

WEST AFRICAN EARTHWORM
GENUS *MILLSONIA* BEDDARD, 1894
(OLIGOCHAETA: ACANTHODRILIDAE, BENHAMIINAE)
REVIEWED AND SEPARATION OF A NEW GENUS

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A detailed morphological revision of the species belonging to the genus *Millsonia* BEDDARD, 1894 is presented, and a new species *Millsonia bouna* sp. n. is described. To accommodate the species possessing enteronephric excretory system a new genus *Reginaldia* gen. nov. is erected. The new genus is divided into two subgenera according to the number of oesophageal gizzards: *Reginaldia (Reginaldia)* subgen. nov. for the species possessing two gizzards in *v* and *vi*, and *Reginaldia (Peritogaster)* subgen. nov. for the species provided with only one gizzard in *vi*.

Key words: earthworms, Oligochaeta, Acanthodrilidae, Benhamiinae, *Millsonia*, new species and genus, *Reginaldia (Reginaldia)*, *Reginaldia (Peritogaster)*, Africa

INTRODUCTION

The earthworm genus *Millsonia* was erected by BEDDARD (1894) for two peculiar earthworm species *Millsonia nigra* BEDDARD, 1894 and *Millsonia rubens* BEDDARD, 1894, which possessed two gizzards, three pairs of calciferous glands and paired intestinal caeca. Later MICHAELSEN (1900) merged all the meronephric genera possessing two gizzards and three pairs of calciferous glands in the region of segments 15–17 to *Dichogaster* BEDDARD, 1888 creating thus a highly heterogeneous genus containing some 70 species. During the next several decades the number of the described species more than doubled and the genus *Dichogaster* became an untenable catch-all taxon. It was OMODEO (1955, 1958) who first tried to separate homogenous groups from *Dichogaster* resurrecting the genus *Benhamia* MICHAELSEN, 1889 and *Millsonia* BEDDARD, 1894.

The genus *Millsonia* according to OMODEO (1955, 1958) differed from *Dichogaster* by presence of paired intestinal caeca and lacking of penial setae. Further common characteristics of these species were the large body size (150–450 mm) and spermathecal diverticula embedded into the wall of the duct.

Later, a number of new species, including small and penial setae bearing ones, were described (SIMS 1965a, OMODEO 1973), which clearly increased the

variability inside the genus. This led SIMS (1986), elaborating on a large sample from Ghana, to carry out a detailed revision of the genus *Millsonia* resulting in the description of 14 new taxa and the recognition of two morphologically distinct groups of species. To the first group he placed the species provided with only meronephridia and into the second the species possessing meronephridia and “holonephridia” (SIMS 1986 p. 278–279).

A detailed examination of the species assigned to the second group revealed that they have a special excretory system in the Benhamiinae subfamily. Beside the normal sac-shaped astomate meronephridia there is one pair of filiform stomate megameronephridia running into a longitudinal collecting canal in each intestinal segment (mixed exo- and enteronephric condition) (Fig. 1). Enteronephry is quite frequent among the octochaetid genera (JULKA 1988) but in the subfamily Benhamiinae it is known only in *Dudichiodrilus* CSUZDI, 1995. However, removing these species to *Dudichiodrilus* is unsupported by other characters (i.e. the lack of intestinal caeca and the structure of receptacles) therefore to accommodate them a new genus needs to be erected.

MATERIAL AND METHODS

During visits to the Natural History Museum, London and Zoologisches Institut und Zoologisches Museum der Universität Hamburg the type material of 24 nominal *Millsonia* species were investigated (CSUZDI 1995a, CSUZDI 2000a). In addition, other identified *Millsonia* species and new material from the earthworm collection of the Royal Central Africa Museum, Tervuren were also examined. Abbreviations referring to the different collections are as follows: MRAC (Museum Royal Afrique Central, Tervuren), BMNH (Natural History Museum, London), ZMUH (Zoologisches Institut und Zoologisches Museum der Universität Hamburg) HNHM (Hungarian Natural History Museum, Budapest).

SYSTEMATICS

Millsonia BEDDARD, 1894

Millsonia BEDDARD, 1894: 380., BEDDARD 1895: 479; OMODEO 1955: 218 (part.); OMODEO 1958: 59 (part.); SIMS 1965a: 299 (part.); SIMS 1965b: 39; OMODEO 1973: 15; SIMS 1986: 277 (part.); CSUZDI 1995a: 116 (part.); CSUZDI 1995b: 34; CSUZDI 1996: 360 (part.); CSUZDI 2000a: 75 (part.); CSUZDI 2000b: 29 (part.).

Dichogaster BEDDARD, 1888; MICHAELSEN 1900: 334 (part.); STEPHENSON 1930: 851 (part.).

Diagnosis. Male terminalia acanthodriline, sometimes with microscoleicine reduction. Two gizzards before the genital segments, three pairs of stalked extra-

mural calciferous glands in segments *xv–xvii*, excretory system meroic with astomate meronephridia and caudal exonephric stomate megameronephridia. Paired digitate caeca present in at least one, usually several adjacent segments of the intestine. Typhlosole present, ventral setae normal.

Type species – *Millsonia nigra* BEDDARD, 1894 (OMODEO 1955 by subsequent designation)

Other species: *M. ashantiensis* SIMS, 1986; *M. caecifera* (BENHAM, 1894); *M. centralis* SIMS, 1986; *M. guttata* (MICHAELSEN, 1913); *M. heteronephra* (MICHAELSEN, 1897); *M. inermis* (MICHAELSEN, 1892); *M. lamtoiana* OMODEO & VAILLAUD, 1967; *M. meridionalis* OMODEO, 1973; *M. mima* (MICHAELSEN, 1891); *M. nilesi* SIMS, 1986; *M. pulvillaris* SIMS, 1986; *M. pumilia* SIMS, 1965; *M. riparia* SIMS, 1986; *M. schlegeli* (HORST, 1884); *M. sokodeana* (MICHAELSEN, 1913).

Remarks. SIMS (1986) excluded from *Millsonia* the penial setae bearing species *M. meridionalis* and *M. schlegeli*, but later CSUZDI (1995*a, b*, 1996) argued for back-placing these species into *Millsonia* on the basis of shared presence of intestinal caeca and the similar structure of spermathecae.

Millsonia heteronephra (MICHAELSEN, 1897)
(Fig. 2)

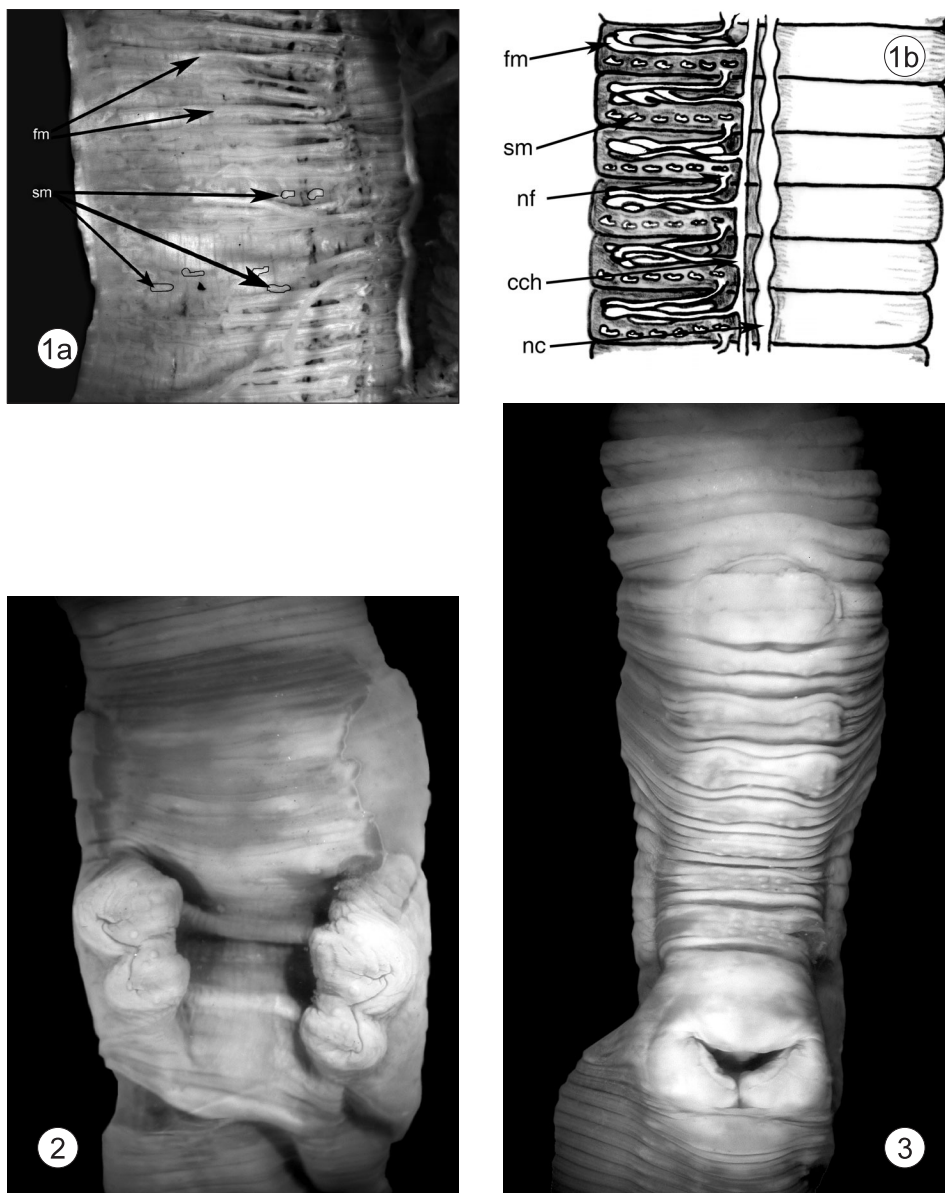
Benhamia heteronephra MICHAELSEN 1897: 22.

Dichogaster heteronephra: MICHAELSEN 1900: 365.

Millsonia heteronephra: OMODEO 1955: 219; OMODEO 1958: 59; SIMS 1965*a*: 299; SIMS 1986: 291, CSUZDI 1996: 361, CSUZDI 2000*a*: 75.

Material examined. MRAC 34.326 1+4 juv. ex., HNHM AF/5125 1+1 juv. ex., Togo, Misa-hohe. Leg. F. PUYLAERT, 6. VIII. 1969.

Remarks. This species is easy to recognize because of the characteristic shape of the male genital field (Fig. 2). SIMS (1986) drew the attention to a possible typing mistake in the original description placing the intestinal caeca between segments *xxvi–xli*, which differed from what he recorded for the specimens from Ghana. Unfortunately the only syntype found in the MICHAELSEN collection Hamburg (V4520) is incomplete; its anterior intestine is missing. Therefore SIMS (1968) was uncertain whether the specimens from Ghana really belong to *M. heteronephra* and in this case the position of the caeca in the original description must be regarded as *lapsus calami* or they represent a new species. Our new material from the type locality corroborates SIMS' opinion that there is a typing mistake in the original description because all of the specimens examined possess intestinal caeca in *xxvi–xxxii, xxxiii*.



Figs 1–3. 1 = *R. (P.) omodeoi* (SIMS, 1986): a = excretory system, b = sketch drawing of the excretory system. Abbreviation – *sm*: exonephric sac-shaped meronephridium; *cch*: collecting channel, *fm*: filiform enteronephric megameronephridium, *nc*: nerve cord, *nf*: nephridial funnel. 2–3 = Male field: 2 = *M. heteronephra* (MICHAELSEN, 1897), 3 = *M. inermis* (MICHAELSEN, 1892)

The type locality of the species is “Togogebiet, Station Misahöhe”. SIMS (1986) places it to Benin with the following coordinates: 6°59'N, 0°40'E. But the locality with these coordinates, as well as the town Misahohe (or Missahohé in other spelling), is found in Togo.

Millsonia inermis (MICHAELSEN, 1892)
(Fig. 3)

Benhamia inermis MICHAELSEN 1892: 209; BEDDARD 1895: 568.

Dichogaster inermis: MICHAELSEN 1900: 366.; MICHAELSEN 1913: 166.; MICHAELSEN 1937: 501.

Millsonia inermis: OMODEO 1955: 218; OMODEO 1958: 59; SIMS 1965a: 299; SIMS 1986: 293; CSUZDI 1996: 361., CSUZDI 2000a: 75., CSUZDI 2000b: 30.

Material examined. MRAC 34.327 1+13 juv. ex., HNHM AF/5124 1+2 juv. ex., Togo, Nameundjega. Leg. F. PUYLAERT, 2. VIII. 1969, MRAC 34.328 2 ex., HNHM AF/5126 1 ex., Togo, Niamtougou. Leg. F. PUYLAERT, 21–24. VII. 1969.

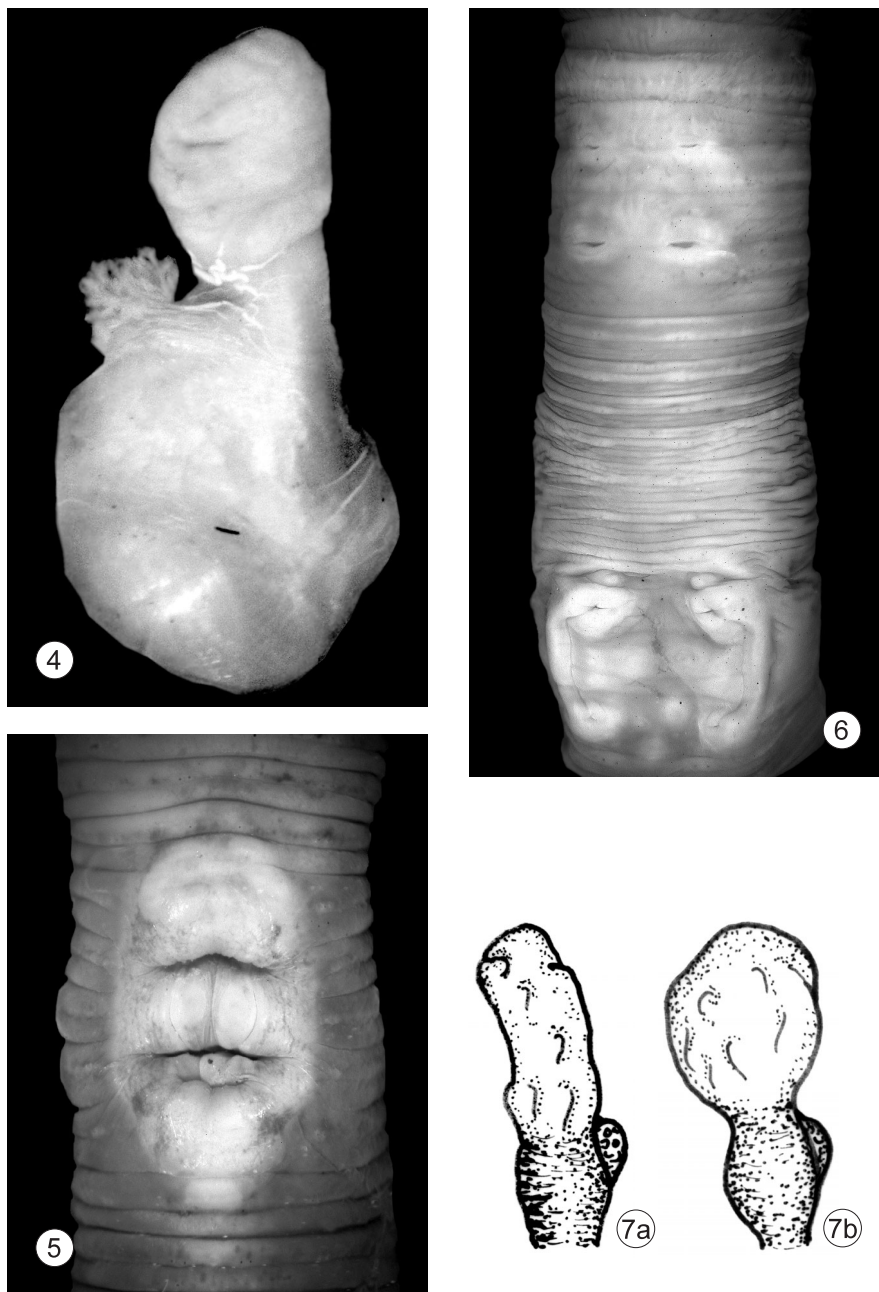
Remarks. This is one of the most widely distributed *Millsonia* species showing high morphological variability, especially in the distribution of the numerous genital papillae and the number of intestinal caeca. The specimens examined externally resemble to those figured by SIMS (1986, Fig. 7c) and possess 11 pairs of intestinal caeca in *xxx-xli* (Fig. 3).

Millsonia lamtoiana OMODEO & VAILLAUD, 1967

Millsonia lamtoiana OMODEO & VAILLAUD, 1967: 932, SIMS 1986: 297, CSUZDI 1996: 361, CSUZDI 2000a: 75.

Material examined. MRAC 33.549 2 ex, HNHM AF/5123 1 ex., Ivory Coast, Doropo. Leg. W. VERHEGEN, 25. VIII. 1966, MRAC 34.152 2 juv. ex., Ivory Coast, Lamto. Leg. VAN MOL, VIII. 1968, MRAC 36.591 1 ex., Ivory Coast, Kossu. Leg. R. JOCQUÉ, 10. VI. 1975. MRAC 37.032 1 ex., 37.044 1 ex., Ivory Coast, Bouaké. Leg. P. ELSEN, V. 1977, MRAC 37.052 2 ex., Ivory Coast, Kossu. Leg. R. JOCQUÉ, 13. V. 1975.

Remarks. *M. lamtoiana* was reckoned among the ‘holonephridia’ bearing species by SIMS (1986). Re-examination of the specimen stored in the Natural History Museum, London (BMNH 1984.12.22, SIMS 1986: 298) revealed that the filiform enteronephric megameronephridia are missing, and the same is true for the present specimens including those from the type locality (Lamto). Therefore, this species shall continue to classify to the genus *Millsonia*.



Figs 4-7. 4-5 = *M. lamtoiana* OMODEO & VAILLAUD, 1967: 4 = spermatheca, 5 = male field. 6-7 = *M. bouna* sp. n.: 6 = ventral view of the clitellar region, 7a = spermatheca from segment vii, 7b = spermatheca from segment viii

M. lamtoiana is a large darkly pigmented species showing high variability in the number of intestinal caeca. In the original description as well as in the diagnosis of SIMS (1986) there are 19 pairs of intestinal caeca reported in *xxviii–xlvi*. The specimens from Bouaké and Lamto well correspond to this description, but those from Kossu have 24–26 pairs of caeca in *xxviii–li, lii, liii*. This number of caeca is similar to that of *M. caecifera*, but there are differences in the position of the clitellum, in the shape of spermathecae and in the male genital field (Figs 4–5).

Millsonia bouna sp. n.
(Figs 6–7)

Holotype: MRAC 33.549/H Ivory Coast, Doropo. Leg. W. VERHEGEN, 20. VIII. 1966.

Paratypes: MRAC 33549/P 2 ex. HNHM AF/5127 1 ex., Ivory Coast, Doropo. Leg. W. VERHEGEN, 20. VIII. 1966.

Etymology. The species is named after the administrative region of the type locality.

Diagnosis. Length 150–160 mm; diameter 5–6 mm; Number of segments 300–345. Setae are closely paired and all on the ventral surface. Female pores paired on *xiv*, prostate pores on *xvii, xix* and spermathecal pores on 7/8, 8/9. Clitellum saddle-shaped, on *xiii–xix*. Two large gizzards in *v, vi*. Septa 6/7–9/10 strongly thickened. Last pair of hearts in *xiii*, and three pairs of calciferous glands in *xv–xvii*. Intestinal caeca 24 pairs in *xxii–xliv*. Excretory system merocric with some ten pairs of meronephridia and a pair of exonephric and stomate megameronephridia. Spermathecae elongated sac-shaped with muscular duct and intraparietal sperm chambers.

Description. Holotype: length 160 mm, diameter just after the clitellum 5 mm. Number of segments 310. Paratypes: 150–160 mm long and 4–6 mm wide. Number of segments 300–345, before the clitellum the segments are bi- or triannulate. Colour yellowish, pigmentation lacking. Prostomium is pro-epilobous, the first dorsal pore occurs in intersegmental furrow 5/6. Setae are closely paired and all on the ventral part of the body. Setal formula at *xxii* aa:ab:bc:cd:dd = 15:2:10:1.5:90. Female pores paired on segment *xiv* slightly anteriorly to the setal ring between *a–a*. Two pairs of spermathecal pores present in furrows 7/8 and 8/9 as great slits in setal lines *ab*. Male pores paired on segment *xviii*, inconspicuous situated along the seminal grooves. The clitellum extends over segments *xiii–xix*, saddle-shaped, interrupted by a ventralmedian genital field situated between segments *xvii* and *xix*. Two pairs of prostatic pores on segment *xvii* and *xix* in setal line *b* connected on each side by a laterally convex seminal groove. A pair of midventral genital papilla is present in 18/19 and two pairs of lateral papillae are associated to the seminal grooves (Fig. 6).

Internal characteristics. Septa 5/6, 10/11–13/14 are slightly thickened and those of 6/7–9/10 are strongly strengthened. Two large distinct gizzards in segments *v* and *vi*. Calciferous glands lamellate and paired in segments *xv–xvii*, decreasing in size backward. The typhlosole arises around

segment *xx* as a moderate slender ridge gradually increasing in size. Intestinal caeca 24 pairs in segments *xxii–xlv*. Last pair of hearts in segment *xiii*. The excretory system is merioc with about 10 sac-shaped meronephridia on each side. Apart from meronephridia there is a pair of exonephric and stomate megameronephridia on the posterior part of the body. Testes and funnels paired in segments *x* and *xi*, sperm sacs apparently missing. Two pairs of small seminal vesicles present in *xi*, *xii* and a pair of large racemose ovaries pendent from the posterior face of septum 12/13. Ovarian funnels moderate, leading into a little ovisac in segment *xiv*. The two vasa deferentia of each side are hardly seen entering the body wall in segment *xviii*. Two pairs of tubular prostatic glands present as long coiled tubes each confined to their segments own. Penial setae are missing. There are two pairs of spermathecae in segment *viii* and *ix*. The ampulla is large, oval shaped, the duct is shorter muscular and on the ental part bears a lateral dilatation filled with sperm chambers (Fig. 7). The first pair of spermathecae is somewhat smaller than the second and its shape is more elongate.

Remarks. *Millsonia bouna* sp. nov. is similar to *M. caecifera* in the number of intestinal caeca, but differs in their more anterior location (*xxii–xlv* versus *xxix–lii*). There are also differences in the position of the last pair of hearts and in the structure of the spermathecae. There is another species possessing similar number of intestinal caeca; *M. lamtoiana*. The new species differs from it in the position of the last pair of hearts and the structure of spermathecae.

Reginaldia gen. n.
(Fig. 1)

Millsonia: OMODEO 1955: 218 (part.); OMODEO 1958: 59 (part.); SIMS 1986: 277 (part.); CSUZDI 1995a: 116 (part.); CSUZDI 1996: 360 (part.); CSUZDI 2000a: 75 (part.).

Diagnosis. Male terminalia acanthodriline, sometimes with microscolecine reduction. One or two gizzards before the genital segments, three pairs of stalked extramural calciferous glands in segment *xv–xvii*, excretory system meroic with astomate meronephridia accompanied caudally by stomate enteronephric filiform megameronephridia (Fig. 1). Paired digitate caeca present in at least one, usually several adjacent segments of the intestine; typhlosole present, ventral setae not modified.

Type species: *Millsonia ghanensis* SIMS, 1965.

Etymology. The new genus is named in honour of the recognized earthworm taxonomist REGINALD WILLIAMS SIMS.

Remarks. The new genus is closely related to *Millsonia* BEDDARD, 1894 but differs from it in the enteronephric condition of the excretory system.

Reginaldia (Reginaldia) subgen. n.

Diagnosis. Two large gizzards before the genital segments.

Type species: *Millsonia ghanensis* SIMS, 1965

Other species: *Millsonia brevicingulata* SIMS, 1986; *Millsonia cruciventris* SIMS, 1986; *Millsonia ditheca* SIMS, 1965; *Millsonia hemina* SIMS, 1965; *Millsonia hortensis* SIMS, 1986; *Millsonia jadvigae* SIMS, 1986; *Millsonia nota* SIMS, 1986; *Millsonia oracapensis* SIMS, 1986.

Reginaldia (Peritogaster) subgen. n.

Diagnosis. One strong gizzard in segment *vi*. The other gizzard is vestigial and replaced by the unusually strongly thickened septum 5/6.

Type species: *Millsonia anomala* OMODEO, 1955

Etymology: From the Latin *pereo*, *peritum* = disappeared.

Other species: *Millsonia artesetosa* SIMS, 1986; *Millsonia moderata* SIMS, 1986; *Millsonia omodeoi* SIMS, 1986.

Reginaldia (Peritogaster) omodeoi (SIMS, 1986)
(Figs 1, 8, 9)

Millsonia anomala f. *leptocystis* OMODEO & VAILLAUD, 1967: 929.

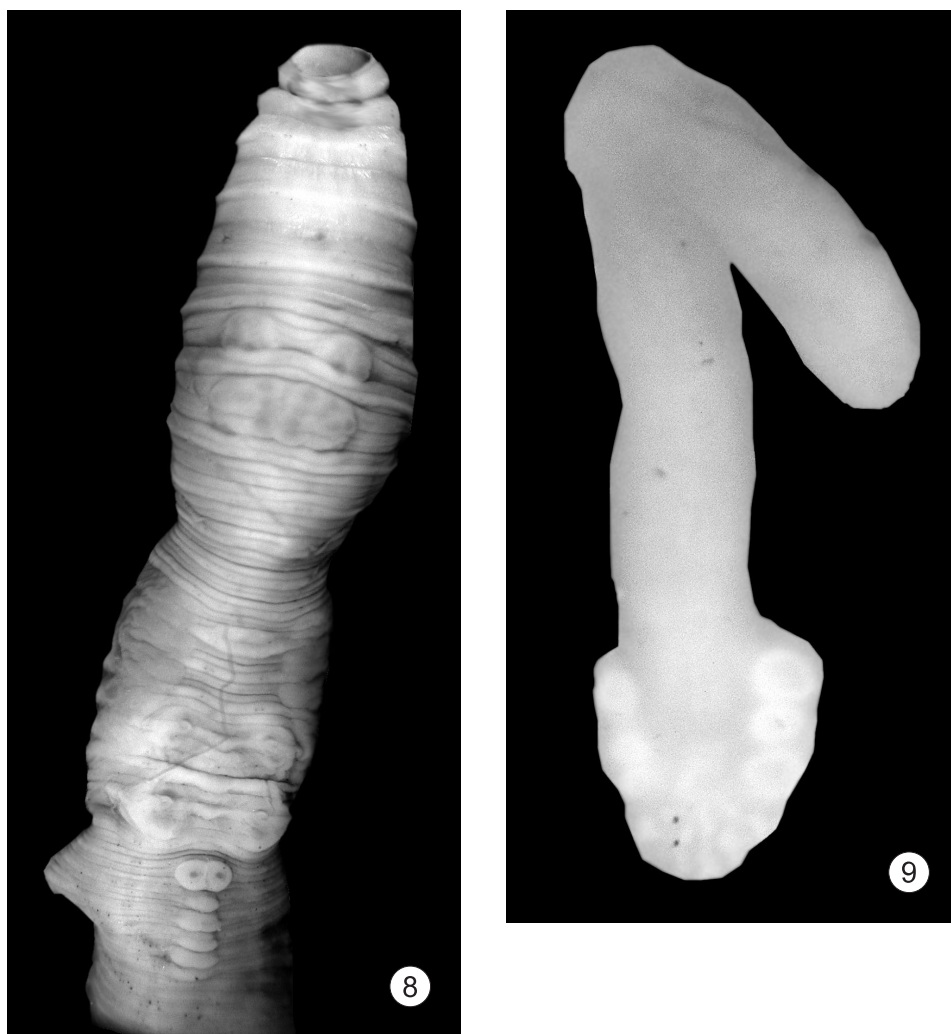
Millsonia omodeoi SIMS, 1986: 304., CSUZDI 1996: 362., CSUZDI 2000a: 75.

Material examined. MRAC 37.048 1 ex., Ivory Coast, Tiassale. Leg. P. ELSEN, 29. III. 1977.

Diagnosis. Length 65–105 mm; diameter 5–6 mm; Number of segments 173–252. Setae are closely paired and all on the ventral surface. Female pores paired on *xiv*, prostate pores on *xvii*, *xix* and spermathecal pores on 7/8, 8/9 (Fig. 8). Clitellum saddle-shaped, on *xiii–xviii*. One gizzard in *vi*. Septum 5/6 extraordinarily thickened. Last pair of hearts in *xii*, and three pairs of calciferous glands in *xv–xvii*. Intestinal caeca seven pairs in *xxvi–xxxii*. Excretory system meroc, with six pairs of meronephridia and a pair of enteronephric and stomate filiform megameronephridia running into a collecting channel alongside the nerve cord (Fig. 1).

Spermathecae elongated sac-shaped without a recognizable duct. The ectalmost part of the spermathecae wear a granulose collar filled with sperm-chambers (Fig. 9).

Remarks. This is the first report of *R. (P.) omodeoi* after the description made on the literature data of *M. anomala* f. *leptocystis* (SIMS 1986). Unfortunately I had no possibility to examine specimens of *R. (P.) anomala* (OMODEO, 1955), but the two species seems to be very similar. The only remarkable difference is found in the shape of spermathecae that possess a long, well separated duct, which is missing in *R. (P.) omodeoi*.



Figs 8–9. *R. (P.) omodeoi* (SIMS, 1986): 8 = ventral view of the praeclitellar region, 9 = spermatheca

KEY TO THE *MILLSONIA* (SENSU LATO) SPECIES

- | | | |
|----|---|---|
| 1 | Excretory system with exonephric megameronephridia (<i>Millsonia</i> s. str) | 2 |
| – | Excretory system with filiform enteronephric megameronephridia (<i>Reginaldia</i> gen. n.) | 18 |
| 2 | Penial setae present | 3 |
| – | Penial setae lacking | 4 |
| 3 | One pair of prostates in <i>xvii</i> | <i>M. meridionalis</i> OMODEO, 1973 |
| – | Two pairs of prostates in <i>xvii, xix</i> | <i>M. schlegeli</i> (HORST, 1884) |
| 4 | One pair of prostate in <i>xvii</i> | 5 |
| – | Two pairs of prostates in <i>xvii, xix</i> | 8 |
| 5 | Spermathecae open through a common ventral-median atrium | <i>M. nigra</i> (BEDDARD, 1894) |
| – | Spermathecae open to the surface separately | 6 |
| 6 | Sole pair of caeca | <i>M. sokodeana</i> (MICHAELSEN, 1913) |
| – | Numerous pairs of caeca | 7 |
| 7 | Clitellum on <i>xiii–xvii</i> | <i>M. ashantiensis</i> SIMS, 1986 |
| | Clitellum on <i>xiii–xxi, xxii</i> | <i>M. mima</i> (MICHAELSEN, 1891) |
| 8 | Last pair of hearts in <i>xiii</i> | 9 |
| – | Last pair of hearts in <i>xii</i> | 12 |
| 9 | 5-8 pairs of caeca | 10 |
| – | 14-16 pairs of caeca | 11 |
| 10 | Spermathecae open above the setal line <i>d</i> | <i>M. heteronephra</i> (MICHAELSEN, 1897) |
| – | Spermathecae open in setal line <i>b</i> | <i>M. riparia</i> SIMS, 1986 |
| 11 | Caeca in <i>xxxviii–lii</i> | <i>M. pulvillaris</i> SIMS, 1986 |
| – | Caeca in <i>xxx–xliv, xlv</i> | <i>M. guttata</i> (MICHAELSEN, 1913) |
| 12 | 19–25 pairs of caeca | 13 |

–	4–15 pairs of caeca		15
13	Last pair of hearts in <i>xiii</i>	M. bouna sp. n.	
–	Last pair of hearts in <i>xii</i>		14
14	Clitellum on <i>xiii–xxiii</i>	<i>M. caecifera</i> (BENHAM, 1894)	
–	Clitellum on <i>xiii–xx</i>	<i>M. lamtoiana</i> OMODEO & VAILLAUD, 1967	
15	4–5 pairs of caeca	<i>M. pumilla</i> SIMS, 1965	
–	Some 14 pairs of caeca		16
16	Calciferous glands are of almost equal size	<i>M. inermis</i> (MICHAELSEN, 1892)	
–	The calciferous glands in <i>xv</i> extremely reduced, sometimes missing		17
17	Female pore paired in <i>ab</i>	<i>M. centralis</i> SIMS, 1986	
–	Female pore single mid-ventral	<i>M. nilési</i> SIMS, 1986	
18	Two gizzards in <i>v, vi</i> (<i>Reginaldia</i> (<i>Reginaldia</i>))		19
	One strong gizzard in <i>vi</i> (<i>Reginaldia</i> (<i>Peritogaster</i>))		27
19	Two pairs of prostates in <i>xvii, xix</i>		20
–	One pair of prostates in <i>xvii</i>		22
20	Spermathecal pores single ventral-median	<i>R. (R.) ditheca</i> (SIMS, 1965)	
–	Spermathecal pores paired		21
21	Spermathecae with extramural stalked diverticulum		
		<i>R. (R.) brevicingulata</i> (SIMS, 1986)	
–	Extramural stalked diverticulum lacking	<i>R. (R.) ghanensis</i> (SIMS, 1965)	
22	Spermathecal pores in 7/8		23
–	Spermathecal pores in 8/9		24
23	Spermathecae with two extramural diverticula	<i>R. (R.) hemina</i> (SIMS, 1965)	
–	Spermathecae with one extramural diverticulum	<i>R. (R.) oracapensis</i> (SIMS, 1986)	
24	Two pairs of caeca in <i>xxviii, xix</i>	<i>R. (R.) nota</i> (SIMS, 1986)	
–	4–9 pairs of caeca		25

- 25 Last pair of hearts in *xiii* *R. (R.) hortensis* (SIMS, 1986)
 – Last pair of hearts in *xii* 26
- 26 Spermathecal pores surrounded by a large glandular field provided with 4–5 papillae lateral to each pore *R. (R.) cruciventris* (SIMS, 1986)
 – Spermathecal pores with medial papillae, glandular field missing *R. (R.) jadowigae* (SIMS, 1986)
- 27 One pair of spermathecal pore 28
 – Two pairs of spermathecal pores 29
- 28 The male field pear-shaped with single papillae in *xvi* and *xviii* *R. (P.) moderata* (SIMS, 1986)
 – The male field ovate with paired papillae in *xvi* and *xviii* *R. (P.) artesetosa* (SIMS, 1986)
- 29 Spermathecae with distinct duct, caeca 9 pairs *R. (P.) anomala* (OMODEO, 1955)
 Spermathecae without distinct duct, caeca 7 pairs *R. (P.) omodeoi* (SIMS, 1986)

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REFERENCES

- BEDDARD, F. E. (1888) On certain points in the structure of Urochaeta, E. P., and Dichogaster, nov. gen., with further remarks on the nephridia of earthworms. *Quarterly Journal of Microscopical Science* **29**: 235–282.
- BEDDARD, F. E. (1894) On two new genera, comprising three new species of earthworms from western tropical Africa. *Proceedings of the Zoological Society, London* **1894**: 397–391.
- BEDDARD, F. E. (1895) *A monograph of the order of Oligochaeta*. Oxford, Clarendon Press. 769 pp.
- BEDDARD, F. E. (1900) On a species of earthworm from western tropical Africa. *Proceedings of the Zoological Society, London* **1900**: 167–173.
- BENHAM, W. B. (1894) On Benhamia caecifera nov. sp. from the Gold Coast. *Quarterly Journal of Microscopical Science* **37**: 103–112.
- CSUZDI, CS. (1995a) A catalogue of Benhamiinae species (Oligochaeta: Acanthodrilidae). *Annalen des Naturhistorischen Museums in Wien* **97B**: 99–123.
- CSUZDI, CS. (1995b) Neue und wenig bekannte Regenwürmer aus Senegal und Sierra Leone (Oligochaeta, Acanthodrilidae: Benhamiinae). *Opuscula Zoologica Budapest* **27–28**: 25–40.

- CSUZDI, CS. (1996) Revision der Unterfamilie Benhamiinae Michaelsen, 1897 (Oligochaeta: Acanthodrilidae). *Mitteilungen aus dem Zoologischen Museum in Berlin* **72**: 347–367.
- CSUZDI, CS. (2000a) A review of the Benhamiinae collection of the Natural History Museum, London (Oligochaeta: Acanthodrilidae). *Opuscula Zoologica, Budapest* **32**: 51–80.
- CSUZDI, CS. (2000b) The first recorded earthworms from Burkina Faso with description of a new species (Oligochaeta: Eudrilidae, Acanthodrilidae). *Miscellanea Zoologica Hungarica* **13**: 29–35.
- JULKA, J. M. (1988) *The fauna of India and the adjacent countries. Megadrile Oligochaeta (Earthworms) family Octochaetidae*. Zoological Survey of India, Calcutta 400 pp.
- MICHAELSEN, W. (1892) Terricolen der Berliner Zoologischen Sammlung II. *Archiv für Naturgeschichte* **58**: 209–261.
- MICHAELSEN, W. (1897) Neue und wenig bekannte afrikanische Terricolen. *Mitteilungen aus dem Naturhistorischen Museum in Hamburg* **14**: 3–71.
- MICHAELSEN, W. (1900) Oligochaeta. In: Das Tierreich, Frieländer und Sohn, Berlin, **10**: 1–575.
- MICHAELSEN, W. (1913) Oligochäten vom tropischen und südlich-subtropischen Afrika I. *Zoologica Stuttgart* **26**(67): 139–170.
- MICHAELSEN, W. (1937a) On a collection of African Oligochaeta in the British Museum. *Proceedings of the Zoological Society, London* **107**: 501–528.
- OMODEO, P. (1955a) Eudrilinae e Octochaetinae della Costa d'Avorio (Oligochaeta). *Memorie del Museo Civico di Storia Naturale di Verona* **4**: 213–229.
- OMODEO, P. (1958) Oligochètes. In: La reserve naturelle integrale du Mont Nimba. *Memoires de l'Institut Francais d'Afrique Noire Douala* **53**: 9–109.
- OMODEO, P. (1973) Oligochètes de l'Angola. *Das publicações culturais da Companhia de Diamantes de Angola* **87**: 13–58.
- OMODEO, P. & VAILLAUD, M. (1967) Les Oligochètes de la savane de Gpakobo en Cote- d'Ivoire. *Bulletin de l'Institut Francais d'Afrique Noire Douala* **29**: 925–944.
- SIMS, R. W. (1965) Acanthodrilidae and Eudrilidae (Oligochaeta) from Ghana. – *Bulletin of the British Museum (Natural History)* **12**(8): 285–311.
- SIMS, R. W. (1965b) The identity of the Western African earthworm *Millsonia nigra* Beddard, 1894 (synonym *Dichogaster eudrilina* Cognetti, 1909) Octochaetinae, Oligochaeta. *Journal of the West African Science Association* **10**: 39–44.
- SIMS, R. W. (1986) Revision of the Western African earthworm genus *Millsonia* (Octochaetidae, Oligochaeta). *Bulletin of the British Museum (Natural History)* **50**: 273–313.
- STEPHENSON, J. (1930) *The Oligochaeta*. Clarendon Press, Oxford, 987 pp.

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