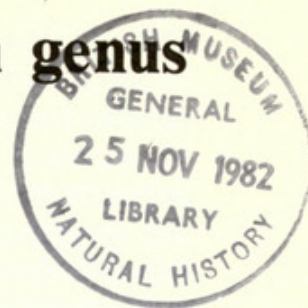


Revision of the eastern African earthworm genus *Polytoreutus* (Eudrilidae : Oligochaeta)

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Synopsis

Fifty-three nominal species and subspecies of the genus *Polytoreutus* are revised; descriptions and a key are provided to seven species groups here recognized and 27 species now regarded as valid (five being new to science).

Introduction

The earthworm genus *Polytoreutus* was described by Michaelsen in 1890 to accommodate a highly variable eudriline species, *coeruleus*, from Tanzania. Its distinguishing characters are: a single male pore, a single spermathedal pore in furrow 18/19, the absence of penial setae and a single pair of testes in segment *xi*. During the first five years following its description, another seven species were recognized on other characters (Beddard, 1895) and altogether eleven species and six subspecies were known by the end of the century (Michaelsen, 1900); at the time that Stephenson published his monograph (1930), the genus contained 32 species compared with the 53 nominal taxa from central and eastern Africa examined during the studies reported below. During the ninety years or so that have elapsed since the description of *Polytoreutus*, the included taxa have not been reviewed nor have intraspecific and other variations been recorded with the result that several species have been described as new more than once. This present report contains the first revisions of the nominal taxa assigned to the genus, seven species groups are recognized containing 27 species now regarded as valid (five being described as new).

The current revision became essential in order to identify material of the genus *Polytoreutus* among the collections of earthworms made in eastern Africa by Miss Edna Oxtoby. In 1964 Miss Oxtoby was appointed to the staff of Kenyatta College, Nairobi and resumed teaching biology after fifteen years as an Education Officer (later Senior Education

Officer) first in Zanzibar then later in Hong Kong. During her career she had encountered problems in teaching about earthworms. The fundamental difficulty was that the boreal species *Lumbricus terrestris* was frequently the only oligochaete described and figured in textbooks. Now she became determined that Kenyan students should be taught from representatives of their own country. The new problem was to select a suitable teaching type. An appropriate species needed to be fairly plentiful and to produce large individuals so that the worms could be examined without the use of a low-power dissecting microscope. To achieve her ambition, Miss Oxtoby collected samples of earthworms from many localities in Kenya and some in nearby territories. Eventually she selected a species of the highly specialized genus *Polytoreutus* and produced a dissection guide describing its anatomy but did not provide the species with a name as the genus was overdue for revision (Oxtoby, 1975). The species is identified below as *P. huebneri* Michaelsen, 1913.

Miss Oxtoby had always been anxious to stimulate research on Kenyan earthworms, especially the genus *Polytoreutus*, due to its frequency of occurrence and to establish the name of her teaching type. She donated many samples of earthworms to the British Museum (Natural History) containing numerous representatives of the families Alluroididae, Sygenodrilidae, Acanthodrilidae, Eudrilidae and Almidiae in addition to introduced species of Megascolecidae and Glossoscolecidae. As *Polytoreutus* was the most commonly represented genus in her large collections, little progress could be made with studying the material until this taxon and its component species were re-examined. Clearly the revision reported below represents the realization of Miss Oxtoby's more recent ambition, made possible solely by her dedication. Sadly in 1979 Miss Oxtoby died in Nairobi before the completion of this present study.

During the course of this investigation material was examined from collections in several institutions. The following abbreviations cited with catalogue numbers denote those specimens and indicate the institution in which they are deposited.

| | |
|-----------|--|
| BM(NH) | British Museum (Natural History), London. |
| Berlin | Zoologisches Museum, Museum für Naturkunde der Humboldt Universität, Berlin. |
| Brussels | Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels. |
| Hamburg | Zoologisches Institut und Zoologisches Museum, Universität Hamburg. |
| Harvard | Museum of Comparative Zoology, Harvard University. |
| Stockholm | Naturhistoriska Riksmuseet, Stockholm. |
| Turin | Museo ed Istituto di Zoologia Sistemica dell'Università di Torino. |
| USNM | National Museum of Natural History, Smithsonian Institution, Washington. |

Variation

In earthworms of the genus *Polytoreutus* many structures are morphologically stable, especially those diagnostic of the genus (single male pore in *xvii* or 17/18, single spermathecal pore in 19/19, alimentary tract and the presence of only a single pair of testes in *xi*), yet other structures, particularly the spermathecal system, are highly variable. The differences, however, cannot always be attributed to specific variation; sometimes extensive modifications in morphology may be associated with growth and sexual activity while the effects of employing (frequently *misemploying*) different techniques to relax, kill, fix and preserve series, have added to the variations which need to be discounted when identifying material. Unfortunately there has been a lack of awareness of individual variation but this has not been the only factor resulting in many nominal species being recognized, there has been too a regrettable oversight of the literature by authors who in addition, apparently seldom re-examined type-series, often their own.

Size. The lengths of clitellate specimens vary between 52 mm for a small individual of

coeruleus (*minutus* at 80 mm is usually regarded as the smallest species in the genus) and 390 mm recorded for the largest specimen of *huebneri*. But length is not a reliable taxonomic character as the range of sizes of any single species usually overlaps those of several others. Differences in size could be caused, as in some Lumbricidae, by growth ceasing at the onset of the first period of aestivation after hatching (breeding, not growth, activity following the diapause). Thus, the earlier that cocoons hatch after the end of a dry season, the longer is the period available for growth before the onset of the next dry season. Often a disparity in size between conspecific series can be attributed to divergent collecting and curatorial techniques, these may result in preserved specimens being excessively contracted, relaxed or subsequently starting to macerate so becoming abnormally long.

Segments. The numbers of segments forming the bodies of the majority of species are 200–300 but only 102 are recorded for a (non-regenerating) individual of *minutus* whereas 670 were present in a specimen of *multiplus* (a member of the *kilindinensis* species group that contains other species with numerous segments).

Prostomium. This structure is basically prolobous but occasionally additional longitudinal furrows occur in the peristomium causing the prostomium to appear to be pro-epilobous or tanylobous. These furrows seem to be associated mainly with a larger body size and may be a function of growth. In some cases they may be no more than wrinkling caused by epidermal shrinkage during preservation.

Setae. The setal ratios (segmental inter-setal distances) are constant among conspecific series which have received comparable treatments during collection and storage. However, by subjecting specimens of a single species to differing techniques for relaxing, fixing and preserving, variations can be produced in the setal ratios of greater magnitude than the differences recorded between species. The reason for these discrepancies appears to lie in the non-uniformity of the thickness of the longitudinal muscles around the body, in particular along the setal lines where the muscles are reduced. Depending on the treatment applied to a specimen, the contractions of the longitudinal and the opposing circular muscles will vary to affect the inter-setal distances sufficiently to reduce the taxonomic usefulness of the measurements. Nevertheless, the positions of setal lines *c* and *d* remain constant relative to the nephridiopores which are located midway between them, i.e. $\frac{1}{2}cd$; the nephridiopores being invariably $\frac{1}{2}$ circumference apart.

Clitellum. A clitellum is present at least on *xiv–xvii* (four segments) in all adults and with increasing maturity extends forwards onto *xiii* and, in many species, also backwards onto *xviii*. It is usually annular but occasionally (*multiplus* and *violaceus*) only poorly developed ventrally and, for taxonomic purposes, is regarded as being saddle-shaped. In addition, the clitellum may fail to develop ventrally in the vicinity of the male pore so although it may be annular over *xiii–xvi*, it becomes saddle-shaped posteriorly.

Male and spermathecal pores. Most species have the true male pore carried by a penis lying within a male pouch. The penis often protrudes externally, the extent of the protrusion depending upon the length of the penis and the collection and preservation techniques to which a specimen has been subjected. The secondary male pore (orifice to the male pouch) is located either on *xvii* or in 17/18. It is often carried on a porophore.

In preserved specimens, the sizes of both the secondary male pore and the porophore can be affected by the degree of relaxation. In contracted specimens the pore may be small (inconspicuous) and circular with the porophore raised whereas if a specimen is relaxed, the pore can be slit-like to rounded (commonly with the penis protruding) and the porophore difficult to detect.

The spermathecal pore is usually an inconspicuous, simple, lateral slit midventrally in 18/19 but it may become enlarged and modified when a spermatophore is present within the orifice. (The presence of a spermatophore may produce a temporary thickening in the wall of

the ectal region of the receptaculum seminis. Authors have mistaken this modification for a 'bursa copulatrix'.)

The male and spermathecal pores are accommodated within a single, common pouch in the adults of the *arningi* species group. Mature individuals possess a large, single pore occupying most the midventral region of *xviii* and sometimes part of *xvii* too. Within the pouch the male pores (possibly the paired ectal ends of the prostatic ducts) are located anteriorly, often concealed under the lips of the orifice; while the spermathecal pore is situated towards the posterior wall.

Female pores. The external apertures of the oviducts are invariably small, simple pores located laterally on the posterior half of *xiv* between setal lines *c* and *d* where their precise location can vary individually. The variation appears to be connected with growth and sexual activity. The oviducts pass obliquely through the lateral parietal walls and as the clitellum thickens with increasing sexual maturity, so the oviducts lengthen correspondingly and maintain the oblique line of flow for the discharging zygotes. The result is for the pores to become located slightly more dorsally and posteriorly.

External genital structures. Most species lack external genital features apart from the clitellum and a porophore. However, a midventral longitudinal seminal groove leads posteriorly for several segments behind the spermathecal pore in *usambariensis* (*coeruleus* species group) and all members of the *kenyaensis* species group. While a single genital pad is present in *pulvillatus* (*meruanus* species group), a series of pads in *gregorianus* (*kilindinensis* species group), a single papilla occasionally in *arningi* and several papillae in *meruanus* and *papillatus* (*magilensis* species group). In addition, raised glandular (?pigmented) areas occur ventrally in *kilindinensis* and *hindei* (*kilindinensis* species group). Other random markings, neither midventral nor bilaterally symmetrically arranged, sometimes occur in the vicinity of the male and spermathecal pores; it is suggested that in some specimens of *coeruleus* such markings may be cyst-like bodies produced by parasites infesting the body wall.

Alimentary canal. Differences in collecting and curatorial techniques can cause superficial differences in the alimentary canal of conspecific individuals from separate series. In preserved specimens, contraction or relaxation of the alimentary canal often fails to correspond with the contraction or relaxation of other systems. Considerable displacement can occur with the paired calciferous glands in *xiii* lying within the parietes of more anteriorly situated segments or of those behind that segment. (In one extreme specimen the calciferous glands were lying over the prostates with septum 11/12 and the anterior portions of the seminal vesicles covering the male pouch.) When the septa are correctly identified, the disparate relative positions of the organs do not cause confusion.

Seminal vesicles. There is considerable individual variation in the gross morphology and extent of the seminal vesicles due to growth and sexual activity. The seminal vesicles lead posteriorly from septum 11/12 as slender ducts, near the hinder ends of the prostates they expand and extend for a varying number of segments as dilated, sperm-filled sacs. Infrequently the slender anterior duct-like portions may also be filled with sperm. Posteriorly the vesicles may be flat and commonly expanded segmentally with a moniliform appearance; sometimes they become almost tubular. Throughout their lengths, their locations in relation to the prostates, intestine and to each other are fortuitous as they often become entwined with one another. In detail, the morphologies of the seminal vesicles of any two conspecific individuals are never alike.

Prostates. Tubular in structure, the prostates are usually long and pass posteriorly through several segments, possibly up to ten or more, with intersegmental constrictions: occasionally small and almond-shaped. Variations in structure are mainly specific so causing them to be taxonomically significant. The common variations are seen at the site of entry of the vasa deferentia. These ducts may lead into the prostates either terminally or subterminally at the ectal ends where the lateral wall of the glands may be raised to become papillate or cornuate

in structure. When the lateral process is cornuate and long, the paired prostates together appear to form an 'H' with the horizontal member leading into the male pouch. When the vasa deferentia pass subterminally into the prostates, the region of the prostates anterior to the union with the ducts, may be flexed forwards or perhaps laterally depending largely on whether a specimen is grossly or moderately contracted.

Male pouch. In most species a penis may be seen within this structure which seems to function as a penial sheath. The size may vary both individually and specifically. In species with a small male pouch, internally there is little sign of the pouch when a specimen is contracted due to the pouch itself being contracted and forced externally by the contracted muscles of the body wall to produce (externally) a raised porophore but in a relaxed specimen the male pouch can be seen internally on the ventral parietes of *xvii* while externally the porophore may be difficult to detect. In species with a large male pouch, the structure is readily evident regardless of the degree of relaxation (or otherwise) of a specimen. In a minority of species, a single or a pair of accessory glands or pouches of unknown function are associated with the male pouch.

Spermathecal System. In the Eudrilidae the female and spermathecal systems are highly specialized, being commonly united. In most the spermathecae have been replaced by coelomic (mesodermal) sacs which communicate entally with the paired oviducts at the 'fertilization chambers' where the ova are fertilized before being discharged through the female pores. In each species group of the genus *Polytoreutus* (and often in individual species) the spermathecal system forms a discrete pattern of major taxonomic importance yet wide ranges of individual variation are often present in the gross morphology (Fig. 1).

Variations are caused by a seeming adventitious development of the coelomic membranes forming the system due to growth, sexual activity and, on occasions, techniques of collection

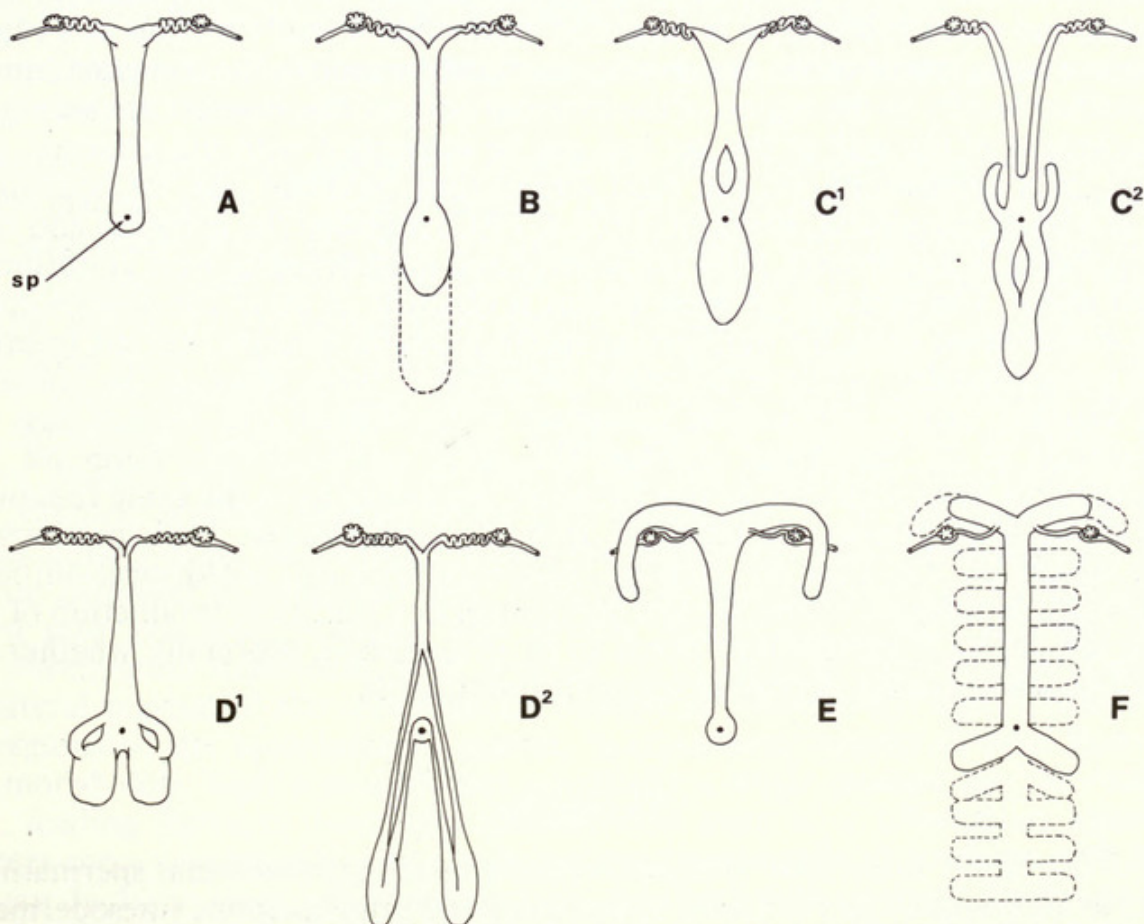


Fig. 1 *Polytreutus* spp. Female and spermathecal systems (schematic dorsal views, not to scale). (A) *kenyaensis* species group; (B) *meruanus* species group; (C. 1-2) *magilensis* species group; (D. 1-2) *kirimaensis* species group; (E) *kilindinensis* species group; (F) *coeruleus* species group. sp, ventral location of the spermathecal pore.

and preservation. A lack of appreciation of the causes of the variations has, in the past, contributed towards some of the species being described as new more than once, sometimes by the same author. In the genus *Polytoreutus* the spermathecal system fundamentally comprises a simple median duct (receptaculum seminis) passing anteriorly from the spermathecal pore in furrow 18/19 to segment *xiii* where it bifurcates with each furca passing laterally to a fertilization chamber which communicates with the exterior by way of an oviduct. In some species the anterior furcae are massive and flexed posteriorly but with proximal, basal, ducts leading to the fertilization chambers (*kilindinensis* species group and, to a lesser extent, *coeruleus* species group). Otherwise the anterior furcae are usually slender, often convoluted, with the fertilization chambers located distally, i.e. terminally. The receptaculum seminis may be simple between *xiii* and 18/19 rarely to *xxi* (*kenyaensis* species group), simple but extending several segments behind the spermathecal pore (*meruanus* species group), divided by the spermathecal pore then reunited so forming a foramen for the ventral nerve cord (*magilensis* species group) or have several pairs of lateral diverticula *coeruleus* species group or have the diverticula unite distally on each side when proximally part of the median duct may fail to develop (*kirimaensis* species group). In all of these conditions there are many variations, some specific, others individual. Variations in the morphology of the spermathecal systems between conspecific individuals depend largely on the volume of received sperm being stored or having been stored previously but now expended. This kind of variation not only affects the gross size of the receptaculum seminis but in the case of diverticulate species, the proportions and number of diverticula. In *magilensis* the furcation occurs more posteriorly with the furcae sweeping forwards to *xiii* before flexing laterally, here partial union of the furcae commonly occurs anteriorly in individuals possessing a large volume of received sperm to give the receptaculum seminis a ladder-like appearance.

In *kilindinensis* the single, unpaired longitudinal portion of the receptaculum seminis is adiverticulate and always slender; it is suggested below that it may function as a vagina with received sperm being stored in the massive furcae. In other species the receptaculum seminis may be modified locally in the region of the external orifice. The changes are seen usually as a slight thickening of the wall of the sac and can be associated with the presence, or recent presence (?), of a spermatophore; the ectal region thus modified has, on occasions, been identified as a bursa copulatrix. Beddard (1901 & 1902) reported the presence and structures of spermatophores in five species, their occurrence and morphologies were confirmed during this present study. The function of these bodies is obscure. In all of the species concerned, there is an intromittant penis for transferring sperm products directly into the receptaculum seminis of a concopulant, while fertilization presumably takes place in the lumina of the anteriorly situated paired fertilization chambers from whence the zygotes pass into the slender oviducts to be discharged through the small paired female pores on *xiv*. The spermatophores of these eudrilids do not therefore seemingly have the same function as the structures of the same present, for example, in many Lumbricidae. Their production gives rise to the possibility that they are perhaps concerned with cell multiplication before cell division and the production of the haploid spermatozoa. Clearly the production of the male gametes in this group of earthworms needs to be investigated, especially whether received male sexual products consist of diploid spermatogonoid cells.

Taxonomy

Members of the family Eudrilidae (Megascolecoidae lacking pretesticular spermathecae) are unique in having complex spermathecal systems derived from coelomic (mesodermal) tissue, which usually unite with the oviducts to permit ova to be fertilized internally by received spermatozoa (Clausen, 1965; Sims, 1964, 1969 & 1980). Apart from allochthonous species, the family is confined to central Africa where two subfamilies are recognized: Pareudrilinae mostly in the east and the Eudrilinae mostly in the west. The latter is characterized by the

presence of single, suboesophageal pouches in *x* and *xi*, or *ix*, *x* and *xi* with paired stalked (extramural) calciferous glands in *xii* or *xiii* respectively and the vasa deferentia investing the testes to form 'sperm reservoirs' which are continuous with the seminal vesicles; the subfamily Pareudrilinae is defined negatively on the absence of the characters diagnostic of the Eudrilinae. The included genera in the subfamily Eudrilinae form two groups on the number of male and spermathecal pores: a minority with paired pores and a larger group of which *Polytoreutus* is a member, with single, midventral pores. The inter-relationships of the individual genera are marked partly by the situation of the spermathecal pore(s) (Sims, 1971). The genus *Polytoreutus* Michaelsen, 1890 (eastern Africa) with the single spermathecal pore located one segment behind the single male pore has seemingly greater affinity with *Teleutoreutus* Michaelsen, 1913 (Ethiopia) and the doubtfully distinct *Eupolytoreutus* Michaelsen, 1910 (western Tanzania, Zaire and Togo) with the spermathecal pore near (before, same segment or behind) the male pore than with *Schubotziella* Michaelsen, 1915 (eastern Zaire) with the spermathecal pore several segments in front of the male pore although *Polytoreutus* and *Schubotziella* are metandric (testes in *xi* only) and *Teleutoreutus* and *Eupolytoreutus* are holandric (testes in both *x* and *xi*). On the other hand, the genus *Polytoreutus* has a low affinity with the holandric *Eutoreutus* Michaelsen, 1922 (synonym *Agrotoreutus* Segun, 1976) from Nigeria and Zaire with rolled penial setae yet the spermathecal pore is behind the male pore and no significant level of similarity with *Keffia* Clausen, 1963 (Nigeria) with rolled penial setae and paired spermathecal pores behind paired male pores.

Genus *POLYTOREUTUS* Michaelsen, 1890

Polytoreutus Michaelsen, 1890 : 24; Michaelsen, 1891 : 55; Beddard, 1895 : 608; Michaelsen, 1900 : 412; Stephenson, 1930 : 877.

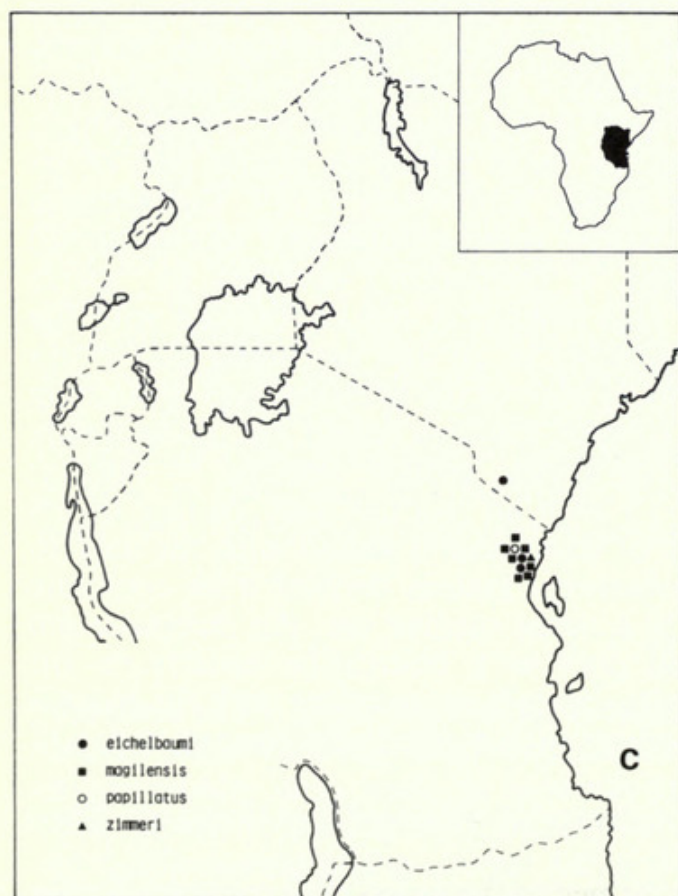
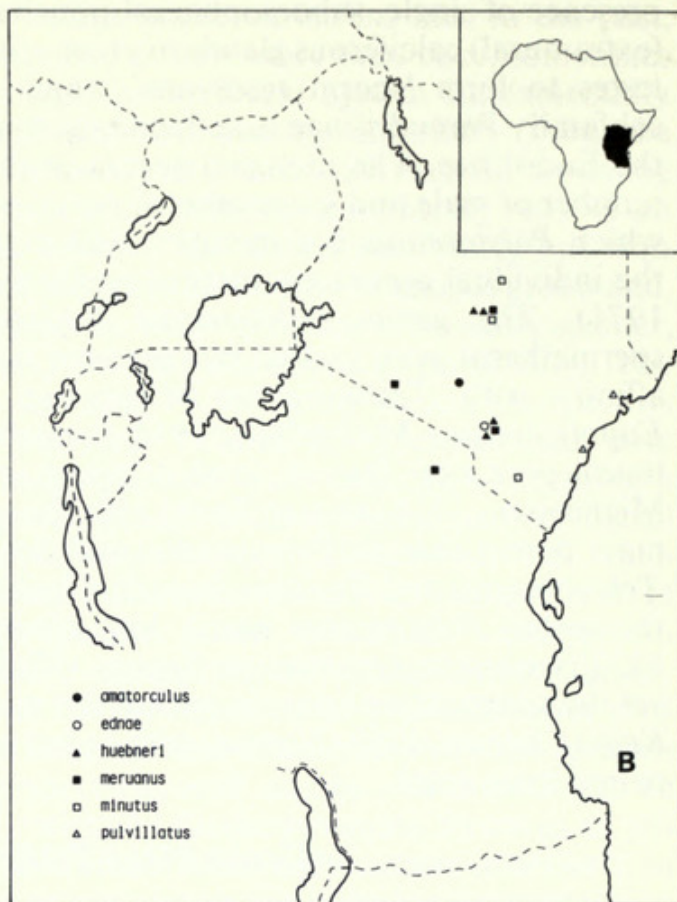
TYPE SPECIES. *Polytoreutus coeruleus* Michaelsen, 1890 by monotypy.

DIAGNOSIS. Metandric Eudrilinae with male pore single, penial setae absent, spermathecal pore single behind the male pore.

DESCRIPTION. Prostomium commonly prolobous, rarely pro-epilobous or tanylobous. Setae *ab* widely paired, setae *cd* closely paired. Dorsal pores absent. Nephridiopores midway between setal lines *c* and *d*, 0.5 body circumference apart. Clitellum commonly annular *xiii*, *xiv*–*xvii*, *xviii*. Secondary male pore (orifice to the male pouch containing the penis), single, midventral *xvii* or 17/18; penial setae absent. Female pores paired on hinder part of *xiv* between setal lines *c* and *d*. Spermathecal pore single, midventral 18/19. Oesophageal gizzard *v*; single sub-oesophageal sacs *ix*, *x*, *xi*; paired supra-oesophageal (dorso-lateral) stalked calciferous glands *xiii*. Testes single pair *xi* (metandric) enclosed by 'sperm reservoirs' formed from the anterior ends of the vasa deferentia and continuous with the seminal vesicles; seminal vesicles single pair originating in *xii* and extending posteriorly usually as slender ducts before dilating near the hinder ends of the prostates and continuing for several segments as expanded sacs. Prostates tubular. Ovaries paired *xiii*, occasionally displaced into *xiv*; rosette-shaped with several egg-strings, usually invested by ovisacs; ovisacs infrequently dependent from septum 12/13 with an ovarian duct leading to the antero-lateral regions of the spermathecal system or (commonly) united with the antero-lateral regions of the spermathecal system. Spermathecal system derived from coelomic tissues, morphology highly variable but essentially a single median sac, the receptaculum seminis, leading forwards from the spermathecal pore to a bifurcation usually in *xiii* (sometimes more posteriorly) with the furcae passing laterally to combine with the ovisacs (or ovarian ducts) to form paired fertilization chambers with oviducts discharging onto *xiv*. Holonephridial.

Note 1. The name *male pouch* is preferred for the muscular structure containing the penis and sometimes termed the 'bursa propulsoria'.

Note 2. The paired, highly specialized structures formed at the union of the anterior furcae



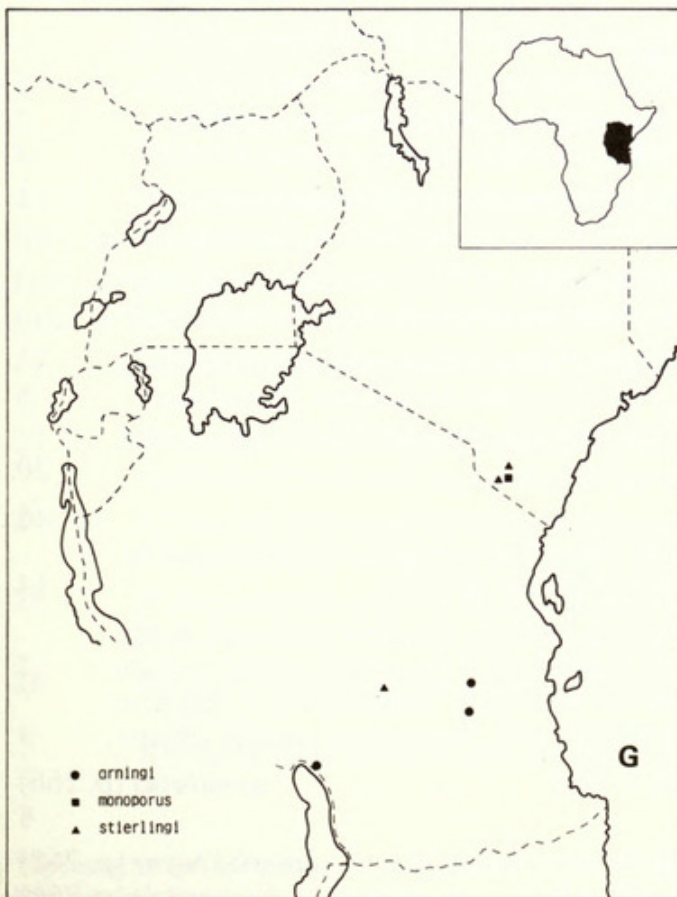
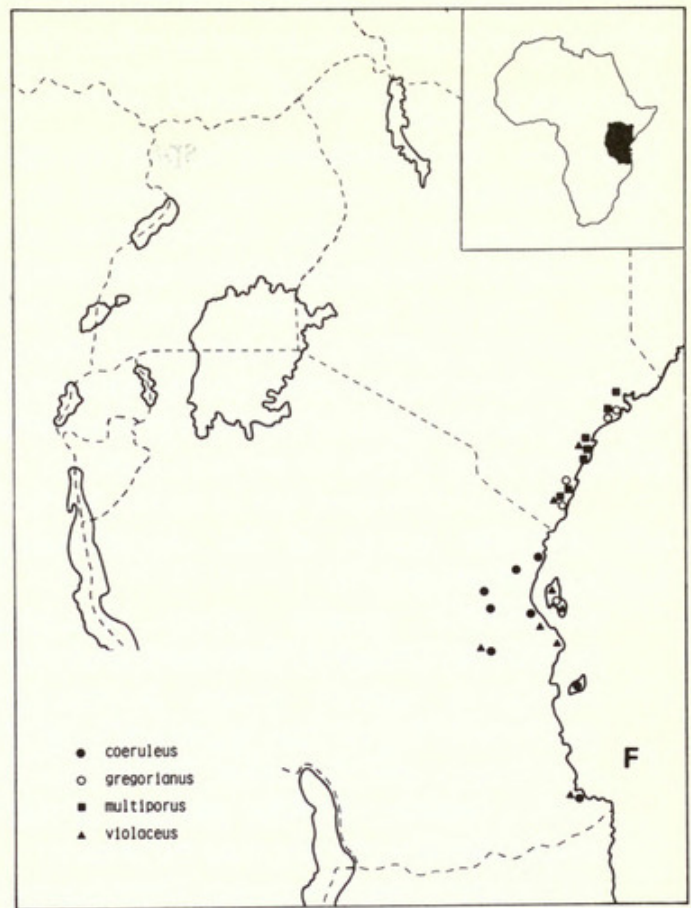
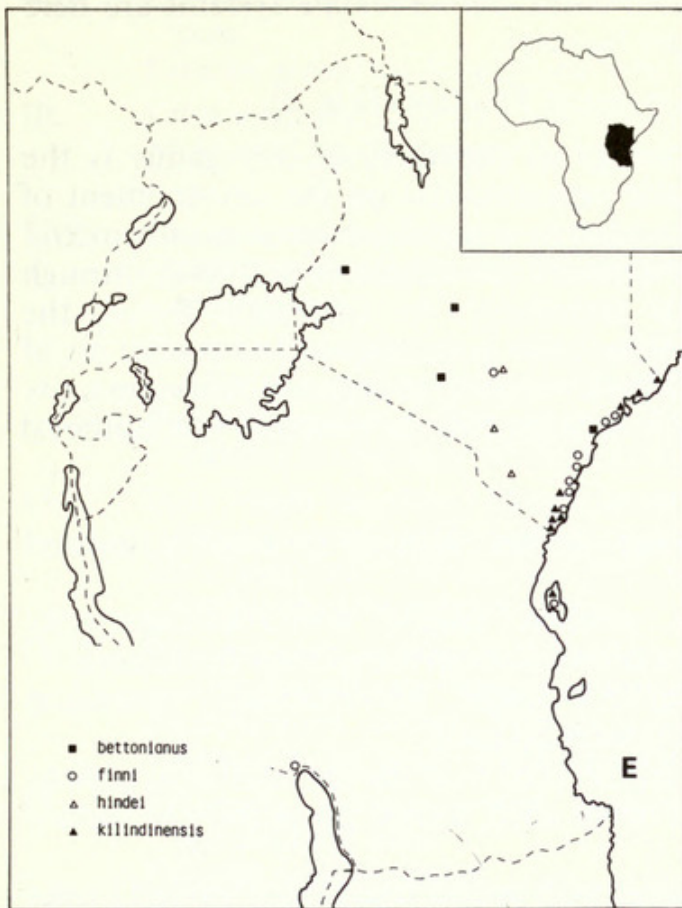


Fig. 2 Distributions of species of the genus *Polytozeut*. Collecting localities: (A) *kenyaensis* species group; (B) *meruanus* species group; (C) *magilensis* species group; (D) *kirimaensis* species group; (E) *kilindinensis* species group; (F) *coeruleus* species group; (G) *arningi* species group.

of the single spermathecal system with the oviducts of the paired female systems are here termed *fertilization chambers* to reflect their primary function.

DISTRIBUTION. Uganda, Rwanda, eastern Zaire, Kenya and Tanzania (Fig. 2).

REMARKS. An outstanding aspect of the morphology of members of this genus is the reduction in the constraints imposed by metameric segmentation on the development of the reproductive systems. Although the testes are located in *xi* and the ovaries usually in *xiii*, the seminal vesicles, prostates and spermathecal systems are extensive and pass through many segments (in some species, perhaps 30 segments). As discussed above, the spermathecal systems are diverse yet the specializations can be categorized to permit six of the seven species groups to be recognized (Fig. 1). (The *arningi* species group, taxonomically the least satisfying of the species groups recognized, is separated on the male and spermathecal pores opening within a common orifice.)

(a) Anterior furcae of the receptaculum seminis slender leading to distally located fertilization chambers.

kenyaensis species group. Receptaculum seminis single, adiverticulate, only occasionally slightly pouched posteriorly (to *xx* or *xxi*) behind the spermathecal pore.

meruanus species group. Receptaculum seminis single, adiverticulate, extending posteriorly for several segments behind the spermathecal pore.

magilensis species group. Receptaculum seminis divided near the spermathecal pore to form a foramen for the passage of the ventral nerve cord, united posteriorly to form a single sac; diverticula may be present.

kirimaensis species group. Receptaculum seminis with paired lateral sacs formed by the distal coalescence of diverticula.

(b) Anterior furcae of the receptaculum seminis with basal (proximal) ducts leading to the fertilization chambers.

kilindinensis species group. Receptaculum seminis adiverticulate.

coeruleus species group. Receptaculum seminis diverticulate.

Key to the adults of species of the genus *Polytoreutus*

| | | |
|------|---|------------------------------|
| 1 | Male and spermathecal pores open into a common orifice (<i>arningi</i> species group) | 2 |
| – | Male pore <i>xvii</i> or 17/18, spermathecal pore 18/19 | 4 |
| 2 | A pair of accessory pouches present internally posterolaterally to the male pouch | 3 |
| – | Accessory pouches absent | <i>monoporus</i> (p. 296) |
| 3 | Receptaculum seminis short (<i>xiii–xix</i>), male pouch large | <i>arningi</i> (p. 295) |
| – | Receptaculum seminis long (<i>xiii–xxii</i> or longer), male pouch small | <i>stierlingi</i> (p. 296) |
| 4(1) | Anterior furcae of the receptaculum seminis usually slender, often convoluted, leading distally to the fertilization chambers | 5 |
| – | Anterior furcae of the receptaculum seminis often massive, proximal ducts lead to the fertilization chambers | 20 |
| 5 | Receptaculum seminis simple, adiverticulate | 6 |
| – | Receptaculum seminis complex, forming a ring near the spermathecal pore and/or diverticulate at least posteriorly, diverticula may coalesce distally | 14 |
| 6 | External median ventral seminal groove present behind the spermathecal pore, internally receptaculum seminis not extending behind <i>xxi</i> (<i>keynaensis</i> species group) | 7 |
| – | External median ventral seminal groove absent, internally receptaculum seminis extending several segments behind the spermathecal pore (<i>meruanus</i> species group) | 9 |
| 7 | Seminal groove interrupted by a pad-like papilla in <i>xxii</i> | <i>annulatus</i> (p. 266) |
| – | Seminal groove without papilla | 8 |
| 8 | Prostates with subterminal ectal cornu receiving the vasa deferentia | <i>montiskenyae</i> (p. 268) |
| – | Prostates simple ectally | <i>kenyaensis</i> (p. 266) |

| | | |
|--------|--|-------------------------------|
| 9(6) | External genital markings (papillae or pad) present ventrally behind the spermathecal pore | 10 |
| – | External genital markings absent from behind the spermathecal pore | 11 |
| 10 | Large single pad <i>xxiii–xxvi</i> between setal lines <i>bb</i> | <i>pulvillatus</i> (p. 274) |
| – | Midventral papilla present in two or three furrows (20/21, 21/22 and often 22/23) | <i>meruanus</i> (p. 272) |
| 11(9) | Prostates simple ectally | <i>minutus*</i> (p. 273) |
| – | Prostates with either a low anterolateral process or a long anterior cornu receiving the vas deferens | 12 |
| 12 | Prostates ectally with a small papilliform process receiving a vas deferens (vasa deferentia lying over the dorsolateral surfaces of a large male pouch) | <i>amatorculus</i> (p. 270) |
| – | Prostates with a distinct anterior cornu receiving the vas deferens (when relaxed, together the two prostates form an 'H') | 13 |
| 13 | Body length less than 150 mm (posterior, glandular region of the prostate less than twice the length of the anterior cornu) | <i>ednae</i> (p. 271) |
| – | Body length over 150 mm (posterior, glandular region of the prostates about five times the length of the anterior cornu) | <i>huebneri</i> (p. 272) |
| 14(5) | Receptaculum seminis with median posterior sac, divided to form a ring near the spermathecal pore (<i>magilensis</i> species group) | 15 |
| – | Receptaculum seminis without median posterior sac but with paired lateral sacs formed by the distal coalescence of diverticula (<i>kirimaensis</i> species group) | 18 |
| 15 | Externally median ventral papillae present on several segments behind the spermathecal pore | <i>papillatus</i> (p. 277) |
| – | External papillae absent | 16 |
| 16 | Receptaculum seminis with a single pair of diverticula in <i>xix</i> , (one side may fail to develop) | <i>magilensis</i> (p. 277) |
| – | Receptaculum seminis adiverticulate | 17 |
| 17 | Prostates with a subterminal ectal cornu receiving the vas deferens | <i>zimmeri</i> (p. 278) |
| – | Prostates simple ectally | <i>eichelbaumi</i> (p. 276) |
| 18(14) | External median ventral seminal groove present behind the spermathecal pore | <i>usambariensis</i> (p. 281) |
| – | External median ventral seminal groove absent | 19 |
| 19 | A pair of accessory pouches associated with the male pouch, prostates often almond-shaped | <i>kirimaensis</i> (p. 280) |
| – | Paired accessory pouches absent, prostates always tubular | <i>usindjaensis</i> (p. 282) |
| 20(4) | Receptaculum seminis adiverticulate (<i>kilindinensis</i> species group) | 21 |
| – | Receptaculum seminis diverticulate (<i>coeruleus</i> species group) | 24 |
| 21 | Anterior bifurcation of the receptaculum seminis <i>xiv–xvi</i> | <i>bettonianus</i> (p. 284) |
| – | Anterior bifurcation of the receptaculum seminis <i>xiii</i> | 22 |
| 22 | Male pouch with single anterior accessory pouch | <i>hindei</i> (p. 286) |
| – | Male pouch lacking accessory pouch | 23 |
| 23 | Secondary male and spermathecal pores small (male pouch small) | <i>kilindinensis</i> (p. 286) |
| – | Secondary male and spermathecal pores large (male pouch large) | <i>finni</i> (p. 285) |
| 24(20) | Receptaculum seminis with a single pair of diverticula (<i>xix</i>) | <i>gregorianus</i> (p. 291) |
| – | Receptaculum seminis with several pairs of diverticula | 25 |
| 25 | Receptaculum seminis short with the last pair of diverticula in <i>xix</i> | <i>coeruleus</i> (p. 288) |
| – | Receptaculum seminis long extending several segments behind the spermathecal pore | 26 |
| 26 | Receptaculum seminis extends <i>xiii–xxiv</i> , <i>xxv</i> or <i>xxvi</i> , diverticulate only behind (?) <i>xviii</i> or <i>xix</i> | <i>multiaporus</i> (p. 292) |
| – | Receptaculum seminis extends <i>xiii–xxi</i> , <i>xxii</i> or <i>xxiii</i> , diverticulate throughout | <i>violaceus</i> (p. 292) |

*Specimens of *eichelbaumi* (*magilensis* species group) will key out as *minutus* when the foramen of the receptaculum seminis is reduced and overlooked (See *Remarks* p. 276).

Polytoreutus kenyaensis species group

(Figs 3, 4 & 5)

DIAGNOSIS. Male and spermathecal pores separate. Receptaculum seminis adiverticulate, rarely distended slightly behind the spermathecal pore; anterior furcae slender, fertilization chambers distal (terminal). Externally a median ventral, longitudinal seminal groove present extending posteriorly from the spermathecal pore.

DISTINGUISHING CHARACTERS. The species group comprises three sympatric species: *kenyaensis* Beddard, 1902; *montiskenyae* Beddard, 1902 and *annulatus* Michaelsen, 1912. They are readily separable externally on the characters of the secondary male pore and the genital field also internally on the morphology of the ectal ends of the prostates.

kenyaensis. The perigenital ridge bordering the seminal groove and genital field is separate from and continues anteriorly around a large secondary male pore bounded by fleshy lips; ectal ends of the prostates simple, vasa deferentia received subterminally.

montiskenyae. The right and left elements of the perigenital ridge bordering the seminal groove, arise anteriorly from the conical porophore bearing a small secondary male pore; ectal end of each prostate with a small lateral cornu receiving the vas deferens (in relaxed specimens, the ectal ends of the prostates are 'Y'-shaped).

annulatus. The right and left elements of the perigenital ridge bordering the seminal groove arise anteriorly from the conical porophore bearing a small secondary male pore (as in *montiskenyae*); seminal groove interrupted in *xxii* by a pad-like papilla joining the right and left elements of the perigenital ridge; ectal end of each prostate with a small lateral bulbous process receiving a vas deferens.

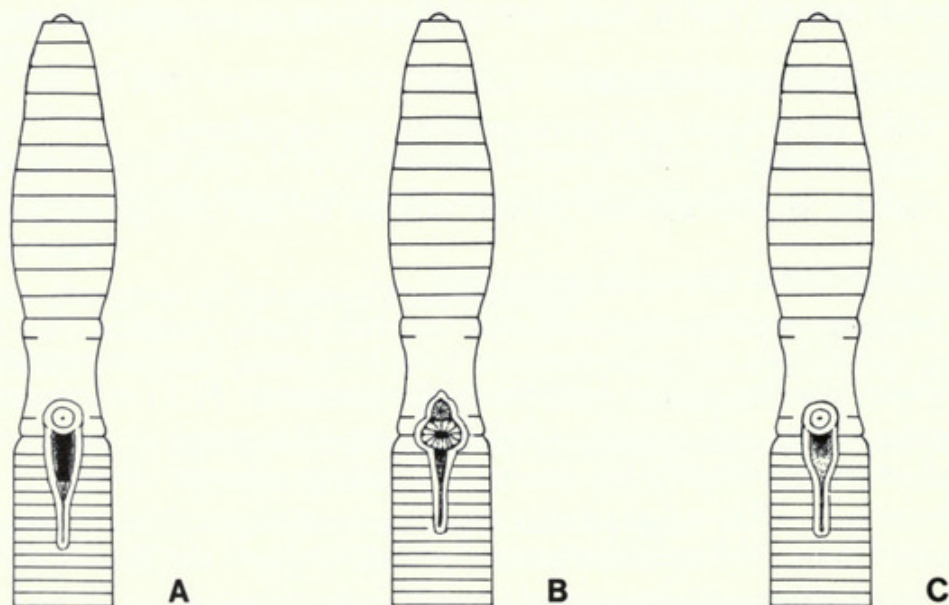


Fig. 3 *Polytoreutus kenyaensis* species group. Genital fields, (external ventral views, schematic): (A) *annulatus*; (B) *kenyaensis*; (C) *montiskenyae*.

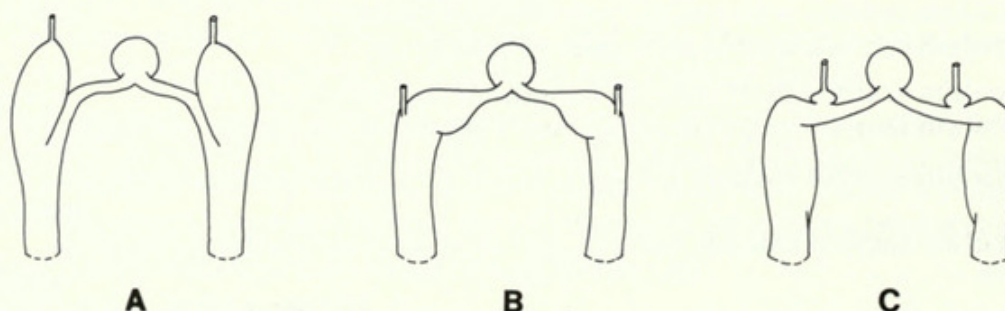


Fig. 4 *Polytoreutus kenyaensis* species group. Prostates, anterior regions (schematic dorsal views, not to scale): (A) *annulatus*; (B) *kenyaensis*; (C) *montiskenyae*.

VARIATION. Knowledge of *annulatus* is based on only two specimens and variation is unknown. However, two kinds of morphological variability, natural and artificial, can be observed in series of the other two species. Natural variation is seen in the considerable ranges in body size and segment numbers but more perplexing taxonomically is the significance of differences in the length of the seminal groove. In most series of both *kenyaensis* and *montiskenyae* the seminal groove terminates at about segment xxv, sometimes more anteriorly in xxiv or xxiii or posteriorly in xxvi to xxviii or xxix even xxx, i.e. it is nearly as long as the seminal groove in *usambariensis* (*coeruleus* species group). The length of the seminal groove in each sample is constant to within two segments but the variation in length between one sample and another, perhaps collected at the same altitude on the same mountain, can be much greater. As these variations cannot be correlated either geographically or altitudinally, they are not considered to be subspecifically significant while evidence is inadequate for believing that species swarms have evolved on each mountain in the region.

The second group of variations, here termed artificial, are the products of the various techniques employed to relax, kill, fix and preserve material. Several nominal species described by Michaelsen and now regarded as junior synonyms, were separated originally on the length and shape of the genital field, mostly the area between the spermathecal pore and the anterior end of the seminal groove. In contracted individuals, the genital field is broader but the perigenital ridges of the posterior part of the field become closely applied so apparently extending the seminal groove forwards. In addition, by the genital field contracting and causing the glandular area to become more concave externally, it produces a corresponding convexity of glandular tissue internally on the parietal wall. These encroachments, products of the preservation techniques employed, have been interpreted as being internal accessory glands and accorded taxonomic significance. The size (and apparent presence) of the male pouch is also affected by the degree of contraction or relaxation of preserved specimens. Preservation techniques can independently affect the size of the penis. In relaxed specimens the penis protrudes through the secondary male pore, if only slightly in *kenyaensis*. Whereas in contracted specimens, the male pouch needs to be dissected to observe the male intromittant organ which may be turgid and filling most of the pouch, slim or, exceptionally, very small and perhaps shrivelled as in Beddard's syntypes of *kenyaensis* and *montiskenyae*.

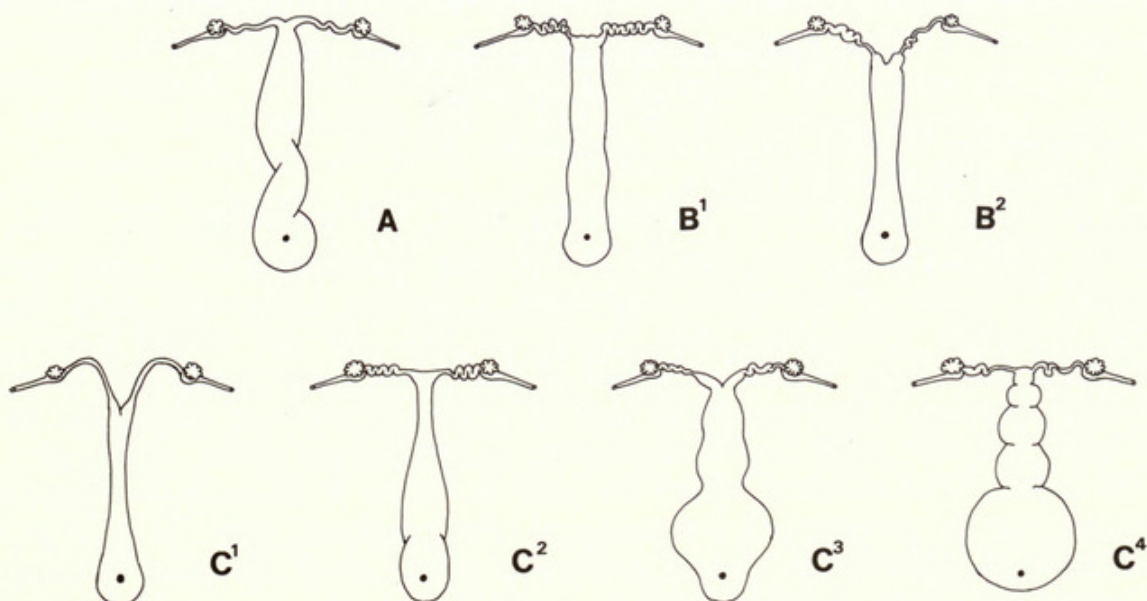


Fig. 5 *Polytozeutis kenyaensis* species group. Female and spermathecal systems (schematic dorsal views, not to scale): (A) *annulatus* (holotype); (B) *kenyaensis* (1. syn *sjoestedti* syntype, 2 *kenyaensis* syntype); (C) *montiskenyae* (1–3. *montiskenyae* syntypes, 4 syn. *alluaudi* holotype).

***Polytoreutus annulatus* Michaelsen, 1912**

(Figs 3A, 4A & 5A)

Polytoreutus annulatus Michaelsen, 1912: 3; Michaelsen, 1913: 5; Michaelsen, 1914: 122; Michaelsen, 1915: 38.

DESCRIPTION. *External characters.* Length 65, 66 mm, diameter 4 mm, segments 186, 191. Prostomium combined pro- and epilobous. Clitellum $\frac{1}{2}$ xiii–xvii, annular. Setae at xxx, aa : ab : bc : cd = 5 : 3 : 4 : 1. Secondary male pore small on a low porophore in 17/18 or displaced somewhat anteriorly, the pore is a small transverse slit (holotype) or rounded with the penis protruding (paratype). Spermathecal pore 18/19, small transverse slit. Genital field extends posteriorly from the porophore as a slender, deeply depressed glandular zone which narrows in xxii to form a longitudinal seminal groove terminating in xxvii–xxx. A perigenital ridge borders the genital field, the left and right elements arise anteriorly in the porophore and unite posteriorly in xxvii–xxx. Uniquely a midventral raised pad, or papilla, unites the two elements of the perigenital ridge in xxii. Female pores paired $\frac{3}{4}$ xiv at $\frac{1}{3}$ cd above setal line c.

Internal characters. Prostates tubular, extending back to lii, liii; they tend to be clavate with the ental diameter about twice the ectal diameter. The ectal end of each prostate is bifid, the vas deferens enters the lateral limb which is bulbous with a diameter similar to the adjacent main body of the prostate; the medial limb which passes to the male pouch, is more slender. Spermathecal system consists of a simple adiverticulate, longitudinal receptaculum seminis passing from the spermathecal pore to the anterior bifurcation in xiii where paired lateral ducts pass with few convolutions to terminally situated fertilization chambers. Receptaculum seminis slightly pouched posteriorly extending behind the spermathecal pore for one or two segments. The parietal wall is highly glandular internally to the area contained by the external ridge. It tends to invest the ventral nerve cord although the glandular area is interrupted in xxii corresponding to the external location of the pad-like papilla separating the genital field from the seminal groove.

TYPE LOCALITY. 'Boma' Meru, Mount Kenya*.

MATERIAL EXAMINED. *Previous record.* 2C Under a fallen tree trunk in woodland, near Meru, northeastern Mount Kenya (0° 03' N, 37° 39' E), +2000 m; Hamburg V. 6730 (dissected holotype of *annulatus*) and Stockholm 136 (undissected paratype of *annulatus*).

OTHER RECORD. 1C Clearing in bamboo forest, northeastern slope of Mount Kenya (0° 10' S, 37° 20' E), 2870 m (Michaelsen, 1914 & 1915).

DISTRIBUTION. Known only from the northeastern slopes of Mount Kenya (Fig. 2A).

***Polytoreutus kenyaensis* Beddard, 1902**

(Figs 3B, 4B & 5B)

Polytoreutus kenyaensis Beddard, 1902: 191; Michaelsen, 1912: 3.

Polytoreutus sjoestedi Michaelsen, 1907: 4.

Polytoreutus gracilis Michaelsen, 1907: 6; Michaelsen, 1914: 120; Michaelsen, 1915: 36.

DESCRIPTION. *External characters.* Length 75–190 mm, diameter 1.5–5.5 mm, segments 125 (regenerating), 135–256. Prostomium epilobous. Clitellum $\frac{1}{2}$ xiii– $\frac{1}{2}$ xviii, xviii, annular but incomplete ventrally xvii– $\frac{1}{2}$ xviii, xviii. Setae at xxx, aa : ab : bc : cd = 2.5 : 2 : 2.5 : 1. Secondary male pore large, posterior region of xvii (adults) surrounded by raised, swollen tissue, circular in relaxed specimens but seen as a transverse slit in contracted individuals; the pore leads into the male pouch containing a papilliform penis which may protrude through the orifice. (The extent to which the penis is visible depends on its degree of dilation and the extent that the male pouch is evaginated.) Spermathecal pore 18/19, large lateral slit with glandular lips, commonly holding a spermatophore. Both the male and spermathecal pores lie within the genital field bordered by a perigenital ridge. Genital field is an elongate hour-glass shape beginning 16/17 and drawn out posteriorly to extend backwards to about xxii whence a seminal groove continues to xxii–xviii. Behind the spermathecal pore, the

*Throughout this report Mount Kirinyaga is referred to by its widely known name of Mount Kenya.

genital field becomes highly glandular and concave, especially midventrally at 19/20 where often superficially it forms a pore-like depression. Female pores paired $\frac{3}{4}$ xiv in setal line *c*.

Internal characters. Prostates tubular, extending back to about xxv–xvii, simple ectally where they receive the vasa deferentia; they enter into the posterolateral surfaces of the male pouch. The size of the male pouch depends on the degree of contraction of specimen, large (penis retracted and not seen externally) or small (penis protruding externally). Spermathecal system comprises a single adiverticulate receptaculum seminis passing from the spermathecal pore to the anterior bifurcation in xiii where the lateral furcae extend with few convolutions to paired distal (terminal) fertilization chambers. The receptaculum seminis may be regular and slender or irregularly dilated and massive in size according to the volume of received sperm within; when massive it seldom pouches posteriorly behind the spermathecal pore and then only slightly. In contracted specimens the parietal wall internally to the genital field may be raised appearing superficially as if an accessory gland.

TYPE LOCALITY. Mount Kenya (1300–1600 m), Kenya.

MATERIAL EXAMINED. *Previous records.* 6C 22A ?Mount Kenya ('Kenya District') (0° 10' S, 37° 20' E) 1200–1400 m ('4000–4800 ft'); BM(NH) 1902.11.26, 6–15, 1902.11.26.19–20 & 1904.10.5.1003–1004 (syntypes of *kenyaensis*). 1C Under decaying leaf mould, tropical rain forest, on the western slope of Kilimanjaro, above Kibonoto station, Tanzania (3° 04' S, 37° 22' E), 2000 m; Hamburg V. 6955 (holotype of *gracilis*). 3C 4A Mountain grassland, Mount Kilimanjaro, Kiboscho, Tanzania (3° 04' S, 37° 22' E), 3000–3800 m; Hamburg V. 6954 & Stockholm 135 (syntypes of *sjostedti*).

New Records. Kenya (Coll. E. Oxtoby): 2C 4A Leaf mould, garden, Kenyatta College, Thika road, 12 miles outside Nairobi (1° 17' S, 36° 49' E), 1500–2500 m, Nov. 1973; BM(NH) 1981.6.876–881. 74C 68A Mbooni, Machakos District (1° 40' S, 37° 28' E), 1000–1500 m, Nov. 1974 & Sept. 1974; BM(NH) 1981.6.892–973 & 1981.6.975–1033. 16C 1A Cultivation, plant nursery, Kenyatta College, Nairobi (1° 13' S, 36° 55' E), 1500–2000 m, Oct. 1974; BM(NH) 1981.6.1034–1045. 1C Forest fishing post near side of road between Gatanga (0° 56' S, 36° 58' E) and Thika (1° 03' S, 37° 05' E), 1000–2000 m, 24 Nov. 1974; BM(NH) 1981.6.974. 3C 6A Leaf litter under eucalyptus trees, Kamiti Forest road, Ruiru, 35 km north of Nairobi (1° 09' S, 36° 53' E), 1500–2000 m, 22 Jul. 1974; BM(NH) 1981.6.1050–1093. 4C 'Black Cotton' soil, Sukari ranch, opposite Kenyatta College, Nairobi (1° 17' S, 36° 49' E), 1500–2500 m, May 1974; BM(NH) 1981.6.888–891. 4C Roots of giant lobelia, grassland, Aberdare Mountains (0° 25' S, 36° 38' E), 3000 m ('10 000 ft') June 1971; BM(NH) 1981.6.798–801. 3C Garden soil, Thogoto Teacher Training College, Kikuyu, Nairobi (1° 15' S, 36° S, 36° 40' E), 2000–3000 m, 14 July 1974; BM(NH) 1981.6.885–887. 3C Sirimon Track, Mount Kenya (0° 03' 17' E) 3000–4000 m 19 Nov. 1974; BM(NH) 1981.6.882–884. 45A Aberdare Mountains (0° 25' S, 36° 38' E), 3000 m, 18 Nov. 1974; BM(NH) 1981.6.811–856. 2C Among arrowroot cultivation near swamp, Machakos Club (1° 31' S, 37° 16' E), 1500–2000 m, Jul. 1971; BM(NH) 1981.6.874–875. 9A Oxtoby's homestead, Kimande, Muranga District (0° 49' S, 36° 48' E), 2800 m ('7500 ft'), Nov. 1976; BM(NH) 1981.6.802–810. 1C 3A Grassland, Mwea (0° 45', 37° 29' E), 1500 m, 7 Mar. 1978; BM(NH) 1981.6.1046–1049. 6A Forest above Oxtoby's homestead Kimande, Muranga District (0° 49' S, 36° 48' E), 2800 m ('7500 ft'), Dec. 1976; BM(NH) 1981.6.779–784. 14 C 12A Beneath leaf litter near soil surface, very wet conditions, Kenya National Museum grounds, Nairobi (1° 17' S, 36° 50' E), 1500–2500 m, 4 May 1977; BM(NH) 1981.6.1094–1119. 6C 7A Roots of giant lobelias and forest loam, Aberdare Mountains, National Park (0° 25' S, 36° 38' S), 3000 m ('10 000 ft'), Jun. 1972; BM(NH) 1981.6.785–797.

(Coll. I Jabbal, University College, Nairobi): 2C 1A Kazita, western slopes of Mount Kenya (0° 25' S, 37° 05' E), 4150 m ('12 500 ft'); BM(NH) 1967.4.219–226.

OTHER RECORDS. Eastern slopes, Mount Kenya (0° 10' S, 37° 20' E), +2000 m; (Michaelsen, 1912). In an area of large *Senecio*, Mount Kenya (0° 10' S, 37° 20' E), 4000 m; (Michaelsen, 1914 : 120; 1915 : 36).

DISTRIBUTION. Kenya and Tanzania (Mount Kilimanjaro), above 1500 m (Fig. 2A).

Polytoreutus montiskenyae Beddard, 1902
(Figs 3C, 4C & 5C)

Polytoreutus montiskenyae Beddard, 1902 : 194.

Polytoreutus montiskenyae jeanneli Michaelsen, 1914 : 120; Michaelsen, 1915 : 37.

Polytoreutus alluaudi Michaelsen, 1914 : 122; Michaelsen, 1915 : 39.

DESCRIPTION. *External characters.* Length (immature 59 mm) 170–235 mm, diameter 3.0–5.5 mm, segments 109–235. Prostomium epilobous, infrequently tanylobous. Clitellum $\frac{1}{2}$ xiii–xvii, annular. Setae at xxx, $aa : ab : bc : cd = 4.5 : 3 : 4 : 1$. Secondary male pore small on a low porophore 17/18 from which the penis or only the tip, may protrude. Spermathecal pore 18/19, small to moderate in size (sometimes containing a spermatophore). Genital field extends posteriorly from the male porophore as a scutate to lanceolate depressed glandular zone that narrows posteriorly to form a median, longitudinal seminal groove terminating xxiii–xxx; the field is bounded laterally by a perigenital ridge with its right and left elements terminating anteriorly in the porophore. Female pores $\frac{1}{2}$ xiv at $\frac{1}{2}$ cd above setal line c.

Internal characters. Prostates tubular extending back to the region of xxv–xxvii. Each has a subterminal ectal cornuate process receiving the vas deferens of its side, in contracted specimens the cornu are located at the flexure of the glands whereas in relaxed specimens the ectal end of each gland appears to be Y-shaped. The prostates enter into the male pouch posterolaterally, in contracted specimens (penis not seen externally) the male pouch forms only a slight swelling internally. Spermathecal system comprises a simple, adiverticulate receptaculum seminis passing from the spermathecal pore to the anterior bifurcation in xiii where the furcae pass laterally with few convolutions to terminally situated fertilization chambers. The receptaculum seminis may be regular and slender or have irregular swellings and be massive depending on the volume of received sperm; when massive it seldom pouches posteriorly behind the spermathecal pore and then only slightly. In contracted specimens, the parietal wall internal to the genital field may be raised as if forming an accessory gland.

TYPE LOCALITY. Mount Kenya (1300–1600 m), Kenya.

MATERIAL EXAMINED. *Previous records.* Kenya: 20C 30A ?Mount Kenya ('Kenya District') 0° 10' S, 37° 20' E, 1200–1400, ('4000–4800 ft'); BM(NH) 1902.11.12.1–5 & 1902.11.16–18 (syntypes of *montiskenyae*). 2C Foot of northern slopes ('lowland forest to the west' [Michaelsen, 1915 : 39]), Mount Kenya (0° 10' S, 37° 20' E), 2400 m; Hamburg V. 8351 (holotype of *alluaudi*). Fragment of 1C Upper limit of grasslands near *Senecio*, Mount Kenya (0° 10' S, 37° 20' E), 4000 m; Hamburg V. 8347 (fragment of holotype of *montiskenyae* var. *jeanneli*).

New records. Kenya (Coll. Oxtoby): 7C 8A Forest, mainly podocarps, Meru, Mount Kenya (0° 05' N, 37° 37' E), 1500–2000 m; BM(NH) 1981.6.1324–1340. 13C 9A Near river, Castle Forest Station, Kirinyaga District, north of Nairobi (0° 23' S, 37° 18' E), 2250 m ('6800 ft'), 30 Jan. 1974; BM(NH) 1981.6.1211–1232. 1C Roadside forest between Thika (1° 03' S, 37° 05' E) and Ilkinangop (0° 38' S, 36° 42' E), 2000 m ('6000 ft'), 23 Jul. 1974; BM(NH) 1981.6.1348. 3C 4A Forest, Nyambeni ('Nyambera') Hill, near Meru, (0° 15' N, 37° 55' E), 1000–2000 m, 15 Jun. 1974; BM(NH) 1981.6.1341–1347. 9C 11A Forest, Kionyo, Nkubu, Meru (0° 07' S, 37° 35' E), 1000–2000 m, 14.8.1974; BM(NH) 1981.6.1304–1323. 13C 1A Forest, Kikuyu escarpment, near Nairobi (0° 55' S, 36° 40' E), 2000–3000 m, Mar. 1972; BM(NH) 1981.6.1281–1294. 20C 13A Sirimon Track, Mount Kenya (0° 03' S, 37° 17' E), 3500 m & 4000 m, 19 Nov. 1974; BM(NH) 1981.6.1233–1266. 4C 5A Aberdare Mountains (0° 25' S, 36° 38' E), 3000 m, 18 Nov. 1974; BM(NH) 1981.6.1267–1271 & 1981.6.1273–1276. 9A Karuruma, Aberdare Mountains (0° 41' S, 36° 50' E), 2000 m, 12 Dec. 1974; BM(NH) 1981.6.1295–1299 & 1981.6.1300–1303. 4A Among grass roots, Oxtoby's homestead, Kimandi, Muranga District (0° 49' S, 36° 48' E), 2800 m ('7500 ft'), Nov. 1976; BM(NH) 1981.6.1277–1280. 1A Bushwackers camp, 20 km northeast of Kibwezi (2° 25' S, 38° 0' E) 500–1000 m, Apr. 1977; BM(NH) 1981.6.1272.

Other new records. 1C Mount Kenya ($0^{\circ} 10' S$, $37^{\circ} 20' E$), +2000 m; USNM 24587. 1A ?Mambu ('Nambu') Region, Eastern Kenya ($2^{\circ} 55' S$, $38^{\circ} 11' E$), 1500 m; Stockholm 279. 3C 5A Kazita, west of valley of Mount Kenya, 4150–4500 m ('12 500–13 500 ft'), Coll. I Jabbal; BM(NH) 1967.4.216–218.

DISTRIBUTION. Kenya, usually above 1500 m (Fig. 2A).

Polytoreutus meruanus species-group
(Figs 6 & 7)

DIAGNOSIS. Male and spermathecal pores separate. Receptaculum seminis single, adiverticulate, extending for several segments behind the spermathecal pore; anterior furcae

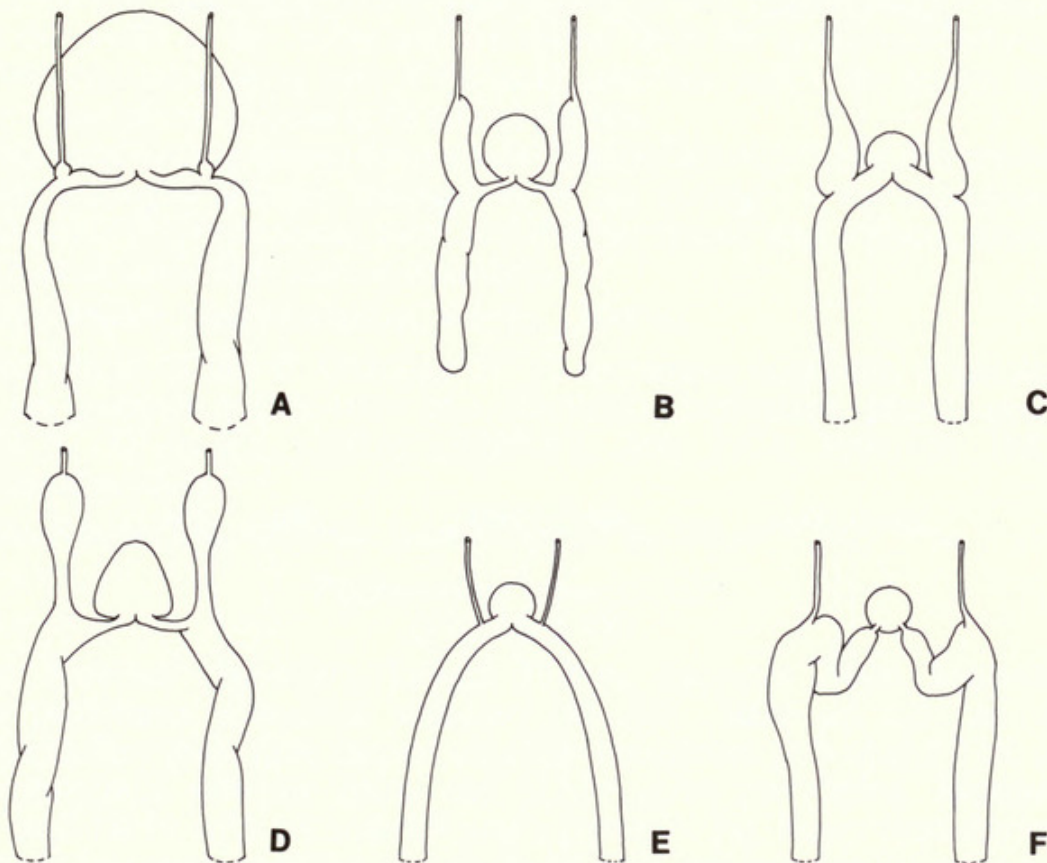


Fig. 6 *Polytoreutus meruanus* species group. Prostates, anterior regions (schematic dorsal views, not to scale): (A) *amatorculus*; (B) *ednae*; (C) *huebneri*; (D) *meruanus*; (E) *minutus*; (F) *pulvillatus*.

slender or truncate with short ducts or absent when replaced by short ducts leading to distally situated (terminal) fertilization chambers. (External median ventral, longitudinal seminal groove absent.)

DISTINGUISHING CHARACTERS. The species-group is formed from six species: *meruanus* Michaelsen, 1907; *minutus* Michaelsen, 1912; *huebneri* Michaelsen, 1913; *amatorculus* sp. nov.; *ednae* sp. nov. and *pulvillatus* sp. nov. They may be separated on the following characters:

pulvillatus. Externally a genital pad present xxiii–xxvi between setal lines *bb*; prostates simple ectally, receiving the vasa deferentia subterminally (ectally often 'S'-shaped with the vasa deferentia entering at the penultimate flexures); anterior furcae of the receptaculum seminis seen as short ducts.

meruanus. Externally single, median porophores present in 20/21, 21/22 and often 22/23; prostates ectally each with a long anterior cornu receiving the vas deferens of its side (together the prostates form an 'H'); anterior furcae of the receptaculum seminis truncate with short ducts.

minutus. Prostates ectally simple with the vasa deferentia joining terminally; anterior

furcae of the receptaculum seminis truncate with short ducts. (Perhaps the smallest species in the genus.)

amatorculus. Externally with a large secondary male pore (possibly with a midventral papilla on the anterior margin); prostates each flexed ectally with a small antero-lateral papilliform process receiving a vas deferens; male bursa large with the vasa deferentia lying over its dorso-lateral surfaces; anterior furcae of the receptaculum seminis tapering gradually, with convolutions, into the fertilization chambers.

huebneri. Prostates long, each with a long anterior cornu receiving a vas deferens (together the prostates form an 'H'), the cornu being less than one quarter of the length of the prostate;

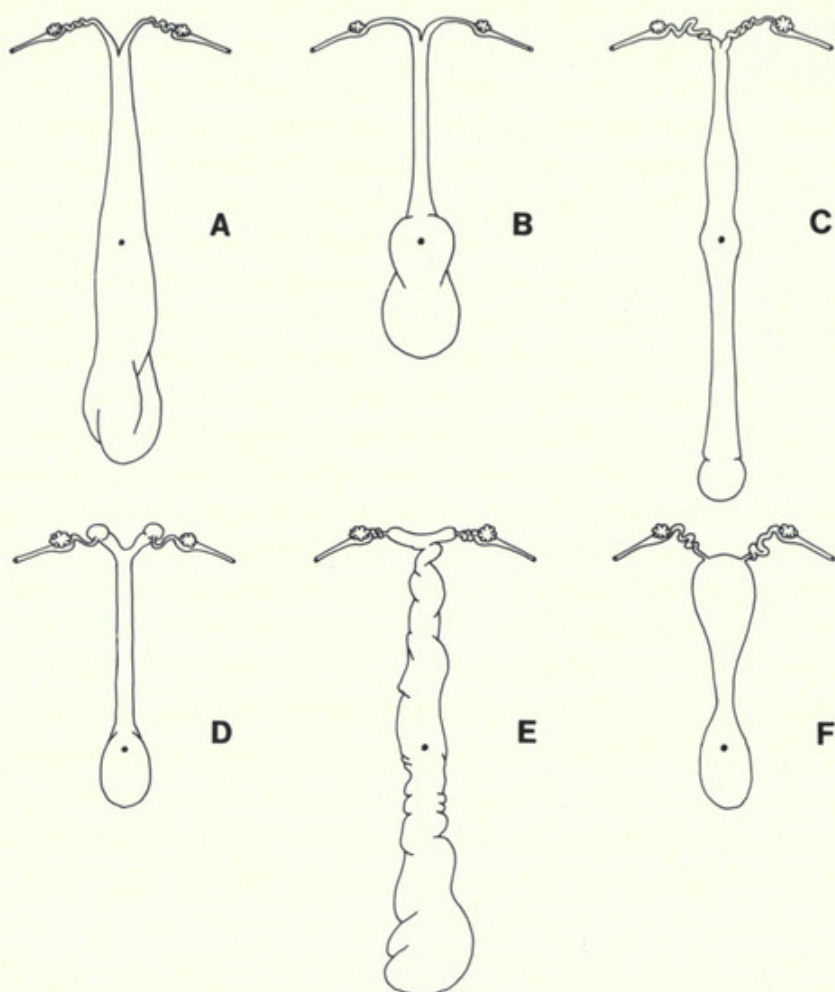


Fig. 7 *Polyoreutus meruanus* species group. Female and spermathecal systems (schematic dorsal views, not to scale): (A) *amatorculus* (syntype); (B) *ednae* (syntype); (C) *huebneri* (new record); (D) *meruanus* (syntype); (E) *minutus* (holotype); (F) *pulvillatus* (syntype).

anterior furcae of the receptaculum seminis slender, tapering gradually. (One of the largest species in the genus.)

ednae. Prostates short, each with a long anterior cornu receiving a vas deferens (together the prostates form an 'H'), the cornu being nearly the same length as the prostates; anterior furcae of the receptaculum seminis slender, tapering gradually.

***Polyoreutus amatorculus* sp. nov.**

(Figs 6A & 7A)

DESCRIPTION. *External characters*. Length 112, 142 mm, diameter 4, 5 mm, segments 153, 211 (2 adults), (1 juvenile: length 55 mm, diameter 2 mm, segments 89). Prostomium prolobous. Clitellum annular $xiii-\frac{1}{2}xviii$. Setae at xxx , $aa:ab:bc:cd = 4:2:6:1$. Secondary male pore large $17/18$, in relaxed specimens $\frac{1}{2}xvii-\frac{1}{2}xviii$, laterally with the body wall swollen between setal lines bb and glandular between setal lines aa ; in the fully developed specimen (the largest), there is a low, domed pad midventrally on the anterior lip

of the male orifice. (Within the secondary male pore paired pads are present on either side of a penis in the anterior wall and paired pads in the lateral and the posterior walls.) Spermathecal pore small but conspicuous due to the ventral surface of *xix* being raised and curving around the posterior margin of the pore. Apart from the domed pad anterior to the secondary male pore, genital papillae and markings absent. Female pores paired $\frac{3}{4}$ *xiv* slightly above $\frac{1}{2}$ *cd*.

Internal characters. Prostates tubular passing back to about *xxx*, slightly constricted intersegmentally; anteriorly they flex medially along the posterior wall of a large male pouch and held by mesenteries, they unite medially and enter the male pouch. A small papilliform process is present on the antero-lateral surface of the flexure of each prostate and receives the vas deferens of its side. The male pouch is large (in dissected, displayed specimens it occupies one-third of the width of the body) and triangular with the apex anteriorly and the ectal ends of the prostates lying along part of the basal, posterior wall of the pouch, the width is so great that the vasa deferentia lie over its lateral regions.

The spermathecal system comprises a single, median adiverticulate receptaculum seminis which extends from the anterior bifurcation in *xiii* (?*xiv*) to a few segments behind the spermathecal pore (18/19) to about *xxiii*; the anterior furcae lead without modification into terminally situated, distal fertilization chambers.

TYPE LOCALITY. Masra, near Machakos, Kenya, 1500 m.

MATERIAL EXAMINED. (Coll. E. Oxtoby): 5C (2 specimens complete, 3 specimens broken posteriorly) 1A (juvenile with a trace of a clitellum) Cultivation, Masra, near Machakos, Kenya (1° 31' S, 37° 16' E), 1500 m ('4500 ft'), July 1971; BM(NH) 1981.6.427–433 (syntypes of *amatorculus*).

DISTRIBUTION. Known only from the type locality (Fig. 2B).

***Polytoreutus ednae* sp. nov.**
(Figs 6B & 7B)

DESCRIPTION. *External characters.* Length 75 mm, diameter 2 mm, segments 165–295. Prostomium prolobous. Clitellum annular *xiii*–*xviii*. Setae at *xxx*, *aa* : *ab* : *bc* : *cd* = 6 : 3 : 4 : 1. Secondary male pore carried on a low porophore $\frac{3}{4}$ *xvii* near 17/18, circular with tumid lips sometimes with the distal end of the penis protruding. Spermathecal pore transversely oval 18/19 with an anterior and a posterior lip, larger than the male pore. A raised glandular area surrounds the spermathecal pore and extends forwards across *xviii* to the male porophore. Genital markings absent. Female pores $\frac{1}{2}$ *xiv* in setal line *d*.

Internal characters. Prostates tubular, short, reaching back only to *xxi*–*xxiii*, each with an anterior cornu extending forward to near 15/16 to receive the vas deferens of its side; together the prostates and the cornu form an 'H' with the transverse horizontal limb passing into the posterior surface of a large male pouch lying between 15/16– $\frac{3}{4}$ *xviii*; each cornu is approximately half to one-third of the total length of the prostate. The spermathecal system comprises a single, adiverticulate receptaculum seminis passing back from the anterior bifurcation to the spermathecal pore where it dilates to form a blind sac extending posteriorly to *xxi* or *xxii*; anterior furcae with distal (terminal) fertilization chambers. Each chamber is attached entally by connective tissue to septum 12/13 and has a short, coiled ovarian duct leading forwards into an ovarian capsule containing the ovary. The ovary is rosette-shaped with several egg strings.

TYPE LOCALITY. Bushwackers, 20 km northeast of Kibwesi, Kamba, Kenya, 600 m.

MATERIAL EXAMINED. (Coll. E. Oxtoby): 9C 2A Bushwackers camp, 20 km northeast of Kibwesi, Kenya (2° 25' S, 38° 00' E), 500 m, Apr. & Nov. 1977; BM(NH) 1981.6.440–447 & 1981.6.448–450 (syntypes of *ednae*).

DISTRIBUTION. Known only from the type locality (Fig. 2B).

REMARKS. Named in memory of the late Miss Edna Oxtoby who by collecting this series and many other earthworms in eastern Africa, stimulated research leading to the present revision.

***Polytoreutus huebneri* Michaelsen, 1913**

(Figs 6C & 7C)

Polytoreutus Hübneri Michaelsen, 1913 : 48; 1931 : 556.*Polytoreutus* sp. nov. (Meru) Oxtoby, 1975 : 27.

DESCRIPTION. *External characters.* Length 210–390 mm (damaged holotype 150 mm *vide* Michaelsen, 1913 : 48), diameter 5–7 mm, segments 288–340. Prostomium prolobous to pro-epilobous. Clitellum annular, *xiii*–*lxviii*. Setae at *xxx*, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Secondary male pore $\frac{2}{3}$ *xvii* to 17/18 being more anteriorly located in breeding individuals, usually on a low porophore; distal end of the penis may protrude. Spermathecal pore 18/19, a narrow transverse slit with tumid lips. Genital papillae and markings absent. Female pores paired $\frac{2}{3}$ *xiv* near setal line *c*.

Internal characters. Prostates tubular, extending posteriorly to the region of *xxx*, anteriorly (lateral) cornu receive the vasa deferentia and together the two prostates and their cornu form an 'H' with the cornu forming the upper limbs which extend forwards to 15/16 while the anterior parts of the prostates form the horizontal limbs which lead into the posterior surface of a low male pouch lying between 15/16 and $\frac{2}{3}$ *xviii*; each cornu is approximately one-sixth of the total length of the prostate. The spermathecal system comprises a single, median adiverticulate receptaculum seminis extending posteriorly from the anterior bifurcation in *xiii* to far beyond the spermathecal pore, possibly to *xxx*; the anterior furcae are slender, frequently convoluted, with distal (terminally situated) fertilization chambers.

MATERIAL EXAMINED. *Previous records.* Fragment (prostates) Kibwezi, Kenya, (2° 25' S, 37° 58' E), 500–1000 m; Hamburg V. 7641 (remnant of holotype of *huebneri*).

New records. Kenya (Coll. E. Oxtoby): 4C 1A Among grass roots, in undergrowth of broad leaved woodland, Nduru, near Kisii (0° 41' S, 34° 46' E), 1500–2000 m, Jun. 1971; BM(NH) 1981.6.774–778. 6C 2A Bushwackers camp, 20 km northeast of Kibwezi (12° 25' S, 38° 00' E), 500–1000 m, Nov. & Apr. 1977; BM(NH) 1981.6.766–767 & 1981.6.768–773. 63C 31A Vegetation mainly comprised of podocarps, Kionyo Forest Station, near Nkubu, Meru District, (0° 04' S, 37° 40' E), 1500 m, June 1974; BM(NH) 1981.6.672–765. 2C Evergreen rain forest, Kionyo, 15 miles from Meru, on southeast slopes of Mount Kenya (0° 08' S, 37° 35' E), +2100 m ('7000–8000 ft'), Dec. 1970; BM(NH) 1981.6.670–671.

OTHER RECORD. Kibwezi, Kenya (2° 25' S, 37° 58' E), 500–1000 m; Michaelsen, 1931 : 556).

DISTRIBUTION. Forests of Kenya, above 500 m (Fig. 2B).

REMARKS. Individuals of *eichelbaumi*, (*magilensis* species group), may occasionally have the receptaculum seminis modified and cause confusion with this species. The two species can be readily separated on other characters, especially the morphology of the prostates (*see* Remarks, p. 276).

***Polytoreutus meruanus* Michaelsen, 1907**

(Figs 6D & 7D)

Polytoreutus meruanus Michaelsen, 1907 : 8.

DESCRIPTION. *External characters.* Length 60–100 mm, diameter 2.0–2.5 mm, segments 144–180. Prostomium prolobous. Clitellum annular, *xiii*–*xviii*. Setae at *xxx*, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Secondary male pore 17/18 on a low circular porophore with a raised rim or elevated to form a low papilliform (?) intromittant organ. Spermathecal pore small in 18/19. Genital field (adults) with single, midventral porophores 20/21, 21/22 and sometimes 22/23. Female pores $\frac{2}{3}$ *xiv* slightly above setal line *c*.

Internal characters. Prostates tubular, together they form an 'H' with somewhat clavate upper limbs extending anteriorly beyond the male pouch to receive the vasa deferentia. The horizontal limb of the 'H' leads into the posterior surface of the male pouch while the paired posterior limbs form the main bodies of the prostates and extend posteriorly, sometimes with

flextures, perhaps to xxxvi. The spermathecal system comprises a median, adiverticulate receptaculum seminis passing posteriorly from the anterior bifurcation in xiii to beyond the spermathecal where it forms a blind sac extending back to xxi or xxii; anterior furcae somewhat convoluted with ducts to the fertilization chambers located slightly subterminally. Additionally, the adults from Kenya possess two or three, median accessory glands that discharge anteriorly through the midventral porophores in 20/21, 21/22 and sometimes 22/23; in appearance they resemble small euprostates by being smooth and clavate, each is long and passes through four or five segments.

TYPE LOCALITY. Mount Meru, Tanzania.

MATERIAL EXAMINED. *Previous record*. 2C (immature) Rainforest, southern slopes of Mount Meru, Tanzania (3° 15' S, 36° 44' E), 3000 m; Hamburg V. 6951 & Stockholm 139 (syntypes of *meruanus*).

New records. Kenya (Coll. E. Oxtoby): 1C Nanyuki Road, Meru Forest, (0° 05' N, 37° 37' E), 2000–3000 m, 13 Dec. 1976; BM(NH) 1981.6.1204. 1A Bushwackers camp, 20 km northeast of Kibwezi, (2° 25' S, 38° 00' E), 500–1000 m, Apr. 1977; BM(NH) 1981.6.1203. 4C 1A Stream bed, temporary water by road side, 'Narosera' (?Narosura = Subukloita), Loita Hills (1° 32' S, 35° 52' E), 2000–3000 m, Dec. 1977; BM(NH) 1981.6.1198–1202.

DISTRIBUTION. Higher altitudes in forest of Kenya and Tanzania (Fig. 2B).

REMARKS. The adult specimens newly recorded from Kenya agree with the immature syntypes of *meruanus* apart from additionally possessing accessory glands. The glands are assumed to develop with maturity.

***Polytoreutus minutus* Michaelsen, 1912**
(Figs 6E & 7E)

Polytoreutus minutus Michaelsen, 1912 : 2; Michaelsen, 1913 : 53; Michaelsen, 1937 : 473.

DESCRIPTION. *External characters*. Length 32–70 mm, diameter 1.8–3.0 mm, segments (84, 95 regenerating) 102–134. Prostomium prolobous to pro-epilobous. Clitellum annular (xiii) xiv–xvii ($\frac{1}{2}$ xviii). Setae at xxx, aa : ab : bc : cd = 4.5 : 3 : 4 : 1. Secondary male pore on a low, broad cushion-like porophore, $\frac{2}{3}$ xvii; the ectal ends of the paired prostatic ducts may be seen within the male orifice (penis apparently absent). Spermathecal pore inconspicuous, small, circular in 18/19. Genital papillae and markings absent. Female pores paired $\frac{2}{3}$ xiv near setal line c.

Internal characters. Prostates tubular extending posteriorly for about ten segments; ectally each is simple and receives the vas deferens of its side directly into the antero-lateral surface; low male pouch present (penis not seen, ?absent). The spermathecal system comprises a single median, adiverticulate receptaculum seminis that extends from the anterior bifurcation in xiii posteriorly to far beyond the spermathecal pore to about xl; the anterior furcae are truncate narrowing sharply into slender ducts with distal (terminally situated) fertilization chambers.

TYPE LOCALITY. Kenya Province, Kenya; subsequently restricted to the vicinity of Mount Kenya (Michaelsen, 1937).

MATERIAL EXAMINED. *Previous records*. 1C 'Kenya Province' (?near Mount Kenya), Kenya; Stockholm 1949 (dissected holotype of *minutus*) and Hamburg V. 7631 (prostates of holotype of *minutus*).

New records. (Coll. E. Oxtoby): 4C Nanyuki road, Meru Forest, Kenya (0° 05' N, 37° 10' E), 2000–3000 m, 13 Dec. 1976; BM(NH) 1981.6.1205–1208.

OTHER RECORD. 1C Mount Mbololo 'Teita' (?Taita), Kenya, (3° 20' S, 38° 30' E), 1400 m ('4800 ft'); Michaelsen, 1937 : 473, specimen not located April 1980, Museum of Comparative Zoology, Harvard).

DISTRIBUTION. Higher altitudes, Mount Kenya area, Kenya (Fig. 2B).

REMARKS. Individuals of *eichelbaumi* (*magilensis* species group) may occasionally have the receptaculum seminis modified and be confused with this species. The two species can be readily separated on other characters (see Remarks, p. 276).

***Polytoreutus pulvillatus* sp. nov.**

(Figs 6F & 7F)

DESCRIPTION. *External characters.* Length 73–92 mm, diameter 1.5–2.0 mm, segments 228–254. Prostomium proepilobous with two indistinct longitudinal striations leading from the 'tongue' back to 1/2 giving superficially a tanylobic appearance. Clitellum annular $\frac{1}{2}$ xiii– $\frac{1}{2}$ xvii. Setae at xxx, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Secondary male pore 17/18 carried on a low porophore extending $\frac{1}{2}$ xvii– $\frac{1}{2}$ xviii; pore circular with crenulated lips, penis present. Spermathecal pore crescentic with the extremities of the crescent in 18/19 and the arc extending anteriorly to $\frac{3}{4}$ xviii; the anterior lip is raised and the concavity so formed is occupied by a papilla formed midventrally from the anterior wall of xix. Raised genital pad present xxiii–xxvi, pigmented, between setal lines *bb*. Female pores paired $\frac{3}{4}$ xiv at $\frac{1}{2}$ cd.

Internal characters. Prostates tubular extending back to about xxvii; anteriorly they have a double flexure producing a S-shape in segments xvii–xix where the vas deferens of the side enters into the second (ental) flexure. Male pouch large, receiving the prostates into its dorso-lateral surfaces. Spermathecal system comprises a simple, adiverticulate receptaculum seminis lying between xiii and xx(xxi) becoming somewhat constricted in xvii where it passes to one side (left side in the two syntypes) of the male pouch; anterior bifurcation lacking, replaced by paired ducts leading directly into the fertilization chambers from the lateral surfaces at the anterior end of the receptaculum.

TYPE LOCALITY. Near Gede, south of Malindi, Kenya.

MATERIAL EXAMINED. Kenya (*Coll.* E. Oxtoby): 2C Under coconut palms, cultivated sandy soil, near Gede, south of Malindi (3° 13' S, 40° 07' E), –200 m, 29 June 1974; BM(NH) 1981.6.1367–1368 (syntypes of *pulvillatus*). 1C Road side bush between Majengo (1° 45' S, 40° 20' E) and Kiunga (1° 44' S, 41° 30' W), –200 m, 12 June 1978; BM(NH) 1981.6.1366.

DISTRIBUTION. Coastal lowlands, southeastern Kenya (Fig. 2B).

***Polytoreutus magilensis* species group**

(Figs 8 & 9)

DIAGNOSIS. Male and spermathecal pores separate. Receptaculum seminis forming a ring near the spermathecal pore and a single blind sac posteriorly to the spermathecal pore, diverticula sometimes present; anterior furcae slender, fertilization chambers distal (terminal).

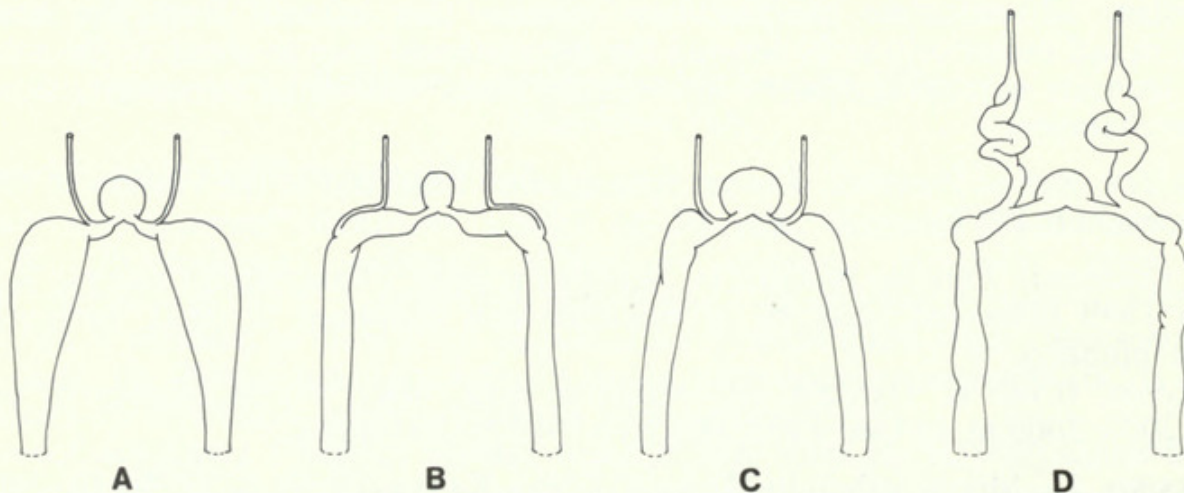


Fig. 8 *Polytoreutus magilensis* species group. Prostates, anterior regions (schematic dorsal views, not to scale): (A) *eichelbaumi*; (B) *magilensis*; (C) *papillatus*; (D) *zimmeri*.

DISTINGUISHING CHARACTERS. The species group contains four sympatric species mainly from northeastern Tanzania: *magilensis* Beddard, 1893; *eichelbaumi* Michaelsen, 1905; *zimmeri* Michaelsen, 1914 and *papillatus* sp. nov. They form two couplets: *magilensis* and *papillatus* with the anterior furcation deeply incised originating in xv or xvi, penis large; *eichelbaumi* and *zimmeri* with the anterior furcation usually in xiii, seldom xiv, penis small or not seen. The four species are separable on the following characters:

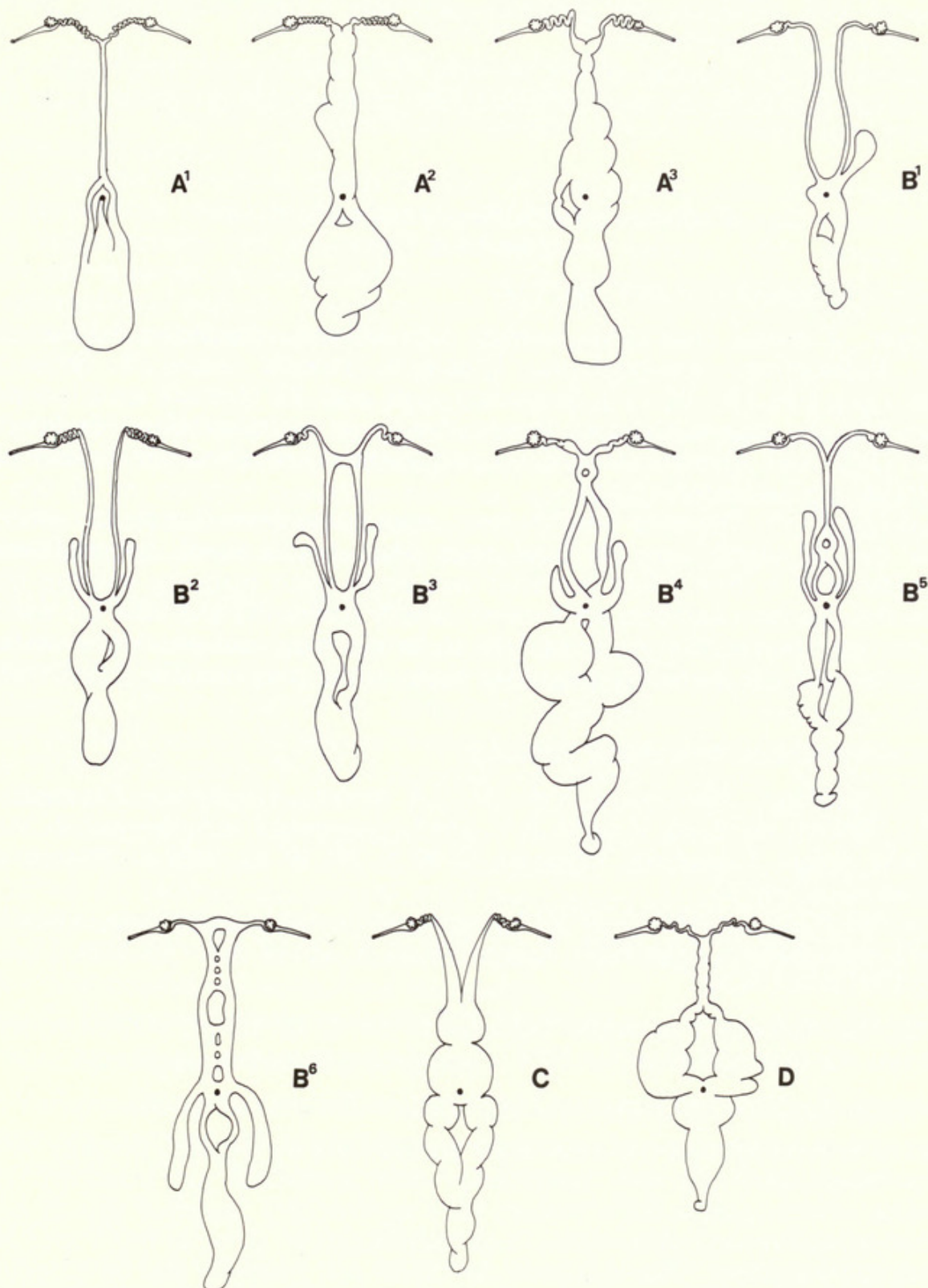


Fig. 9 *Polytoeuretus magilensis* species group. Female and spermathecal systems (schematic dorsal views, not to scale): (A) *eichelbaumi* (1 new record, 2–3 syntypes); (B) *magilensis* (1 syn. *ehlersi monozyga* (sic) syntype, 2–4 syn. *ehlersi typica* (sic) syntypes, 5 syn. *ehlersi dizyga* (sic) syntype, 6 *magilensis* holotype); (C) *papillatus* (syntype); (D) *zimmeri* (syntype).

papillatus. Genital papillae present, midventral, one on each of several segments behind the spermathecal pore; receptaculum seminis with 'ring' posterior to the spermathecal pore, adiverticulate; prostates simple ectally, vasa deferentia terminal.

magilensis. Genital papillae absent; receptaculum seminis with 'ring' posterior to the spermathecal pore, single pair of diverticula *xix* (one may fail to develop); prostates simple ectally, vasa deferentia terminal.

zimmeri. Genital papillae absent; receptaculum seminis with 'ring' anterior to the spermathecal pore, adiverticulate; prostates each with a long, subterminal, lateral cornu receiving the vas deferens of its side.

eichelbaumi. Genital papillae absent; receptaculum seminis with 'ring' either anterior or posterior to the spermathecal pore, adiverticulate; prostates simple ectally, vasa deferentia terminal.

***Polytoreutus eichelbaumi* Michaelsen, 1905**
(Figs 8A & 9A)

Polytoreutus eichelbaumi Michaelsen, 1905 : 357.

DESCRIPTION. *External characters.* Length 125–360 mm, diameter 2–3 mm, segments 370–512. Prostomium proepilobous. Clitellum annular *xiii–xvii*. Setae at *xxx*, $aa : ab : bc : cd = 3.5 : 3.0 : 3.0 : 1.0$. Secondary male pore 17/18 small on a low porophore sometimes with the penis protruding, surrounded by an oval glandular area. Spermathecal pore small 18/19 with adjacent areas of *xviii* and *xix* modified, glandular. Female pores $\frac{1}{3}$ *xiv* in line with the nephridiopores at $\frac{1}{2}$ *cd*.

Internal characters. Prostates tubular, long, convoluted extending to *xxx* with the vasa deferentia passing simply into the ectal ends. Male pouch small. Spermathecal system adiverticulate with a short, blind posterior sac; single apart from the anterior bifurcation where the fertilization chambers are located distally (terminal) and near the spermathecal pore where the receptaculum divides briefly to form a 'ring' and provide an orifice for the ventral nerve cord. (Occasionally one of the limbs of the 'ring' may be reduced or possibly missing.)

TYPE LOCALITY. Amani, Usambara, Tanzania.

MATERIAL EXAMINED. *Previous records.* 5C 2A Amani, Usambara, Tanzania (5° 09' S, 38° 36' E), 1000 m; Hamburg V. 6665 & V. 6667 (syntypes of *eichelbaumi*). 2C 4A Coastal stream, near Amani, Usambara, Tanzania (5° 09' S, 38° 36' E), 1000 m; Hamburg V. 6481 (syntypes of *eichelbaumi*).

New records. (Coll. E. Oxtoby): 5C 21A Among white roots of plantains, in black volcanic soil, Vuria radio station, Taita Hills, Kenya (3° 25' S, 38° 18' E), –1500 m, 13 Aug. 1978; BM(NH) 1981.6.451–476.

OTHER RECORD. Sakarre, Usambara, Tanzania (4° 59' S, 38° 26' E), –1500 m; (syntypes of *eichelbaumi*, not located September 1978, Zoologisches Museum, Hamburg).

DISTRIBUTION. Southeastern Kenya and northeastern Tanzania (Fig. 2C).

REMARKS. The foramen of the receptaculum seminis may be reduced, possibly becoming an indistinct longitudinal slit and overlooked when specimens are extended. Hence the morphology of the receptaculum seminis may superficially resemble that of *huebneri* or the worms mistaken for exceptionally large individuals of *minutus* (both members of the *meruanus* species group). The species *eichelbaumi* and *huebneri* can be separated on the characters of the prostates: in *eichelbaumi* the vasa deferentia pass simply into the anterior ends of the prostates while in *huebneri* each vas deferens enters into a long subterminal, anterolateral cornu of the prostate. The characters of the prostates are similar in *eichelbaumi* and *minutus* but these species are separable on segment number, the positions of the female pores and preserved specimens of *eichelbaumi* commonly having the penis protruding.

***Polytoreutus magilensis* Beddard, 1893**
(Figs 8B & 9B)

Polytoreutus magilensis Beddard, 1893 : 243; Beddard, 1895 : 610; Michaelsen, 1900 : 415.

Polytoreutus ehlersi f. *typica* [sic] Michaelsen, 1905 : 346.

Polytoreutus ehlersi f. *monozyga* [sic] Michaelsen, 1905 : 350; 1910 : 81.

Polytoreutus ehlersi var. *dizyga* [sic] Michaelsen, 1905 : 350.

DESCRIPTION. *External characters.* Length 120–370 mm, diameter 6–8 mm, segments 160–270. Prostomium prolobous, Clitellum annular $\frac{1}{2}$ xiii–xvii. Setae at xxx, $aa : ab : bc : cd = 5.7 : 2.5 : 5.0 : 1.0$. Secondary male pore wide with anterior and posterior tumid lips, often raised giving a sucker-like appearance 17/18. Spermathecal pore small, broadly oval 18/19. Genital field smooth and elongate xvii–xix. Female pores paired $\frac{1}{2}$ xiv in line with the nephridiopores at $\frac{1}{2}$ cd.

Internal characters. Prostatic glands tubular, long, somewhat convoluted and frequently extending throughout most of segments xii–xxx; slender ectally, simple receiving the vasa deferentia subterminally but becoming more massive entally. Male pouch small but posteriorly with a penial sheath joined entally to the parietal wall between the male pouch and the spermathecal pore (in poorly relaxed specimens, the penial sheath may be contracted into a U-shape). Spermathecal system highly variable but basically the receptaculum seminis consists of a pair of ‘ducts’ uniting only at the spermathecal pore and again more posteriorly to form a single median posterior sac; paired diverticula (as lateral sacs or pouches) present dorsolaterally on the main ‘ducts’ above the spermathecal pore, often with one of the pair failing to develop. Although essentially paired, the two ‘ducts’ frequently coalesce and in an extreme condition form an apparently single receptaculum seminis perforated by numerous medial foramina which give a ladder-like appearance. The fertilization chambers are distal (terminally situated) on the anterior furcae.

TYPE LOCALITY. Magila, Tanga, Tanzania.

MATERIAL EXAMINED. *Previous records.* Tanzania: 9C Magila, Tanga (5° 08' S, 38° 46' E), 200 m; BM(NH) 1904.10.5.442–450 (holotype and paratypes of *magilensis*). 5C 3A Wugiri, western Usambara (4° 45' S, 38° 30' E), 1000–2000 m; Hamburg V. 6656 & Stockholm 127 (syntypes of *ehlersi* f. *typica*). 2C Mkusa ?Valley ('Tal'), western Usambara (approx. 5° 00' S, 38° 20' E), 1100 m; Hamburg V. 6214 (syntypes of *ehlersi* f. *typica*). 1C Msimni ?Valley ('Tal'), western Usambara (approx. 5° 00' S, 38° 20' E), 1000 m; Hamburg V. 6243 (syntypes of *ehlersi* f. *monozyga*). 2C Sakarani, western Usambara (4° 49' S, 38° 24' E), 1500 m; Hamburg V. 6722 (syntypes of *ehlersi* f. *monozyga*). 4C Mombo, western Usambara (4° 52' S, 38° 14' E), 1400 m; Hamburg V. 6207 (syntypes of *ehlersi* v. *dizyga*). 5C 1A River bank, Muhesa, near Tanga (approx. 5° 10' S, 38° 40' E), –500 m; (*ehlersi* f. *monozyga*: Michaelsen, 1910). 5C 3A Potwe, native village near Magila and Muhesa (5° 08' S, 38° 46' E), –500 m; (*ehlersi* f. *monozyga*: Michaelsen, 1910).

New records. 1C Musambara (approx. 4° 45' S, 38° 30' E), +1000 m; Turin OL. 197.

DISTRIBUTION. Northeastern Tanzania (Fig. 2C).

REMARKS. Variation in the extent of the coalescence between the paired main ‘ducts’ forming the receptaculum seminis led Michaelsen to separate these growth (sexual or seasonal) phases as separate taxa. The basic paired condition he named *ehlersi* f. *typica*, further coalescence he recognized as *ehlersi* var. *dizyga* and the fully mature state, receptaculum seminis superficially single but with medial perforations giving a ladderlike appearance, he identified as *magilensis* Beddard. He separated the asymmetry when one of the paired dorsolateral diverticula failed to develop as *ehlersi* f. *monozyga*.

***Polytoreutus papillatus* sp. nov.**
(Figs 8C & 9C)

DESCRIPTION. *External characters.* Length (19, 24 mm a clitellate) 50, 60 mm, diameter

1–1.5 mm, segments (71, 100 acitellate) 128, 146. Prostomium epilobous. Clitellum annular *xiii*–*xvii*. Setae at *xxx*, $aa : ab : bc : cd = 6 : 2 : 4 : 1$. Secondary male pore on a low porophore $\frac{2}{3}$ *xvii*, penis, when seen, tapered uniformly and protruding to a length equal to the diameter of the *xvii*. Spermathecal pore inconspicuous, small lateral slit 18/19. Genital papillae present (clitellate syntypes), median ventral, one per segment, *xviii*, *xxi*–*xxiii* (smaller clitellate syntype) and *xx*–*xxvi* (larger clitellate syntype); each papilla is circular and cushion-like being flattened centrally with the lateral borders investing setae *aa*. Female pores $\frac{2}{3}$ *xiv* in line with the nephridiopores in $\frac{1}{2}$ *cd*.

Internal characters. Prostates tubular, extending posteriorly nearly to *xxx*; anteriorly each narrows slightly before passing into the posterior surface of the male pouch, the vasa deferentia enter the prostates simply at the ectal constriction. Spermathecal system consists of a single median, adiverticulate receptaculum seminis, the anterior bifurcation with distal (terminally located) fertilization chambers, arises only two or three segments anterior to the spermathecal pore, posterior to the spermathecal pore the receptaculum seminis divides briefly only to form a ring and reunite after two or three segments then to terminate in a small blind sac.

TYPE LOCALITY. Baga I Forest Reserve, Lushoto District, Tanzania.

MATERIAL EXAMINED. (Coll. K. M. Howell): 2C 2A Baga II Forest Reserve, Lushoto District, Tanzania (4° 48' S, 38° 23' E), 1000–2000 m, June 1980; BM(NH) 1981.7.1–4 (syntypes of *papillatus*).

DISTRIBUTION. Known only from the type locality (Fig. 2C).

***Polytoreutus zimmeri* Michaelsen, 1914**
(Figs 8D & 9D)

Polytoreutus zimmeri Michaelsen, 1914 : 117.

DESCRIPTION. *External characters.* Length 28–32 mm, diameter 2 mm, segments 130–160. Prostomium prolobous. Clitellum annular (*xiii*)*xiv*–*xvi*(*xvii*). Setae at *xxx*, $aa : ab : bc : cd = 2.3 : 2.0 : 2.6 : 1.0$. Secondary (?) male pore small lateral slit 17/18 with perhaps the ectal ends of the prostatic ducts seen within (penis, ?absent); male pore carried on a low, circular porophore extending 16/17–18/19. Spermathecal pore inconspicuous, small lateral slit in 18/19. Genital papillae absent. Female pores $\frac{1}{2}$ *xiv* in setal line *c*.

Internal characters. Prostates tubular, extending posteriorly to about *xxviii*; anteriorly each is bifid with a lateral subterminal cornu leading forwards into *xiv* where it receives the vas deferens of its side. Male pouch of moderate size. Spermathecal system comprises a slender, short median, adiverticulate duct passing backwards from the anterior furcation to *xvi* where it divides to form a massive ring around the male pouch then unites at the

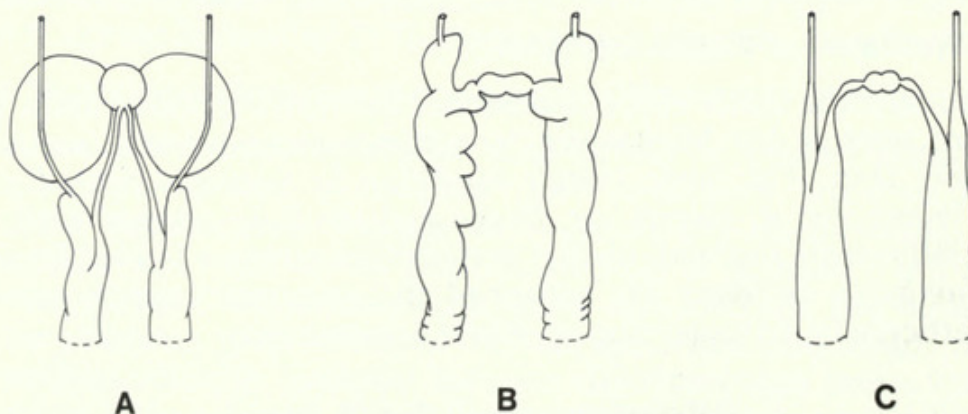


Fig. 10 *Polytoreutus kirimaensis* species group. Prostates, anterior regions (schematic dorsal views, not to scale): (A) *kirimaensis*; (B) *usambariensis*; (C) *usindjaensis*.

spermathecal pore and continues posteriorly as a blind sac for perhaps six or seven segments; the fertilization chambers are distal, terminally situated on the anterior furcae.

TYPE LOCALITY. Amani, Usambara, Tanzania.

MATERIAL EXAMINED. *Previous record*. 2C 3A Amani, Usambara, Tanzania (5° 09' S, 38° 36' E), 1000 m; Hamburg V 8345 (syntypes of *zimmeri*).

DISTRIBUTION. Known only from the type locality (Fig. 2C).

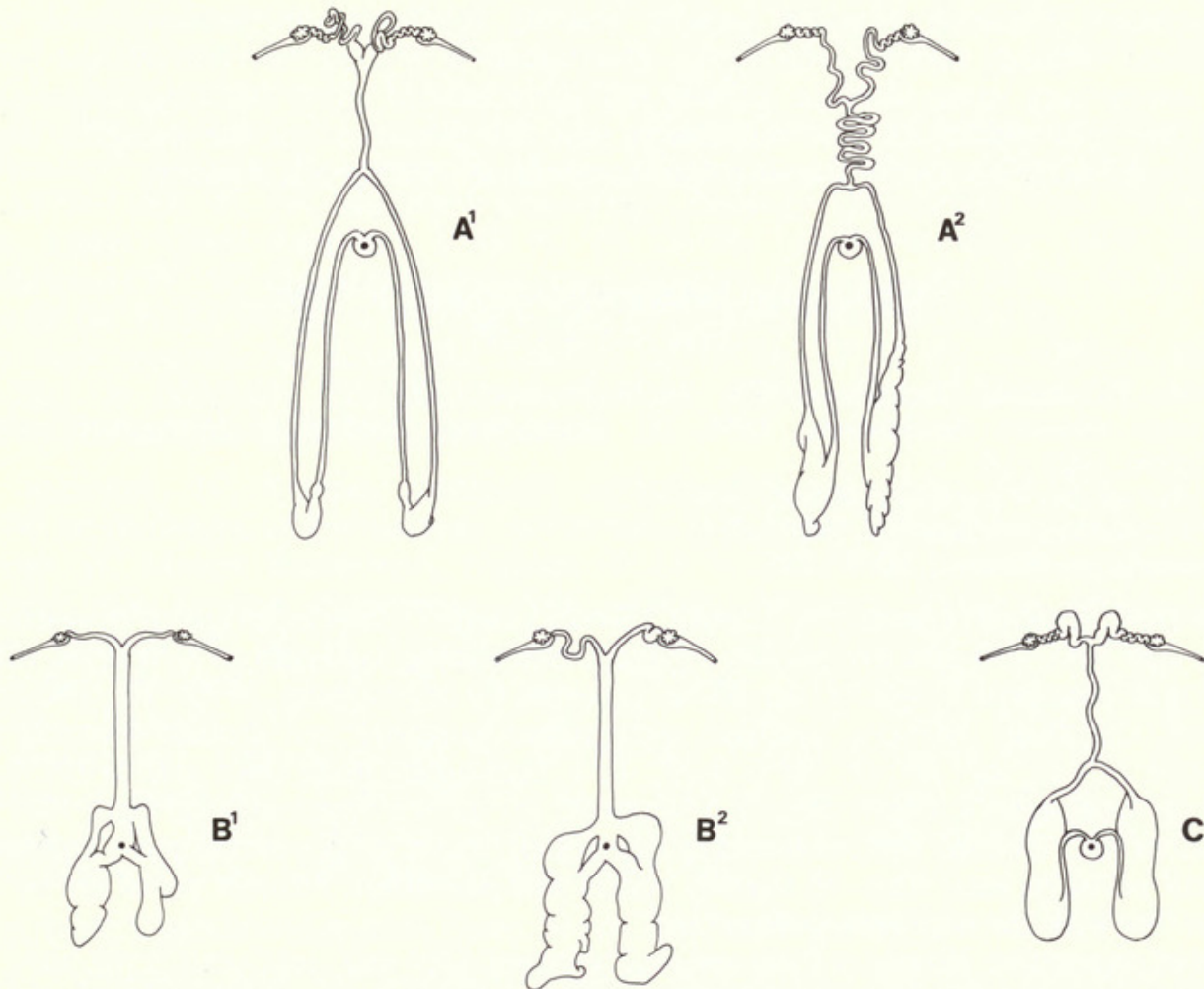


Fig. 11 *Polytoreutus kirimaensis* species group. Female and spermathecal systems (schematic dorsal views, not to scale): (A) *kirimaensis* (1 after Michaelsen, 1896 and after Beddard, 1907 syn. *ruwenzori*, 2 syn. *sylvestris* syntype and after Beddard, 1907 syn. *granti*); (B) *usambariensis* (1, 2 syntypes); (C) *usindjaensis* (syntype).

***Polytoreutus kirimaensis* species group**
(Figs 10 & 11)

DIAGNOSIS. Male and spermathecal pores separate. Receptaculum seminis with two pairs of posterior diverticula united distally to form a pair of lateral sacs, diverticula may be elongate to form a system of afferent and efferent ducts serving the paired lateral sacs, the median longitudinal element of the receptaculum seminis may be lacking between (xvi), xvii and xviii; anterior furcae mainly slender with terminal (distal) fertilization chambers.

DISTINGUISHING CHARACTERS. The species group consists of three species: *kirimaensis* Michaelsen, 1896; *usindjaensis* Michaelsen, 1896 and *usambariensis* Michaelsen, 1905. They are separable on several characters.

usambariensis. Externally a longitudinal, midventral seminal groove extends posteriorly from the genital field to near or behind xxx (resembling the shorter seminal groove present in

members of the *kenyaensis* species group); receptaculum seminis with short diverticula in *xviii* and *xix* united distally and extending posteriorly for only a few segments, median longitudinal element of receptaculum present throughout; prostates tubular, ectally with paired lateral cornu receiving the vasa deferentia.

usindjaensis. External seminal groove absent; receptaculum seminis with median longitudinal element absent posteriorly, diverticula moderately long united at lateral pouch about the level of the spermathecal pore; prostates tubular, ectally deeply incised to form two long cornu with the lateral cornu receiving the vasa deferentia and the medial cornu forming the prostatic ducts; paired accessory glands absent from the male pouch.

kirimaensis. External seminal groove absent; receptaculum seminis with median longitudinal element absent posteriorly, diverticula very long and convoluted united at paired lateral sacs some distance behind the spermathecal pore; prostates often almond-shaped, the vasa deferentia pass terminally into the prostates but the prostatic ducts are subterminal; paired accessory glands present associated with the male pouch.

***Polytoreutus kirimaensis* Michaelsen, 1896**
(Figs 10A & 11A)

Polytoreutus kirimaensis Michaelsen, 1896 : 16; Michaelsen, 1900 : 417.

Polytoreutus silvestris Michaelsen, 1896 : 18; Michaelsen, 1900 : 418; Michaelsen, 1910 : 80; Michaelsen, 1921 : 19.

Polytoreutus sylvestris (lapsus) Beddard, 1907 : 415.

Polytoreutus ruwenzorii Beddard, 1907 : 415.

Polytoreutus granti Beddard, 1907 : 420.

DESCRIPTION. *External characters.* Length 110–265 mm (77 mm holotype of *ruwenzorii*, not located, and 310, 430 mm excessively relaxed, macerating syntypes of *silvestris*), diameter 4.0–5.5 mm, segments 114–236 (not 300 as reported by Michaelsen, 1896 : 18). Prostomium epilobous. Clitellum *xiii*–*xvii*, annular, incomplete ventrally *xvii* around secondary male pore. Setae at *xxx*, *aa* : *ab* : *bc* : *cd* = 4 : 3 : 4 : 1. Secondary male pore *xvii* to 17/18, penis usually protruding to a length up to 1.5 segments (or more). Spermathecal pore 18/19, seen as a narrow slit. Genital field sometimes developed *xix*–*xl* with ventral setae enlarged and body wall between setal lines *bb* slightly raised and glandular. Female pores *xiv* by furrow 14/15 in line with the nephridiopores at $\frac{1}{2}cd$.

Internal characters. Prostates flattened and 'almond-like' *xvii*, *xviii*–*xxii*, *xxiii*, *xxiv*, *xxv* or *xxvi*, muscular prostatic duct situated subterminally passing to a small male pouch, ectally each prostate is simple where it receives the vas deferens of its side; depending on individual variation, growth and/or preservation techniques, the ectal end of the prostate may appear to taper towards the prostatic duct with the vas deferens closely applied; alternatively the terminal portion receiving the vas deferens may be folded or diverging from the prostatic duct so causing the ectal end to have a bifid appearance. The spermathecal system is complex: two slender afferent ducts (left and right) pass posteriorly, rarely posterolaterally, from a small spermathecal atrium at the spermathecal pore, these dilate to form a small sac in the region of the prostates; an efferent duct passes forwards from each sac (the efferent ducts are often entwined with the afferent ducts) and the left and right efferent ducts unite mid-ventrally anteriorly to the male pouch to form a single longitudinal duct; this median duct continues forwards to form the main body of the receptaculum seminis extending to near *xiv* where it bifurcates with the furcae passing laterally to distal (terminally situated) fertilization chambers. The median duct and the furcae are variably convoluted, often there is an abrupt transition between an enlarged ental and slender ectal region of the furcae but this disparity in size between the two ends of a furcae is variably present, even between the left and right furcae in a single individual. The spermathecal atrium is variable in appearance from globular to onion-shaped depending on methods of preservation; never large in size, often difficult to see. Paired 'accessory glands', or pouches, of uncertain function present in

xvi–xix, situated laterally to both the small male pouch and the spermathecal atrium, communicating with the former.

TYPE LOCALITY. Kirima, northwestern Lake Albert, Zaire.

MATERIAL EXAMINED. *Previous records*. Uganda: 2C Primary forest, northwest of Mount Ruwenzori ('Runssoro') (0° 30' N, 3° 10' E), 800–1200 m; Hamburg V. 246 (syntypes of *silvestris*). 2C Entebbe (0° 04' N, 32° 28' E), 1000–1500 m; Stockholm 392 (*silvestris*: Michaelsen, 1921). 13C Pasture, banana plantation and bush, University farm, Makerere College, ?Kabanyolo ('Kabanyola'), near Kampala (0° 27' N, 32° 37' N), 1500 m; BM(NH) 1981.8.1–12 (*Polytoreutus* sp., Block and Banage, 1968). 3C Eucalyptus and Acacia woodland, Makerere Hill, near Kampala (0° 20' N, 32° 34' E), –1500 m; BM(NH) 1981.8.13–15 (*Polytoreutus* sp., Block and Banage, 1968).

New Records. Uganda (Coll. E. Oxtoby): 13C 4A Leaf litter under hedge in house garden in '25th January' Avenue, Kampala (0° 19' N, 32° 35' E), –1500 m, May 1974; BM(NH) 1981.6.1173–1189. 1C 6A Makerere University, Zoology Department Rest House, near Butiaba, Lake Albert (approx. 1° 49' N, 31° 19' E), –1000 m, May 1974; BM(NH) 1981.6.1191–1197. 1C Grassland beside road between Kampala (0° 19' N, 32° 35' E) and Entebbe (0° 04' N, 32° 28' E), +1000 m, 6 June 1974; BM(NH) 1981.6.1190.

Other new records. 3C Kampala, Uganda (0° 19' N, 32° 35' E), +1000 m; BM(NH) 1924.6.28.1 & BM(NH) 1932.5.418–19. 2 'lots' Kibale Forest, (0° 30' N, 30° 25' E), –2000 m; Harvard (personal communication).

OTHER RECORDS. 1C Kirima, northwest of Lake Edward, Zaire (0° 10' S, 29° 39' E), 500–1500 m; (holotype of *kirimaensis*, not located September 1978, Zoologisches Museum, Hamburg). 1C Mount Ruwenzori, Uganda (0° 23' N, 29° 54' E), +1500 m; (holotype of *ruwenzorii*, not located November 1976, British Museum (Natural History)). 10C Entebbe, Uganda (0° 04' N, 32° 29' E), –1500; Turin OL.199. 2C Mitiana, Mount Ruwenzori, Uganda (0° 23' N, 29° 54' E), +1000 m, Turin OL.282. 6C Ibanda, Mount Ruwenzori, Uganda (0° 20' N, 30° 06' E), +1000 m; Turin OL.283. 4C Toto, Mount Ruwenzori, Uganda (0° 30' N, 30° 30' E), –2000 m; Turin OL.198. 1C Mount Ruwenzori, Uganda (0° 23' N, 29° 54' E), +1000 m; (holotype of *granti*, not located November 1976, British Museum (Natural History)). ?Primary forest, Avakubi, River Aruwimi, Zaire, 22 Apr. 1908; (Michaelsen, 1910 : 80).

DISTRIBUTION. Uganda and eastern Zaire, below 2000 m (Fig. 2D).

REMARKS. Variation was not understood when this species was first described so when variants were collected they were separated usually as distinct taxa. There was, too, a misconception about the morphological stability of the coelomic tissues forming the complex spermathecal systems. Now it is evident that while maintaining a basic pattern, the spermathecal systems can vary widely depending on growth and the volume of received sperm also the methods employed to preserve the specimens. Previously the result was that both Beddard and Michaelsen described species (three on single specimens) by giving undue significance to minor internal individual differences. When describing *ruwenzorii* and *granti*, Beddard remarked on the coincidence of this couplet occurring on Mount Ruwenzori in the same way that *kenyaensis* and *montiskenyae* are sympatric on Mount Kenya. Although these Mount Ruwenzori taxa are now considered to be synonymous, there is nevertheless a couplet in this area but comprising *kirimaensis* and *usindjaensis* from northwestern Tanzania and Rwanda.

***Polytoreutus usambariensis* Michaelsen, 1905**
(Figs 10B & 11B)

Polytoreutus usambariensis Michaelsen, 1905 : 353; Michaelsen, 1910 : 81; Michaelsen, 1914 : 120.

DESCRIPTION. *External characters*. Length 140–280 mm, diameter 6–8 mm, segments

216–292. Prostomium prolobous. Clitellum annular $\frac{1}{2}$ xiii–xvii. Setae at xxx, $aa : ab : bc : cd = 9 : 3 : 6 : 1$. Secondary male pore small $\frac{2}{3}$ xvii, carried on a low porophore; penis very small (seldom seen). Spermathecal pore 18/19, seen as a narrow slit (larger than the secondary male pore). Genital field comprises a median, longitudinal seminal groove with raised glandular walls passing from the male pore to xxx, xxxii between setal line aa ; posteriorly the walls broaden to form a scutate area between $\frac{1}{2}ab$ over xxx–xxxv, xxxvi. Female pores $\frac{1}{3}$ xiv slightly below setal line d .

Internal characters. Prostates tubular, often massive, occasionally extending back to xxx; the ectal ends are bifid with the lateral cornu receiving the vas deferens. Male pouch small, almost double being transversely ‘dumb-bell’ shaped, receiving the prostates postero-laterally. Spermathecal system comprises a simple receptaculum seminis with paired diverticula in xviii and xix fused together entally on each side (occasionally ectally too, Michaelsen, 1914) with the posterior pair sometimes penetrating several segments back to xxii, xxiii; fertilization chambers distal (located terminally) on the anterior furcae.

TYPE LOCALITY. Amani, Usambara, Tanzania.

MATERIAL EXAMINED. *Previous records.* Tanzania: 2C 1A Amani, Usambara (5° 09' S, 38° 36' E), –1000 m; Hamburg V. 6666 (syntypes of *usambariensis*). 2C Coastal stream area, ‘probably Amani in Usambara’ Tanzania, 5° 09' S, 38° 36' E, –1000 m; Hamburg V. 6478 (syntypes of *usambariensis*). 2A in stream alluvium and foliage of ‘Mogaweges’, Amani, Usambara (5° 09' S, 38° 36' E), –1000 m; Hamburg V. 6724 (*usambariensis*: Michaelsen, 1910).

New records. Amani, Usambara (5° 09' S, 38° 36' E) Tanzania, –1000 m, 22 Nov. 1962; Hamburg V. 12288, *Coll. Loveridge*.

OTHER RECORDS. Tanzania: Nguelo, Usambara (4° 45' S, 38° 30' E), 500 m; Berlin 3893 (syntypes of *usambariensis*). 1C Amani, Usambara, (5° 09' S, 38° 36' E), –1000 m; (*usambariensis*: Michaelsen, 1914).

DISTRIBUTION. Coastal region, northeastern Tanzania (Fig. 2D).

***Polytoreutus usindjaensis* Michaelsen, 1896**
(Figs 10C & 11C)

Polytoreutus usindjaensis Michaelsen, 1896 : 14; Michaelsen, 1900 : 416.

Polytoreutus wittei Michaelsen, 1937b : 12.

DESCRIPTION. *External characters.* Length 125–255 mm, diameter 4.5–6.0 mm, segments 150–253. Prostomium prolobous, longitudinal striations may be seen on the peristomium giving the appearance of a tanylobic condition. Clitellum annular xiii–xvii. Setae at xxx, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Secondary male pore, small ovoid, 17/18, distal end of the small penis may be seen; small area around the male pore somewhat glandular and possibly raised slightly (male pore apparently not carried on a porophore). Spermathecal pore small, circular 18/19, vicinity of pore slightly glandular. Genital markings absent. Female pores $\frac{1}{2}$ xiv in setal line d .

Internal characters. Prostates tubular extending back to xxx–xxxii; ectally strongly incised to form two cornu, the lateral cornu tapers gradually to receive the vas deferens while the mesial cornu develops into a short muscular prostatic duct that leads into the hinder dorso-lateral surface of a small, incipiently paired male pouch. Spermathecal system is composed of a pair of lateral sacs extending posteriorly xvii–xxv (less in juveniles and subadults) with paired afferent ducts passing from the equators of the sacs (posterior ends of the sacs in subadults) to a small spermathecal atrium and paired efferent ducts issuing anteriorly which unite mesially in xvii to form a single median, somewhat convoluted, duct that leads to the anterior furcation in xiii; fertilization chambers distal (located terminally) on the anterior furcae.

TYPE LOCALITY. Usindja ($3^{\circ} 30' S$, $31^{\circ} 30' E$), northern Western Province, Tanzania.

MATERIAL EXAMINED. *Previous records*. 1C In hot springs, Mtagata, north of Bukoba, Lake Victoria, Tanzania ($1^{\circ} 15' S$, $31^{\circ} 05' E$), -1500 m; Hamburg V. 248 (syntype of *usindjaensis*). 1C Amranda, southwestern Lake Victoria, Tanzania ($2^{\circ} 56' S$, $32^{\circ} 10' E$), -1500 m; Hamburg V 247, (syntype of *usindjaensis*). 2C N'Gando Lake, north of Lake Kivu, Rwanda ($1^{\circ} 35' S$, $29^{\circ} 35' E$), 2400 m; Brussels 1 G.14949 (syntypes of *wittei*).

OTHER RECORDS. Swampy stream, north Usindja, Tanzania ($3^{\circ} 30' S$, $30^{\circ} 31' E$), 2000 m; Berlin 2434 (syntype of *usindjaensis*). Bukoba, Lake Victoria, Tanzania ($1^{\circ} 20' S$, $31^{\circ} 58' E$), 1500 m; Berlin 2435 (syntype of *usindjaensis*). Kafuro, Karagwe, near Lake Burig, Tanzania ($2^{\circ} 20' S$, $31^{\circ} 2' E$), 2000 m; Berlin 2455 (syntype of *usindjaensis*).

DISTRIBUTION. Rwanda and northwestern Tanzania (Fig. 2D).

Polytoreutus kilindinensis species group
(Figs 12 & 13)

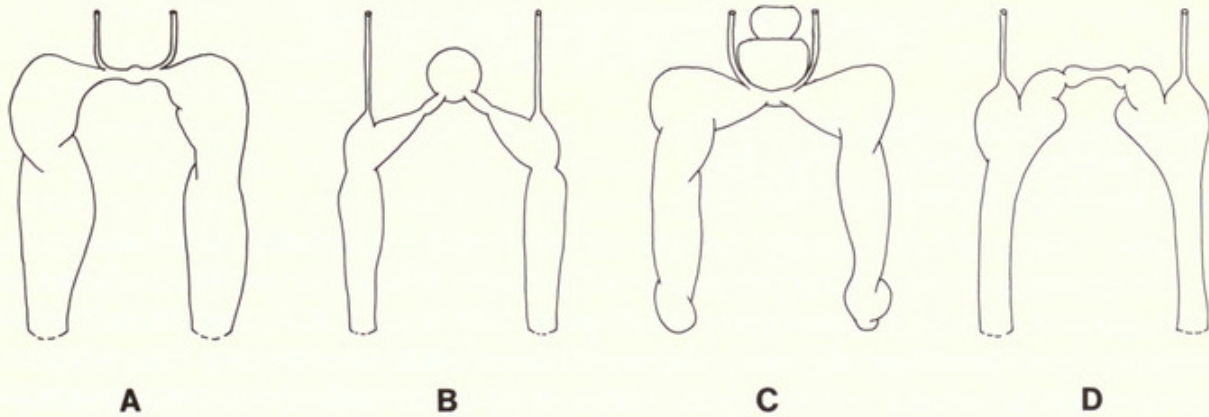


Fig. 12 *Polytoreutus kilindinensis* species group. Prostates, anterior regions (schematic dorsal views, not to scale): (A) *bettonianus*; (B) *finni*; (C) *hindei*; (D) *kilindinensis*.

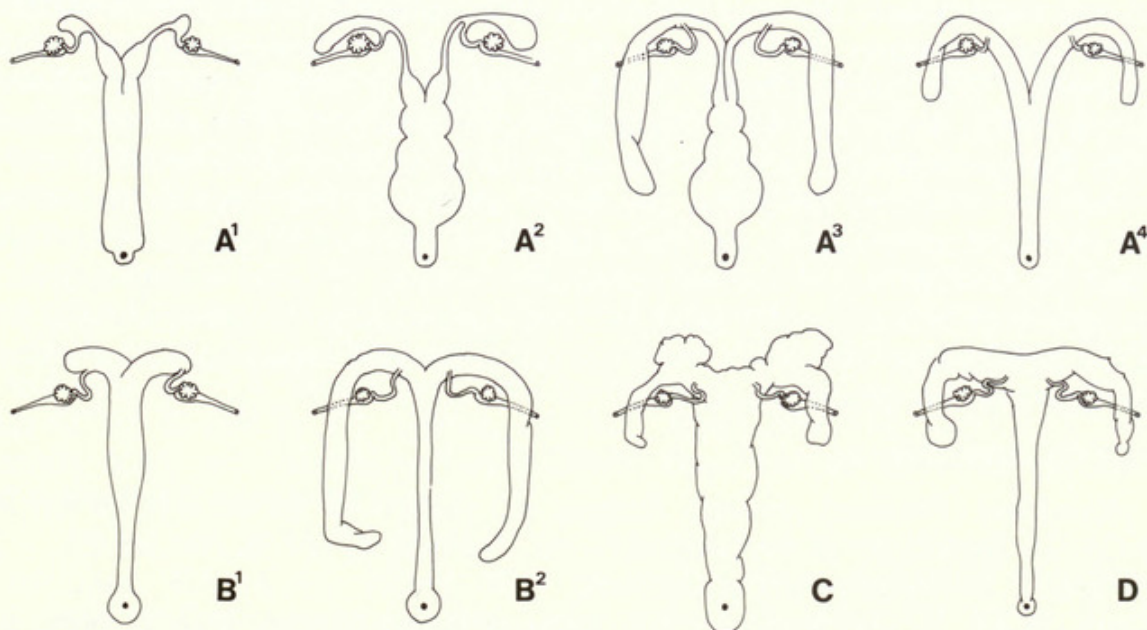


Fig. 13 *Polytoreutus kilindinensis* species group. Female and spermathecal systems (schematic dorsal views, not to scale): (A) *bettonianus* (1 holotype, 2 new record, 3 syn. *baralypton* holotype, 4 after Michaelsen, 1937 syn. *loveridgei*); (B) *finni* (1 after Stephenson, 1933 syn. *striatus*, 2 holotype and syn. *chaloneri* holotype); (C) *hindei* (paratype); (D) *kilindinensis* (syntype).

DIAGNOSIS. Male and spermathecal pores separate, receptaculum seminis adiverticulate; anterior furcae often massive and flexed backwards for several segments, each furca with a proximal (basal) duct leading to a fertilization chamber.

DISTINGUISHING CHARACTERS. The species group is formed from four species: *kilindinensis* Beddard, 1894; *finni* Beddard, 1894; *hindei* Beddard, 1901 and *bettonianus* Beddard, 1902. They can be separated on the morphologies of the receptaculum seminis and the male pouch.

kilindinensis. Anterior bifurcation of the receptaculum seminis in *xiii*; male pouch small (secondary male and spermathecal pores small).

finni. Anterior bifurcation of the receptaculum seminis in *xiii*; male pouch large (secondary male and spermathecal pores large).

hindei. Anterior bifurcation of the receptaculum seminis in *xiii*; male pouch with anterior accessory pouch (secondary male pore large, spermathecal pore small).

bettonianus. Anterior bifurcation of the receptaculum seminis beginning *xiv*–*xvi*; male pouch small, transversely oval.

***Polytoreutus bettonianus* Beddard, 1902**
(Figs 12A & 13A)

Polytoreutus bettonianus Beddard, 1902 : 199.

Polytoreutus baralypton Cognetti, 1911 : 507.

Polytoreutus loveridgei Michaelsen, 1937 : 454.

DESCRIPTION. *External characters.* Length 90–230 mm, diameter 2.5–5 mm, segments 175–314. Prostomium pro- proepilobous. Clitellum *xiii*–*xviii*, annular. Setae at *xxx*, $aa : ab : bc : cd = 5 : 3 : 5 : 1$. Secondary male pore 17/18 on a low, somewhat transversely oval porophore $\frac{1}{2}$ *xvii*– $\frac{1}{2}$ *xviii* usually with the papilliform penis protruding. Spermathecal pore 18/19, surrounded by raised tumid lips; in contracted specimens the spermathecal pore is a narrow slit and the lips seen as a transverse pad, in relaxed specimens both the pore and the lips are circular. Female pores at $\frac{3}{4}$ *xiv* at the same level as the nephridiopores in $\frac{1}{2}$ *cd*.

Internal characters. Prostates tubular extending back to *xxii*–*xxvi*, somewhat constricted intersegmentally. Ectally they taper sharply to form a short muscular duct which enters a small, transverse male pouch; the vasa deferentia enter simply into the lateral surfaces of the prostates at the region of taper. (Infrequently the ectal end of a prostate may coil causing it to appear as a bulla.) The spermathecal system comprises a simple median adiverticulate receptaculum seminis, frequently with slight segmental pouching. The receptaculum passes forwards from the spermathecal pore to the anterior bifurcation sited between *xiv*–*xvi* (the greater the volume of sperm products, the more anteriorly the bifurcation occurs). The lateral furcae continue anteriorly to *xiii* where they flex laterally. In subadults the furcae may be slender and the fertilization chambers terminally located, in older worms a diverticulum develops on each furca which in fully adult individuals becomes the massive distal end of the furca while the fertilization chambers and their ducts become apparently non-terminal and proximal on these massive secondary furcae.

TYPE LOCALITY. Lugari, Kenya.

MATERIAL EXAMINED. *Previous records.* Kenya: 1C Lugari (0° 39' N, 34° 53' E); BM(NH) 1902.11.26–21–25 (holotype of *bettonianus*). 1C Nairobi (0° 17' S, 36° 50' E), –2500 m; BM(NH) 1911.4.21.1. (holotype of *baralypton*).

New records. (Coll. E. Oxtoby): 3C Wet grass, Sirimon Track, Mount Kenya, Kenya (0° 03' S, 37° 17' E), 4000 m, 19 Nov. 1974; BM(NH) 1981.6.434–436.

OTHER RECORDS. 2C Golbanti, on the Tana River, Kenya (2° 27' S, 40° 07' E), –200 m; (syntypes of *loveridgei* not located April 1980, Museum of Comparative Zoology, Harvard).

DISTRIBUTION. Kenya (Fig. 2E).

***Polytoreutus finni* Beddard, 1894**
(Figs 12B & 13B)

Polytoreutus finni Beddard, 1894 : 241; Beddard, 1895 : 611; Michaelsen, 1900 : 415.

Polytoreutus elongatus (lapsus) Beddard, 1894 : 242.

Polytoreutus chaloneri Smith & Green, 1919 : 156; Michaelsen, 1937 : 473.

?*Polytoreutus striatus* Stephenson, 1933 : 241.

DESCRIPTION. *External characters.* Length 90–188 mm, diameter 2–5 mm, segments 147–501. Prostomium prolobous. Clitellum $\frac{1}{3}$ xiii– $\frac{1}{3}$ xviii, annular, sometimes incomplete ventrally by the secondary male pore. Setae at xxx, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Secondary male pore located in the posterior half of xvii, carried on a large glandular porophore extending 16/17 to 17/18 sometimes with indistinct radiating grooves, tip of the penis protruding (in excessively relaxed specimens, the penis may be seen within the secondary male pore together with a pair of lateral pads situated more posterolaterally). Spermathecal pore usually large 18/19 possibly with tumid lips surmounting a glandular pad (extending $\frac{1}{2}$ xviii– $\frac{1}{3}$ xx) which may unite anteriorly with the glandular porophore carrying the secondary male pore. (When the genital field is fully developed, the precise locations of the secondary male and spermathecal pores are difficult to determine.) Female pores $\frac{1}{2}$ – $\frac{2}{3}$ xiv at the same level as the nephridiopores in $\frac{1}{2}$ cd.

Internal characters. Prostates tubular but tend to be somewhat moniliform due to inter-segmental constrictions, often flexed anteriorly (depending on relaxation of specimen) leading back possibly to xxvii; ectally each has a small lateral, subterminal cornu receiving the vas deferens of its side (when the prostates are strongly moniliform, the vasa deferentia enter into the penultimate ectal chambers); the main body of each prostate passes into the posterolateral surfaces of the large male pouch. Spermathecal system comprises a simple, adiverticulate median receptaculum seminis leading from the spermathecal pore (where in fully adult specimens the adjacent portion of the receptaculum is thickened as if to form a ‘bursa copulatrix’) to the anterior bifurcation in xiii; the lateral furcae are massive and flexed ventrally and/or posteriorly with their distal extremities located near the flexures of the prostates; fertilization chambers served by ducts arising proximally (basally) from the furcae.

TYPE LOCALITY. Zanzibar, Tanzania.

MATERIAL EXAMINED. *Previous records.* 1C Garden soil; Kilindini, Mombasa Island, Kenya (4° 04' S, 39° 39' E), 0–200 m; BM(NH) 1904.10.5.439 (holotype of *finni*). 1C Mkonumbi, near Lamu, Kenya (2° 18' S, 40° 42' E), –200 m; USNM 16834 (holotype of *chaloneri*). 1A Mombosasa near Witu, Kenya (2° 20' S, 40° 30' E), –200 m; Hamburg V. 12283 (*chaloneri*: Michaelsen, 1937). 1C Fragments Madehani, Ukinga Mountains, ‘at north end of Lake Nyasa’, Tanzania (9° 21' S, 34° 02' E), +1000 m; Harvard 2101 (holotype of *striatus*).

New records. Kenya (Coll. E. Oxtoby): 2C 5A Sandy soil in forest road, Roka Forest, off the Malindi-Kilifi road, Kilifi District (3° 26' S, 39° 54' E), 100 m, 29 June 1974; BM(NH) 1981.6.484–490. 5C 2A Sandy soil, sisal plantation, inland of Kilifi, 20 miles north of Mombasa (3° 38' S, 39° 51' E), 100 m, 18 Oct. 1970; BM(NH) 1981.6.491–498. 3C 4A Beside sandy road, near Shimo-la-Tewa school, Mombasa (3° 58' S, 39° 44' E), 100 m, 29 June 1974; BM(NH) 1981.6.477–483.

OTHER RECORDS. Kenya: 1C Rabai, near Mombasa (3° 56' S, 39° 34' E), 65 m (‘200 ft’); BM(NH) 1909.8.12.4. 1A Mkonumbi, near Lamu (2° 16' S, 40° 42' E), 16 m (‘50 ft’); (*chaloneri*: Michaelsen, 1937; not located, Museum of Comparative Zoology, Harvard, April, 1980).

DISTRIBUTION. Apart from the single record of (?) *striatus* Stephenson from western Tanzania, sandy soils near sea level in the coastal regions of Kenya and Tanzania (Fig. 2E).

Polytoreutus hindei Beddard, 1901
(Figs 12C & 13C)

Polytoreutus hindei Beddard, 1901 : 336.

DESCRIPTION. *External characters.* Length 92–157 mm, diameter 3–4 mm, segments 239–342. Prostomium pro-epilobous. Clitellum annular *xiii–xviii*. Setae at *xxx*, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Male pore large, superficially rectangular occupying the entire midventral area of *xvii* between setal lines *aa*; bounded laterally by a pair of raised longitudinal pads each filling the intersetal area *ab* between 16/17 and 17/18 and limited anteriorly and posteriorly on *xvi* and *xviii* by a raised, transverse pad formed from the ventral surfaces of these segments between setal lines *bb*: within the male pore, the floor is glandular and slopes up to 16/17 where a slit-like transverse orifice to the internal accessory pouch may be seen. Penis absent. Spermathecal pore 18/19, seen as a lateral slit. (Additionally, a pore-like pit often present midventrally in 19/20.) Genital field present consisting of a raised, pigmented area, somewhat scutate in appearance, on *xix–xxii* between setal lines *bb*. Female pores on the posterior region of *xiv*, near furrow 14/15, in setal line *d*.

Internal characters. Prostates tubular, short extending only to about *xxv*; ectally they are flexed mesially to pass into the posterior surface of a large male pouch; the vasa deferentia lie over the lateral parts of the male pouch to pass simply into the dorsal surfaces of the ectal ends of the prostates. The spermathecal system comprises a massive adiverticulate median sac passing from the anterior bifurcation to the spermathecal pore; the anterior furcae are massive and flexed with their distal ends lying above the male pouch, they are connected basally (proximally) to the fertilization chambers by ducts arising from the posterior surfaces of the posterior part of the furcae. Accessory pouch present lying immediately before (almost overlaid by) the large male pouch, the accessory pouch tapers posteriorly to discharge midventrally into the male pouch.

TYPE LOCALITY. Kitui, Kitui District, Kamba Province, Kenya.

MATERIAL EXAMINED. *Previous records.* 2C 1A ?Kitui ('Titui'), Kamba Province, Kenya ($^{\circ} 21' \text{ S}$, $38^{\circ} 01' \text{ E}$), 900–1200 m ('3000–4000 ft'); BM(NH) 1902.1.21.1 & 1964.4.1 (holotype and paratype of *hindei*).

New records. Kenya (Coll. E. Oxtoby): 1C 15A Ngangao ('Ngangau') Forest, Taita Hills ($3^{\circ} 22' \text{ S}$, $38^{\circ} 20' \text{ E}$), 1500 m, 10 Aug. 1978; BM(NH) 1981.6.650–665. 3C 1A 'Bushwackers' camp, 20 km northeast of Kibwesi ($2^{\circ} 25' \text{ S}$, $38^{\circ} 00' \text{ E}$), –1000 m, Apr. 1977; BM(NH) 1981.6.666.669.

DISTRIBUTION. Southeastern Kenya, above 1000 m (Fig. 2E).

Polytoreutus kilindinensis Beddard, 1894
(Figs 12D, 13D & 14)

Polytoreutus kilindinensis Beddard, 1894 : 236; Beddard, 1895 : 611; Michaelsen, 1900 : 415.

DESCRIPTION. *External characters.* Length 118–352 mm, diameter 2.5–6.0 mm, segments 220–652. Prostomium prolobous. Clitellum annular *xiii–xviii* ($\frac{1}{3}xix$), incomplete ventrally and saddle-shaped $\frac{1}{3}xvii$ – $\frac{1}{3}xix$. Setae at *xxx*, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Secondary male pore small on a low porophore 17/18, sometimes with the penis everted (penis long and bifid distally, Fig. 14). Spermathecal pore small transverse slit in 18/19. Genital field forming a somewhat trapezoidal glandular area 17/18–21/22, occasionally extending anteriorly around the male porophore. Female pores paired at $\frac{1}{4}xiv$ at the same level as the nephridiopores at $\frac{1}{2}cd$.

Internal characters. Prostates tubular but tending to become moniliform ectally due to intersegmental constrictions, extending posteriorly to *xxxv*; ectally subterminally bifid with each lateral cornu receiving the vas deferens of its side and each mesial cornu leading into a small male pouch (or seemingly directly into the ventral parietes depending on the preservation techniques employed). The spermathecal system comprises a slender median

adiverticulate receptaculum seminis passing anteriorly from the spermathecal pore to the anterior bifurcation located usually in *xiii* but in more mature individual sometimes in *xiv*; the lateral furcae are massive being flexed posteriorly with their distal extremities reaching to the region of the male pouch. The ducts to the paired fertilization chambers arise basally from the proximal ends of the furcae.

TYPE LOCALITY. Kilindini, Mombasa Island, Kenya.

MATERIAL EXAMINED. *Previous records*. 2C 2A Garden soil (dampened by regular deposits of household slops), Kilindini, Mombasa Island, Kenya ($4^{\circ} 04' S$, $39^{\circ} 39' E$), -200 m; BM(NH) 1904.10.5.440–441 (syntypes of *kilindinenses* [label data 'Zanzibar District', 2A not noted in original description]).

New records. Kenya (Coll. E. Oxtoby): 3C 7A Damp soil, not flooded, in rice cultivation area, off the old Mombasa road, inland of ?Shanzu ('Shansu') ($3^{\circ} 58' S$, $39^{\circ} 45' E$), 100 m, 5 May 1972; BM(NH) 1981.6.1149–1158. 5C 5A Sandy loam, temporary flood area, paddy field, Magazoni village, Tiwi Location ($4^{\circ} 15' S$, $39^{\circ} 32' E$), -100 m, 28 June 1974; BM(NH) 1981.6.1163–1172. 1C Sandy soil, under Neem trees, Shimo-la-Tewa school, Mombasa ($3^{\circ} 58' S$, $39^{\circ} 44' E$), -100 m, 29 Jun. 1974; BM(NH) 1981.6.1162. 3C Origin uncertain; probably from, flooded sandy soil, Kenya-Somali border, Northern Territories (approx. $2^{\circ} 00' S$, $42^{\circ} 00' E$), 100 m, ?1973; BM(NH) 1981.6.1159–1161. 17C 5A Grassland, Bargoni School, Lamu District ($2^{\circ} 03' S$, $40^{\circ} 47' E$), -100 m, 12 Jul. 1978; BM(NH) 1981.6.1120–1142. 2C Kiunga road, near Milimani (approx. $1^{\circ} 46' S$, $40^{\circ} 50' E$), 100 m, 14 Jul. 1978; BM(NH) 1981.6.1143–1144. 3C 1A Cultivation, near pipe-line office, road between Kinango ($4^{\circ} 09' S$, $39^{\circ} 19' E$) and Kwale ($4^{\circ} 10' S$, $39^{\circ} 28' E$), Shimba Hills, -500 m, 12 Aug. 1978; BM(NH) 1981.6.1145–1148.

OTHER RECORD. 1C (fragment) Mombasa, Kenya ($4^{\circ} 03' S$, $39^{\circ} 40' E$), $0-100$ m; Stockholm 390.

DISTRIBUTION. Sandy soils, frequently in wet situations especially in coastal areas, eastern Kenya (Fig. 2E).

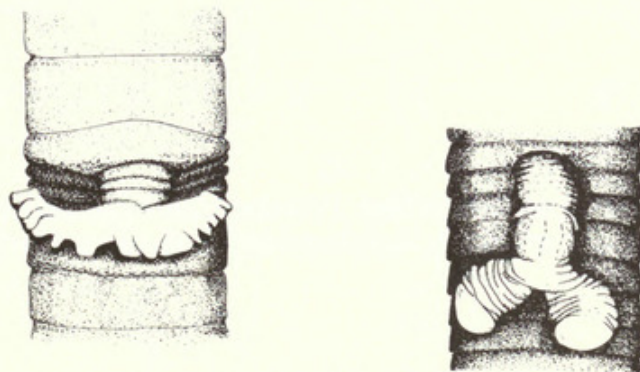


Fig. 14 *Polytoreutus kilindinensis*. External ventral view, penes of two individuals subjected to different techniques of preservation.

REMARKS. Sometimes when the curious bifid penis is relaxed and (?)fully everted, it extends externally up to five segments in length. The size suggests that during copulation when, presumably, the penis is dilated, it would fill the posterior longitudinal region of the receptaculum seminis and the bifid distal ends could be accommodated within the proximal ends of the anterior furcae of the receptaculum seminis. (The primary male pore was not seen, possibly it lies between the bifid ends of the penis.)

Polytoreutus coeruleus species group
(Figs 15 & 16)

DIAGNOSIS. Male and spermathecal pores separate; receptaculum seminis diverticulate

anterior furcae often massive and flexed backwards for several segments, each furca with a proximal (basal) duct leading to a fertilization chamber.

DISTINGUISHING CHARACTERS. The species group comprises four species: *coeruleus* Michaelsen, 1890; *violaceus* Beddard, 1894; *gregorianus* Beddard, 1895 and *multiplus* Smith & Green, 1919. They are readily separable on the number and arrangement of the diverticula on the receptaculum seminis.

gregorianus. Receptaculum seminis extending *xiii–xix* with a single pair of diverticula in *xix*.

coeruleus. Receptaculum seminis extending *xiii–xix*, diverticulate throughout.

violaceus. Receptaculum seminis extending *xiii–xxi*, *xxii* or *xxiii*, diverticulate throughout.

multiplus. Receptaculum seminis extending *xiii–xxiv*, *xxv* or *xxvi*, diverticulate posteriorly, behind (?) *xviii* or *xix*.

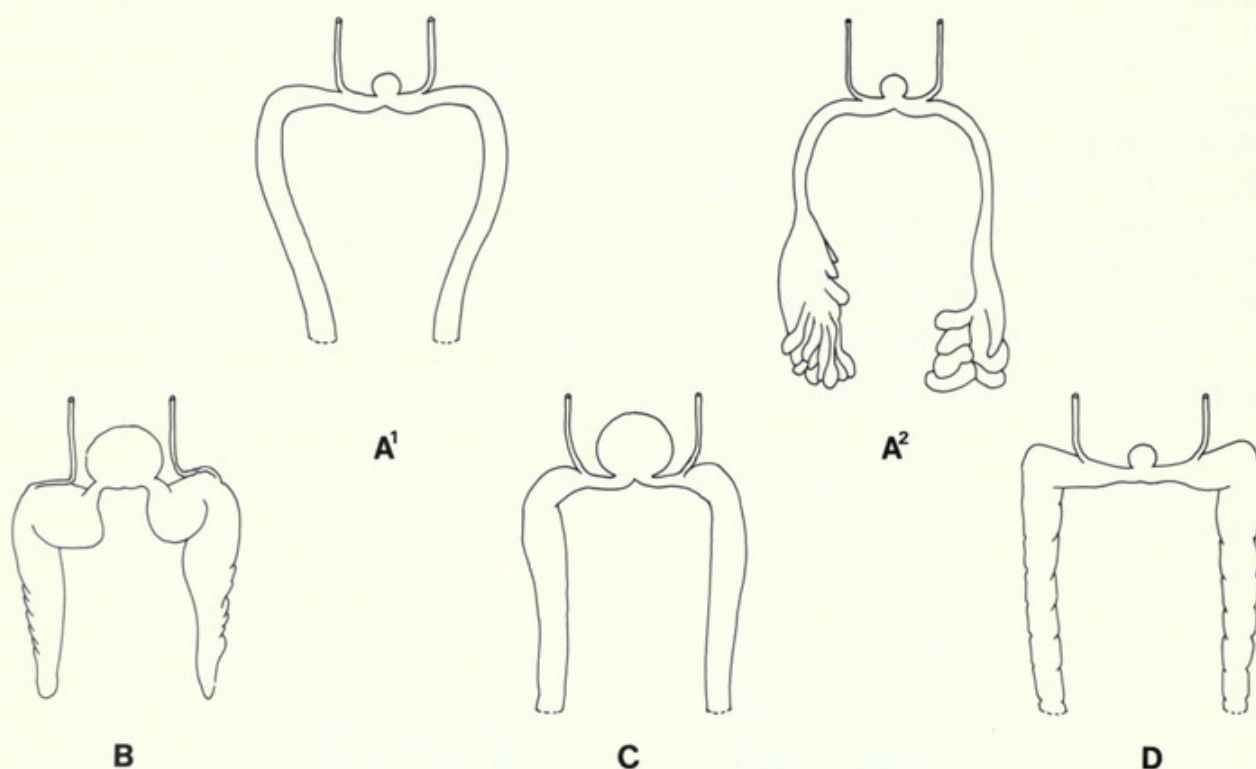


Fig. 15 *Polytoreutus coeruleus* species group. Prostates, anterior regions (schematic dorsal views, not to scale): (A) *coeruleus* (1 moderate development, 2 massive development); (B) *gregorianus*; (C) *multiplus*; (D) *violaceus*.

***Polytoreutus coeruleus* Michaelsen, 1890**
(Figs 15A & 16A)

Polytoreutus coeruleus Michaelsen, 1890 : 24; Michaelsen, 1891 : 34; Beddard, 1895 : 609; Michaelsen, 1900 : 414.

Polytoreutus coeruleus affinis Michaelsen, 1890 : 24; Michaelsen, 1891 : 36; Beddard, 1895 : 610; Michaelsen, 1900 : 414.

Polytoreutus coeruleus korogweensis Michaelsen, 1890 : 24; Michaelsen, 1891 : 36; Beddard, 1895 : 610; Michaelsen, 1900 : 414; Michaelsen, 1905 : 351.

Polytoreutus coeruleus makakallensis Michaelsen, 1890 : 24; Michaelsen, 1891 : 35; Beddard, 1895 : 610; Michaelsen, 1900 : 414.

Polytoreutus coeruleus mhondaensis Michaelsen, 1890 : 24; Michaelsen, 1891 : 36; Beddard, 1895 : 610; Michaelsen, 1900 : 414.

Polytoreutus hexathecus Beddard, 1925 : 60.

Polytoreutus askarorum Michaelsen, 1937 : 464.

Polytoreutus bagiloanus Michaelsen, 1937 : 468.

DESCRIPTION. *External characters.* Length 52–118 mm, diameter 2–4 mm, segments 150–202 (72 *bagiloanus*). Prostomium prolobous. Clitellum *xiii–xviii* annular, in *xviii* incomplete ventrally and saddle-shaped. Setae at *xxx*, $aa : ab : bc : cd = 4 : 2 : 3 : 1$. Secondary male pore 17/18 to posterior third of *xvii*, seen as a low porophore spreading from $\frac{1}{2}xvii$ – $\frac{1}{2}xviii$, mostly circular, often with the tip of the penis protruding. Spermathecal pore 18/19 with narrow lips seen either as a narrow transverse slit or partly opened forming a somewhat oval aperture surrounding the papilliform ectal end of the receptaculum seminis. Genital papillae absent (other papillae, *see* Remarks). Female pores $\frac{1}{2}xiv$ in or slightly above setal line *c*.

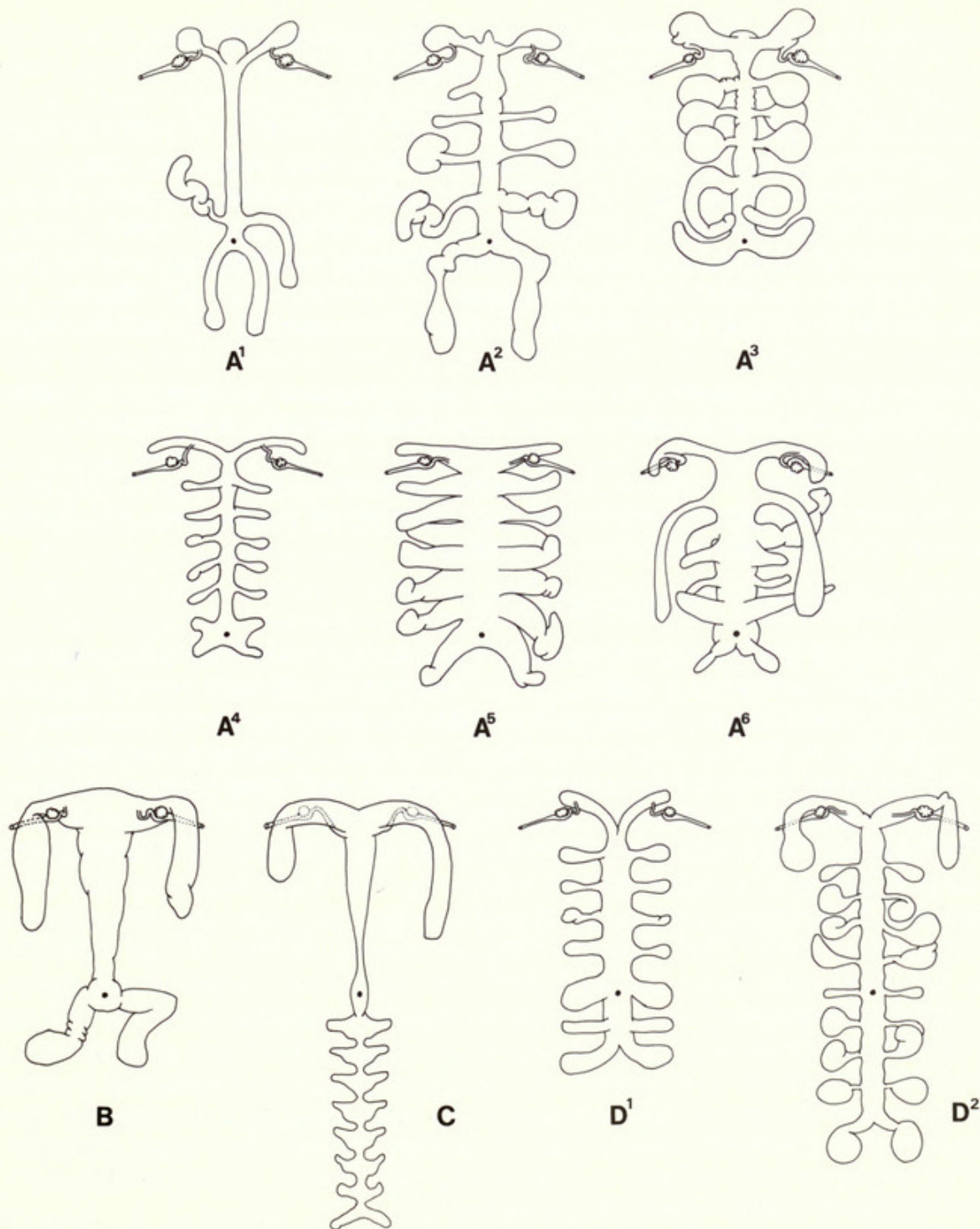


Fig. 16 *Polytozeutus coeruleus* species group. Female and spermathecal systems (schematic dorsal views, not to scale): (A) *coeruleus* (1 syn. *affinis* syntype and syn. *korogweensis* syntype, 2 syn. *makakallensis* syntype, 3 syn. *hexathecus* syntype, 4 after Michaelsen, 1937 syn. *bagiloanus*, 5 after Michaelsen, 1937 syn. *askarorum*, 6 new record); (B) *gregorianus* (holotype); (C) *multiporus* (holotype); (D) *violaceus* (1 holotype and after Michaelsen, 1937 syn. *malindus*, 2 syn. *variabilis*: Michaelsen, 1905).

Internal characters. Prostatic glands tubular, extending posteriorly to xxvii–xxx, occasionally the distal portions with segmental diverticula; ectally undifferentiated with the vasa deferentia entering simply near the union with the male pouch. The spermathecal system comprises a single median, diverticulate receptaculum seminis passing from the spermathecal pore to the anterior bifurcation in xiii. The diverticula are paired segmentally between xiv–xix although some may fail to develop while others may become greatly enlarged and pass through several segments. The anterior furcae are often poorly developed with short proximal ducts leading into the fertilization chambers.

TYPE LOCALITY. Korogwe, Usambara, Tanzania.

MATERIAL EXAMINED. *Previous records.* Tanzania: 3C 7A Near Korogwe, at or on the Rufu, Usambara (25° 09' S, 38° 29' E), –500 m; Hamburg V. 249 (holotype of *affinis*), Hamburg V. 252 & BM(NH) 1904.10.5.451 (syntypes of *korogweensis* Michaelsen, 1891). 2C 2A Msiri Stream, Makakalla Valley ('Thal'), East Unguru (5° 43' S, 37° 44' E), –1000 m; Hamburg V. 250 (syntypes of *makakallensis*). 2C 6A Watering place near Mhonda, Pangani (6° 01' S, 37° 55' E), –1000 m; Hamburg V. 251 & BM(NH) 1904.10.5.452 (syntypes of *mhondaensis*). 1C Tanga (5° 00' S, 39° 06' E), –200 m; Hamburg V. 6659 (*korogweensis*: Michaelsen, 1905). 3C (fragments) River-bed soil, ?Wanga, near Kidele (6° 45' S, 36° 45' E), –1000 m; BM(NH) 1924.10.20.2–5 (syntypes of *hexathecus*). 1C Bagilo, Ulunguru Mountains (6° 50' S, 37° 50' E), 2000 m ('6000 ft'); Hamburg V. 12284 (syntype of *bagiloanus*).

New records. (Coll. E. Oxtoby): 2C 1A Sandy soil, grassland, at 'Klosser's', Mafia Island, Tanzania (7° 50' S, 39° 50' E), 0–100 m, Apr. 1974; BM(NH) 1981.6.437–439.

OTHER RECORDS. Bagilo, Ulunguru Mountains, Tanzania (6° 50' S, 37° 50' E), 2000 m ('6000 ft'); (unique holotype of *askarorum* and syntype of *bagiloanus*, not located April 1980, Museum of Comparative Zoology, Harvard).

DISTRIBUTION. Northeastern Tanzania (Fig. 2F).

REMARKS. In the past the characters defining this species have been obscured due to the original type series comprising pathological specimens affected by (?) parasitization. Externally these specimens have one to four pit-like invaginations in the body wall in or near the mid-ventral line in the vicinity of the male and spermathecal pores, internally these structures are seen to be cyst-like within the circular and longitudinal muscles. In the specimens examined, most of the pits were empty but a few had a blackened, amorphous contents. Michaelsen regarded these apertures as genital pits, 'pubertätsgruben', and provided an illustration of a section of one (1890 : fig. 29). Then believing that they formed discrete patterns, Michaelsen went on to describe a separate *forma* for each arrangement of his 'pubertätsgruben'. Later when Beddard received specimens from Wanga which he named *hexatheca*, the large pits were confused with the male and spermathecal pores in one specimen and the locations of these pores were recorded incorrectly, while internally one cyst near the spermathecal duct was reported as a bursa copulatrix although there is no communication between the cyst and the spermathecal system. Additionally in one syntype of *hexatheca*, a cyst has developed near the male pore causing it to atrophy so as to be scarcely visible while internally the cyst has enveloped most of the male terminalia causing the region to appear superficially as a large bursa propulsoria. There are no signs of cyst development in the new records from Mafia Island.

The cyst-like structures by their large mass frequently affect nearby organs. The partial suppression of the male pore in *hexatheca* is exceeded in other specimens where the emission of sperm is prevented. When the latter condition prevails, there is a massive store of sperm in segment xii, the distal portions of the seminal vesicles are grossly dilated while the distal valves of the prostates may be expanded with segmentally arranged digitate diverticula. In other specimens the ectal region of the receptaculum seminis, also possibly the spermathecal

pore, may be affected so preventing an interchange of sperm while the anterior pairs of diverticula on the receptaculum fail to develop.

The effects of the cyst-like structures on the morphologies of the worms are variable and prevent any two specimens within a series from sharing the degree of resemblance usually encountered among conspecific individuals. As a result the morphology of the species is poorly understood. This report provides the only account of deformation, probably due to parasitization, in a species of *Polytoreutus*. It is curious that since the incidence is seemingly widespread in *coeruleus* that comparable teratological changes have not been detected in other species of the genus. (See also below, *Remarks* under *P. violaceus*.)

***Polytoreutus gregorianus* Beddard, 1895**
(Figs 15B & 16B)

Polytoreutus gregorianus Beddard 1895 : 612; Michaelsen, 1900 : 415; Beddard, 1901 : 187.

DESCRIPTION. *External characters.* Length (11 adults) 205–338 mm, diameter 6–8 mm, segments 350–569. Prostomium prolobous. Clitellum annular *xiii–xviii*. Setae at *xl*, *aa : ab : bc : cd* = 6 : 3 : 4 : 1. Secondary male pore 17/18 small lateral slit with glandular, crenulated lips through which the distal end of the small penis may protrude. Spermathecal pore small, circular 18/19. A genital pit, or depression, present on *xviii* in fully mature individuals, transversely oval lying between setal lines *bb*. Pad-like, transversely rectangular genital pads or papillae present (*xix*) *xxiv–xxxiv* (*xxxvi*) each completely occupying the ventral surface of its segment between lines *bb*; the tissue forming the pads is more deeply pigmented and obliterates setae *a* always and setae *b* sometimes; each pad is somewhat concave or at least (especially the more anteriorly located pads) incised with a lateral groove. Female pores $\frac{3}{4}$ *xiv* in line with the nephridiopores at $\frac{1}{2}$ *cd*.

Internal characters. Prostates tubular, each clearly formed of two parts, with a short, stout anteriorly directed proximal portion separated by a flexure from a long, more slender posteriorly directed distal portion extending back to *xxvi–xxviii* (the whole resembling the hind limb of a tetrapod); the vas deferens passes entally along the antero-lateral surface of the proximal portion of the prostate of its side which it enters at the flexure. Male pouch large, receiving the prostates latero-posteriorly. The spermathecal system comprises a massive, single, adiverticulate receptaculum seminis passing from the spermathecal pore to the anterior bifurcation; posteriorly there is a pair of short, lateral diverticula extending backwards for four to six segments, anteriorly the furcae are massive and flexed posteriorly with their distal ends extending to the level of the male pouch: proximal ducts lead to the fertilization chambers issuing basally from the posterior surfaces of the proximal ends of the furcae.

TYPE LOCALITY. Fuladoya, Giriama District, Seyidie Province, Kenya.

MATERIAL EXAMINED. *Previous records.* 1C Near Fuladoya Giriama, Seyidie Province, Kenya (3° 48' S, 39° 35' E), –200 m; BM(NH) 1904.10.5.438 (holotype of *gregorianus*).

New records. Kenya (Coll. E. Oxtoby): 4C Sandy soil, sisal plantation, inland of Kilifi, 20 miles north of Mombasa, Giriama District, Seyidie Province (3° 38' S, 39° 51' E), –200 m, Aug. 1970; BM(NH) 1981.6.644–647. 1C Mwea or Sukari Ranch (opposite Kenyatta College), Nairobi; BM(NH) 1981.6.648. 10C 125A Cultivated sandy soil, field near Gede, Malindi, Seyidie Province, (3° 18' S, 40° 01' E), –100 m, 29 June 1974; BM(NH) 1981.6.507–643. 6 Juveniles ?Ngangao ('Ngangau'), Taita Hills, (3° 22' S, 38° 20' E), –1500 m, 10 Aug. 1978; BM(NH) 1981.6.499–504. 1C Mombasa-Malindi road, near radio station, –100 m, Aug. 1974, BM(NH) 1981.6.649. 1C 1A Sandy soil at edge of Roka Forest, off Kilifi-Malindi road (3° 26' S, 39° 54' E), –100 m, 29 June 1974; BM(NH) 1981.6.505–506.

DISTRIBUTION. Coastal lowlands, southeastern Kenya (Fig. 2F).

***Polytoreutus multiporus* Smith & Green, 1919**

(Figs 15C & 16C)

Polytoreutus multiporus Smith & Green, 1919 : 161; Michaelsen, 1937 : 475.

DESCRIPTION. *External characters.* Length 100–370 mm, diameter 3–5.5 mm, segments 264–670. Prostomium prolobous. Clitellum (xiii) xiv–xvii, xviii (xix), saddle-shaped. Setae at xxx, $aa : ab : bc : cd = 8 : 4 : 6 : 1$; genital setae (mature adults) borne on papillae xiii–xvi, xix–xxvi with *ab* enlarged to about twice the size of *cd* (in adults, setae absent xvii, xviii and more anteriorly or posteriorly situated genital setae and papillae may fail to develop too). Secondary male pore xvii, seen as a low crenulated tumid porophore, usually with the tip of the penis protruding through the aperture; in one paratype the penis is fully everted. Spermathecal pore 18/19, seen mostly as a narrow transverse slit bordered by raised, tumid lips, clearly seen as a circular aperture in excessively relaxed specimens. Intersegmental accessory pores located midventrally in 19/20–23/24, small 24/25 or 25/26 (the pores lead into a diverticulate posterior prolongation of the receptaculum seminis). Female pores $\frac{3}{4}$ xiv at the same level as the nephridiopores in $\frac{1}{2}$ cd.

Internal characters. Prostates long, reaching back nearly to vi; ectally each tapers sharply into a short muscular duct which leads into the posterior surface of a large male pouch, each vas deferens enters simply into the sharply tapering ectal end of the prostate of its side. The spermathecal system comprises a median receptaculum seminis adiverticulate anteriorly but with a posterior prolongation with paired segmental diverticula extending from the spermathecal pore to xxvi, xxv or xxvi (communicating with the exterior through the midventral intersegmental accessory pores).

The lateral furcae are massive and flexed posteriorly, possibly extending to the anterior (ectal) ends of the prostates, communicating with the fertilization chambers by proximal, basally arising ducts.

TYPE LOCALITY. Mkonumbi, near Lamu, Kenya.

MATERIAL EXAMINED. *Previous record.* 5C Mkonumbi, near Lamu, Kenya (2° 16' S, 40° 42' E), 16 m USNM 16835, (holotype and paratypes of *multiporous*).

New records. Kenya (Coll. E. Oxtoby): 1C Sandy soil on road between staff housing, Shimo-la-Tewa school, Mombasa (3° 58' S, 39° 44' E), –200 m, 29 Jun. 1974; BM(NH) 1981.6.1365. 2C Cultivated sandy soil, field near Gede, Malindi (3° 18' S, 40° 01' E), –200 m, 29 Jun. 1974; BM(NH) 1981.6.1349–1350. 11C 3A Bushland by the road between Majenjo (approx. 1° 45' S, 40° 20' E) and Kiunga (1° 44' S, 41° 30' E), –200 m, 12 Jul. 1978; BM(NH) 1981.6.1351–1364.

OTHER RECORDS. Kenya: Michaelsen, 1937 : 475 (not located April 1980. Comparative Zoology, Harvard): 2? Mkonumbi, near Lamu, (2° 16' S, 40° 42' E), 16 m ('50 ft'); 4? Gongoni, 10 miles north of Malindi (3° 05' S, 40° 10' E), 25 m ('75 ft'); 1? Malindi, 65 miles north of Mombasa (3° 13' S, 40° 08' E), 33 m ('100 ft'); 1? Changamwe, 3 miles west of Mombasa (4° 01' S, 39° 37' E), 63 m ('192 ft').

DISTRIBUTION. Eastern Kenya (Fig. 2F).

***Polytoreutus violaceus* Beddard, 1894**

(Figs 15D & 16D)

Polytoreutus violaceus Beddard, 1894 : 230; Beddard, 1895 : 610; Michaelsen, 1897 : 51; Michaelsen, 1900 : 413; Michaelsen, 1905 : 352.

Polytoreutus violaceus variabilis Michaelsen, 1897 : 52; Michaelsen, 1900 : 413; Michaelsen, 1905 : 352; Michaelsen, 1913 : 55.

Polytoreutus malindus Michaelsen, 1937 : 460.

DESCRIPTION. *External characters.* Length 80–140 mm, diameter 2.5 mm, segments 83–209. Prostomium prolobous but in contracted (preserved) specimens seemingly epilobous or

when longitudinal striations present on segment *i*, possibly tanylobous. Clitellum saddle-shaped $\frac{1}{2}$ xiii–xviii. Setae at xxx, $aa : ab : bc : cd = 3 : 2 : 3 : 1$. Secondary male pore xvii, variable in appearance according to the degree of eversion of the penis: when the penis is retracted, the secondary male pore is seen as a lateral slit with crenulated lips; when the penis is partly everted, the secondary male pore seen as a low circular ridge around the distal part of the penis; when the penis is fully everted, the tissues previously forming the lips of the secondary male pore are now drawn out to form the basal portion of the penis. Penis small, onion-shaped when turgid. Spermathecal pore inconspicuous, lateral slit 18/19. Flattened, pad-like genital papillae present, single, median ventral: characteristically present on a single segment xxi–xxxiii, commonly xxii–xxiv with the papilla frequently impinging on the adjacent segments; other single midventral papillae may be present xiv, xv, xvi and/or xviii, frequently imperfectly developed but may cause the clitellum superficially to appear to be annular. Female pores paired $\frac{1}{2}$ xiv above setal line *c*.

Internal characters. Prostates tubular, variable in length extending back usually to c. xxx exceptionally only to xxiii, constricted intersegmentally. Ectally the prostates commonly pass laterally before curving posteriorly, the anterior surface of the lateral flexure receives the vas deferens of its side. Male pouch small, usually not seen as it is contained within the body wall, the prostates discharge into its posterior surface. Spermathecal system comprises a single, diverticulate longitudinal receptaculum seminis extending forwards from xxi (occasionally xxiii) to the anterior bifurcation in xiii. In addition to the anterior furcae, there are commonly seven pairs of diverticula occurring more or less segmentally, occasionally only six pairs of diverticula develop, exceptionally more (nine pairs are present in one individual from Mchinga so increasing the number of pairs posteriad to the prostates from the typical 3 to 5 pairs). The fertilization chambers are sub-terminal on the massive anterior furcae, their ducts arise from the posterior surfaces of the basal (proximal) portions of the furcae.

TYPE LOCALITY. Zanzibar, Tanzania.

MATERIAL EXAMINED. *Previous records.* 1C Zanzibar, Tanzania (6° 06' S, 39° 13' E), –200 m; BM(NH) 1904.10.5.437 (syntype of *violaceus*). 5C 2A Dar-es-Salaam, Tanzania (6° 48' S, 39° 18' E), –200 m; Hamburg V. 4516 (surviving syntypes of *variabilis*). 8C 2A Mtschinga, Wanga, north of Lindi, Tanzania (9° 40' S, 39° 40' E), 3–5 m; Hamburg V. 6207 & V. 6216 (Michaelsen, 1905 : 352). 4C 1A Damp soil, close by a water course, Bububu, Zanzibar (6° 06' S, 39° 13' E), –200 m; Hamburg V. 7512 (Michaelsen, 1913 : 55).

Other records. Malindi, Kenya (3° 13' S, 40° 08' E), 15 m ('50 ft'); (unique holotype of *malindus*; not located April, 1980 in the Museum of Comparative Zoology, Harvard). Mombasa, Kenya (4° 03' S, 39° 40' E), –200 m; (Michaelsen, 1897 : 51). Danda, near Kingani River, Tanzania (6° 23' S, 38° 52' E), 200 m; (Michaelsen, 1896 : 51). Mrogoro, Tanzania (6° 49' S, 37° 40' E), –1000 m; (Michaelsen, 1897 : 51). ?Mbanja ('Banja'), Wanga, north of Lindi, Tanzania (9° 45' S, 39° 40' E), –200 m; (Michaelsen, 1897 : 52).

DISTRIBUTION. Eastern districts of Kenya and Tanzania at low altitudes (Fig. 2F).

REMARKS. Preserved material of this species exhibits a range of variations most of which are natural, that is biological, but some are due to the differing techniques employed by collectors. Unfortunately undue taxonomic significance has been attributed to both categories of differences with the result that several new taxa have been recognized to accommodate variants. Externally the genital papillae vary in number, location and size, presumably according to the age and degree of sexual development of the individual. Michaelsen seemingly considered that the position and development of the papillae were taxonomically important but re-examination of his material reveals that these differences are individual although sometimes constant in the members of a single series. Other external variations in preserved material are seen in the presence and size of the penis, i.e. the extent to which the penis protrudes through the secondary male pore and its shape, whether flattened or rounded. But these differences appear to be directly attributable to collecting

techniques and subsequent preservation. Extremes may be seen in contracted, well-preserved specimens having the penis retracted to excessively relaxed, often almost macerating, specimens in which the penis is well-formed and onion-shaped with no sign remaining of the secondary male pore. (Intermediately relaxed, moderately well preserved specimens usually have only the distal portion of the penis protruding.) The extent to which the penis protrudes can be correlated with internal variations in the size of the male pouch, this structure is usually evident when the penis is retracted but not seen when the penis is everted.

Also internally, the receptaculum seminis may vary in detail both in the numbers of diverticula and in the size and shape of these sacs. Comparable variations are present in most species of this family since the spermathecal systems are composed of delicate, coelomic tissues whose morphologies within the limits of the species, are largely determined in detail by the volume and main sites of aggregation of the sperm carried and to some extent, the disposition and development of adjacent organs. The prostates can vary too. In subadult specimens the prostates are short and regular but in older individuals these glands may be long, occasionally convoluted and constricted intersegmentally when large. The differences between this species and *coeruleus* are slender. The two species can be separated on the characters of the receptaculum seminis, *coeruleus* possesses only a single pair of diverticula behind the spermathecal pore whereas there are three or more pairs in *violaceus*.

***Polytoreutus arningi* species group**
(Figs 17 & 18)

DIAGNOSIS. Male and spermathecal ducts (in mature adults) open externally into a common pore or concavity. Anterior furcae of the receptaculum seminis often poorly developed with proximal (basal) or distal (terminal) ducts leading to the fertilization chambers.

DISTINGUISHING CHARACTERS. The group comprises three species: *arningi* Michaelsen, 1897 from Tanzania, *stierlingi* Michaelsen, 1899 from Kenya and Tanzania, *monoporus* sp. nov. from Kenya. They are separable mainly on the occurrence of 'copulatory sacs' and the size of the male pouch also the morphology of the spermathecal system.

arningi. Male pouch large with paired posterolateral 'copulatory sacs'. Receptaculum seminis simple passing directly from the anterior bifurcation to the spermathecal pore; anterior furcae poorly developed and may be overlooked.

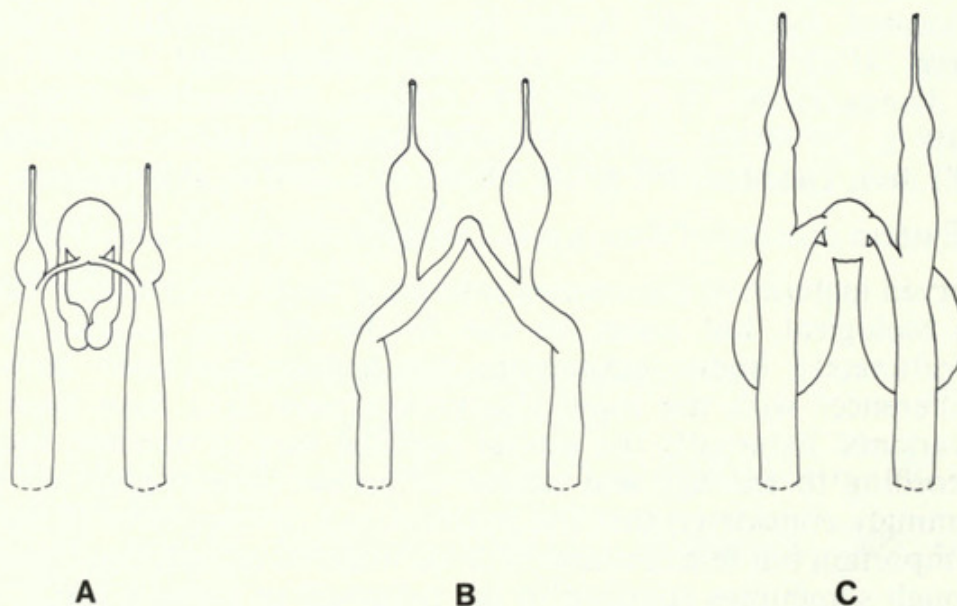


Fig. 17 *Polytoreutus arningi* species group. Prostates, anterior regions (schematic dorsal views, not to scale): (A) *arningi*; (B) *monoporus*; (C) *stierlingi*.

stierlingi. Male pouch small with paired posterolateral 'copulatory sacs'. Receptaculum seminis simple extending posteriorly as a blind sac behind the spermathecal pore to about xxv; anterior furcae swollen but truncate.

monoporus. Male pouch inconspicuous, parietal 'copulatory sacs' absent. Receptaculum seminis simple but extending posteriorly as a blind sac to about xxv; anterior furcae well developed but not massive as in members of the *kilindinensis* species group.

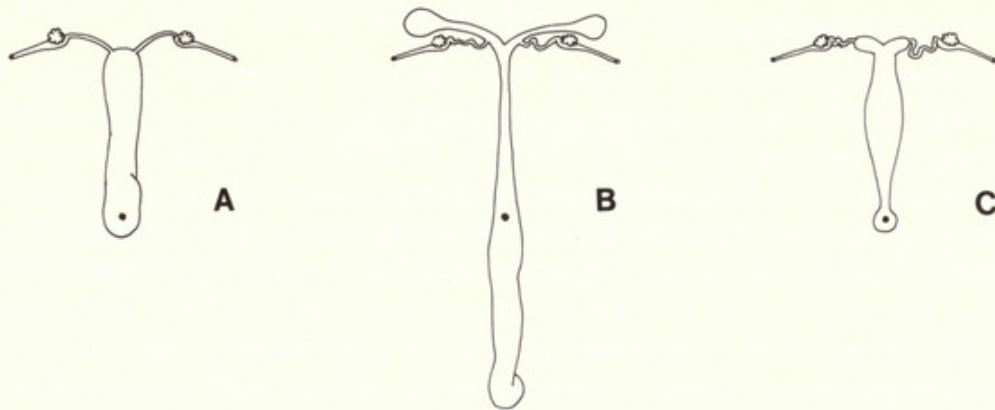


Fig. 18 *Polytoreutus arningi* species group. (A) *arningi* (syn. *fuellerborni* syntype); (B) *monoporus* (syntype); (C) *stierlingi* (syntype).

***Polytoreutus arningi* Michaelsen, 1897**
(Figs 17A & 18A)

Polytoreutus arningi Michaelsen, 1897 : 53; 1900 : 417.

Polytoreutus fuellerborni Michaelsen, 1905 : 360.

DESCRIPTION. External characters. Length 150–230 mm, diameter 4–6 mm (up to 11 mm at clitellum), segments circa 270. Prostomium prolobous. Clitellum *xiii–xvii* annular, incomplete ventrally in subadults and seemingly saddle-shaped. Setae at *xxx*, *aa* : *ab* : *bc* : *cd* = 4 : 2 : 4 : 1. Male and spermathecal pores concealed within a common copulatory pouch with a large circular to scutate orifice *xviii* bordered by an elevated glandular ridge; within the pouch the spermathecal pore may be seen surrounded by raised lips and immediately posteriorly, paired copulatory appendages (the copulatory appendages may appear as papillae or in excessively relaxed individuals, may even extend outside of the pouch). The perigenital ridge is horseshoe-shaped latero-posteriorly and limited anteriorly (in mature specimens) by a transverse bow-shaped ridge in *xvi* and *xvii* raised into a median papilla. Female pores paired $\frac{3}{4}$ *xiv* in setal line *c*. Pore-like, median papillae occasionally in 19/20.

Internal characters. Prostatic glands tubular, somewhat clavate being more slender ectally, extending back perhaps to *xxxii* but possibly only to *xxii* when strongly flexed; subterminal ectal cornu present receiving the vas deferens of its side. Male pouch large, penis not seen. The spermathecal system comprises a simple, adiverticulate receptaculum seminis passing forwards from the spermathecal pore to the anterior bifurcation in *xiii*, the fertilization chambers are located distally (terminally) on the lateral furcae. A pair of raised pads are present in the parietal wall posterolaterally to the spermathecal pore (termed 'copulatory sacs' by Michaelsen); these contain the copulatory appendages which when everted, protrude externally through the orifice of the copulatory pouch (their size depending on the preservation techniques employed).

TYPE LOCALITY. Kirombero (Ulanga valley) and Ruaha valley, Tanzania.

MATERIAL EXAMINED. Previous records. 2C 6A (fragments) Kirombero, Ulanga valley (approx. 8° 10' S, 37° 30' E) and Ruaha valley (approx. 7° 40' S, 37° 30' E), Uhehe Territory, Tanzania, –200 m; Hamburg V. 4484 (syntypes of *arningi*). 2C Langenburg north of Lake

Malawi ('Njassa') (9° 30' S, 34° 10' E), Tanzania; Hamburg V. 6669 (holotype of *fuelleborni*) and Hamburg V. 7643 (paratype of *fuelleborni*).

DISTRIBUTION. Central and western Tanzania (Fig. 2G).

***Polytoreutus stierlingi* Michaelsen, 1899**
(Figs 17B & 18B)

Polytoreutus stierlingi Michaelsen, 1899 : 134; 1900 : 416.

DESCRIPTION. *External characters.* Length 60, 102 mm, diameter 3, 4 mm, segments 104, 247, posterior half of the body slender about half the diameter of the anterior region (2 clitellate specimens). Prostomium pro(epi)lobous. Clitellum annular, $\frac{2}{3}$ xiii–xvii. Setae at xxx, $aa : ab : bc : cd = 4 : 3 : 4 : 1$. Male and spermathecal pores (of adults) contained within a single 'copulatory' pore or concavity extending $\frac{1}{2}$ xvi, xvii– $\frac{1}{2}$ xix, in subadults the male pore opens into a shallow concavity extending between $\frac{1}{2}$ xvi or xvii to $\frac{2}{3}$ xviii with the spermathecal pore slit-like and inconspicuous in 18/19; 'copulatory' pore with a stout penis protruding anteriorly and the distal ends of paired copulatory appendages seen posteriorly, the body wall around the 'copulatory' pore or concavity is raised and highly glandular. Genital papillae and markings absent. Female pores paired $\frac{2}{3}$ xiv in setal line *c*.

Internal characters. Prostates tubular extending back to xxx–xxxii, anteriorly each has a long anterior cornu reaching forward from xvii to xv where it receives the vas deferens of its side; male pouch inconspicuous with large, paired posterolateral accessory pouches (containing the copulatory appendages) lying ventrally xviii–xx. The spermathecal system comprises a single, median adiverticulate receptaculum seminis extending from the anterior bifurcation in xiii to beyond the spermathecal pore, perhaps to xxv; the anterior furcae are swollen but short (possibly longer in mature adults), proximally paired (basal) ducts lead to the fertilization chambers.

TYPE LOCALITY. 'Iringa' (?Kuirenga), Tanzania.

MATERIAL EXAMINED. *Previous record.* 1C fragment ?Kuirenga ('Iringa'), Ruaha Valley Uhehe Territory, Tanzania (7° 46' S, 37° 42' E), –200 m; Hamburg V. 5040 (holotype of *stierlingi*).

New records. Kenya (Coll. E. Oxtoby): 2C(subadults) 31A(juveniles) ?Ngangao ('Ngangau', Forest, Taita Hills, (3° 22' S, 38° 20' E), –1500 m, 10 Aug. 1978; BM(NH) 1981.6.1369–1404. 5A (juveniles) Roadside mud, Vuria radio station, Taita Hills, (?3° 25' S, 38° 18' E), –1500 m, 13 Aug. 1978; BM(NH) 1981.6.1405–1409.

DISTRIBUTION. Central Kenya to central Tanzania (Fig. 2G).

***Polytoreutus monoporus* sp. nov.**
(Figs 17C & 18C)

DESCRIPTION. *External characters.* Length 67, 102 mm, diameter 2.0, 2.5 mm, segments 121, 225. Prostomium epilobous, open posteriorly. Clitellum $\frac{1}{2}$ xiii–xvii annular. Setae at xxx, $aa : ab : bc : cd = 3 : 2 : 3 : 1$. Male and spermathecal pores contained within a single elongate; 'copulatory pore' or concavity, 17/18– $\frac{1}{2}$ xviii long and *aa* wide; a prominent male porophore (? penis present) occupies the anterior part of the 'copulatory pore' while the posterior part is deeply sunken with a glandular floor and a pair of lateral and a pair of posterior pads surrounding a medial spermathecal pore. Female pores paired $\frac{2}{3}$ xiv midway between setal lines *c* and *d*.

Internal characters. Prostates tubular, long and slender, reaching back to about xxx; anteriorly each has a long subterminal anterior cornu extending to 15/16 where it receives the vas deferens of its side. Male pouch not seen. Spermathecal system single, adiverticulate with a simple receptaculum seminis extending posteriorly far behind the spermathecal pore

to about xxv; the furcae of the anterior bifurcation are massive with proximal (basal) ducts leading to the fertilization chambers.

TYPE LOCALITY. Vuria, Taita Hills, Kenya.

MATERIAL EXAMINED. (*Coll.* E. Oxtoby): 2C Roadside mud, Vuria radio station, Taita Hills, Kenya (3° 25' S, 38° 18' E), -1500 m, 13 Aug. 1978; BM(NH) 1981.6.1209-1210 (syntypes of *monoporous*).

DISTRIBUTION. Known only from the type locality (Fig. 2G).

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