



Scientific Note

A retrospective of *Helicosiphon biscoeensis* Gravier, 1907 (Polychaeta: Serpulidae): morphological and ecological characteristics

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Abstract. This note gathers the main information and illustrations published concerning the Antarctic/Subantarctic polychaete *Helicosiphon biscoeensis* (Spirorbinae). It provides a short historical overview about the knowledge of this species, including information on its morphology and ecology, and contributes new digital images.

Key words: ecology, life story, Southern Ocean, Spirorbinae, taxonomy

Resumo. Restrospectiva do *Helicosiphon biscoeensis* Gravier, 1907 (Polychaeta: Serpulidae): características morfológicas e ecológicas. Esta nota reúne a maior parte das informações e ilustrações publicadas sobre o poliqueta antártico/subantártico *Helicosiphon biscoeensis* (Spirorbinae), faz uma breve retrospectiva da evolução de seu conhecimento, incluindo considerações sobre sua morfologia e ecologia, e contribui com imagens digitais inéditas.

Palavras chave: ecologia, história de vida, Oceano Austral, Spirorbinae, taxonomia

Taxonomic classification (Rzhavsky *et al.* 2013):

Annelida (Phylum) > Polychaeta (Class) > Canalipalpata (Subclass) > Sabellida (Order) > Serpulidae (Family) > Spirorbinae (Subfamily) > Romanchellini (Tribe) > *Helicosiphon* (Genus) > *Helicosiphon biscoeensis* Gravier, 1907 (Species)

Although serpulids are less common at high latitudes (ten Hove & Kupriyanova 2009), *Helicosiphon biscoeensis* Gravier 1907 only has occurred in Antarctic and Subantarctic waters. Some serpulids, sessile and often fixed to hard substrates, were found in soft bottom samples of several Antarctic expeditions (Gravier 1907, Monro 1930, Knight-Jones *et al.* 1973, Knight-Jones & Knight-Jones 1994, San Martin *et al.* 2000, Pabis & Sicinski 2010). The occurrence of these serpulids can be explained by the presence of brachiopods, bryozoans (Knight-Jones & Knight-Jones 1994) and dropstones that were used as substrates to grow and found on soft bottoms. All species belonging to the Romanchellini tribe draw attention because they

have an egg string externally attached to their bodies, usually as a stalk or epithelial funnel (Knight-Jones & Knight-Jones 1994). Besides the peculiarity of the egg string, *H. biscoeensis* has an initially flat coiled tube that projects from the substrate forming an almost straight ascending spiral coiling. It was originally described by Gravier (1907) as a serpulid with a free tube, coiled and of smooth texture (Figs. 1a-1f).

Images of tubes attached to a rock were first given by Gravier (1911) who identified them as tubes of *Serpula vermicularis* (Fig. 1g). Later Hartman (1966) believed that those tubes probably belonged to *H. biscoeensis*; comparing those images with our tubes we agree with her interpretation. Monro (1930) found a helically twisted tube of *H. biscoeensis* fixed basally to a rock fragment (Fig. 1h) and, thus, different from the smooth tubes recorded until that moment. Knight-Jones *et al.* (1973) described *H. biscoeensis* with more details concerning its morphology and ecology (Figs. 1i-1r). The tube presented striae helically twisted basally

and smooth texture at the end portion (Fig. 1q). Gravier (1907) verified the existence of an embryo attachment stalk (“sac incubateur”), but in the analyzed specimen it was empty. The same author believed that this structure would probably be linked to reproduction. Knight-Jones *et al.* (1973) first published a figure of embryo attachment stalk full of eggs (Fig. 1r). More recently, Knight-Jones &

Knight-Jones (1994) reports *H. biscoeensis* specimens trawled in the Norway Bight (Figs. 1s-1v) and Pillai (2009) compared illustrations between *H. biscoeensis* (Figs. 1w-1z) and *Knightjonesia platyspira*. This note aims to clarify the life history and taxonomy of *Helicosiphon biscoeensis* in its natural environment and contributes new digital images.

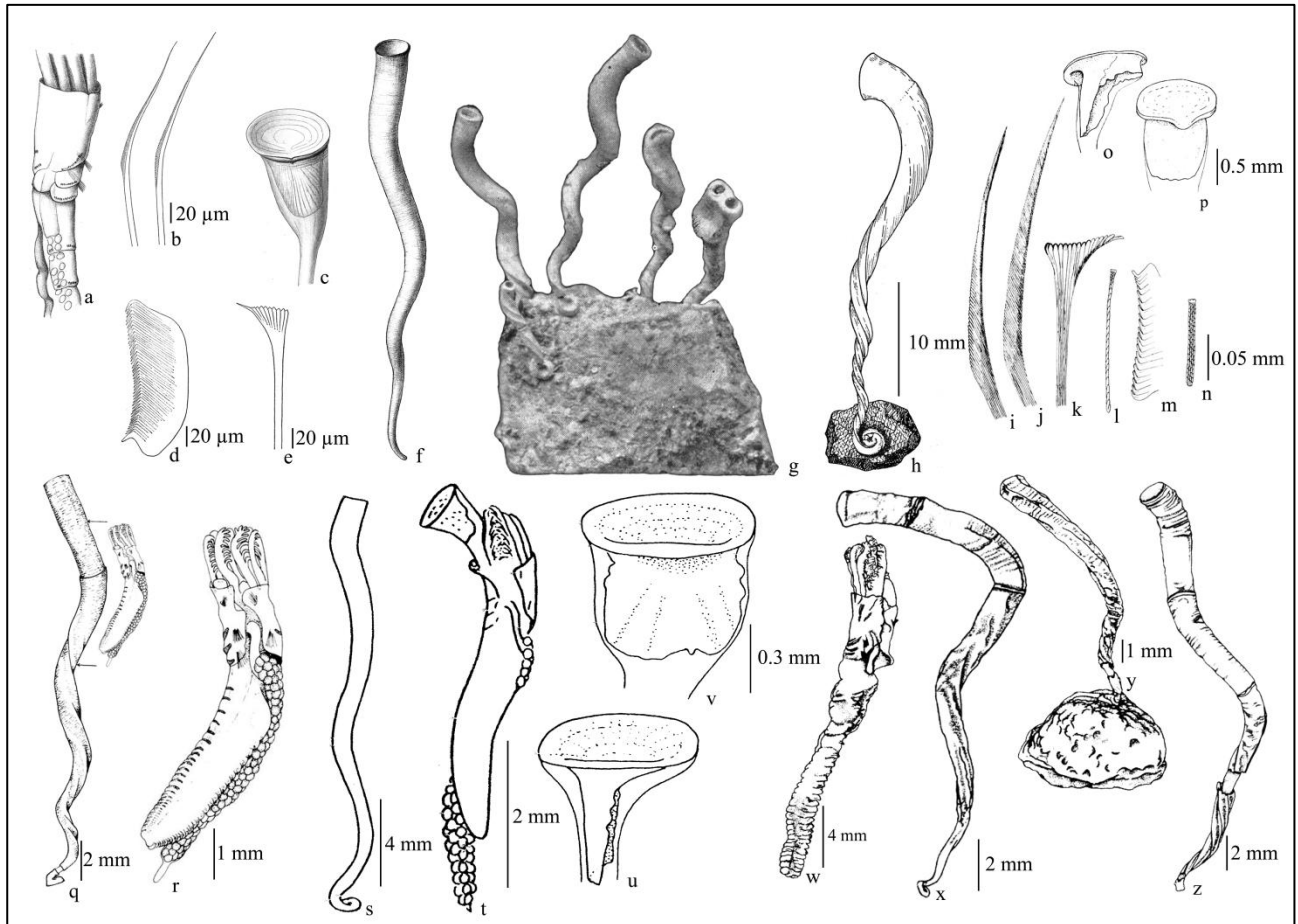


Figure 1. *Helicosiphon biscoeensis* figures published since its original description. Gravier (1907): ventral view of the body (a); chaetae of the first segments (b); operculum (c); thoracic uncinial plaque in lateral view (d); distal end of abdominal chaeta (e); calcareous tube, not attached (f). Gravier (1911): tubes attached to stone (g). Monro (1930): tube attached to stone (h). Knight-Jones *et al.* (1973): collar chaeta (i); chaeta of the second and third fascicles (j); abdominal chaeta (k); front view of thoracic uncinus (l); lateral view of thoracic uncinus (m); front view of abdominal uncinus (n); lateral view of the operculum (o); front view of the operculum (p), tube with the region occupied by the animal (q); dorsal view of animal, showing the embryo attachment stalk and the position of the opercular stalk (r). Knight-Jones & Knight-Jones (1994): tube (s); whole animal (t); lateral view of operculum (u); front view of operculum (v). Pillai (2009): whole animal (w); tubes (x-z).

Eight specimens of *H. biscoeensis* were collected during two Brazilian Antarctic Expeditions (austral summer of 2008/2009 and 2011/2012) between 30 and 65 m depth in the nearshore zone of Martel Inlet (Admiralty Bay, King George Island, South Shetlands, Antarctic, Table I). The samples were examined at the Antarctic Benthic Laboratory of the Oceanographic Institute of the University of

São Paulo (IOUSP). Due to the difficulty of removing the animals from their tubes, four of them were left intact and the others were fragmented. Two specimens were dissected for a detailed analysis of their morphology and the other two whole specimens (ANT4700 & ANT4701) were deposited in the Biological Collection “Prof. Edmundo F. Nonato” (IOUSP).

Table I. Records of *Helicosiphon biscoeensis* in Antarctic and Subantarctic waters (NA= data not available).

Sampling site	Coordinates	Depth (m)	Sampling date	Sampling gear	Specimens	Density (ind/m ²)	Substrate	Reference
Biscoe Bay, Anvers Island	NA	110	Feb/1904	Dredge	NA	NA	NA	Gravier (1907)
Bransfield Strait, South Shetlands	63°17,33'S 59°48,25'W	200	Mar/1927	Dredge	NA	NA	NA	Monro (1930)
May Bay, South Georgia	NA	148	May/1902	-	NA	NA	Mud	Hartman (1953)
Signy Island, South Orkneys	NA	60	Mar/1969	Agassiz trawl	3	NA	Muddy sand	Knight-Jones <i>et al.</i> (1973)
Signy Island, South Orkneys	60°47'S 045°56'W	158	1969	Dredge	3	NA	NA	Knight-Jones & Knight-Jones (1994)
Terra Nova Bay, Ross Sea	74°42'S 164°46'E	2	Summer 1989-90	SCUBA diving	NA	6	Hard bottom	Gambi <i>et al.</i> (1994)
Terra Nova Bay, Ross Sea	74°42'S 164°46'E	12	Summer 1989-90	SCUBA diving	NA	50	Hard bottom	Gambi <i>et al.</i> (1994)
Terra Nova Bay, Ross Sea	74°42'S 164°46'E	16	Summer 1989-90	SCUBA diving	NA	12	Hard bottom	Gambi <i>et al.</i> (1994)
Terra Nova Bay, Ross Sea	74°42'S 164°46'E	16	Summer 1989-90	SCUBA diving	NA	224	Hard bottom	Gambi <i>et al.</i> (1994)
Terra Nova Bay, Ross Sea	74°42'S 164°46'E	16	Summer 1994-95	SCUBA diving	1	NA	Hard bottom	Gambi <i>et al.</i> (2000)
Livingston Island, South Shetlands	62°37'S 60°23'W	68	Jan-Feb 1995	van Veen grab	NA	6,7	Soft bottom	San Martin <i>et al.</i> (2000)
Livingston Island, South Shetlands	62°39'S 60°39'W	170	Jan-Feb 1995	van Veen grab	NA	3,3	Soft bottom	San Martin <i>et al.</i> (2000)
Admiralty Bay, South Shetlands	NA	NA	1988	Dredge	NA	NA	NA	Pabis & Sicinski (2010)
Admiralty Bay, South Shetlands	62°05,312'S 58°23,196' W	54	Dec/2008	Agassiz trawl	1	NA	Dropstones	This study
Admiralty Bay, South Shetlands	62°07,276'S 58°24,056'W	64	Jan/2009	Agassiz trawl	4	NA	Dropstones	This study
Admiralty Bay, South Shetlands	62°05,77'S 58°20,60'W	30	Jan/2012	Box-corer	3	NA	Dropstones	This study

The tube of *H. biscoeensis* starts as a small flat spiral attached to the substrate and grows vertically loosely coiled with an increasing diameter. The tubes attached to dropstones were removed and fixed in 70% alcohol. Almost all the tubes had a fragile region between the spiral and the erected portions. The texture was smooth, very similar to that of the specimens described by Gravier (1907). Many empty spaces, not colonized by other animals, were observed between the tubes on the substrate (Fig. 2a). The tube was internally formed by a protein layer and covered by calcium carbonate (Fig. 2b).

The body was slightly twisted and only one specimen had an egg sac attached by a stalk to the thoracic region that extending to the end of the abdomen (Fig. 2c). Detailed analysis and dissection of the branchial crown were not possible due to its reduced length. The opercula were easily dissected and their calcareous nature was confirmed by polarizing microscopy (Cowdry 1952), confirming the hypothesis of Gravier (1907) regarding the nature of this rigid structure (Fig. 2d). The tori (Fig. 2e), structures composed by a series of uncini, were present in the thoracic (three rows) and abdominal region (Fig. 2c). Each uncinus presented a marginal

denticulation, similar to a small comb (Fig. 2f). The other chaetae were analyzed under optical microscopy and their morphology was compatible with past literature (Knight-Jones *et al.* 1973, Figs. 1i-1k).

This species presented perpendicular growth to the substrate, not related to the absence of space for lateral growth (Fig. 2a). The tube texture was slightly different from that one described by Monro (1930), which was fluted, and similar to the one described by Gravier (1907).

Part of the literature has not affirmed that the tube of *H. biscoeensis* is attached to a hard substrate and has described it as a free tube (Gravier 1907, Knight-Jones *et al.* 1973). Nevertheless, our recent records and images (Fig. 2a) clarify this aspect, showing that the basal portion of the tube is a small spiral attached to a hard substrate (mainly dropstones), in agreement with the observation of Monro (1930). Currently, the distribution of the species extends to the Subantarctic Islands (South Orkneys and South Georgia), proximities of the Antarctic Peninsula (South Shetland Islands) and Ross Sea (Terra Nova Bay) at depths from 2 to 170 m. (Table I).

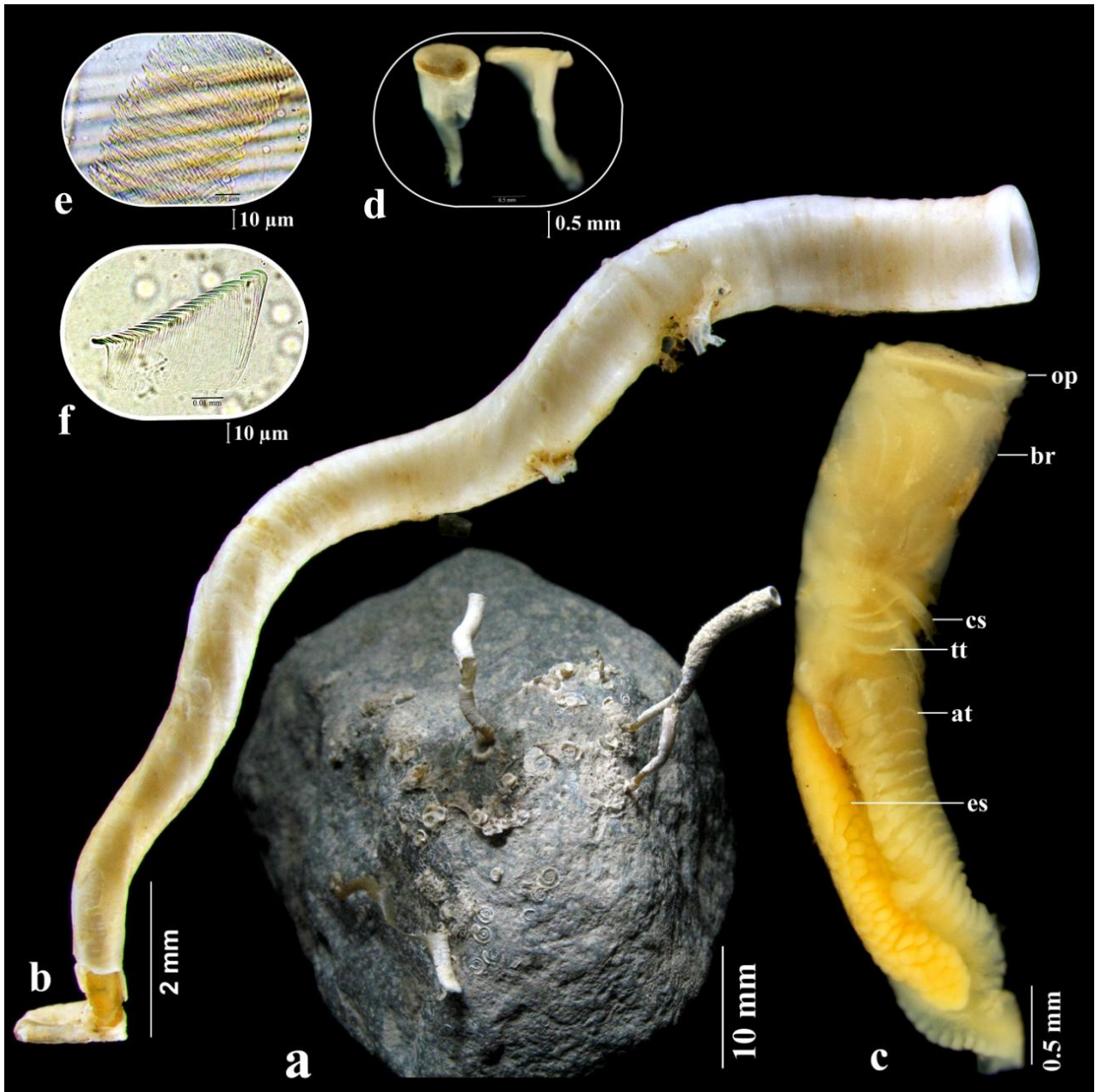


Figure 2. *Helicosiphon biscoeensis* from Martel Inlet. Tubes attached to dropstone (a); lateral view of the entire tube (b); lateral view of entire animal showing the egg sac (c); Front and lateral view of operculum (d); thoracic torus (e); uncinus (f). (op: operculum, br: branchial crown, cs: collar chaetae, tt: thoracic tori, at: abdominal tori, es: egg stalk)

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References

- Cowdry, E. V. 1952. **Laboratory technique in biology and medicine**. Williams & Wilkins, 3rd ed. 382 p.
- Gambi, M. C., Buia, M. C., Mazzella, L., Lorenti, M. & Scipione, M. B. 2000. Spatio-temporal variability in the structure of benthic populations in a physically controlled system off Terra Nova Bay: the shallow hard bottoms. Pp. 527-538. *In*: Faranda, F., Guglielmo, L. & Ianora, A. (Eds). **Ecology of the Ross Sea (Antarctica)**. Springer-Verlag, Milan, Italia, 604 p.
- Gambi, M. C., Lorenti, M., Russo, G. F. & Scipione, F. 1994. Benthic associations of the shallow hard bottoms off Terra Nova Bay, Ross Sea: zonation biomass and population structure. **Antarctic Science**, 6(4): 449-462.
- Gravier, C. 1907. **Annélides Polychètes. Expédition Antarctique Française (1903-1905)**. Masson, Paris, 75 p.
- Gravier, C. 1911. Annélides polychètes recueillies par la seconde expedition antarctique française (1908-1910). **Deuxième Expédition Antarctique Française**, 1: 1-165.
- Hartman, O. 1953. Non-pelagic polychaeta of the Swedish Antarctic Expedition 1901-1903. **Further Zoological Results of the Swedish Antarctic Expedition 1901-1903**, 4: 1-83.
- Hartman, O. 1966. Polychaeta Myzostomidae and Sedentaria of Antarctica. **Antarctic Research Series**, 7: 1-158.
- Hove, H. A. ten & Kupriyanova, E. K. 2009. Taxonomy of Serpulidae (Annelida, Polychaeta): the state of affairs. **Zootaxa**, 2036: 1-126.
- Knight-Jones, E. W., Knight-Jones, P. & Bregazzi, P. K. 1973. *Helicosiphon biscoeensis* Gravier (Polychaeta: Serpulidae) and its relationship with other Spirorbinae. **Zoological Journal of the Linnean Society**, 52: 9-21.
- Knight-Jones, P. & Knight-Jones, E. W. 1994. Spirorbidae (Polychaeta) from Signy Island, South Orkneys, including three new species. **Ophelia**, 40(2): 75-94.
- Monro, C. C. A. 1930. Polychaete worms. **Discovery Reports**, Cambridge, 2: 1-222.
- Pabis, K. & Sicinski, J. 2010. Distribution and diversity of polychaetes collected by trawling in Admiralty Bay: an Antarctic glacial fiord. **Polar Biology**, 33:141-151.
- Pillai, T.G. 2009. *Knightjonesia*, a new genus (Polychaeta: Spirorbidae) with a winged opercular peduncle, and its taxonomy. **Zootaxa**, 2059: 46-50.
- Rzhavsky A.V., Kupriyanova E.K. & Sikorski A.V. 2013. Two new species of serpulid polychaetes from the Barents Sea. **Fauna Norvegica**, 32: 27-38.
- San Martín, G., Parapar, J., Garcia, F. J. & Redondo, M. S. 2000. Quantitative analysis of soft bottoms infaunal macrobenthic polychaetes from South Shetland Islands (Antarctica). **Bulletin of Marine Science**, 67(1): 83-102.

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