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Lygodium circinatum (Burm) Sw: Distribution Pattern and Environment Factors Influencing its growth in Lombok Island Forest Nature, ntb

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Abstract

Ketak (*Lygodium circinatum* (Burm.) Sw naturally grows in the forest and is classified into ferns group which produced from non-timber forestry product (HHBK). Ketak growth and productivity data are not represented well so cultivation strategic research must be constructed. This research is aimed to explore biological characteristic rely on Ketak distribution and cultivation in Lombok island, determine host plant for vegetative and tendril growth, identify tendril requirement to support cane works. The method is used purposive systematic sampling using looking for target and sampling as survey area. Then, a survey area was based on three high sea level as follows, 0-250; 250-500 dan above 500 on sea level. Research parametric were investigated including relative humidity, temperature, relative light intensity to tendril productivity. Co-variance and regression were used to process environmental influence on Ketak productivity, height and tendril diameter. This research observed that the largest tendril diameter and populated Ketak occurred in the lowest sea level cultivation whereas the highest tendril was found in the highest cultivation. Then, higher relative humidity supported ketak and tendril growth however lowering temperature growth produced longer and small tendril diameter. A larger amount light intensity enhanced tendril productivity. Host plants that support Ketak growth are Aren and Cecuring (0-249 m osl); Waru and Kumbi (250-499 m osl) and coffee and Aren (>500 m osl).

Keywords: Distribution; Environment; Ferns; Ketak; Tendril

Introduction

Based on UU 41/1999, a forest has some main functions such as conservation, preservation and production to social, culture and economic aspects. Forest provide some rural residents benefit including timber forest product and non-timber forest product. In addition, service benefit can be described for example; hydrology, carbon stock, soil fertility, biodiversity, education and natural aesthetic.

As biomass, non-timber forest product gives some advantages to the citizen welfare. Permenhut No 37/2007 classified non-timber forest product (NTFP) are biological products include vegetative and animals and the derivates, except timber. NTFP products are developing in West Nusa Tenggara that have been encouraging society income such as, honey, rattan, gaharu, bamboo, coconut sugar, candlenut and ketak cane works [1,2].

Ketak is classified into ferns plant and compose tropical forest characteristic. Then, Ketak economical value used to apply for cane works. On the other hand, Ketak plantation distribution data is not available yet causing inventory Ketak supply do not flow well. Moreover, there is no Ketak cultivication in West Nusa Tenggara.

Ketak cane works are export potential products that emerge into Germany, France, England and Japan market (Disperindag, 2010). However, Lomboknese crafters must filled Ketak raw material from other islands like Sumbawa, Kalimantan (Indriyanto and Aji, 2010) while local ketak is ony from natural Ketak production which lower productivity and capacity.

Quality and quantity are the main obstacle to support locally Ketak crafters to produce cane works. Younger Ketak is harvested by the local farmers to encourage Ketak demand which imply to biodiversity and disturbing Ketak growth. To tackle this condition, this research was aimed to identify biological identification rely on Ketak distribution, determine host plant to generate Ketak ferns growth and identify ferns characteristic that fulfill cane works requirement.

Methods

This research was done in natural plantation and greenhouse. Secondary data was supported including based map, climate data, soil, field, area, rainfall data, topography and previously Ketak reports. This research was divided into three subsequent research.

Natural Ketak distribution

Locus: Height sea level between 0-249 meters in Kekait village, Gunungsari, Lombo Barat.

Height sea level between 249-499 meters KPH Rinjani Barat Pusuk Lestari village, Gunungsari, Lombok Barat

Height sea level between 500-750 meters KPH Rinjani Barat Genggelang village, Gangga, Lombok Utara

Instruments: Global Positioning System Etrex Garmin 12, compass, hagameter, clinometer, hygrometer, lux meter LX-1010B, meter, tally sheet, analytic scale.

Procedures

Purposive approach was used to determine biological Ketak characteristic. Every altitude level used 10 plots with a dimension 20 m × 20 m. a purposive and systematic method were applied. Plot numbers were used in this research totally at 33 plots. Environmental factors were measured including relative humidity, temperature, altitude and light intensity. Ketak ferns were measured the diameter, length and distribution. Morisita Dispersion Indeks (MDI) was applied to calculate Ketak distribution (Krebs, 1989) [3].

$$Id = n\frac{\left(\sum X_i^2 - \sum X_i\right)}{\left(\sum X_i\right)^2 - \sum X_i}$$

where:

n=Plot number.

∑x= Individual species per plot.

$\sum x^2$=quadratic of Individual species per plot.

If, Ip<0 shows uniformly distribution; Ip=0 randomly distribution, and Ip>0 grouping distribution.

Ketak host plants

This research was applied 10 nested sampling which dimension 20m × 20 m each nested. The altitude was grouped into three classes (0-250 osl; 250-500 osl and 500-750 osl). The variety and height host plant were observed in every nested.

Vegetative data was generated including height and species host plant, Ketak growth (fernes length and amount). Vegetative analysis can be calculated by Dumbois-Muller and Ellenberg equation (1974). Vegetative biodiversity is also determined using Shannon Whiener index (Ludwig and Reynolds, 1988) [4-6].

Result and Discussion

Result

Presurvey indicated that natural ketak vegetative is very rare in higher sea level vegetation. Previously, this research will be using height sea level vegetative until 800 meters (between 400-800 m) but the Ketak vegetation is very difficult to growth although ketak can growth until 1500 m [14]. Based on survey facts, this research used three sea level vegetation i.e. 0-250 m, 249-499 m and 500-750 meters. Ketak vegetative can be concluded at a tighter distribution in Lombok island. The Ketak vegetation can be shown in pictures below (Figure 1).

In the vegetative, Ketak produces two leaves i.e. vegetative and gerative leaves. Vegetative leaves are characterized wider size, shiny and growth as Ketak's growth (Figure 2a). Else, generative leaves are characterized narrower size, lancet and appear after ketak developing or approximately after 1 year (Figure 2b).

Morsita dispersion index (MDI) was calculated the MDI index was 0.00 that indicated Ketak vegetation randomly growth in a heavy, medium and light shelter [7].

Figure 1: Ketak vegetation in host plant 0-249 m sea level (a) 250-449 m sea level in Pusuk village (b), and above 500 m sea level in Genggelang village (c).

Figure 2: Vegetative leaves at beginning (a) and generative leaves (b).

Discussion

Environmental factors: External factor was investigated from the micro climate value to Ketak productivity. Height levels were grouped into three classes (0-249, 250-499, and 500-up sea level).

No	Variables	Degree of freedom	Ketak +	Fern	Height of fern	Diameter of fern
1	Height	2	**	**	**	**
2	Humidity	2	ns	*	**	**
3	Temperature	2	ns	ns	**	**
4	Light intensity	1	ns	*	ns	ns
Noted: * = very significant, **= significant, ns= not significant. + regression analysis						

Tabel 1: Environmental factors to Ketak growth.

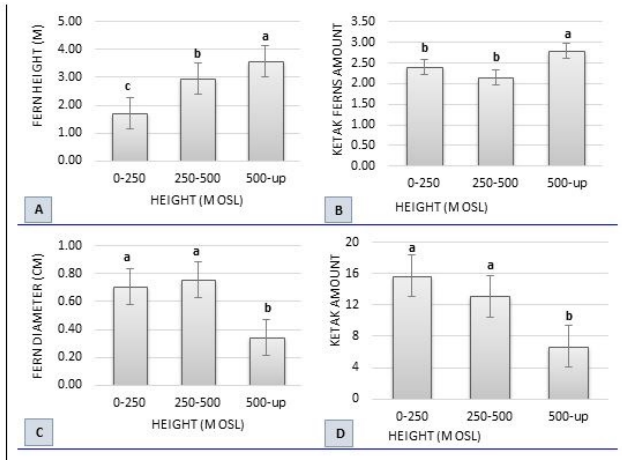

Figure 3: A. Fern height mean (m), B. Fern amount, C. Fern diameter (cm), and D. Ketak amount (per plot) based on altitude.

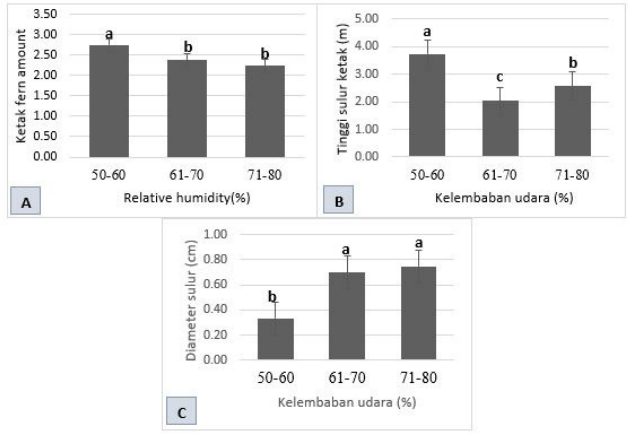

Figure 4: A. Fern amount mean, B. Fern height, and C. Fern diameter.

Humidity and temperature were also classified into three classes (low, medium and high) [8]. Low temperature was 27,7-29,9°C; medium temperature was from 61-70%; and high temperature was from 31.1-33°C. Then, humidity scale, Low temperature was between 50-60%; medium humidity was between 61-70%; and high humidity was between 71-80%. In this temperature and humidity was neglected height factor so amount plots were 30 plots. Temperature and humidity were measured can be shown in the Table 1.

Height Factor: Height level showed very significant to all determine variables. Further analysis using Duncan that showed on Figure (3a-3d) resulted Ketak vegetation growth that was above 500 meters sea level had longest and populated ferns. The humidity factors correlated to the ketak growth because humidity ratio is lower and suitable for ferns growth. It supported from data collection that showed long ferns can be generated when ketak is growing on lower humidity relative environment [9-13].

On the contrary, the bigger fern diameter and most populated ketak grew in the lowest altitude (Figure 3c and 3d). In the lowest altitude was assumed higher relative humidity. It can be supported from data that can be seen on Figure 4a-4c. Higher altitude influences Ketak growth because higher altitude did not support Ketak vegetation. Ketak grow relatively under shelter, higher relative humidity and medium temperature condition.

Humidity: Duncan test indicated the relative humidity significantly affected fern length, distribution and diameter although did not affect Ketak population in a plot. Relative humidity influence on drought threat on the Ketak leaves. Water insufficient influences reducing leaves area, stomata closure and protoplasmic hydration.

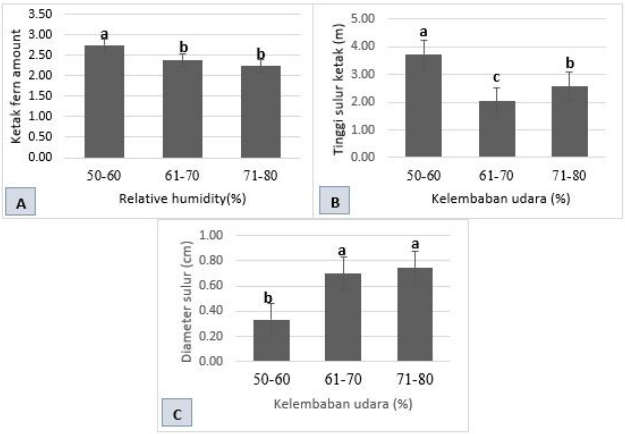

Figure 5: temperature effect to fern height (5A) and fern diameter (5B).

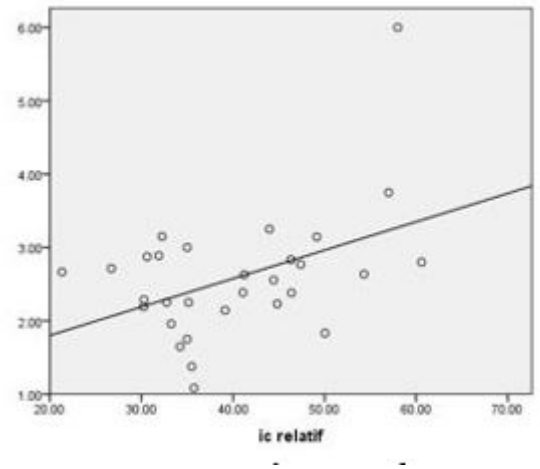

Figure 6: ICR correlation to fern amount.

Temperature: Temperature was significantly Ketak diameter and height but did not showed significant to fern distribution and population. Lower scale temperature enhanced ferns growth based on ferns diameter and medium temperature supported ferns length.

Inversely. High temperature created better fern diameter although Ketak ferns were shorter (Figure 5).

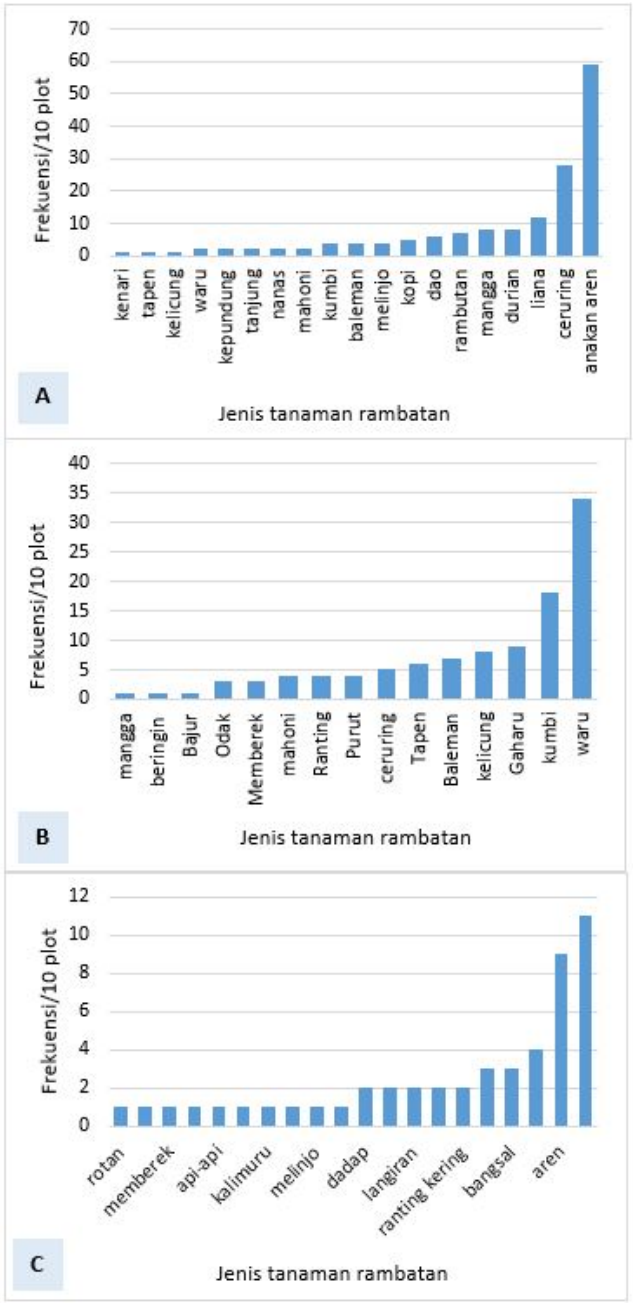

Figure 7: Frequency and type of host plants: A. 0-250 m osl, B. 250-500 m osl, and C. 500-up m osl.

Light intensity: Relative light intensity showed significant to ketak fern population after regression analysis. Less dense shelter indicated ferns growth is better.

It can be correlated to the altitude growth that indicated Ketak ferns were most populated (Figure 6).

Host plant: Ketak growth is depent on host plant. Lower altitude is sufficient many host plant variances for Ketak growth although naturally not well distributed.

Frequency analysis observed some Ketak host plant were Aren and Ceruring (0-249 m sea level), Waru and Kumbi (250-499 m sea level) and Coffee and Aren (500-up m sea level). The possibility, those host plants were not old plant and are still growing (Figure 7) [14-17].

Conclusion

Environmental factor influences Ketak and ferns growth. Ferns growth is significantly influenced from relative humidity. Higher relative humidity produces longer and populated ferns. Then, lower temperature results tiny ferns diameter although longer. Light intensity encourages ferns production. Temperature and relative humidity are suitable to Ketak and ferns growth. Some host plants which suitable to Ketak growth are Aren and Ceruring (0-249 m sea level), Waru and Kumbi (250-499 m sea level) and Coffee and Aren (500-up m sea level).

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