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THE LEAF COLOUR OF MANGROVE (*Rhizophora mucronata* Lamk) IN TERMS OF ENVIRONMENTAL FACTORS IN MANGROVE FOREST OF MOJO VILLAGE, PEMALANG, INDONESIA

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ABSTRACT

Mangrove (*Rhizopora mucronata*) is one kind of mangrove vegetation that planted on rehabilitation area of Mojo village's mangrove forest. This species was choosen due easily obtained and sowed so that it dominated in the location. This research aimed to know the conditioning aspect from its leaves color and environmental factors from September - October 2019 in the Mojo village's mangrove forest. A total of 405 leaf samples were chosen in the same condition and derived from three research ie the zone closest to the sea, the zone closest to the river and the Central Zone. The leaf tip has the highest range of leaves color than the other leaf parts. Based on two-way ANOVA analysis, the observed zones having a difference of each other also the observed leaf parts too, while the interaction of them having no distinction significantly. The average color value on the part of the upper leaf surface was 115.3º and the under leaf surface was 88.55º more dynamic than the undersurface. The result of Pearson's correlation analysis was 0,396 that means low. Based on PCA analysis, the leaf color on the part of the upper leaf surface was negatively correlated with soil salinity in the location.

Keywords: Leaf color; mangrove forest; Mojo Village's.

INTRODUCTION

Mangrove forests, both as natural resources and as a protector of the environment has a role which is very important in ecological aspects and economy (Zhila *et al*., 2014). Mangrove area is the habitat for various types of wildlife, as primates, reptiles, and avian. In addition to shelter and feed, mangrove is also a breeding ground for birds (Buelow and Sheaves, 2015). For various kinds of fish and shrimp, mangrove waters are the ideal for nursing, feeding and also spawning ground. Mangrove also has a protective function as coastal areas of abrasion (Lugendo *et al*., 2007; Rajpar and Zakaria, 2014). (Uddin *et al*., 2013; Walters *et al*., 2008) added that the economic function of mangrove forest is as producer wood for raw materials and building material, foods and medicines. In addition, (A. D. Setyawan and Winarno, 2006) also added economic function of mangrove forest such as a timber, firewood, plywood, paper pulp, fishing chart, dock, wood for furniture and handicrafts, the roof tilled land, tannin, medicine, sugar, alcohol, acetic acid, animal protein, honey, carbohydrates, and coloring matter.

Mangrove ecosystem as one of the coastal ecosystems has important role both ecologically and economically (Puryono and Suryanti, 2019). As one of the ecosystems that considered to have an important role, many countries in the world are now starting to keep the ecosystem of mangrove forests (Malik *et al*., 2015). Indonesia is a country that has some potential areas of mangrove forests. One is in the Central Java Province. Almost all north coast area in the central java is a mangrove planting area. One of the planting areas is in the Mojo village (Murdiyarso *et al*., 2015). The main problem is currently facing the village mangrove mojo is the abrasion that reduced the coastal area. The northern coastal area in Pemalang Regency has been exposed to abrasion as far as more or less 2 km. Government efforts and the surrounding society to handle this issue is rehabilitation (Rusdianti and Sunito, 2012). Mangrove ecosystems in Mojo Village Pemalang have changed the area due to rehabilitation activities, natural factors and human factors such as settlements, ponds, tourism and other uses (Saputro and Ardhiansyah, 2018). Mangrove species found in the village of Mojo are *Rhizophora mucronata*, *Avicennia marina* and *Avicennia officinalis* (Puryono and Suryanti, 2019)

Mangrove forest in the Mojo village formed of cooperation with the Organization for Industrial Spiritual andCultural Advancement (OISCA) and it is the result of the rehabilitation 72 ha area with the species of Rhizophora *mucronata* and *Avicennia marina*.. Since 1998 mangrove rehabilitation in the village mojo is implemented in 1998 of 25 ha, 2000 of 7 ha, 2002 of 25 ha, 2003 of 2 ha, 2004 of 75 ha, 2005 of 25 ha, and 2007 of 80 ha. Based on a Bupati decree 2008, the farmers to village mojo have received mangrove management of 72 ha (Yuliana *et al*., 2013).

Research on ecology in the mangrove forest area of Mojo Village, Ulujami District has been carried out by two researchers, namely Rakhmasari (2011) and Syawala (2013). According to the results of research by Rakhmasari (2011), the dominant type of mangrove in the mangrove forest area of Mojo Village is mangrove (R. mucronata) with a relative dominance value of 87.77%. According to the results of the study by Syawala (2013), the number of stands in the mangrove forest area of Mojo Village was dominated by R. mucronata with the highest IVI of 147%. Based on Bengen (2000), the INP range close to 0–300 indicates the representativeness of mangrove species that play a role in an ecosystem so that if the INP value is at a certain value, it indicates the level of importance of each mangrove species in the environment. Most of the *R. mucronata* seeds were planted by the community in collaboration with OISCA (Organization for Industrial and Cultural Advancement) and Tokio Marine. The reason why R. mucronata was chosen as a seed for mangrove forest rehabilitation at Mojo Beach was because initially this area was a fishpond area where the mangrove forest area is now the result of replanting. Meanwhile, *A. marina* and *A. officialis* is also planted, but most of it grows by itself by the presence of fruit that falls in the current because many people plant the A. marina mangrove species in their fishpond area which is close to the mangrove area on Mojo Beach.

Plants consist of two main parts, namely, the above-ground part in the form of stems and leaves, and the underground part in the form of a root system. Environmental factors of plant parts above the ground consist of sunlight, air temperature, humidity, gas content in the air, and rain. Environmental factors of plant parts in the soil consist of soil temperature, soil water content, salinity, pH, nutrient content, toxic element content, soil texture and structure, and soil aeration. The components of these environmental factors individually and their interactions directly or indirectly affect plant growth. The response of plants to the environment varies depending on the type and cultivar of the plant. Plants can respond positively or negatively to changes in the growing environment. These diverse responses lead to interactions between the environment and genotypes, and this phenomenon is often encountered in multi-location testing. These responses can be seen from the physical changes of plants in the form of changes in growth, and changes in plant phenotypes. Plant responses can also be seen from changes in physiological processes such as photosynthesis speed, and photosynthate translocation (Taufiq and Titik, 2012).

Naturally the leaves of R. mucronata have a light green to dark green color. The results of research from Adip *et al*., (2014) showed that the correlation test between hue values and leaf chlorophyll content had a negative value, meaning that if the hue value decreased, the organic matter content in the leaves would increase. According to Susanto (2008), the process of photosynthesis is influenced by the age of the leaves and this affects the color of the leaves, because in the process of photosynthesis there are pigments associated with the color of the leaves. Indirectly the above statement is possible to state that changes in green pigment or chlorophyll also affect leaf hue color. The high content of organic matter affects the intake of nutrients that are absorbed by plants for the photosynthesis process. The process of photosynthesis is what will play a role in the content of chlorophyll or leaf green substances in plants. Organic matter which is the main element forming nutrients has an influence on the amount of chlorophyll contained in the leaves. The leaves of plants get nutrients from the roots which are distributed to the leaves. Leaves that tend to be old have more nutrients, so the amount of chlorophyll contained in the leaves is getting bigger, therefore the color of the leaves becomes greener.

The three primary hues in light are red, green, and blue. Thus, that is why televisions, computer monitors, and other full-range, electronic color visual displays use a triad of red, green, and blue phosphors to produce all electronically communicated color. In light, all three of these wavelengths added together at full strength produces pure white light. The absence of all three of these colors produces complete darkness, or black. Although additive and subtractive color models are considered their own unique entities for screen vs. print purposes, the hues CMY do not exist in a vacuum. They are produced as secondary colors when RGB light hues are mixed, as follows: Magenta (blue + red light), Yellow (red + green light), and Cyan (green + blue light).

The colors on the outermost perimeter of the color circle are the "Hues," which are colors in their purest form. This process can continue filling in colors around the wheel. The next level colors, the tertiary colors, are those colors between the secondary and primary colors.

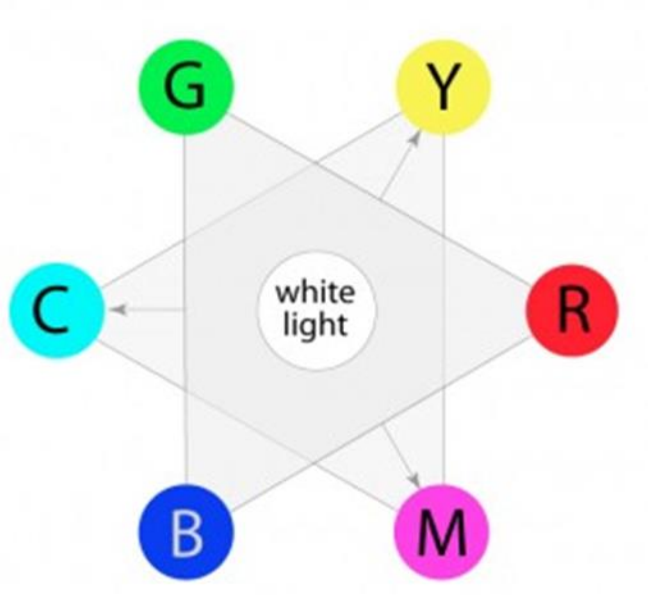

Figure 1. RGB and CMY Diagram

The colors on the outermost perimeter of the color circle are the "Hues," which are colors in their purest form. This process can continue filling in colors around the wheel. The next level colors, the tertiary colors, are those colors between the secondary and primary colors.

Discoloration of the leaves generally hard to explain cause its qualitative. There is currently an analysis system that could change discoloration of the leaves to be quantitative in which use computer software. In this analysis, leaf color can be expressed in hue. According to (Hummie, 2011) (Sass *et al*., 2012), later color was reflected or transmitted by an object that can be seen by the value of hue which measured by a wheel standard color that is expressed with the degrees in 0° to 360°. When there discoloration of the leaves that observed and measured through hue it can be said that also evidence for changes about the condition of the plant. Leaves also one part of cycle nutrition in plants so that environmental factors will influence leaves quantitatively. Based on this assessment should be conducted to know the relationship between the color of mangrove R. *mucronata* by factors of the Mojo village's mangrove forest environment.

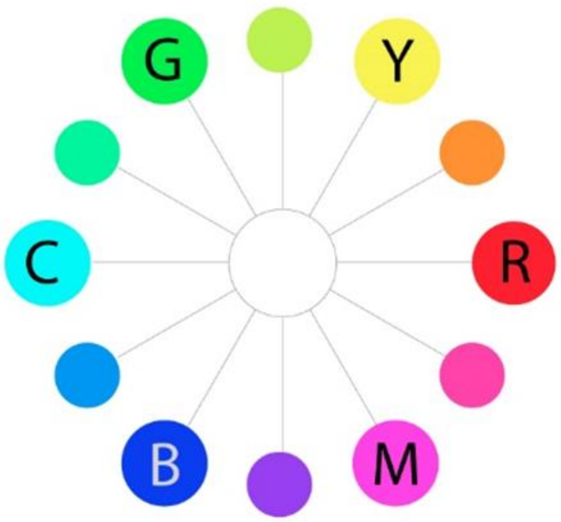

Figure 2. Hues Diagram

RESEARCH METHODS

Equipment and Materials

The tools used in this study include meter rolls, measuring cylinders, zipper plastic, cool box, syringe, GPS, refractometer, Nikon D3000 camera, mini photo studio, pipettes, pH paper, and thermometer. Materials used in this study are R. *mucronata* leaves, ice cubes, mangrove soil, and aquadest.

Research Procedures

The research held in the mangrove forest region located in the Mojo village, Ulujami district, Pemalang regency. The Mojo village is the area within the north coast java and bordered by a Comal river. The mangrove forest area of Mojo village is at the end of the downstream of the comal river and located between aquaculture areas. To get to the location of mangrove forests has to be using a boat. Mangroves in the region starting grown since 1998 undertaken by a government, and Pelita Bahari community also assisted by several parties. Mangrove trees planted in research sites have a purpose for an area of conservation, it is also to hold sea waves and abrasion the coast so that it does not damage the aquaculture area belonging to those who live behind the mangrove forest. Along with the development of the time, the area developed the return of as a recreational area. Mangrove species that dominated the research locations consisting of R. *mucronata* and A.*marina*. Mangroves in the location are generally have reached the size of a tree.

This research held from September - October 2019 in the Mojo village's mangrove forest. It because that month entered the rainy season so that the supply of nutrients in the mangrove forest area was higher than during the dry season. *R. mucronata* leaves which observed and measured its color taken from 27 *R. mucronata* trees randomly selected in 9 stations divide three zones research. Mangrove tree taken its leaves has roving ±30 cm. Each tree taken 15 sample leaves originating in a part of third canopy (header) or above in the tree of which leaves chosen in good condition. The leaf samples that obtained then laid into an artificial mini photo studio to be taken the images on the upper and lower surfaces with a high resolution camera and standardized lighting for photography in laboratorium. The distance for taking photos of leaves are 30 cm. The color value is taken from the surface at the tip, middle, and base of the leaf (1 point each) with the determination of the point value of the color taking on the leaf part is done randomly. Methods used value taking colored leaves this is a method of haphazard sampling. According to Hall *et al*., (2001), Haphazard sampling is a nonstatistical technique used by auditors to simulate random sampling when testing the error status of accounting populations.. It doesn't usually work, because of selection bias, where you knowingly or unknowingly create unrepresentative samples. To create a truly random selection, you need to use one of the tried and testing random selection methods, like simple random sampling.

The results of the actual shot mangrove leaves applied to computer software Adobe Photoshop CS3. The value of colored leaves mangrove can be seen through the value of hue that was found in the software ("Glossary," 2009). Identification technique is used also on (Sari, 2014), arrangement that using cameras and the lighting standardized test was to observe the influence of a variety of food to its color on coral fishes Nemo (*Amphiprionocellaris*) who assisted-use Adobe Photoshop software 7.0. The identification technique is used also (Purwanti *et al*., 2013) by using the same technique to observe the condition habitus R. *Apiculata* in a northern beach area of Semarang city based on the value of hue leaves.

The study was conducted at 9 stations which were divided into 3 zones, namely zone A consisting of stations 1, 2, and 3; zone B consists of stations 4, 5 and 6; zone C consists of stations 7, 8 and 9. The division of zones is distinguished based on the distance from the river mouth. Zone A is the zone closest to the river area. Zone B is a zone between the river and the sea. Zone C is the zone closest to the sea area and farthest from the river area.

At each station, precisely around the mangrove trees whose leaves were taken, physical and chemical parameters were also measured including water temperature, water salinity, soil salinity, water pH, soil pH and soil texture. Before the soil sample is taken, the surface is cleaned first. The soil was taken using a sand shovel at a depth of 50 cm. The method used in the analysis of soil texture using the Soil Jar Test method (Cottenie, 1980) by using a measuring cup measuring 500 ml which is filled about half full with the soil to be analyzed for texture and add water to the limits of the measuring cup. Cover the measuring cup with a plastic cover and shake for 2-3 minutes so that all the sediment is completely homogenized and place the measuring cup on a flat place. Wait up to 3 hours then mark and measure the height of the layers formed. The order of layers formed from below is sand, dust (mud), and clay.

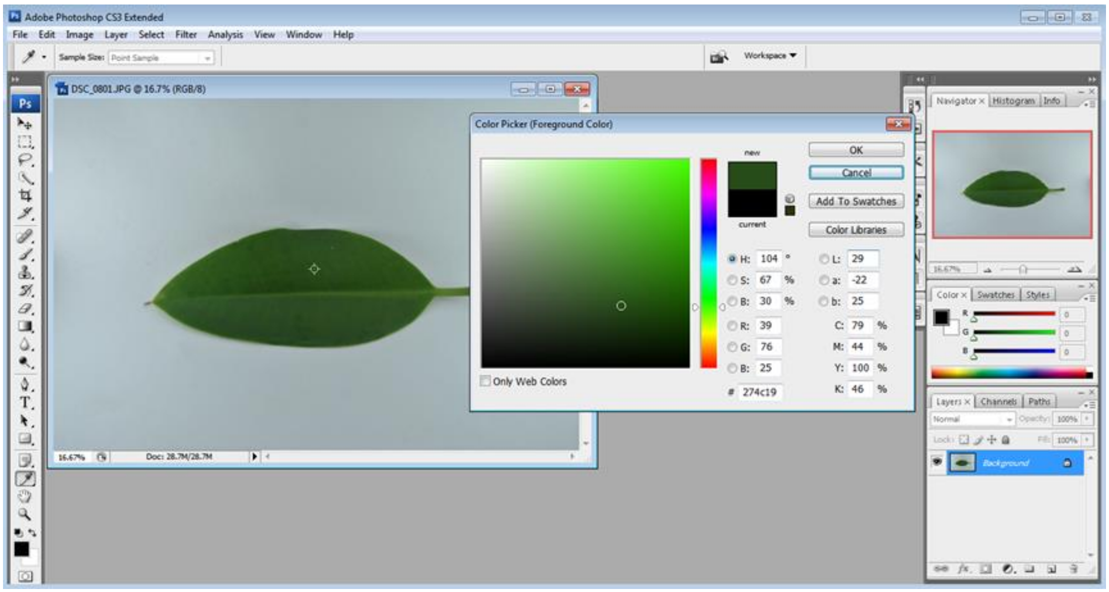

Figure 3. Image Result of Upper *R. mucronata* Leaf

Figure 4. Research Sites

RESULT AND DISCUSSION

The Average hue value of colored leaves on the above surface part is 115,3º with standard deviations 5,79º, meanwhile, the value of its color on the bottom surface having the average hue value 88,55º with standard deviations 3,37º. Charts the average hue value of the color of R. *mucronata* leaves at the upper and lower surfaces can be seen in Figure 5 and Figure 6.

Based on the results of the measurement of color value on the upper and lower surfaces leaves, it can be seen that color value on the tip of having the highest hue value part than the other parts. Besides, zone c is the zone with the highest hue value zone than the other observation zones.

Data of hue leaf value at the upper and lower surfaces that are mixed with using analysis Anova Two Way by the application of SPSS to know the impact of the region or zoning distribution and an observed foliar part also interaction of them on leaf color. The results can be seen in Table 1 and Table 2.

Based on the results of the Two-Way ANOVA analysis, leaf color on the upper and lower surface leaves, it can be seen the significance value of the impact of the zones and a foliar part that examined is < 0,05. This means in each zone and a foliar part that examined was different or having the characteristics of each other. But, to value the significance of the interaction of them on leaf color is > 0,05. This means the interaction of them on the colored leaves was not different or it can be said interaction them at research locations almost entirely the same.

Data of the leaf color value at the upper and lower surfaces then processed by correlation analysis Pearson in the SPSS application to know the correlation between them. The results can be seen in table 3.

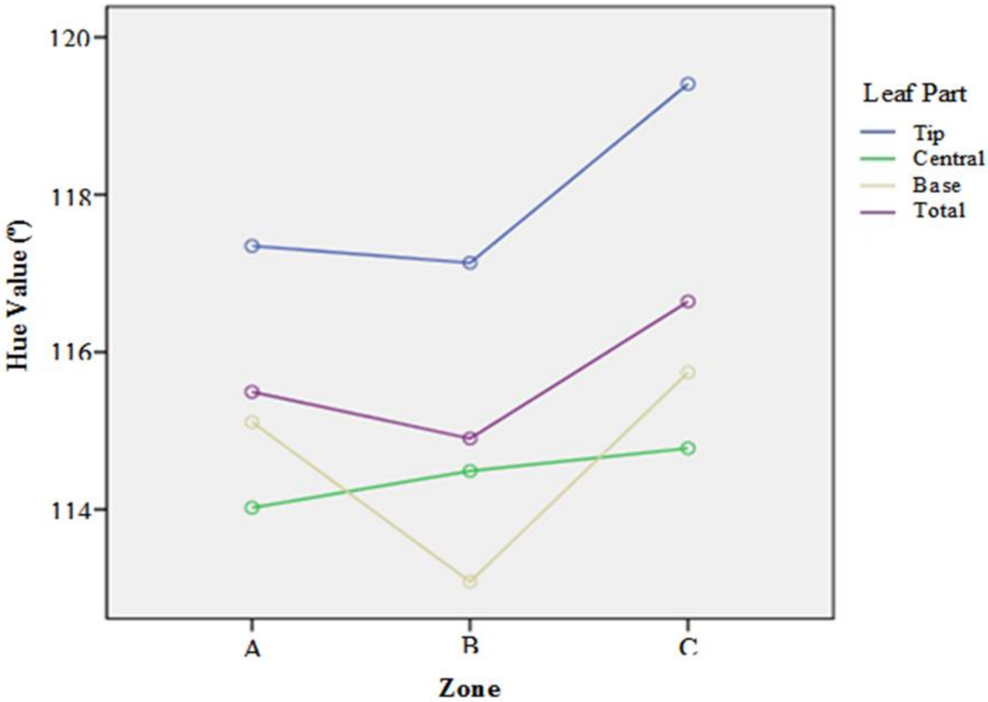

Figure 5. Chart of Average Color Value Range in Upper Leaf Surface

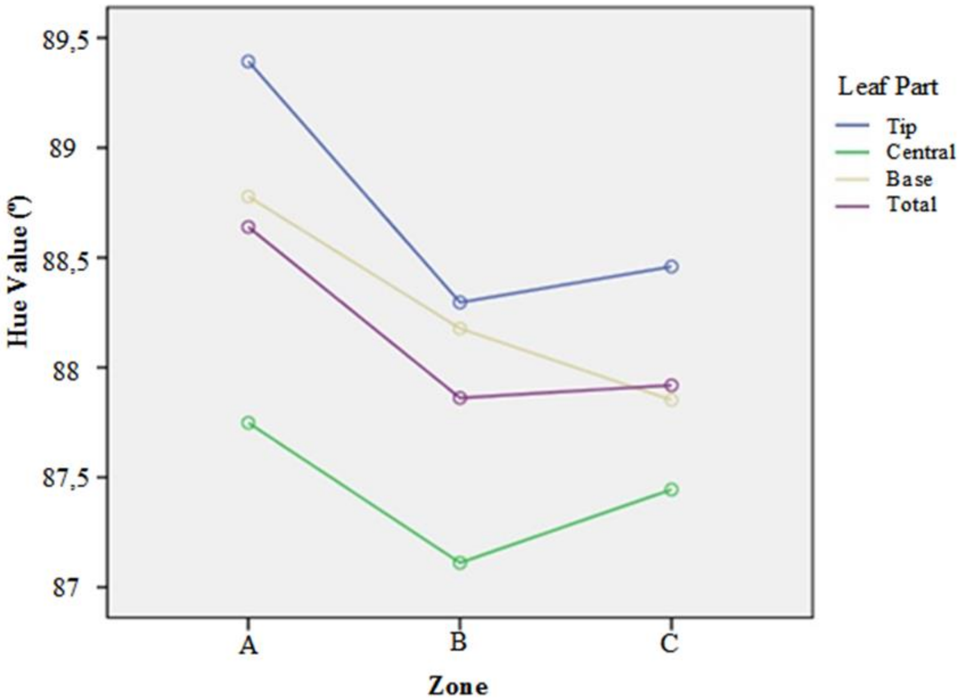

Figure 6. Chart of Average Color Value Range in Under Leaf Surface

Table 1. Results of Two-Way ANOVA Analysis of Color Value on Upper Leaf Surface

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4376.069[a]	11	397.824	7.235	.000
Intercept	2.168E7	1	2.168E7	3.942E5	.000
Zona	845.891	2	422.946	7.691	.000
Bagian	3178.326	3	1059.442	19.266	.000
Zona * Bagian	351.852	6	58.642	1.066	.381
Error	88422.770	1608	54.989		
Total	2.177E7	1620			
Corrected Total	92798.839	1619			

a. R Squared = .047 (Adjusted R Squared = .041)

Table 2. Results of Two-Way ANOVA Analysis of Color Value on Under Leaf Surface

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	574.864[a]	11	52.260	3.215	.000
Intercept	1.259E7	1	1.259E7	7.743E5	.000
Zona	203.002	2	101.501	6.245	.002
Bagian	342.688	3	114.229	7.028	.000
Zona * Bagian	29.174	6	4.862	.299	.937
Error	26136.008	1608	16.254		
Total	1.261E7	1620			
Corrected Total	26710.871	1619			

a. R Squared = .022 (Adjusted R Squared = .015)

Table 3. Results of Pearson Correlation Test Analysis

		Hue **Upper**	***Hue*** **Lower**
Hue Upper	Correlation	1	.396
	Sig.		.291
Hue Lower	Correlation	.396	1
	Sig.	.291	

From the results of the Pearson correlation test, it can be seen a correlation coefficient indicates its value 0,396 that it could be a low correlation, while of the value of sig. (significance) shows the results of 0,291 that it could be the influence of between them is not significant. Based on the results of the analysis, the part of a surface upper and lower leaf having a low correlation. The color value on the lower surface of the leaf is not used in the following analysis because the color on the upper surface is more dynamic than the color on the lower surface of the leaf and the correlation between the two is also low.

Based on the measurement result and the analysis that has been done, it can be seen that color value in each zona and foliar parts that observed have different characteristics and color values on the upper surface more dynamic compared with on the under surface. These conditions can be influenced by an environmental factor as the light of the sun and the shade.

Light of the sun is a source of energy for plants to perform the process of photosynthesis. Sunlight will affect color leaves because the light of the sun will affect chlorophyll or constituting a green substance leaves. This was confirmed by (Rahmawati, 2009), saying quality, intensity, and the length of sun radiation about herbs have a big influence on various the process of plant physiology. Lightly affect the formation of chlorophyll and the process of photosynthesis. The effect of light improves cooperation enzymes to a substance producing metabolic to the formation of chlorophyll. The establishment of chlorophyll influenced by several factors namely genetic factor plants, the intensity of light, oxygen, carbohydrates, the element of the disturbances, water and temperature.

In addition to the light of the sun, the other factor that affects color the leaves is a shade. A shade will affect the amount of light on the leaves, both in the shadow of either natural or artificial resulting in a reduction in the amount of light received by the plant (Amandolare, 2018). The shade of mangrove plants affects the growth, leaf color and chlorophyll content shows a change in the color of yellowish-green to dark green and an increase in chlorophyll concentration (Ye *et al*., 2005)

The surface of the leaves which more exposed sunlight having a consequence of the shade resulted in chlorophyll contained in them away from the angle of incidence sunlight. It is spotted with differences in the range of color leaves on each observed leaves. Said that the plant to adapt the shade determined by its ability to be photosynthesis normally in the deprived of light (Haryanti, 2008). Solar radiation position will affect chloroplasts clump together with the nearest and furthest cell walls of radiation. The situation is causing the leaves to look greener on shading conditions because its chloroplasts clump together on the surface of the leaf. Shade indirectly affects the position of chloroplasts on leaf surfaces and results in non-uniform color in some parts (Child and Adolescent Psychology, *et al*., 2010). The intensity of sunlight will affect the green color of the leaves and indirectly affect the chlorophyll content (Rezai, S., Etemadi, N., Nikbakht, A., Yousefi, M ., Majidi, 2018)

Environmental Factors

The measurement result of soil texture on research location at the mangrove forest of Mojo village is presented in table 4. Based on the results of the measurement of soil texture has done, that obtained the type of medium loam and sandy loam. The type of sandy loam was the most found in research locations. The measurement results of other environmental factors can be seen in Table 5.

Table 4. Soil Texture Measurement Results

Zone	Soil Texture	Average±SD
A	Sand (%)	51,77±22,05
	Silt (%)	35,33±23,01
	Clay (%)	12,90±5,70
	Soil Type	Medium loam
B	Sand (%)	68,76±11,3
	Silt (%)	18,67±9,87
	Clay (%)	12,57±5,47
	Soil Type	Sandy Loam
C	Sand (%)	74,83±13,20
	Silt (%)	13,33±14,47
	Clay (%)	11,84±2,00
	Soil Type	Sandy Loam

SD = Standard Deviation

Based on the measurement environmental factors that have been done, the value of environmental factors that is not very significant with the same standard deviations. Water temperature in all research stations fluctuated very small because almost all the ground and waters under shaded by mature mangrove and high that made the solar radiation were reduced.

Mangroves are very dynamic ecological entities that supply energy to water and land habitats through the production and decomposition of plant debris (T. Noor *et al*., 2015). According to (D. A. Setyawan and Winarno, 2006), that the high temperature on mangrove habitats caused by the intensity of sunlight received by a body of water, volume of water on mangrove habitats, weather and the whereabouts of the shade by plants. It is also supported by (Sakhare and Kamble, 2014). Temperature is an important parameter, with a vital role in chemical and biological activities and is one of the essential and changeable environmental factors, since it has a major influence on the growth and distribution of flora and fauna.

Table 5. Environmental Factors Measurement Results

Zone	Environmental Factors	Average
A	Water Temperature (ºC)	29,67
	Water pH	8,33
	Water Salinity (ppt)	26,33
	Soil pH	6,33
	Soil Salinity (ppt)	25,67
B	Water Temperature (ºC)	29,67
	Water pH	8,33
	Water Salinity (ppt)	26,33
	Soil pH	6,33
	Soil Salinity (ppt)	25,67
C	Water Temperature (ºC)	29,33
	Water pH	8,33
	Water Salinity (ppt)	26,33
	Soil pH	6,33
	Soil Salinity (ppt)	25,67

Water and sediment salinity that observed om research location also fluctuate very small. In terms of its, location in the middle of mangrove forest so that it can be said on a condition in which intrusion of saltwater and freshwater in balanced, but there is some location have a higher salinity.

The high sedimentation rates and deforestation are likely to prevent the formation of a mature forest there. Tree communities are more equilibrated in the eastern lagoon which points to a more stable and less disturbed mangrove forest (Hinrichs *et al*., 2009). This could be caused by the saltwater intrusion that enters it more so the water salinity in the area higher. According to (Kushartono, 2009), the salinity concentration influenced by saltwater enters into the ground derived from intrusion which came upon the tides where permeate down to impermeable strata.

The measurement result of the soil pH shows that in all research sites ranges 6-7. According to (Rachmawati, 2012) most of the soil pH on mangrove forest to be around 6-7, although there were several having the value pH land below 5. While for water pH also quite stable which ranges 8-9. According to(Juwita *et al*., 2015), the water pH in the mangrove area around 7.5-8.5. (Suwondo *et al*., 2018), also added that the range of pH 6.5-9 still supports water organisms in the mangrove forest.

The measurement result of sediment texture analysis that has been carried out at the depth of 50 cm in the research locations, obtained the sand higher than two types of other sediment and the silt (dust/mud) higher than clay. The that exist can be caused by the tides of the sea that is quite high because the location is near the coast, while the texture of mud that is usually caused by the rooting system of mangrove trees. It was also raised by (Mahmud *et al*., 2014), who found that a type of soil that dominated the mangrove area usually dusty clay fraction as a result of mangrove roots. Meanwhile according to the results of (Boronina *et al*., 2017), shows that the existence of the binding of dust particles and clay by the roots of mangrove vegetation, later or sooner such particles will settle and forming mud.

Leaf Color Relationship with Environmental Factors

The results of the Principal Component Analysis (PCA) analysis against the upper surface of the leaf color section with environmental factors in the area of Mojo village mangrove forests can be seen in table Rotated Component Matrix which presented in Table 6.

Table 6. Rotated Component Matrix

	Component			
	1	2	3	4
Sand	-.960	-.092	.183	-.015
Silt	.948	.053	-.171	-.205
Clay	.030	.166	-.050	.941
Water Temperature	.735	-.466	.272	.109
Water Salinity	.017	.374	.910	.076
Soil Salinity	-.042	.933	.297	.044
Water pH	.191	-.33	-.879	.070
Soil pH	.311	.574	-.098	-.680
Upper Leaf Hue	.042	-.933	-.297	-.044

Based on the above table, the color on the upper surface of the leaves of the mangrove R. *mucronata* or relates to the salinity of the soil. The color on the upper surface of the leaves has a negative correlation with the salinity of the soil. This means that if the value of the color on the upper surface has decreased, then the soil salinity increases so does the contrary to the condition. Other environmental factors, namely the texture of sand (sand), dust (silt), and water temperature but not coupled with the color of the leaves on the upper surface. Similarly to the salinity of the water with a pH of the water and the soil pH with the texture of clay (clay) correlates with each other but have no relation with the color part of the upper surface of the leaves on the location of research.

Generally, salinity plays an important role in the life of mangrove vegetation. According to the results of the research of the difference in salinity range will illustrate the difference in the distribution of types of mangrove that dominates a region because each type of mangrove has a different salinity tolerance range (Dasgupta *et al*., 2017). Salinity is one of the physical factors that can affect the life and growth of mangrove, mangrove though said to be salt-tolerant, but these factors need to be measured so that it can form a salinity distribution pattern in the get on each location which produces different levels of salinity distribution. The salinity range for mangrove R. *mucronata* is 23-29 ppt. It is also reinforced by the (Wantasen, 2013), stating that the salinity of the water and the salinity of the soil are important factors in the growth, durability and mangrove species zoning. Mangrove vegetation thrives in areas of estuaries with 10- 30 ppt. Some species can grow in areas with very high salinity.

Any species of organisms including plants obtain the different tolerance range to the environmental factors. Mangroves that have a wide range of tolerance can withstand unfavorable environmental conditions, which in certain conditions are referred to as environmental stress. These conditions include dryness, moisture, high temperatures, low temperatures, and high salinity (Lv *et al*., 2019). Added stress is all environmental conditions that will reduce and disadvantages the growth or development of plants. As mentioned above, one kind of environment stress occurring in plants is salinity stress (Ramayani, 2012).

Mangrove is a plant that can handle environmental stress coming from the range of salinity. According to (Y. R. Noor *et al*., 2006), various types of mangrove overcome salinity levels in different ways. Some of them are selectively able to avoid the absorption of salt from the growth media, while some other species capable of removing salt from special glands on their leaves. However, if the salinity level does not comply with acceptable salinity levels in a region of mangrove vegetation, mangrove vegetation growth will be hampered, including the growth of leaves. The presence of water will increase the turgor cell wall and cause the cell walls to stretch so that the bond between the cell wall weakened. This has encouraged the wall and cell membrane to grow larger so that the shortage of water will inhibit the growth of plants. It also reinforced by (Harjadi and Yahya, 1988) states the effect of salinity on growth and changes in the structure of plants which include the more small size of the leaves. So that the absorption of nutrients and water that will inhibit the rate of photosynthesis is reduced, which will inhibit plant growth.

The salt resulting in increased transpiration so that changes color and becomes wilted. Besides, the high salinity will lead the process of respiration and photosynthesis becomes unbalanced. According to research results (Ramayani, 2012), these conditions will result in reduced fresh weight and dry weight of roots, stems, and leaves. This is because the increase in the rate of transpiration decreases the amount of water the plant so that the plant fresh weight will decrease. While the decline in dry weight due to the provision of the salt concentration (salinity) causes the amount of water in the plant is reduced so that the turgor cells of stomata closing down. Decreased turgor stomata resulted in the photosynthesis process is inhibited so that the amount of assimilates produced by plants on the wane and increased respiration process or both become unbalanced.

CONCLUSION

The leaves of mangrove R. *mucronata* in mangrove forest areas Mojo Village has an average range of color values in the upper surface of the leaf is 115,3º with a standard deviation is 5,79º, while the value of the color on the lower leaf surface has an average range of 88,55º with 3,37º standard deviation. There is the influence of the zone and the leaves of R. *mucronata* to the color of leaves. The zone adjacent to the coastal areas has the highest average value of the leaf color of the upper surface than other growing zones. The zone adjacent to the basin has the highest value of the leaf color of the bottom surface zone than to other growing zones. The zone in the middle of the study site has an average value of leaf color is the lowest compared to other growing zones. The base of the leaf has a brighter color and the middle part has a color that most pale in comparison to other parts of the leaf.

The correlation between the color of R. *mucronata* mangrove leaves on the upper surface of the lower leaf surface is 0.396 which shows that the correlation between them was low. Relationship mangrove leaf color R. *mucronata* with environmental factors in the mangrove forest in Mojo village is R. *mucronata* mangrove leaf color on the upper surface negatively or inversely correlated with soil salinity.

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