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MORALITY BEFORE KNOWLEDGE

Diversity of Meliaceae family in Bogani Nani Wartabone national park (Hungayono tourism object)

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ABSTRACT
Introduction: The Meliaceae family is a group of flowering plants that are widely distributed in tropical and subtropical regions around the world. Some of its members have important economic value. Based on initial surveys in the Bogani Nani Wartabone National Park area, especially the Hungayono tourist attraction area of Gorontalo Province, it is known that there are various species of Meliaceae familli plants. However, it has not been identified what types of Meliaceae plants are and how the value of diversity index in the tourist attraction area. **Methods:** The purpose of this study was to determine how the diversity of Meliaceae plant species in the Hungayono tourist attraction area of Gorontalo Province. Data collection techniques using exploratory or cruising methods using sampling techniques Probability Sample. **Findings:** The results of the study found 10 species of Meliaceae familli plants in the Hungayono tourist attraction area. The index value of plant diversity of Meliaceae familli found in the Hungayono tourist attraction area is 1.91 with moderate criteria which indicates a fairly stable ecosystem condition. **Conclusion:** these findings provide valuable baseline data on the Meliaceae family in the region, contributing to future conservation and biodiversity management efforts in the area. **Novelty/Originality of this article:** The novelty of this research lies in the first recorded identification and diversity assessment of Meliaceae species in the Hungayono tourist attraction area.

KEYWORDS: diversity, Meliacea family, environmental parameters

1. Introduction

National parks are nature conservation areas that have original ecosystems, managed by a zoning system that is used for the purposes of research, science, education, culture, tourism, and natural recreation (Rhama, 2019). National parks according to Obenaus (2005) in Rhama (2019) are areas created or used "to preserve the natural environment from surrounding development and to provide social benefits in the form of learning, recreation, and tourism". The purpose of national parks is to protect the natural environment from overdevelopment and provide access for visitors to use nature as a temporary recreational destination (Holden, 2008; Rhama, 2019). Indonesia has many national parks scattered across the archipelago, reflecting its extraordinary wealth of biodiversity.

One of them is Bogani Nani Wartabone National Park in Gorontalo province. Bogani Nani Wartabone National Park (TNBNW) is a tropical rainforest with various influences

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such as biotic, abiotic, socio-economic, and cultural factors. National parks have an important role in supporting people's lives both directly and indirectly, such as eco-tourism, water sources, fuel and culture (Sune, 2012). There are 331 vegetation species recorded in Bogani Nani Wartabone National Park, consisting of 314 tree species, 13 palm species, and 4 herbaceous species (fern, taro, pandanus). This number is the result of a survey conducted by the Wildlife Conservation Society - Indonesia Program in December 1999-February 2000 in Pinogu Gorontalo, as part of the Biological Survey in Bogani Nani Wartabone National Park (Lee, 2000; Bashari, 2020). This species list was also combined with the results of a survey conducted by the Manado Forestry Research Institute at Tulabolo Pinogu Resort in October-November 2010, which became a series in the survey of ebon species in Bogani Nani Wartabone National Park, (Suryawan & Kinho 2012; Bashari, 2020). Almost the entire area of Bogani Nani Wartabone National Park is covered by lowland forests and lower montane forests, but with a high slope level with fertile soil conditions, making the forest canopy slightly open.

Biodiversity is the various forms of life that exist on land, air and water in a space and time, in the form of plants, animals, and even the smallest living things such as microorganisms. According to Rohman (2021) biodiversity is the biological diversity that lives on earth which refers to the variation of life which includes the form, number and other characteristics found at the genetic, species and community levels. Biodiversity is a variation or difference in the forms of living things, including differences in plants, animals, and microorganisms, the genetic material they contain, and the forms of ecosystems in which a living thing lives (Ridwan, 2012).

The biodiversity found in Indonesia is not entirely identifiable, this is due to limited knowledge to conduct biodiversity research. In addition, natural conditions also affect the research carried out. Biodiversity includes three levels, namely gene diversity, species diversity and ecosystem diversity. One of the regions in Indonesia that has high diversity is Gorontalo. This is characterized by the discovery of various species sourced from flora and fauna in the region (Baderan, 2021). One of the species diversity in Gorontalo is the diversity of plants from the Meliaceae family.

According to Tambunan (2021), the Meliaceae family is a group of flowering plants that are widely distributed in tropical and subtropical regions throughout the world. Some of its members have important economic values, such as strong wood, edible seeds, and the content of active compounds used in medicine. In addition, the Meliaceae family also has potential for the development of new medicines.

Meliaceae, comprising woody plants is widespread in the tropics and subtropics, occasionally occurring in temperate regions. With about 740 species in 58 genera, Meliaceae is a medium-sized family in Sapindales. The Indo-Malesian region is the geographic center of diversity (Koenen, 2015). Meliaceae, otherwise known as duku-dukuan, has the stature of a tree or shrub. The leaves are pinnately compound, lacking stipules. Flowering is a limited panicle. The flowers are androgynous. The calyx and corolla leaves are 3-6. The stamens are 8-10. The fruits are capsules or chunks. Species of the tribe Meliaceae commonly grow as lower canopy trees, in the lowlands throughout Malesia (Keng, 1969). Most Meliaceae species are tropical trees with compound leaves, and the family includes the largest known tree in Africa - the Entandrophragma excelsum Sprague tree, 81.5 m tall on Mount Kilimanjaro (Hemp, 2017). Meliaceae family plants are widely distributed in tropical rainforest areas, one of is in Bogani Nani Wartabone National Park, especially the Hungayono Tourism Object area, Bone Bolango Regency, Gorontalo Province. Hungayono Nature Tourism Object is located in Tulabolo Village, East Suwawa Sub-district, Bone Bolango Regency, Gorontalo Province. Hungayono Tourism Object area has natural beauty such as cool primary forest, grassland, limestone cave and sauna cave. The location of Hungayono Tourist Attraction can be reached using two-wheeled and four-wheeled vehicles. From Gorontalo city center, you can reach Tulabolo village by vehicle with a travel time of ± one hour or ± 2 hours from Jalaluddin Gorontalo Airport and continued by walking to Hungayono campsite with a travel time of ± 45 minutes.

2. Methods

The research was conducted in Bogoni Nani Wartabone National Park, Hungayono Tourism Object sub-area. The research was conducted from July to September 2022. This type of research is descriptive quantitative. This research was conducted to identify the types of plants of the Meliaceae family in Bogani Nani Wartabone National Park sub-area Hungayono Tourist Attraction. The research method used an exploratory cruising method using the Probability Sample sampling technique, in the Hungayono Tourism Object area, referring to research (Baderan, 2022).

The object of this research is all types of plants of the Meliaceae family in Bogani Nani Wartabone National Park, Hungayono Tourism Object sub-area, Bonebolango Regency, Gorontalo Province. The method used in this research is exploratory cruising method by using Probability Sample sampling technique (Sugiyono, 2018) in Bogani Nani Wartabone National Park area of Hungayono Tourism Object area, Bonebolango Regency, Gorontalo Province. The tools used in this research are GPS (Global Positioning System) for the position and location of research, Hygrometer to measure air humidity, Thermometer to measure air temperature, Soil tester to measure soil pH and temperature, digital camera to record images of plants as physical evidence of research, determination key, as well as stationery, ruler, hanging etiquette, black cloth, and map. The materials in this study are all types of plants of the Meliaceae family found Hungayono Tourism Object.

2.1 Research procedure

The first step taken is the initial observation which is intended to directly observe the situation at the location that will be used as a research site to obtain the information needed to continue the research. Data collection techniques were carried out using the cruising or exploration method, namely by walking through every corner of the location, in this case the location is the Hungayono Tourism Object area, and counting the number of Meliaceae plant samples found during exploration and documented as physical evidence. The samples were then brought to the base camp for further identification. In addition, measurements were also made of physical environmental factors including air temperature, air humidity, soil pH and temperature, and the height of the location at the research site.

Identification is done by considering morphological characteristics. The identification method is to observe samples that are still on natural substrates, then macroscopically observe their morphological characteristics, including roots, stems, leaves, flowers and fruits, then adjusted to the determination key. Validation of the accepted name of each plant species was carried out using the website POWO (2023). The identification results were then analyzed descriptively qualitatively and their conservation status was determined based on the IUCN website (http://www.iucnredlist.org) (IUCN, 2023).

2.1 Socio-economic, community understanding, coral reef

The level of diversity was measured descriptively using data collected from the research site, which was then analyzed through the diversity index formula. The results of this analysis are further elaborated in the discussion section. The diversity index (H') mathematically represents species population conditions within a community, facilitating data analysis on the number of individuals per species. This calculation was performed using the Shannon-Wiener equation, as outlined by Krebs (1989) in Fatima (2019) (Equation 1).

$$H' = - \Sigma si=s\ (pi)\ \ln i(pi) \quad \text{(Eq. 1)}$$

In this equation, H' represents the Shannon-Wiener Diversity Index. Pi is calculated as ni/N, where ni is the number of individuals of the i-th species, and N is the total number of

individuals. Based on the categorization by Sirait (2018), the diversity index (H') obtained from the Shannon-Wiener formula is classified as follows H' > 3 indicates high diversity. 1 < H' < 3 indicates medium diversity. H' ≤ 1 indicates low diversity.

3. Results and Discussion

Bogani Nani Wartabone National Park is the largest land conservation area in Sulawesi, administratively located in two provinces. The eastern part of the park is located in North Sulawesi Province. While the area in the west is in the territory of Gorontalo Province, which borders only Bone Bolango Regency (Hanom, 2020). Bogani Nani Wartabone National Park serves as a habitat for various flora and fauna, including plants of the Meliaceae family. In this study, sampling was conducted in the Hungayono Tourism Object area.

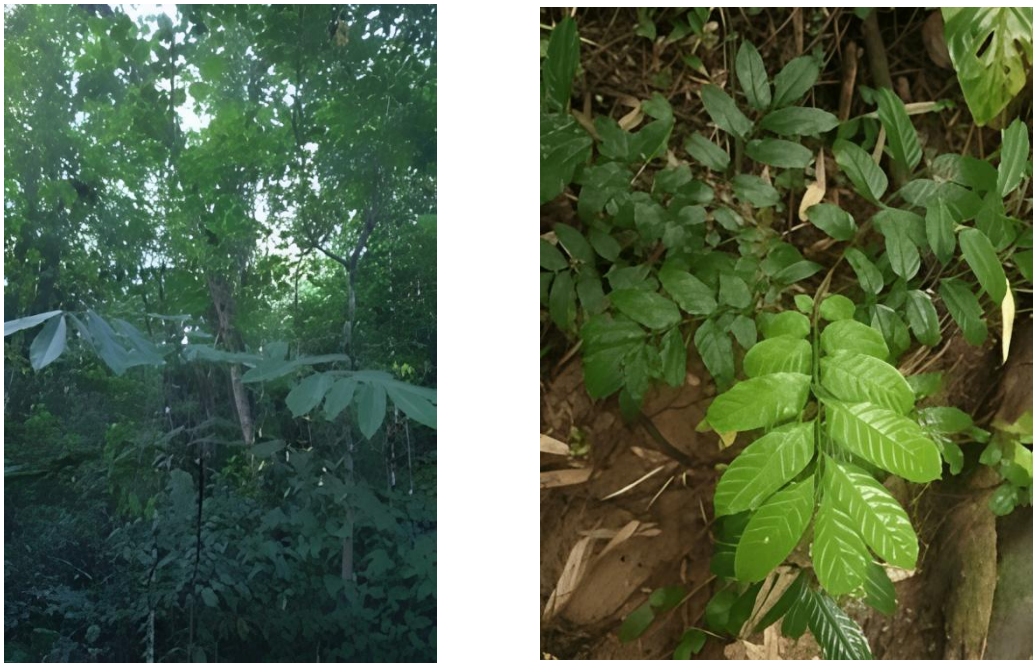
Based on the results of research conducted in the Bogani Nani Wartabone National Park area, there are 10 species of Meliaceae family plants. Plants of the Meliaceae family are generally trees, shrubs, or shrubs. Meliaceae leaf types are compound, pinnate, and some are multiple. Flowers in Meliaceae are usually hermaphroditic or mostly unisexual (Wulandari et al, 2018). Based on the results of plant identification of the Meliaceae family at the research site, 4 plant species were found in the IUCN conservation category. The list of Meliaceae family plants identified in the Hungayono tourist attraction area is presented in Table 1.

Table 1. List of Meliaceae family plants identified in Hungayono tourist attraction area

Familly	Genus	Species	Status	Number of individuals
Meliaceae	Aglaia	Aglaia puberulanthera C.DC.	Near Threatened (NT)	14
		Aglaia coriacea Korth. ex Miq.	Vulnerable under (VU)	12
		Aglaia Angustifolia (Miq.) Miq.	Vulnerable under (VU)	8
		Aglaia argentea Blume	least concern (LC)	10
		Aglaia Sp.	-	39
	Didymocheton	Didymocheton gaudichaudianus A. Juss	-	20
	Walsura	Walsura pinnata Hassk.	-	13
	Dysoxylum	Dysoxylum sp.1	-	5
		Dysoxylum sp.2	-	3
	Lansium	Lansium domesticum Corrêa	-	68
Total number of individuals				192

3.1.1 Aglaia puberulanthera C.DC. and Aglaia coriacea Korth. ex Miq.

This type of Aglaia plant has incomplete leaves, thickened petioles at the base, inverted ovoid leaf shape, tapered leaf tip, blunt leaf base, flat-edged leaf edges, leaf branch bones united with other branch bones, flat-edged incised leaf edges, dark green leaf color, shiny smooth leaf surface, gasal pinnate compound leaf type with a gasal number of leaflets. Habitat and distribution found as understory trees in primary forest on clay soils, 80-750 m altitude. Malesian distribution: New Guinea (Maberley, 1995).



(a) (b)

Fig. 1. (a) *Aglaia puberulanthera* C.DC.; (b) *Aglaia coriacea Korth*. ex Miq.

This type of Aglaia plant has incomplete leaves, the petiole thickens at the base, the shape of the leaf is jorong, the tip of the leaf is pointed, the base of the leaf is blunt, the bones of the leaf branches are united with the bones of other branches, the edges of the leaves are incised with flat edges, the color of the leaves is dark green, the surface of the leaves is smooth and shiny, the type of compound leaves is gasal pinnate with a gasal number of leaves. Habitat and distribution found in primary forest; up to 270 m elevation. Malesian distribution: Peninsular E & C Malaysia, South Borneo (known only from type collections) and Brunei (one collection only) (Maberley, 1995).

3.1.2 Aglaia angustifolia (Miq.) Miq., Aglaiaargentea blume, *and Aglaia Sp*

This plant has incomplete leaves, the petiole thickens at the base. The leaf shape is lanceolate. The leaf tip is pointed, the base of the leaf is runiced. The leaf bone arrangement is pinnately bony, the branch bones are united with the bones of other branches. The edges of the leaves are incised choppy. The leaf color is dark green, the leaf surface is smooth and shiny, the leaf type is gasal pinnate compound with a gasal number of leaflets. Habitat and distribution found in lowland and hilly primary forest, swamp forest, occasionally along riverine forest, roadside, kerangas forest on sandy soil and yellow-red loam; altitude 35-1450m; often common. Malesian distribution: Northern Sumatra & C, Southern Peninsular Malaysia (Johore), Southern & Western Borneo, Bunguran Island, Philippines (known only from type collections of A. ste nophylla) (Maberley, 1995).

This type of Aglaia plant has incomplete leaves, thickened petioles at the base, lanceolate leaf shape, tapered leaf tips, pointed leaf bases, leaf branch bones united with other branch bones, leaf edges with wavy incisions, yellowish green leaf color, shiny smooth leaf surface, gasal pinnate compound leaf type with a gasal number of leaflets. Habitat and distribution found in primary, secondary, and riparian forests, evergreen or semi-evergreen, on granite, basalt, sandstone, coral sand, clay or limestone; rises to sea level to 1200 m elevation; locally scattered to rather common. Aril eaten by monkeys, hornbills, children. Distribution Nicobar Islands, Thailand, Solomon Islands, Sumatra, Peninsular Malaysia, Borneo, Java, Philippines, Sulawesi, Lesser Sunda Islands, Moluccas, New Guinea (Maberley, 1995).

(a) (b)

Fig. 2. (a) *Aglaia angustifolia* (Miq.) Miq.; (b) *Aglaiaargentea* Blume

This plant has incomplete leaves. The petiole thickens at the base, the leaf shape is lanceolate, and the leaf tip is pointed. The base of the leaf is rounded, the leaf bone arrangement is pinnately bony, the branch bones are united with other branch bones, the edges of the leaves are incised choppy, the leaf color is dark green, the leaf surface is smooth and shiny, the leaf type is gasal pinnate compound with a gasal number of leaflets.

Fig. 3. *Aglaia* Sp.

3.1.3 Didymocheton gaudichaudianus A.juss

This plant has incomplete leaves. Thickened petioles at the base, the shape of the leaf is an inverted ovoid shape and the tip of the leaf is pointed. The base of the leaf is blunt, the bones of the leaf branches are united with the bones of other branches, the edges of the leaves are incised with flat edges, the color of the leaves is yellowish green, the surface of the leaves is smooth and shiny, the type of compound leaves is gasal pinnate with a number of gasal leaves.

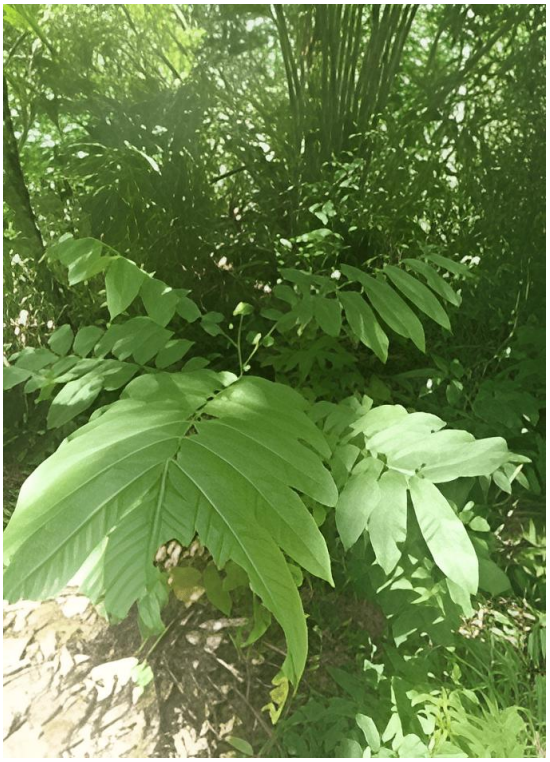


Fig. 4. *Didymocheton gaudichaudianus* A.juss

Habitat and distribution. Primary and secondary forests including swamp forests, bamboo forests and forests on limestone, up to 1800m altitude. Common tree, seeded by pigeons. Distribution, Christmas Island (Indian Ocean), Queensland, Solomon Islands, New Hebrides, Samoa; Malesia: Java, Philippines (Luzon, Masbate, Mindanao, Palawan), Sulawesi, Lesser Sunda Islands (Sumbawa, Flores, Timor), Moluccas (Seram, Tenim bar, Aru), New Guinea, Bismarck Archipelago (Maberley, 1995).

3.1.4 Walsura pinanta Hassk.

This type of Walsura plant has incomplete leaves. The petiole thickens at the base, the shape of the leaves is jorong, the tip of the leaf is spiny. The base of the leaf is pointed, the arrangement of the leaf bones is pinnately bony. The edges of the leaves are incised with double serrations, the color of the leaves is yellowish green, the surface of the leaves is smooth and shiny.

The type of compound leaves is gasal pinnate with a gasal number of leaves. Distribution, Burma, Thailand, Yunnan, Hainan, Cambodia, Vietnam; Malesia: Malay Peninsula, Java (cult: Bogor), Borneo, Philippines (Palawan to Luzon), Halma hera, western tip of Irian Jaya. Walsura pinnata has the widest range of all Walsura species (and Pseu doclausena) and is highly variable, especially in leaf size and leaflets, but also, to a lesser extent, in leaflet number (Maberley, 1995).

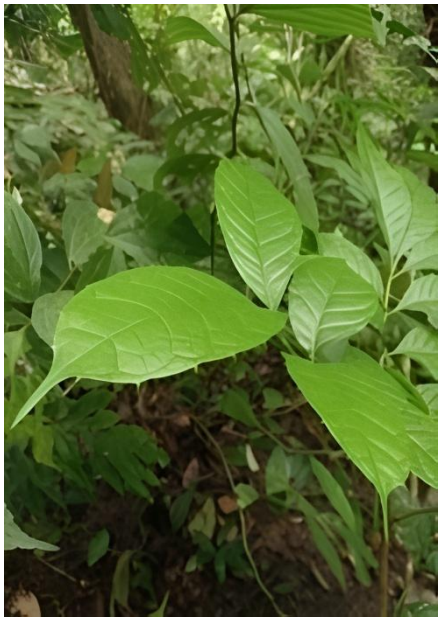


Fig. 5. *Walsura pinanta* Hassk.

3.1.5 *Dysoxylum Sp1. and dysoxylum Sp2.*

This plant has incomplete leaves. The petiole is thickened at the base, the shape of the leaf is jorong, the tip of the leaf is tapered, the base of the leaf is rounded, the arrangement of the leaf bones is pinnately bony, the bones of the branches are united with the leaves. The leaf color is dark green, the leaf surface is smooth and shiny, the leaf type is gasal-pinnate compound with a gasal number of leaflets.

Fig. 6. *Dysoxylum* Sp1.

This plant has incomplete leaves. The petiole thickens at the base, the shape of the leaf is jorong, the tip of the leaf is tapered, and the base of the leaf is rounded. The leaf bone arrangement is pinnately bony, the branch bones are united with the bones of other branches, the edges of the leaves are incised choppy, the leaf color is dark green, the leaf surface is smooth and shiny, the leaf type is gasal pinnate compound with a gasal number of leaflets.

3.1.6 *Lansium domesticum* Correa

Lansium domesticum Correa plants have incomplete leaves. The petiole thickens at the base, the shape of the leaves is jorong, the tip of the leaf is tapered. The base of the leaf is blunt, the arrangement of the leaf bones is pinnately bony, the edges of the leaves are incised with flat edges, dark green leaf color, smooth shiny leaf surface, type of gasal pinnate compound leaves with a gasal number of leaflets.

Fig. 7. Lansium domesticum Correa

Lansium domesticum Correa is a tree-shaped plant with a hard and tall trunk that lives in various land habitats both forests and mountains, both in lowlands and highlands. Langsat has a fruit with characteristics that are easily recognized by the public in the form of fruit bunches or clusters (Purnamawati, 2024). Habitat and distribution, rainforest including hardwoods and limestone, 0-110 m altitude. The trees are very scattered with a density of 0.2 trees per 40 ha of forest in Ulu Kelantan, Peninsular Malaya. The fruits are said to be spread by bats. Distribution, PeninsularThailand; Malesia (wild, cultivated and naturalized): Sumatra, Malay Peninsula, Borneo, Java, Philippines, Sulawesi, West New Guinea. Cultivated in Indochina, India, Florida (Maberley, 1995). Langsat plants are spread in Sumatra, Kalimantan, Sulawesi and Java. Even in the province of West Sulawesi, langsat plants are superior fruits and important commodities (Anjasasmara, 2020).

The diversity index of the Meliaceae family in the Hungayono tourist attraction area amounted to 1.91 which, when reviewed based on the diversity index criteria, is in the range of 1>H'<3. The diversity index of the Meliaceae plant family is shown in Table 2

Table 2. Plant Diversity Index of Meliaceae Family in Hungayono tourist attraction area

No	Species Name	number of individuals	Pi	Ln Pi	Pi Ln Pi
1	*Aglaia puberulanthera* C.DC.	14	0.072917	-2.61844	-0.19093
2	*Aglaia coriacea* Korth. ex Miq.	12	0.0625	-2.77259	-0.17329
3	*Aglaia Angustifolia* (Miq.) Miq.	8	0.041667	-3.17805	-0.13242

4	*Aglaia argentea* Blume	10	0.052083	-2.95491	-0.1539
5	*Aglaia* Sp.	39	0.573529	-0.55595	-0.31885
6	*Didymocheton gaudichaudianus* A.Juss	20	0.104167	-2.26176	-0.2356
7	*Walsura pinnata* Hassk.	13	0.067708	-2.69255	-0.18231
8	*Dysoxylum* sp.1	5	0.026042	-3.64806	-0.095
9	*Dysoxylum* sp.2	3	0.015625	-4.15888	-0.06498
10	*Lansium domesticum* correa	68	0.354167	-1.03799	-0.36762
	amount =	192		H'=	1.91

Environmental factors that can affect plants, especially the Meliaceae family in the Hungayono tourist attraction area based on observations and measurements include ambient temperature, humidity, and soil pH.

Environmental Factors	Unit	Value
Ambient Temperature	oC	28.3oC
Humidity	%	84%
Soil pH	-	6.5
Altitude	Sea level	± 1,200 meters above sea level

3.2 Discussion

Based on the results of research conducted in the Bogani Nani Wartabone National Park area, there are 10 species of Meliaceae family plants consisting of Aglaia puberulanthera C.DC, Aglaia coriacea Korth. ex Miq, Aglaia Angustifolia (Miq.) Miq, Aglaia argentea Blume, Aglaia Sp, Didymocheton gaudichaudianus A.Juss, Walsura pinnata Hassk, Dysoxylum sp.1, Dysoxylum sp.2, Lansium domesticum correa. With a total of 192 individuals dominated by Lansium domesticum correa plants as many as 68 individuals, Aglaia Sp. As many as 39 individuals, and Didymocheton gaudichaudianus A.Juss as many as 20 individuals. All species have the same way of life, namely terrestrial with shrub stature. According to Mabberley et al. (1995) Meliaceae are very common trees in the canopy and primary understory of lowland forests throughout Malesia, accounting for between 2.3% (Van Steenis 1984) and 17% of all trees with a trunk diameter greater than 10 cm (Whitten et al. 1984) in Sumatran forests for example.

Furthermore, of the 10 species found in Hungayono tourist attraction, there are 4 plants that are included in the category of rare plants according to the conservation status category of the Union for the Conservation of Nature and Natural Resource (IUCN) Red List with a low risk category of 1 species namely Aglaia argentea Blume. Vulnerable category found as many as 2 species namely Aglaia coriacea Korth. ex Miq. and Aglaia Angustifolia (Miq.) Miq., almost threatened category found one species namely Aglaia puberulanthera C. DC. Hungayono tourist attraction is one of the natural attractions in Gorontalo Province that is often visited by tourists. As a result, rare plant habitats are increasingly degraded. The number of species and individuals of a community determines the diversity of the community itself (Baderan, 2021; Sutrisna et al., 2018). If a community has many species without any dominating species, the species diversity of the community will be high. The high and low value of diversity in an area determines the level of community stability in the area itself (Baderan, 2021; Wirakusumah, 2003; Indriyanto, 2012).

The index of plant diversity of the Meliaceae family in Bogani Nani Wartabone National Park in the Hungayono tourist attraction sub-area is moderate or can be said to be quite stable at 1.91, based on the calculation of the Shannon-Wiener diversity index listed in Table 2. The diversity index value known as H' is a diversity index value that determines how diverse a species is in a particular area, an area is said to have moderate species diversity if

the H' value exceeds 1 or is equal to 1, if the H' value is more than 3 then the diversity of species is high or abundant, but if the H' found exceeds 0 but less than 1 then it can be said that a community in the area has a low species diversity. (Fachrul, 2007; Rahim & Baderan, 2019; Baderan, 2021). A moderate diversity index in an area illustrates a fairly stable ecosystem balance (Sirait, 2018). This shows that the Hungayono tourist attraction area is an area whose ecosystem is still quite well maintained in the midst of ecological pressure. Furthermore, moderate species diversity is caused by repeated changes in vegetation, as well as nutrients, light, and water taken by vegetation. Therefore, the shape and number of plant species are arranged according to where they grow. Therefore, the shape and number of plant species are arranged according to where they grow. Furthermore, Azizah, 2017; Baderan et al, 2021 stated that the low level of plant species diversity is due to the vulnerability of the area where the plant lives to various disturbances.

According to Baderan (2021), the most useful vegetation parameter for comparing communities is the diversity index. This parameter is very useful for studying the various impacts of environmental or abiotic factor disturbances on communities, as well as for understanding the state of succession and community stability. This is based on the fact that a community has many types of vegetation plants, so the older and more stable the condition of the community, the more different types of plants. Furthermore, Simarmata&SWahyuningsih (2012) also argue that a large or small number of species determines a high or low level of diversity. If the number is not large, then the community consists of only one or a few species, and a high level of diversity indicates that each species is evenly distributed in various areas.

Abiotic factors affect the amount of plant vegetation, including soil pH, soil temperature, soil moisture and air temperature. The existing ambient temperature in the Hungayono tourist attraction area is inversely proportional to humidity. Temperature and humidity are reversed facts. If the temperature is high, the humidity is low, and if the temperature is low, the humidity will increase. Wijayanto (2012) states that temperature and humidity, components of microclimate, are interconnected to create ideal environmental conditions for plant growth. Based on the values shown in Table 3, the temperature in the Hungayono Tourist Attraction area is 28.3°C. The soil pH value is 6.5, indicating that the soil pH is neutral, and the air humidity level is 84%. Tropical rainforests are forest areas formed by climax vegetation with rainfall areas between 2000-4000 mm per year. With small temperature differences throughout the year and an average air humidity of 80%, temperatures range between 25°C and 27°C. Based on the findings in the field, the Hungayono Tourism Object subregion of Bogani Nani Wartabone National Park is a tropical rainforest area because it consists of climax vegetation with a temperature of 28.30°C and 84% humidity. As a result, plants grow well with neutral soil pH (6-7). Due to the high availability of nutrients, plants can regenerate growth quickly. The diversity and presence of plants in it will be influenced by the environment. Plant regeneration power will be higher in a more fertile environment, so new plants will grow in the area, starting from seedlings, belta to trees.

The results of environmental temperature measurements at the research site were 28.3 °C. The results of these environmental temperature measurements are still in accordance with the optimal temperature for plant development of the Meliaceae family. The optimal temperature to stimulate the growth of Meliaceae is between 25-35°C. Temperature is an important factor in the process of spreading and living organisms, especially plants of the Meliaceae family. According to Morton (1987) and Verheij (1991) temperatures lower than 15°C tend to slow growth, while temperatures that are too high, more than 38°C, can cause heat stress in plants.

The measurement result of air humidity at the study site is 84%. This value shows that the climatic conditions at the research site are categorized as humid. According to Aditio (2023) climatic conditions can be determined based on air humidity where climatic conditions can be categorized as humid if the air humidity value ranges from 80 - 85%. Aglaia and Didymocheton plants thrive in lowland forests with relative humidity around 70–85%, while Walsura plants require relatively high humidity, usually around 75 - 90%

(Mabberley 1995). Dysoxylum plants require an environment with high humidity, around 75% to 90%. Dysoxylum grows in wet tropical areas, often in lowland forests (Kebler 1994). Lansium domesticum requires relatively high humidity, around 75% to 85%, and is very sensitive to drought. Moist environmental conditions throughout the year are very favorable for its growth (Verheij, 1991).

The soil pH value at the research location is 6.5. The soil pH at the research location is in normal condition or still in accordance with the soil pH quality standards ranging from 60 - 8.5 based on the Decree of the Minister of Environment No. 128 of 2003. Plants of the Meliaceae family have variations in tolerance to soil pH, but in general, Meliaceae plants prefer soils with slightly acidic to neutral acidity. According to Mabberley (1995) Aglaia, Didymocheton, and Walsura plants prefer soils with slightly acidic to neutral pH, which ranges from 5.5 to 7.0. Meanwhile, for plants Dysoxylum and Lansium Domesticum generally grow in soils that have a pH of 5.0 to 6.5, slightly acidic (Kebler, 1994; Verheij, 1991).

Overall, plants of the Meliaceae family have many benefits for life. Some plants from the Meliaceae family have potential as medicines, for example Didymocheton gaudichaudianus A.Juss. Didymocheton gaudichaudianus A.Juss contains tripterpene compounds, tripterpene glycosides, tetranortriterpenoids, diterpenes, steroids, and alkoloids. The meliaceae family is also used in traditional ceremonies, for example Lansium domesticum. According to Uny (2018) Lansium domesticum (Langsat) tree trunks are often used in traditional ceremonies in West Halmahera. Besides being used in traditional ceremonies, Lansium domesticum is also used as a consumption fruit. Langsat (Lansium domesticum Corr) is a well-known fruit plant in Indonesia. Langsat belongs to the species Lansium domesticum (Anjasasmara, 2020). Meliaceae family plants also play a role in maintaining the ecosystem, for example the Aglaia argantea plant. The fruit of the Aglaia argantea plant feeds animals such as hornbills (Katili, 2024).

4. Conclusions

The results showed that in the Bogani Nani Wartabone National Park area in the Hungayono tourist attraction area there were 10 species of Meliaceae family plants with a total of 192 individuals dominated by Lansium domesticum correa plants as many as 68 individuals, Aglaia Sp. As many as 39 individuals, and Didymocheton gaudichaudianus A.Juss as many as 20 individuals. The results of the diversity index of the Meliaceae family in the Hungayono tourist attraction area using the Shannon-Wiener diversity index formula obtained a value of H' 1.914899 with moderate criteria which indicates a fairly stable ecosystem.

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Author Contribution
This research was conducted by C. D. A., Z, N. A and Y. D. S. C. D. A. Z was responsible for the conceptualization, methodology, data collection, analysis, and drafting of the manuscript. N. A and Y. D. S. C. D. A. Z contributed through critical review, manuscript editing, and supervision throughout the research process.

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References
Aditio, R., Sudiar, N. Y., Dwiridal, L., & Amir, H. (2023). Microclimate characteristics in mangrove forest areas in Padang City. *Journal of Climate Change Society, 1*(2), 104-114. https://doi.org/10.24036/jccs/Vol1-iss2/17

Anjasasmara, Suriyanti, & Alimuddin, S. (2020). Identification of morphological characters of langsat plants (*Lansium domesticum* Corr) as a local superior fruit in Polewali Mandar Regency, West Sulawesi Province. *AGrotekMAS Indonesian Journal: Journal of Agricultural Sciences, 1*(3), 26-42. https://doi.org/10.33096/agrotekmas.v1i3.115

Baderan, D. W. K., Rahim, S., Angio, M., & Salim, A. B. (2021). Diversity, evenness, and richness of plant species from the potential geosite of Fort Otanaha as a pilot for the development of the Gorontalo Province Geopark. *Al-Kauniyah: Journal of Biology, 14*(2), 264-274. https://dx.doi.org/10.15408/kauniyah.v14i2.16746

Baderan, D., Baderan, D. W. K., & Kumaji, S. S. (2022). Plant diversity of *Piperacyeae* tribe in Lombongo waterfall area, Gorontalo Province. *Biome: Makassar Journal of Biology, 7*(1), 95-102. https://dx.doi.org/10.20956/bioma.v7i1.19494

Fatimah, H., Nuraini, R. A. T., & Santoso, A. (2020). Community structure of *Echinodermata* in seagrass beds of Karimunjawa, Jepara, Central Java. *Journal of Marine Research, 9*(3), 311-316. https://doi.org/10.14710/jmr.v9i3.27566

Fachrul, M. F. (2007). *Bioecological sampling methods*. Bumi Aksara.

Hanom, B., Rahmanita, D., Lela, M. W., Datunsolang, I., Mokodompit, A., & Mokoginta, R. P. (2020). Status of animal and plant species diversity in Bogani Nani Wartabone National Park, North Sulawesi-Gorontalo. *Kotamobagu: Bogani Nani Wartabone National Park and Enhancing the Protected Area System in Sulawesi for Biodiversity Conservation (EPASS)-Project.*

Hemp, A., Zimmermann, R., Remmele, S., Pommer, U., Berauer, B., Hemp, C., & Fischer, M. (2017). Africa's highest mountain harbors Africa's tallest trees. *Biodiversity and Conservation, 26*, 103-113. https://doi.org/10.1007/s10531-016-1226-3

IUCN. (2023). *IUCN Red List of Threatened Species.* https://www.iucnredlist.org/

Katili, A. S., Podungge, S., Lamangantjo, C. J., Ahmad, J., Hamidun, M. S., & Zakaria, Z. (2024). Composition and structure of food vegetation of Sulawesi julang (*Rhyticeros cassidix*)

in the Marisa waterflow district of Pohuwato. *Journal of Biogeneration, 10*(1), 277-286. https://doi.org/10.30605/biogenerasi.v10i1.4578

Kebler, P. J. A., & Sidiyasa, K. (1994). *Flora of Indonesia: Dysoxylum.* LIPI Press.

Keng, H. (1987). *Orders and families of Malayan seed plants.* NUS Press.

Koenen, E. J., Clarkson, J. J., Pennington, T. D., & Chatrou, L. W. (2015). Recently evolved diversity and convergent radiations of rainforest mahoganies (*Meliaceae*) shed new light on the origins of rainforest hyperdiversity. *New Phytologist, 207*(2), 327-339. https://doi.org/10.1111/nph.13490

Mabberley, D. J., Pannell, C. M., & Sing, A. M. (1995). *Flora Malesiana: Series I. Spermatophyta Volume 12.* Meliaceae.

Morton, J. F. (1987). *Fruits of warm climates.* Echo Point Books and Media.

POWO. (2023). *Meliaceae.* https://powo.science.kew.org/results?q=meliaceae.

Purnamawati, R., Mahrudin, & Iriyati, R. (2024). Species diversity of langsat (genus *Lansium*) in Tanta Village, Tabalong Regency. *Jurnal Bioshell, 13*(1), 71-80. https://doi.org/10.56013/bio.v13i1.2753

Rahim, S., & Baderan, D. W. K. (2019). Species composition, vegetation structure, and mangrove diversity of Langge association of North Gorontalo Regency-Province of Gorontalo. *Jurnal Ilmu Lingkungan, 17*(1), 181-188. https://doi.org/10.14710/jil.17.1.181-188

Rhama, B. (2019). *National parks and ecotourism* (Vol. 1). Bhayu Rhama.

Rohman, N. A., Qohar, I. A., Puspita, N. T., Harianto, S. P., Winarno, G. D., & Dewi, B. S. (2021). Analysis of faunal diversity case study in 24 (twenty four) national parks in Indonesia. *JOPFE Journal, 9*(2), 1-10. http://dx.doi.org/10.23960/jopfe.v1i1.4689

Simarmata, F. S., & Wahyuningsih, H. (2012). Macrozoobenthos diversity in rehabilitated mangrove forests on the East Coast of North Sumatra. *Journal of Natur Indonesia, 11*(2), 94-103. https://doi.org/10.36987/jpbn.v10i2.5690

Sirait, M., Rahmatia, F., & Pattulloh, P. (2018). Comparison of diversity index and dominant index of phytoplankton at Ciliwung river Jakarta. *Indonesian Journal of Marine Science and Technology, 11*(1), 75-79. https://dx.doi.org/10.21107/jk.v11i1.3338

Sugiyono. (2018). *Quantitative, qualitative and R&D research methods.* Alfabeta.

Sune, N. (2012). Spatial ecological modeling of the national park inti zone (Case study of In Bogani Nani Wartabone National Park, Gorontalo-North Sulawesi Province). (Dissertation). Universitas Gadjah Mada. https://etd.repository.ugm.ac.id/penelitian/detail/57097

Tambunan, G. U. F., Nurlelasari, N., & Gaffar, S. (2021). Limonoid group compounds from *Chisocheton* genus plants and their anticancer activity. *ALCHEMY Journal of Chemical Research, 17*(1), 10-26. https://dx.doi.org/10.20961/alchemy.17.1.41279.10-26

Uny, E., Pangemanan, E. S., & Kainde, R. P. (2018). Ethnobiological study of traditional ceremony in Worat-Worat Village, Sahu Sub-district, West Halmahera Regency. *Cocos, 10*(3).

Van Steenis, C. G. G. J. (1984). *Flora Malesiana Series (Vol I).* Rijksherbarium Verheij.

E. W. M., & Coronel, R. F. (1991). *Edible fruits and nuts*. Plant resources in South-East Asia.

Whitten, A. J., Soeriaatmadja, R. E., & Afiff, S. A. (1984). *The Ecology of Java and Bali.* Gadjah Mada University Press.

Wijayanto, N., & Nurunnajah, N. (2012). Light intensity, temperature, humidity, and lateral rooting of mahogany (*Swietenia macrophylla* King.) in RPH Babakan Madang, BKPH Bogor, KPH Bogor. *Journal of Tropical Silviculture, 3*(1). https://journal.ipb.ac.id/index.php/jsilvik/article/view/5389

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