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New Acanthodriline earthworms from Mexico  
(Oligochaeta: Megascolecidae)

**Samuel W. James**

Número 60  
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***Instituto de Ecología, A.C.***  
**Xalapa, Veracruz**  
**México**

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**NEW ACANTHODRILINE EARTHWORMS FROM MEXICO  
(OLIGOCHAETA: MEGASCOLECIDAE)**

**25 NO**

**Samuel W. James**

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**ABSTRACT**

Five new species and two new genera of earthworms are described from several locations in southern and eastern Mexico. These species are all acanthodriline Megascolecidae without nephridial vesicles or calciferous glands. The new genus *Protozapotecia* has two discrete gizzards in segments separated by a muscular septum, just as in the closely related *Zapotecia* with three gizzards. The new genus *Larsonidrilus* has doubled prostates or prostate homologs and muscular sucker-shaped genital markings.

**Key words:** Earthworms, Oligochaeta, Taxonomy, Mexico

**RESUMEN**

Se describen cinco nuevas especies y dos nuevos géneros de lombrices de tierra procedentes de varias localidades en el este y sureste de México. Estas especies pertenecen a los acantodrilinos Megascolecidae que carecen de vesículas nefridiales o glándulas calcíferas. El nuevo género *Protozapotecia* posee dos mollejas discontinuas en segmentos separados por un septum muscular, precisamente como en el género relacionado *Zapotecia* que tiene tres. El nuevo género *Larsonidrilus* posee próstatas dobles o próstatas homólogas y marcas genitales en forma de ventosas.

**Palabras Clave:** Lombrices de tierra, Oligochaeta, Taxonomía, México.

## INTRODUCTION

Recently the work of Fragoso (1988; 1991; pers. comm.) has indicated that a very diverse oligochaete fauna is present in eastern and southern Mexico. The late W. R. Murchie also made some collections in this area during the early 1960's. These lay unprocessed in the shelves of the Smithsonian Institution's National Museum of Natural History until I began to look at them a few years ago. Remarkably, though Murchie collected in one of the areas in which Fragoso now works, the state of Veracruz, Fragoso and I have discovered few species in common between the two collections. With this publication Murchie's collection has yielded seven new species of acanthodriline Megascolecidae, with several new species of Megascolecinae and Ocnerodrilinae still in preparation (James, unpub. data). A picture of Mexico as a home of great earthworm diversity is emerging. Some indication of this diversity is apparent in Eisen (1896, 1900), Gates (1967, 1970, 1971, 1973) and Pickford (1938), but clearly their work is the tip of an immense iceberg. With its mountainous terrain and diversity of climates and habitats, Mexico has great potential for discovery of large numbers of yet unknown taxa. The following new taxa are placed in the Acanthodrilinae as defined by Jamieson (1971 a, b; 1974).

***Zapotecia nova*, sp. nov.**  
(Figures 1a,b,c.)

**Material Examined:** MEXICO. One near adult specimen from "2 miles beyond Progreso Industrial", Mexico state, W. R. Murchie coll., 2 October, 1962. USNM 47719. HOLOTYPE: USNM 169143

**Description**

**External characteristics:** Dimensions 67 mm by 3 mm; diameter at segment xxx, 4 mm at x; unpigmented body cylindrical in cross section throughout, segments 162. Setae closely paired throughout, setae **ab**

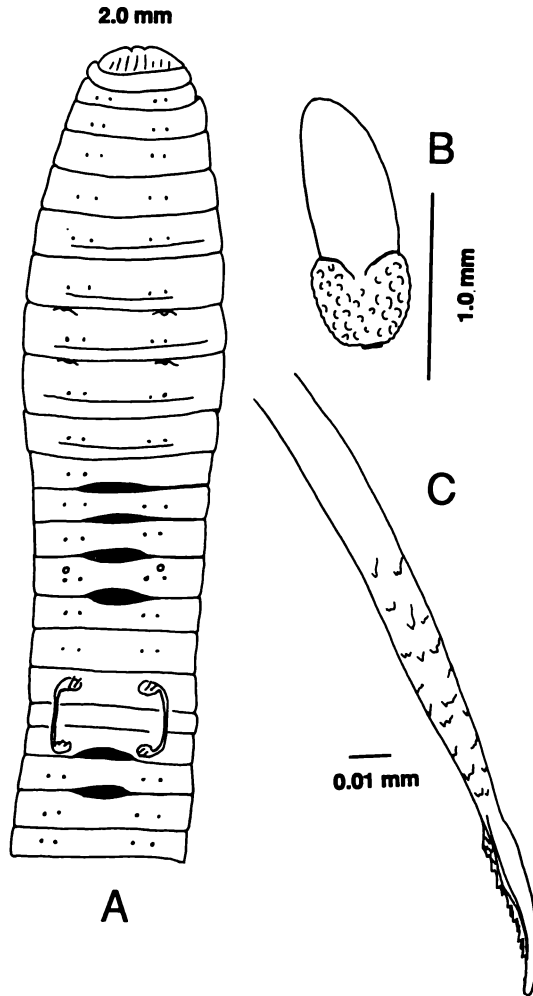
of xviii lacking; setal formula AA:AB:BC:CD = 6:1:5:3.5 at x, 2.5:1:2.8:1.8 at c, DD > 1/2 circumference throughout. Prostomium epilobous one-half, open; segments with postsetal secondary annulus iv-x, pre- and postsetal annuli xi-xx, in xxi+ dorsally presetal annulus only but ventrally pre- and postsetal secondary annuli. Nephridiopores not seen, first dorsal pore 10/11, spermathecal pores at leading edges of viii, ix in B. Ovipores presetal in B in xiv; male pores at 1/2xviii; prostatic pores and penial setae on small papillae at ends of seminal grooves which are in AB in xvii-xix. Clitellum not developed, mid-ventral lenticular genital markings spanning AA at 11/12, 12/13, 13/14, 14/15, 19/20, 20/21 (Figure 1a).

**Internal characteristics:** Septa 5/6-11/12 muscular, greatest thickness at 8/9, 12/13, 13/14 less so to membranous. Alimentary canal with three discrete gizzards in v-vii; esophagous with pebbly internal texture vii-xii, valvular in xv, intestinal origin xvi; typhlosole a simple fold originating over xxvi-xxviii, height about one tenth lumen diameter; ventral intestinal groove xxxix-liv. Stomate meganephridia 2 per segment, exoic with duct entering body wall near D, avesculate, tubules in elongate flat coil over AD.

Vascular system with ventral trunk, single dorsal trunk, these connected by lateral trunks in vi-ix, latero-esophageal hearts in x-xiii. Lateral trunks of vi-ix have branches to septa from a point just above attachment to subintestinal trunk. Extra-esophageal vessel from pharyngeal glands on ventral-lateral face of gizzard, esophagous v-xiii, in xiii branching out to body wall of xiii-xvii. Supra-esophageal vessel ix-xiii, with lateral bulges at points of attachment of hearts.

Fan-shaped ovaries composed of long strings, with funnels in xiii; paired spermathecae in viii, ix, each an ovoid ampulla with sessile cordate diverticulum on anterior face of duct (Figure 1b), diverticulum composed of one empty chamber with thick walls, no spermatozoal iridescence present; ampulla under esophagous, ampulla long axis oriented posteriorly.

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**Figure 1**

*Zapotecia nova*: a) ventral view, b) spermatheca from segment ix, c) distal portion of penial seta from segment xvii.

Male sexual system holandric, testes and iridescent funnels free in x, xi; acinous seminal vesicles in xi, xii; vasa deferentia in body wall from xii posteriorly; tubular prostates with slender ducts shorter than glandular portion, in one or two folds within segments of origin (xvii, xix); penial setal follicles just anterior to ducts. Penial setae 0.9 mm by 0.015 mm, bowed with slight recurve toward distal end; tip with broader portion covered with fine notches (Figure 1c); genital setae lacking.

**Considerations.** *Zapotecia amecamecae* Eisen 1900 differs from *Z. nova* in the following characters, the states given belonging to *Z. nova*: much smaller body size, wider separation of setae **c** and **d**, more anterior location of first dorsal pore, presence of numerous genital markings, shorter prostate glands, last hearts in xiii, more dorsal location of nephridial ducts, more posterior intestinal origin, presence of a typhlosole. Much information is lacking in the description of *Z. amecamecae*, and it is unclear if Eisen's reference to a "sacculated intestine", said to begin in xiii, is equivalent to a section of the esophagus, as it is currently understood, or to what is currently called the intestine.

Since the holotype and only known specimen was destroyed, there is no way to resolve this question without further collecting. Zicsi and Csuzdi (1991) give an account of a specimen identified as *Z. amecamecae*, but which had last hearts in xiii, and they did not indicate the intestinal origin. *Zapotecia keiteli* Michaelsen 1903, known from two Haitian specimens, differs from *Z. nova* in having larger body size, roughly three times as many segments, no setae in i-v, prolobous prostomium, one fewer muscular septa, and muscular prostatic ducts. Michaelsen (1903) did not give any information on the circulatory system and little on the alimentary canal. His specimens were not mature and therefore characters of the spermathecae may have been undeveloped. No mention is made of genital markings. If such are indeed lacking in *Z. keiteli*, that would be another difference.



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Michaelsen (1903) stated that his species differed from *Z. amecamecae* mainly in the arrangement of the setae and perhaps in the shape of the penial setae. If one can then assume that some of the characters noted above as missing from Michaelsen's description are the same in the two previously described species, *Z. nova* is unique in the genus in having slender prostatic ducts, numerous genital markings, and a small body size compared to its congeners.

Since the one specimen is not clitellate, there is some uncertainty about the extent of the clitellum. Based on clitellar segment blood supply from the clitellar vessel (cf James 1991), the clitellum probably extends no more than xii-xviii.

Zicsi and Csuzdi (1991) suggest that *Z. keiteli* is a synonym of *Z. amecamecae* in spite of the different location of the last pair of hearts and the contrast in segment number (200 vs 460 or 480). The differences between Eisen's (1900) description of *Z. amecamecae* and the worm discussed in Zicsi and Csuzdi (1991) include location of last hearts (12 vs 13, respectively) and absence of a typhlosole in Eisen's material. It would be better to obtain material from the type locations before proposing this synonymy, particularly since it could be equally well argued that Zicsi and Csuzdi (1991) were looking at yet another species.

***Protozapotecia*, gen. nov.**

**Type species:** *Protozapotecia aquilonalis* sp. nov.

**Definition:** Acanthodrilinae with two discrete gizzards in v, vi, separated by muscular septum, no calciferous glands, stomate exoic avesciculate meganephridia, holandric, tubular prostates, paired spermathecal pores at B, nephridiopores regular at C, seminal grooves xvii-xix with prostatic pores at ends and male pores within grooves at 1/2xviii, clitellum not extending posterior of male field; penial setae present.

***Protozapotecia aquilonalis*, sp. nov.**

(Figures 2a, 2b, 2c.)

**Material Examined:** MEXICO. Two adults from "2 miles beyond Progreso Industrial", Mexico state, W. R. Murchie coll., 2 October, 1962. USNM 47719. HOLOTYPE: USNM 169137

**Description**

**External characteristics:** Dimensions 95 mm by 3 mm, 53 mm by 2.5 mm; diameter at segment xxx, slightly greater diameter at x in all cases; unpigmented body cylindrical in cross section throughout, segments 116, 92, respectively. Setae closely paired throughout; setal formula AA:AB:BC:CD = 4.5:1:3.5:1.3 at x, 4.3:1:4:1 at xxx, DD > 1/2 circumference throughout, setae **ab** of xviii lacking. Prostomium epilobous 1/3, open, retracted nearly within mouth; segments with postsetal secondary annulus v-vii, pre- and postsetal annuli viii-end, with additional post-setal furrow in post-clitellate segments.

Nephridiopores at C, first dorsal pore 9/10; spermathecal pores at leading edges of viii, ix in B. Ovipores presetal in B in xiv on round papillae; male pores at 1/2xviii; prostatic pores and penial setae at ends of seminal grooves in AB in xvii-xix. Clitellum saddle xiii-xvii, 1/2 xviii; mid-ventral ovate genital marking spanning 1/2BC-1/2BC over 10/11 (both specimens; Figure 2a).

**Internal characteristics:** Septa 5/6-11/12 muscular, greatest thickness at 8/9, then decreasing, 13/14 membranous. Alimentary canal with two discrete gizzards in v, vi; esophagous with long digitiform villi ix, x, pebbly internal texture xi-xiii, valvular in xiv or 13/14; pair of acinous septal glands low on esophagous in xiv; intestinal origin xv or xiv but fully expanded in xv; typhlosole a simple fold originating xix, height about one half lumen diameter. Stomate meganephridia 2 per segment, exoic with duct entering body wall near C, avesculate, tubules in elongate flat coil over BD, coil bound in membranous sheath.

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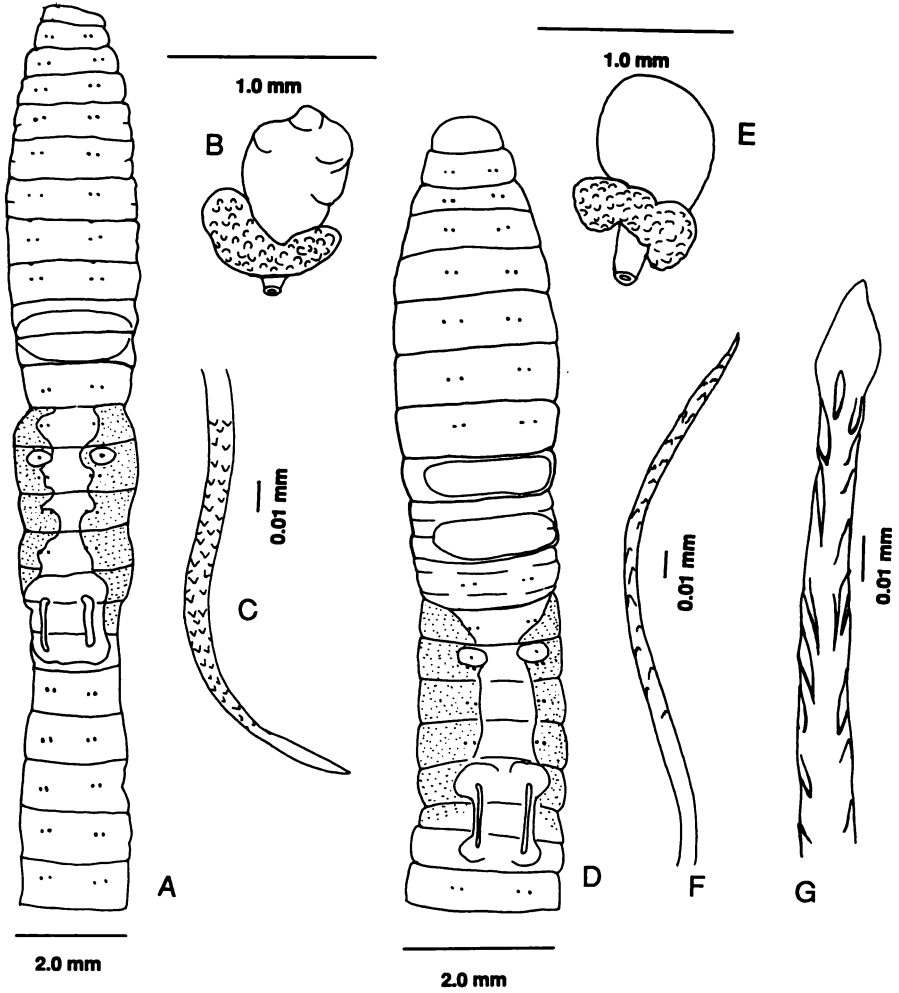


Figure 2

*Protozapotecia aquilonalis*: a) ventral view, b) spermatheca from segment ix, c) distal portion of penial seta from segment xvii; *P. australis*: d) ventral view, e) spermatheca from segment ix, f) distal portion of penial seta from segment xvii, g) distal portion of genital seta from segment ix.

Vascular system with ventral trunk, single dorsal trunk, these connected by lateral trunks in v-ix, latero-esophageal hearts in x-xii. Lateral trunks of v-ix have branches to septa from a point near attachment to ventral trunk. Extra-esophageal vessel from pharyngeal glands on ventral-lateral face of gizzard, esophagous v-xiii, in xiii branching out to body wall of xiii-xvii. Supra-esophageal vessel viii-xiii, with lateral bulges at points of attachment of hearts in x-xii.

Fan-shaped ovaries composed of long strings, with funnels in xiii; paired spermathecae in viii, ix, each an ovoid ampulla with narrowly reniform diverticulum attached by short stalk to anterior face of duct (Figure 2b), diverticulum axis perpendicular to ampulla axis, diverticulum walls with numerous small sperm-filled pockets, walls enclose lumen free of spermatozoal iridescence; ampulla under esophagous, ampulla long axis oriented posteriorly.

Male sexual system holandric, testes and iridescent funnels free in x, xi; seminal vesicles in xi, xii, composed of 50 + deeply divided lobes; vasa deferentia superficial, enter body wall in xvii; tubular prostates with slender non-muscular ducts about one tenth length of glandular portion, in one or two folds within segments of origin (xvii, xix) or also one adjacent segment; penial setal follicles just anterior to ducts. Penial setae 0.84 mm by 0.011 mm, bowed to nearly semicircular, with recurve toward distal end; tip slightly broader than immediately proximal portion, smooth covered with fine notches (Figure 2c); genital setae lacking.

***Protozapotecia australis*, sp. nov.**

(Figures 2d, 2e, 2f, 2g.)

**Material Examined:** MEXICO. two adults from railroad crossing at km 47, Route 85, Mexico D.F., W. R. Murchie, coll., 5 October, 1962. USNM 47720. HOLOTYPE: USNM 169139

### **Description**

**External characteristics:** Dimensions 73 mm by 2.5 mm, 54 mm by 2.2 mm; diameter at segment xxx, slightly greater diameter at x in all cases; unpigmented body cylindrical in cross section throughout, segments 109, 110 respectively. Setae closely paired throughout; setal formula AA:AB:BC:CD = 4.5:1:3.5:1.3 at x, 4.3:1:4:1 at xxx, DD > 1/2 circumference throughout, seate **ab** of xviii lacking. Prostomium epilobous one-half, open; segments with postsetal secondary annulus v-vii, pre- and postsetal annuli viii-end, with additional post-setal furrow in post-clitellate segments. Nephridiopores at C, first dorsal pore 6/7; spermathecal pores at leading edges of viii, ix in B. Ovipores presetal in B in xiv on round papillae; male pores in xviii; prostatic pores and penial setae on small papillae at ends of seminal grooves in AB in xvii-xix. Clitellum saddle xiii-xvii, 1/2 xviii; ovate mid-ventral genital markings spanning 1/2BC-1/2BC at ix, 10/11, the former more swollen, surrounds genital setae (both specimens; Figure 2d).

**Internal characteristics:** Septa 5/6-11/12 muscular, greatest thickness at 8/9, then decreasing, 13/14 membranous. Alimentary canal with two discrete gizzards in v, vi; esophageal lining villous ix, x, pebbly internal texture xi-xiii, valvular in xiv; pair of acinous septal glands low on esophagous in xiv; intestinal origin xv; typhlosole a simple fold originating xix, height about one half lumen diameter. Stomate meganephridia 2 per segment, exoic with duct entering body wall near C, avesculate, tubules in elongate flat coil over BD, coil bound in membranous sheath.

Vascular system with ventral trunk, single dorsal trunk, these connected by lateral trunks in v-ix, latero-esophageal hearts in x-xii. Lateral trunks of v-ix have branches to septa from a point near attachment to ventral trunk. Extra-esophageal vessel from pharyngeal glands on ventral-lateral face of gizzard, esophagous v-xiii, in xiii branching out to body wall of xiii-xvii. Supra-esophageal vessel viii-xiii, with lateral bulges at points of attachment of hearts in x-xii.

Fan-shaped ovaries composed of long strings, with funnels in xiii; paired spermathecae in viii, ix, each an ovoid ampulla with sessile bilobed diverticulum on anterior face of duct (Figure 2e), diverticulum axis perpendicular to ampulla axis, the two lobes forming elongate oval slightly nipped at point of contact with spermathecal duct, diverticulum walls with numerous small sperm-filled pockets, walls enclose lumen free of spermatozoal iridescence; ampulla under esophagous, ampulla long axis oriented posteriorly.

Male sexual system holandric, testes and iridescent funnels free in x, xi; seminal vesicles in xi, xii, composed of 50 + deeply divided lobes; vasa deferentia superficial, enter body wall in xvii; tubular prostates with slender non-muscular ducts about one tenth length of glandular portion, in one or two folds within segments of origin (xvii, xix) or also one adjacent segment; penial setal follicles just anterior to ducts. Penial setae 0.82 mm by 0.012 mm, bowed to nearly semicircular, with recurve toward distal end; tip slightly broader than immediately proximal portion, smooth covered with fine notches (Figure 2f); genital setae in ix with 4-6 rows of 8 grooves sculpted in distal end, tip conical or sagittate, smooth; 0.47mm x 0.012mm.(Figure 2g).

**Considerations.** The differences between the two *Protozapotecia* are the location of dorsal pores (9/10 vs. 6/7) and the presence of a large papilla and genital setae in ix of *P. australis*. Internally they are virtually identical. Though these distinctions are small, the separation seems justified in view of the importance of genital setae in mating.

Fragoso (pers. comm.) has examined 33 adult *Protozapotecia* sp. from Tamaulipas and northern Veracruz, of which all had genital setae in ix, and some of which also had genital setae in viii. First dorsal pores were generally in 7/8 or the neighboring furrows. Further collections in both type locations and intervening areas or earthworm-habitable sites connecting the sampling locations may bear out the consistency of the differences among the species populations. The type locations are about 70km apart, across the valley occupied by Mexico City. The

species names refer to the locations; *aquilonalis* means northern, while *australis* means southern.

Both *Protozapotecia* species have ovipores in B, muscular septa separating discrete gizzards, deeply lobed acinous seminal vesicles, male field xvii-xix, and similar structure of the penial setae. It is these shared conditions that lead me to place *P. aquilonalis* and *P. australis* in a genus separate from *Diplocardia* Garmann 1888. *Diplocardia* species all have a double gizzard without a muscular septum at 5/6, even in very large species, and without a marked thinning of the gizzard wall or narrowing of the gizzard outer diameter at 5/6.

**Table 1**

Distinguishing characteristics of *Protozapotecia*, *Diplocardia* and *Zapotecia*. See text for further explanation of these characters

	<i>Protozapotecia</i>	<i>Diplocardia</i>	<i>Zapotecia</i>
Gizzards	2 discrete	2 fused as 1	3 discrete
Septum 5/6	muscular	membranous	muscular
Intestinal origin	xv	xvii or later	xiii?, xvi
Sperm storage in diverticulum	within walls	within lumen	within walls
Seminal vesicles	xi, xii	ix, xii (most)	xi, xii
Male pores in	xviii	xviii (1), xix + (43)	xviii
Female pore location	B	medial to A	B

The gizzard of *Diplocardia* appears as a single gizzard occupying two segments, rather than two or three discrete gizzards as is the case in *Protozapotecia* and *Zapotecia*, respectively (Table 1). The form of *Diplocardia* spermathecae also differs, in that none have sac-like diverticula with sperm chambers in the walls only. The *Diplocardia* diverticulum is composed of one to several large lobes or chambers that receive sperm. Ovipores in *Diplocardia* are median to A, in contrast to *Protozapotecia*'s ovipores in B. The *Zapotecia/Protozapotecia* lineage

also is uniform (so far) in having seminal vesicles in xi and xii, while *Diplocardia* generally have these organs in ix and xii, though other arrangements, including the former, do occur. The male field in *Diplocardia* is usually in xviii-xx or later, with one exception, the Mexican species *D. koebeli* Eisen 1900 which has the male field in xvii-xix. However, in discriminating between *Protozapotecia* and *Diplocardia*, the difference in male field location is consistent with other characters.

***Larsonidrilus* gen. nov.**

**Type species:** *Larsonidrilus orbiculatus* sp. nov.

**Definition:** Acanthodrilinae with single gizzard in v, no calciferous glands, stomate exoic avesculate meganephridia, holandric, tubular prostates, paired spermathecal pores, clitellum not extending posteriorly from male field; with muscular genital papillae, consisting of hemispherical muscle masses protruding into body cavity, externally round sucker-like disks with thickened margin; accessory slender tubules associated with prostates, opening to outside via own duct or through common duct shared with prostates; penial setae absent, setae **a**, **b** of xviii present, unmodified.

***Larsonidrilus orbiculatus* sp. nov.**

(Figures 3a,b,c.)

**Material Examined:** MEXICO. Four adults from ditch along roadside west of Veracruz. Veracruz state, 29 July 1962, W. R. Murchie, coll., USNM 47711. HOLOTYPE: USNM 169142

**Description**

**External characteristics:** Dimensions 44-55 mm by 1.6-1.7 mm, diameter at segment x; unpigmented body cylindrical in cross section throughout, segments 95-108. Setae closely paired throughout; setal formula AA:AB:BC:CD = 3:1.3:3.3:1 at x, 2.5:1:3:1 at xxx, DD > 1/2 circumference throughout. Prostomium epilobous 1/4, closed; segments



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vi-xii triannulate. Nephridiopores not seen, first dorsal pore 7/8 (3) or 8/9 (1); spermathecal pores at leading edges of viii, ix in A. Ovipores presetal, median to A in xiv; male pores in 18 just posterior to 17/18; male grooves in AB in xvii-xix; prostatic pores at ends of grooves in xvii, xix. Setae **ab** present in xviii, unmodified, median to male grooves. Clitellum annular 1/2xiii-1/2 xiv, saddle 1/2xiv-xvi (1), 1/2xvii (3). Genital marking locations highly variable, including following configurations: 1) paired in AA of ix, lateral to B in xix; unpaired midventral in xvii, in AB of xviii; 2) paired each centered on A in ix, lateral to B in xix; unpaired midventral in xvi, xvii; 3) paired lateral to B in viii, lateral to B in xvii, median to male grooves in xix; unpaired midventral at 14/15, in xvi, unpaired lateral to B in ix, in AB in xvi; 4) as in Figure 3a.

Genital markings circular, sucker-like, consisting of nearly hemispherical masses of muscle projecting into body wall, clearly visible on inside of body wall.

**Internal characteristics:** Septum 5/6 membranous, 6/7 thin but some muscle, 7/8-12/13 muscular, greatest thickness at 8/9, 9/10 then decreasing. Alimentary canal with one gizzard in v; esophagous vascularized in x-xii, pebbly internal texture x-xii, valvular in xiii; intestinal origin xiv; typhlosole simple fold originating xvii, height about one half lumen diameter. Stomate meganephridia 2 per segment, exocoelomic with duct entering body wall near D, avascular, tubules in simple flat coil centered on CD.

Vascular system with ventral trunk, single dorsal trunk, these connected by lateral trunks in v-ix, latero-esophageal hearts x-xii. Extra-esophageal vessels large, clearly paired v-ix, but subesophageal and intramural x-xii, branching out to form clitellar vessel in xiii, ramifying into xvii. Supra-esophageal vessel vii-xii, with lateral bulges at points of attachment of hearts in xi, forked to points of attachment in xii.

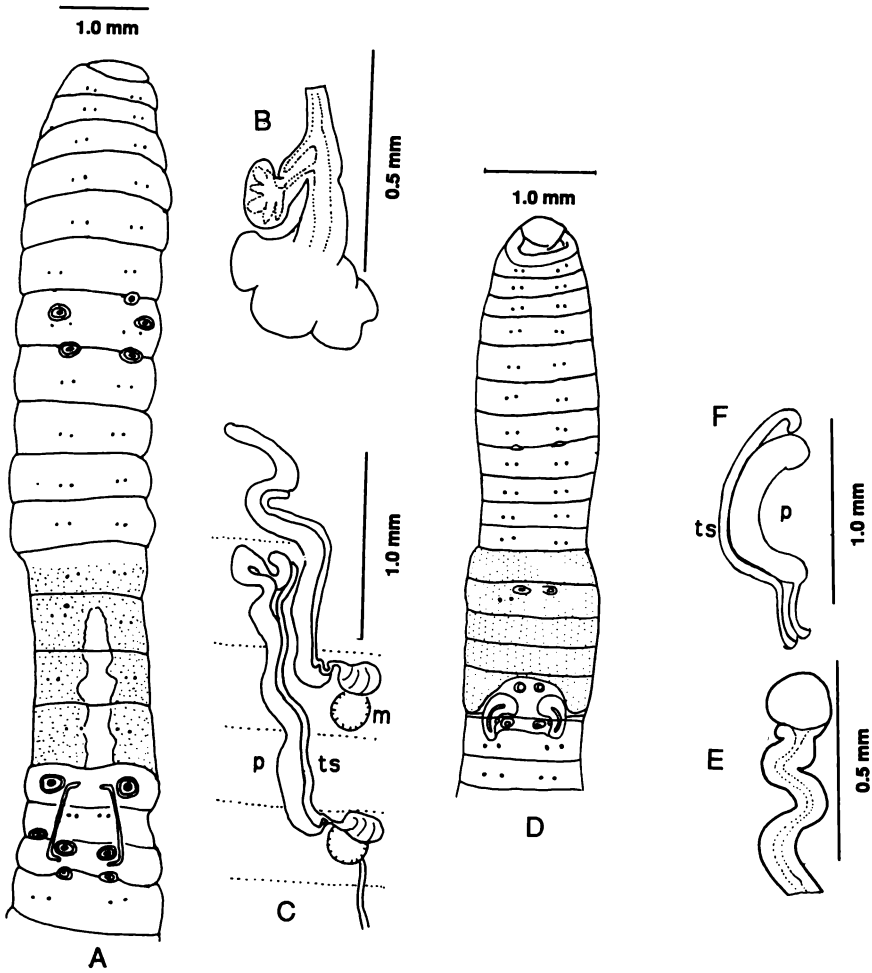


Figure 3

*Larsonidrilus orbiculatus*: a) ventral view, b) spermatheca from segment ix, c) prostates and accessory tubules of segments xvii and xix; *Larsonidrilus microscolecinus*: d) ventral view, e) spermatheca from segment ix, f) prostate and accessory tubule of segment xvii; m = dome of muscle corresponding to external genital marking, p = prostate, ts = tubular sac.

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Fan-shaped ovaries composed of long strings, with funnels in xiii; paired spermathecae in viii, ix, each composed of lobed ampulla with equally long duct with stalked internally multichambered diverticulum; adjacent and distal to diverticulum is slender digitiform chamber one half diverticulum length (Figure 3b).

Male sexual system holandric, testes and iridescent funnels free in x, xi; seminal vesicles in ix, xii, multilobed; vasa deferentia superficial, enter body wall in xvii; tubular prostates with very short muscular ducts, each duct expanding in diameter towards body wall to make conical muscle mass, glands extending posteriorly 3-5 segments, each prostate with slender, hollow non-glandular tubular sac parallel and closely adherent to most of length of gland, these tubular sacs with slender ducts joining prostatic ducts just proximal to beginning of enlarged portion of prostatic ducts (Figure 3c); penial setal follicles absent. Domes of muscle tissue visible in all segments with genital markings, these being internal portion of sucker-like genital markings.

**Considerations.** This new species presents two characteristics believed to be novel, at least among New World Acanthodrilinae: the sucker-like genital papillae consisting of thick domes of muscle and the slender tubular structures adherent to the prostates and emptying via a duct to the male field. While the numbers and locations of genital markings are often quite variable within species or genera, the type of genital marking is usually consistent within a taxon. *Larsonidrilus* has a unique type of genital marking consistent within the material available for both species now known. The tubular sacs are also unique to the genus.

These sacs appear to be homologous to prostates, but they are clearly non-glandular, having thin walls and large lumens. In *L. orbiculatus*, the sac duct joins the prostatic duct within the body cavity, but in the other member of the genus described here (see below), the two ducts are separate at their junction with the body wall.

*Notiodrilus vasliti* Eisen 1896 was described as having two slender, tubular, non-glandular and somewhat muscular prostates with separate ducts and pores for each of the usual acanthodriline prostates, giving it eight. Figures 150-152 and 154 in Eisen (1896) indicate the prostates were slender and closely parallel to one another, perhaps adherent to one another as is the case in *L. orbiculatus*. Eisen's species (types of which no longer exist) and the present are distinguished by the glandularity of half the prostates or prostate-like structures in *L. orbiculatus* and the presence and nature of the genital papillae in *Larsonidrilus*. *Notiodrilus vasliti* lacks a typhlosole, has no genital markings, has a more posterior intestinal origin, and the nephridia of intestinal segments are covered with a cellular envelope not seen in *L. orbiculatus*. Eisen did not detect any diverticula or even any sign of them on the spermathecae, but his specimen was not fully mature. Should this lack be confirmed in mature individuals, it would be yet another distinguishing feature. In consideration of the shared derived characteristic of doubled prostates (or presumed prostate homologs), *N. vasliti* is transferred to *Larsonidrilus*. An additional similarity between *N. vasliti* and *L. orbiculatus* is the presence of unmodified setae a and b in xviii, which though it may be a symplesiomorphy, is rare enough in the Acanthodrilinae to count for something in estimation of phylogeny. This could be a shared reversion to an ancestral condition, rather than a shared ancestral condition present in all ancestors of these species.

The genus is named in honor of the cartoonist Gary Larson, whose use of earthworms in his work has provided the author's friends and family opportunities to send him Larson's cartoons. The species name refers to the shape of the genital papillae.

***Larsonidrilus microcolecinus* sp. nov.**

(Figures 3d,e,f.)

**Material Examined:** MEXICO. eleven adults from northeast of Ciudad Aleman along roadside, Veracruz state, 28 July 1962, W. R. Murchie,

to Veracruz, Veracruz state, W. R. Murchie, coll., 29 July, 1962, USNM 47716. HOLOTYPE: USNM 169140

### **Description**

**External characteristics:** Dimensions 26-36 mm by 0.8-1.3 mm (avg. 32 x 1.2), diameter at segment x, slightly lesser diameter at xxx in all cases; unpigmented body cylindrical in cross section throughout, segments 90-99. Setae closely paired throughout; setal formula AA:AB:BC:CD = 4.7:1:4:1.3 at viii, 6.5:1:5:1 at xxx, DD  $\leq$  1/2 circumference throughout. Prostomium epilobous 1/2, closed; segments without conspicuous secondary annuli. Nephridiopores not seen, first dorsal pore 7/8 (9) or 8/9 (2); spermathecal pores at leading edge of ix in AB. Ovipores presetal, median to A in xiv; male pores in xviii just posterior to 17/18; male grooves in AB in 1/3xvii-1/3xviii; prostatic pores at anterior ends of seminal grooves in xvii. Clitellum annular xiii-xvii; paired genital markings presetal, median to A in xvii, median to male pores at 17/18; either or both pairs may be in sunken zone bounded by male grooves and posterior edge of clitellum. Genital markings circular, sucker-like, consisting of nearly hemispherical masses of muscle projecting into body wall, clearly visible on inside of body wall (Figure 3d).

**Internal characteristics:** Septa 5/6, 6/7 thin, 7/8-12/13 muscular, greatest thickness at 8/9, 9/10 then decreasing. Alimentary canal with one gizzard in v; esophagous vascularized in x-xii, pebbly internal texture vii-xii, valvular in xiv, acinous septal glands low on esophagous in xiv; intestinal origin xv; typhlosole a simple fold originating xvi or 16/17, height about one third lumen diameter. Stomate meganephridia 2 per segment, exoic with duct entering body wall near D, avesciculate, tubules in simple flat coil centered on CD.

Vascular system with ventral trunk, single dorsal trunk, these connected by lateral trunks in v(?), vi-x, latero-esophageal hearts in xi, xii. Extra-esophageal vessel seen only at xiii where it branches out to

xii. Extra-esophageal vessel seen only at xiii where it branches out to clitellar zone, extending to xvii. Supra-esophageal vessel viii-xii, with lateral bulges at points of attachment of hearts in xi, forked to points of attachment in xii.

Fan-shaped ovaries composed of long strings, with funnels in xiii; paired spermathecae in ix, variable: most commonly a long duct with iridescent gathered in folds of inner lining, duct terminating in small knob-shaped ampulla little greater in diameter than duct; or an ovoid ampulla much greater in diameter than duct, sometimes with sessile diverticulum little more than bulge in duct wall; spermathecae under esophagus.

Male sexual system holandric, testes and iridescent funnels free in x, xi; seminal vesicles in ix, xii, multilobed; vasa deferentia superficial, enter body wall at 17/18; tubular prostates with muscular ducts about one fifth length of glandular portion, within segment of origin (xvii); each prostate with slender tubular sac parallel and closely adherent to length of gland, these tubular sacs with muscular ducts similar in appearance to prostatic ducts, meeting body wall next to prostatic ducts; penial setal follicles absent. Domes of muscle tissue visible in xvii, xviii, these being internal portion of sucker-like genital markings.

**Considerations.** *Larsonidrilus microscolecinus* is so named for having the microscolecine reduction of the male field and loss of the posterior pair of prostates. As is often the case in microscolecine reductions, (cf Eisen 1900) it lacks the pair of spermathecae ordinarily present in viii. It differs from the other members of its genus in having the microscolecine reduction.

## CONCLUSIONS

The five species described here add two new genera to the Acanthodrilinae of the Americas. Each has at least one distinguishing feature previously unknown in the subfamily. *Protozapotecia* has two

joined together and their respective segments separated by a thin septum. Multiplication of gizzards is common among the Megascolecidae (Sims, 1987), and has no doubt taken place independently in many lineages. This is but one example of the many cases in which one faces the task of weighting characters according to systematic importance. For example, *Zapotecia* and *Trigaster* were once placed in a subfamily Trigastrinae (Michaelsen 1900) sharing the trigiceriate condition. Currently these two taxa are placed in different subfamilies that accord greater importance to the nephridial condition, among other characters.

*Larsonidrilus* shows two novel characteristics, as discussed above. Were it not for these, the worms would be placed in *Notiodrilus*. This new genus and *Lavellodrilus* Fragoso 1988 demonstrate the diversification of a simple ancestral acanthodriline form more or less equivalent to *Notiodrilus*. No doubt there will be many more new species and genera described in the future, as progress on Mexican Oligochaeta accelerates. One of the most pressing research needs in the study of the Acanthodrilinae is the revision of *Notiodrilus* and various related genera. Analyses of the problem are given in Fragoso (1988) and James (1990).

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