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Inventory of Epiphytes Aquatic Microfungi in Pond of Tailing Bauxite in Tanjungpinang, Bintan Island, Riau Islands Province

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ABSTRACT

On the washing process of bauxite mining will produce waste, that was red mud. Those red mud will be streamed in pond of tailing bauxite. *Eleocharis* sp. has been pioneer plant in pond of tailing bauxite. The objective of this study was identify the epiphytes aquatic microfungi in pond of tailing bauxite, at Tanjungpinang, Bintan Island. Samples were collected by three different stations from *Eleocharis* sp. assemblage with three samples points as repetition in each stations. In this research, the results of epiphyte aquatic microfungi were cultured had gotten five genera and six different species of aquatic microfungi, such as *Mucor* sp., *Curvularia* sp. (1 and 2), *Phialophora* sp., *Phoma* sp., and *Arthrographis* sp.

Keywords: *aquatic microfungi, bauxite, Bintan, Eleocharis sp., tailing*

1. Introduction

Bintan Island is one of bauxite mining regions in Indonesia (Sembiring, 2008). Senggarang is one of mining regions that located in Tanjungpinang, Bintan Island. According to Aziz et al. (2009), one of bauxite mining process is washing process of bauxite ore. On that process will produced waste called red mud. Those red mud will streamed into pond of tailing bauxite. The existence of that pond will affected the surrounding environment, both landscape conditions and ecological conditions. Over time, the pond will be filled by runoff and form a new living environment. It usually has low biogeophysics conditions.It takes about twenty years to recovering the environment's biogeophysics conditions like stagnant natural waters in generally (Gandjar et al., 2006).

Plants are important component in an ecosystem that works as recyclers of pollutants, and as oxygen producer into an anaerobically conditioned substrate (Khiatuddin, 2003). One of those plants that lived in ecosystem of tailing bauxite pond is *Eleocharis* sp. Several studies have been conducted regarding the existence of aquatic microfungi in the former pond of mining activities, such as in limestone mining (Prayudyaningsih, 2014), gold mining (Suharno, 2014), and coal mining. The objective of this study was to identify the epiphytes aquatic microfungi in pond of tailing bauxite, at Tanjungpinang, Bintan Island.

2. Materials and Methods

2.1. Study area

The research was conducted in November 2017. Sampling of aquatic microfungi and data of water parameters were collected on *Eleocharis* sp. that grown in pond of tailing bauxite in Senggarang, District Tanjungpinang city, Riau Island Province (**Figure 1**).

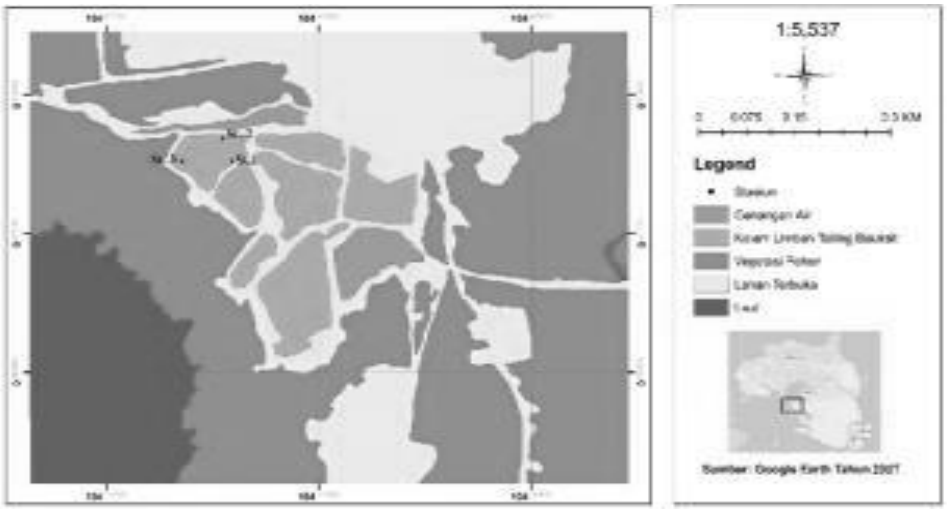


Figure 1. Sampling site

Samples of microfungi on *Eleocharis* sp. were analyzed at Marine Biology Laboratory Faculty of Marine Science and Fisheries, Raja Ali Haji Maritime University.

2.2. Tools and Materials

Tools and material used in this study were Multitester Lutron YK 2005 WA for water quality checker, *Eleocharis* sp., Potatoes Carrot Agar (PCA), sterilization equipments (oven and autoclave), microfungi culture equipment (petri dish, ose), microfungi identification (microscope, identification books).

2.3. Methods

Samples were collected by three different stations from *Eleocharis* sp. assemblage with three samples points in each stations (as repetition). Station 1 with high *Eleocharis* sp. assemblage, Station 2 with medium *Eleocharis* sp. assemblage, and station 3 with low *Eleocharis* sp. assemblage.

Eleocharis sp. were collected following sterile procedure (aseptic methods). The submerged stalks of *Eleocharis* sp. were cutten by sterilized scissor and distributed to the laboratory using sterilized plastics. Furthermore, a part of *Eleocharis* sp. stalks cultured on PCA media in laboratory by sterile procedure and incubated in incubator at 35-40 ^{o}C. After 3-4 days, the consortium of microfungi were isolated and recultured in new PCA media using scratch methods. This process aimed to purify the concortium based on colour differentiation of the microfungi colony. The different colours of colony suspected as different species of microfungi. These process repeated until only one species were indentified in PCA media. Microfungi identification by morphology based on Kidd et al. (2016), Webster and Weber (2007), Humber (2005), and (Navi et al. 1999). The microfungi was observed under microscope with mignification 10x40.

Environmental monitoring was done by checked physical dan chemical parameter of water. pH, DO, and temperature were checked by Mutitester (APHA, 2012).

3. Results and Discussion

3.1. Physico-chemical water parameters

The value of pH decreases in each station with range 4.94-5.04, DO range 6.6-6.7, and temperature range 31.2-31.8 (**Table 1**). Tailing bauxite pond had been acid waters (Putra 2018).

Table 1. Physico-chemical water parameters in Tailing Bauxite Pond, Tanjungpinang, Bintan Island.

Parameter	Station		
	1	2	3
pH	5,04 ± 0,02	5,00 ± 0,10	4,94 ± 0,08
DO (mg L^{-1})	6,7 ± 0,21	6,6 ± 0,15	6,6 ± 0,30
Temperature (^{o}C)	31,8 ± 0,25	31,8 ± 0,06	31,2 ± 0,01

Over the times, the pond of tailing bauxite will be filled by runoff until. Microfungi more like low value of pH (acid) because it can increase metabolism of microfungi in organic

matter decomposition and DO was affected the decomposition rate of that organic matter. So microfungi were be able to growth on extreme though. It is because of aquatic microfungi were be able to utilized every kind of organic matter in environment.

3.2. Epiphytic aquatic microfungi

The results of epiphytic aquatic microfungi were cultured got five genera and six different species of aquatic microfungi, such as *Mucor* sp., *Curvularia* sp., *Phialophora* sp., *Phoma* sp., and *Arthrographis* sp (**Table 2**). There were 4 species at station 3, 3 species at station 1, and 1 species at Station 2.

Table 2. Epiphytic aquatic microfungi in Tailing Bauxite Pond, Tanjungpinang, Bintan Island

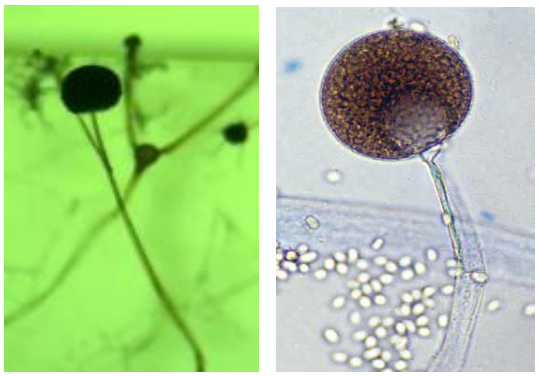
Station	Species	Sample Repetition		
		1	2	3
1	*Mucor* sp.	-	✓	-
	Athrographis sp.	✓	✓	✓
	Phoma sp.	-	✓	-
2	*Athrographis* sp.	✓	✓	✓
3	*Curvularia* sp. 1	✓	-	-
	Curvularia sp. 2	✓	-	-
	Phialophora sp.	-	-	✓
	Phoma sp.	-	-	✓

✓ : present
\- : absent

Mucor sp.

Mucor sp. just found on station 1. *Mucor* sp. contains about 50 recognized taxa, widespread occurrence and considerable economic importance (Zycha et al., 1969 *in* Kidd et al., 2016). *Mucor* was species of fungi which thermotolerant, cosmopolite, and human infection in low intensity. Besides, *Mucor* sp. can also growth on plants and became pathogen for them. Plants were proved to be infected are apples, pears, tomatoes, and rose apple.

These species also found to infected grasses, peas, wheat seeds, and rice (Gandjar, 2006). Instead being infector, *Mucor* sp. can also utilized in several activities such as bioremediation (Purnomo *et al.*, 2010; Srinavasan & Viraghavan, 2010), bioethanol production (Alam et al., 2009), bio protein (Jamal et al., 2007), and in the pharmaceutical field and enzymes industrial and chemicals (Yadzi et al., 2006). Morphology of *Mucor* sp. have been shown at Figure 1.

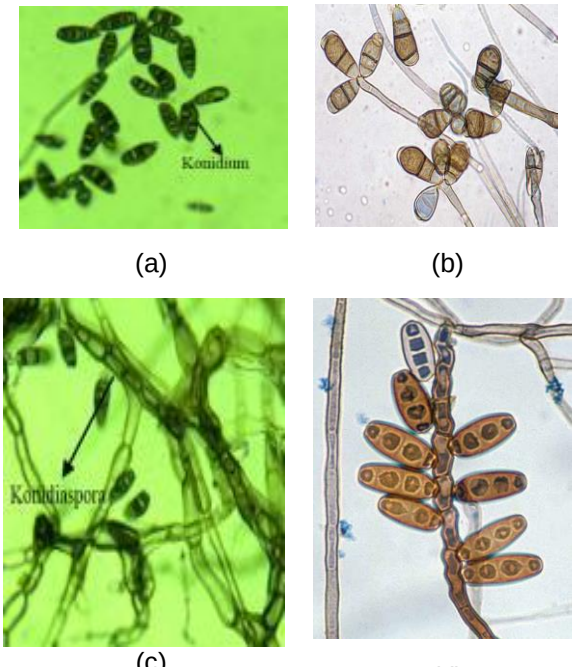


(a) (b)

Figure 1. (a) *Mucor* sp. (personal documentation) and (b) reference (Kidd et al., 2016)

Curvularia sp.

Curvularia sp. were found on station 3 in the first and second sample repetitions. Morphology of *Curvularia* sp. 1 and 2 have been shown at Figure 2. *Curvularia* contains about 80 recognized taxa, and most of them were pathogen for soil and plants. On the research before, *C. lunata, C. Americana, C. brachyaspora,* and the other species were recorded as infector in several clinical (da Cunha et al. 2012, Madrid et al. 2014).



(a) (b)

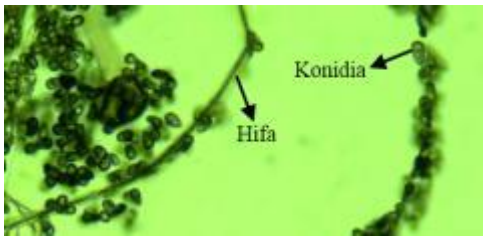
(c) (d)

Figure 2. (a) *Curvularia* sp.1 (personal documentation), (b) reference (Kidd et al., 2016), (c) *Curvularia* sp. 2 (personal documentation), (d) reference (Kidd et al., 2016), (e) conidium *Curvularia* sp. 2 (personal documentation).

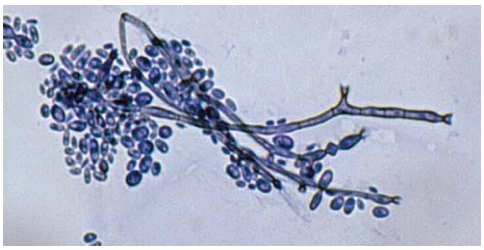
Curvularia sp. were found on several species of grasses, one of them is species of grasses from Brazil namely *Hymenanachne amplexiaulis* and pathogenic (Monteiro et al., 2003). These species were also used as biological control agents for rice plants (Motlagh, 2011).

Phialophora sp.

Phialophora sp. were found on Station 3 in the third repetition. These genus contain about 40 species and most of them were found on soil and some plants such as kiwi (Prodi et al., 2008), and a kind of insect, i.e. *Tribe attini* (Angelis et al., 2013). Morphology of *Phialophora* sp. have been shown at Figure 3.



(a)

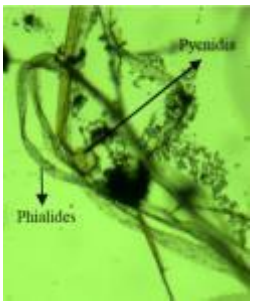


(b)

Figure 3. (a) *Phialophora* sp. (personal documentation, (b) reference (Kidd et al., 2016)

Phoma sp.

Phoma sp. was found on station 1 in the first and third repetition. *Phoma* sp. have worldwide distributions and are obiquitous in nature, with over 200 species which growth on soil, as saprophytes for plants (Kedar, 2014), and pathogen for plants and animals (de Hooge*t al.* 2000 *in* Kidd et al., 2016). Morphology of *Phoma* sp. have been presented at Figure 4.

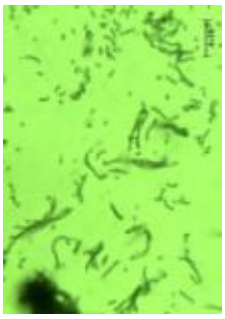


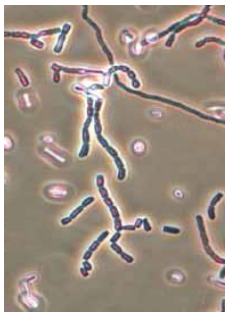
(a) (b)

Figure 4. (a) *Phoma* sp. (personal documentation), (b) reference (Kidd et al*.,* 2016)

Arthrographis sp.

These genus were found on station 1 and 2 in each repetitions. They commonly found on soil, wood, air, and water (Sandoval-Denis et al., 2014). Morphology of *Arthrographis* sp. have been presented at Figure 5.





(a) (b)

Figure 5. (a) *Artrhographis* sp. (personal documentation), (b) reference (Kidd *et al.* 2016)

4. Conclusion

Aquatic microfungi were found in pond of tailing bauxite Tanjungpinang, Bintan Island are *Mucor* sp., *Curvularia* sp., *Phialophora*sp., *Phoma* sp., and *Arthrographis* sp. *Phoma* sp., and *Arthrographis* sp.

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