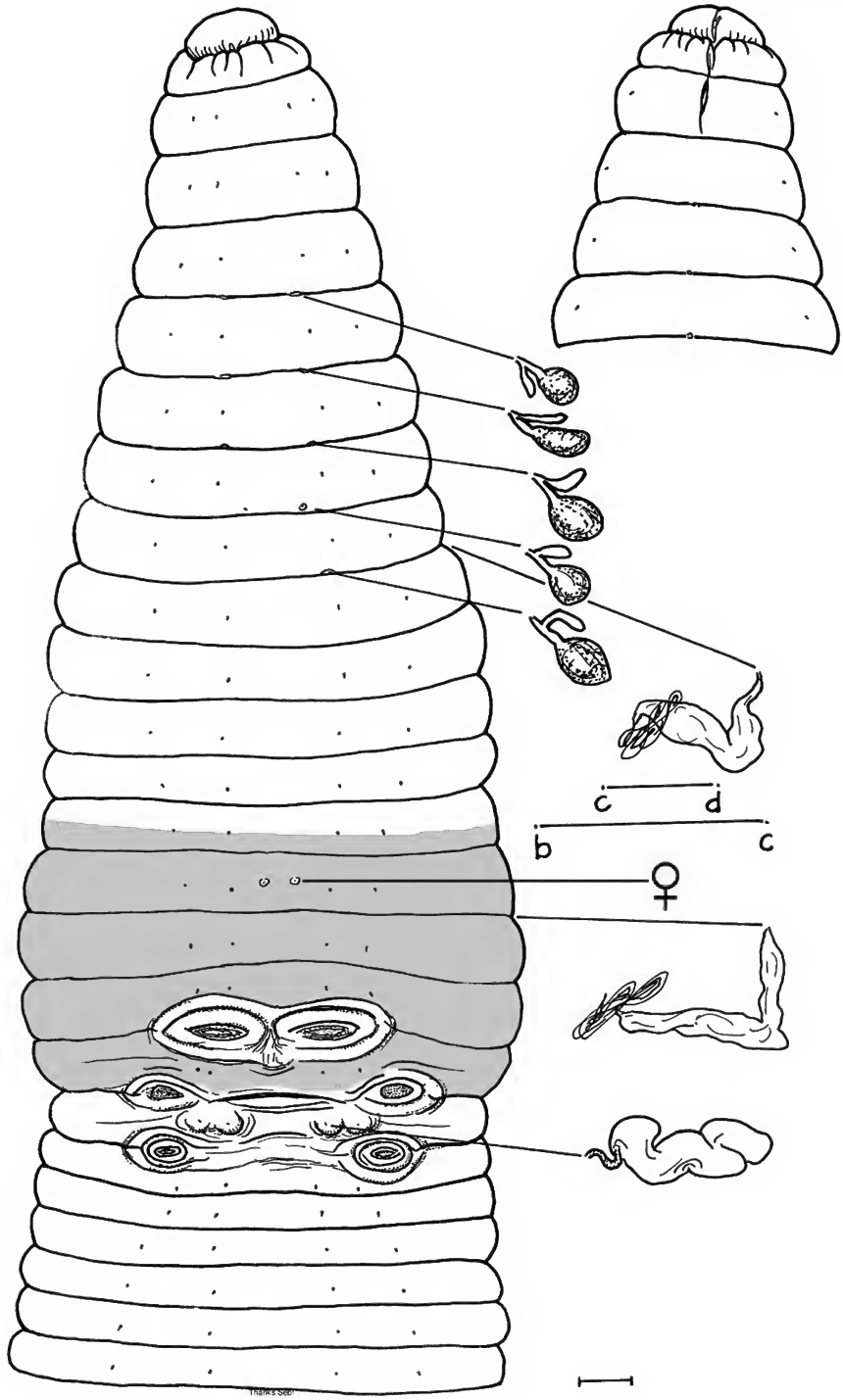


Fig. 37. Vesiculodrilus g. glandiferus (Jam., 1974), 14:3120.



Figs. 38. Vesiculodrilus glandiferus pyengana, H.

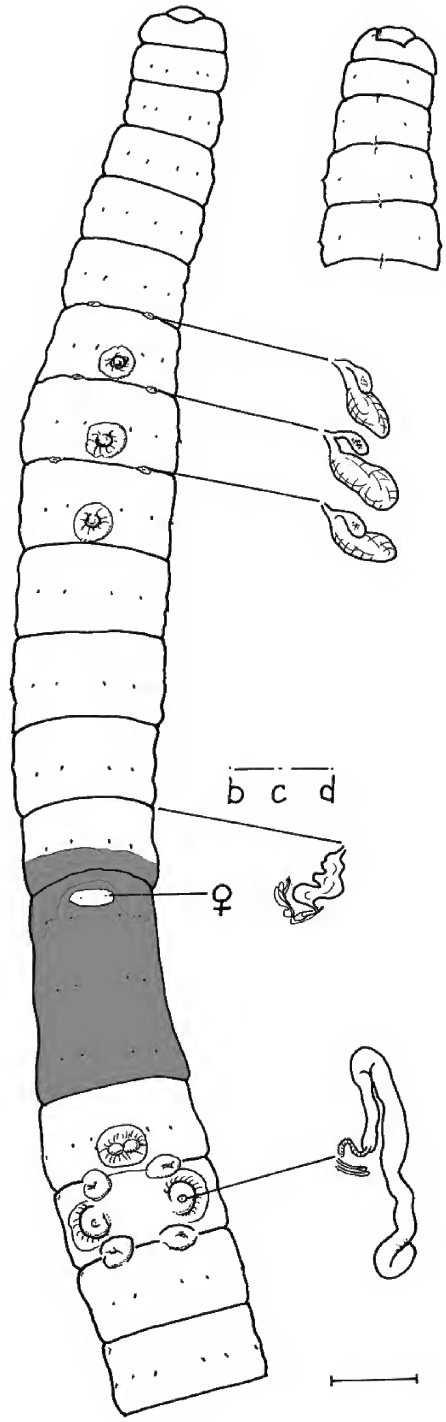
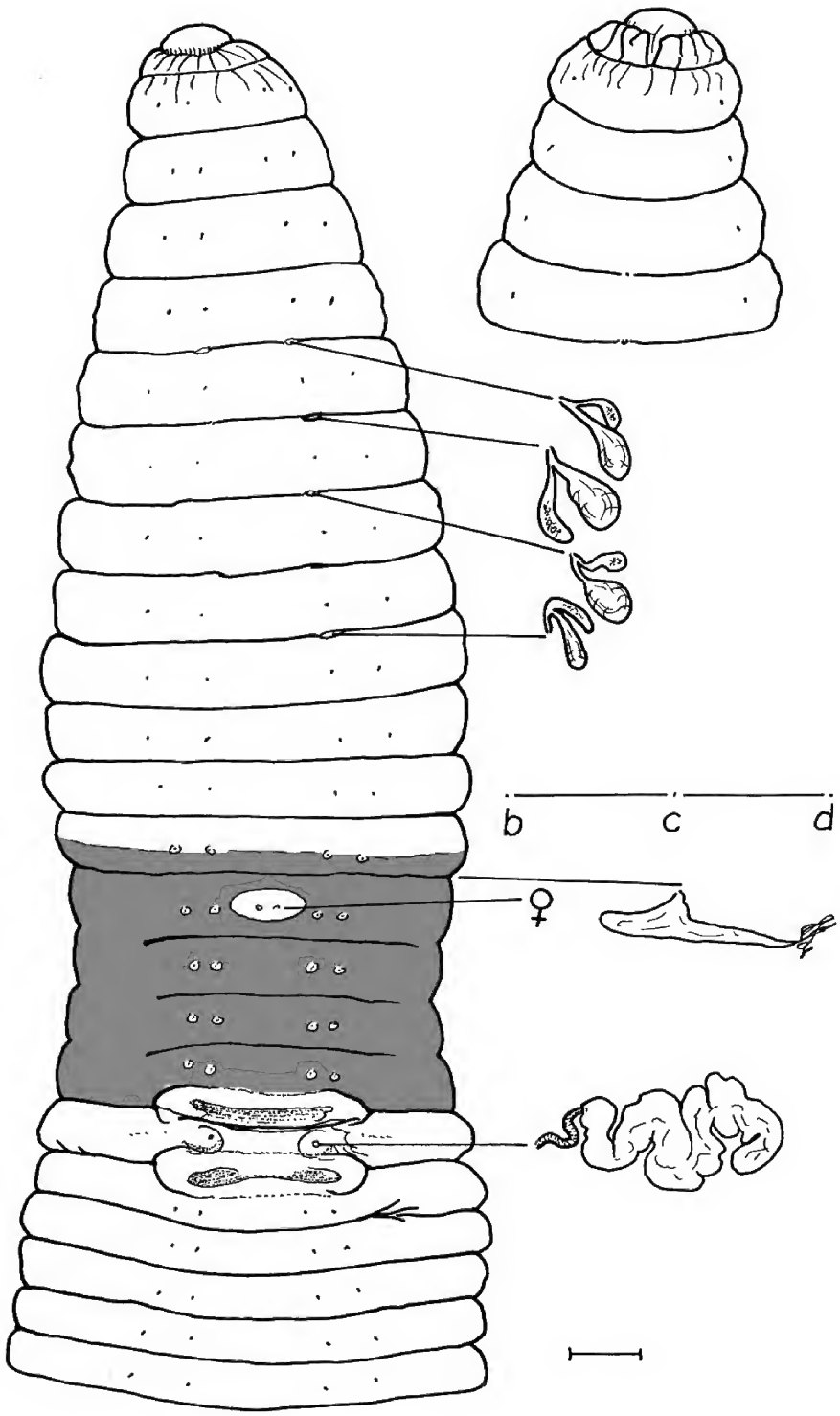


Fig. 39. Vesiculodrilus gracilis, H.



Figs. 40. Vesiculodrilus gryps, H.

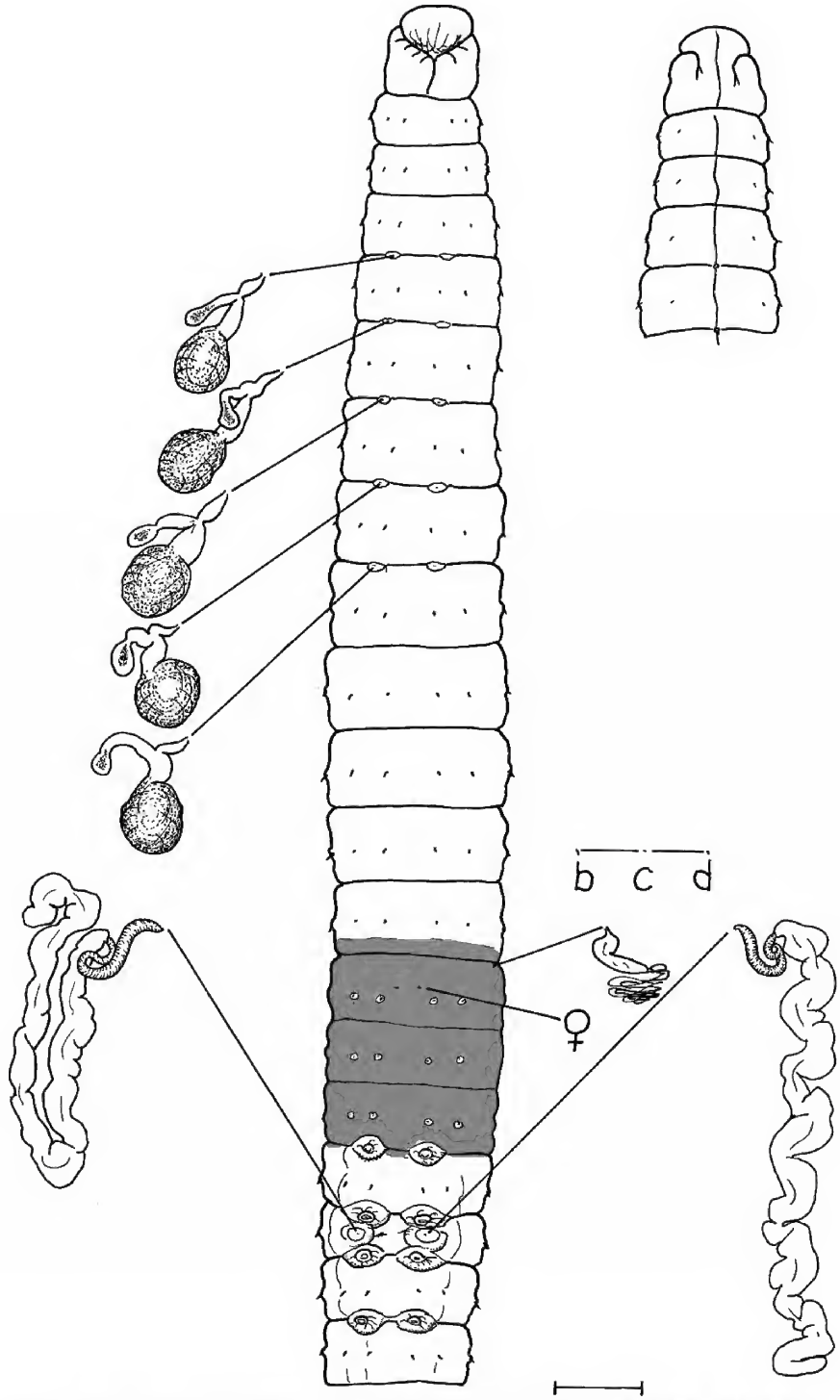


Fig. 41. Vesiculodrilus hobartensis (Spencer, 1895), 14:3502.

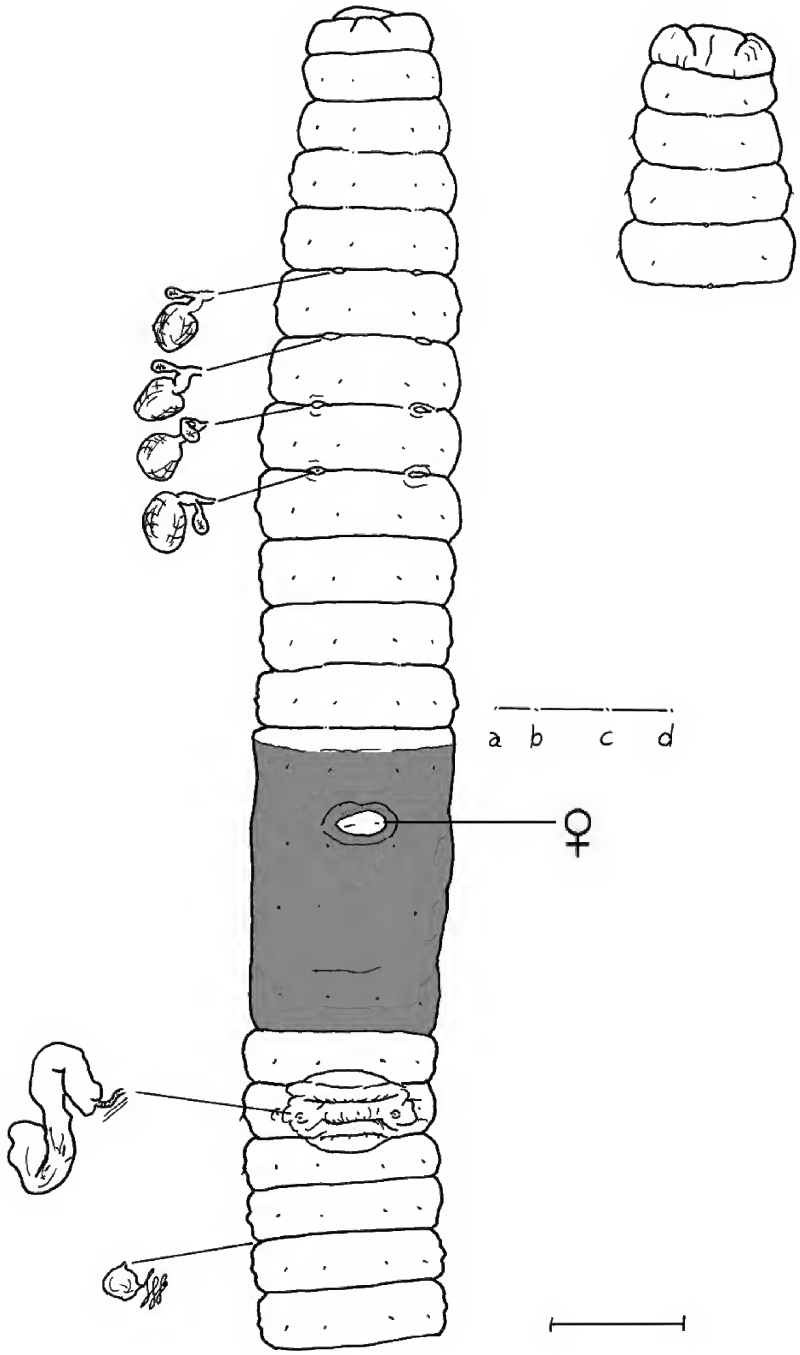


Fig. 42. Vesiculodrilus inornatus, H.

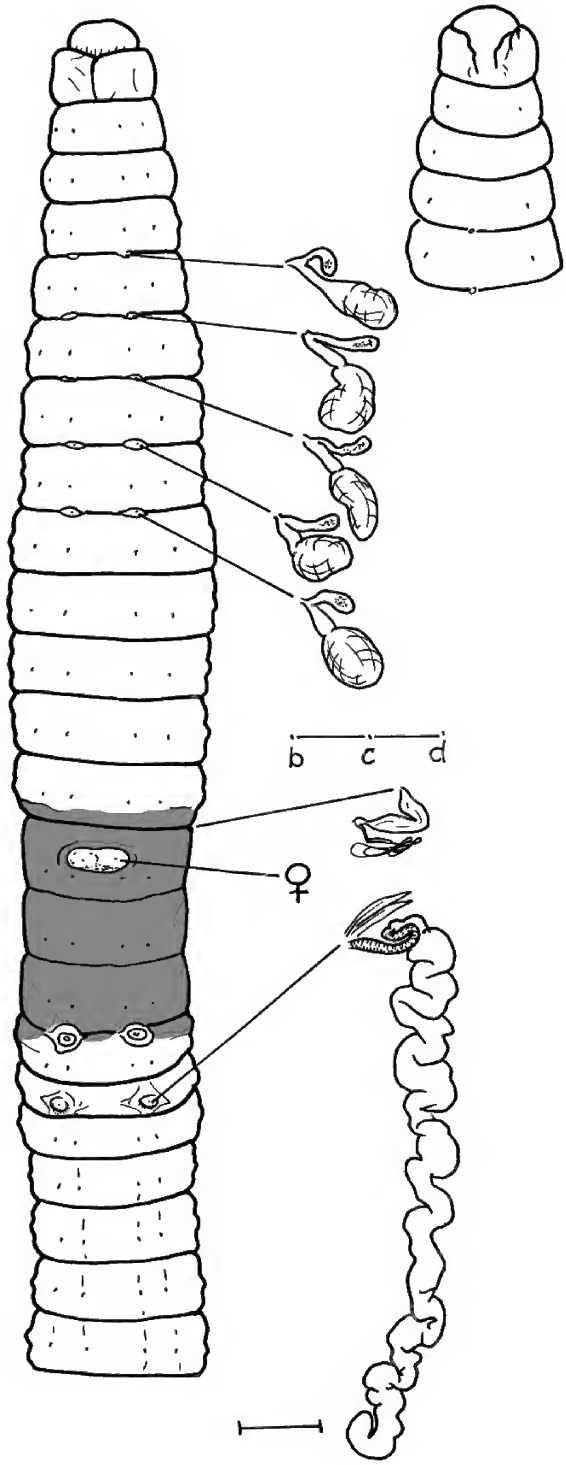


Fig. 43. Vesiculodrilus insularis (Spencer, 1895), 14:3511.

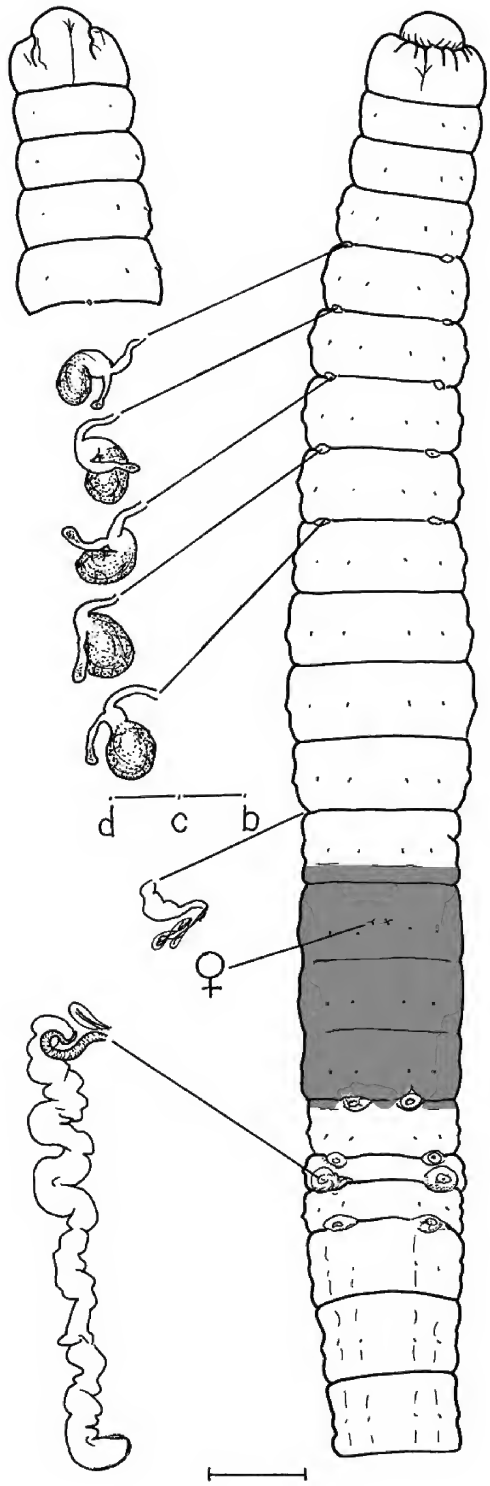


Fig. 44. Vesiculodrilus lateralis, H.

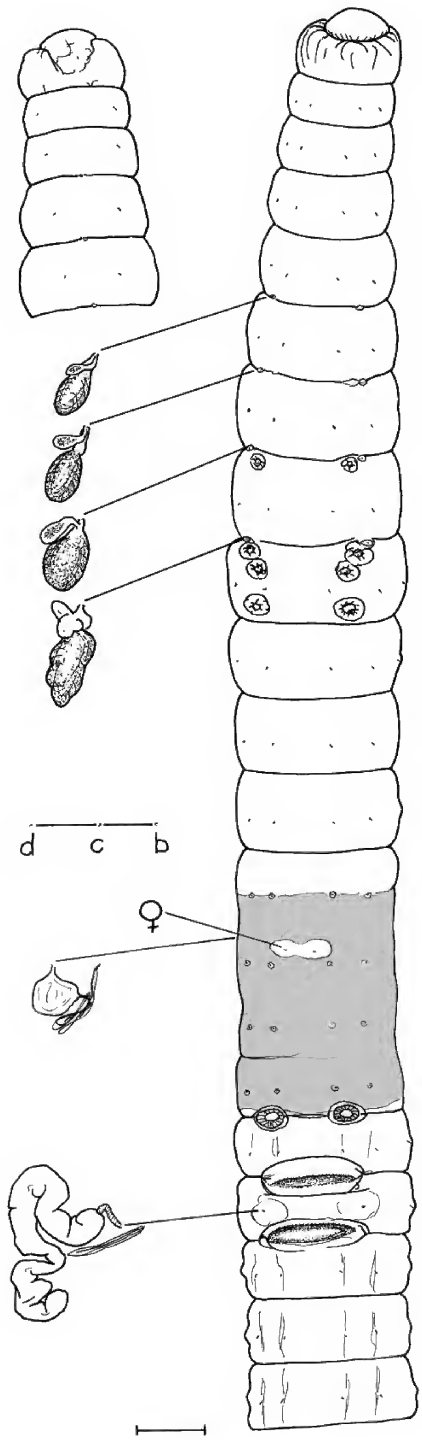


Fig. 45. Vesiculodrilus lepidus, H.

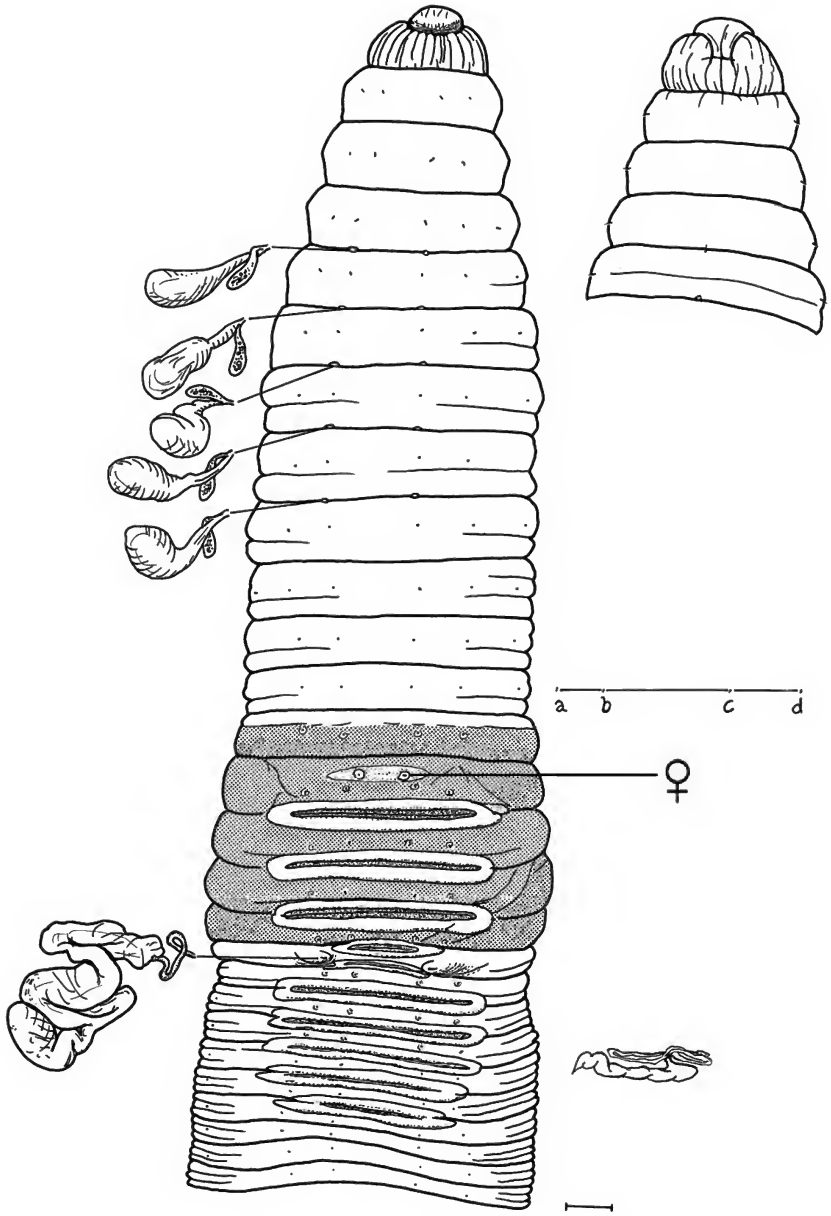


Fig. 46. Vesiculodrilus lilliputensis, H.

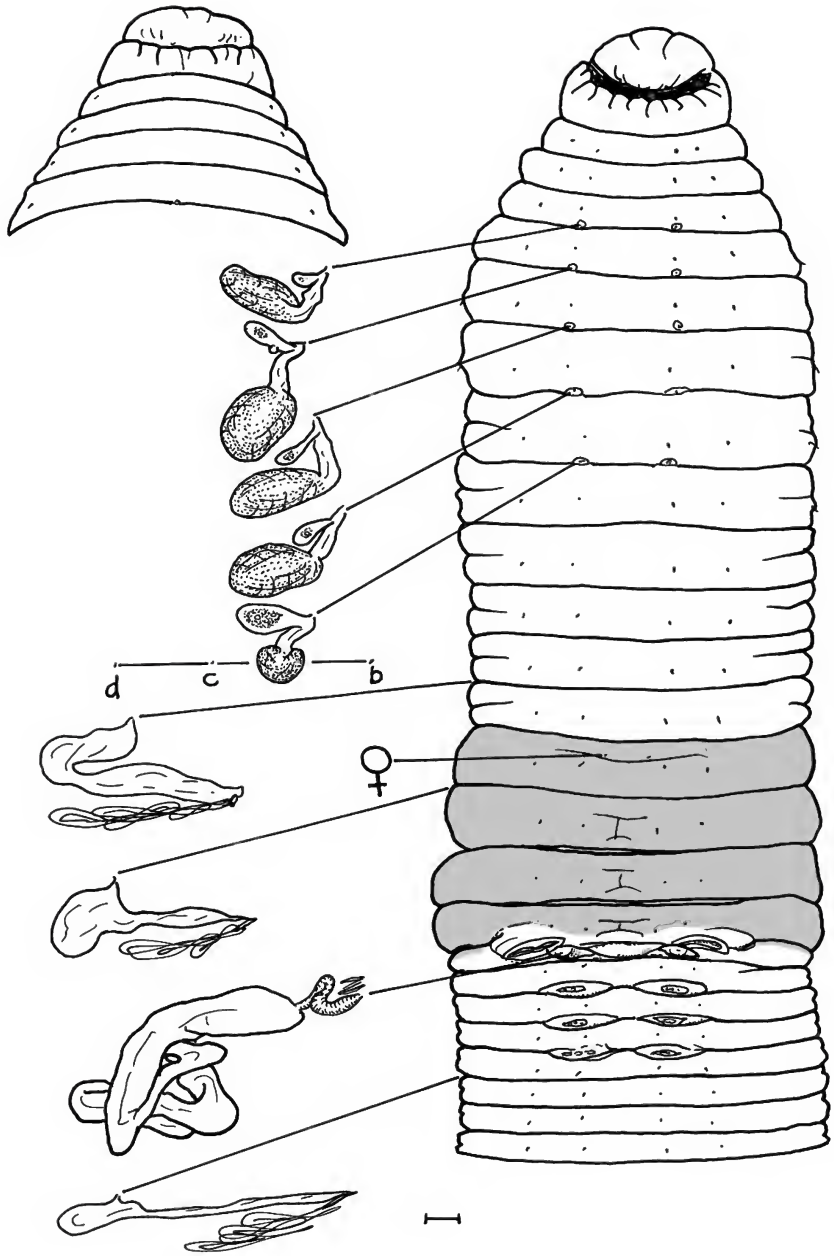


Fig. 47. Vesiculodrilus marian, H.

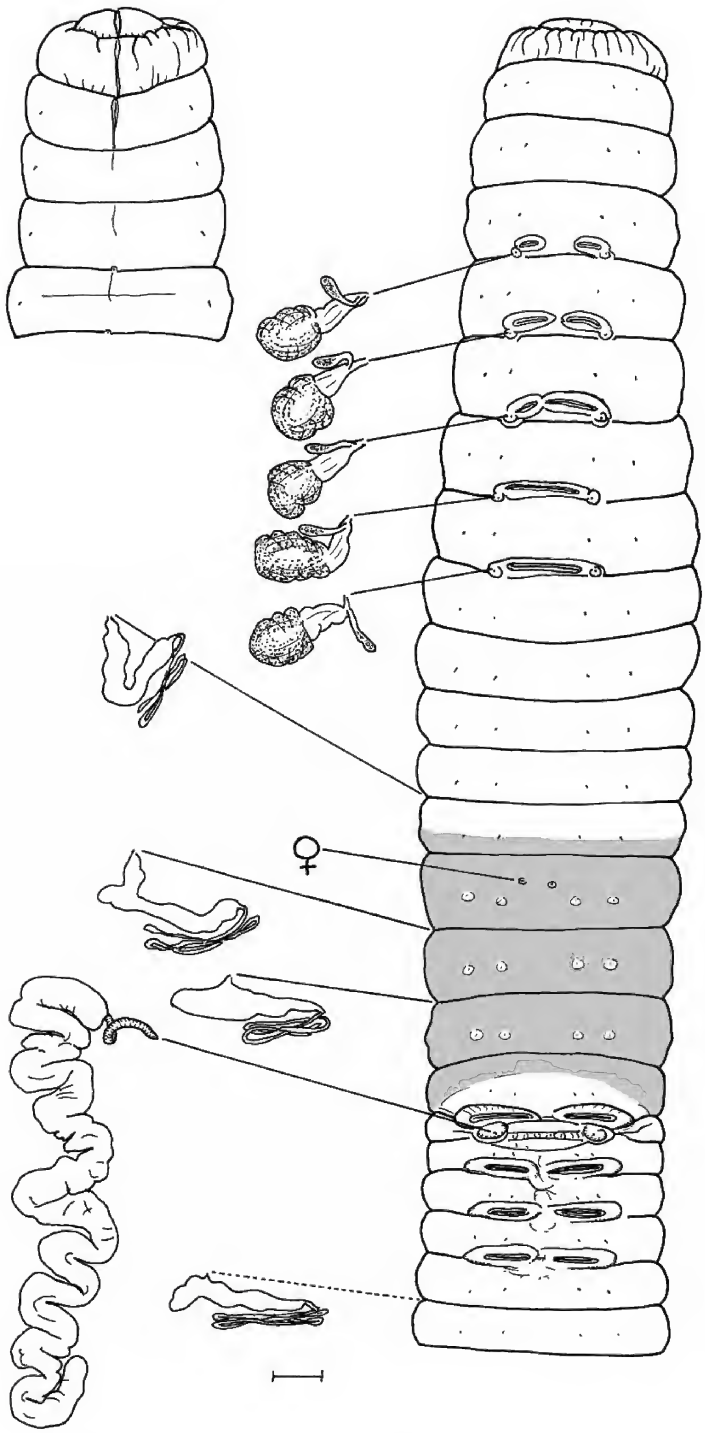


Fig. 48. Vesiculodrilus maritimus, H.

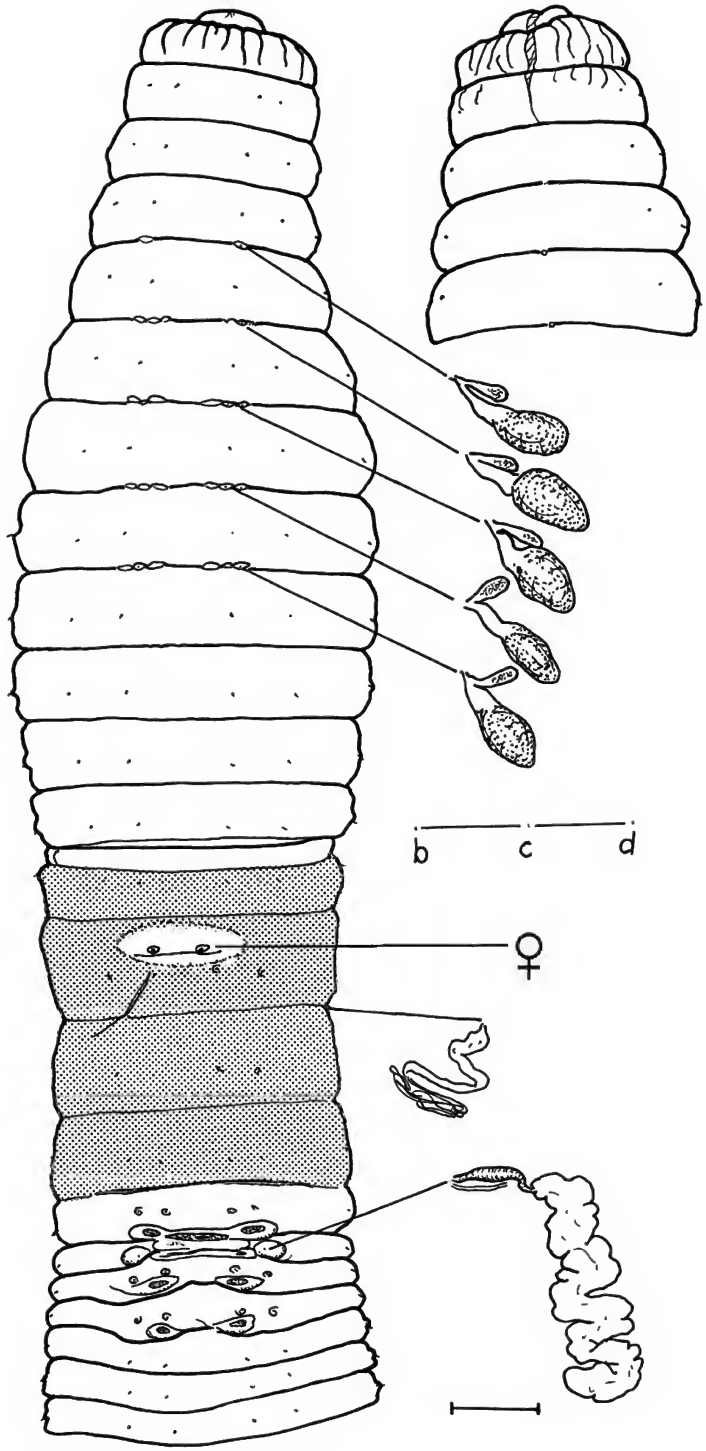


Fig. 49. Vesiculodrilus mathinna, H.

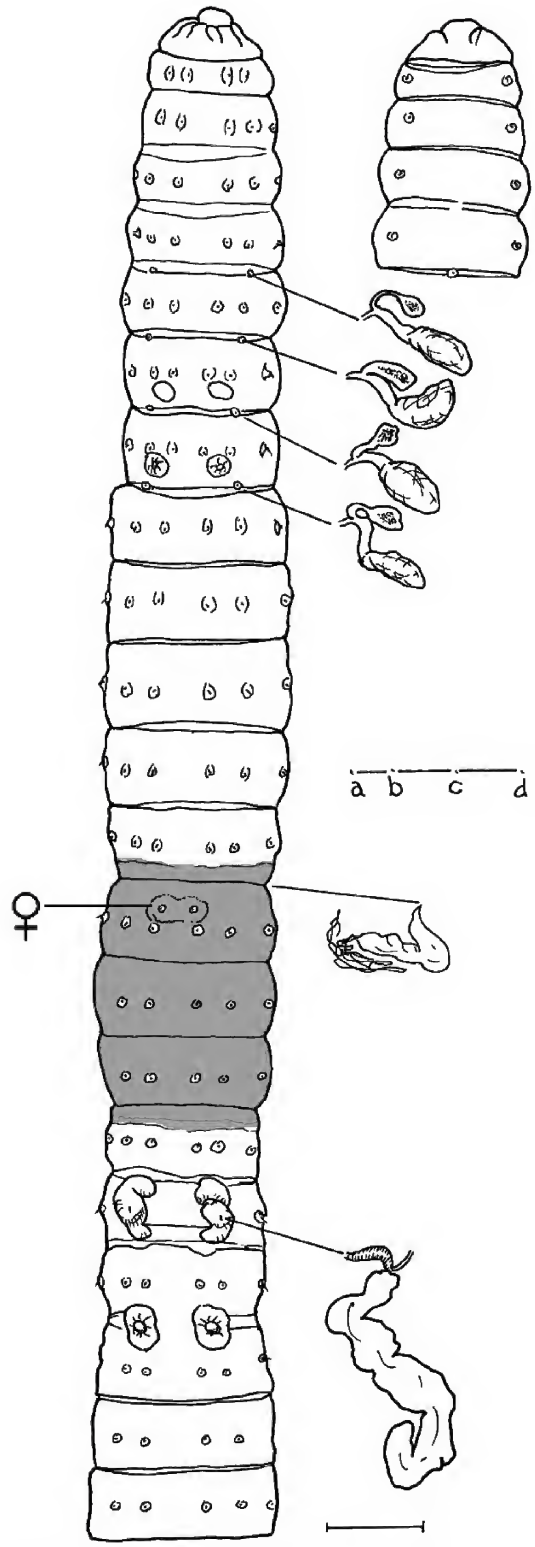


Fig. 50. Vesiculodrilus melaleuteus, H.

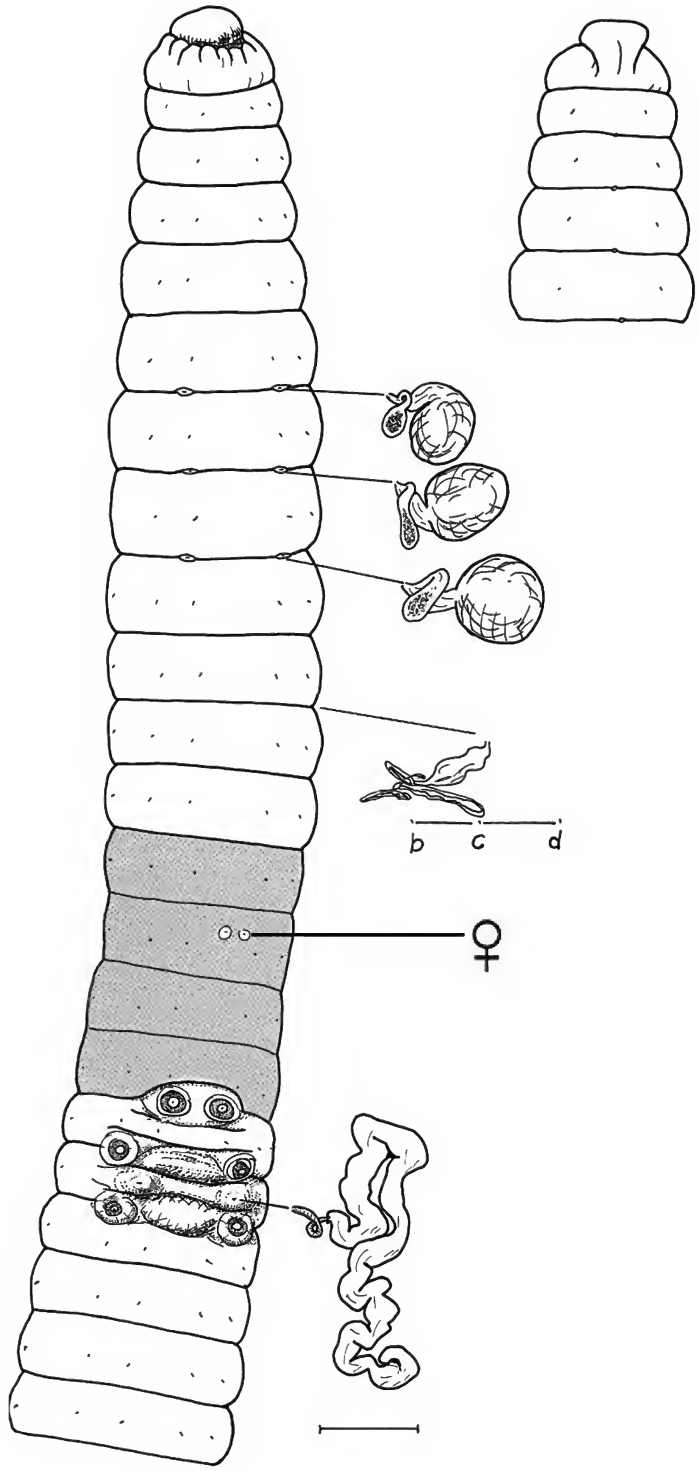


Fig. 51. Vesiculodrilus mesibovi, H.

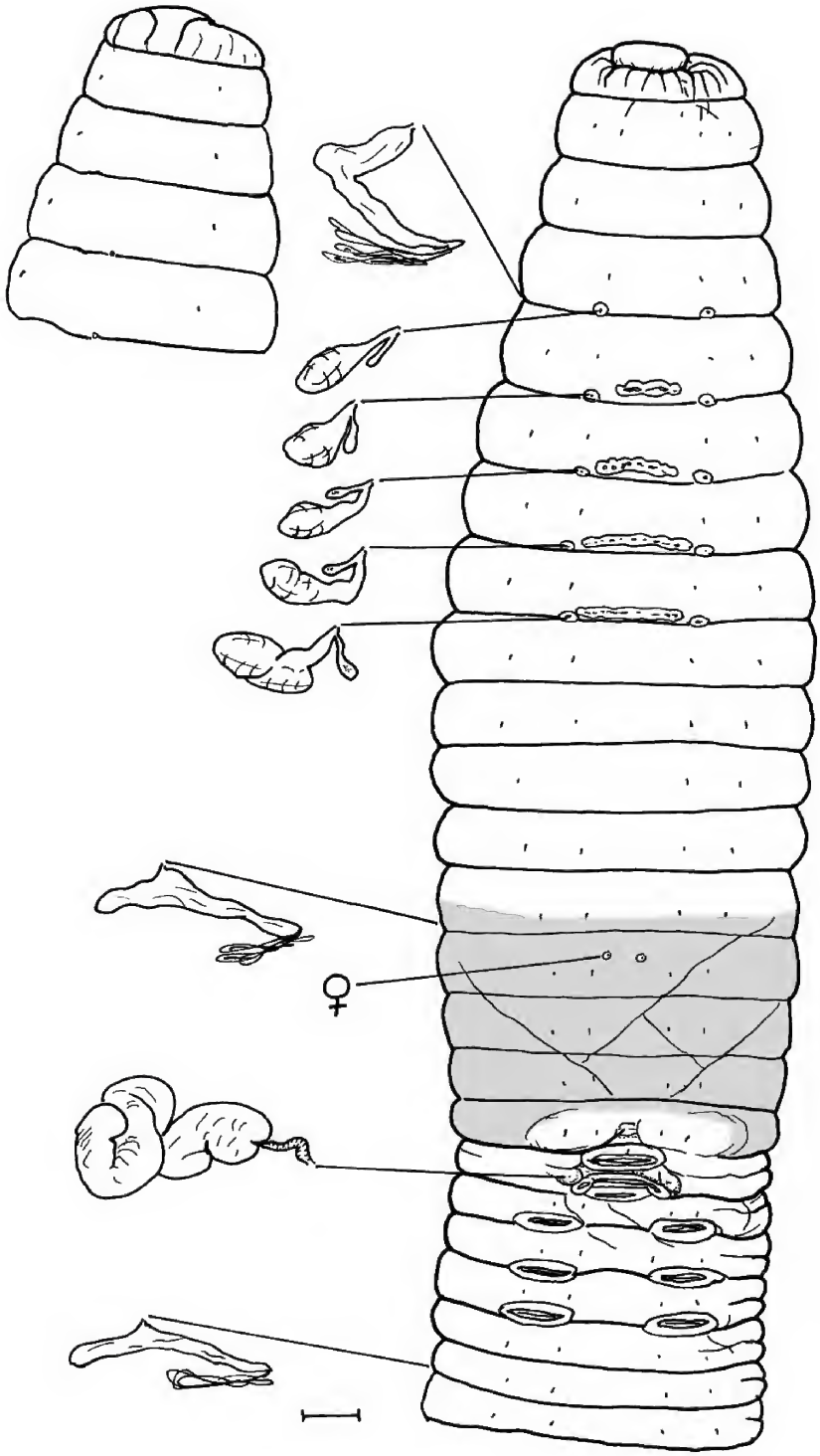


Fig. 52. Vesiculodrilus metandris, H.

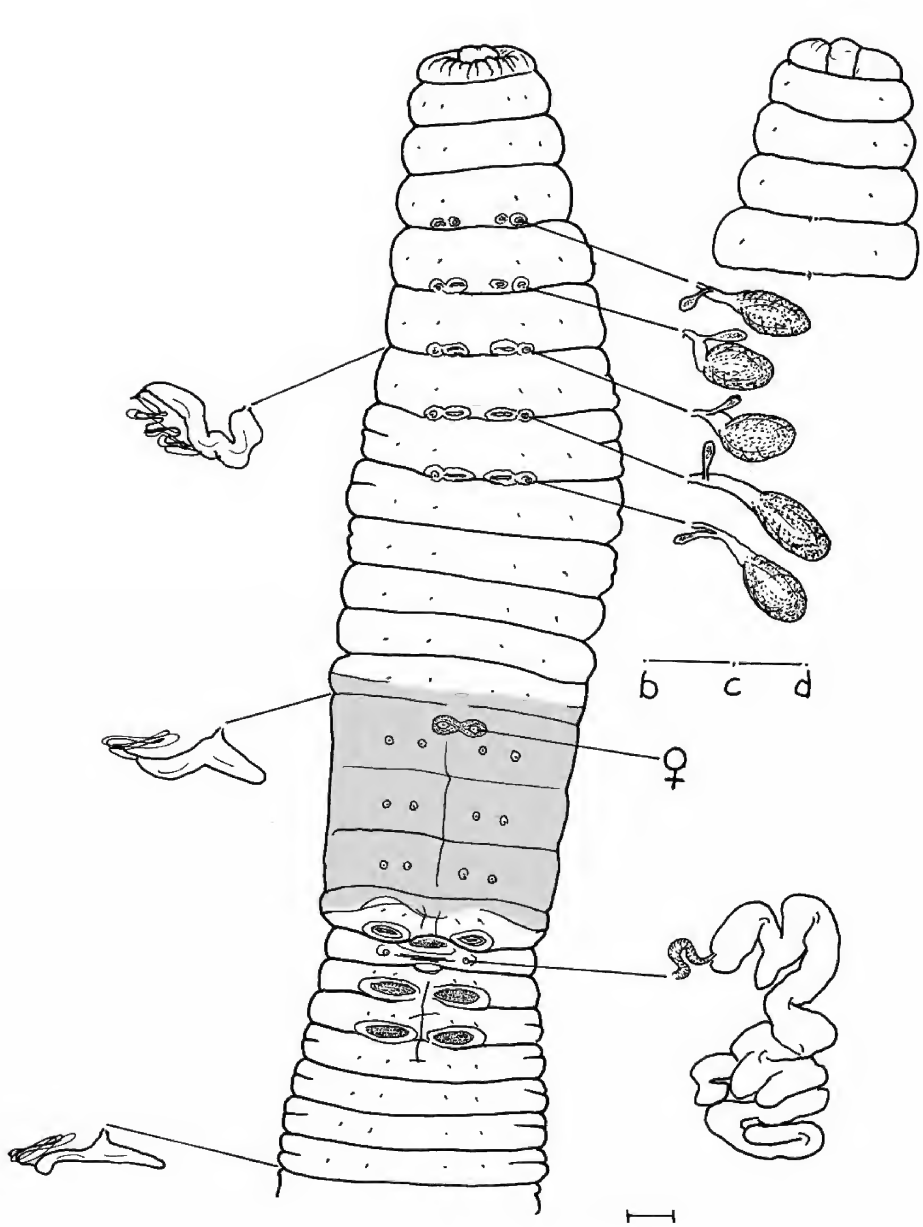
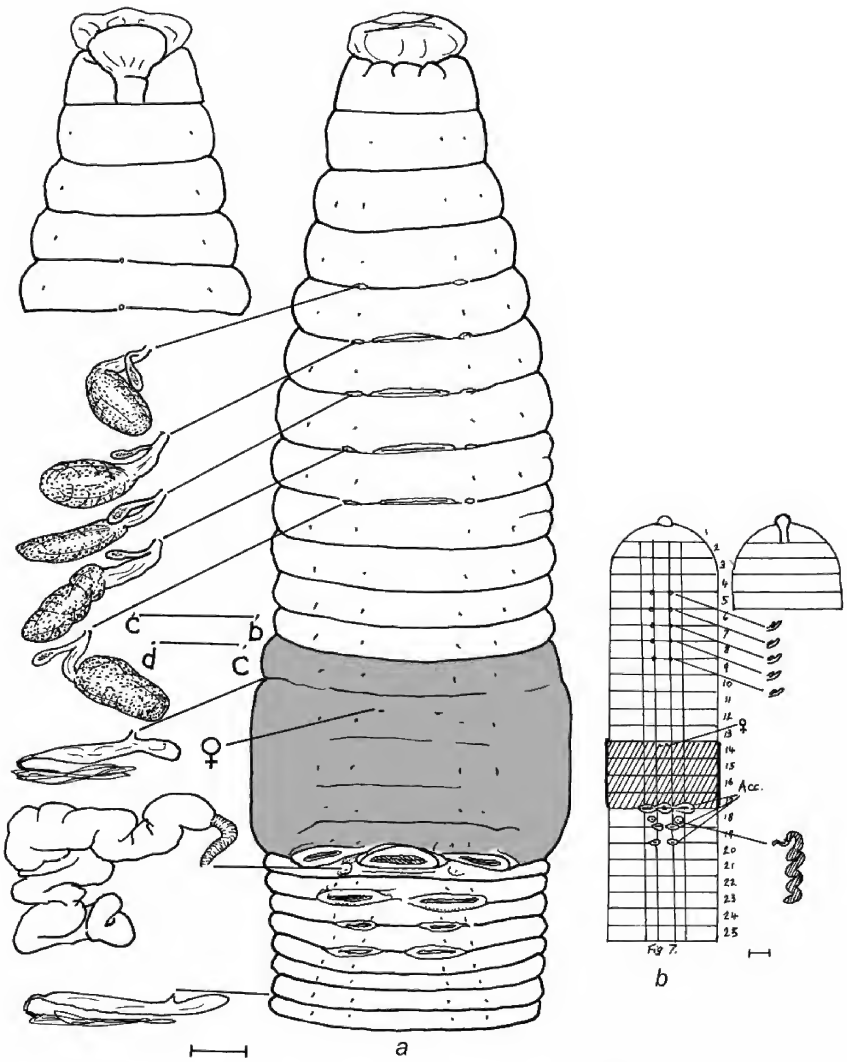


Fig. 53. Vesiculodrilus mortoni montis, H.



Flg. 54. Vesiculodrilus m. mortoni (Spencer, 1895), a - TM:K418, b - after Spencer.

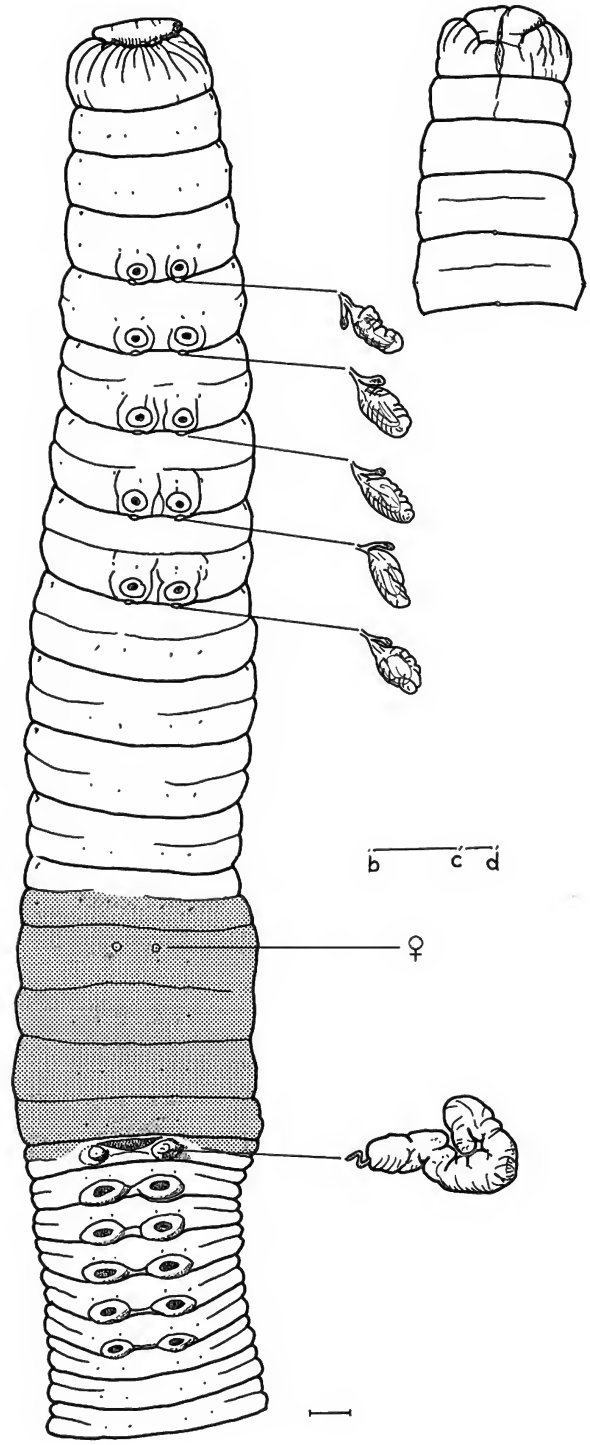


Fig. 55. Vesiculodrilus narcissus, H.

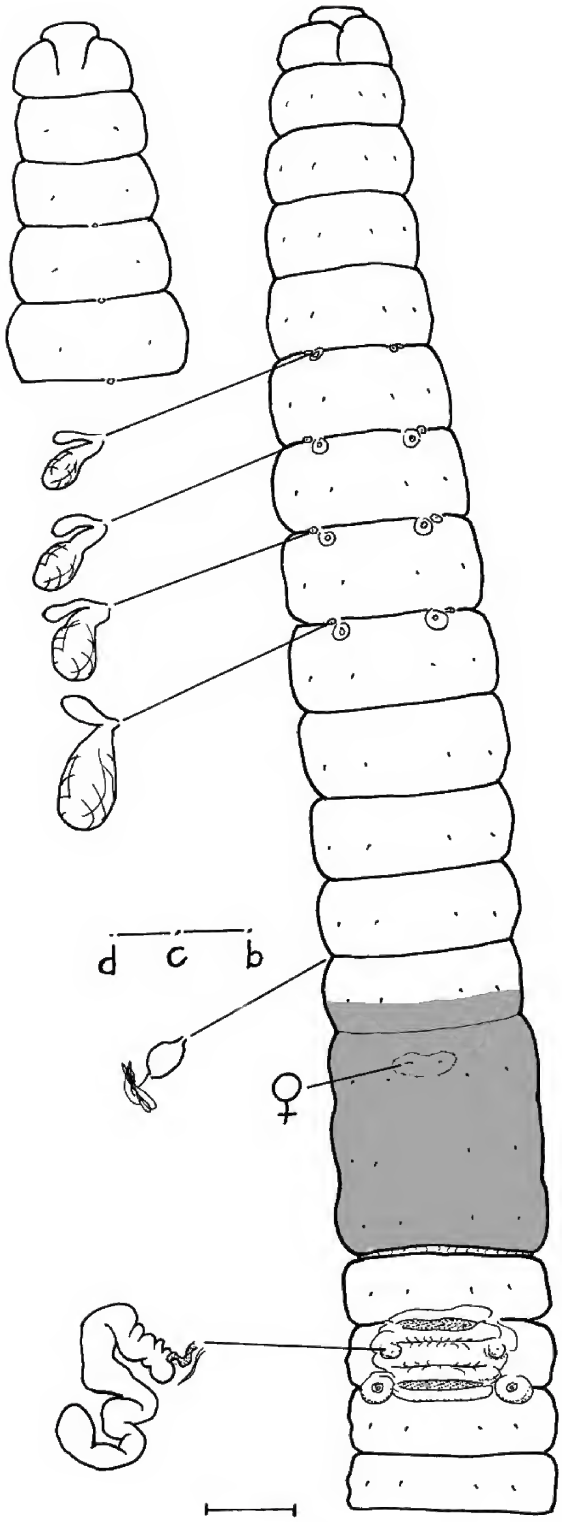


Fig. 56. Vesiculodrilus octothecatus, H.

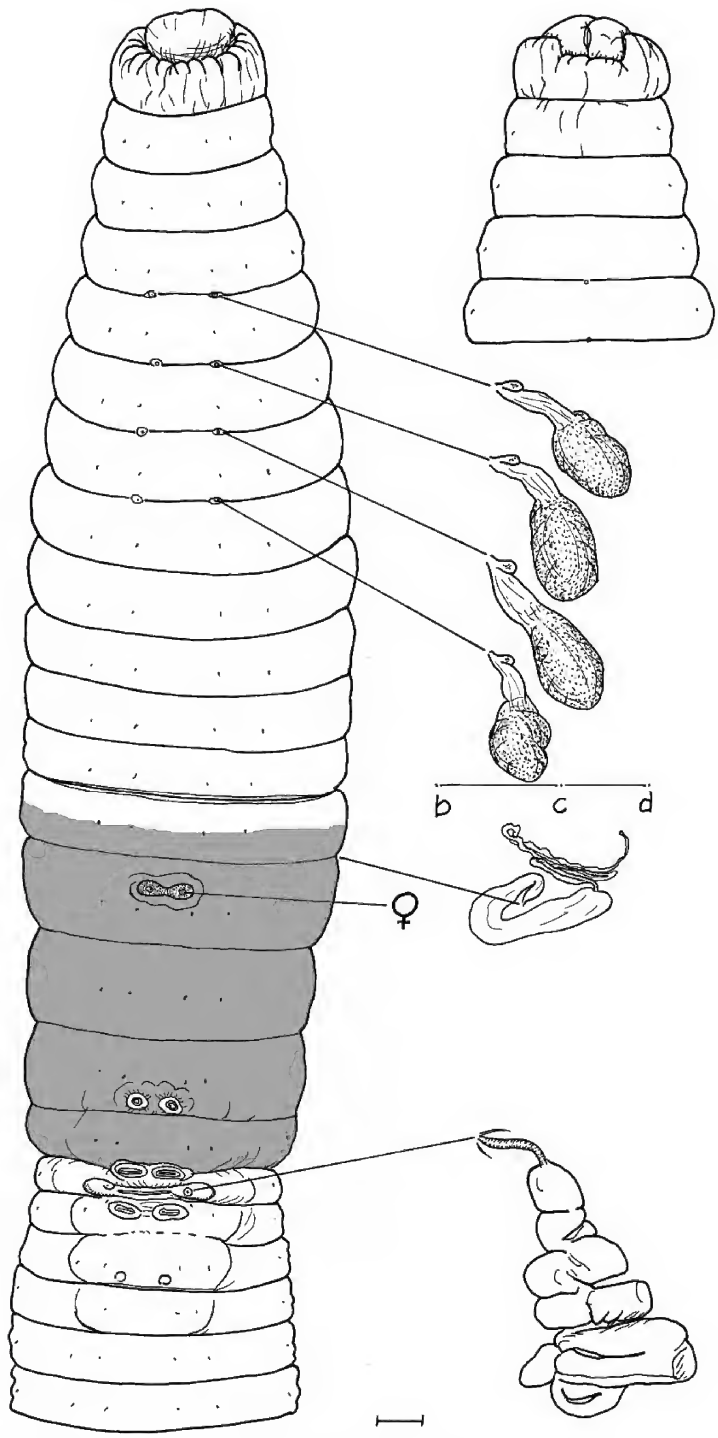


Fig. 57. Vesiculodrilus oeconomicus, H.

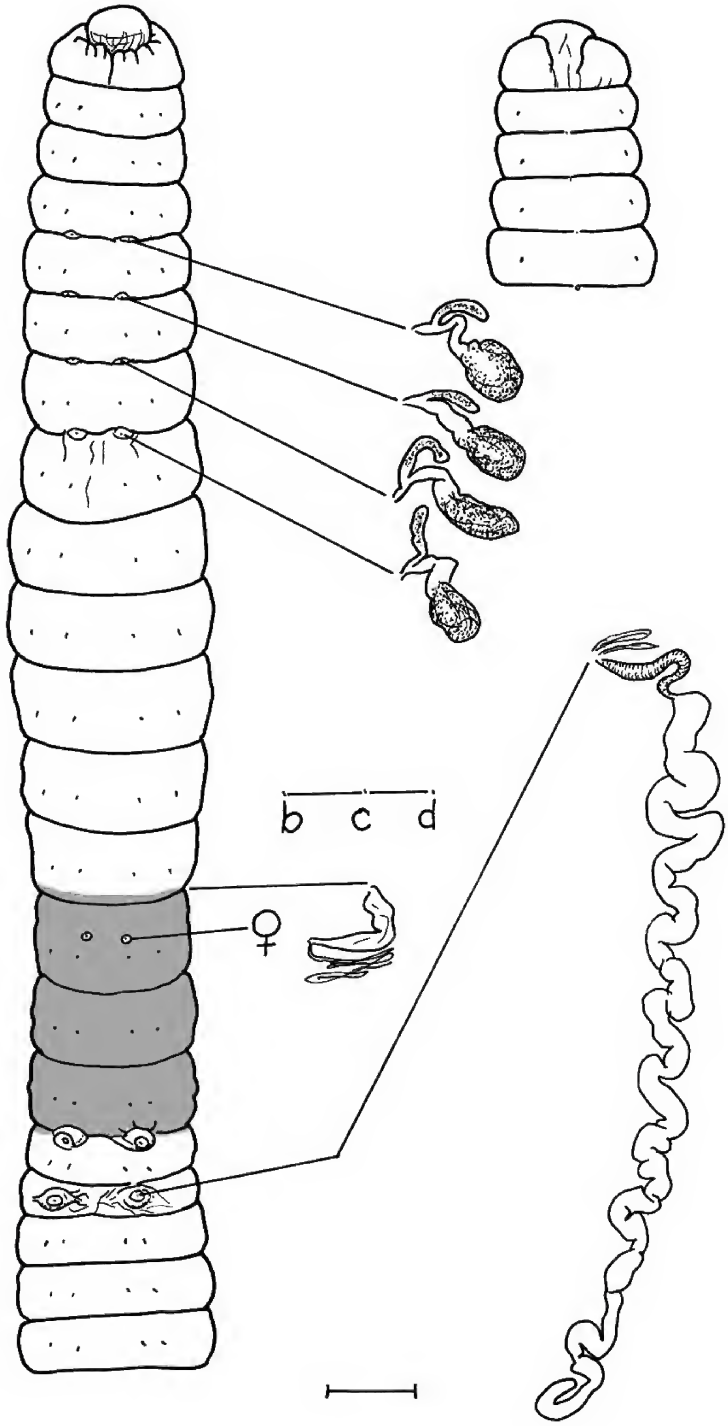


Fig. 58. Vesiculodrilus parattah, H.

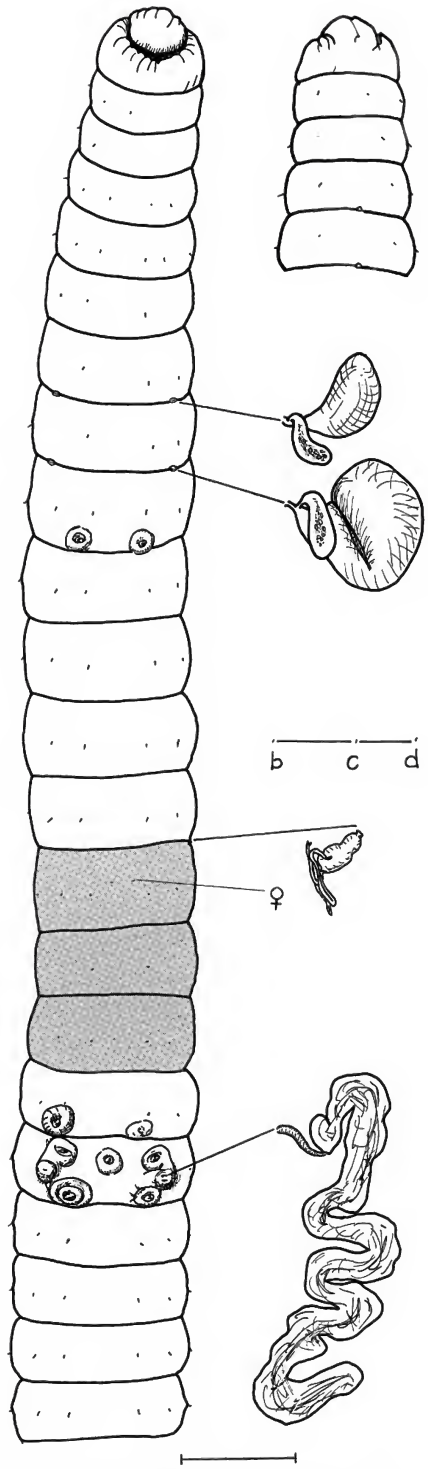


Fig. 59. Vesiculodrilus pennyae, H.

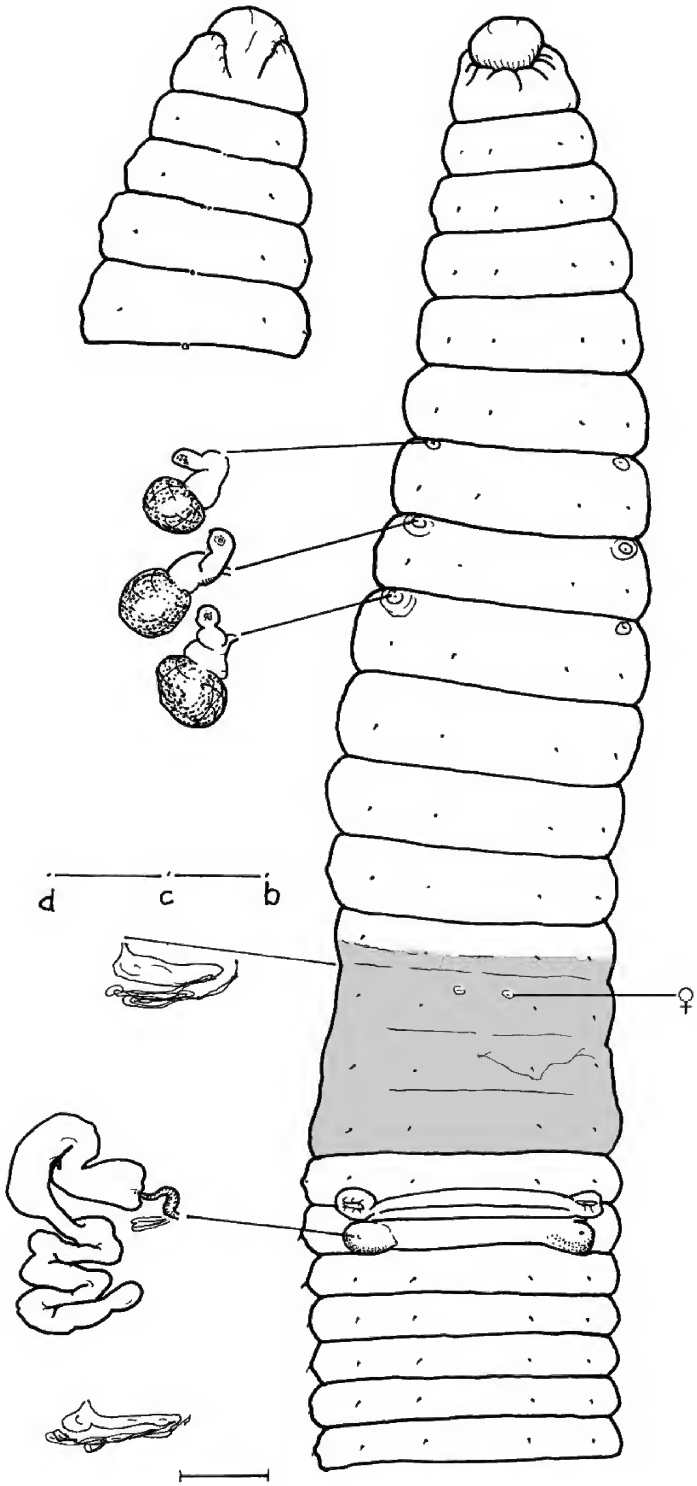


Fig. 60. Vesiculodrilus pollex, H.

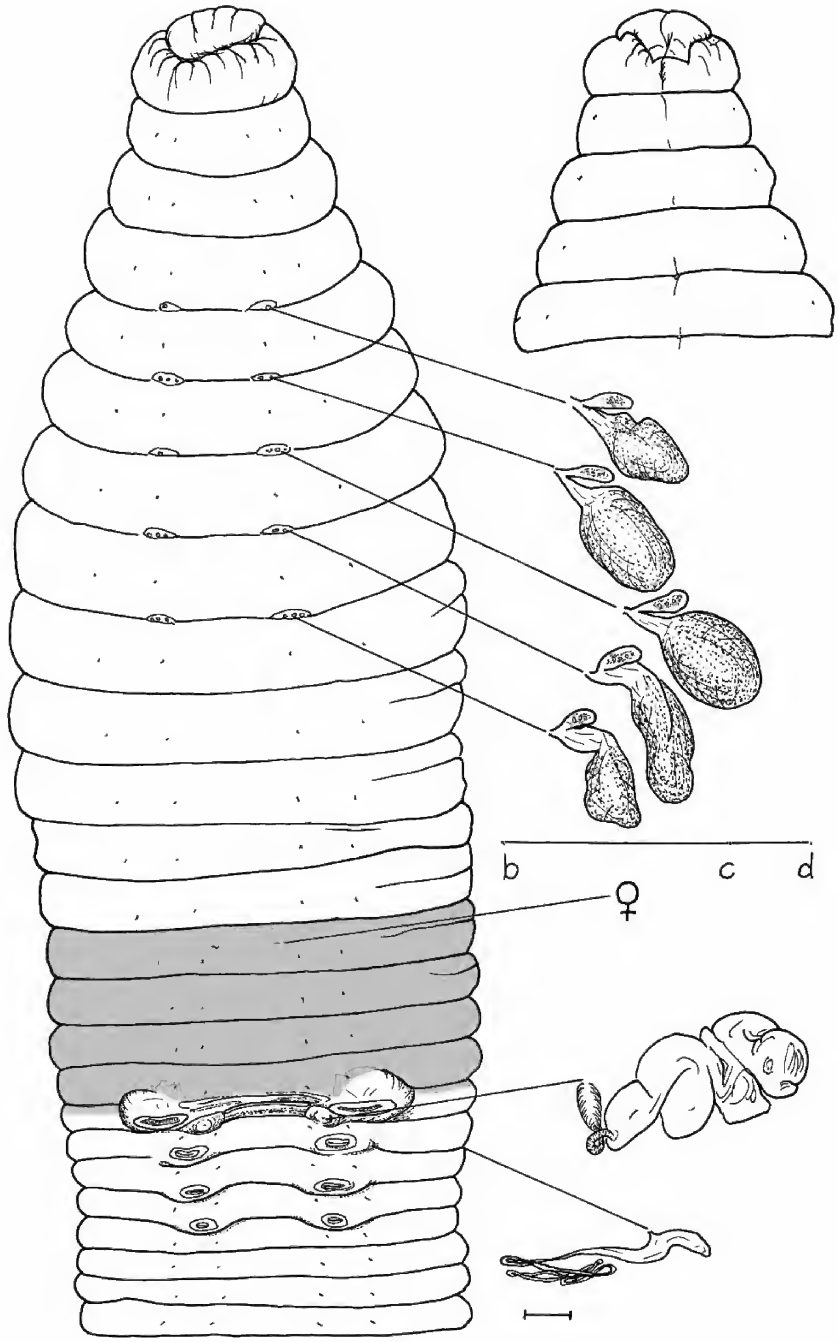


Fig. 61. Vesiculodrilus prospectus, H.

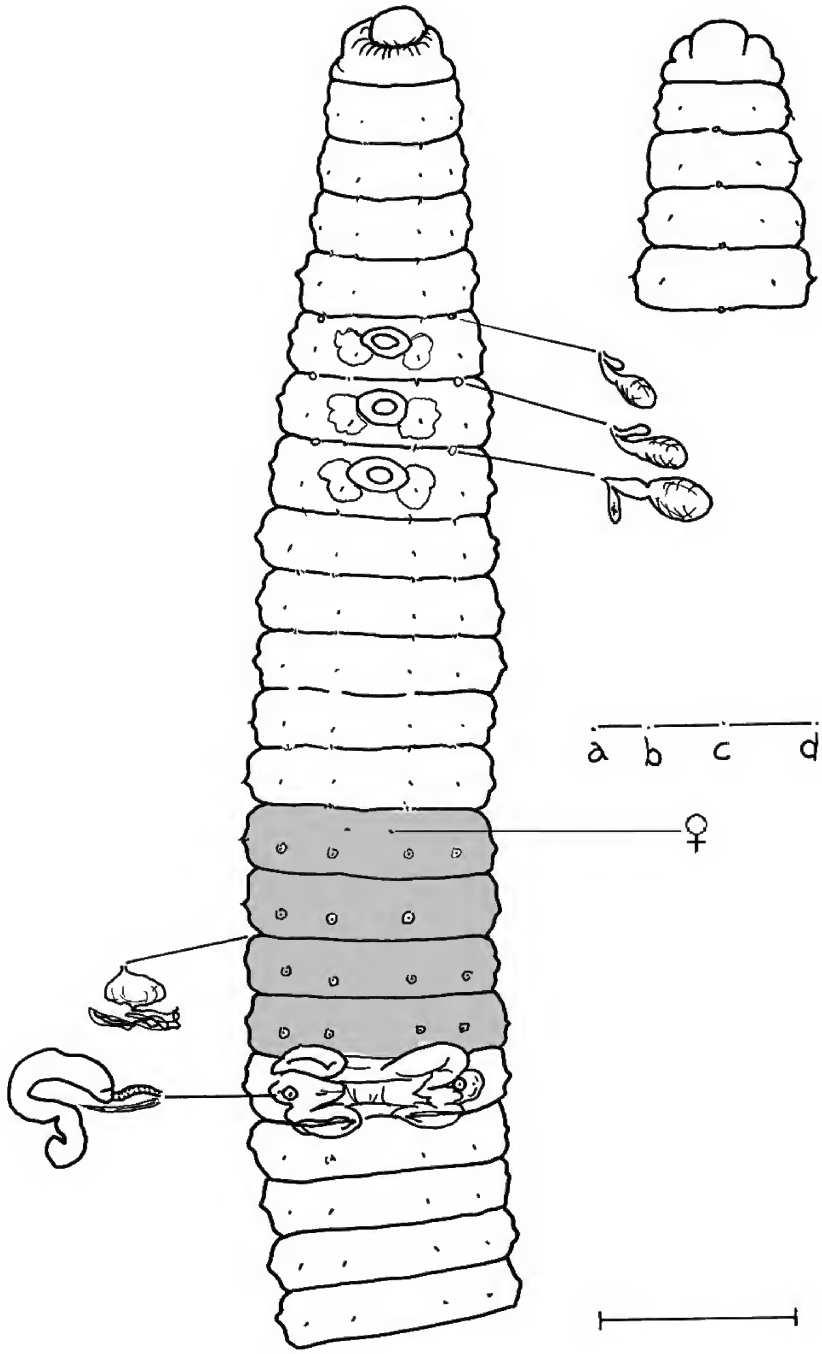


Fig. 62. Vesiculodrilus pulchellus, H.

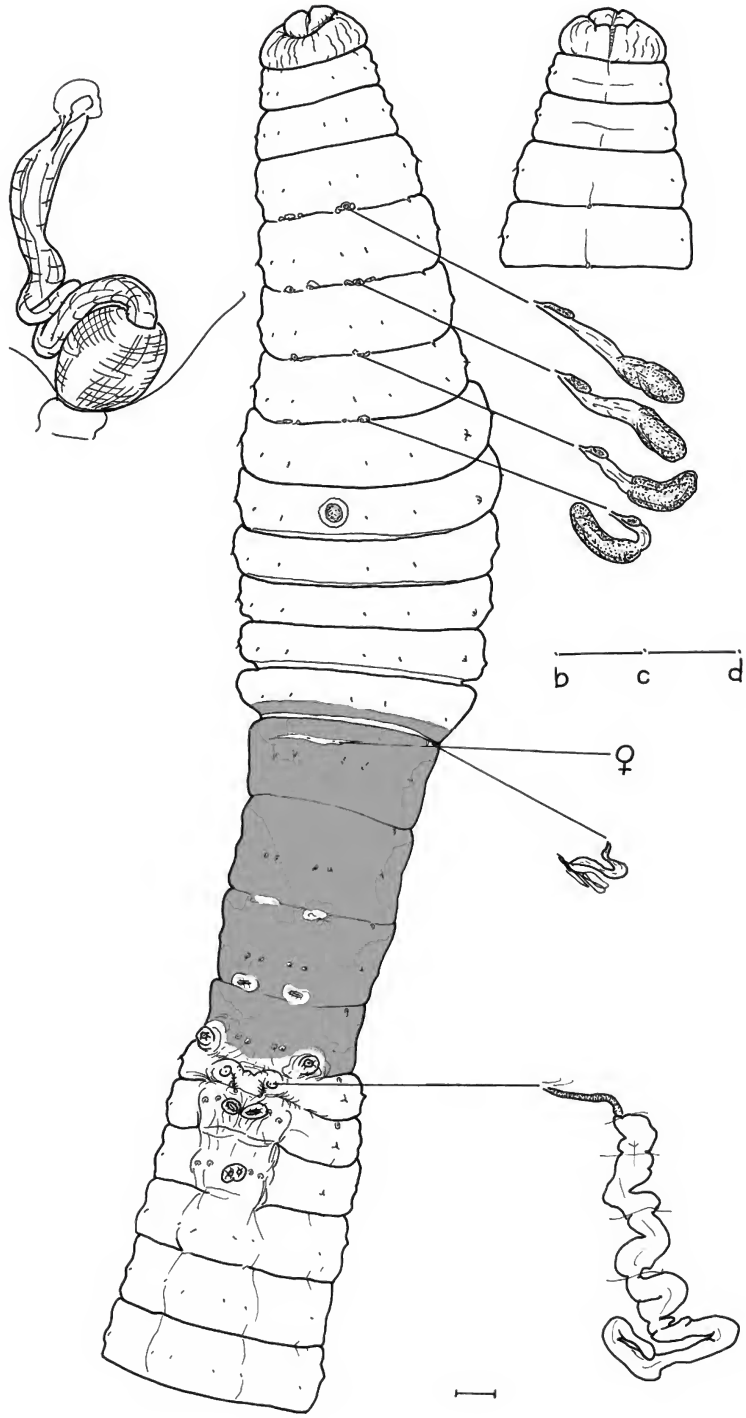


Fig. 63. Vesiculodrilus quadruparus, H.

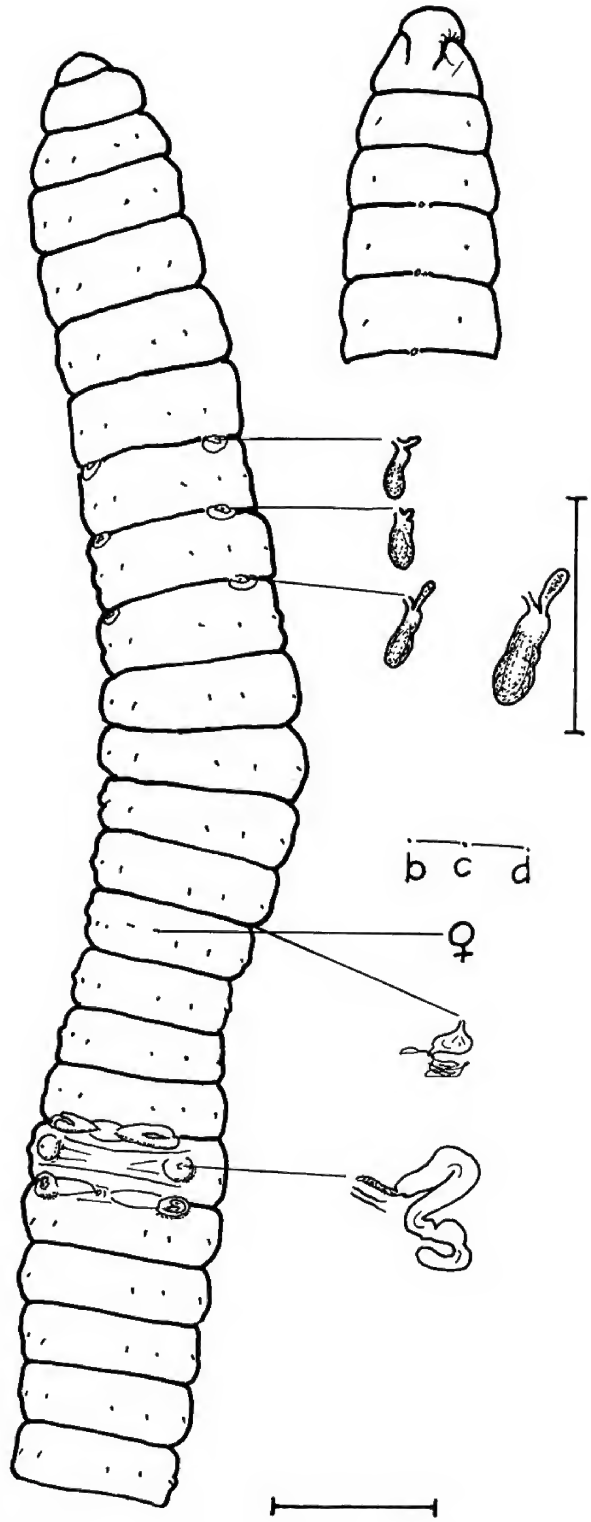


Fig. 64. Vesiculodrilus recessus, H.

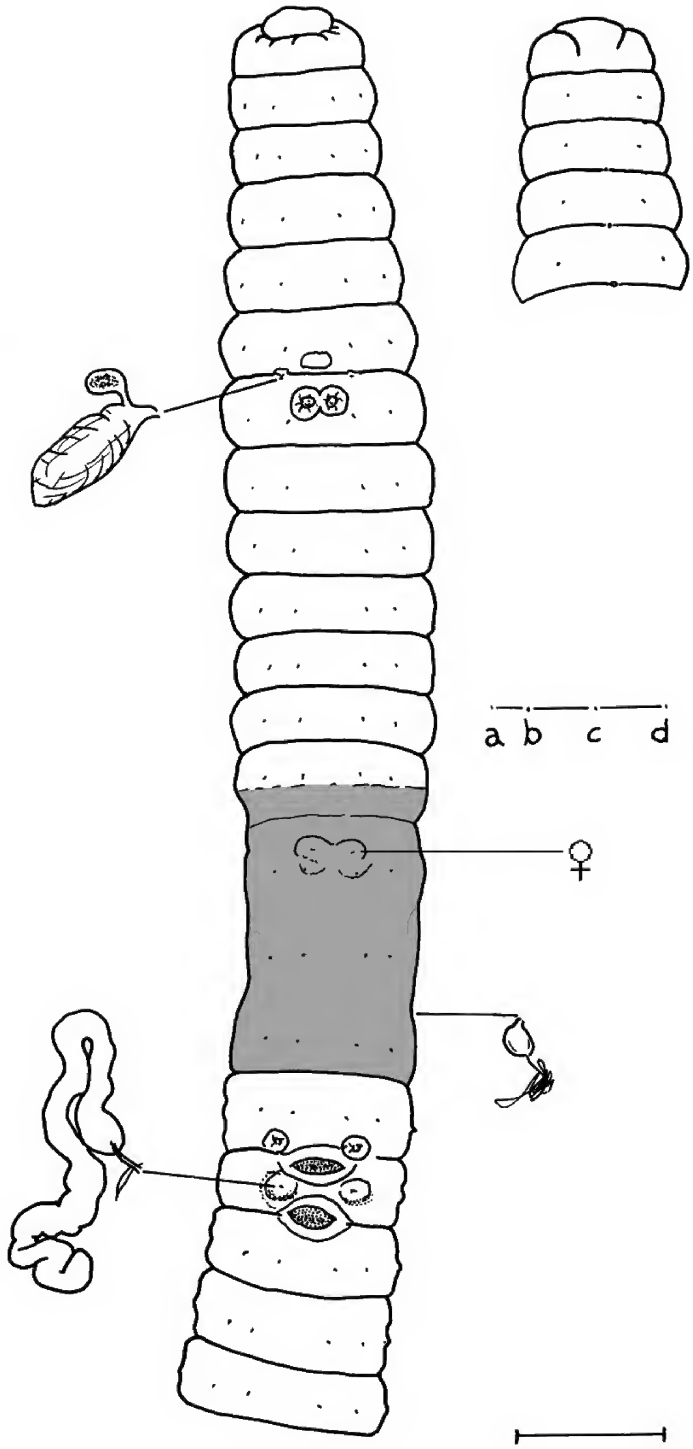


Fig. 65. Vesiculodrilus santaclairis, H.

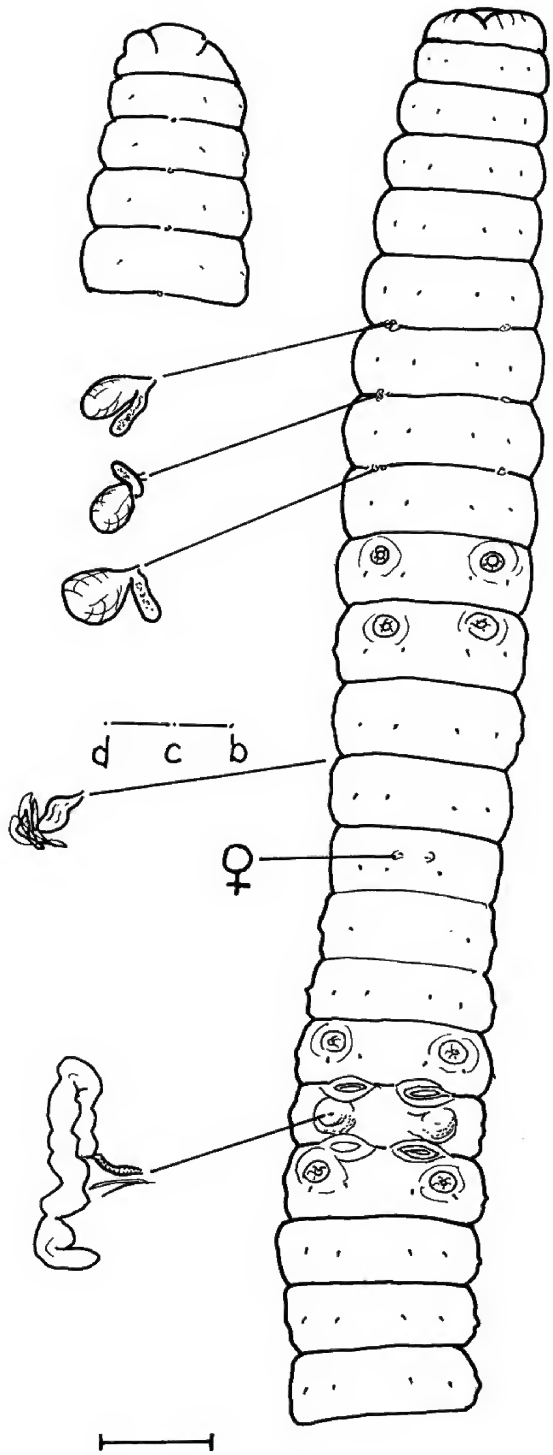


Fig. 66. Vesiculodrilus symmetricus, H.

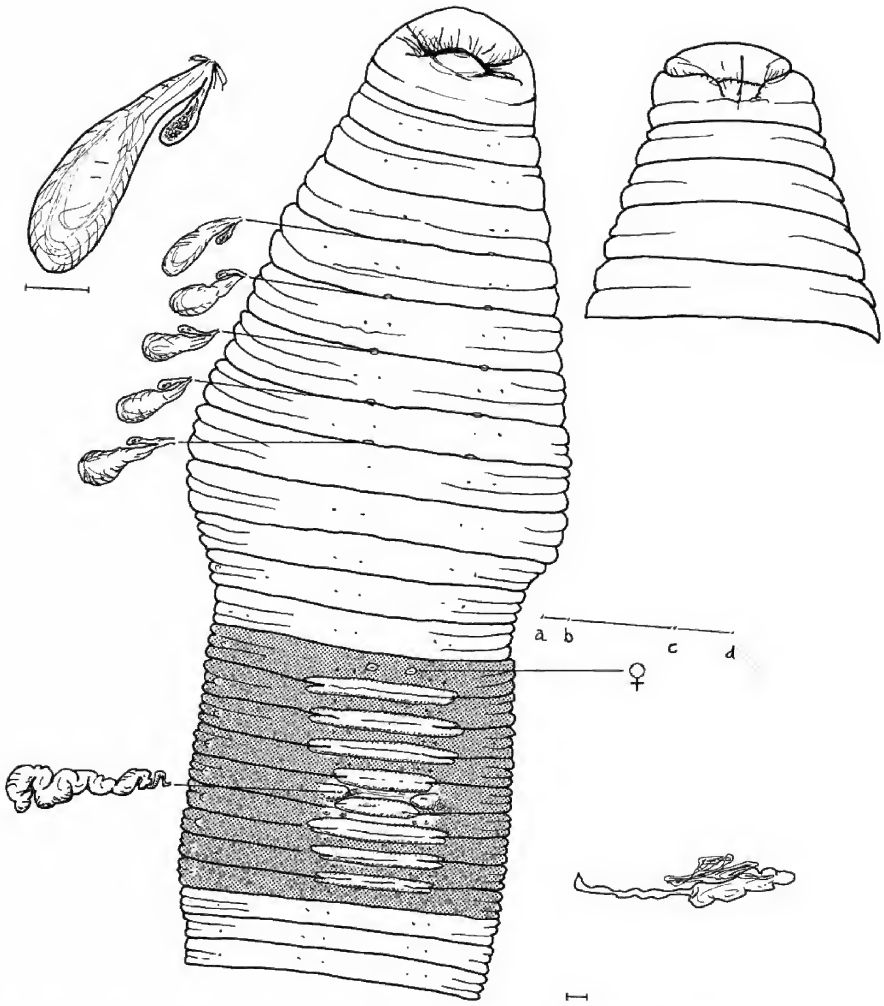


Fig. 67. Vesiculodrilus tasmanianus (Fletcher, 1887), 14:3105, with enlargement of spermatheca 5lhs to show diverticulum.

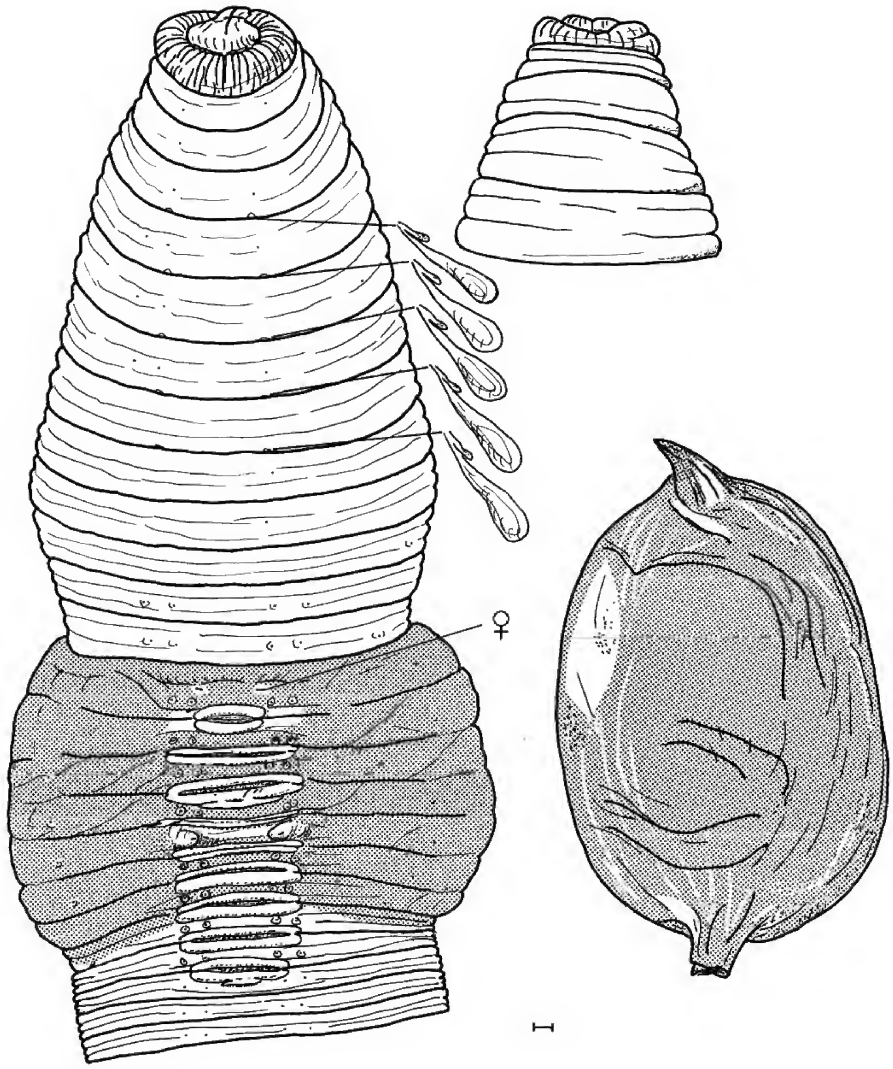


Fig. 68. Vesiculodrilus tasmanianus (Fletcher, 1887), 14:3140, cocoon 14:3144.

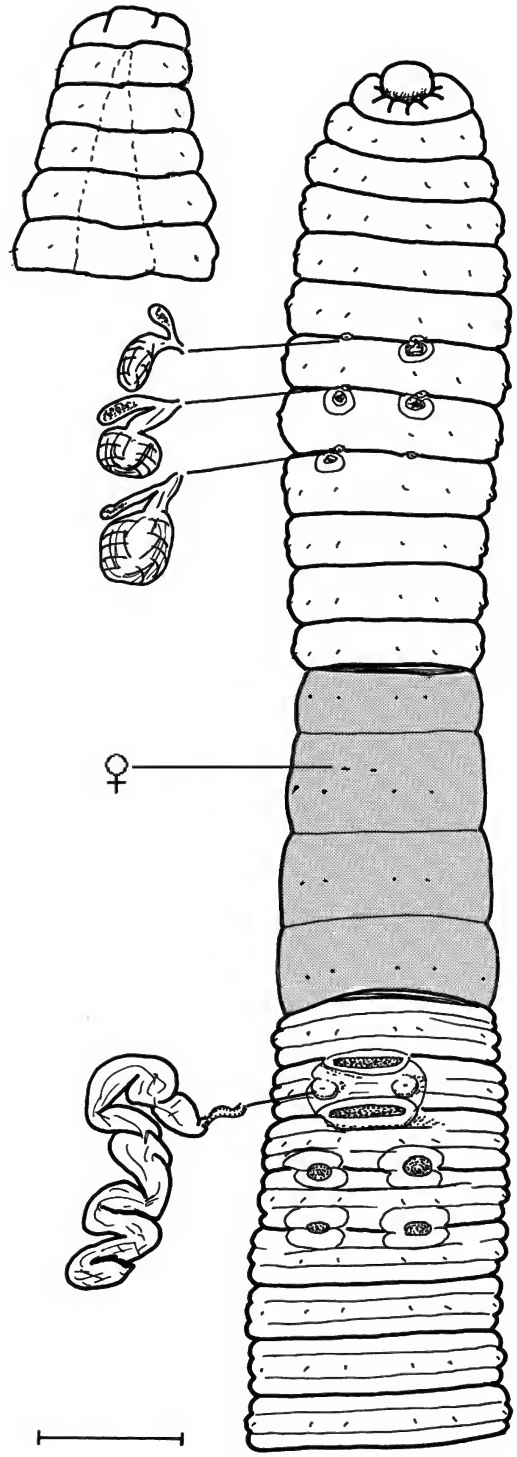


Fig. 69. Vesiculodrilus tunnackensis (Jam., 1974), H.

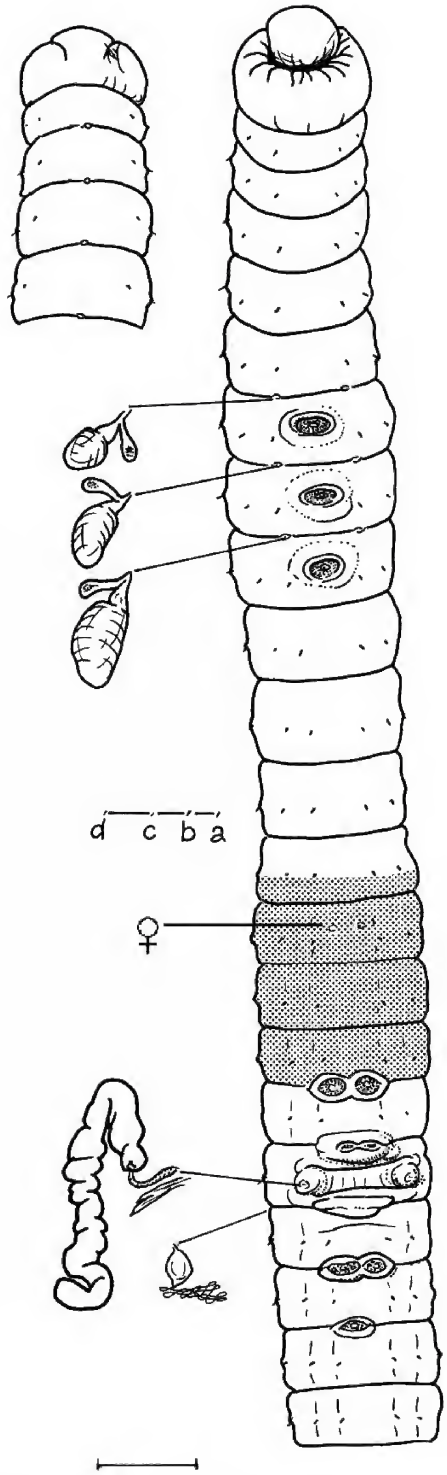


Fig. 70. Vesiculodrilus ventralis Blakemore, 2000, H.

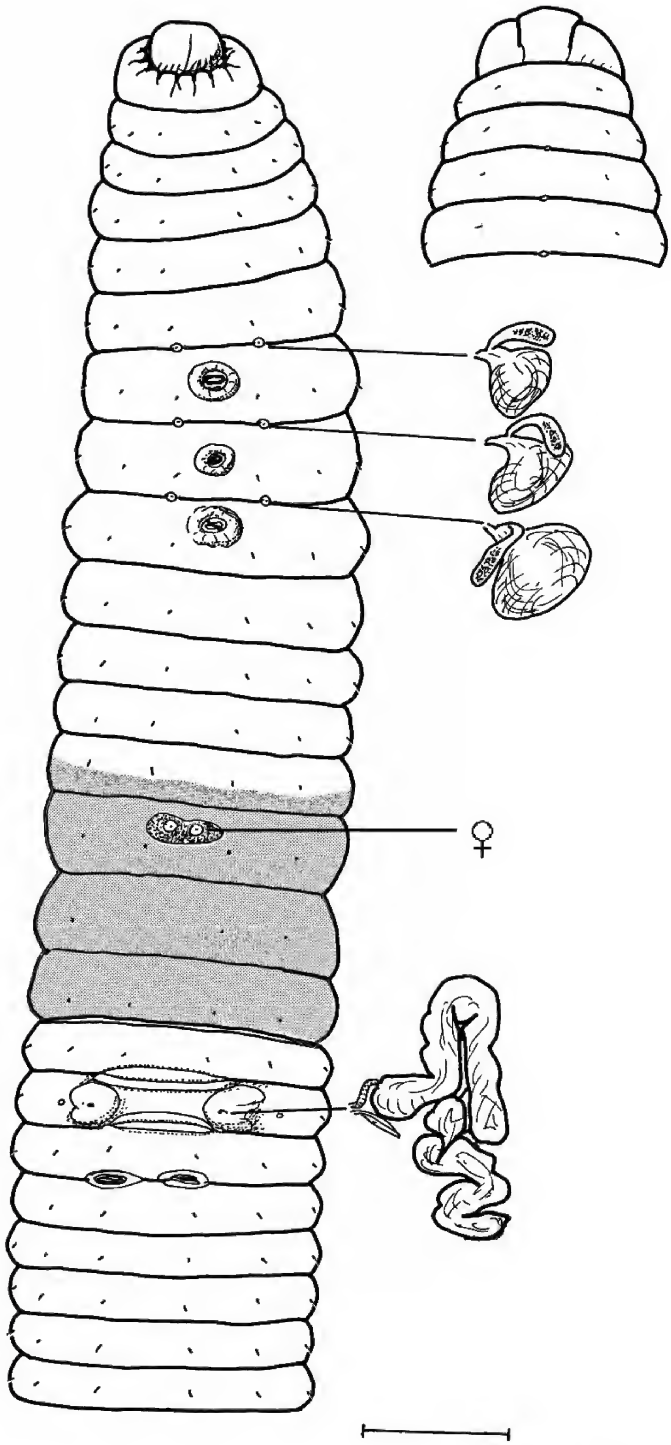


Fig. 71. Vesiculodrilus ventralis Blakemore, 2000, P5.

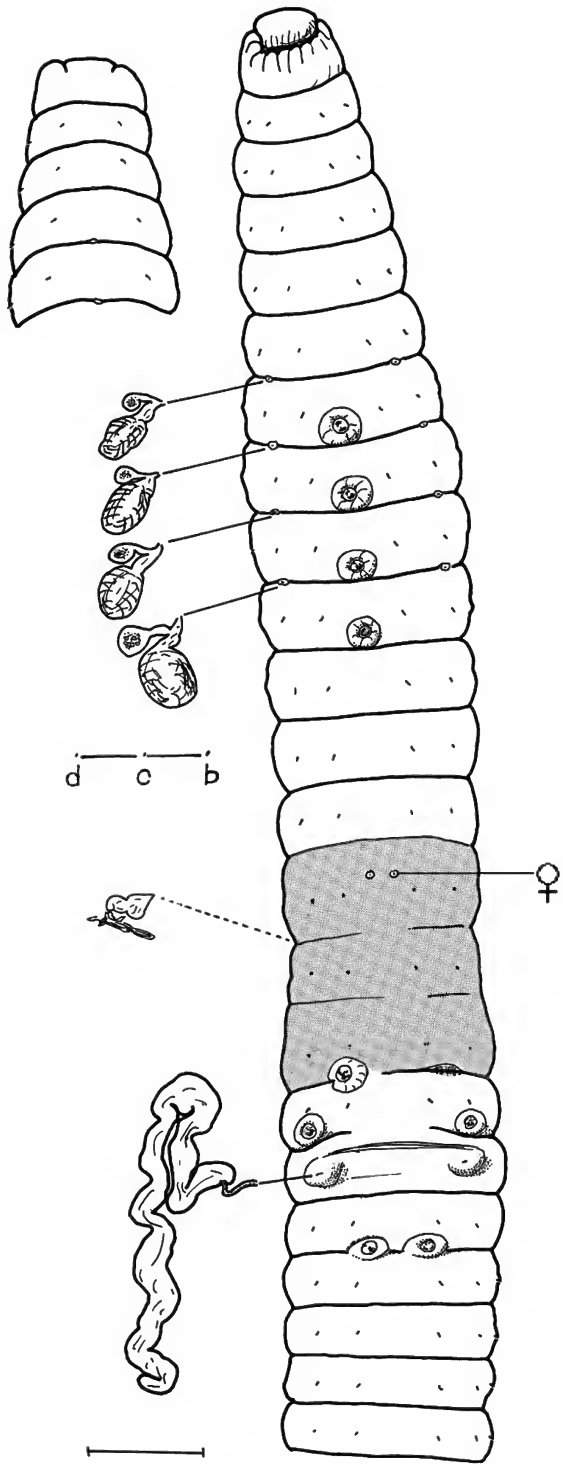


Fig. 72. Vesiculodrilus zeehan, H.

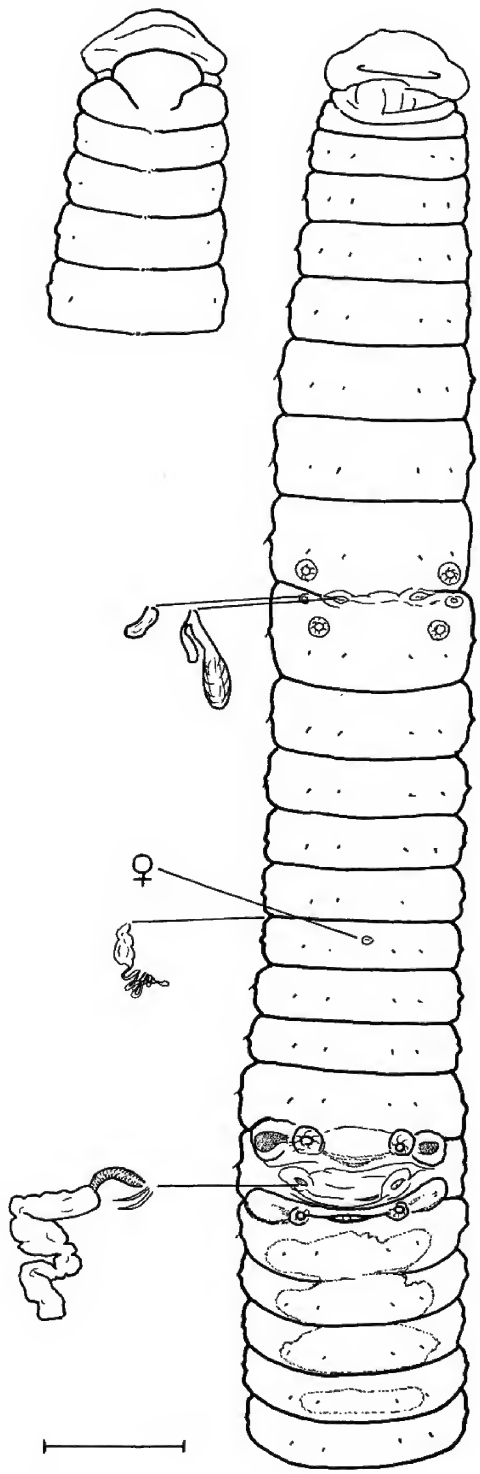


Fig. 73. Amphimiximus delicans, H.

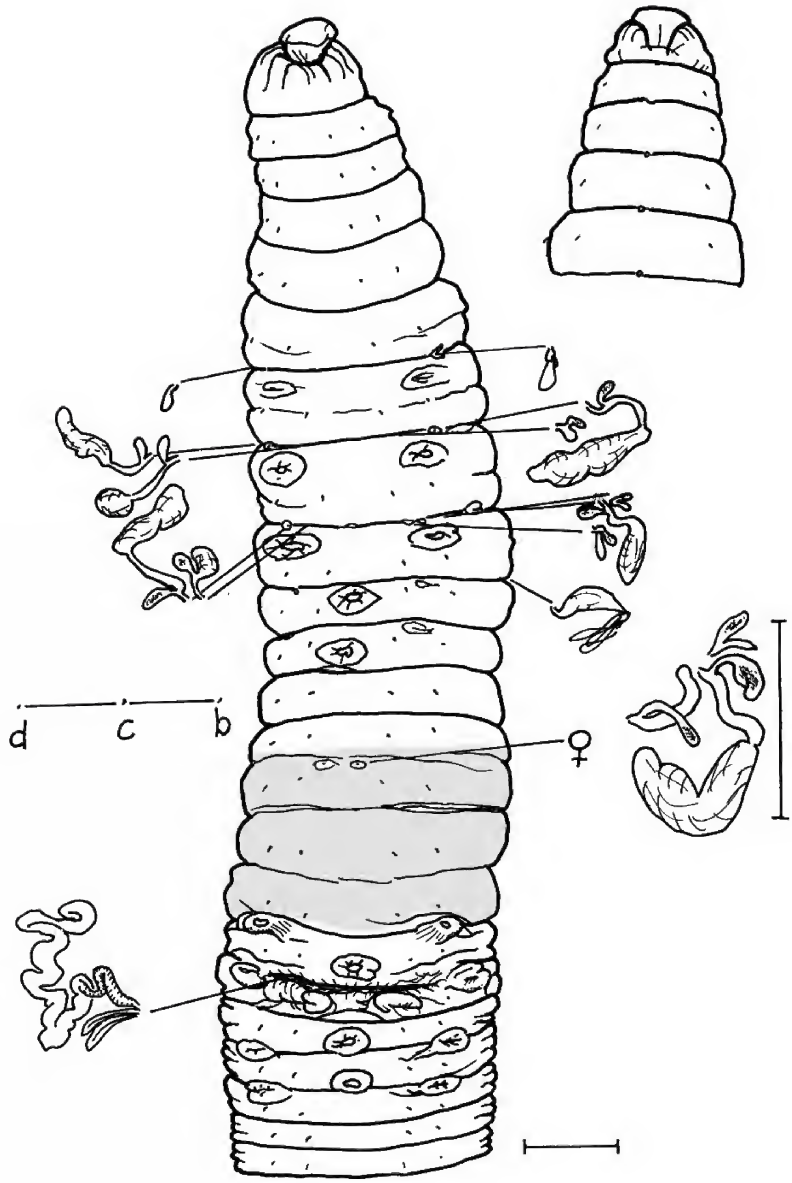


Fig. 74. Amphimiximus stumpyi, H with enlargement of 9rhs spermathecae.

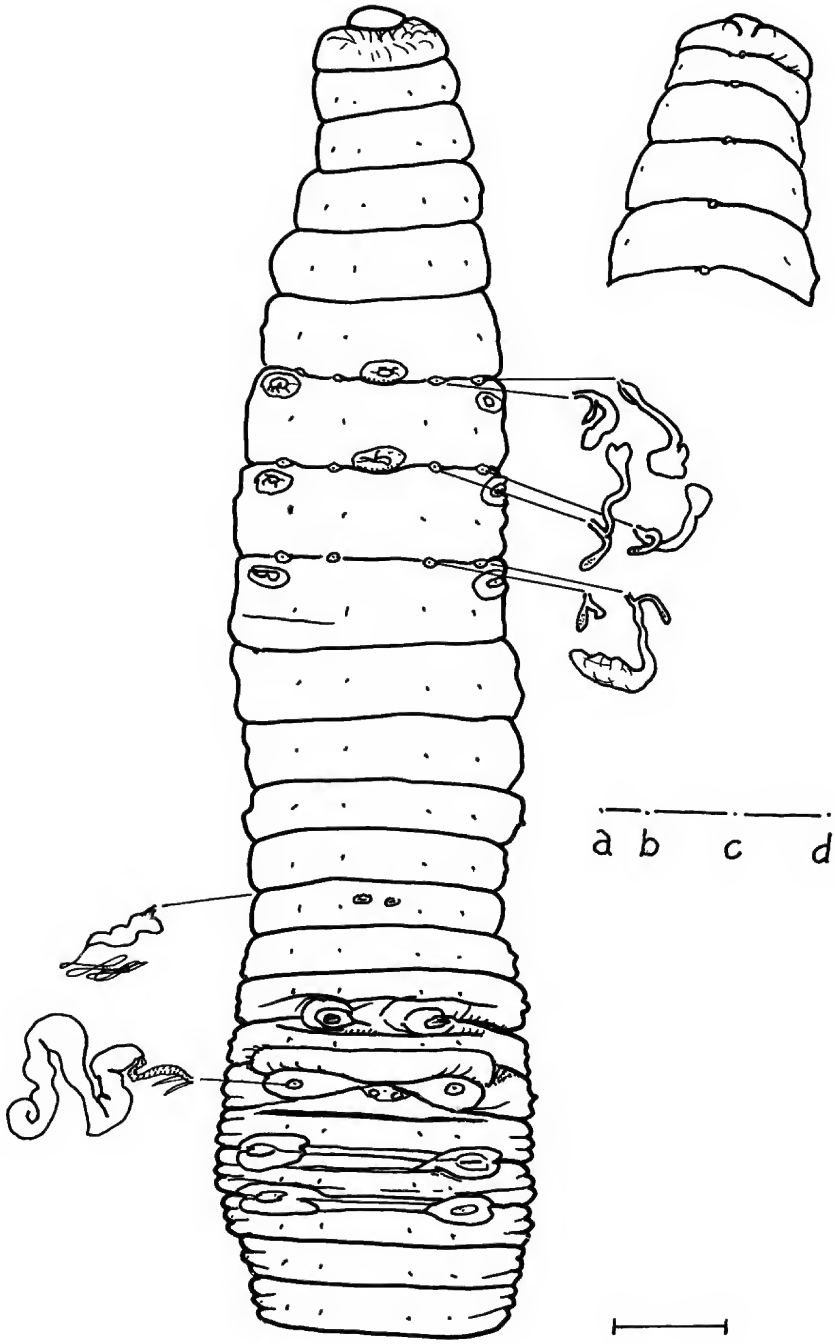


Fig. 75. Amphimiximus stumpyi, P1.

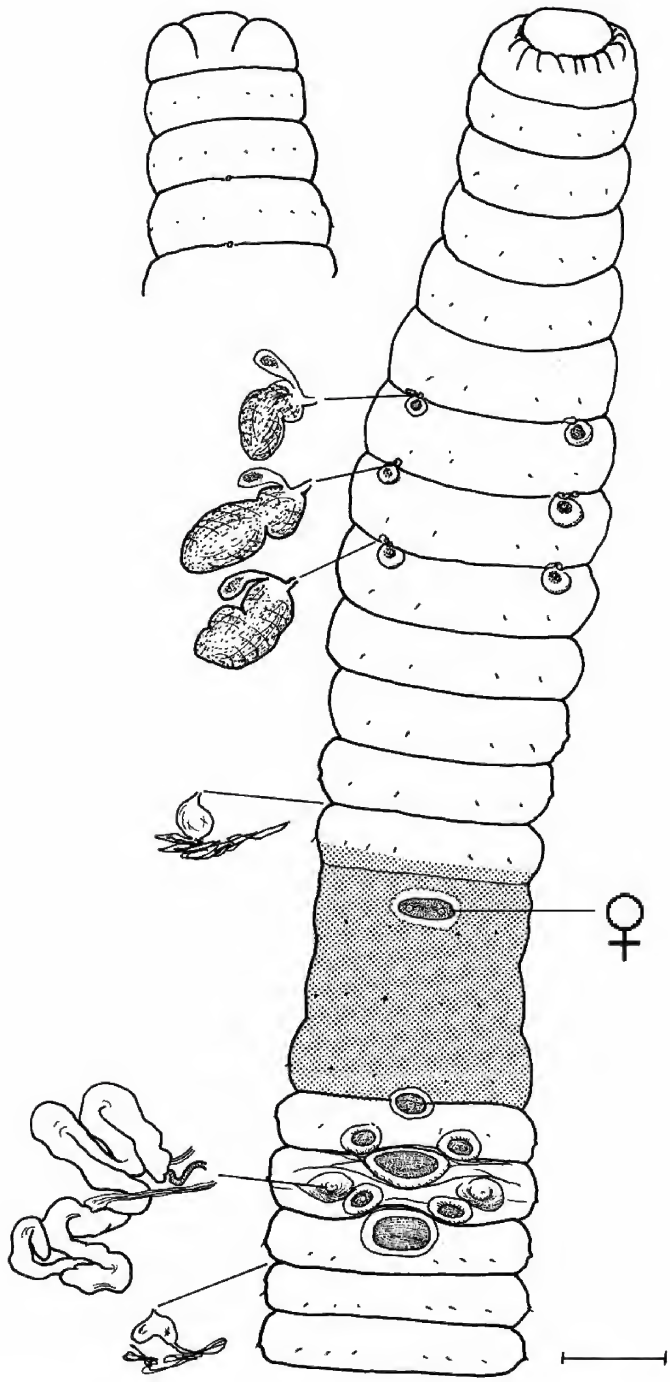


Fig. 76. Diporochaeta ateramnis, H.

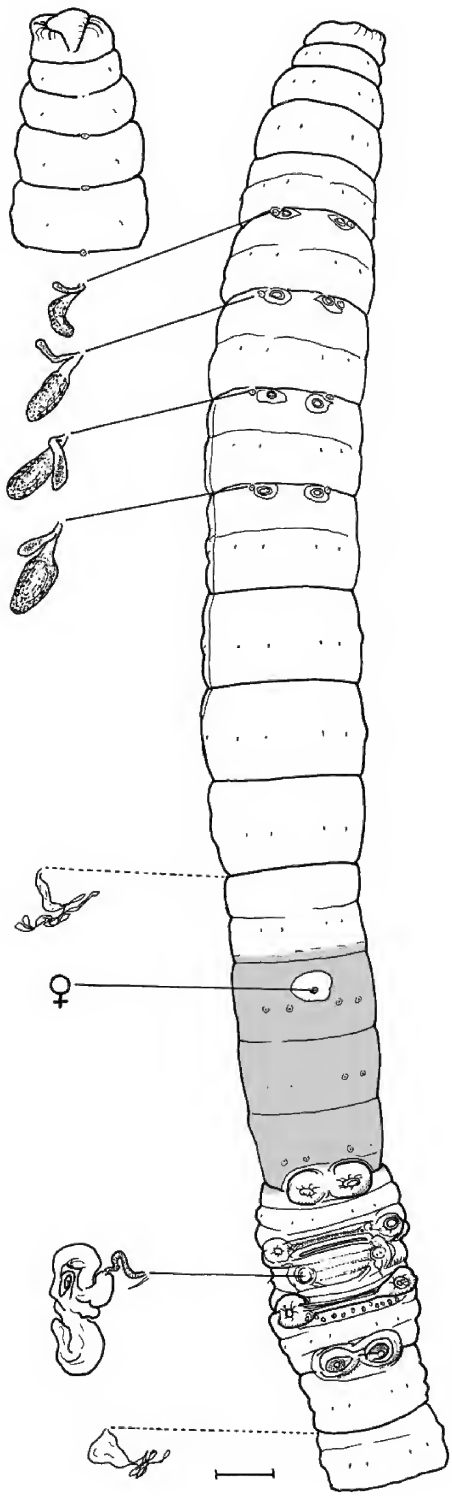


Fig. 77. Diporochaeta coccyx, H.

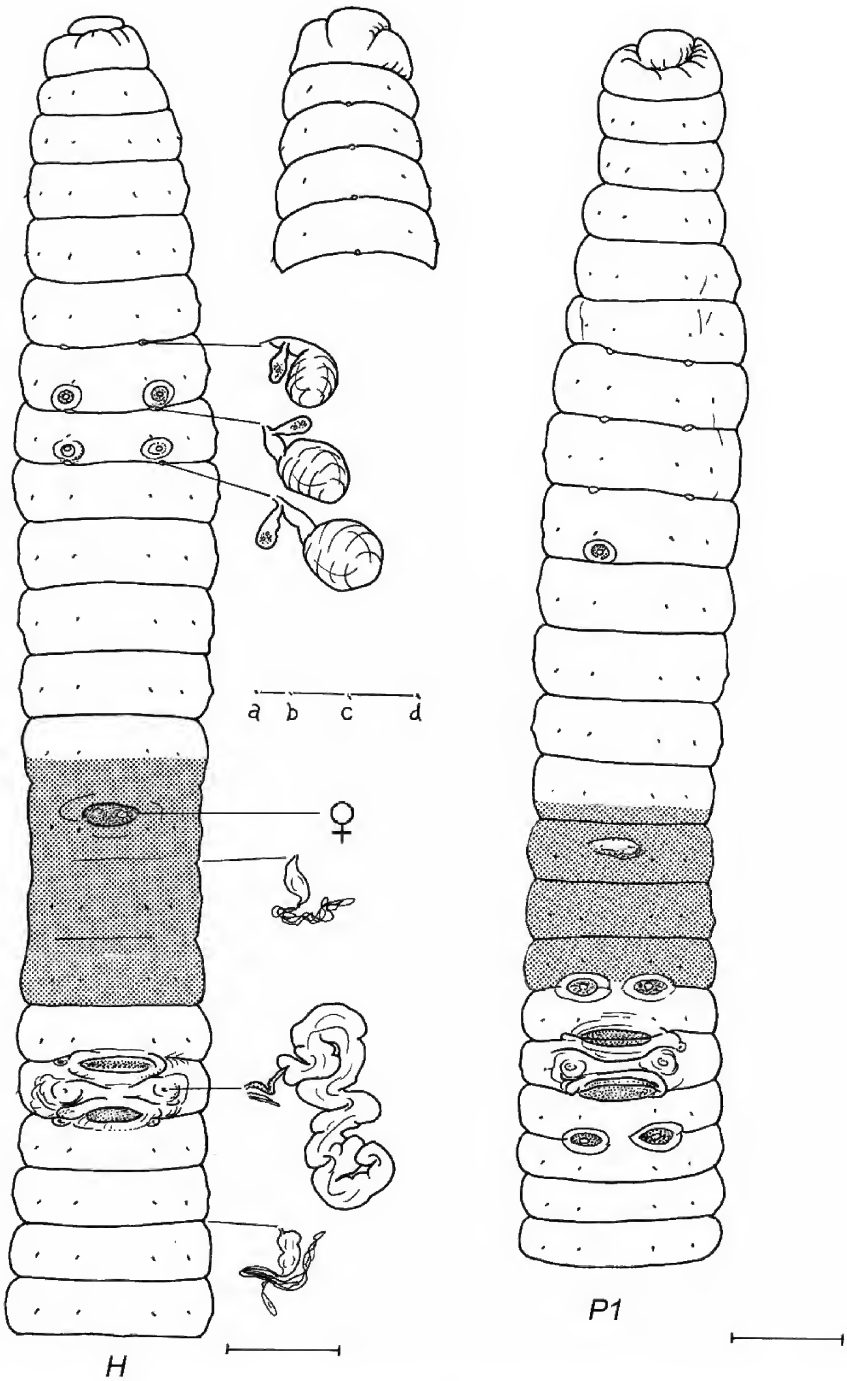


Fig. 78. Diporochaeta diadema Blakemore, 2000, H and P1.

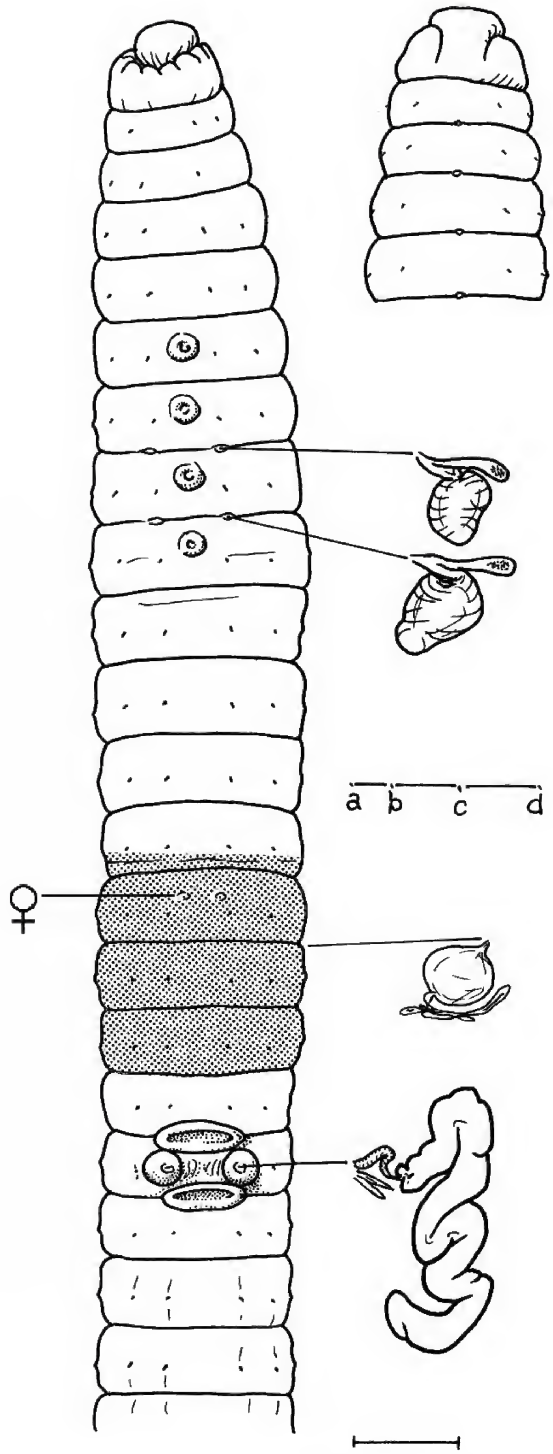


Fig. 79. Diporochaeta gordoni Blakemore, 2000, H.

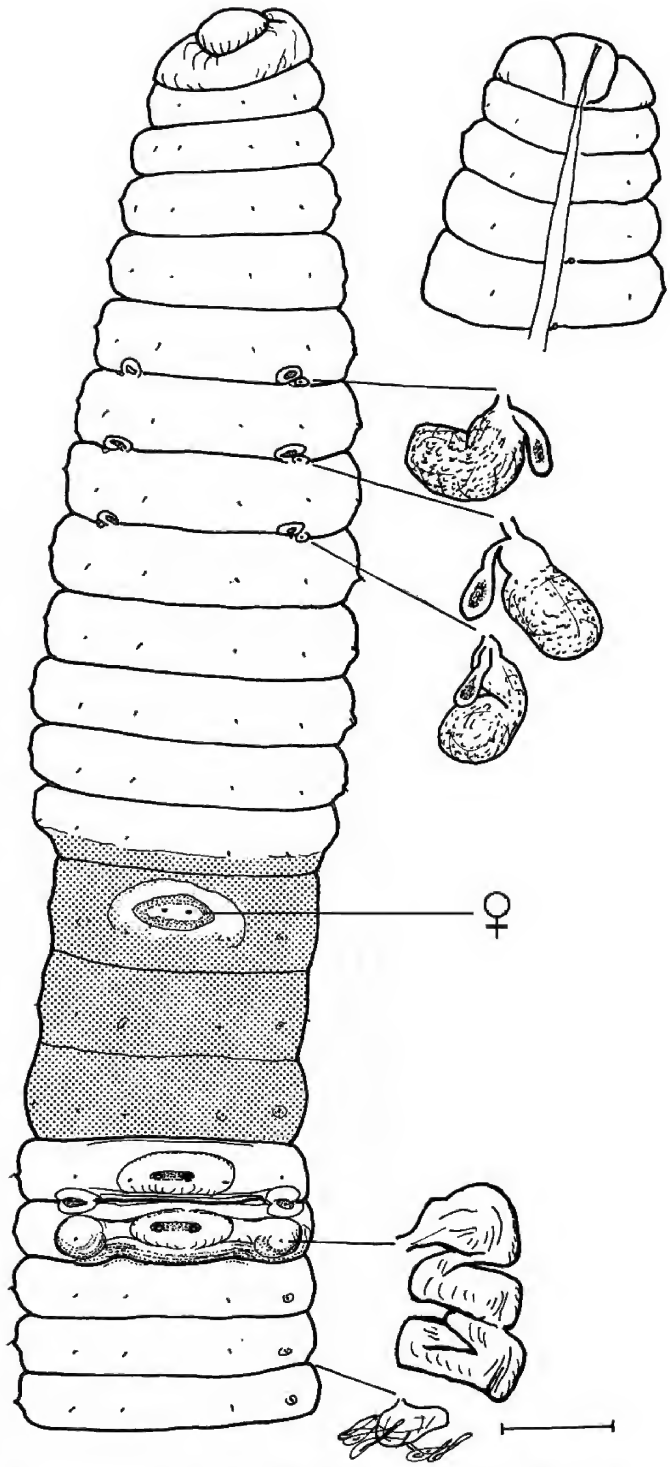


Fig. 80. Diporochaeta hellyeri (Jamieson, 1974), H.

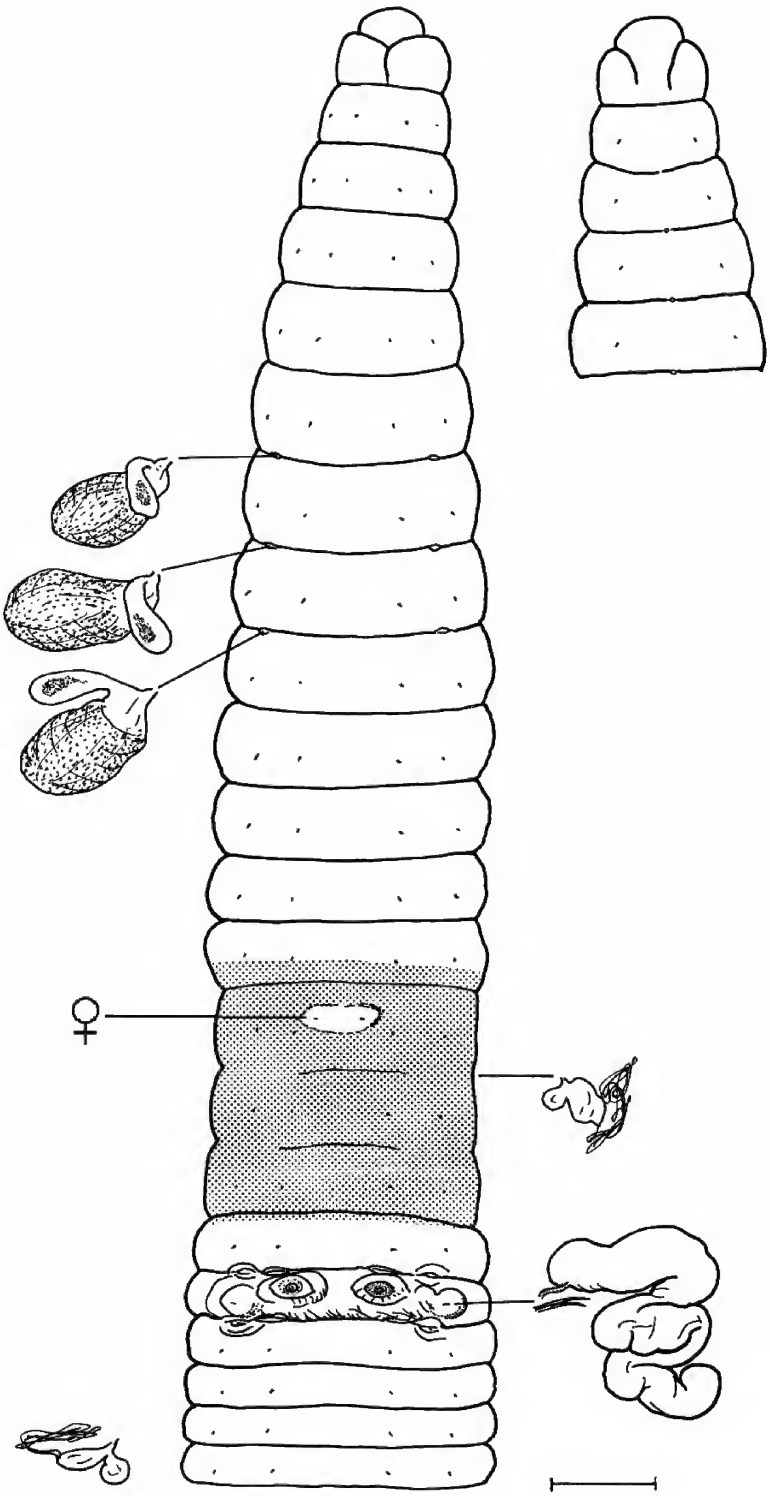


Fig. 81. Diporochaeta iseo, H.

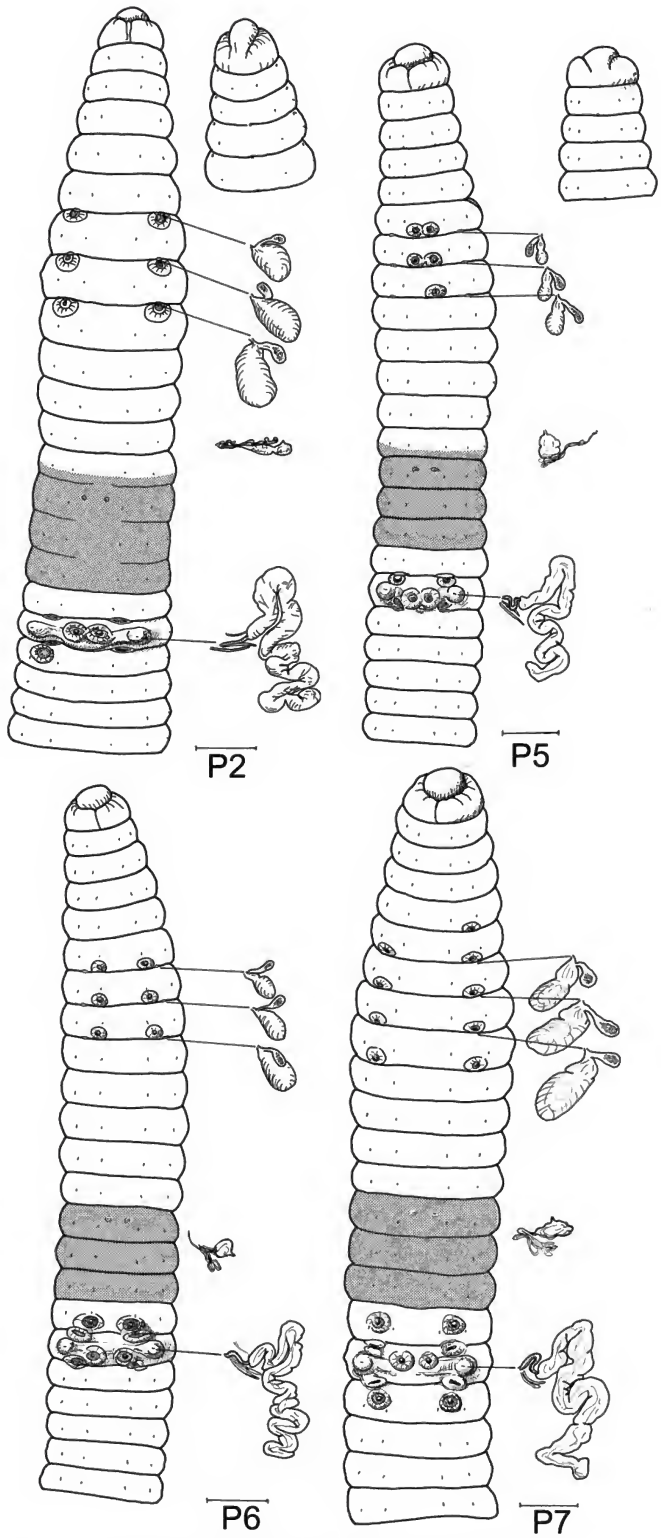


Fig. 82. Diporochaeta iseo, Paratypes.

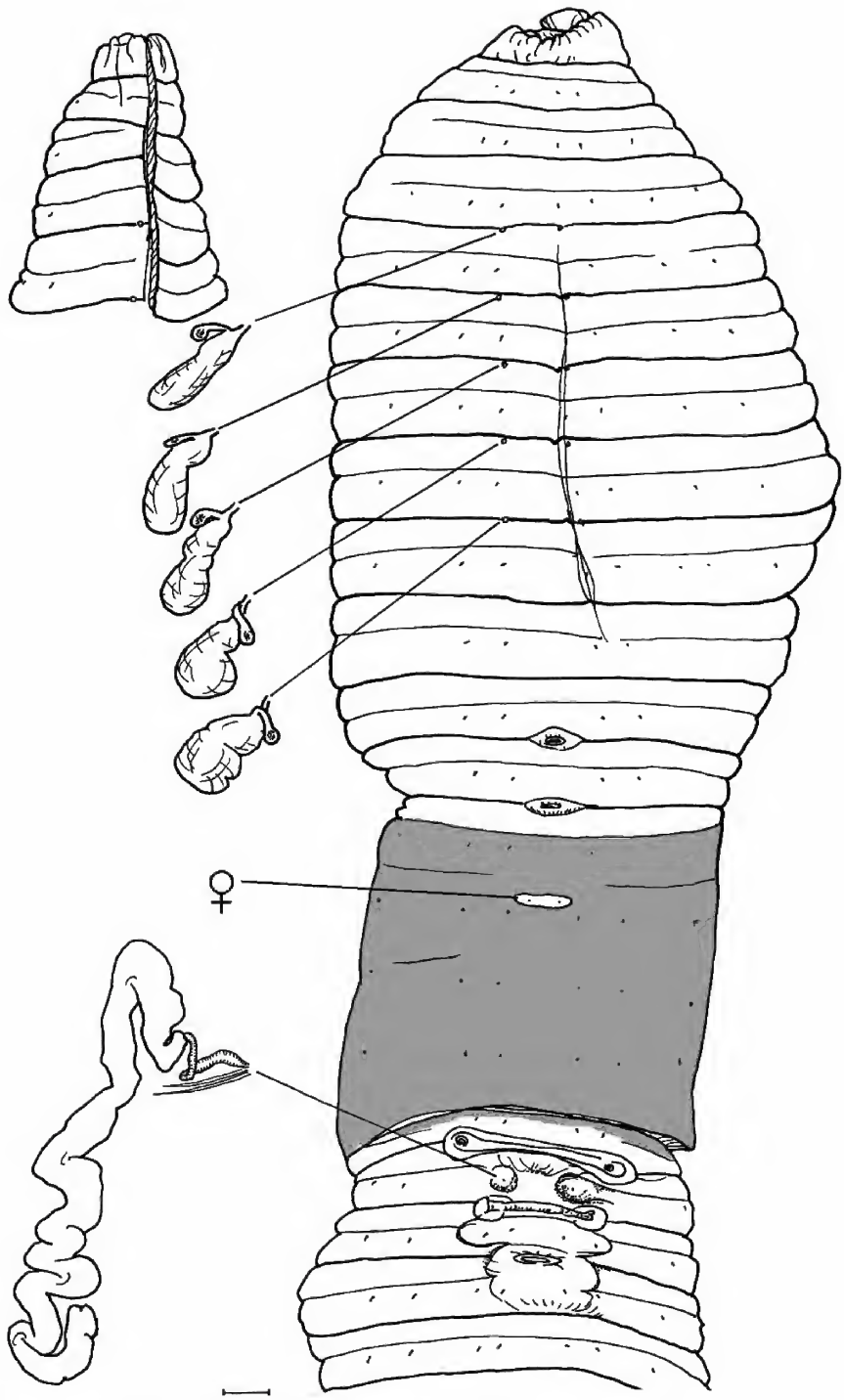


Fig. 83A. Diporochaeta kershawi (Jamieson, 1974), H.

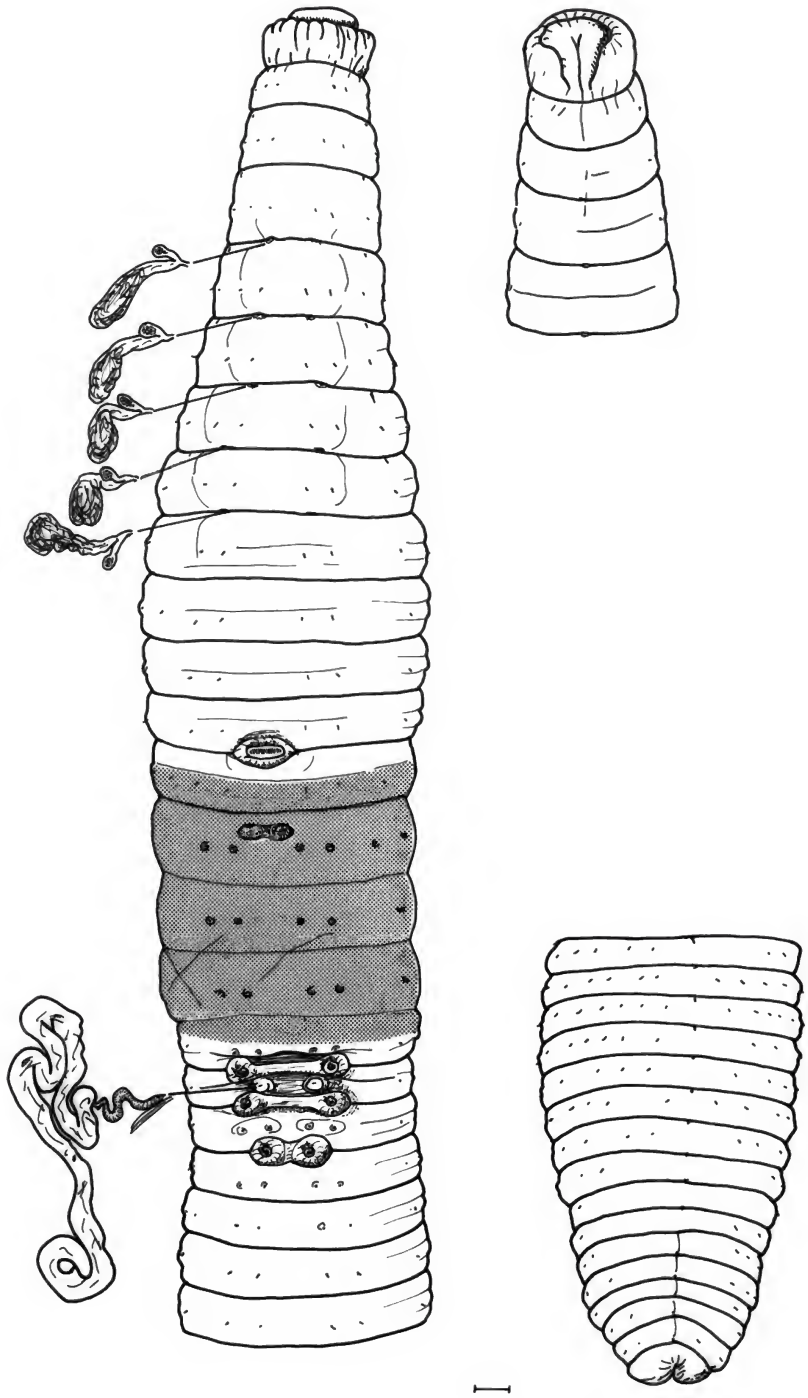


Fig. 83B. Diporochaeta kershawi (Jam., 1974), 14:1115.

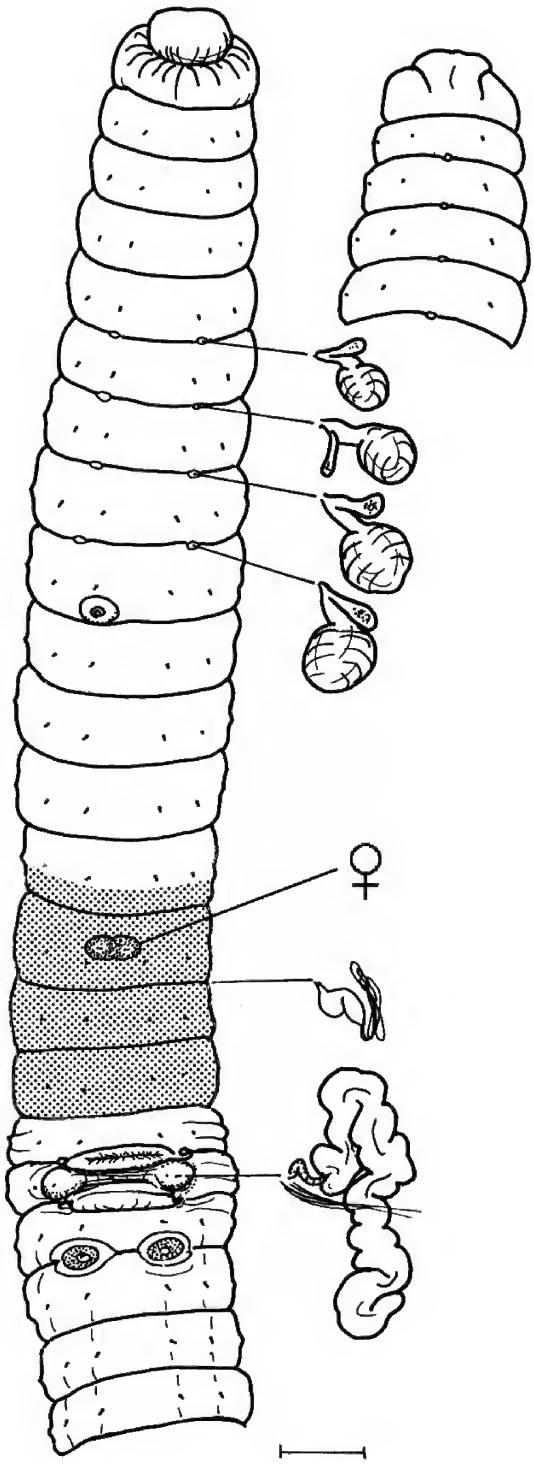


Fig. 84. Diporochaeta lacustris Blakemore, 2000, H.

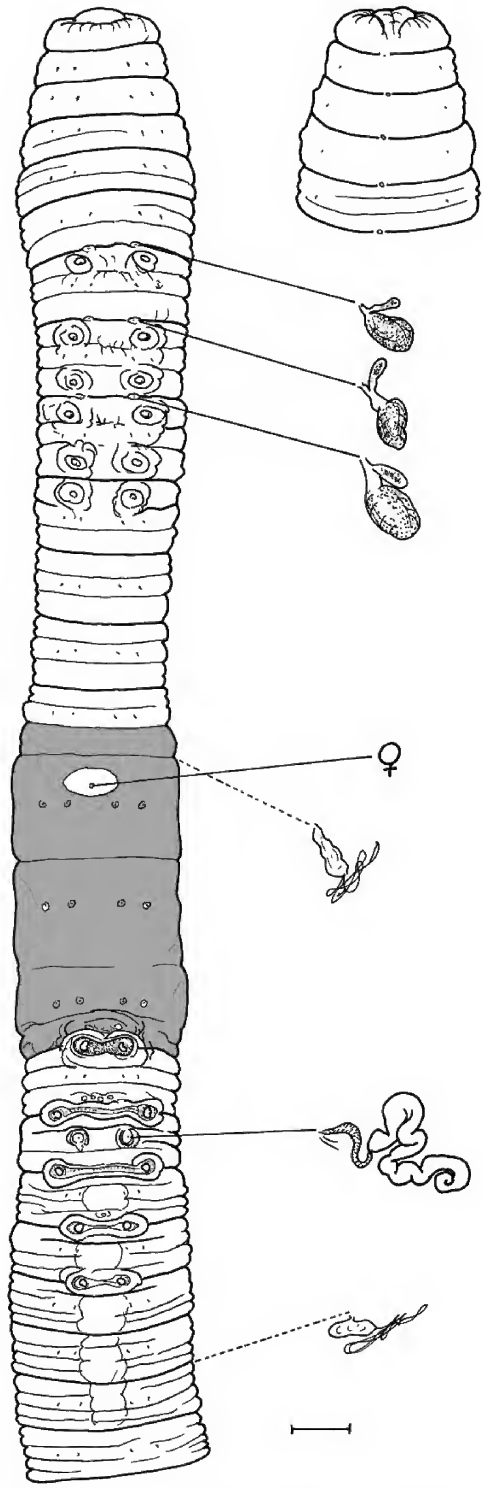


Fig. 85. Diporochaeta monogyna, H.

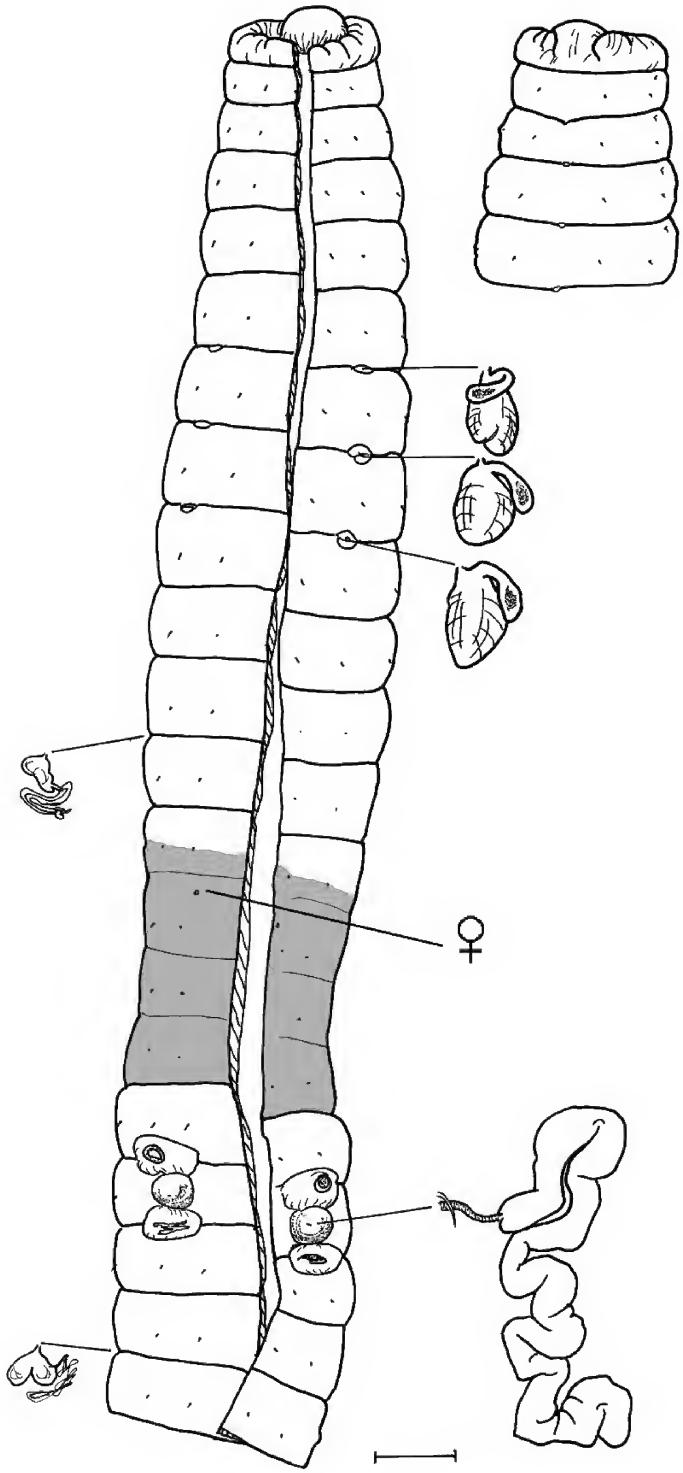


Fig. 86. Diporochaeta montisarthuri (Jam., 1974), H.

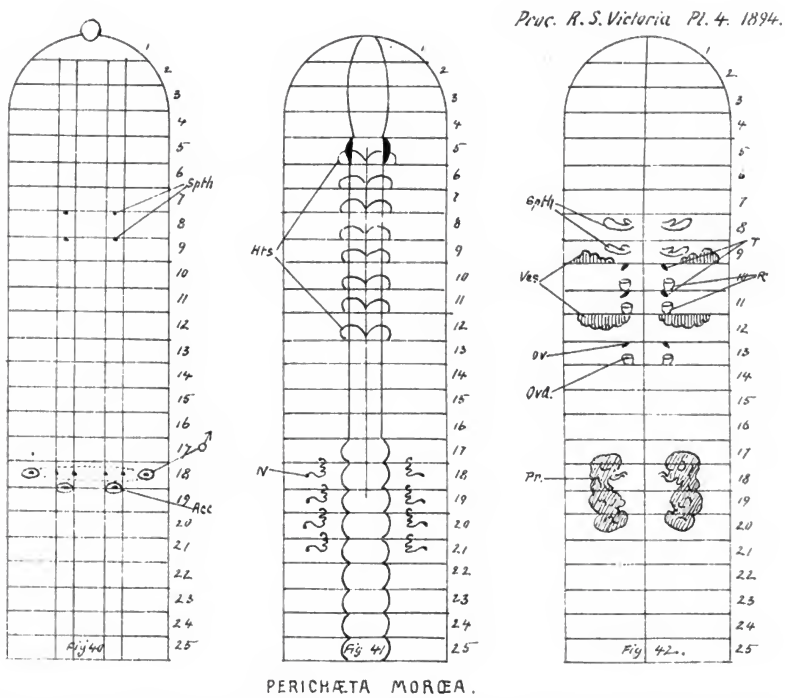


Fig. 87. Diporochaeta moroea (Spencer, 1895), from original. [Note: in lectotype F40292, spermathecal pores are in c lines, markings are in 19/20 and prostates are tubular (pers. obs.)].

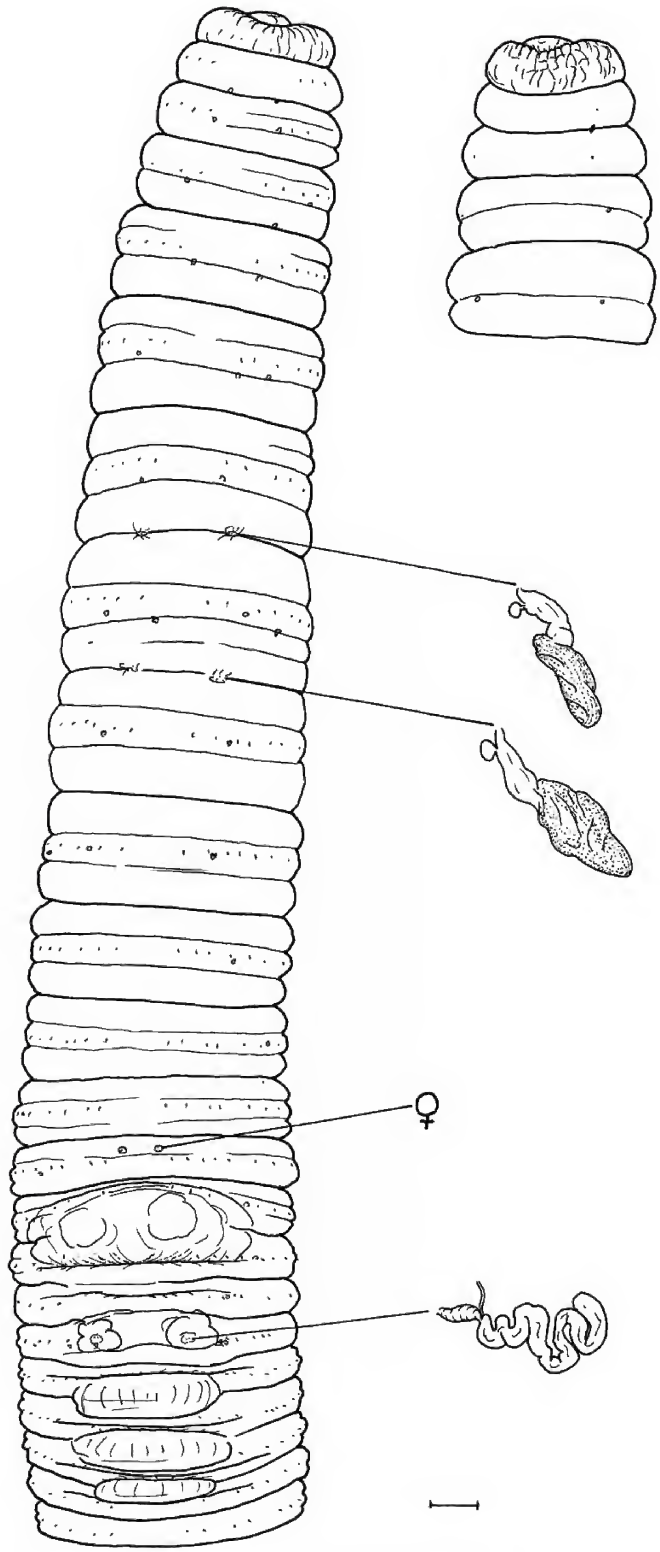


Fig. 88. Diporochaeta pulvilla, H.

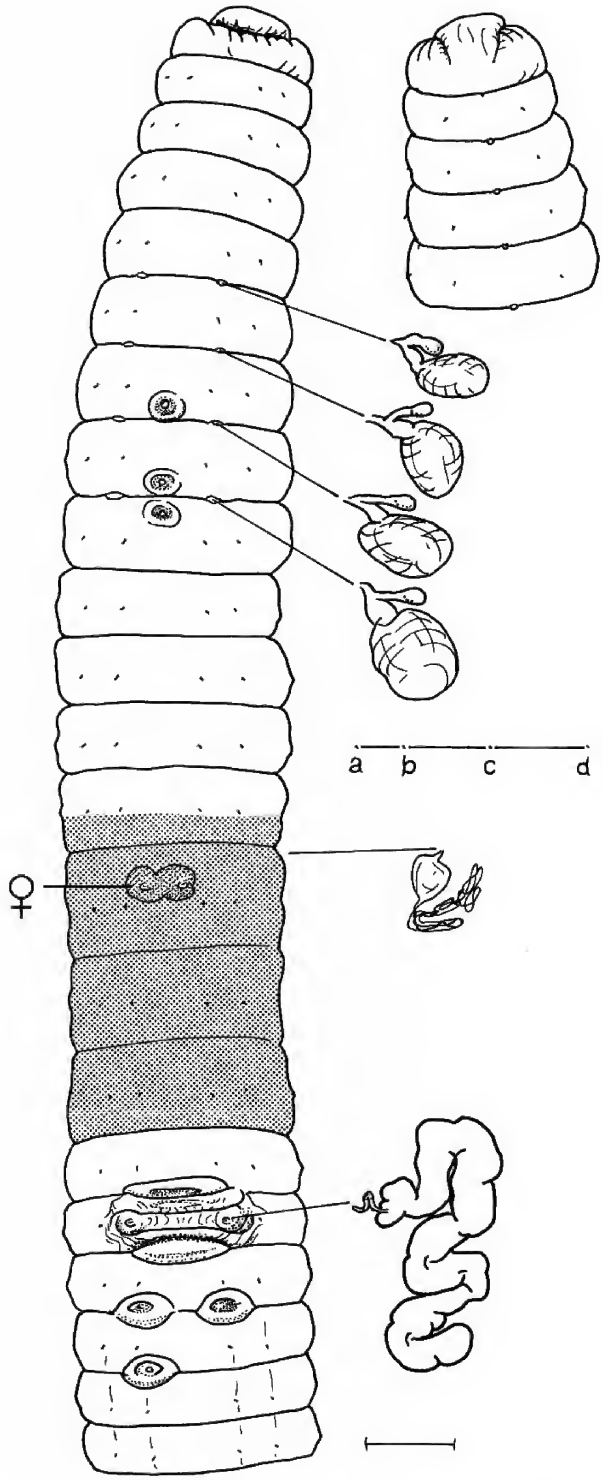


Fig. 89. Diporochaeta rubertumula Blakemore, 2000, H.

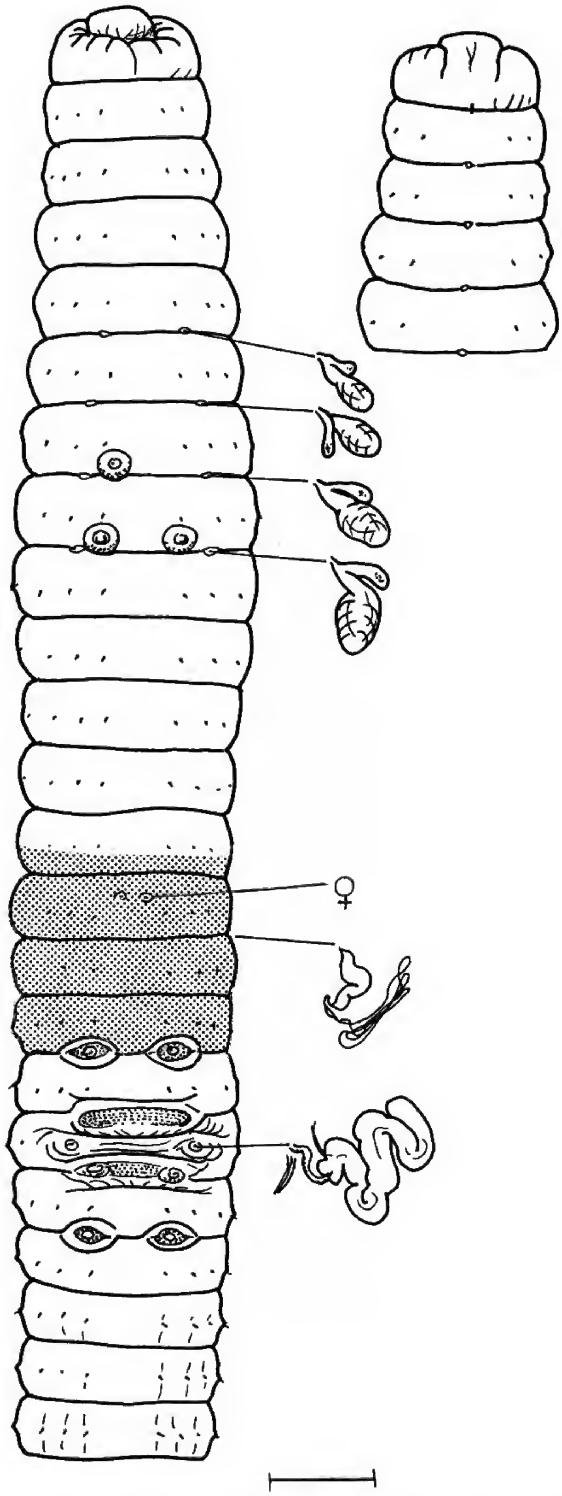


Fig. 90. Diporochaeta setosa Blakemore, 2000, H.

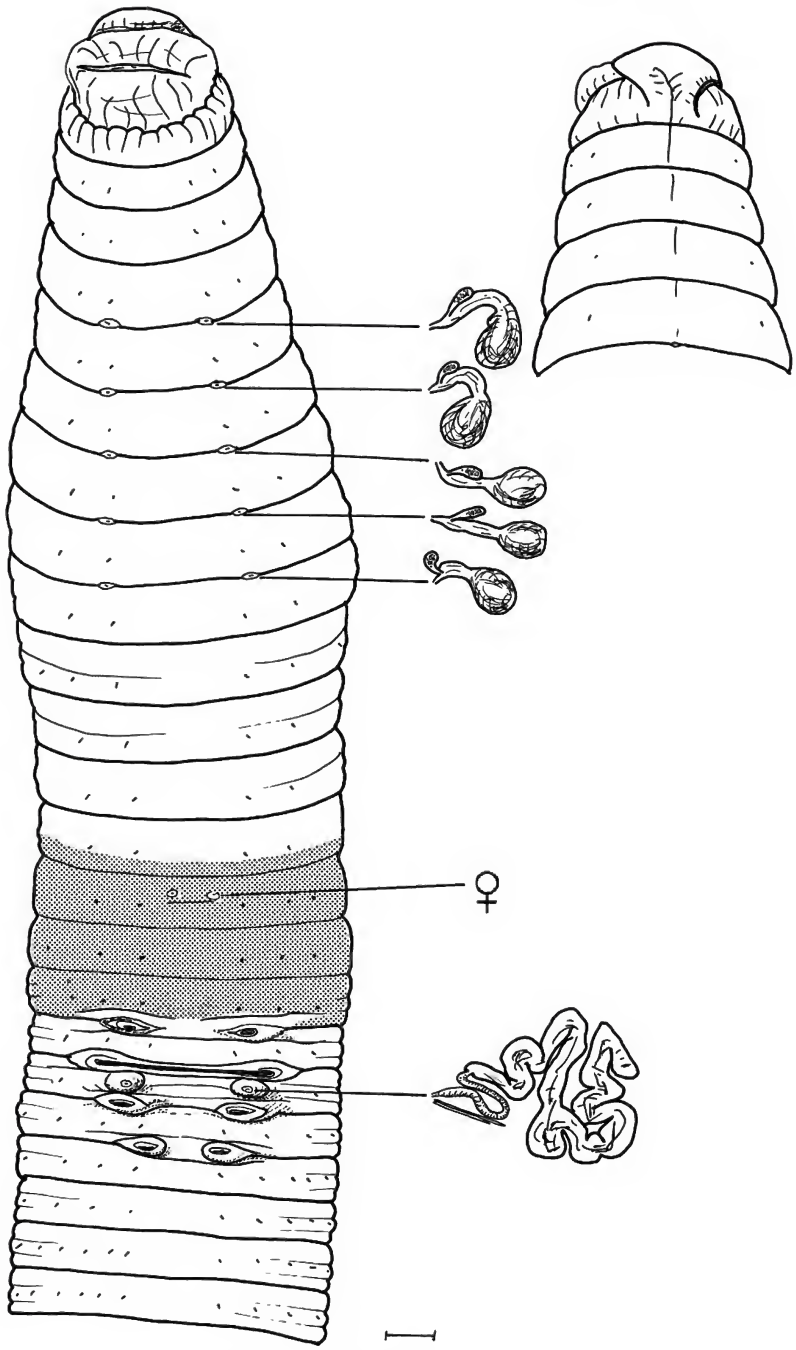


Fig. 91. Diporochaeta soccoli, H.

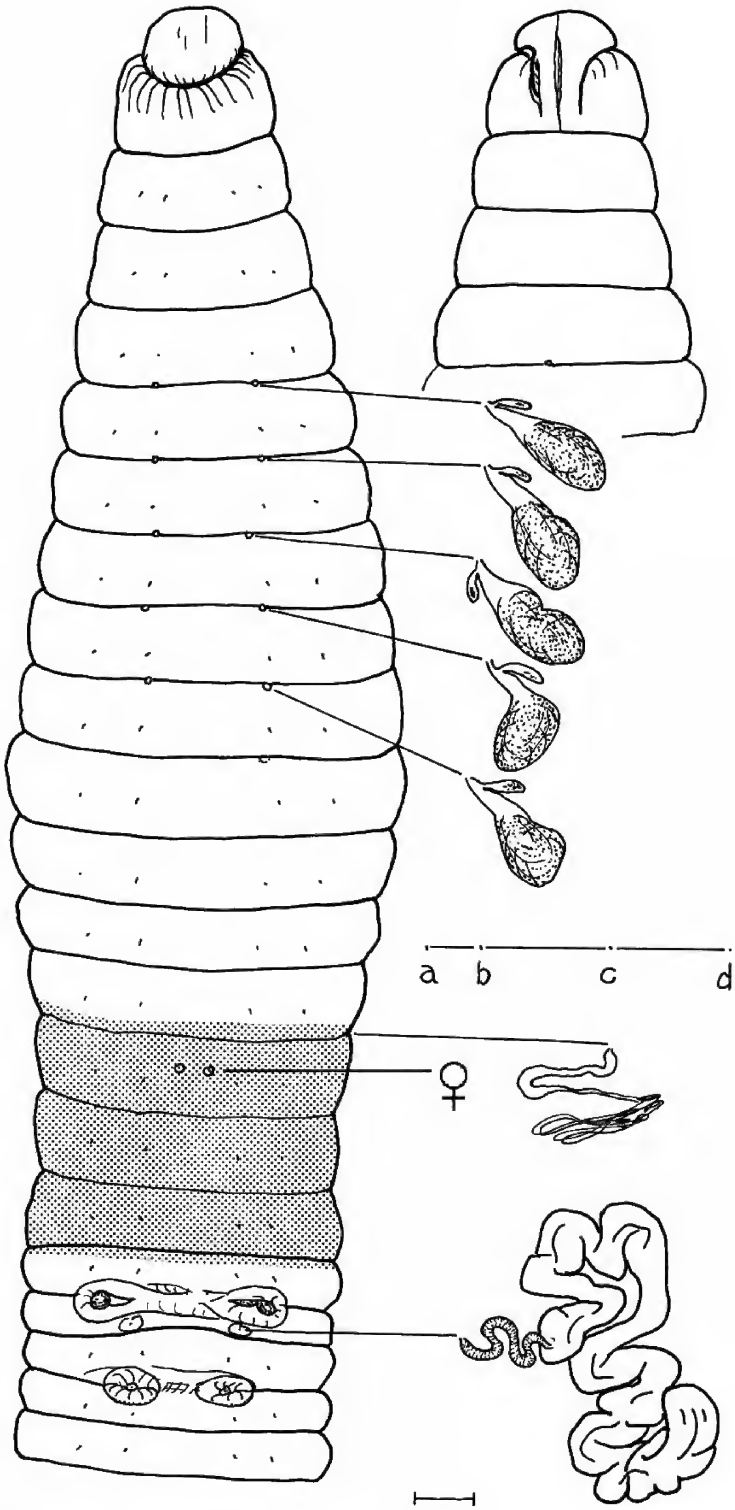


Fig. 92. Diporochaeta stronach, H.

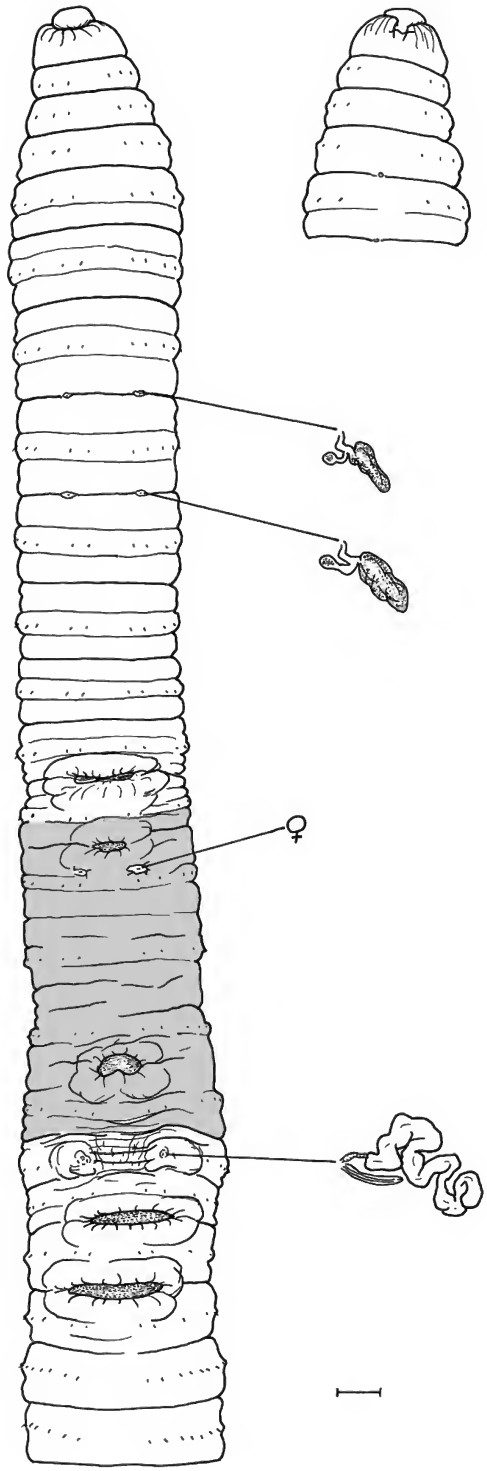


Fig. 93. Diporochaeta sucta, H.

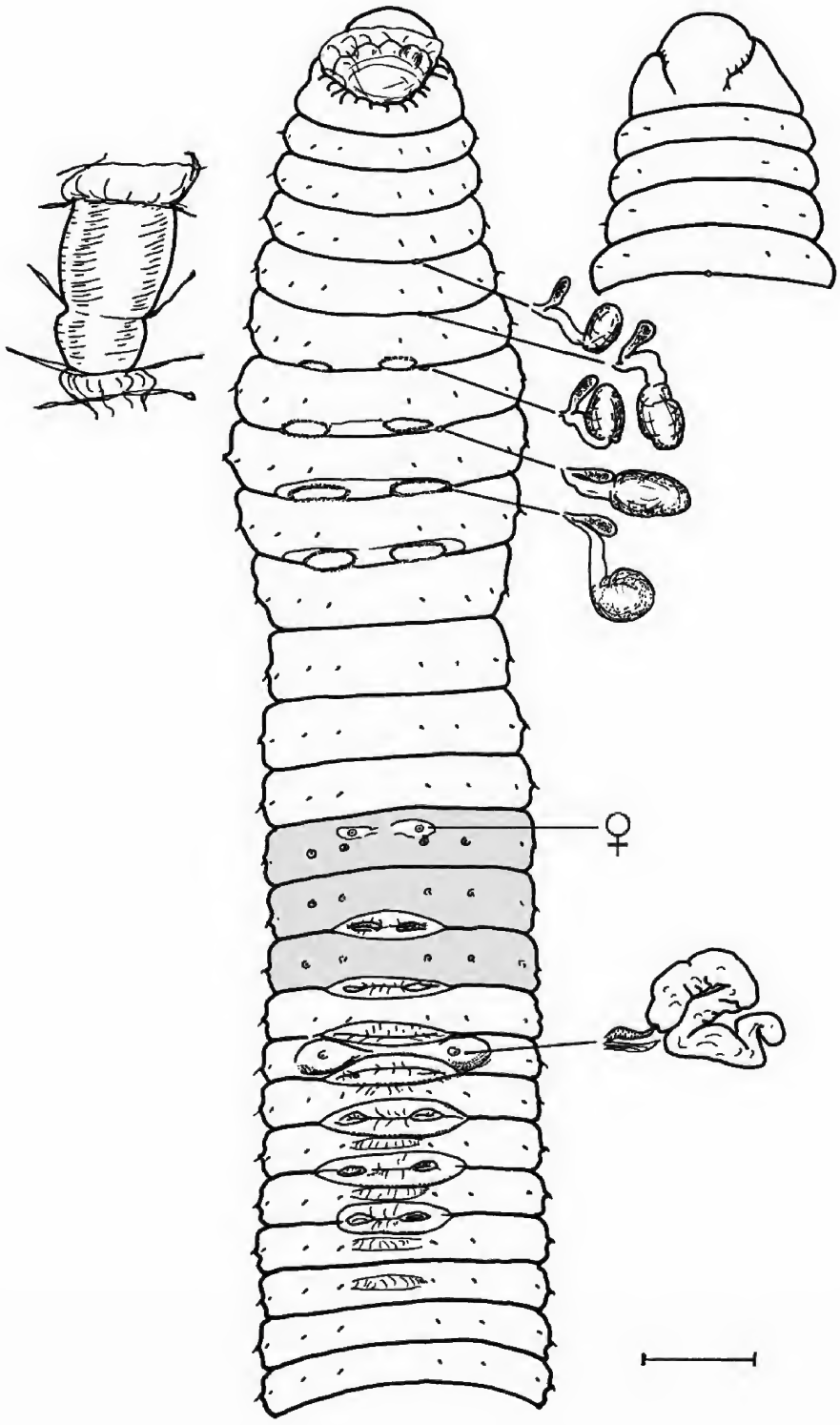


Fig. 94. Provescus crottyi, H.

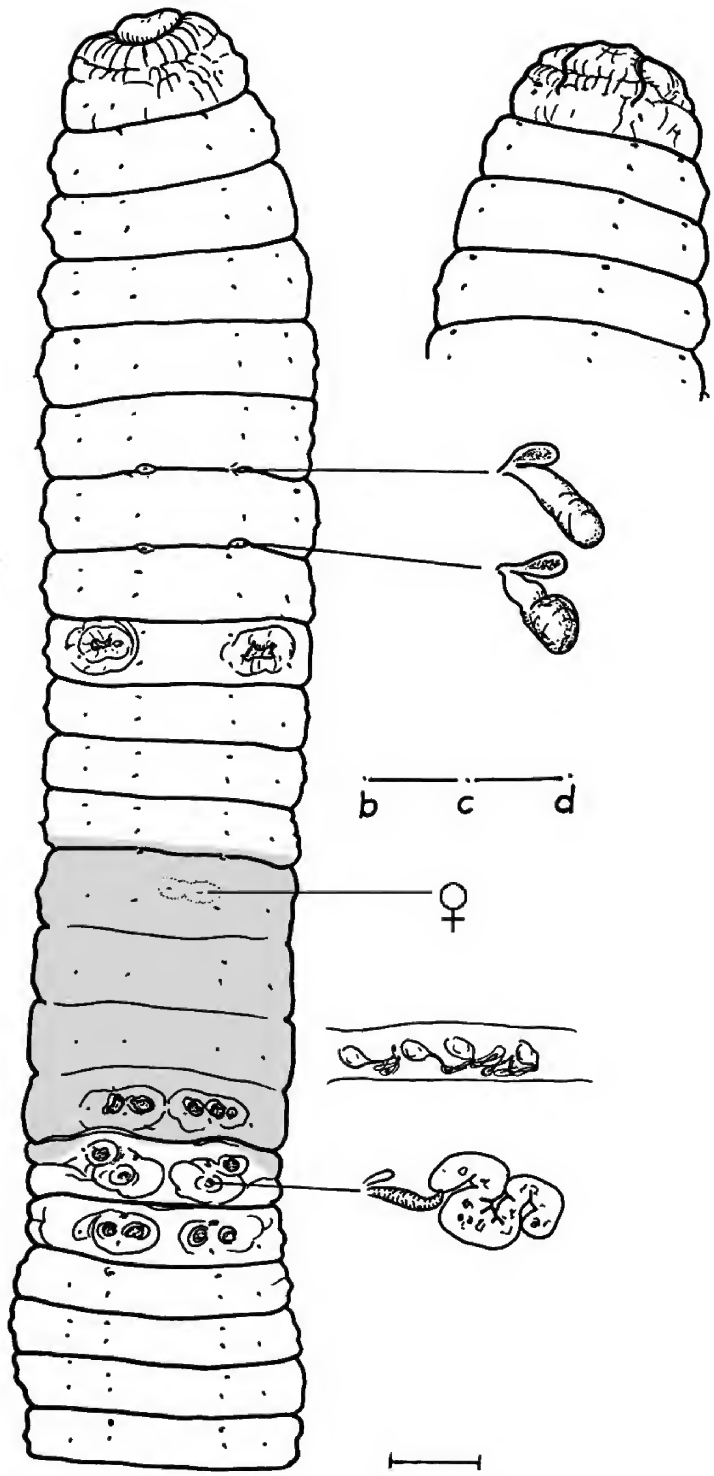


Fig. 95. Megascolides cataractus, H.

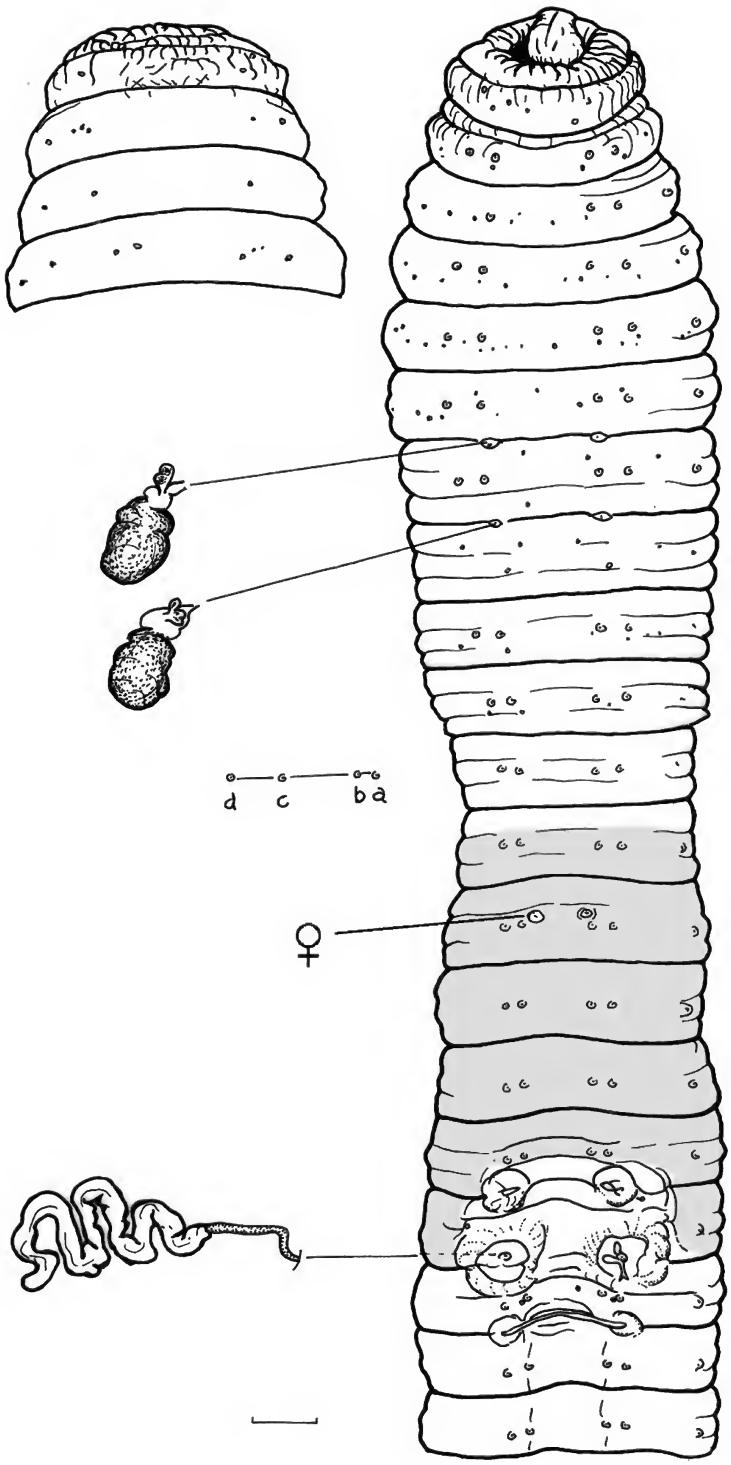


Fig. 96. Megascolides catenastagnis, H.

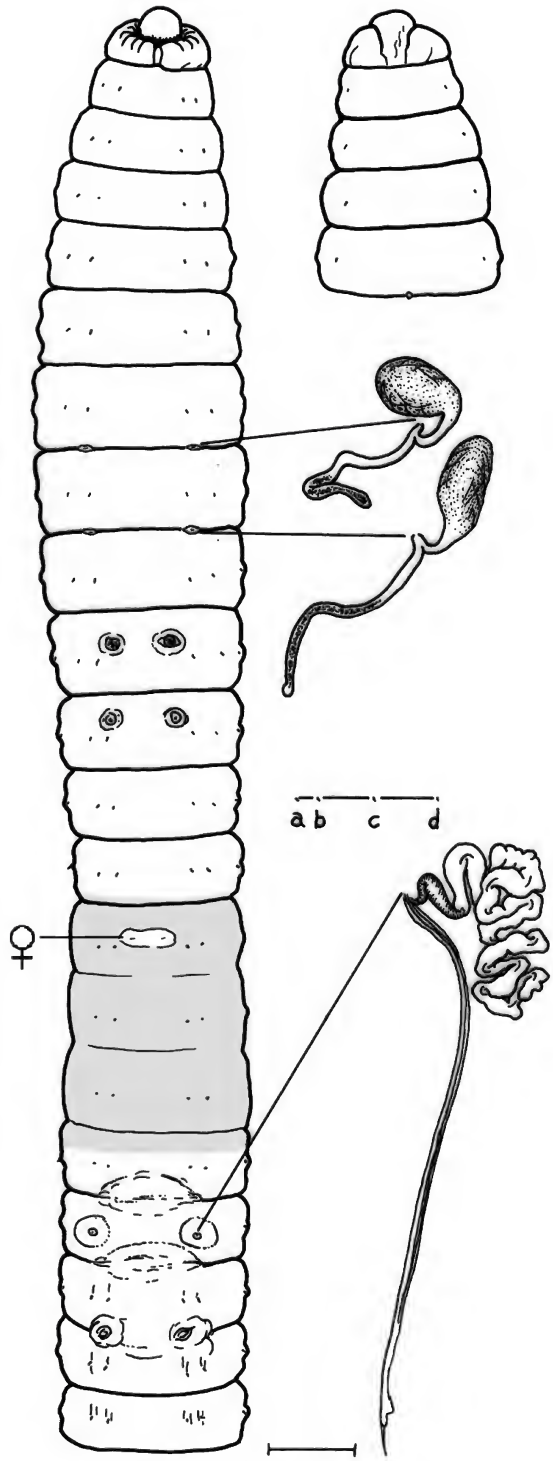


Fig. 97. Megascolides croesus, H.

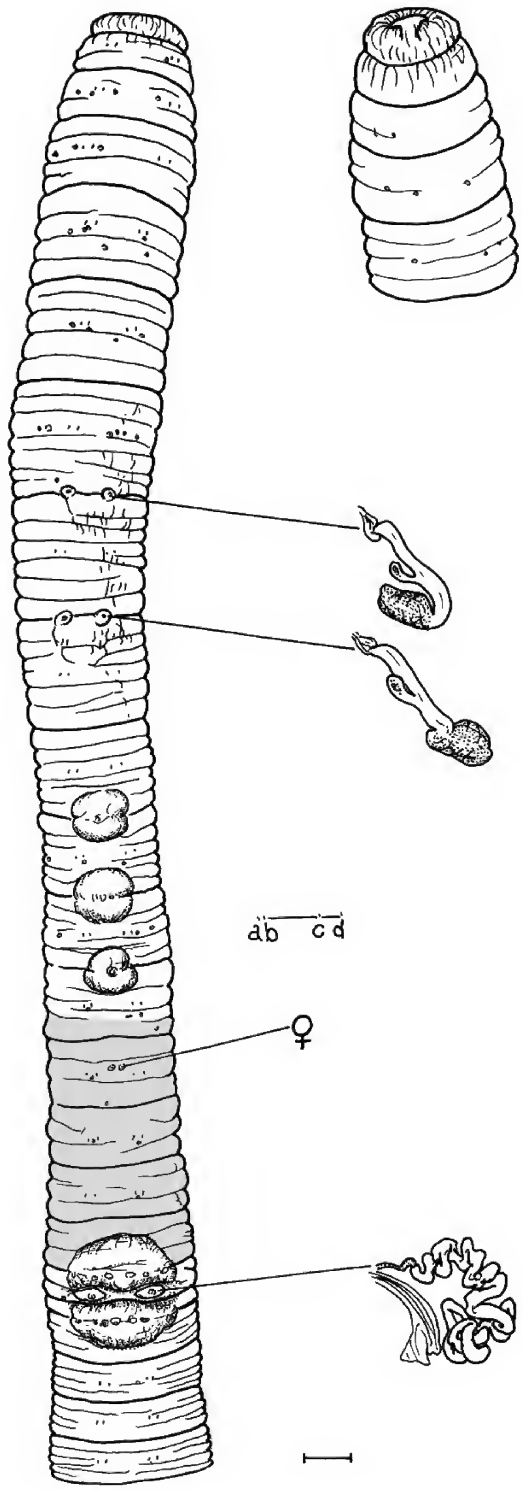


Fig. 98. Megascolides fontis, H.

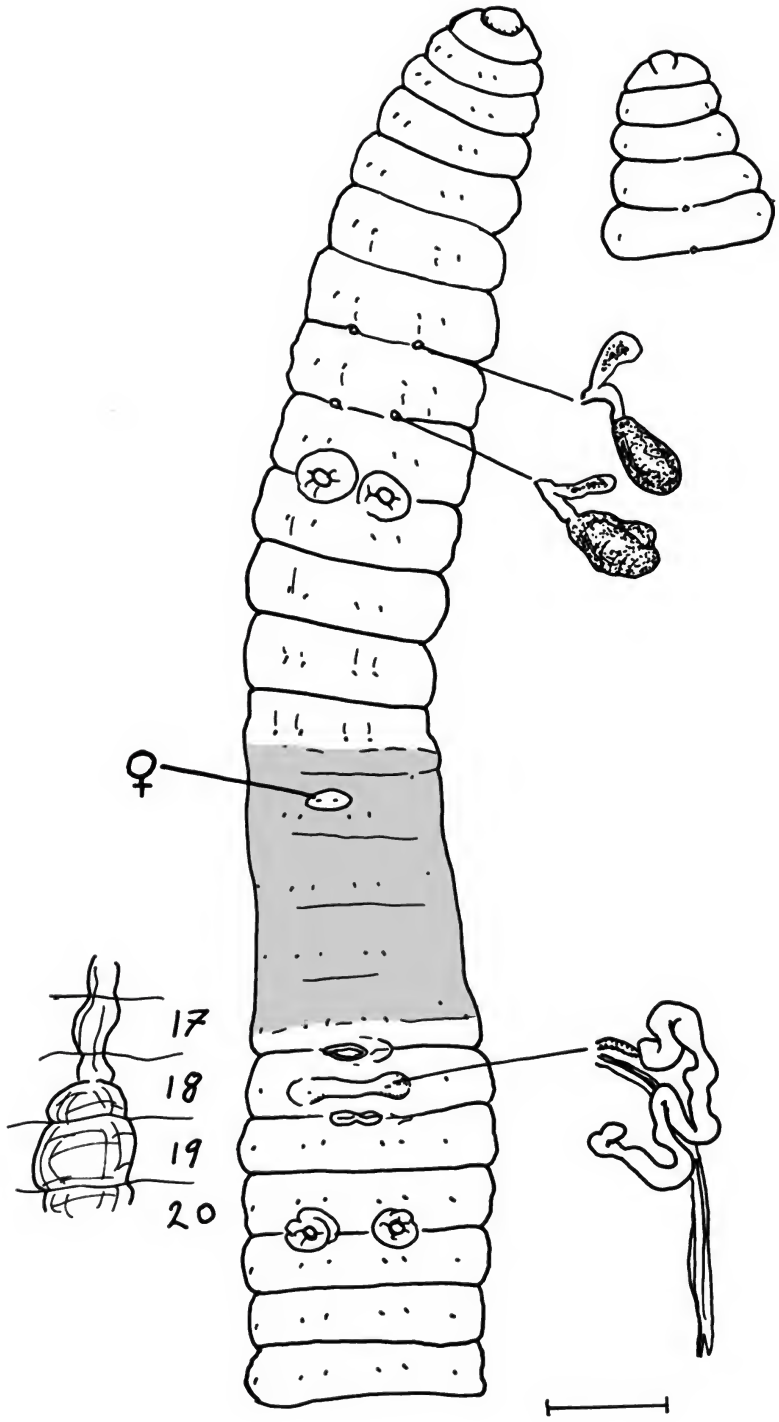


Fig. 99. Megascolides improbus, H.

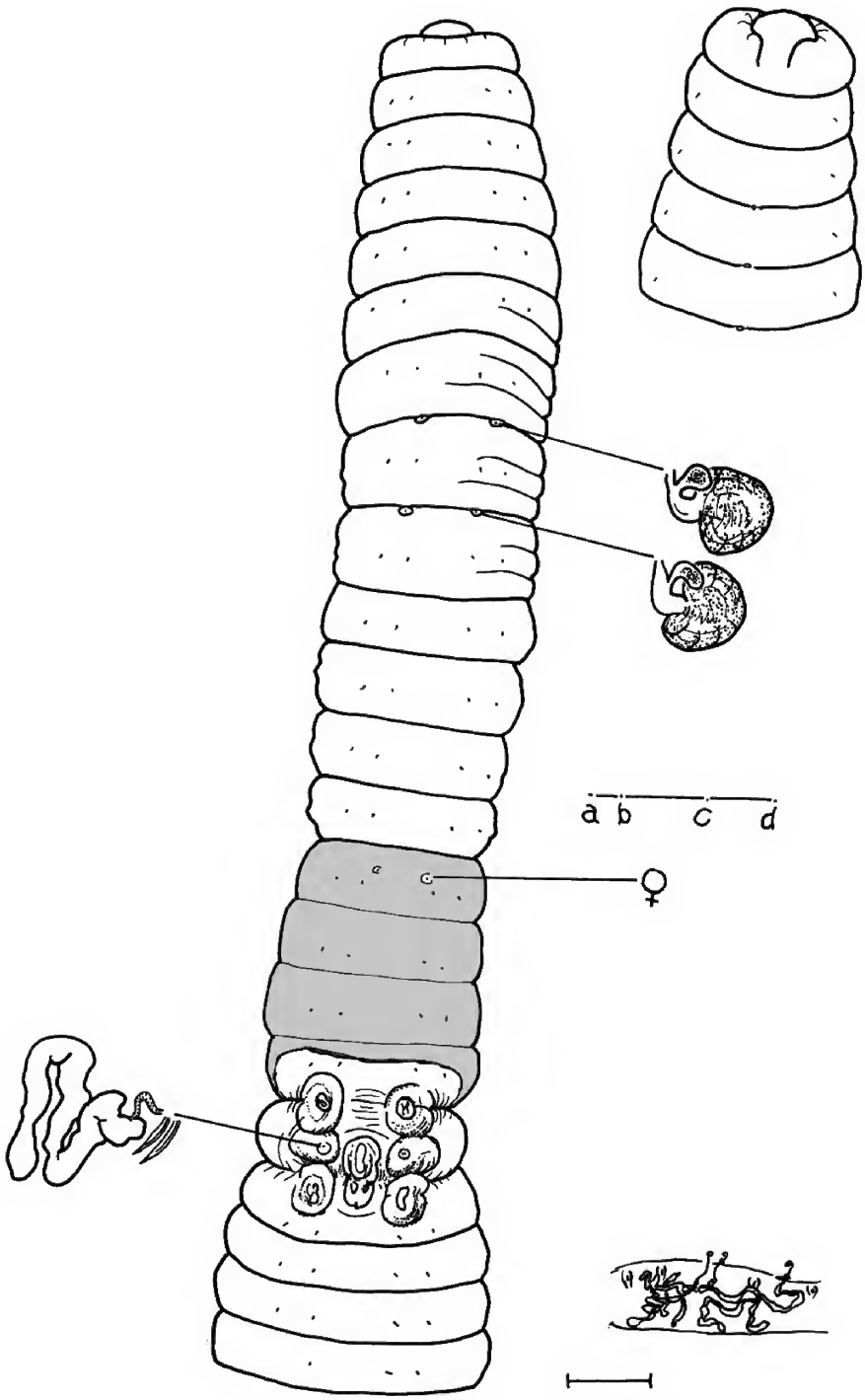


Fig. 100. Megascolides intestinalis, H, with nephridia in ca. 32rhs shown in relation to setal lines.

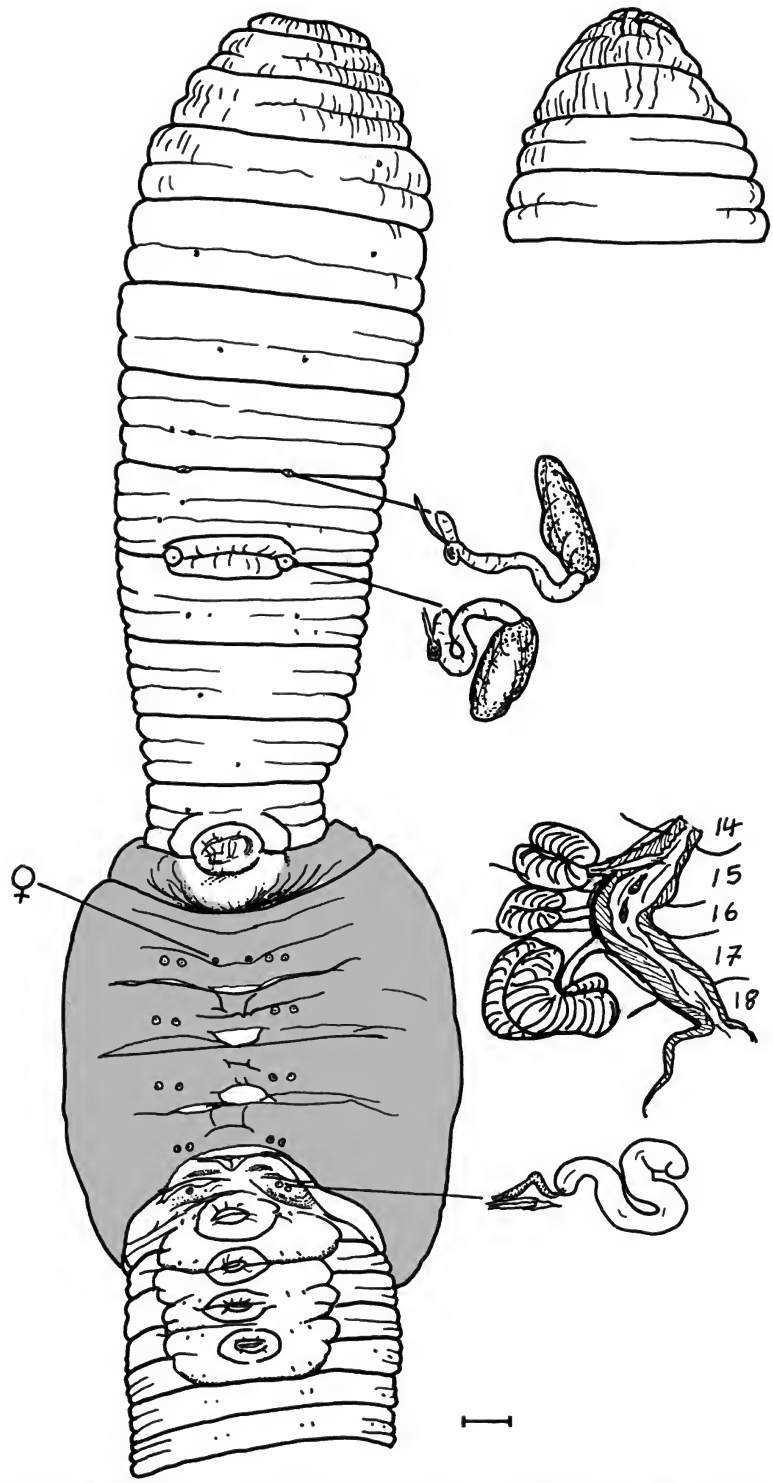


Fig. 101. Megascolides jotaylorae, H, with calciferous glands in 15-17lhs shown on oesohagus.

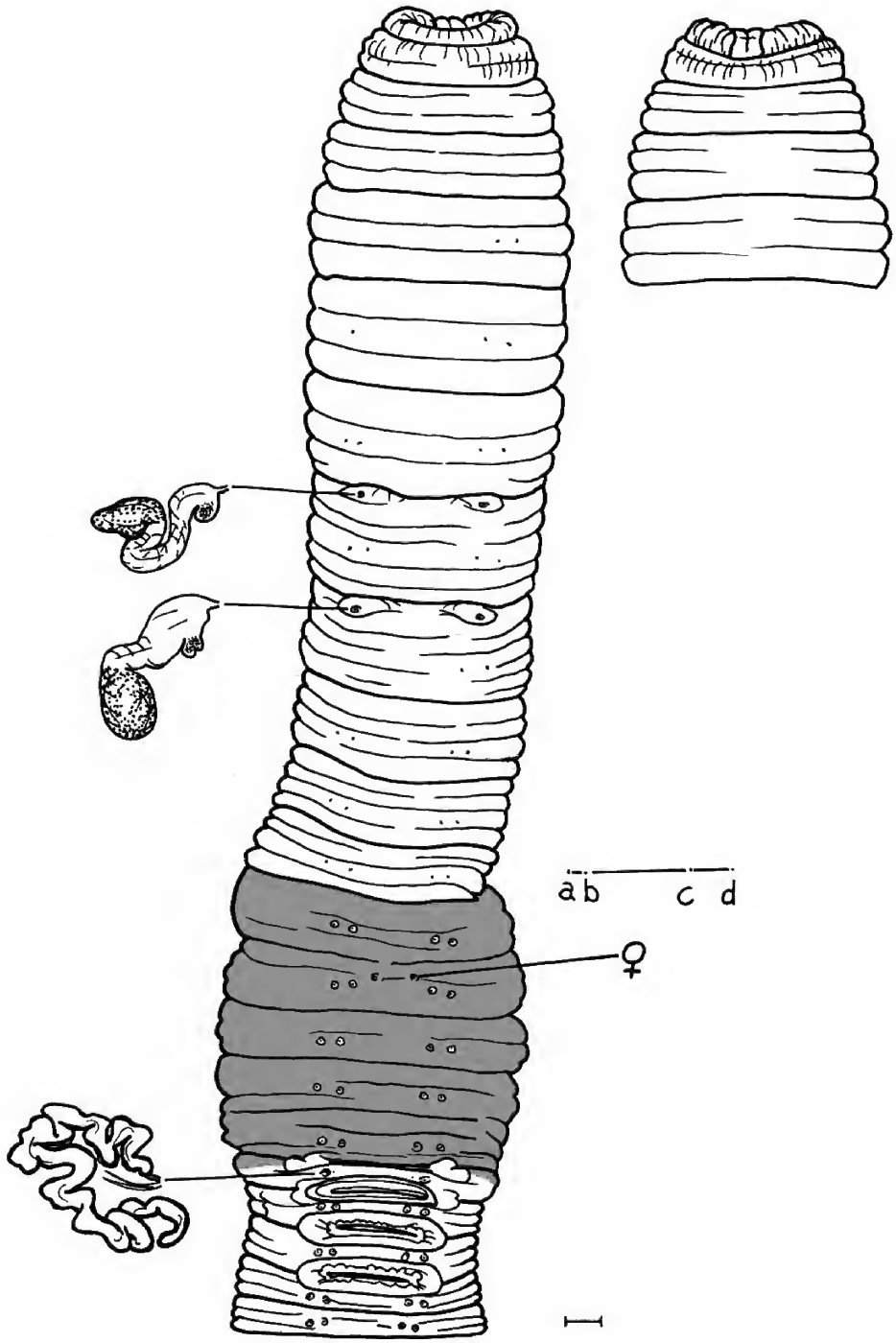


Fig. 102. Megascolides laffani, H.

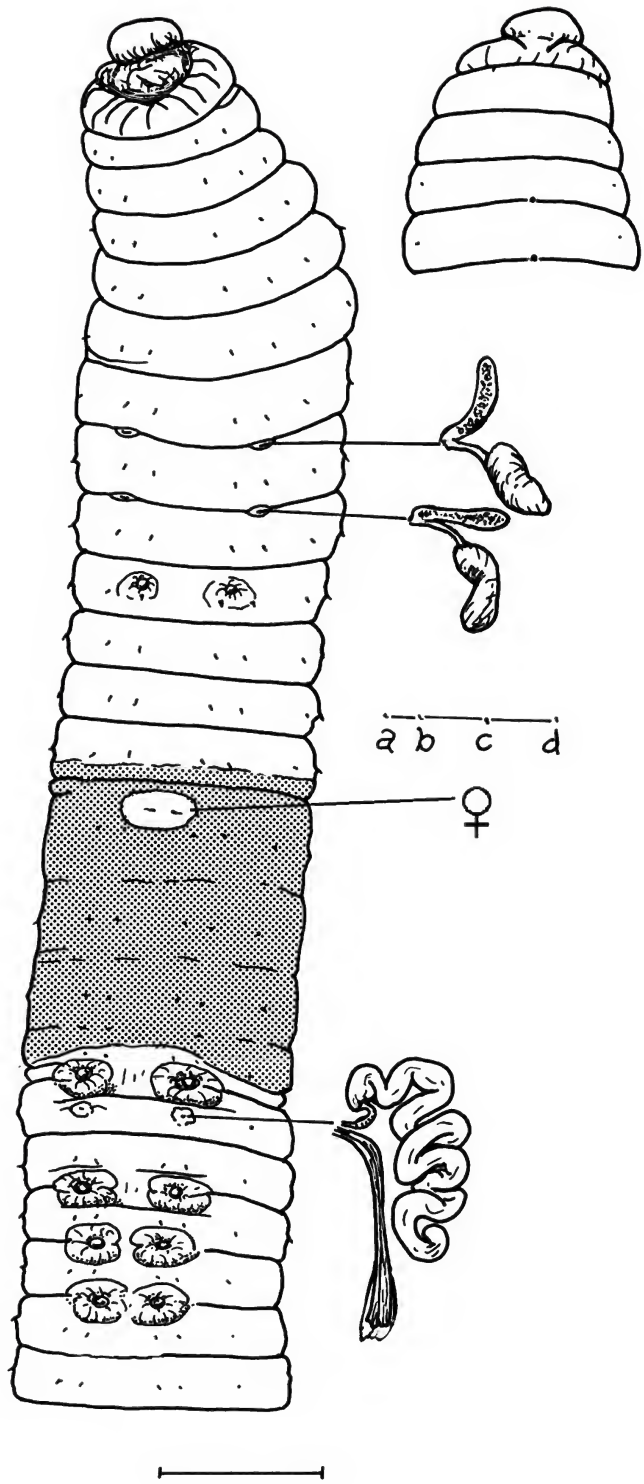


Fig. 103. Megascolides maestus Blakemore, 1997, H.

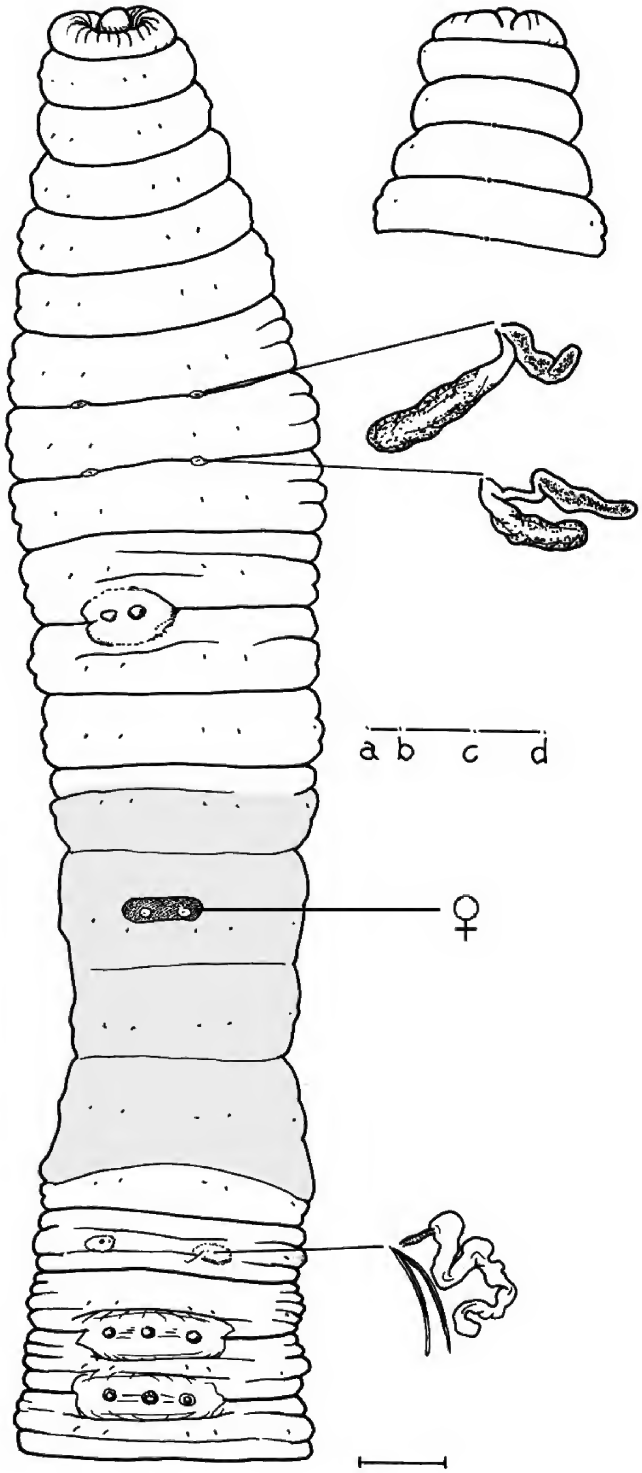


Fig.104. Megascolides oppidanus, H.

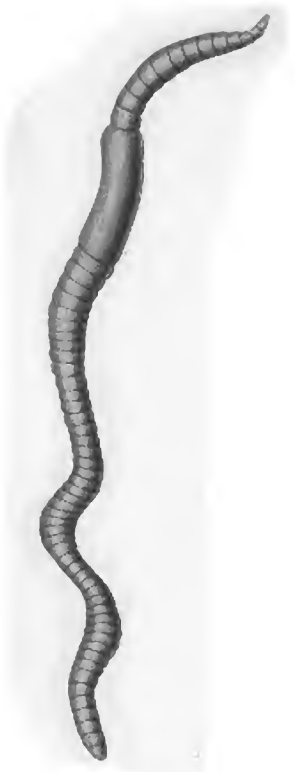


Fig. 105.
Megascolides orthostichon (Schmarda, 1861), from Schmarda (1861) Plate XVIII, fig. 159.

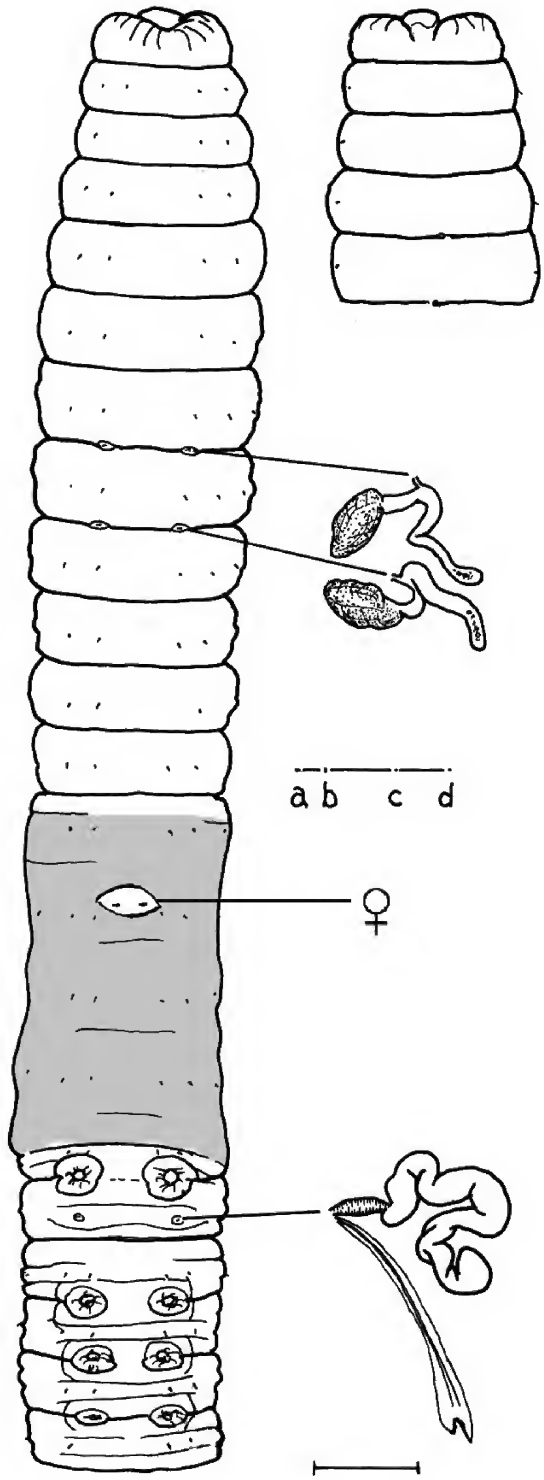


Fig. 106. Megascolides salmo, H.

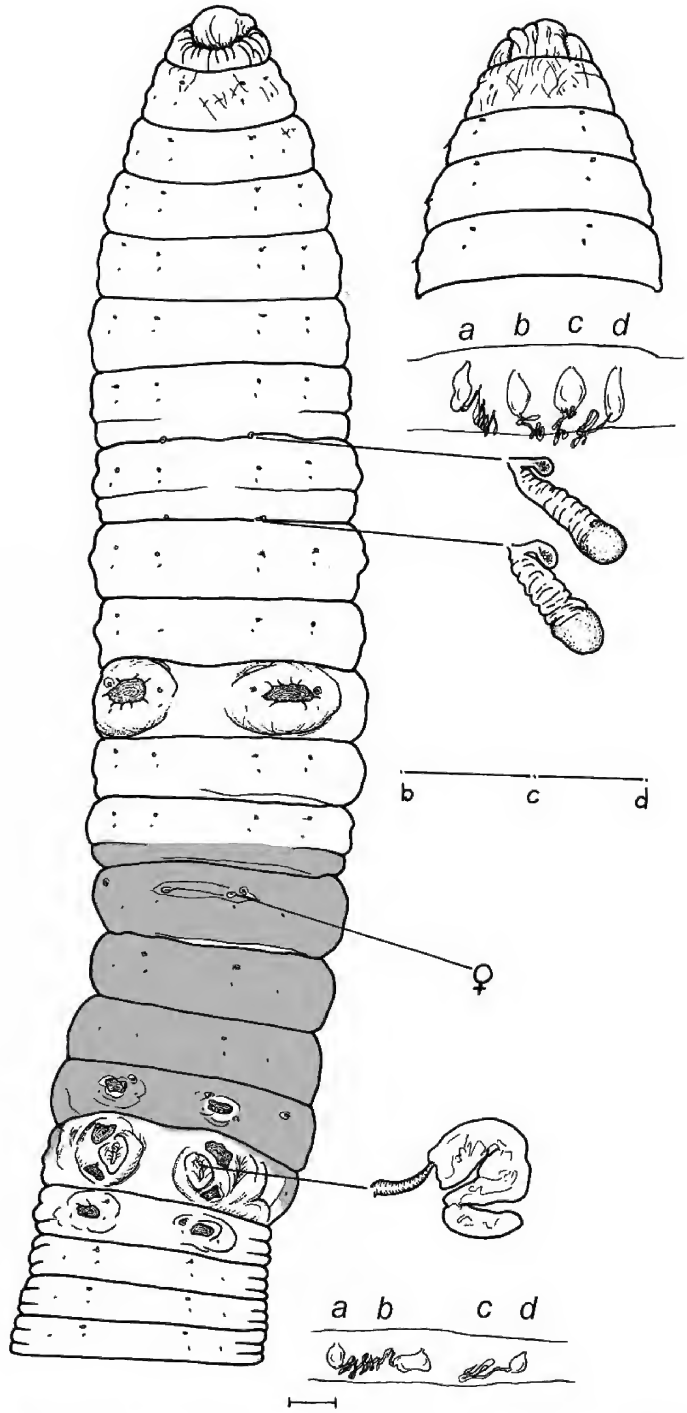


Fig. 107. Megascolides sanctorum, H, with nephridia in 7rhs and 25 rhs shown in relation to setae.

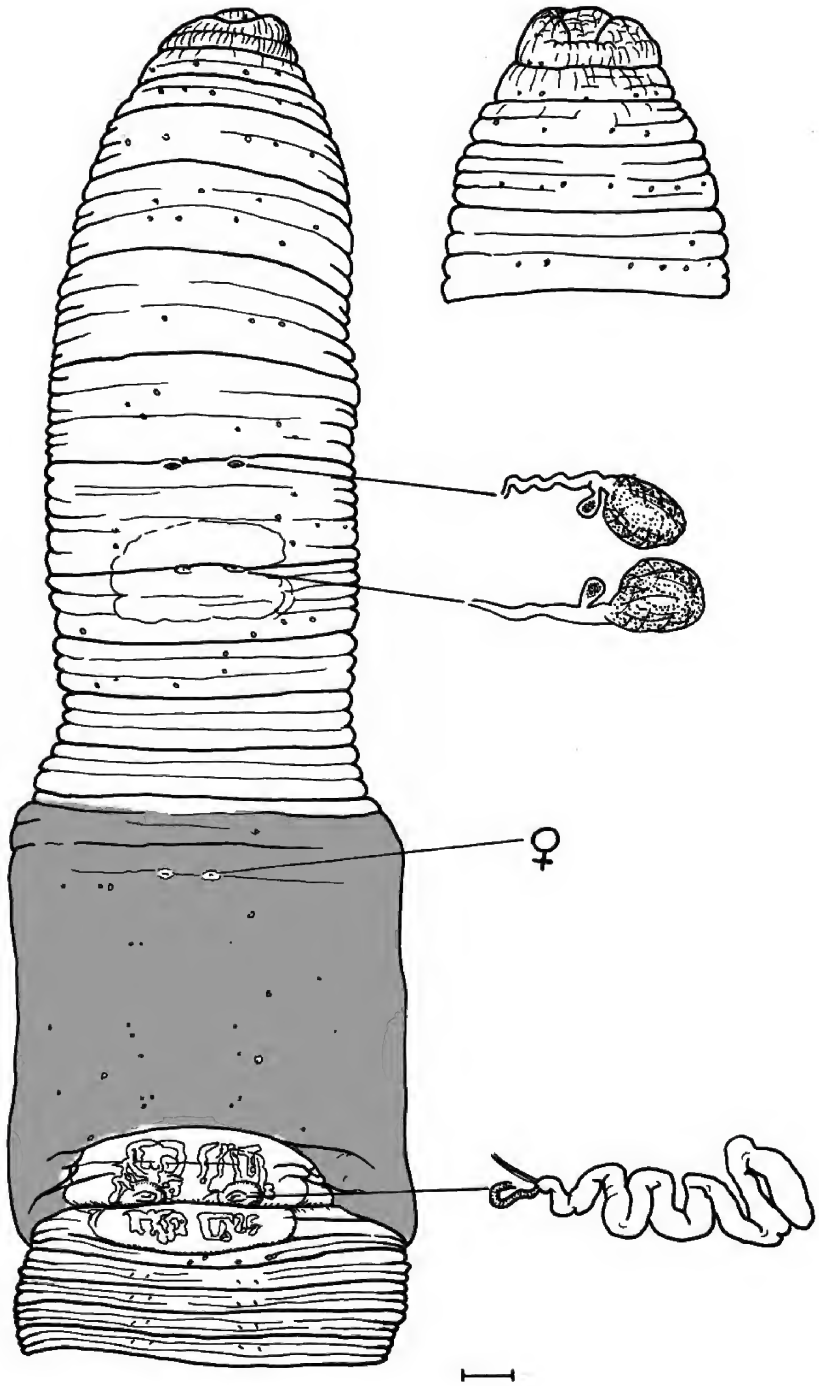


Fig. 108. Megascolides tener, H.

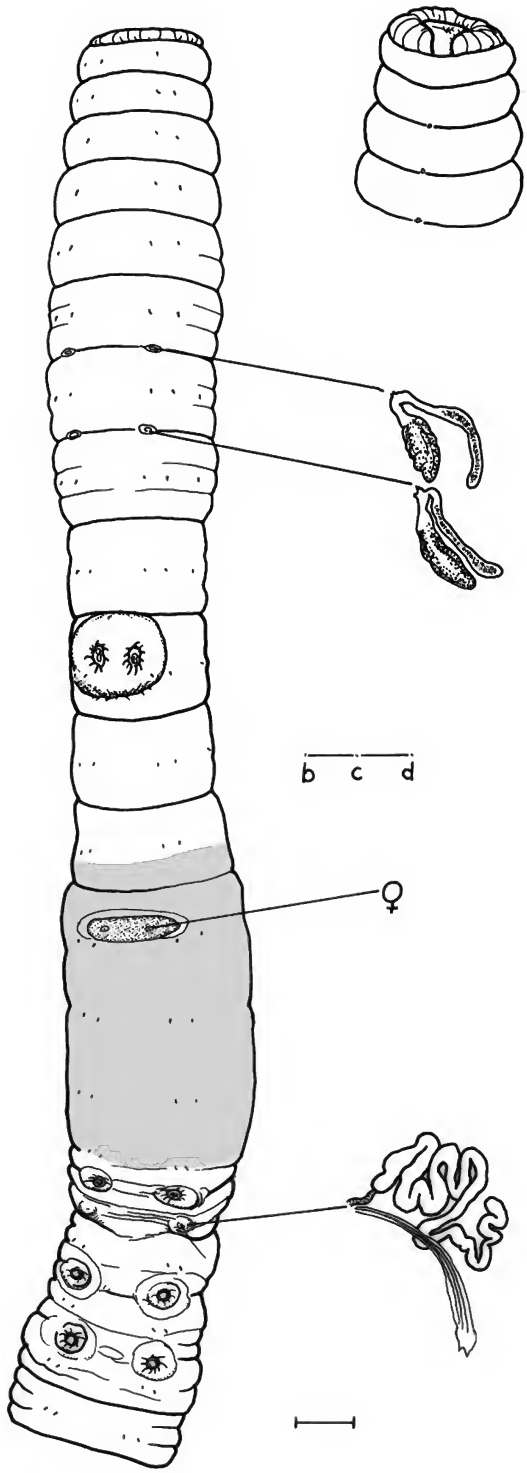


Fig. 109. Megascolides tortuosus, H.

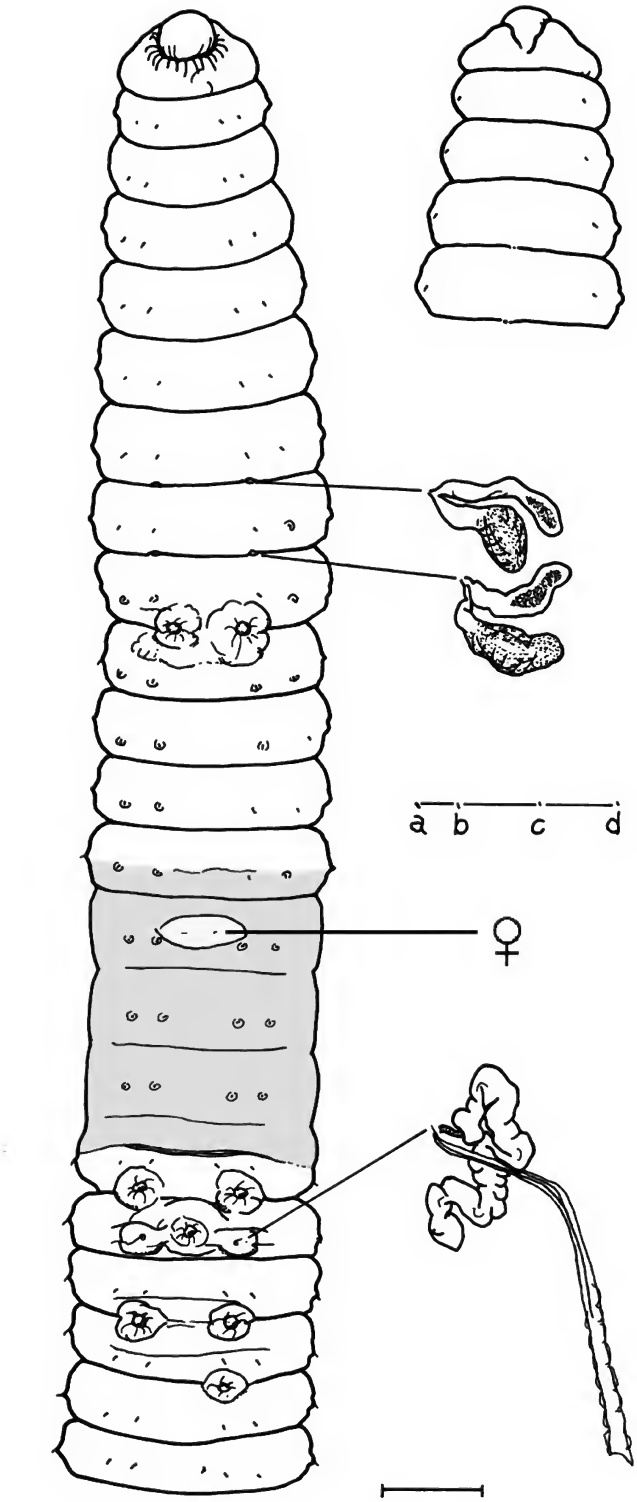


Fig. 110. Megascolides umbonis, H.

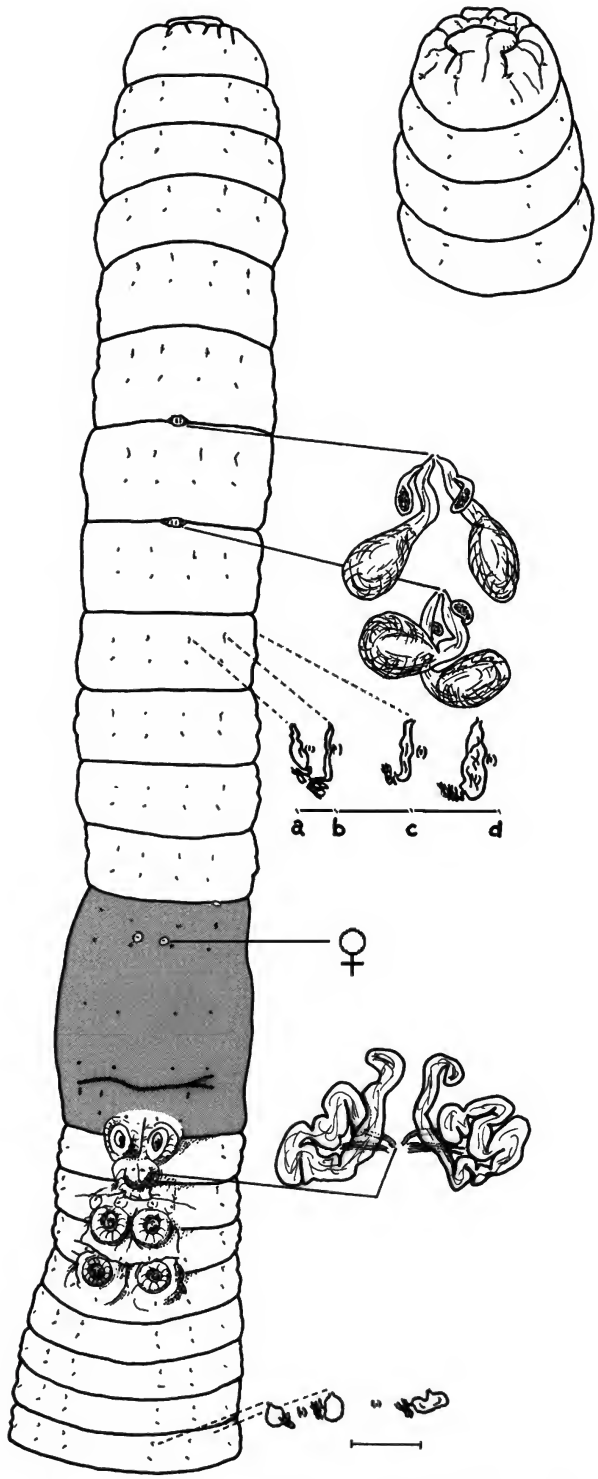


Fig. 111. Megascolides xanthus, H, showing both spermathecal and prostate sets, and nephridia in 8rhs and ca. 30rhs.

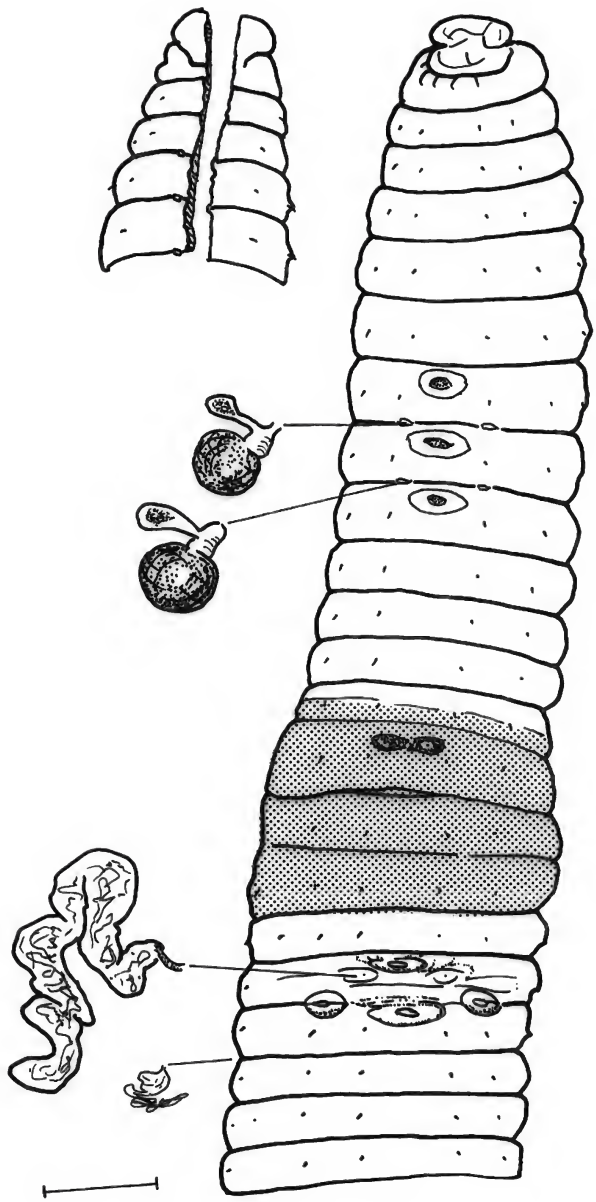


Fig. 112. Zacharius evansi (Jamieson, 1974), H.

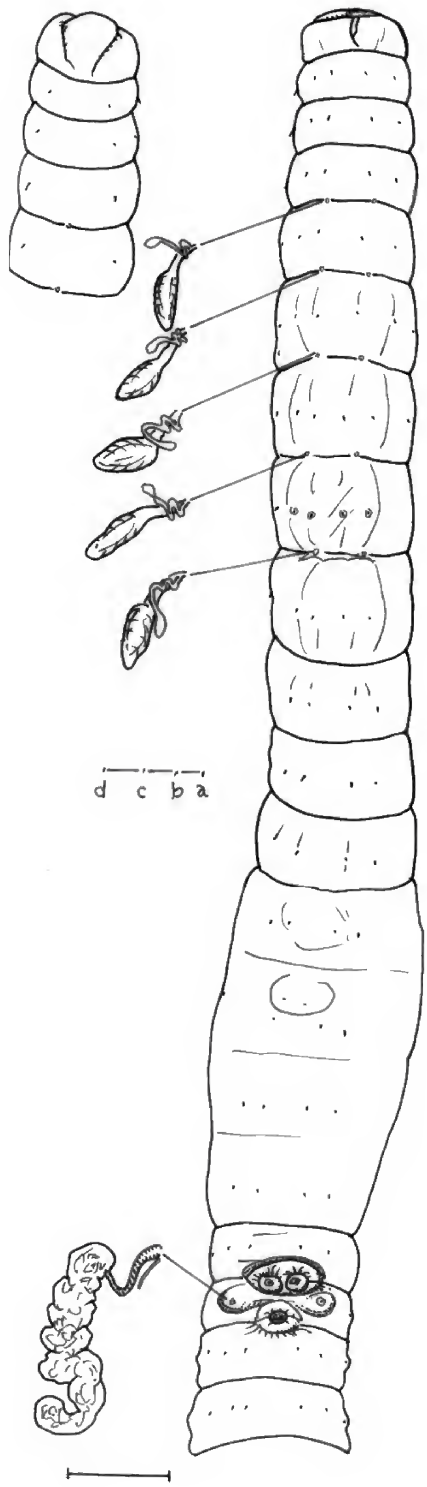


Fig. 113. Zacharius weldboroughi (Jam., 1974), H.

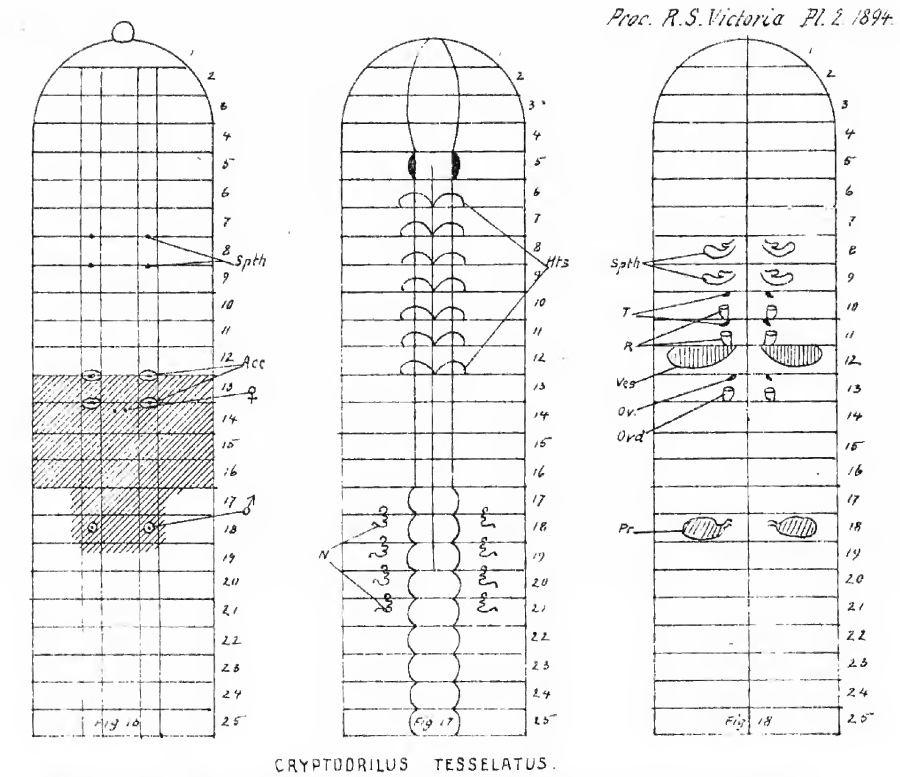


Fig. 114. Woodwardiella tesselatus (Spencer, 1895).

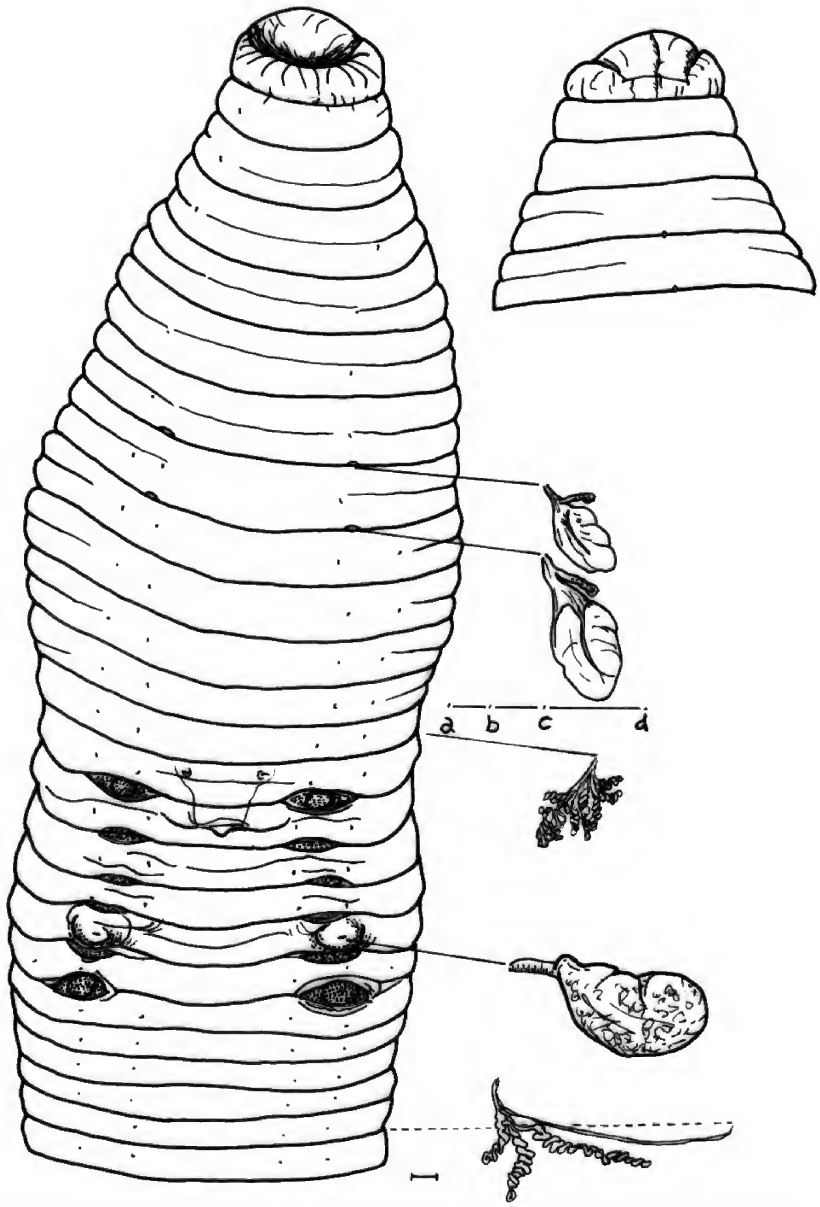


Fig. 115. Woodwardiella tiki, H, showing nephridia in 14rhs and 27rhs.

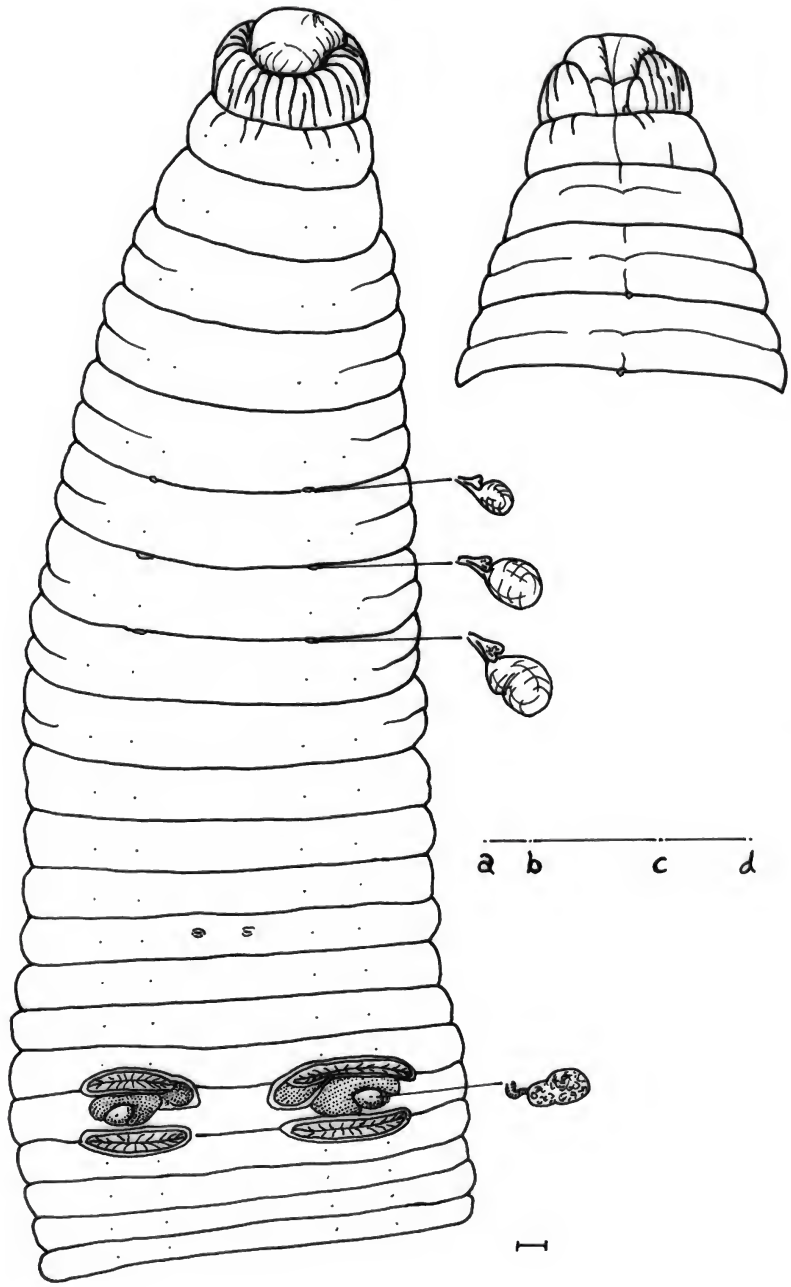


Fig. 116. Woodwardiella vandiemensis, H.

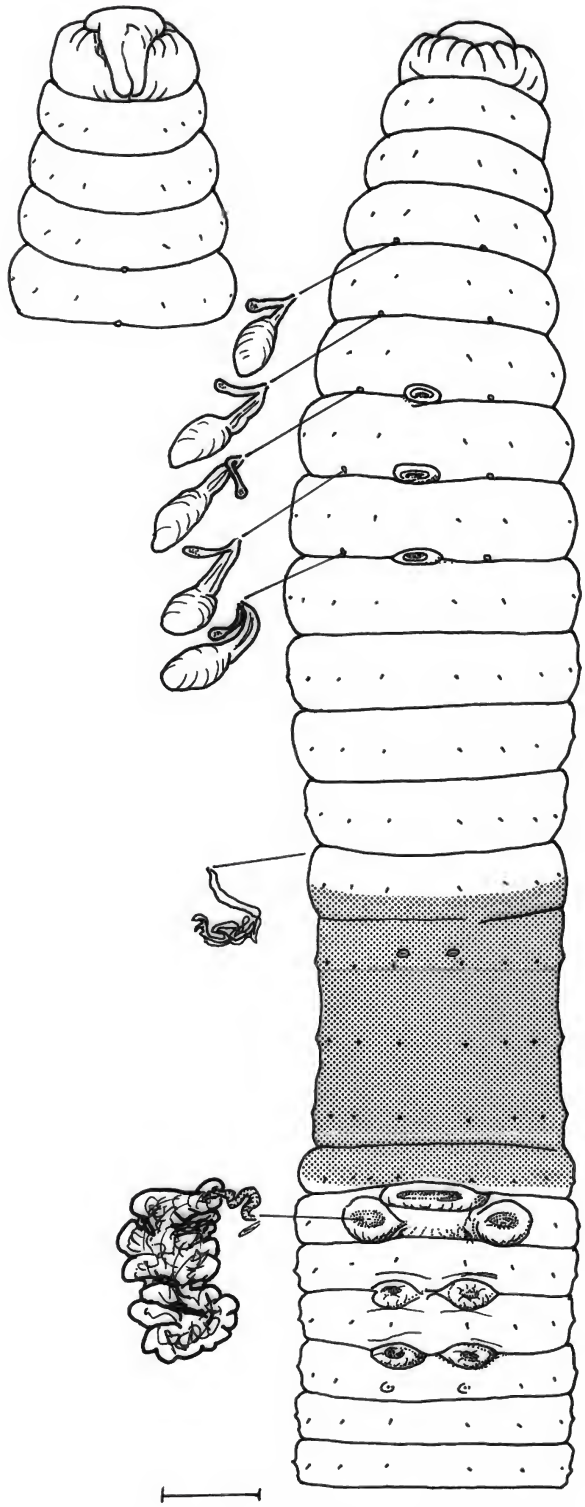


Fig. 117. Perionychella dilwynnia (Spencer, 1895), 14:3335.

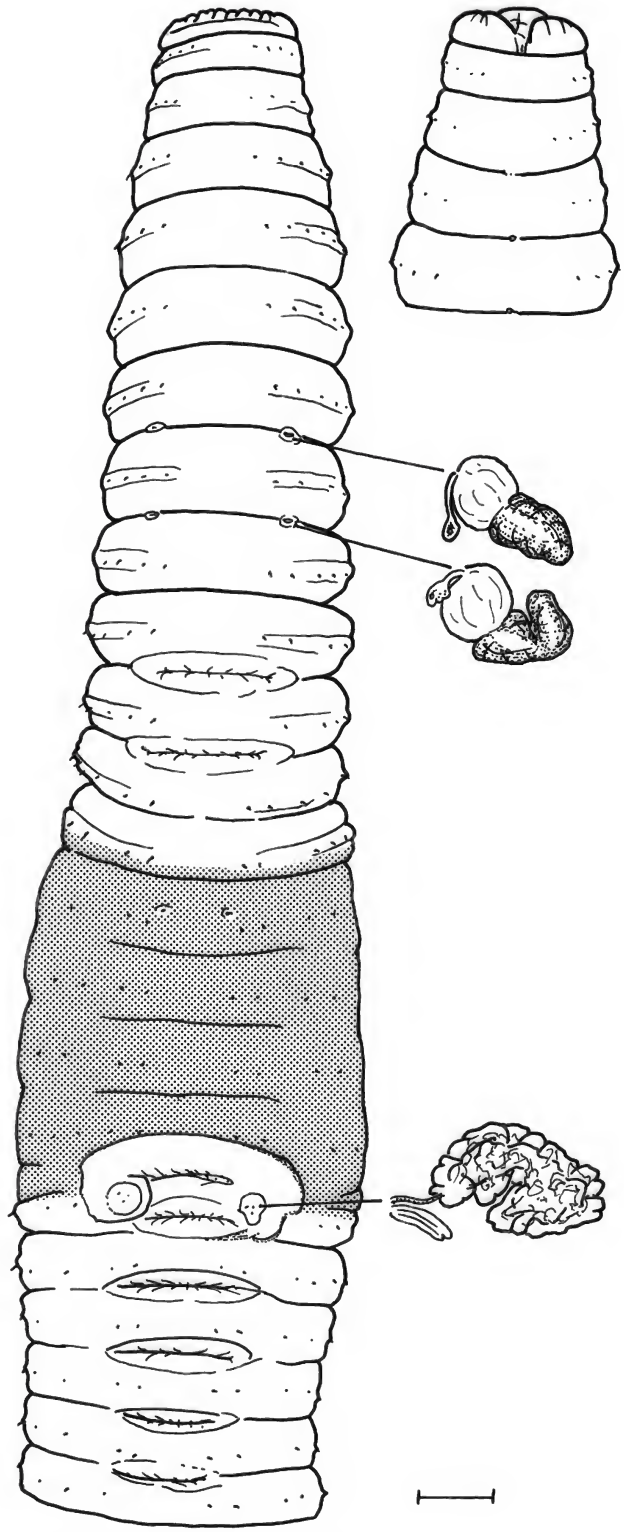


Fig. 118. Perionychella eruca, H.

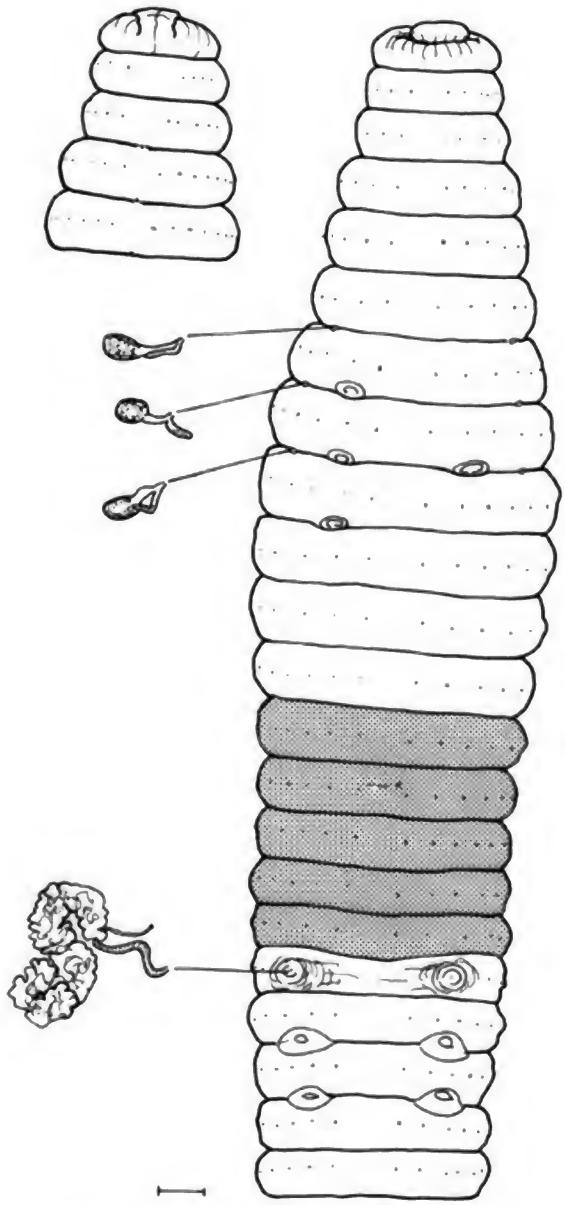


Fig. 119.
Perionychella irregularis (Spencer, 1895), 14:3537.

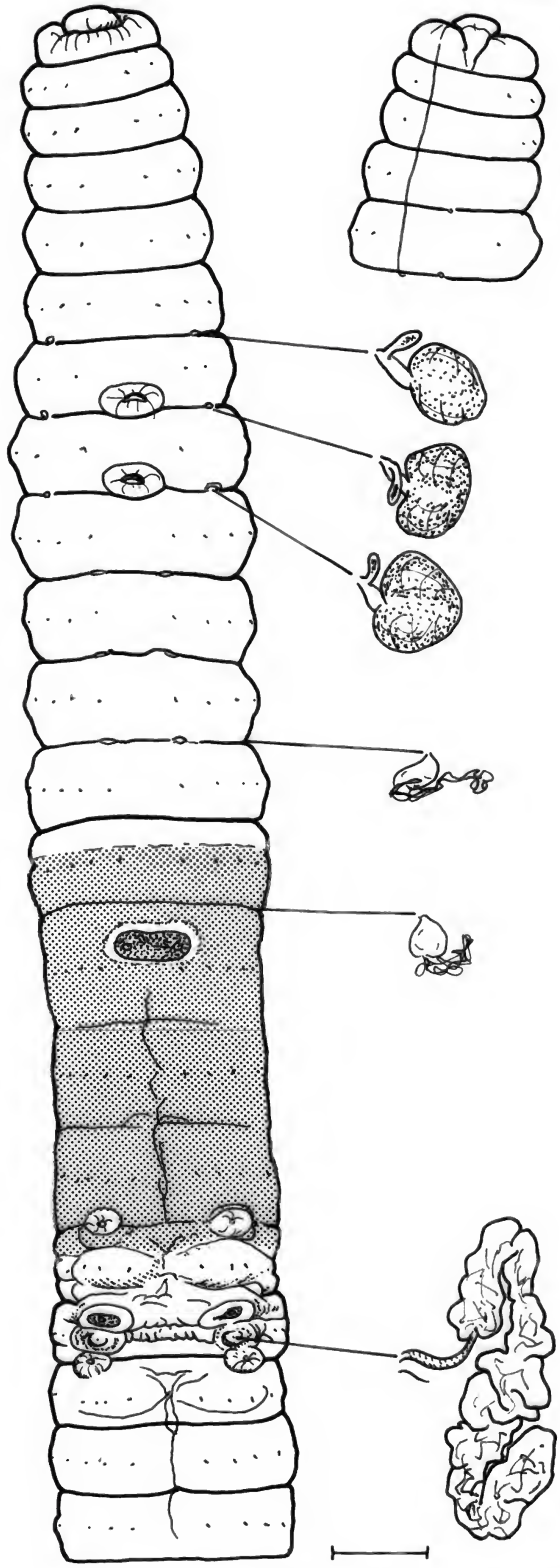


Fig. 120. Perionychella lacustris (Stephenson, 1924), K265.

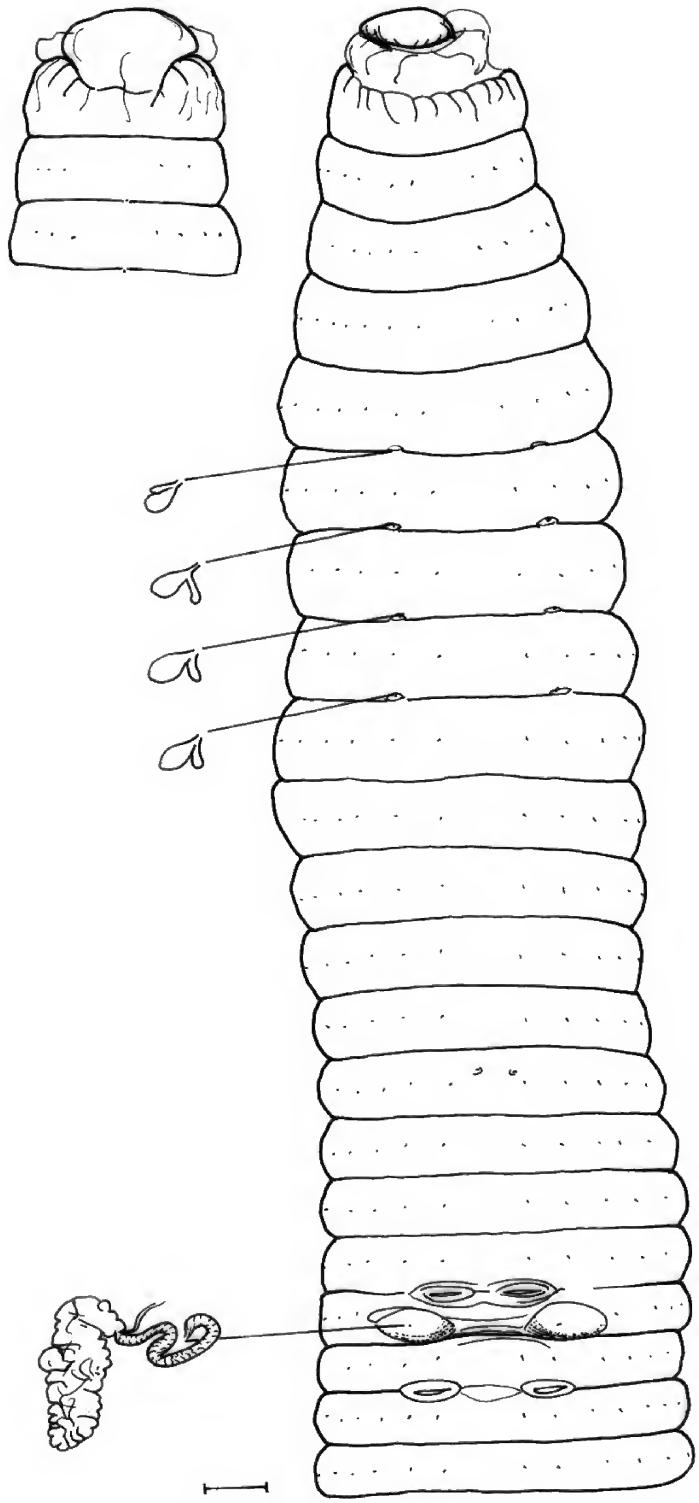


Fig. 121. Perionychella myrtea, H.

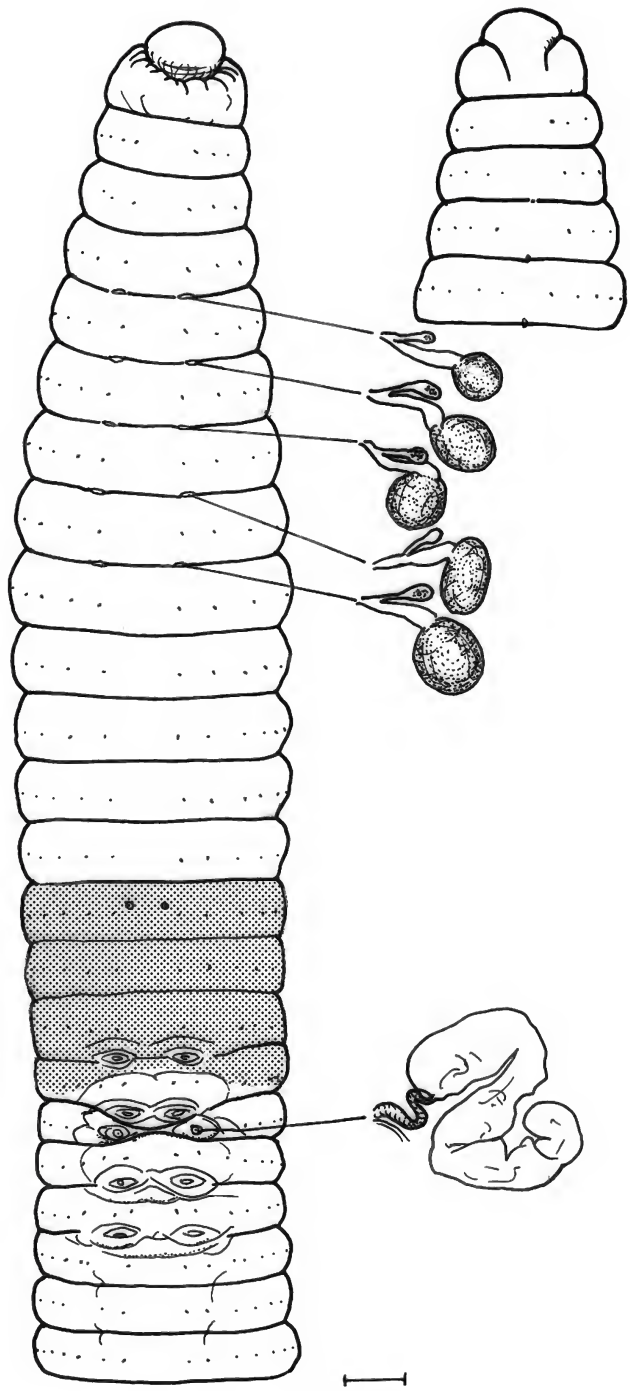


Fig. 122. Perionychella richea (Spencer, 1895), Neotype, 14:3300.

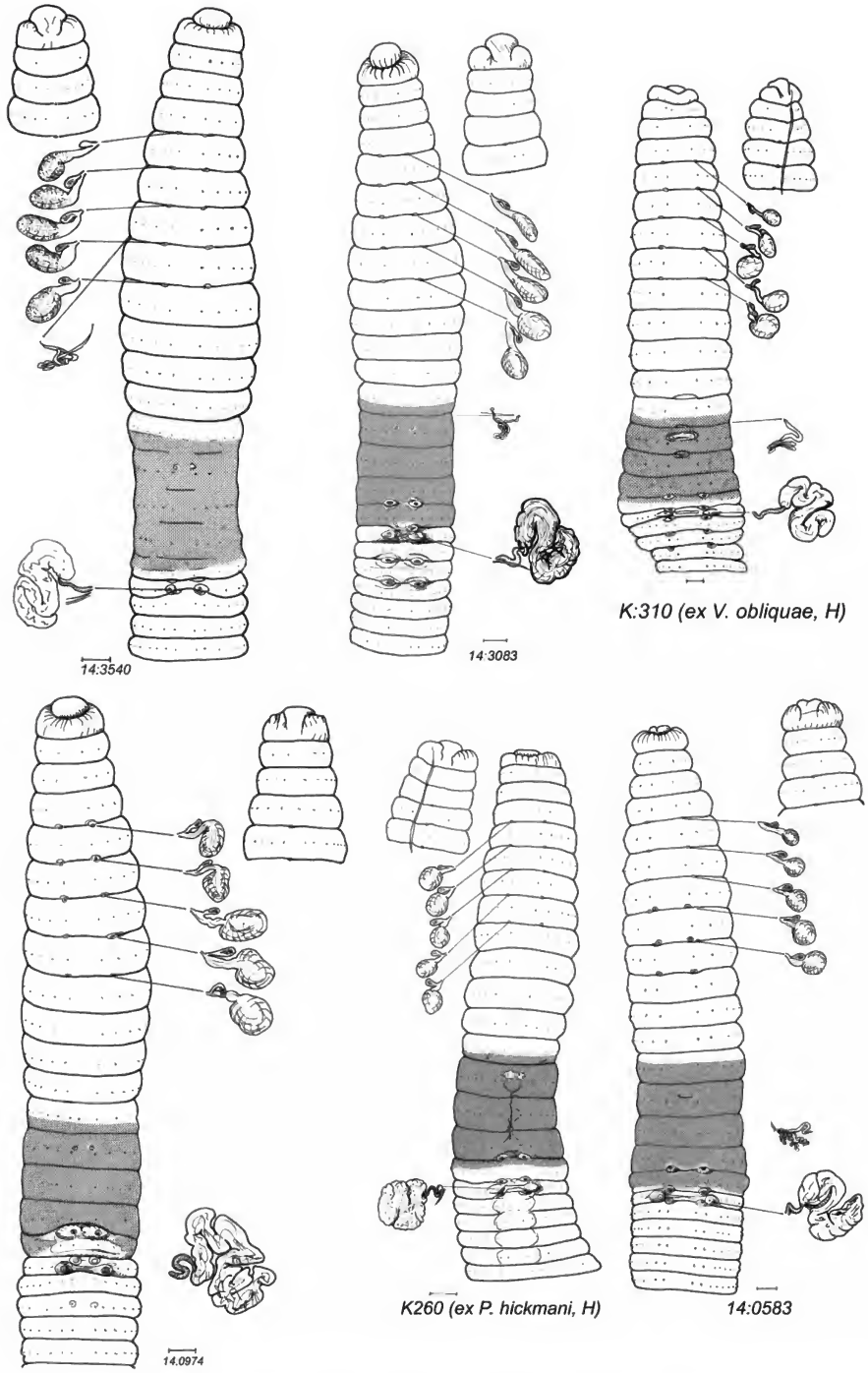


Fig. 123. Perionychella richea (Spencer, 1895), specimens.

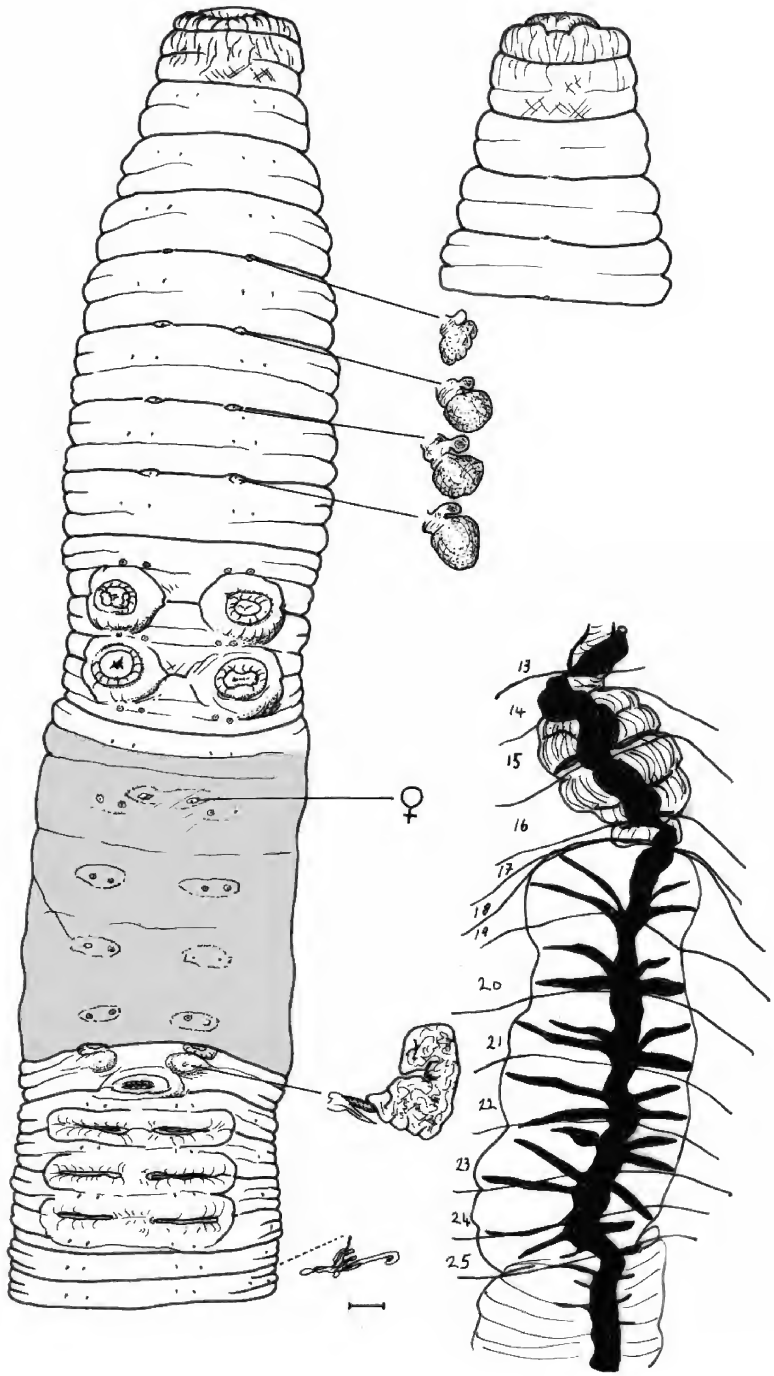


Fig. 124. Perionychella strzeleckii, H, showing calciferous glands 15 &16 and dilated intestine in 18-25.

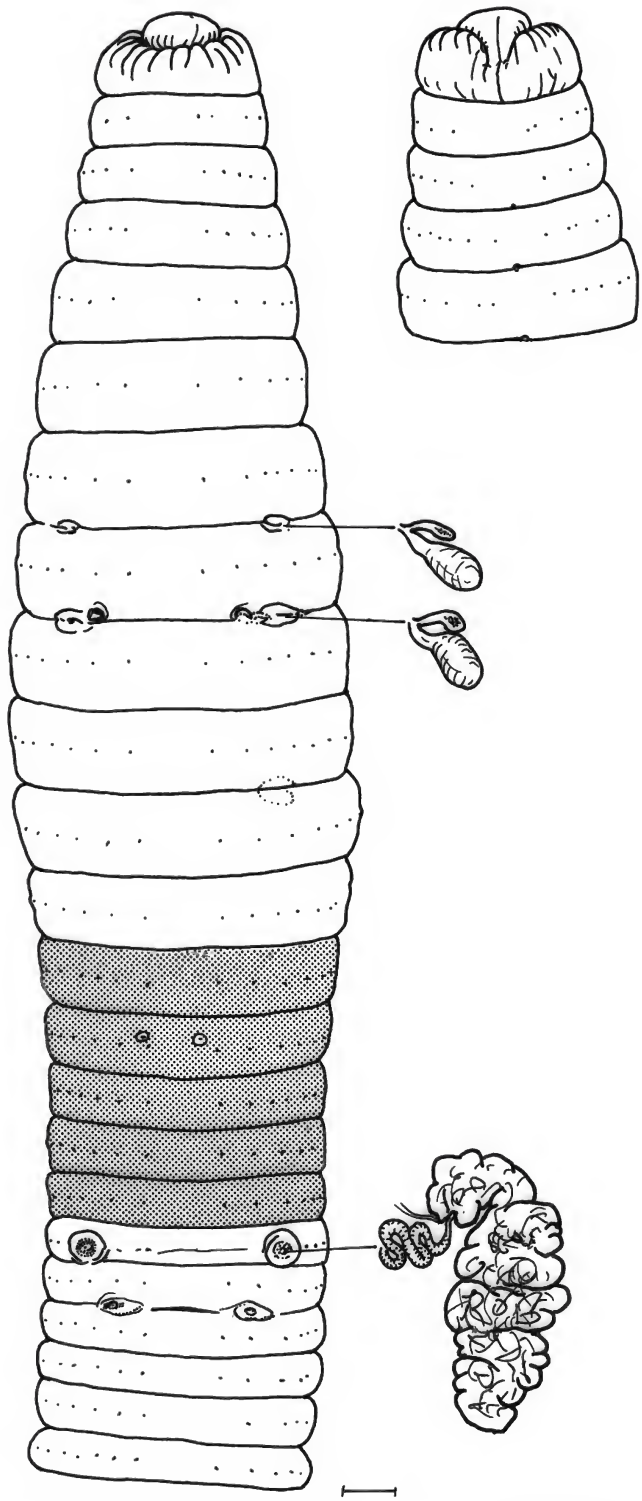


Fig. 125. Perionychella variegata Blakemore, 2000, H.

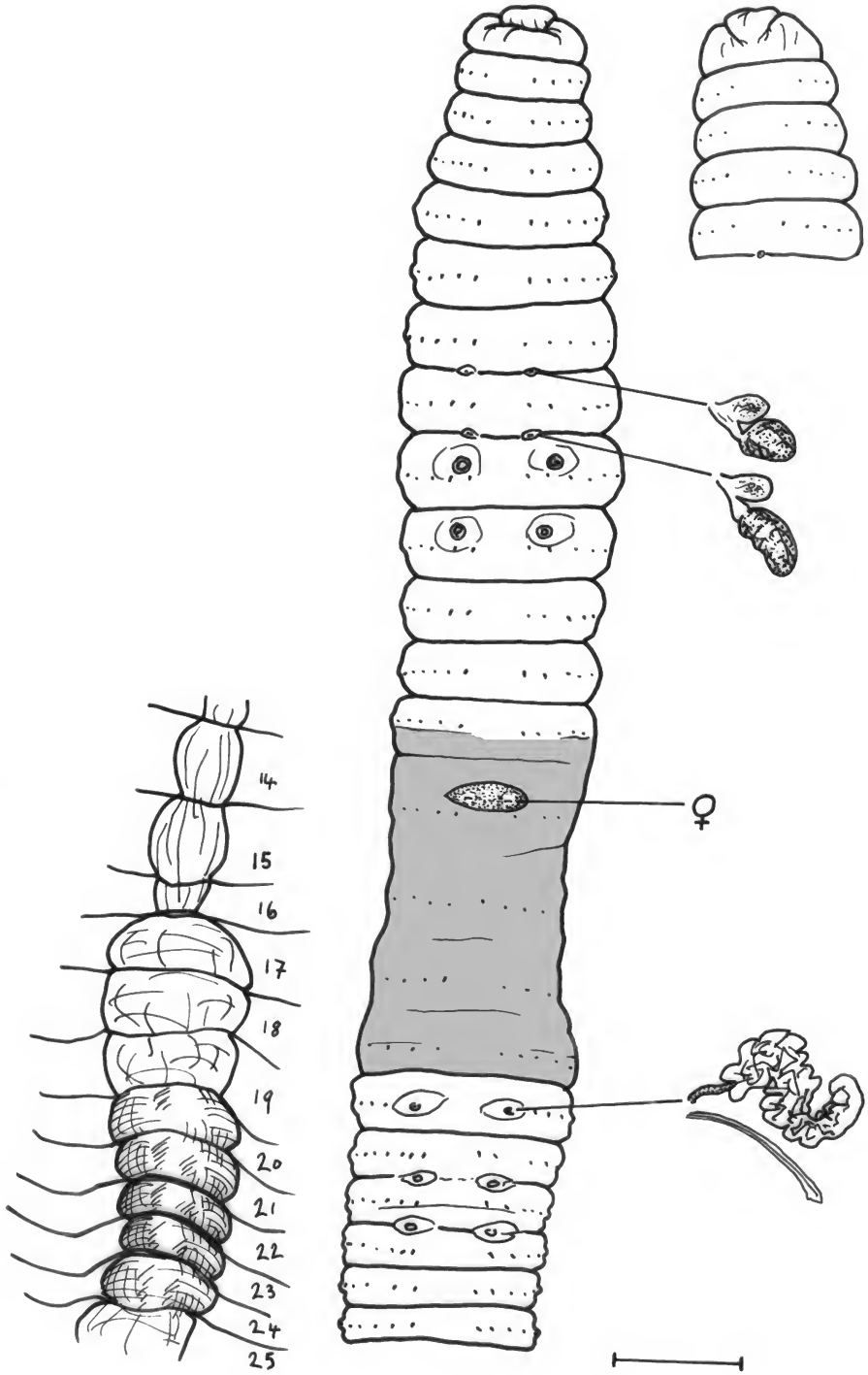


Fig. 126. Tassiedrilus griffithae, H, showing intestinal gizzards.

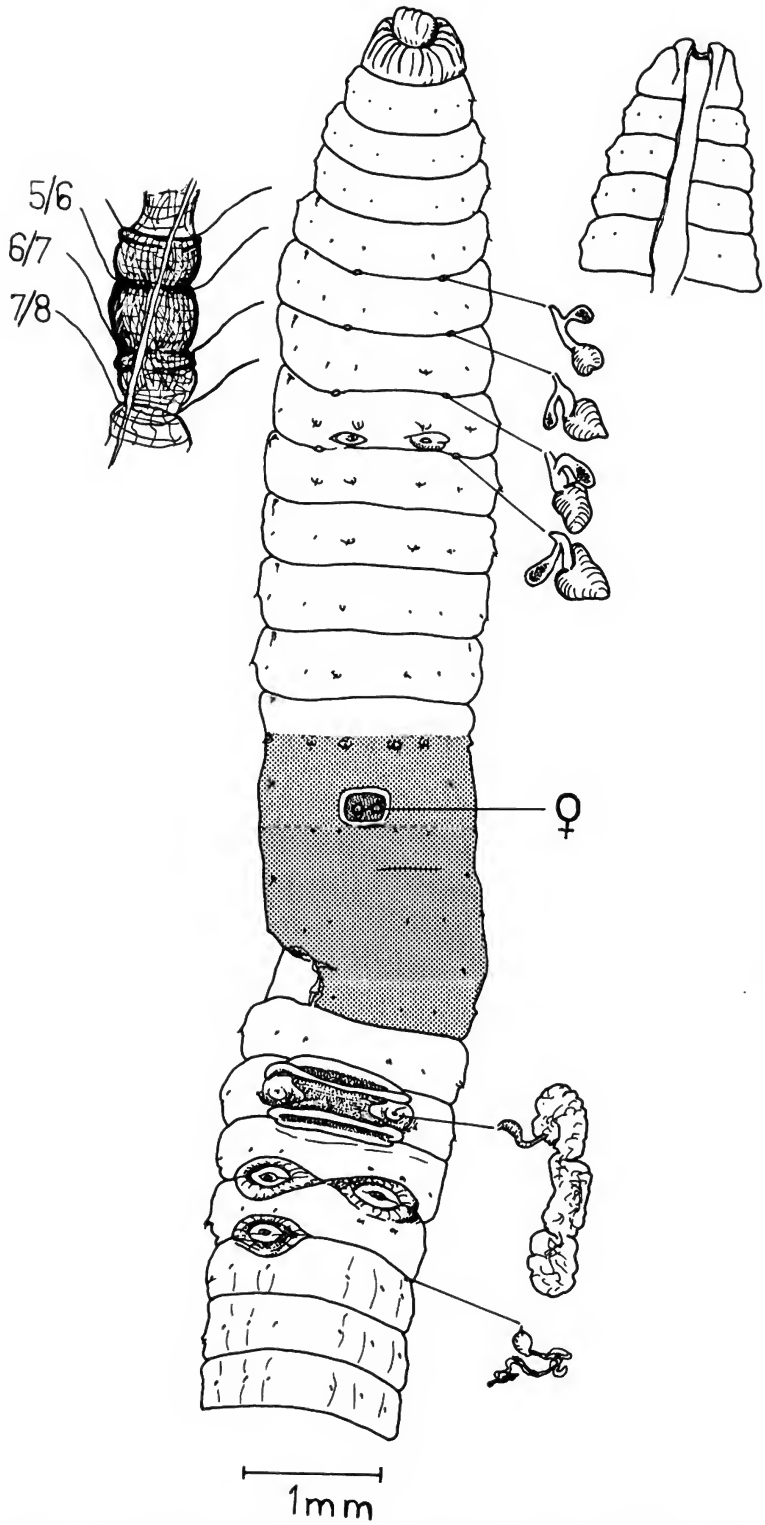


Fig. 127. Hypolimnus pedderensis (Jamieson, 1974), H.

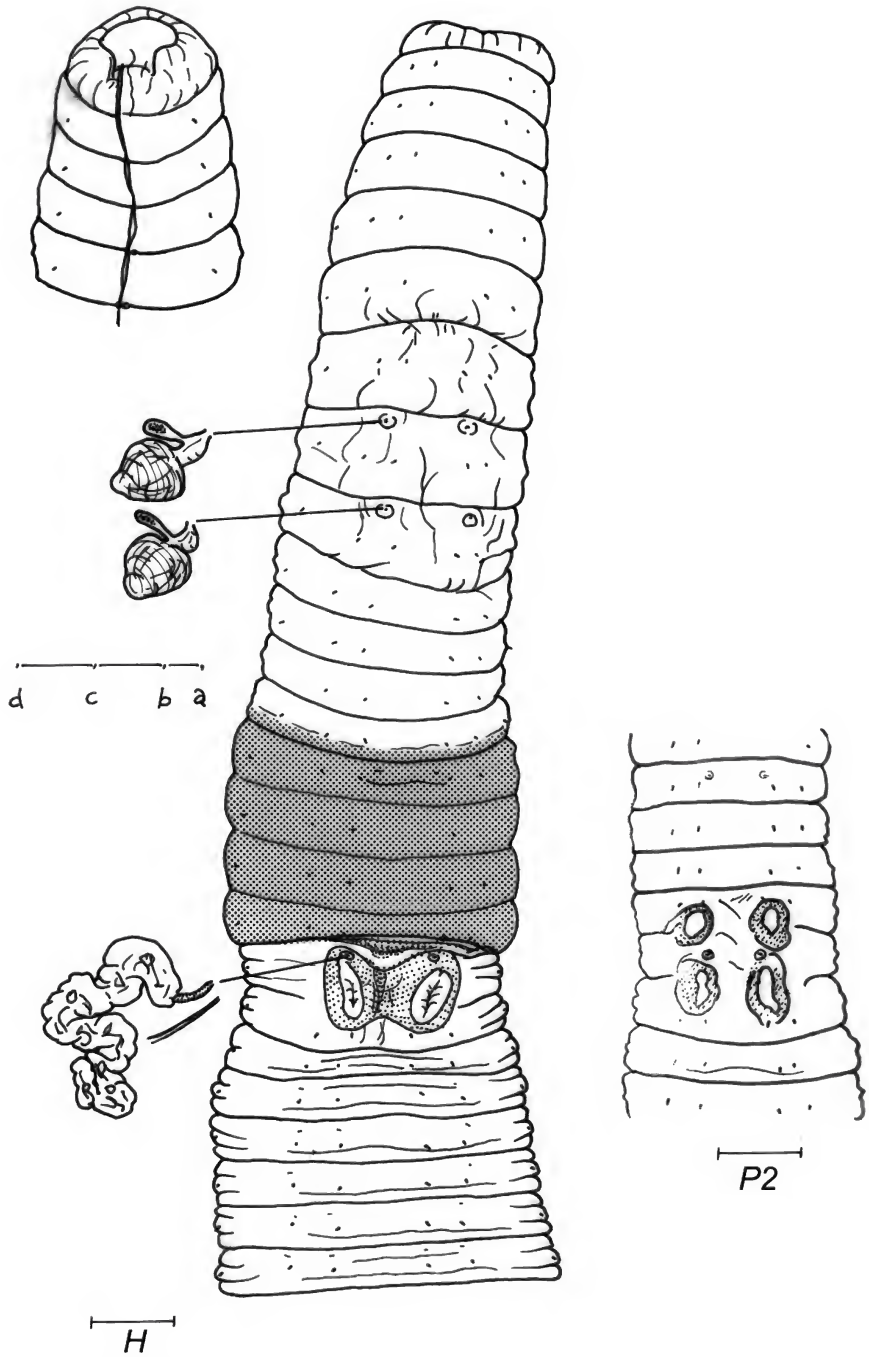


Fig. 128. Notoscolex acanthodriloides (Jamieson, 1974), H, P2.

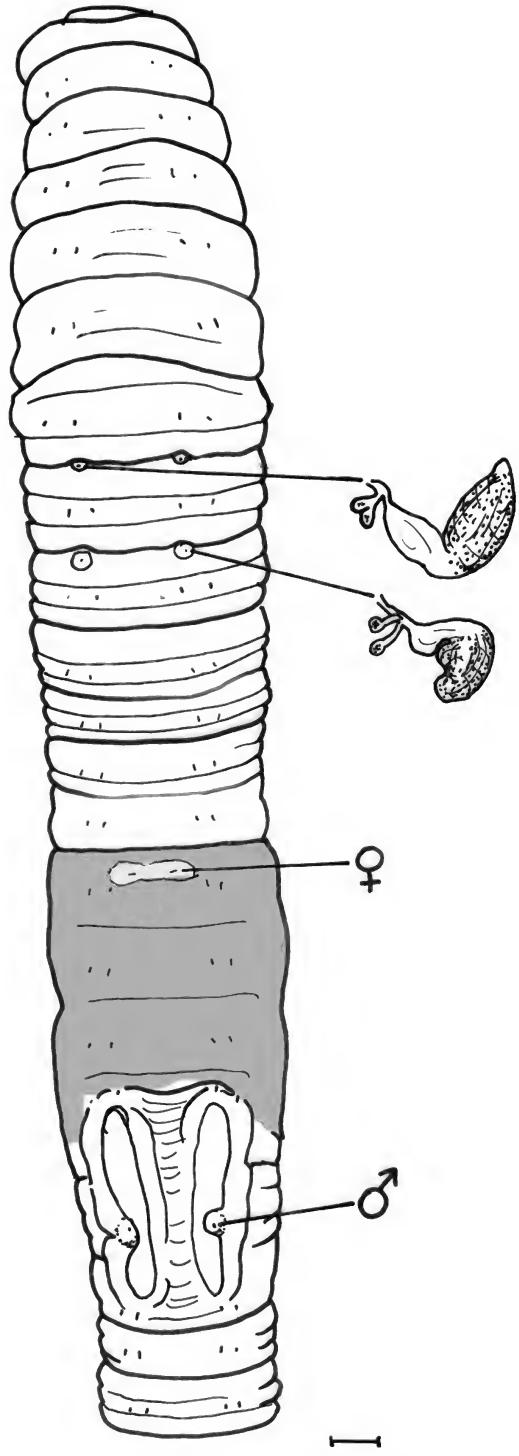


Fig. 129. Notoscolex bidiverticulatus (Jam., 1974), H.

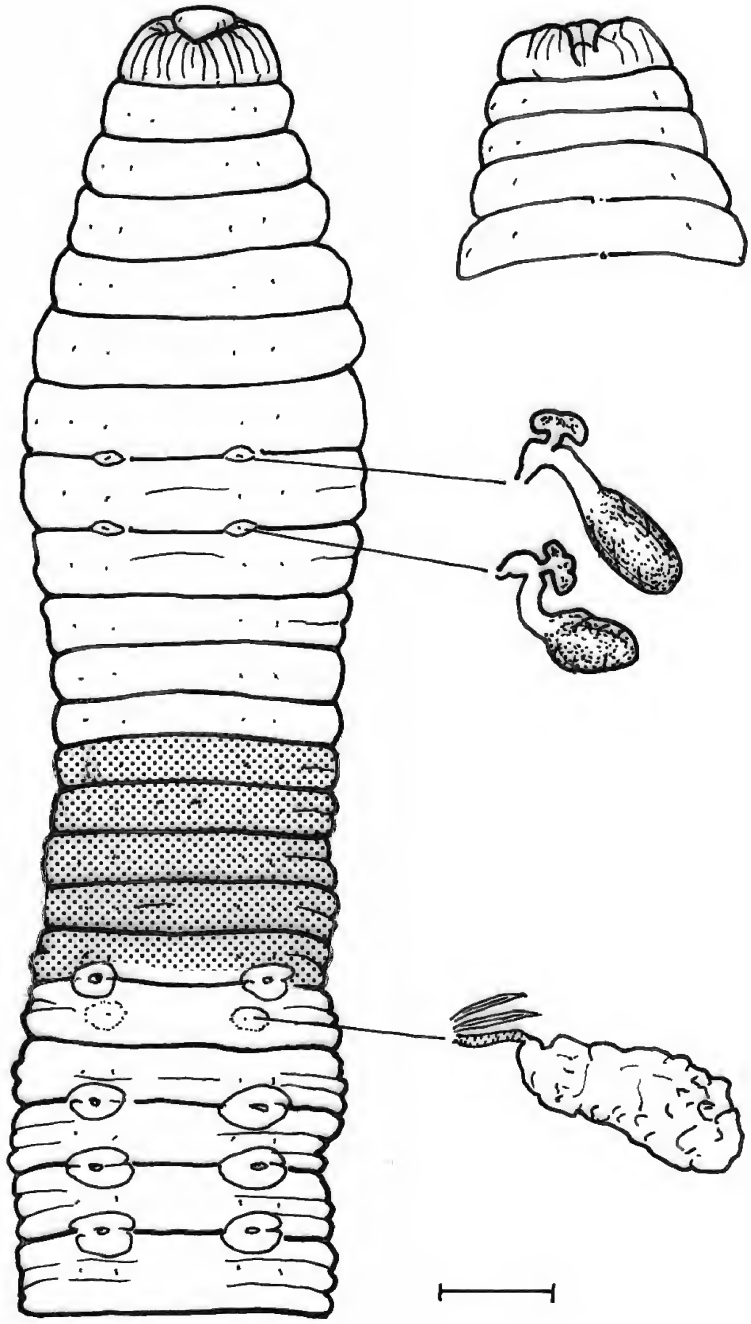


Fig. 130. Notoscolex campestris (Spencer, 1895), K298.

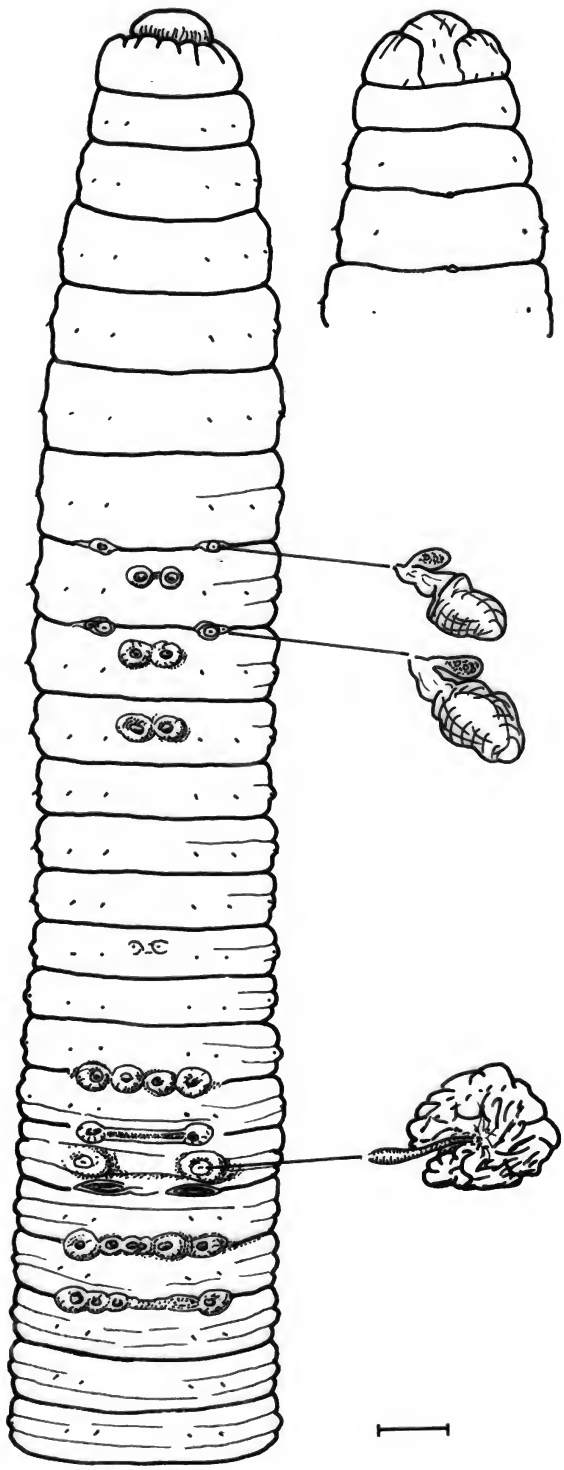


Fig. 131. Notoscolex dorazioi, H.

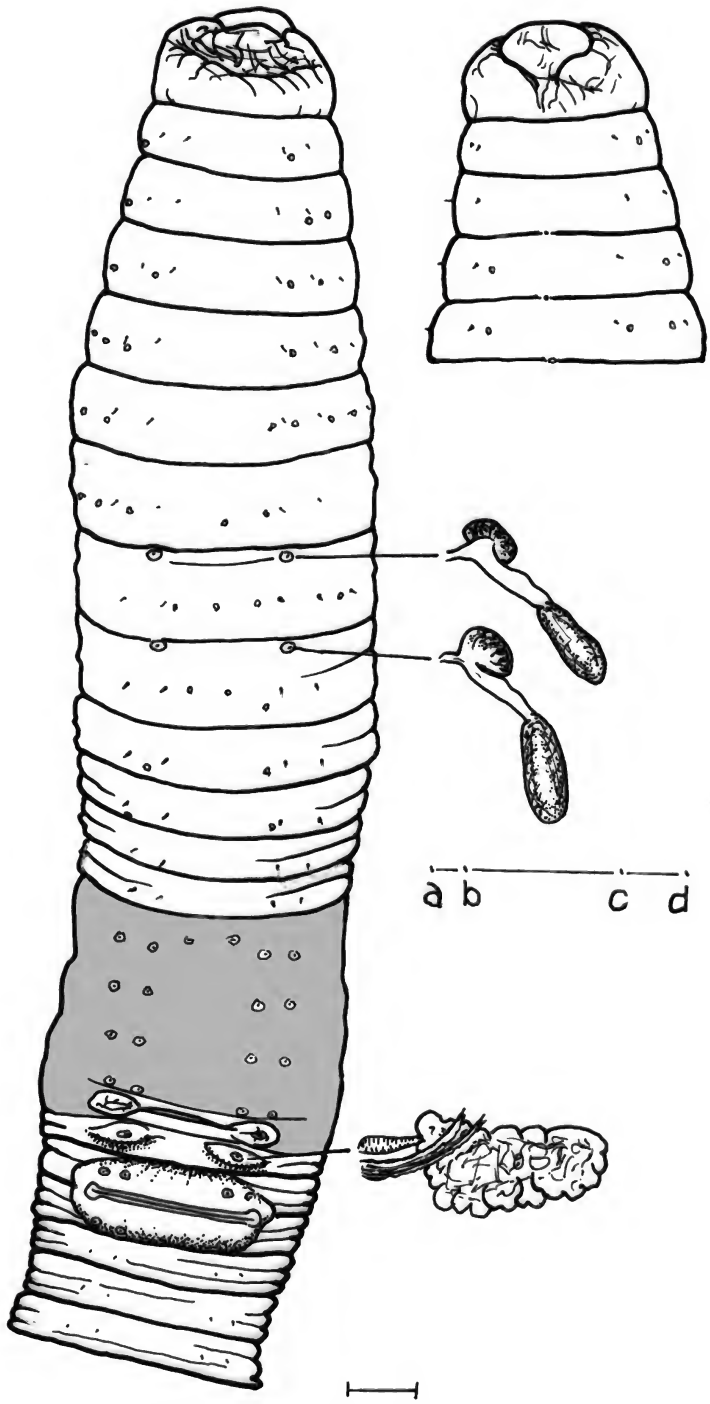


Fig. 132. Notoscolex duplex, H.

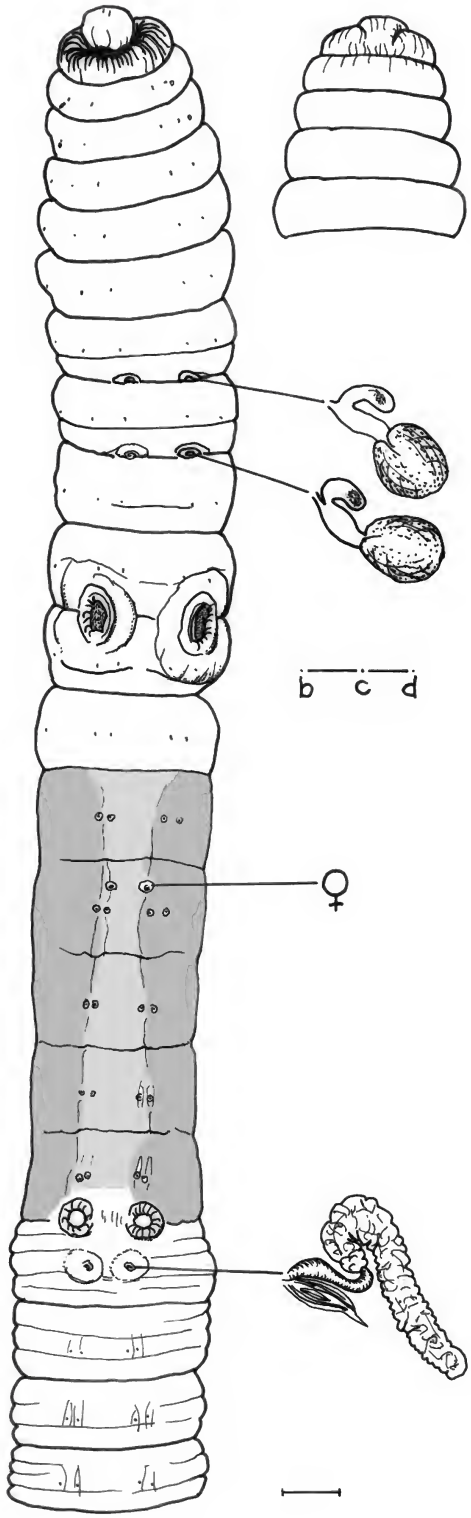


Fig. 133. Notoscolex geevestoni, H.

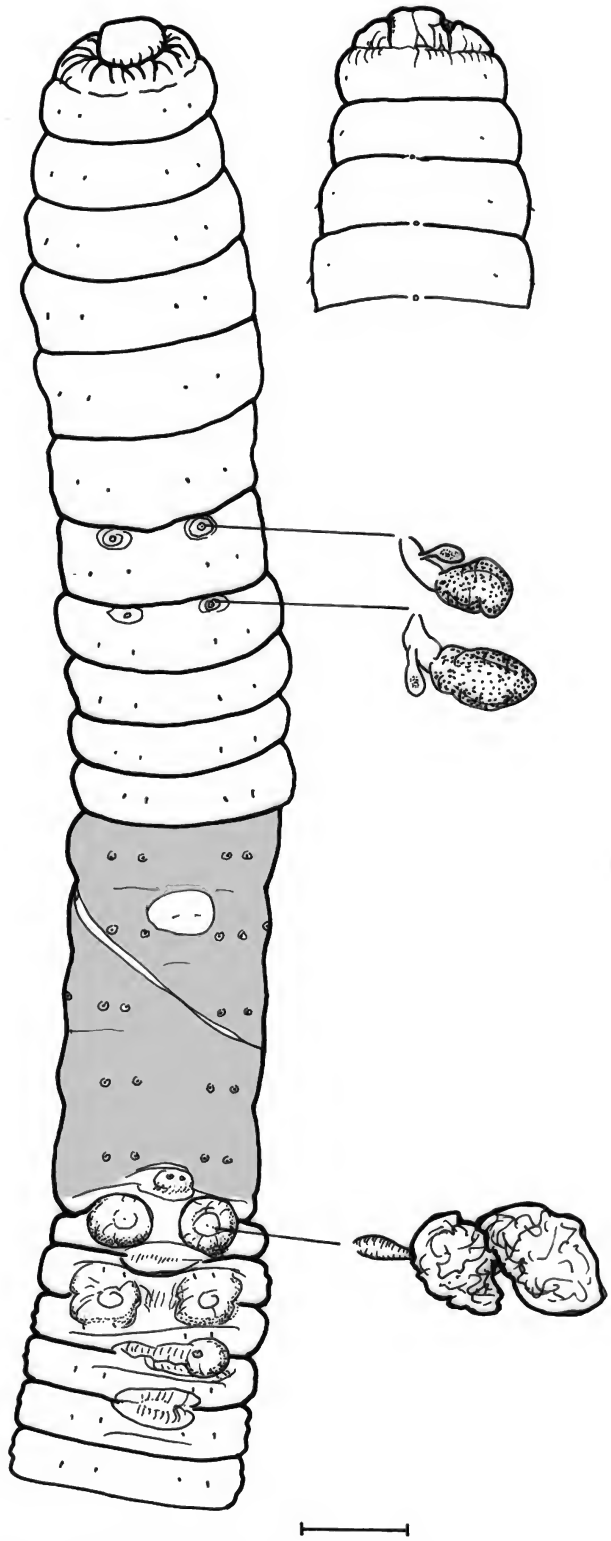


Fig. 134. Notoscolex gogensis, H.

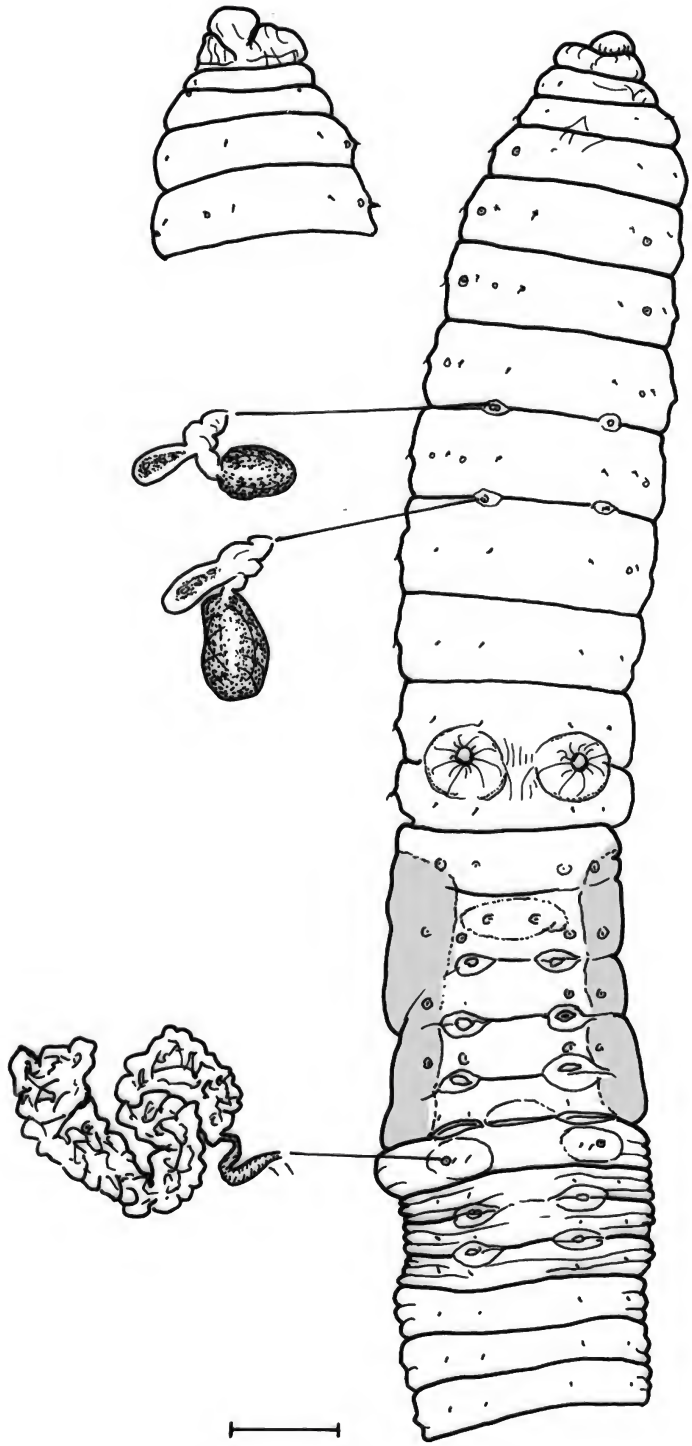


Fig. 135. Notoscolex huoni, H.

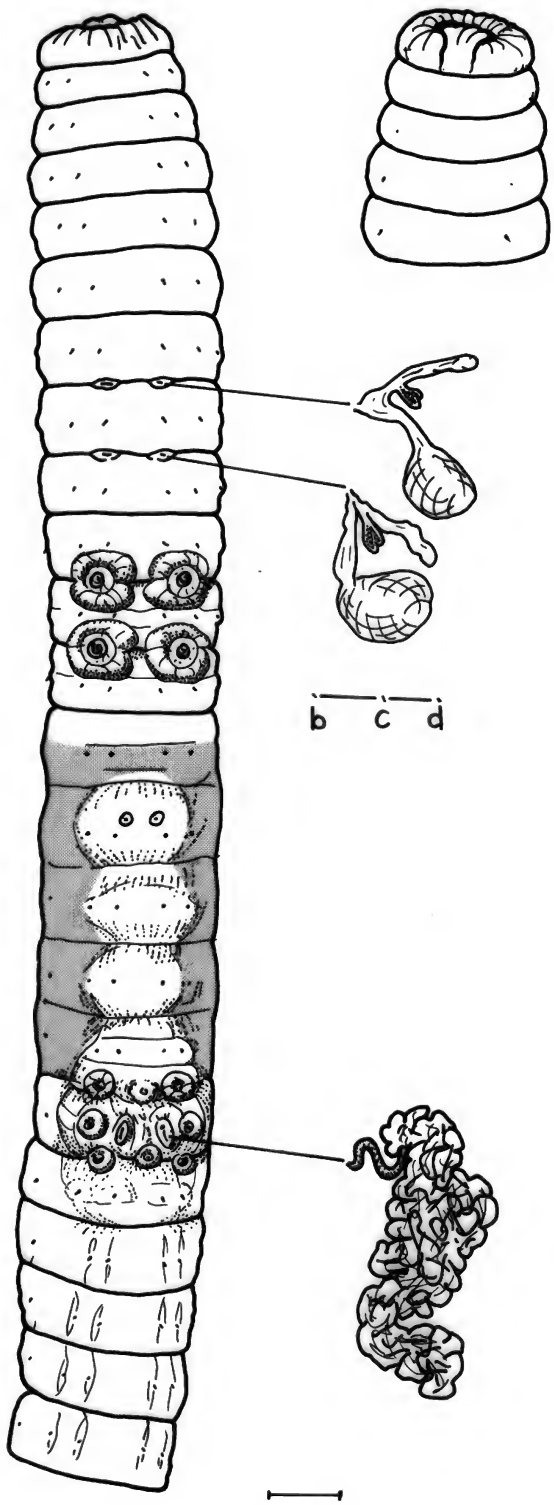


Fig. 136. Notoscolex index, H.

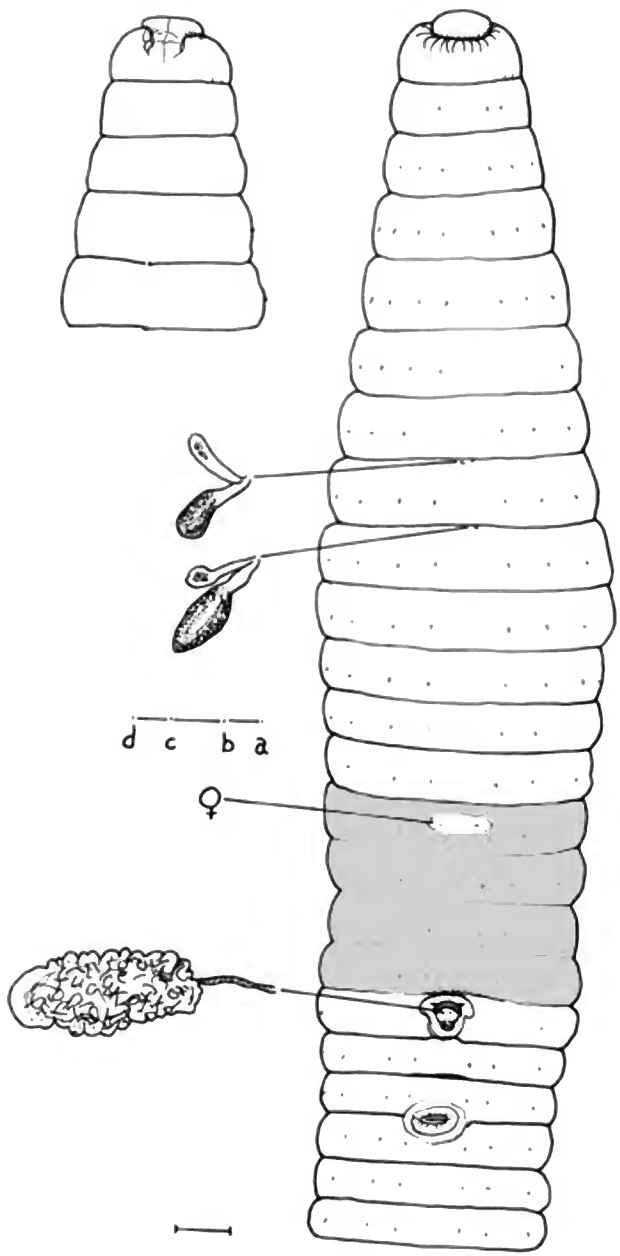


Fig. 137. Notoscolex irregularis (Spencer, 1895), 14:1259.

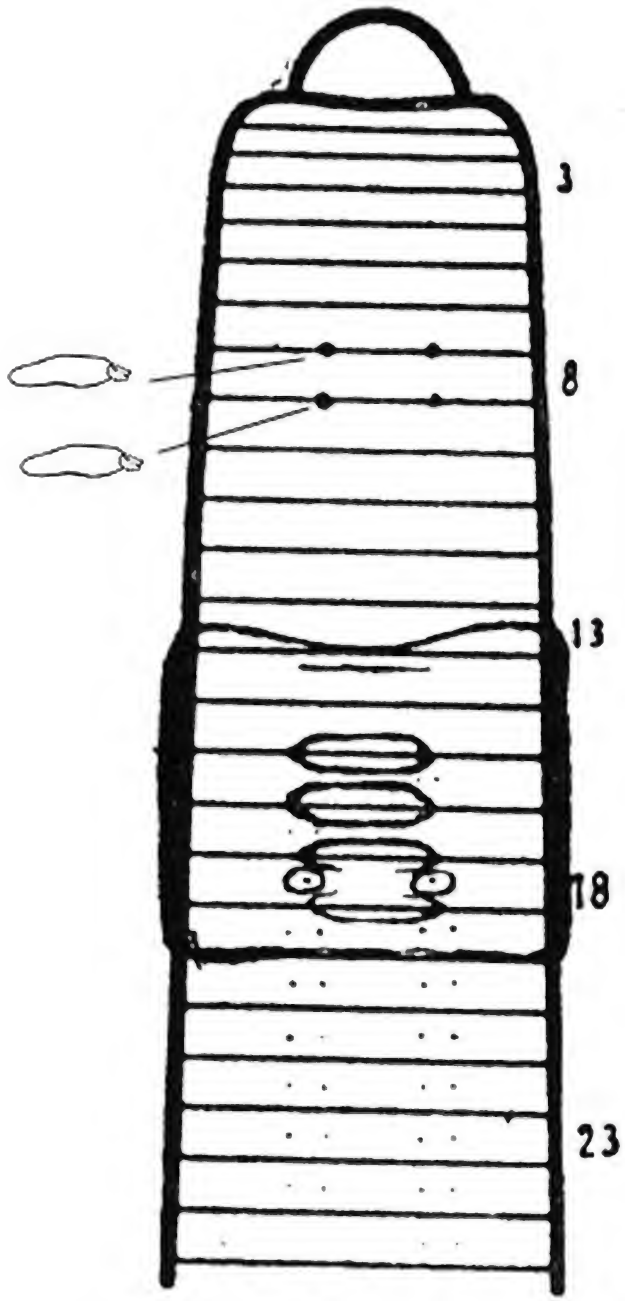


Fig. XVIII.

Fig. XIX.

Fig. 138. Notoscolex leai Michaelsen, 1910, after original figures.

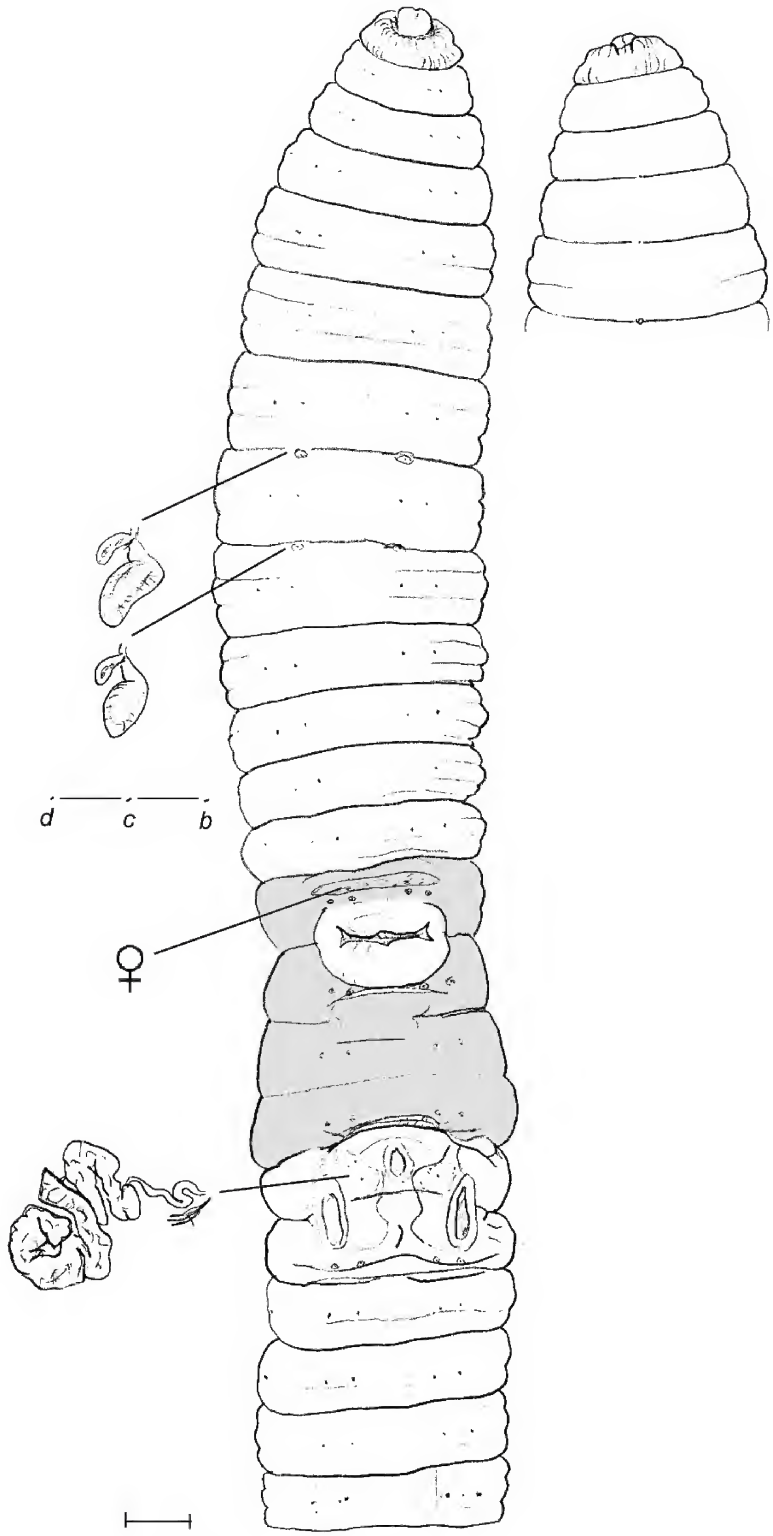


Fig. 139. Notoscolex liffeyi, H.

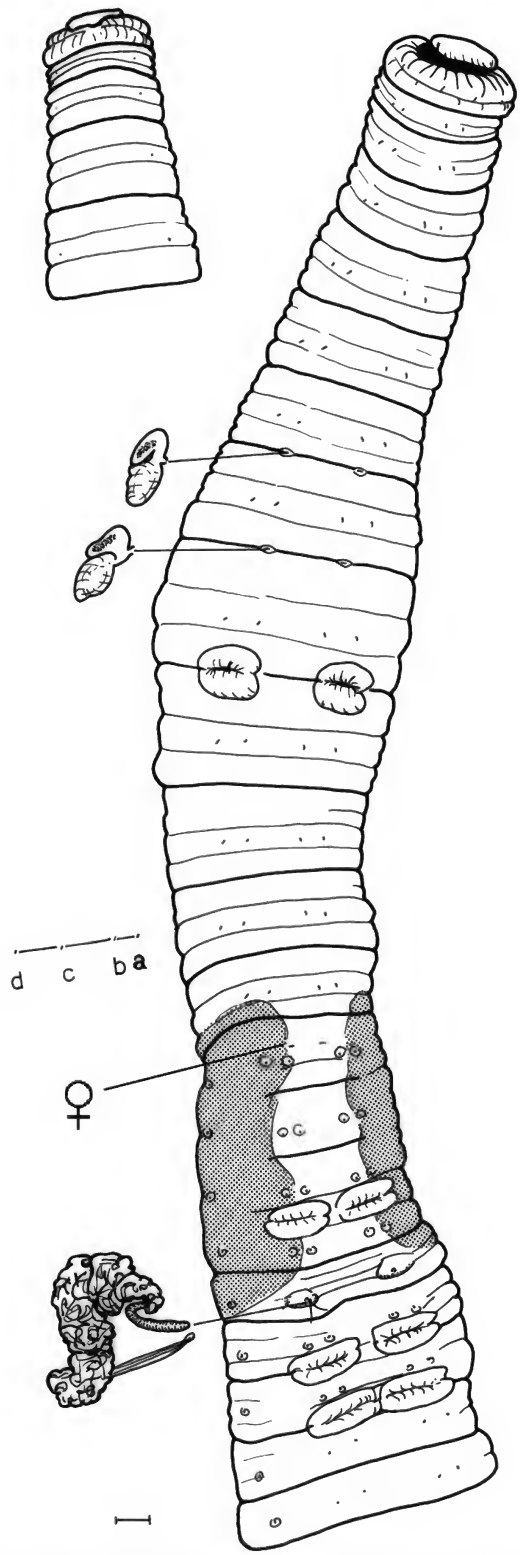


Fig. 140. Notoscolex longus (Jam., 1974), H.

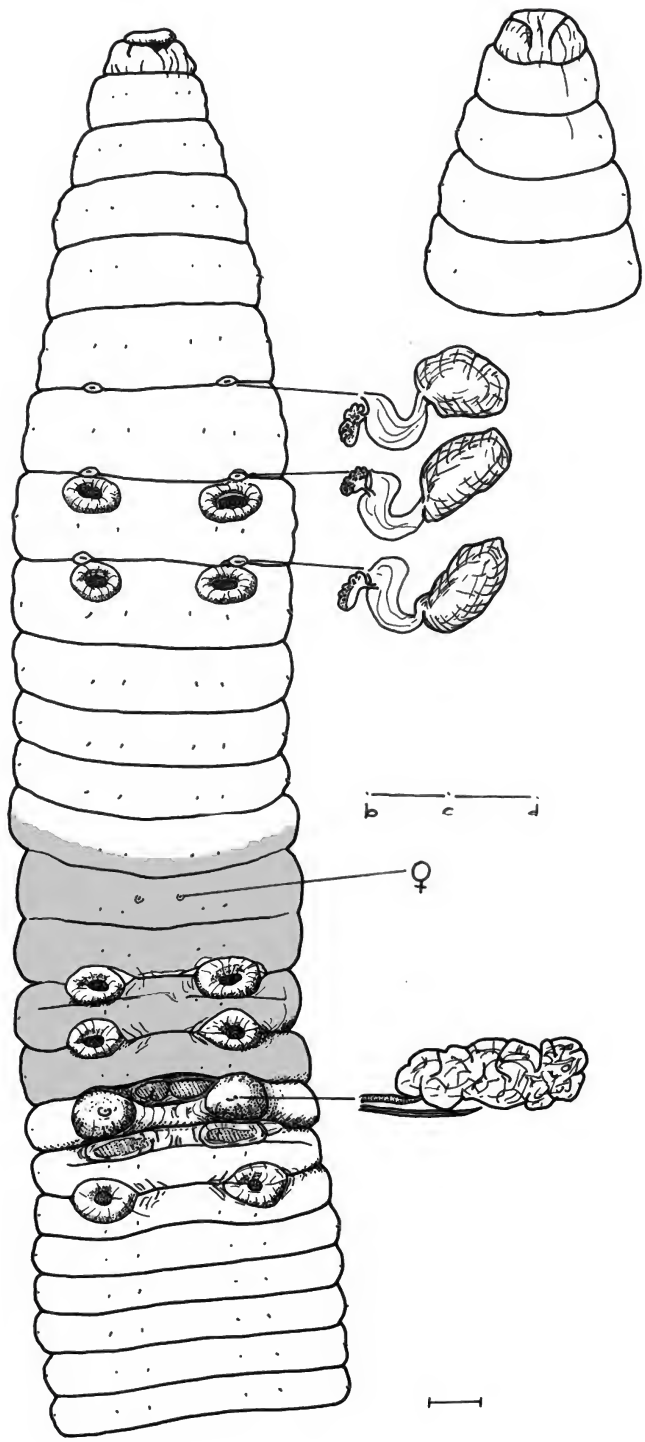


Fig. 141. Notoscolex officeri (Spencer, 1895), 14:1283.

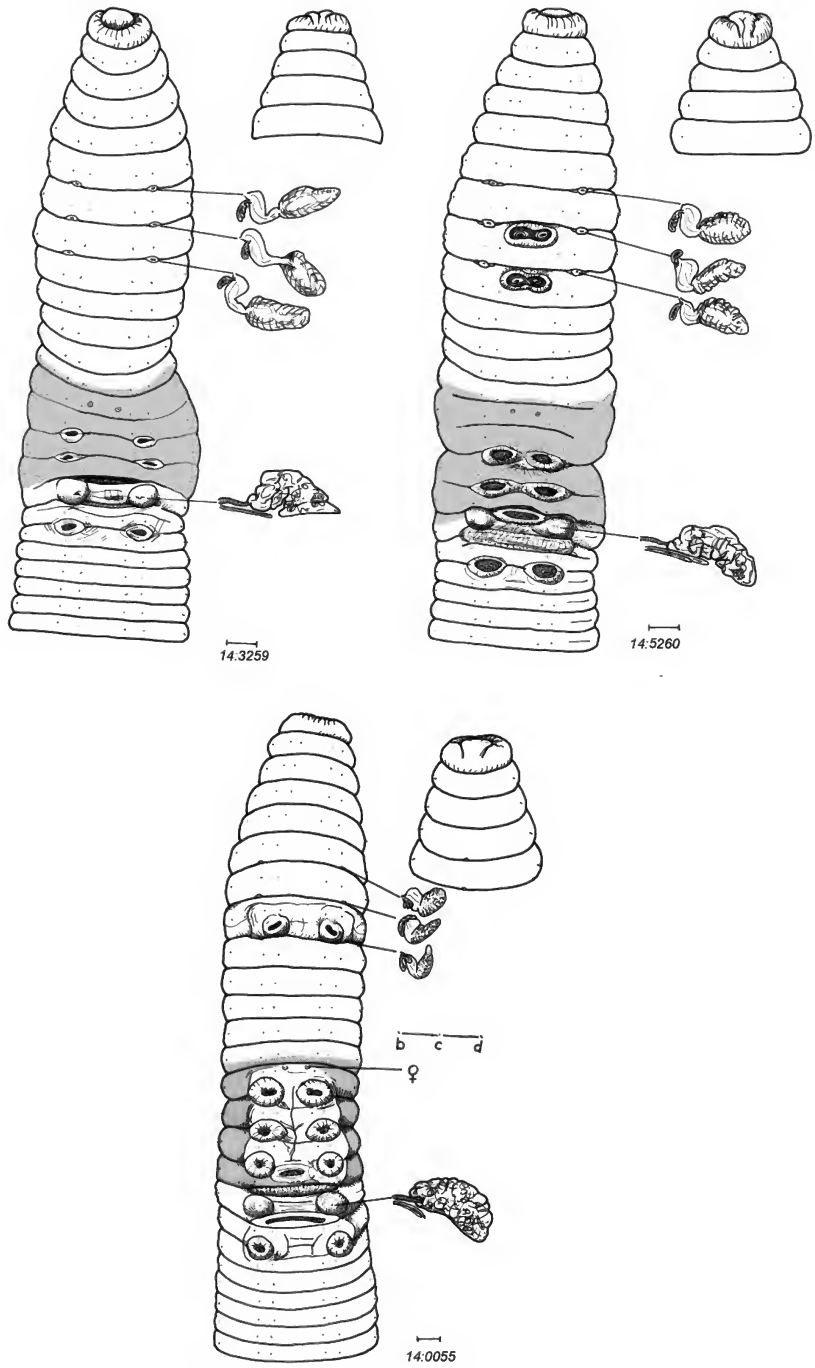


Fig. 142. Notoscolex officeri (Spencer, 1895).

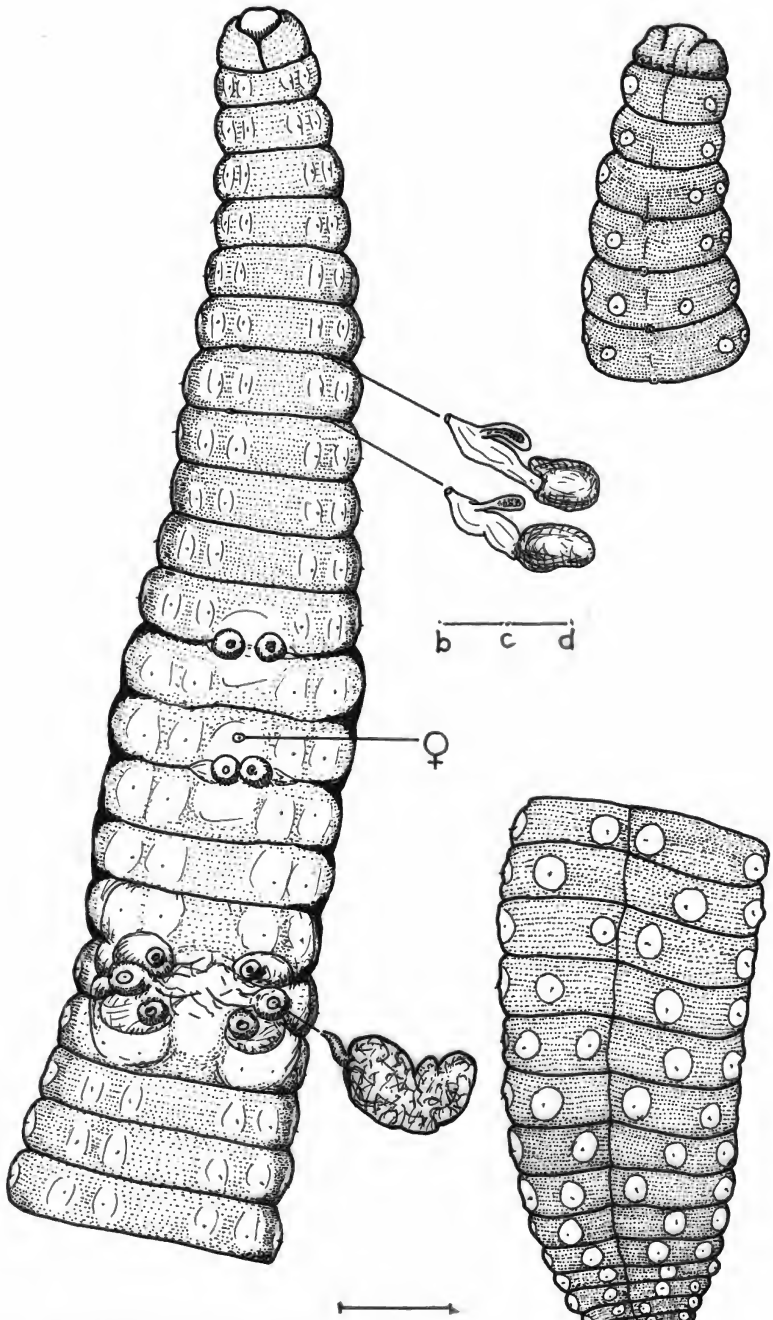


Fig. 143. Notoscolex pardus, H.

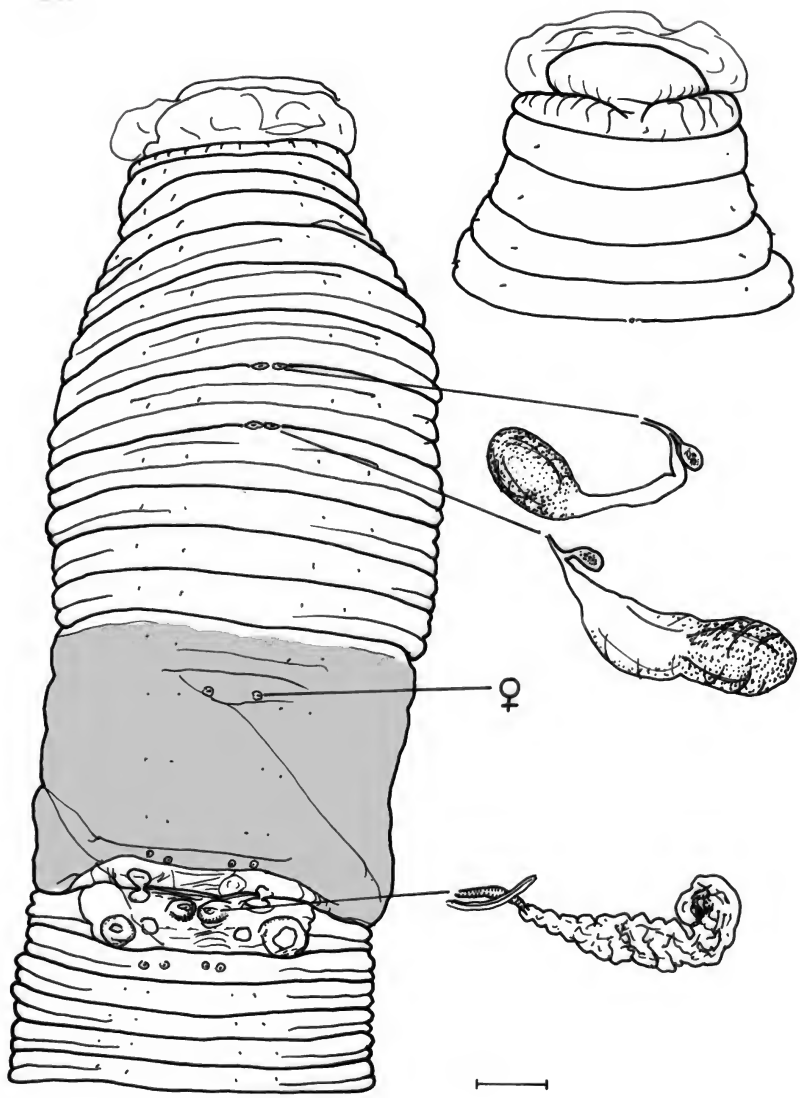


Fig. 144. Notoscolex peculiaris (Jamieson, 1974), 14:3522.

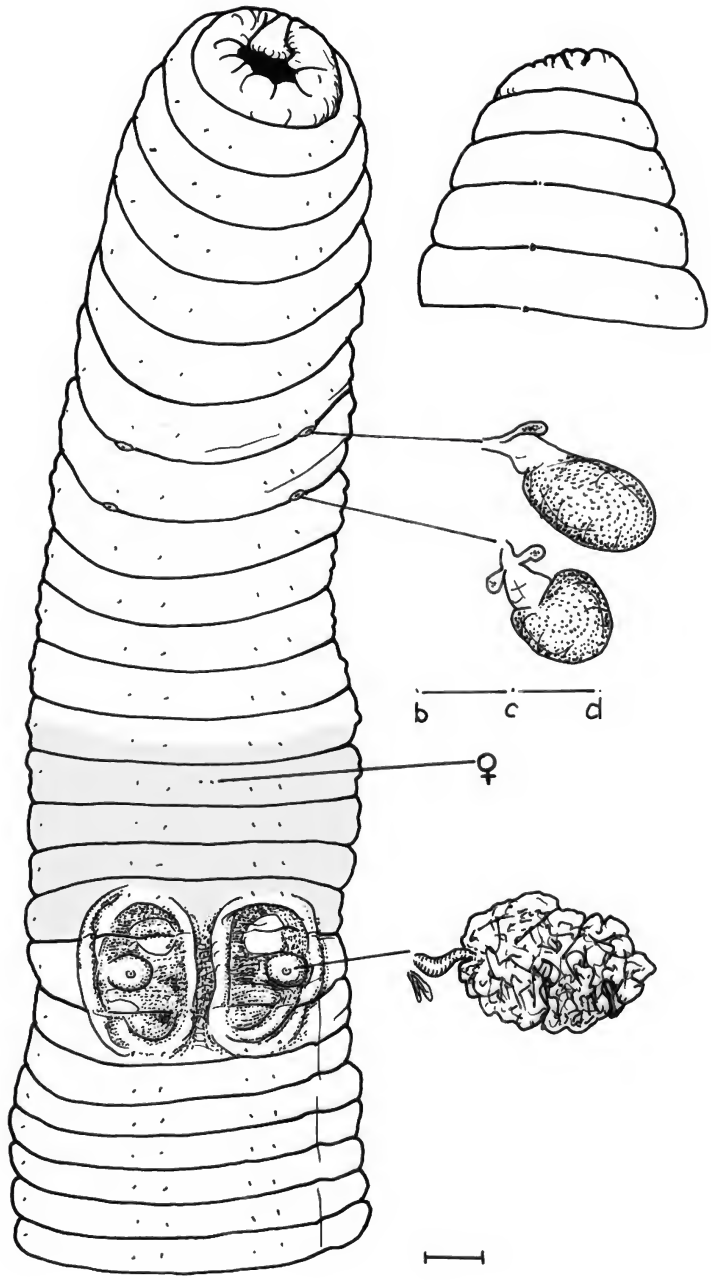


Fig. 145. Notoscolex penguini, H.

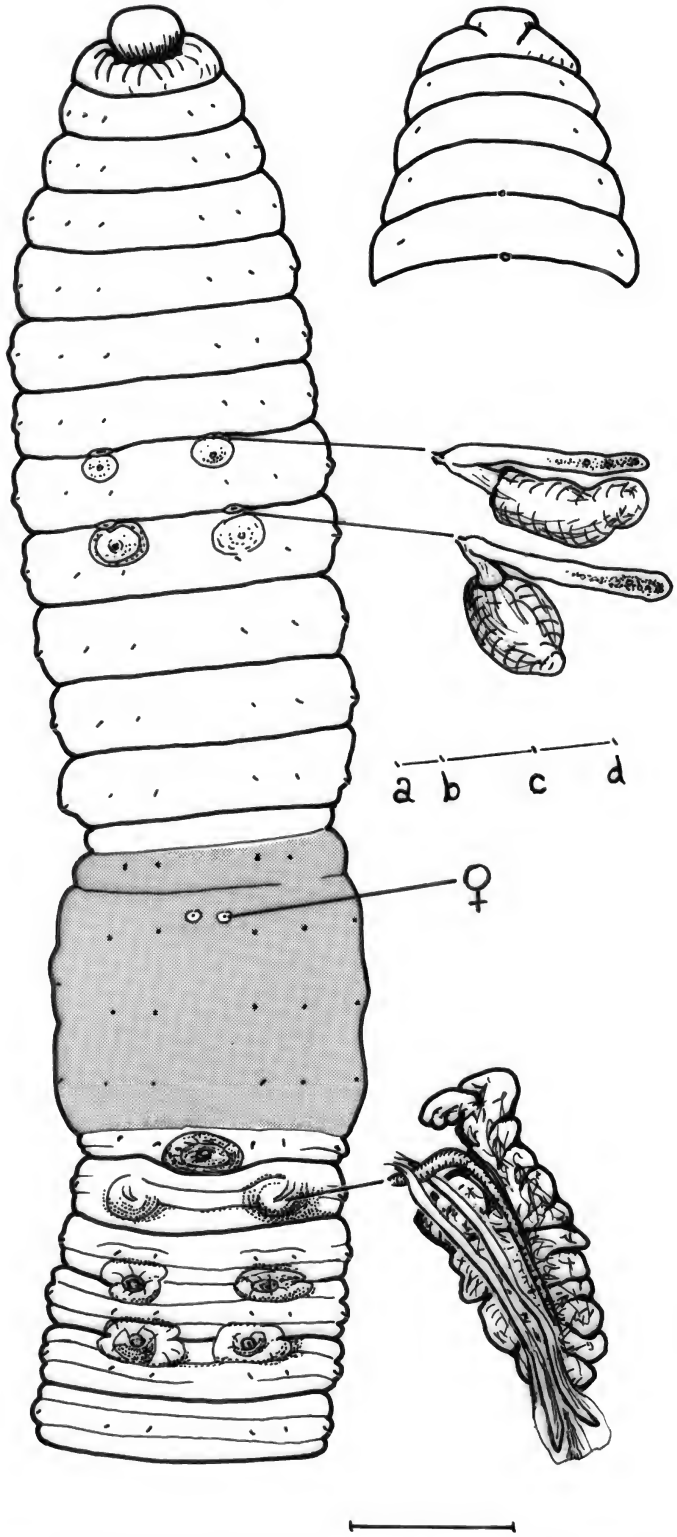


Fig. 146. Notoscolex pilus Blakemore, 1997, H.

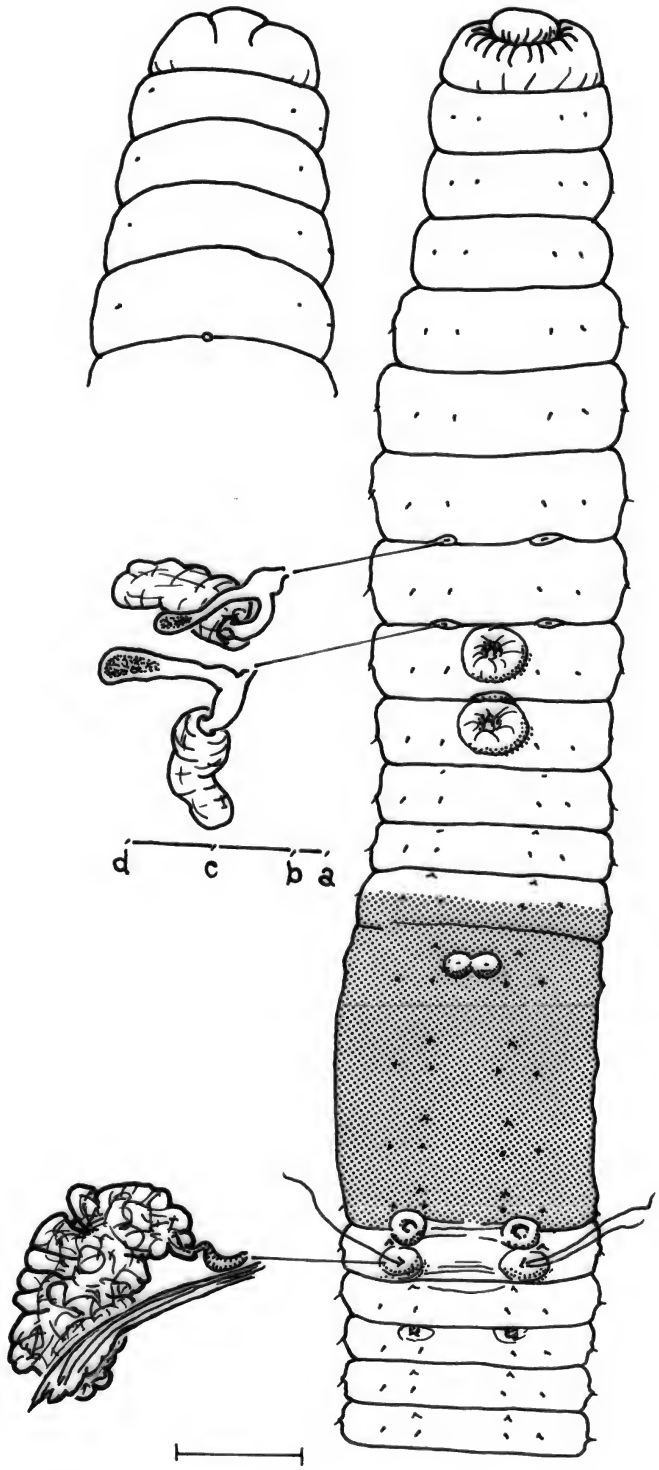


Fig. 147. Notoscolex pilus Blakemore, 1997, (ex. N. dinephrus Blakemore, 2000).

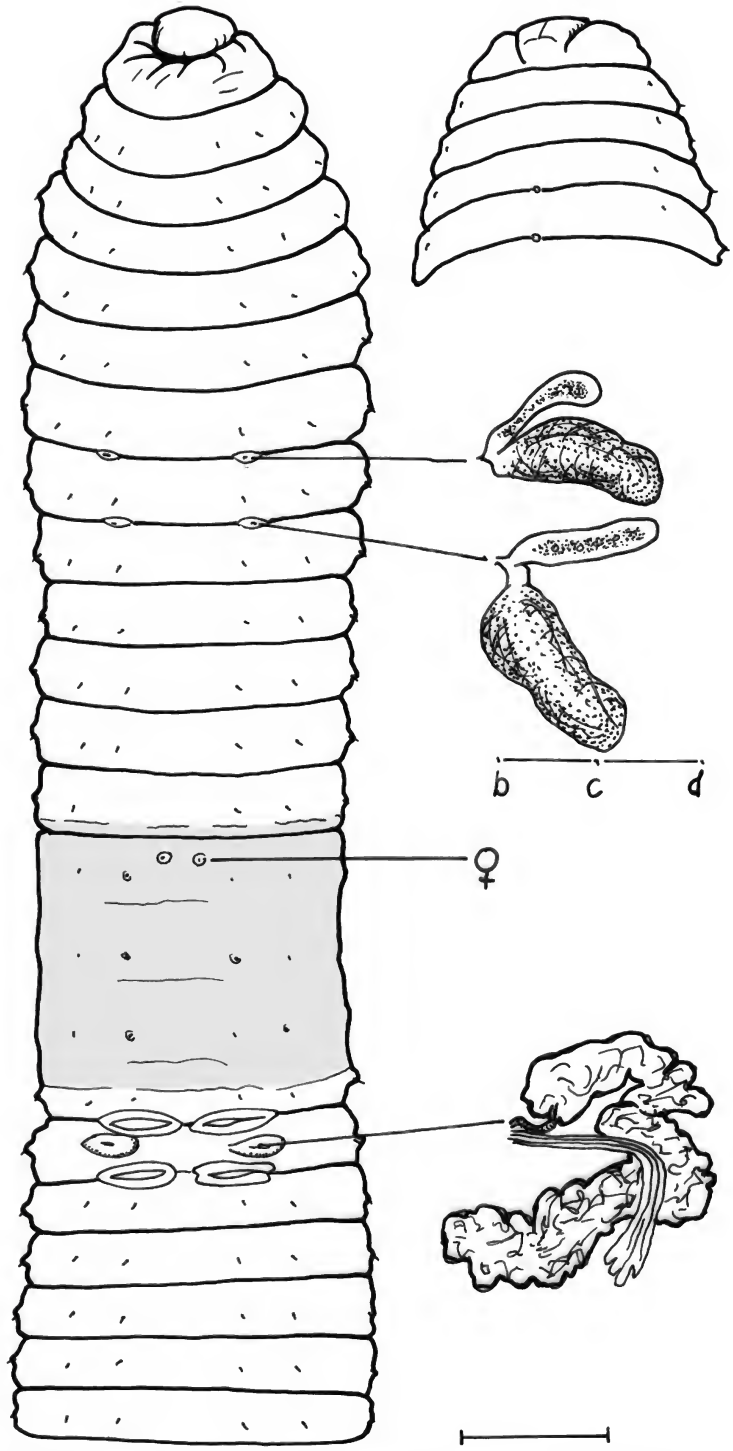


Fig. 148. Notoscolex pilus Blakemore, 1997, 14:2833.

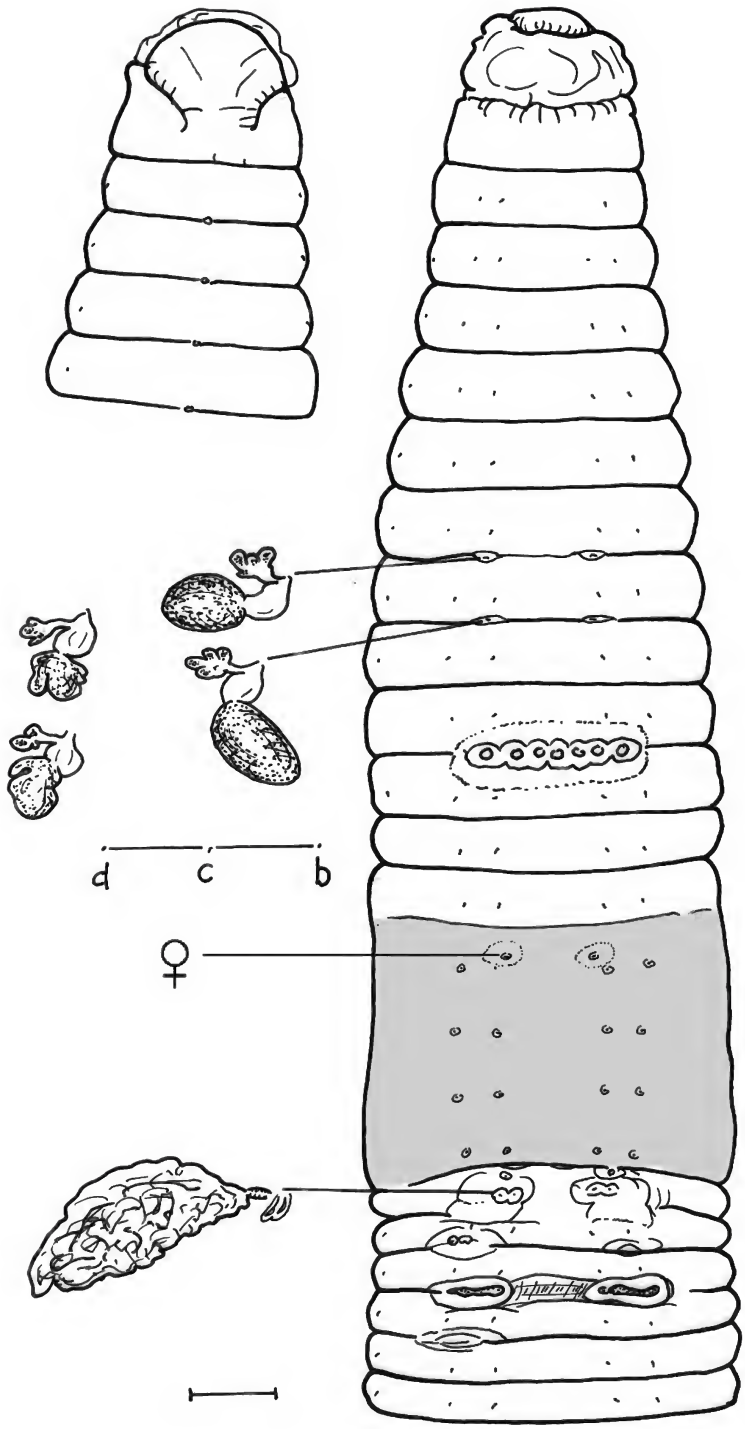


Fig. 149. Notoscolex salutigerulus, H, showing spermathecae from P1lhs.

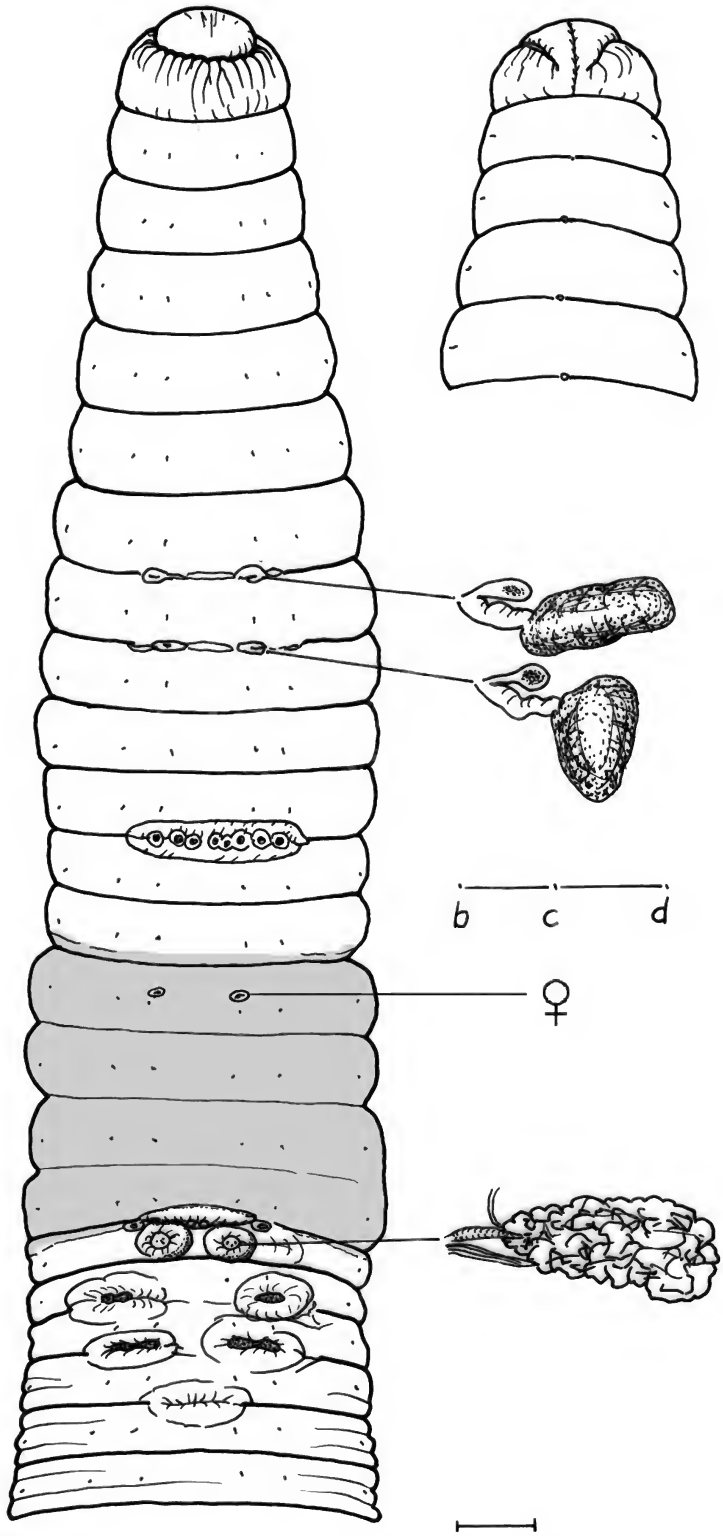


Fig. 150. Notoscolex simsoni (Spencer, 1895), K352.

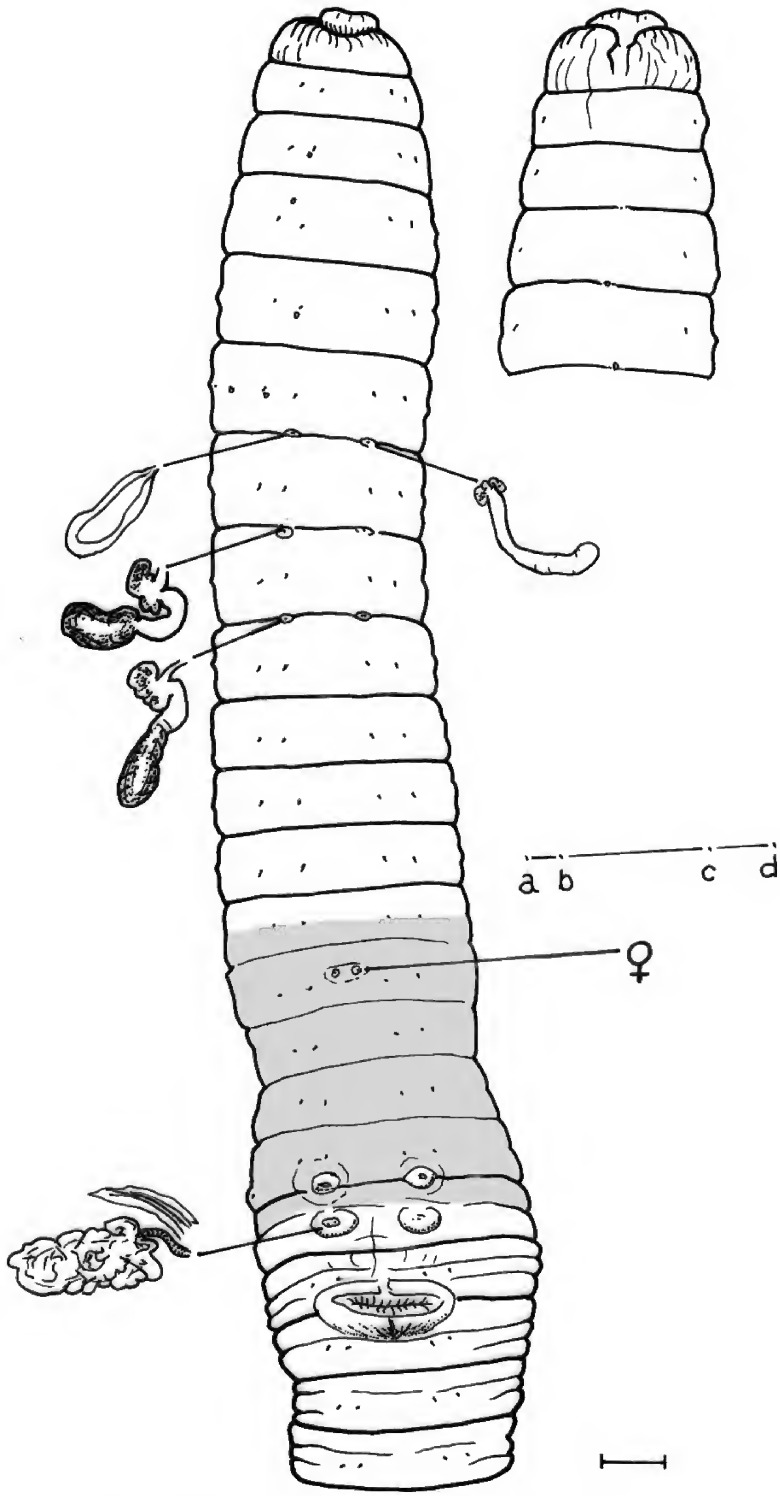


Fig. 151. Notoscolex triplex, H.

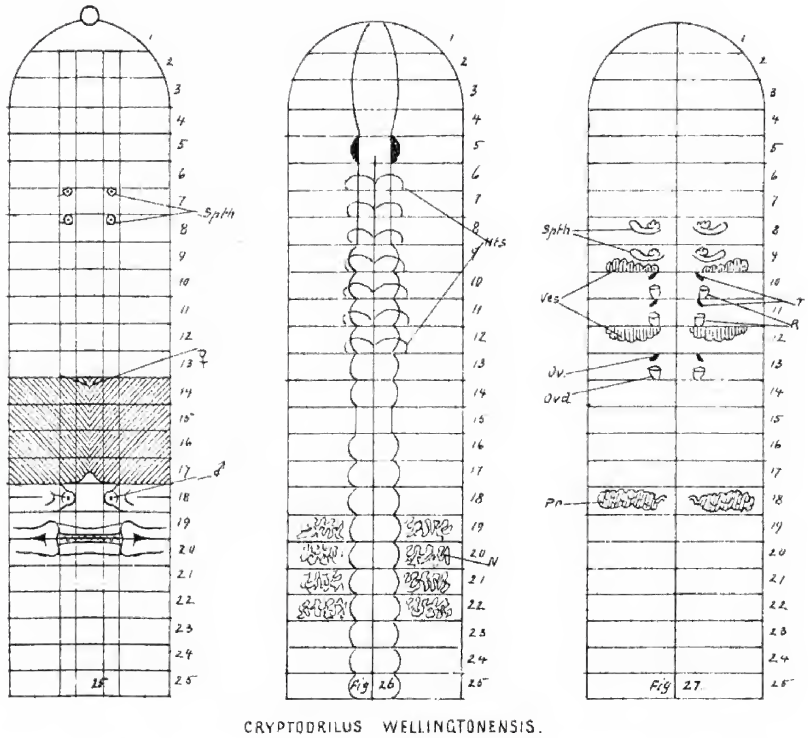


Fig. 152. Notoscolex wellingtonensis (Spencer, 1895), after Spencer's original figures.

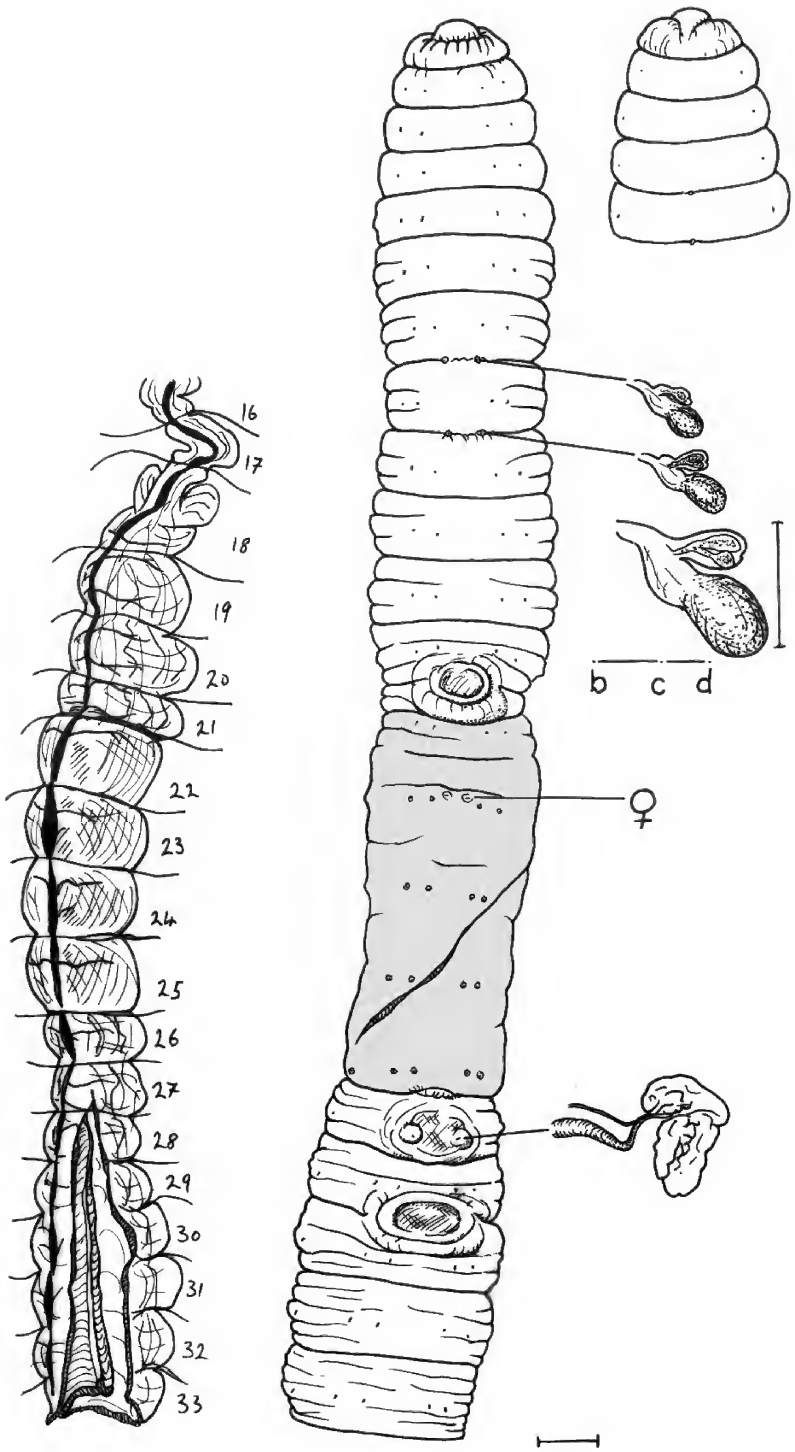


Fig. 153. Nexogaster quaterni, H, showing intestinal gizzards in 22-25, typhlosole, and an enlargement of spermatheca 9rhs.

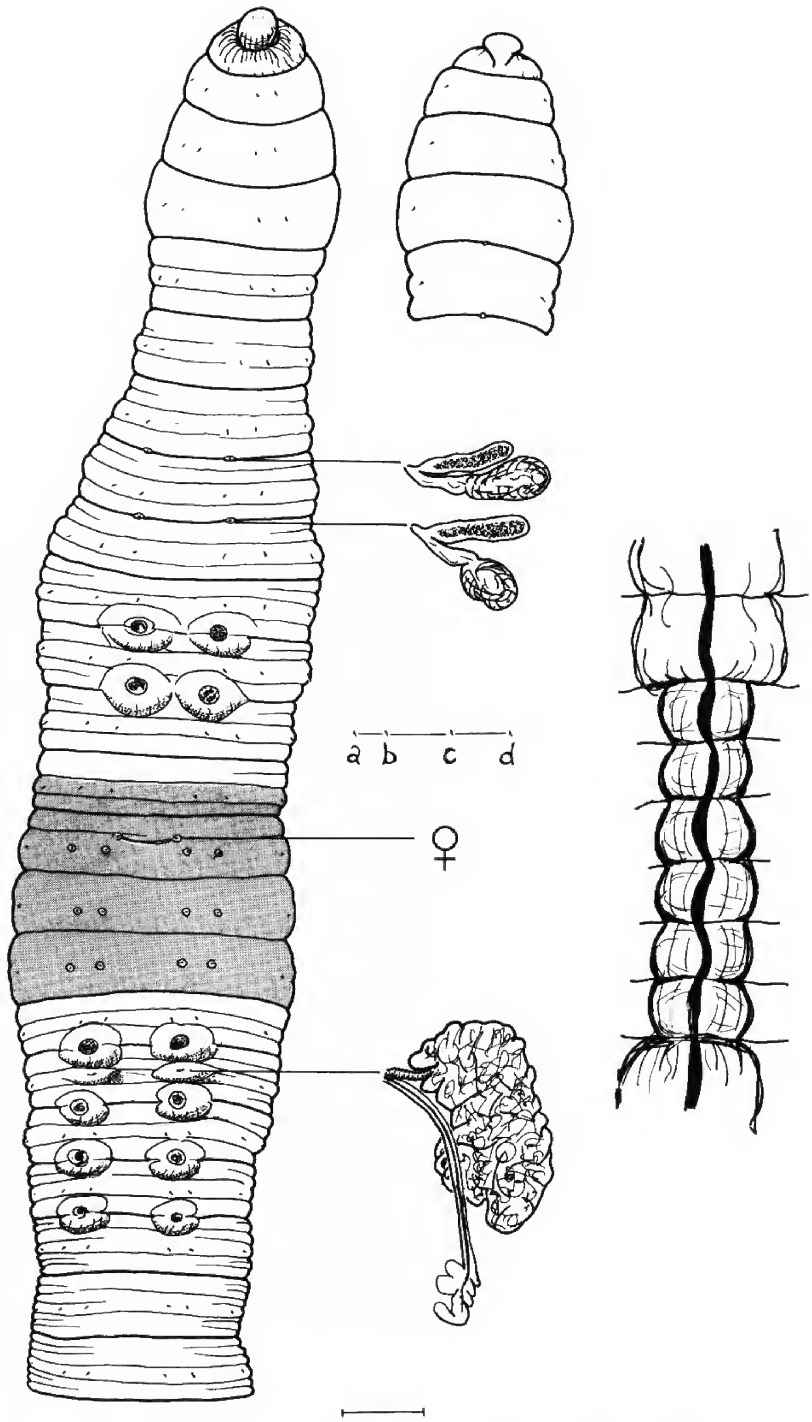


Fig. 154. Nexogaster sexies Blakemore, 1997, H.

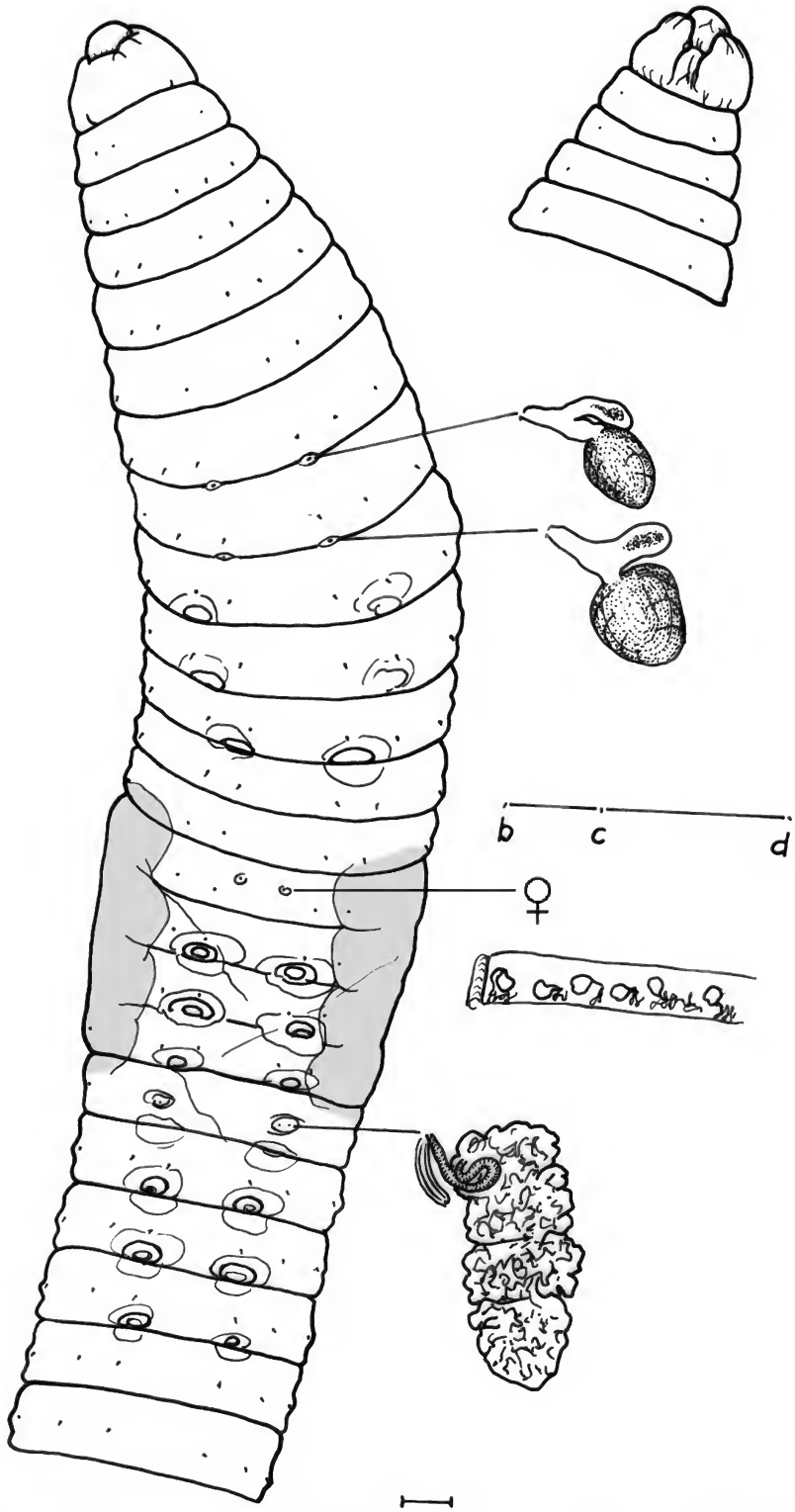


Fig. 155. Cryptodrilus polynephricus Spencer, 1895, Neotype, showing nephridia in segment 15lhs.

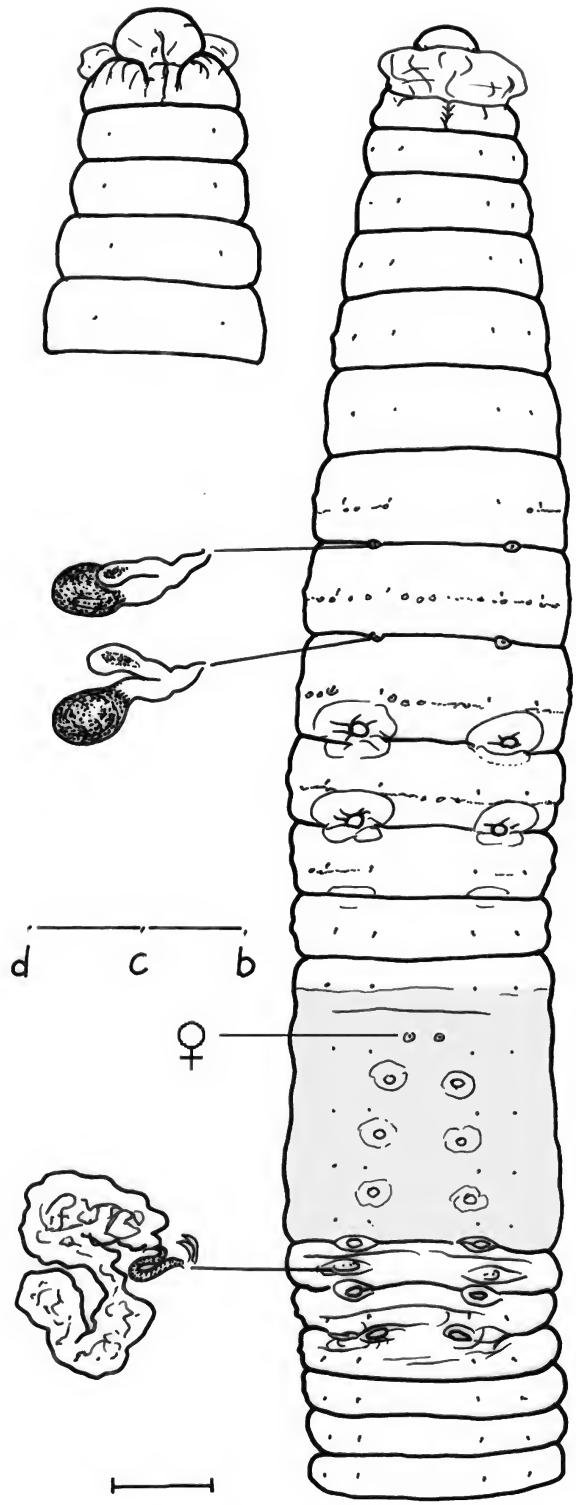


Fig. 156. Cryptodrilus ramosus copiafluvis, H.

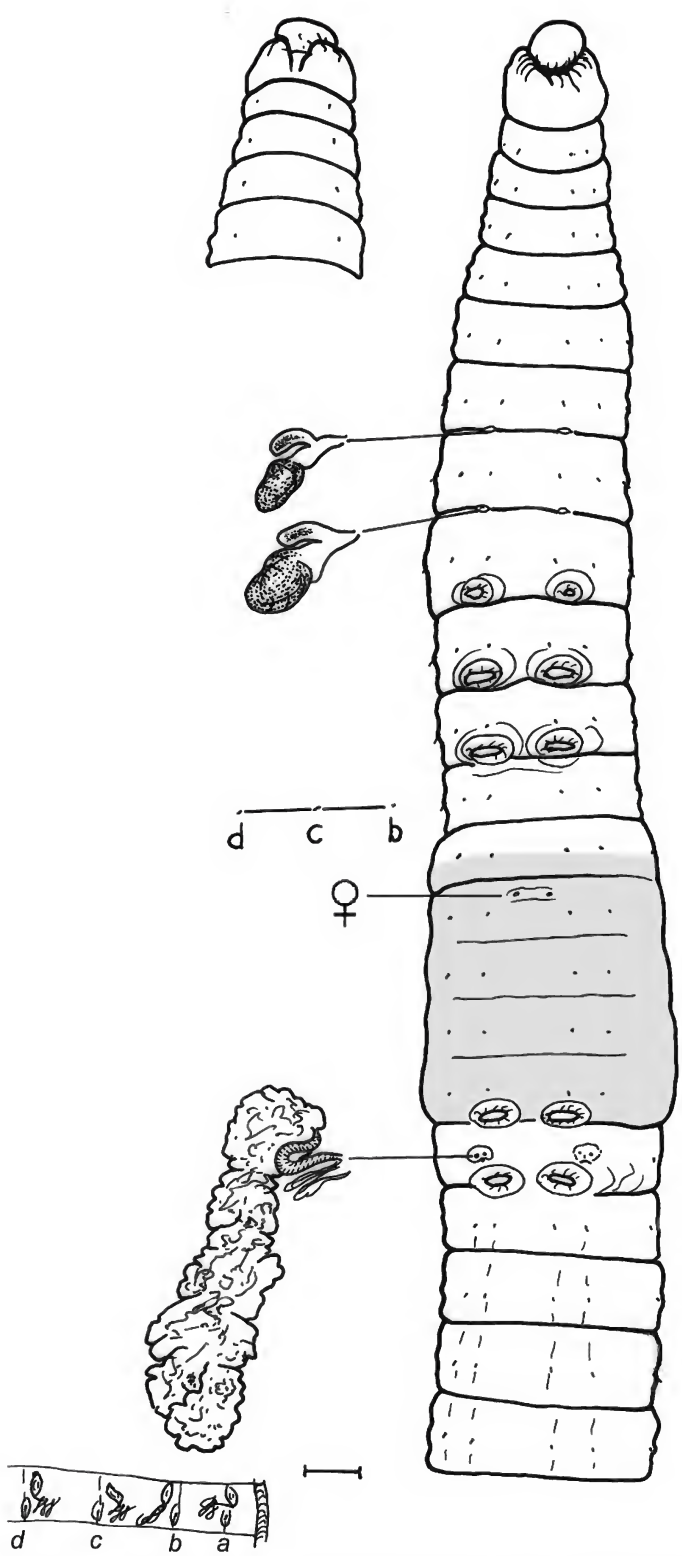
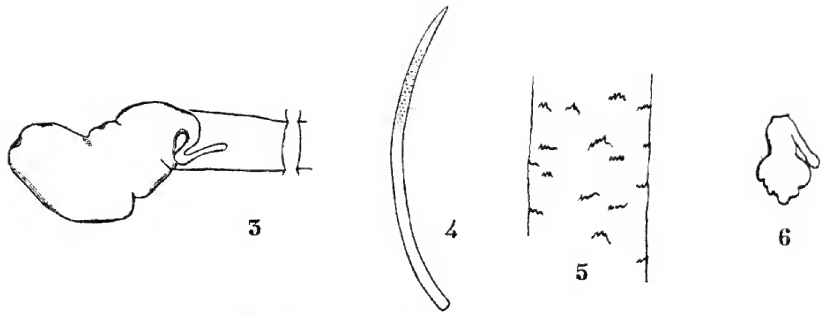


FIg. 157. Cryptodrilus spenceri, H, + nephridia in 33lhs.



Megascolides Albertisii

Fig. 158. Aporodrilus ? albertisii (Cognetti de Martiis, 1910), after original figs. of (3) prostate, (4-5) penial setae, (6) spermathca.

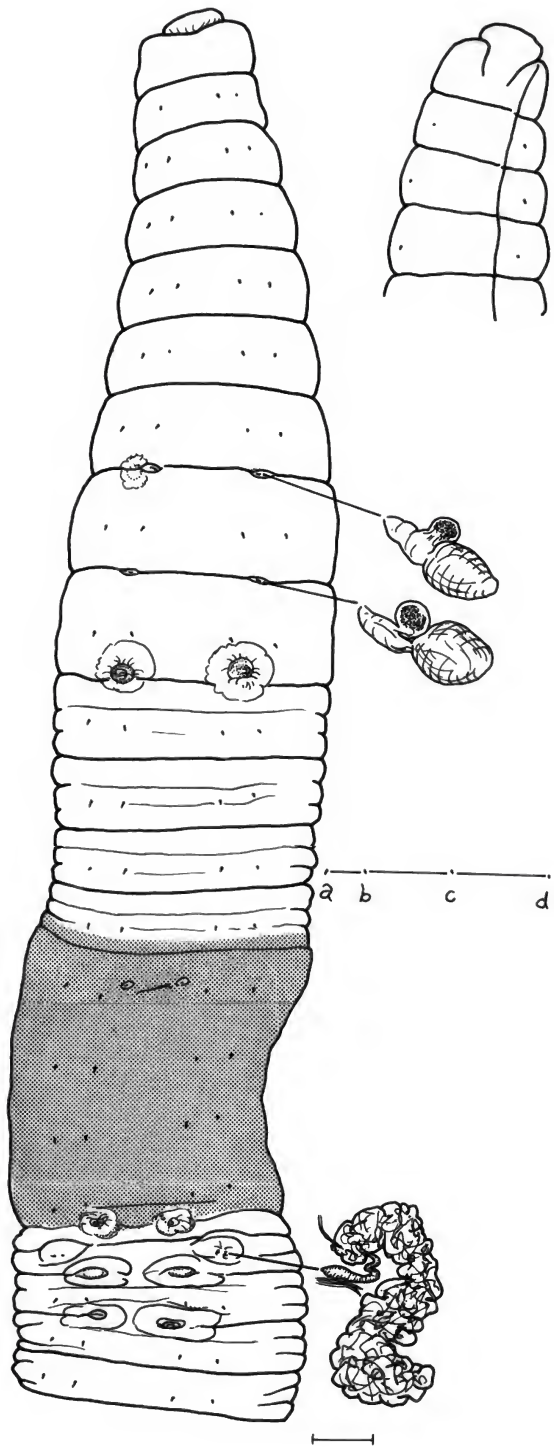


Fig. 159. Aporodrilus avesiculatus (Jam., 1974), H.

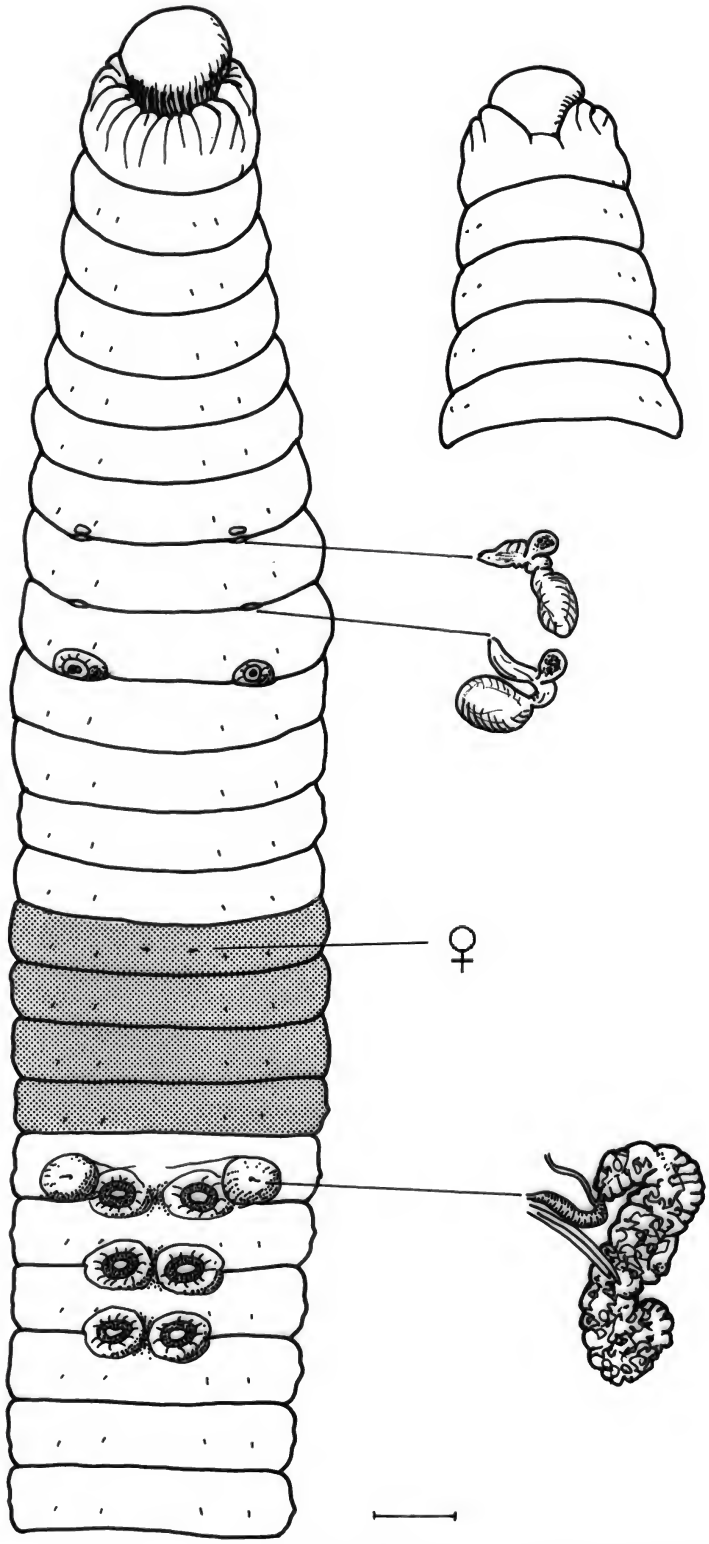


Fig. 160. Aporodrilus avesiculatus (Jam., 1974), 14:3101.

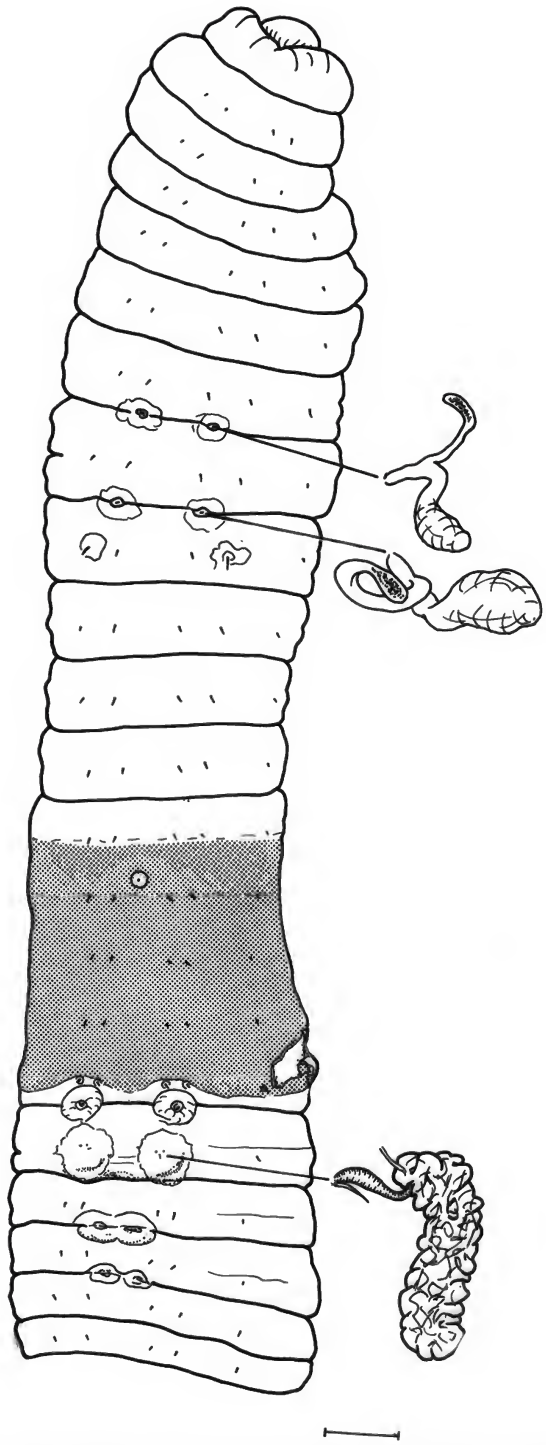


Fig. 161. Aporodrilus brunyensis (Jamieson, 1974), H.

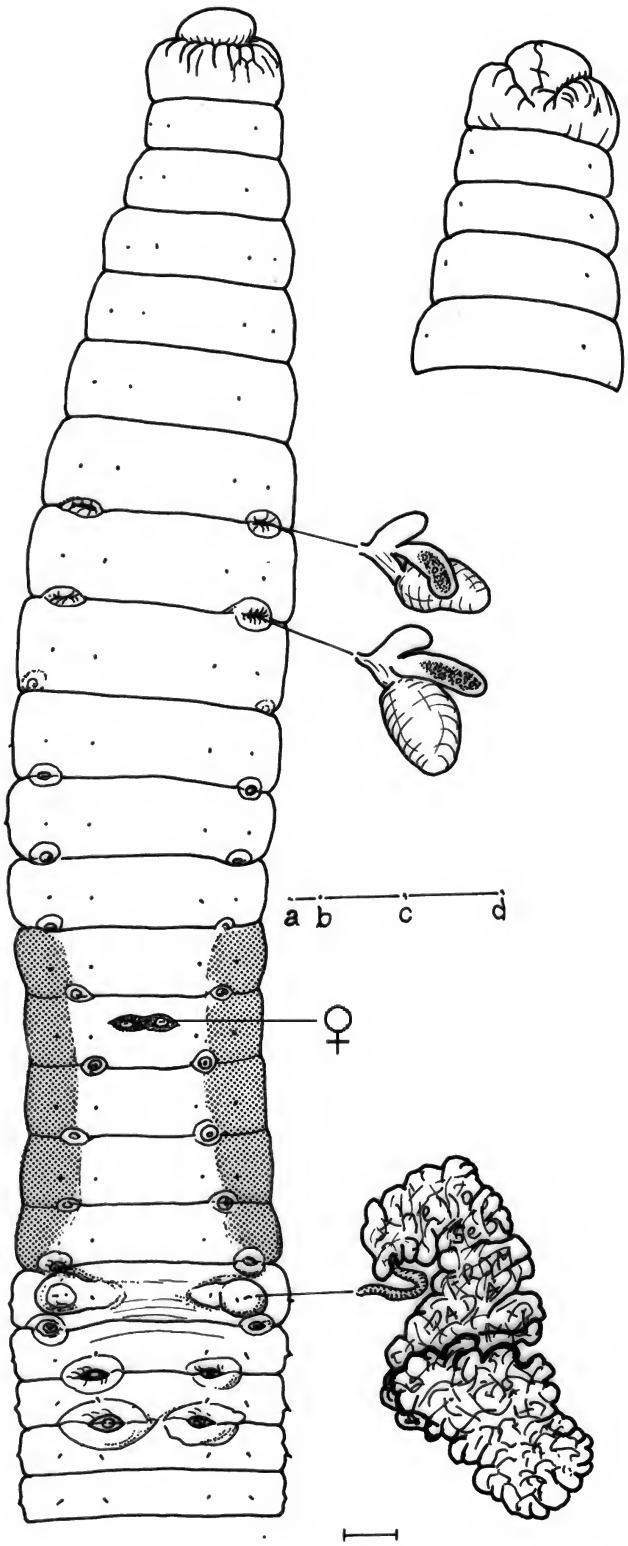


Fig. 162. Aporodrilus dombrovskisi Blakemore, 2000, H.

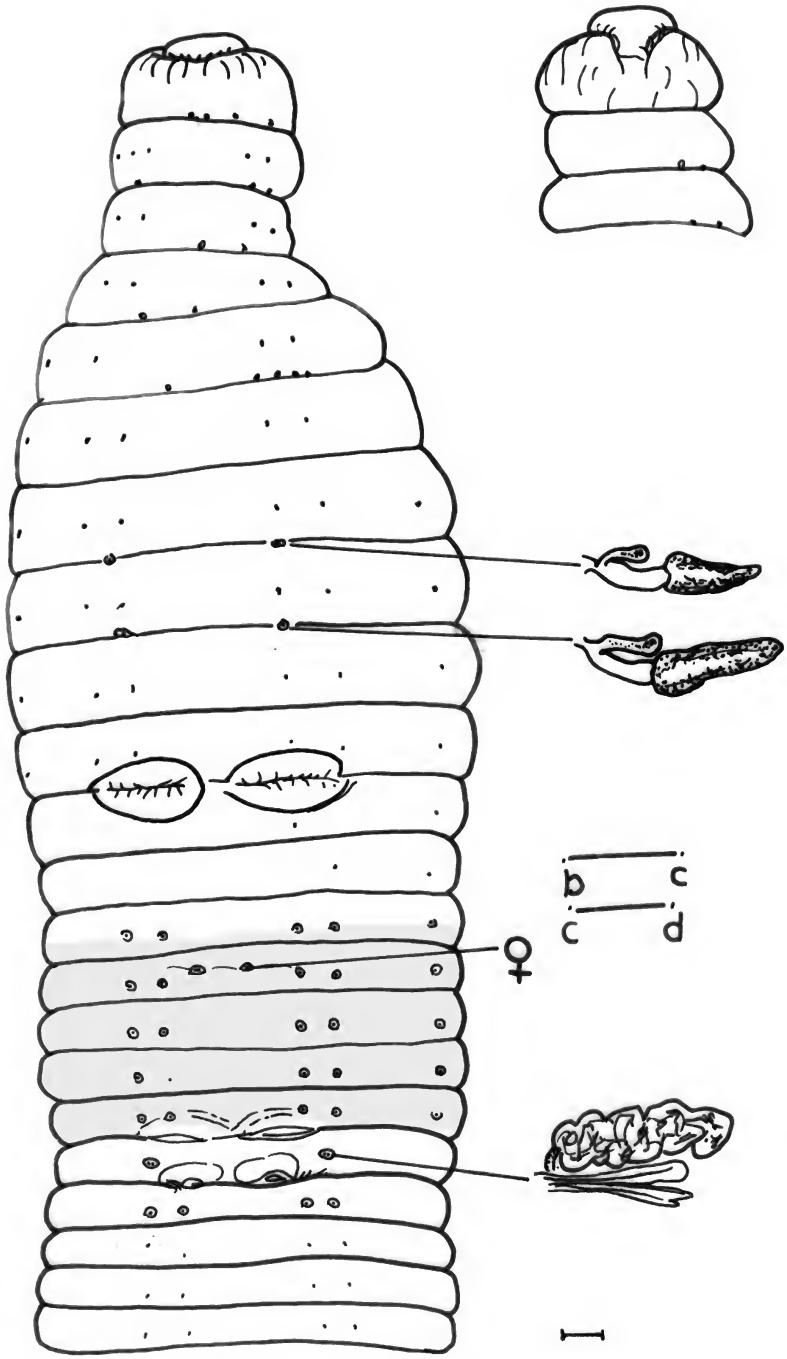


Fig. 163. Aporodrilus doveri, H.

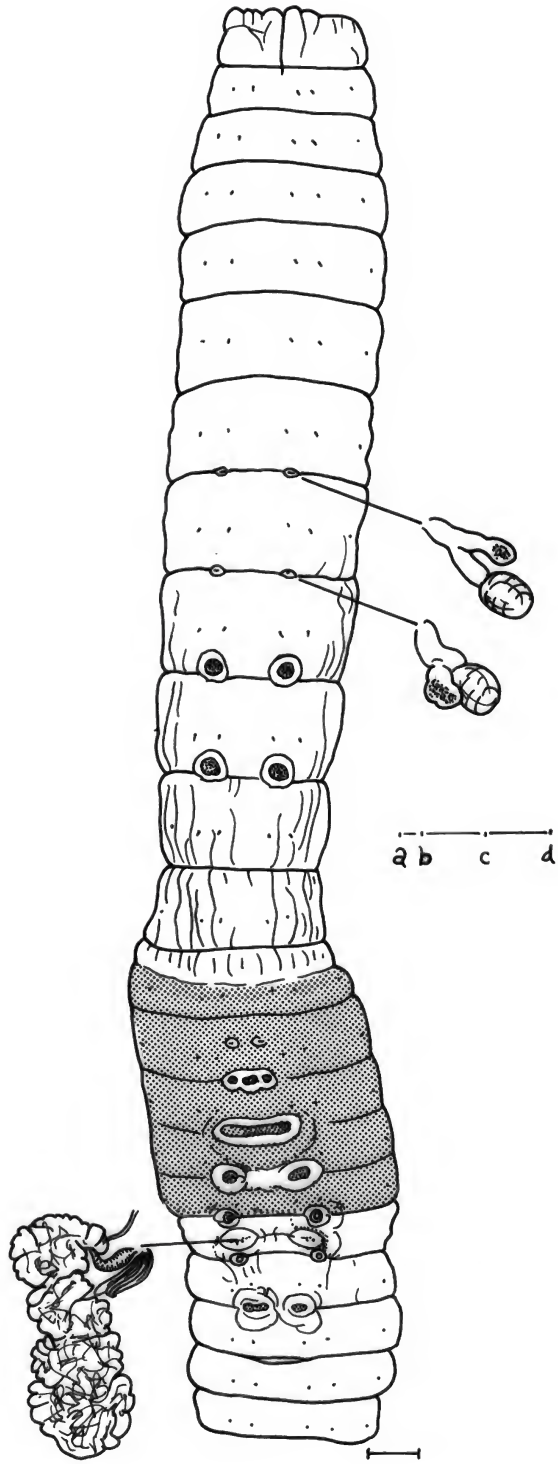


Fig. 164. Aporodrilus enteronephricus (Jam., 1974), H.

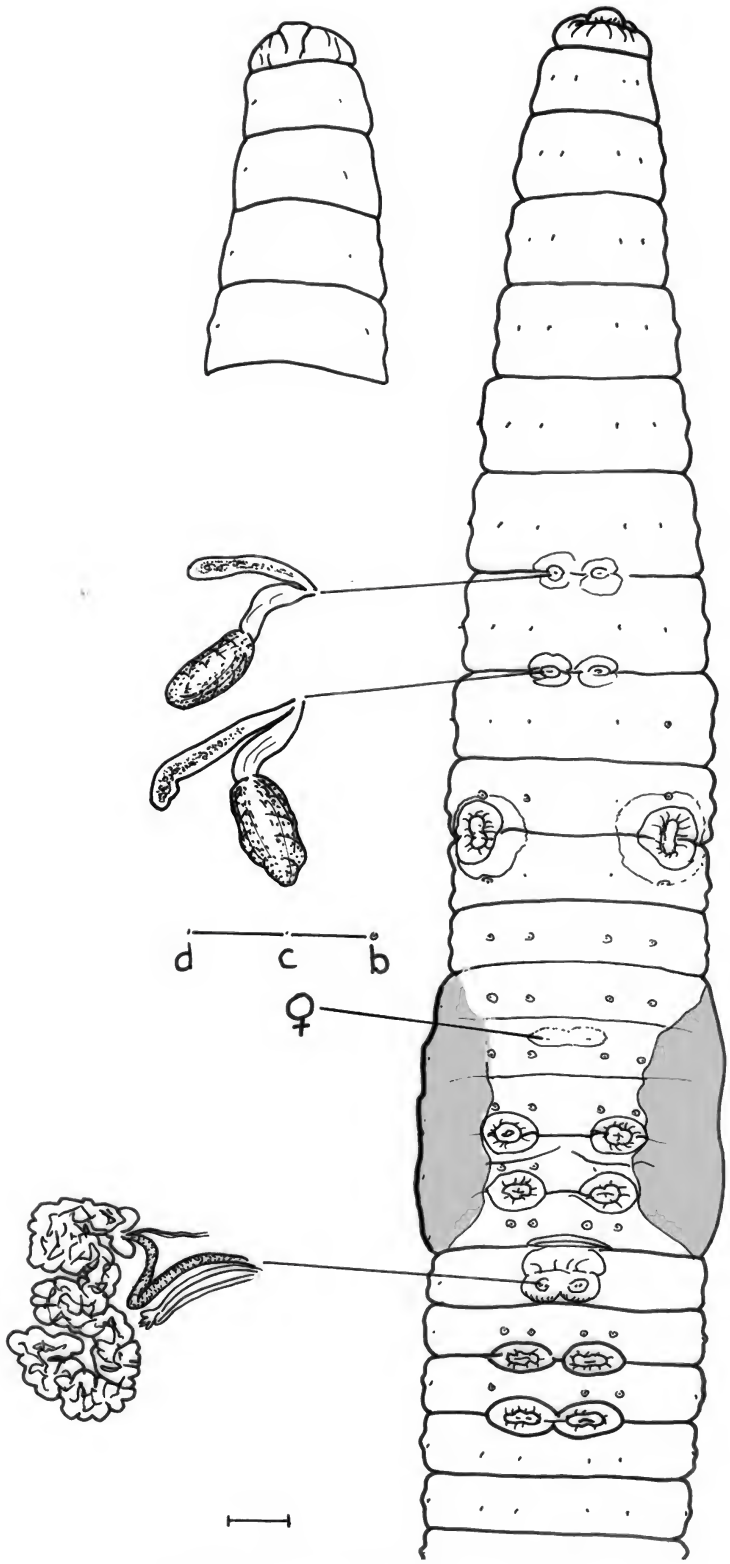


Fig. 165. Aporodrilus fuscus fuscus, H.

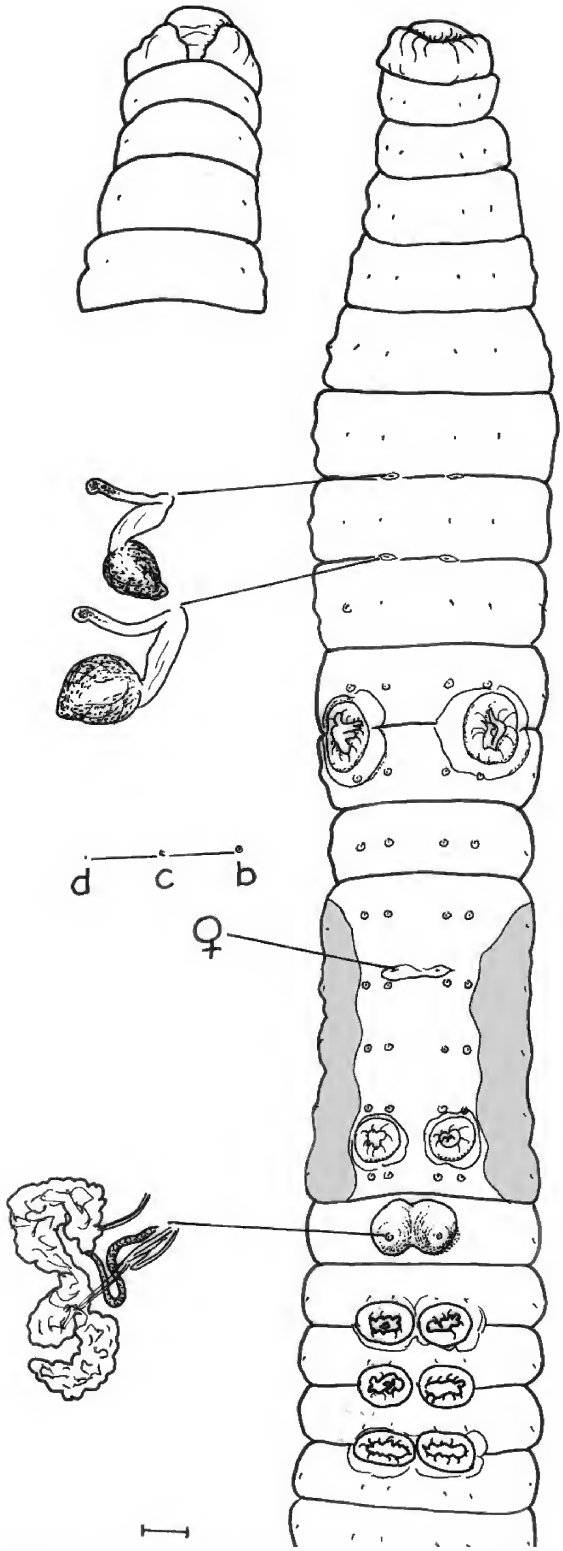


Fig. 166. Aporodrilus fuscus violaceus, H.

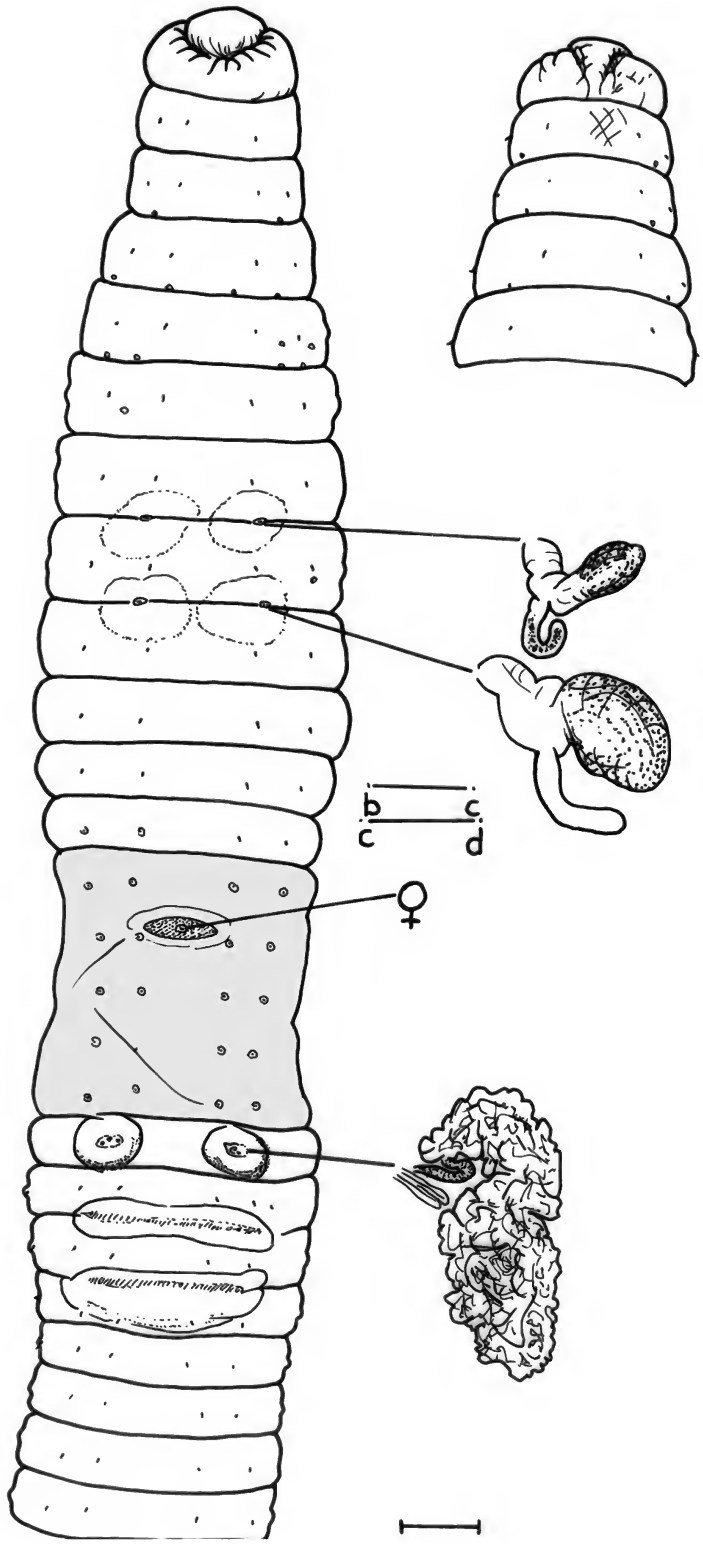


Fig. 167. Aporodrilus hartzi, H.

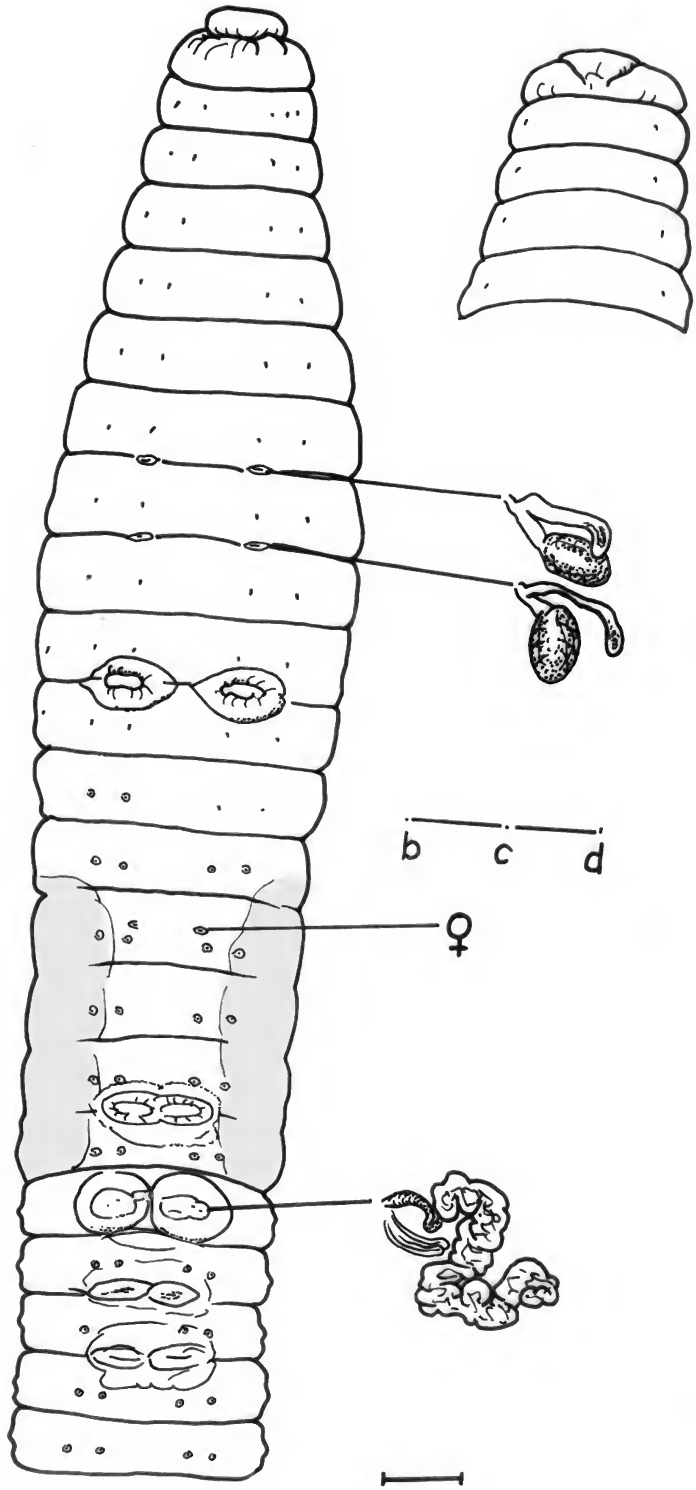


Fig. 168. Aporodrilus melaleucus, H.

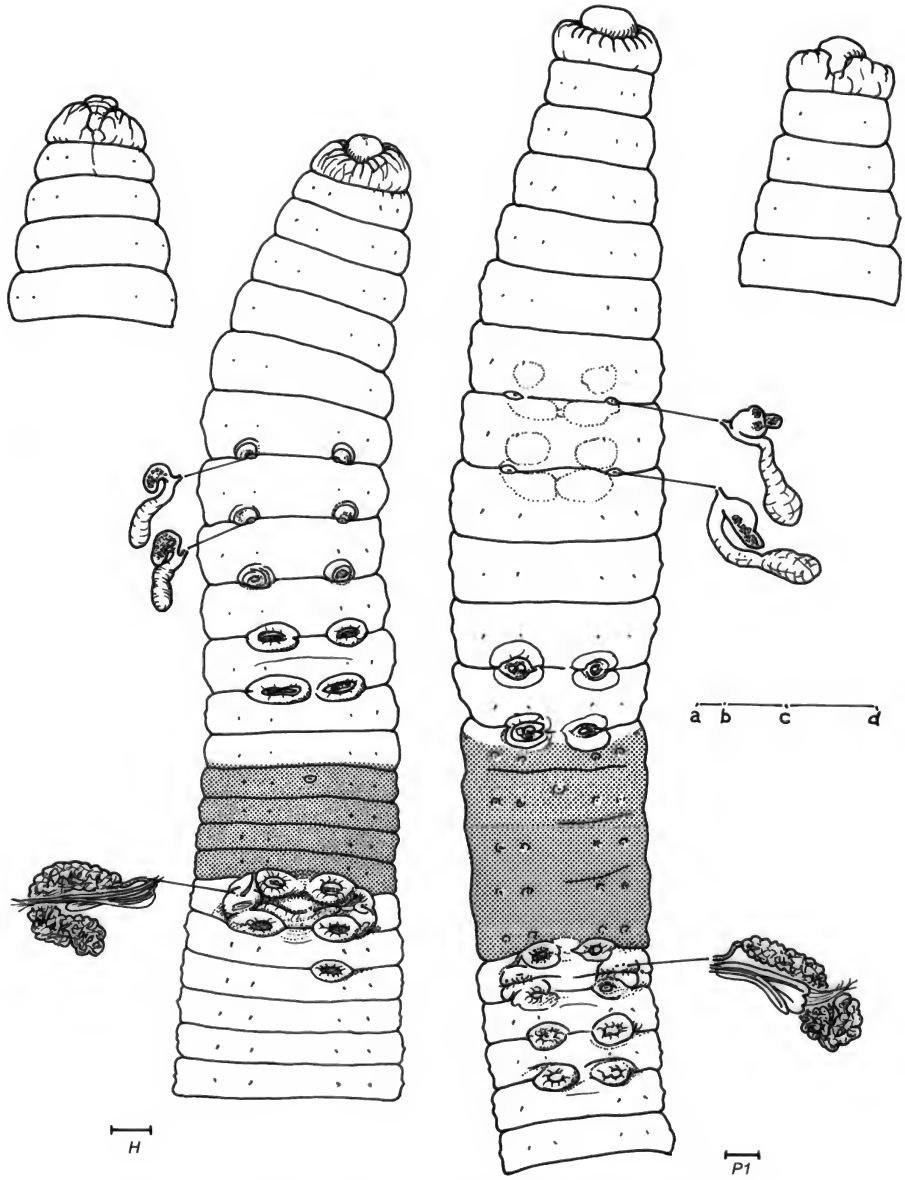


Fig. 169. Aporodrilus monogynus Blakemore, 2000, H, P1.

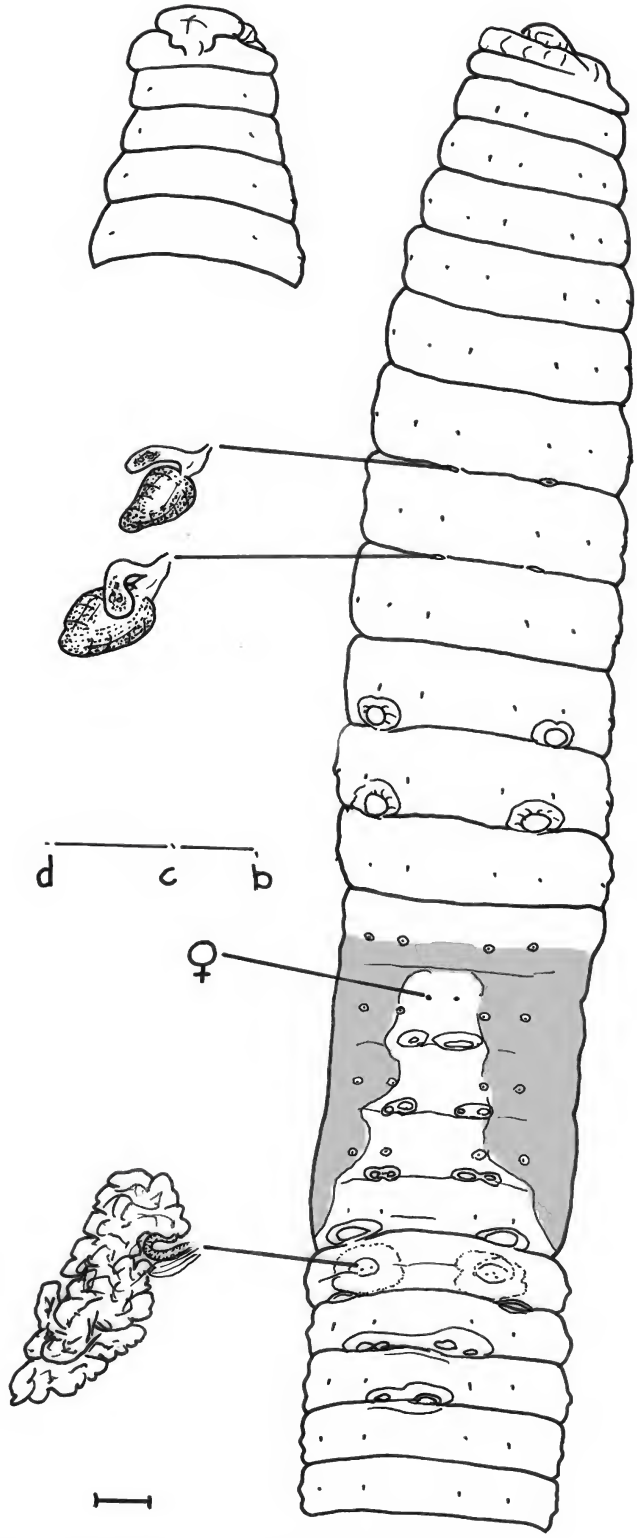


Fig. 170. Aporodrilus nubigenus, H.

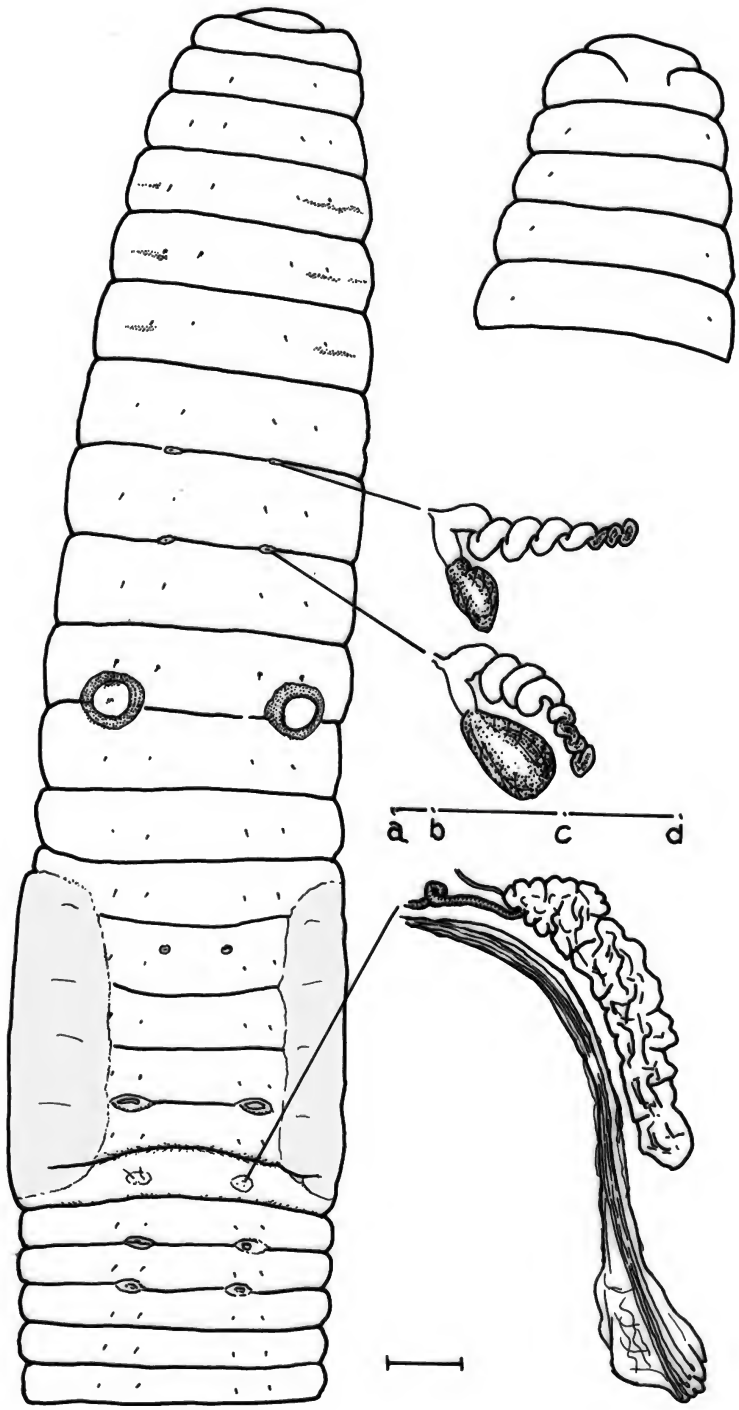


Fig. 171. Aporodrilus olympus, H.

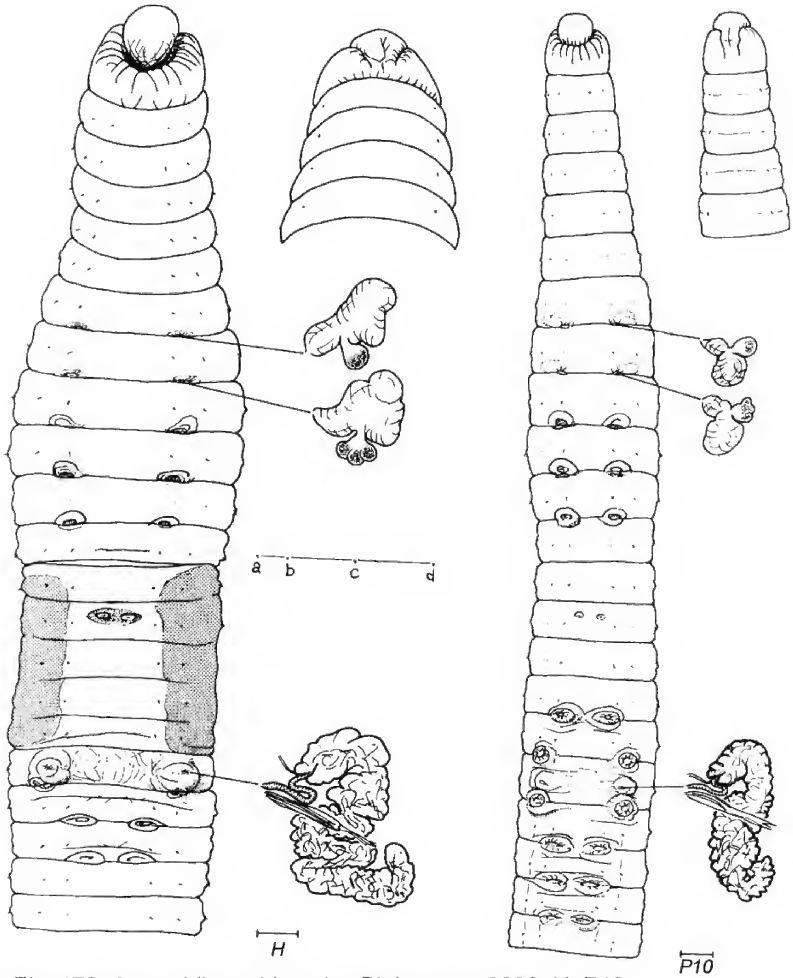


Fig. 172. Aporodrilus rubicundus Blakemore, 2000, H, P10.

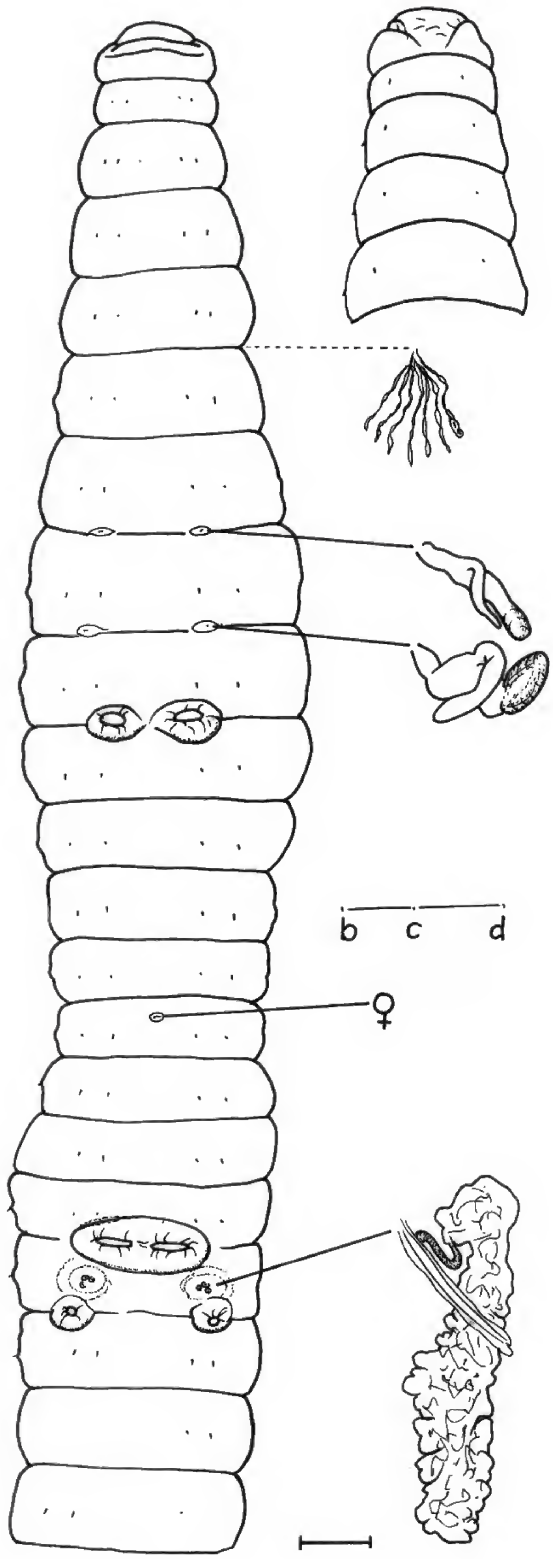


Fig. 173. Aporodrilus semisilvus, H.

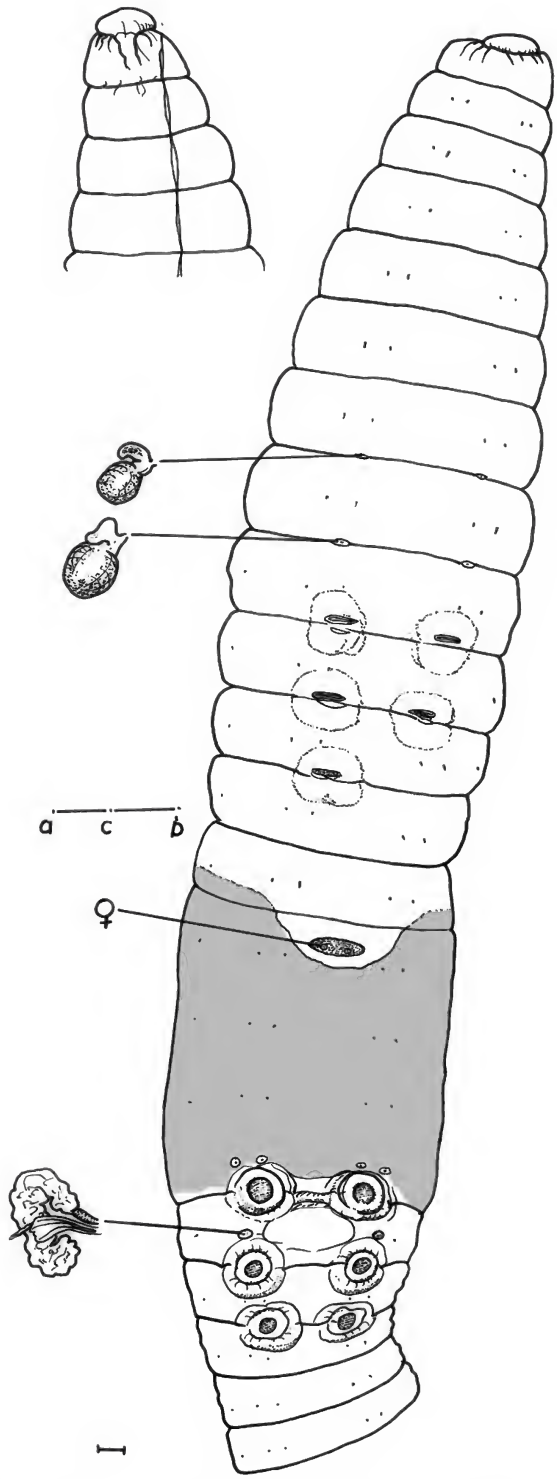


Fig. 174. Aporodrilus urethrae (Jamieson, 1974), H.

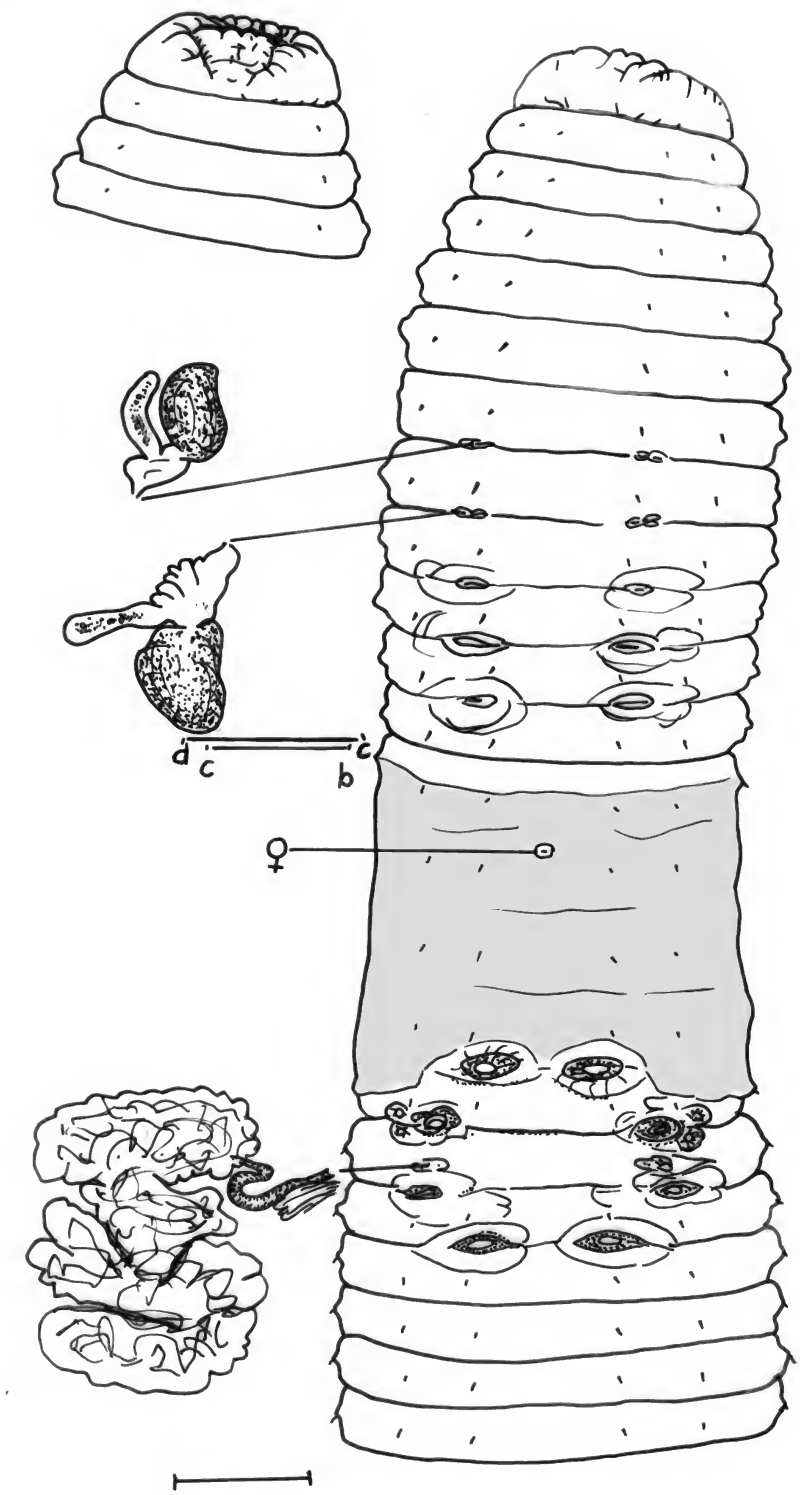


Fig. 175. Aporodrilus warrai, H.

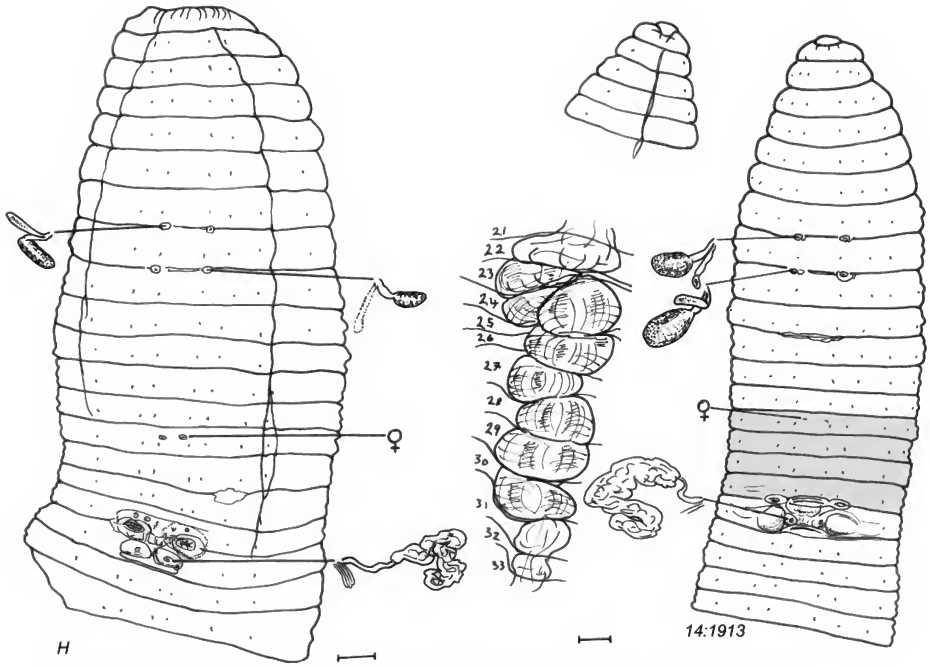


Fig. 176. Gastrodrilus dartnalli (Jamieson, 1974), H and 14:1913 showing intestinal gizzards.

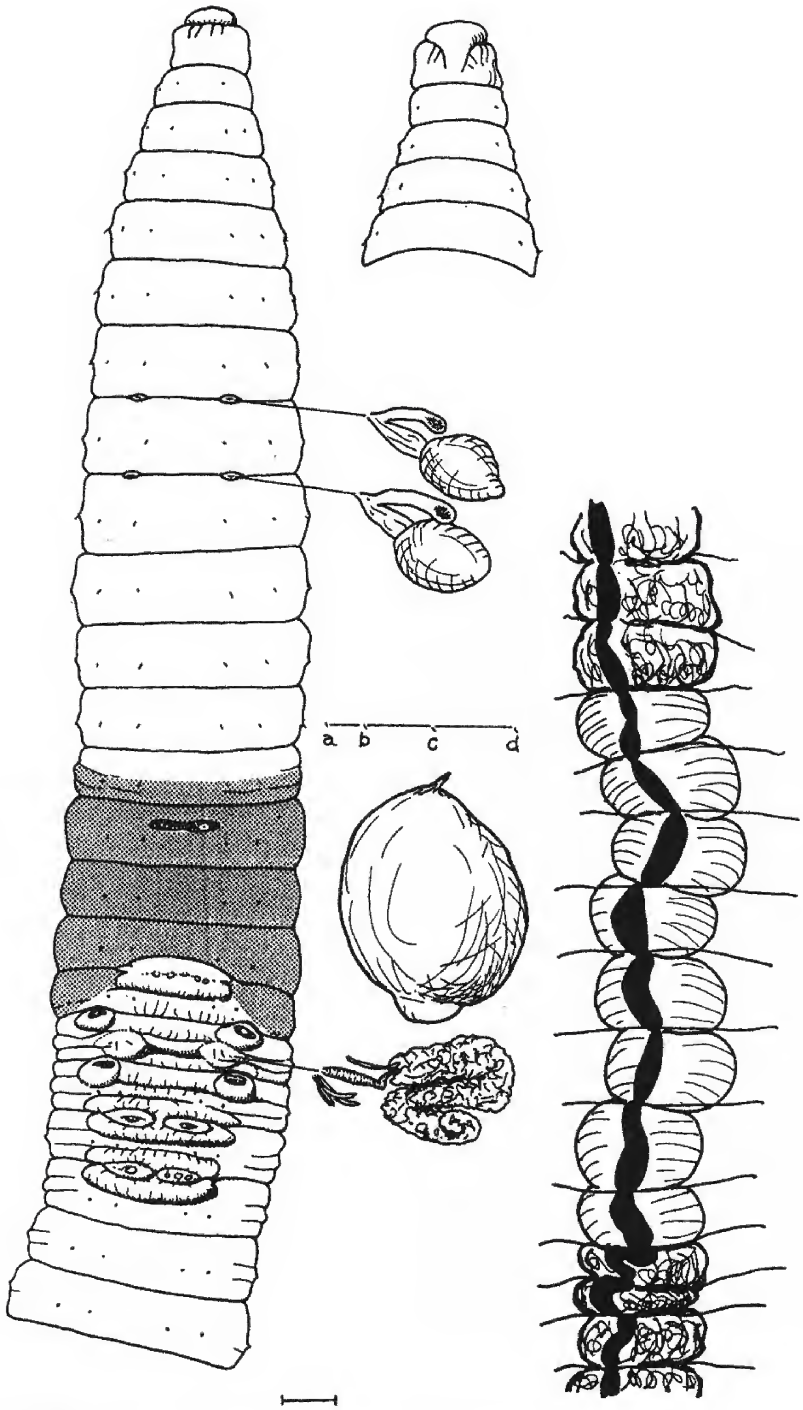


Fig. 177. Gastrodrilus driesseni Blakemore, 2000, H showing intestinal gizzards + cocoon.

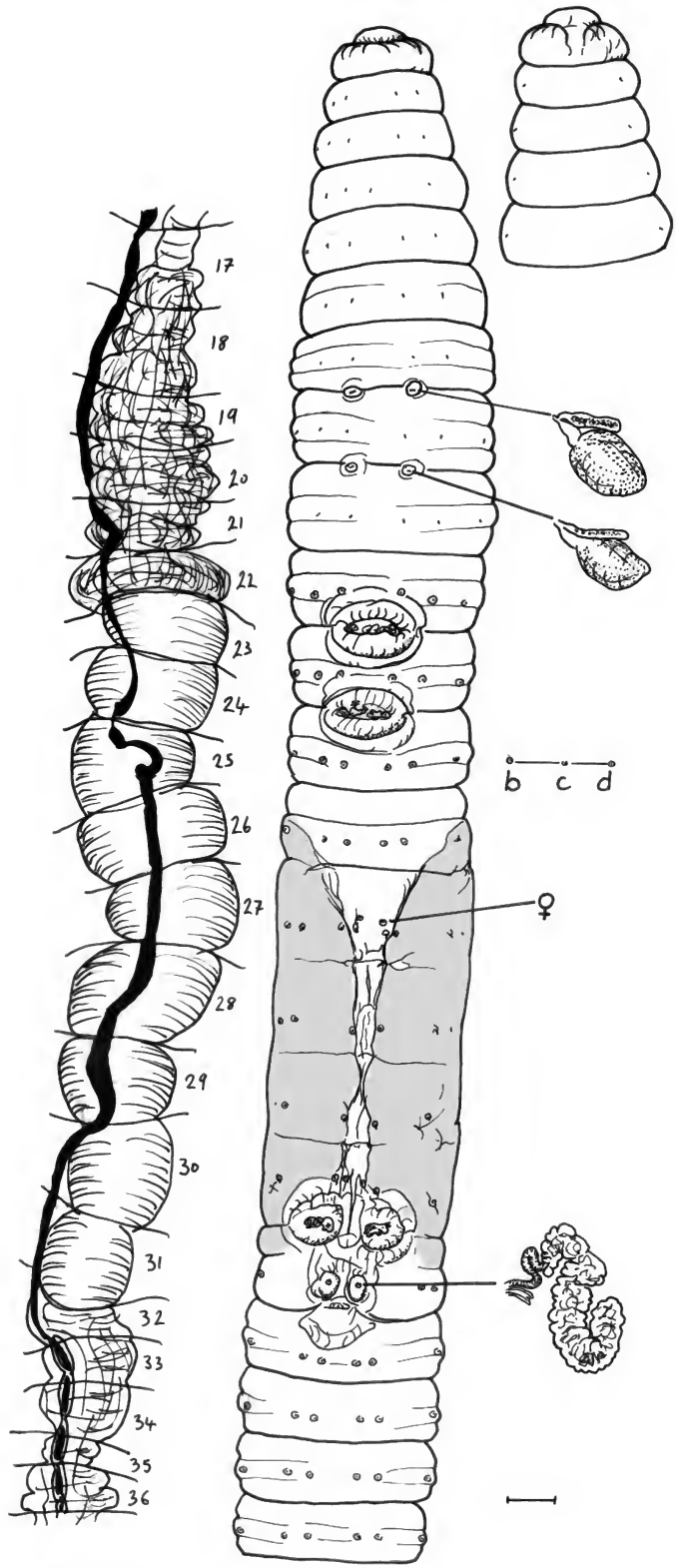


Fig. 178. Gastrodrilus iosem , H.

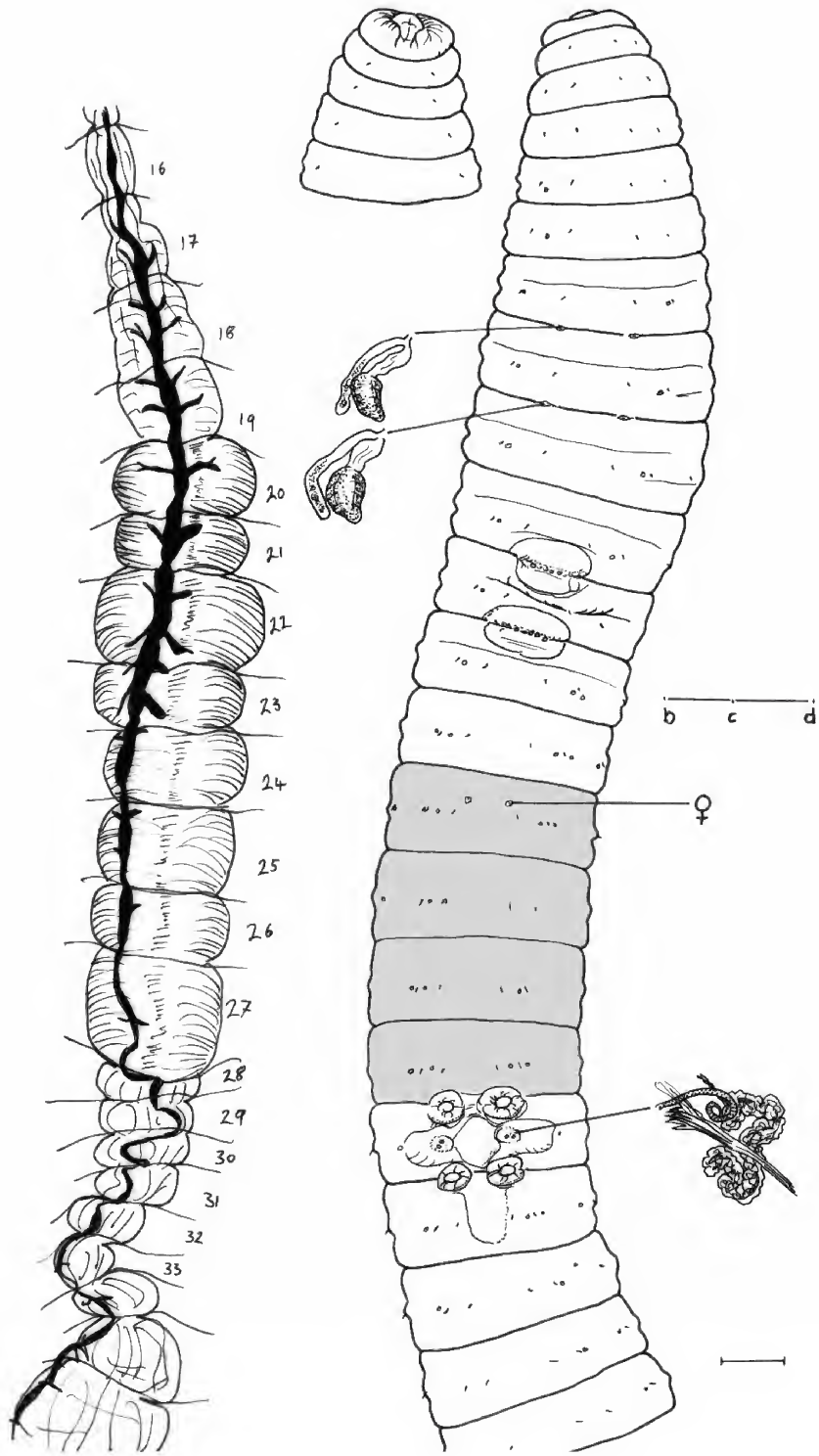


Fig. 179. Gastrodrilus kingi, H.

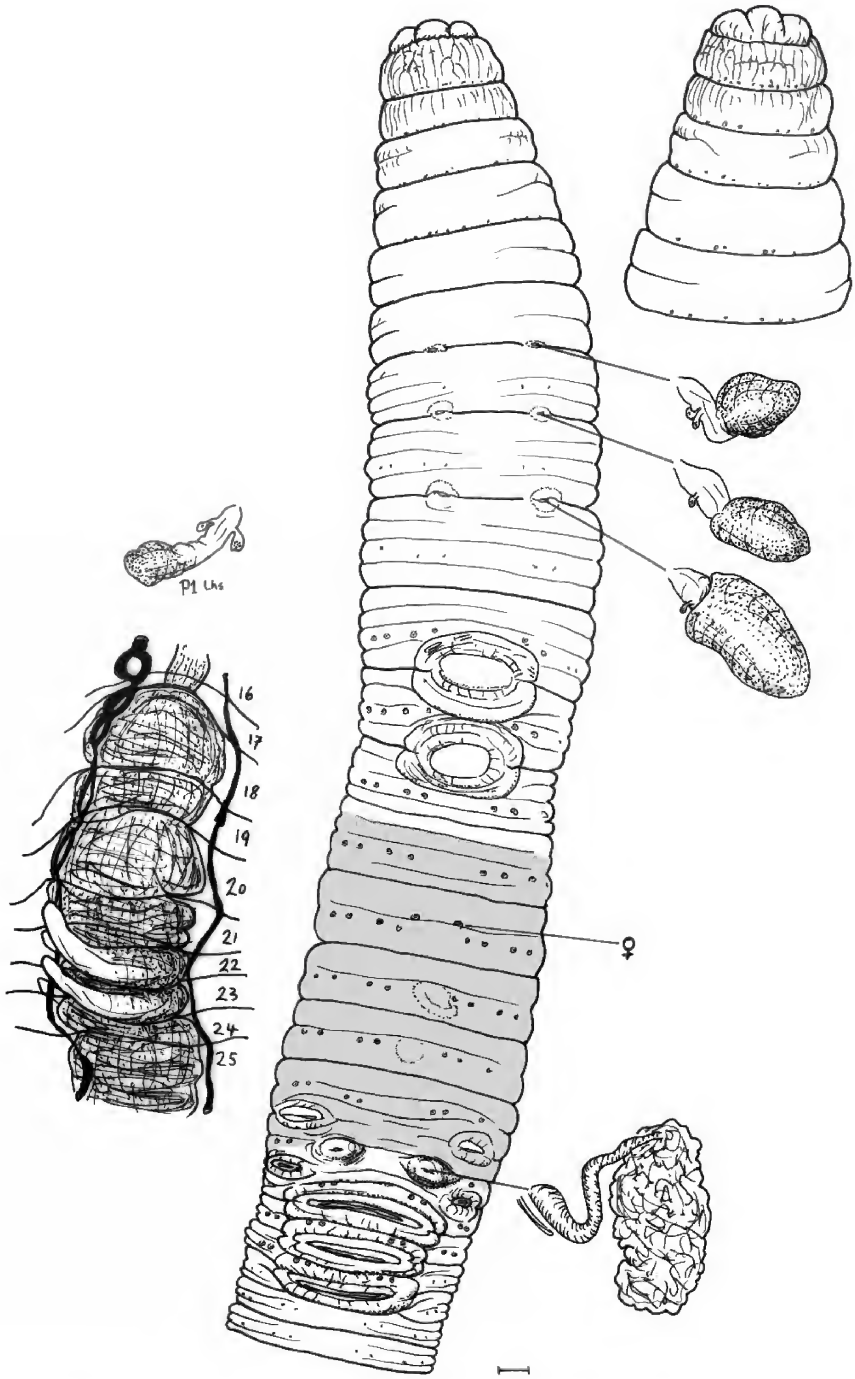


Fig. 180. Caecadrilus flindersi, H showing caeca in 22-23, plus 9lhs spermatheca of P1.

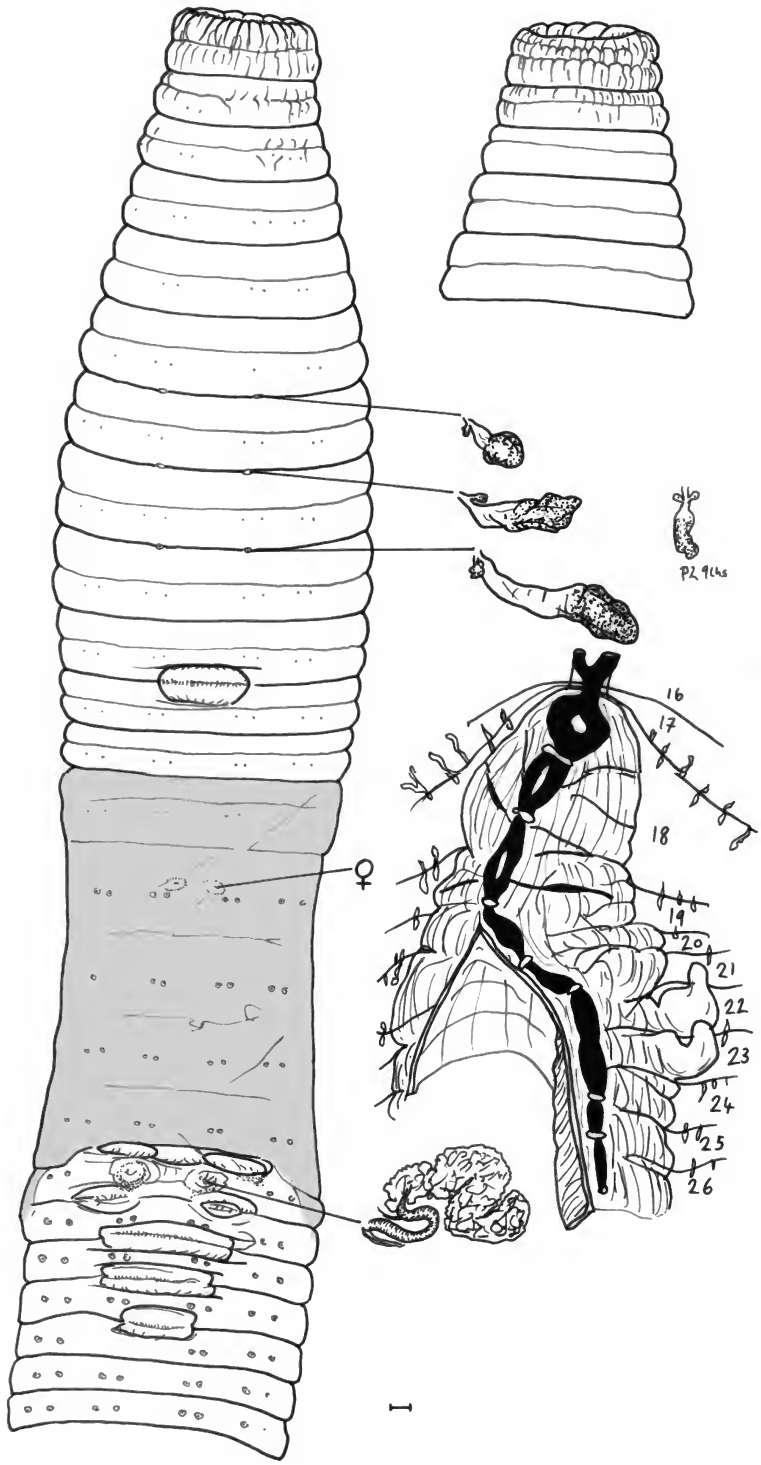


Fig. 181. Caecadrilus strzelecki, H showing caeca and typhlosole, plus spermatheca 9lhs from P2.

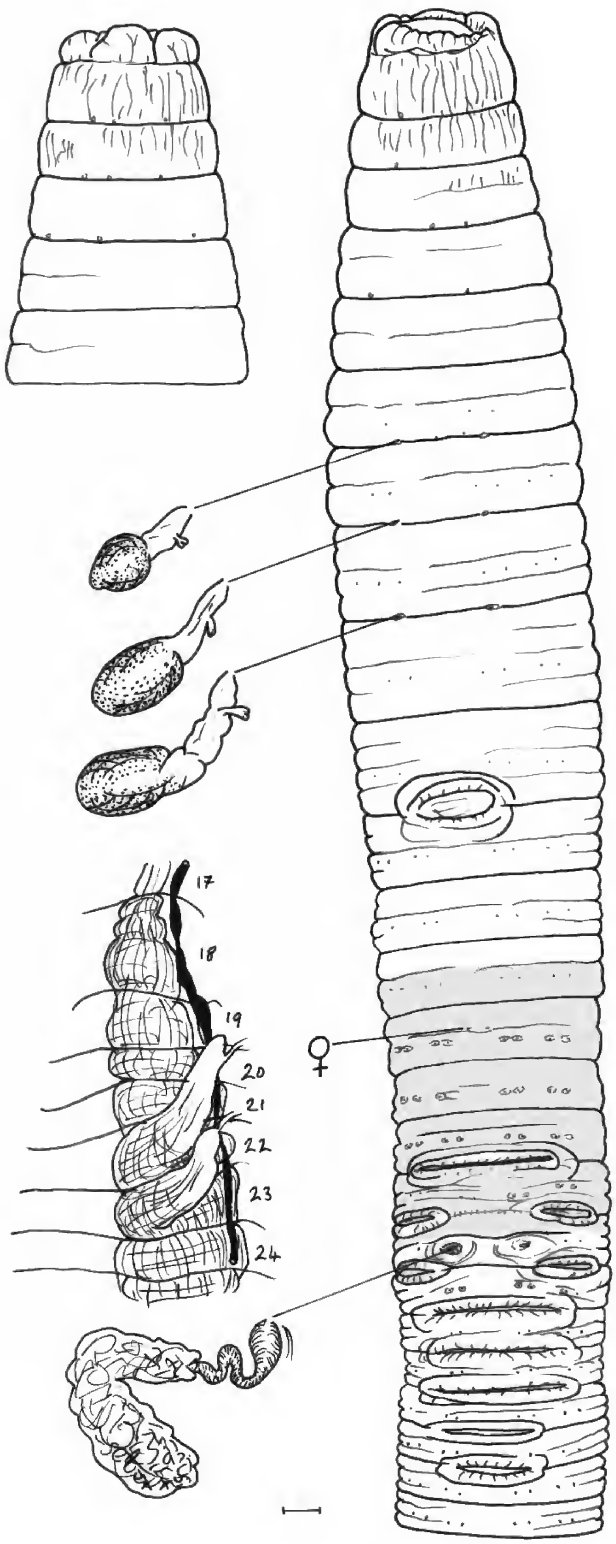


Fig. 182. Caecadrilus walkersi, H.

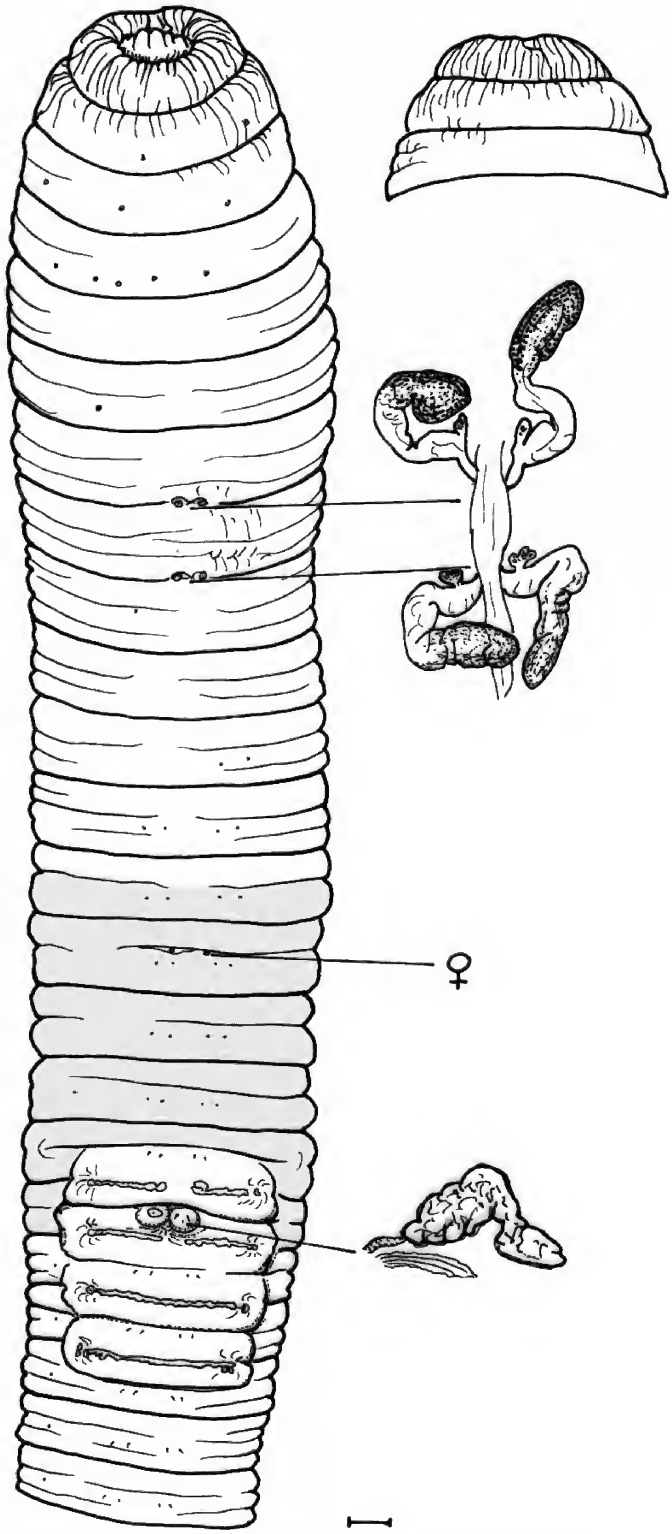


Fig. 183. Anisochaeta alba, H showing both sets of spermathecae converging under V,N,C.

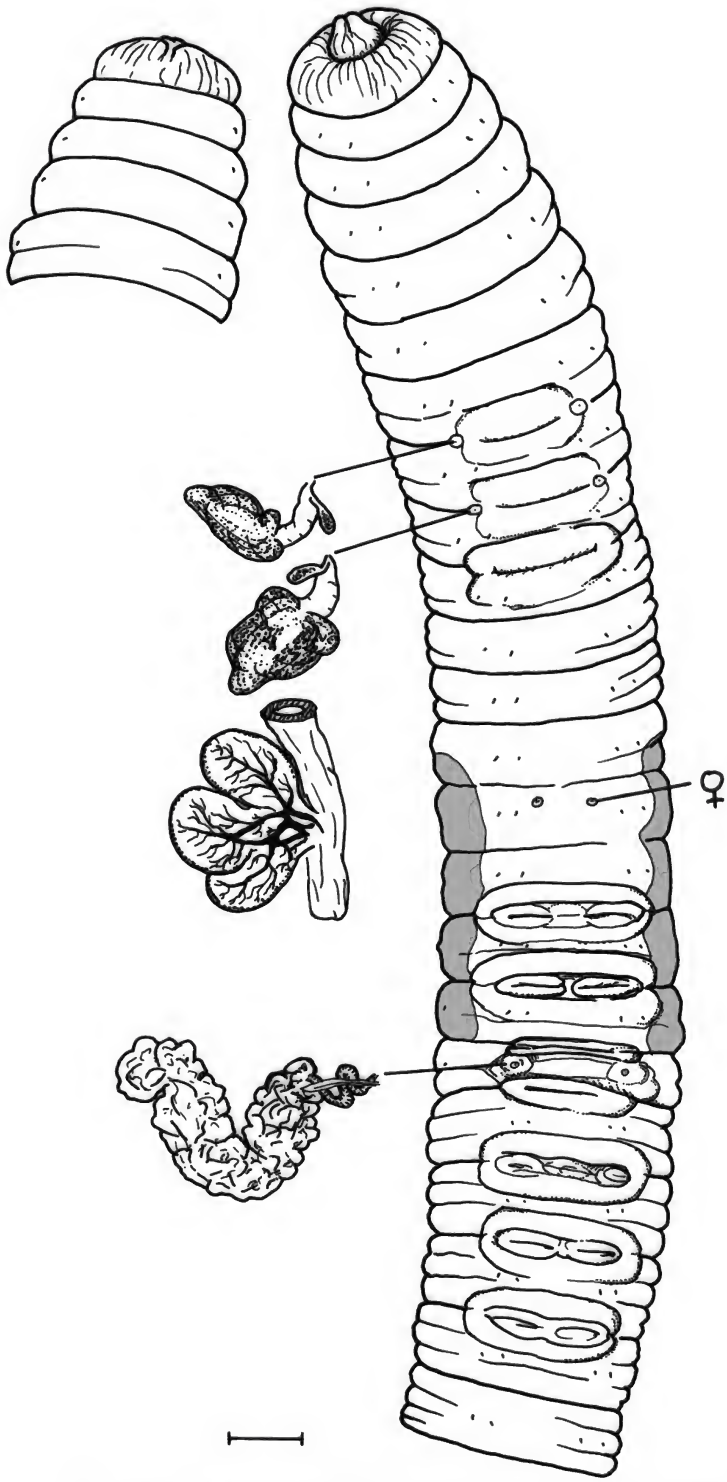


Fig. 184. Anisochaeta andrea, H showing extra-mural calciferous glands in 11-13.

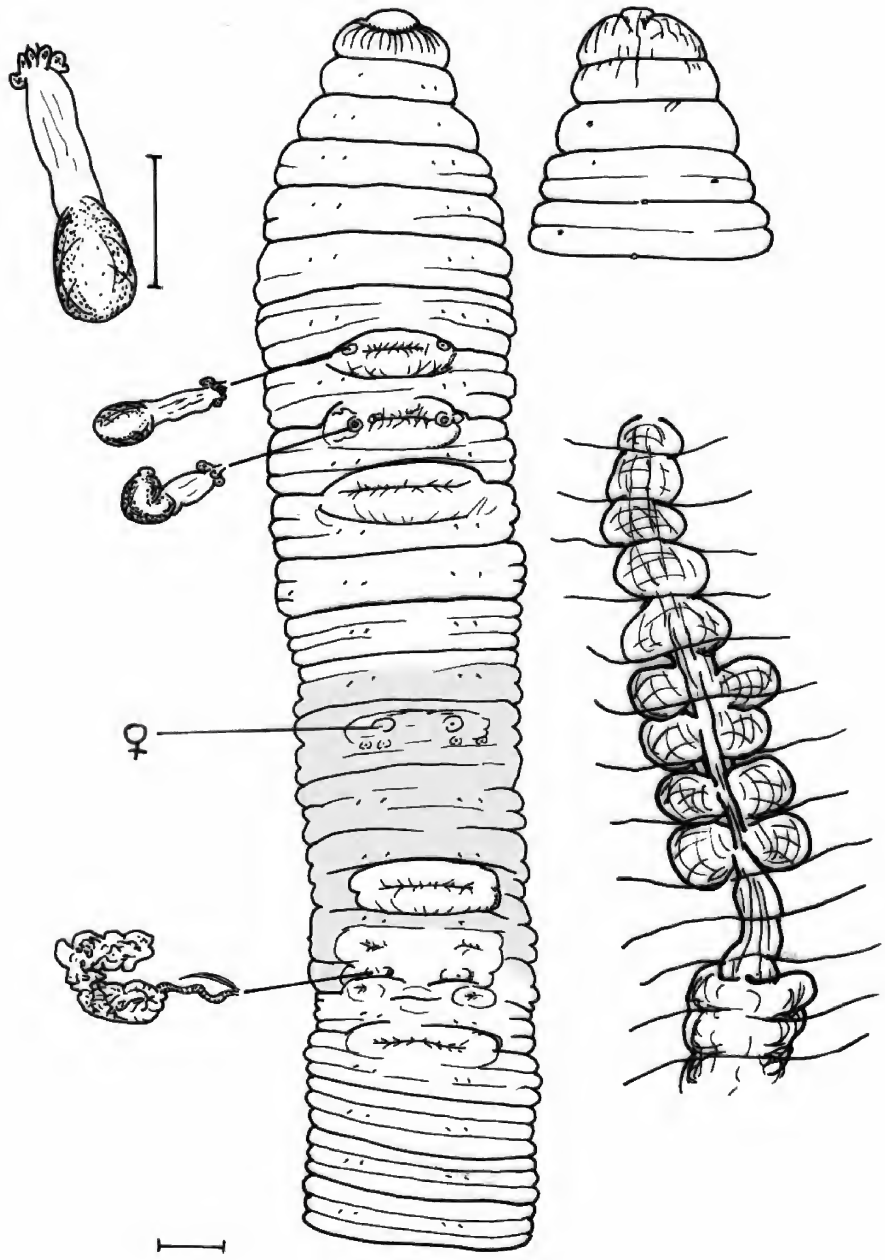


Fig. 185. Anisochaeta brevis, H showing oesophageal pouches in 13-16 and enlaged 8lhs spermatheca.

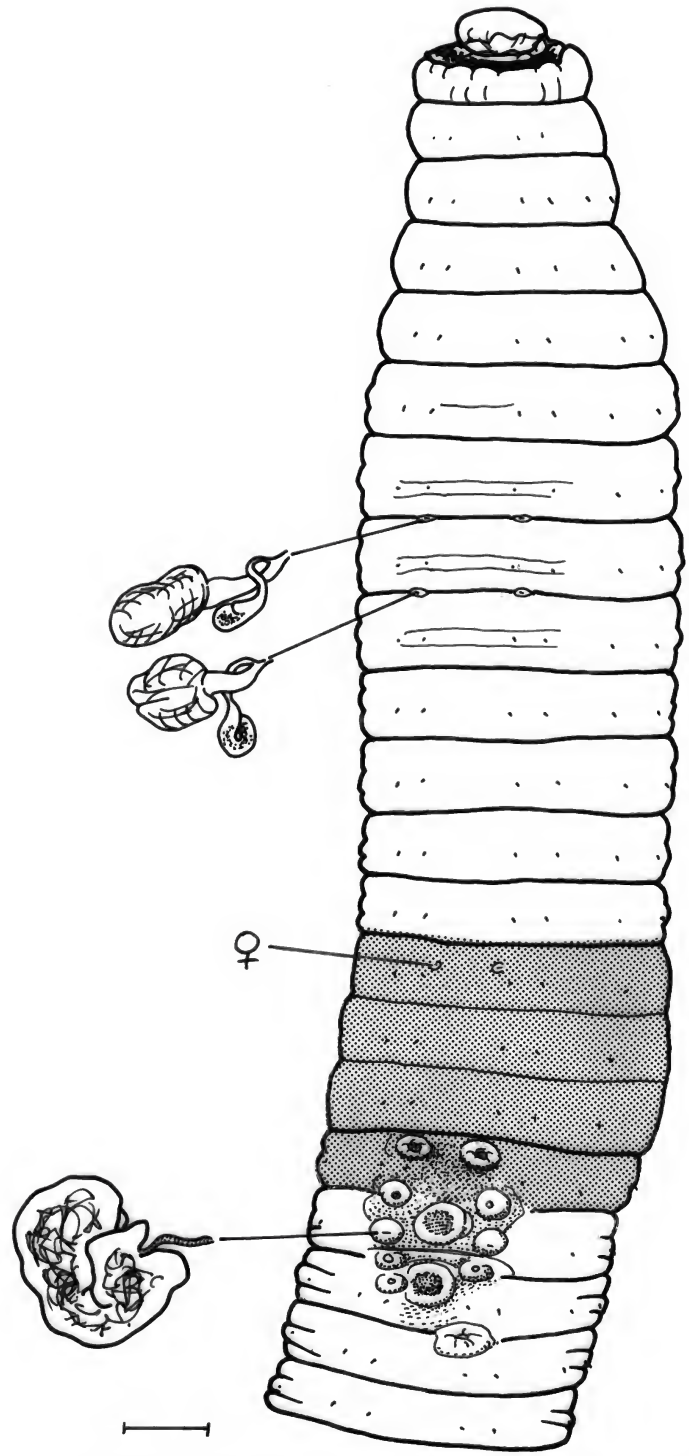


Fig. 186. Anisochaeta burniensis (Jamieson, 1974), H.

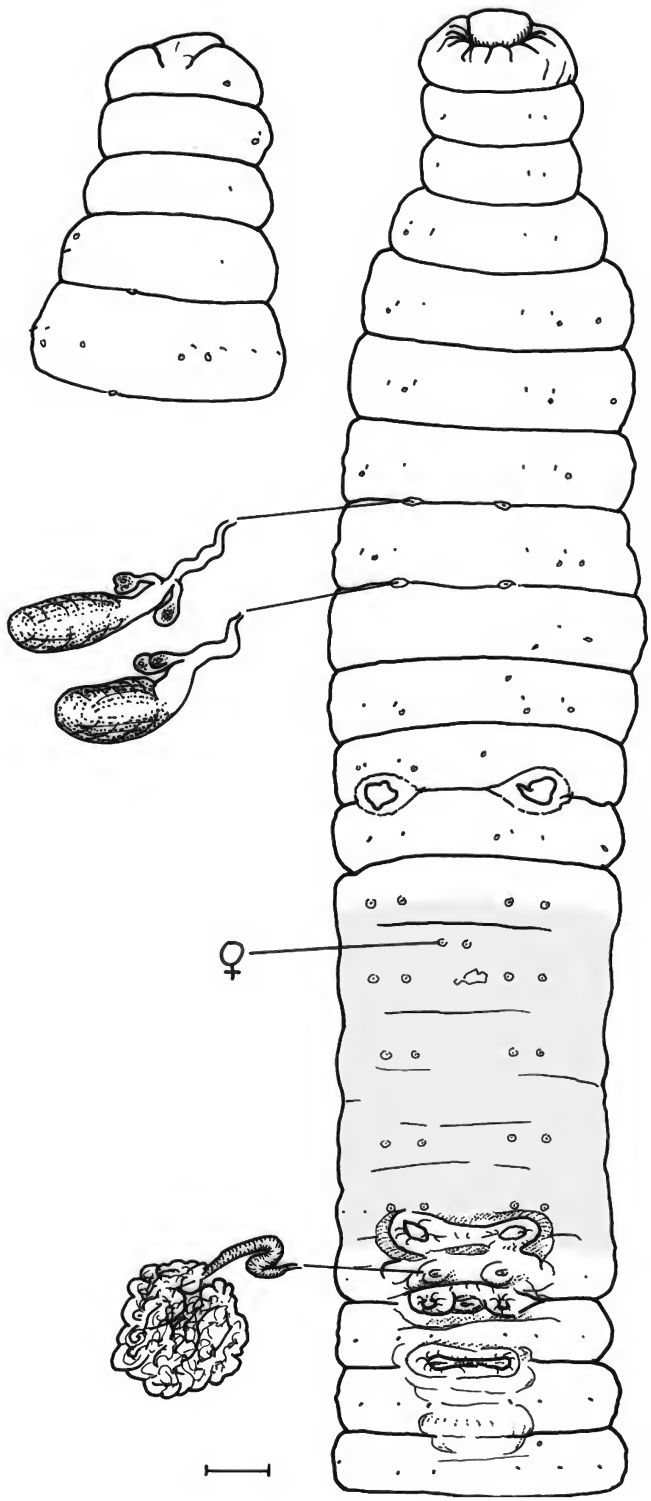


Fig. 187. Anisochaeta cethana, H.

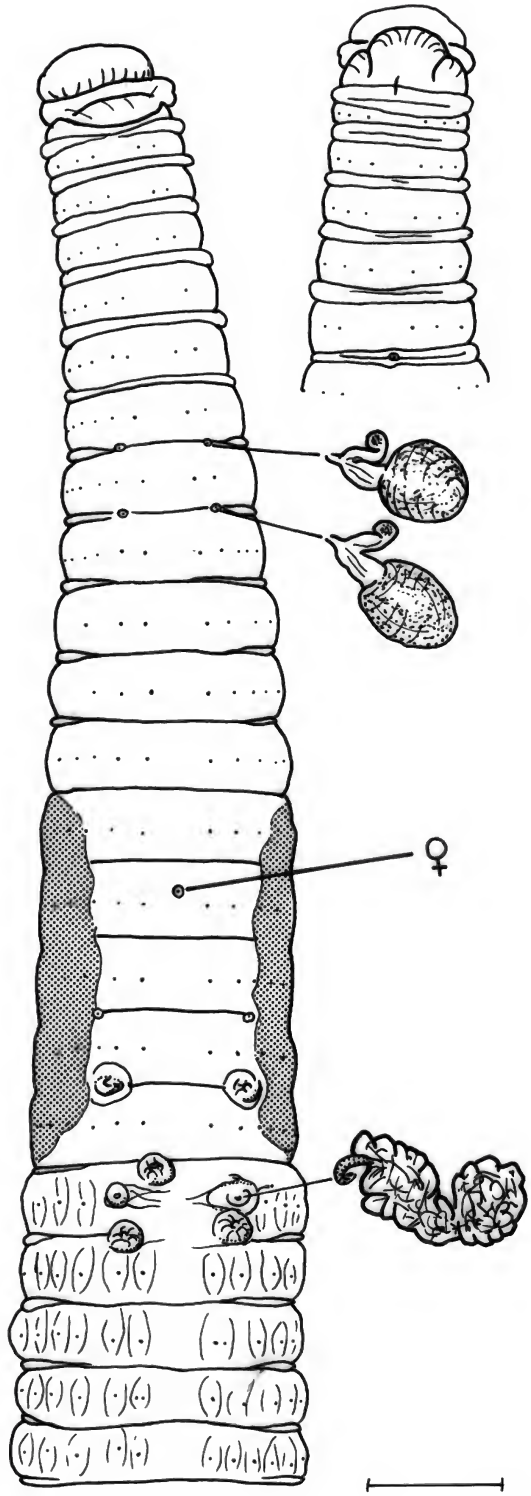


Fig. 188. Anisochaeta clavi Blakemore, 2000, H.

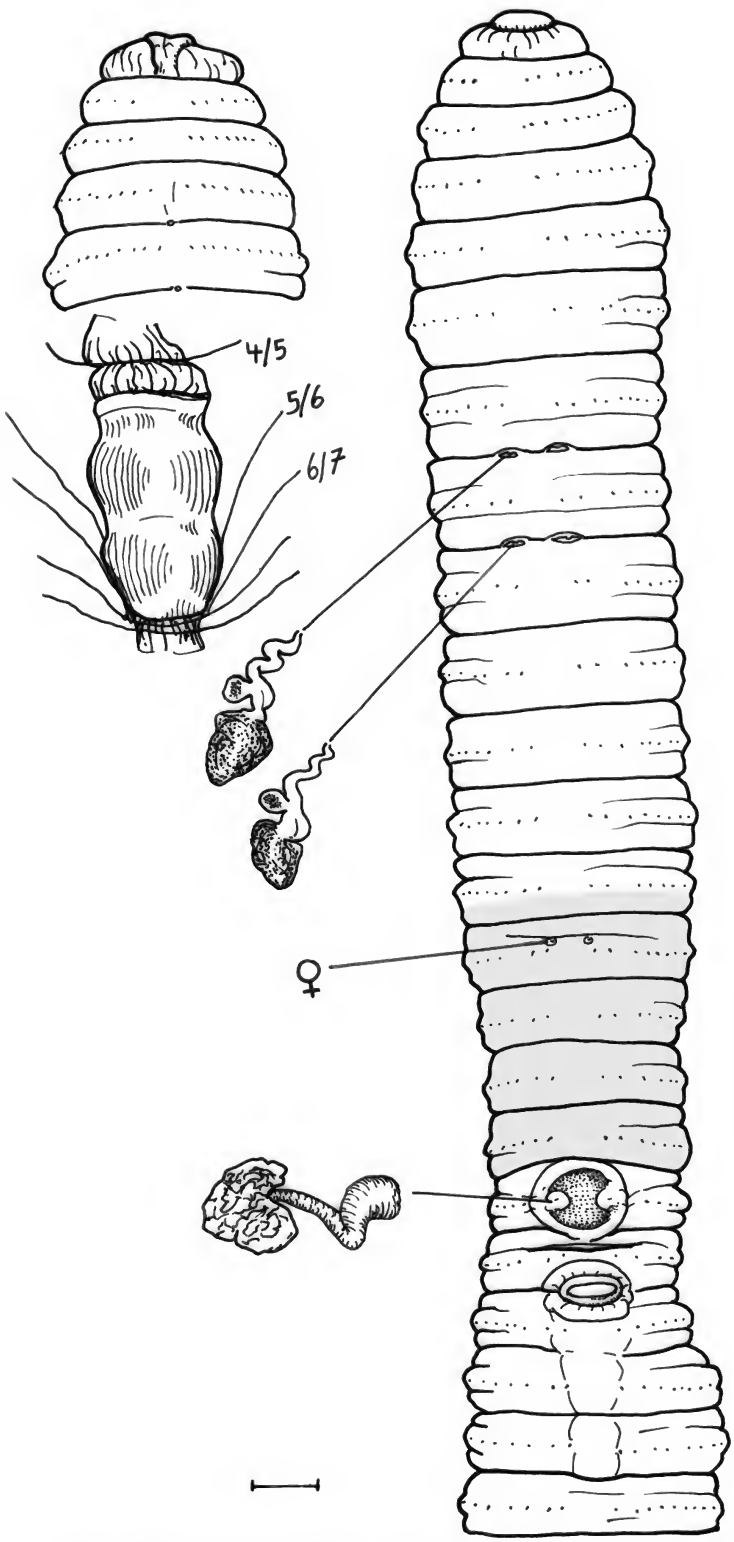


Fig. 189. Anisochata corinna, showing duplicated or waisted gizzard in 5.

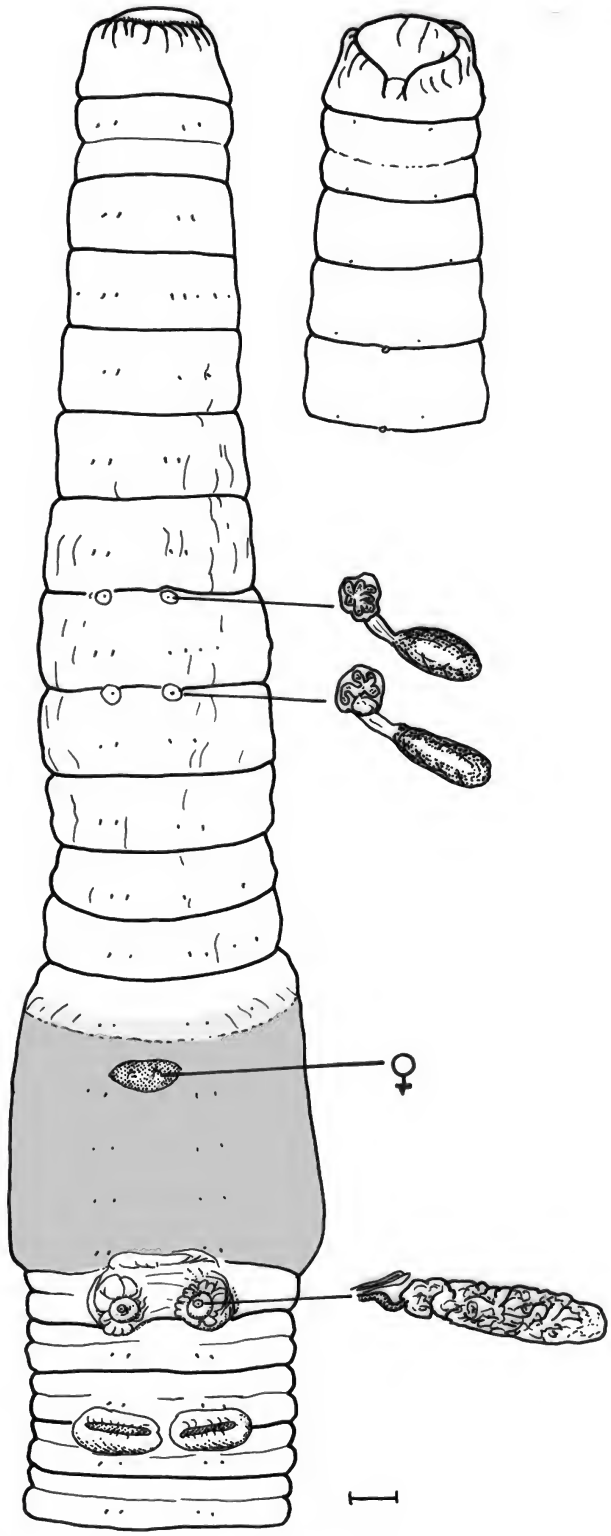


Fig. 190. Anisochaeta floris, H.

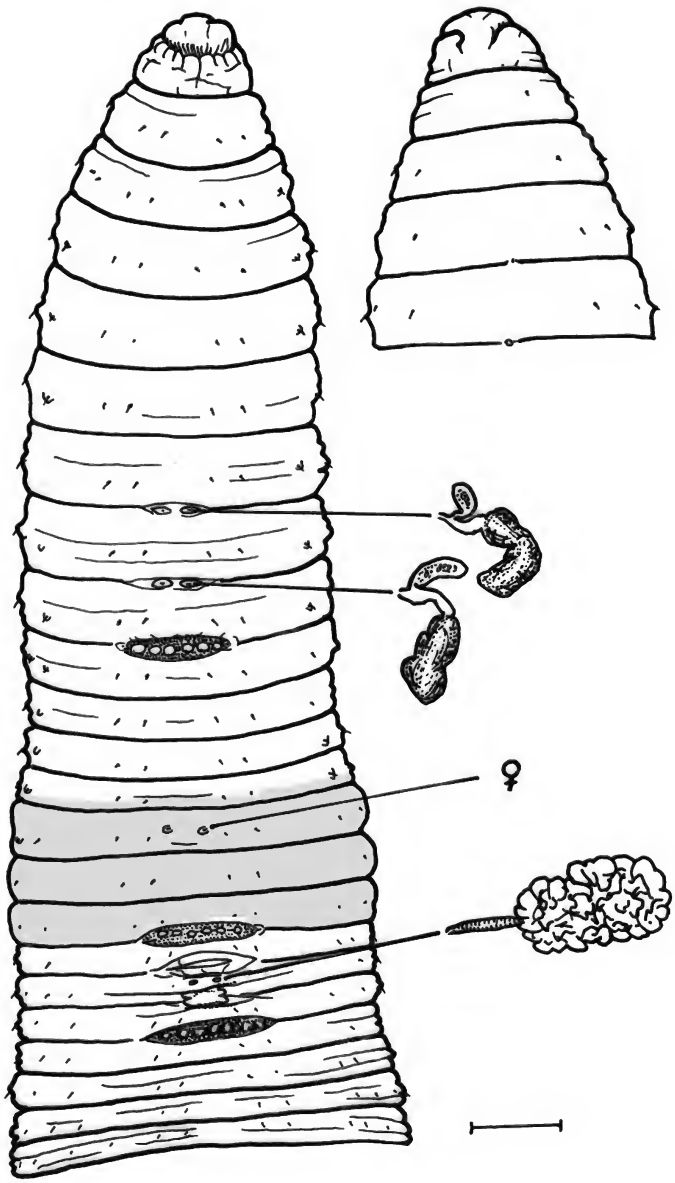


Fig. 191. Anisochaeta greeni, H.

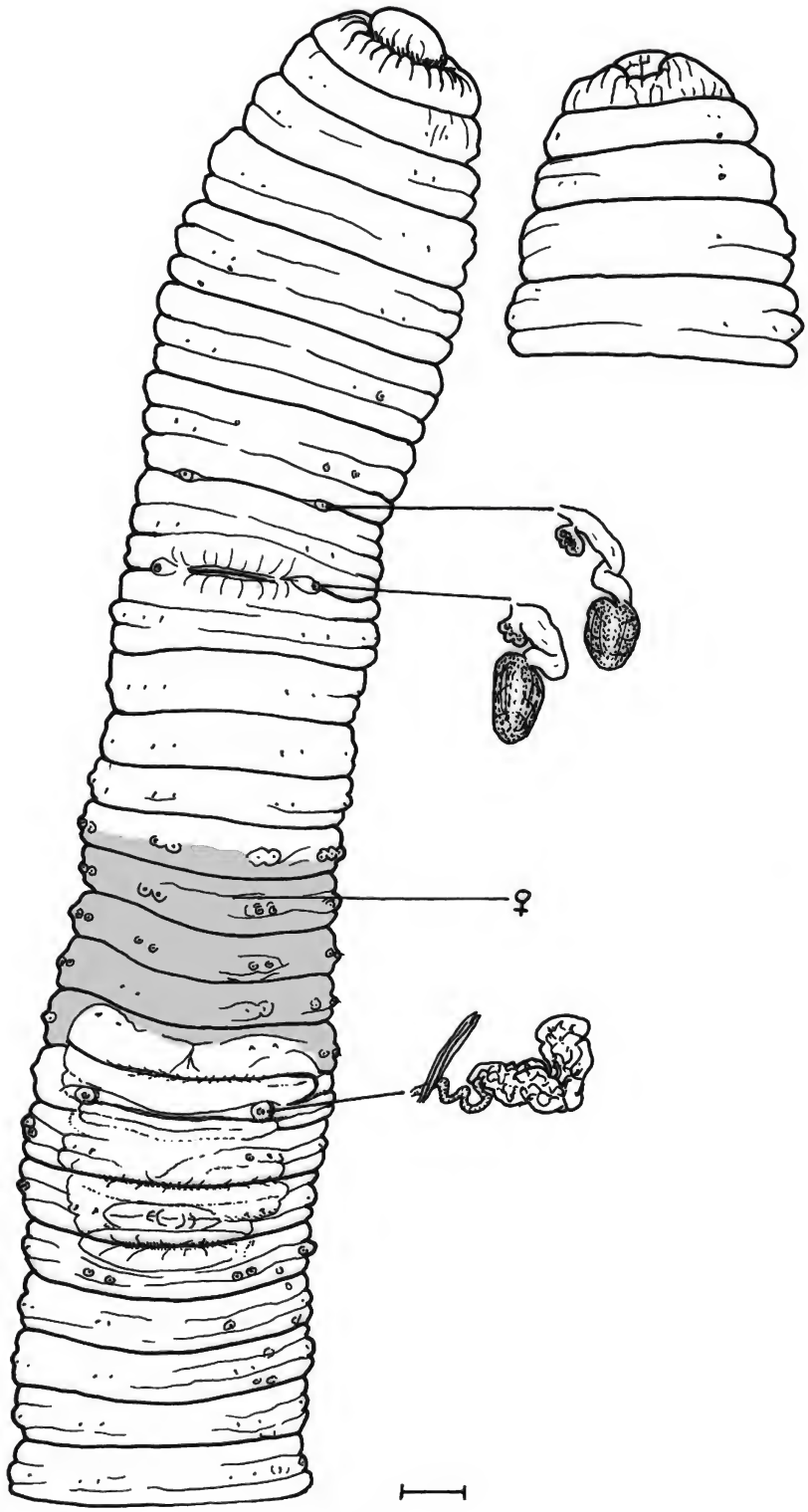


Fig. 192. Anisochaeta isla, H.

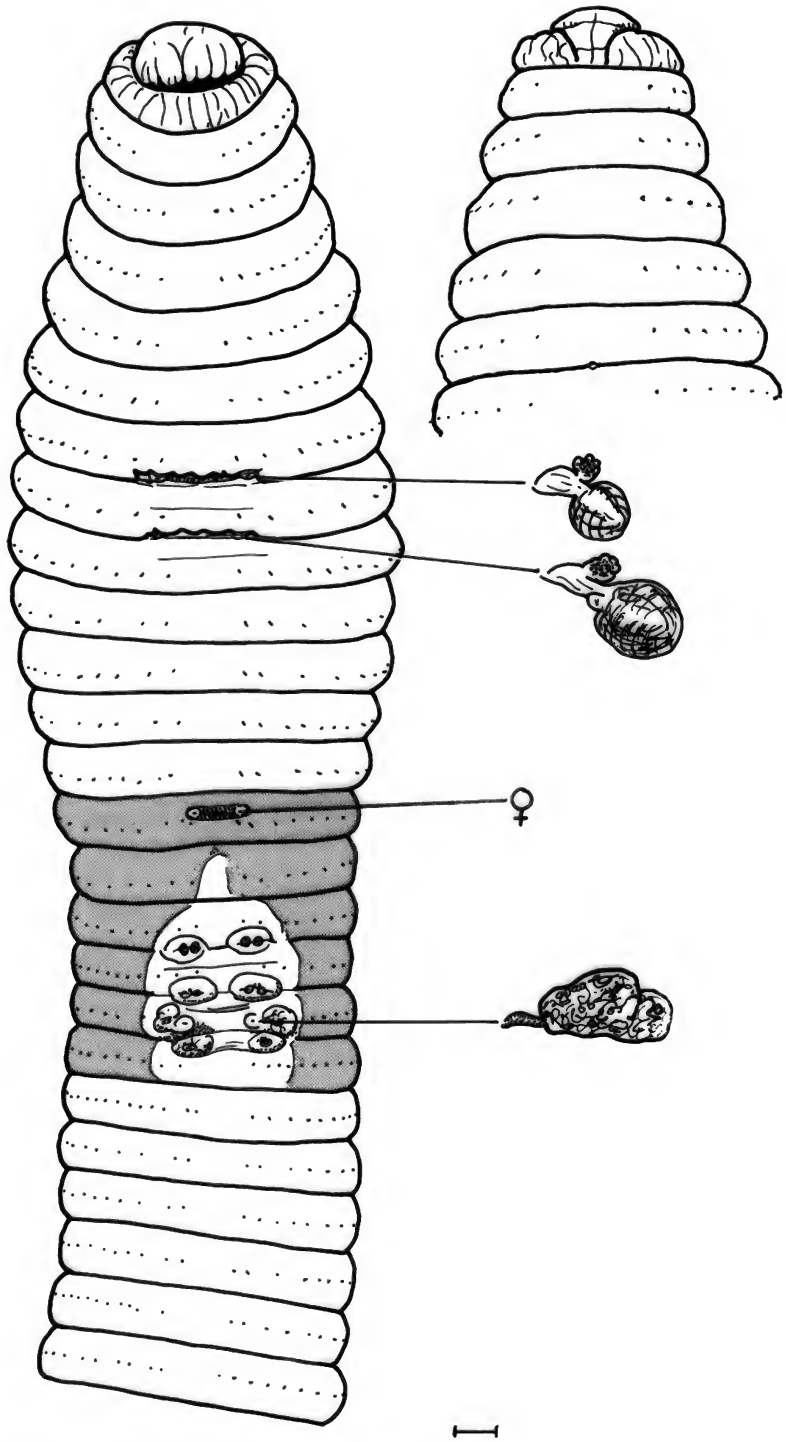


Fig. 193. Anisochaeta magna, H.

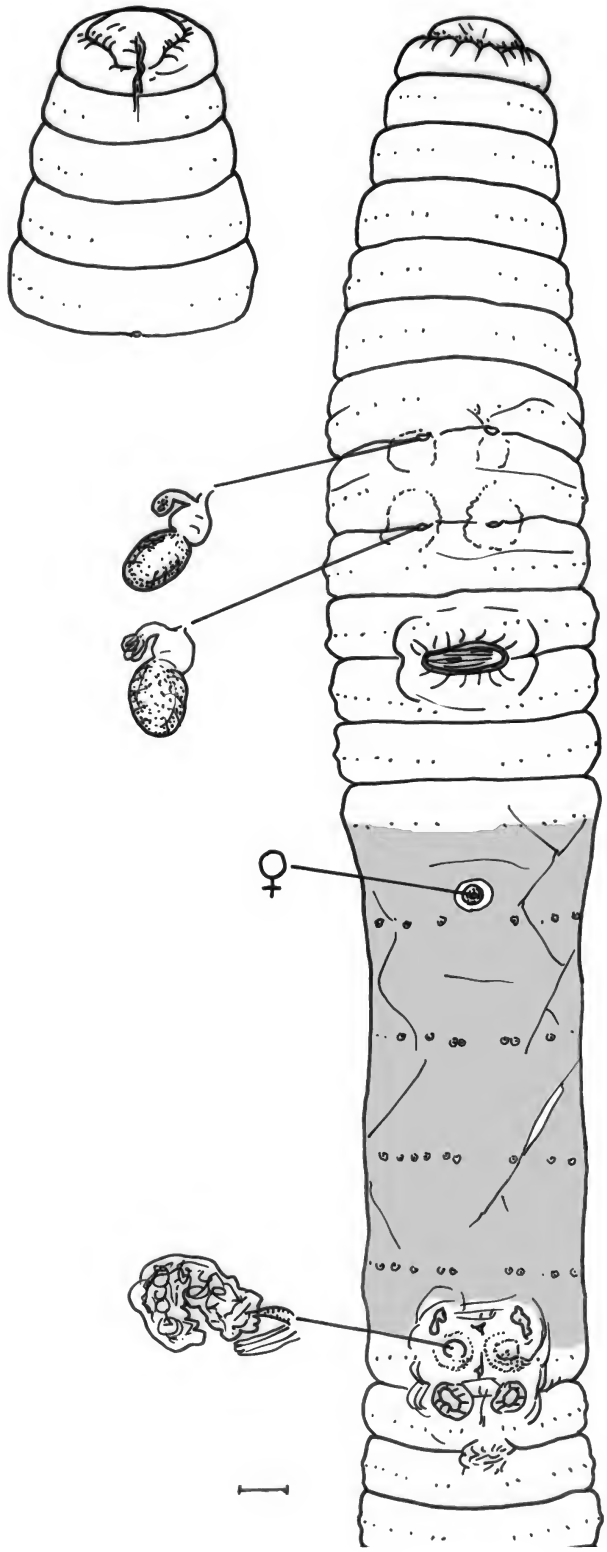


Fig. 194. Anisochaeta martha, H.

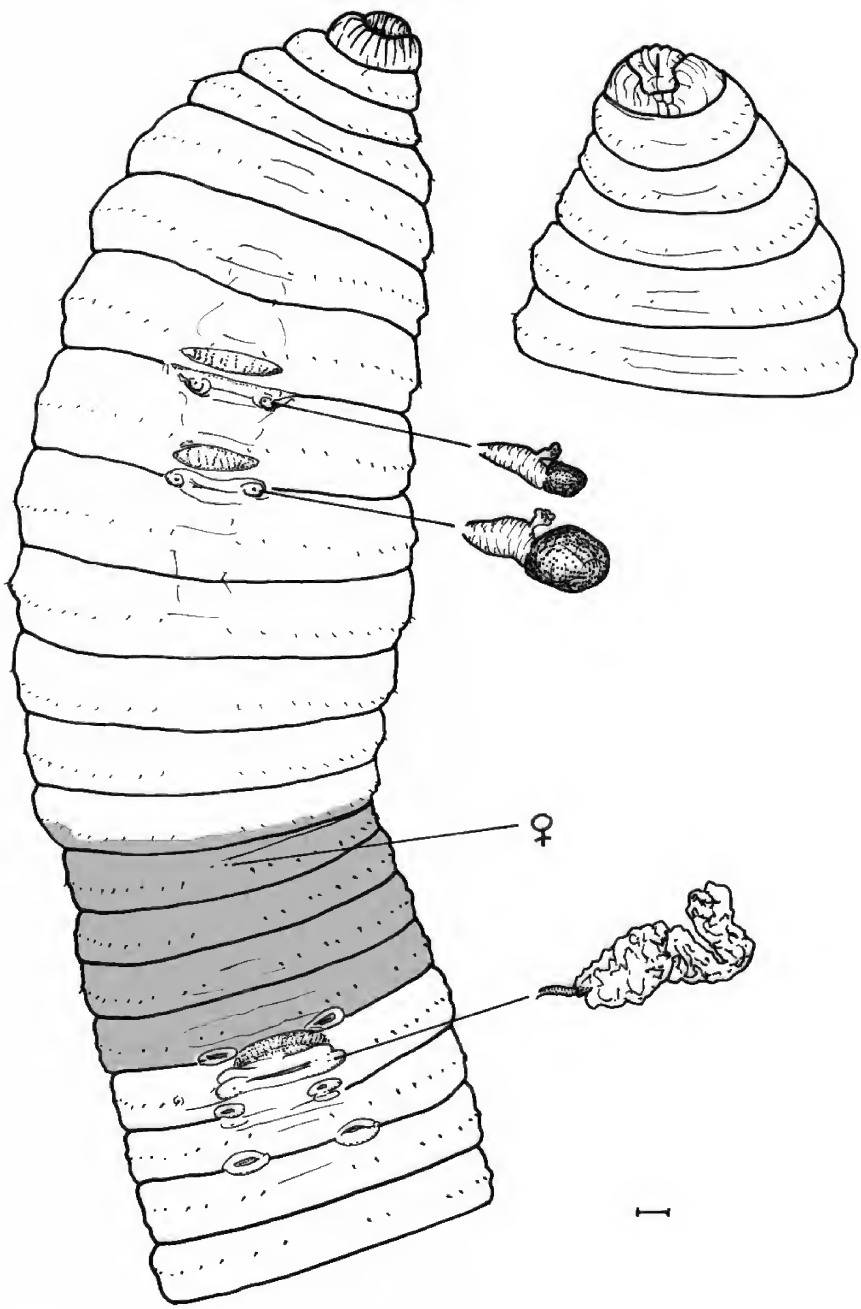


Fig. 195. Anisochaeta mawbanna, H.

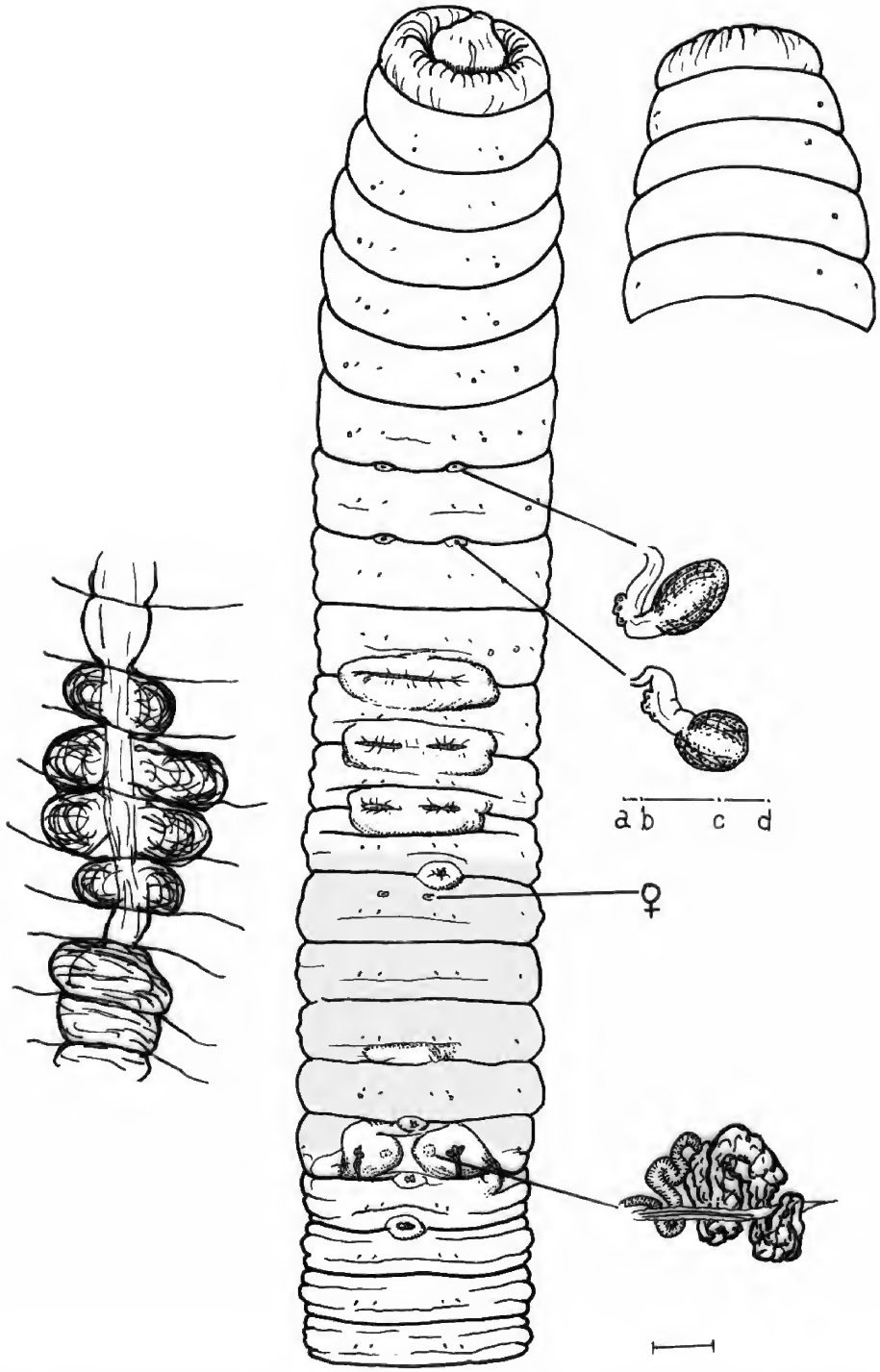


Fig. 196. Anisochaeta metandris, H with oesophageal pouches in 11-14.

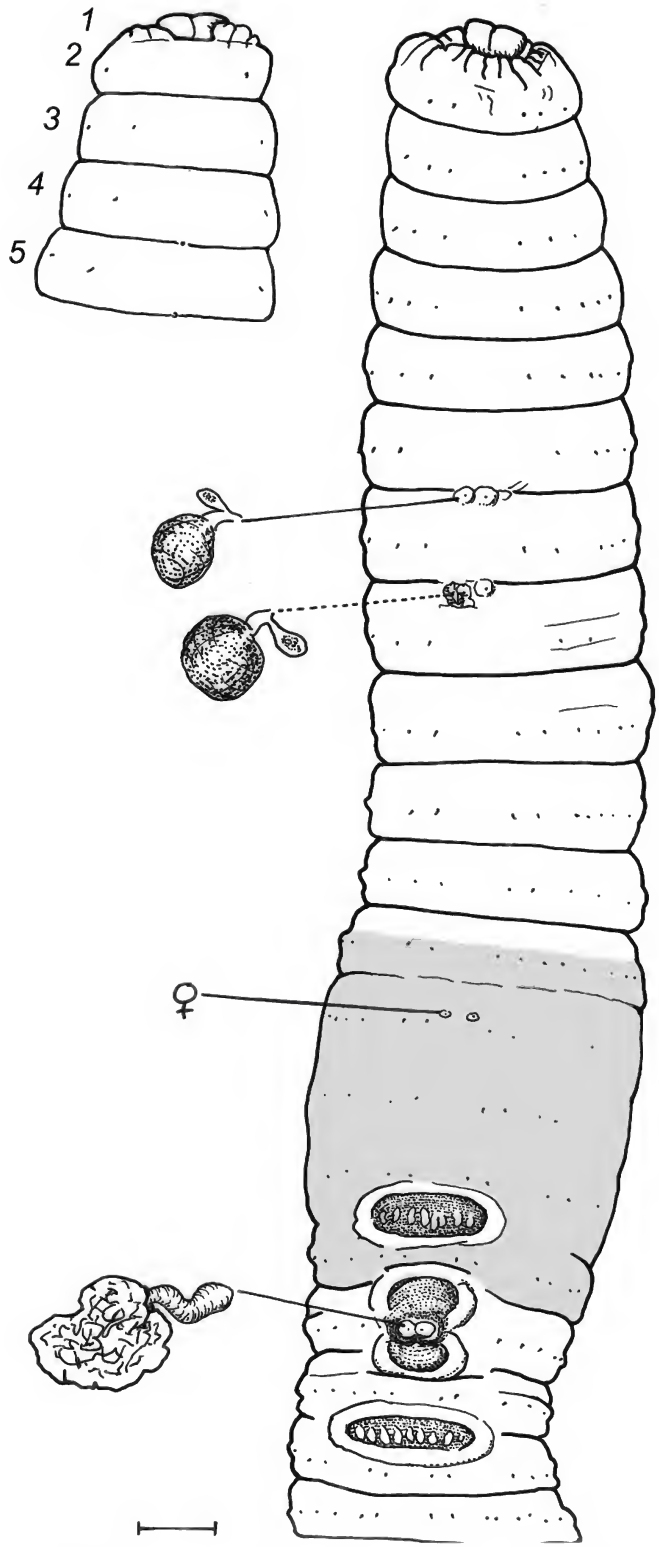


Fig. 197. Anisochaeta montisarthuri (Jamieson, 1974), H.

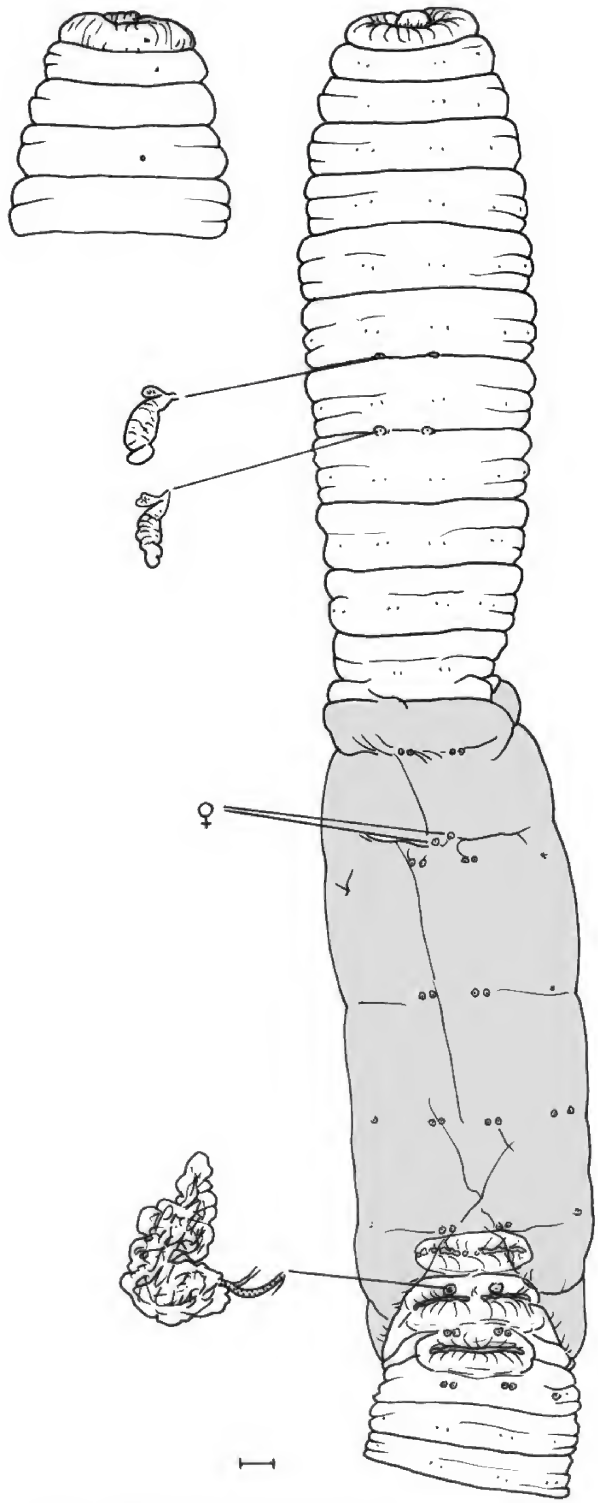


Fig. 198. Anisochaeta portusarturi, H.

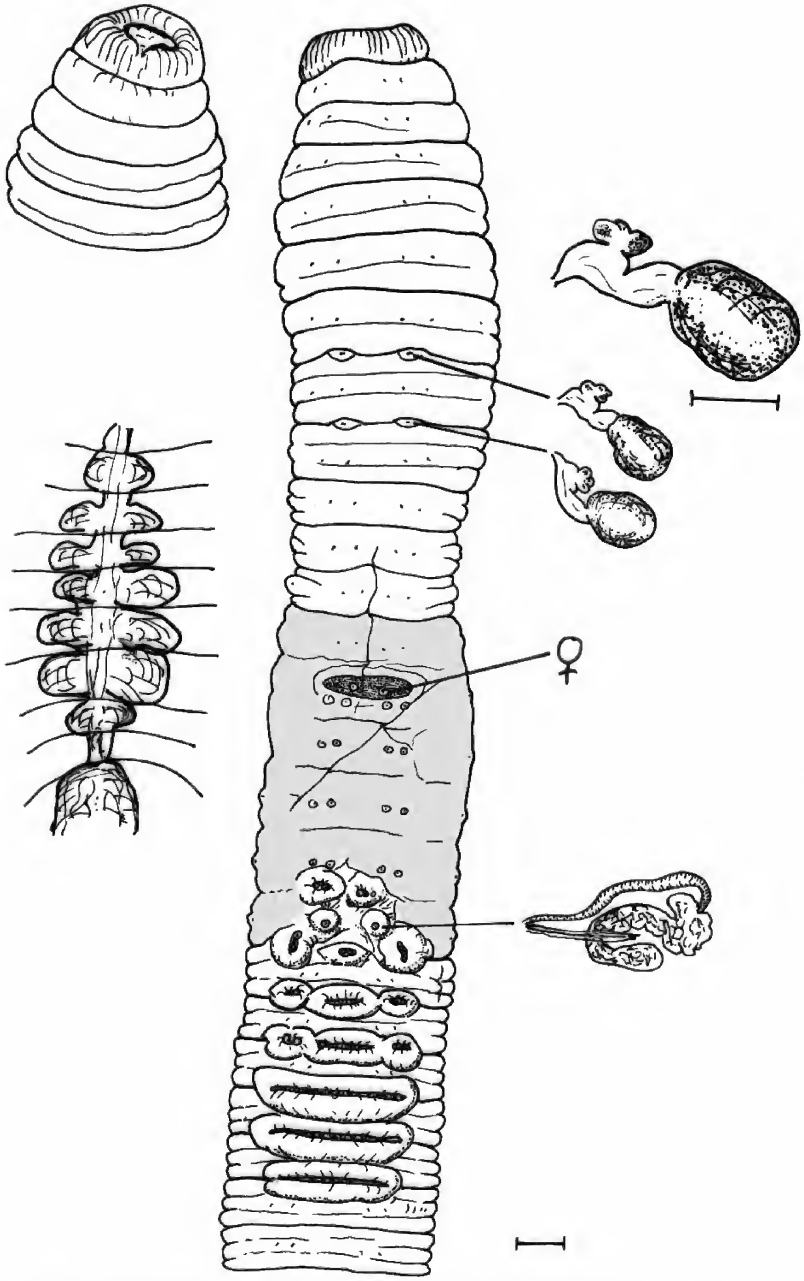


Fig. 199. Anisochaeta proandris, H showing oesophageal pouches in 10,11-14 and enlargement of 8rhs spermatheca.

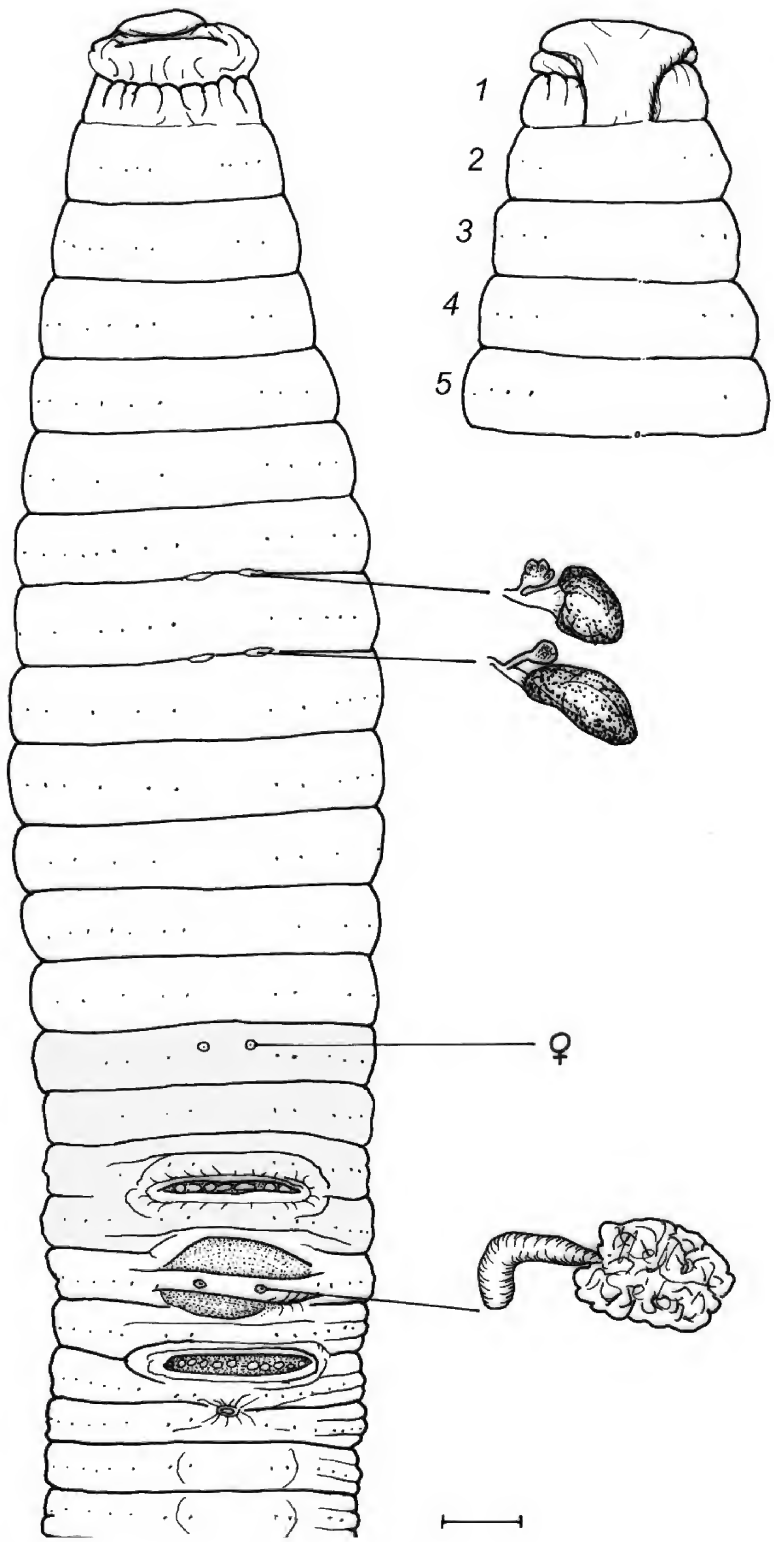


Fig. 200. Anisochaeta scottsdalei, H.

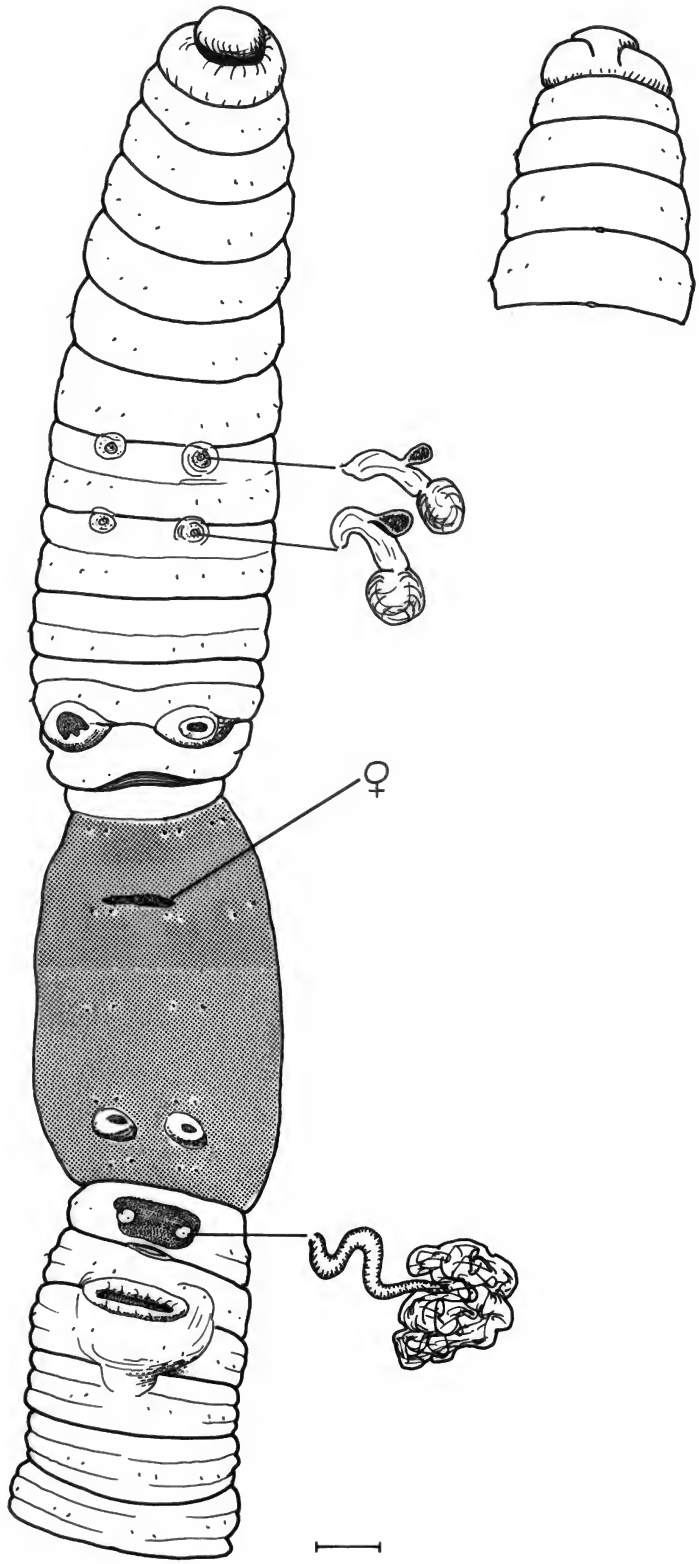


Fig. 201. Anisochaeta simpsonorum Blakemore, 1997, H.

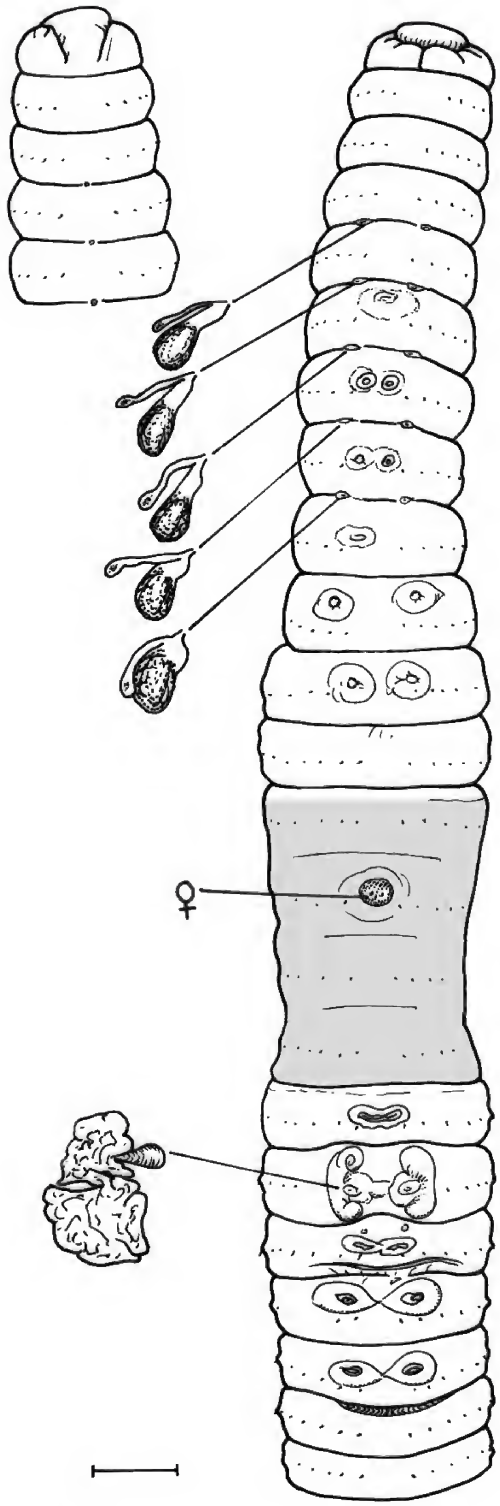


Fig. 202. Anisochaeta stumpysinensis, H.

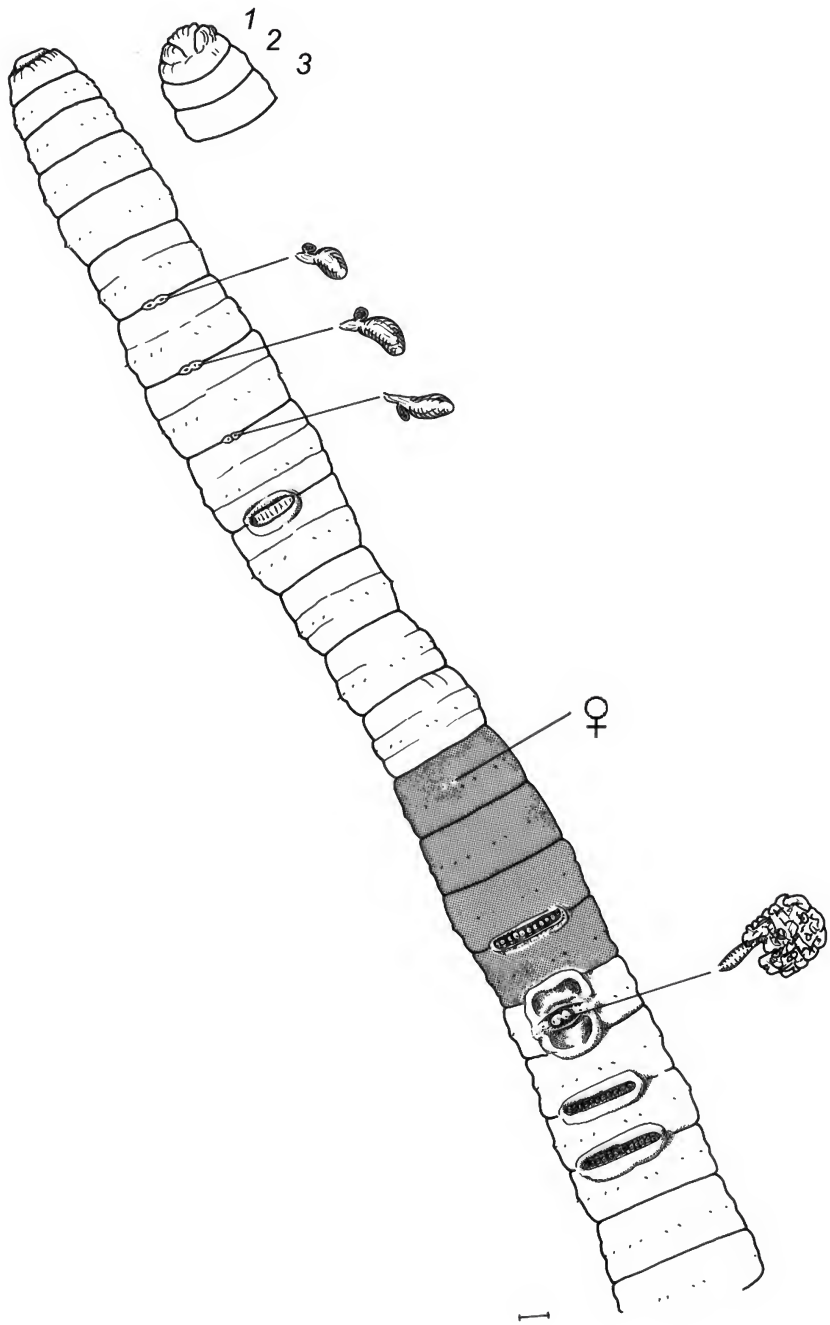


Fig. 203. Anisochaeta tamara, H.

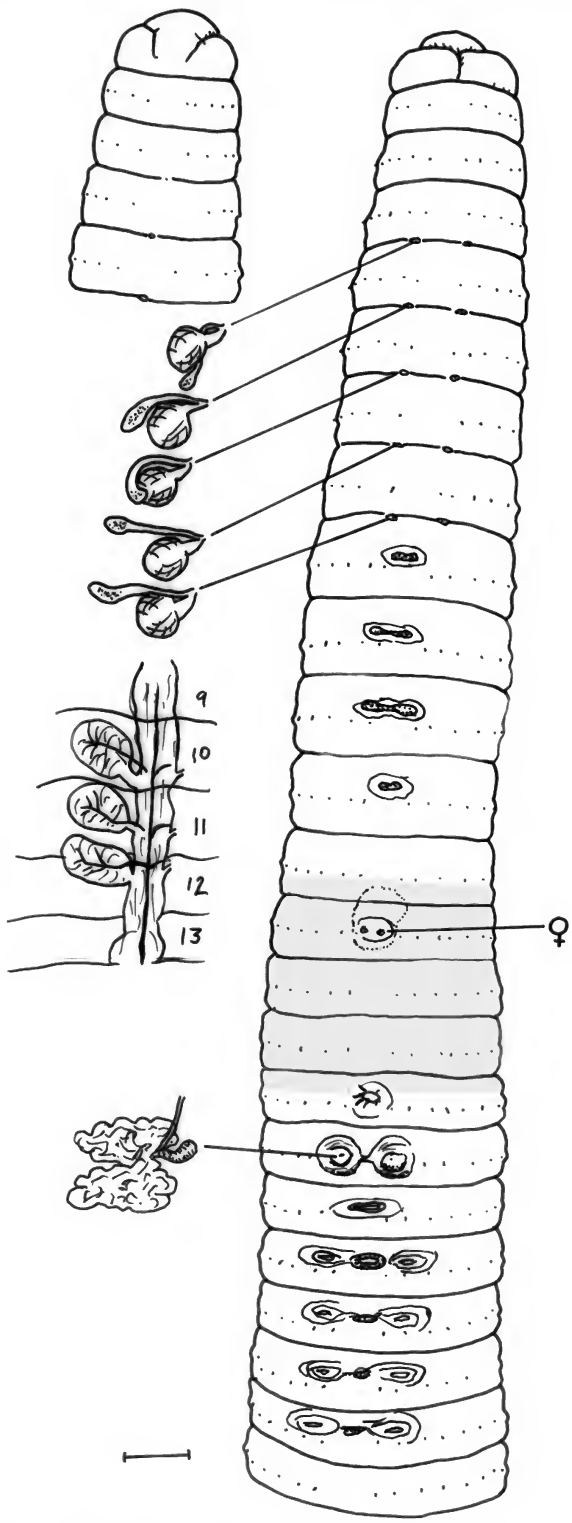


Fig. 204. Anisochaeta tasmanica (Spencer, 1895), K395 showing calciferous glands in 10-12.

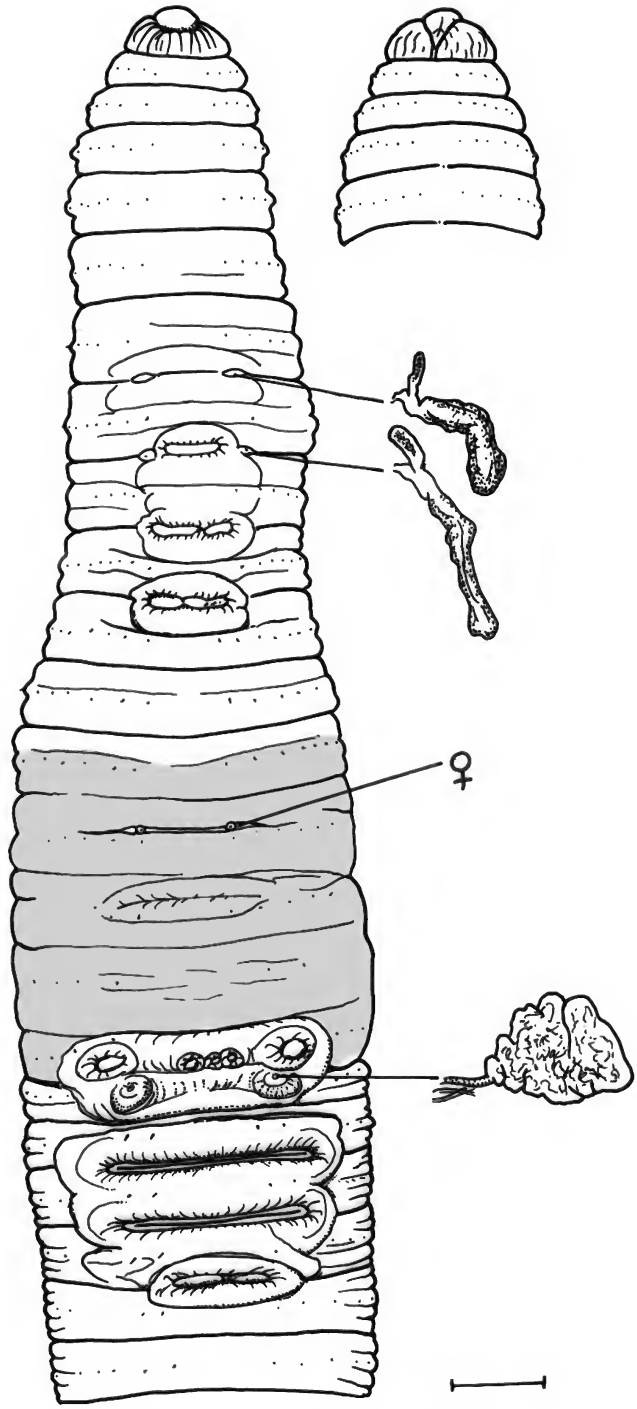


Fig. 205. Anisochaeta vincula, H.

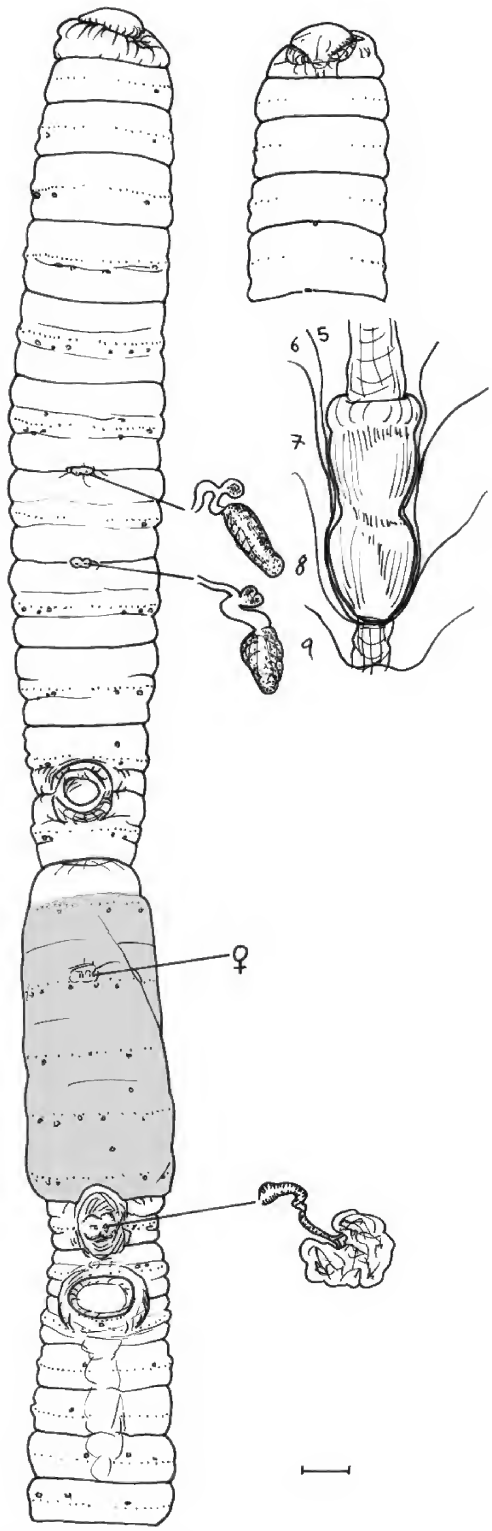


Fig. 206. Anisochaeta zeehan, H showing duplicated gizzard in 5.

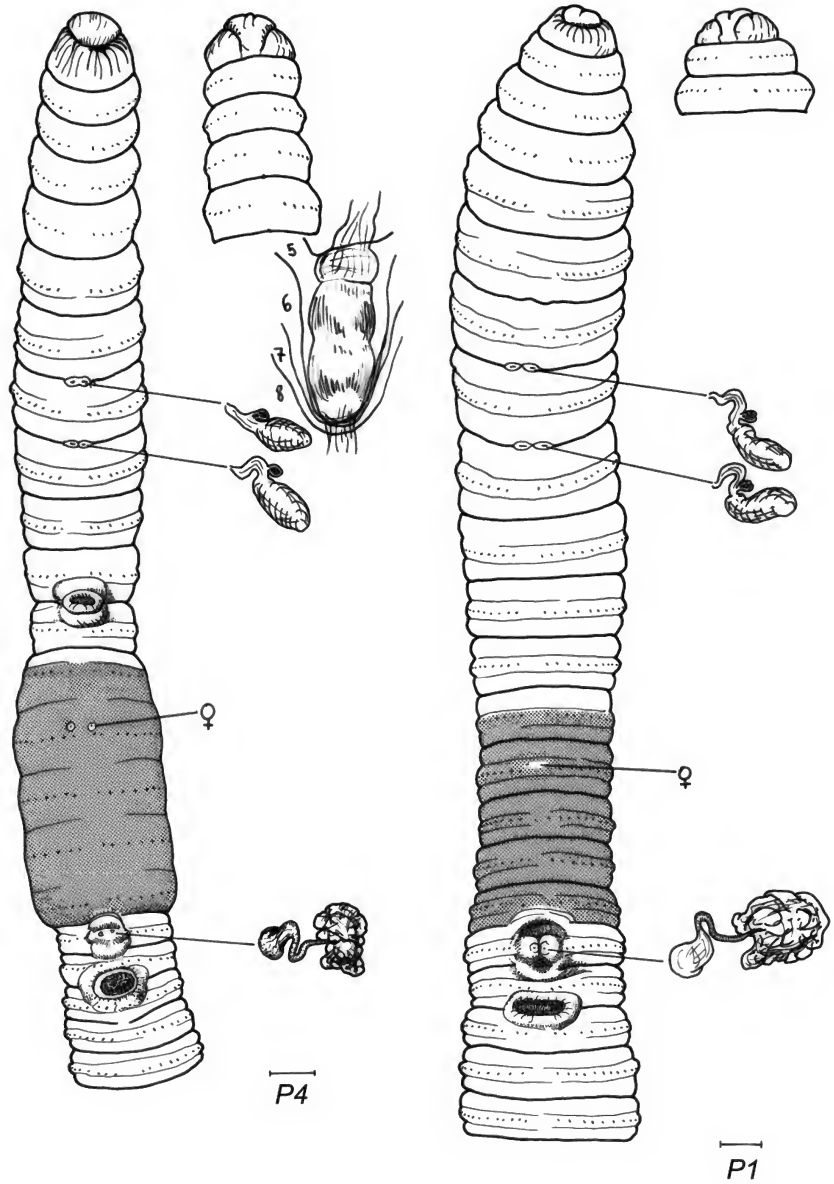


Fig. 207. Anisochaeta zeehan, paratypes with gizzard develpment in 5 shown for P4.

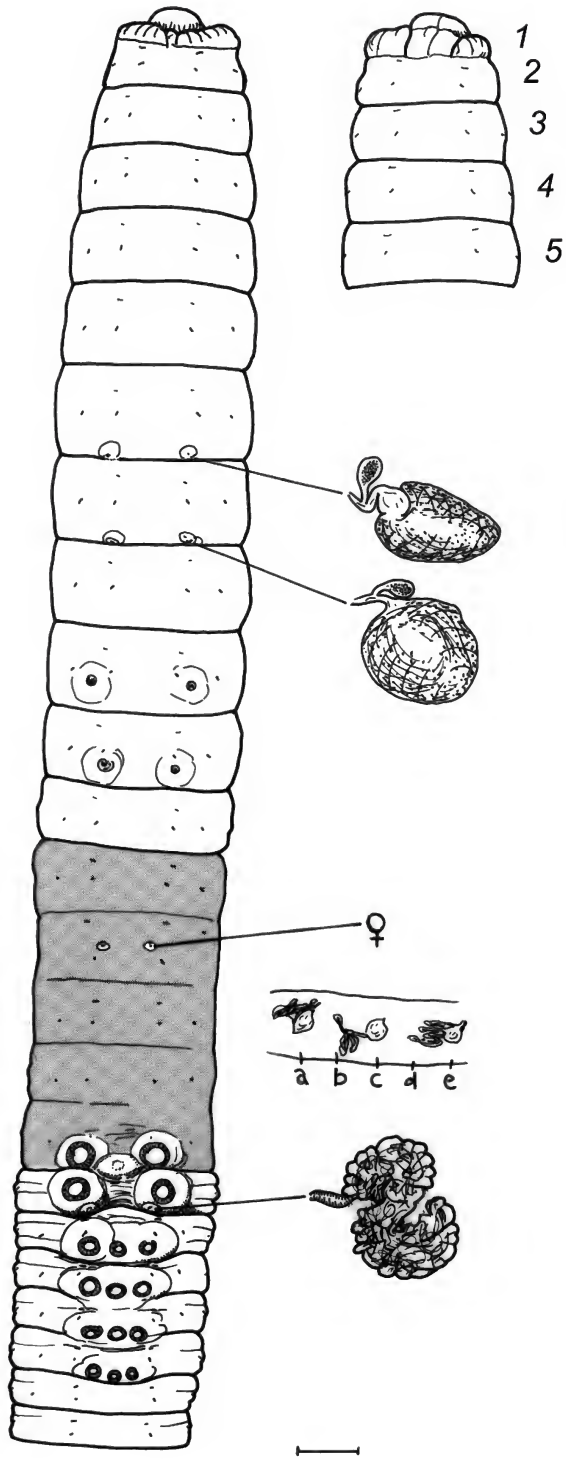


Fig. 208. Aceeca dee, H, showing nephridia in ca. 17 lhs.

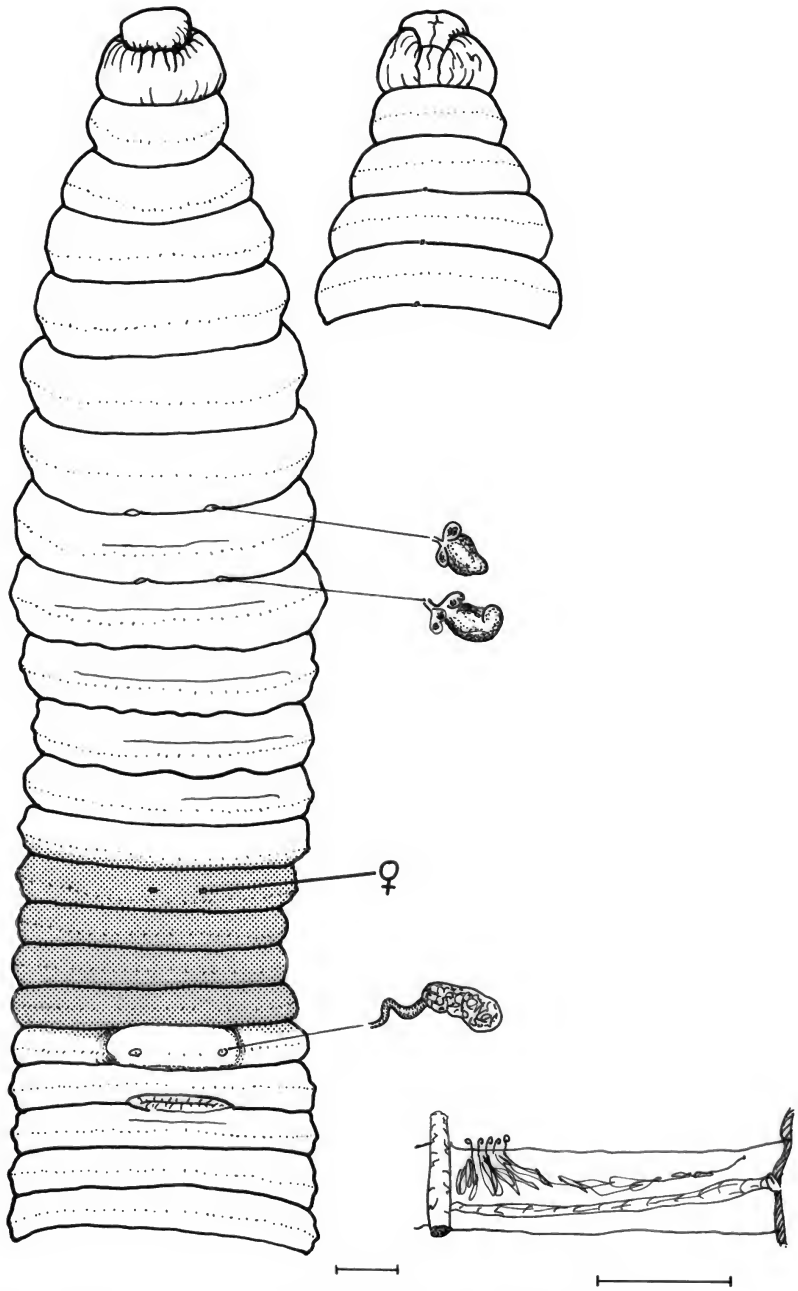


Fig. 209A. Scolecoidea scolecoidea (Spencer, 1895), 14:0073, showing meroic nephrostomes in ca. 40rhs.

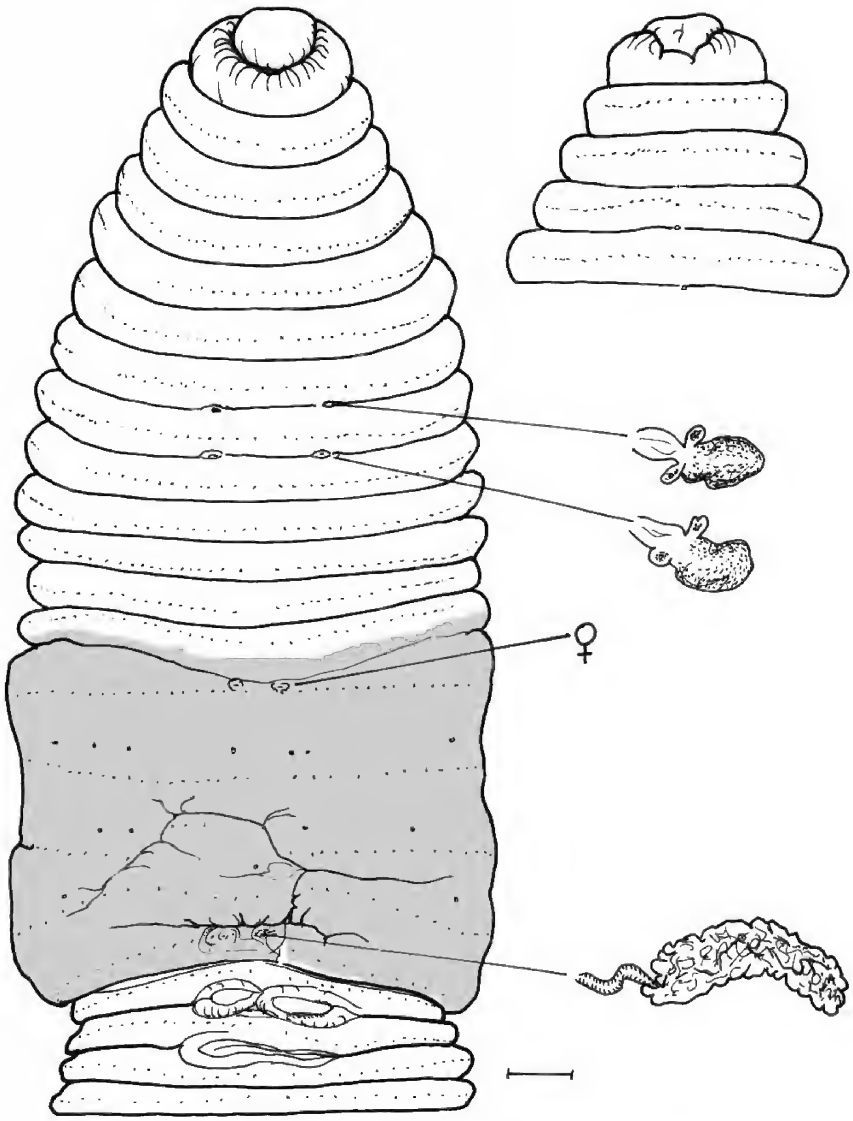


Fig. 209B. Scolecoidea scolecoidea (Spencer, 1895) 14:1852.

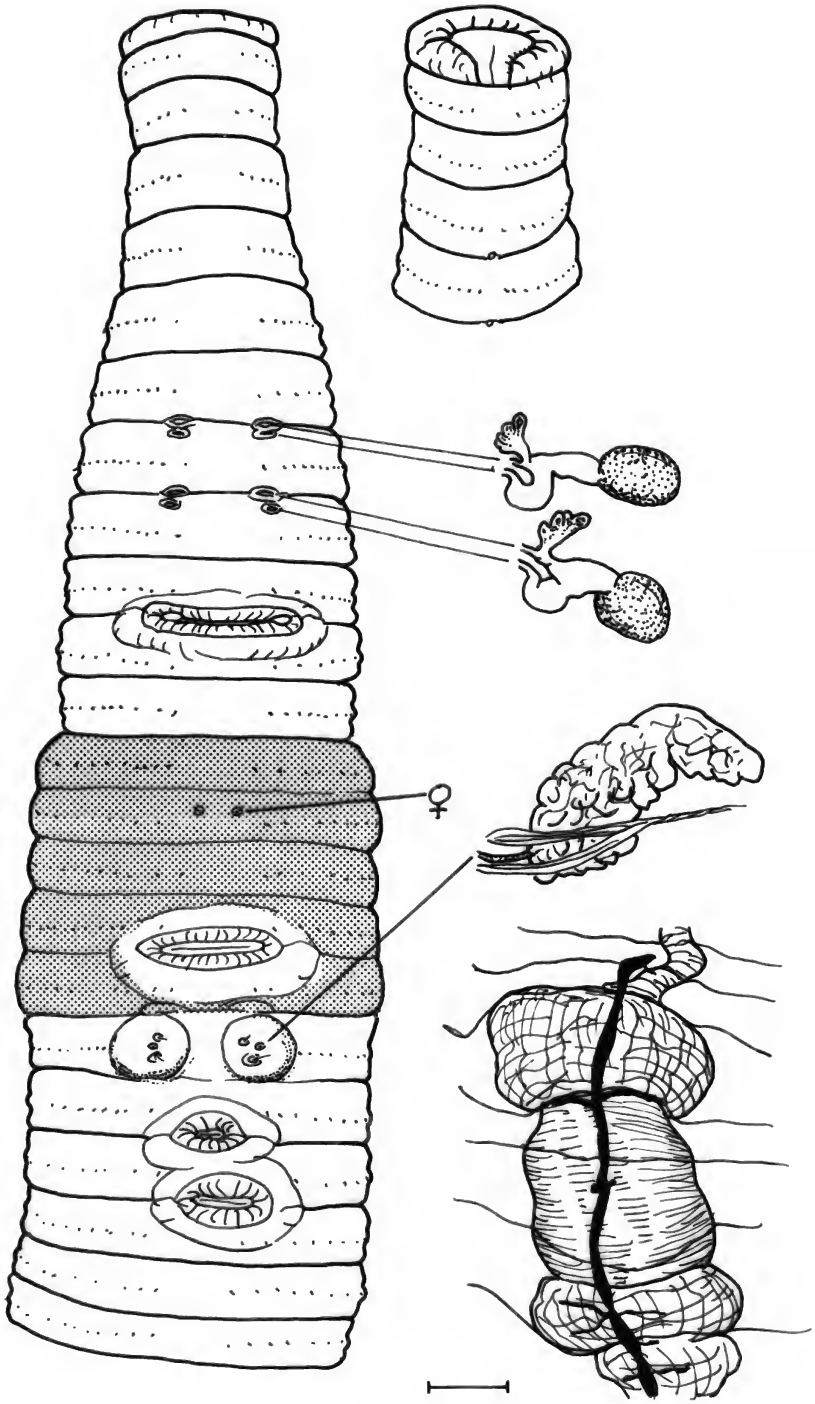


Fig. 210. Hickmaniella classica, H showing intestinal gizzard in 19-20 and spermathecae with double entries.

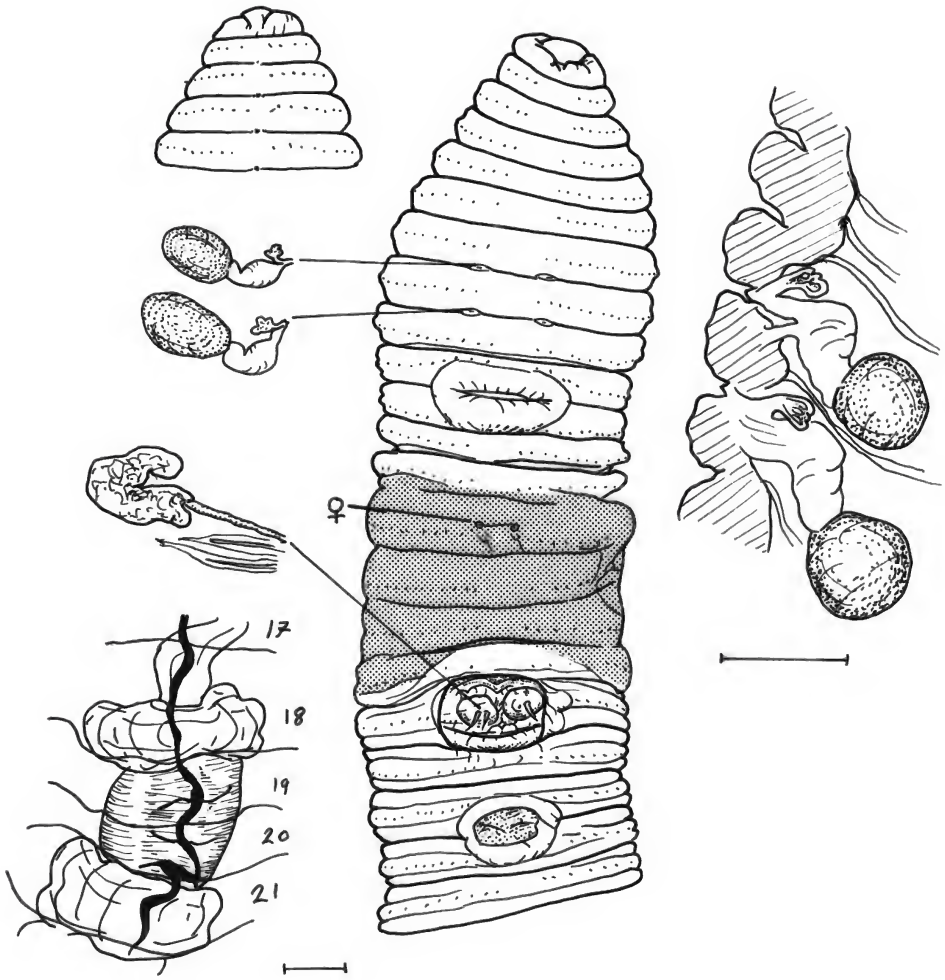


Fig. 211. Hickmaniella faba, H, showing intestinal gizzard in 19-20 and enlargement of P1's section of spermathecal ducts in the body wall.

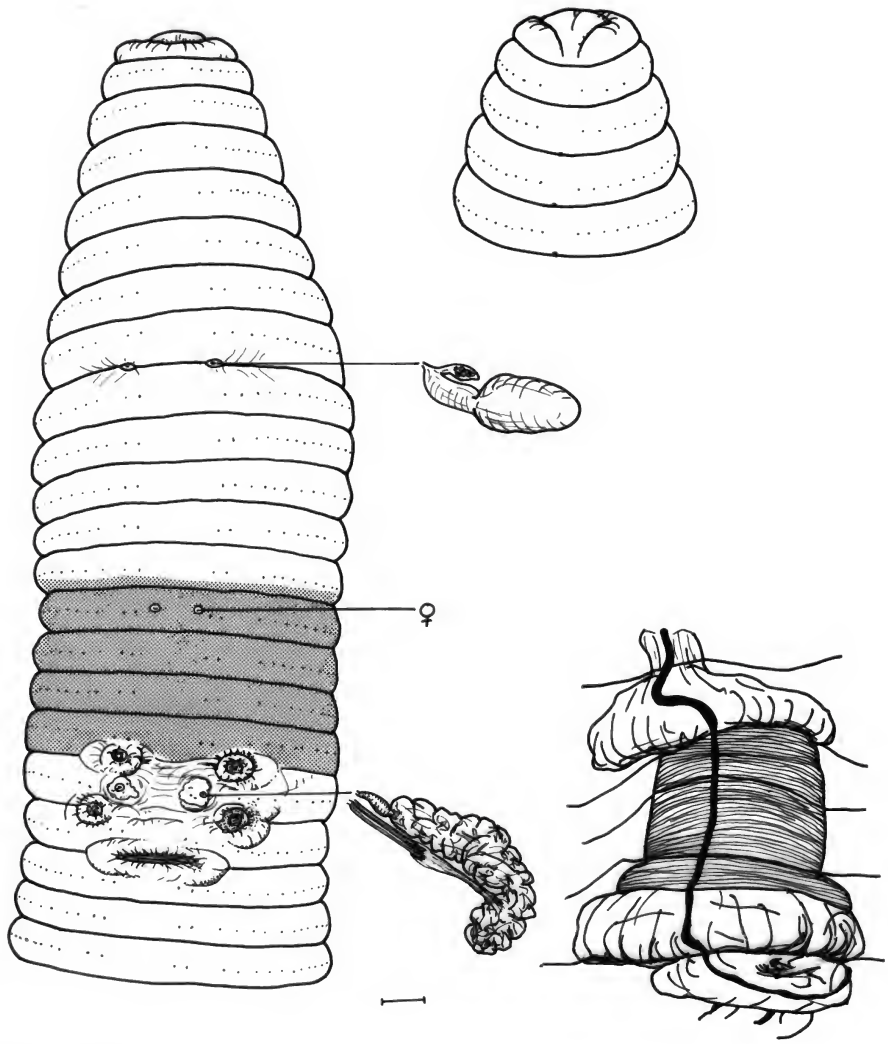


Fig. 212. Hickmaniella gogi Blakemore, 1997, H.

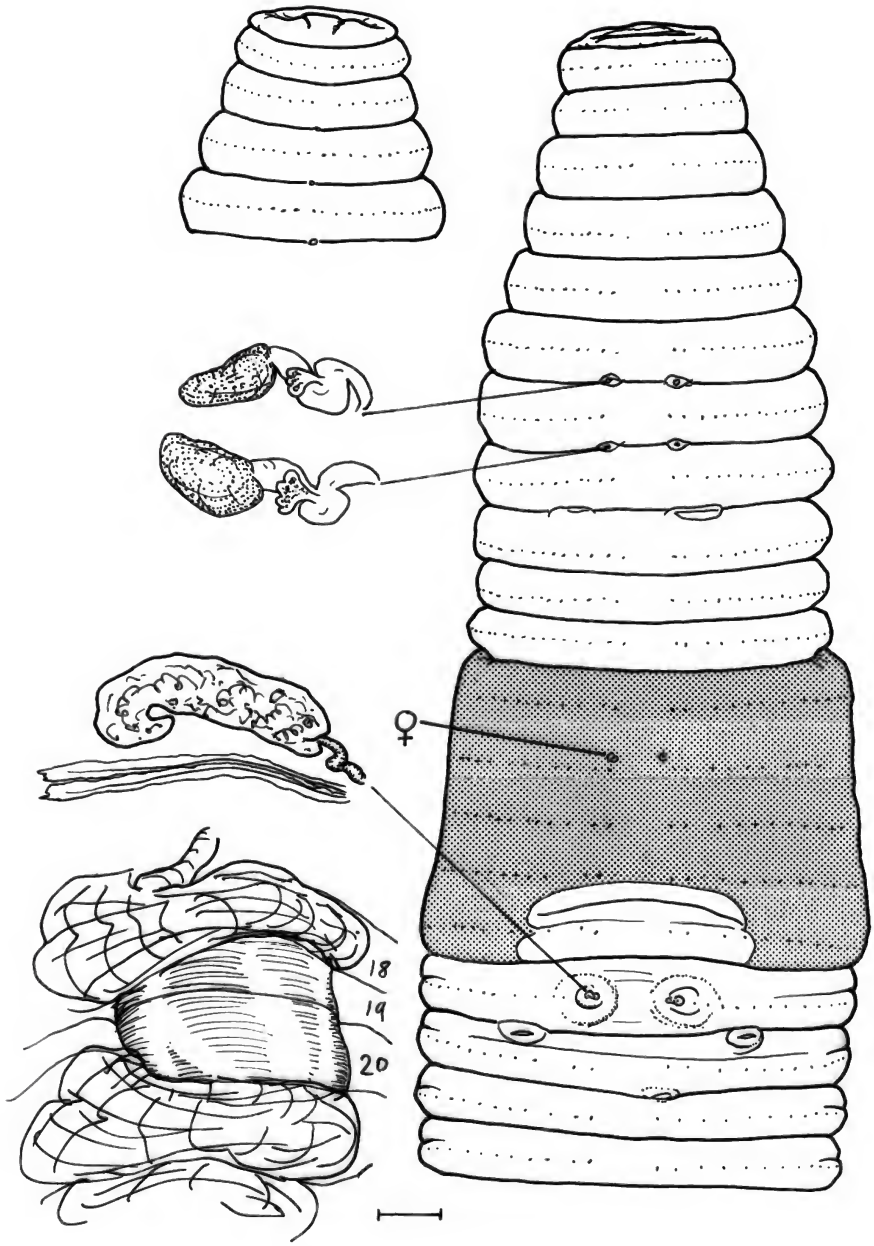


Fig. 213. Hickmaniella noda, H.

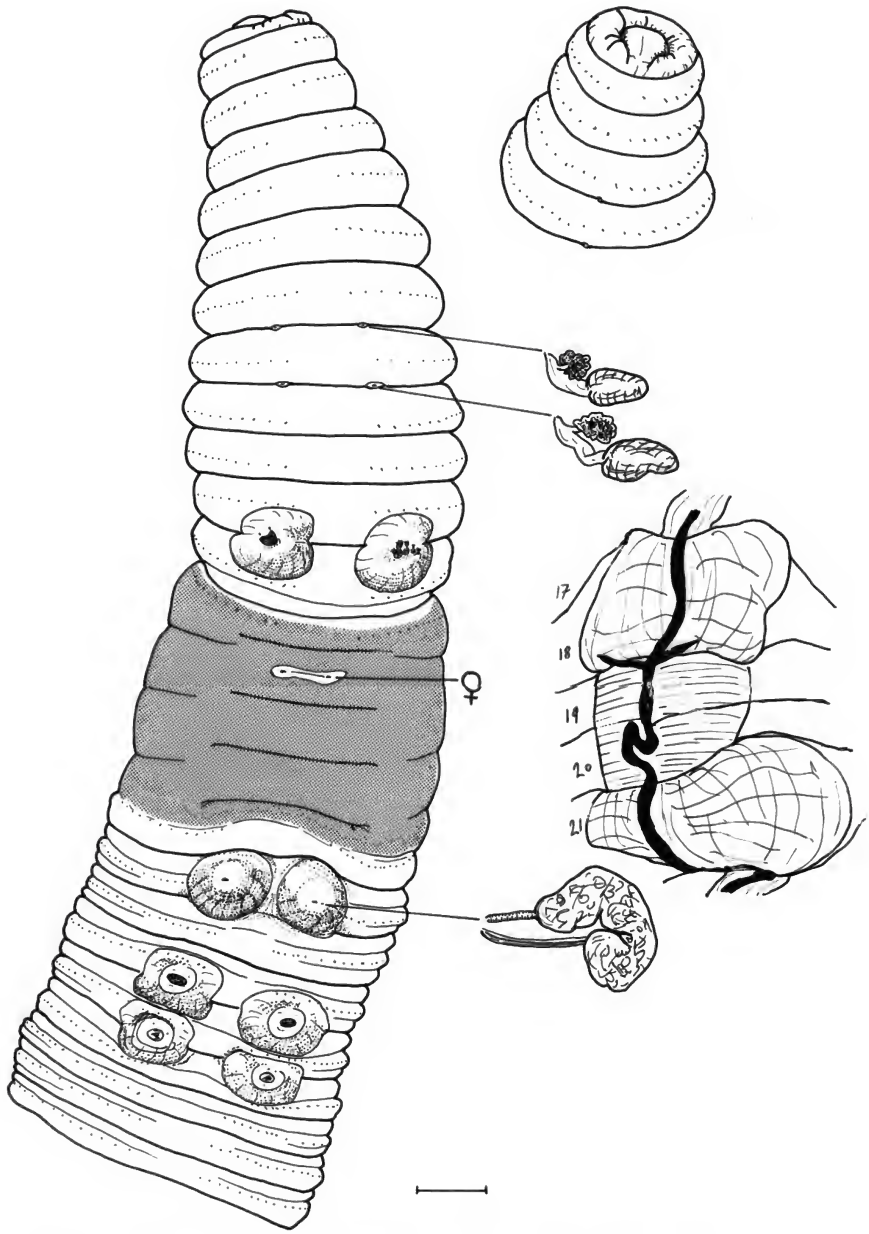


Fig. 214. Hickmaniella opisthogaster Jamieson, 1974, 14:1619.

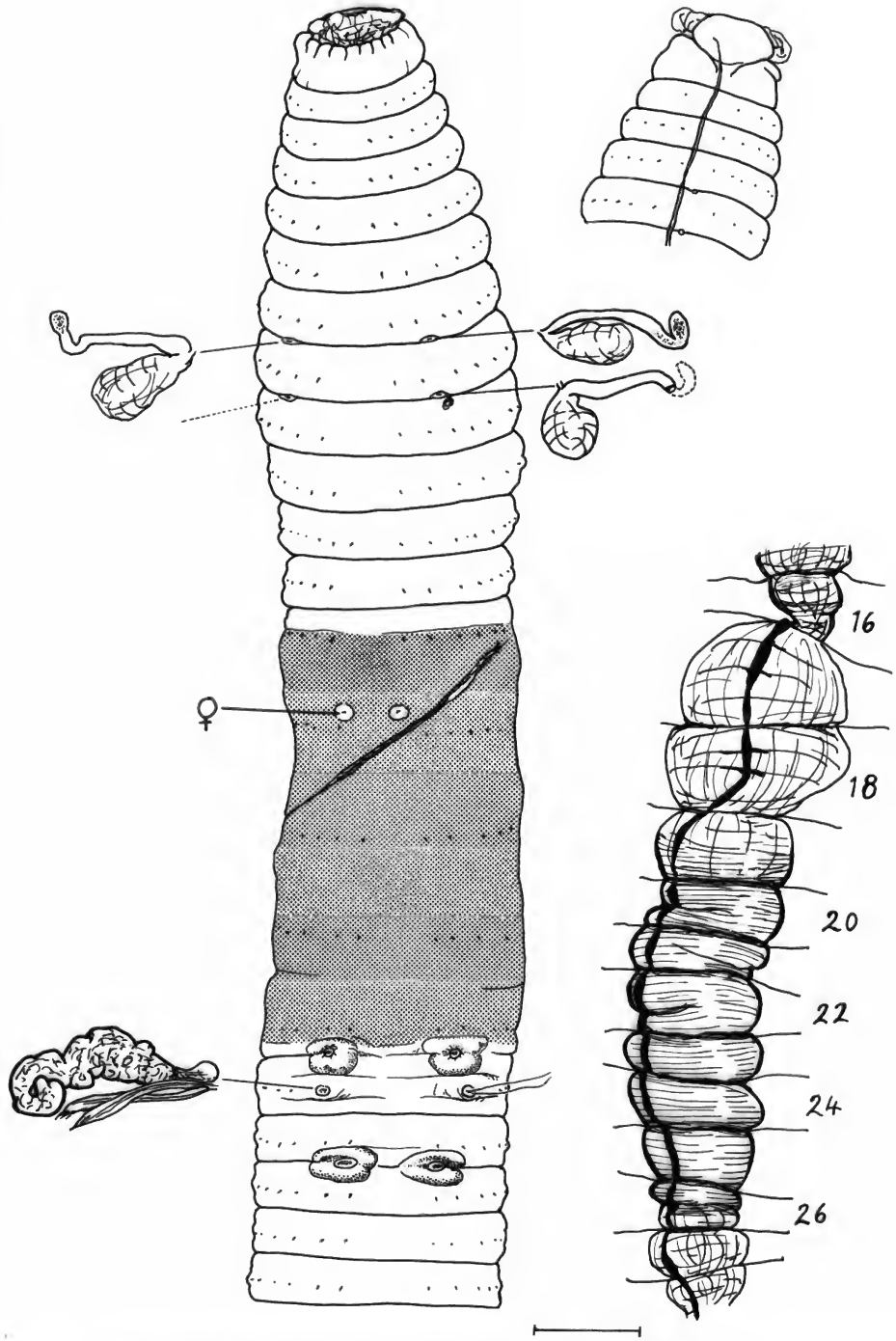


Fig. 215. Retrovescus capensis (Jamieson, 1974), H.

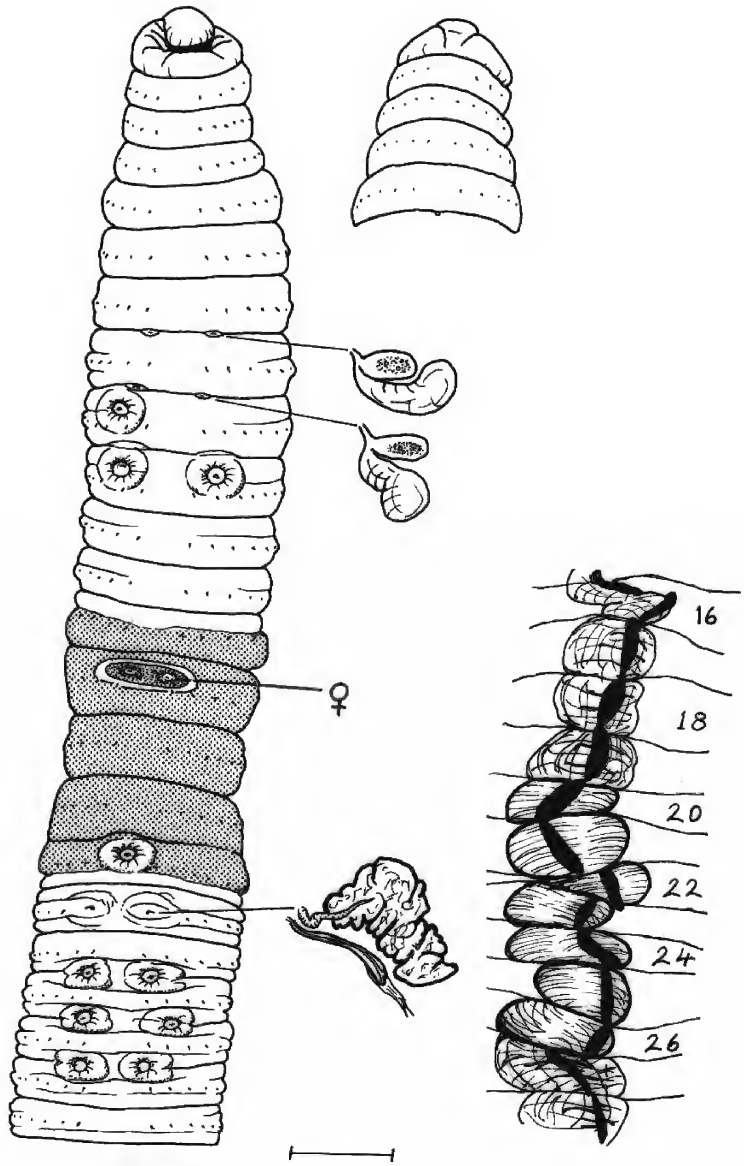


Fig. 216. Retrovescus mesibovi Blakemore, 1998, H.

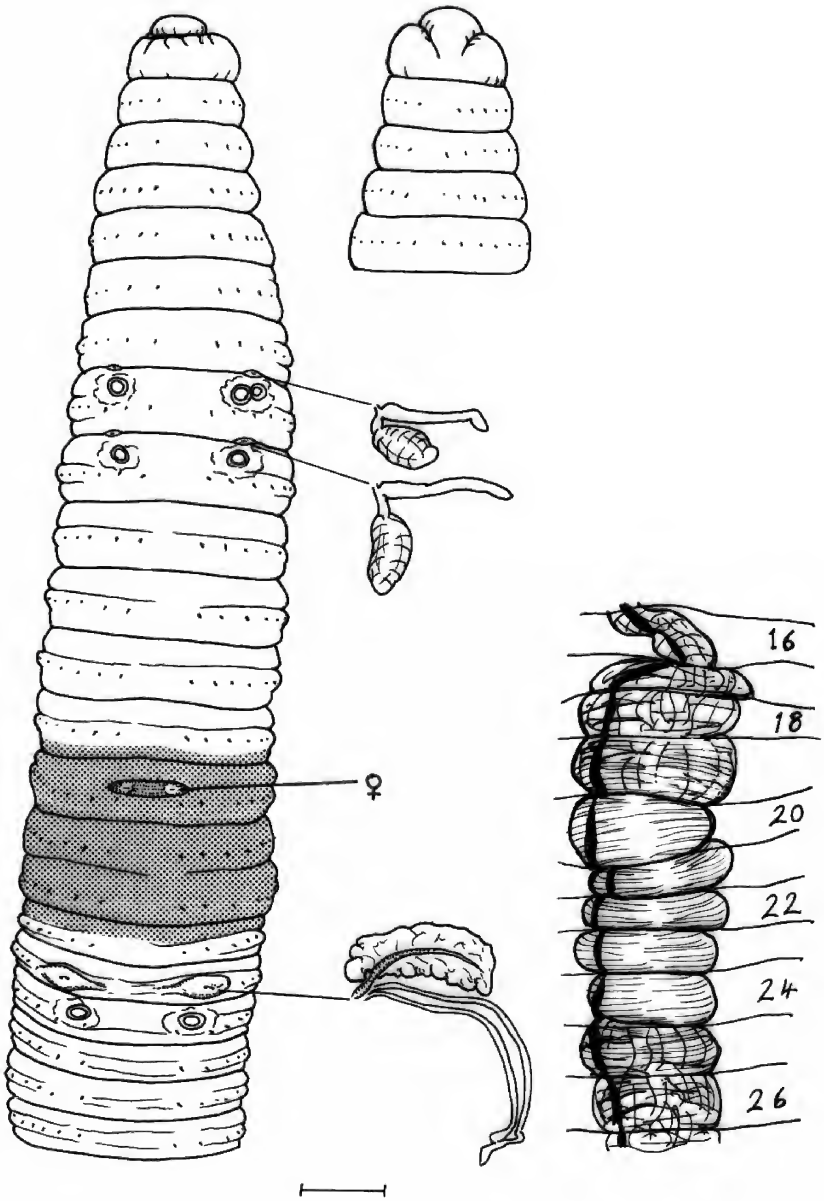


Fig. 217. Retrovescus plomleyi Blakemore, 1998, H.

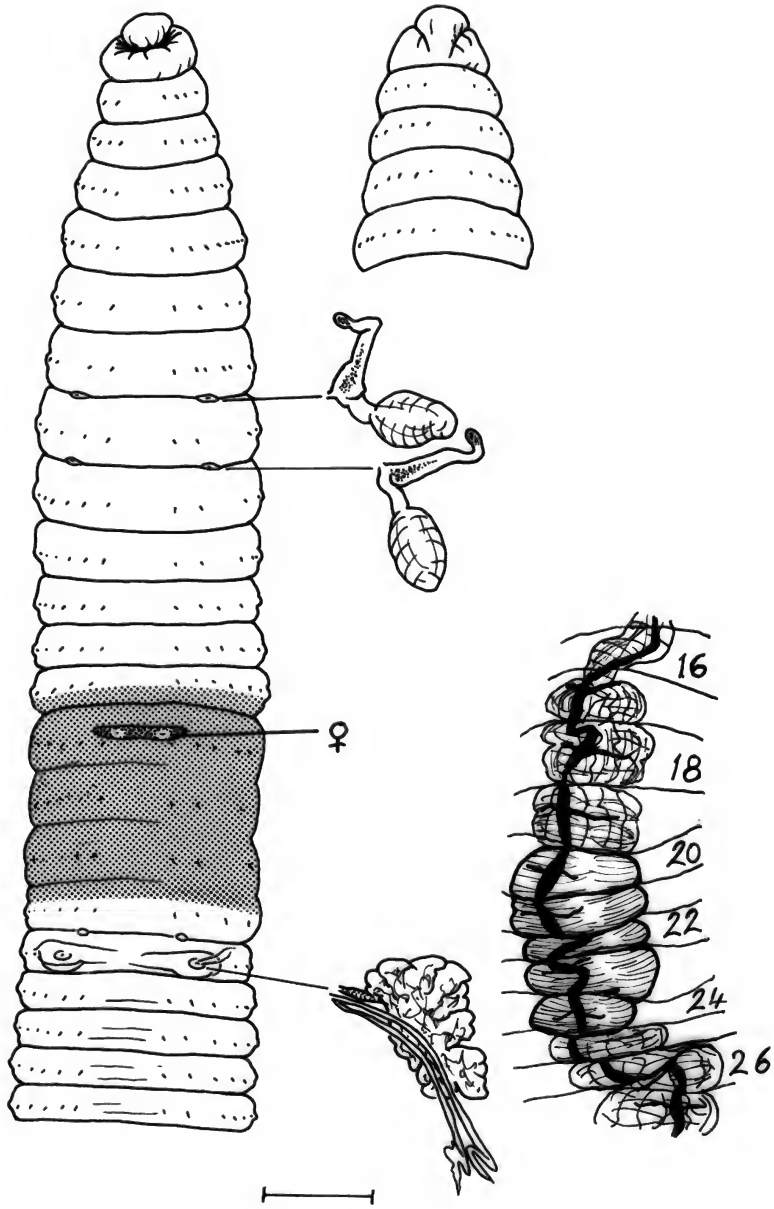


Fig. 218. Retrovescus simplex Blakemore, 1998, H.

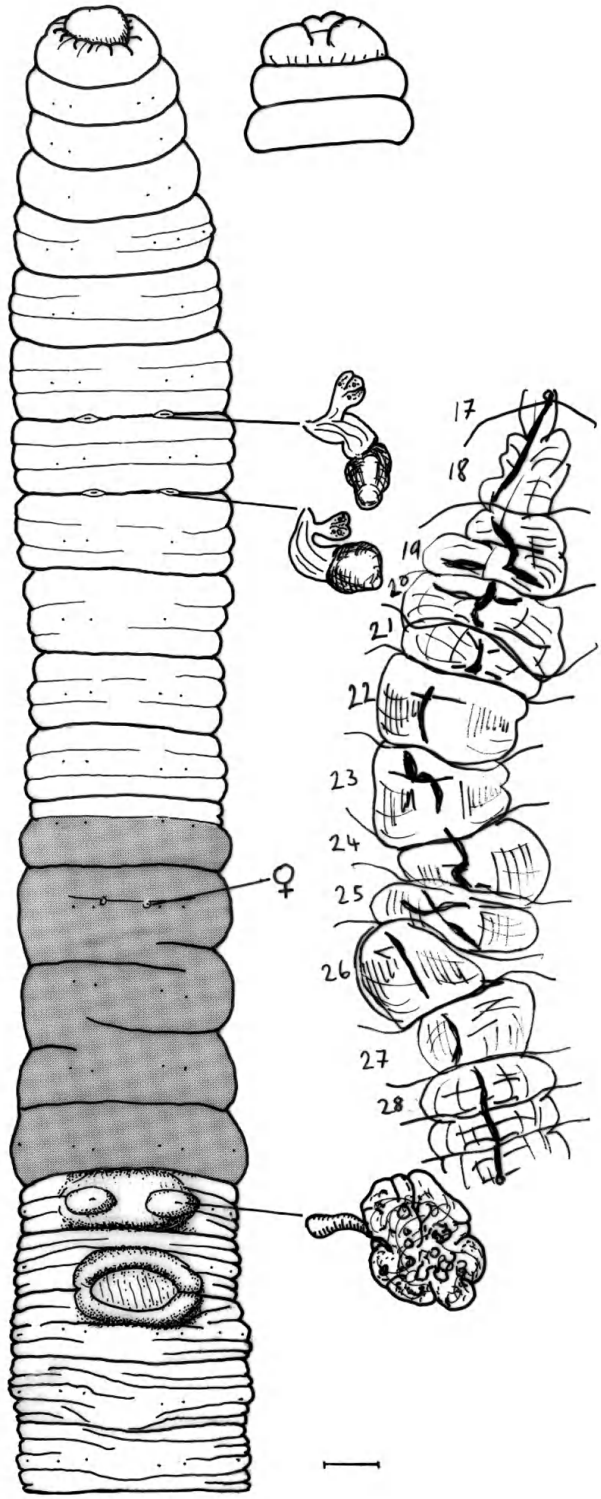


Fig. 219. Anisogaster quini, H.

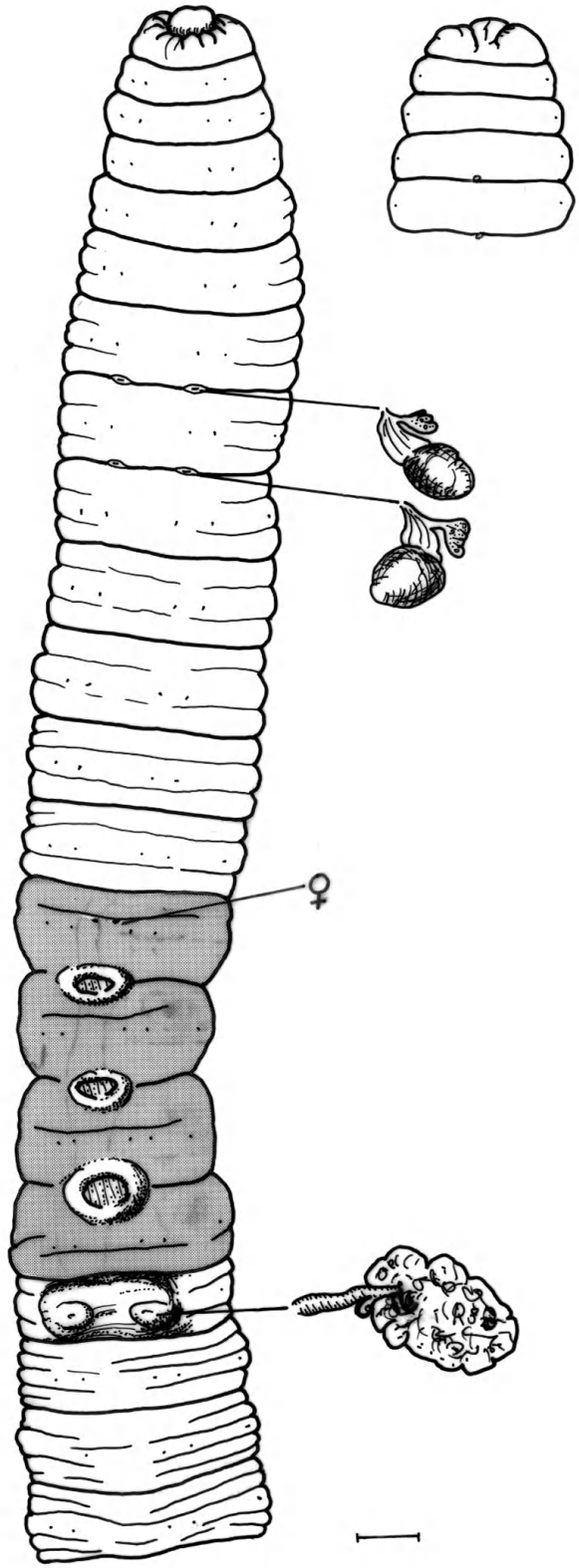


Fig. 220. Anisogaster remora, H.

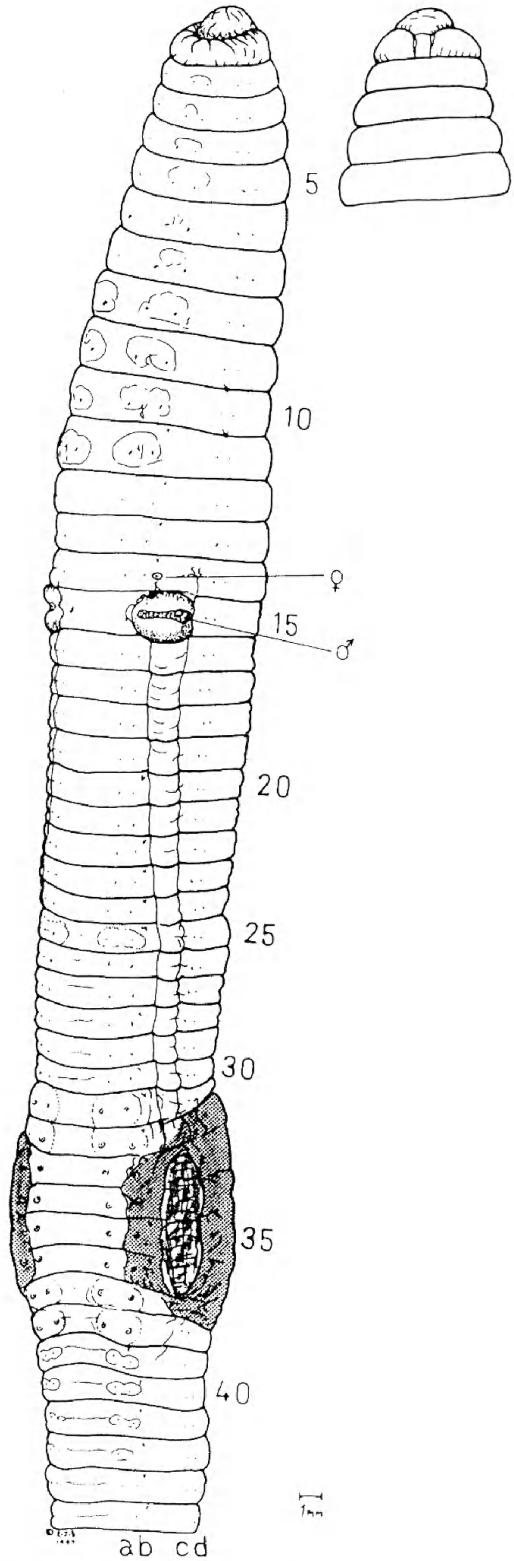


Fig. 221. Lumbricus terrestris Linnaeus, 1758, 14:3648.

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