

Cryptonome mooreae sp. nov., AND REDESCRIPTION OF *C. oculata* (TREADWELL, 1941) comb. nov. (POLYCHAETA: AMPHINOMIDAE)

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Abstract: During the revision of *Pareurythoe* GUSTAFSON, 1930, two sets of specimens previously identified as belonging to *Eurythoe* KINBERG, 1858, are herein regarded as belonging in *Cryptonome* BORDA, KUDENOV, BIENHOLD & ROUSE, 2012. Some specimens identified as *E. parvecarunculata* from Cameroon and Equatorial Guinea from decaying wood boats are newly described as *C. mooreae* sp. nov. One specimen identified as *E. dubia* from Pacific Panama with a specimen collected swimming was regarded as a new species, but it is conspecific with *Eurythoe oculata* TREADWELL, 1941 and is transferred and newly combined as *Cryptonome oculata* (TREADWELL, 1941) comb. nov. A key to identify all *Cryptonome* species is also included.

Keywords. Caruncle, branchiae, neurochaetae, furcates, spurred, capillaries.

RESUMEN: En la revisión de *Pareurythoe* GUSTAFSON, 1930, dos series de ejemplares identificados previamente como especies de *Eurythoe* KINBERG, 1858, son considerados como parte de *Cryptonome* BORDA, KUDENOV, BIENHOLD & ROUSE, 2012. Unos ejemplares recolectados en Camerún y Guinea Ecuatorial en botes de madera deteriorados e identificados como *E. parvecarunculata* se describen como *C. mooreae* sp. nov. Otro ejemplar fue hallado nadando en la costa Pacífica de Panamá e identificado como *E. dubia*, mismo que se consideró como especie indescrita, pero es conspecífico con *Eurythoe oculata* TREADWELL, 1941 y se transfiere y se combina como *Cryptonome oculata* (TREADWELL, 1941) comb. nov. Se incluye una clave para identificar todas las especies de *Cryptonome*.

Palabras clave. Carúncula, branquias, neurosetas, furcadas, espolonadas, capilares.

INTRODUCTION

The processes involved in destroying submerged wood have been relevant because ancient ships and harbors were made with wood. Teredinid bivalves, or shipworms, have been regarded as the main responsible for destroying wood, and their impact has been involved in some historical events like the shipwreck of Columbus, the sinking of the Spanish Armada, or the collapse of San Francisco wharves (NELSON 2016; GOODELL *et al.* 2024).

Drifting, fixed or submerged wood fragments provide substrate and energy for marine invertebrates capable of boring into wood, and some even ingesting and digesting cellulose and lignin. Biological aspects of teredinids have been extensively documented (NAIR & SARASWATHY 1971), but the corresponding ecological succession has not yet attracted much attention. NISHIMOTO *et al.* (2015) documented it in shallow temperate waters, whereas BIENHOLD *et al.* (2013) documented it for deep-sea wood-falls.

In both cases, teredinids are among the first arrivals, followed by pholadid bivalves, with some opportunistic species groups outside the wood particles. The next main stage involves the arrival of some xylophilic isopods (Limnoridae), and the arrival of some detritus-feeding polychaetes, especially amphinomids. The final stages involve only isopods, or other chemosynthetic organisms (deep water). The amphinomid species of *Cryptonome* BORDA, KUDENOV, BIENHOLD & ROUSE, 2012 are sometimes present in intermediate stages, and have been recorded as associated with decaying wood, long before the genus was proposed.

AUGENER (1918) recorded *Eurythoe parvecarunculata* (HORST, 1912) in tropical West Africa, but the species was originally described from Malaysia. After studying some West African specimens, I regard them as belonging in an undescribed *Cryptonome* species, and described as *C. mooreae* sp. nov. On the other hand, MONRO (1933) recorded *E. dubia* HORST, 1912 for the Pacific Panamian coast, and the species was later described as *Eurythoe oculata* TREADWELL, 1941. The species was later transferred to *Pseudeurythoe* FAUVEL, 1932, and then to *Linopherus* DE QUATREFAGES, 1866, but because it has branchiae present along most body segments it is herein newly combined as *C. oculata* (TREADWELL, 1941) comb. nov.

MATERIAL AND METHODS

Amphinomids were measured as body length from anterior margin of the prostomium to the last segment. The body width was measured by about chaetiger 15, without chaetae, and the number of chaetigers was counted. A few selected parapodia were removed for observing parapodial and chaetal features; for the latter, especially when chaetae are abundant, chaetal bundles were separated, and each was further dissected for separating chaetae and improving visibility of their structures. Type specimens were photographed in a sequence of successive focal plains, then they were stacked with HeliconFocus8. Plates were prepared with PaintShopPro9. Sometimes specimens or their parts were stained with Methyl green or Shirlastain-A for increasing visibility of some features. Species are presented in alphabetical sequence. The material belongs to the following institutions:

AMNH: American Museum of Natural History, New York, United States of America.

BMNH: The Natural History Museum, London, England.

ZMH: Museum of Nature Hamburg, Leibniz Institute for the Analysis of Biodiversity Change, Hamburg, Germany.

Systematics

Family Amphinomidae KINBERG, 1858

Subfamily Amphinominae KINBERG, 1858

Cryptonome BORDA, KUDENOV, BIENHOLD & ROUSE, 2012

Key to species of *Cryptonome* Borda, Kudenov, Bienhold & Rouse, 2012

(modified from TOVAR-HERNÁNDEZ *et al.* 2024; references therein)

- 1 Parapodial cirri smooth, non-pseudoarticulate; median antenna longer than laterals 2
- Parapodial cirri pseudoarticulate, especially along anterior region; size of median antenna variable 7
- 2(1) Caruncle small, cushion-shaped 3
- Caruncle elongate, tapered; first branchiae with about 10 filaments; median antennae minute, shorter than laterals *C. elongata* (TREADWELL, 1931) Caribbean Sea
- 3(2) First branchiae with about 10 filaments; harpoon notochaetae with two series of denticles (barbed) *C. barbada* BARROSO, KUDENOV, HALANYCH, SAEEDI, SUMIDA & BERNARDINO, 2018 Southwestern Atlantic
- First branchiae with about 20 filaments; harpoon notochaetae with a single series of denticles 4
- 4(3) Branchiae of anterior segments very long, covering dorsum *C. conclava* BORDA, KUDENOV, BIENHOLD & ROUSE, 2012 Eastern Mediterranean
- Branchiae of anterior segments short, not covering dorsum 5

- 5(4) Neuropodia with abundant capillaries and furcate or spurred neurochaetae 6
- Neuropodia with a few or no capillaries, only with furcate and spurred neurochaetae
..... *C. mooreae* sp. nov. Cameroon
- 6(5) Caruncle longer than wide; dorsal cirri with large truncate conical cirrophores; spurred neurochaetae
with longer tine slightly bent outwards *C. americana* (HARTMAN, 1951) Gulf of Mexico
- Caruncle as long as wide; dorsal cirri with cylindrical cirrophores; spurred neurochaetae with longer tine
straight *C. oculata* (TREADWELL, 1941) comb. nov. Pacific Panama
- 7(1) Median antenna as long as laterals; anterior eyes slightly larger than posterior ones
..... *C. turcica* (ÇINAR, 2008) Eastern Mediterranean
- Median antenna markedly longer than laterals, reaching anterior prostomial margin 8
- 8(7) Eyes minute, of similar size (deep water form) *C. parvecarunculata* (HORST, 1912) Malaysia
- Eyes large, anterior eyes larger than posterior ones (shallow water form)
..... *C. beatrizae* TOVAR-HERNÁNDEZ, GONZÁLEZ-VALLEJO & SALAZAR-VALLEJO, 2024 Western Mexico

Remarks. *Linopherus* de Quatrefages, 1866 with *Amphinome incarunculata* PETERS, 1854 as type species (by monotypy), includes species provided with small caruncles and branchiae present along anterior to median regions. HARTMAN (1956, 1959) and FAUCHALD (1972) included *Eurythoe oculata* TREADWELL, 1941 in *Pseudeurythoe* FAUVEL, 1932. However, FAUCHALD (1977a: 102) reestablished *Linopherus*. Regretfully, *E. oculata* was included in this genus despite the fact its branchiae are present along almost all body segments, and it was found in decaying wood, as is the case for most *Cryptonome* species, and this explains the new combination (see below).

***Cryptonome mooreae* sp. nov.**

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Fig. 1

Eurythoe parvecarunculata: AUGENER 1918: 90-93, Pl. 2, Fig. 3, Pl. 3, Fig. 37, 38 (*non* (HORST, 1912)).

Diagnosis. *Cryptonome* with smooth parapodial cirri; dorsal cirri without conical basal lobe, ventral cirri blunt cirriiform; first branchiae with about 20 filaments; neuropodial postchaetal lobe semicircular; neurochaetae only furcate and spurred chaetae.

Type material. Cameroon. Holotype (ZMH Ann V08113) and two paratypes (ZMH Ann V08113b), Sud-Ouest, Fako, Bibundi, in Teredo tubes in a wood boat, 21 Oct. 1913, H. WENKE, coll. (paratypes twisted, many chaetae broken, notochaetae with capillaries and harpoon-chaetae, neurochaetae only furcates and spurred chaetae, no capillaries; one complete, the other larger, without posterior end; complete with anterior eyes 3-4 times larger than posterior ones; branchial filaments per chaetiger: 3(21), 10(44), 30(38), 50(40); body 65 mm long, 4 mm wide, 102 chaetigers; posteriorly incomplete paratype with anterior eyes 3 times larger than posterior ones).

Additional material. Equatorial Guinea. Three specimens (ZMH Ann V03343), Elobey Grande, in bore holes of Teredo and other wood-boring organisms, H. ALLDAG & H. NÄGELEN, coll. (body bent laterally or ventrally, anterior end variably bent ventrally, many chaetae broken; larger specimen regenerating right prostomial margin (not shown); anterior eyes 3-4 times as large as posterior ones; smaller and larger specimens with venter wider than dorsum; right parapodium of chaetiger 20 removed for observation (kept in container); 18-22 branchial filaments; notochaetae include capillaries and harpoon-chaetae (denticles eroded), neurochaetae only furcates and spurred chaetae (largest specimen with 2 smooth neurocapillaries; body 21-38 mm long, 2.0-3.5 mm wide, 78-86 chaetigers).

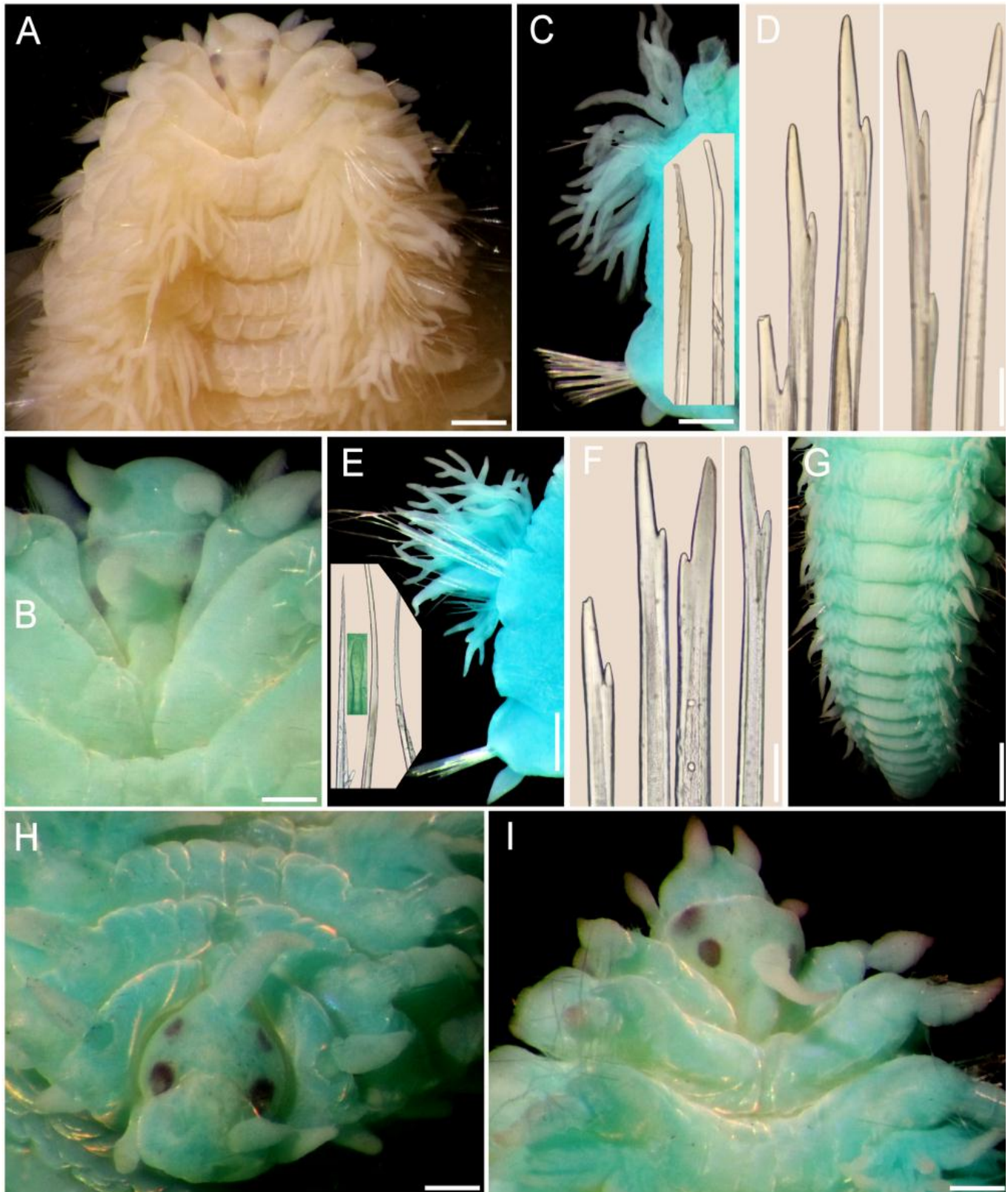


Fig. 1. *Cryptonome mooreae* sp. nov., holotype (ZMH Ann V08113). A. Anterior region, dorsal view. B. Anterior end, dorsal view, after Methyl green staining. C. Chaetiger 14, right parapodium, anterior view, after Methyl green staining (inset: harpoon and furcate capillary tips). D. Same, upper and lower neurochaetal tips. E. Chaetiger 54, right parapodium, anterior view, after Methyl green staining (inset: harpoon and furcate capillaries tips plus acicular chaeta). F. Same, upper and lower neurochaetal tips. G. Posterior region, dorsal view, after Methyl green staining. H. Smaller paratype (ZMH Ann V08113b), anterior end, frontal view, after Methyl green staining. I. Larger paratype (ZMH Ann V08113b), anterior end, dorsal view, after Methyl green staining. Scale bars A, E, 0.5 mm; B, H, 0.2 mm; C, 0.4 mm; D, F, 30 μ m; G, 0.7 mm, I. 0.3 mm.

Description. Holotype (ZMH Ann V08113) complete, markedly bent ventrally, twisted, pale (Fig. 1A); breaking into two pieces; chaetae variably damaged; body tapered and depressed along anterior and posterior regions, medially swollen, venter slightly wider than dorsum; right parapodia of chaetigers 14 and 54 removed for observation (kept in container); venter pale; body 64 mm long, 5.5 mm wide, 98 chaetigers.

Prostomium subpentagonal, partially covered by first chaetiger (Fig. 1B), slightly longer than wide; anterior prostomial lobe clearly set off from posterior one; lateral antennae and palps smooth, non-articulated, antennae tapered; palps fusiform, slightly longer than lateral antennae, directed ventrolaterally. Posterior prostomial lobe slightly longer than anterior one; median antenna tapered, directed upward, about two times as long as caruncle; eyes black, anterior eyes directed anterolaterally, two times as large as posterior, dorsally directed ones. Caruncle small, globular, longer than wide, reaching anterior area of chaetiger 2. Peristomium reduced to two longitudinal cushions, tapered posteriorly; mouth between chaetigers 2-3.

Parapodia all biramous, progressively larger medially, smaller along posterior region. Notopodia and neuropodia barely projected lobes. Dorsal and ventral cirri smooth, not articulated; dorsal cirri tapered, as long as branchial filaments along anterior and median regions, longer in posterior segments, 2-3 times longer than ventral cirri.

Branchiae from chaetiger 3, continued along body, missing from last few chaetigers. Branchial filaments tapered, progressively larger along median segments, decreasing in size posteriorly; chaetiger and branchial filaments: 3(22), 10(30), 30(40), 50(50), progressively decreasing in number posteriorly.

Notochaetae include simple and spurred capillaries, with delicate denticulation, and shorter, coarser harpoon-chaetae; more damaged in anterior chaetigers (Fig. 1C, inset), than in median chaetigers (Fig. 1E, inset). Neurochaetae only furcate and spurred chaetae (Fig. 1D); spurred neurochaetae present in median (Fig. 1F) and posterior chaetigers.

Posterior region tapered; pygidium with anus terminal, anal plate notched.

Variation. The paratypes have more exposed anterior end; anterior eyes are 3-4 times as large as posterior ones (Fig. 1H, I), although the best comparison is in lateral view. Notopodia include capillaries and harpoon-chaetae, and neuropodia only have furcate and spurred chaetae. The complete paratype also has an anal plate notched. The additional specimens (ZMH Ann V03343) have 1-2 capillary neurochaetae in median chaetigers.

Etymology. The specific epithet is after Dr. Jenna MOORE, Curator and Head of Section Annelida, Museum of Nature Hamburg, Leibniz Institute for the Analysis of Biodiversity Change, in recognition of her research progresses in polychaetes and collections, and especially after her support for our research activities.

Remarks. AUGENER (1918) recorded this species as *E. parvecarunculata* and provided a detailed description of small and medium-sized specimens, and of the largest one (73 mm long, Eloby, or Elobie) which was regarded as an epitoke after the presence of abundant capillaries in both parapodial rami, especially regarding the neurochaetae because they were scarce or none in the other atoke specimens. He provided illustrations for the different types of neuropodia (his plate 3, figures 37 and 38).

Cryptonome parvecarunculata (HORST, 1912) was redescribed by ÇINAR (2008) and after the redescription the main differences with the specimens Augener studied is in the size of eyes, and type of dorsal cirri: eyes are large and dorsal cirri almost smooth in West African material, whereas eyes are very small and cirri are irregularly articulated in the type of *C. parvecarunculata*; BORDA *et al.* (2012: 319) newly combined it in *Cryptonome*. The key above shows the affinities among the species of the genus.

Cryptonome mooreae sp. nov. resembles *C. americana* (HARTMAN, 1951) from the Gulf of Mexico and *C. oculata* (TREADWELL, 1941) comb. nov. (see below) from Pacific Panama, by having first branchiae with

about 20 filaments, and branchial filaments not covering dorsum. However, *C. mooreae* clearly separates from these two other species because its neuropodia have few to none capillaries, and mostly furcate or spurred neurochaetae.

Distribution. Cameroon to Equatorial Guinea, in Tereido holes in wood.

***Cryptonome oculata* (TREADWELL, 1941) comb. nov.**

Figs. 2, 3

Eurythoe dubia: MONRO 1933: 5-6, Text-fig. 1 (*non* HORST, 1912).

Eurythoe oculata TREADWELL, 1941: 18, Textfigs 1-3; Hartman 1956: 250.

Pseudeurythoe oculata: HARTMAN 1956: 266, 274 (n. comb.); HARTMAN 1959: 138; FAUCHALD 1972: 40 (key).

Linopherus oculata: FAUCHALD 1977b: 12 (n. comb.); SALAZAR-VALLEJO 1987: 81 (key); SIBAJA-CORDERO & ECHEVERRÍA-SÁENZ 2015: 65 (Table 19), 66, Fig. 5A, B (syn.).

Diagnosis. *Cryptonome* with smooth parapodial cirri; dorsal cirri without conical basal lobe, ventral cirri blunt cirriform; first branchiae with about 15 filaments; neuropodial postchaetal lobe semicircular; neurochaetae include capillaries and spurred chaetae.

Type material. Panamá, Balboa. Holotype of *Eurythoe oculata* TREADWELL, 1941 (AMNH 3540), RV Antares, 25 Jul. 1933, depth 0, probably swimming in surface (no further details in BEEBE 1933).

Additional material. Panamá, Balboa. One specimen (BMNH 1932.12.24.320), S.Y. Saint-George Expedition, Balboa Dock, swimming, C. CROSSLAND, leg. (used for redescription). One specimen (USNM 35042), caught with night light, 23 May 1958, W.L. KLAWE, coll. (female epitoke; soft; anterior end markedly contracted, damaged by dissection; branchiae from chaetiger 3 with 9 filaments; chaetae as long as one-third or half as body width; pale; oocytes 100 µm in diameter; body 63 mm long, 6 mm wide, 99 chaetigers).

Description. Holotype (AMNH 3540), mature female broken into three pieces, body wall variably broken (Fig. 2A); body about 116 mm long, 17 mm wide, 153 segments. Anterior region with body wall broken after dissection of some parapodia; prostomium subpentagonal about as long as wide, anteriorly entire (Fig. 2B); eyes blackish, large, anterior and posterior eyes of similar size; median antenna tapered, reaching anterior eyes; frontal margin (now broken); caruncle minute, restricted to chaetiger 1. Notochaetae all capillaries; neurochaetae furcates; branchiae from chaetiger 3, with about 6 filaments. Posterior region tapered (Fig. 2C), with branchiae present almost to last chaetiger. Oocytes about 50-60 µm.

Topotype (BMNH 1932.12.24.320) complete, bent laterally, pale; body tapered depressed along anterior and posterior ends (Fig. 3A), medially swollen, wider ventrally (neuropodia projected farther away than notopodia); right neuropodia of chaetigers 24, 30, parapodia of chaetigers 39-41 previously removed, not in container; left parapodia of chaetigers 20 and 50 removed for observation (kept in container); venter with a longitudinal thin brownish band; body 165 mm long, 15 mm wide (without chaetae), 117 chaetigers.

Anterior region tapered (Fig. 3A, inset). Prostomium subpentagonal, about as long as wide, anteriorly entire (Fig. 3B); anterior prostomial lobe clearly set off from posterior one; lateral antennae and palps smooth, non-articulated, antennae partially eroded; palps digitate, directed laterally. Posterior prostomial lobe about three times longer than anterior lobe; median antenna lost; eyes blackish, of similar size, anterior eyes directed anterolaterally, posterior eyes dorsal. Caruncle small, slightly shorter than first chaetiger. Peristomium reduced to two longitudinal cushions posteriorly tapered; mouth between chaetigers 2-3.

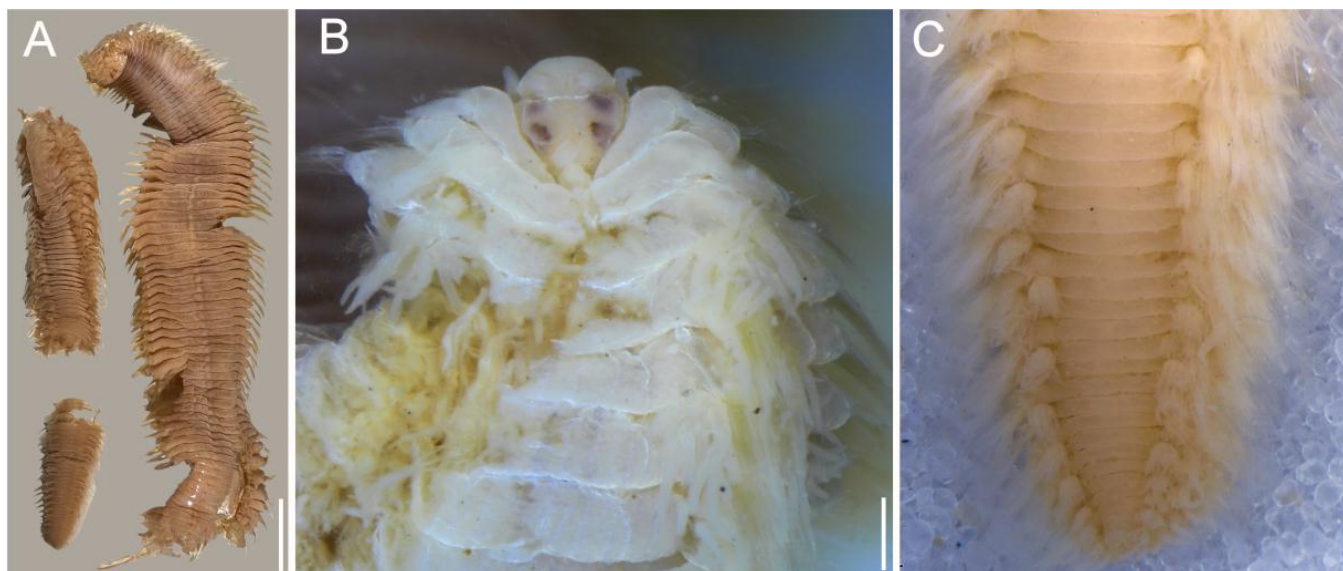


Fig. 2. *Cryptonome oculata* (TREADWELL, 1941) comb. nov., holotype (AMNH 3540). A. Anterior fragment, ventral view; median fragment, dorsal view; posterior fragment, ventral view. B. Anterior end, dorsal view. C. Posterior region, dorsal view. Scale bars: A, 9 mm; B, 0.9 mm; C, 0.8 mm (Photos: Lily Berniker, AMNH).

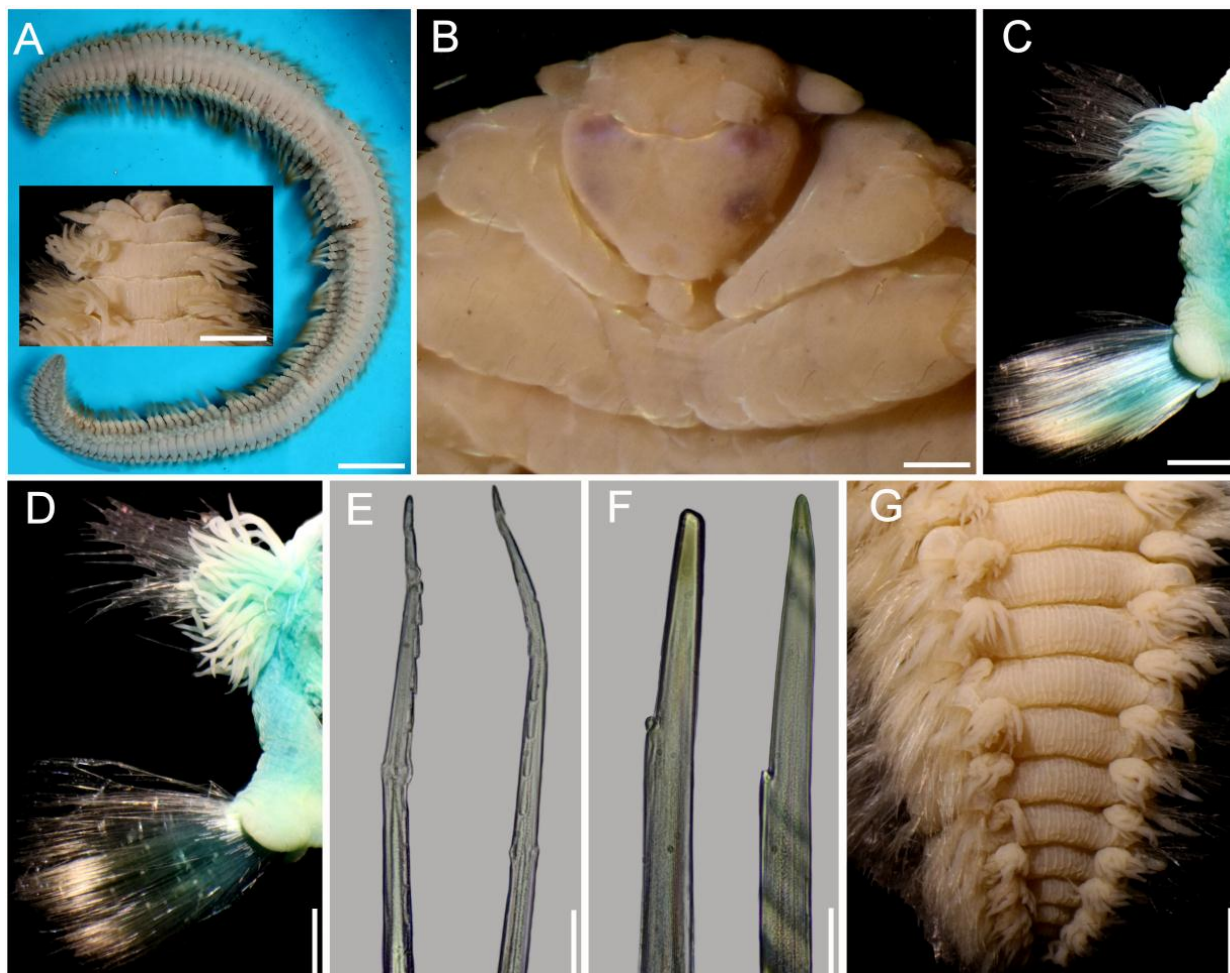


Fig. 3. *Cryptonome oculata* (TREADWELL, 1941) comb. nov., topotype (BMNH 1932.12.24.320). A. Dorsal view (inset: anterior region, dorsal view). B. Anterior end, dorsal view. C. Chaetiger 20, left parapodium, posterior view, after Methyl green. D. Chaetiger 50, left parapodium, posterior view, after Methyl green. E. Same, eroded harpoon-chaetae. F. Same, tips of spurred neurochaetae. G. Posterior region, dorsal view. Scale bars: A, 'D, 1.1 mm (inset, 1.4 mm); B, 0.2 mm; C, 1.3 mm; E, F, 70 μ m; G, 1 mm.

Parapodia all biramous (Fig. 3C), progressively larger medially, smaller along anterior and posterior regions. Notopodia and neuropodia barely projected lobes. Dorsal and ventral cirri smooth, not articulated; dorsal cirri tapered, as long as branchial filaments along anterior and median regions, longer in posterior segments, 2-3 times longer than ventral cirri.

Branchiae from chaetiger 3, continued along body, missing from last chaetiger. Branchial filaments tapered, shorter anteriorly (Fig. 3C), progressively larger along median segments (Fig. 3D), decreasing in size posteriorly, with about 15 filaments in chaetiger 3, 50 by chaetiger 20, 45 by chaetiger 50, progressively decreasing in number posteriorly.

Chaetae mostly long capillaries. Notochaetae include harpoon-chaetae with up to 10 lateral denticles (Fig. 3E). Neurochaetae include spurred chaetae with tiny spurs (Fig. 3F).

Posterior region tapered (Fig. 3G); pygidium with anus terminal, anal plate round. Oocytes about 80 μm in diameter.

Remarks. *Eurythoe oculata* TREADWELL, 1941 was described with a mature female collected in Balboa, Panama. How the holotype was collected was not indicated. HARTMAN (1956, 1959) included *E. oculata* in *Pseudeurythoe* FAUVEL, 1932, and this was modified by Fauchald (1977b) for the current combination into *Linopherus* DE QUATREFAGES, 1866.

However, because *Linopherus* species have branchiae along anterior and median regions, *L. oculata* does not match it. MONRO (1933) hesitated about its generic affinities, but because of its reduced caruncle, high number of branchial filaments in first branchiae, and branchiae present along most body segments, it belongs in *Cryptonome*, as emended elsewhere (TOVAR-HERNÁNDEZ *et al.* 2024), and it is herein newly combined as *C. oculata* (Treadwell, 1941) comb. nov.

The two topotype specimens of *C. oculata* were caught swimming in Balboa Dock, Panama. The London's museum specimen (BMNH 1932.12.24.320) was dull red alive, and apparently was collected during daylight hours. The holotype of *E. oculata* was also found in the same locality. They are all regarded as epitokes after Fauvel (1953: 16-17) detailed characterization of reproductive amphinomids. Cephalic appendages and parapodia are not modified, but chaetal bundles incorporate many long capillaries, especially in neuropodia, although capillaries also increase their size and abundance in notopodia, and sometimes can outnumber neurochaetae.

On the other hand, *C. oculata* resembles *C. americana* (HARTMAN, 1951) as redescribed elsewhere (TOVAR-HERNÁNDEZ *et al.* 2024: 543-545, Figs 6, 7). The main differences are in caruncle, branchial and parapodial features; in *C. oculata* the caruncle is small, cushion-shaped, as long as wide, first branchiae has about 15 filaments (165 mm long), dorsal cirri do not have a conical basement, ventral cirri are blunt fusiform, neuropodial postchaetal lobe is semicircular, and spurred neurochaetae have longer tine straight, whereas in *C. americana* the caruncle was longer than wide, first branchia has about 25 filaments (224 mm long), dorsal cirri have a conical basement, ventral cirri are tapered or fusiform, neuropodial postchaetal lobes are truncate or barely projected, and spurred neurochaetae have longer tine bent outwardly.

SIBAJA-CORDERO & ECHEVERRÍA-SÁENZ (2015) found mature and juvenile specimens in decaying wood in Costa Rica; this confirms the ecological resemblance to other *Cryptonome* species and extends its distribution along Central American Pacific coasts.

Distribution. Pacific shallow water areas, especially in decaying wood, from Costa Rica to Panama.

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Emma SHERLOCK (BMNH) and Jenna MOORE (ZMH) kindly allowed me to study a small part of their collections. Lily Bernaker (AMNH) provided some details and photographs of the holotype of *E. oculata*. This contribution was made during a research visit to the Muséum National d'Histoire Naturelle, Paris, thanks to the generous funding through the kind support of Dr. Laure CORBARI. Another part was made after a research visit to the Los Angeles County Museum of Natural History, thanks to the kind support by Leslie HARRIS and David OCKER. Madeleine THOMPSON, librarian in the Wildlife Conservation Society, provided some information about the collection of the RV Antares in Panama. This contribution was improved after the careful reading by two anonymous referees.

I met Mikel LIÑERO during a marine sciences meeting in Cumaná, Venezuela. He kindly read a draft of my early book on marine pollution and made interesting recommendations regarding the relevance of mineralogical properties of sediments. He also invited me for teaching a course on marine pollution ecology, and kindly allowed me to stay in his home. We had some interesting conversations about taxonomy of polychaetes. I deeply regret these interactions were so few, but with some colleagues we named some species after him for recognizing his studies on taxonomy of marine annelids.

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