

## Phylogeny and Evolution of the Forcipulatacea (Neoasteroidea, Echinodermata)

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Forcipulatacea is one of the main clades of extant Asteroidea (also called sea stars or starfish), with approximately 400 described extant species, but a relatively sparse fossil record. Recent research demonstrated that phylogenetically informative morphological characters can successfully be defined in echinoderms from the comparative analysis of skeletal elements (ossicles), using ossicle shape, articulations among ossicles, and marks left behind by soft tissues. This allows for the joint analysis of extant and extinct taxa. The first chapter of this thesis describes the post-metamorphic ontogeny of the forcipulatacean species *Zoroaster fulgens*. The study of this ontogenetic series allows for the description of new morphological characters and a better understanding of the homology of ossicle structures found in the ossicles of *Z. fulgens* in particular, and other forcipulatacean sea stars in general (i.e. muscle insertions and articulation areas). The second chapter describes the anatomy of 29 extant forcipulatacean asteroids, followed by the definition of 115 morphological characters, resulting in the largest character/taxon matrix assembled to date for Forcipulatacea. Subsequent phylogenetic analysis recovers the main groups as monophyletic: Asteroidea, Brisingida, Stichasteridae, and Zoroasteridae. Morphological synapomorphies are proposed for these clades and homologies and convergences between different clades are discussed. The last two chapters focus on the study of Mesozoic forcipulataceans. Five Jurassic and one Cretaceous taxon are reappraised and new anatomical observations with emended diagnoses are provided for four others. The phylogenetic position of these fossils is investigated using the character/taxon matrix from chapter 2. The reanalysis of these fossils permits performing the most comprehensive phylogenetic analysis based on morphological data for this group to date. The results suggest an early diversification of the Forcipulatacea, during the Jurassic. Mesozoic forcipulataceans exhibit a unique combination of characters that distinguish them from extant taxa. The early diversity of the Forcipulatacea was greater than previously thought and challenges existing perceptions of the evolutionary history of this major clade.

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