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**THALIACEA FROM THE RED SEA,  
THE GULF OF ADEN  
AND THE WESTERN INDIAN OCEAN**

by

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RÉSUMÉ

En dépit des apparences, la faune des Thaliacés de la mer Rouge, comme celle du golfe Persique, est d'origine indo-pacifique. Seules quelques espèces à distribution mondiale sont communes avec la Méditerranée orientale.

En raison des conditions très dures (température et surtout salinité élevée) et de la présence des seuils, la faune de la mer Rouge et surtout celles du golfe de Suez et du golfe Persique, sont plus pauvres que celle de l'océan Indien et du golfe d'Aden.

SUMMARY

Despite the appearances, the Thaliacean fauna of the Red Sea (as well as the fauna of the Persian Gulf) is of an indo-pacific origin. Only a few worldwide scattered species are common with the eastern Mediterranean.

Owing to the severe environmental conditions (heat et mostly high salinity) and the presence of sills, the fauna of the Red Sea and especially those of the Gulf of Suez and of the Persian Gulf, are poorer than the fauna of the Indian Ocean proper and of the Gulf of Aden.

The Red Sea is a relatively young sea which was insulated during the drying Messinian period and was invaded by an indo-pacific fauna at the beginning of the Pliocene. That fauna is still present nowadays.

The Red Sea, a deep, long and narrow trench, is connected with the Gulf of Aden and the western Indian Ocean by the Strait of Bab-el Mandab, a sill, some 100 m deep, which separates two deeper marine areas. At this northern tip, the Red Sea ends into two appendices, the shallow Gulf of Suez (maximum depth at the entrance 60 m) and the deep oceanic Gulf of Aqaba (maximum depth 1800 m) which is somewhat a reduction of the main basin. Owing to its situation in the desert belt and the total lack of any freshwater supply, the sea undergoes an extreme evaporation with the consequence of a salinity increasing from the southern entrance ( $S = 37 ‰$ ) to the northern Gulfs ( $\geq 41 ‰$ ). Summer water temperatures reach 28° C.

The Persian Gulf belongs to the neritic zone (maximum depth 75 m); it opens through the Hormuz Strait into the Gulf of Oman, the depth of which increases very fast. The Gulf is also located in the arid zone and despite the large supply of freshwater from the Tigris and Euphrates Rivers, the salinity is high even in the offshore waters ( $S \geq 40 ‰$ ). Moreover pollution by oil spilling is prominent.

As the shelf is narrow, the Indian Ocean (see Gulf of Aden) quickly becomes deep along the Somalian and Arabic Coasts. This area is submitted to the monsoon system. The main freshwater supply comes from the Indus River. The 35 ‰ isohaline is found along the Somali Coast and the 36 ‰ isohaline crosses the Arabian Sea about 10°N.

The investigations on the Thaliacea of these different regions have been undertaken for three decades and several papers have appeared (see literature below). Nevertheless, the southern half of the Red Sea still remains unexplored with respect to Tunicates.

The thaliacean fauna of the Indian Ocean is rich : 8 species of Doliolidae, 5 species of Pyrosomidae and 18 species of Salpidae have been recorded between the Equator and 25°N, as well in the offshore waters as in the vicinity of the coasts (GODEAUX, 1972 ; GODEAUX et MEURICE, 1978 ; SEWELL, 1953). It is noteworthy that *Doliolina indicum* (Neuman), *Cyclosalpa sewelli* Metcalf, *Thalia rhomboides* (Quoy and Gaimard) and *Metcalfina hexagona* (Quoy and Gaimard) are four strictly indopacific species. Several more are either circumtropical or temperate species : *Dolioletta gegenbauri*, *Doliolum denticulatum*, *Doliolum nationalis*, *Pyrosoma aherniosum*, *Pyrosoma spinosum*, *Brooksia rostrata*, *Salpa maxima*, *Salpa cylindrica*, *Ritteriella amboinensis*, *Iasis zonaria*, *Thalia democratica*, *Thalia cicar*, *Thalia orientalis*, *Thetys vagina* and *Pegea confederata*.

Among these, a few are present in eastern Mediterranean : *Doliolum denticulatum*, *Doliolum nationalis*, *Thalia democratica*, *Thalia orientalis*, *Pegea confederata* (GODEAUX, 1974).

Most of the species belong to the epiplanktonic or to the upper mesoplanktonic faunas with the exception of *Pyrosoma spinosum*, often caught in deeper waters (SEWELL, 1953). These species have been especially recorded from the Gulf of Aden.

Perhaps the still of Bab el Mandab selects the species which are furthermore submitted to increasingly harder ecological conditions. In the northern part of the Sea, only 4 species of Doliolidae and 9 species of Salpidae have been identified so far ; no *Pyrosoma* has ever been observed till now. *Cyclosalpa sewelli* and *Metcalfina hexagona* are missing, but *Cyclosalpa bakeri* is present. However it remains to be investigated if the Thaliacea are not undergoing the same fate than the Pteropods, the shells of which are covering the sea bed. The fauna of the Gulf of Suez is still poorer (GODEAUX, 1974) as only two species of Doliolidae (*D. denticulatum*, *D. nationalis*) and two species of Salpidae (*Brooksia rostrata*, *Thalia orientalis*) have been caught. The commonest form is *Doliolum nationalis* (asexually propagating phorozoids) reaching up to 16.000 individuals in a single catch. It is accompanied by the cladocera, *Penilia avirostris*, another indicator of the neritic waters, which is able to live in the hyperhaline Bitter Lake (GURNEY, 1927) ; it is again very abundant in the Kuwaiti coastal waters (YAMAZI, 1974).

Contrarily to the Gulf of Suez, the fauna of the Gulf of Aqaba is as rich as that of the main basin (GODEAUX, 1973) but exhibits some discrepancies : *Doliolum nationalis* is lacking ; *Ritteriella amboinensis*, considered as a rare species, is quite common and characteristic ; *Salpa maxima* and *Salpa maxima tuberculata* caught several times in the Gulf remain still unknown from the main basin (VAN NAME, 1952). *Thalia cicar* is more abundant in the Gulf and *Thalia rhomboides* forms large swarms in the Sea (unpublished).

The populations living as well in the Red Sea as in its appendices prove able to tolerate high salinities ( $S \geq 41$  ‰) and temperatures (up to 28°C) and may

result from progressive selection and adaptation to the hardest ecological conditions known in the world ocean.

Few species (*D. denticulatum*, *D. nationalis*, *Dolioletta gegenbauri* and *Salpa cylindrica*, beside a few blastozooids of *Thalia* sp.), penetrate the Persian Gulf to almost its far end (up to 48°E). *Thalia democratica* and *Thalia rhomboides* are present in the strait of Hormuz. It must be pointed out that *Iasis zonaria*, *Metcalfina hexagona*, *Thalia cicar*, *Thalia orientalis*, *Pegea confoederata* are known from the Gulf of Oman. Again the fauna of the shallow Persian Gulf is poorer than that of the neighbouring oceanic deep waters.

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Le genre *Thalia* a été jusqu'à présent considéré comme le genre *Thalia* et a divisé l'espèce *Thalia orientalis* Yoklavich 1967 en trois espèces: *Thalia orientalis* Yoklavich 1967, *Thalia cicar* et *Thalia rhomboides* Quoy et Gaimard 1834.

Dans ce travail, la stabilité des deux espèces, *Thalia orientalis* et *Thalia cicar*, est contrôlée.

Le genre *Thalia* a été longtemps décrit sous trois espèces:

a) *Thalia longicauda* Quoy et Gaimard 1834, rencontrée dans l'Océan Atlantique et l'Océan Indien au delà de 40°S. L'espèce a été redécouverte récemment (GODEAUX 1967). La forme solitaire, entre un muscle intermédiaire (II) et un muscle (II à VII) transversaux et parallèles au niveau du reme et deux très longs prolongements tubulaires postérieurs; il a y a pas de paires de crochets. La forme agrégée présente le même aspect général que les formes correspondantes des autres espèces, mais ses muscles occupent environ deux fois plus de fibres (II à III fibres d'un côté, 27 à 28 fibres d'autre part, GODEAUX 1967, voir aussi GODEAUX et MEURICE 1978).

b) *Thalia democratica* (Fossil 1776), largement répandue dans les 3 océans et en Méditerranée. La forme solitaire possède aussi un arête au muscle inter-

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