International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Stomata Dynamic on All Types of Mangrove in Rembang District, Central Java, Indonesia

Dafit Ariyanto

Departement of Aquaculture, Agricultural Faculty, Asahan University, Jl. A Yani Kisaran, North Sumatera 21224 Indonesia

Email: dafitariyanto676@gmail.com

Abstract

Mangrove is vegetation type that can grow on different environment. The anatomy approachment can be used to support physiology and morphology within determine the mangrove capability to adjust environment condition. This purpose research is to identify a characteristic difference in all types of mangroves. Sampels were taken from Banggi Coastal Rembang District Central Java and analyzed in Agronomy and Horticulture Department, Bogor Aqriculture University on August – September 2016. The results showed that the lower of stomata density was 18,84446 /mm2 in *Avicennia marina* and the higher of stomata density was 127,2001/mm2 in *Rhizopora apiculata.*

Keywords: Mangrove leaves; density stomata; morphology; Rembang district.

1. Introduction

Mangrove is a type of plant that can grow in coastal areas. Mangroves can be found in wetlands that often receive different pollutants from disposal of industrial and domestic sources, freshwater and tidal water. Morphology and physiological mechanisms of mangroves differ in nature due to their complexity of structure and differences in flooding regime, tidal inundation, rapid influx of extra nutrients as well as type of soil [1,2] . It can be assumed that all plants have the ability to cope with stress and response to environmental change [3,4]. Leaves are organ variables in plants.

---

* Corresponding author.

The mangrove leaves showed various forms of features and developments in response to environmental physiological conditions, including thick cuticles, wax coatings, sunken stomata, large cells, and small volumes [5]. The characteristics of plant morphology correlate with certain combinations of environmental conditions in which individual plants are established and grow [6]. Many physiological parameters have been used as indicators of stress levels such as leaf shape, leaf area [7,8]. Stomata response in ecophysiological adaptation of plants to the environment. The little information about the stomata's in supporting the existence of mangrove growing and developing in coastal area. The objective of the study was to identify a characteristic difference in all types of mangroves.

2. Materials dan method

2.1 Study Sites

The observed mangrove leaves originated in Rembang District, Central Java, Indonesia. Mangrove leaves consited of *Rhizhopora mucronata, Rhizophora apiculata, Rhizophora stylosa, Sonneratia alba,* and *Avicennia. marina*. The analysis of leaves stomata were conducted at Agronomy and Horticulture Laboratory, Bogor Agricultural University on August 2016 - September 2017.

2.2 Research procedure

Observation and calculation of leaf stomata by cutting the leaves with size ± 2 mm. The leaf piece was placed above the glas object with leaf condition should not dry out. The sample preparation was steady conditions in observation [9]. The epidermis of leaves was peeled until visible epidermal layer. Then, it put on glass objects and staining with safranin 1%. Leaf stomata observation was done by using microscopic shooting method.

Stomata density = (Number of stomata) / (Area of view)

Measuring stomatal density, the area of view used size amflication 40 x 10 and diameter of view was 0.52 mm2.

Wide field of view = $\frac{1}{4} \pi d^2$

$= 1/4 \times 3.14 (0.52)^2$

$= 1/4 \times 3.14 (0.2704)$

$= 1/4 \times (0.8490576)$

$= 0.212264$ mm2

3. Results and Discussion

Stomata observation was done to know the number of stomata every various types of mangrove that exist in

Rembang District, Central Java. (Figure 1) calculating the number of stomata in several fields of view of the various mangroves showed the higher density of stomata in *Rhizopora apiculata*. The lowest of stomata density was found in *Avicennia marina* (18.84446 / mm2) and the highest of stomata density was in *Rhizopora apiculata* (127,2001 / mm2). The density of stomata in various types of mangrove shows the variation in number (Figure 1). The stomata of *Rhizopora apiculata* appeared to be lined up in a series of straight lines parallel to the long cell, the stomata filling the field of view.

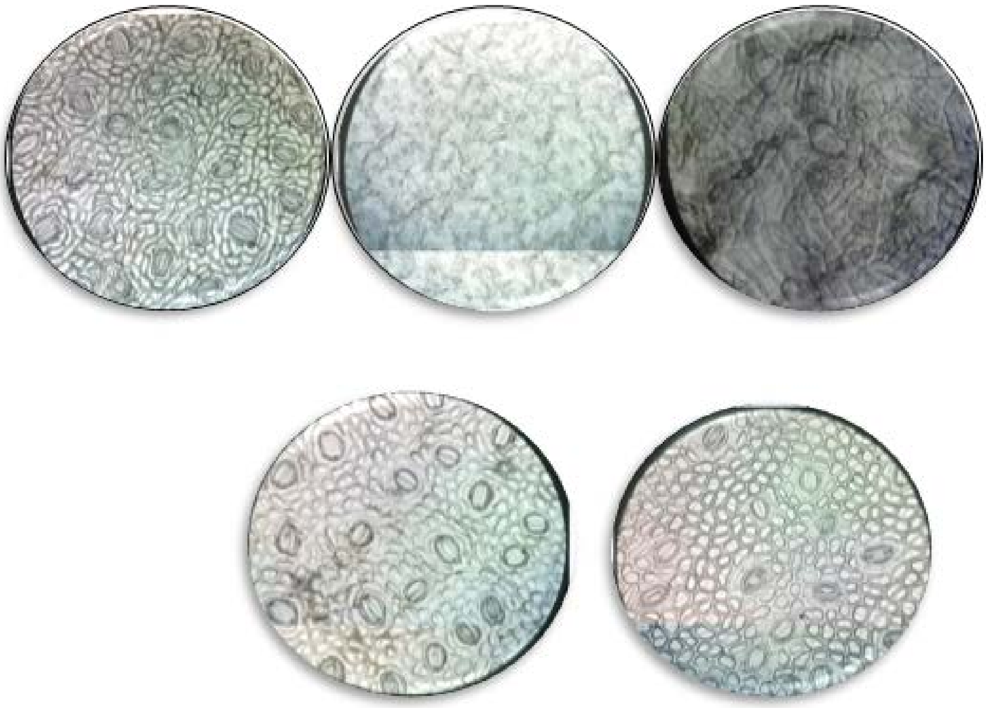

Figure 1: Observation of stomata Density (a) *Rhizophora apiculata* (b) *Sonneratia alba* (c) *Avicennia marina* (d) *Rhizophora stylosa* (e) *Rhizopora mucronata*

Stomata plays an important role as a tool for plant adaptation to conditions. In drought conditions stomata caused to close as an attempt to restrain transpiration rate. The compound that plays a role in the opening and closing of stomata was the abscisic acid (ABA). ABA was a compound that acts as a signal of drought stress so that stomata immediately close [10].

Table 1: Stomata density of various mangrove species in Rembang District, Central Java, Indonesia.

No	Mangrove	Stomata Density (mm2)
1	*Rhizophora mucronata*	61,24449
2	*Rhizophora apiculata*	127,2001
3	*Sonneratia alba*	37,68892
4	*Rhizophora stylosa*	98,9334
5	*Avicennia marina*	18,84446

Some plants adapt to by reducing the size of stomata and the number of stomata [11]. The mechanism of opening and closing stomata in plants is so effective that plant tissue can avoid water loss through evaporation [10,11]. Other studies have revealed that with the high salinity of most causes of anatomical changes such as reduction in stomata [12] .Mangrove can be classified into two groups, salt-secretors and non-secretors, based on their way of overcoming salinity [13]. Salt-secretors, including *Avicennia marina* (Forsk.) Vierh. (Acanthaceae), has either saline glands or salt hair to remove excess salt. Conversely, non-secretors, exemplified by *Rhizophora stylosa* Griff. (Rhizophoraceae), has no morphological characteristics such as for the excess excretion of salt. *A. marina* and *R. stylosa*. The leaf *A. marina* system was more sensitive toward a pool than other types of mangroves [14]. All mangrove species have thick, waxy, flat cuticles that seem to be inhibiting evaporative loss [5]. The anatomy of the leaves on the whole leaf showed that from the leaves some varieties decreased under salinity pressure. The indicated that the lower and upper epidermis, and the diameter of the vascular bundles of the leaves of some varieties decreased under salinity pressure [15]. Furthermore, other studies have revealed that with the high salinity of most causes of anatomical changes such as leaf thickness [16]. Stomata provided an important connection between internal and external air space in plants. The stress conditions in salt have a bearing with leaf structure, transpiration rate, stomatal conductance and photosynthetic rate [17,18], and changes in chloroplast structure and function [19]. Stomata distribution was closely related to the velocity and intensity of transpiration in the leaves, such as the location of each other with a certain distance. To some extent, the more piercing the faster the vaporization. If the holes are too close together, then evaporation from one hole will inhibit evaporation of the nearby hole. This was because the path through which water molecules pass through the hole is not straight but turns due to the influence of the corners of the closing cells. The oval shape of stomata makes it easier to remove water than the round shape. A row of water molecules passing more if the perimeter perimeter of the stomata was longer. Maximum water expenditure occured when the distance between the stomata was 20 times its diameter [20]. The results showed that on the leaves of the monocots, the size of the stomena was relatively smaller, so it looked very dense than the dicoty leaf stomata, such as in rice. Stomata density can affect two important processes in plants that are photosynthesis and transpiration. Plants with high stomata densities have higher transpiration rates than plants with low stomatal density [21]. The lowest of stomatal density was found 18.84446 / mm2 in *Avicennia marina* and the highest was at 127,2001 / mm2 *R. apiculata*. Mangrove *R. apiculata* results showed a series of layers, and meet the field of view, but on some somaclones produce stomata with low density. many factors that affect plant resistance to drought include the tendency to slow dehydration such as efficient absorption of surface water and water conduction systems, leaf surface area and structure [22] .

4. Conclusion

The number of stomata densities had a characteristic difference depended on growth zone in coast zone. The bigger or the the lower of condition caused the stomata devepoment from stress condition.

References

[1] BF. Clough. Growth and salt balance of the mangroves Avicennia marina (Forssk.) Vierh. and Rhizophora stylosa Griff. in relation to salinity. Journal of Plant Physiology 11: 419–430. 1984.

[2] G. Naidoo. Effects of salinity and nitrogen on growth and plant water relations in the mangrove Avicennia marina (Forssk.) Vierh. New Phytol 107: 317–326. 1987.

[3] DA. Meloni, MA. Oliva MA, CA. Martinez.. Photosynthesis and activity of superoxide dismutase, peroxidase and glutathione reductase in cotton under salt stress. Environmental and Experimental Botany 49, 69–76. 2003

[4] Z. Zhu, J. Chen, HL. Zheng. 2012. Physiological and proteomic characterization of salt tolerance in a mangrove plant, Bruguiera gymnorrhiza (L.) Lam. Tree Physiol.32 (11), 1378–1388.

[5] P. Saenger. Mangrove Ecology, Silviculture and Conservation. Kluwer Academic Publishers, The Netherlands. 2002.

[6] NC Arens. Responses of leaf anatomy to light environment in the tree fern Cyathea caracasana (Cyatheaceae) and its application to some ancient seed ferns. Palaios 12, 84–94. 1997.

[7] D. Swarthout D, E Harper, S Judd, D. Gonthier, R. Shyne, T. Stowe, T. Bultman.. Measures of leaf-level water-use efficiency in drought stressed endophyte infected and non-infected tall fescue grasses. Environment and Experimental Botany. 66, 88–93. 2009.

[8] JZ. Wang, LJ. Cui. Y Wang, JL Li. 2009. Growth, lipid peroxidation and photosynthesis in two tall fescue cultivars differing in heat tolerance. Biology Plant. 53, 237–242

[9] AK. Parida, AB. Das, B. Mittra. Effects of salt on growth, ion accumulation, Photosynthesis and leaf anatomy of the mangrove, Bruguiera parviflora. Trees – Structure Function. 18, 167–174. 2004a.

[10] FI. Pugnaire, J. Pardos. Constrains by water stress on plant growth. In Passarakli, M. (ed.) Hand Book of Plant and Crop Stress. New York: John Wiley & Sons. 1999.

[11] A Price. B. Courtois. Mapping QTLs Associated with Drought Resistance in Rice; Progress Problem and Prospect. Los Banos: International Rice Research Institute. 1991.

[12] KS. Cavusoglu KS, Kilic and Kabar K. 2007. Some morphological and anatomical observations during alleviation of salinity (NaCl) stress on seed germination and seedling growth of barley by polyamines. Acta Physiol. Plant., 29: 551-557.

[13] PB. Tomlinson PB. The Botany of Mangroves. Cambridge University Press, London. 1986.

[14] W. Wang, M. Wang. The Mangroves of China. Science Press, Beijing. 2007.

[15] S. Atabayeva, N. Akmaral, M. Subhash, A. Aygul, K. Saule, A. Saule, N. Asil, Z. Anar A. Saltanat, A. Ravilya, L, Tamara. The effect of salinity on growth and anatomical attributes of barley seedling

(Hordeum vulgare L.). Vol. 12(18), pp. 2366-2377, 1 May, 2013 African Journal of Biotechnology 2013.

[16] KS. Cavusglu, Kilic. K, Kabar. Effects of some plant growth regulators on leaf anatomy of radish seedlings grown under saline conditions. Journal of Application Biology Science 2: 47-50. 2008.

[17] A. Parida, AB. Das, P. Das. NaCl stress causes changes in photosynthetic pigments, proteins and other metabolic components in the leaves of a true mangrove, Bruguiera parviflora, in hydroponic cultures. Journal of. Plant Biology 45, 28-36. 2002.

[18] LS. Santiago, TS. Lau, PJ Melcher, OC. Steele, G Goidstein. Morphological and physiological responses of Hwvaiion Hibisues tiliaceus population to light and salinity. International Journal of Plant Science 161, 99-106. 2000.

[19] AK, Parida. AB, Das, B Mittra. Effects of NaCl stress on the structure, pigment complex composition and photosynthetic activity of mangrove Bruguiera parviflora. Photosynthetica. 41, 191-200. 2003

[20] D. Dwijoseputro, 1978. Pengantar Fisiologi Tumbuhan. Jakarta : PT Gramedia.

[21] EK. Miskin, DC. Rasmusson, DN. Moss. Inheritance and physiological efects of stomatal frequency in barley. Crop Science 12: 780-783. 1972.

[22] J. Levit. 1951. Frost, drought and heat resistance. Annual Review of Plant Physiology 2: 245-268.