A new species of Fabricinuda Fitzhugh, 1990 (Fabriciinae: Sabellidae: Polychaeta) from the Caribbean, with an emendation of the genus

Eduardo López*a and Carmen T. Rodríguezb

aLaboratorio de Biología Marina e Invertebrados, Departamento de Biología (Zoología), Universidad Autónoma de Madrid, Spain; bDepartamento de Biología, Facultad Experimental de Ciencia y Tecnología, Universidad de Carabobo, Venezuela

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During a survey of the infauna of seagrass meadows in Venezuela, several specimens of an unknown species of Fabriciinae were collected. The species could not be assigned to any genus of the subfamily, although it was most closely allied to Fabricinuda Fitzhugh, 1990. However, the absence of pseudospatulate inferior notochaetae on chaetiger 8 prevented assignment of the specimens to this genus since their presence on chaetigers 3 to 8 is one of its diagnostic apomorphies. In order to decide whether to establish a new genus for the species or to redefine Fabricinuda, a phylogenetic analysis of the subfamily was made on the basis of a pre-existing character matrix. Twenty-two anatomical characters were analysed for 59 species including the new one, and from the resulting consensus tree it was clear that the new species must be included within Fabricinuda and consequently an emendation of the genus is provided herein.

Keywords: Polychaeta; Sabellidae; Fabriciinae; Fabricinuda; Caribbean

Introduction

The Fabriciinae fan-worms are a group of small bodied sabellids of over 70 species (Rouse and Pleijel 2001). The subfamily was erected by Rioja (1923) to include all Sabellidae taxa with acicular thoracic hooks, although Fitzhugh’s (1989) cladistic analysis of sabellid genera resulted in an emendation of the subfamily diagnosis after which a number of genera were transferred to Sabellinae. The genera remaining within Fabriciinae are characterized by the lack of ventral lips and by the shape of the uncini, acicular and bearing a little hood in thoracic chaetigers and supported by an elongated manusbrum in abdominal ones (Fitzhugh 1989), as well as by the presence of branchial hearts, a unique character of the subfamily not cited by the author. Between the original description of the subfamily and the emendation by Fitzhugh, the most important publications devoted to the subfamily were those by Hartman (1951), Banse (1956, 1957), Gitay (1970) and Jones (1974) and, after the new definition of the subfamily, those by Fitzhugh (1990a, b, c, d, e, 1998, 2002) and Rouse (1994). Most of the fabriciins inhabit fine sediments at shallow depths, where they can achieve population densities of $1.5 \times 10^6$ m$^{-2}$ (Lewis 1968), although a few species can be found at shelf depths (Fitzhugh 2002). Contrary to most sabellids, they are not only filter-feeders, but capable of deposit feeding (Fauchald and Jumars 1979).

A research project aiming to characterize the benthos associated with shallow Thalassia testudinum Bank ex König, 1805 and sedimentary adjacent areas in
Parque Nacional Morrocoy (Caribbean, Venezuela) was conducted during the year 2000. While processing the samples, several specimens of an unidentified species of Fabriciinae were obtained. Although not fitting exactly the diagnosis of the genus, they seemed to be close to the genus *Fabricimunda* Fitzhugh, 1990, which comprised six species occurring mostly at intertidal depths (Fitzhugh 1990a, 2002). In several cladistic analyses of Fabriciinae genera (Fitzhugh 1993, 1998, 2002), *Fabricimunda* consistently remained monophyletic. Originally, the genus was defined on the basis of three synapomorphies: the anterior peristomial ring being longer than wide, reduction of the anterior margin of the anterior peristomial ring to a low ridge, and the presence of inferior thoracic pseudospatulate notochaetae on chaetigers 3–8; subsequently Fitzhugh (2002) reassessed the first character and rejected it as an autapomorphy of the genus. Due to the lack of pseudospatulate inferior notochaetae on chaetiger 8, the new species herein described did not fit exactly the diagnosis of *Fabricimunda* and a systematic decision was to be made about whether emending the diagnosis of the genus or erecting a new one. Thus a phylogenetic analysis became necessary to place the new taxon correctly within the systematics proposed by Fitzhugh (1998); not only relationships among *Fabricimunda* species were to be reassessed with the addition of the new one but those among these taxa and the remainder of the Fabriciinae genera.

**Methods**

The meadows and adjacent sedimentary areas were sampled quarterly, in February, May, August and November of 2000. At each site within the meadows, samples of epifauna (three replicates) were obtained by means of a suction pump applied over an area of 0.152 m², followed by infauna samples (two replicates at each of the previously sucked areas) using PVC cylinders of 0.005 m², as described in previous works (Bone and Rodriguez 2005; Chollet and Bone 2007). In adjacent areas only infauna samples were taken. The samples were collected, preserved in 10% formalin and transported to the laboratory, in which they were passed through sieves of 1 mm and 0.5 mm gauge mesh; the retained organisms were roughly separated into general taxonomic groups under a stereomicroscope. Subsequently, the specimens pertaining to the subfamily Fabriciinae were examined using a stereomicroscope and a compound microscope with differential contrast optics (Nomarski) provided with a drawing tube for the figures. After publication of the description, ethanol preserved type material will be deposited in the polychaete collection of Museo Nacional de Historia Natural de Madrid.

Aiming to place the new taxon accurately within the subfamily Fabriciinae, several analyses were performed from a modified version of the character matrix published by Fitzhugh (1998). Since the objective of the study was not the evolutionary study of the genus but a correct placement of the new species within a widely accepted system, the changes were reduced to a minimum. As in the original paper, unknown states of characters were coded as a "?" and several multistate characters were used; all of them were considered unordered, and always of equal weight. Fitzhugh (1998) performed the analyses rooting the trees with two alternative outgroups, differing in the state of character 11. In the first one (option I sensu Fitzhugh) the main fang of thoracic uncini was surmounted by rows of teeth that gradually decreased in size, and in the other (option II) the main fang was
surmounted by a large secondary tooth slightly offset from midline and followed by series of smaller teeth. Whereas the states combination of option I did not correspond to any real taxon but was a fictitious one, that of option II exactly fitted that of genus Amplicorina Claparède, 1864, the genus of Sabellinae considered to be the closest to Fabriciinae (Fitzhugh 1998). Thus, option II was selected as outgroup for the present analysis. The matrix was edited to include the data sets referred to Fabricinuda longilabrum Fitzhugh, 2002 and the new taxon herein described. Also the emendation to the state of character 8 of F. pseudopalpa Fitzhugh, 1990 proposed by the same author (Fitzhugh 2002) was considered; in this paper the anterior peristomial ring was re-described as being as wide as long instead of longer than wide. Thus character 8 (formerly with two states: longer than wide and wider than long), resulted in a three states, unordered character. Eventually, the matrix summarized information about 22 anatomical characters for 59 species, including the new one (Table 1).

Although the original analysis was implemented with Hennig86 (Farris 1988), in the present parsimony analysis it was performed using the more powerful PAUP software, version 4.0b10 (Swofford 2001), implementing a heuristic search. In order to replicate as exactly as possible the original analysis (Fitzhugh 1998), just 1100 equally parsimonious, shortest trees were calculated to obtain a strict consensus.

Results

The analysis yielded a strict consensus of the 1100 equally parsimonious trees calculated, which is shown in Figure 1. It had a length of 68 steps, a consistency index of 0.60, and a retention index of 0.89. In this plot, Augeneriella dubia Hartmann-Schröder, 1986 and Genus A sensu Fitzhugh (1989) make a monophyletic group that is the earliest branching, at the same level as the outgroup. The remainder of the studied Fabriciinae species form a very large polytomy. Apart from the monotypic genera Pseudofabricia Fitzhugh, 1992, Pseudaugeineriella Fitzhugh, 1998, Fabricia de Blainville, 1828, Parafabricia Fitzhugh, 1992 and Britacia Fitzhugh, 1998, several monophyletic genera are apparent in the next node. Pseudofabriciola Fitzhugh, 1990, Manayunkia Leidy, 1868 (including Monroika africana Hartman, 1951) and Fabricinuda Fitzhugh, 1990 (this one including the new species herein described) maintain their monophyletic status. As happened with Fitzhugh’s analysis, the internal relationships of the first two genera cannot be established from the consensus. However, in the present analysis, relationships within Fabricinuda are also unsolved, since in the consensus all the species within this genus form a polytomy. On the other hand, Fabriciola Friedrich, 1939, whose monophyly was challenged in Fitzhugh’s analysis, appears as a monophyletic clade here. Neither in Fitzhugh’s analysis nor in the present one do Novafabricia Fitzhugh, 1990 and Augeneriella Banse, 1957 appear as monophyletic clades.

Fabricinuda Fitzhugh, 1990 emended

Diagnosis

Small bodied fabricins, with eight thoracic and three abdominal chaetigers. Branchial crown composed of three pairs of radioles, dorsal lips well developed or
Table 1. Character state distributions among outgroup and Fabriciinae species used to determine relationships of the new species (modified from Fitzhugh 1998). See Appendix for details on character description and codification.

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Figure 1. Consensus of the 1100 equally parsimonious obtained trees (68 steps, C.I.=0.60; R.I.=0.89).
absent, ventral filamentous appendages unbranched and vascularized or absent; 
branchial crown shifted dorsally to some extent; mouth in typical sabellid position 
between branchial lobes or shifted dorsally to attachment position of branchial 
lobes. Peristomium divided in two rings; anterior one as long as wide or longer, 
longer than posterior one; annulation between the two rings indistinct dorsally; 
rounded lobe present or absent on either side of dorsal midline; anterior peristomial 
ing collar as a low ridge all around; peristomial eyes black, rounded to crescentic. 
Inferior thoracic notochaetae short elongate, narrowly hooded on chaetiger 2; 
pseudospatulate from chaetiger 3 to chaetiger 7 or 8; if not pseudospatulate short 
elongate, narrowly hooded on chaetiger 8. Thoracic uncini acicular; large secondary 
up tooth slightly offset from midline; small hood present. Abdominal neurochaetae as 
modified, elongate, narrowly hooded. Manubrium of abdominal uncini as long as 
dentate region; dentate region with several teeth per row. Pygidial eyes black.

Remarks

When it was first described, Fitzhugh (1990a) based the monophyly of the genus in 
three apomorphies, namely the reduction of the anterior peristomial ring collar to a 
low ridge, the anterior peristomial ring being at least as wide as long, and the 
ocurrence of pseudospatulate inferior notochaetae on chaetigers 3–8. In subsequent 
papers (Fitzhugh 1998, 2002), the second of these characters suffered a number of re-
definitions in such a way that it was discarded as a valid autapomorphy of the genus, 
although it did not change the validity of the genus, which in every analysis 
performed was found to be monophyletic. In these analyses, the phylogenetic 
relationships among the species were also assessed and Fabricinuda pseudopalpa 
Fitzhugh, 1990, with dorsal lips but without ventral filamentous appendages and 
with anterior peristomial ring as long as wide, appeared to be the most 
plesiomorphic species. From the present analysis, it seems clear that the new species 
herein described must be referred to genus Fabricinuda. Although it does not exactly 
fit the original generic diagnosis, the erection of a new genus is not justified; on the 
contrary, the generic diagnosis should be modified to accommodate the new species. 
Thus the sole valid autapomorphy for the genus is the reduction of the anterior 
peristomial ring collar to a low ridge.

Fabricinuda rosaelenae n. sp.

(Figures 2, 3)

Material examined

Type series. MNCN 16.01/11031, Las Luisas (10°51'15"N–68°16'45"W), Thalassia 
testudinum meadow, February 2000, holotype. MNCN 16.01/11032, Tumba Cuatro 
(10°50'09"N–68°15'07"W), Thalassia testudinum meadow, May 2000, two paratypes. 
MNCN 16.01/11033, Tumba Cuatro (10°50'09"N–68°15'07"W), Thalassia 
testudinum meadow, August 2000, paratype. MNCN 16.01/11034, Boca Seca 
(10°49'59"N–68°14'21"W), Thalassia testudinum meadow, February 2000, 
paratype. MNCN 16.01/11035, Tumba Cuatro (10°50'09"N–68°15'07"W), 
Thalassia testudinum meadow, February 2000, paratype. MNCN 16.01/11036, 
Boca Seca (10°49'59"N–68°14'21"W), dredging beside Thalassia testudinum
Figure 2. *Fabricimuda rosaelena* n. sp., holotype. (A) Entire body, dorso-lateral view; (B) anterior end, ventral view; (C) same, lateral view; (D) same, dorsal view; (E) detail of branchial crown base showing a ventral filamentous appendage and a dorsal lip; (F) abdomen and pygidium, dorsal view. Abbreviations: apr=anterior peristomial ring, bf=basal flange, bh=branchial heart, dl=dorsal lip, ppr=posterior peristomial ring, pre=peristomial eye, pye=pygidial eye, vfa=ventral filamentous appendage. Scale bars. (A)=0.29 mm, (B–F)=0.15 mm.
Description

Holotype largest specimen; length 2.24 mm plus 0.54 mm for branchial crown; width at fourth chaetiger level 0.2 mm; complete; holotype and one paratype are mature males, with spermatids between chaetigers 6 and 8. All specimens with eight thoracic and three abdominal chaetigers (Figure 2A). Branchial crown attachment to peristomium slightly shifted dorsally (Figure 2C). Three pairs of radioles; distal ends filamentous, same width as pinnules. Radioles each with 3–4 pairs of pinnules, all terminating at same height as radioles. Dorsal lips present, short and rounded (Figure 2E); ventral lips absent. One pair of unbranched, vascularized ventral filamentous appendages (Figures 2B, 2E), distinctly wider than pinnules; width of each uniform except for slightly wider distal third (uniform throughout in paratype 3); appreciable dark brown pigmentation and minute transverse wrinkles all along; two thirds as long as radioles. Dorsal margins of branchial lobes not fused to one another (Figure 2D); bases dorsally bearing minute, pigmented basal flanges. Branchial hearts present (Figures 2B, 2C, 2D). Body cylindrical and not too slender (Figure 2A). Peristomial eyes black, crescentic (Figures 2A, 2C, 2D); pygidial eyes (Figure 2F) black and ill-defined, situated in posterior fourth of pygidium. Anterior margin of anterior peristomial ring as a low ridge of even height ventrally, slightly oblique laterally (Figures 2B, 2C, 2D); rounded lobe to either side of dorsal midline, slightly overlapping the higher middorsal conical lobe (Figure 2D); anterior margin pigmented in black all around, dorsal lobes darker. Anterior peristomial ring ventrally glandular; longer than wide, 3–4 times longer than posterior ring; annulation distinct only ventrally (Figure 2B). Chaetigers 1–3 shortest, wider than long; chaetigers 4–8 longer than wide, increasing length posteriorly; chaetiger 9 slightly shorter than 8; remaining abdominal chaetigers successively shorter, chaetiger 11 wider than long (Figures 2A, 2F). Pygidium conical, longer than chaetiger 11 (Figure 2F). Collar chaetae short elongate narrowly hooded (Figure 3A), 4–6 per fascicle. Superior thoracic notochaetae elongate, narrowly hooded, stouter than collar chaetae (Figures 3B, 3F, 3H), 3–6 per fascicle. Inferior thoracic notochaetae of chaetiger 2 similar to collar chaetae (Figure 3C), 2–3 per fascicle; chaetigers 3–7 bearing 1–3 pseudospatulate chaetae (Figure 3G) per fascicle; chaetiger 8 with short, elongate narrowly hooded inferior notochaetae (Figure 3I), similar to those of chaetiger 2, 1–3 per fascicle. Thoracic uncini acicular (Figure 3D); 4–8 per fascicle in straight single rows; large secondary tooth oblique to main fang (Figure 3E); apical teeth slender and slightly decreasing in size towards tip of uncinus; small hood present. Abdominal neuropodia with very elongate, narrowly hooded chaetae (Figure 2F); 1–4 per fascicle. Abdominal uncini with about 10 rows of teeth in profile, 3–4 teeth per row; manubrium about the same length as dentate region, slightly expanded proximally; number of uncini per fascicle slightly decreasing posteriorly, 18–25 on chaetiger 9, 13–20 on chaetiger 10, and 13–16 on chaetiger 11.
Figure 3. Fabricinuda rosaelenae n. sp., holotype. (A) Collar chaeta (notochaeta from chaetiger 1); (B) superior narrowly hooded notochaetae, chaetiger 2; (C) inferior narrowly hooded chaetae, chaetiger 2; (D) thoracic uncinus (neurochaeta), chaetiger 4; (E) head of the same, apical view; (F) superior narrowly hooded notochaetae, chaetiger 4; (G) pseudospatulate notochaetae (inferior), chaetiger 4; (H) superior narrowly hooded notochaetae, chaetiger 8; (I) inferior narrowly hooded chaetae, chaetiger 8. Abbreviations: hd=hood; mf=main fang; st=secondary tooth. Scale bar. (A–J)=20μm.
Etymology
The new species is named after Rosa Elena Fernández, the first author's wife, as a little acknowledgement for her unconditional support and understanding.

Remarks
Although superficially resembling Fabricinuda limnicola (Hartman, 1951) (Hartman 1951; Fitzhugh 1990a), the new species herein described is unique within the genus in having both dorsal lips and unbranched, vascularized ventral filamentous appendages. Two species, Fabricinuda pseudopalpia Fitzhugh, 1990 and F. longilabrum Fitzhugh, 2002, possess well-developed dorsal lips, but lack ventral filamentous appendages (Fitzhugh 1990a, 2002). In turn, the other four described species of the genus, F. limnicola, F. bikini (Hartman, 1951), F. trilobata (Fitzhugh, 1983) and F. pseudocollaris Fitzhugh, 1990, have unbranched, vascularized ventral filamentous appendages in their branchial crowns, but lack dorsal lips of any kind (Fitzhugh 1990a). Another unique feature of the new species is the absence of pseudospatulate inferior notochaetae on chaetiger 8 (the remainder of the Fabricinuda species bear this kind of chaeta on chaetigers 3–8). This feature led to a slight re-definition of the genus (see above).

Outside of the genus Fabricinuda, the only similar species is Augeneriella dubia Hartmann-Schröder, 1986, from southern Australia (Hartmann-Schröder 1986). This species is unique within Augeneriella in having unbranched, vascularized ventral filamentous appendages, similar to those of some species of Fabricinuda. Another resemblance with F. rosaeleanae is the peristomial anterior ring with two dorso-lateral and one mid-dorsal lobes that are very well defined. However, in the former species the anterior end of the peristomial anterior ring has a clear ventral projection forming a rounded, wide lobe as in all other species referred to Augeneriella, and the body wall is covered with calcareous spicules, a unique trait in Fabriciinae.

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References


Appendix. Characters and states used in the analysis of relationships within Fabriciinae species (modified from Fitzhugh 1998, 2002)

1. Ventral filamentous appendages: (0) absent; (1) nonvascularized, unbranched; (2) vascularized, unbranched; (3) vascularized, branched.
2. Dorsal lips: (0) well-developed, triangular lobes, with dorsal margins well separated from proximalmost pinnules of dorsal radioles; (1) dorsal margins fused with proximalmost radioles to some extent; (2) absent.
3. Position of branchial crown: (0) extends over entire anterior end; (1) shifted dorsally to some extent.
4. Branchial lobe shape: (0) wide and short; (1) narrow and elongate and/or with peduncle like process.
5. Anterior peristomial ring collar: (0) low ridge dorsally and laterally, ventrally as narrow lobe; (1) membranous, of varying height; (2) low ridge dorsally and laterally, ventrally as broad lobe; (3) low ridge all around.
6. Middorsal collar surface: (0) separate; (1) entire and distinctly grooved; (2) entire and smooth.
7. Middorsal collar margin: (0) separate; (1) entire; (2) notched or incised.
8. Anterior peristomial ring dimensions: (0) wider than long; (1) longer than wide; (2) as wide as long.
9. Peristomial eyes: (0) red in live specimens, disappear in preservation; (1) red in live specimens, persist in preservation; (2) black, well developed, in live and preserved specimens; (3) black, poorly developed, in live and preserved specimens.
10. Distribution of inferior thoracic pseudospatulate notochaetae among chaetigers 2–8: (0) absent; (1) 2–5; (2) 3–5; (3) 3–6; (4) 3–7; (5) 3–8; (6) broadly hooded, flagellate in 2–8 or 3–7.
11. Dentition above main fang of thoracic uncini: (0) series of uniformly small teeth; (1) teeth gradually decrease in size away from main fang; (2) large tooth slightly offset from midline, followed by series of smaller teeth.
12. Dentition of abdominal uncini: (0) more than one row of teeth; (1) a single row of teeth.
13. Manubrium of abdominal uncini: (0) Amphicorina-like; (1) about two times longer than dentate region; (2) about 1.5 times longer than dentate region; (3) same length as dentate region.
14. Pygidial eyes: (0) absent both in live and preserved specimens; (1) black, in live and preserved specimens; (2) red in live specimens, persist in preservation; (3) red in live specimens, disappear in preservation.
15. Radioles: (0) three or more pairs; (1) two pairs.
16. Body wall spicules: (0) absent; (1) present.
17. Branchial hearts: (0) absent; (1) present.
18. Displaced pinnules: (0) absent; (1) present.
19. Pinnule arrangement: (0) typical, pectinate arrangement; (1) 2–4 pinnules originating directly from branchial lobe.
20. Abdominal neuropodial pin-headed chaetae: (0) absent; (1) present.
21. Branchial skeleton: (0) present; (1) absent.
22. Number of pairs of radioles: (0) three or more; (1) two.