

NOTES ON SOME TROPICAL OCTOCORALS AT THE ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN, DENMARK (CNIDARIA: OCTOCORALLIA)

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ABSTRACT. — The reef-dwelling octocorals at the Zoological Museum, University of Copenhagen, were studied and revised. All specimens of the families Helioporidae, Clavulariidae, Alcyoniidae, Xenidae and Briareidae were examined. This yielded 26 species including 13 new zoogeographical records for a variety of Indo-West-Pacific regions. The findings indicate the bio-geographical importance of this collection, the majority of which was acquired during Mortensen's expeditions (1914–1915, 1922, and 1929–1930) and later during the Galathea expedition (1950–1952).

KEY WORDS. — Alcyonacea, coral reefs, Galathea expedition, Mortensen's expeditions, new record

INTRODUCTION

The study of past octocoral collections has resulted in thorough taxonomic revisions, including descriptions of new taxa (e.g., Verseveldt, 1980, 1982, 1983; Ofwegen, 2005). Examination of such collections has also been gratifying in occasionally leading to the discovery of type specimens, whose depository had previously been considered unknown, as for example the case of *Sinularia leptoclados* (Ehrenberg, 1834) (see Verseveldt, 1980; Ofwegen et al., in press). The revision of such valuable old octocoral material has facilitated updating of the zoogeographic distribution of certain species and also led to the recognition of their abundance (e.g., Benayahu & Chou, 2010; Benayahu & Ofwegen, 2012).

The octocoral collection of the University of Copenhagen, Zoological Museum (ZMUC), Natural History Museum of Denmark, has yielded in the past two new species: the deep-sea *Primnoella krampi* Madsen, 1956 and the reef-dwelling *Lobophytum hapalolobatum* Verseveldt, 1983. In addition, Verseveldt (1983: 63–65) verified the identification of *L. lighti* Moser, 1919, deposited in this museum and originally identified by Tixier-Durivault (1956).

The current paper addresses all the tropical, reef-dwelling, octocorals of the families Helioporidae, Clavulariidae, Alcyoniidae, Xenidae, and Briareidae at the ZMUC. Most of the examined colonies were collected during Th. Mortensen's (1914–1915, 1922, and 1929–1930) expeditions (e.g., Mortensen, 1923) and the Danish

Galathea expeditions (1950–1952; Bruun et al., 1956), while the remaining specimens were donated to the ZMUC. The present study has verified or revised, as appropriate, the taxonomic identification of these octocorals. It presents for the first time a list of the respective material, with the zoogeographical distribution of the species and an indication of new zoogeographical records.

MATERIAL AND METHODS

The collection was studied during a visit to the ZMUC (Apr.2010) and in part was sent to the Zoological Museum, Tel Aviv University (ZMTAU) for further examination. In total, 33 colonies were identified and are included in the current publication. At the time of examination some colonies bore a label with a scientific name, but mostly with no indication of who had identified the material, and with only partial collection data. O. S. Tendal and M. T. Tøttrup of the ZMUC verified the collection data, completed the missing information and provided for the first time collection numbers (ZMUC-ANT) for the examined material.

For species identification, sclerites were obtained by dissolving small tissue samples in 10% sodium hypochlorite, rinsed in distilled water, and examined under a light microscope. Identification of species was in part facilitated by comparisons with permanent sclerite preparations of type material kept at the ZMTAU.

TAXONOMY

The examined material yielded 26 species of five families: Helioporidae, Clavulariidae, Alcyoniidae, Xeniidae, and Briareidae (Table 1). Twelve of the original identifications were verified and 14 revised. Thirteen species were found to be new zoogeographical records for a variety of Indo-West-Pacific regions.

DISCUSSION

The overall objective of the present study was to revise and identify the reef-dwelling octocorals at the ZMUC. The collection includes some widespread Indo-West-Pacific species such as *Heliopora coerulea* and others of the genera *Cladiella*, *Lobophytum*, *Rhytisma*, *Sarcophyton*, and *Sinularia* (Table 1). Establishing the new zoogeographical records within the respective genera was based on the available literature as follows: *Cladiella* – Tixier-Durivault, 1948; Benayahu & Schleyer, 1996; Benayahu et al., 2004; *Lobophytum* – Verseveldt, 1983; *Sarcophyton* – Verseveldt, 1982; *Sinularia* – Verseveldt, 1980; Ofwegen, 2002. Later octocoral studies by Benayahu (1997, 2002) and Benayahu et al. (2004) were also used for this purpose as well as for the *Briareum*, *Clavularia*, and *Rhytisma*, where applicable. Reinicke (1997) and the literature sources therein were applied for *Xenia*. In total, the study yielded 13 new zoogeographical records: four for the Philippines, two each for Madagascar, Ceylon and Tonga, and one each for Ambon, Java and, Papua New Guinea. It is noteworthy that the findings extend for the first time the distribution of two species beyond their type locality (Table 1): *S. birkelandi* to Java (type locality Micronesia: Verseveldt, 1978) and *L. rigidum* to the Philippines (type locality Okinawa: Benayahu, 1995). The Philippine octocorals are poorly known and, since the early publication by Roxas (1933), there have been no further in-depth taxonomic studies on this fauna. The four new records from there, as well those from Ambon, Java and Papua New-Guinea, thus contribute to our knowledge of those reefs, which are included within the highly diverse coral triangle (Veron et al., 2011). Similarly, the other new records, from Tonga, Ceylon and Madagascar, extend the bio-geographical distribution of the respective species and these localities deserve further study.

The ZMUC collection encompasses octocorals from a variety of geographic regions, ranging from Zanzibar, East Africa, to Tonga and the South Pacific Ocean. This collection thus emphasizes the importance of the past collections made during the Danish scientific expeditions, and the ZMUC collection as a whole. It is anticipated that further examination of other past octocoral collections will also yield significant findings concerning their distributional range, also in comparison to newly obtained material, if available.

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Table 1. List of species of Octocorallia of the orders Helioporacea Bock, 1938 and Alcyonacea (Lamouroux, 1816) at the University of Copenhagen, Zoological Museum, Natural History Museum of Denmark, with indication of inventory numbers (ZMUC-ANT), collection details, and Geographical distribution. — (*) indicates original identification verified, new zoogeographical records are indicated.

Classification

Family Helioporidae Blainville, 1830

Genus *Heliopora* Moseley, 1786

Heliopora coerulea (Pallas, 1766)

1 colony (ZMUC-ANT-000226), Philippines, Dinagat, Tubajon Bay, coral reef, tidal zone, 19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. (*)

Geographical distribution. — Indo-West-Pacific reefs.

Family Clavulariidae Hickson, 1894

Genus *Clavularia* Blainville, 1830

Clavularia köllikeri (Dean, 1927)

1 colony (ZMUC-ANT-000248), Philippines, Dinagat, Tubajon Bay, coral reef, tidal zone (10°20'N, 125°32'E), 19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. Det. Y. Benayahu, Sep.2011.

Geographical distribution. — West-Pacific reefs. New record for the Philippines.

Clavularia viridis (Quoy & Gaimard, 1883)

1 colony (ZMUC-ANT-000247), Philippines, Dinagat, Tubajon Bay, coral reef, tidal zone (10°20'N, 125°32'E), 19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. Det. Y. Benayahu Sep.2011; 1 colony (ZMUC-ANT-000260), Philippines, Tubajon Bay, Dinagat, 17–19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. Det. Y. Benayahu, Sep.2011.

Geographical distribution. — Indo West-Pacific reefs.

Family Alcyoniidae Lamouroux, 1812

Genus *Cladiella* Gray, 1869

Cladiella australis (Macfadyen, 1936)

1 colony (ZMUC-ANT-000243), Viti. Donation from Museum Godeffroy, Hamburg (Material older than 1869). Det. Y. Benayahu, Apr.2010.

Geographical distribution. — Indo-West-Pacific reefs.

Cladiella pachyclados (Klunzinger, 1877)

1 colony (ZMUC-ANT-000250), Tonga, Makaha'a at Nukualofa (21°07'S, 175°10'W), coral reef, 0.5–1 m. The Danish Galathea expedition 1950–52, station 682. Det. Y. Benayahu, Sep.2011.

Geographical distribution. — Indo-West-Pacific reefs. New record for Tonga Islands.

Genus *Lobophytum* von Marenzeller, 1886

Lobophytum crassum von Marenzeller, 1886

1 colony (ZMUC-ANT-000259), Philippines, Marongas, ~25 fathoms. Dr. Th. Mortensen's Pacific expedition 1914–15. Det. Y. Benayahu, Apr.2011.

Geographical distribution. — Indo-West-Pacific reefs.

Lobophytum hapalobatum Verseveldt, 1983

Type, 2 colonies (ZMUC-ANT-000125 and ZMUC-ANT-000126), Indonesia, Java, Onrust Island, coral reef, 26 Apr.1929. Dr. Th. Mortensen's Java-South Africa expedition 1929–30. Det. Y. Benayahu, Apr.2010.

Geographical distribution. — Java Sea.

Lobophytum lighti Moser, 1919

1 colony (ZMUC-ANT-000244), Philippines, Mindoro, Puerto Galera, coral reef, dredge, 1 Feb.1914. Dr. Th. Mortensen's Pacific expedition 1914–15. Det. A. Tixier-Durivault. (*)

Geographical distribution. — Philippines; Great Barrier Reef, Australia.

Lobophytum rigidum Benayahu, 1995

1 colony (ZMUC-ANT-000246), Philippines, Dinagat, Tubajon Bay, coral reef, tidal zone (10°20'N, 125°32'E), 19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. Det. Y. Benayahu, Sep.2011.

Geographical distribution. — Okinawa. New record for the Philippines and thus extends this species distribution beyond its type-locality.

Genus *Rhytisma* Alderslade, 2000

Rhytisma fulvum fulvum (Forskål, 1775)

1 colony (ZMUC-ANT-000242), Kokotoni, Zansibar, coll. Stühlmann. Donation from Riksmuseet, Stockholm. Det. Y. Benayahu, Apr.2010.

Geographical distribution. — Indo-West-Pacific reefs.

Table 1. Cont'd

Classification
Genus <i>Sarcophyton</i> Lesson, 1834
<i>Sarcophyton birkelandi</i> Verseveldt, 1978
1 colony (ZMUC-ANT-000253), Java, Onrust, coral reef, 26 Apr.1929. Dr. Th. Mortensen's Java-South Africa expedition 1929–30. Det. Y. Benayahu, Sep.2011.
Geographical distribution. — Micronesia. New record for Indonesia and thus extends this species distribution beyond its type-locality.
<i>Sarcophyton cinereum</i> Tixier-Durivault, 1946
1 colony (ZMUC-ANT-000251), Tonga, Makaha'a at Nukualofa, coral reef, 0.5–1 m, 8 Mar.1952. The Danish Galathea expedition 1950–52, station 682. Det. Y. Benayahu, Sep.2011.
Geographical distribution. — Indo-West-Pacific reefs, including New Hebrides, new record for Tonga and thus further extends this species distribution within the South Pacific Ocean.
<i>Sarcophyton crassocaule</i> Moser, 1919
1 colony (ZMUC-ANT-000258), Kei Islands, Toal, sand and corals, 0–2 m, 25 Mar.1922. Dr. Th. Mortensen's Danish expedition to the Kei-Islands 1922. Det. Y. Benayahu, Sep.2011.
Geographical distribution. — West-Pacific reefs.
<i>Sarcophyton glaucum</i> (Quoy & Gaimard, 1833)
2 colonies (ZMUC-ANT-000224), Indonesia, Banda, off Naira, sand, 10 m, 5 Jun.1922. Dr. Th. Mortensen's Danish expedition to the Kei-Islands 1922. (*); 1 colony (ZMUC-ANT-000234), Indonesia, Java, Onrust, coral reef, 26 Apr.1929. Dr. Th. Mortensen's Java-South Africa expedition 1929–30. (*)
Geographical distribution. — Indo-West-Pacific reefs.
<i>Sarcophyton tenuispiculatum</i> Thomson & Dean, 1931
1 colony (ZMUC-ANT-000235), Indonesia, Amboina, 1–2 m, on block of coral. 11 Feb.1922. Dr. Th. Mortensen's Danish expedition to the Kei-Islands 1922. (*); 1 colony (ZMUC-ANT-000236), Madagascar, Cape Diego, rocky bottom with corals, 0.5–1 m, 3 Mar.1951. The Danish Galathea expedition 1950–52, station 223 (*); 1 colony (ZMUC-ANT-000237), Tonga. Donation of Museum Godeffroy, Hamburg. Det. Y. Benayahu, Apr.2010.
Geographical distribution. — Flores Sea, New Caledonia. New record for both Ambon and Madagascar. The material extends the distributional range of this species also to the Indian Ocean.
<i>Sarcophyton trocheliophorum</i> Von Marenzeller, 1886
4 colonies (ZMUC-ANT-000252), Ceylon, Galle, coral reef west of the fortress, station 29d, 0.3–1 m, 19 Oct.1951, coll. Dr. H. Lemche. Det. Y. Benayahu, Sep.2011.
Geographical distribution. — Indo-West-Pacific reefs. New record for Ceylon.
Genus <i>Sinularia</i> May, 1898
<i>Sinularia brassica</i> May, 1898
1 colony (ZMUC-ANT-000240), Indonesia, Vatek at Toal, rocky coast, 1–2 m, 28 Mar.1922. Dr. Th. Mortensen's Danish expedition to the Kei-Islands 1922. Det. Y. Benayahu, Apr.2010.
Geographical distribution. — Indo-West-Pacific reefs.
<i>Sinularia compressa</i> Tixier-Durivault, 1945
1 colony (ZMUC-ANT-000229), Philippines, Dinagat, Tubajon Bay (10°20'N, 125°32'E), coral reef, tidal zone, 17–19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. (*); 1 colony (ZMUC-ANT-000257), donation from Museum Godeffroy (Hamburg), coll. before 1869. Det. Y. Benayahu, Sep.2011.
Geographical distribution. — Indo-West-Pacific reefs. New record for the Philippines.
<i>Sinularia gibberosa</i> Tixier-Durivault, 1970
1 colony (ZMUC-ANT-000232), Philippines, Dinagat, Tubajon Bay (10°20'N, 125°32'E), coral reef, tidal zone, 17-19 Jul. 1951. The Danish Galathea expedition 1950–52, station 415. Det. Y. Benayahu, Apr.2010.
Geographical distribution. — Indo-West-Pacific reefs. New record for the Philippines.
<i>Sinularia lochmodes</i> Kolonko, 1926
1 colony (ZMUC-ANT-000228), Ceylon, Galle, coral reef west of the fortress, 0.3–1 m, 19 Oct.1951, coll. Dr. H. Lemche, station 29d. (*)
Geographical distribution. — Indo-West-Pacific reefs. New record for Ceylon.
NR.
<i>Sinularia molesta</i> Tixier-Durivault, 1970
1 colony (ZMUC-ANT-000245), Madagascar, Cape Diego, Rocky bottom with corals, 0.5–1 m, 3 Mar.1951. The Danish Galathea expedition 1950–52, station 223. Det. Y. Benayahu, Apr.2010.
Geographical distribution. — Indo-West Pacific reefs. New record for Madagascar.
<i>Sinularia mollis</i> Kolonko, 1926
1 colony (ZMUC-ANT-000233), Papua New Guinea, off Tatana Island, Bay of Port Moresby (09°35'S, 147°05'), 0.5–1 m, 20 Oct.1951. The Danish Galathea expedition 1950–52, station 525. (*)
Geographical distribution. — Indo-West-Pacific reefs. New record for Papua New Guinea.
<i>Sinularia polydactyla</i> (Ehrenberg, 1834)
1 colony (ZMUC-ANT-000238), Philippines, Dinagat, Tubajon Bay (10°20'N, 125°32'E), 17–19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. (*)
Geographical distribution. — Indo-West-Pacific reefs.

Table 1. Cont'd

Classification	
<i>Sinularia querciformis</i> (Pratt, 1903)	
4 colonies (ZMUC-ANT-000241), Indonesia, Kei-Islands, Doe Roa Bassin, sand and shells, ~50 m, (Trawl). 14 Apr.1922. Dr. Th. Mortensen's Danish expedition to the Kei-Islands 1922, station 20. (*)	
Geographical distribution. — Indo-West-Pacific reefs.	
Family Xenidae Wright & Studer, 1889	
Genus <i>Xenia</i> Lamarck, 1816	
<i>Xenia umbellata</i> Lamarck, 1816	
1 colony (ZMUC-ANT-000225), Red Sea. Donation from Berlin Museum (*); ZMUC-ANT-000227, Philippines, Dinagat, Tubajon Bay, coral reef, tidal zone. 17–19 Jul.1951. The Danish Galathea expedition 1950–52, station 415. Det. Y. Benayahu, Apr.2010;	
1 colony (ZMUC-ANT-000254), Indonesia, Kei-Islands, Banda off Naira, sand, ~10 m, 5 Jun.1922. Dr. Th. Mortensen's Danish expedition to the Kei-Islands 1922. Det. Y. Benayahu, Jun.2012.	
Geographical distribution. — Indo-West-Pacific reefs.	
Family Briareidae Blainville, 1830	
Genus <i>Briareum</i> Blainville, 1830	
<i>Briareum excavatum</i> (Nutting, 1911)	
1 colony (ZMUC-ANT-000239), Indonesia, Kei Islands, Vatek at Toeal, rocky coast, 1–2 m, 28 Mar.1922.. Dr. Th. Mortensen's Danish expedition to the Kei-Islands 1922. Det. Y. Benayahu, Apr.2010.	
Geographical distribution. — West-Pacific reefs.	
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Morphology and Molecular Phylogenetic Analysis of Deep-Sea Purple Gorgonians (Octocorallia: Victorgorgiidae) from Seamounts in the Tropical Western Pacific, with Description of Three New Species. Yang Li^{1,2,3}, Zifeng Zhan^{1,2,3} and Kuidong Xu^{1,2,3,4*}. However, genetic divergence at the species level was found to be inadequate for differentiation of some close species. Each of the four species was found only from a single seamount, suggesting limited biological connectivity among the four seamount gorgonians. It is worthy of note that each of the species was collected from a single seamount. Their genetic distances and phylogenetic relationships within Victorgorgia were analyzed and discussed. See what's new with book lending at the Internet Archive. Notes on some tropical octocorals at the Zoological Museum, University Of Copenhagen, Denmark (Cnidaria: Octocorallia). Item Preview. > remove-circle. Notes on some tropical octocorals at the Zoological Museum, University Of Copenhagen, Denmark (Cnidaria: Octocorallia). by. Benayahu, Y. Some of the best-known and most-developed coral reefs of southern Taiwan are those of the Hengchun Peninsula, mainly at Nanwan Bay, Kenting National Park (Dai 1997). Vouchers of all specimens are deposited at the Zoological Museum, Tel Aviv University (ZMTAU). NA, no accession. Table 2. List of species of Octocorallia of the order Alcyonacea (Lamouroux, 1812), their occurrence in the Penghu Archipelago with inventory numbers of the Zoological Museum, Tel Aviv University (ZMTAU Co) and Center for Biodiversity (NCB), Naturalis, Leiden (RMNH). Field notes include abundance estimates with numbers of sites where species were collected (in brackets) and an indication of respective underwater photographs when available. Classification.