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The Museum
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MEDUSÆ OF THE BAHAMAS

BY

ALFRED GOLDSBOROUGH MAYER.

WITH SEVEN PLATES.

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MEDUSÆ OF THE BAHAMAS

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ALFRED GOLDSBOROUGH MAYER.

ALPHABETICAL LIST OF SPECIES.

HYDROMEDUSÆ.

SCYPHOMEDUSÆ.

SIPHONOPHORÆ.

CTENOPHORÆ.

INTRODUCTION.

The following observations were made while the writer was in charge of a scientific expedition to the Bahamas under the direction of the Museum of the Brooklyn Institute of Arts and Sciences. The report has received the benefit of valuable suggestions from Professor Charles B. Davenport.

The studies were made in the period extending from June 4-July 27, 1903, and numerous surface hauls were made under most favorable conditions for working.

The medusa-fauna of the Bahamas is poor in comparison with that of the Tortugas, Florida. For example, the writer secured ninety species of Hydromedusæ, Scyphomedusæ, Siphonophoræ and Ctenophoræ at the Tortugas, while only forty-three species were found at the Bahamas.

What is more interesting, the relative abundance of specific forms is quite different in the two regions. Thus the three commonest species at the Tortugas are Pseudoclytia pentata, Halitiara formosa, and Turritopsis nutricula; yet the first was not found at the Bahamas, while the two others were rare. On the other hand one of the commonest medusæ of the Bahama Banks, a new species of Lymnorea, has never been seen at the Tortugas, and species of Netocertoides, Olindias, and Cubaia are abundant on the borders of the Bahama Banks, but very rare at the Tortugas.

Altogether, of 43 Bahama medusæ, 23 are about equally abundant at the Tortugas, and 13 of these are either Trachylina forms or Siphonophoræ, which are widely distributed over the Tropical Atlantic. 16 are more abundant at the Bahamas than at the Tortugas, while 4 are more abundant at the Tortugas. 5 medusæ are known only from the Bahamas, and 2 of these are locally abundant.

These considerable differences in the medusa-fauna of two regions upon the same latitude, and being only about 300 miles apart, are co-ordinated with differences in local conditions. For example, the Tortugas lie to leeward of the Gulf Stream, and the rich pelagic life of the great current is constantly driven upon their shores; while the Bahamas lie to windward of the stream,

and their local fauna is not reinforced by creatures characteristic of the current. It is interesting to observe, however, that at the Tortugas we find more than a mere concentration of individuals, for a number of characteristic species appear to be confined to this region alone.

Moreover, at the Tortugas we have a small land mass surrounded by pure, deep ocean water, while at the Bahamas we find vast areas of shallow flats, covered mainly with coralline mud. These great banks of the Bahamas are veritable submarine deserts, covered only with a sparse growth of coralline, algæ, and with here and there a cluster of reef-corals and gorgonians.

It is remarkable, also, that the water over these shallow banks is almost as deficient in life as is the desert bottom itself. Almost no Sagittæ, Salpæ or Crustacea being found, and among Medusæ only Olindias, Cubaia, and Lymnorea are abundant.

Indeed, the water over the banks is usually charged with a flocculent mass of silt, which readily adheres to pelagic animals, and appears to be rapidly fatal to them. Only in this manner can we account for the poverty of pelagic life over the Bahama banks, for the deep-water regions of the Bahamas, such as the Tongue of the Ocean or the area to the eastward of Great Abaco Island, are rich in pelagic animals, which appear to be free from silt and in excellent condition. The water from the deep areas must, however, often be driven over the shallow banks and its life destroyed.

The coral reefs of the Bahamas are richer in species than are those of the Tortugas. They are best developed along the windward edges of the banks, the richest single reef being probably that which extends along almost the entire eastern shore of the Andros Islands, about one mile out from the beach. On the other hand fewer species of marine invertebrates and fishes are found among the Bahama reefs than among those of the Tortugas. The actual area occupied by corals is insignificant in comparison with the great extent of barren flats around them.

In general it appears that while the Tortugas fauna is recruited from the pelagic life of the Gulf Stream, and from the drift caused by prevailing winds, the Bahama fauna is depleted by the same winds, and is poor in those creatures which are mainly dependent upon great currents for their distribution.

Morphology, etc. A unique opportunity was afforded for the study of the post-embryonic development of Cubaia, and Olindias, and it appears that

Gonionemus, Cubaia, Vallentinia, Olindioides and Olindias are closely related genera, which may be grouped into one family, the Olindiadæ.* The marginal (velar) tentacles of Cubaia and Olindias are secondary and arise quite late in ontogeny. The distinguishing feature of the Olindiadæ is the development of a pad-like cluster of modified nematocyst cells upon the aboral side, near the distal extremity, of each and all of the primitive tentacles. These pad-like expansions may serve as adhesive disks or organs of temporary attachment.

A study was also made of the phenomenon of asexual budding in medusæ. One of the most interesting examples is afforded by *Eucheilota paradoxica,* which is the only Leptomedusa known that produces an asexual generation of medusæ by a direct process of budding. These daughter medusæ are derived from both entoderm and ectoderm of the gonad of the parent (Fig. 65, Plate VII).

We have, therefore, a graded series of phenomena in the asexual production of medusa buds by hydromedusæ. In forms where the ectoderm and entoderm are both thin-layered and of about equal thickness, such as in the *Sarsiadae* and *E. paradoxica,* both entoderm and ectoderm take an equal share in the formation of the bud. In forms such as Rathkea octopunctata and Lizzia Clapereidei, according to Chun, 1895, a different condition is observed, for the medusa buds are formed entirely within the ectoderm of the parent, although the gastro-vascular cavity of the bud finally acquires a connection with that of the parent; the entoderm of the bud becoming continuous with that of the parent manubrium.

In Bougainvillia niobe from the Bahamas, however, the ectoderm is very thick, and the budding medusæ are developed within it alone; the entoderm remaining inert and passive during the growth of the bud, and no connection ever being established between the gastro-vascular cavities of the bud and the parent. (See Figs. 15-15c, Plate II.) This result may be regarded as due to a gradual process favored by the thickness of the ectoderm, which prevented the deep-lying entoderm from taking an equal share in the formation of the bud, until finally, as in B. niobe, it remains passive throughout the period of the formation of the bud. Medusæ produced from ectoderm alone may, therefore, be phylogenetically homologous with medusæ produced by

* Goto, S. 1903; Mark Anniversary Volume.

the more primitive and universal co-operation of both ectoderm and entoderm.

New Species. Two new species were established, Lymnorea Alexandri, named in honor of the author's constant friend, Alexander Agassiz. It is the most abundant medusa of the Bahama Banks throughout the summer.

The other new form has been named Parvanemus degeneratus, and is the most degenerate free-swimming hydromedusa yet described. It lacks tentacles, sense organs, and peripheral vascular system. It swims, however, with great activity, but is short-lived. In this form nature appears to have performed Loeb's experiment, in which, as is well known, he cut away the rim of the bell, depriving the medusa of tentacles and sense organs. Yet the bell still contracted rhythmically when placed in a solution having the same osmotic pressure as sea water, but having no calcium or potassium ions.

Murbach, 1903; Amer. Journ. Physiology, X, p. 201, has shown, however, that in Gonionemus the marginal otocysts have nothing to do with the maintenance of equilibrium, but that it is probable "that muscular sensation (largely in the velum) is the seat of static function in Gonionemus and in hydromedusæ." It is interesting to observe that the velum of Parvanemus is exceptionally large and provided with powerful muscles. Such "muscular sensation" is not always found in the velum, however, for in Rhacostoma dispar the bell opening is much reduced and the medusa is propelled by the movements of its widely open mouth. Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXXVII, p. 61, 1900.

DESCRIPTION OF SPECIES.

For the sake of completeness we present a brief description of all species of Hydromedusæ known from the Bahamas.

The classification is essentially that of Haeckel.

HYDROMEDUSÆ.

Parvanemus degeneratus, gen. et. sp. nov.

Fig. 22, Plate III.

Generic Characters: Parvanemus: Codonidæ without tentacles, radial canals, or circular vessel.

Specific Characters: The bell is thin-walled, about 0.75 mm. high and 0.3 mm. in diameter. The bell-walls are quite rigid and the velum powerful and well developed. There are neither tentacles, radial canals, circular vessel, nor marginal sense organs. The manubrium is spindle shaped and about one-third as long as the bell-height. The fluids within the stomach-cavity are maintained in rapid motion apparently through the action of cilia. Near the aboral end of the bell there is a deep conical cicatrice which evidently marks the place of last connection between the medusa and its hydroid stock. The bell is translucent and milky in color while the manubrium is cream colored. Only five specimens, all males, were found in Nassau Harbor, Bahamas, on the nights of July 18-19. They swam actively in arcs of circles, but all died early in the morning although maintained in large glass dishes filled with pure sea-water. They appeared to be mature, for sperm was discharged constantly from the sides of the manubrium.

This is the only free swimming hydromedusa, yet described, that lacks all traces of tentacles, radial canals, and marginal sense organs. It is even more degenerate than the medusæ of Amalthæa and Pennaria, and may be compared with Eucopella (R. von Lendenfeld, 1883; Zeit. für Wissen. Zoöl., Bd. 38, p. 497), and Agastra (C. Hartlaub, Wissen. Meeresuntersuch. Biologish. Anstalt auf Helgoland, neu folge, Bd. 2, Heft 1, Abt. 2, p. 504, Taf. XXII, Fig. 5, 8-10). In these remarkable medusæ we find neither manubrium nor marginal tentacles. There are, however, eight otocysts, and the radial and circular vessels are well developed.

Syndictyon angulatum, Mayer.

Fig. 6, Plate I.

Mayer, 1900; Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXXVII, p. 5, Figs. 6-8, Pl. 8.

The bell is 3 mm. high; half egg-shaped, with moderately thick walls, and becomes almost square in cross section when contracted. There are four slender tentacles with fairly thick spindle-shaped ends. These tentacles are each about as long as the bell height, and their distal halves are armed with nematocysts. The basal bulbs of the tentacles are not very large and each one bears an ocellus formed by a cup-like invagination of ectodermal cells. The velum is large, and the radial canals and circular vessel are of fine calibre. The manubrium is spindle-shaped with a narrow tubular œsophagus,