DIPLOTREMA MURCHIEI AND *D. PAPILLATA*, NEW EARTHWORMS (OLIGOCHAETA : MEGASCOLECIDAE) FROM MEXICO.

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ABSTRACT

Two species of earthworms from Veracruz state, Mexico are described: *Diplotrema murchiei* and *D. papillata* spp. nov. Their affinities are with the primitive genera of the subfamily Acanthodrilinae, and they are provisionally placed in *Diplotrema,* an Australian genus. The relationships of these new species and other Mexican earthworms variously placed in *Notiodrilus* and *Eodrilus* to Australian *Diplotrema* require clarification.

Key Words: Earthworms, Oligochaeta, Taxonomy, Veracruz.

RESUMEN

Se describe dos nuevas especies del estado de Veracruz, México *Diplotrema murchiei*y *D. papillata* spp. nov. Estas especies se relacionan con los géneros primitivos de la Subfamilia Acanthodrilinae y se colocan, provisionalmente, en el género australiano *Diplotrema.* Las relaciones de este último género con estas nuevas especies y con otras lombrices de tierra mexicanas ubicadas en los géneros *Notiodrilus* y *Eodrilus,* requieren ser aclaradas.

Palabras clave: Lombrices de tierra, Oligochaeta, Taxonomía, Veracruz.

INTRODUCTION

Material gathered in Mexico by the late W. R. Murchie and now in the collection of the United States National Museum of Natural History (USNM) include several lots of two taxa here presented as new species. These worms were provisionally identified by Murchie as "*Eodrilus* sp." Recent modifications in the classification of Acanthodrilinae require placement in a different genus.

All material is in the collection of the United States National Museum of Natural History (USNM), a division of the Smithsonian Institution.

Diplotrema murchiei, sp. nov.

(Figs. 1a,b,c.)

MATERIAL: USNM 47710, near Tierra Blanca, Veracruz State, Mexico. 28 July, 1962, W. R. Murchie. USNM 47712, roadside northwest of Veracruz, Veracruz State, Mexico. 29 July, 1962, W. R. Murchie.

HOLOTYPE: USNM 47710, near Tierra Blanca, Veracruz State, Mexico. 28 July, 1962, W. R. Murchie.

DESCRIPTION

External characteristics:

55-75 by 2 mm, width at segment xxx, unpigmented body cylindrical in cross section throughout, segments 105-111. Setae closely paired throughout; setal formula aa:ab:bc:cd = 4:1:4.8:1. Prostomium epilobous, segments triannulate posterior to iv. Nephridiopores not seen, first dorsal pore 8/9 (1) or 9/10 (3), spermathecal pores in 7/8, 8/9 in ab. Ovipores presetal just median to setal line a in xiv; male pores in xviii; prostatic pores and penial setae at ends of grooves which are in ab in xvii-xix. Clitellum annular in xiii-xviii, midventral genital markings in xix (5 specimens; Figure 1a); xvii, xix (2); xvii-xix (1).

Internal characteristics:

Septum 5/6 membranous, attached 2/3 distance from anterior end of gizzard; septa 6/7-13/14 muscular, greatest thickness at 7/8. Alimentary canal with single, undivided gizzard in v, vi (2) or vi only (1); oesophagus with pebbly

internal texture vii-xii, valvular in xiii, xiv, paired ventral ridges ix-xii, fusing to single ridge in xiii, oesophagus wall vascularized xi, xii; intestinal origin xv; typhlosole a simple fold originating at 16/17, reaching full size by xx-xxii.

Pair of acinous glandular structures postseptal in xiv, near oesophageal wall.

Stomate meganephridia 2 per segment (holonephridia), exoic with duct entering body wall near d, avesiculate, tubules in a flat coil in region of bc, with one blind tubule.

Vascular system with subintestinal trunk, single dorsal trunk, these connected by lateral trunks in vix, laterooesophageal hearts in xi, xii. Lateral trunks of vii-ix have branches to septa from a point just above attachment to subintestinal trunk. Extraoesophageal vessel from pharyngeal glands on ventral-lateral face of gizzard, oesophagus v-ix, then on ventral face to xiii, in vii-ix with small segmental branches, in xii a branch to body wall, in xiii branching out to body wall of xiii-xvi. Supraoesophageal vessel viii-xii, with lateral bulges at points of attachment of hearts of xi, forked to same attachments of xii.

Fanshaped ovaries, funnels in xiii; spermathecae in viii, ix, an ovoid ampulla at right angle to axis formed by duct and diverticular stalk (Figure 1b), diverticula 4-7 lobed internally, iridescent; ampulla oriented under oesophagus with diverticulum located lateral to oesophagus.

Male sexual system holandric, testes and iridescent funnels free in x, xi; acinous seminal vesicles in xii; vasa deferentia superficial, entering body wall near 17/18; prostates with stout muscular ducts increasing in diameter distally, prostates tubular in regular sinuous folds extending from xvii to xxv or xxvi and xix to xxvi or xxvii; penial setal follicles extend back between the folded prostates to xxv, xxvi (5 mm). Penial setae approximately 3.5 mm long, straight with slight bend near tip, distal portion smooth with slight longitudinal striations on extreme end (Figure 1c); genital setae lacking.

CONSIDERATIONS

The species is named for its collector, W. R. Murchie, who died before he had a chance to examine it.

The characteristics of the spermathecae distinguish it from members of its own and related genera. The spermathecal diverticulum is at the end of a long extension of the spermathecal duct, termed a crypt by Murchie (1961), in such a manner that the normally straight main spermathecal axis of duct and ampulla is bent at a right angle. The diverticulum, the crypt, and the ectal portion of the

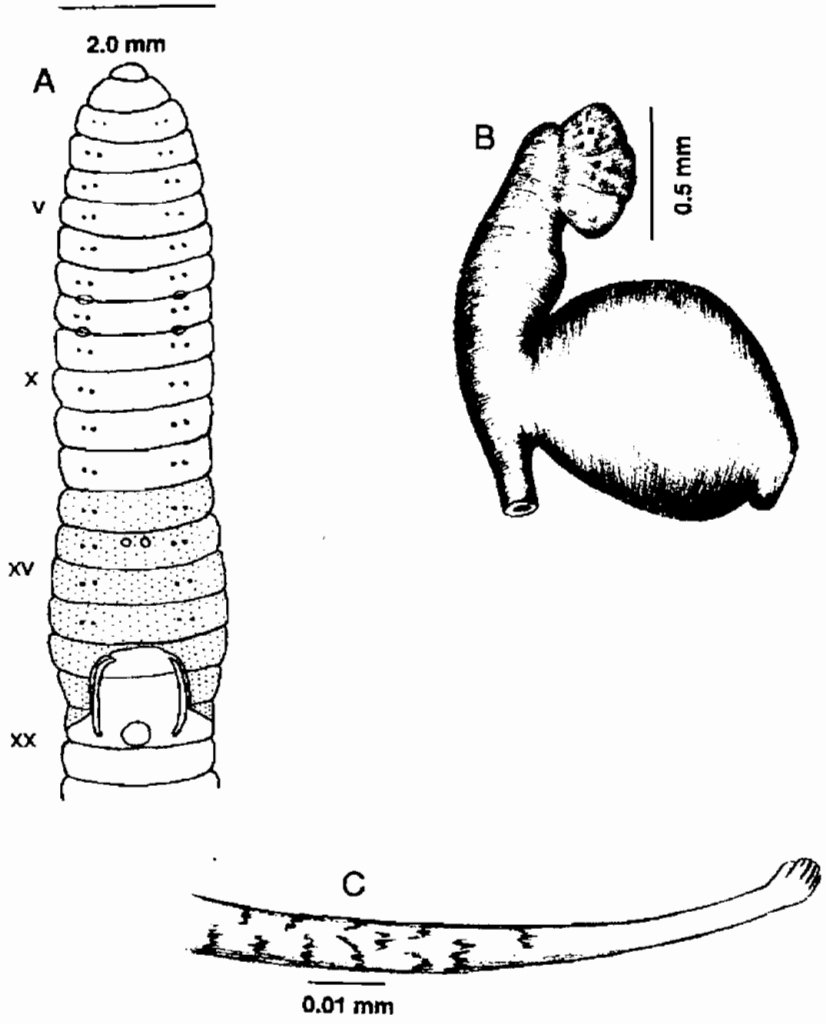


Fig.1 *Diplotrema murchiei:* a) ventral view, b) spermatheca from segment ix, c) penial seta from segment xvii.

spermathecal duct make an approximately straight line of parts, with the ampulla attached laterally.

Other distinguishing characteristics are the loss of seminal vesicles from segment ix and the presence of intrasegmental (as opposed to spanning a segmental furrow) midventral genital markings exclusively in the male field segments.

Diplotrema papillata, sp. nov.

(Figs. 2a,b,c,d.)

MATERIAL: USNM 47709, near Tierra Blanca, Veracruz State, Mexico, 28 July 1962, W. R. Murchie; USNM 47712, roadside NW of Veracruz, Veracruz State, Mexico, 29 July 1962, W. R. Murchie; USNM 47715, Ciudad Aleman, Veracruz Rd., elevation 90 feet, Veracruz State, Mexico, 30 July 1962, W. R. Murchie; USNM 47716, NE of Tierra Blanca, on road to Veracruz, Veracruz State, Mexico, 29 July 1962, W. R. Murchie; USNM 46321, NW of Rinconada Antigua on Rte 140, Veracruz State, Mexico, 31 July 1962, W. R. Murchie.

HOLOTYPE: USNM 47716, NE of Tierra Blanca, on road to Veracruz, Veracruz State, Mexico, 29 July 1962, W. R. Murchie

DESCRIPTION

External characteristics:

65-90 by 2 mm, width at segment xxx, unpigmented body cylindrical in cross section throughout, segments 131-149. Setae closely paired throughout; setal formula aa:ab:bc:cd = 4:1:6:1. Prostomium proepilobous, segments triannulate posterior to vii. Nephridiopores not seen, first dorsal pore 11/12 (4) or 12/13 (1), spermathecal pores at posterior edges of vii, viii in ab, covered by small hoods facing posteriorly. Ovipores presetal just median to setal line a in xiv; male pores in xviii; prostatic pores and penial setae at ends of grooves in AB of xviii-xix. Clitellum annular in xiii-xiv, saddleshaped xv-xviii. Genital markings on *ab* in x or viii but never both, paired rectangular papillae on 14/15-16/17, sometimes fused within segments as single papilla over bb, paired round genital markings between male grooves in xviii or 3 pairs between grooves, paired genital markings in ab at 19/20 (Figure 2a).

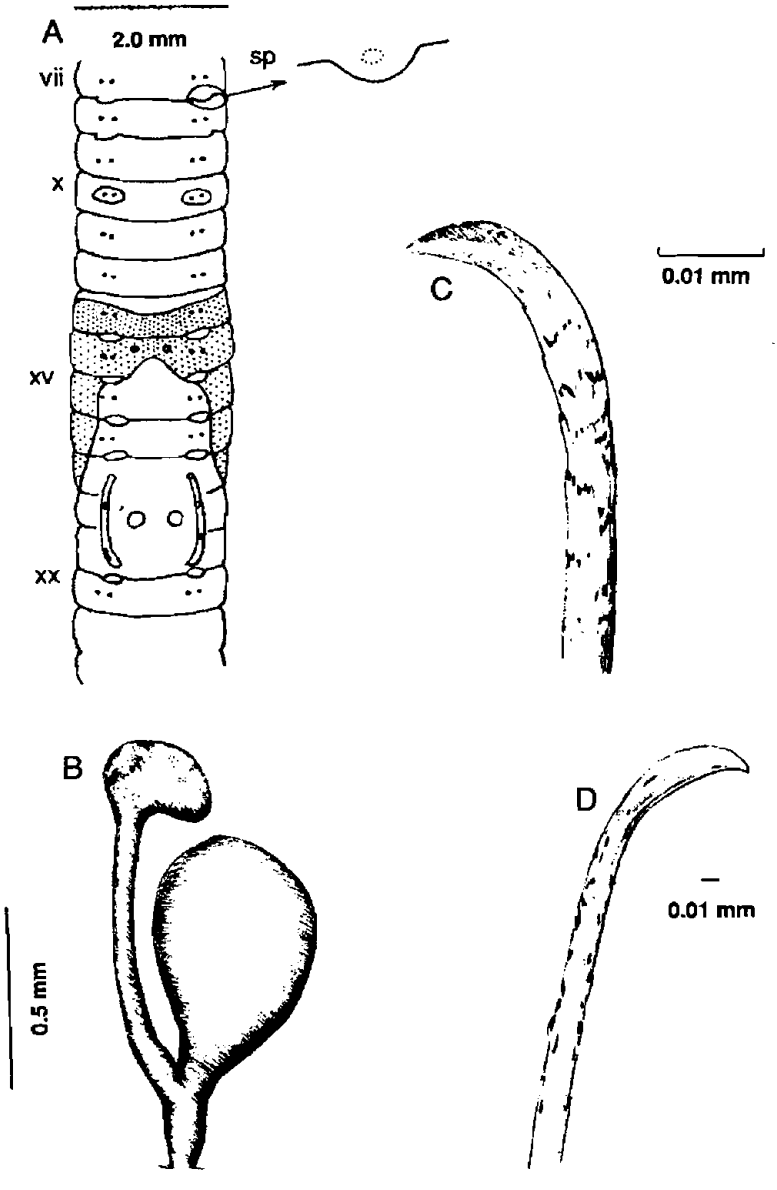


Fig.2 *Diplotremapapillata*: a) ventral view, showing the hoods covering the spermathecal pores (sp), b) spermatheca of segment ix, c) tip of penial seta from segment xix, d) tip of copulatory seta from segment x.

Internal characteristics:

Septum 5/6 membranous, septa 6/7-12/13 muscular, greatest thickness at 8/9-9/10. Alimentary canal with single, undivided gizzard in vi, but partially in v; oesophagus with pebbly internal texture vii-xii, valvular at 13/14, paired internal ventral ridges containing blood vessels ix-xii, oesophagus wall vascularized xii, xiii; intestinal origin xiv, slight intestinal constriction 18/19; typhlosole a simple fold originating at 15/16, reaching full size of half lumen diameter by xix-xx.

Stomate meganephridia 2 per segment (holonephridia), exoic with duct entering body wall near setal line d, avesiculate, tubules in a flat coil in region of bc to above setal line d, with one blind tubule.

Vascular system with subintestinal trunk, single dorsal trunk, these connected by lateral trunks in v-ix, laterooesophageal hearts x-xii, connections of hearts to dorsal vessel very small. Lateral trunks of viii-ix have branches to septa from a point just above attachment to subintestinal trunk, trunk of ix with branch to body wall of x, xi. Extraoesophageal vessel from pharyngeal glands on ventral-lateral face of gizzard, oesophagus in v-ix, then within ventral oesophageal ridges to xiii, in vi-ix with small segmental branches, in xii a branch to body wall, in xiii branching out to body wall of xiii-xvii. Supraoesophageal vessel vii-xii, with lateral bulges at points of attachment of hearts of x, xi, forked to same attachments of xii.

Fanshaped ovaries, funnels in xiii; spermathecae in viii, ix, consisting of ovoid ampulla on short duct, large and variable diverticulum. Diverticular stalk and chamber together longer than ampulla, chamber portion either polylocular terminal knob (Figure 2b) or elongate club shape. Both shapes occur in one specimen. Ampulla ventrallateral to oesophagus, diverticulum dorsallateral to oesophagus.

Male sexual system holandric, testes and iridescent funnels free in x, xi; seminal vesicles of ix smaller and lobed, of xii a solid mass; vasa deferentia superficial, entering body wall near 17/18; prostates with faintly muscular ducts increasing in diameter distally, prostates tubular, coiled within segments of origin (xvii, xix) or also one adjacent segment; penial setal follicles extend back to xxii, xxiv adjacent to ventral nerve cord. Penial setae approximately 3.3 mm long, straight with right-angle bend near tip, distal portion smooth, bent tip with coarse texture (Figure 2c). Genital setae in viii, ix and x, or x, distal portion of shaft scalloped, tip lanceolate and slightly hooked (Figure 2d).

CONSIDERATIONS

The species is named for the numerous conspicuous genital papillae present in clitellar and postclitellar segments, whose arrangement is apparently unique in the genus. Several specimens were fixed with the penial setae extended out at an acute angle from the body wall, the bent tips pointing outward. It is possible that these hooks are able to grasp the prominent genital papillae of another worm during copulation.

D. papillata most closely resembles "*Eodrilus*" *zilchi* Graff 1957, and differs from it in the structure of the penial setae, the arrangement of genital papillae, and the structure of the spermathecal pores. The hoods over the spermathecal pores, and their location on the posterior edges of vii and viii, yet with spermathecae in viii and ix, is unique in the genera *Diplotrema* and *Notiodrilus*.

DISCUSSION

Eodrilus Michaelsen, 1907 was created to accommodate worms from *Notiodrilus* Michaelsen, 1899, whose typespecies was transferred to *Microscolex* Rosa, 1887 (Michaelsen, 1905). *Notiodrilus* was resurrected by Jamieson (1971a,b, 1974) following his observations that the type species of *Eodrilus, E. cornigravei*, was congeneric with *Diplotrema* Spencer, 1900, emend., and that *Acanthodrilus georgianus* Michaelsen, 1888 (the type species of *Notiodrilus*) is sufficiently distinct to merit subgeneric status within *Microscolex*. Jamieson and Dyne (1976) redefined *Diplotrema* to include all acanthodrilin Australian worms without nephridial vesicles, regardless of presence of genital setae (which formerly were diagnostic of *Diplotrema*). This placed all Australian *Notiodrilus* in *Diplotrema*, leaving the non Australian *Notiodrilus* in need of further investigation.

Lavellodrilus Fragoso, 1988 is considered by its author (Fragoso, 1988 and pers. comm.) to be distinguished from other avesiculate acanthodrilin genera by the midventral location of spermathecal and prostatic pores, but is otherwise quite similar to *Diplotrema* as defined by Jamieson and Dyne (1976). If this separation is justified, the species described below cannot be placed in *Lavellodrilus*. Consequently I place them provisionally in *Diplotrema*, from which they cannot be distinguished based on Jamieson and Dyne (1976). My position is that no other placement is warranted until distinguishing characteristics between Australian and Mexican *Diplotrema* can be found. Presently the only reason to place these species, as well as other Central American "*Eodrilus*," in

a separate genus, is geography. Jamieson and Dyne (1976) consider *Diplocardia* as an apomorph sister group of *Diplotrema*, the two differing in the duplication of the gizzard in the former. The species described above and the Central American "*Eodrilus*" have single gizzards, placing them closer to *Diplotrema* than *Diplocardia*.

The review of nomenclatural history presented above and in Fragoso (1988) makes it clear that much remains to be done to establish a natural classification of the Acanthodrilinae. As Fragoso indicated, *Notiodrilus* is now heterogeneous with respect to nephridial vesicles and calciferous glands. For this reason, and to further stimulate revision of *Notiodrilus* and *Diplotrema*, I elected to place the two species described here in the latter genus. With further collecting and close attention to morphological details it may be possible to find synapomorphies diagnostic of one or more "*Notiodrilus*"like genera in Central America.

There are striking similarities among several *Diplotrema* described in Jamieson and Dyne (1976) and *D. murchiei*, including the size and disposition of prostate glands (cf Fig. 9d,f,g,h,i of Jamieson and Dyne (1976)), the structure of spermathecae (cf Fig. IOb,g,i,j,k op. cit.), and the extraordinary length of the penial setae. On the other hand, only *D. murchiei* has intrasegmental genital markings. The similarities exist to a lesser degree with *D. papillata*, and this species shares with Australian species intersegmental placement of genital markings.

Other characteristics, such as details of the circulatory systems, may provide distinguishing features but are not recorded in sufficient detail in previous *Diplotrema.*

In general, it appears that character evolution in the Acanthodrilinae has been very slow. For similarities as numerous and as profound to persist over as much as 150 million years is quite remarkable.

CONCLUSIONS

Diplotrema murchiei and *D. papillata* further underscore the need for detailed investigation of the relationships between Australian and Central American earthworms, and for increased efforts to understand the earthworm fauna of the American tropics. This earthworm fauna may be of some biogeographic importance, if the tremendous gaps in knowledge can be filled.

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