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The Orbiniidae (Annelida: Polychaeta) of Pacific Costa Rica

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Abstract

Seven species of Orbiniidae are described from the Pacific coast of Costa Rica including two new species. *Leodamas hamatus* n. sp., a commonly occurring species on the coast of Pacific Costa Rica, is described from 11–18 m in the Gulf of Nicoya and Bahia Culebra. This species is unusual in that the neuropodial uncini differ morphologically from anterior to posterior in the thorax. *Scoloplos cryptospinigerus* n. sp. is described from 18–22 m in the Gulf of Nicoya and has only a few short, toothed spines amidst numerous capillary setae in most of the thoracic neuropodia. This arrangement of thoracic neurosetae is unusual and has been seen only in one other described species of *Scoloplos* from Australia.

Key words: Polychaeta, Orbiniidae, *Leitoscoloplos*, *Leodamas*, *Naineris*, *Scoloplos*, Eastern Pacific, new species

Introduction

The polychaete fauna of the Central American eastern Pacific coast, while now better known, has not yet been adequately characterized. Dean (2009) reviewed the polychaete literature and reported 583 known species of polychaetes from the Pacific coast of Central America between El Salvador and Panama. However, this total is believed to be an underestimation of polychaete diversity because very few samples have been collected in El Salvador, Honduras and Nicaragua. In the more extensively sampled countries, the number of reported species is lower than expected. Costa Rica, for example, has been relatively well sampled (Dean 1996 a, b; 1998 a, b; 2001 a, b; 2009; Dean & Blake 2007; 2009; Vargas 1987; 1988; Vargas *et al.* 1985) but Dean (2009) listed only 317 species from the Pacific coast and this is believed to be an underestimate. This is shown by Dean *et al.* (2012) who sampled the polychaete fauna of Cocos Island and reported 12 species new to Pacific Central America and about 41 new records for Pacific Costa Rica. It is apparent that future work will reveal a much richer polychaete fauna for Costa Rica and the Tropical eastern Pacific in general.

The orbiniids are burrowing deposit feeders commonly found in shallow water and intertidal muds and sands. Early work in the tropical eastern Pacific included Chamberlin (1919) who described *Scoloplos (Leodamas) latum* Chamberlin, 1919 and Monro (1933) who described *Haploscoloplos panamensis* (Monro, 1933, both from Pacific Panama. Fauchald (1972) described *Califia mexicana* Fauchald, 1972, *Haploscoloplos mexicanus* Fauchald, 1972, and *Scoloplos (Leodamas) mazatlanensis* Fauchald, 1972, all from deep waters in the eastern Pacific off Mexico. De León-González & Rodríguez (1996) described *Leitoscoloplos bajacaliforniensis* de León-González & Rodríguez, 1996 from the Pacific side of the Baja California peninsula. López *et al.* (2003) described two new species of *Leodamas*, *L. minutus* López, Caldera & San Martín 2003 and *L. platythoracicus* López, Caldera & San Martín, 2003, and López *et al.* (2006) described *Orbinia oligopapillata* López, Claders, & San Martín, 2006, all from Coiba Island off the Pacific coast of Panama. More recently, Hernández-Alcántara & Solís-Weiss (2014) have analyzed three species of *Leitoscoloplos*, including a new species, *L. multipapillatus* Hernández-Alcántara & Solís-Weiss, 2014, from the Gulf of California. Here seven species of orbiniids are described, from Bahia Culebra, the Gulf of Nicoya, and Golfo Dulce, Costa Rica, including descriptions of two new species.

Material and methods

Subtidal specimens were collected with a modified 0.1 m² Smith-McIntyre grab in the Gulf of Nicoya and were sieved with 500 µm and 1000 µm mesh screens while those in Bahía Culebra were collected with an Eckman grab (15.2 by 15.2 cm = 0.023 m²) and passed through a 220 µm mesh sieve. Intertidal specimens were sampled with a core sampler or by direct collection of surface sediment. Specimens were preserved in 10% formalin and later transferred to 80% ethanol or (in more recent samplings) preserved directly in 95% ethanol.

Type specimens of the two newly described species are deposited in the Museum of Comparative Zoology (MCZ) in Cambridge, MA, USA and the Museum of Zoology University of Costa Rica (MZUCR), San Pedro, CR. Non-type materials are deposited in the general collections of the MCZ with the exception of specimens deposited in the collections of the MZUCR.

Taxonomic account

Genus *Leitoscoloplos* Day, 1977

Leitoscoloplos multipapillatus Hernández-Alcántara & Solís-Weiss, 2014

Figures 1 (A–C), 2 (A), 4 (A)

Leitoscoloplos multipapillatus Hernández-Alcántara & Solís-Weiss, 2014:143–146.

Material examined. Gulf of Nicoya: Station (STA.) 24, 9°49'25"N, 84°41'20"W, 11 m, sand, 1 Oct 1980 (1). STA 29, 9°54'55"N, 84°45'15"W, 18 m, muddy sand, 1 Oct 1980 (1); 6 Jul 1980 (2); 4 Apr 1982 (1). STA. 30, 9°54'40"N, 84°45'50"W, 18 m, muddy sand, 27 Jan 1981 (1). Bahía Culebra: STA. 1, 10°35'24.8"N, 85°39'41.6"W, 1.5 m, 19 May 2011 (2).

Description. Complete specimen 21.9 mm long, 0.61 mm maximum thoracic width for 76 setigers (Fig. 1A, 2A); incomplete specimens maximum thoracic width 0.60–0.66 mm. Prostomium conical, longer than wide; eyespots absent; paired dorso-lateral nuchal organs present. Peristomium approximately one-half prostomial length, subequal to first setiger. Thorax with 15–19 setigers, widest in middle. Branchiae from setiger 9, short, triangular at first, becoming longer and more robust in posterior thoracic setigers each branchial pair located along dorsal mid-line. Thoracic parapodia weakly developed as low ridges; neuropodial postsetal lobes triangular, those of notopodia narrow; postsetal lobes increasing in length along thorax, subequal to setal length in posterior thoracic setigers; conical ventral cirrus present (Figs. 1A, 4A). Stomach papillae present in the posterior thoracic and anterior abdominal region, on setigers 14–19 of 17 thoracic setiger specimen, on setigers 17–22 of 18 and 19 thoracic setiger specimens respectively, and on setigers 14–18 on 15 thoracic setiger specimen; maximally 12 papillae per setiger (Fig. 4A). Abdominal notopodial postsetal lobes subequal to branchiae, wide with narrow distal region; neuropodial postsetal lobes bifid, lateral branch approximately one-half median branch length; well-developed subpodial flange ventral to neuropodial lobe (Fig. 1B). Interramal cirri usually present on first several abdominal setigers; larger specimen with interramal cirri on last two thoracic setigers and first five abdominal setigers, those on thoracic segments actually emerging from superior border of notopodial pre-setal lobe. Posterior end slightly widened with approximately 12 closely spaced, dorso-ventrally flattened segments, pygidium scoop-shaped (Fig. 1C).

Notosetae and neurosetae all camerated capillaries; thoracic neuropodia with row of longer capillaries and row of shorter capillaries in upper region of fascicle, lower region with double row of many short setae (Fig. 1A); abdominal notopodia with 6–8 long capillaries, neuropodia with 3–5 long capillaries; furcate setae absent (Fig. 1B).

Remarks. Based on the number of setigers in the thorax and first appearance of the branchiae, *L. multipapillatus* is most similar to *L. panamensis* (Monroe, 1933), *L. mammosus* Mackie, 1987 and *M. bifurcatus* (Hartman, 1957). *L. panamensis* has a 17 setiger thorax and branchiae from setiger 9, but the thoracic neuropodial postsetal lobes are bifurcate in *L. panamensis*. Additionally, a single subpodial papilla occurs on three or four posterior thoracic segments with two on the last thoracic segment of *L. panamensis* while *L. multipapillatus* has numerous ventral papillae (stomach papillae) on both posterior thoracic and anterior abdominal segments. *L.*

bifurcatus has 20–21 thoracic setigers and branchiae from setigers 8–9 but this species differs from *L. multipapillatus* in having bifurcate thoracic neuropodial lobes in posterior thoracic setigers and lacking stomach papillae. *L. mammosus* also has branchiae from setigers 9–11 but only has 14–15 thoracic setigers (Mackie 1987). *L. mammosus* also lacks stomach papillae and has a long, digitate (rather than foliaceous) notopodial lobe in abdominal setigers.

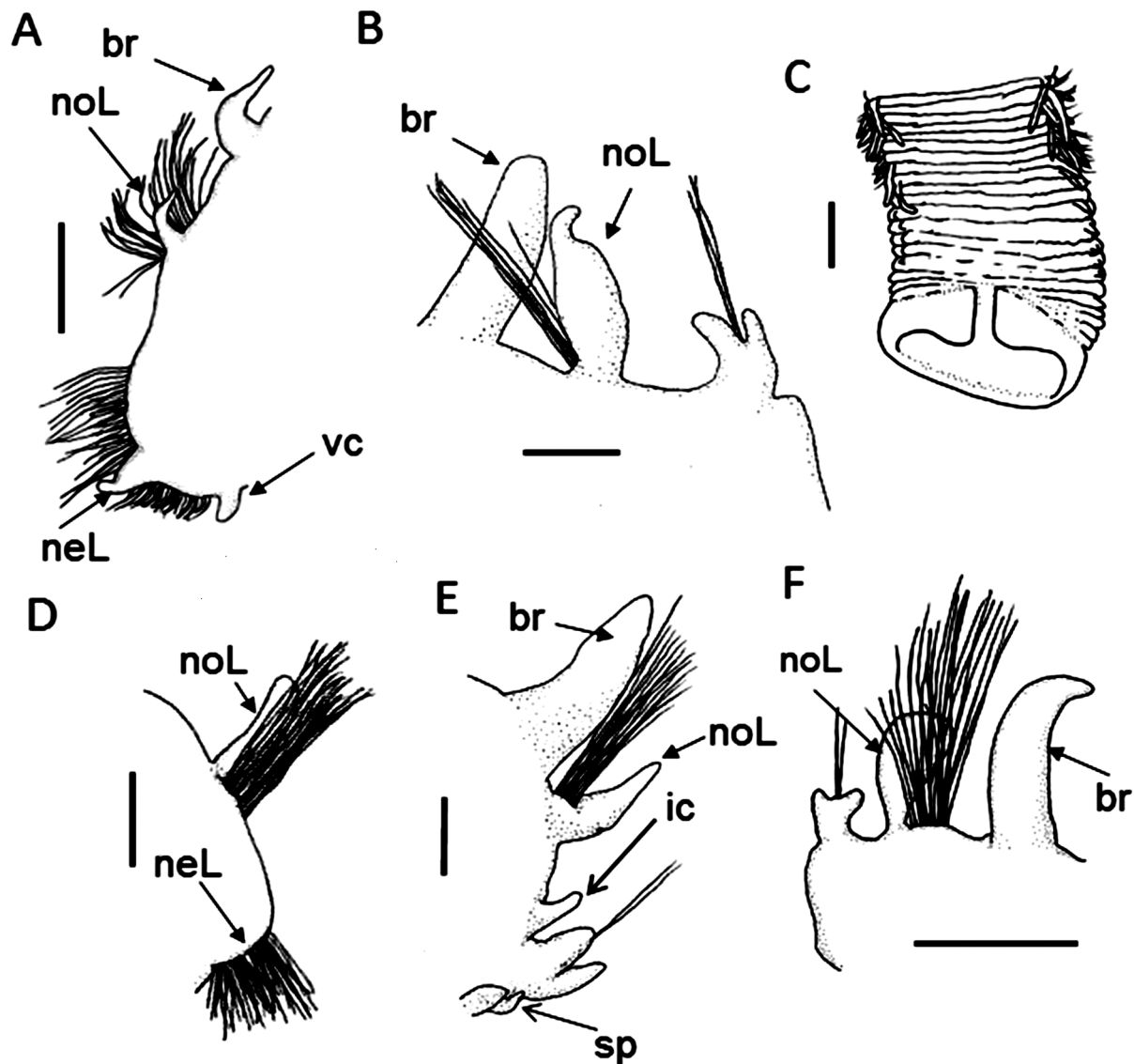


FIGURE 1. *Leitoscoloplos multipapillatus*: A, Posterior thoracic parapodium, posterior view; B, Station 29, Gulf of Nicoya specimen, thoracic setiger, anterior view; C, Station 1, Bahia Culebra specimen, posterior end and pygidium. *Leitoscoloplos panamensis*: D, Station 29, Gulf of Nicoya specimen, thoracic setiger, anterior view; E, Station 29, Gulf of Nicoya specimen, anterior abdominal setiger, anterior view; F, Station 28 Jun, Gulf of Nicoya specimen, posterior abdominal setiger, anterior view. Scale bars: A–F = 100 μ m. *br* = branchiae, *ic* = interramal cirri, *neL* = neuropodial lamellae, *noL* = notopodial lamellae, *p* = prostomium, *per* = peristomium, *sp* = subpodial papillae, *vc* = ventral cirri.

A ventral fringe of stomach papillae on the last several thoracic and first several abdominal setigers has been reported in several genera of orbiniids including *Phylo*, and *Orbinia* (Blake 1996). In his review of the genus *Leitoscoloplos* Mackie (1987) reported that *L. obovatus* Mackie, 1987 was the only member of the genus with stomach papillae on the last several thoracic setigers with a single papilla located some distance from the neuropodial lobe. This single papilla, however, represents a subpodial lobe rather than stomach papillae which are numerous and extend as a band of papillae transversely across the ventrum (Blake 1996). Eibye Jacobsen (2002) later described two species from the Andaman Sea in the Indian Ocean with a well-developed array of stomach papillae, *L. mackiei* Eibye Jacobsen, 2002 and *L. papillatus* Eibye Jacobsen, 2002. Both differ from *L.*

multiapillatus in the length of the thorax and first occurrence of branchiae with *L. mackiei* having 17 thoracic setigers with branchiae beginning on setiger 13 and *L. papillatus* having a thorax of 14–15 setigers with branchiae beginning on setigers 9–11.

L. mackiei has up to six stomach papillae on posterior thoracic setigers while there are only one or two subpodial papillae on anterior abdominal setigers. *L. papillatus* has up to seven stomach papillae but they are found only on the abdomen. Both of these species differ from *L. multiapillatus* in that it has up to 12 stomach papillae per segment and a large number of stomach papillae occurring on both thoracic and abdominal setigers.

Distribution. This species was recently described by Hernández-Alcántara & Solís-Weiss (2014) from shallow subtidal waters in fine to muddy sands in the Gulf of California in eastern Pacific Mexico. It is known from the Gulf of Nicoya and Bahía Culebra on the Pacific coast of Costa Rica in sand and mud/sand sediments.

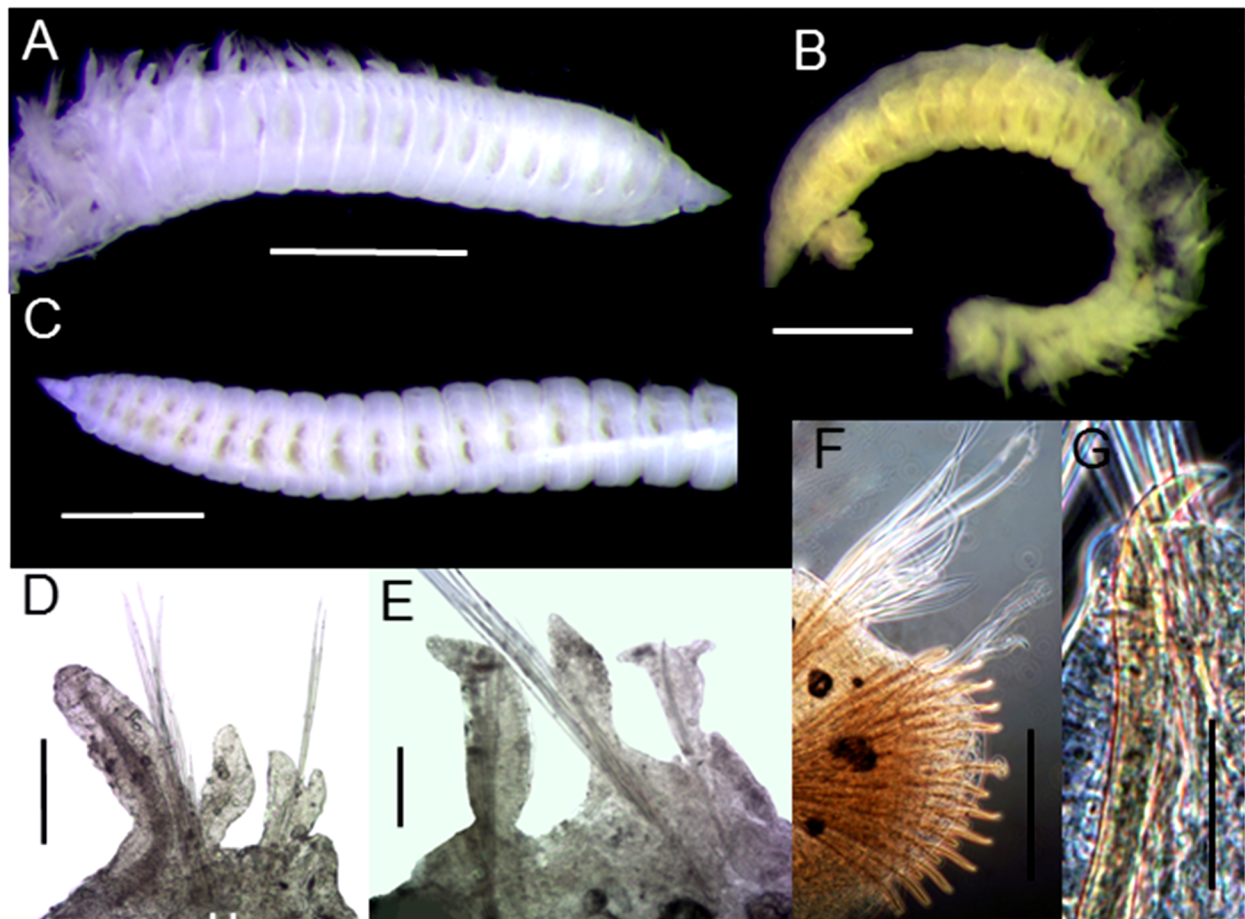


FIGURE 2. *Leitoscoloplos multiapillatus*: A, Anterior end, lateral view. *Leitoscoloplos panamensis*: B, Station 29, Gulf of Nicoya specimen, anterior end, lateral view. *Leitoscoloplos pugettensis*: C, Station 22, Gulf of Nicoya specimen, anterior end, lateral view; D, Station 9, Bahía Culebra specimen, midbody abdominal setiger, anterior view; E, Station 9, Bahía Culebra specimen, posterior abdominal setiger, posterior view. *Leodamas hamatus* n. sp.: F, Holotype, posterior thoracic setiger, anterior view; G, Holotype, Posterior notopodial emergent hook. Scale bars: A, C = 1000 μ m, B = 500 μ m, D, E = 100 μ m, F = 50 μ m G = 10 μ m.

Leitoscoloplos panamensis (Monro, 1933)

Figures 1 (D–F), 2 (B)

Haploscoloplos panamensis Monro, 1933:1045–1046, Fig. 1A–D.—Fauchald, 1977: 46. Not Hartman, 1957: 277, pl. 28, 1–3 (= *Scoloplos alaskensis*) Fide Mackie, 1987.

Leitoscoloplos panamensis: Mackie, 1987: 19–20, Fig. 20.—Hernández-Alcántara & Solís-Weiss, 1999: 27; 2014: 146–149.

Material examined. Gulf of Nicoya: Sta. 22, 9°48'25"N, 84°52'40"W, 22 m, muddy sand, 10 Jul 1980 (1); Sta. 29, 9°54'55"N, 84°45'15"W, 18 m, muddy sand, 27 Jan 1980 (1), 7 Jun 1981, 1 (MZUCR); Bahía Culebra: Sta.

1, 10°35'24.8"N, 85°39'41.6"W, 1.5 m, 19 May 2011 (2); Sta. 2, 10°35'51.8"N, 85°39'24.7"W, 18 m, 19 May 2011 (2); Sta. 4, 10°35'26.7"N, 85°39'16.8"W, 6 m, 19 May 2011, 1 (MZUCR); Sta. 21, 10°37'12.7"N, 85°38'31.2"W, 16 m, 19 May 2011 (3); Sta. 29, 9°54'55"N, 84°45'15"W, 18 m, muddy sand, 7 Jun 1981 (1). Jicaral, intertidal, 9°58'N, 85°06'W, mangrove roots Jan 1996, 1 (MZUCR).

Description. All specimens incomplete, maximum thoracic width 0.18–0.74 mm (Fig. 2B). Prostomium conical, longer than wide, eyespots lacking; paired dorsolateral nuchal organs present. Peristomium subequal in length and width to first segment, about two-thirds prostomial length. Thorax 12–17 setigers long. Branchiae from setiger 9 in all specimens, short, papilla-like at first, increasing in length and width posteriorly.

Thoracic notopodial postsetal lobes triangular, increasing in length posteriorly; neuropodial postsetal lobes mammiform in setigers 1–9 of specimen with 17 thoracic setigers; bifurcate in subsequent thoracic setigers; mammiform in setigers 1–7, bifurcate in remaining thoracic setigers of specimens with 12 and 13 thoracic setigers (Fig. 1D). Single, small papilla on last 2–3 thoracic setigers, 2–3 papillae on subsequent 4–5 abdominal setigers (Fig. 1E). Interramal cirri on first five abdominal setigers; accompanied by triangular notopodial postsetal lobe; neuropodial postsetal lobe bifurcate (Fig. 1E). Notopodial postsetal lobe widens, becoming foliaceous in mid-abdominal setigers (Fig. 1F), then longer and more narrow posteriorly; neuropodial postsetal lobe reduced, only weakly bifurcate in posterior abdominal setigers, lateral branch smaller than medial; subpodial flange present (Fig. 1F).

Notosetae and neurosetae camerated capillaries throughout, densely packed in thoracic parapodia, reduced to 2–3 weakly camerated capillaries in abdominal neuropodia (Fig. 1F); furcate setae absent.

Remarks. This species was originally described by Monro (1933) from shallow water muds in Pacific Panama. The thorax was 17 setigers long and the branchiae were reported to begin on setiger 12; however, Mackie (1987) examined Monro's type material and reported that the branchiae actually began on setiger nine which is true of the Costa Rica specimens. *L. panamensis* is most similar to *L. bifurcatus* and *L. multipapillatus* in possessing branchiae from setiger nine. *L. panamensis* lacks the numerous stomach papillae of *L. multipapillatus* and has subpodial papillae which are lacking in *L. bifurcatus*.

Distribution. This species has been previously reported from the Pacific coast of Panama (Monro 1933) and the Gulf of California, Pacific Mexico (Hernández-Alcántara & Solís-Weiss 1999, 2014).

Leitoscoloplos pugettensis (Pettibone, 1957)

Figures 2 (C–E), 6 (A–B)

Scoloplos elongata Johnson 1901: 412–413, Pl. 10, Figs. 105–110.

Haploscoloplos elongata: Hartman, 1944: 257; 1948: 30; 1955: 174.

Haploscoloplos elongatus: Hartman, 1957: 273–275, pl. 26, Figs. 1–11; 1960: 107–108; 1961: 265; 1963: 36; 1969: 19–22, Figs. 1–5.—Fauchald, 1972: 166.—Vargas *et al.*, 1985: 336.—Maurer *et al.* 1988: 47.—Molina-Lara & Vargas Zamora, 1995: 198.—Dean, 1996a: 74. Not Imajima & Hartman, 1964.

Scoloplos (Scoloplos) pugettensis Pettibone, 1957: 163.

Leitoscoloplos pugettensis: Blake, 1980: 1–18, Figs. 1–3; 1996: 9–10, Fig. 1.2.—Hobson & Banse, 1981: 28.—Mackie, 1987: 8–9, Fig. 8.—Hernández-Alcántara & Solís-Weiss, 1993: 1029.—de León-González & Rodríguez, 1996: 172.

Scoloplos acmeceps: Vargas *et al.* 1985: 336.—Dean, 2009: 146. Not Chamberlin, 1919.

Material examined. Gulf of Nicoya: Sta. 22, 9°48'25"N, 84°52'40"W, 22 m, muddy sand, 11 Jul 1980 (2), 1 Oct 1980, 1 (MZUCR); Sta. 24, 9°49'25"N, 84°41'20"W, 11 m, sand, 1 Oct 1980, 4 (MCZ 83994), 8 Jun 1981 (9); 4 Aug 1981, 3 (MZUCR); Sta. 28, 9°52'16"N, 84°45'30"W, 26 m, mud, 4 Aug 1981 (2); Sta. 29, 9°54'55"N, 84°45'15"W, 18 m, muddy sand, 1 Oct 1980 (1); 1 Apr 1982, 1 (MCZ 70322), 1 (MCZ 85626), 2 (MCZ 85695); Sta. 30, 9°54'40"N, 84°45'50"W, 18 m, muddy sand, 27 Jan 1980 (1). Punta Morales, Playa Blanca, 10°04'N, 84°58'W, lower intertidal, muddy sand, col: J. A. Vargas, 1986 (1); col: H.K. Dean, 20 Dec 1986 (31). Guanacaste, Bahía Culebra: Sta. 5, 10°35'25.2"N, 85°39'31.1"W, 2 m, 19 May 2011 (1); Sta. 9, 10°35'30.0"N, 85°39'43.4"W, 5 m, 19 May 2011 (11). Golfo Dulce, intertidal, 1996, (1), col: H. Buttner.

Description. Complete specimens 12.6, 15.7, and 18.5 mm long; 0.52, 0.54 and 0.45 mm. maximum thoracic width, respectively; incomplete specimens from 0.15–1.25 mm maximum thoracic width (Fig. 2C). Prostomium short, conical; eyespots lacking; paired dorsolateral nuchal organs present. Peristomium short, one-half prostomial length, subequal to setiger one. Thorax with 12–17 setigers, flattened dorso-ventrally. Branchiae from penultimate thoracic segment, occasionally in last thoracic segment of smaller individuals.

Thoracic notopodia with triangular postsetal lobe, larger in posterior thoracic setigers; neuropodial postsetal lobe short, digitate, larger in posterior thoracic segments (Fig. 6A). Abdominal notopodial postsetal lobes subtriangular in mid-body segments, shorter than branchiae (Fig. 2D), becoming more lanceolate and subequal to branchiae posteriorly (Fig. 2E); neuropodial postsetal lobes foliose, bifurcate, medial arm twice length of lateral branch, with well-developed subpodial flange (Fig. 2D, E).

Camerated capillary setae present throughout thoracic setigers and abdominal neuropodia, with an additional flail setae (Fig. 6B) accompanying camerated capillaries in abdominal notopodia.

Pygidium with long paired dorso-lateral anal cirri.

Remarks. *Leitoscoloplos pugettensis* was described by Pettibone (1957) from Puget Sound in Washington State from mud and gravelly sand. She synonymized *Haploscoloplos elongatus* (Johnson, 1901), also described from Puget Sound, and later reported from British Columbia, Canada, California and Pacific Panama.

The variability in thoracic length of this species may be correlated with the body size of Costa Rican specimens. Mackie (1987) reported 19–20 thoracic setigers in specimens from Washington State and 19–22 in specimens from British Columbia while Blake (1996) reported thorax lengths of 14–20 in California specimens.

Mackie (1987) examined paratypes of this species from Puget Sound and found branchiae first occurred as small papillae on setigers 13–15 in specimens with 19–22 thoracic setigers. Pettibone (1957) reported the branchiae from setigers 15–18 in specimens with 19–22 setigers. Blake's (1996) California specimens were of a greater size range, with branchiae from setigers 14–20 with the onset of branchiae from the one or two most posterior thoracic segments. Costa Rican specimens agree with Blake's California material in that the branchiae are almost always present from the last two thoracic segments.

L. pugettensis is similar to *L. chilensis* (Hartmann-Schröder, 1965) which is redescribed by Mackie (1987) as having a maximum of 15–16 thoracic setigers, thoracic branchiae, and morphologically similar abdominal notopodial and neuropodial lamellae. It differs from *L. chilensis* in the more triangular neuropodial postsetal lobes in the thorax and the shape of the branchiae which are medially expanded in *L. chilensis*. Flail setae have not been previously reported for *L. pugettensis*.

Distribution. Eastern Pacific Ocean from Alaska to Costa Rica, intertidal to 220 m. Found in muddy to sandy sediments from 11–22 m. in the Gulf of Nicoya and 1.5–5 m in Bahia Culebra.

Genus *Leodamas* Kinberg, 1866

Leodamas hamatus new species

Figures 2 (F–G), 3 (A–G), 4 (B–G)

Scoloplos (*Leodamas*) *ohlini*: Vargas *et al.* 1985: 336.—Maurer *et al.* 1988: 47.—Dean, 1996a: 74; 2009: 146. Not Ehlers, 1901.

Scoloplos (*Leodamas*) *tribulosus*: Dean, 1996a: 74; 2009: 146. Not Ehlers, 1897.

Material examined. Gulf of Nicoya: Punta Morales, South point, 10°3'30.2"N, 84°57'4.8"W, intertidal, muddy sand, Jul 1995, **Holotype** (MCZ 50373); Sta. 2, 9°55'28"N, 84°52'05" W, 18 m, muddy sand, 13 July 1980 (1); Sta. 24, 9°49'25"N, 84°41'20"W, 11 m, sand, 10 Jul 1980 (1), 1 Oct 1980 (5), 27 Jan 1981, **2 Paratypes** (MCZ 83993) (1), 4 Apr 1982, **1 Paratype** (MCZ 50374); Sta. 28, 9°52'16"N, 84°45'30"W, 26 m, mud, 1 Apr 1982, **2** (MCZ 83996); Sta. 29, 9°54'55"N, 84°45'15"W, 18 m, muddy sand, 1 Oct 1980, **1 Paratype** (MZUCR 30-3) (6), 27 Jan 1981, **(2) Paratypes** (MZUCR 153-01 & MZUCR 31-02) (6), 7 Jun 1981, **1 Paratype** (MCZ 50375) (2), 1 Apr 1982, **2 Paratypes** (MCZ 50377 (SEM) (2)); Sta. 30, 9°54'40"N, 84°45'50"W, 18 m, muddy sand, 10 Jul 1980, **1 Paratype** (MCZ 83992); Sta. 31, 9°44'00"N, 84°59'42"W, 20 m, mud/sand, 9 Jul 1980 (1); Sta. 35, 9°55'42"N, 84°47'40"W, 13 m, sand, 12 Jul 1980 (1). Punta Morales: Playa Blanca, 10°04'N, 84°58'W, lower intertidal, muddy sand, 1986, **1 Paratype** (MZUCR 156-01), col: J. A. Vargas; South point, 10°3'30.2"N, 84°57'4.8"W, mid intertidal, muddy sand, 29 Aug 1988, col: H. K. Dean, (2); east of South Point, 10°3'34.9"N, 84°57'6.0"W, intertidal fine sand, col: H. K. Dean, 29 Aug 1988, **2 Paratypes** (MCZ 50378). Guanacaste, Bahia Culebra: Sta. 3, 10°35'42.9"N, 85°39'16.6"W, 13 m, 19 May 2011 (1); Sta. 12, 10°35'56.5"N, 85°40'34.6"W, 12 m, 19 May 2011 (1).

Description. An elongate species, all specimens incomplete, maximum thoracic width 0.30–1.23 mm.

Holotype incomplete, 32 mm long, 0.8 mm wide with 115 segments (Figs. 3A, 4B). Prostomium conical; eyespots absent; paired dorsolateral nuchal organs present. Peristomium slightly shorter than prostomium, subequal to first setiger. Thorax with 13–21 setigers, holotype with 18; transition to abdomen abrupt. Short, conical branchiae from setiger 6 in all specimens, increasing in length posteriorly.

Thoracic notopodial presetal lobe a low ridge, postsetal lobe short, conical at first, increasing in length posteriorly; thoracic neuropodia with low presetal ridge, postsetal ridge somewhat higher (Fig. 2F). Abdominal notopodial postsetal lobe conical, shorter than branchiae; abdominal neuropodia with presetal lobe a low ridge, postsetal lobe triangular; with a single well-developed, projecting acicula which enlarges with a hooked tip (Fig. 3B, G) and becomes greatly emergent in far posterior setigers (Fig. 4G).

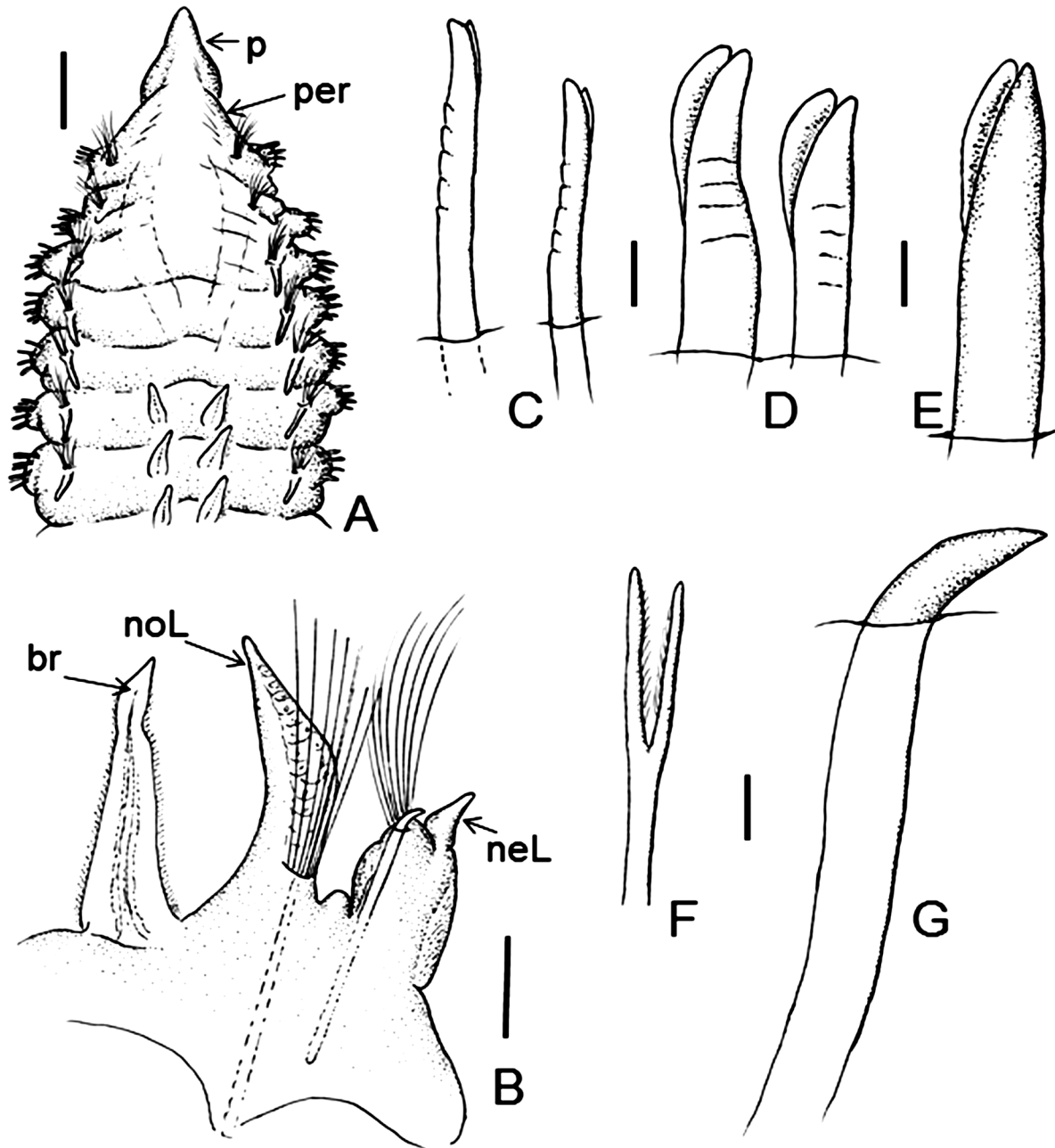


FIGURE 3. *Leodamas hamatus* n. sp.: A, holotype, anterior end, dorsal view; B, Holotype, posterior abdominal setiger, anterior view; C, Holotype, anterior thoracic mid-neuropodial spine; D&E, Holotype, posterior thoracic mid-neuropodial spines; F, Holotype, abdominal notopodial furcate setae; G, Holotype, posterior neuropodial emergent hooked spine. Scale bars: A = 200 μ m, B = 100 μ m, C–G = 10 μ m.

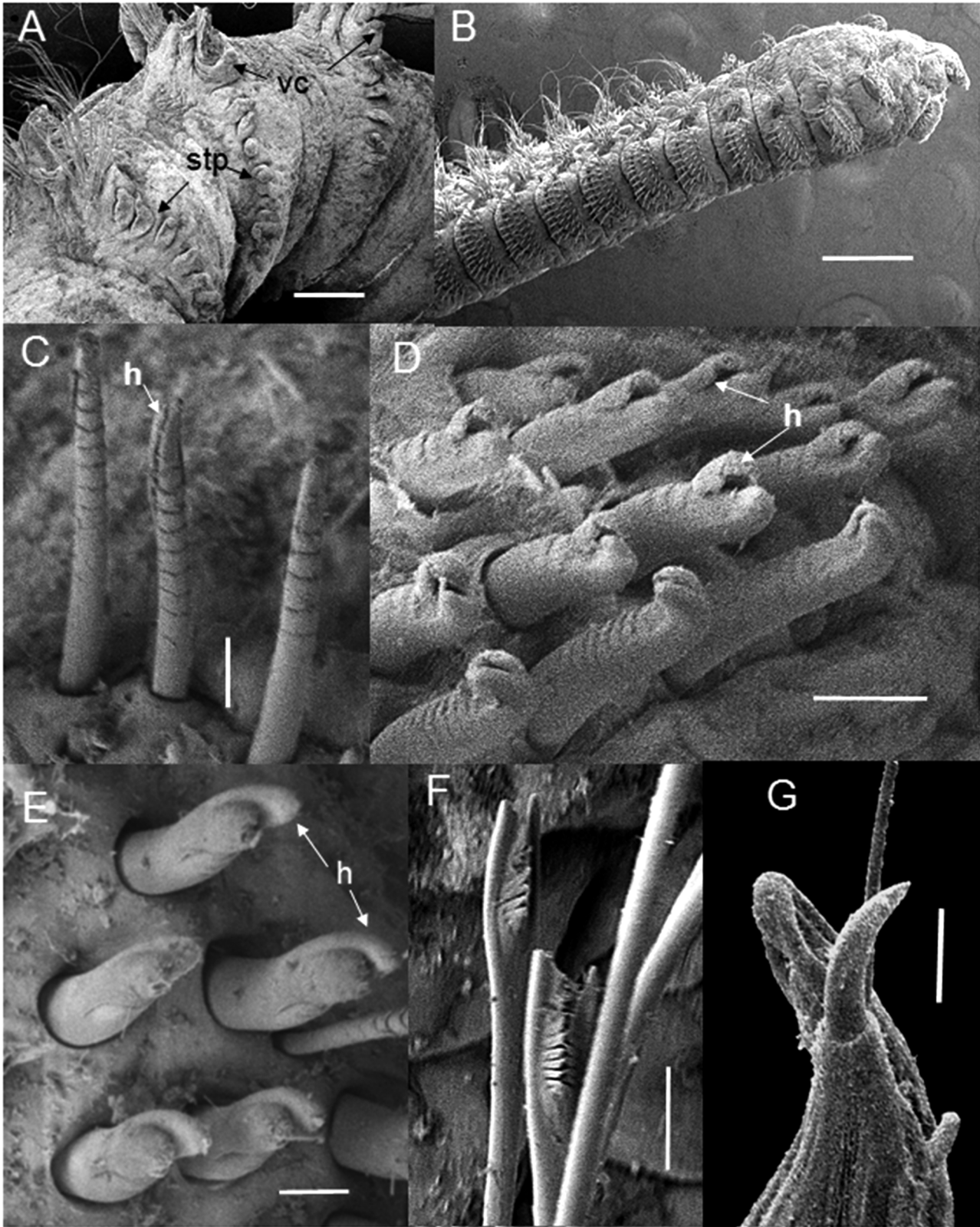


FIGURE 4. *Leitoscoloplos multipapillatus*: A, Setigers 17–19, ventral view. *Leodamas hamatus* n. sp.: B, Paratype XXX Anterior region, lateral view; C, Anterior thoracic spines, setiger three, mid-neuropodial region; D, Posterior thoracic spines, setiger 15, mid-neuropodial region; E, Posterior thoracic spines, upper neuropodial region; F, Furcate notosetae, posterior abdominal region; G, Posterior emergent neuroaciculum, posterior abdominal region. Scale bars: A = 200 μ m, B = 500 μ m, C–E, F, G = 10 μ m. *h* = hoods, *stp* = stomach papillae.

Thoracic notosetae camerated capillaries throughout; neurosetae include a small dorsal fascicle of 2–7 thin capillaries and rows of heavy uncini arranged in 2–4 complete longitudinal rows, with a partial posteriormost fifth row; uncini with 5–8 transverse rows of small serrations on shaft (Figs. 3C–D, 4–D). First four or five thoracic setigers with narrow uncini with a blunt tip, and thin, appressed hood (sometimes eroded) (Figs. 3C, 4C); subsequent thoracic uncini much more robust with thickened hood (Figs. 3D, 4D) that together with curved tip, providing uncini with a bifurcate appearance; 5–8 serrated ridges on shaft (Figs. 3E, 4D). Uppermost few uncini short with wide rounded tip and a thick hood projecting slightly beyond the tip in all thoracic setigers (Fig. 4E). Abdominal notosetae camerated capillaries accompanied by 1–3 furcate setae posteriorly (Figs. 3F, 4F), each with slightly unequal length tines and coarse spines along the median borders.

Remarks. Blake (2000) noted that *Leodamas* should be recognized as a genus separate from *Scoloplos* as its thoracic neuropodial spines are thicker than the narrow, pointed spines of *Scoloplos* and are not accompanied by numerous capillaries in the setal fascicle (see *S. cryptosetosa* n. sp. below) as occurs in *Scoloplos*. Blake (1996) considered the subgenus *Scoloplos* (*Leodamas*) to differ from *Scoloplos* (*Scoloplos*) in that the onset of branchiae occurred anterior to setiger 7 rather than posterior to setiger 8. Later, Blake (2000) treated *Leodamas* as a full genus and noted that while most species in this genus have the first branchiae on the anterior part of the thorax at about setiger 6, there is one group of species represented by *L. treadwelli* (see below) where the branchiae begin more posteriorly; the generic status of this group of species is currently being reviewed (Blake, in prep.).

Leodamas hamatus n. sp. is unusual in the structural differences of the neuropodial uncini along the thorax. Blake (in prep.) has noted a similar transition in the neuropodial uncini along the thorax of *L. cochleata* Ehlers, 1900 from Patagonia. The uncini of the first 2–3 setigers of *L. cochleata* are straight shafts with a rounded apex, weak transverse ridges, and an elongate groove along one side. In the remaining thoracic setigers, however, the uncini have well-developed transverse ridges and a more expanded distal end with a round, cup-like concavity (see Ehlers 1901: pl. 21, Figs. 20–21). The thoracic uncini of *L. hamatus* n. sp. also exhibit a transition in morphology of the uncini along the thorax but the uncini of anterior setigers are more pointed than those of *L. cochleata*, have a thin, distal hood, and more robust transverse ridges. These thoracic uncini are replaced posteriorly to setiger 5 by heavily ridged, thick uncini with a slightly curved apex and a thickened, oblique hood, sometimes giving the appearance of a biramus end (Figs. 3E, 4D). Also, *L. hamatus* n. sp. has a single, large, curved neuropodial acicular spine in posterior abdominal segments (Fig. 4g). *L. cochleata* possesses 1–2 weakly curved spines in both the notopodia and neuropodia of abdominal segments.

The unusual thickened hood in middle and posterior thoracic neuropodial uncini appears similar to the uncini of *L. chevalieri* (Fauvel, 1902) (Fauvel 1902, Fig. 26) but there is no mention of variability of the uncini along the thorax of that species. *L. chevalieri* is similar to *L. hamatus* n. sp. based on the length of the thorax, first occurrence of branchiae and morphology of the abdominal parapodia but lacks the large emergent, curved acicular spines in the posterior neuropodia (Figs. 3B, G; 4E) as well as the furcate setae present in the posterior notopodia of *L. hamatus* n. sp. (Figs. 3F; 4E, F).

Etymology. *Hamatus* is Latin for hooked, referring to the large curved neuropodial spines found on this species.

Distribution. Collected in muddy to sandy sediments from 11–26 m in the Gulf of Nicoya and from 12–13 m in Bahia Culebra, Costa Rica.

***Leodamas treadwelli* Eisig, 1914**

Figures 5 (A–B), 6 (C)

Aricia cirrata Treadwell, 1901: 201, Figs. 54–57. Homonym, Not Ehlers, 1897

Scoloplos treadwelli Eisig, 1914 (new name for *A. cirrata* Treadwell).—Augener, 1927: 69.—Hartman, 1957: 283.—Maciolek & Holland, 1978: 164.—Vargas *et al.* 1985: 336.—Maurer *et al.* 1988: 47.—Dean, 1996a: 74.—de León-González & Rodríguez, 1996: 173.

Scoloplos armiger: Dean, 1996: 74; 2009: 146. Not Müller, 1776.

Material examined. Gulf of Nicoya: Sta. 15, 9°57'40"N, 84°47'00"W, 15 m, sandy mud, 12 Jul 1980 (1). STA. 24, 9°49'25"N, 84°41'20"W, 11 m, sand, 1 Oct 1980 (1); Sta. 28, 9°52'16"N, 84°45'30"W, 26 m, mud, 10 Jul 1980, 1 (MZUCR), 1 Oct 1980 (1), 7 June 1981, 1 (MZUCR); Sta. 29, 9°54'55"N, 84°45'15"W, 18 m, muddy

sand, 29 Jan 1981 (1); 4 Apr 1982, 1 (MZUCR); Sta. 30, 9°54'40"N, 84°45'50"W, 18 m, muddy sand, 1 Oct 1980 (1). Punta Morales, Playa Blanca, lower intertidal, 10°3'47.2" N, 84°57'9.2" W, muddy sand, 20 Dec 1986, 3 (MZUCR).

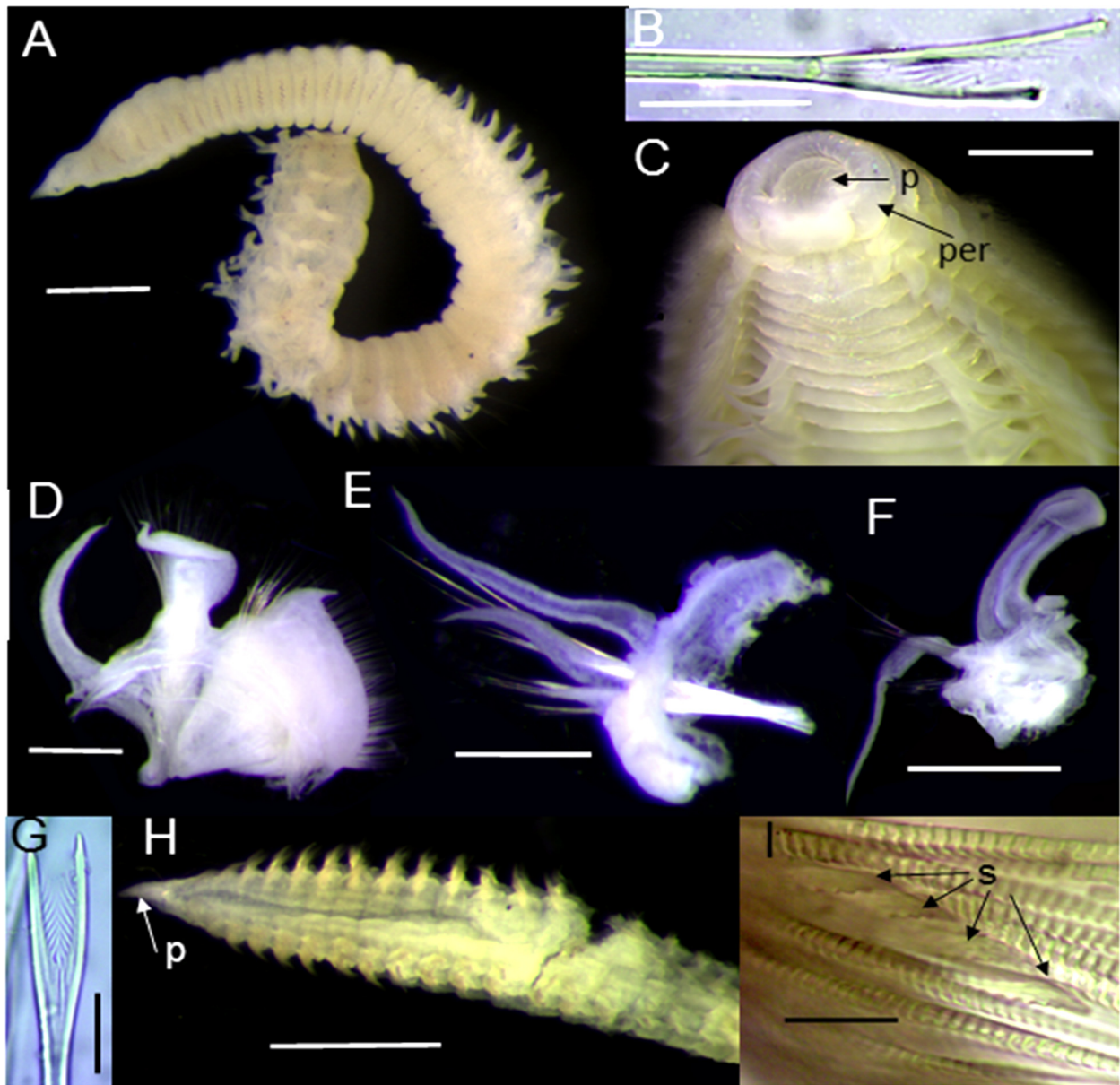


FIGURE 5. *Leodamas treadwelli*: A, Station 28 Oct, Gulf of Nicoya specimen, anterior and midbody, lateral view; B, Station 28 Jun, Gulf of Nicoya specimen, notopodial furcate seta. *Naineris setosa*: C, Playa Blanca specimen, anterior end, dorsal view; D, Playa Blanca specimen, thoracic parapodia, posterior view; E, Playa Blanca specimen, anterior abdominal parapodia, posterior view; F, Playa Blanca specimen, posterior abdominal parapodia, posterior view; G, Playa Blanca specimen, notopodial furcate seta. *Scoloplos cryptospinigerus* n. sp.: H, Holotype, anterior end, dorsal view; I, Holotype, posterior thoracic neuropodial spines. Scale bars: A, D–E, H = 500 μ m, B, G, I = 10 μ m, C, F = 1000 μ m. *s* = neuropodial spines.

Description. All specimens incomplete, maximum thoracic width 0.66–1.75 mm (Fig. 5A). Prostomium small, triangular, pointed; lacking eyespots; nuchal organs not apparent. Peristomium subequal to prostomium, approximately 1.25 times as long and equal in width to setiger 1. Thorax wide, dorso-ventrally flattened; 14–20 setigers long, transition to abdomen abrupt. Branchiae from first abdominal setiger in all specimens, small at first, more erect, longer than parapodial lobes, in posterior segments.

Thoracic notopodia with short digitate postsetal lobe, approaching setal length in posterior thoracic setigers; thoracic neuropodia low ridges. Abdominal notopodial lobe erect, postsetal lobe large, triangular, longer than

branchiae in anterior setigers, shorter in subsequent setigers; neuropodial parapodial lobe erect, truncate; presetal lobe a weak ridge (Fig. 6C).

Thoracic notosetae camerated capillaries; thoracic neurosetae short, acicular, in two rows anteriorly, single row in posterior thoracic setigers (Fig. 5A); thoracic acicula accompanied by a few dorsal capillaries in posterior thoracic setigers. Abdominal notosetae camerated capillaries accompanied by a single furcate setae with unequal smooth tines with blunt tips; delicate thin teeth on inner faces of each tine (Fig. 5B); abdominal neurosetae all camerated capillaries.

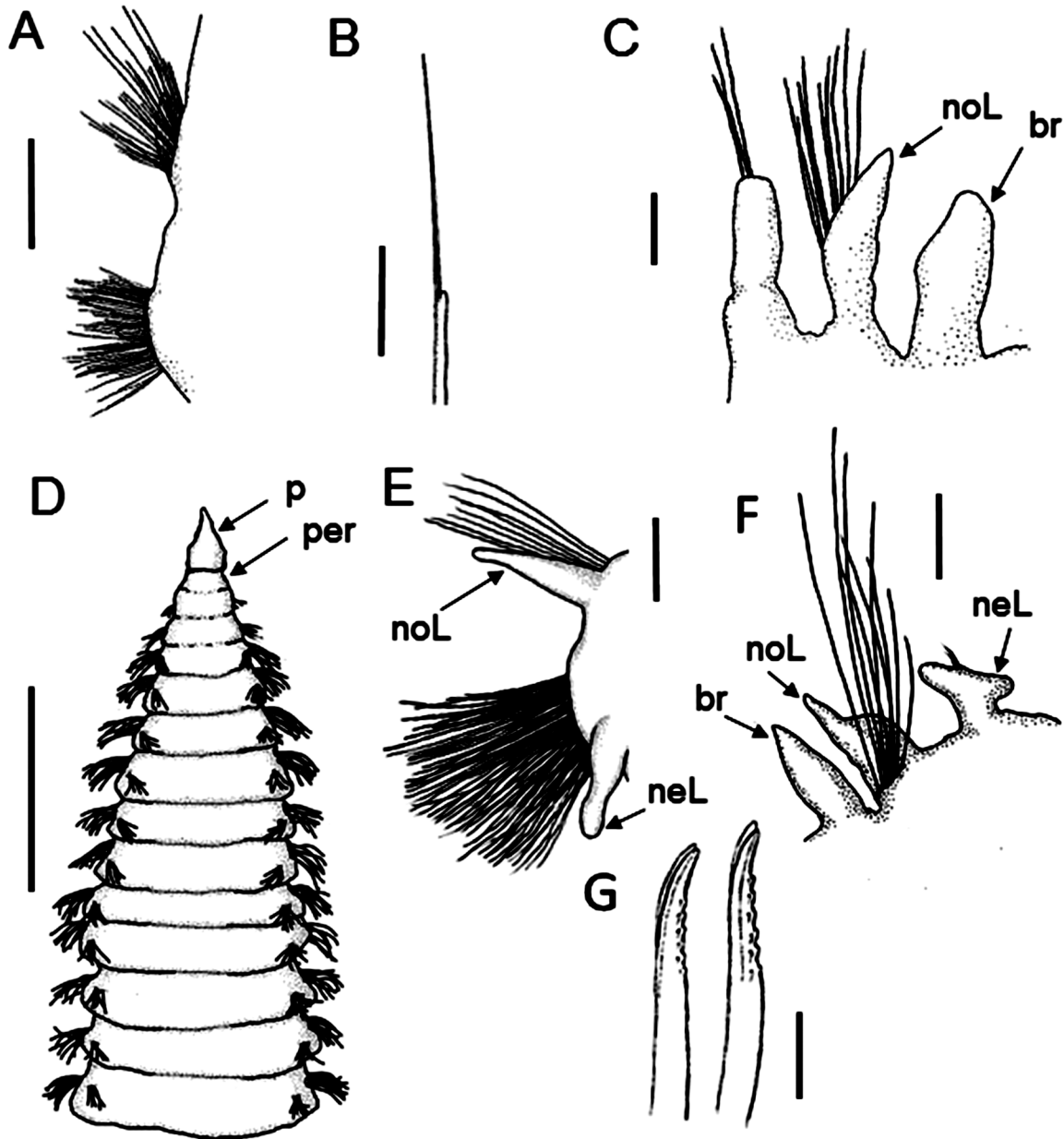


FIGURE 6. *Leitoscoloplos pugettensis*: A, Station 9, Bahia Culebra specimen, thoracic setiger, anterior view; B, Station 9, Bahia Culebra specimen, posterior notopodial flail setae. *Leodamas treadwelli*: C, Station 28 Jun, Gulf of Nicoya specimen, posterior abdominal setiger, anterior view; *Scoloplos cryptospinigerus* n. sp.: D, Holotype, anterior end, dorsal view; E, Holotype, thoracic parapodia, posterior view; F, Paratype, abdominal parapodia, anterior view; G, Paratype, thoracic neurosetal spines. Scale bars: A, F = 50 μ m, B = 10 μ m, C, E = 100 μ m, D = 500 μ m, G = 20 μ m.

Remarks. *Aricia cirrata* Treadwell, 1901, originally described from Puerto Rico, is a homonym of *A. cirrata* Ehlers, 1897 and was renamed *Scoloplos treadwelli* by Eisig, 1914. This species has now been more widely reported from the Caribbean, and the Pacific coast of Mexico; the species was redescribed by Hartman (1957) and

Maciolek & Holland (1978). López, *et al.* (2003) described *L. platythoracicus* López, Claders, & San Martín, 2003, from Pacific Panama which is similar to *L. treadwelli* in the thoracic length and setal morphology but differs in the nature of the abdominal neuropodia. The anterior abdominal neuropodia is erect and blunt-ended in both species but those of *L. platythoracicus* have a notch on the lateral edge and a single, slightly protruding, aciculum. *L. treadwelli* lacks a notch in the anterior neuropodial lobe and the slightly projecting aciculum is accompanied by 2–3 deeply embedded aciculae. *L. texana* (Maciolek & Holland, 1978) from the Gulf of Mexico is also similar to *L. treadwelli* but has only single rows of acicular spines in the thoracic neuropodia whereas *L. treadwelli* has several double rows of spines on anterior thoracic neuropodia and single rows in posterior thoracic segments. *L. minutis* López, Cladera & San Martín, 2003, also described from Pacific Panama, is morphologically similar to *L. treadwelli* but is unusual in that the first three thoracic setigers are uniramous with notopodia and notosetae entirely absent.

Distribution. *Leodamas treadwelli* was described by Treadwell (1901) as *Aricia cirrata* Treadwell, 1901, from Puerto Rico and has been subsequently been reported from Colombia, Cuba, Curaçao, and Jamaica in the Caribbean (Dean, 2012). Hartman (1957) reported this species from Acapulco on the Pacific coast of Mexico and Maciolek & Holland (1978) later verified this identification. De León-González & Rodríguez (1996) reported the species from Baja California, Mexico. The present records extend the distribution south to Costa Rica in the Central American eastern Pacific. Collected in muddy to sandy sediments from 11–26 m. in the Gulf of Nicoya.

Genus *Naineris* Blainville, 1828

Naineris setosa (Verrill, 1900)

Figure 5 (C–G)

Aricia setosa Verrill, 1900:651–653.

Anthostoma latacapitata Treadwell, 1901:203–205, Figs. 61–65.

Naineris latacapitata: Treadwell, 1939:254, Fig. 81.

Naineris setosa: Treadwell, 1936:55.—Hartman, 1942:61, Figs; 116–118; 1951:67–70, pl. 17, Figs. 1–6; 1957:305, pl. 41, Figs. 1–6.—Rioja, 1960: 303.—Solis-Weiss & Fauchald, 1989:774–778, Fig. 2.—Blake & Giangrande, 2011:20–26, Figs. 1–2.—Khedhri *et al.*, 2014:85–86.

Material examined. Punta Morales, Playa Blanca, 10°3'47.2" N, 84°57'9.2" W, lower intertidal, muddy sand, 1988 (1), col: J. A. Vargas. Off Costa Rica, Cocos Island, Silverado, 11 m, 23 May 2008 (1 MZUCR); Bahia Chatham Braga, 65 m, 9 April 2008 (1 MZUCR); Wafer Buceo, 10 m, 10 April 2008 (1 MZUCR).

Description. Single complete specimen 196 mm long for approximately 670 setigers, 4.7 mm maximum thoracic width, posterior region narrow with many closely spaced setigers. Prostomium short, rounded, eyespots lacking, nuchal organs not visible (Fig. 5C). Peristomium a simple ring, subequal in length to setiger 1. Thoracic region 30 setigers long, flattened dorso-ventrally. Long cirriform branchiae present from setiger 6 (Fig. 5C–D).

Thoracic notopodia with low-lying presetal ridge and long, triangular postsetal lobe; presetal neuropodial lobe a low ridge, postsetal lobe expanded, approaching setal length, with short, triangular point dorsally (Fig. 5D). Abdominal notopodial presetal lobe a low ridge, postsetal lobe long, cirriform, extending beyond branchial length; pre- and postsetal lobes of abdominal neuropodia short, triangular ridges, postsetal lobe with a dorsal point (Fig. 5E); in far posterior setigers postsetal lobes on notopodia long, narrow, shorter than branchiae, neuropodial postsetal lobe long, narrow, approximately one-third length of notopodial postsetal lobe (Fig. 5F). Setae crenulated capillaries throughout; accompanied by 1–3 furcate setae in abdominal notopodia (Fig. 5G).

Remarks. A more detailed description of *Naineris setosa* together with a review of its taxonomic history, distribution, biology and ecology was presented by Blake & Giangrande (2011) who reported on an invasive occurrence of the species at a fish aquaculture facility in Brindisi, Italy.

Distribution. A widely distributed species first described from Bermuda and reported from numerous sites in the tropical western Atlantic, Caribbean and Gulf of Mexico (Blake & Giangrande 2011, Dean 2012). Hartman (1957) first reported this species from Pacific Mexico and Blake & Giangrande (2011) extended its range from Mexico to Costa Rica in the Eastern Pacific. In Costa Rica it was found in the muddy intertidal of Playa Blanca, Punta Morales.

Genus *Scoloplos* Blainville, 1828

Scoloplos cryptospinigerus n. sp.

Figures 5 (H–I), 6 (D–G)

Material examined. Gulf of Nicoya, Sta. 22, 9°48'25"N, 84°52'40"W, 22 m, muddy sand, 11 Jul 1980, **Holotype**, (MCZ 50379); STA. 29, 9°54'55"N, 84°45'15"W, 18 m, muddy sand, 7 Jun 1981, **Paratype** (MCZ 50380).

Description. Both specimens incomplete; holotype 38 setigers, 7.18 m long, 0.41 cm maximum thoracic width. Paratype 19 setigers, 3.60 cm long, 0.47 cm maximum thoracic width. Prostomium sharply conical; lacking eyespots; paired nuchal organs located dorso-laterally at posterior border (Figs. 5H, 6D). Peristomium subequal in length to prostomium. Thorax with 17 setigers in holotype, 15 setigers in paratype, widest in middle setigers. Branchiae from first abdominal setiger as short digitate process, thereafter increasing in size and subequal to notopodial lamellae in mid-body segments (Fig. 6F).

Thoracic notopodial and neuropodial postsetal lobes digitate to triangular, beginning at setiger 3 as small papillae, reaching two-thirds setal length in posterior thoracic setigers; notopodial postsetal lobe longer than that of neuropodium (Fig. 6E). Subpodial lobes and stomach papillae lacking. Abdominal notopodial postsetal lobes triangular, subequal in length to branchiae (Fig. 6F). Neuropodial post-setal lobes weakly bilobed, becoming narrow and elongate posteriorly, slightly shorter than notopodial lobe; emergent, slightly hooked, acicula present.

Thoracic neurosetae densely packed camerated capillaries accompanied by an antero-ventral row of slightly curved, serrate spines (Figs. 5I, 6E) with a thin, translucent hood (Fig. 6G); up to 4–6 spines present per segment from setigers 1–15 in the 17 setiger thorax of the holotype and 1–12 in 15 setiger thorax of paratype. Thoracic notopodial setae camerated capillaries, fewer in number than in neuropodia. All abdominal setae crenulated capillaries. Notopodial furcate setae absent.

Remarks. The presence of few serrate uncini among numerous capillary setae in the thoracic neuropodia is similar to *Scoloplos normalis* (Day, 1977) from Australia, originally described in the genus *Leitoscoloplos* as no spines were seen in the neuropodia. Mackie (1987) later examined the type material and found neuropodial uncini in thoracic setigers and therefore transferred this species to the genus *Scoloplos*. All specimens examined by Mackie (1987) had 15 setigers in the thoracic region and single neuropodial spines in the first three setigers except for a smaller specimen that had spines to setiger 11. De León-González & Rodríguez (1996) later reported *S. normalis* from Baja California (Mexico) but saw no spines in their specimens and retained them within the genus *Leitoscoloplos*. Díaz-Castañeda *et al.* (2005) later reported specimens of *L. normalis* from the Pacific coast of Baja California, Mexico presumably also lacking neuropodial spines. In the review of the Orbiniidae of Mexico by Solís-Weiss *et al.* (2009), *Scoloplos normalis* was reported from Pacific Mexico (presumably referring to the above mentioned citations) with a single weakly serrate spine in the second setiger (see their Fig. 4a) with no further explanation presented. It is thus unclear whether this report of *Scoloplos normalis* from the tropical eastern Pacific is the same species as that described by Day (1977).

S. normalis and *S. cryptospinigerus* n. sp. have similar numbers of thoracic setigers, 15–16 and 15–17 respectively, and the branchiae occur from the first or second abdominal setiger in both species. While *S. normalis* has single, blunt uncini with small dentitions in the first few thoracic neuropodia, *S. cryptospinigerus* n. sp. has 1–5 more strongly toothed spines in all thoracic setigers but the final two (Fig. 5I). The postsetal lobes of the thorax are longer and more digitate than the shorter, more triangular, postsetal lobes seen in *S. normalis*. Additionally, the abdominal notopodial postsetal lobe is medially enlarged and the neuropodial postsetal lobe is bifid with large subequal branches giving an anvil-like appearance in *S. cryptospinigerus* n. sp. (Fig. 6F). Based on the descriptions of Day (1977) and Mackie (1987), the abdominal notopodial lobe of *S. normalis* is not enlarged and, according to Day (1977), the neuropodial postsetal lobe is bifid but with an inner arm three times as long as the outer arm. Also, notopodial furcate setae were reported for *S. normalis* by Day (1977), Mackie (1985) and Díaz-Castanea *et al.* (2005) but none were observed in *S. cryptospinigerus* n. sp..

Other species of *Scoloplos* with similar numbers of thoracic setigers include *Scoloplos cylindrifer* Ehlers, 1904 and *S. simplex* (Hutchings, 1974). These species differ from *S. cryptospinigerus* n. sp. by the presence of dendritically branched branchiae in *S. cylindrifer* and the presence of thoracic branchiae in *S. simplex*.

Etymology. The species name refers to the spines in the anterior thoracic neuropodia which are often hidden from view by the numerous capillary setae.

Distribution. Gulf of Nicoya, Pacific Costa Rica, in muddy sand from 18–22 m.

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