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The Structure and Composition of Plants in Habitat of Kantong Semar (Nepenthes SPP.)

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Abstract – The existence *Nepenthes* in its natural habitat has begin to be threatened with extinction due to several factors, namely by illegal logging, forest fires and forest land conversion. This study aims to determine the structure and composition of plants in the habitat of the kantong semar (*Nepenthes* spp.). This study used the plot method squared and determined the research location by *purposive sampling*, with the plot size determined based on the vegetation strata, namely: understorey and seedling (2x2 m^2). , poles (5x5 m^2), and trees (10x10 m^2). Analysis *Canonical Correspondence Analysis (CCA).* The results of the study found as many as 13 families consisting of 22 species of plants scattered in the *Nepenthes* which were divided into understorey plants and seedlings, poles and trees. The highest Important Value Index (INP) in the tree strata is 80.44% in the *Syzygium* sp. The Diversity Index (H') of plants in the *Nepenthes* was classified as moderate, ranging from 1.75 to 2.1. The environmental factor that most determines the presence of *Nepenthes* is temperature with a CCA score of 0.45.

Keywords – Habitat, *Nepenthes*, Purposive Sampling.

I. INTRODUCTION

Nepenthes is an ornamental plant, as an ornamental plant this plant has its own charm because of the uniqueness of its pouch. The uniqueness *Nepenthes* lies in how to get food. In addition to roots that absorb nutrients from the soil, this plant is also able to absorb nutrients from insects trapped in its pockets. The insects are destroyed by a kind of compound resembling stomach acid and then sucked the juices, causing *Nepenthes* to be able to survive in areas that are classified as poor area. *Nepenthes* can grow well in soil that is poor in nutrients and slightly exposed to sunlight [1].

Nepenthes has many types and some of them are protected plants based on Government Regulation No. 20 of 2018. The existence *Nepenthes* in its natural habitat has begun to be threatened due to several factors, including conversion to agricultural and mining land, damage to natural habitat due to disasters or human actions, and overexploitation [2]. This will certainly affect the structure and composition of plants in the *Nepenthes* so that there is a change in vegetation. To determine the structure and composition of plants in the *Nepenthes* a plant vegetation analysis was carried out. Vegetation analysis can be used as a form of environmental evaluation that leads to efforts to conserve *Nepenthes*.

This study aims to determine the structure and composition of plants in the habitat of *Nepenthes* and to determine the environmental factors that influence the existence of *Nepenthes*. This research is expected to provide information about the dominant plant species in the habitat of *Nepenthes* and the main environmental factors that most influence the existence of *Nepenthes.*

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II. Research Methods

Data collection was carried out in Gunung Kunyit Forest, Kerinci Seblat National Park, located in Talang Kemuning Village, Bukit Kerman District, Kerinci Regency, Jambi Province (Fig. 1). The location of this mountain is approximately 32 kilometers from Sungai Penuh City, and can be reached by traveling for 30 minutes to an hour. The time needed to reach the top of Gunung Kunyit is about 6 hours. Data collection was carried out from February to May 2022. Characterization and identification of plants was carried out at the Andalas Herbarium, Faculty of Mathematics and Natural Sciences, Andalas University.

The method used in this study was a *purposive sampling method* which is a modification of the method used by Mueller Dumbois and Ellenberg (1974). Based on the total population of *Nepenthes*, 10 research plots were made at the research site. Plots were made with sizes of 10x10 m, 5x5 m and 2x2 m. Each plot has a different function. A plot measuring 10x10 m was used for tree data collection with a trunk diameter of 4 cm. The 5x5 m plot was used for data collection of tillers (poles) with diameters between 1-4 cm. While the plot measuring 2x2 m was used for data collection of understorey and seedlings with a height of < 1 m. For each species whose Latin name is not known in the field, a herbarium specimen is made for identification. Then measured environmental parameters such as soil moisture, soil temperature, light intensity, air temperature, and humidity.

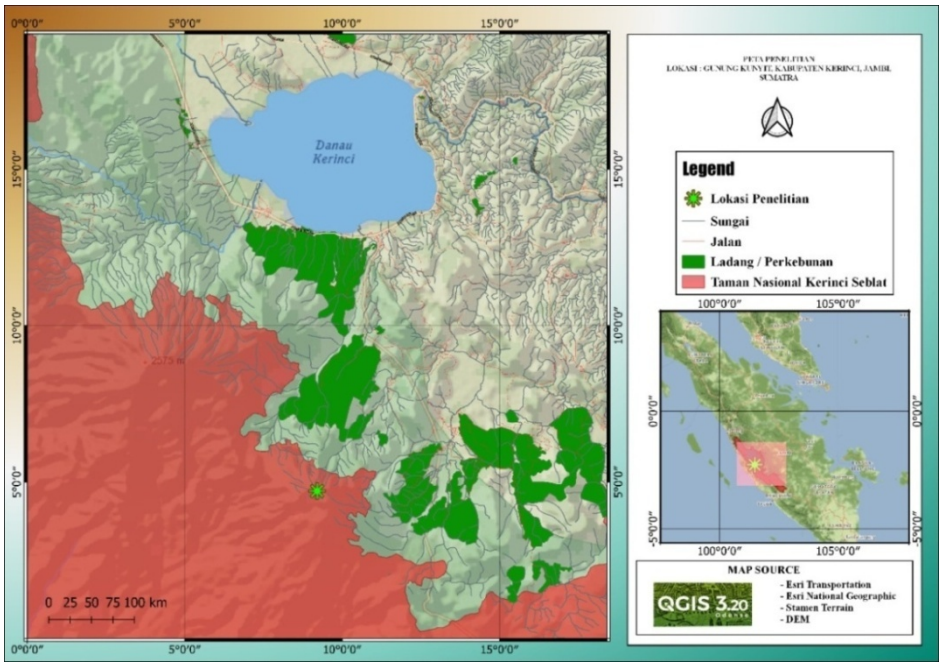

Fig. 1. Map of Gunung Kunyit

Analysis of vegetation structure data was analyzed using the Mueller-Dombois and Ellenberg (1974) formula or equation.

Density (D) $= \frac{\text{Number of individuals of species}}{\text{Plot area}}$

Relative Density (RD) $= \frac{Species\ density}{Density\ of\ all\ species} x\ 100\%$

Frequency (F) $= \frac{\text{Number of plots round of a type}}{\text{Total number of plots}}$

Relative Frequency (RF) $= \frac{\text{Frequency of a species}}{\text{Frequency of all types}} x\ 100\%$

Dominance (D) $= \frac{Number\ of\ basic\ area\ of\ a\ type}{Total\ area\ of\ plots}$

Relative Dominance (RD) $= \frac{Dominance\ of\ a\ species}{Number\ of\ dominance\ of\ species} x\ 100\%$

IIV = Relative Density (%) + Relative Frequency (%) + Relative Dominance (%)

Plant Diversity Index in Gunung Kunyit

To see the diversity of plant species, it is done by calculating the Shannon-Wiener diversity index [4]:

H' = -Σ pi ln pi

Information:

H' = diversity index

Pi = ni/N

ni = number of individual species to -i

N = total number of individuals of all types

Determination Criteria:

H'≤ 1 = Low diversity

1≤ H'≤ 3 = Medium diversity

H'≥ 3 = High diversity

To determine the environmental factors that affect the presence of *Nepenthes*, several parameters were measured, namely altitude, temperature, pH, soil moisture, air humidity and light intensity referring to Muharani (2022) analyzed by *Canonical Corespodence Analysis* (CCA) using the *Palentological Statistical* (PAST) version 7 [6].

III. Results And Discussion

Results of observations on the structure of tree strata around the *Nepenthes*, it was found as many as 6 plant species from 4 families, which had the highest Important Value (80.44%) namely *Syzygium* sp. (Table 1). Furthermore, the strata sapling plant structure around the *Nepenthes* was found as many as 7 plant species from 6 families, which had the highest important value (69.36%) namely *Rhododendron* sp. (Table 2).

Table 1. Vegetation Structure of Tree Strata at Research Site

No	Family	Species	RD (%)	RF(%)	RD(%)	IIV
1	Myrtaceae	*Syzygium* sp.	22,22	16,67	41,55	80,44
2	Ericaceae	*Rhododendron* sp.	38,89	25,00	9,92	73,81
3	Ericaceae	*Rhododendron citrinum*	16,67	25,00	7,77	49,44
4	Ericaceae	*Diplycosia* sp.	11,11	16,67	8,85	36,62
5	Hamamelidaceae	*Exbucklandia populnea*	5,56	8,33	20,11	34,00
6	Lauraceae	*Litsea* sp.	5,56	8,33	11,80	25,69

Notes : RD: Relative Density, RF: Relative Frequency, RD: Relative Dominance, IIV : Indices of Important Value

Table 2. Vegetation Structure of Sapling Strata at Research Site

No	Family	Species	RD(%)	RF(%)	RD(%)	IIV
1	Ericaceae	*Rhododendron* sp.	27,27	27,27	14,81	69,36
2	Ericaceae	*Gaultheria leucocarpa*	18,18	18,18	16,93	53,29
3	Theaceae	*Gordonia densifolia*	18,18	18,18	16,37	52,74
4	Phyllanthaceae	*Antidesma* sp.	9,091	9,09	15,85	34,03
5	Pandanaceae	*Pandanus* sp.	9,091	9,09	13,56	31,74
6	Moraceae	*Ficus* sp.	9,091	9,09	11,62	29,80
7	Symplocaceae	*Symplocos* sp.	9,091	9,09	10,86	29,04

Notes : RD: Relative Density, RF: Relative Frequency, RD: Relative Dominance, IIV : Indices of Important Value

The plant structure of understorey and seedling strata around the *Nepenthes* was found as many as 16 plant species from 9 families, which had the highest significance value (52,01%) namely the type of *Dipteris conjugata* (Table 3). Significant Value (NP) describes the level of control of a species in vegetation and the importance of the role of a species in its community [8]. If the INP of a species is of high value, then the species greatly affects the balance and functioning of the community. The higher the value means the more important and dominant the role and the better the adjustment and utilization of energy sources in the community [9]. The comparison above shows that the differences in vegetation strata indicate different plant composition structures.

Table 3. Vegetation Structure of Lower Plant Strata and Seedlings at Research Locations

No	Family	Species	RD (%)	RF (%)	IIV
1	Dipteridaceae	*Dipteris conjugata*	40,11	11,90	52,01
2	Rubiaceae	*Argostemma parvifolium*	16,04	2,38	18,42
3	Moraceae	*Ficus deltoidea*	5,88	11,90	17,79
4	Melastomataceae	*Melastoma* sp.	6,95	9,52	16,48
5	Ericaceae	*Gaultheria leucocarpa*	4,28	9,52	13,80
6	Melastomataceae	*Medinilla verrucosa*	3,74	7,14	10,89
7	Ericaceae	*Rhododendron retusum*	2,67	7,24	9,82
8	Ericaceae	*Diplycosia punctulata*	2,14	7,14	9,28
9	Ericaceae	*Rhododendron citrinum*	1,60	7,14	8,75
10	Rubiaceae	*Argostemma uniflorum*	5,88	2,38	8,26
11	Ericaceae	*Rhododendron* sp.	3,21	4,76	7,97
12	Myrtaceae	*Syzygium* sp.	2,67	2,38	5,05

13	Pandanaceae	*Pandanus* sp.	1,07	4,76	4,54
14	Araliaceae	*Schefflera* sp.	0,53	2,38	2,92
15	Ericaceae	*Vaccinium* sp.	0,53	2,38	2,92
16	Symplocaceae	*Symplocos* sp.	0,53	2,38	2,92

Notes : RD: Relative Density, RF: Relative Frequency, IIV : Indices of Important Value

The presence of understorey and seedlings on the forest floor can function as a rainwater barrier and surface runoff thereby minimizing the risk of erosion. In addition, understorey vegetation and seedlings play an important role in forest ecosystems and determine the microclimate [10]. Undergrowth species are annual, bilennial, perennial and the distribution pattern can occur randomly, clumps/groups and evenly.

Table 4. Value of Plant Diversity Index in Gunung Kunyit Forest

Habit	Diversity Index (H')	Description
Tree	1,75	Medium
Sapling	1,85	Medium
Undergrowth	2,1	Medium

Habitat *Nepenthes* are classified as moderate because the criteria for the plant diversity index are between 1,75-2,1 (Table 4) so that they are included in the medium category, which means that the *Nepenthes* has a balanced productivity and ecosystem. Based on the calculation of the Shannon Winner diversity index ($H^{'}$), the highest value was found in the understorey and seedling strata with a value of 2,1 which means that this area has a variety of species, According to Mawazin and Subiakto (2013), the higher the value of $H^{'}$, the higher the level of stability of the forest vegetation community. A species that has a high level of stability has a greater opportunity to maintain the sustainability of its species, While the lowest diversity is found in the tree strata, which is 1,75. Indriyanto (2006) said that a community is said to have low species diversity if the community is composed of a few species or there are only a few species that dominate, on the contrary a community is said to have high diversity if the community is composed of varied plants [13].

Nepenthes is found in secondary forest locations at an altitude of 1.768-1.993 masl. The effect of altitude on plant growth is closely related to environmental factors. Differences in altitude cause differences in climatic conditions such as soil temperature, air temperature, soil moisture and air humidity [14]. The physical condition of the environment is one of the factors that affect the growth and species composition in a community [15]. The results of the abiotic component factor analysis using CCA analysis can be seen in Table 5.

Table 5. *Canonical Corespodence Analysis* (CCA) core the relationship between the presence of *Nepenthes* and environmental factors

	Plant		**Environment**	
	axis 1	axis 2	axis 1	axis 2
N. bongso	2.76	-1.47	-	-
N. gymnamphora	-0.64	-0.52	-	-
N. inermis	0.39	1.42	-	-
Elevatiom	-	-	0.39	0.18
Light Intensity	-	-	-0.15	0.15

Temperature	-	-	0.24	**0.45**
Humidity	-	-	-0.34	-0.14
pH	-	-	-0.37	0.33
Soil Moisture	-	-	-0.43	-0.12

Based on environmental factors that most determine the presence of *Nepenthes* habitat is temperature with a CCA score of 0.45 (Table 5) which is depicted on axis 2. This factor greatly determines the presence of *Nepenthes.* This is in accordance with the opinion of Saleh *et al,* (2013) that temperature is one of the most limiting environmental factors for vegetation growth, *Nepenthes* Upland.

IV. Conclusion

From the results of the study, it is known that the composition of plants found around the *Nepenthes* is as many as 13 families consisting of 22 plant species which are divided into trees, poles and undergrowth/seedlings, habitat is *Nepenthes* dominated by *Syzygium* sp., 80,44% in tree strata, *Rhododendron* sp., 69,36% in sapling strata and *Dipteris conjugata* 52,01% in understorey and seedling strata. In the quantitative analysis conducted on the vegetation in the *Nepenthes* the results of the calculation of the diversity index ranged from 1,75 to 2,1 which means that the species diversity in the study area is classified as moderate. The environmental factor that most determines the existence *Nepenthes* from the results of the CCA analysis is temperature with a CCA score of 0.45.

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