

# Shallow-water benthic hydroids from Tethys Bay (Terra Nova Bay, Ross Sea, Antarctica)

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**Abstract** The shallow-water hydrozoan Antarctic fauna is still poorly studied, and available knowledge mostly refers to samples gathered by traditional ship-operated gears. By scuba diving in the coastal areas off the Italian Antarctic station “Mario Zucchelli” (Ross Sea, Terra Nova Bay), in the austral summer 2002–2003, a total of 20 hydrozoan species were found, belonging to 10 families and 13 genera. As hypothesized, Anthoathecata (11 species), usually under-represented in collections from indirect sampling gears, are common as also are Leptothecata (9 species). Hydractiniidae and *Hydractinia* are the dominant family and genus, followed by Haleciidae and *Halecium*. A new species to science, *Halecium exaggeratum* sp. nov. is also described. Most species are either endemic to Antarctic waters or restricted to Antarctic/sub-Antarctic areas; only two species have a wider distribution. Material reared in aquaria at the Italian Antarctic Base *Mario Zucchelli* facilitated knowledge of the life cycle and reproductive biology of several species. In particular, *Opercularella belgicae* was found to liberate a medusa stage referable to

*Phialella*, and the species is assigned here to that genus, as *Phialella belgicae*. Also, extraordinary is the complete absence or scant representation of the most typical Antarctic benthic hydroid genera (*Antarctoscyphus*, *Oswaldella*, *Schizotricha*, *Staurotheca*, and *Symplectoscyphus*), likely related to the shallow limits of sampling (down to 48 m).

**Keywords** Biodiversity · Hydrozoa · Life cycle · New records · New species · Southern Ocean

## Introduction

Hydrozoans represent an important component of the cnidarian fauna which, in turn, constitutes one of the most conspicuous taxonomic groups of the Antarctic shelf benthos (Arntz et al. 1994). The scientific knowledge on Antarctic benthic hydroids has considerably increased in recent years (see, for example, Peña Cantero 2004, 2008, 2009, 2012; Peña Cantero et al. 1997, 1999, 2002; Peña Cantero and Vervoort 2003, 2004, 2005). These studies were mainly carried out on hydroids collected during scientific cruises investigating the structure and organization of deep, or relatively deep, benthic communities. However, there are vast areas around Antarctica where the composition of sessile filter feeders, including the hydrozoans, is still unknown.

In addition, limited information is available on the benthic hydrozoan fauna inhabiting the Antarctic shallow waters. Stepanjants (1972) provided the first taxonomical report on 32 species of Antarctic hydroids collected by scuba diving during the XI Soviet Antarctic expedition (1965–1966) in the Davis Sea. Naumov and Stepanjants (1972) listed 32 species collected by indirect sampling

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gears at depths from the littoral zone to 250 m during the XII and XV French Antarctic expeditions in 1961–1963 and 1964–1965 in d'Urville Sea (Adélie Land). Most species were found on macroalgae or other invertebrates, as epibiosis appears to be a common strategy for Antarctic hydrozoans (see, for instance, Robins 1972; Jarms and Tiemann 1996; Jarms and Mühlenhardt-Siegel 1998; Piraino et al. 2003). Furthermore, 27 out of those 32 species were recorded at depths between 0 and 50 m. Stepanjants (1979) studied additional material (mostly leptothebate hydroids) collected by scuba diving during Soviet Antarctic Expeditions in the Davis, Cosmonauts, and Sodruzestva seas. More recently, the taxonomy and feeding ecology of one hydractiniid and three eudendriid hydroid species collected by scuba diving at Terra Nova Bay (Ross Sea) were investigated (Cerrano et al. 2000, 2001; Puce et al. 2002). Finally, Galea and Schories (2012) listed 20 hydroids collected by scuba diving in the sublittoral of King George Island, South Shetland Islands, during the Chilean Antarctic Expedition 2010–2011.

This study is based on a collection of hydroids gathered off the Italian Antarctic Base “Mario Zucchelli” (Ross Sea) in December 2002–January 2003, as part of a long-term investigation on the biodiversity and spatiotemporal dynamics of the rocky bottom benthic invertebrate assemblages along a shallow depth gradient (0–40 m) in the framework of the XVIII Italian PNRA Expedition. A total of 20 hydrozoan species were found, including a new species to science.

The present report aims to provide new information on the Antarctic shallow-water hydroid fauna through the study of material obtained by scuba diving and the analysis of material kept alive and reared in the laboratory. In fact, by culturing living colonies in aquaria, it was possible to observe the development of the sexual (medusa or medusoid) stage in species including *Sarsia* sp., *Lafoeina longithecata*, *Obelia bidentata*, and *Opercularella belgicae* (here referred to

*Phialella*) and to detect previously unnoticed characters, which cannot be easily seen in preserved material, in several others. The complex, pelago-benthic life cycles of hydrozoans have caused many taxonomic problems, because polyps and medusae of the same species have been considered often as different entities. This led to the creation of two separate classification systems for the two life stages of the same species. Therefore, the reconstruction of the life cycle, coupling benthic and planktonic stages, is an essential prerequisite for the identification of hydrozoans and for the goal of a unified classification (Boero et al. 1996, 1997).

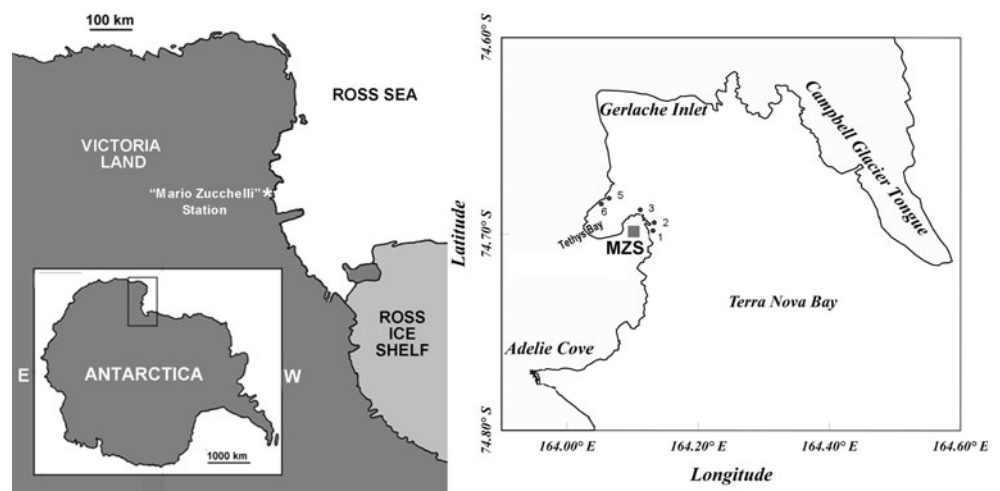
## Materials and methods

The hydroid collection studied here comes from 23 quantitative samples collected from five stations in Terra Nova Bay, Antarctica (Fig. 1; Table 1). Terra Nova Bay is located between Cape Washington and the Drygalski ice tongue, along the coast of Victoria Land. The stations were chosen to sample rocky bottoms with different slopes, on vertical transects from pack ice–seawater interface to a depth of 48 m.

Samples were collected by scuba diving by two methods: (a) scraping the substrate on 40 × 40 cm standard squares, coupled by suction with an underwater hood device, for a quantitative analysis of the overall benthic community (data not shown); or (b) a visual hydroid-targeted sampling. Visually oriented sampling was adopted for conspicuous species, whereas inconspicuous ones were tentatively sampled by collecting the substrates where hydroids can be presumably present. The identification of inconspicuous hydroids required careful sorting of samples, inspecting each substrate fragment under a stereomicroscope.

This report is mainly based on material gathered by the visual method. Colonies of some species were reared under

**Fig. 1** Area of study and location of the sampling stations

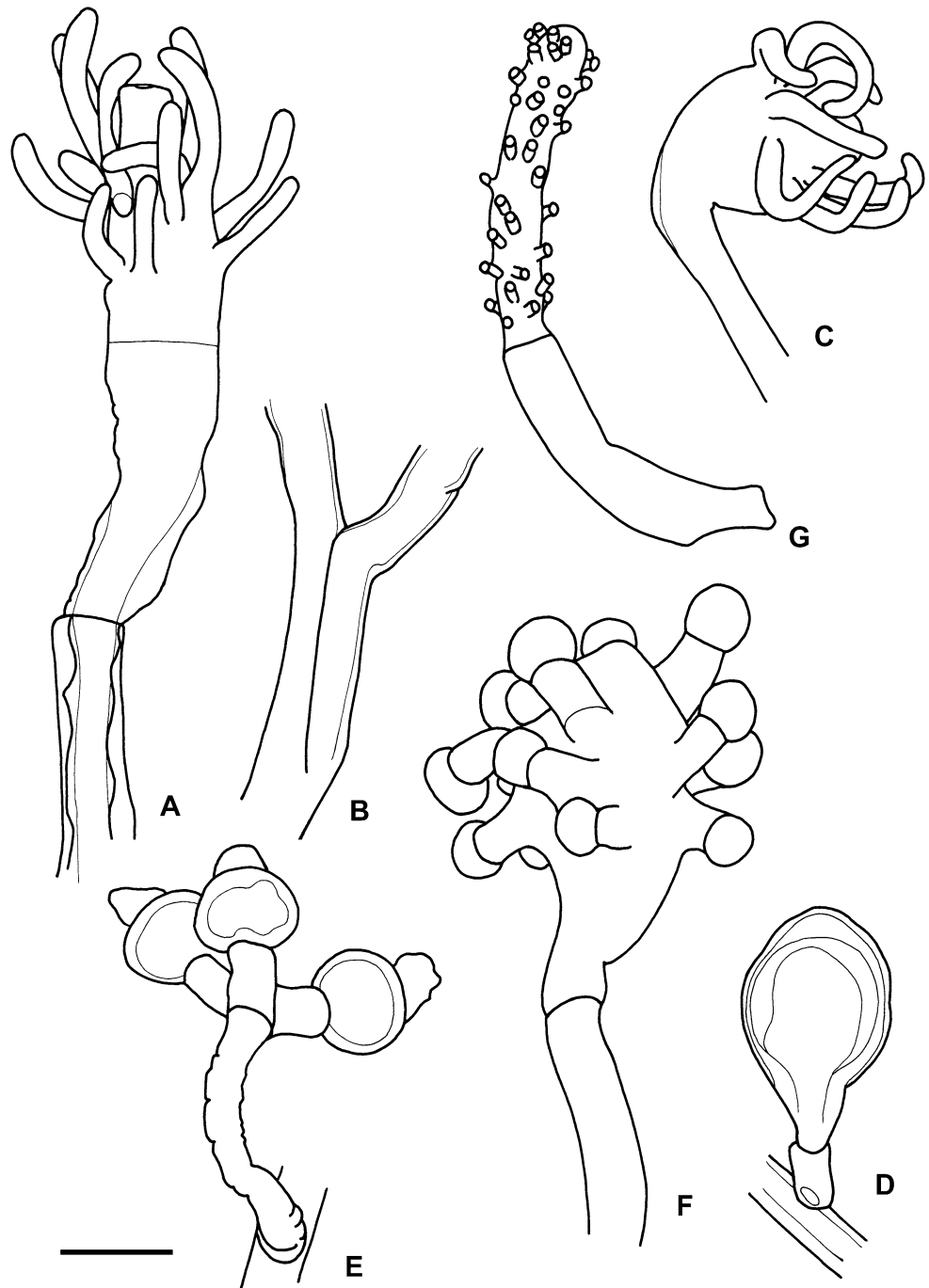


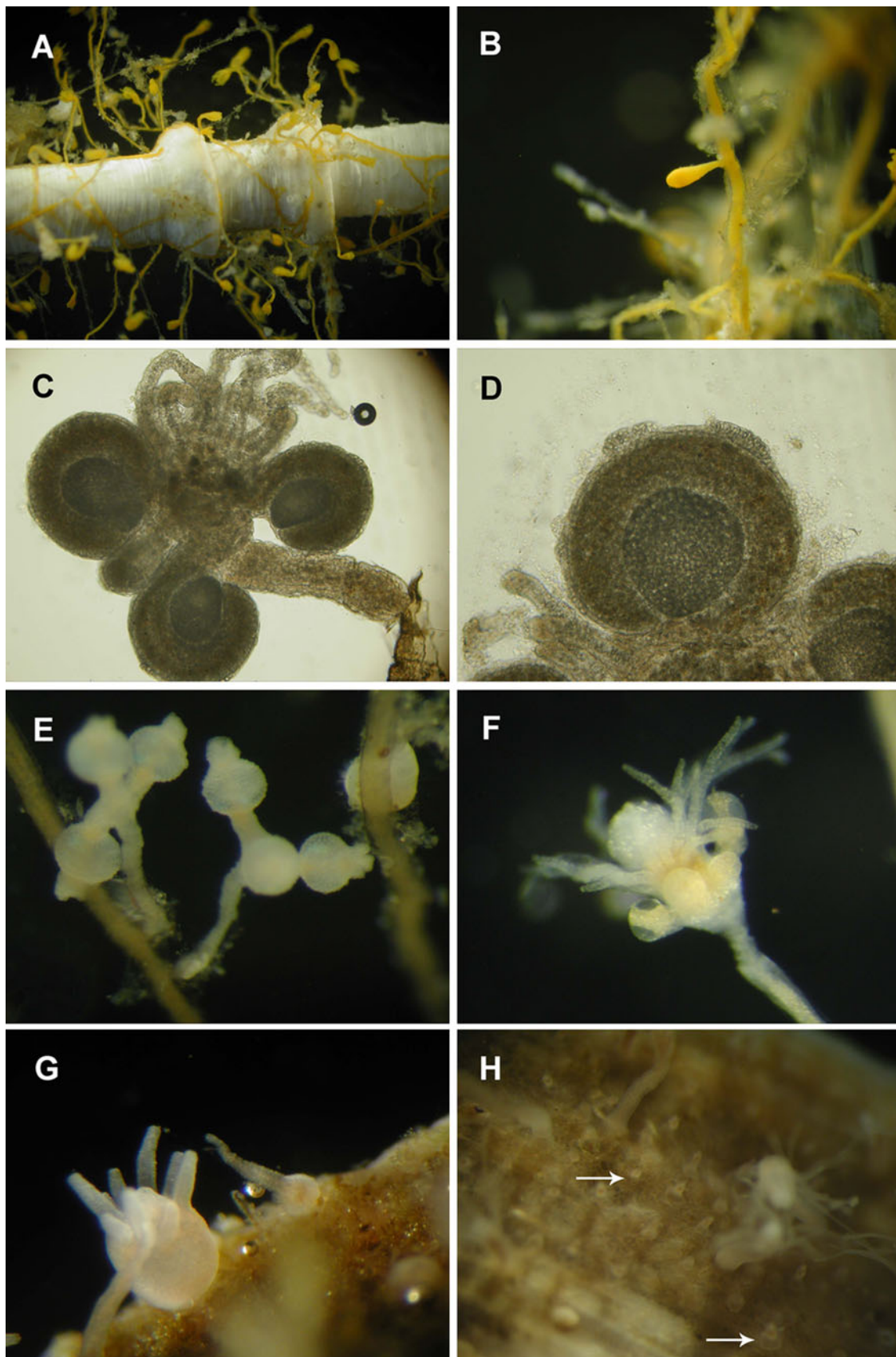
**Table 1** Position of sampling stations at Gerlach inlet, Terra Nova Bay (Ross Sea)

| Station | Latitude (S) | Longitude (E) | Location        |
|---------|--------------|---------------|-----------------|
| Stn 1   | 74°41'40.3'' | 164°07'37.5'' | Rod Bay         |
| Stn 2   | 74°41'45.2'' | 164°07'37.6'' | Punta Stocchino |
| Stn 3   | 74°41'24.5'' | 164°06'48.5'' | Tethys Bay      |
| Stn 5   | 74°40'28.1'' | 164°04'11.6'' | Tethys Bay      |
| Stn 6   | 74°40'50.0'' | 164°03'26.2'' | Tethys Bay      |

controlled conditions in aquaria or small glass containers filled with natural sea water, filtered through a 0.45- $\mu$ m mesh, to study reproductive strategies and reconstruct life cycles. The rearing facilities at the *Mario Zucchelli* Station consisted of a cold laboratory with open-circulation system aquaria and running seawater at  $T = -1.8^{\circ}\text{C}$  with direct uptake from the shore, at a depth of 3 m below the pack ice. The rearings were kept up to 5 weeks. Polyps and medusae were fed every third day with 2-day-old *Artemia salina* nauplii.

**Fig. 2** **a–b** *Turritopsis* sp.: **a** distal part of branch, showing double-layered perisarc and polyp; **b** origin of branch. **c–d** *Rhizorhagium antarcticum*: **c** polyp; **d** gonophore. **e** *Eudendrium generale*: male gonophores. **f** *Sarsia* sp.: polyp. **g** *Zanclea hicksoni*: polyp. (**a–b** from Stn 1; **c, e** from Stn 3; **d** from Stn 5; **f–g** from Stn 2). Scale bar 500  $\mu$ m (**g**); 250  $\mu$ m (**a–f**)







◀**Fig. 3 a–b** *Rhizorhagium antarcticum*: **a** general appearance of colony; **b** gonophore. **c–e** *Eudendrium generale*: **c** female gonophores; **d** detail of female gonophores showing nematocyst pads on spadix; **e** male gonophores. **f** *Eudendrium scotti*: polyp with male gonophores. **g–h** *Hydractinia angusta*: **g** polyp and dactylozoid; **h** gastrozooids and gonozooids with gonophores (arrows)

Observation of living specimens was carried out daily with a stereomicroscope equipped with a photographic camera Olympus Camedia C5050. Drawings were made by camera lucida assembled to a light microscope. Nematocysts were observed and measured by interference contrast microscopy.

Subsamples were fixed in 4 % formaldehyde solution in sea water (buffered with  $\text{CaCO}_3$ ) or in 80 % ethanol.

#### Station list

Stn 1, 74°41'40.3"S 164°07'37.5"E, Rod Bay  
*Turritopsis* sp., *Rhizorhagium antarcticum* (Hickson and Gravely, 1907), *Eudendrium generale* von Lendenfeld, 1885, *E. scotti* Puce, Cerrano and Bavestrello, 2002, *Hydractinia angusta* Hartlaub, 1904, *Hydractinia* sp. 4, *Sarsia* sp., *Zanclaea hicksoni* (Stepanjants, 1972), *Lafoeina longithecata* Jäderholm, 1904, *Phialella belgicae* (Hartlaub, 1904), *Halecium exaggeratum* sp. nov., *H. ovatum* Totton, 1930, *Campanularia* sp.  
 Stn 2, 74°41'45.2"S 164°07'37.6"E, Punta Stocchino  
*Eudendrium generale*, *E. scotti*, *Hydractinia* sp. 1, *Sarsia* sp., *Z. hicksoni*, *L. longithecata*, *P. belgicae*, *H. ovatum*, *Campanularia* sp.  
 Stn 3, 74°41'24.5"S 164°06'48.5"E, Tethys Bay  
*Rhizorhagium antarcticum*, *E. generale*, *E. scotti*, *Hydractinia* sp. 2, *Hydractinia* sp. 3, *L. longithecata*, *P. belgicae*, *H. ovatum*, *Campanularia* sp., *Obelia bidentata* Clark, 1875  
 Stn 5, 74°40'28.1"S 164°04'11.6"E, Tethys Bay  
*Rhizorhagium antarcticum*, *E. generale*, *E. scotti*, *Hydractinia* sp. 3, *Sarsia* sp., *L. longithecata*, *P. belgicae*, *H. exaggeratum* sp. nov., *H. ovatum*, *H. secundum* Jäderholm, 1904, *Hydrodendron arboreum* (Allman, 1888), *Symplectoscyphus plectilis* (Hickson and Gravely, 1907), *Campanularia* sp., *O. bidentata*  
 Stn 6, 74°40'50.0"S 164°03'26.2"E, Tethys Bay  
*Rhizorhagium antarcticum*, *P. belgicae*, *H. ovatum*, *S. plectilis*, *Campanularia* sp.

## Results and discussion

#### Taxonomic account

Family Clavidae McCrady, 1859  
*Turritopsis* sp. (Fig. 2a, b)

Material examined **Stn 1**, 11.12.02, 20 m, a few stems, up to 15 mm high, basibiont of *L. longithecata*.

**Description** Irregularly branched stems up to 15 mm high. Branches basally adnate and parallel to stem (Fig. 2b). Stem and branches with double-layered perisarc (Fig. 2a). Distal part of branches and basal part of polyps only provided with a thin layer of perisarc not reaching tentacles (Fig. 2a). Polyp distal, elongated, with c. 14 fili-form tentacles irregularly arranged on distal third.

Cnidome consisting of desmonemes, c.  $5.5 \times 4 \mu\text{m}$ , and badly preserved microbasic euryteles? (not seen discharged), c.  $11 \times 6 \mu\text{m}$ .

**Remarks** Stepanjants (1979) described as *Corydendrium* sp. a species of Clavidae from Antarctic waters that could be conspecific with our material. Stepanjants (1979) indicated that her material had large fixed gonophores with pedicels attached directly on either the hydrorhiza or the branches. Unfortunately, our material is infertile and, therefore, it is not possible to ascertain even its generic position. However, we have considered it belonging to the genus *Turritopsis* because of the double-layered perisarc of the stems, so characteristic of that genus.

**Ecology** *Turritopsis* sp. was found at a depth of 20 m in Rod Bay. It is used as substratum by *L. longithecata*.

Family Bougainvilliidae Lütken, 1850

*Rhizorhagium antarcticum* (Hickson and Gravely, 1907) (Figs. 2c–d, 3a–b)

*Perigonimus* sp. Hartlaub, 1904: 8, pl. 1 fig. 2.

*Perigonimus antarcticus* Hickson and Gravely, 1907: 4–6, pl. 1 figs 1–3, pl. 4 fig. 32; Naumov and Stepanjants, 1972: 35; Stepanjants, 1972: 56, fig. 1; 1979: 10, pl. 1 fig. 1.

*Atractylis antarcticus*—Vanhöffen, 1910: 283, fig. 8; Ritchie, 1913: 11.

*Rhizorhagium antarcticum*—Peña Cantero, 2004: 768.

*Gravelya antarctica*—Totton, 1930: 139, fig. 1a, b.

Material examined **Stn 1**, 10.12.02, 25 m. **Stn 3**, 23.12.02, 18 m, one stem, c. 20 mm high, with several polyps, basibiont of *P. belgicae* and *L. longithecata*; **Stn 3**, 23.12.02, 20 m, many stems, up to 15 mm high, basibiont of *P. belgicae* and *L. longithecata*. **Stn 5**, 31.12.02, 20 m, two stems, up to 40 mm high, basibiont of *P. belgicae* and *Hydractinia* sp. 3; **Stn 5**, 02.01.03, 35 m, a few polyps, on *E. generale*; **Stn 5**, 05.01.03, 40 m, several polyps, with gonophores, on tube of polychaete. **Stn 6**, 07.01.03, a few stems, up to 17 mm long.

**Description** In vivo colonies with a strongly yellow-colored coenosarc (Fig. 3a, b). Hydrorhiza usually giving rise to quite long pedicels with a single distal polyp, though

some stems distinctly larger, branched, and with several polyps. Polyps with conical hypostome and c. 10 filiform tentacles (Fig. 2c). Gonophores as fixed sporosac on hydrorhiza (Figs. 2d, 3b).

Cnidome consisting of microbasic euryteles ( $6.5\text{--}7 \times 3.5\text{--}4 \mu\text{m}$ ) and desmonemes ( $4.5 \times 2.5 \mu\text{m}$ )

**Ecology** *Rhizorhagium antarcticum* has been found at depths from zero (Hickson and Gravely 1907) to 450 m (Totton 1930), epibiotic on hydroids (Hartlaub 1904; Ritchie 1913; Totton 1930; Naumov and Stepanjants 1972); present material between 18 and 40 m, epibiotic on *E. generale* and tube of polychaete and basibiont for colonies of *Hydractinia* sp. 3, *L. longithecra*, and *P. belgicae*.

Gonophores in January and February (Totton 1930) and in August (Ritchie 1913); in our material in January.

**Distribution** Probably Antarctic-Kerguelen, although a careful re-examination of previous records is needed. In Antarctic waters, recorded from the Ross Sea (Hickson and Gravely 1907; Ritchie 1913; Totton 1930), Adélie Land (Naumov and Stepanjants 1972), Davis Sea (Vanhöffen 1910; Stepanjants 1972, 1979), and Cosmonauts Sea (Stepanjants 1979), in East Antarctica, and from the Bellingshausen Sea (Hartlaub 1904), in West Antarctica. Our material comes from Rod Bay and Tethys Bay.

Family Eudendriidae L. Agassiz, 1862

***Eudendrium generale* von Lendenfeld, 1885** (Figs. 2e, 3c–e)

*Eudendrium generale*—Puce, Cerrano and Bavestrello, 2002: 368–370, fig. 2, fig. 3A, B; Peña Cantero, 2009: 1745.

**Material examined** **Stn 1**, 10.12.02, 25 m, several stems, up to 25 mm high, with female gonophores. **Stn 2**, 16.12.02, 10 m, a few monosiphonic stems, up to 10 mm high, on *Phyllophora* sp. **Stn 3**, 23.12.02, 20 m, numerous monosiphonic stems, up to 30 mm high; **Stn 3**, 23.12.02, 25 m, one slightly polysiphonic stem, c. 35 mm high; **Stn 3**, 25.12.02, 15 m, a stem fragment, c. 8 mm long, with two male gonophores; **Stn 3**, 27.12.02, 30 m, several monosiphonic stems, up to 18 mm high; **Stn 3**, 28.12.02, 20 m, five monosiphonic stems, up to 25 mm high. **Stn 5**, 31.12.02, 20 m, many stems, up to 40 mm high, with female gonophores, basibiont of *P. belgicae* and *Hydractinia* sp. 3; **Stn 5**, 02.01.03, 35 m, one stem, c. 35 mm high, basibiont of *R. antarcticum*; **Stn 5**, 09.01.03, 14–40 m, several stems, up to 20 mm high.

**Description** Stems usually monosiphonic, but largest ones basally polysiphonic. Male gonophores on completely reduced polyps and one chambered (Figs. 2e, 3e). Female gonophores on polyps with reduced number of tentacles

(Fig. 3c); spadix simple (Fig. 3c–d). Large microbasic euryteles ( $10\text{--}12.5 \times 5\text{--}7 \mu\text{m}$ ) in a narrow band just above the basal groove, in groups on the spadix (Fig. 3d), and also frequent in pedicels and branches.

**Ecology** *Eudendrium generale* has been found in Antarctic waters at depths between 10 (Puce et al. 2002) and 702 m (Peña Cantero 2009); present material from 10 to 40 m, epibiotic on algae (*Phyllophora* sp.). It has been reported as basibiont for colonies of *Hydractinia* sp. (Peña Cantero 2009); we found colonies of *Hydractinia* sp. 3, *P. belgicae*, and *R. antarcticum*.

In our material, fertile colonies in December.

**Distribution** Australian-Antarctic (Peña Cantero 2009). Recorded in Antarctic waters at Terra Nova Bay, in the Ross Sea (Puce et al. 2002) and off Sturge Island, in the Balleny Islands (Peña Cantero 2009). Our material constitutes the third Antarctic record and comes from Rod Bay, Tethys Bay, and Punta Stocchino.

***Eudendrium scotti* Puce, Cerrano and Bavestrello, 2002** (Fig. 3f)

*Eudendrium scotti* Puce, Cerrano and Bavestrello, 2002: 370, fig. 3C, D, fig. 4, fig. 5A, B; Peña Cantero, 2008: 452; 2009: 1745; Peña Cantero and Vervoort, 2009: 84.

**Material examined** **Stn 1**, 10.12.02, 25 m, several monosiphonic stems, up to 26 mm high. **Stn 2**, 19.12.02, 20 m, a few stems, up to 10 mm high, on algae. **Stn 3**, 28.12.02, 20 m, three stems, up to 22 mm high, with male gonophores. **Stn 5**, 30.12.02, 25 m, a few monosiphonic stems, up to 10 mm high, on bryozoans.

**Remarks** This species is clearly recognizable by the two bands of large macrobasic euryteles ( $21\text{--}23 \times 7.5\text{--}10 \mu\text{m}$ ), a narrow one at the end of the hypostome and a wide band just above the basal groove (Fig. 3f).

**Ecology** Shelf species collected at depths between 10 (Puce et al. 2002) and 135 m (Peña Cantero and Vervoort 2009); present material between 20 and 25 m. It had been found epilithic on pebbles (Peña Cantero 2009) and epibiotic on hydroids and bryozoans (cf. Peña Cantero 2008; Peña Cantero and Vervoort 2009); we found it on algae and bryozoans. It is used in turn as substratum for other hydroids (Peña Cantero and Vervoort 2009).

In our material, colonies with gonophores in December.

**Distribution** Circum-Antarctic (Peña Cantero 2009) reported from the South Shetland Islands (Peña Cantero 2008), Bransfield Strait and Low Island (Peña Cantero and Vervoort 2009), in West Antarctica, and from the Ross Sea (Puce et al. 2002) and off Sturge Island, in the Balleny

Island (Peña Cantero 2009), in East Antarctica. We found it in Rod Bay, Tethys Bay, and Punta Stocchino.

Family Hydractiniidae L. Agassiz, 1862

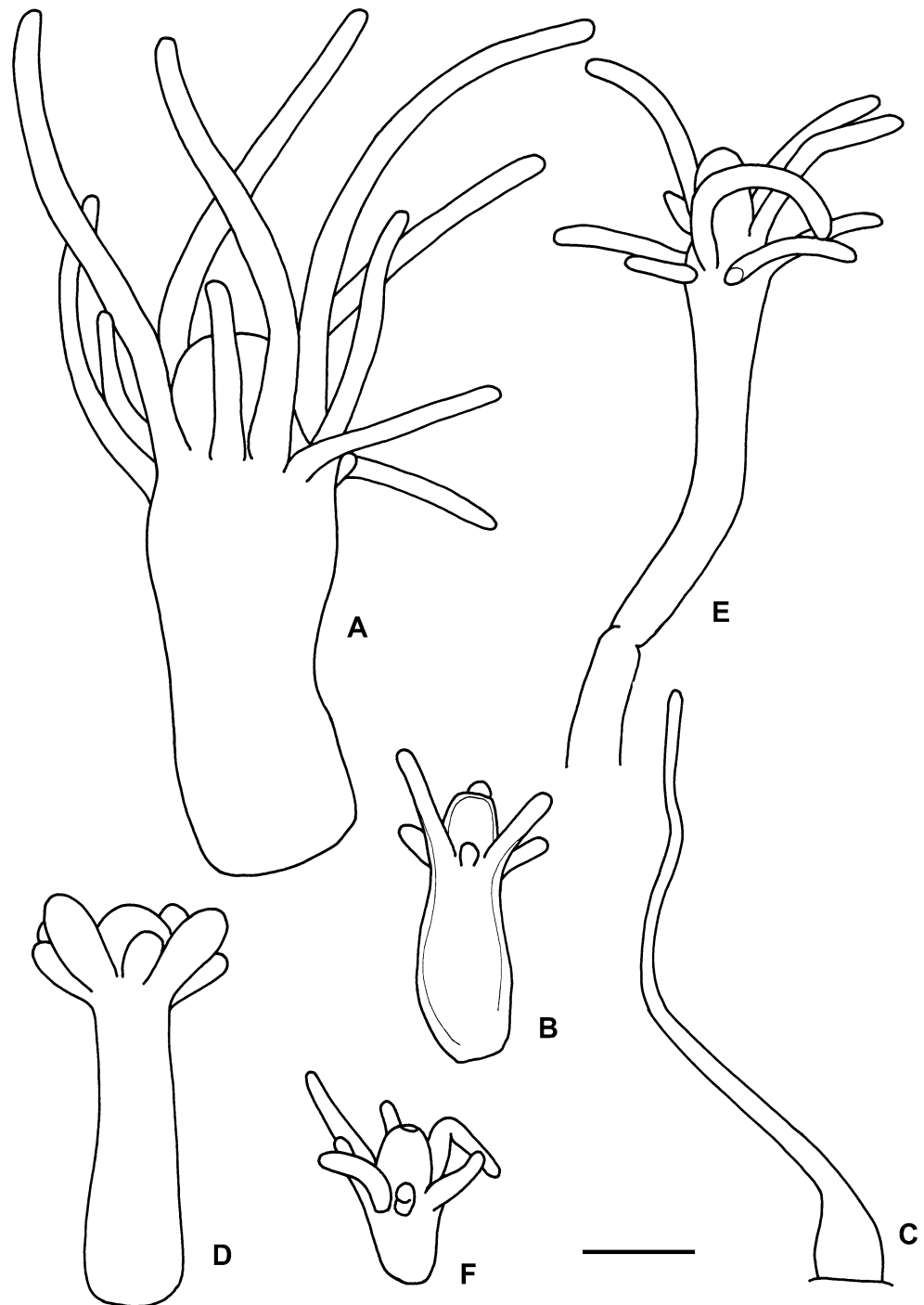
*Hydractinia angusta* Hartlaub, 1904 (Figs. 3g–h, 4a–c)

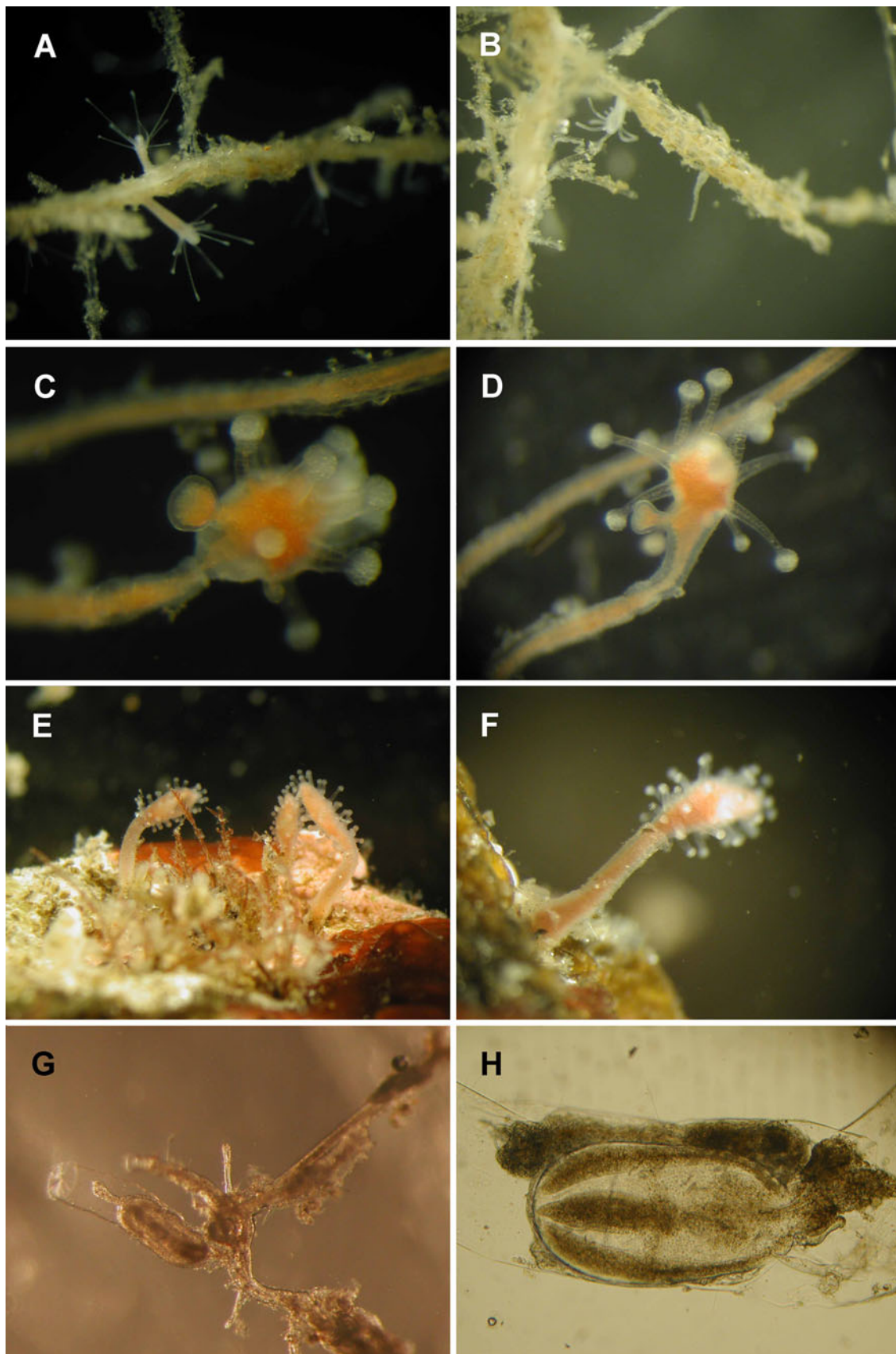
*Hydractinia angusta*—Peña Cantero and Ramil, 2006: 950–951, fig. 2 (synonym); Galea and Schories, 2012: 2, pl. 1A–E, fig. 2A–C.

Material examined **Stn 1**, 10–13.12.02, 10–20 m, several colonies, on shells of *Adamussium* sp.

**Description** Colonies growing on mollusk shell (Fig. 3g–h), with branched and anastomosed hydrorhizal stolons, more compact near the polyps. With tentaculozoids (Figs. 3g, 4c), but without spines. Gastrozoids relatively large (Fig. 4a), c. 2 mm high and c. 700  $\mu$ m in maximum

**Fig. 4** a–c *Hydractinia angusta*: **a** gastrozoid; **b** gonozoid; **c** dactylozoid. **d** *Hydractinia* sp. 1: gastrozoid; **e** *Hydractinia* sp. 2: gastrozoid. **f** *Hydractinia* sp. 3: gastrozoid. **a–c** from Stn 1, **d** from Stn 2, **e–f** from Stn 3. Scale bar 250  $\mu$ m







◀ **Fig. 5** **a** *Hydractinia* sp. 2: general colony appearance. **b** *Hydractinia* sp. 4: general colony appearance with polyp and dactylozoid. **c–d** *Sarsia* sp.: polyps with gonophores. **e–f** *Zanclea hicksoni*: **e** general colony appearance; **f** polyp. **g–h** *Lafoeina longithecata*: **g** colony fragment showing gonothecae and nematothecae; **h** fixed medusoid

diameter, with conical hypostome and a crown of c. 12–16 tentacles. Gonozooids much smaller (Figs. 3h, 4b), c. 1 mm high and c. 350  $\mu$ m in maximum diameter, and with a distinctly smaller number (one to six) of short and thin tentacles, also arranged in a single whorl. Two to four rounded gonophores (sporosacs), c. 100–150  $\mu$ m in diameter, observed in a single ring at the base of gonozooids (Fig. 3h). Areas surrounding gonozooids characterized by naked coenosarc.

Cnidome consisting of two types of nematocysts in gastrozooids and gonozooids: microbasic euryteles (not seen discharged) and desmonemes. Tentaculozooids only provided with microbasic euryteles of the same size range.

Measurements of nematocysts (in  $\mu$ m): microbasic euryteles,  $7.9 \pm 0.2 \times 2.6 \pm 0.2$  ( $n = 10$ , range 7.5–8  $\times$  2.5–3), ratio  $3.0 \pm 0.2$  (range 2.7–3.2); desmonemes, c.  $5 \times 2.5$ .

**Remarks** Cerrano et al. (2000, 2001) investigated the trophic role of the Terra Nova Bay population of *H. angusta*, providing the description of mature female sporosacs from the same locality and substrate. The small size and typical arrangement of gonophores on the small gonozooids is a diagnostic feature of *H. angusta*.

**Ecology** *Hydractinia angusta* has been found at depths from three (Stepanjants 1979) to 922 m (Peña Cantero and Ramil 2006); our material was found at depths between 10 and 20 m. Epibiotic on hydroids and other invertebrates (cf. Peña Cantero and Ramil 2006); we observed it on shells of *Adamussium*.

**Distribution** Circum-Antarctic (Peña Cantero and Ramil 2006). It has been reported from the Bellingshausen Sea (Hartlaub 1904) and the South Shetland Islands area (Peña Cantero and Ramil 2006; Galea and Schories 2012), in West Antarctica, and from off King George Land (Briggs 1938; Stepanjants 1979), Adélie Land (Naumov and Stepanjants 1972), the Ross Sea (Totton 1930; Stepanjants 1979), the Davis Sea (Stepanjants 1972, 1979) and the Sodruzestva and the Cosmonauts seas (Stepanjants 1979), in East Antarctica. We found it in Rod Bay.

#### *Hydractinia* sp. 1 (Fig. 4d)

**Material examined** **Stn 2**, 18.12.02, 12–20 m, a few polyps, on stone.

**Description** Pinkish polyps, widely dispersed on rocky substrate. Hydranth c. 1 mm high, with conical hypostome and a crown of about eight tentacles (Fig. 4d).

Cnidome consisting of microbasic euryteles, in two size classes, isorhizas (seed-like haplonemes) and desmonemes. Larger microbasic euryteles concentrated on hypostome, but also present on hydranth body. Smaller microbasic euryteles and isorhizas on tentacles and less abundant on hydranth body.

Measurements of nematocysts (in  $\mu$ m): larger microbasic euryteles (not seen discharged),  $25.4 \pm 0.9 \times 9.4 \pm 0.4$  ( $n = 10$ , range 24–27  $\times$  9–10), ratio  $2.7 \pm 0.1$  (range 2.5–2.8); smaller microbasic euryteles,  $11.0 \pm 0.3 \times 6.1 \pm 0.2$  ( $n = 10$ , range 10.5–11.5  $\times$  6–6.5), ratio  $1.8 \pm 0.1$  (range 1.7–1.8); isorhizas,  $17.7 \pm 0.7 \times 6.9 \pm 0.2$  ( $n = 10$ , range 16–18  $\times$  6.5–7), ratio  $2.6 \pm 0.2$  (range 2.3–2.9); and desmonemes, 6–6.5  $\times$  3.5–4.

**Remarks** Unfortunately, the scarcity of material and its infertile condition prevent us from properly characterizing this species. It is remarkable by the diversified cnidome and the large size of the larger microbasic euryteles, and it could be characterized by those attributes. However, it is necessary to make a revision of the Antarctic species of the genus before establishing its systematic position.

**Ecology** The colony was collected at a depth of 12 m, off Punta Stocchino, epilithic on stone.

#### *Hydractinia* sp. 2 (Figs. 4e, 5a)

**Material examined** **Stn 3**, 24.12.02, 12 m, several polyps, on algae and bryozoans.

**Table 2** Measurements of *Zanclea hicksoni* (Stepanjants 1972) in  $\mu$ m

|                      | Hickson and Gravely (1907) | Stepanjants (1979) | Present study          |
|----------------------|----------------------------|--------------------|------------------------|
| Height of stem       | 3,500                      | 1,500              | 3,000                  |
| Height of polyp      | 2,000                      | 3,500              | 3,000                  |
| Diameter of polyp    | 600                        | 900                | 450                    |
| Length of tentacle   | 300                        | 600–1,000          | 200                    |
| Large stenotele      | –                          | –                  | 14–17 $\times$ 12.5–13 |
| Small stenotele      | –                          | –                  | 10 $\times$ 7.5–8      |
| Haploneme (isorhiza) | –                          | –                  | 13.5 $\times$ 6        |
| Desmonemes           | –                          | –                  | 7.5 $\times$ 5.5       |

**Description** Relatively long and thin gastrozooids (Figs. 4e, 5a), sparsely distributed on the substrate. Polyps connected through a branched stolon covered with perisarc. Gastrozoid c. 2.3 mm high and 330  $\mu$ m in maximum diameter, with conical hypostome and about nine tentacles. Apparently without tentaculozooids. No gonophores.

Cnidome consisting of microbasic euryteles (not seen discharged) and desmonemes. Measurements of nematocysts (in  $\mu$ m): microbasic euryteles,  $8.9 \pm 0.6 \times 3.3 \pm 0.2$  ( $n = 10$ , range  $8\text{--}10 \times 3\text{--}3.5$ ), ratio  $2.7 \pm 0.2$  (range  $2.4\text{--}3.0$ ); desmonemes,  $5.5 \times 3$ .

**Remarks** The scarcity of material and its infertile condition preclude its identification to species level.

**Ecology** *Hydractinia* sp. 2 was collected at a depth of 12 m, epibiotic on algae and bryozoans.

#### *Hydractinia* sp. 3 (Fig. 4f)

**Material examined** **Stn 3**, 24.12.02, 15 m, several polyps, on algae. **Stn 5**, 31.12.02, 20 m, several scattered polyps, on *E. generale* and *R. antarcticum*.

**Description** Polyps relatively small (Fig. 4f), c. 600  $\mu$ m high and c. 200  $\mu$ m in maximum diameter. Conical hypostome and a crown of about 7 filiform tentacles. Polyps connected through a branched stolon. No spines. No dactylozooids. Cnidome consisting of microbasic mastigophores (not seen discharged) and desmonemes. Measurements of nematocysts (in  $\mu$ m): microbasic mastigophores,  $8.2 \pm 0.6 \times 2.9 \pm 0.3$  ( $n = 10$ , range  $7.5\text{--}9 \times 2.5\text{--}3.5$ ), ratio  $2.9 \pm 0.2$  (range  $2.7\text{--}3.2$ ); desmonemes,  $5.5 \times 2.5$ .

**Remarks** We limit identification of this species to genus level because available material is insufficient for complete characterization. In the size of its nematocysts, it is close to *Hydractinia* sp. 2, although the cnidome of that species apparently includes a different category of nematocyst (microbasic euryteles).

**Ecology** *Hydractinia* sp. 3 was collected at depths between 15 and 20 m in Tethys Bay, epibiotic on algae, *E. generale* and *R. antarcticum*.

#### *Hydractinia* sp. 4 (Fig. 5b)

**Material examined** **Stn 1**, 15.12.02, 20 m, five polyps, on bryozoans, in bad condition (dried sample).

**Remarks** The preserved material is in very bad condition as it was completely dried, and only one polyp was present. However, in field photographs of the hydroid, dactylozooids and several polyps were present on bryozoans (cf. Fig. 5b). By the cnidome (microbasic mastigophore c.  $7\text{--}7.5 \times 2.5$   $\mu$ m and desmonemes c.  $4 \times 2.5$   $\mu$ m) and

general appearance of the polyp, it is close to *Hydractinia* sp. 3 and they could be conspecific. We keep them separated because of the presence of dactylozooids in *Hydractinia* sp. 4.

**Ecology** *Hydractinia* sp. 4 was collected at a depth of 20 m in Rod Bay, epibiotic on bryozoans.

Family Corynidae Johnston, 1836

***Sarsia* sp.** (Figs. 2f, 5c–d)

? Corynidae Species A Hickson and Gravely, 1907: 15.

? *Coryne tubulosa*—Stepanjants, 1972: 62–63; 1979: 24–25, pl. 3 fig. 1.

**Material examined** **Stn 1**, 13.12.02, 15 m, two polyps in bad condition. **Stn 2**, 16.12.02, 10 m, a polyp, on algae (dried sample); **Stn 2**, 18.12.02–05.01.03, 15 m, a few polyps, with gonophores, on algae. **Stn 5**, 04.01.03, 40 m, one polyp, on tube of polychaete.

**Description** Monosiphonic stems irregularly branched. Hydranth with 10–14 capitate tentacles (Figs. 2f, 5c–d). Gonophores at polyp base, below last row of tentacles (Fig. 5c–d).

Cnidome consisting of stenoteles, in two size groups, and microbasic euryteles. Smaller stenoteles and microbasic euryteles very abundant on tentacle tips. Measurements of nematocysts (in  $\mu$ m): larger stenoteles,  $22.1 \pm 1.0 \times 14.1 \pm 0.8$  ( $n = 9$ , range  $20\text{--}23 \times 12\text{--}15$ ), ratio  $1.6 \pm 0.1$  (range  $1.5\text{--}1.7$ ); smaller stenoteles  $15.7 \pm 0.9 \times 10.4 \pm 0.5$  ( $n = 10$ , range  $14\text{--}17 \times 10\text{--}11$ ), ratio  $1.5 \pm 0.1$  (range  $1.4\text{--}1.6$ ); microbasic euryteles,  $12.6 \pm 0.4 \times 4.9 \pm 0.2$  ( $n = 10$ , range  $12\text{--}13 \times 4.5\text{--}5$ ), ratio  $2.6 \pm 0.1$  (range  $2.4\text{--}2.9$ ).

**Remarks** The scarcity of material and the incomplete development of gonophores (although indicating medusa bud formation) prevent us from identifying these specimens properly. However, the laboratory rearings allowed following the partial development of the early bud up to detection of a tetradial pattern with four endodermal stripes (i.e., radial canal primordia) along the main axis and the formation of a subumbrellar cavity. By the basal position of the buds (below the tentacles), and the early tetradial structures, it may be convincingly assigned to the genus *Sarsia* (cf. Bouillon et al. 2006).

The only species of Corynidae reported from Antarctic waters, in particular from the Davis Sea (cf. Stepanjants 1979), is *Sarsia* (*Coryne*) *tubulosa* (M. Sars, 1835). According to Stepanjants (1972, 1979), *Coryne conferta* and *Syncoryne sarsii* are conspecific with *C. tubulosa*. Consequently, this species would be widely distributed in boreal and austral waters, being considered as having a bipolar distribution by Stepanjants (1979). Our material

could be conspecific with Stepanjants's Antarctic material with which it agrees. Stepanjants (1979) pointed out that her Antarctic material consisted of young, mainly unbranched colonies formed by solitary polyps, characterized by having a more rounded body. Her Antarctic material was infertile, but her material from off Kerguelen had medusoid buds.

Hickson and Gravely (1907) also found a polyp of Corynidae from McMurdo Sound, in the Ross Sea, but they could not identify it, even to generic level. They pointed out that the hydranth was almost spherical, with conical hypostome and six scattered capitate tentacles. It could also be conspecific with Stepanjants's Antarctic material and the present material.

**Ecology** The species was collected at depths between 10 and 40 m, epibiotic on algae and a tube of polychaete. Stepanjants's material was found at depths between three and 10 m, and that of Hickson and Gravely (1907) at a depth of 36 m.

Gonophores in December (present study).

**Distribution** As indicated above, Stepanjants's material was collected in the Davis Sea and that of Hickson and Gravely (1907) in the Ross Sea. Our material comes from Rod Bay, Tethys Bay, and Punta Stocchino.

Family Zancleidae Russell, 1953

*Zanclea hicksoni* (Stepanjants, 1972) (Figs. 2g, 5e–f; Table 2)

Corynidae Species B Hickson and Gravely, 1907: 16, pl. 3, fig. 17.

*Gemmaria hicksoni* Stepanjants, 1972: 63, fig. 8; 1979: 25, pl. 4 fig. 1.

**Material examined** **Stn 1**, three polyps, up to 8 mm high. **Stn 2**, 18.12.02, 12–20 m, two polyps, up to 6 mm high, on stone; **Stn 2**, 19.12.02, 20 m, one polyp.

**Description** Solitary polyps up to 6 mm high. Basal half of polyp deprived of tentacles, but with a perisarc covering (Figs. 2g, 5f). Distal half of polyp with numerous short irregularly arranged capitate tentacles (Figs. 2g, 5e–f). Rounded hypostome.

Cnidome consisting of stenoteles (in two size groups), isorhizas, and desmonemes (cf. Table 2). They all occur at the distal end of the tentacles.

Gonophores unknown.

**Remarks** This is an uncommon species, hitherto reported only three times. According to Hickson and Gravely (1907), the proximal end of the hydrocaulus gives off three or four hydrorhizal filaments for attachment to sponge spicule debris. Although they did not indicate the number

of tentacles, Stepanjants (1979) pointed out that polyps are provided with more than 60 tentacles irregularly arranged, though four tentacles by the mouth form a row.

**Ecology** *Zanclea hicksoni* had been found at depths from 20 (Stepanjants 1979) to 183 m (Hickson and Gravely 1907). It was found growing on sponge spicule debris (Hickson and Gravely 1907) and on rocky bottom (Stepanjants 1979). Our material was found at depths between 12 and 20 m, epilithic on stone.

**Distribution** East Antarctic (Stepanjants 1979). Hitherto, it was known from McMurdo, in the Ross Sea (Hickson and Gravely 1907), the Davis Sea (Stepanjants 1972, 1979) and off Amery Glacier, in the Sodruzestva Sea (Stepanjants 1979). We found it in Rod Bay and Punta Stocchino.

Family Campanulinidae Hincks, 1868

*Lafoeina longithec* Jäderholm, 1904 (Fig. 5g–h)

*Lafoeina longithec*—Peña Cantero et al., 2004: 2274–2276, fig. 1A, B (synonym); Peña Cantero and Vervoort, 2009: 84, fig. 1b, c; Peña Cantero, 2009: 1746–1747, fig. 2b–d.

**Material examined** **Stn 1**, 11.12.02, 20 m, a few hydrothecae, on *Turritopsis* sp.; **Stn 1**, 14.12.02, 15 m, a few hydrothecae, on *Phyllophora* sp. **Stn 2**, 16.12.02, 10 m, a few hydrothecae, on *Phyllophora* sp.; **Stn 2**, 18.12.02, 15 m, a few hydrothecae, on bryozoans; **Stn 2**, 18.12.02, 12 m (dried). **Stn 3**, 23.12.02, 18 m, a few hydrothecae, on *R. antarcticum*; **Stn 3**, 23.12.02, 20 m, a few hydrothecae, on *Campanularia* sp. and *R. antarcticum*. **Stn 5**, 30.12.02, 25 m, a few hydrothecae, with gonothecae, on *Campanularia* sp.; **Stn 5**, 31.12.02, 20 m, a few hydrothecae; **Stn 5**, 02.01.03, 35 m, several hydrothecae, on algae, bryozoans and mollusk shell.

**Remarks** Peña Cantero (2009) found putative empty gonothecae (cf. Fig. 2d). In the present material, we found fully developed gonothecae confirming his finding and also demonstrating the occurrence of fixed medusoids (cf. Fig. 5g–h).

**Ecology** Shelf species (Peña Cantero et al. 2004) found at depths between five (Stepanjants 1979) and 470 m (Peña Cantero et al. 2004); we found it from 10 to 35 m. Usually found epibiotic on hydroids (Jäderholm 1904; Billard 1914; Naumov and Stepanjants 1972; Peña Cantero et al. 2004; Peña Cantero 2009; Peña Cantero and Vervoort 2009), but also on bryozoans (Ritchie 1913; Billard 1914; Peña Cantero and Vervoort 2009); we observed it on algae (*Phyllophora*), bryozoans, mollusk shells, *Campanularia* sp., *R. antarcticum* and *Turritopsis* sp.

Gonothecae in March (Peña Cantero 2009) and December–January (present study).

**Distribution** Pan-Antarctic (Peña Cantero and Vervoort 2009). Known in Antarctic waters from the Ross Sea (Hickson and Gravely 1907; Ritchie 1913), Davis Sea (Stepanjants 1972, 1979), Sodruzestva and Cosmonauts seas (Stepanjants 1979), off Adélie Land (Naumov and Stepanjants 1972) and the Balleny Islands (Peña Cantero 2009), in East Antarctica, and from the Antarctic Peninsula area (Billard 1914; Peña Cantero and Vervoort 2009), off South Georgia (Jäderholm 1904) and the Weddell Sea (Peña Cantero et al. 2004), in West Antarctica. We found it in Rod Bay, Tethys Bay, and Punta Stocchino.

*Phialella belgicae* (Hartlaub, 1904) (Figs. 6a, 7a–i, 8a–h)  
*Opercularella belgicae*—Peña Cantero et al., 2004: 2276–2278, fig. 1c–h (synonym); Peña Cantero, 2008: 453.

**Material examined** **Stn 1**, 10.12.02, 25 m, several hydrothecae, on bryozoans; **Stn 1**, 11.12.02, 20 m, a few hydrothecae, on *Phyllophora* sp. **Stn 2**, 16.12.02, 10 m, a few stems, on *Phyllophora* sp. and bryozoans; **Stn 2**, 18.12.02, 15 m, a few hydrothecae, on bryozoans; **Stn 2**, 18.12.02, 20 m, several hydrothecae, on bryozoans. **Stn 3**, 23.12.02, 18 m, a few hydrothecae on *R. antarcticum*; **Stn 3**, 23.12.02, 20 m, a few hydrothecae, on *Campanularia* sp. and *R. antarcticum*. **Stn 5**, 31.12.02, 20 m, a few hydrothecae, on *E. generale* and *R. antarcticum*; **Stn 5**, 02.01.03, 35 m, several (some branched) stems, on *Adamussium* sp.; **Stn 5**, 09.01.03, 14–40 m, several hydrothecae, on algae. **Stn 6**, 07.01.03, a few stems, on *Campanularia* sp. and *H. ovatum*.

**Description** Stems up to 5 mm high, some branched (Fig. 6a), with up to two secondary hydrothecae. Height of hydrothecae c. 550 µm (up to diaphragm); maximum diameter c. 120 µm.

**Description of the medusa development.** At liberation (Fig. 7e–f), medusa higher than wide, with distinct constriction at the middle and with both apical canal and process, the latter quickly disappearing (Fig. 7g). Manubrium short, opening into the gastral cavity which communicates with four radial canals and the apical process (Fig. 7g). Four marginal tentacles present.

One day after liberation (Figs. 7h–i, 8a), umbrella bell shaped, high, c. 1 mm tall (Fig. 7h). Both apical canal and umbrellar constriction missing. Manubrium short, cruciform. Margin of umbrella with four tentacles and eight bulbs (four primary radial ones and four secondary interradial bulbs) (Fig. 8a). With eight adradial statocysts (Fig. 8a), each with three to four statoliths (Fig. 7i). Nematozooids distributed all over the umbrella (Fig. 7h).

Five days after liberation (Fig. 8b–d), medusa c. 3 mm high. Umbrellar margin with eight tentacles (four primary radial ones and four secondary interradial tentacles)

(Fig. 8b, c). Appearance of third-order, adradial bulbs (Fig. 8c). Still eight statocysts, located between interradial and adradial bulbs (Fig. 8c, d).

Twenty days after liberation (Fig. 8e–g), gonads started to develop. Medusa wider than high. Appearance of fourth-order bulbs (Fig. 8g) situated between the statocysts and the interradial bulbs. Finally, medusa with 24 tentacles (Fig. 8h).

**Remarks** The benthic form of this species has repeatedly been reported from Antarctic waters, mainly based on infertile records. Gonothecae of this species were first described by Peña Cantero et al. (2004), but unfortunately they were empty and, consequently, they could not throw light on the question about whether or not this species produces a medusa. Because of this, this species had provisionally been considered belonging to *Opercularella* (cf. Peña Cantero et al. 2004 for a wide description on the colony structure and the hydrothecal and gonothecal shape). The finding of fertile colonies alive (Fig. 7a, b), and its maintenance in the laboratory, allowed us to follow their development over time, both demonstrating the existence of a medusa in its lifecycle and following its development long enough to establish its generic allocation.

Our material clearly belongs to *Phialella*, as it has eight adradial statocysts, each with three to four statoliths, situated on the margin of the umbrella between two tentacles. The medusa has many tentacles (at least 24 tentacles), the umbrella is wider than high, and the manubrium is short and quadrangular.

Unfortunately, the medusa development could not be carried out to completion and, consequently, its specific assignment should be taken with caution. It is close to *Phialella falklandica* Browne, 1902, and could be conspecific, but in Browne's species, there are 60–70 marginal tentacles, whereas in our material, only 24 tentacles were observed. Browne's material, however, included a series extending from an intermediate to the adult stage (very early stages were not present), just contrary to what we had available. In any case, we prefer keeping them as two different species, hoping that new studies will finally solve this question. Anyhow, our Terra Nova Bay material is referred here to as *Phialella belgicae* (Hartlaub 1904).

**Ecology** *Phialella belgicae* has been found at depths from the low tide level (Billard 1914) to 650 m (Millard 1977); we found it from 10 to 40 m. Frequently reported epibiotic on hydroids, but also on bryozoans, crustacean legs and echinoid spines (cf. Peña Cantero et al. 2004); we found it epibiotic on algae (*Phyllophora* sp.), bryozoans, mollusk shells (*Adamussium* sp.), *Campanularia* sp., *E. generale*, *H. ovatum*, and *R. antarcticum*.



Peña Cantero et al. (2004) found gonothecae in January; in our material, fertile colonies in January and February.

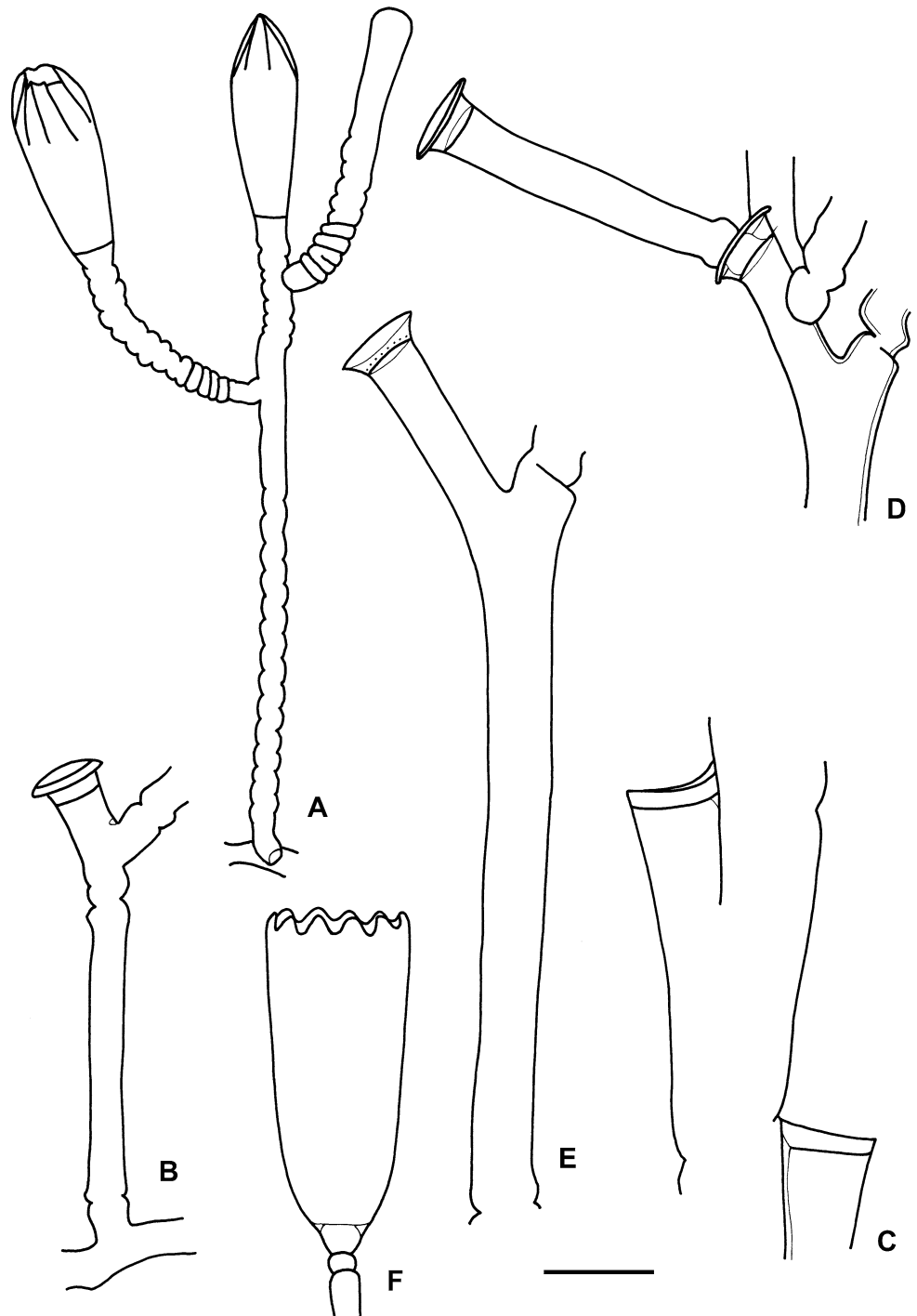
**Distribution.** Uncertain (Peña Cantero et al. 2004), probably Pan-Antarctic. In Antarctic waters, known from the Ross Sea (Hickson and Gravely 1907; Ritchie 1913; Totton 1930), the Davis Sea (Briggs 1938; Stepanjants 1972, 1979), off Sabrina Coast and Queen Mary Coast (Naumov and Stepanjants 1962), off Adélie Land (Naumov and Stepanjants 1972), and the Sodruzestva Sea

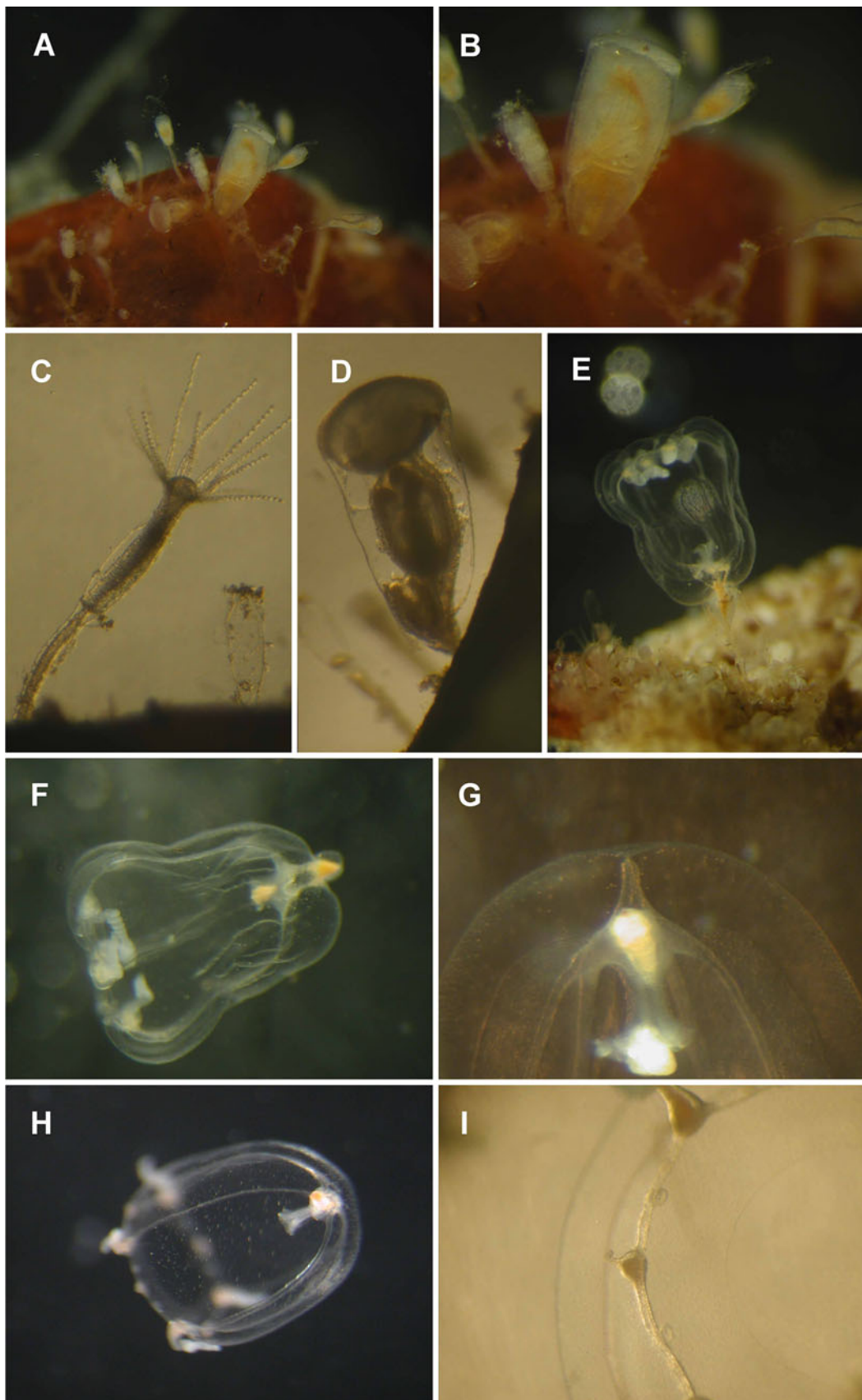
(Stepanjants 1979), in East Antarctica, and from the Bellingshausen Sea (Hartlaub 1904), the South Shetland Islands (Billard 1914; Peña Cantero 2008), Peninsula Antarctica (Blanco 1984) and the Weddell Sea (Peña Cantero et al. 2004), in West Antarctica. Our material was collected in Rod Bay, Tethys Bay, and Punta Stocchino.

Family Haleciidae Hincks, 1868

*Halecium exaggeratum* sp. nov. (Fig. 6d, e)

**Fig. 6** **a** *Phialella belgicae*: stem showing hydrothecal arrangement. **b** *Halecium ovatum*: basal part of stem. **c** *Halecium secundum*: branch fragment showing hydrothecal arrangement. **d–e** *Halecium exaggeratum* sp. nov.: **d** distal part of stem internode showing primary and secondary hydrothecae and origin of paired branches; **e** hydrothecal internode. **f** *Campanularia* sp.: hydrothecae (**a–e** from Stn 5; **f** from Stn 2). Scale bar 250  $\mu$ m





◀ **Fig. 7** *Phialella belgicae*: **a** general appearance of colony; **b** gonotheca; **c** hydrothecae and polyp; **d** gonothecae with developing medusa; **e** medusa at liberation; **f** newly released medusa; **g** detail of apical part; **h** 1 day after liberation; **i** margin of umbrella showing statocysts and statoliths

*Halecium* sp.1 Peña Cantero, 2008: 455–456, fig. 1 J.

*Halecium* sp. Peña Cantero and Vervoort, 2009: 85, fig. 1I.

**Material examined** **Stn 1**, 10.12.02, 25 m, two stems, up to 15 mm high. **Stn 5**, 30.12.02, 25 m, a few stems, up to 10 mm high, on bryozoans [stem c. 10 mm high with paired branches holotype—University of Salento, Hydrozoan Collection (USHC) #2012.Halex1; remaining stems are paratypes]; **Stn 5**, 05.01.03, 30 m, a few stems, on bryozoans.

**Description** Stems monosiphonic, up to 15 mm high, divided into relatively long and thin internodes by alternately arranged oblique nodes. Internodes slightly arranged in zigzag fashion. Hydrothecae alternately arranged in about one plane and situated at the end of extremely long hydrophores (Fig. 6e). Hydrothecae surpassing distal node of internode for great distance. Hydrophores straight, gently diverging from internode. Stems scarcely branched. Some branches formed from primary hydrothecae which give rise to a typical series of internodes. In other situations, however, there are primary paired branches arising from opposite sides of hydrophore of stem internodes (Fig. 6d). Hydrothecae low, walls strongly diverging upwards from diaphragm and usually with everted rim (Fig. 6d). Ratio between adcauline length of hydrophore and diameter at diaphragm 2.5–3.3. Usually, a single secondary hydrothecae at the end of a relatively long pedicel (Fig. 6d).

**Measurements** (in  $\mu\text{m}$ ): internode, length c. 1700, maximum diameter c. 100; hydrothecae, diameter at aperture 200–215, diameter at diaphragm 120–130, height 50–60; adcauline length of hydrophore 310–400. Cnidome (not seen discharged) consisting of two types of heteronemes: one with rounded ends [range  $6.5\text{--}7.5 \times 3.0\text{--}4.0$ , mean  $7.2 \pm 0.3 \times 3.9 \pm 0.3$  (10), ratio 1.6–2.5, mean  $1.9 \pm 0.2$  (10)] and another with sharp ends ( $6.5\text{--}7.5 \times 3 \mu\text{m}$ ).

**Remarks** In spite of the relative scarcity of material, the species is so well characterized by the exceedingly long hydrophores, the hydrothecal shape and the paired branches that we feel confident in considering it as a new species to science. Anyway, *H. exaggeratum* sp. nov. is clearly close to *H. frigidum* Peña Cantero, 2010 by the long hydrophores and paired branches. However, it differs from this species, among other things, in having much smaller

and monosiphonic stems, larger and strongly diverging hydrothecae, with everted rim, distinctly longer hydrophores (ratio between adcauline length of hydrophore and diameter at diaphragm 2.3–2.8 in *H. frigidum*) and smaller nematocysts ( $9\text{--}10 \times 4.5\text{--}5 \mu\text{m}$  in *H. frigidum*).

The material described as *Halecium* sp.1 by Peña Cantero (2008: 455, Fig. 1j) is undoubtedly conspecific with *H. exaggeratum* sp. nov., agreeing in every detail. It is probably identical as well with material described as *Halecium* sp. by Peña Cantero and Vervoort (2009: 85, fig. 1I). These authors also remarked on the extremely long hydrophores (ratio between adcauline length of hydrophore and diameter at diaphragm c. 2.9) and internodes (c. 2000  $\mu\text{m}$  long and c. 100  $\mu\text{m}$  wide). Peña Cantero and Vervoort (2009) already pointed out that their material might be conspecific with Peña Cantero's (2008) material.

**Ecology** *Halecium exaggeratum* sp. nov. seems to be a shelf species. Peña Cantero (2008) found it at depths from 92 to 256 m, on *Symplectoscyphus naumovi* and tube of polychaete, and Peña Cantero and Vervoort (2009) at 275 m, growing on *S. plectilis*. Our material was collected at depths between 25 and 30 m, epibiotic on bryozoans.

**Distribution** *Halecium exaggeratum* sp. nov. seems to have a circum-Antarctic distribution. It is known from off the south of Livingston Island (Peña Cantero 2008), off Bransfield Island (Peña Cantero and Vervoort 2009) and from Rod Bay and Tethys Bay (present study).

**Etymology** The specific name *exaggeratum* refers to the extraordinarily long hydrophore.

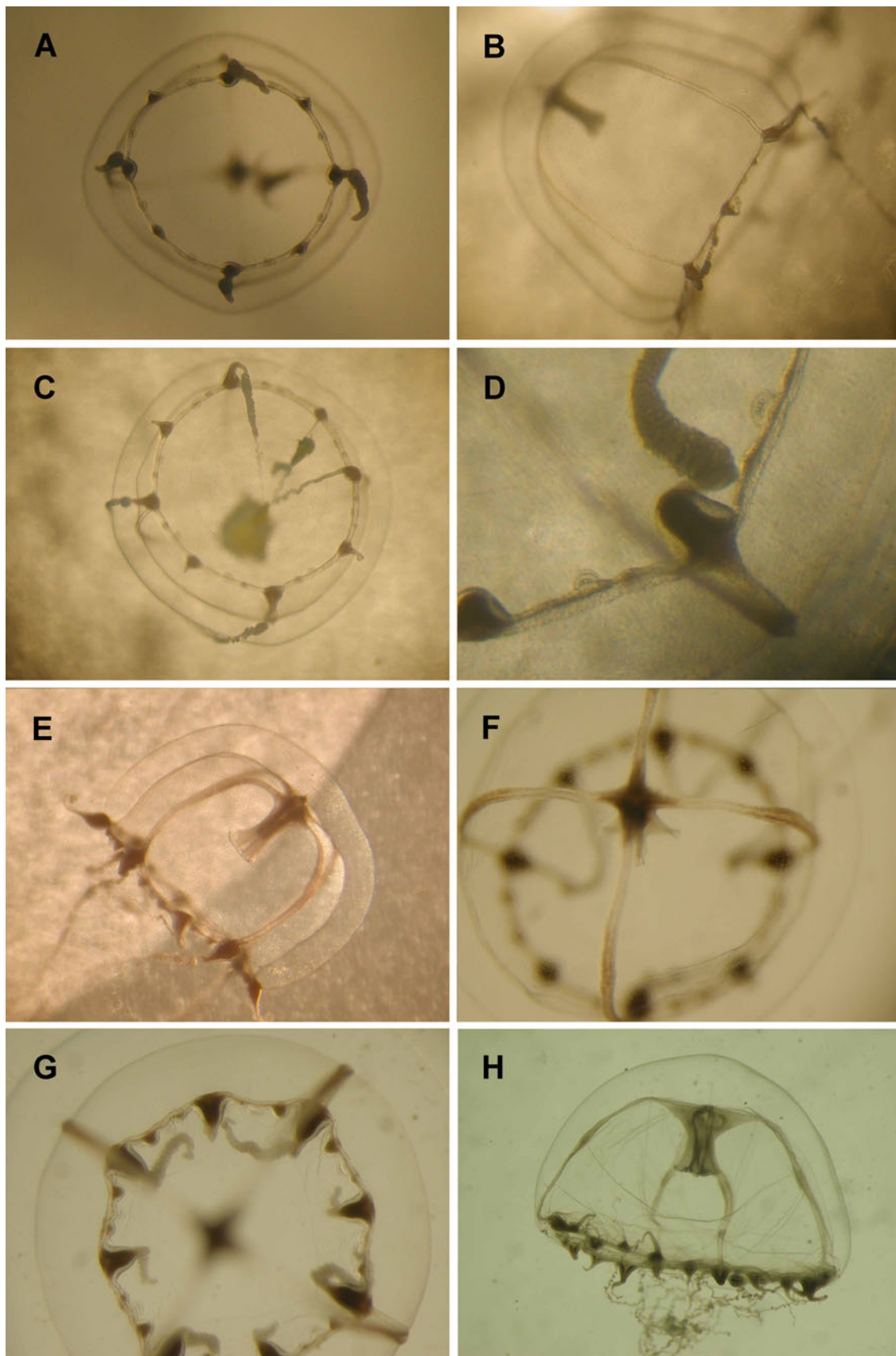
***Halecium ovatum* Totton, 1930** (Fig. 6b)

*Halecium ovatum* Totton, 1930: 143, fig. 3; Stepanjants, 1979: 103, pl. 20 fig. 1; Peña Cantero and García Carrascosa, 1995: 12–13, fig. 2g–h; Peña Cantero, 2008: 455, fig. 1e–g; Galea and Schories, 2012: 9, fig. 2J–K.

*Halecium tenellum*—Stepanjants, 1972: 72.

**Material examined** **Stn 1**, 10.12.02, 25 m, a few stems, up to 10 mm high, on bryozoans; **Stn 1**, 10.12.02, 25 m, a few stems, up to 10 mm high. **Stn 2**, 16.12.02, 9 m, a few incipient stems with up to two polyps, on *Phyllophora* sp.; **Stn 2**, 19.12.02, 20 m, a few incipient stems, on algae. **Stn 3**, 25.12.02, 15 m, one stem c. 10 mm long; **Stn 3**, 27.12.02, 20 m, four stems, up to 12 mm high, on algae. **Stn 5**, 30.12.02, 25 m, a few incipient stems, up to 5 mm high; **Stn 5**, 05.01.03, 30 m, a few stems, on bryozoans; **Stn 5**, 09.01.03, 14–40 m, several stems, up to 10 mm high, on algae. **Stn 6**, 07.01.03, several stems, up to 20 mm high, with one gonotheca, basibiont of *P. belgicae*.

**Ecology** Shelf species (Peña Cantero 2008) found at depths between three (Stepanjants 1979) and 471 m (Peña





◀ **Fig. 8** *Phialella belgicae*: **a** margin of umbrella with tentacles and bulbs; **b** 5-day-old medusa (lateral view); **c** *Idem* (ventral view); **d** detail of statocysts and statoliths; **e** 20-day-old medusa (lateral view); **f** *Idem* (dorsal view); **g** *Idem* (ventral view); **h** 24-tentacles state

Cantero and García Carrascosa 1995); present material between nine and 40 m. Frequently reported epibiotic on other species of hydroids (Totton 1930; Stepanjants 1979; Peña Cantero and García Carrascosa 1995; Peña Cantero 2008; Peña Cantero and Vervoort 2009), but also on sponges (Stepanjants 1979) and polychaete tubes (Totton 1930; Stepanjants 1979); we observed it on algae (*Phyllophora* sp.) and bryozoans and as basibiont for colonies of *P. belgicae*.

Gonothecae in January (Totton 1930; Stepanjants 1979; present material), February (Peña Cantero 2008; Galea and Schories 2012), and December (Stepanjants 1979).

Distribution Circum-Antarctic (Peña Cantero 2008) reported from Palmer Archipelago (Vervoort 1972a), off Elephant Island (Peña Cantero and García Carrascosa 1995), Low Island (Peña Cantero and Vervoort 2009), and from the South Shetland Islands (Peña Cantero 2008; Galea and Schories 2012), in West Antarctica, and from the Ross Sea (Totton 1930), the Davis Sea (Stepanjants 1979) and the Balleny Islands (Peña Cantero 2009), in East Antarctica. We found it in Rod Bay, Tethys Bay, and Punta Stocchino.

***Halecium secundum* Jäderholm, 1904** (Fig. 6c)

*Halecium secundum* Jäderholm, 1904: 3; 1905: 11–12, pl. 4 figs. 4–7.

Material examined **Stn 5**, 04.01.03, 40 m, two polysiphonic stems, 78 and 50 mm high.

Description Stems polysiphonic and branched. Branching usually alternate in one or two planes forming a very obtuse angle. Hydrothecae sessile (Fig. 6c) alternately arranged in one plane. Cnidome consisting of microbasic euryteles (seen discharged),  $12 \times 5\text{--}5.5\text{ }\mu\text{m}$ , extremely abundant, particularly into internodes, and also present on tentacles, and microbasic mastigophores (seen discharged),  $7.5 \times 2\text{ }\mu\text{m}$ .

Ecology *Halecium secundum* had been previously collected at a depth of 150 m, on sponges and bryozoans (Jäderholm 1905); our material comes from a depth of 40 m.

Distribution *Halecium secundum* was only known from off Cape Seymour, Seymour Island, in Graham Land (Jäderholm 1905). Our material, representing the second record of the species, comes from Tethys Bay, pointing to a circum-Antarctic distribution.

***Hydrodendron arboreum* (Allman, 1888)** (Fig. 9a–c)

*Hydrodendron arboreum*—Peña Cantero and Ramil, 2006: 952–953, fig. 2c (synonym); Peña Cantero and Gili, 2006: 766; Peña Cantero, 2008: 456; 2009: 1747.

Material examined **Stn 5**, 04.01.03, 40 m, a colony at least 200 mm high and several colony fragments, up to 95 mm high, basibiont of *Campanularia* sp.; **Stn 5**, 05.01.03, 40 m, several colony fragments, up to 80 mm long.

Description Hydrothecae free and relatively high, particularly at the adcauline side. Coenosarc full of endosymbionts. There are some unidentifiable masses at the axil of every pair of tentacles (Fig. 9c). Nematophores with nematocysts restricted to distal tip (Fig. 9a, b). Large nematocysts  $18\text{--}19 \times 5.5\text{--}6\text{ }\mu\text{m}$ .

Ecology Eurybathic species found at depths from 18 (Hickson and Gravely 1907) to 1370 m (Peña Cantero and Ramil 2006); present material at 40 m. Reported epilithic on pebbles (Peña Cantero 2009) and epibiotic on other hydrozoans and invertebrates (cf. Peña Cantero and Ramil 2006). Used as substratum for other species of hydroids (Stepanjants 1979; Peña Cantero 2008); we observed colonies of *Campanularia* sp.

Gonothecae in January and February (Hickson and Gravely 1907; Stepanjants 1979), April (Millard 1977), from June to August (Ritchie 1913; Stepanjants 1979), in November (Peña Cantero and García Carrascosa 1995) and in December (Stepanjants 1979).

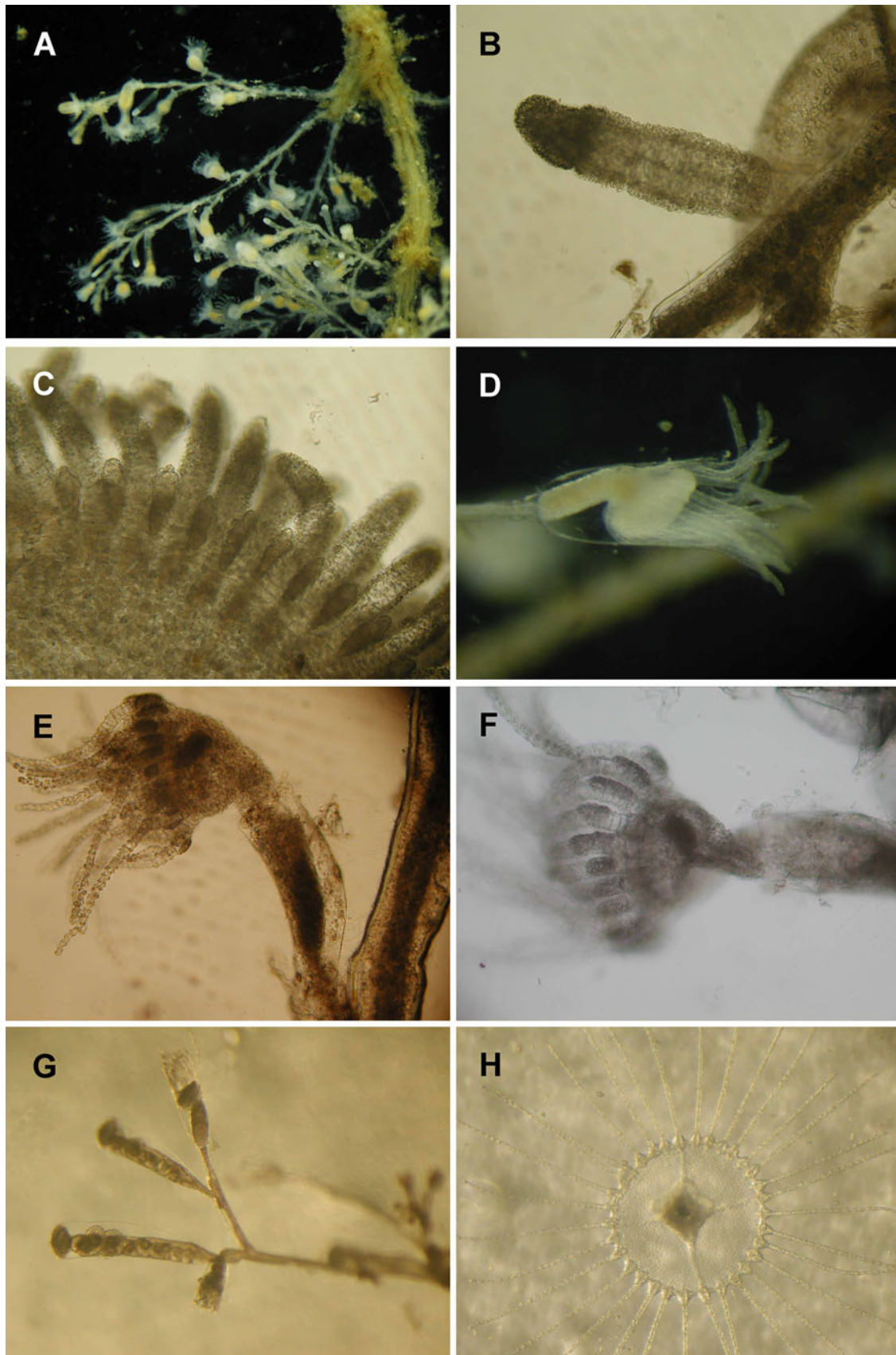
Distribution Pan-Antarctic (Peña Cantero and Ramil 2006). In Antarctic waters, known from the Ross Sea (Hickson and Gravely 1907; Ritchie 1913; Totton 1930), Gauss Station (Vanhöffen 1910), the Davis, Sodruzestva, and Cosmonauts seas (Stepanjants 1979), and the Balleny Islands (Peña Cantero 2009), in East Antarctica, and from Palmer Archipelago (Billard 1914), the Bellingshausen Sea (Stepanjants 1979), off Peterman Island (Blanco 1978), Elephant Island, Snow Island and Shag Rocks (Peña Cantero and García Carrascosa 1995), the Bransfield Strait area (Peña Cantero and Ramil 2006), the South Shetland Islands (Peña Cantero 2008) and off Bouvet (Peña Cantero and Gili 2006), in West Antarctica. Our material comes from Tethys Bay.

Family Sertulariidae Lamouroux, 1812

***Symplectoscyphus plectilis* (Hickson and Gravely, 1907)** (Fig. 9e, f)

*Symplectoscyphus plectilis*—Peña Cantero, 2010: 40 (synonym); 2012: 862.

Material examined **Stn 5**, 05.01.03, 48 m, three masses of stems, up to 40 mm in diameter, with immature



◀ **Fig. 9 a–c** *Hydrodendron arboreum*: **a** fragment of stem and branches; **b** nematophores; **c** polyp tentacles showing unidentified masses at the axil of tentacles. **d** *Campanularia* sp.: hydrotheca and polyp. **e–f** *Symplectoscyphus plectilis*: **e** hydrothecae and polyp; **f** nematocyst pads at base of tentacles. **g–h** *Obelia bidentata*: **g** fragment of colony with hydrothecae and gonothecae; **h** medusa

gonothecae, basibiont of *Campanularia* sp.; **Stn 5**, 09.01.03, 14–40 m, several masses of stems, several centimeters in diameter; **Stn 5**, 09.01.03, 35 m, several masses of stems, up to 70 mm in diameter, basibiont of *Campanularia* sp.; **Stn 5**, 09.01.03, 40 m, several masses of stems, several centimeters in diameter, with immature gonothecae. **Stn 6**, 07.01.03, two masses of stems, up to 15 mm in diameter.

**Remarks** In our material, hydrothecae commonly collapsed due to weakness of the perisarc (Fig. 9e). For the first time, we report the presence of a distinct nematocyst pad at the base of each tentacle on the external side (Fig. 9e, f).

**Ecology** Recently reviewed by Peña Cantero (2010). *Symplectoscyphus plectilis* was considered a shelf species (Peña Cantero 2010), but Peña Cantero (2012) considerably extended its lower bathymetric limit to 1,958 m. Our material was collected at depths between 14 and 48 m. Used as substratum by colonies of *Campanularia* sp.

**Distribution** Also reviewed by Peña Cantero (2010). It is considered to have a circum-Antarctic distribution (Stepanjants 1979). Our material comes from Tethys Bay.

Family Campanulariidae Johnston, 1836

***Campanularia* sp.** (Figs. 6f, 9d)

*Campanularia* sp. Peña Cantero et al., 2004: 2299, fig. 1J; Peña Cantero, 2006: 946, fig. 5E.

**Material examined** **Stn 1**, 10.12.02, 25 m, numerous hydrothecae, on bryozoans. **Stn 2**, 18.12.02, 15 m, several hydrothecae, on bryozoans; **Stn 2**, 18.12.02, 20 m, numerous hydrothecae, on bryozoans. **Stn 3**, 23.12.02, 20 m, many hydrothecae, basibiont of *P. belgicae* and *L. longithecata*. **Stn 5**, 30.12.02, 25 m, a few hydrothecae, basibiont of *L. longithecata*; **Stn 5**, 04.01.03, 40 m, several hydrothecae, on *H. arboreum*; **Stn 5**, 05.01.03, 30 m, many hydrothecae, on tube of polychaete, bryozoans and ascidians; **Stn 5**, 05.01.03, 48 m, many hydrothecae, on *S. plectilis* and bryozoans; **Stn 5**, 09.01.03, 14–40 m, several hydrothecae, on polychaete tube; **Stn 5**, 09.01.03, 35 m, several hydrothecae, on *S. plectilis*; **Stn 5**, 09.01.03, 40 m, numerous hydrothecae, on polychaete tube. **Stn 6**, 07.01.03, many hydrothecae, basibiont of *P. belgicae*.

**Remarks** Our material is probably conspecific with the species described as *Campanularia* sp. by Peña Cantero

et al. (2004) and later found by Peña Cantero (2006). They also agree in the size of the nematocysts (c.  $9 \times 2 \mu\text{m}$ ). However, the gonotheca of this species has never been found and, consequently, the species cannot be completely characterized. Therefore, we prefer keeping it at generic level.

**Ecology** *Campanularia* sp. was collected at depths from 15 to 48 m in Rod Bay, Tethys Bay, and Punta Stocchino; epibiotic on bryozoans, tube of polychaete, ascidians, *H. arboreum*, and *S. plectilis*. Used in turn as substratum by colonies of *L. longithecata* and *O. belgicae*.

***Obelia bidentata* Clark, 1875** (Fig. 9g, h)

*Obelia austro-georgiae* Jäderholm, 1904: 7; 1905: 17, pl. 7 figs 1, 2.

*Laomedea (Obelia) bicuspidata*—Vervoort, 1972b: 92, fig. 26d.

*Obelia paulensis*—Naumov and Stepanjants, 1972: 37, fig. 2.

*Obelia bicuspidata*—Stepanjants, 1979: 37, pl. 7 fig. 1.

*Obelia longa*—Blanco, 1984: 20–21, pl. 14 figs 32–33, pl. 15 figs 34–36.

*Obelia bidentata*—Peña Cantero and Gili, 2006: 768; Peña Cantero, 2008: 462; 2009: 1749, fig. 3g; Peña Cantero and Vervoort, 2009: 89; El Beshbeeshy and Jarms, 2011: 89–92, fig. 26; Galea and Schories, 2012: 16.

**Material examined** **Stn 3**, 28.12.02, 20 m, a fragment, c. 4 mm long, with a single badly preserved hydrotheca and another fragment, c. 15 mm long, with two gonothecae. **Stn 5**, 02.01.03, 35 m, a few stems, up to 17 mm high.

**Ecology** Eurybathic species (Peña Cantero 2008). In Antarctic/sub-Antarctic waters found at depths from three (Stepanjants 1979) to 377 m (Peña Cantero and Gili 2006); present material between 20 and 35 m. Frequently reported epilithic and epibiotic on hydrozoans and other marine organisms (cf. Peña Cantero 2008) and even basibiont for other hydroids (Peña Cantero 2009).

We found gonothecae in December, and medusae were liberated in the laboratory rearings.

**Distribution** Cosmopolitan. In Antarctic waters, known from off South Georgia (Jäderholm 1905), Antarctic Peninsula (Blanco 1984), the South Shetland Islands (Peña Cantero 2008; Galea and Schories 2012), Low Island (Peña Cantero and Vervoort 2009), and Bouvet (Peña Cantero and Gili 2006), in West Antarctica, and off Adélie Land (Naumov and Stepanjants 1972), the Sodruzestva Sea (Stepanjants 1979), and the Balleny Islands (Peña Cantero 2009), in East Antarctica. Our material comes from Tethys Bay.



## General remarks

Twenty species have been found in the hydroid collection from five stations off the Italian Base “Mario Zucchelli” (Ross Sea), belonging to the orders Anthoathecata and Leptothecata, to 10 families, and to 13 genera. Anthoathecates, particularly well represented, include 11 species belonging to Clavidae, Bougainvilliidae, Eudendriidae, Hydractiniidae, Corynidae, and Zancleidae. Leptothecates, surprisingly little represented, include nine species belonging to Campanulinidae, Haleciidae, Sertulariidae, and Campanulariidae. Seven species could not be identified to species level because of the scarcity of material and/or the absence of gonophores/gonothecae.

At the family level, Hydractiniidae is the most diverse family with five species (25 %), followed by Haleciidae with four (20 %). These two families, representing only 20 % of the family diversity, account for almost half of the species diversity. At the generic level, the biodiversity is dominated by *Hydractinia*, with five species (25 %), and *Halecium* with three (15 %). Both genera, representing only 15 % of the genus diversity, account for 40 % of the species diversity.

The relatively low hydrozoan biodiversity found in the studied area seems to be a constant in most of the shallowest Antarctic areas and seems to be related to the harshness of the environment due to the effects of ice in the upper subtidal (i.e., anchor-ice formation and sea-ice scouring and abrasion).

It is remarkable the high representation of Anthoathecata, usually poorly represented in collections, particularly those obtained by indirect sampling gears. The fact that the studied material was collected by scuba diving may be one, but not the single reason of its high representation. Stepanjants (1979) already pointed out that anthoathecates are better represented in shallow waters. According to her, this larger representation was probably due to a higher tolerance of anthoathecates to reduced salinity at shallow levels. However, this interpretation is not supported by evidence of phylogenetically unrelated low salinity tolerance both in Leptothecata and in Anthoathecata species, and by proofs of osmoconformation and adaptation abilities across the two orders (e.g., Mills 1984). Peña Cantero (2004) found an inverse relationship in the bathymetric distribution between anthoathecate and leptothecate hydroids, with the former dominating in the upper levels and leptothecates being more frequent in the lower ones. According to Peña Cantero (2004), apart from Stepanjants’s explanation, other reasons (either ecological or evolutionary) could possibly explain local gradients of zonation. However, it is highly probable that a strong bias is due to sampling methods. As indicated above, anthoathecate soft bodies are usually badly recovered from indirect sampling gears, making

identification extremely difficult or even impossible. Consequently, it is not surprising that most records of anthoathecates from shallow waters are based on sampling undertaken by diving, as undertaken here, thereby providing specimens that are in generally better condition and facilitating collection of small and delicate anthoathecate polyps, often found in cryptic, sheltered micro-habitats.

The collection is also extraordinary in the complete absence or scant representation of the most typical Antarctic benthic hydroid genera (*Oswaldella*, *Staurotheca*, *Schizotricha*, *Antarctoscyphus*, *Symplectoscyphus*), likely related to the shallow depths that were sampled.

Material kept in aquaria at the Italian Antarctic Base “Mario Zucchelli” facilitated knowledge of the biology of several species. Most notably, *Opercularella belgicae* was found to liberate a medusa stage conforming to diagnoses of *Phialella*, and the species is referred to that genus here, as *P. belgicae*.

Species were found directly attached on rocks or, more often, epibiotic on other invertebrates or on macroalgae (cf. Table 3). The species with the broadest array of substrates were *P. belgicae* and *L. longithecata* with seven and six, respectively. Seven hydrozoans were observed in turn as basibionts for other species of hydroids. *Rhizorhagium antarcticum* and *E. generale* had the higher number of epibiotic hydroids (cf. Table 3).

Concerning the biogeographical distribution (cf. Table 3), of 13 species identified to species level, seven (54 %) are endemic to Antarctic waters. These include *Z. hicksoni*, with an East Antarctic distribution, and six circum-Antarctic species (*E. scotti*, *H. angusta*, *H. exaggeratum* sp. nov., *H. ovatum*, *H. secundum*, and *S. plectilis*). Four other species are also present in sub-Antarctic waters. These include three species with a Pan-Antarctic distribution (*L. longithecata*, *P. belgicae*, and *H. arboreum*) and one Antarctic-Kerguelen species (*R. antarcticum*). Thus, 11 species (c. 85 %) are restricted in their distribution to Antarctic and sub-Antarctic waters. The remaining two species have a wider distribution: *E. generale* has an Australian-Antarctic distribution, and *O. bidentata* has a worldwide distribution.

Finally, in relation to the other studies on Antarctic shallow-water hydroids, our study has some remarkable similarities and differences with them. Stepanjants (1972) found in the Davis Sea, at depths between 0 and 50 m, a higher number of species (32), with a similar number of anthoathecates (11), but a much better representation of leptothecates (as indicated above these are surprisingly little represented in our study); seven species are shared (*R. antarcticum*, *Coryne tubulosa*, *Z. hicksoni*, *L. longithecata*, *P. belgicae*, *H. arboreum*, and *S. plectilis*). Naumov and Stepanjants (1972) found in d’Urville Sea, at depths between 0 and 50 m, a slightly higher number of species



**Table 3** Benthic hydroids from Tethys Bay (Ross Sea)

|   | Depth | Known range | Substrate  | Epibionts  | Distribution |
|---|-------|-------------|--|--|--------------|
| <i>Turritopsis</i> sp.  | 20    | –           | –  | <i>L. longithec</i> a  | –            |
| <i>Rhizorhagium antarcticum</i> (Hickson and Gravely, 1907)   | 18–40 | 0–450       | Tube of polychaete, <i>E. generale</i>   | <i>Hydractinia</i> sp., <i>L. longithec</i> a, <i>P. belgicae</i>  | AK           |
| <i>Eudendrium generale</i> von Lendenfeld, 1885               | 10–40 | 10–702      | Algae  | <i>Hydractinia</i> sp., <i>P. belgicae</i> , <i>R. antarcticum</i> | AuA          |
| <i>E. scotti</i> Puce, Cerrano and Bavestrello, 2002          | 20–25 | 10–135      | Algae, bryozoans   | –  | CA           |
| <i>Hydractinia angusta</i> Hartlaub, 1904                     | 10–20 | –           | Shells of <i>Adamussium</i>  | –  | CA           |
| <i>Hydractinia</i> sp. 1                                      | 12–20 | –           | Stones   | –  | –            |
| <i>Hydractinia</i> sp. 2                                      | 12    | –           | Algae, bryozoans   | –  | –            |
| <i>Hydractinia</i> sp. 3                                      | 15–20 | –           | Algae, <i>E. generale</i> , <i>R. antarcticum</i>  | –  | –            |
| <i>Hydractinia</i> sp. 4                                      | 20    | –           | Bryozoans  | –  | –            |
| <i>Sarsia</i> sp.   | 10–40 | 3–36        | Algae, tube of polychaete  | –  | –            |
| <i>Zanclaea hicksoni</i> (Stepanjants, 1972)                  | 12–20 | 20–183      | Stones   | –  | EA           |
| <i>Lafoeina longithec</i> a Jäderholm, 1904                   | 10–35 | 5–470       | Algae, bryozoans, mollusk shells, <i>Campanularia</i> sp., <i>R. antarcticum</i> , <i>Turritopsis</i> sp.                | –  | PA           |
| <i>Phialella belgicae</i> (Hartlaub, 1904)                    | 10–40 | 0–650       | Algae, bryozoans, mollusk shells, <i>Campanularia</i> sp., <i>E. generale</i> , <i>H. ovatum</i> , <i>R. antarcticum</i> | –  | PA?          |
| <i>Halecium exaggeratum</i> sp. nov.                          | 25–30 | 92–275      | Bryozoans  | –  | CA           |
| <i>H. ovatum</i> Totton, 1930                                 | 9–40  | 3–471       | Algae, bryozoans   | <i>P. belgicae</i>   | CA           |
| <i>H. secundum</i> Jäderholm, 1904                            | 40    | 150         | –  | –  | CA           |
| <i>Hydrodendron arboreum</i> (Allman, 1888)                   | 40    | 18–1,370    | –  | <i>Campanularia</i> sp.  | PA           |
| <i>Symplectoscyphus plectilis</i> (Hickson and Gravely, 1907) | 14–48 | 7–1,958     | –  | <i>Campanularia</i> sp.  | CA           |
| <i>Campanularia</i> sp.                                       | 15–48 | –           | Bryozoans, tube of polychaete, ascidians, <i>H. arboreum</i> , <i>S. plectilis</i>                                       | <i>L. longithec</i> a, <i>P. belgicae</i>                          | –            |
| <i>Obelia bidentata</i> Clark, 1875                           | 20–35 | 3–377       | –  | –  | W            |

Depth and known range in meters. *Distribution* AK Antarctic-Kerguelen, AP Antarctic-Patagonian, AuA Australian-Antarctic, CA circum-Antarctic, EA East Antarctic, PA pan-Antarctic, W wider distribution

(27) and four common species (*H. angusta*, *L. longithec*a, *P. belgicae*, and *S. plectilis*). This study is remarkable by the low number of anthoathecates (only two at depths between zero and 50 m), probably due to the indirect sampling methods employed (as was already indicated by those authors). Finally, Galea and Schories (2012) found off King George Island, up to a depth of 43 m, the same number of species (20), but surprisingly only three of them anthoathecates, in spite of having also obtained the material by scuba diving. Only three species are shared (*H. angusta*, *H. ovatum*, and *O. bidentata*).

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