

# Sponge Diversity at Pecaron Bay Situbondo Based on Macroscopic and Microscopic Observation

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**Abstract**—The sponge species diversity recruited *insitu* macroscopic observation i.e., underwater photograph for sponges species diversity and spicula microscopic examination for sponges order group specimens have been conducted at Pecaron Bay Situbondo. Seventeen sponges species have been identified out of twenty species. The microscopic examination showed that the Diactinal oxea types were dominant in our 13 samples whereas the monoactinal oxea and style were represented only with 7 samples. Moreover, diactinal type of spicula can be used as an order group of sponges species at Pecaron bay Situbondo.

**Keywords**—Sponges species diversity, macroscopic observation, spicules microscopic observation, sponge groups order, Pecaron bay Situbondo.

## I. INTRODUCTION

Sponges are the most ancient multicellular animals, having existed for more than 580 million years (Muller et al., 2004). At least 15000 species are classified into the Phylum Porifera, which is divided into three classes, the Hexactinellida, the Demospongiae, and the Calcarea, based on the nature of their mineral skeleton. The methods for identifying sponges species are varied. The most simple one is morphological spicules identification. Early investigators of sponge biology and taxonomy have already described that spicules and skeletal structures use light microscopic techniques besides *insitu* morphology character in order to describe sponges diversity and its taxonomy relationship. Therefore, recent developments in sponge spicules research (Sethmann and Worheide 2008), will give an account for early fundamental works sponges taxonomy and diversity.

Pecaron Bay is located at Situbondo East java. This bay has reef structure which consists of Poriferan and Coelenterata. It has been known that poriferan or marine sponge has several roles such as an impacts on substrate (including bioerosion, reef creation, and substrate stabilization, consolidation and regeneration), benthos-pelagic coupling (including carbon cycling, silicon cycling, oxygen depletion and nitrogen cycling) and associations with other organisms (facilitating primary

production, secondary production, provision of microhabitat, enhanced predation protection, survival success, range expansions and camouflage though association with sponges, sponges as a settlement substrate, disrupting near-boundary and reef level flow regimes, sponges as agents of biological disturbance, sponges as releasers of chemicals and sponges as tools for other organisms) (Bell 2008). Since the sponges has play a vital role for marine ecosystem, studying the diversity marine sponge will help to conserve the sponges life and marine ecosystem it selves.

Spicules type the classes taxonomy groups of sponge. Spicules from calcarean groups consist of calcareous spicules with a considerable morphological diversity, in two subclasses Calcinea and Calcaronea with four basic spicules types ie, monoactine, diactiane, triactine and combination (Sethmann and Worheide 2008) whereas, Demospongiae, characterized by monoaxonic or tetraxonic spicules and Hexactinellida, characterized by sincitial organization and hexaradiate spicules. Furthermore two kinds of spicules are produced: megascleres, generally elongate and compose the main architecture of the sponge skeleton, and microscleres, varied in shape and size, with auxiliary functions (Croce et.al, 2004). Moreover, examining the spicule microscopic observation will help the description of sponges diversity at Pecaron bay Situbondo, East java.

## II. MATERIAL AND METHOD

Sponge samples were taken from Pecaron Bay on the last July 2009 using scuba diving in 5-20 m depth, 500 m from coast line (Fig. 1). The sponge samples had been photopgraphed underwater to describe the *insitu* habitat morphology. The samples were preserved by 70% ethanol solution for spicules identification and morphological identification used as the determination key of Van Soest (1989) and Hooper and Van Soest (2002) whereas for spicules preservation and identification were done by bleaching and acid method for rapid sponge survey (Hooper, 2000). The identification of spicule character is used as the key determination of Andri et al. (2001).

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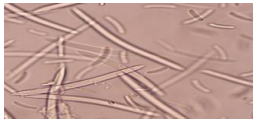

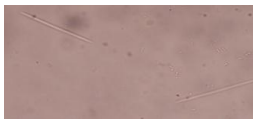

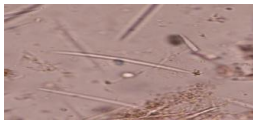

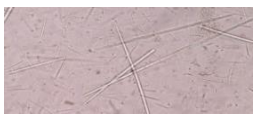

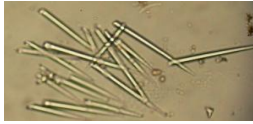

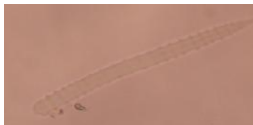
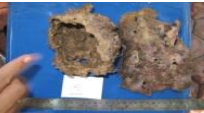
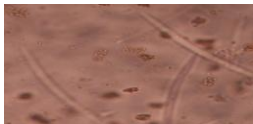

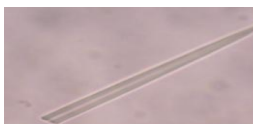


Sitemap 1 S 07°41'22.30" E 113°49'42.60"  
 Sitemap S 07°41'21.90" E 113°49'41.10



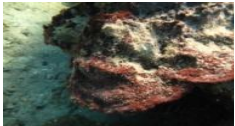




Fig. 1. Research sitemap area of Pecaron bay Pasir Putih Situbondo

III. RESULT

TABLE 1. UNDERWATER, PHOTOGRAPH, CHARACTERISTIC, TYPE OF SPICULA AND SPECIES OF SPONGE

z	Underwater Photograph	Characteristic	Spicula Observation (Scale 1:100X)	Type Spicula	Species (order)
1		Often giant sized, red-grey, with heavily ridged outer walls, stony hard		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Xestospongia testudinaria</i> (Haplosclereida)
2		Large masses with reticulate surface, dark brown to black, hard but fibrous		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Fascaplysinopsis reticulata</i> (Dictyoceratida)
3		Sharply conulose, laminated, red-orange, fragile, easily torn		Monactinal Style (monaxon rounded at one end and pointed at the other end with one end blunt and the other pointed) /MS	<i>Dysidea cinerea</i>
4		Blue-green-grey, with sharp conules, resilient		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Callyspongia schulzei</i>
5		Creeping masses with variable presence of low conules, large oscules, purple, spongy-resilient		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Gelliodes pumila</i>

z	Underwater Photograph	Characteristic	Spicula Observation	Type Spicula	Species (order)
6		Flattened branches, irregularly conulose, conules blunt, erect-creeping, light brown, very toughly spongy		Monactinal Style (monaxon rounded at one end and pointed at the other end with one end blunt and the other pointed) /MS	<i>Dactylospongia elegans</i>
7		Arm-thick creeping branches with thick-walled oscular chimneys, red-brown, stony hard		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Petrosia contignata</i>
8		Flattened branches, regularly conulose, black, toughly spongy		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Hyrtios erectus</i>
9		Flatly incrusting with undulating surface, ornamented with network of fine grooves, mud-grey, grooves reddish, spongy		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Liosina arenosa</i>
10		Irregular, with sharp ridges and conules, orange-red with yellow-orange sheen, rubbery		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Acanthella carteri</i>
11		Rounded clathrate-cavernous masses consisting of intertwined trabeculae surrounding rounded cavities, bright orange		Monactinal Style (monaxon rounded at one end and pointed at the other end with one end blunt and the other pointed) /MS	<i>Acanthella cavernosa</i>
13		-		Monactinal Strongyle (monaxon rounded at one end and pointed at the other end with rounded ends) / MS	-
14		-		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	-
15		Masses of globular osculiferous lobes, orange-brown, rough to the touch but compressible; turns black in alcohol		Monactinal Style (monaxon rounded at one end and pointed at the other end with one end blunt and the other pointed) /MS	<i>Aaptos aaptos</i> cv <i>Suberitoides</i>
16		Irregular undulating-conulose surface, often covered by sediment, salmon-coloured, compressible		Monactinal Style (monaxon rounded at one end and pointed at the other end with one end blunt and the other pointed) /MS	<i>Clathria reinwardtii</i>

z	Underwater Photograph	Characteristic	Spicula Observation	Type Spicula	Species (order)
17		Cups or fans, thin-walled, grey, regularly spaced star-shaped oscules on inside surface, tough Massively incrusting with stiff erect branches or laminations, smooth, dark brown, tough-crumbly		Monactinal Style (monaxon rounded at one end and pointed at the other end with one end blunt and the other pointed) /MS	<i>Phyllospongia papyraceae</i>
18				Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Xestospongia exigua</i>
19		Erect slender-branched bushes, brownish green-red, cartilaginous		Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	<i>Haliclona cymaeformis</i>
20				Diactinal Oxea (monaxons with similar ends and pointed at both ends) /MDO	(Haplosclereida)

IV. DISCUSSION

In order to explore sponge species diversity, sponge spicules are used as a tool for describing sponges morphology and relationship instead of *insitu* underwater specimen photograph and microscopic tissue observation. Based on spicules microscopic description, the sponges have been grouped into three classes: Demospongiae (mostly sponges with a skeleton, composed of siliceous spicules), Hexactinellida (always Siliceous skeleton) and Calcarea (always calcareous skeleton) (Hooper, 2000). Almost 90% of sponges species in the world are from Demospongiae Class. In sampling area, 100% of Demospongian classes after morphology identification based on Van Soest (1989) key determination. Therefore after morphological identification, the spicule observation was performed for species group orders. We could not define the specimen no 13, 14, and 20 since we lost the underwater photograph for 3 specimens. Moreover we just put those three species in order groups based on spicula microscopic examination. After spicules microscopic observation based on key determination of Andri (2001), we grouped 5 orders i.e: Haplosclereida (specimen number 1,4,5,7,18,19) which characterized by diactinal spicules, Dictyoceratida (specimen number 2, 3, 6, 8, 17), Halichondridae (specimen number 9,10,11) which characterized by styles, oxeas and strongyles, often intergrading into each other with apices ranging from sharply and gradually tapering, to bluntly rounded, often with characteristic stair-stepped appearance, Handromerida (specimen number 12, 15) which characterized by monaxonic megascleres (tylostyles, subtylostyles, oxeas or derivatives spicules,) and Poeciloscloreida (specimen number 16) which characterized by monoactinal and diactinal siliceous spicules (Hopper and Van Soest, 2002). Order Haplosclereida in our specimen shows diactinal type (monoaxinal with similar ends) Oxea (pointed at both

ends) which correspond into Hopper (2002).The species of our haplosclereida refers to specimen 1 *Xestospongia testudinaria*, specimen 4 *Callyspongia schulzei*, specimen 5 *Gellioides pumila*, specimen 6 *Petrosia contignata*, specimen 18 *Xestopongia exigua*, specimen 19 *Haliclona cymaeformis* and unidentified specimen no 14 and 20. Our specimen in group Dictyoceratida were shown Diactinal oxea on specimen 2 (*Fascaplysinopsis reticulata*) and specimen 8 *Hyrtilos erectus* whereas monoactinal (monaxon rounded at one end and pointed at the other end) Style (monoactinal monaxon with one end blunt and the other pointed) were shown on specimen 3 (*Dyidea cinerea*), specimen 6, *Dactylospongia elegans*, and specimen 17 (*Phyllospongia papyraceae*). On Halichondrida specimen, the spicules type Diactinal oxea showed on specimen 9 *Liosina arenosa* and specimen 10 *Achantella carteri* whereas the correspond result specimen to Hopper and Van Soest (2002) concerning monoaxon spicules only showed on specimen 11 *Acanthella cavernosa*. On the Handromerida orders, only specimen no 15, *Aaptos aaptos* corresponded with monoactinal style type from Hopper and Van Soest (2002) whereas specimen 12, *Tethya robusta* showed the type of diactinal spicules. Finally on Poeciloscloreida group on specimen 16 *Clathria reinwardtii* showed that spicules type correspond with the result on Hopper and Van Soest (2002) which described that Poeciloscloreida group has two type either monoaxinal or diactinal.

Compared to the result of sponge diversity which has been conducted by de Vogt and Clearly 2008 at Jakarta bay, the sponge species at Pecaron bay is less varied. It has happened since the site location of the research in Jakarta were extended into 40 km from the coastline. On the other hand, our research site location is only 2 km length from the coast line. In spite of lack species diversity on Pecaron bay, the species most abundancespecies in Jakarta bay which were *Aaptos suberitoides* (Brønsted, 1934), *Clathria* (Thalysias)

reinwardti (Vosmaer, 1880), and *Xestospongia testudinaria* (Lamarck, 1813) were also presented species at our research site on Pecaron bay.

#### V. CONCLUSION

In the microscopic diversity spicules Diactinal spicules type showed on mostly of our sampling which refers to 13 species whereas the Monoactinal spicules type showed on 7 specimens. Spicules type only can be used as a tool for describing Haplosclereida order which showed the same character of Diactinal oxea type; whereas Dictyoceratida, Halichondrida, Handromerida and Poecilosclereida groups could not be defined by spicules microscopic description character since the type of those groups order were varied between Monoactinal and Diactinal type. Three specimens in Pecaron Bay, ie *Aaptos aaptos* cv *suberitoides*, *Clathria reinwardi* and *Xestospongia testudinaria* corresponds with the specimen in Jakarta bay

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