

Morphology and Anatomy Histology of Brittle Star (*Ophiocoma dentata*)

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Abstract. This study aims to know the anatomy structure of the Morphology down to the and Histology of the Brittle star (*Ophiocoma dentata*). Brittle star is one of the Echinodermata phylum whose ecosystem is on a coral reefs, coral floors and hiding behind corals. Animal removal was made by observation of Nguyahan beach's coral floor, at the same time as the site of morphology, followed by morphological and anatomic observations using stereo microscopes at the Zoology Lab of UIN Sunan Kalijaga, histological research using the eosin-hematoxylin method was also carried out in the same place. The results of the morphological observations of the star were obtained data on habitat, distribution, reproduction, a type of food, adaptation, movement and structure in the dorsal and ventral areas. While observation of the anatomy of the Brittle star (*Ophiocoma dentata*), data was obtained data on both horizontal and vertical disks, and leg structures by surgery. And the anatomical data of histology with eosin-hematoxylin got results on the disk, arms and spikes.

Keywords: Brittle star (*Ophiocoma dentata*), Echinodermata. Nguyahan Beach, eosin-hematoxylin

Running Title : Morphology and Anatomy Histology of Brittle Star

INTRODUCTION

Echinodermata (Animal Skin with Thorns) comes from the Greek "echinos" which means "spiny" and "derma" which means "skin". Therefore the animals in this phylum are also called prickly skin animals. Phylum Echinodermata is one of the phylum which has an average existence in the sea, the animals in this phylum have the characteristics of spiny and granular skin. Phylum Echinodermata itself is divided into 5 classes, namely Asterozoa, Crinozoa, Echinozoa, Holothurozoa, and Ophiurozoa. Ophiurozoa or snaking stars, consisting of 3 classes (orders), 16 tribes (families), and 276 genera (genus). At this time it is estimated that there are about 1600 species (species) of snaking stars. This snaking star is found in all seas and oceans with a depth limit between 0 meters to 6720 meters (Marshall 1979). In general, these biota live in groups (aggregations) on the seabed, especially on the bottom of the waters consisting of mud or a mixture of mud and sand.

The Ophiurozoa class is found in many large marine areas both in Indonesia and outside Indonesia. The Ophiurozoa class is widely distributed in the Arctic Ocean, Atlantic Ocean, Pacific Ocean, Indian Ocean, South America, Africa South, and the Indo Pacific (Stohr et al. 2012). The most identified Ophiurozoa species come from the Indo Pacific with 831 species. In addition, Ophiurozoa can also be found in the waters of the Philippines, New Caledonia, Papua New Guinea, Madagascar, Australia, and the Caribbean (Maluf 1988). The Order of Ophiurids (Brittle stars) are widely distributed in shallow and sandy waters in tropical waters, Central America, the Caribbean Islands and the Australian Coast (Maluf 1988). The order Euryalida (Basket stars) are found in many deep waters in the Pacific Ocean and Atlantic Ocean (Gage and Tyler 2002).

MATERIALS AND METHODS

This research went through two stages, the first was taking Star (*Ophiocoma dentata* the Sniping) which was carried out at Nguyahan beach, Gunung Kidul, in the afternoon (before 18:00 WIB) and in the morning (before 06:30) since December 2019. - February 2020. The second phase of Anatomy research to making histological and morphological preparations was carried out at the Integrated Laboratory of UIN Sunan Kalijaga Yogyakarta in January-March 2020.

The tools used in this study were binocular microscope, stereo microscope, jar, microtome, oven, glass object, slide warmer, piece glass, cover cup, paraffin, gauze, surgical instruments and digital cameras. Meanwhile, the materials used were Bintang (*Mengular Ophiocoma dentata*), bouine solution, chloroform, graded alcohol, toluene, xylol, hematoxylin, eosin, entelan and 5% HNO₃.

Sampling of the star (*snaking Ophiocoma dentata*) at Nguyahan beach Gunung Kidul Yogyakarta was carried out by observation. Furthermore,

the Morphology and Anatomy research was carried out using a stereo microscope, and histological preparations were made using the method *eosin-hematoxylin* which was added to the decalcification process.

RESULT AND DISCUSSION

Morphology of *Ophiocoma dentata*

Based on the morphological observations that have been made, it was found that the snaking star (*Ophiocoma dentata*) has a body shape with the same radial pentamerous symmetry as starfish, but snaking stars have a harder texture, this is due to the from the snaking

star (*Ophiocoma dentata*) itself from limestone plates containing calcium carbonate and magnesium carbonate. So that the texture of the snaking star is quite (*Ophiocoma dentata* hard) than the starfish. The pentamerous radial symmetry of the snaking star is clearly visible, between the curves of the five bodies that are arranged there are sharp depressions, so that the break between the parts also has no effect on other parts. The arrangement of the body part of the beetle snakes (*Ophiocoma dentata*) the same as the part of the spines in each part, so of course the spines are also hard textured, the shape of the spines is observed to be blunt and short. The snaking star (Ophiuroidea) has a means of movement in the form of an ambulacral system assisted by an internal framework composed of calcium carbonate.

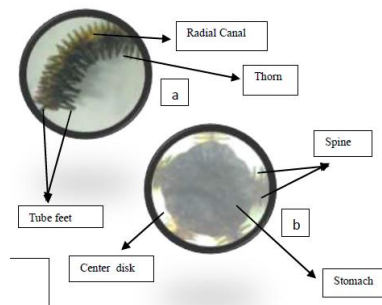


Figure 1. body *Ophiocoma dentata* a) Morphology in the Vertical section b) Morphology on the Dorsal section

Based on the results of research over time, snaking stars can occupy the coral floor ecosystem which consists of various coralreefs. This biota has negative phototaxis properties and tends to live in hiding in its spreading area. So that the snaking star *Ophiocoma dentata* always hides behind the coral, showing a part of its body, namely the arms to meet the needs of the systems in its body.

Based on the observations of *Ophiocoma denata*, it belongs to the Ophiuridae family., This tribe includes snaking stars whose way of eating and eating is carnivores, usually has short spiny hands, tube feet that are in charge of moving captured prey towards the mouth, this animal does not have anus, remains -The rest of the meal will come out of the mouth.

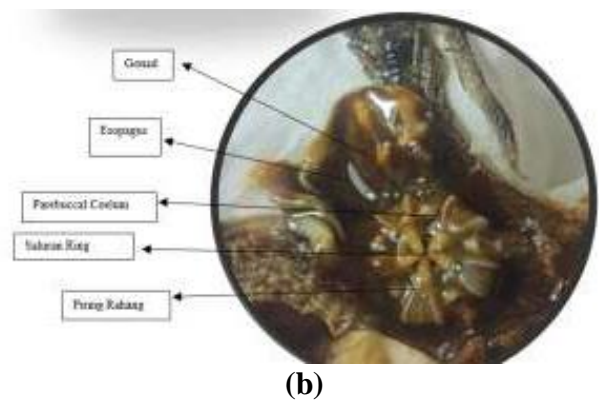
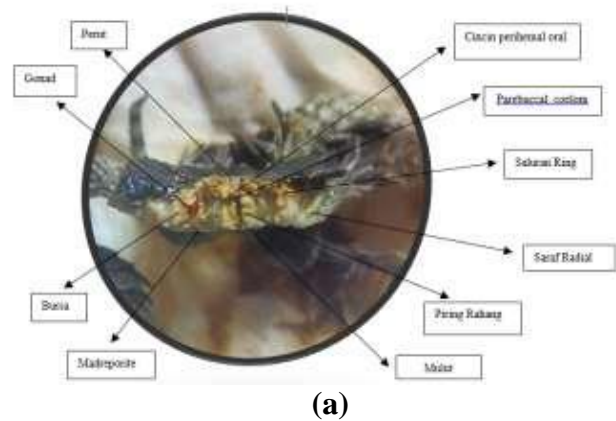
Snuffling stars have two systems in their reproduction. First sexual. In general, the sex of the star snakes apart, but there are also only gonads. In this study only morphology and anatomy were found and detected only gonads. Asexual reproduction is the second reproductive system, where this system is also a form of adaptation

for snaking stars to survive, when threatened, this animal will break its arm, this arm will also become a new individual, the broken body will grow arms with some time.

Anatomy of *Ophiocoma denata*

Ophiuroidea has five jaws and has neither intestines nor anus. The respiratory system includes air exchange and excretion carried out by 5 pairs of small bags that open around the mouth called the bursae slit and this tool is connected to the tract of the reproductive organs (gonads).

The nervous system consists of a main nerve ring that operates around the main disc. The digestive system of Ophiuroidea is in the stomach. The digestive organs are contained in a ball disc, starting from the mouth which is located in the center of the body and then the stomach which is shaped like a pouch. The vessels of the water vascular system end at the foot of the tube and the water vascular system generally has one madreporite. Around the mouth there is a jaw which is a group of five chalk plates. The food is held by one or more of its arms, then snapped and with the help of tentacles put into the mouth. The undigested material is thrown out through his mouth.



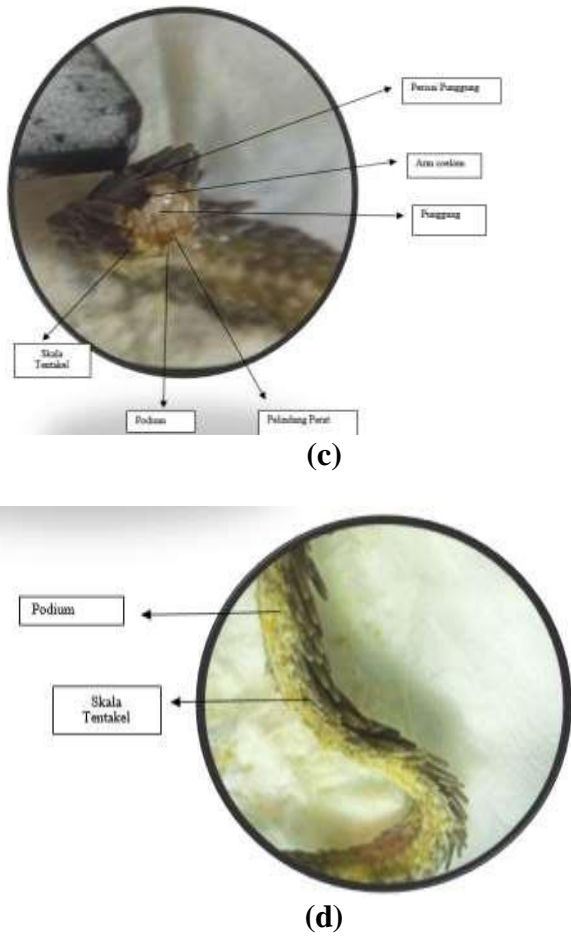


Figure 2. Anatomii *Ophiocoma dentata* a) Vertical Disk b) Horizontal disk c) Vertical Sleeve d) Horizontal Sleeve

Ophiuroides are characterized by the jointed appearance of their highly calcified arms. Each joint or segment contains a central vertebral oss and a belt of four scales or shields, apical, lateral and oral in position. In *O. longicauda* the apical shield is no longer divided. Each lateral scale produces a row of starting points for the spines at its distal end. Additional attachments are missing if not present. The adjacent vertebrae are held together by intervertebral ligaments and intervertebral muscles. They are surrounded by a thick sheath of tissue that supports and holds the calcareous scales together via collagen bundles which pass through the basal and lateral portions of the scale pore space.

Anatomy Histology of *Ophiocoma dentate*

In places the fiber bundle runs from the spinal column to the connective tissue sheath, but on the contrary there is a developed somatocoel between it. The calcite ossicles embedded in the tissue also fill the interconnected pore spaces in the ossicles. The latter contains a large amount of fluid and some cellular elements. Thus, in the decalcification section, the

osula appeared unclear. The animal is covered with layered cuticles. The outermost calcite trabeculae of the scale almost reach the surface. They are enveloped with a thin cytoplasmic layer, the cell body belonging to this layer is located within the scale pore space. This way they are mostly protected from damage. The epidermis fully penetrates the scales, and the pore spaces of the scales contain the skin as tightly as the epidermal tissue which are both separated from each other.

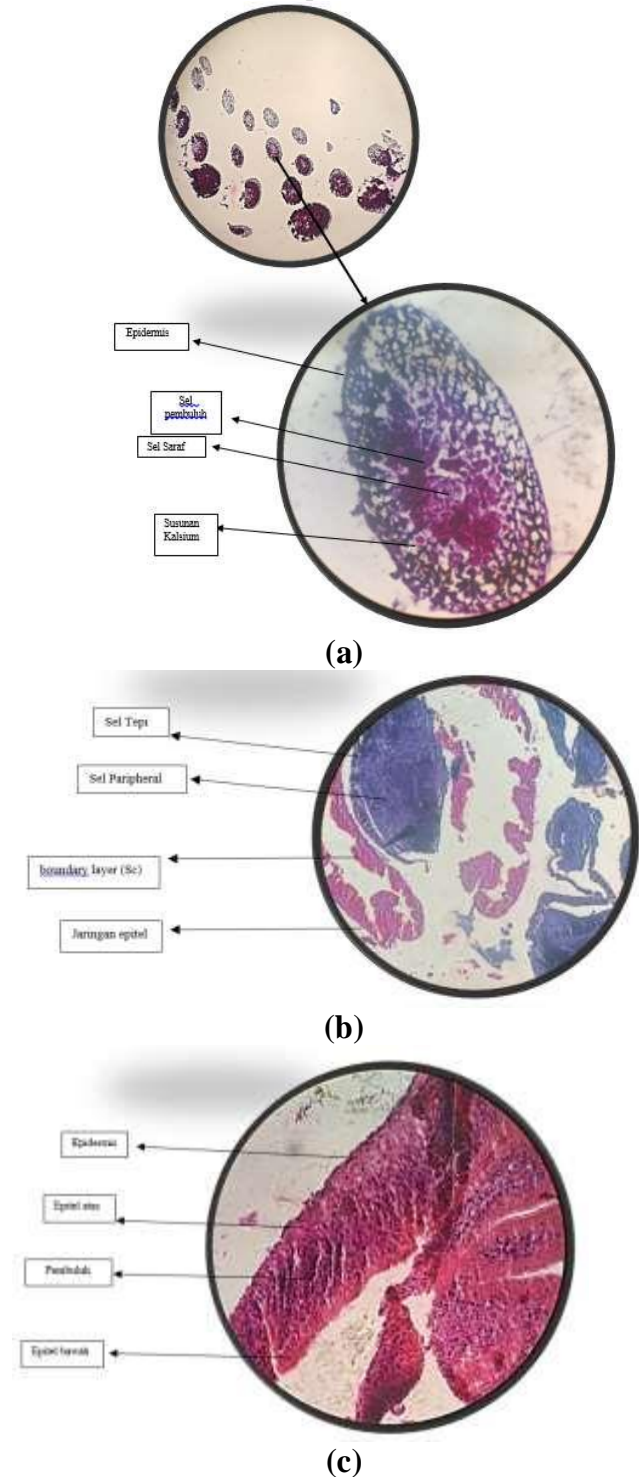


Figure 3. Histology *Ophiocoma dentate* a) thorn b) disc c) arm

The body of Ophiuroidea is not segmented and has a well-developed internal skeleton consisting of limestone plates containing calcium carbonate and small amounts of magnesium carbonate. Nerve cells and vessels also extend to the parts of the arms and spines.

In the body (disk) are various organs such as the gonads, digestive tract and vascular system. Each gonad consists of several separate units by which two cells are observed. The peripheral cells as a single layer have a very basophilic nucleus with a very high N / C ratio. The inner cell layer beneath the peripheral cells resembles fat tissue with a hyaline appearance. These gonads function in the reproductive system. In making histological preparations, it has differences with the making of other animal histological preparations.

Making preparations in animals as usual using hemotoxillin and eosin stains has a technical means by means of fixation, dehydration, clearing, paraffin infiltration, embedding, sectioning, deparaffinization, staining and mounting. In this study, because the snaking star has calcium and magnesium in its body, the previous method cannot produce preparations because it cannot be processed and cannot be sliced, so there must be an additional process here, namely there is a process of decalcification (calcium softening), with the addition of this process so that there is a different process again, namely that there is not just one-time decalcification. So that the sequence of preparation using hemotoxillin and eosin staining, namely fixation, dehydration I, decalcification, dehydration II clearing, paraffin infiltration, embedding, sectioning, deparaffinization, staining and mounting. In this study, the process of decalcification used 5% HNO₃ and 70% alcohol.

CONCLUSION

Observations of the morphology of the Sniping Star (*Ophiocoma dentata*) obtained data on habitat, distribution, reproduction, food types, adaptation, movement, and dorsal and ventral parts. Meanwhile, the observation of the anatomy of the Sniping Star (*Ophiocoma dentata*) obtained data on the horizontal and vertical disk structures, and the structure of the legs. Histologic anatomical sections were obtained on the disks, arms, and spines.

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