

THE HISTORY OF SPONGOLOGY OF THE INDIAN OCEAN*

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ABSTRACT

A historical account of the studies pertaining to the different groups of sponges from different areas of the Indian Ocean is presented in this paper. Detailed bibliography (area-wise) has also been included.

INTRODUCTION

THE PERIOD between 1765 and 1892 marked what could be termed a glorious era in the history of spongology and this was largely due to the pioneering work of scientists like Carl Linnaeus, George Cuvier, Jean Lamarck, J. E. Gray, R. E. Grant, G. D. Nardo, J. S. Bowerbank, H. J. Carter, N. Lieberkuhn, F. E. Schulze, E. O. Schmidt, G. C. J. Vosmaer, E. H. P. A. Haeckel, A. Hyatt, C. Keller, W. J. Sollas, S. O. Ridley, R. von Lendenfeld, N. Polejaeff, A. Dendy and E. Topsent in systematising the various groups of sponges, after studies on their physiology and the phylogeny. The sponges were till then considered to be plants and it was Ellis (1765) who first demonstrated the animal nature of sponges by observing the water currents produced by the oscula and the movements of the general body surface. As a result, scientists like Linnaeus, Lamarck and Cuvier grouped them together with the coelenterates, until Blainville (1816) placed them in a special group, Spongiaria. Grant (1836), who studied the morphology and physiology of this group, established the name Porifera. Later workers like Huxley (1875) and Sollas (1884) argued for the separation of the sponges from other multicellular forms (metazoa). According to the modern zoologists, this group constitutes an isolated branch of metazoa called Parazoa, after Sollas.

Four different periods can be broadly demarcated in the history of spongology. A general interest which found expression in an overall study of the local fauna forms the central theme of the first period. This got amplified in the second on account of the facilities provided by many countries venturing for extensive voyages and expeditions. The material thus collected from far off places resulted in the monographic treatment of the families and the genera. The impact of the theory of evolution reached its zenith during this period. Darwinism came into existence with the publication of 'The Origin of species' (1859) and consequent on this the taxonomists began searching for the 'missing link' and 'primitive ancestors' to correlate the phylogeny of the various groups. From the study of the major taxa and their evolution the attention then got diverted to the study of intra-specific variations, and this marks the third period. The fourth period, which includes the more recent works on sponges, belongs to the present century

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which has come to be characterised by a 'continuous refinement of the methods and concepts developed in the 19th century' (Mayr *et al.*, 1953) and as Huxley (1940) put it the new systematics came to be 'a synthesis of such modern approaches as geographic, ecologic, cytologic and physiologic and of population genetics'. The works of Levi (1956) and Tuzet (1948) on the embryology and systematics, of Bergmann (1949) on sterols, of Hartman (1958) on systematics, ecology and life history of porifera are examples, to cite a few.

The history of the spongyology of the Indian Ocean is rather a short one. The area which received some attention in the 19th century was Sri Lanka, and among the earlier major studies dealing with the Sri Lanka species were those of Esper (1798-1806), Ehlers (1870), Haeckel (1872), Bowerbank (1873), Carter (1880, 1881), Ridley (1884), Dendy (1887, 1889), Sollas (1888) and Lendenfeld (1889). Of the above, the works of Ridley (1884), Sollas (1888) and Lendenfeld (1889) make only occasional references to the fauna of Sri Lanka.

Towards the beginning of the present century there was an extensive survey of the pearl banks of Sri Lanka by the Fisheries Department of Sri Lanka. The large collections made by Prof. Herdman in 1902, from Sri Lanka, were worked out by Dendy (1905). Of a total of 146 species that he described, 77 (52.7%) were new to science! A comprehensive list of all known species, about 215 in number, together with their geographical distribution was also presented in this paper. Considering the richness, both in number and species, Dendy regarded the Gulf of Mannar as 'an extremely rich centre of sponge distribution', and taking into account the affinity of Sri Lanka sponges with those of the Australian region he (Dendy, 1905) included Sri Lanka in the Indo-Australian area, which, at the time of the *Challenger* report, included only Australia, East Indies and the Philippines. Burton (1930, 1937) added substantially to our knowledge of the sponge fauna of the Gulf of Mannar, and his latter work 'The littoral fauna of Krusadai Island in the Gulf of Mannar' is of particular interest for its list of fauna and diagnosis of species. Rao (1941) in a paper 'Indian and Ceylon sponges of the Naturhistoriska Riksmuseet, Stockholm, collected by K. Fristedt' dealt with 42 species and 3 varieties, of which 7 species and 3 varieties were new to science. An extensive survey of the marine sponges, with special reference to those of the Gulf of Mannar and the Palk Bay, was undertaken during the years 1964-'67 by Thomas (1968 a), who recorded 125 species of Demospongiae belonging to 84 genera divided among 33 families. Of these 8 species were new to science and 20 were new records to the Indian region; the interesting species collected during this survey have been dealt with in greater detail in the subsequent papers (Thomas, 1970 a, 1970 b, 1970 c, 1970 d, 1970 e).

Comparatively very little work has been done on the shallow water marine sponge fauna of peninsular India. Along the east coast, Madras and Chilka Lake were investigated to some extent. Dendy (1887) and Ali (1954, 1956 a) worked on the sponge fauna of Madras. The development of *Lissodendoryx similis* Thielew as worked out by Ali (1956 b) who in a later paper also discussed the ecology of the sponge fauna of Madras Harbour (Ali, 1960). Sivaramakrishnan (1951) studied the development and regeneration of *Callyspongia diffusa* and *Tedania nigrescens* from the Madras Coast. The fauna of the Chilka Lake in Orissa State was investigated by Annandale (1914, 1915 a) and this lake is of great biological interest for the marine and freshwater environments.

The major studies dealing with the deep sea sponge fauna of the Bay of Bengal are those of Dendy and Burton (1926) and Burton (1928), based on the deep sea sponges collected by R.I.M.S. 'Investigator' and deposited in the Indian Museum, Calcutta. Kumar (1925) reported on the sponges dredged by the Bengal Fisheries Steamer 'Golden Crown'. Shallow water marine sponges collected from India, Burma, Sri Lanka and Andamans were studied by Burton and Rao (1932). Of the 82 species reported in this work, 12 species and 3 genera were new. The main works dealing with the calcareous sponges of the Bay of Bengal are those of Hozawa (1937, 1940). The sponges of the Mergui Archipelago received considerable attention from Carter (1887).

The boring sponges of the Indian Seas form a group that has been fairly well worked out in the past. The work of Annandale (1915 b) dealing with those of the family Clionidae is an outstanding contribution in this field not only for the significant additions to the fauna but also for the elaborate key and comprehensive diagnosis of 11 species of *Cliona* and 4 species of *Thoosa*. The specimens dealt with in this paper were from the Bay of Bengal, Arabian Sea, Persian Gulf and from several other places along the Indian Coast. Studies on the same lines were continued in the subsequent work of Annandale (1915 c). Coral-boring sponges of the Gulf of Mannar and the Palk Bay were studied by Thomas (1969 a). About 20 species of boring sponges have so far been found to infest the coral reefs of the Gulf of Mannar and Palk Bay.

The fauna of the west coast of India is rather poorly worked out when compared to that of the east coast. The major contributions dealing with the fauna of the Gulf of Kutch are those of Dendy (1915, 1916) on *Calcarea* and non-*Calcarea* respectively collected by Mr. James Hornell at Okhamandal in Kattiawar, in 1905-1906. The sponge fauna of Karachi has also received some attention, (Kumar, 1924 a, 1924 b, 1924 c; Kumar and Dyal, 1932). Species collected from the Gulf of Kutch, Bombay, Mangalore, Minicoy Island, Cochin, Quilon, Kovalam and Cape Comorin have been discussed by Thomas (1968 a).

Sponges are well known for their association with other animals and plants. Annandale (1911) discussed in detail the association of some sponges with molluscs of the family Vermetidae from the Bay of Bengal and in a later publication (Annandale, 1914) he dealt with similar association with oysters and mussels from the Madras Harbour. Devanesan and Chacko (1941) reported the interesting association of the alga, *Ceratodictyon spongiosum* (Zanard) with the sponge *Sigmadocia fibulata* (Schmidt), and also that of cirri-pede *Balanus longirostrum* Hoek with *Spirastrella inconstans* (Dendy) from the Krusadi Island. Rao (1914) recorded the association of the alga *Phormidium spongeliae* (Schulze) with *Dysidea herbacea* (Keller). The association of the holothurian *Chondrocloea striata* (Sluiter) with *Petrosia testudinaria* (Lamarck) has been recorded from the pearl banks of Tuticorin (Nayar and Mahadevan, 1965). The polychaete *Polydora armata* Langerhans is also found in association with *Aulospongia tubulatus* (Bowerbank, 1873; Dendy, 1905, 1921).

The various expeditions conducted in the latter half of the 19th century and the first half of the present century have contributed substantially to our knowledge of the sponge fauna of the Indian Ocean. The zoological collection

made in the Indo-Pacific during the voyage of H.M.S. 'Alert' (1881-1882) made possible more studies on the fauna of Port Jackson, Queensland, South Australia, Western Australia, Mozambique, Gloriosa Island, Providence Island, Amirante Island and Seychelles Bank. Other expeditions like the 'John Murray' (1933-'34) and the 'Sealark' (1905) also added substantially to our knowledge of the fauna of Seychelles Bank, South Arabian Coast, Zanzibar, Gulf of Aden, Amirante Island, Saya de Malha, Salomon, Diego Garcia, Paraslin Reef, Providence Island, Cargados Carajos and the Maldives. Calcarea, Homosclerophora and Astrotetrazonida, Hexactinellida and Sigmatotetrazonida collected by the 'Sealark' were worked out by Dendy (1913, 1916 a, 1916 b, 1921). Levi (1961) reported on a collection comprising 42 species from the Aldabra Island. Burton (1959), based on the specimens collected by the 'John Murray' Expedition and other earlier works, listed 315 species from the Indian Ocean area.

The fauna of Seychelles Bank also received some attention in the past. Works dealing with the fauna of the Seychelles Bank include those of Owen (1857), Topsent (1893), Wright (1881), Ridley (1884), Dendy (1916 a, 1916 b, 1921) and Thomas (1969).

Papers dealing with the Indian Ocean species in general are those of Carter (1881, 1883), Hyatt (1887), Lendenfeld (1889, 1903), Levi (1964) and Vosmaer and Vernhout (1902). Unfortunately the 'Challenger' collections added no direct information about the fauna of the Indian Ocean. But the elaborate monographs that appeared as an outcome of this expedition marked considerable advancement in the study of sponges, especially of the deep water forms. Of the 'Challenger' collections, Monaxonida was worked out by Ridley and Dendy (1886, 1887), Tetractinellida by Sollas (1888), Calcarea and Keratosa by Polejaeff (1883, 1884), and Hexactinellida by Schulze (1887).

Hexactinellida of the Indian Ocean is a group which has received considerable attention in the past. The works of Schulze (1887, 1895, 1896, 1900, 1902, 1904), Smith (1872), Dendy (1916), Levi (1964) and Burton (1959) form the major contributions in this field. Ijima (1926) published a list of recognisably known recent Hexactinellids after studying critically all the species collected by the previous authors from this region.

South African sponges have been the subject of intensive investigation in the past. Burton (1926, 1929) studied the Myxospongida, Astrotetrazonida and Lithistidae collected by South African Marine Survey. The order Lithistida, as defined by Sollas (1888), is a heterogenous group, this diversity suggesting a polypyletic origin of their order; and Burton (1929) briefly pointed out the affinities of the various genera of this order. Burton studied the sponge fauna of South Africa from different areas like Natat (Burton, 1931, 1933 b), Still Bay (Burton, 1933 a), Oude Kraal, St. James, Seaforth and Muizenberg (Burton, 1936). Other accounts dealing with the South African sponges include those of Kirkpatrick (1901, 1902, 1903 a, 1903 b, 1913), Levi (1963) and Bosraug (1913). The fauna of Madagascar is known from the works of Bosraug (1913), Levi (1956, 1964), Vacelet (1967 a, 1967 b) and Vacelet and Vasseur (1965). The study of Vacelet (1967 a, 1967 b) brought to light several interesting genera and species of Pharetronid sponges. The fauna of Zanzibar is known from the works of Baer (1905), Jenkin (1908), Lendenfeld

(1897) and more recently through the collection made by the 'John Murray' Expedition (Burton, 1959).

A complete account of the then known sponge fauna of the Red Sea was published in 1889 and 1891 by Keller who could record only 88 species. The list has been enlarged since then as a result of the works of Schulze (1900) and Topsent (1892, 1893, 1906) to include 108 species. Further notable additions to the fauna of Red Sea were made by the collections of Mr. Crossland during the 1904-1905 period. Calcarea and non-calcarea were worked out by Row (1909, 1911) wherein he could record a total of 187 species. During 1948-49 the motor yacht 'Manihine' was sent by the British Museum (Natural History) to the Gulf of Aqaba for biological investigations. The material collected was worked out by Burton (1952) who recorded 33 species from the Gulf of Aqaba. The Red Sea is geologically very young, with fauna derived from Arabian Sea and possibly from the Mediterranean. The samples collected by the 'Calypso' were worked out by Levi (1958). Of a total of 53 species, 19 were new to science. The Israel South Red Sea Expedition (1962) collected some 39 identifiable species including 3 that were new (Levi, 1965). Fishelson (1966) studied the ecological relationships of *Spirastrella inconstans* (Dendy) from the Dahlak Archipelago. The Cambridge Expedition to the Suez Canal (1924) investigated the migration of sponges into the Canal and found that it has been almost entirely from the Red Sea (Burton, 1926).

The fauna of the Australian Coast has been well explored in the past. Lendenfeld's monographs and catalogues on Australian sponges, despite their errors and omissions, still remain the classic works on Australian sponges. Lendenfeld's 'species' were later reinvestigated and revised by many workers and the studies of Hallmann (1914, in three parts), Burton (1927), Whitelegge (1902 b), are worth mentioning in this context. An extensive study of the South Australian sponges, especially those from the neighbourhood of Port Phillip Heads, was undertaken by Carter in the years 1885-1886. Dendy's monograph of the Victorian sponges appeared in 1891 and his synopsis of the Australian calcarea Heterocoela in 1892. This was followed by the catalogue of non-calcareous sponges collected by Bracebridge Wilson from neighbourhood of Port Phillip Heads, in two parts (Dendy, 1895, 1896). F.I.S. 'Endeavour' conducted extensive fishing experiments in the years 1909-1910 along the coasts of New South Wales, Victoria, Queensland and Tasmania. Monaxonid sponges collected during this expedition were studied by Hallmann (1912) and the same author also revised the family Axinellidae provisionally including forms having microscleres (Hallmann, 1916, 1917). The major accounts dealing with the Tasmanian sponges are those of Guiler (1950) and Shaw (1927). The sponge fauna of the Western and South-Western Australia also received some attention. Works of Dendy and Frederick (1924) on the fauna of Abrolhos Island, of Rao and Hozawa (1931) on the Calcarea of South-West Australia, of Hentschel (1909, 1911) and Whitelegge (1905) on the fauna of South-West and West Australia respectively are the major contributions in this field. The sponges collected by the trawling expedition of H.M.C.S. 'Thetis' resulted in two volumes by Whitelegge (1906, 1907). The fauna of the Indonesian region also has been the subject of extensive study. Ternate sponges were investigated by Kieschnick (1896), Breitfuss (1898) and Thiele (1900, 1903); Amboina sponges by Kieschnick (1898) Schulz (1900), and Topsent (1897); and Aru and Kei Island sponges by Hentschel (1912).

Work dealing with the fauna of the Christmas Island has been rare in the 19th century. Upto 1900, when Kirkpatrick published the account of the marine fauna of Christmas Island, the only work dealing with this Island was that of Dendy (1887). Kirkpatrick (1900) recorded 32 species from this Island. Other papers relating to the fauna of this Island are those of Kirkpatrick (1910, 1911).

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