
ISSN:

Print - 2277 - 0593

Online - 2315 - 7461

© FUNAAB 2015

**Journal of Natural
Science, Engineering
and Technology**

FOUR NEW EARTHWORM GENERA (ANNELIDA: OLIGOCHAETA) FROM NIGERIA

A.A. ALADESIDA*¹ AND S.O. OWA²¹Department of Biological Sciences., Federal University of Agriculture, Abeokuta, Ogun State, Nigeria²Dept of Biological Sciences, Landmark University, Omu-Aran, Nigeria***Corresponding author:** aaladesida@gmail.com **Tel:** +234

ABSTRACT

The taxonomy of earthworms in Nigeria has been mainly on the family Eudrilidae. The present work describes four new earthworm genera belonging to earthworm families other than the Eudrilidae. Earthworm samples were collected using the digging and hand-sorting method. The earthworms are preserved in formic acid alcohol. The four taxa described here include *Imekodrilus hexagastricus* (family Moniligastridae), *Adodrilus stephana* (family Megascolecidae), *Parnematogenia eyinwaensis* and *Ekitidrilus alabataensis* (family Ocnerodrilidae). *Imekodrilus hexagastricus* from Imeko, Ogun State has six gizzards, characteristic of members of the family Moniligastridae. The genus *Adodrilus* is compared with 3 earthworm genera, *Diporochoeta*, *Plutellus* and *Perionyx*. The genus and species lacks gizzards. The calciferous glands (a pair) are present, with left and right united in segment X. Four individuals of *P. eyinwaensis* were collected from Eyinwa, Odogbolu Local Government Area of Ogun State. The species is here described as having same position and number of calciferous glands, testes and male pores as the genus *Nematogenia*. Also described here is *E. alabataensis*, which was collected from both Ado-Ekiti and Alabata, south west Nigeria. These four genera and species are here presented as new taxa of earthworms from southwest Nigeria.

Key words: Earthworm, *Imekodrilus hexagastricus*, *Adodrilus stephana*, *Parnematogenia eyinwaensis*, *Ekitidrilus alabataensis*, Moniligastridae, Megascolecidae, Ocnerodrilidae

INTRODUCTION

There have been several works on the taxonomy of the Oligochaeta in Nigeria, however though; attention has been mainly on the family Eudrilidae. This family, Eudrilidae, has been studied extensively by various authors (Beddard, 1890, 1891, 1893; Michaelsen, 1910, 1915, 1937; Taylor, 1949; Clausen, 1963, 1965, 1967; Sims, 1971; Segun, 1976a, 1976b, 1977, 1978a); the most extensive and intensive being that of Owa (1992) who identified and described thirty-

six species, two of which were new to science. Owa (1993, 1994a, 1994b, 1994c, 1995a, 1995b, 1996a, 1996b, 1996c, 1997, 1998a, 1998b) also discovered and described several new genera and species belonging to the family Eudrilidae.

However, little is known about the non-eudrilid earthworms belonging to families other than the Eudrilidae. Thus the species diversity, distribution and ecology of the non-eudrilid earthworms of Nigeria are poorly

known. The non-eudrilid earthworms include the families Alluroididae, Moniligastridae, Megascolecidae, Acanthodrilidae, Octochaetidae, Ocnerodrilidae, Diplocardidae and Glossoscolecidae (Sims and Gerard, 1999).

The family Alluroididae has one genus *Alluroides* Bedd., with two species *A. pordagei* and *A. tanganyikae*. These have been reported from East Africa, but no record so far from Nigeria.

The Moniligastridae has two sub-families namely Syngenodrilinae (one species) and Moniligastrinae (four genera). This family has been recorded in the Himalayas, India, Philippine island, Japan and Bahamas. Syngenodrilinae have been found only in Tropical East Africa (Sims and Gerard, 1999). This paper presents a record and description of four new genera and species of non-eudrilid earthworms.

MATERIALS AND METHODS

The earthworm samples used for this work were collected during a sampling study of earthworm diversity and abundance in southwestern Nigeria. Earthworm samples were collected using digging and hand-sorting method (Reynolds, 1977; Owa, 1992), which allowed determination of soil volume with little loss of worms which may migrate in other directions when the alternative chemical extraction methods are employed. This method involved using a shovel to dig up the soil in blocks. The soil blocks were placed on wooden sorting-trays; the soil was broken loose to expose the earthworms, which due to the light are betrayed by their movements, and were picked up. Collecting or digging the soil in blocks helped reduce damage to the earthworms during digging. One advantage of

using this method is that it reduces the possibility of damage to the soil, as the soil is returned after picking out the earthworms.

The earthworms were killed and preserved in formoacetic alcohol (F.A.A) prepared on volume bases of 10% formalin, 2% acetic acid, 50 % alcohol and 38 % distilled water. This, according to Owa (1992) causes minimal shrinkage, leaving the worms pliable and easy to dissect.

The earthworm samples were examined externally and dissected to verify the taxon. Comparison was made with previous literature to establish the status of each taxon.

RESULTS AND DISCUSSION

Imekodrilus hexagastricus genus *et. sp. nov.*

Type Locality: Three (3) acitellate specimens were collected from Imeko, Ogun State, Nigeria.

Type material: The holotype is deposited in the British Museum of Natural History, while the syntype is deposited at the Natural History Museum, Olabisi Onabanjo University, Ago-Iwoye, Nigeria.

External Diagnosis

Prostomium is Epibolous. Dorsal pores present, from intersegmental furrow 7/8 backward. The specimens are acitellate and no reproductive pores were present dorsally.

Internal Diagnosis

There is the presence of last heart in segment XI. Gizzards are oesophageal, pre-testicular, from segment V to X (i.e. 6 gizzards) in location. The intestine begins at segment XIV.

Remarks: The multiple gizzards in *I. hexa-*

gastricus are characteristic of the members of the family Moniligastridae (i.e. having beaded intestine). This family comprises two sub-families Moniligastrinae, which have been reported in South India, Sri Lanka, Burma, and East Himalayas, and Syngenodrilinae reported as being present only in East Africa (Sims and Gerard, 1999). Five genera have been earlier reported from this family.

The species, *I. hexagastricus*, shares similarities with the mono-specific Syngenodrilinae sub-family. These similarities are:

1. Last heart in XI;
2. Intestine beginning at XIV and
3. Gizzards are in front of testis segments.

The major diagnostic difference between *Imekodrilus* and *Syngenodrilus* lies in the possession of six gizzards by *Imekodrilus* as against three in the later. In the present collection, however the specimens were not mature enough to assess the reproductive structures, but the above features are quite distinctive enough to determine the specific, generic and familial status of the specimens.

Etymology: The genus *Imekodrilus* is named after its type locality, Imeko, Ogun State, SW Nigeria. The specific name is derived from the number (6) of gizzards.

Genus *Adodrilus stephana* genus et sp. novo

Type Locality: Eight individuals, all clitellate, were collected from Ado-Ekiti, Ekiti State

Type material: The holotype has been deposited at the British Museum of Natural History, while the syntype is at the Museum of Natural History, Olabisi Onabanjo University, Ago-Iwoye, Nigeria.

External Diagnosis

The somatic setae are sigmoid shaped. Setal arrangement lumbricine, except in the hinder parts of the body. Dorsal pores are absent. The clitellum starts at mid-segment XIV and extends to segment XVII. Spermathecal pores paired, in intersegmental furrow 7/8. Male pores not visible externally, but internally, united with prostatic pores in intersegmental furrow 17/18. Genital papillae absent.

Internal Diagnosis

Both intestinal and oesophageal gizzards are absent. Prostates one pair, bag shaped, confined to locus on intersegmental furrow 17/18. Each prostate is vertically positioned on the furrow (figure 1). Excretory system is holonephric and meganephridial.

Female pores paired, in segment XIV. Testes naked and holandric. Calciferous glands left and right united in segment X, latero-mediad. Spermathecae one pair, adiverticular, bow-shaped, in segment VIII (figure 1). Ovary is racemose and located in segment XIII.

Remarks: *Adodrilus stephana* belongs in the family Megascolecidae. It shares features which could have included it in any of *Diporochoeta*, *Plutellus* or *Perionyx*, but with some independence of a subgenus. However, considering the shape of prostate and status of gizzard in these genera (Table 1), it is neater to separate *Adodrilus* as a different genus.

It shares a few similarities with the *Diporochoeta* and *Pontodrilus* in setae number, nephridium type and status of the gizzard. However, unlike *Diporochoeta* which has two to five pairs of spermathecal pores and *Pontodrilus* with two to four pairs, *Adodrilus* has

only one pair. The shape of the prostates also differs in *Adodrilus* with the baggy type while other members of the family have racemous to tubular prostates. **Etymology:** The genus derives its name from Ado-Ekiti its type locality, while the

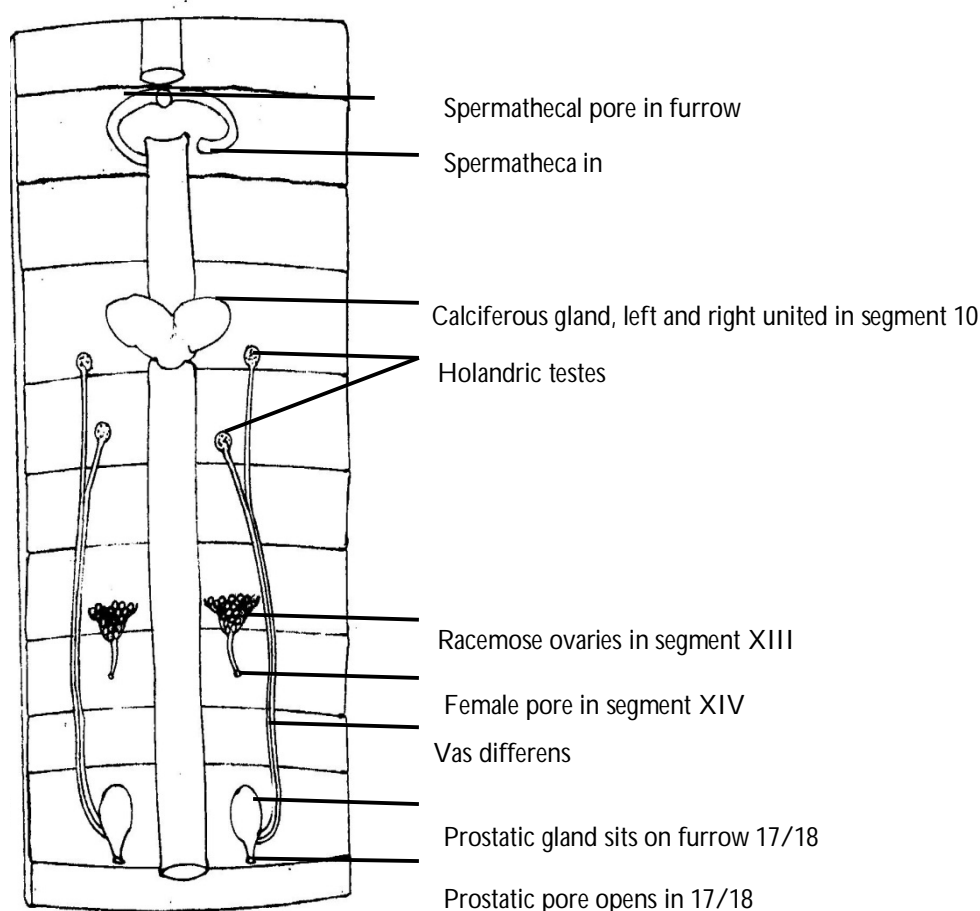


Fig. 1: Internal diagnostic features of *Adodrilus stephana*

Table 1: Comparison between *Diporochaeta*, *Plutellus*, *Perionyx* and *Adodrilus*

Feature	Diporochaeta	Plutellus	Perionyx	Adodrilus
Gizzard	Present, seldom vestigial	More or less vestigial	Present, but vestigial	Absent
Prostate	Tubular with simple un-branched duct	Racemose	Racemose	Club-shaped
Somatic setae	Lumbricine except in the hinder part of the body	Perichaetine	Lumbricine	Lumbricine except in the hinder part of the body

***Parnematogenia eyinwaensis* genus et sp. novo** Ocnerodrilidae.

Type Locality: Four individuals, 3 clitellates and 1 aclitellate, were collected from Eyinwa, Ogun State, Nigeria.

Type material: The holotype has been repositied at the British Museum of Natural History, while the syntype is at the Museum of Natural History, Olabisi Onabanjo University, Ago-Iwoye, Nigeria.

External Diagnosis

Dorsal pores are present, starts in intersegmental furrow 13/14. A pair of male pore present on segment XVII and united with prostatic pores. Spermathecal pores one pair, in intersegmental furrow 7/8. Female pores not visible externally but internally paired, on segment XIV.

Internal Diagnostics

Excretory system is Meronephric, micronephridial and flattish. Single calciferous gland present, on segment IX. Gizzards are oesophageal and two pairs are present, in segments IX and X. Testis is metandric. Spermathecae one pair present, in segment VIII and is diverticulated (figure 2b); one pair of ovary is present in segment XIII. The ovary in *P. eyinwaensis* is a chain of eggs enclosed in a bow-shaped sac (figure 2c).

Remarks: The species *Paranematogenia eyinwaensis* is in many ways similar to the genus *Nematogenia*. Differences however, arise in the position of the gizzards, spermathecal pore and diverticulation of the spermathecae. The position and numerary of the calciferous gland, testes, male pores and presence of dorsal pores are same in the both genera, however, position of gizzards and spermathecal pores are different (table 2). The genus is classified in the family

Etymology: The genus is named after its nearest neighbouring genus *Nematogenia*, while the specific name is after Eyinwa the type locality.

Type Locality: Two individuals were collected from Ado-Ekiti and four (4) other individuals were collected from Alabata, Abeokuta, Ogun State. The specimens from Ado-Ekiti were both clitellate, while 3 individuals from Alabata were clitellate.

Type material: The holotype has been repositied at the British Museum of Natural History, while the syntype is at the Museum of Natural History, Olabisi Onabanjo University, Ago-Iwoye, Nigeria.

External Diagnosis

Prostomium is prolobous. Dorsal pores present. Clitellum is saddle-shaped. Male pore is single and located mid-ventrally in segment XIX; there two pairs of prostatic pores in intersegmental furrow 17/18 and 18/19. Seminal groove present, in the region of male and prostatic pores. Spermathecal pores two pairs, in intersegmental furrow 7/8 and 8/9, on setal line **b**. Female pores in 13/14, on **b**, visible only internally.

Internal diagnosis

Oesophageal gizzards are present in segment IX. Calciferous gland present in segment X, but is rudimentary. Intestinal caeca is absent. Testes is Holandric. Prostates in XVII and XVIII. Two pairs of spermathecae present in segments VIII and IX, adiverticulated (Fig. 3a). Ovaries one pair present, in segment XIII; rosette-shaped, naked, on ventral parietal; while ovarian funnels is in segment XIII on anterior face of septum 13/14.

Remarks: The genus *Ekitidrilus* is placed in the family Ocnerodrilidae. The spermathecae in the species are hand-fan-shaped with the stalk forming a set of foldings narrowing down to open in the furrow in front of the segment bearing the spermathecae (Fig. 3b). The shape of the prostates is noteworthy, being like a folded long tube with three

different regions, a thin, thick and thickest stalk (Fig. 3c).

Etymology: The genus is named after the first point of collection, Ado-Ekiti, while the species is named after Alabata town from which the second sets of samples were collected.

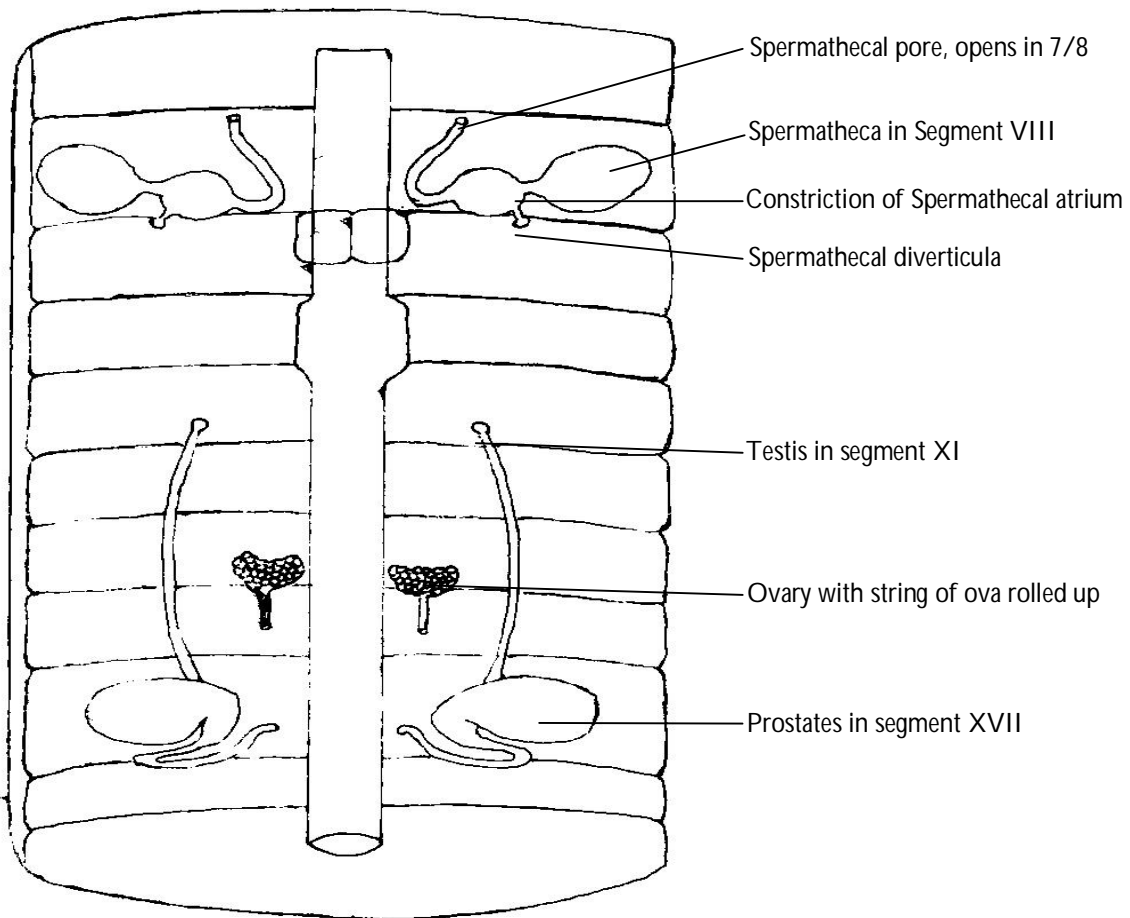


Fig. 2a: Internal diagnostic features of *P. eyinwaensis*

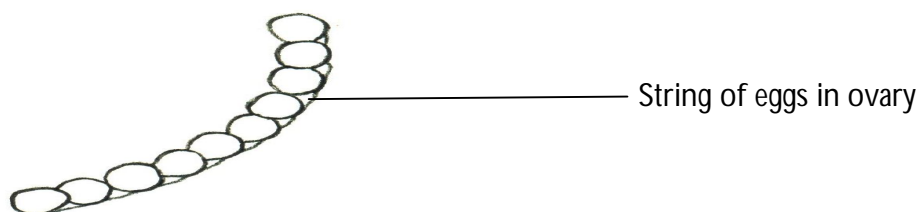


Fig. 2b: Bow-shaped ovary of *P. eyinwaensis*. Eggs are enclosed in a slender sac, making them look like a chain of beads.

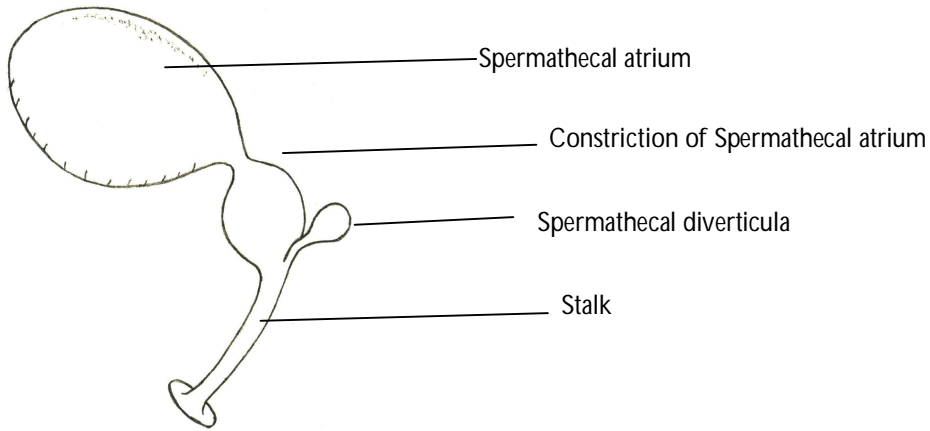


Fig. 2c: Spermatheca of *P. eyinwaensis*. Atrium is constricted close to the diverticula.

Table 2: A comparison between the *Paranematogenia* and *Nematogenia*

Feature	Paranematogenia	Nematogenia
Male pore	Located in segment XVII and united with prostatic pore	Located in segment XVII and united with prostatic pore
Dorsal pores	Present	Present
Spermathecae	Pores in 7/8; spermatheca is diverticulated	Pores in 8/9 or immediately after and spermatheca adiverticula
Testes	Metandric	Metandric
Oesophageal gizzards	Two present and located in Segments IX and X	Two present but located in Segments VI and VII
Calciferous glands	One present and located in Segment IX	One present and located in Segment IX

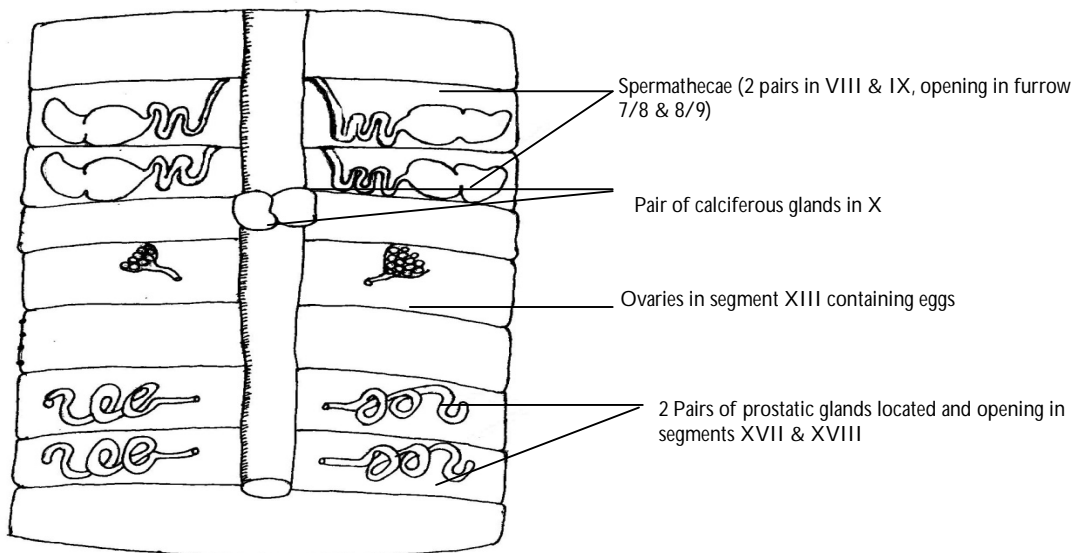


Fig. 3a: Internal diagnostic features of *Ekitidrilus alabataensis*

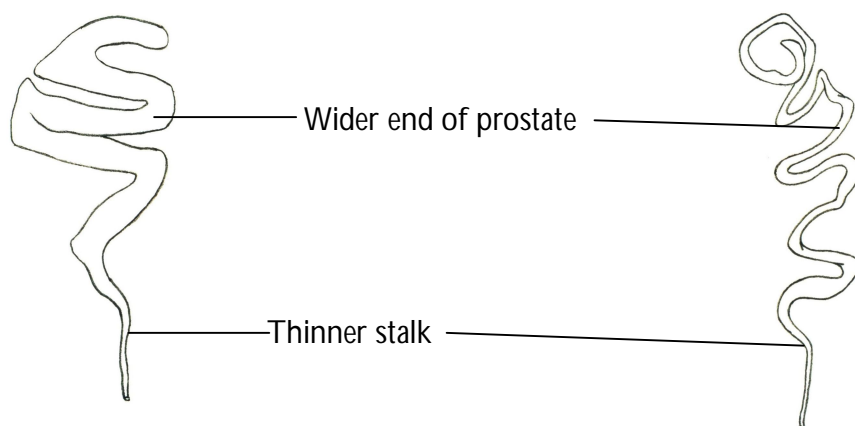


Fig. 3b: Prostatic glands of *E. alabataensis*, showing the variant folding of each pair

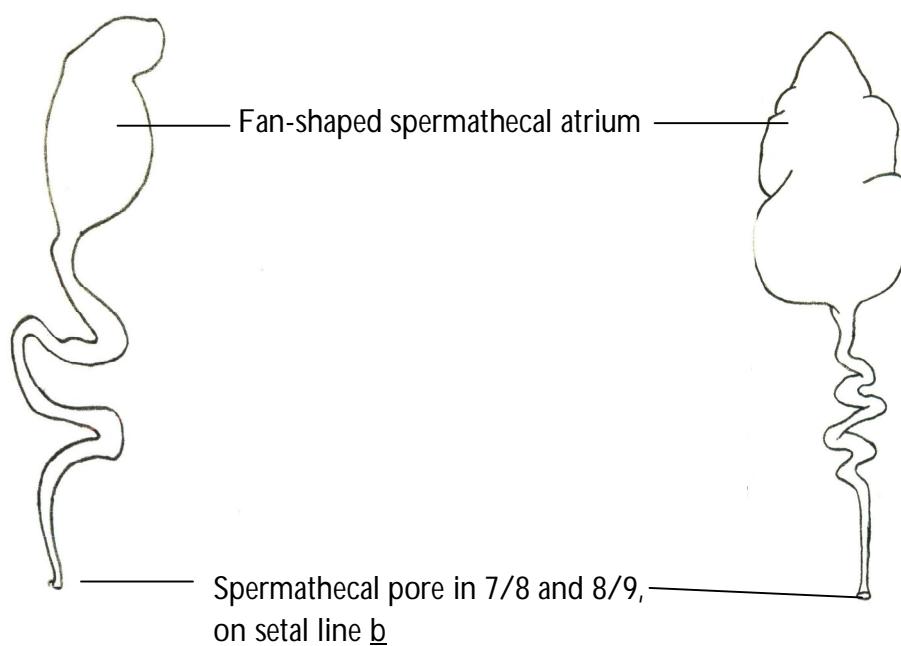


Fig. 3c: Spermathecae of *E. alabataensis*. Shape of the pair in segment VIII is shown on the right, while the pair in segment IX is represented on the left. Both pairs have a fan-shaped atrium.

REFERENCES

- Beddard, F. (1890).** Preliminary note upon *Heliodrillus* a new genus of Eudrilidae. *Zoologischer Anzeiger* 13: 627-629.
- Beddard, F. (1891).** On the structure of two genera of earthworms belonging to the Eudrilidae, and some remarks on *Nematodrilus*. *Quart. J. Micr. Sci.* 32: 235-278.
- Beddard, F. (1893).** Two new genera and some species of earthworms. *Quart. J. Micr. Sci.* 34: 243-278.
- Clausen, M.W. (1963).** Two new genera and three new species of earthworms from West Africa. *Vidensk. Medd. Dansk. Naturhist Foren.* 126: 1-15.
- Clausen, M.W. (1965).** Description of two new species of *Libyodrillus* Beddard, 1891, with remarks on the genus and on the female system in the family Eudrilidae. *Vidensk. Medd. Dansk. Naturhist Foren.* 128: 273-292.
- Clausen, M.W. (1967).** The African Oligochaete genera *Hyperiodrilus* Beddard, 1891 and *Legonea* Clausen, 1963 (Oligochaeta). *Vidensk. Medd. Dansk. Naturhist Foren.* 130: 179-207.
- Michaelsen, W. (1910).** Oligochaten von Verschieden Gebieten. *Mitt. Mus. Harburg, Jg. XXVII.*
- Michaelsen, W. (1915).** Zentralafrikanische Oligochaten. *Erg Zweit. Beutsch. Zentral-Afrika-Exp.* 1910-1911, Bd. 1 Zool.
- Michaelsen, W. (1937).** A collection of African Oligochaeta in the British Museum. *Proc. Zool. Soc. Lond.* **107**: 528
- Owa, S.O. (1992).** Taxonomy and distribution of Nigeria Earthworms of the family Eudrilidae and their use as possible indicators of soil properties. Ph.D Thesis submitted to the Department of Zoology, Obafemi Awolowo University, Ile-Ife.
- Owa, S.O. (1993).** Description of a new earthworm species, *Iridodrillus kayodei* from eastern Nigeria and an identification key on the species of the genus *Iridodrillus* Beddard, 1897 (Eudrilidae: Oligochaeta: Annelida). *Nig. J. Sci.* **27**: 91-96.
- Owa, S.O. (1994a).** Two new earthworm species *Iridodrillus abinsiensis* and *Eminoscolex betukwelensis* (Oligochaeta: Eudrilidae) from Nigeria. *Durban Mus. Novit.* **19**: 8-12.
- Owa, S.O. (1994b).** Description of two new earthworm species *Iridodrillus abujaensis* and *Iridodrillus furcothecata* (Eudrilidae: Oligochaeta) from Nigeria. *S. Afr. J. Zool.* **29**: 235-239.
- Owa, S.O. (1994c).** Description of two new *Iridodrillus* species and a re-examination of the earthworm genera *Heliodrillus* Beddard, *Iridodrillus* Beddard and *Segunia* Sims (Annelida: Oligochaeta: Eudrilidae). *J. Nat. Hist.* **28**: 9-25
- Owa, S.O. (1995a).** A new earthworm genus (Eudrilidae: Oligochaeta) from Nigeria. *J Nat Hist.* **29**: 571-579.
- Owa, S.O. (1995b).** A new earthworm genus and four new species of earthworms (Oligochaeta: Annelida) from Nigeria. *J.*

Afr. Zool. **109(3)**: 193-211

Owa, S.O. (1996a). Two new species of *Beddardiella* (Eudrilidae: Oligochaeta: Annelida) from Nigeria. *J Nat Hist.* **30**: 977-987.

Owa, S.O. (1996b). A new earthworm species: *Eminoscolex buraraensis* (Annelida: Oligochaeta: Eudrilidae) from Nigeria. *Biosci. Research Comms.* **8 (2)**: 85-91

Owa, S.O. (1996c). New earthworm species, *Eudrilus milliemosbyae* and *Eudrilus sodeindei* (Oligochaeta: Eudrilidae) from *Isoberlinia* savanna of Nigeria. *Durban Mus. Novit.* **21**: 43-48.

Owa, S.O. (1997). Description of a new earthworm species, *Nsukkadrilus funmie* (Eudrilidae: Oligochaeta: Annelida) from Nigeria. *S. Afr. J. Zool.* **32 (1)**: 5-8.

Owa, S.O. (1998a). New eudriline earthworm, *Iridodrilus encombopapillare* (Eudrilidae) from Nigeria. *Nig. J. Sci.*

Owas, S.O. (1998b). Taxonomy of five polytoreutoid earthworm genera and three new species from Nigeria (Oligochaeta: Eudrilidae). *Durban Mus. Novit.* **23**: 29-38.

Reynolds, J.W. (1977). The earthworms

Lumbricidae and Spiraanophilidae of Ontario. Royal Ontario Museum Life Sciences Miscellaneous Publications.

Segun, A.O. (1976a). Two new genera of eudrilid earthworms from Nigeria. *Proc. Biol. Soc. Wash.* **88**: 383-394.

Segun, A.O. (1976b) Oligochaete annelids of Nigeria: Hyperiodrilus species including two new species. *Rev. Ecol. Biol. Sol.* **13 (14)**: 653-665.

Segun, A.O. (1977). The genera *Iridodrilus* (Eudrilidae: Oligochaeta) in Nigeria. *J. Nat. Hist.*, **11**: 579-589.

Segun, A.O. (1978). Eudrilid earthworms from Ile-Ife, western Nigeria. *J. Nat. Hist.*, **12**: 15-31.

Sims, R.W. (1971) Eudrilinae from Southern Nigeria and a taximetric appraisal of the family Eudrilidae (Oligochaeta). *J. Zool. Lond.*, **164**: 529-549.

Sims, R.W. and Gerard, B.M. (1999). A synopsis of the earthworm. Linnean Society, London, pp. 806-884.

Taylor, A.G. (1949) A West African Earthworm, *Hippopera nigeriae* belonging to a new family, Hippoperidae. *Proc. Zool. Soc. Lond.*, **119**: 703-710.

(Manuscript received: 4th March, 2014; accepted: 3rd March, 2015).