

Species Diversity and Phylogenetic Studies on the Anthozoans in Korea

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Class Anthozoa belonging to phylum Cnidaria is the nearest ancestral taxon of metazoans, and occupies an important position in the marine biodiversity. Approximately 6,000 species of anthozoans which occupy 2/3 of the phylum Cnidaria are known. Anthozoans are exclusively marine, solitary or colonial, mostly benthic polyps without medusoid stages, and reproduce both sexually and asexually. Among them madreporarians, as the largest group in Anthozoa with over 2,500 extant species, play a central role in the formation of bioherms (coral reefs). Highly adapted, diverse faunas of symbionts including polychaetes, bivalves, barnacles, zooxanthellae, and other crustaceans are associated with various anthozoan species. Because most of anthozoans usually live in very clear waters and are important to the formation of fishing grounds, they are economically a very important taxon in the marine biodiversity.

This class contains 15 orders which are categorized by two subclasses (Octocorallia and Hexacorallia) or three subclasses (Alcyonaria, Zoantharia, and Ceriantipatharia). To date, 9 orders containing 121 species, 59 genera and 32 families in the anthozoans are reported in Korea. In addition to these, two orders (Corallimorphoria and zoanthinaria) will be introduced. With all these, works using molecular technology were done. Especially, a new species named *Dichopsammia granulosa* Song, as a true stony coral from the Korea Strait was reported in a new genus.

The identification of the anthozoans requires the following characters: the growth pattern of colonies; the composition and shape of the skeleton; the shape and distribution of spicules and cnidae; the arrangement of tentacles and mesenteries; the reproductive patterns; and others.

Subclass Alcyonaria (=Octocorallia) from Korea contains 81 species, 33 genera, 18 families in 5 orders which indicate a peculiar diversity of the

temperate water form. Particularly, the soft coral community is found in the southern part of Cheju Island, the shallow waters of Mun-do Island and Beom-do Island. The worst is the destruction of sea-fans because of the increase of SCUBA diving and tourism.

Subclass Zoantharia (=Hexacorallia) from Korea was reported 36 species, 23 genera, 12 families in 2 orders, of which sea anemones includes 11 species and 10 more species will be added. About 87.5 % of stony corals inhabit in the Cheju Islands area due to the influence of the Kuroshio warm current, but they are different from coral reefs in the composition of species.

Subclass Ceriantipatharia from Korea occupies 4 species, 3 genera, 2 families in 2 orders, of which 3 species are black or thorny corals, and should be protected from collection for decorations and jewelry. A paper about tube anemone, *Cerianthus filiformis* associated with phoronids unrecorded in Korea is in preparation.

Based on the arrangement of tentacles and mesenteries, class Anthozoa is divided by two or three subclasses. The systematic scheme is not established because of subjective decisions and serious views on morphological characters. Because the classification of the anthozoan based on main morphological characters has been criticized, the systematic phylogeny of them must be reconsidered. Recently the molecular techniques have been enable to systematize the objective phylogenetic analysis, and especially the sequencing data of genes could be used in the phylogenetic study.

Therefore, it has been tried to reexamine the phylogeny of anthozoans for 7 years by using the sequencing data of rDNA on the speciation of anthozoans in Korea. For the analysis of the phylogenetic relationship among the species, the samples of 28 representative anthozoan species belonging to three subclasses and 3 hydrozoan species as outgroup were selected, and then cloned to 18S rRNA gene by PCR cloning method and sequenced by using 12 primers and a Taqtrack kit. The sequencing data of 31 species were aligned by using CLUSTAL W program and analyzed their phylogenetic relationships with PAUP and PHYLIP programs.

The results indicate the differences of the classical phylogenetic relationship based on morphology. Although all species belonging to anthozoans show a monophyletic group at each phylogenetic trees, orders Ceriantharia and Anthipatharia are not related to each other, namely the former comes off the

tree first, and the latter relates to subclass Hexacorallia closely. Order Corallimorpharia is more related to order Scleractinia, and distant from order Actiniaria.

Moreover, the results on studying subclass Octocorallia show a monophyletic group except for a little difference that order Pennatulacea comes off the tree first, and orders Alcyonacea and Gorgonacea are attached to the cluster one by one. Order Stolonifera is more related to *Bellonella* group in order Alcyonacea. Order Telestacea is more related to scleractinian group in order Gorgonacea. Also nephtheidae group in order Alcyonacea is related to holaxonian group in order Gorgonacea.

As shown in the present results, even though the phylogenetic relationships among the group of Anthozoa show a monophyletic group, order Ceriantharia comes off first, and next subclasses Octocorallia and Hexacorallia branch off two main groups according to the development of mesenteries. Especially the result supports that orders Ceriantharia and Antipatharia have to be divided into different group from subclass Ceriantipatharia.

This work will be contributed to construct more reliable phylogenetic trees of Anthozoa and Cnidaria, and also used as basic data for the study on phylogenetic relationship of other taxa. For example, the study of natural products was conducted on seven bioactive steroids from the soft coral *Alcyonium gracillimum*, new secosteroids from one gorgonian *Muricella* sp.1, and mucellaxanthin from another gorgonian *Muricella* sp.2.