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IDENTIFICATION OF THE CHEMICAL PROFILE OF *RHIZOPHORA MUCRONATA* MANGROVE GREEN LEAVES FROM THE EASTERN COAST OFASAHAN, NORTH SUMATRA, INDONESIA.

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Abstract

Mangrove plants play an economically and ecologically important role and give various benefits to the people living on the eastern coast of North Sumatra, Indonesia. The purpose of the present study was to determine the nutritional value and tannin content of *Rhizophora mucronata* mangrove leaves. Proximate analysis of the green mangrove leaves revealed that they contained fat (2.62±0.61% DM), crude protein (6.79 ±0.17% DM), ash (9.32±0.61% DM), moisture (19.95±0.70% DM), and carbohydrate (61.32±1.77% DM). The tannin content of the green leaves was 2.42±1.39 mg/g DM.

Key words : Eastern Coast of Asahan, mangrove leaves, proximate composition, tanin.

Introduction

Rhizophora is believed to play a more important role compared to all the other mangrove genera in the entire eastern coast North Sumatra. *Rhizophora mucronata* (Rhyizophoraceae) is also known as the red mangrove or the Asiatic mangrove. Mangroves are a productive (Komiyama *et al.,* 2003) and dynamic ecosystem of carbon absorption (Ray and Jana, 2017). Moreover, mangroves play an important role in the protection of the coastline, in improving the water quality around the coastal environment and in supporting the coastal and marine food chains (Lee *et al.,* 2014, Naidoo, 2017, Ariyanto, 2019), higly productive ecosystem (Ariyanto *et al.*, 2018a, Ariyanto *et al.,* 2019) climate change mitigation Gilman *et al.*, 2008 and organism habitat (Ariyanto *et al.,* 2018b).

Mangroves are capable of adapting to environmental conditions, including changes in salinity (Hoppe-Speer *et al.,* 2011). Kathiresan *et al.,* (2018) revealed that the *R. mucronata* mangrove has a rough leaf characteristic with a thick wax layer which can protect against excessive radiation from sunlight and can prevent transpiration, helping preserve water in the leaf's tissues. Salinity can affect plants in various ways such as causing ion toxicity, nutritional disorders, physiological dehydration, oxidative stress, metabolic process modifications, membrane incapacity and reduction of cell division (Parida and Das, 2005).

Litter, especially leaf litter, is exported from the mangrove ecosystem by tidal water both in fresh and unfresh conditions in the form of large and fine pieces of leaves which can enrich the intertidal sediment with nutrients. The compound often found in *R. mucronata* is tannin (Hardoko *et al.,* 2016, Aljaghthmi *et al.,* 2018, Ariyanto *et al.*, 2018c, Kathiresan *et al.*, 2018). Kraus *et al.*, (2003) stated that this compound is found in the leaves, roots, wood, bark and fruits of this plant. Shelaret *et al.,* (2012) revealed that this plant produces various nutritional chemical compounds which play a role in protecting against and preventing various diseases. The differences in the chemical composition of the material could be due to the influence of the environment or the

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habitat and mangrove species (Nurjanah *et al.*, 2014). Chemical compounds are able to react positive effects in physiologically (Azmir *et al.* 2013). The chemical compounds found in mangrove leaves can act as antioxidant, (Reddy *et al.* 2016; Chakraborty dan Raola, 2017; Kaur *et al.* 2019), antidiabetic (Pandey *et al.* 2014; Nour *et al.* 2016; Adhikari *et al*. 2018), and anti-inflammatory agents (Chakraborty and Raola, 2017; Ray *et al.* 2017). The purpose of the present study was to determine the nutritional contents and chemical composition of *R. mucronata* mangrove leaves.

Materials and Methods

Time and Location

The study was conducted February to May 2019. Mangrove leaf samples were collected from Asahan Regency, North Sumatra. The data analysis was conducted at the SIG Laboratory, Bogor.

Sample Preparation

The leaves collected were taken to the laboratory and then classified based on their color. The leaves were rinsed using distilled water, ground using a 1mm mesh, and had a chemical analysis conducted on them.

Proximate Composition

Rhizophora mucronata leaves were analyzed for their moisture, protein, crude fat and ash contents and their extractive value using the method explained by AOAC (2005).

Tannin

An amount of 0.5g of *R. mucronata* leaf powder was boiled for 30 minutes in a 250 ml conical flask filled water until it reached a volume of 75 ml. 1ml of the product was then diluted using water until it reached a volume of 75 ml, corrected using 5 ml, Folin-Denis reagent and 10ml sodium carbonate solution. The Folin-Denis reagent was made in a dark-colored bottle by dissolving 100g of sodium tungstate and 20g phosphomolybdic acid in 750ml of distilled water, adding 50ml of phosphoric acid, making it a 1L solution by adding water after 2 hours. The intensity of the color of the mixture was assessed at 700 nm after 30 minutes. The tannin content was stated as mg tannic acid equivalent.

Statistical analysis

The statistical analysis was conducted using descriptive statistics. The sample average and deviation standard were calculated triplicate.

Results and Discussion

Table 1 shows the difference between proximate contents of green leaves. Protein Content and Carbohydrate have 61.32±1.77 (%) and 6.79 ±0.17(%). Protein Content and Carbohydrate have the relationship with the potency for rumimant of fish. The high protein has the impact for growth in fish.

Table 1: The difference between proximate contents of green leaves collected on the Coast of Asahan, North Sumatra, Indonesia.

Parameters	Green leaves
Energy from fat (Kacl/100g)	23.58 ± 5.48
Ash Content (%)	9.32±0.61
Protein Content (%)	6.79 ±0.17
Total Fat (%)	2.62±0.61
Moisture Content (%)	19.95±0.70
Carbohydrate (%)	61.32±1.77
Total Energy (Kcal/100g)	296.01±4.96
Tanin (mg / g)	2.42±1.39

Kaur *et al.*, (2019), reported that the *R. mucronata* leaves protein, fat, fiber, ash and moisture content were 11.32 ± 0.35 %, 0.29 ± 0.20%, 0.78± 0.65%, 1.81±0.13% and 34.91±0.41. The normal function of the digestive system depends on the presence of adequate crude fiber. Fiber aids in maintaining health and reducing cholesterol content (Bello *et al.*, 2008) and preventing diabetes (Lajide *et al.*, 2008). The moisture content is an activity index which is used as a measurement for stability and susceptibility to microbial contamination (Davey, 1989). High moisture content indicates a higher water-soluble enzyme and co-enzyme activity which is needed for metabolism. High water content in plants makes them susceptible to microbial growth and thus decomposition (Iheanacho *et al*., 2009).

Dasgupta *et al.*, (2018) reported that the carbohydrate content of *R. mucronata Lamk* leaves is 70% mg/g. The carbohydrate content indicates the composition of various saccharides and represents the carbohydrate fraction digestible by enzymes and can be absorbed through metabolism (FAO, 2003). Carbohydrates can be a source of energy. High carbohydrate content can be considered as a potential energy source. Yadav *et al*., (2014) added that the plant's carbohydrate content is beneficial in the immune system if it is used as a food supplement. The proportion of ash content reflects the mineral content of the food material.

The researach of tanin shows 2.42±1.39 mg/g. Khattab *et al.*, (2012) reported that the tannin content of *R. mucronata* leaves ranged between 2.26 and 3.86mg/g. Kathiresan *et al.*, (2018) *also reported that Rhizophora mucronata* had a higher tannin content than *Avicennia marina* at 0.86±0.16 mg/g. Hardoko *et al.*, (2016) reported that the total tannin (mg/100g) was 110,000.00 ± 11,422.01. Balakrishnana *et al.*, (2016) found that the tannin content of *R. mucronata* leaves ranged between 1.231 and 5.452 (mg g-1). (Cruz *et al.*, 2015) stated that the tannin content of *R. mangle* was 4.5 ± 0.2 (mg g-1) of mangrove leaves.

Tannin is an anti-nutritional compound (cyanide, phytate, and tannin). Tannin is a plant polyphenol which has the ability to form a complex with metal ions and macromolecules such as protein and polysaccharides (Dei *et al.*, 2007, Bruyne *et al.*, 1999). Tannin is also claimed to have a negative effect on protein digestibility (Sathe and Salunkhe, 1984). Leaves undergo changes in tannin concentration during leaf development and maturation (Kandil *et al.*, 2004, Lin *et al.*, 2006).

The factors that affect the tannin content include age, reproductive development and levels of regulating components such as hormones. Mangrove leaves are photosensitive and contain a high concentration of tannin which can transform quickly (Hernes *et al.*, 2000). Various studies regarding tannin include the concentration of various vegetation types, growth stages and environmental conditions 9 (Lin *et al.*, 2006, Maie *et al*., 2008).

The relatively high tannin content in immature leaves is unsurprising as tannin protects leaves against herbivores (Roberetson and Duke, 1987). Balakrishnana *et al.*, (2016) added that younger leaves are more susceptible to the effect of herbivores compared to older leaves. Meanwhile, a high tannin content in immature leaves is expected to provide structural support for photosynthesis and protection (Coley and Barone, 1996). When leaves reach maturity and begin to age, the tannin content declined as seen in table 1. The total content declined gradually during the orange phase, followed by a rapid decline in the brown and black phases (Lin *et al.*, 2007).

Conclusion

A high carbohydrate content indicates a rich potential energy source. The tannin content was relatively high in immature leaves.

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