

***Tubulanus riceae* new species (Nemertea: Anopla: Palaeonemertea: Tubulanidae), from South Florida, Belize and Panama**

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Abstract

Specimens of *Tubulanus riceae* new species (Nemertea: Palaeonemertea) were collected from a *Phragmatopoma* worm reef in the surf zone at Fort Pierce (Florida, USA) and from sublittoral rubble at Carrie Bow Cay (Belize) and Bocas del Toro (Panama). They have well-developed lateral sensory organs, form a cellophane-like tube and appear to have ocelli-like structures. The latter, if confirmed as ocelli, would be the first reported for a tubulanid. The new species is characterized by a unique color pattern, resembling that of *Tubulanus rhabdotus*, but it is distinctive in its milky-tan ground color with annular bands of brown pigment bounded by white margins and in having up to six to eight dorsal, longitudinal, but broken, reflective white stripes.

Keywords: Nemertea, Tubulanidae, taxonomy, littoral, worms, anatomy

Introduction

The genus *Tubulanus* Renier, 1804 has had a confusing nomenclatural history. Renier (1804), in an unpublished work, erected the name *Tubulanus polymorphus* for a new species of nemertean. In 1833, Johnston named a new species, *Carinella trilineata*, which subsequently was determined to be a junior synonym of a species named *Gordius annulatus* by Montagu (1804). The latter clearly was wrongly assigned to the genus *Gordius* Linné, 1758, and was referred to *Tubulanus* by Joubin (1890). In the meantime and subsequently, *Carinella* and *Tubulanus* were both used for additional species. Melville (1986), on behalf of the International Commission on Zoological Nomenclature (ICZN), proposed reinstating *Tubulanus* as the valid genus name, based on the work of Renier's 1804 *Prospetto della Classe dei Vermi*, but with the mistaken argument that *Carinella trilineata* is a synonym of *Tubulanus polymorphus* (rather than *T. annulatus*). Nevertheless, this does not compromise the subsequent opinion of the ICZN (1988) that *Tubulanus* Renier, 1804, is validly

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published and available, with *T. polymorphus* Renier, 1804, the type species. The ICZN also followed Melville (1986) in its opinion that the family name Tubulanidae proposed by Bürger (1897–1907) takes precedence over the date of Carinellidae, its senior subjective synonym, and should be cited as Tubulanidae Bürger 1905 (1874), 1905 being the year when the relevant part of Bürger's (1897–1907) treatise was published. However, the name already appears in Bürger (1904); hence, Tubulanidae Bürger 1904 (1874) is the correct citation (Hiroshi Kajihara, in litt.).

There are approximately 33 species of *Tubulanus* currently accepted as valid. Many of the descriptions of these taxa are brief and based on poorly preserved material, and some on single, immature specimens. Many lack either external or internal character information for interspecific comparison. In consequence of such missing character data, Sundberg and Hylbom (1994) excluded 16 of 30 *Tubulanus* taxa from their phylogenetic analysis of the subclass Palaeonemertea. Based on that analysis, they favored a paraphyletic view of the genus but made no relevant nomenclatural recommendations.

Members of the genus *Tubulanus* are benthic marine palaeonemerteans that typically live among algal holdfasts, within crevices, in sand and under rocks. Many, perhaps most, *Tubulanus* secrete cellophane- or parchment-like tubes (Coe 1943; Hylbom 1957; pers. obs.). *Tubulanus* species described from southern Florida include *T. floridanus* Coe, 1951, *T. pellucidus* (Coe 1895) and *T. rhabdotus* Corrêa, 1954. The present paper describes *Tubulanus riceae* new species, regularly found in Florida at Walton Rocks, St. Lucie County since 1983, where it occurs in crags and “fouling” communities of fossil coquina reef overgrown by “worm reef” produced by the polychaete *Phragmatopoma lapidosa* Kinberg, 1867. It also has been found in shallow-water sublittoral coral rubble in Belize and Panama.

Materials and methods

Examined specimens

Tubulanus riceae n. sp. Twenty-two specimens were collected in May, September and November 2002, and in March 2003, from an intertidal worm and coquina reef at Walton Rocks near Fort Pierce (Florida), as well as from coral rubble at 3–5 m depths at both Carrie Bow Cay (Belize) in June 2002 and Bocas del Toro (Panama) in August 2003. All specimens are deposited in the Division of Worms, National Museum of Natural History (USNM), Smithsonian Institution, Washington, DC, USA.

Type locality. The type locality is a *Phragmatopoma* worm reef at Walton Rocks Beach, St. Lucie County, on South Hutchinson Island, south of Fort Pierce, Florida, N 27.339012, W 80.233059.

Type specimens. Holotype (USNM 1083007) a mature male specimen, incomplete caudally, 30 mm long and 0.5 mm wide; one paratype (USNM 1083008); both collected 14 May 2002.

Additional specimens. From Walton Rocks Beach, FL. USNM 1083009: female, whole except for small tail region, 11 complete bands, 25 mm gliding length; USNM 1083010: female, whole, strongly contracted, 50 mm gliding length; 25 complete annuli; USNM 1083011: whole worm (three pieces: snout to about 12th annulus, midbody and posterior region), 70–80 mm gliding length, 26 complete annuli; USNM 1083012: two sets of slides:

three slides of anterior body (snout through 5th annulus), sagittal sections; 24 slides of remaining body (end of previous set through tail), cross sections; USNM 1083013: male; two sets of slides: eight slides of anterior body (snout through 5th annulus), cross sections; 19 slides of mid-body (starting behind 5th annulus through tail), cross sections. USNM 1083014: two sets of slides; two slides of anterior (snout through 4th annulus), sagittal sections; four slides of mid-body (from previous but not including tail), sagittal sections.

Methods

Fragments of coquina rubble well covered with mixed algal growth and fouling biota were collected from the surf-zone. These were brought into the laboratory and placed in aquarium tanks and covered with seawater and allowed to foul for 3–4 days. During this time, the nemerteans moved to the surface of the water, from where they were pipetted into Petri dishes. The living worms were annotated, illustrated and photographed (Nikon Coolpix 4500 digital camera) with aid of a dissecting microscope. Subsequently, specimens were prepared for histological study by relaxing them in isotonic MgCl₂ (prepared with bottled drinking water) mixed 1:1 with seawater, followed by fixation in Hollande Bouin's (cupri-picro-formal-acetic) fixative (Galigher and Kozloff 1971) or 10% seawater formalin. For internal morphological examination, specimens were embedded in Formula "R" Surgipath® paraffin, sectioned on a rotary microtome at 8 µm at room temperature and stained with a modified Mallory trichrome stain (Crandall et al. 1998).

Results

Systematics

Order Palaeonemertea
Family Tubulanidae Bürger 1904 (1874)
Genus *Tubulanus* Renier, 1804
***Tubulanus riceae*, n. sp.**

Figures 1–3

Etymology

The specific epithet is a noun in the genitive singular and honors Dr. Mary E. Rice, first and long-term director of the Smithsonian Marine Station at Fort Pierce, Florida, for her extraordinary dedication to furthering the study of marine organisms.

Systematic account

Genus *Tubulanus* Renier, 1804: Diagnosis of the genus *Tubulanus* from Gibson and Sundberg (1999) (italics excluded):

"Length at the onset of sexual maturation 2–10 cm; coloured, usually with a conspicuous pattern; head furrows present; body wall musculature consisting of outer and inner circular and middle longitudinal layers; muscle crosses present between outer and inner circular muscles in some species; diagonal muscles present; cerebral sensory organs consisting of ciliated pits or ciliated canals in the epidermis; side organs present in foregut region in some species; cephalic region with nerve layer; two nerves in rhynchodaegal epithelium; proboscis nerves present; brain and lateral

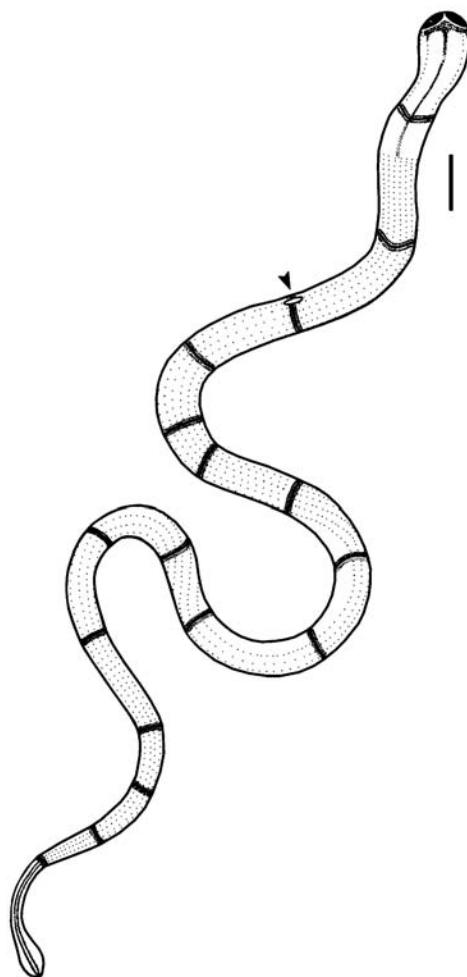


Figure 1. *Tubulanus riceae* n. sp. Dorsal view of entire specimen. Arrowhead denotes lateral sensory organ. Scale bar=1 mm.

nerves situated between epidermal basement membrane and outer circular muscles; epidermal basement membrane usually thick; nervous system with neither neurochords nor neurochord cells; buccal nerves present and paired; intestine with shallow lateral diverticula; rhynchocoel wall with circular muscles only; proboscis musculature with outer longitudinal and inner circular layers; circular muscle layer in rear end of rhynchocoelic or in nephridial regions strongly developed; gland-like anterior part of excretory system entering lateral blood vessels; blood vascular system without mid-dorsal vessel; eyes absent; sexes separate."

Description

External features. External morphology of nine specimens was examined in detail. Gliding specimens ranged from 10 to 55 mm long and 0.2 to 0.4 mm wide. The blunt, spatulate head can change shape – usually flattening when disturbed – and is slightly wider than the overall body-width, as is common for *Tubulanus* species (Figure 1). Individuals secrete a thin, cellophane-like, transparent tube. The ground color is milky-tan with a serial pattern

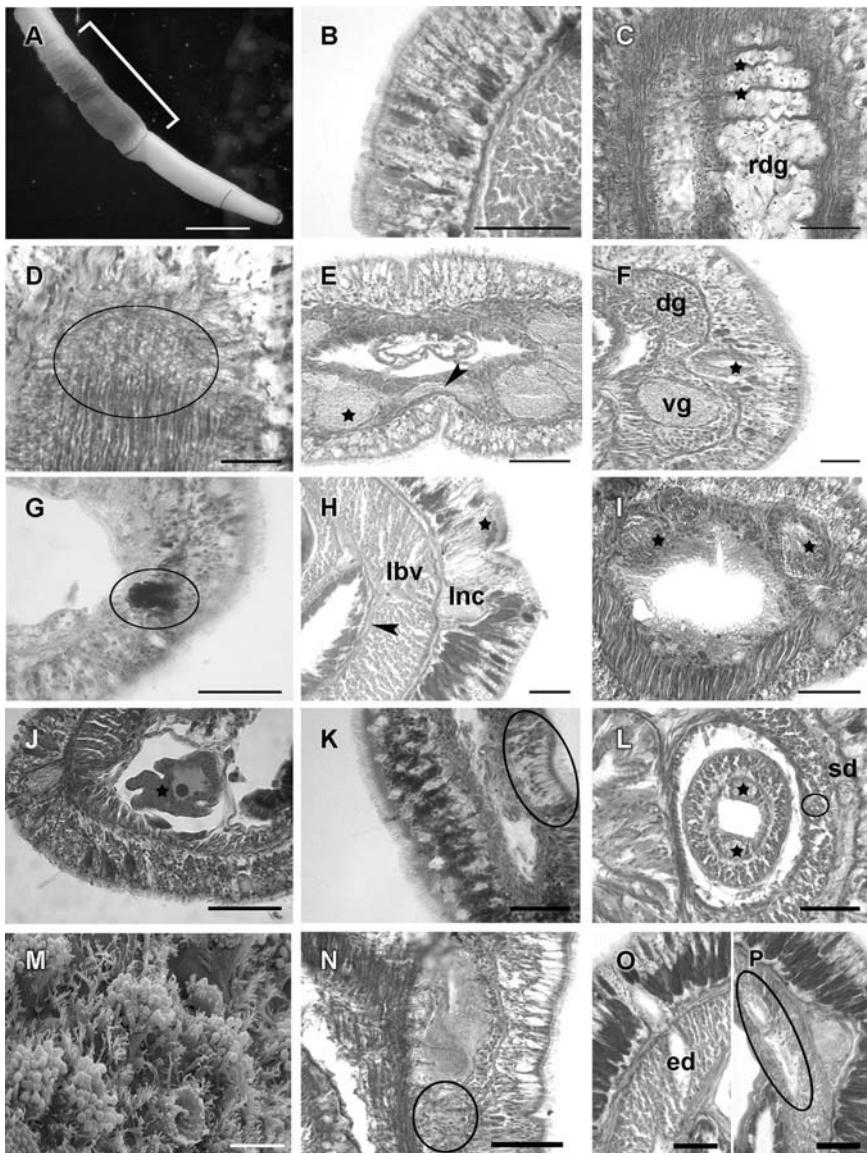


Figure 2. *Tubulanus riceae* n. sp. transverse sections, except A, C, D, N. Scale bar lengths in parentheses. (A) Fixed anterior third of specimen; bracket denotes post-fixation staining band (1 mm). (B) Body wall; epidermis with variety of glandular cells (15 µm). (C) Sagittal section showing transverse musculature (star) passing between the epidermal mucus cells and the rhynchodeal glandular cells (rdg) (6 µm). (D) Sagittal section showing oblique (diagonal) musculature (oval) (6 µm). (E) Ventral ganglia (star) and ventral commissure (arrowhead) (12 µm). (F) Middle region of the cerebral sensory organ (star) (12 µm). (G) Putative ocellar pigment (oval) (12 µm). (H) Middle of lateral sensory organ (star), lateral blood vessel (lbv), lateral nerve cord (lnc) and inner circular muscle passing under foregut (arrow) (12 µm). (I) Testes (star) with mature sperm (12 µm). (J) Ovary with single maturing oocyte (14 µm). (K) Anterior of cephalic region, apical organ (oval) and epidermal brown pigment (star). (L) Anterior-most region of proboscis, proboscis nerves (star), subdorsal nerve (sd) and rhynchodeal nerve (circled) (6 µm). (M) SEM of surface of everted proboscis (5 µm). (N) Frontal section through right cerebral ganglion showing neurocord cell (oval) (20 µm). (O) Excretory duct (ed) (50 µm). (P) Main nephridial tubule (upper part of oval) and cyrtocytes projecting into lateral blood vessel (lower part of oval) (50 µm).

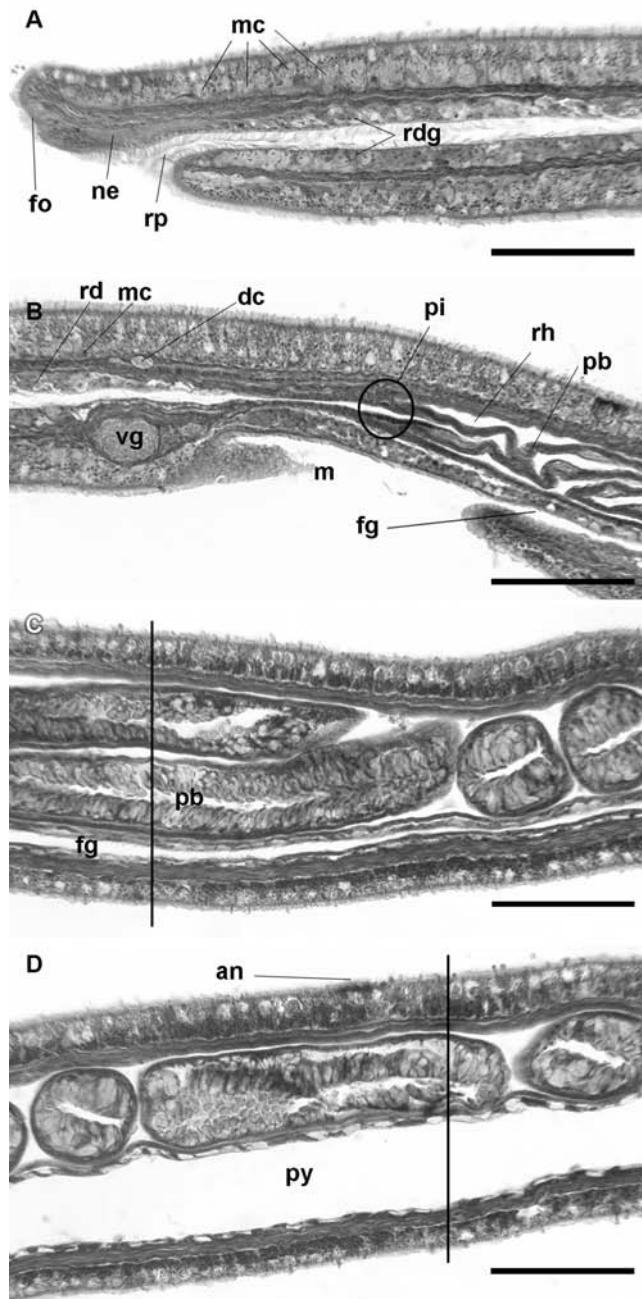


Figure 3. *Tubulanus riceae* n. sp. Approximately sagittal sections. Scale bar=100 µm. (A) Precerebral region of head. (B) Cerebral and post-cerebral region of head, contiguous from A. (C) Anterior of fixation band region (to right of vertical line). (D) Mid-point transition of fixation band, at third annulus (anterior is to left and posterior is to right of vertical line). Abbreviations: an, pigment annulus; dc, dorsal commissure; fg, foregut; fo, frontal organ; m, mouth opening; mc, basal mucoid cell bodies of pseudostratified epidermis; ne, nerve; pb, proboscis; pi, proboscis insertion; py, pylorus; rd, rhynchodeum; rdg, rhynchodeal glandular epithelium; rh, rhynchocoel; rp, rhynchopore; vg, ventral cerebral ganglion.

of dark brown annuli repeating at 2–3 mm increments, each annulus sandwiched by reflective white pigment bands. The cephalic and caudal tips are dark brown (Figure 1). Dorsally, two large, wide and softly defined stripes of white reflective granules (similar to granules found in *Tubulanus rhabdotus*) extend from the pigment at the cephalic tip to the first annulus. These continue posteriorly as six to eight irregularly formed longitudinal white stripes broken up by the annuli, with only a single mid-dorsal stripe on the tail region. The annuli are more or less disrupted ventrally and there are no stripes on the ventral surface. The color and patterns are very characteristic and very different from other described species in this genus. In life, two small horizontal rows of dark brownish-black, ocelli-like structures are visible along the front margin of the head. The mouth interrupts the first anterior annulus. Gonads extend posteriorly from about the fourth or fifth annulus. The pre-gonadal region is a fourth to a third of the body length and is the most muscular portion of the body. A faint cephalic furrow encircles the body in front at the first annulus and remains visible after fixation. Distinct lateral sensory organs interrupt the third annulus (Figure 1).

Worms of this species tend to contract the posterior region into a knot or spiral, a common behavior among *Tubulanus* species. Fragmenting, when it occurs, is at the pigmented annuli, and consists of the body wall cinching and then pinching off fragments. Sexually mature females have a thin-walled gonadal region packed with individual oocytes appearing dark pinkish-orange in color. Sexually mature males have thin-walled testes with packets of sperm cells. Sexually mature specimens occur from at least March to September.

Body wall. Specimens fixed in formalin rapidly exhibit a dark band (Figure 2A) around the body between the second and fourth annuli. This fixation band is most opaque anteriorly, with a relatively sharp anterior margin, and gradually fades toward the fourth annulus. Close examination shows a sharp transition, immediately in back of the third annulus, that divides the fixation band into posterior and anterior halves, although the color change is subtle. This can be seen in living and fixed specimens. The fixation band is a commonly reported feature of *Tubulanus* specimens and reflects a difference in cell type distribution (Figure 3A, D) visible as a more subtle change in opacity in living animals. This darkening is retained and readily evident in histological sections, especially sagittal sections.

Epidermal thickness varies substantially along the body length and is, of course, affected by differential contraction during fixation. It is thickest in the cephalic region (up to about 45 µm), where it is conspicuously pseudostratified, with a very well-developed basal stratum of cell bodies filled with blue-staining mucus (Figure 3A). These resemble the cephalic gland of other nemerteans. They open individually to the epidermal surface. This stratum thins posteriorly, giving way to a thickening apical stratum at approximately the second epidermal annulus (Figure 3B). The cephalic apical stratum consists primarily of ciliated cells and serous or bacillary cells containing red-staining, widely spaced, small granules. They are replaced abruptly at the second annulus by a dense population of large, deeply red and coarsely granular secretory goblets of serous cells that extend through most of the height of the epidermis. These latter characterize the anterior half of the fixation band, extending to the third annulus (Figure 3C). They are replaced in a sharp transition to the posterior half of the fixation band by distinctly more opaque brownish-red secretory goblets concentrated more basally in the epidermis (Figure 3D). Red-staining, more loosely granular, secretory material is the dominant glandular element of the remaining epidermis throughout the intestinal region.

The brown pigment of the annuli, cephalic and caudal tips occurs throughout the thickness of the apical stratum of epidermis, but tends to be concentrated near the apical surface (Figure 3D).

Dermis and connective tissue. A relatively thin dermal connective tissue, mostly less than 10% of epidermal thickness, reaches a maximum thickness of about 5 µm near the brain (Figures 2C, H, O and 3B). It is weakly basophilic throughout, except for a denser apical zone corresponding to the basement membrane. There are only traces of other extracellular matrix in the remainder of the body.

Apical organ. A shallow depression about 100 µm in diameter and immediately above the rhynchopore may represent an apical organ (Figures 2K and 3A). It is lined exclusively by cells with cilia somewhat longer than the general body ciliation.

Body musculature. The body-wall outer circular musculature (OCM) is evident only posterior to the brain, and is one or two fibers thick throughout the body, but may be up to three fibers in the foregut region (Figure 2B, H, O). This overlies the longitudinal musculature (LM), which is five to seven fibers thick through most of its length and may be about nine fibers thick in the foregut region (Figure 2B, H, O, P). There is a trace of inner circular (ICM) musculature only in the foregut region and it appears to be incomplete ventrally, with the fibers appearing to terminate in the LM as they bend underneath the foregut on either side (Figure 2H). An oblique (diagonal) musculature of very widely spaced fibers can be seen between OCM and LM in frontal sections of the foregut region (Figure 2D). The connections between the dorsal and rhynchocoelic nerves would make it difficult to detect a muscle cross between OCM and ICM, but we could not find convincing evidence for such a cross.

Dorsoventral, radial and transverse muscles are well-developed in the cephalic lobe anterior to the brain (Figure 2C). Frontal sections show three or four transverse muscle bundles of approximately four fibers each.

Rhynchodeum. A discrete ring of ciliated cells forms the rhynchopore (Figure 3A). The entire rhynchodeum is richly lined by mucoid cells, interspersed by inconspicuous cells bearing long cilia (Figure 3A, B). This epithelium is about 30 µm thick anteriorly and thins toward the brain, with the mucoid cells becoming progressively more vacuolated. The transition to proboscis is marked by more acidophilic cells and squamous epithelium and a loss of ciliation (Figure 3B). A thin connective tissue separates the epithelium from a thin circular musculature.

Rhynchocoel. The rhynchocoel appears to extend throughout the length of the body. The proboscis sheath comprises an epithelium and a longitudinal musculature, which is enclosed by the body-wall ICM (Figure 2H, L). The LM is one fiber thick anteriorly and gradually becomes thicker in its main part.

Proboscis. In life, most of the proboscis lies more or less coiled in the region of the foregut and anterior intestine. The proboscis insertion is above the mouth and consists of only a few muscle fibers crossing into the body-wall LM (Figure 3B). A proboscis nerve originates from each end of the ventral commissure and they are the most conspicuous elements of the proboscis insertion (Figure 2E). The epithelium of the proboscis differentiates it into four

regions. The anterior 10% of the proboscis has a pair of stout nerves (Figure 2L) and bears a relatively flat epithelium with predominantly acidophilic serous cells (Figure 3B). The epithelium of the succeeding approximate 25% of proboscis is differentiated as a pair of glandular ridges of tall columnar cells. The two proboscis nerves here are significantly expanded and the LM underlying the epithelium is thickened (Figure 3C, D). Distal to this, another approximately 40% of the proboscis is highly coiled and consists of tall, weakly basophilic columnar glandular cells. These glandular cells bear clusters of rhabdite-like projections visible by scanning electron microscope (SEM) (Figure 2M). The posterior 25% of the proboscis bears a flattened, thinner acidophilic epithelium. A bundle of LM retractor muscles extends from the end of the proboscis to the LM of the proboscis sheath.

Digestive system. The mouth is elongate and opens into a cavity lined by glandular cells, mostly blue-staining anteriorly and increasingly red-staining posteriorly (Figure 3B, C). This is followed quickly by a long, straight pyloric tube with primarily ciliated epithelium, extending to slightly past the approximate midpoint of the fixation band (Figure 3D). Diverticula are apparent only as the result of gonad development.

Circulatory system. The vascular system is a simple loop formed by a pair of lateral vessels anastomosing anteriorly as a large cephalic lacuna and posteriorly by a simple commissure, as in other *Tubulanus*. The lacuna extends far forward in the head (Figure 2E, G, I). Dorsoventral muscle fibers partition the cephalic lacuna incompletely into two lateral halves, whereas more posteriorly, the rhynchodeum completely divides it (Figure 2E). In the region of the proboscis insertion, about five widely spaced radial muscle bundles extend across the body from the OCM and incompletely split the paired lateral lacunae into upper and lower blood vessels dorsolateral to the mouth. The two ventral components anastomose via a ventral connective just behind the proboscis insertion. This may be a new feature for *Tubulanus*. The dorsal, main lateral vessels lie between LM and ICM and gradually become non-lacunar as they proceed posteriad alongside the foregut. The endothelium of the blood vessels is visible but no circular muscle fibers are evident.

Nervous system. The cerebral ganglia are between the basement membrane and the OCM (Figure 2E, F). A neurilemma is not evident. The dermal connective tissue is much thicker in the region of the brain and lamellae of connective tissue push into and through the brain. A pair of neurocord cells appears to be present in this species (Figure 2N). The dorsal commissure reaches 18 µm in thickness and gives rise to a mid-dorsal nerve. The ventral commissure is approximately 44 µm thick (Figure 2E). The pair of proboscis nerves arises from the posterior surface of the ventral commissure where it meets the medial face of the ventral ganglia. A pair of buccal nerves comes off the mid-ventral region of the ventral ganglia, just anterior to the mouth, and lie alongside the mouth and anterior foregut region. Neither transverse connective between the buccal nerves (as in *Tubulanus lutescens* Cantell, 2001) nor neural plexus could be recognized. A pair of nerves approximately 9 µm in diameter extends forward along the ventral region of the rhynchodeum. The ventral ganglia extend posteriorly as the lateral nerve cords.

Sensory organs. The cerebral sensory organs are located just posterior to the ventral ganglia (Figure 2F). They are simple ciliated pits, approximately 22 µm wide and 66 µm deep, consisting of a relatively straight canal portion with small reddish glandular cells

surrounding the interior end and a densely ciliated cerebral organ pore that is about 150 µm anterior to the first annulus. The epidermal region surrounding the cerebral sensory organs does not appear to differ from nearby epidermis. There do not appear to be specialized glandular cells associated with the inner portion of the cerebral sensory organs.

Ocelli-like structures are located deep in the epidermis at the antero-lateral margin of the head (Figure 2G). They are visible in life as an irregular horizontal grouping of two or three dark-brown pigment spots to either side of the rhynchopore. In section, some of these pigment spots are cup-shaped, with the opening directed outward (Figure 2G). Although no nerve fibers are identifiable as leading to these putative ocelli, their location on the body and at the base of the epidermis, deeper than the anterior epidermal pigment, suggests that they may be ocelli.

The lateral sensory organs are located in the third annulus, in the middle of the fixation band, as is typical of *Tubulanus* (Figure 1). They are positioned close to the lateral nerve cord but there is no conspicuous connection (Figure 2H). They are epidermal depressions consisting of thin, columnar ciliated cells with very small nuclei and with cilia longer than that of adjacent epidermis. Their association with the fixation band suggests that they may play a role in the formation of the cellophane-like tube commonly secreted by various *Tubulanus* species.

Excretory system. Nephridial canals are located mediad to the LM in the mid-intestinal region and adjacent to the lateral blood vessels (Figure 2P), and run forward about 800 µm from an excretory pore positioned dorsolaterally near each lateral sensory organ (Figure 2O). The terminal duct is about 17 µm in diameter. About 280 µm anterior from the pores, each main canal gives off a small canal that terminates in about five to seven cyrtocytes projecting into the lateral blood vessel, but presumably separated from the vascular fluid by the vascular endothelium (Figure 2O). This is repeated six or seven times (in one specimen) at intervals of 50–100 µm.

Reproductive system. The new species is gonochoric, with gonads arranged pseudometamERICALLY and linearly on each side of the intestine. Testes are paired, each pair forming an interdiverticular space alongside the intestine (Figure 2I). There is a single maturing oocyte per ovary (Figure 2J). Gonopores are located dorso-laterally along each side of the intestine.

Natural history

In Florida, worms of this species hide in crags of “worm reef” built by the polychaete *Phragmatopoma lapidosa* on intertidal coquina shell conglomerate, and especially among the holdfasts of the rhodophyte *Gelidiella acerosa* (Forsskål) growing on the worm reef. In Belize and Panama, the worms were found among epifauna and flora of sublittoral (3–5 m depth) coral rubble. These worms do not burrow, but build delicate “parchment” tubes, and do so readily in dishes. *Tubulanus* species exhibit a characteristic coiling or spiral contraction when disturbed, possibly facilitated by their body-wall oblique musculature.

Discussion

Tubulanus riceae n. sp. is a typical *Tubulanus*, as diagnosed by Gibson and Sundberg (1999). It strongly resembles those forms having conspicuous coloration and pattern. It resembles

many other *Tubulanus* species in having a head furrow, oblique body-wall muscle, cerebral sensory organs consisting of ciliated canals in the epidermis, lateral sensory organs, cephalic region with nerve layer, two nerves in rhynchodeal epithelium, a pair proboscis nerves, brain and lateral nerves situated between epidermal basement membrane and outer circular muscle, paired buccal nerves, and separate sexes. Gibson and Sundberg (1999) propose that body-wall muscle crosses and the presence of proboscis nerves as synapomorphies for the genus *Tubulanus*. However, our best interpretation is that *T. riceae* lacks muscle crosses between outer and inner circular muscle, which is not surprising given the delicate nature of the body-wall musculature in this species. The connections between the dorsal and rhynchocoelic nerves could easily be confused for muscle crosses, in this and other species.

There are currently 33 valid species in the genus *Tubulanus*, of which 25 are described as having body coloration or a pigment pattern. Most of these are described incompletely, lacking key data for external and/or internal characters. *Tubulanus* species are variable in presence/absence of several key characters, notably: lateral sensory organs, oblique (diagonal) body-wall muscle, nephridia, rhynchocoelic blood vessels, and a fixation band. Although absence of these features may be real, our work with *T. riceae* n. sp., *T. pellucidus*, and *Carinomella lactea* Coe, 1905, as well as other nemerteans, cautions us that “presence” is easy to overlook and “absence” can be very difficult to confirm, even in living or superbly fixed specimens. Lateral sensory organs can be exceedingly difficult to detect in pale or unpigmented forms. In addition, the presence of oblique body-wall muscle in *T. riceae* and many nemerteans can only be confirmed from suitable longitudinal sections. Neither rhynchocoelic vessels nor villi were observed, but this may be a function of small size. The diagnosis for *Tubulanus* species eyes absent, but a pair of small horizontal rows of ocelli-like pigment clumps flanks the rhynchopore along the anterior cephalic margin of several species, including *Tubulanus riceae* n. sp., *T. rhabdotus*, and *T. nothus* (Bürger 1892). These pigment clusters are separate from other integumentary pigment and, at least in *T. riceae* n. sp., are appropriately situated for ocelli. Neural innervation would be convincing, but it is not evident with our routine histological procedures and may require transmission electron microscopy.

Tubulanus riceae n. sp. differs from the three other species of *Tubulanus* known from the Atlantic coast of southern Florida: *T. floridanus* Coe, 1951; *T. pellucidus* (Coe 1895); and *T. rhabdotus* Corrêa, 1954. *Tubulanus floridanus* was minimally described by Coe (1951) from a single specimen but its base color was described as brown, thereby differing significantly from *T. riceae* n. sp. *Tubulanus pellucidus* lacks pigmentation and patterning (Coe 1895). *Tubulanus rhabdotus* is most similar to *T. riceae* n. sp., but differs in much larger body length, tan base color, and different color and form of patterning. Whereas there can be uncertainty about presence and uniqueness of various internal features of tubulanids, the color pattern of *T. riceae* n. sp. distinguishes it clearly from all other tubulanids.

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