Four New Records of Two Genera Balanophyllia and Cladopsammia (Anthozoa: Hexacorallia: Scleractinia: Dendrophylliidae) from Korea

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ABSTRACT

The four species of the family Dendrophylliidae are newly recorded in Korea: Balanophyllia (Balanophyllia) cumingii Milne Edwards and Haime, 1848, Balanophyllia (Balanophyllia) vanderhorsti Cairns, 2001, Cladopsammia eguchii (Wells, 1982), and Cladopsammia gracilis (Milne Edwards and Haime, 1848). The two genera of Balanophyllia and Cladopsammia, to which the four species belong, are newly recorded in Korea. They were collected from the subtidal zones in Jeju-do Island, Korea by SCUBA diving from 1987 to 2012. This study aims to identify the four dendrophyllid species based on external and internal morphological characters including growth form, size, budding, and color of colonies, shape and size of corallites, columella, theca, and septa. Balanophyllia (Balanophyllia) cumingii is distinguished by its solitary growth form, small and low subturbinate corallite with enlarged calice, and expanded basal part, exsert first and second septa, and Pourtalès plan. Balanophyllia (Balanophyllia) vanderhorsti is characterized by its quasi-colonial growth form, subturbinate corallites with compressed calice, thick theca, and Pourtalès plan. Cladopsammia eguchii is characterized by its phaceloid growth form of compressed corallites basally united with common coenosteum, flat spongy columella, thick theca, and Pourtalès plan. Cladopsammia gracilis is distinguished by its phaceloid growth form of corallites basally united with common coenosteum, and pronounced Pourtalès plan forming flower patterns.

Keywords: Scleractinia, Dendrophylliidae, Balanophyllia, Cladopsammia, Korea

INTRODUCTION

The family Dendrophylliidae Gray, 1847 includes 20 genera and approximately 150 species (Daly et al., 2007). It accounts for 10% of 1,488 species in the order Scleractinia, and 21% of 711 azooxanthellate scleractinian corals (Roberts et al., 2009). Dendrophylliids occur worldwide except in Antarctic regions at depths from the intertidal zone to 2,165 m, but most commonly at depths of 50–300 m (Cairns, 2001). The family Dendrophylliidae is characterized by its synapticulotheca with septa of one fan system. Seven species and three sub-species of four genera in the family have been reported from Korean waters since 1982 (Song, 1982, 1988, 1991, 1994, 2004; Song and Lee, 1998). The two newly recorded genera in Korea, Balanophyllia and Cladopsammia, are distinguished as follows. The genus Balanophyllia is characterized by its solitary or quasi-colonial growth form, and low subturbi-
developed. Pourtalès plan present. Columella spongy. Costae usually well developed. Synapticulotheca well developed. The specimens of the present study are deposited at the Ewha Womans University Zoological Systematics and Conservation Ecology Lab (EWZS), the Korean Coral Resource Bank (KCRB), and the Ewha Womans University Natural History Museum (EWNHMAN) in Korea.

**SYSTEMATIC ACCOUNTS**

Phylum Cnidaria Hatschek, 1888  
Class Anthozoa Ehrenberg, 1834  
Subclass Hexacorallia Haeckel, 1866  
Order Scleractinia Bourne, 1900  
Suborder Dendrophylliidae Gray, 1847

**Diagnosis.** Synapticulotheca developed. Septa of one fan system. Pourtalès plan usually developed.

18° *Genus Balanophyllia* Wood, 1844

**Diagnosis.** Corallum solitary or quasi-colonial, attached or free. Costae usually well developed. Synapticulotheca well developed. Pourtalès plan present. Columella spongy.

28° *Subgenus Balanophyllia* Wood, 1844


38° *Balanophyllia (Balanophyllia) cumingii* Milne Edwards and Haime, 1848 (Fig. 1)

*Balanophyllia (Balanophyllia) cumingii* Milne Edwards and Haime, 1848: 87, Pl. 1, fig. 8; Ogawa, 1968: C51, Pl. C21, figs. 7, 8; Cairns, 1994: 81, Pl. 35d, e; Ogawa, Takahashi and Chiba, 1998: 147, Pl. 2, figs. 6, 7.


**Description.** Corallum solitary, attached. Corallite subturbinate with enlarged calice, slender lower part, and expanded basal part, 7 × 9 mm in calicular diameter, 7 × 7 mm in pedicel diameter, 8 × 16 mm in basal diameter, 10–19 mm in height. Calice circular or elliptical, irregular. Upper calicular margins compressed, enlarged. Columella rudimentary spongy interconnected by inner edges of septa, 0.5 × 1.8 mm in diameter. Fossa 6 mm in depth. Theca 0.17–0.56 mm (average 0.33 mm) in thickness. Epitheca absent. Synapticulotheca developed in costae and intercostal striae. Costae linearly granulated, 0.12–0.33 mm (average 0.21 mm) in width. Costal granule 0.03–0.12 mm (average 0.08 mm) in diameter. Intercostal striae irregularly porous. Synapticulae 0.06–0.27 mm (average 0.13 mm) in length, 0.12–0.29 mm (average 0.22 mm) in width. Intercostal pore 0.09–0.48 mm (average 0.21 mm) in length, 0.09–0.26 mm (average 0.18 mm) in width. Septa hexameroously arranged with 48 in 4 complete cycles. Pourtalès plan present. S1 > outer S4 ≥ S2 > inner S4 > S3. S1 closely aligned in parallel with its neighboring S4s. S1, S2, S3 straightly aligned. Outer S4 slightly curved toward S2. Pairs of S4s united before common S3. S1, outer S4 fused with columella. Inner edges of all septa vertical, straight. Inner edges of S2, S3 usually free, rarely fused. Upper margins of S1, S2 exerted. Outer thecal margins of S1, S2 thickened. Septal faces covered with small spines.

**Habitat.** The species inhabits subtidal zones of 20–25 m in depth.

**Remarks.** This species is characterized by its small low solitary corallite with enlarged calice, and expanded basal part. The specimen in the present study has small calicular diameter, hexameroeous septa of 4 complete cycles, indistinctive pedicel, and rudimentary columella in comparison with the species in the previous descriptions (Milne Edwards and Haime, 1848; Cairns, 1994; Ogawa et al., 1998).

**Distribution.** Pacific Ocean: Korea (Jeju-do Island); Japan (Amami, Aomori, Jogashima Island, Minabe, Sagami Bay, Suruga Bay, Toyama Bay, Wakasa Bay); Philippines.

48° *Balanophyllia (Balanophyllia) vanderhorsti* Cairns, 2001 (Fig. 2)

*Balanophyllia ponderosa* van der Horst, 1926: 49, Pl. 3, figs. 6, 7; Cairns, 1994: 83, Pl. 36a, b; Ogawa, Takahashi and Chiba, 1998: 147, Pl. 2, figs. 6, 7.

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Balanophyllia (Balanophyllia) vanderhorsti Cairns, 2001: 14; Tachikawa, 2005: 11, Pl. 4, figs. I, J [replacement name for Balanophyllia ponderosa van der Horst, 1926].


Description. Corallum quasi-colonial, attached. Growth form phaceloid of corallites basally united without main trunk, 20–50 mm in width, 30–35 mm in height. Extratentacular budding. Lateral branching once or twice from upper outer edges of axial corallite walls. Corallite compressed subturbinate (ceratoid to trochoïd) with basal angle of 20–45°. Axial corallite 9 × 10–13 × 17 mm (average 11.3 × 15.0 mm) in calicular diameter, 7 × 9–9 × 13 mm (average 8.3 × 11.2 mm) in pedicel diameter, 12–35 mm (average 22.6 mm) in height. Lateral corallite 4 × 5–6 × 8 mm (average 5.0 × 6.3 mm) in calicular diameter, 4–8 mm (average 5.3 mm) in height. Calice compressed, elliptical. Columella well developed oval spongy, 2.7 × 5.8–3.4 × 7.1 mm (average 2.8 × 6.8 mm) in diameter. Fossa 3–10 mm (average 9.4 mm) in depth. Theca 0.38–0.88 mm (average 0.53 mm) in thickness. Epitheca absent. Synapticulotheca developed in costae and intercostal striae. Costae linearly granulated, 0.23–0.58 mm (average 0.33 mm) in width. Costal granule 0.07–0.26 mm (average 0.13 mm) in diameter. Intercostal striae irregularly porous. Synapticulae 0.10–0.45 mm (average 0.22 mm) in length, 0.10–0.29 mm (average 0.16 mm) in width. Intercostal pore 0.07–0.43 mm (average 0.20 mm) in length, 0.06–0.28 mm (average 0.14 mm) in width. Septa hexamerously arranged with 82–96 (average 88) in 5 cycles. Pournalé plan present, but weakly, irregularly developed. S1 ≥ S2 > S3 > S4 ≥ S5. S1, S2 straightly arranged, entire, thick. Inner margins of S1, S2 straight, vertical. Outer thecal margins of S1, S2 thickened. S4, S5 often weakly developed. Pairs of S4s slightly curved or fused toward common S3, pairs of S5s slightly curved.

Chiba, 1998: 148, Pl. 3, figs. 2, 3, Pl. 4, figs. 5, 6 [Not Balanophyllia ponderosa Vaughan, 1900].

Balanophyllia (Balanophyllia) vanderhorsti Cairns, 2001: 14; Tachikawa, 2005: 11, Pl. 4, figs. 1, J [replacement name for Balanophyllia ponderosa van der Horst, 1926].

**Fig. 1.** Balanophyllia (Balanophyllia) cumingii. A, Corallum, solitary subturbinate with enlarged calice, and expanded basal part; B, Septal arrangement, Pournalé plan; C, Collumella, rudimentary spongy; D, Costae (c) granulated, intercostal striae (is) porous. Scale bars: A=1 cm, B–D=1 mm.
toward common S4. S1, S2, S3 fused with columella. Septal faces covered with small spines.

Habitat. Bryozoans, worm tubes, hydroids, and shells attach to the basal part of the corallum of the species.

Remarks. The species has been known as _Balanophyllia ponderosa_ van der Horst, 1926. However, _Balanophyllia (Balanophyllia)_ vanderhorstii as a replacement name was proposed by Cairns in 2001 because the name is preoccupied by _Balanophyllia ponderosa_ Vaughan, 1900 (Vaughan, 1900; Cairns, 2001). This species was originally described as a solitary form (van der Horst, 1926; Cairns, 1994). The quasi-colonial growth form of the specimens in the present study has been similarly reported from Japan (Ogawa et al., 1998). The specimens in the present study differ slightly from the species in the previous descriptions by the corallites of smaller calicular diameter, and irregular and weak Pourtalès plan (van der Horst, 1926; Cairns, 1994; Ogawa et al., 1998; Tachikawa, 2005).

Distribution. Pacific Ocean: Korea (Jeju-do Island); Japan (Amakusa Islands, Cape Shiono, Sagami Bay, Shirahama, Suruga Bay, Tokyo Bay); Indian Ocean: Maldive (Maldive Islands).

Genus _Cladopsammia_ Lacaze-Duthiers, 1897

Colonies phaceloid from common coenosteum. Branching rare. Pourtalès plan well developed. Columella spongy.

2* _Cladopsammia eguchii_ (Wells, 1982) (Fig. 3)

_Balanophyllia eguchii_ Wells, 1982: 211, Pl. 1, figs. 4–6; 1983: 239, Pl. 14, figs. 6–8; Ogawa, Takahashi and Chiba, 1998: 147, Pl. 2, figs. 4, 5, Pl. 4, figs. 3, 4. _Cladopsammia eguchii_: Cairns, 1994: 88, Pl. 38, figs. a, b.

Description. Corallum colonial, attached. Growth form phaceloid of corallites basally united without main trunk, 15–90 mm in width, 50–65 mm in height. Extratentacular budding from common basal coenosteum. Corallite cylindrical or sub-turbinate, 2.5 × 3.0–10.0 × 16.0 mm (average 10.0 × 15.0 mm) in calicular diameter, 6–40 mm (average 31 mm) in height. Calice strongly compressed, elongate, elliptical, but circular in young corallites. Columella elongate, deep, flat, spongy, 0.5 × 0.6–1.3 × 6.7 mm (average 1.0 × 5.4 mm) in diameter. Fossa 1.5–9.0 mm (average 9.0 mm) in depth. Theca 0.09–1.15 mm (average 0.58 mm) in thickness. Epi-theca present at lower parts of some corallites or in young corallites. Synapticulopitheca developed in costae and intercostal striae. Costae distinctive, linearly granulated, 0.12–0.60 mm (average 0.29 mm) in width. Costae of S1, S2 wider. Costal granule 0.02–0.60 mm (average 0.18 mm) in diameter. Intercostal striae porous. Synapticulae 0.07–0.35 mm (average 0.15 mm) in length, 0.06–0.24 mm (average 0.16 mm) in width. Intercostal pore 0.06–0.33 mm (average 0.14 mm) in length, 0.05–0.23 mm (average 0.12 mm) in width. Coenosteum covered by calcareous substances. Septa hexa-merously arranged with 33–96 (average 92) in 4–5 cycles, typically 5 cycles. Pourtalès plan present. S1=S2=S3>outer S5>inner S5>S4. S1, S2, S3, S4 straightly arranged, entire. Upper margins of S1, S2, S3 rounded. Inner edges of S1, S2, outer S5, S4 vertical, straight. Outer S5 united with inner S5 before common S4, extended to columella. S1 fused with its neighboring outer S5s, S2 with its neighboring outer S5s, S3 with its neighboring inner S5s at outer thecal margins. S1, S2, S3, outer S5 fused with columella. Septal faces covered with small spines.

Color. Coenosarc orange in living.

Habitat. Worm tubes, hydroids, and barnacles attach to the corallum of the species.

Remarks. The species is distinguished by its phaceloid growth form from common basal coenosteum, compressed corallites, elongate flat spongy columella, and thick theca.
**Distribution.** Pacific Ocean: Korea (Jeju-do Island); Japan (Hachijojima Island, Manadzuru, Nakagi, Oshima Island, Shirahama, Tateyama); Hawaii (Hawaiian Islands); Australia (Queensland); Panama (Gulf of Panama); Columbia (Malpelo Island); Equador (Galápagos Islands).

1* *Cladopsammia gracilis* (Milne Edwards and Haime, 1848) (Fig. 4)

*Dendrophyllia gracilis* Milne Edwards and Haime, 1848: 100, Pl. 1, fig. 13; Wells, 1983: 240, Pl. 17, figs. 1–4; Ogawa and Takahashi, 1995: 21, Pl. 5, figs. 1–12, Pl. 7, fig. 8.


**Material examined.** Korea: 1 ind., Jeju-do: Seogwipo-si, Munseom, 28 Dec 1987, Han HS, 15 m below deep (EWNHMAN 2030); 6 inds., Seogwipo-si, Beomseom, 22 Oct 1991, Song JI, Won JH by SCUBA diving, orange (EWZS 4120); 3 inds., Seogwipo-si, Mara-do, 25 Oct 1991, Song JI, Won JH by SCUBA diving (EWZS 4109); 1 ind., Seogwipo-si, Beomseom, 2 Jul 1993, Song JI, 20 m deep (EWNHMAN 473); 1 ind., Seogwipo-si, Munseom, 22 Jan 1998, Song JI (EWZS 5191); 2 inds., Seogwipo-si, Munseom, 20 Oct 1998, Song JI (EWZS 4110); 2 inds., Seogwipo-si, Beomseom, 3 Nov 2000, Korean Cultural Heritage Administration (EWZS 3978); 5 inds., Seogwipo-si, Mara-do, 4 Nov 2000, Song JI, 30 m deep (EWZS 3980); 2 inds., Seogwipo-si, Munseom, 7 Nov 2000, Korean Cultural Heritage Administration, 15–25 m deep (EWZS 3979); 10 inds., Seogwipo-si, Beomseom, 21 Feb 2001, Korean Cultural Heritage Administration, 26 m (EWZS 4119); 2 inds., Seogwipo-si, Beomseom, 6 Jun 2001, Song JI (EWZS 3982); 2 inds., Seogwipo-si, Beomseom, 6 Jun 2001, Song JI (EWZS 3984); 1 ind., Seogwipo-si, Supseom, 27 Jul 2006, Moon HY, Cho IY (EWZS 3981); 5 inds., Seogwipo-si, Beomseom, 7 Jan 2009, INTHESEA KOREA (EWZS 4144); 3 inds., Seogwipo-si, Beomseom, 23 Feb 2009.

Korean name: **단순가지돌산호** (신칭)
INTHESEA KOREA (EWZS 4145); 2 inds., Seogwipo-si, Beomseom, 23 Feb 2009, INTHESEA KOREA (EWZS 5192); 3 inds., Seogwipo-si, Beomseom, 16 Apr 2010, Song JI (EWZS 3854, 3855, 3856); 1 ind., Seogwipo-si, Beomseom, 9 Feb 2012, Song JI, Hwang SJ, orange (EWZS 5082).

Description. Corallum solitary or colonial, attached. Growth form cylindrical or phaceloid of corallites basally united without main trunk, 10–90 mm in width, 30–80 mm in height. Extratentacular budding from common basal coenosteum. Intratentacular budding rare. Corallite cylindrical, 2 × 2–14 × 15 mm (average 10.0 × 10.9 mm) in calicular diameter, 1.5–75.0 mm (average 26.3 mm) in height. Lateral branching rare, irregular, asymmetric, once or twice. If lateral branching present, axial corallite 9×10–13×15 mm (average 11.2×12.3 mm) in calicular diameter, 38–75 mm (average 56 mm) in height, lateral corallite 5–5×11×12 mm (average 7.8×8.8 mm) in calicular diameter, 3–35 mm (average 17.5 mm) in height. Calice circular or elliptical. Columella elliptical, spongy, 0.6×1.2–4.0×10.0 mm (average 6.7×10.2 mm) in diameter. Fossa 3–11 mm (average 7.4 mm) in depth. Theca thin. Epitheca absent. Synapticulotheca developed in costae and intercostal striae. Costae linearly granulated, 0.11–0.38 mm (average 0.23 mm) in width. Costal granule 0.04–0.18 mm (average 0.08 mm) in diameter. Intercostal striae porous. Synapticulae 0.05–0.32 mm (average 0.14 mm) in length, 0.06–0.37 mm (average 0.14 mm) in width. Intercostal pore 0.04–0.28 mm (average 0.12 mm) in length, 0.03–0.31 mm (average 0.11 mm) in width. Coenosteum costate. Septa hexamerously arranged with 40–114 (average 69) in 4–6 cycles, typically 5 incomplete cycles. Pourtalés plan well developed. S1 > outer S5 ≥ S2 > inner S4 > S3 > inner S5 > outer S4. S1, S2 straightforwardly arranged. S1, S2, outer S5 fused with columnella. Outer S5 curved downward, fused with inner S5 before outer S4, extended to inner S4, curved toward S2. S1 fused with its neighboring outer S5. S2 fused with its neighboring inner S4s at outer thecal margins. Upper margins of S1, S2 exsert. Septal faces covered with small spines.

Color. Coenosarc orange, tentacles yellow in living.

Habitat. The species inhabits subtidal zones of 15–30 m in depth. Sponges, hydroids, bryozoans, bivalves, oyster shells, worm tubes, and barnacles attach to the basal part of the corallum of the species.

Remarks. This species is characterized by its phaceloid growth form of cylindrical corallites budding from common basal coenosteum, and the distinctive flower-pattern Pourtalés plan. The intratentacular budding of the species is observed in the present study.

Distribution. Pacific Ocean: Korea (Jeju-do Island); Japan (Bonin Islands, Hachijoujima Island, Kushimoto, Sagami Bay, Shirahama); China; Indo-West Pacific; Australia.

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REFERENCES


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