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Diversity of orchid types in the Oeluan Tourism Forest, Bijeli Village, Noemuti District, North Central Timor Regency

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Abstract
Indonesia as a mega biodiversity country has a variety of fauna and flora. One of the floras that is often found in Indonesia is orchids. Orchids have high economic value and are able to balance the ecosystem in their habitat. This study was aimed at determining the diversity of orchid species in the Oeluan tourism forest. The current study employed a quantitative descriptive study by using the transect and the purposive sampling method. The research was conducted in February at the Oeluan Tourism Forest. The results of this study indicated that there were four terrestrial orchid genera and three epiphytic orchid genera. The analysis of the diversity index of orchid species in the Oeluan tourism forest resulted in the diversity index of (H') 1.0438 in the medium category. The measured environmental factors at the study site were an average soil pH of 7, an average humidity of 76.33% and an average air temperature of 27.400C. The diversity of orchid species in the Oeluan tourism forest, bijeli village, Noemuti district, North Central Timor regency, East Nusa Tenggara Province, was included in the medium category.

Keywords: ecosystem; orchid habitat; species; terrestrial orchid

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INTRODUCTION

Forests are one of the important resources for human life. There is a complex structure in the forest where there are various plants. Forests in Indonesia have many species of plants such as ferns, food, and ornamental plants in the forest, namely orchids (Febriandito & Soetopo, 2019). One of the plants that can grow in the forest is orchids. Indonesia is classified as a country that has a high level of orchid diversity, namely, Indonesia has 6,000 orchid species among the 25,000 orchid species in the world (Wahyudiningsih et al., 2017). According to Darmawati et al., (2018), this is due to the climate conditions in Indonesia, where Indonesia has a tropical climate with sufficient sunlight intensity and high rainfall, which can help the growth of orchids in the forest.

Orchids are a plant that has a lot of potential. Orchids can be used as ingredients for medicines and are also used as ornamental plants which have a high selling value because orchids have attractive and long-lasting orchid flower morphology, which is a trigger for their development as ornamental plants or plants in charcoal, brick, potting media. ferns, coconut fiber, and *Kadada* roots (Wati et al., 2015; Tini et al., 2019). However, in North Central Timor Regency, orchids are left to grow in the forest and no effort is made to cultivate these orchid plants. This is due to a lack of public knowledge of the benefits and potential of orchids. Apart from that, there is also no specific data regarding the distribution of orchid plants in the Oeluan Tourism Forest.

The Oeluan Tourism Forest was previously a production forest managed by the local community as agricultural land. In 2019, the Environment and Forestry Service took over part of the forest area to be used as a tourist forest area. The area used as the Oeluan tourist forest area is 100 hectares. In 2020, the government in North Central Timor Regency, in this case the Environment and Forestry Service, built a tree house in the Oeluan tourist forest area. The process of building a tree house requires the government to cut down trees according to the area where the tree house will be

built. This is certainly a threat to plant sustainability, especially to the preservation of orchids that live in the Oeluan tourist forest. The tree, which was supposed to provide support for the orchid plants, was cut down and used as a place to build a tree house.

Another research conducted by Puspitaningtyas (2018), regarding the Identification of Orchid Types in the Lemor Botanical Gardens, Suela Village, Suela District, East Lombok Regency. The carried-out research was one with a qualitative approach and was descriptive. The presence of the researcher played a role in collecting data and the instruments or tools in collecting the data. The obtained data was a type of qualitative descriptive data obtained from several criteria collected including, the name of the orchid, either Indonesian (regional name) or Latin, type of orchid, orchid habitat, host plant (if the orchid is epiphytic), number of orchids and description and benefits of orchids. The results of this research were: (1) 2 types of orchids are endemic to Lombok, namely Vanda Lombokenesis and Dendrobium Rinjaninsis. Meanwhile, only Vanda Lombokenesis was identified. The characteristic of this orchid flower endemic to Lombok was the basic color of the flower petals, namely white and yellow, and the distinctive spots with brown and red colors and 58 types of non-endemic Lombok orchids had been identified. (2) The types of orchids found based on their habitat are epiphytic, and terrestrial, with a total of 38 epiphytic species and 22 terrestrial species. (3) It was found that there were 6 supports for orchids, namely mango, guava, Jabon rambutan, frangipani, and orange. Therefore, it is necessary to carry out this research entitled "Diversity of Orchid Types in the Oeluan Tourism Forest, Bijeli Village, Noemuti District, North Central Timor Regency" to determine the diversity of orchid species in the Oeluan tourism forest.

METHODS

This research was conducted from September to October 2022 in Oeluan, Bijeli Village, Noemuti District, North Central Timor Regency (Figure 1). The method used in this research was the transect method, namely following an existing route, then if an orchid is found a transect is made taking into account accessibility and safety. In this research, 6 transects were formed at different heights. Transect length 150 m, distance between transects 200 m. On one transect there are 3 observation plots measuring 20 m x 20 m. The orchid plants found were observed for type, number, and host tree and documented. All identified orchid types were recorded in the observation table, namely the tally sheet (Nahlunnisa et al., 2016). The parameters observed in this research were the morphological forms of orchid roots, stems, leaves, flowers, and capsules. Apart from that, to determine the diversity of orchids, it was necessary to count them individually in each transect.

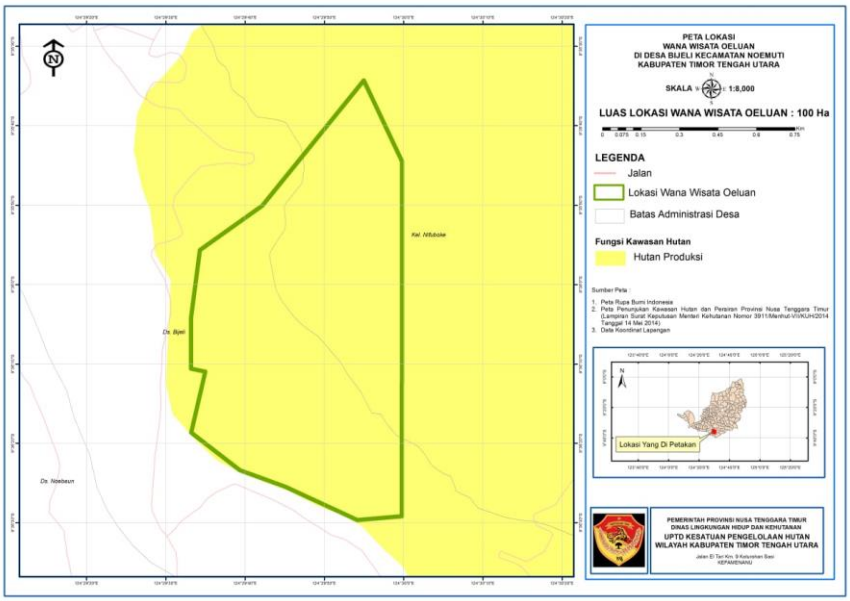

Figure 1. Research Location Map (Source: Forest Management Unit, 2022)

Work procedures

Placement of Research Plots

Before collecting data on orchid types, a preliminary service was first carried out with observations at each location to be studied. Based on the area and potential of each location, could be used to observe the types of orchids in the Oeluan Tourism Forest. Apart from conducting surveys to determine the location, researchers also used maps as a reference to determine land use. The location of the research plot used the Stratified systematic sampling technique in the form of transects based on land use in the Oeluan Tourism Forest. The purpose of making research plots was to represent the diversity and distribution of each type of orchid.

Data Collection Techniques

Types of orchids found and identified during observations. Data recording was carried out along the transect for each type of orchid found in the plot at the time of observation. Data collected included local or regional names, Latin or scientific names, and the number of individuals per type. All data was recorded in a tally sheet of all identified types.

Data Analysis

The diversity of orchid species is a statement regarding the various types or variations in shape, appearance, number, and characteristics found at various levels of living creatures. Several indices were commonly used to assess the level of species (plant) diversity in a particular place. The index used to determine the value was the diversity index.

$H' = \sum (Pi) \ln (Pi)$

H' = Diversity index

Ni = Number of individuals of each type observed

N = Total number of all species observed

The level of diversity is classified based on criteria, namely:

High if $H>3$

Medium if $H<3$

Low if $H<1$

RESULTS AND DISCUSSION

Types of orchids identified in the Oeluan Tourism Forest

Oeluan tourist forest was a tourist forest in Bijeli Village, Noemuti District, North Central Timor Regency. This tourist forest was dominated by several types of ferns, moss, and tall trees. This ecological condition was also supported by higher humidity and rainfall compared to other areas in North Central Timor Regency. With external factors influencing this, one of the plants that could grow in this tourist forest is orchids. Therefore, several types of orchids have been found through the current study, namely 7 orchid species were found, consisting of 4 terrestrial orchids and 3 epiphytic orchids. The following are the types of orchids that have been identified:

a

b

c

d

e

f

g

Figure 2. Orchids (a. *Liparis* Sp., b. *Spathoglottis* Sp., c. *Nervilia* Sp., d. *Eulophia* Sp., e. *Vanda* Sp., f. *Dendrobium* Sp., g. *Pteroceras* Sp.)

Based on the results of the identification (Figure 2a) carried out on the *Liparis* orchid, the following morphological characteristics were obtained: This orchid had ground roots in the form of fibers. The stem of this orchid had a sympodial pattern with a stiff and hard texture. The leaves of this orchid were dark green, the upper surface of the leaf was smooth and the lower surface was glabrous, the leaves were thin, the edges of the leaves were wavy, and the tip of the leaf was sharp or tapered sharply towards the front, the length of the leaves generally ranged between 10-30 cm and the width of the leaf's ranged between 4-10 cm. The flowering position was that the flower was at the top, the labellum was cream colored, the color of the petals and sepals was yellowish white, the flowers were scentless, the length of the flower stalk was between 10-20 cm, and the length of the flower arrangement was 4-10 cm, the number of flower heads on one stalk and arrangement ranged between 15 -30 flowers. The fruit was a capsule with a length of 1-5 mm and a width of 1-3 mm. The white seeds are in powder form (Suwandi et al., 2016).

Based on the results of the identification (Figure 2b) carried out on *Spathoglottis Plicata*, the following morphological characteristics were obtained: This orchid had ground roots in the form of fibers and there were bulbs embedded underground. There were approximately 2-3 bulbs in one orchid stem. The stem of this orchid was embedded about 3-4 cm into the ground and had a sympodial pattern with a stiff texture. The leaves of this orchid were dark green, the upper surface of the leaf was smooth and the lower surface was glabrous, the leaves were thin, the edge of the leaf was straight, and the tip of the leaf was sharp or tapered sharply towards the front, the length of the leaf was generally between 20-40 cm and the width of the leaf was between 4-10 cm. The position of flowering was that the flower was at the top, the labellum was purple, the color of the petals and sepals looked pink, the flowers had no scent, the length of the flower stalk was between 10-20 cm and the length of the flower arrangement was 4-10 cm, the number of flower heads on one stalk and arrangement ranged between 10-20 flowers. The fruit was in the form of a capsule 1-5 cm long and 1-3 mm wide. The white seeds were in powder form (Tini et al., 2019).

Based on the results of the identification (Figure 2c) carried out on *Nervilia*, the following morphological characteristics were obtained: this type of orchid had bulbs that were embedded in the ground, round in shape. The leaves were single, had 5-8 veins, and were shiny green or bluish. The flowers were single with flower stalks reaching 10-15 cm, the flowers were slightly greenish brown with white lips dotted with purplish pink spots (Wahyuni *et al.,* 2019). Usually grew in groups.

Based on the results of the identification (Figure 2d) carried out on *Eulophia* orchids, the following morphological characteristics were obtained: orchids in the *Eulophia* genus were mostly

terrestrial plants with underground rhizomes or pseudo-tubers on the surface. This orchid did not have leaves, but if it did, the leaves were long and narrow, sometimes reaching a height of around 0.4-0.8 m (up to 1.2 m). The flowers were borne on flowering stems that sometimes appeared before the leaves with few or many flowers. The flower diameter was about 25-45 mm. This orchid had large and striking flowers that were white and purple. The sepals looked larger than the petals but the labellum had three lobes and a spur or pouch at the base. In general, this type of orchid lived in various forest conditions, one of which was tropical rainforests.

Based on the results of the identification (Figure 2d.) carried out on the *Vanda* orchid, the following morphological characteristics were obtained: the *Vanda* orchid had round stems, long and sturdy. The plant could reach a height of 2 m, and the leaves were slightly curved ribbon-shaped with sharp-angled leaf tips with a width of approximately 3 cm and a length of up to 45 cm, arranged alternately on stems that grow upright. The flower clusters could reach 50 cm and support 10-20 flowers that emerge from the leaf axils. The sepals and petals were basic in color between white and yellow with brown to yellow spots, with purplish-red spots. The diameter of the *Vanda* orchid flower could reach 10 cm, the flowers could last up to 20-25 days. Vanda orchid flowers smell fragrant, and this fragrant aroma was greatly influenced by the altitude at which they lived, in the highlands the aroma was very strong and as you went down to the lowlands the aroma decreased (Metusala, 2006).

Orchids were herbaceous plants (Figure 2e). Apart from that, orchids liked shady places and usually grew on mossy trees. The roots were attached to the tree or place where they grew and were white, hollow, and soft. The stem was 10-20 cm long, it was still easily upright, and if it was old, it hung down, the leaves were only found at the bottom and the top was leafless, the leaves were green, the leaf edges were flat and fleshy, the surface of the leaves was bare, the tip of the leaves was pointed, the width is 1.1 cm, leaf length 2.4 cm. The leaves were arranged like a braid of hair. The small flowers were white and were at the tip or side of the stem, the labellum was white with a cream base, the sepals and petals were white, the flowers did not give off a scent, and the flowers were grain-type. The fruit was a purple berry, 0.5 cm long and 0.3 cm wide. The seeds were so small that they were powdery and white (Prayoga et al., 2022).

Based on the results of the identification (Figure 2f.) carried out on *Pteroceras*, the following morphological characteristics were obtained: This orchid was an epiphytic orchid with a stem height of between 21 cm. This orchid plant had a true stem type. The shape of the stem was cylindrical, bright green, and had no curves on the mature stem. Apart from that, this plant did not have stems that grew hanging down (Wahyudiningsih et al., 2017).

The leaves were in the shape of an inverted sword with the tip of the leaf forming two curves of unequal size. The leaf blades had leaf sheaths covering the stems. The color of the upper surface of the leaves was dark green. The color of the edges of the young leaves was green. The texture of the leaf surface was flat and the leaves formed symmetry. The growing points of the leaves were along the stem and had a thick structure. The length of the leaves was between 17.2-23.8 cm, while the width was between 4.2-5.0 cm. The flowers were yellow with brown transverse stripes and a white labellum. The type of sepals and petals was elliptical. The flowers were clustered with the flower growing point dangling from the leaf axils and had a fragrant smell. The length of the flower was 2.6 cm, the width was 1.2 cm, and the length of the bunch and flower arrangement was 12-18 cm (Rosanti et al., 2018).

Based on the results of observations (Figure 2g.) that had been made, it could be seen that in total there were 7 types of orchids in the Oeluan Tourism Forest area. The most commonly found type was the Nervilia orchid. The genus Nervilia consists of 80 species spread across tropical, subtropical, and warm-temperature areas such as Africa, Asia, Australia, and the southwest Pacific. This orchid was a kind of orchid that lived in the ground, a sympodial growing type with large round or ovoid and fleshy tubers. Leaves were kidney, heart, or orbicular shaped. Generally, leaves and flowers were not visible together (Damanik et al., 2018). Based on the results of research carried out

at the Oeluan tourist forest location, there were several types of orchids identified which can be seen in Table 1 below.

Table 1. Types of Orchids Identified in The Oeluan Tourism Forest

Name of Orchids	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Total
Nervilia	105	61	127	113	79	126	611
Liparis	3	2	31	60	1	39	136
Spathoglotis	14	21	2	13	9	7	66
Eulophia	1	1	8	1	1	1	13
Dendrobium	23	30	2	4	3	1	63
Vanda	25	12	22	1	1	1	63
Pteroceras	1	2	8	2	1	1	15
Total							**967**

Table 1. showed that at the research location in the Oeluan Tourism Forest, 967 individu orchid species were found, including 4 genera of terrestrial orchids and 3 genera of epiphytic orchids with varying numbers. The four (4) genera of terrestrial orchids identified included: *Nervilia* with a total of 611 individuals, *Liparis* with a total of 136 individuals, *Spathoglottis* with a total of 66 individuals, *Eulophia* with a total of 13 individuals. Three (3) genera of epiphytic orchids identified included: *Dendrobium* with a total of 63 individuals, *Vanda* with a total of 63 individuals, *Pteroceras* with a total of 15 individuals.

Orchids in nature could grow in various media including soil (terrestrial), attached to trees (epiphytes), leaf litter (saprophytes), and (lithophytes) on rocks or cliffs (Hasanah et al., 2014). Orchids could grow in lowland to highland habitats. Each habitat had a richness of different species. Therefore, each region had a different orchid species composition (Cahyanto, 2018). At the research location, there were only 2 types of groups identified, namely the terrestrial group and the epiphyte group. Epiphytic orchids were orchids that grow on trees but did not act as parasites (Djordjevic et al., 2022). In tropical forests, epiphytic orchids received better sunlight than terrestrial orchids. Epiphytic orchids were also more easily pollinated by insect pollinators (Chandra De et al., 2014).

Diversity index of orchid species in the Oeluan Tourism Forest

The following results of the Diversity Index (H') calculation in the Oeluan Tourism Forest can be seen in Table 2:

Table 2. Orchid Species Diversity Values Based on The Shannon–Wiener Index

No	Orchids	Diversity Value	Category
1	*Nervilia*	0,2757	low
2	*Liparis*	0,1796	low
3	*Spathoglotis*	0,1947	low
4	*Eulophia*	0,0579	low
5	*Dendrobium*	0,1408	low
6	*Vanda*	0,1450	low
7	*Pteroceres*	0,0501	low
Total		1,0438	**currently**

The diversity value of orchid species in Table 2. showed that a type of orchid had a moderate diversity index. This was caused by environmental factors where orchids lived. Factors that influenced the similarity of the types that made up vegetation were influenced by the microclimate conditions in the area, such as air temperature, air humidity, vegetation density and the types of trees that made up vegetation which did not differ much from one location to another (Fitriani et al., 2019).

CONCLUSION

Based on research that has been conducted regarding the diversity of orchid species in the Oeluan Tourism Forest, it can be concluded as follows: There were 7 species of orchids identified, namely 4 terrestrial orchids such as Nervilia, liparis, Spathoglotis, Eulophia and 3 epiphytic orchids such as Dendrobium, Vanda and Pteroceras. Based on the calculation of the diversity index for orchid species found in the Oeluan Tourism Forest, it showed that the orchid species has a value of 1.0438, which is classified as medium.

Limitations and Future Direction

The limitation of this research is that this research is in the initial stage and there is a need for further research on identifying orchid types down to the species level. Apart from that, there is a need for further research on observing orchid diversity in other forests on the island of Timor.

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Declarations

The authors declare there is no conflict of interest in any part of this research.

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