

Checklist of Singaporean Bryozoa and Entoprocta

Kevin J. Tilbrook¹ & Dennis P. Gordon²

Abstract. A checklist of 118 Singaporean species of Bryozoa (3 Cyclostomata, 7 Ctenostomata, 108 Cheilostomata) and three taxa of Entoprocta is presented, based upon sampling during recent workshops (2012–2014), registered museum material, incidental collecting and historical records. Accordingly, many species are reported for the first time from Singaporean waters, including a freshwater bryozoan (*Hislopia malayensis*), numerous marine bryozoans and an entoproct (*Pedicellina* sp.). Several easily collected intertidal species, including a population of the globally rare mangrove epiphyte *Amphibiobeania epiphylla* and certain alien-invasive taxa, are amenable to research on their biology (growth and reproduction) and ecology.

Key words. Singapore, marine biodiversity, Cyclostomata, Ctenostomata, Cheilostomata, Entoprocta

INTRODUCTION

This paper presents a checklist of 118 species of Bryozoa (3 Cyclostomata, 7 Ctenostomata, 108 Cheilostomata) and three taxa of Entoprocta for Singapore. The list was compiled from interim lists prepared by Kevin Tilbrook (October 2012, June 2013 and July 2014) and Dennis Gordon (May 2013). Species collected in 2012 during the Comprehensive Marine Biodiversity Survey of Singapore (CMBS) (Tilbrook & Gordon, 2015) and the Bryozoan and Hydroid Workshop (held at TMSI, Singapore, 29 April – 3 May 2013) are a component of the present checklist, augmented by museum material and additional collecting by Singaporean biologists in the course of other work. On the occasion of the Bryozoan Workshop, shore bryozoans were collected from St John's Island, Sisters Island, the mangrove shore on Johor Strait at the north end of Lim Chu Kang Road, and a small embayment near the west side of Kranji Dam (examined for freshwater bryozoans). Ria Tan, author of the Wild Singapore website, also brought to the workshop bryozoans collected at other locations. In total, 34 taxa of Bryozoa and one of Entoprocta were seen during the five days of the 2013 workshop. Dennis Gordon examined some species in the Raffles Museum in July 2012 and Kevin Tilbrook in October 2012 and July 2014 (registering the entirety of the Lee Kong Chian Natural History Museum bryozoan collection); Karenne Tun subsequently sent photos of *Lanceopora*. The balance of the species in the checklist is based on all other records accumulated by the authors, including from the literature (e.g., Harmer, 1915, 1926, 1934, 1957; Tilbrook, 2006).

MATERIAL AND METHODS

As noted by Tilbrook & Gordon (2015), specimens from the CMBS, earlier survey work and dredge material collected by the National University of Singapore RV Galaxea were registered into the collections of the Lee Kong Chian Natural History Museum (ZRC.BRY). All specimens collected during the 2013 workshop, including those contributed by Ria Tan, were preserved subsequent to examination of living material and likewise registered. Some material collected during the CMBS surveys were photographed or filmed live, and subsamples of certain species/colonies were separated for gene sequencing prior to long-term preservation. In a few instances where there were multiple species on a rock, the name registered is that pertaining to the one species that dominates; accordingly, the other species on the rock are not noted as being registered but are retained in the checklist (e.g., *Hippothoa flagellum*, *Parkermavella* sp. and *Crepidacantha* sp.). Specimens illustrated herein were photographed mostly by scanning electron microscopy (SEM) of colony fragments cleaned of organic material by soaking in liquid domestic bleach (aqueous sodium hypochlorite). The SEM illustrations show the skeletons of autozooids (feeding zooids) and, where present, zooid polymorphs (avicularia), reproductive structures (ooecia) and other characters.

SPECIES LIST AND SYSTEMATIC NOTES

The classification below follows that given by Bock & Gordon (2013) and Ostrovsky (2013). The 33 species listed for the Johor Straits by Tilbrook & Gordon (2015) are included below (asterisked) to show the total diversity per family. Registration numbers and localities are given for the additional species and specimens in the ZRC Collection. Other records are indicated as to source—i.e., species not seen by the authors but noted as having occurred in Singaporean waters by Harmer (1915, 1926, 1934, 1957) and Tilbrook (2006) are respectively superscripted SFH and KJT.

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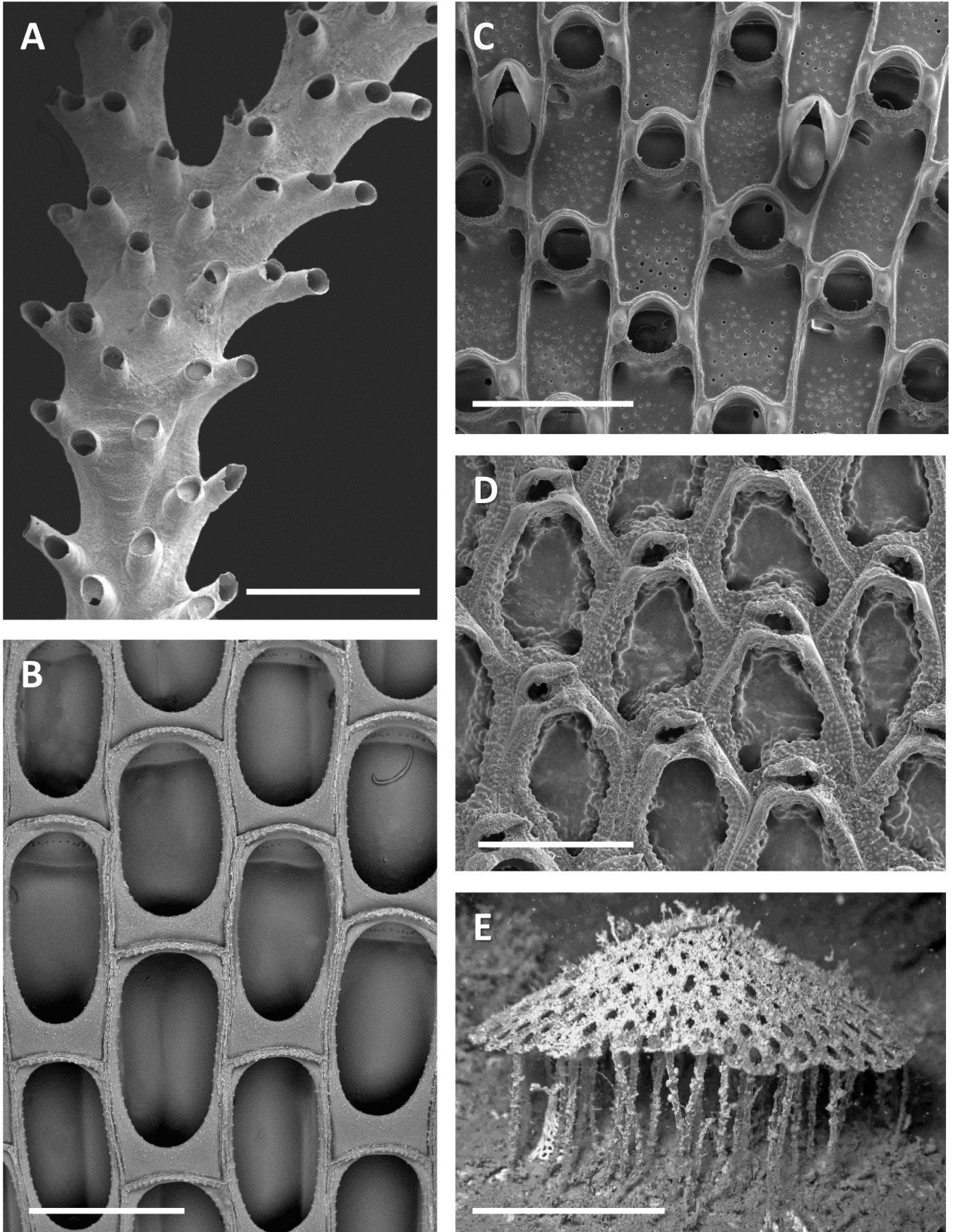


Fig. 1. A, *Nevianipora pulcherrima* (Kirkpatrick, 1890), an infertile branch; B, *Biflustra grandicella* (Canu & Bassler, 1929); C, *Thalamoporella labiata* Levinsen, 1909; D, *Cranosina coronata* (Hincks, 1881); E, *Retiflustra schoenau* Levinsen, 1909, a live colony on mud supported on stilt-like rhizoids and the feeding surface is on the underside of the elevated portion. Scale bars = 1 mm (A); 0.5 mm (B–D); 50 mm (E).

PHYLUM BRYOZOA Ehrenberg, 1831

Class STENOLAEMATA Borg, 1926

Order CYCLOSTOMATA, Busk, 1852

Suborder Tubuliporina Milne Edwards, 1838

Family Diastoporidae Gregory, 1899

Desmeplagioecia lineata (MacGillivray, 1885)
SFH

Family Diaperoeciidae

Nevianipora pulcherrima (Kirkpatrick, 1890)
ZRC.BRY.0114 Sisters Buoy

Suborder Articulata Busk, 1859

Family Crisiidae Johnston, 1847

Crisia cf. *setosa* MacGillivray, 1869 ZRC.
BRY.0062–64, 0659 St John's Island; Eastern
Fairway off Marina East

Class GYMNOLAEMATA Allman, 1856

Order CTENOSTOMATA Busk, 1852

Superfamily Hislopioidea Jullien, 1885

Family Hislopiidae Jullien, 1885

Hislopia malayensis Annandale, 1916
ZRC0323 Kranji Dam Reservoir.

Superfamily Alcyonidioidea Johnston, 1838

Family Alcyonidiidae Johnston, 1838

Alcyonidium jauhar Tilbrook & Gordon, 2015*
ZRC0548–0550 north coast of Pulau Ubin

Superfamily Arachnidioidea Hincks, 1880a

Family Arachnidiidae Hincks, 1880a

Nolella cf. *gigantea* (Busk, 1856)* ZRC.
BRY.0474, 0575, 0577, 0622, 0625 Lim Chu
Kang mangroves.

Superfamily Victorelloidea Hincks, 1880a

Family Sundanellidae Jebram, 1973

Sundanella sibogae (Harmer, 1915)* ZRC.
BRY.0484, 0484 Lim Chu Kang mangroves.

Superfamily Vesicularioidea Johnston, 1847

Family Vesiculariidae Johnston, 1847

Amathia vermetiformis Harmer, 1926*
Amathia verticillata (Della Chiaje, 1822)*
ZRC.BRY.0457, 0476 SW47, 0574, 0576,
0585, 0587, 0589, 0591–93, 0602, 0639 OBS
Camp jetty, Pulau Ubin; Pulau Ubin jetty;
Pulau Seletar; Changi; Pulau Serangoon.
Amathia sp. ZRC.BRY.0485, 0569, 0571,
0573, 0580, 0623 OBS Camp jetty, Pulau
Ubin; Southern Fairway; Raffles Lighthouse.

Order CHEILOSTOMATA

Suborder Inovicellina Jullien, 1888

Superfamily Aeteoidea Smitt, 1868a

Family Aeteidae Smitt, 1868a

Aetea ligulata Busk, 1852*
Aetea sp. 'short' ZRC.BRY.0032, 0034, 0043,
0495, 0505; Pulau Hantu; Cyrene Reef; St
John's Island jetty.

Suborder Malacostegina Levinsen, 1902

Superfamily Membraniporoidea Busk, 1852

Family Electridae Stach, 1937

Arbopercula bengalensis (Stoliczka, 1869)*
ZRC.BRY.0075, 0451, 0454, 0647, 0660
Eastern Bunkering A anchorage off Changi
East; Laba Buoy, W Johor Strait; Sungei Buloh
Besar; Pulau Tekong coastal area.

Conopeum sp.* ZRC.BRY.0099, 0487 Lim
Chu Kang mangroves

Tarsocryptus laboriosus (Tilbrook, 2006) ZRC.
BRY.0408, 0410, 0483 Changi, on seagrass

Family Membraniporidae Busk, 1852

Biflustra grandicella (Canu & Bassler, 1929)
ZRC.BRY.0001, 0471, 0558, 0643 west of
Sungei Buloh Besar; Pulau Tekong coastal
area; Pulau Ubin jetty.

Biflustra perambulata Louis & Menon, 2009*
Biflustra sp. ZRC.BRY.0482, 0524 Brani Buoy;
Eastern Bunkering A anchorage off Changi
East.

Jellyella tuberculata (Bosc, 1802) ZRC.
BRY.0073, 0421, 0582, 0596 Eastern
Bunkering A anchorage off Changi East;
Sungei Buloh Besar; Tanjong Tajam, Pulau
Ubin

Family Sinoflustridae Gordon, 2009

Sinoflustra amoyensis (Robertson, 1921)*
ZRC.BRY.0072, 0076, 0448, 0664 Eastern
Bunkering A anchorage off Changi East.

Sinoflustra annae (Osburn, 1953)* ZRC.
BRY.0048, 0111, Pulau Tekong coastal area;
OBS Camp, Pulau Ubin

Suborder Thalamoporellina Ostrovsky, 2013

Superfamily Thalamoporelloidea Levinsen, 1902

Family Thalamoporellidae Levinsen, 1902

Thalamoporella labiata Levinsen, 1909* ZRC.
BRY.0122 Angler Buoy, East Johor Strait
Thalamoporella tubifera Levinsen, 1909 not
ZRC-registered

Family Steginoporellidae Hincks, 1884

Steginoporella magnilabris (Busk, 1854) ZRC.
BRY.0626 Pulau Biola

Suborder Flustrina Smitt, 1868b

Superfamily Calloporoidea Norman, 1903

Family Calloporidae Norman, 1903

Cranosina coronata (Hincks, 1881) ZRC.
BRY.0004, 0042, 0439, 0500, 0620 Pulau
Hantu; St John's Island; Sisters Islands;
Lazarus Island

Crassimarginatella corniculata Tilbrook,
Hayward & Gordon, 2001 ZRC.BRY.0024
Pulau Hantu

Parellisina curvirostris (Hincks, 1862)

Family Cymuloporidae Winston & Vieira, 2013

Crepis sidneyi Reverter-Gil, Souto &
Fernández-Pulpeiro, 2011 ZRC.BRY.0115
Eastern Petroleum A anchorage

Family Antroporidae Vigneaux, 1949

Antropora minor (Hincks, 1880b) ZRC.
BRY.0127, 0130, 0494 Pulau Jong; Little
Sister Island, Eastern Boarding Ground A

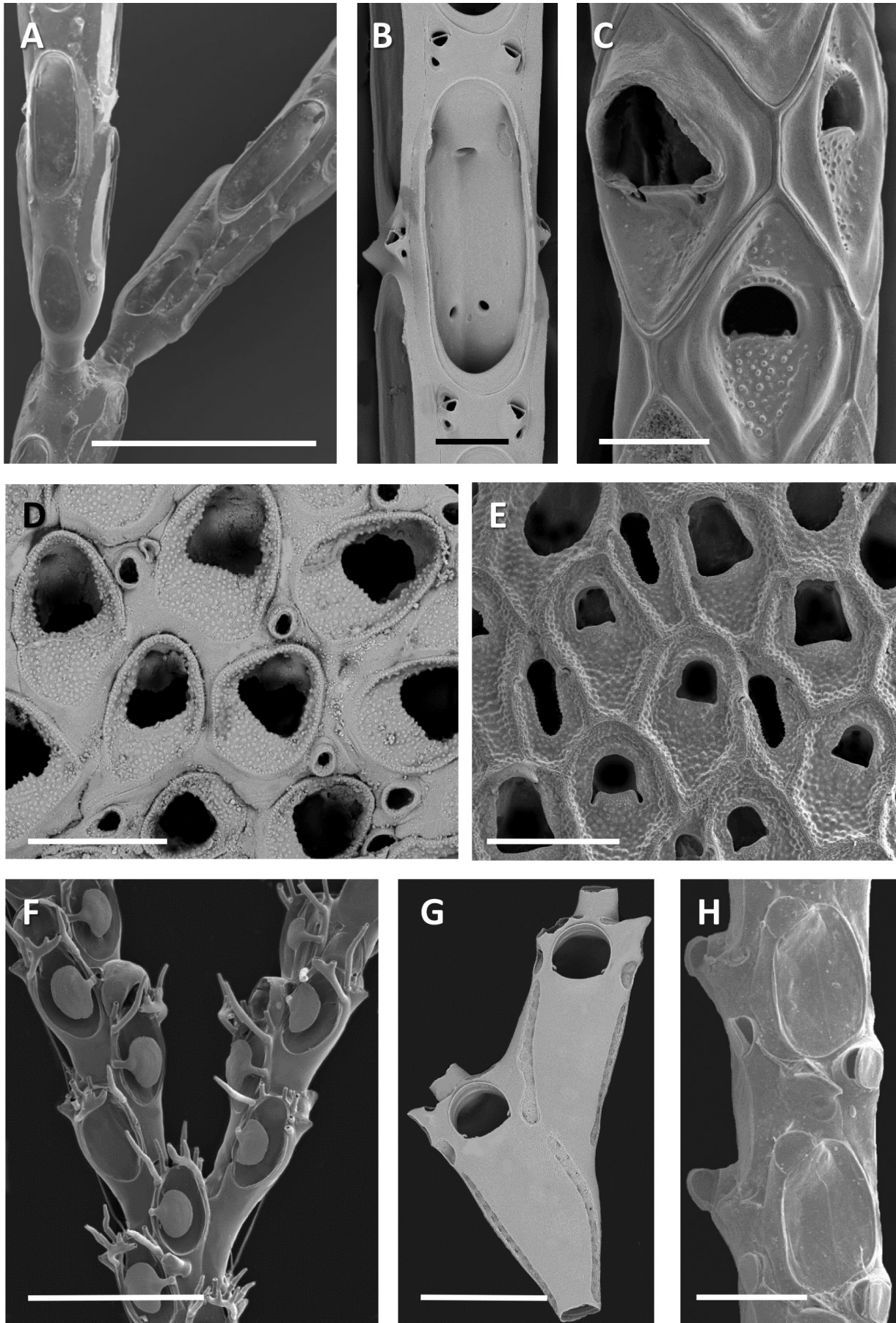


Fig. 2. A, B, *Nelliella tenella* (Lamarck, 1816), respectively showing a branch bifurcation (unbleached) and a bleached zooid; C, *Cellaria punctata* (Busk, 1852); D, *Antropora minor* (Hincks, 1880); E, *Smittipora cordiformis* (Harmer, 1926); F, *Aspiscellaria frondis* (Kirkpatrick, 1890); G, bizooidal internode of *Catenicella tuberculifera* Harmer, 1957. H, *Poricellaria ratoniensis* Waters, 1887. Scale bars = 0.5 mm (A, E, F); 0.1 mm (B, C); 0.2 mm (D, G, H).

- Family Cupuladriidae Lagaaij, 1952
Cupuladria guineensis (Busk, 1854) ^{SFH}
- Family Quadricellariidae Gordon, 1984
Nellia tenella (Lamarck, 1816)* ZRC.
 BRY.0060, 0362, 0649 Pulau Tekong coastal areas
- Superfamily Flustroidea Fleming, 1828
 Family Flustridae Fleming, 1828
Retiflustra schoenau Levinsen, 1909 ZRC.
 BRY.0256, 0293, 0568, 0570 W of Terumbu Pempang Laut; Eastern Bunkering A anchorage off Changi East
- Superfamily Buguloidea Gray, 1848
 Family Bugulidae Gray, 1848
Bugula neritina (Linnaeus, 1758)* ZRC.
 BRY.0027, 0028, 0450, 0563, 0614, 0624, 0640–42, 0646, 0653 Pulau Jong; OBS Camp jetty, Pulau Ubin; fish farm off Changi; Pulau Ubin jetty
Bugula sp. 1*
Bugula sp. 2 ZRC.BRY.0012, 0014 St John's & Lazarus Island jetties
Caulibugula sp. ZRC.BRY.0016 Eastern Boarding Ground A off Changi East
Virididentula dentata (Lamouroux, 1816) ZRC.
 BRY.0334 off Changi Naval Base
- Family Beaniidae Canu & Bassler, 1927
Amphibiobeania epiphylla Metcalfe, Gordon & Hayward, 2007* ZRC.BRY.0435, 0488, 0490 Lim Chu Kang mangroves
Beania cookae Tilbrook, Hayward & Gordon, 2001 ZRC.BRY.0092, 0093 St John's Island
Beania regularis Thornely, 1916 ZRC.
 BRY.0247 Pulau Jong
- Family Candidae d'Orbigny, 1851
Aspiscellaria frondis (Kirkpatrick, 1890) ZRC.
 BRY.0067, 0567 Pulau Jong
Caberea transversa Harmer, 1926 ZRC.
 BRY.0036 St John's Island jetty
Licornia curvata (Harmer, 1926) ZRC.
 BRY.0489 5514TB1
Licornia diadema Busk, 1852* ZRC.
 BRY.0058, 0453, 0479 Pulau Tekong coastal area, Balok Buoy off Pulau Senang
Licornia ferox Busk, 1852 ^{SFH}
Licornia longispinosa Harmer, 1926 ^{SFH}
Paralicornia sinuosa (Canu & Bassler, 1927)* ZRC.BRY.0054, 0061 Sungei Besar, Eastern Fairway
- Family Epistomiidae Gregory, 1893
Synnotum aegyptiacum (Audouin, 1826)* ZRC.BRY.0006, 0540, 0545, 0566 near Pulau Sudong; Pulau Semakau; St John's Island; Pulau Tekong
- Superfamily Microporoidea Gray, 1848
 Family Calescharidae Cook & Bock, 2001
Caleschara minuta (Maplestone, 1909)* ZRC.
 BRY.0449 Johor Strait
- Family Onychocellidae Jullien, 1882a
Smittipora cordiformis Harmer, 1926 ZRC.
 BRY.0010, 0309, 0621, 0628 Pulau Hantu; Raffles Lighthouse; Pulau Biola
- Family Poricellariidae Harmer, 1926
Poricellaria ratoniensis (Waters, 1887b) ZRC.
 BRY.0022, 0101, 0446 St John's Island
- Superfamily Cellarioidea Fleming, 1828
 Family Cellariidae Fleming, 1828
Cellaria punctata (Busk, 1852) ZRC.
 BRY.0011, 0019 St John's Island
- Superfamily Cribrilinoidea Hincks, 1879
 Family Cribrilinidae Hincks, 1879
Figularia fissa (Hincks, 1880b) ^{SFH}
Puellina vicariata (Waters, 1923) ^{SFH}
Puellina sp. ZRC.BRY.0030, 0428, 0436, 0442 Pulau Tekukor; Kusu Island; Big Sister Island
- Superfamily Catenicelloidea Busk, 1852
 Family Catenicellidae Busk, 1852
Catenicella triangulifera (Harmer, 1957) ZRC.
 BRY.0013 St John's Island jetty
Catenicella uberrima (Harmer, 1957) ^{SFH}
Vasignyella otophora (Kirkpatrick, 1890) ZRC.
 BRY.0020 no location
- Family Savignyellidae Levinsen, 1909
Savignyella lafontii (Audouin, 1826) ZRC.
 BRY.0017, 0071 St John's & Lazarus Island jetties
- Superfamily Hippothooidea Busk, 1859
 Family Hippothoidae Busk, 1859
Hippothoa flagellum Manzoni, 1870 unregistered, St John's Island
- Family Chozoporidae Vigneaux, 1949
Chozopora brongniartii (Audouin, 1826) ZRC.BRY.0031, 0506 Pulau Hantu; Pulau Tekukor
- Family Trypostegidae Gordon, Tilbrook & Winston in Winston, 2005
Trypostega henrychaneyi Tilbrook, 2006 ZRC.
 BRY.0123 Eastern Bunkering A anchorage off Changi East
- Superfamily Arachnopusioidea Jullien, 1888
 Family Arachnopsiidae Jullien, 1888
Poricella celleporoides (Busk, 1884) ZRC.
 BRY.4413 DR1-009
Poricella spathulata (Canu & Bassler, 1929) ZRC.BRY.0021 Lazarus Island jetty
- Family Exechonellidae Harmer, 1957
Exechonella ampullacea Hayward & Ryland, 1995 ZRC.BRY.0039, 0597 Pulau Jong; Jurong Island
Exechonella cf. *grandis* (Duvergier, 1921) ZRC.BRY.0084, 0486 Raffles Lighthouse; Pulau Tekong
- Superfamily Adeonoidea Busk, 1884
 Family Adeonidae Busk, 1884
Adeona articulata Canu & Bassler, 1929 ^{SFH}
Adeonella extensa Harmer, 1957 ^{SFH}
Adeonella intricaria Busk, 1884 ^{SFH}
Adeonella lichenoides (Lamarck, 1816) ^{SFH}
- Superfamily Lepralielloidea Vigneaux, 1949
 Family Lepraliellidae Vigneaux, 1949

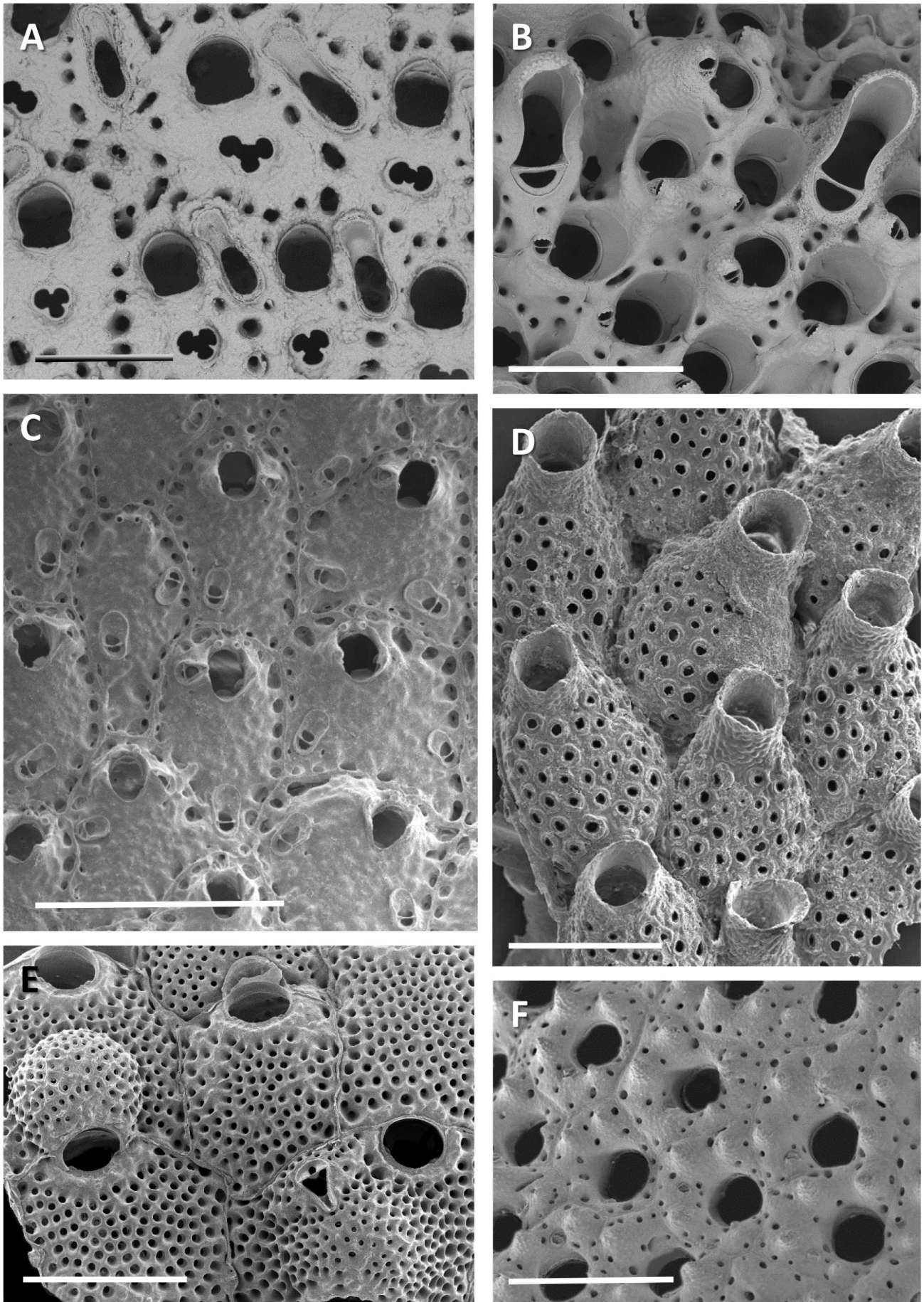


Fig. 3. A, *Poricella celleporoides* (Busk, 1884); B, *Celleporaria aperta* (Hincks, 1882); C, *Parasmittina galerita* Ryland & Hayward, 1992; D, *Exechonella ampullacea* Hayward & Ryland, 1995; E, *Calyptotheca tenuata* Harmer, 1957; F, *Trematoecia clivulata* Tilbrook, 2006. Scale bars =0.5 mm.

- Celleporaria aperta* (Hincks, 1882)* ZRC.
BRY.0413, 0529, 0531, 0532, 0537, 0652
Pulau Biola; Pulau Hantu; Kusu Island; Pulau
Tekukor; Raffles Marina
- Celleporaria fusca* (Busk, 1854)^{SFH}
- Celleporaria tridenticulata* (Busk, 1881)*
ZRC.BRY.0052, 0512, 0535, 0560 Sungei
Buloh Besar; Pulau Tekong; Pulau Jong
- Celleporaria* sp. ZRC.BRY.0077, 0078, Pulau
Hantu
- Drepanophora indica* Hayward, 1988 ZRC.
BRY.0025 Pulau Hantu
- Family Romancheinidae Jullien, 1888
- Hippomenella* sp. ZRC.BRY.0629 Pulau Biola
- Superfamily Smittinoidea Levinsen, 1909
- Family Smittinidae Levinsen, 1909
- Parasmittina galerita* Ryland & Hayward,
1992*
- Parasmittina vacuramosa* Lu, Nie & Zhong
in Lu, 1991 ZRC.BRY.0109 St John's Island
DSTA lagoon
- Parasmittina* sp. 1 ZRC.BRY.0053 no location
- Parasmittina* sp. 2*
- Parasmittina* sp. 3 ZRC.BRY.0081–83 St
John's Island; Kusu Island
- Pleurocodonellina macroporata* Tilbrook,
2006 ZRC.BRY.0098, 0104, 0105, 0426, 0536,
0613, 0617 St John's Island; Big Sister Island;
Kusu Island; Pulau Jong; Tanjong Tajam,
Pulau Ubin
- Family Bictiporidae MacGillivray, 1895
- Hippoporina indica* Pillai, 1978* ZRC.
BRY.0051, 0055, 0455, 0461, 0561, 0581,
0650, 0655 Sungei Buloh Besar; Pulau Tekong
coastal area; OBS Camp jetty, Pulau Ubin
- Parkermavella* sp. unregistered, St John's
Island
- Family Lanceoporidae Harmer, 1957
- Calyptotheca tenuata* Harmer, 1957* ZRC.
BRY.0059, 0499, 0533 Sungei Buloh Besar;
Pulau Jong
- Calyptotheca wasinensis* (Waters, 1913) ZRC.
BRY.0116, 0416, 0452, 0599 Sisters Buoy;
Lazarus Island; Jurong Island
- Lanceopora* sp. ZRC.BRY.0007 Eastern
Fairway, Singapore Strait
- Family Watersiporidae Vigneaux, 1949
- Watersipora subatra* (Ortmann, 1890) ZRC.
BRY.0496 Little Sisters Island
- Superfamily Schizoporelloidea Jullien, 1882b
- Family Schizoporellidae Jullien, 1882b
- Stylopoma amboyna* Tilbrook, 2001 ZRC.
BRY.0586 Raffles Lighthouse
- Stylopoma velatum* Tilbrook, 2001 ZRC.
BRY.0087, 0414, 0627, 0636 Raffles
Lighthouse; Pulau Biola; Labrador Park
- Stylopoma viride* (Thornely, 1905) ZRC.
BRY.0003, 0131–37, 0221, 0429, 0501, 0608,
0609, 0619 St John's Island; Raffles Lighthouse;
- Sisters Islands; Kusu Island; Tanjong Tajam,
Pulau Ubin
- Family Escharinidae Tilbrook, 2006
- Bryopesanser latesco* Tilbrook, 2006 ZRC.
BRY.0530 Eastern Holding area off Marina
East
- Family Hippaliosinidae Winston, 2005
- Hippaliosina triforma* Canu & Bassler, 1929
KJT
- Family Hippopodinae Levinsen, 1909
- Hippopodina feegeensis* (Busk, 1884)* ZRC.
BRY.0119 Sungei Buloh Besar
- Hippopodina iririkiensis* Tilbrook, 1999* ZRC.
BRY.0012, 0456, 0605–07, 0610, 0611, 0615,
0638 Brani Buoy; Pulau Tekong coastal area;
Labrador Park; Kusu Island; Lazarus Island
- Hippopodina tahitiensis* (Leca & d'Hondt,
1993) ZRC.BRY.0637 Labrador Park
- Family Margaretidae Harmer, 1957
- Margaretta opuntioidea* (Pallas, 1766)^{SFH}
- Family Microporellidae Hincks, 1879
- Microporella* sp.* ZRC.BRY.0121 Pulau
Tekong
- Family Petraliellidae Levinsen, 1909
- Mucropetraliella bifidata* Tilbrook, 2006 ZRC.
BRY.0026 south of Kusu Island
- Mucropetraliella loculifera* Harmer, 1957^{SFH}
- Mucropetraliella thenardii* (Audouin, 1826)
SFH
- Petraliella dentilabris* (Ortmann, 1892)* ZRC.
BRY.0008, 0117, 0246, 0417, 0520 Tanjong
Tajam, Pulau Ubin; Johor Strait; Kusu Island;
Lazarus Island; St John's Island
- Family Robertsoniidae Rosso, Sciuto & Sinagra,
2010
- Robertsoniella argentea* (Hincks, 1881) ZRC.
BRY.0015, 0432 Pulau Jong; St John's Island
- Superfamily Mamilloporoidea Canu & Bassler, 1927
- Family Crepidacanthidae Levinsen, 1909
- Crepidacantha* sp. (unregistered) St John's
Island
- Superfamily Celleporoidea Johnston, 1838
- Family Colatooeciidae Winston, 2005
- Cigclisula areolata* (Kirkpatrick, 1890) ZRC.
BRY.0033, 0035, 0038, 0556, 0557, 0656,
0657 Eastern Boarding Ground, off Marina
East; Terumbu Raya off Pulau Semakau;
Changi
- Cigclisula fruticosa* Hayward & Ryland, 1995*
ZRC.BRY.0046, 0056 Johor Straits
- Cigclisula occlusa* (Busk, 1884)^{SFH}
- Trematooecia clivulata* Tilbrook, 2006 ZRC.
BRY.0029, 0598 St John's Island; Jurong
Island
- Family Phidoloporidae Gabb & Horn, 1862
- Iodictyum sanguineum* (Ortmann, 1890)*
Iodictyum sp. ZRC.BRY.0057, 0118 Eastern
Fairway off Marina East
- Lifuella* sp. ZRC.BRY.0079, 0469, 0538, 0542
Pulau Hantu

Plesiocleidochasma laterale (Harmer, 1957)
 ZRC.BRY.0124, 0477, 0525 Southern Fairway
 off St John's Island; Pulau Jong
Rhynchozoon haha Hayward, 1988 ZRC.
 BRY.0079, 0107, Pulau Hantu; St John's
 Island
Triphyllozoon arcuatum (MacGillivray, 1889)
 ZRC.BRY.0018, 0037 Kusu Island
Triphyllozoon hirsutum (Busk, 1884) ^{SFH}
Triphyllozoon tubulatum (Busk, 1884) ^{SFH}
 Superfamily Conescharellinoidea Levinsen, 1909
 Family Conescharellinidae Levinsen, 1909
Conescharellina catella Canu & Bassler, 1929
 ZRC.BRY.0002, Pulau Hantu
Flabellopora irregularis Canu & Bassler, 1929
 ZRC.BRY.0005 near Eastern Bunkering A
 anchorage off Changi East

PHYLUM ENTOPROCTA Nitsche, 1870

Order SOLITARIA Emschermann, 1972

Family Loxosomatidae Hincks, 1880a
Loxosoma spp. ^{SFH}

Order COLONIALES Emschermann, 1972

Family Barentsiidae
Barentsia gracilis (M. Sars, 1835) ^{SFH}
 Family Pedicellinidae Johnston, 1847
Pedicellina sp. unregistered St John's Island

A fuller account of the species listed above requires more-detailed taxonomic analysis of those species having uncertain identity, in some instances because colonies were represented by small or infertile specimens that lacked diagnostic characters. For example, a ctenostome bryozoan that resembles *Nolella gigantea* Busk, 1856 was found growing intermixed with *Sundanella sibogae* among mangroves at the east side of the north end of Lim Chu Kang Road (W Johor Strait). It may be the same as "*N. sp.* (as *N. papuensis* Menon, 1972)" in d'Hondt (1983, p. 46), non *N. papuense* Busk, 1886 (= *N. gigantea*). Live zooids had eight tentacles. In the same environment an undetermined species of *Conopeum* grew on the underside of carapaces of the mangrove horseshoe crab *Carcinoscorpius rotundicauda*. Other undetermined species belong to the order Cyclostomata and the cheilostome families Aeteidae, Electridae, Membraniporidae, Thalamoporellidae, Calloporidae, Bugulidae, Cribrellinidae, Exechonellidae, Lepraliellidae, Romancheinidae, Smittinidae, Bitectiporidae, Lanceoporidae, Microporellidae, Crepidacanthidae and Phidoloporidae. All of these need to be examined in detail by scanning electron microscopy and compared with congeners from the wider region. The record of *Thalamoporella tubifera* in the checklist is based on a colony found attached to a specimen of *Iodictyum* from Singapore in the Australian Museum. An historic record of undetermined loxosomatid entoprocts (Harmer, 1915) on colonies of *Triphyllozoon* signifies that these solitary creatures too are in need of further study. They are not uncommon epizoites of fenestrate bryozoans and certain other invertebrates but are mostly very small and easily overlooked.

DISCUSSION

The 118 species of Bryozoa listed herein were collected from a wide range of habitats, including muddy and rocky shores, seagrass meadows, macroalgae, anthropogenic substrata like wharf pilings and subtidally by diving and dredging. The most unusual habitat is, arguably, mangrove leaves at waist- to chest-height off the mangrove floor; the beaniid cheilostome *Amphibiobeania epiphylla* occurs on the undersides of leaves of *Avicennia alba* and *A. rumphiana* at a slightly lower level on these trees than the saddle oyster *Enigmonia aenigmatica*. Nothing is known about the reproductive biology of this apparently rare bryozoan species (previously known only from the Darwin area, Australia), and the easily accessible population at the north end of Lim Chu Kang Road would be worthy of study. In the same habitat, the ctenostome *Sundanella sibogae* is abundant. Masses of colonies, instantly recognisable by the relatively large size of the zooids, occur in bands around the bases of mangrove trees and on other substrata (mostly trash). Although this unusual species is geographically widespread in the tropical Indo-Pacific, it has never been the subject of an intensive autecological study, which would make a valuable contribution to the broader knowledge of Ctenostomata. The large zooid size renders this species a potentially useful model organism for bryozoan studies.

The occasion of the Bryozoan and Hydroid Workshop held at the Tropical Marine Science Institute on St. John's Island, Singapore, 29 April – 3 May 2013 provided an opportunity to examine live Singaporean bryozoans microscopically, learning details of biology not previously recorded for some species. For example, colonies of *Tarsocryptus laboriosus*, a tiny transparent species found on the leaves of sea grasses (*Halophila ovalis*, *H. spinulosa*) provided by Ria Tan to the workshop, was found to be producing abundant sperm on 2 May. This workshop also yielded the first Singaporean record of a freshwater bryozoan (*Hislopia malayensis*), several marine bryozoans, and a new generic record of phylum Entoprocta (*Pedicellina*). The freshwater bryozoan, which is widely distributed in SE Asia, was found in Kranji Dam reservoir (1°22'32.18" N, 104°00'21.3" E) under rocks and submerged leaves of large plants. Only a few zooids of the entoproct were found, on the underside of a rock along the northwestern shore of St John's Island at low tide. Harmer (1915, pp. 17, 28) had previously reported undetermined species of solitary entoprocts and the colonial entoproct *Barentsia gracilis*; the wide geographic distribution attributed to this latter taxon, however, suggests that more than one species is involved.

Some of the species in the checklist are clearly invasive (for example, *Bugula neritina* and *Watersipora subatra*); others are probably invasive (e.g., *Biflustra perambulata* and *Hippoporina indica*); many others on the list are certainly cryptogenic. The majority of bryozoan species, however, generally widespread in the tropical Indo-West Pacific, are anticipated to be native to Singapore.

The Bryozoa of Singapore have long been overlooked and

understudied. In the event, several easily collected intertidal species, including populations of *Sundanella sibogae*, *Amphibiobeania epiphylla* and some of the alien-invasive taxa, are amenable to research on their biology (growth and reproduction) and ecology. Although a number of taxa in the above list are presently undetermined to species, the total number encountered is at least indicative of the hitherto unappreciated diversity of phylum Bryozoa in Singapore's waters. As Tilbrook & Gordon (2015) pointed out, the actual diversity of Singaporean Bryozoa is likely to reach or exceed 200 species.

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