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FECUNDITY (*Rhizophora mucronata* Lamk.) TOWARDS LOW-STANDING PUDDLES AT MAROBO RIVER CENTRAL MAWASANGKA BUTON, SOUTHEAST SULAWESI

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Abstract

Rhizophora mucronata Lamk. is widely used for rehabilitation of mangrove areas because the fruit is easily obtained, sowing and can grow in areas of high or low tidal inundation. This study aims to know the effect of high-low waterlogging on fecundity (the development of fruit into mature propagules) *Rhizophora mucronata* Lamk and to determine the characteristics of the ecosystem environment on the *Rhizophora mucronata* Lamk fecundity. The study was conducted in the Marobo River Mawasangka, Buton Tengah, Southeast Sulawesi. Observations were made in the downstream area towards the headwaters of the river. Each zone is made 100m baseline; the distance between sub-transects is 25m. Each subplot was plotted by making 2x2m2 quadrant plots for *Rhizophora mucronata* Lamk. earning productive interest, propagules and seedlings, making it easier to count the number of seedlings. Fecundity (counting the number of fruits until the propagules ripen each tree) and measurement of environmental chemical physics. Fecundity comparison analysis between the two zones by using a t-test. The results of the study based on the t-test, there is a significant difference in the percentage of fruit and propagules in zones 1 and 2 with a value of $p < 0.05$, the highest average fruit is in zone 1 (79.9%). The highest propagule average is in zone 2 (33, 9%), highly influential in the high-low of puddles with salinity levels of zone 1 (20%) and zone 2 (10%). The results showed that there was a high-low waterlogging effect on the *Rhizopora mucronata* Lamk fecundity.

Keyword: Fecundity, *Rhizophora Mucronata* Lamk.

A. Introduction

Mangrove, as part of coastal and marine ecosystem plays an important role in ensuring the sustainability of biodiversity of animals and plants contained therein as a constituent of coastal resources, according to Gunarto (2004) that each mangrove location has a different composition of vegetation diversity. Furthermore, mangrove forests in Mawasangka, Central Buton are coastal forests consisting of various species of mangrove plants that can survive in conditions of high salinity and lack of fresh water sources. This forest functions as a spawning ground, nursery and feeding ground for various types of animals that live in water (Noor et al., 2006).

Rhizophora mucronata Lamk is type of mangrove used for rehabilitation of mangrove areas on the West Coast and East Coast of South Sulawesi. This species has been chosen for mangrove forest rehabilitation because its fruit is easily obtained, easily planted and can grow in areas of high tidal inundation or low inundation (Supriharyono, 2000). The condition of mangroves will affect the development of vegetation that can exist, as indicated by the percentage of success of flowers into fruit, fruit into propagules and propagules into seedlings of fecundity.

The structure of the fecundity of *Rhizophora mucronata* Lamk. will change with increasing age and duration of production. The condition of mangroves will affect the development of vegetation that can exist, indicated by the presence of fecundity (flowers, propagules and seedlings). Furthermore, the success of fecundity (flowers, propagules and seedlings) is influenced by the condition of mangroves through soil fertility, standing water, seasons, and productivity in producing flowers, propagules and seedlings.

According to Barbour et al. (1987) fecundity or percentage growth rate at a certain age is the total number of seeds produced by the cohort per age interval divided by the number of individuals living in the cohort or the average number of seeds produced by individuals in a population at a time or age interval x. The Rhizophoraceae family starts flowering at the age of 3 to 4 years. According to Kamal (2003), the time required is *Rhizophora mucronata* Lamk. for flower formation until the fruit ripens and falls for 19 months. The time for the formation of the inflorescence is 2 months, the development of shoots is 6 months, the development of flowers is 3 months, the development of fruit is 4 months and the development of propagules is 4 months. *Rhizophora mucronara* Lamk. flowering throughout the year, the peak season is August to December and fruitful season in October.

Through this research, it is expected that the *Rhizophora mucronata* Lamk fecundity can be compared in zone 1 downstream and area 2 upstream. The purpose of this study was to look at the effect of high-low waterlogging on fecundity (development of fruit into mature propagules) *Rhizophora mucronata* Lamk and determine the characteristics of the ecosystem environment can influence the *Rhizophora mucronata* Lamk fecundity

B. Literature Review

1. *General Description of Rhizophora muccronata Lamk*

Tree's height reaches 27 m, rarely exceeding 30 m. The stem has a diameter of up to 70 cm with dark to black bark and horizontal gaps. Air roots and aerial roots that grow from the lower branching (Noor et al., 2006).

a. Flower. Flower-head handles such as forks, are bisexual, each attached to an individual handle of 2.5-5 cm in length. Location: in the armpit. Formation: Group (4-8 flowers per group). Crown: 4; white, there is hair. 9 mm. Flower petals: 4; pale yellow, 13-19 mm long. Stamens: 8; not stemmed.
b. Leaves are skinned. The leaf handle is green, 2.5-5.5 cm long. Leaf pineapple is located at the base of the handle measuring 5.5-8.5 cm. Unit & Location : simple & opposite. Shape: ellipse extends to elongated round. Edge: tapered. Size : 11-23 x 5-13 cm.
c. Oblong/long to egg-shaped fruit measuring 5-7 cm, brownish-green, often rough at the base, single-seeded. Hypocotyl cylindrical, rough and nodular. Yellow cotyledon neck when ripe. Size: Hypocotyl: length 36-70 cm and diameter 2-3 cm can be seen in figure 1.

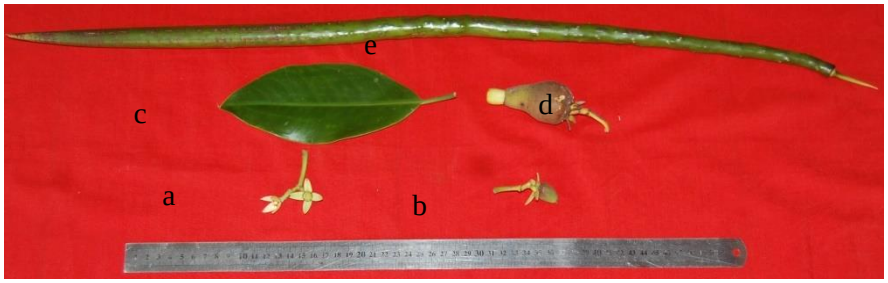

Figure 1. Information: (a) flowers (b) fruit (c) leaves (d) propagules (e) hypocotyl
Image source: Personal documents, 2016.

2. *Ecology of Rhizophora muccronata Lamk*

It can be found in the same area as *Rhizophora apiculata* but more tolerant of tougher substrates and sand. It generally grows in groups, near or on tidal river embankments and in river mouths, rarely growing in areas far from tidal water. Optimal growth occurs in areas that are inundated, as well as on soils that are rich in humus. It is one of the most important and most widespread mangrove species. Flowering occurs throughout the year. Tillers are often eaten by crabs, thus inhibiting their growth. Tillers that have been dried in the shade for several days will be more resistant to crabs. This may be due to the accumulation of tannins in the tissue, which then protects them (Noor et al., 2006). Distribution: East Africa, Madagascar,

Mauritania, Southeast Asia, throughout Malaysia and Indonesia, Melanesia and Micronesia. Carried and planted in Hawaii.

3. Benefits of Rhizophora muccronata Lamk

Wood is used as fuel and charcoal. Tannins from bark are used for colouring and are sometimes used as medicine in cases of hematuria (bleeding in urine) and sometimes planted along the pond to protect the embankment.

C. Methodology

1. Research Design

Mangrove fecundity analysis uses Point Centered Quarter Method (PCQM). This method is a method without a plot, by measuring the closest distance from the sampling point to the nearest tree in each quadrant. Each sub transect was plotted by making a 2x2 m^2 quadrant plot for *Rhizophora mucronata* Lamk. The productive plant produces flowers, propagules, and seedlings so it easy to count the number of seedlings and measure the height of the puddle.

This research was conducted in the Marobo River Mawasangka, Buton Tengah, Southeast Sulawesi. This area is located at 05 0 12 '- 05 0 8' South Latitude and 122 0 18 '- 122 0 20' East Longitude (Anonymous, 2014).

2. Instruments

The tools used in this research are GPS (*Global Positioning System*), thermometer, soil tester, lux meter, hygrometer, hagameter, camera, and others.

a. Physicochemical data collection

Data on chemical, physicochemical parameters include measurements of air temperature, humidity, soil pH and light intensity. Data is taken at each sample point under the canopy and the canopy gap. Data on chemical, physicochemical parameters were taken once in 2 weeks with three repetitions from December to February 2016. Analysis of chemical, physicochemical parameters were descriptive in two zones.

b. Data collection of the *Rhizophora mucronata* Lamk fecundity

The procedure used to determine the mangrove tree *Rhizophora mucronata* Lamk. which will be used as a sample for measuring fecundity, namely:

Mark and count the total number of samples of the *Rhizophora mucronata* Lamk tree. Productive, who has fruit until the propagules are ripe. Data retrieval is done every two weeks. The comparison of *Rhizophora mucronata* Lamk's fecundity in zone 1 downstream, and zone 2 upstream were analyzed using the t-test.

D. Result and Discussion

1. *Result*

a. Description of Research Locations

The results of surveys and studies in zone 1 have the characteristics of the front side of the mangrove forest area, and there is a small estuary with a width reaching 8m, the length of the little inlet until the land reaches 250m. While zone 2 of the research location is behind the crossing bridge from Mawasangka sub-district to Muna Regency, near the river mouth leading to the upstream river. The topography of the Marobo River region in zone 2 is quite gentle with a mud depth of 20cm - 40cm. The distribution of the coordinates of the sampling point at the research location can be seen in Figure 2.

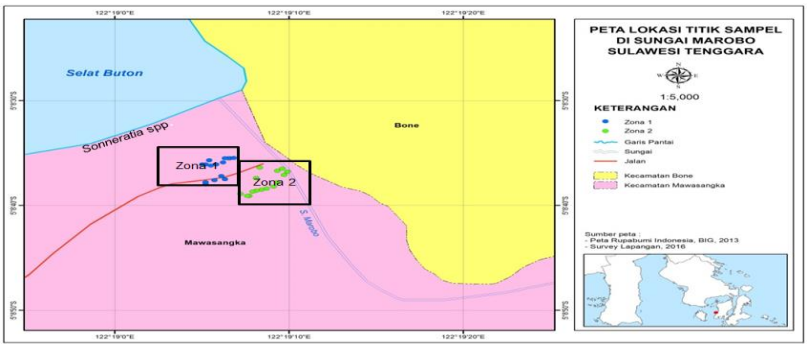

Figure 2. Map of the coordinates of the research location

b. *The position of Rhizophora mucronata Lamk* .

The position of *Rhizophora mucronata* Lamk. in the Marobo River, Mawasangka Subdistrict, Buton Tengah is located in zone 1 downstream and zone 2 upstream, however, the percentage of the presence of *Rhizophora mucronata* Lamk. in zone 1 is very low in caused the location is more dominated by the kind of Bruguiera gymnoriza (L) Lamk. with high-low conditions of puddles, substrates, and salinity that support its growth. The highest percentage of the presence of the species is *Rhizophora mucronata* Lamk . located in zone 2.

c. Environmental Parameters

1) Air Humidity, Light Intensity, and soil pH

The results of the analysis of environmental parameters in the river can be seen in Figure 3

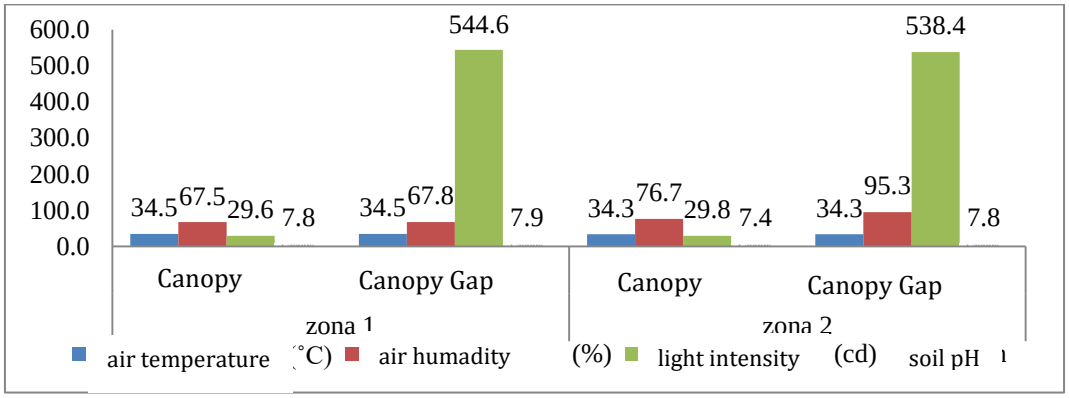

Figure 3. Data on the Measurement of Environmental Parameters in the River

2) Salinity

The results of measurements of salinity zone 1 (20% 0) and Zone 2 (10% 0) distribution of salinity in the estuary of the river is influenced by factors such as the circulation of water, evaporation, precipitation of rain, and the flow of the river (Notji, 2002).

3) High Puddle Surface Air Sea (Tidal)

The high level of sea-level inundation can be seen in Figure 4.

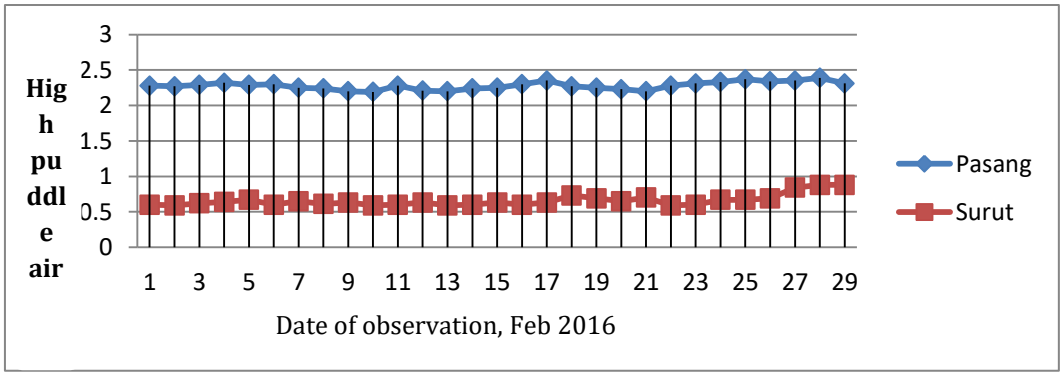

Figure 4 . Results Measurement of High Puddle tides - Receding Water Seafood on the River Marobo

4) Fruit Fecundity to Propagul *Rhizophora mucronata* Lamk

Fruit fecundity to Propagul *Rhizophora mucronata* Lamk can be seen in Table 1

Table 1. Observation of the mangrove *Rhizophora mucronata* Lamk. from Fruit to Propagul

Zona	Observation	DBH (cm)	Fruit	%	Propagul	%
1	1	18,5	74,4	75,4	21,7	24,6
	2	18,5	73,7	74,7	22,1	25,3
	3	18,5	128	76,5	21,8	23,5
	4	18,5	125,5	75,1	22,4	24,9
	5	18,5	69,5	72,6	22,7	27,4
2	1	17,0	57,3	66	30,1	34
	2	17,0	57,7	66,2	29,2	33,8
	3	17,0	57,1	66,4	29	33,6
	4	17,0	55,7	66,4	28,7	33,6
	5	17,0	53,7	65,4	29,5	34,6

2. *Discussion*

The highest percentage of the presence of the species is *Rhizophora mucronata* Lamk. located in zone 2, this is because of this location strongly supports the growth of the species of *Rhizophora mucronata* Lamk. It can be seen from the high-low water pool, substrate and salinity 0-20 ‰ which still supports the growth of mangroves in the Marobo River. Arief (2003) stated levels of salinity kind of stands *Rhizophora mucronata* Lamk., ranged between 32-36 ‰, the current state of the water sea is not experiencing tide receded still can grow with either. The condition of the high-low puddle of water, salinity, and substrate greatly affect the position of mangrove, especially on species *Rhizophora mucronata* Lamk. in the Marobo River, Mawasangka , Buton Tengah, Southeast Sulawesi.

The results of the analysis of parameters of the environment are conducted for five times observation and three times over the first time observations of both the canopy and the gap canopy obtained results of the average temperature of the air in the canopy (34.5 0 C), gap canopy (34.5 0 C). It is supported by research conducted by Zamroni and Rohyani (2008) the temperature of the air of forest mangrove Teluk Sepi ranged between 27, 8 -31.7 0 C is a temperature of air that is optimum for the family Rhizophoraceae. The humidity of the air, the intensity of the light and the pH of the soil can be seen in picture 2. The range of pH is still to be neutral, showed that in all locations research still supports the ongoing all the processes of nitrification and deployment of elements of nutrients by the soil in zones one downstream and zone 2 upstream very potentially support mangrove planting growth.

The high salinity in zone 1 due to the location being in the area near the mouth of the river that is towards the sea, while the low salinity in zone 2 allegedly because the location is located near the mouth of the river that is towards the upstream of the river. In addition, the measurement time can be a determining factor in the low point of salinity content.

Measurement of a high pool of surface water sea at the time of tide the highest average (2, 2 m) and receding low (0.66 m) during the 29 days of measurement. Tide receding influence on the growth of species of mangrove, the results of the analysis of tidal ebb location research greatly affect the growth of mangrove *Rhizophora mucronata* Lamk., can be seen from the fecundity (from fruit to propagules).

Observations fecundity did as much as five times with an interval time of 2 weeks once. *Rizkhora mucronata* Lamk fecundity measurement in each zone used 15 trees with an average DBH of 18.5 cm (zone 1) and 17 cm (zone 2). The value of fruit fecundity until ripe propagules *Rizophora mucronata* Lamk., in zone 1 downstream and zone 2 upstream. This is due to the time calculation of the number of fruits and propagules calculated based on research Kamal (2011).

Based on the results of the fruit into propagules in Zone 1, the average fruit is 94, 2 (74.86%) and the mean propagules is 22.14 (25.14%). It is very low due to the factor of the environment (salinity high, the substrate, the wind strong and rain as well as high-low standing water). Whereas in zone 2, the fruit averaged 56, 2 (66.08%) were low, and propagules averaged 29.3 (33.92%) were high. It was caused by environmental factors (low salinity, substrate, rain, and strong winds and high-low inundation) water). Saenger et al. (1983) in Tendra et al. (2014) stated that the number of flowers develops into the fruit is very low because it is caused by fungi, insects and a high-low puddle of water as well as factors of genetic plant it themselves and factor the environment more.

E. Conclusion

Based on research in the Marobo River, Mawasangka District, Buton Tengan, Southeast Sulawesi, it can be seen that there are significant differences in the Rhizophora mucronata Lamk fecundity in each zone. High-low puddles greatly affect the development of the fecundity of *Rhizophora mucronata* Lamk. where the highest average fruit is in zone 1 (79.9%) and the highest average propagule is in area 2 (33.9%).

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