Abstract

Approximately 22 species of sea anemones and 20 species of aleyonarians were found on the reef fringing the shallow water at Eilat (Gulf of Aqaba) and other localities along the Red Sea coast of the Sinai Peninsula. Investigations showed that these 2 groups of non-scleractinian coelenterates form (on different substrates) well identified colonies, part of them inhabiting sandy bottoms, other groups growing on the reef surface. Observations lead to the conclusion that several of the sea anemones and aleyonarians can act, under certain conditions, as factors limiting the development of hermatypic corals. In some areas, several species of the 2 groups of animals are found together with their symbiotic partners, such as fishes and crustaceans.

Introduction

During the past, as well as recently, a great deal of the attention of marine biologists and ecologists working on tropical reefs was centered on scleractinians, as the typical reef builders and most important contributors to the reef biocoenosis. Less interest was focused on soft corals and especially actinians, which in most instances were mentioned only in the framework of coral habitats. Concerning the Red Sea, two of the first and best summaries on these two groups were written by Ehrenberg (1834) and Klunzinger (1877) after their successful expeditions in this region. From this time on, only small additions were published on both soft corals and actinians. For a general view of the publications on Alcyonaria and Actiniaria, the systematic summary of Bary (1955) is very important; and for the sea anemones, the taxonomic paper published by Carlgren (1949).

Other papers published were of more specific character. A part of them, dealing with sea anemones, was mostly concerned with various problems of their symbiotic relations with other animals (Gohar, 1948; Fishelson, 1964, 1965; Garre, 1964; Jacquotte, 1964; Graaf, 1968). Papers published on Red Sea Aleyonaria were either systematic (Gohar, 1940; Versveeldt, 1965), physiological (Gohar, 1948) or behavioristic (Magnus, 1966).

Observations showed that the Aleyonaria and Actiniaria are important factors in most coral reefs, especially in the colder regions, participating to a great extent in the energy balance of their environment (Squires, 1964). For example, according to several authors, the Aleyonaria on Tortugas reef produce approximately 1 ton of microscopic calcareous sclerites per year per acre. This great amount of minerals, as well as the minerals bound in living tissues, may play a very important role in the mineral balance of the reef and surrounding waters (Marshall, 1965). Aleyonaria also form additional ecotones, exploited by large numbers of commensalic and mutualic animals (Jacquotte, 1964; Robertson, 1965).

The aim of this paper is to describe, in general terms, the occurrence and distribution of the shallow-water sea anemones and soft corals in the Northern Red Sea, with special emphasis on those found in the vicinity of Eilat, Gulf of Aqaba. The observations summarized here are the product of a 15 year investigation of the distribution and behavior of the Red Sea littoral fauna, especially those of the infratidal and shallow subtidal zones. The taxonomy used is based mostly on the works of Carlgren (1949) and Bayer (1955), as well as on the phylogenetical approach summarized by Rensi (1966).

The population of sandy bottoms

Locating the sea anemones along a transecting line that travels from the shore, through the lagoon, and covers the coral reef table (Fig. 1), it is clear that the outermost species are the small specimens of Anthopleura elatensis, described by Gohar (1969; Fishelson, 1964, 1965; Garre, 1964; Jacquotte, 1964; Graaf, 1968). Papers published on Red Sea Aleyonaria were either systematic (Gohar, 1940;
greenish lines on the tentacles, especially on their outer sides. The body of *A. elatensis* is mostly enveloped in a mucous sheet, with adhered sand granuli.

During the daytime and low tide, they are mostly contracted and flattened on the stone base. During high tide, and especially during the night, they stretch out, extend their filamentous tentacles high up in the water and obtain food from the plankton passing overhead. In most places, the groups consist of single large specimens and a great number of small ones. It seems that all such groups are products of laceration. According to ROBINSON (1965), commensalic molluscs of the genera *Epitonium* and *Alexandria* are found on closely related species of the genus *Anthopleura* of South East India.

Towards the sea, in the uppermost subtidal region, begins the population of the swimming sea anemone *Boloceroides memuriichi*, as well as the population of the sand-dweller *Radianthus (= Antheopsis) koseiren-sis*. The very peculiar brachynuran boxer-crab *Lybia leptochelis* is also found here, bearing in each of its claws one small sea anemone, usually *Triactis producta*. *B. memuriichi* is mainly found attached to the sides of the substrate, or in caves of stones or dead coral parts, sometimes 5 to 10 specimens together (Fig. 3). In most of the observed specimens there are 2 kinds of tentacles: the longer ones are mostly raised upwards, and among them are smaller, short tentacles. The latter seem to be young regenerates (CARLSSON, 1949). Most of the specimens are light brown in color, with violet-whitish rings on their tentacles. Any disturbance in their vicinity causes them to break away from their holding place and, in most cases, they also autotomise into pieces, each of them bearing from one to several tentacles. According to Pax (1923/1925), such behavior occurs also in different species of the genera *Bolocera* and *Bunodeopsis* and is caused by a special muscle bundle, called by him "Brechmuskel". Immediately after breaking away, the detached parts start to swim, waving their tentacles in the fashion described by Ross and Sutton (1964a, b) for *Stomophia coccinea*. After a short while, these pieces not caught by passing waves, sink down slowly, attach themselves anew, and crawl into shadowy places.

The occurrence of *Triactis producta* in this particular region is doubtless connected with the preference of this niche by its host, the crab *Lybia leptochelis*. This crab finds its ecological niche under stones and corals, from the border of the low tidal region down to a depth of 1.5 m. Most specimens of *T. producta* observed within the chela of the crabs are of pinkish color, with prominent lateral buds (Fig. 4), greatly resembling KUNZINGER's figure of this species (1877). BORRODAILLE's publication (1902) gives a very accurate description of this crab-actinian symbiosis. It may be interesting to add that, during all the years of observation in nature, no crabs were ever found without actinians. Also, in extended experiments in aquaria, it was impossible to keep crabs alive separately for any length of time.

The small specimens of *Triactis producta* are only miniature representatives of the real populations of this sea anemone found in dark, deep crevices of dead corals, or among branches of *Millepora dichotoma*. They are mostly found in groups of tens together, brown-reddish in appearance, with pale pinkish color occurring on branched vesicular outgrowths close to their oral disc. In aquaria they tend to expand, and then the upper protractile oral disc opens, extending the long filamentous oral tentacles (Fig. 5). It was found that these small, beautiful anemones are protected by very strong batteries of nematoeysts. At least on one occasion, a touch of one of these animals on a diver's arm caused swelling, acute irritation, and temperature, for several days.

According to CURTRESS (personal communication), additional species of actinians should also occur in this region, such as small species of *Bunodactis* involved in the same symbiosis with *Lybia leptochelis*.

On the stones of this region, the first small colonies of *Xenia umbellifera* are found and, beneath the stones, in deeper, shadowed excavations, the small red gorgonian *Agabaria pulchra*. From this level, which is the lowest part of extreme tides, the inner lagoon begins. It is covered mostly by erosive material originating both from the shore and the sea, and forms a water passage between the shore and the reef table. The bottom of this part is mostly composed of coralogenous...