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CHAPTER 15

BARNACLES (CIRRIPEDIA, THORACICA) OF THE COCOS (KEELING) ISLANDS

BY

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INTRODUCTION

The barnacle fauna of the Cocos (Keeling) Islands has not been documented prior to the present report. Previous reports on the crustaceans of these islands have listed Brachyura, Anomura, Caridea, Stomatopoda and Paguridae (Calman 1909, Wood-Jones 1909, Gibson-Hill 1947, 1948, Tweedie 1950, Forest 1956).

The present collection of barnacles was made by sampling a wide variety of habitats throughout the atoll. Sampling stations included all reef flat zones and a range of lagoonal habitats and outer reef slopes (see Chapter 1, Fig. 2, List of barnacles). Specimens were collected by walking on shores and reef flats during low tide, snorkelling and SCUBA diving.

A total of 13 species of barnacles in 11 genera are now recorded from the Cocos (Keeling) Islands. Nine of these species were collected at one locality only. Although the number of barnacles is small, this collection is of considerable interest since nothing is known of the barnacles of these islands, and knowledge of the barnacle fauna of coral atolls in the Indian Ocean in general is scanty. Eleven species were collected during the Western Australian Musum Cocos (Keeling) Island expedition of February, 1989. Two additional species from these islands (*Capitulum mitella, Megabalanus ajax*) are housed in the crustacean collection of the Western Australian Museum and are included in the species list. The species list given below must be considered provisional and further detailed collecting may well reveal additional species, particularly from sub-tidal areas.

DISCUSSION

The barnacle fauna of the Cocos (Keeling) Islands is composed of widespread Indo-West Pacific species (8) and species exhibiting cosmopolitan distributions (5).

Of the cosmopolitan barnacles, *L. anatifera* and *L. anserifera* are pelagic in habitat and attach to floating objects. Freshly beached specimens were collected on reef platforms and beaches, attached to bamboo, wood, etc. However, large numbers of the abundant terrestrial hermit crab *Coenobita perlatus* Milne Edwards were observed actively predating these barnacles. Consequently strandings of pelagic barnacles may be more numerous, and more pelagic species may be represented than are presently recorded, but ensuing rapid predation (by terrestrial hermit crabs in particular) makes the collection of all but recently stranded specimens unlikely.

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The cosmopolitan pedunculate barnacle *O. lowei* occurs on the gills of decapod crustaceans and was obtained from the gills of the rock lobster *Panulirus penicillatus* Oliver at the Cocos Islands. The cosmopolitan fouling species, *M. tintinnabulum*, occurred on mooring buoys in the main lagoon. This species may have been introduced via shipping since it was not found elsewhere in island waters and the species is a well-known fouler of ship hulls. *T. divisa* has a circumtropical insular and occasional mainland distribution. This species was first described from material collected on the west coast of Sumatra and the Java Sea. At Cocos (Keeling) the species was rare, only a few specimens being collected from deep, narrow crevices in beachrock.

The Indo-West Pacific species *T. wireni* was the only sessile species collected at more than one locality. It was collected subtidally from a variety of hard substrata (mooring buoys, carapace of *P. penicillatus*, shell of *Trochus maculatus* Linnaeus) as well as from a sponge collected in beach drift. *L. nicobarica* bores into limestone substrates in the Indo-West Pacific region. The species was rare at the Cocos (Keeling) Islands, boring into the upper areas of coral and limestone boulders on intertidal and seaward reef flats. The Indo-West Pacific species *C. mitella* occurs in crevices in mid-tidal areas under conditions of semi to full wave exposure. *T. fissum* occurs on the mouthparts of decapod crustaceans in the Indo-West Pacific region, and was collected from the third maxillipeds of *P. pencillatus*. Two balanomorphs, *E. hembeli* and *M. ajax*, both very large, robust species, are known from the Indo-West Pacific region although both are extremely rare. *E. hembeli* occurs on high intertidal rocks and shores and at the Cocos (Keeling) Islands a solitary individual was collected from high up on the limestone boulder on an ocean reef flat. *M. ajax* occurs mainly in the subtidal on corals. The low live coral cover at Cocos is reflected in the very low number of coral barnacles collected. Although numerous samples of live and dead coral were examined, only one sample harboured coral barnacles - viz. *S. dentatum* on the coral *Favia stelligera* (Dana). The genus *Acasta* occurs in sponges and has many Indo-West Pacific representatives. Parietal plates of *Acasta* sp. were obtained from a sponge found in beach drift at the Cocos (Keeling) Islands.

Barnacles are relatively rare and inconspicuous intertidal organisms at Cocos (Keeling) and their paucity in the overall marine invertebrate community is notable. The total of 13 species is small and may reflect inadequate sampling procedures. It may, however, be a true representation, since coral reefs are known to be unfavourable habitats for cirripedes (Darwin 1854, Borradaile 1903). The lack of development of barnacle populations on coral reefs has been documented in the tropical West Pacific (Newman 1960), the Tokara Islands, Japan (Utinomi 1954) and Heron Island, Australia (Endean et al. 1956). The scouring action of waves by rolling light coral limestone fragments and boulders is restrictive or adverse to barnacle settlement, especially in intertidal areas, where settlement would be restricted to crevices and underhangs. Newly settled and juvenile barnacles are indirectly predated on by herbivorous fish, which rasp limestone and coral reefs for micro-algae. Consequently barnacles may be restricted to higher intertidal areas or to boring into limestone substrata. Other known predators in the marine environment are molluscs (e.g. whelks) and sublittoral echinoderms (e.g. *Diadema*). These factors may all contribute to the general lack of intertidal barnacles at the Cocos (Keeling) Islands. In intertidal areas barnacles occur rarely and very sparsely, in interstices in or between and under rocks (e.g. *C. mitella, T. divisa*) or high on rocks which are only covered during high tides (*E. hembeli*). Burrowing forms occur in limestone and coral boulders (*L. nicobarica*) or live coral (*S. dentatum*). Some *T. divisa* individuals collected at Cocos (Keeling) exhibited gastropod bore holes in parietal plates.

On fouling buoys in the main lagoon a small fouling community (e.g. sponges, ascidians, barnacles) is developing and many large specimens of the fouler *M. tintinnabulum*

were collected here as well as individuals of *T. wireni*. The presence and abundance of *M. tintinnabulum* and *T. wireni* at this site compared to the paucity of barnacle species elsewhere may be associated with a lack of coral. This, combined with a lack of shelter from piscivorous fish, may result in an absence of reef fish (e.g. Scaridae) and hence the predation pressure on newly settled barnacles and juveniles may be correspondingly reduced. The origin of the Cocos specimens of *M. tintinnabulum* is unknown. However, the presence of this species may be of some concern since it is a noted fouling species overseas.

The thoracic cirripede fauna of the Indian Ocean is relatively well-known, with upwards of 280 species estimated to occur there (Stubbings 1936, Nilsson-Cantell 1938, Daniel 1972). The nearest localities to the Cocos (Keeling) Islands are Christmas Island, 900 km to the east and Java Head, 1000 km to the north-east. Only two cirripede species are recorded from Christmas Island (Nilsson-Cantell 1934 Daniel 1972), but the Western Australian Museum crustacean collection holds an additional five species making a total of seven. Java is part of Indo-Malay faunistic province, an area rich in both number of species and in the geographical distribution of cirripedes. At least 246 species are recorded from this area (Hoek 1907, 1913, Broch 1931, Nilsson-Cantell 1934). Compared to the nearest mainland shores (Sumatra, Java) which exhibit rich barnacle faunas in both the intertidal and the sub littoral (Nilsson-Cantell 1921), the fauna of the Cocos (Keeling) Islands must be considered depauperate.

The number of cirripedes recorded from the Cocos (Keeling) Islands is larger than that at present recorded from other isolated Indian Ocean atolls (e.g. Diego Garcia, Chagos) but less than that presently known from larger atoll groups (e.g. Maldives and Laccadives). Table 1 compares the numbers of barnacle species recorded from islands and atolls in the Indian Ocean, and the species in common with the Cocos (Keeling) Islands. However, meaningful comparisons with other atolls and islands are difficult to make since the collecting effort at these localities is not known.

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LIST OF BARNACLES

x = specimens without precise locality data

ORDER THORACICA	Collection Station
Suborder Lepadomorpha	
Family Scalpellidae Pilsbry, 1916	
Subfamily Lithotryinae Gruvel, 1905	
Lithotrya nicobarica Reinhardt, 1850	1, 32
Subfamily Pollicipinae Gruvel, 1905	
Captitulum mitella (Linnaeus, 1767)	x
Family Lepadidae Burmeister, 1834 ("Fam. Lepadea")	
Lepas anatifera Linnaeus, 1767	24, 27, 30
Lepas anserifera Linnaeus, 1767	27, 30, 32
Family Poecilasmatidae Annandale, 1910	
Temnaspsis fissum Darwin, 1851	10
Octolasmis lowei (Darwin, 1851)	20
Suborder Balanomorpha	
Family Chthamalidae Darwin, 1854	
Subfamily Euraphiinae Newman & Ross, 1976	
Euraphia hembeli Conrad, 1837	1
Family Tetraclitidae Gruvel, 1903	
Subfamily Tetraclitinae Gruvel, 1903	
Tetraclita divisa Nilsson-Cantell, 1921	10
Tesseropora wireni Nilsson-Cantell, 1921	1, 2, 6, 20 ,28
Family Archaeobalanidae Newman & Ross, 1976	
Acasta sp.	1
Family Pyrgomatidae Gray, 1825	
Savignium dentatum (Darwin, 1854)	31
Family Balanidae Leach, 1817	
Megabalanus ajax (Darwin, 1854)	x
Megabalanus tintinnabulum (Linnaeus, 1758)	28

Table 1 : A comparison of the numbers of thoracic cirripede species recorded from Indian Ocean atolls (A) and islands, and the species in common with the Cocos (Keeling) Islands.

Locality		Total Species	Spp. in common with Cocos (Keeling)	References
Christmas I.		7	4	Nilsson-Cantell 1934; Daniel 1972; WA Museum Collection
Diego Garcia	(A)	3	3	Smith 1971
Chagos	(A)	6	3	Gruvel 1909
Andamans & Nicobars		17	2	Gruvel 1909; Daniel 1972
Sri Lanka		31	3	Annandale 1906; Daniel 1972
Maldives & Laccadives	(A)	25	2	Borradaile, 1903; Annandale 1906; Daniel 1972
Seychelles		9	2	Gruvel 1909; Taylor 1968
Providence I.		2	0	Gruvel 1909