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Diversity of Dendrobium Orchids in the Mangrove Forest of Nubuai Village, Urei-Faisei District, Waropen Regency, Papua Province

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Abstract: One of the islands that has a high diversity of orchids is Papua, which is approximately 2500 species. In Indonesia, there are around 5,000 species and an estimated 731 are found in Java. Besides functioning as an important function in maintaining the balance of coastal or coastal ecosystems, the mangrove ecosystem also serves as a host for epiphytic orchids. Research on epiphytic orchid species in mangrove forests is still lacking, including in Papua. This study aims to determine the type and diversity of Dendrobium orchids in the mangrove forest of Kampung Nubuai, Urei-Faisei District, Waropen Regency, Papua. The method used in this study is the method of observation, interviews, documentation, literature, and checkered lines. Data analysis techniques used are density, frequency, relative density, relative frequency, significance value index, and Shannon-Wiener diversity index. The results of the study found 18 species of Dendrobium orchids at the study site with a diversity index ($H' = 2.51$) or moderate.

Keywords: Diversity; Orchid types; Dendrobium

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Introduction

Indonesian forests save so many species of orchids. Not only rich from the number of genera but from having so many species with their varieties and types. Various sources state that Indonesia has a diversity of natural orchids of approximately 5000 species. One of the islands that has a high diversity of orchids is Papua, which is approximately 2500 species. In Indonesia, there are around 5,000 species and it is estimated that 731 are found in Java and around 3,000 species are found in Papua. Papua memiliki potensi kekayaan anggrek yang besar. Menurut (Pammai et al., 2022) state that almost half of the orchid species found in Indonesia are almost half in Papua. The diversity of Bulbophyllum and Dendrobium orchids is the

dominant genus in Papua (Agustini et al., 2018). Based on their habitat, orchids are grouped into three, namely: terrestrial, epiphytic, and lithophyte. Terrestrial orchids: these orchids grow in the ground. Epiphytic orchid: the name for an orchid that grows by riding on another tree or host. This lithophytic orchid grows on rocks or rocky soil. Terrestrial orchids are known to have fewer species than epiphytic orchids. Epiphytic orchids dominate most types of orchids. In Papua, the diversity of orchids is estimated Keep going increased due to exploration that has not been maximized in several areas (Farokhah et al., 2018). Dendrobium is one of the largest orchid genera in the Orchidaceae family and includes more than 2,000 species. Dendrobium is one of Indonesia's natural wealth, and its number is estimated at 275 species (Panjaitan et al., 2021). The best

Dendrobium orchid species are found in eastern Indonesia, such as Papua and Maluku. The Dendrobium orchid is used in flower arrangements because it has a relatively long freshness, the colors and shapes of the flowers vary, the flower stalks are flexible so they are easy to assemble, and the productivity is high. (Tsai et al., 2021).

Apart from being known for its primary forests, Papua also has many mangrove forests because it is an archipelago so that many of its coasts are covered with mangroves (Cahyaningsih et al., 2022). The area of mangrove forests in Papua is 1,634,003.454 ha, almost a third of Indonesia's mangrove forests, namely 3,244,018.460 ha. Besides functioning as an important function in maintaining the balance of coastal or coastal ecosystems, the mangrove ecosystem also serves as a host for epiphytic orchids (Prapitasari & Kurniawan, 2021). Research on epiphytic orchid species in mangrove forests is still lacking, including in Papua.

Waropen Regency is a Regency in Papua Province. Waropen is a division of Yapen Waropen Regency in 2003. Based on its astronomical location, Waropen Regency is located at position 1350 93' 00" – 1370 42' 00" E and 30 35' 00" – 20 12' 00" South Latitude. Waropen Regency as a whole has an area of 10,847.91. Waropen Regency is a coastal district (Darmawan et al., 2019). As a coastal district that grows mangrove forests scattered along the coast starting from the upper, middle and lower Waropen, making Waropen district fertile and rich in quite high biological resources. According to data released by the Environment Agency in 2010, the area of mangrove forest in Waropen is 26,491.03 ha.

According to the Tourism Office of Waropen Regency, the area of mangrove forests in the eastern part is 12,111.23 ha which grows along the coast, while the mangrove forest area in the west has an area of 6,498.85 ha which grows along the coast. For a long time, indigenous peoples on the coast of Waropen Regency have lived from mangrove forests which have economic and ecological benefits, such as preventing coastal erosion, a place for marine life such as clams,

crabs, shrimp, fish, tambelo caterpillars, which are useful for supporting people's livelihoods and also as a tourist attraction. Potential natural resources such as flora and fauna. One of the flora terdapat di mangrove adalah anggrek (Irawan et al., 2021).

Damage to mangrove forests due to abrasion (Kalsum et al., 2022) and currently the population in Waropen Regency is increasing, and during the recent development period, many mangrove areas have been cut down to meet needs such as the use of mangroves as building materials, traditional medicines, firewood, household utensils, drinking charcoal, and land conservation into ponds, as well as road construction.

As a result, there will be damage to the mangrove ecosystem which can also damage the habitat of the orchids in the mangrove forest. It is even estimated that some types of orchids may become extinct before they are identified. Previously, research on the diversity and distribution of the epiphytic orchid Dendrobium section Spatulata on host plants in the Cyclops Mountains Nature Reserve in Papua was carried out, nineteen species of Dendrobium section Spatulata were identified as living epiphytes on 12 phorophytes (Arobaya et al., 2022). The importance of this research was conducted to determine the types and diversity of Dendrobium orchids that exist in mangrove vegetation, in Nubuai Village, Urei-Faisei District, Waropen Regency, before they became extinct due to the destruction of the mangrove habitat which is their host tree.

Method

The method used in this study is the method of observation, interviews, documentation, literature and checkered lines. Data analysis techniques used are density, frequency, relative density, relative frequency, significance value index and Shannon-Wiener diversity index.

Checked line method

This method is considered a modification of the double-plot method or the path method, namely by skipping one or more tiles in a path, so that along the line there are squares that are equally spaced. 20 m x 20 m plot of tree observation.



Figure 1. Plot Plot Method

Research procedure

The steps taken in the research procedure are as follows:

- a. Preparation of tools and materials
- b. interviews with the public
- c. Observation
- d. field observations
- e. making 3 transects
- f. Documenting the types of orchids that exist
- g. Results of the description of morphological characters
- h. Creation of living collections

Figure 2. Steps in the research procedure

Result and Discussion

Description of the types of Dendrobium Orchids

The genus Dendrobium comes from the Greek dendro meaning tree and bios meaning life.

Dendrobium orchids live only in trees ((Wijarini et al., 2022). Generally epiphytic, fibrous roots, sympodial growth type, pseudo stems that are long, cylindrical and inflated. The single leaf is located alternately along the pseudo stem. The shape of the sepals resembles a triangle with the base joining the foot of the monument to form a spur. The petals separate. Gynostemium has a column foot, the labellum is attached to the end of the column foot. The description of the types of dendrobium orchids found at the research location in Kampung Nubuai is as follows:

Dendrobium antennatum Lindl.

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length 13-15 cm, brownish white. Sympodial trunk, cylindrical, yellowish green, average stem length 30-55 cm. Leaf shape is lanceolate, leaf tip is tapered, leaf edge is flat, leaf surface is smooth, leaf average length is 6.5-9 cm, leaf width is 1.7-2.6 cm, leaf arrangement is alternate, leaf veins parallel. The sepals are white, triangular in shape, the number of sepals is 3, while the petals are yellowish-white in the form of ribbons, the number of petals is 2, while the labellum is white with purple stripes (middle canopy), the color of the stalks is yellowish green. Oblong-shaped fruit. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree and the branches of the *Rhizophora stylosa* Griff tree, with a height of 1.5-7.50 m from the ground.

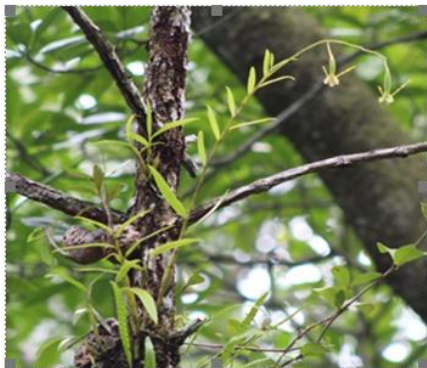


Figure 3. *Dendrobium antennatum* Lindl

Dendrobium sp1

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 11 cm, brownish white. Sympodial trunk, cylindrical in shape, yellowish green in color, average stem length of 18 cm. The leaves are lanceolate in shape, the leaf tip is tapered, the leaf edges are flat, the leaf surface is smooth, the average leaf length is 10 cm, the average leaf width is 3 cm, the leaves are alternate, the veins are parallel. It grows on *Rhizophora mucronata* Lamarck trees, with height of 1 m from the ground level.



Figure 4. *Dendrobium* sp1

Dendrobium sp2

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 12 cm, brownish white. Sympodial trunk, cylindrical, green, average stem length of 20 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 11 cm, the average leaf width is 1.7 cm, the leaves are alternate, the veins are parallel. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree, with a height of 3.5 m from the ground.



Figure 5. *Dendrobium* sp2

Dendrobium sp3

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 20 cm, brownish white. Sympodial trunk, brownish yellow, average stem length of 28 cm. The leaves are oval in shape, the leaf tip is split (retusus), the leaf edges are flat, the leaf surface is smooth, the average leaf length is 9.5 cm, the average leaf width is 5.5 cm, the location of the leaves is alternate, the veins are parallel. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree, which has fallen 1.5 m from the ground.



Figure 6. *Dendrobium sp3*

Dendrobium sp4

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 18 cm, brownish white. Sympodial trunk, cylindrical in shape, yellowish green in color, average stem length of 30 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 12 cm, the leaf width is 2.5 cm, the leaves are alternate, the veins are parallel. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree, with a height of 1.5 m from the ground.



Figure 7. *Dendrobium sp4*

Dendrobium smillieae F. Muell

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, an average root length of 15-20 cm, brownish white in color. Sympodial trunk, cylindrical, yellowish green in color, average stem length 70.5-75 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 13-14 cm, the average leaf width is 1.8-3.4 cm, the leaves are alternate, the veins are parallel. Flowers were not found at the time of research in the mangroves, but were found at the time of the green house. The flowers are arranged in bunches, the sepals are white and the tips are green, the petals are greenish white. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree, with a height of 1-2 m from the ground.



Figure 8. *Dendrobium smillieae* F. Muell

Dendrobium sp5

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 5 cm, brownish white. Sympodial trunk, cylindrical, green, average stem length 10 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 11 cm, the average leaf width is 3 cm, the leaves are alternate, the veins are parallel. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree, with a height of 1.5 m from the ground.



Figure 9. *Dendrobium sp5*

Dendrobium sp6

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 10 cm, brownish white. Sympodial trunk, cylindrical in shape, grayish green in color, average stem length of 40 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 10 cm, the leaf width is 4 cm, the leaves are alternate, the veins are parallel. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree, with a height of 4 m from the ground.



Figure 10. *Dendrobium sp6*

Dendrobium antennatum 1

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 10-13 cm, brownish white. Sympodial trunk, cylindrical, dark yellow, average stem length 27-45 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 7 cm, the average leaf width is 2-2.5 cm, the leaves are alternate, the veins are parallel. The sepal flower is yellow, triangular in shape, the number of sepals is 3, while the petals are yellowish-white in the form of a ribbon, the number of petals is 2, while the labellum is white with purple stripes (middle canopy), the color of the stem is yellowish green. No fruit at the time of study. Grows on branches of the *Rhizophora mucronata* Lamarck tree, which has fallen to a height of 2 m, and tree trunks *Avicenia alba* with a height of 1.50-2.50 cm from the ground surface.

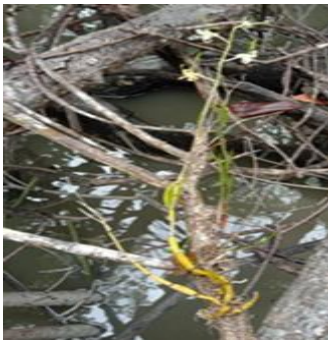


Figure 11. *Dendrobium antennatum 1*

Dendrobium litoreum F.M.Baylei

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 9 cm, brownish white. Sympodial trunk, flat shape, brownish green, average stem length 47 cm. Leaf shape is line, leaf tip shape is tapered, leaf edge is flat, leaf surface is smooth, leaf average length is 12 cm, leaf width is 0.5 cm, leaf location is alternate, leaf veins are parallel. It grows on fallen branches of the *Rhizophora mucronata* Lamarck tree, up to 2 m high.



Figure 12. *Dendrobium litoreum F.M.Baylei*

Dendrobium sp7

Anggrek epifit, perawakan tumbuh tegak dan berumpun. Memiliki akar serabut, panjang akar rata-rata 5 cm, warna putih kecoklatan. Berbatang simpodial, berbentuk silindris, berwarna coklat, panjang batang rata-rata 5,5 cm. Daun bentuk lanset, bentuk ujung daun meruncing, tepi daun rata, permukaan daun licin, panjang rata-rata daun 6 cm, lebar daun rata-rata daun 1,7 cm, letak daun berseling, tulang daun sejajar. Tumbuh pada cabang pohon *Rhizophora mucronata* Lamarck, yang sudah tumbang dengan tinggi 2 m



Figure 13. *Dendrobium sp7*

Dendrobium sp8

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, an average root length of 13.5 cm, brownish white. Sympodial trunk, cylindrical in shape, yellowish green in color, average stem length of 16.5 cm. The leaves are oval in shape, the leaf tip is split (retusus), the leaf edges are flat, the leaf surface is smooth, the average length of the leaf is 12.5 cm, the average leaf width is 5 cm, the location of the leaves are alternate, the veins are parallel. It grows on branches of the *Rhizophora mucronata* Lamarck tree, which has fallen to a height of 2.5 m.

Figure 14. *Dendrobium sp8*.*Dendrobium controides* T.E.Hunt)

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 17 cm, brownish white. Sympodial trunk, cylindrical, green, average stem length 56 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 6.5 cm, the leaf width is 4 cm, the leaves are alternate, the veins are parallel. It grows on the trunk of the *Rhizophora mucronata* Lamarck tree, with a height of 1.5 m from the ground.

Figure 15. *Dendrobium controides* T.E.Hunt*Dendrobium sp9*

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, an average root length of 9 cm, white in color. Sympodial trunk, cylindrical, green, average stem length of 15 cm. The leaves are lanceolate in shape, the leaf tip is tapered, the leaf edges are flat, the leaf surface is smooth, the average leaf length is 12.5 cm, the leaf width is 2.7 cm, the leaves are alternate, the veins are parallel. It grows on the trunks of the *Rhizophora mucronata* Lamarck tree, with a height of 2 m from the ground.

Figure 16. *Dendrobium sp9**Dendrobium sp10*

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 15 cm, brownish white. Sympodial trunk, cylindrical, green, average stem length 24 cm. The leaves are lanceolate in shape, the tip is tapered, the edges are flat, the leaf surface is smooth, the average leaf length is 10.5 cm, the leaf width is 2 cm, the leaves are alternate, the veins are parallel. It grows on the branches of the *Rhizophora stylosa* Griff tree, with a height of 5 m from the ground.

Figure 17. *Dendrobium sp10**Dendrobium sp11*

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 17.5 cm, brownish white. Sympodial trunk, cylindrical, yellow, average stem length 24 cm. The leaves are oval in shape, the leaf tip is split (retusus), the leaf edges are flat, the leaf surface is smooth, the average length of the leaf is 11 cm, the average leaf width is 5 cm, the location of the leaves is alternate, the veins are parallel. Grows on *Avicennia sp* stems, with a height of 1.5 m from the ground.

Figure 18. *Dendrobium sp11**Dendrobium sp12*

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 15.5 cm, green color. Sympodial trunk, cylindrical, brownish green, average stem length 23 cm. The leaves are oval in shape, the leaf tip is split (retusus), the leaf

edges are flat, the leaf surface is smooth, the average length of the leaf is 11.5 cm, the average leaf width is 6 cm, the location of the leaves is alternate, the veins are parallel. Grows on *Avicennia* sp. tree trunks, with a height of 2 m from the ground.



Figure 19. *Dendrobium* sp12

Dendrobium sp13

Epiphytic orchids, stature grows upright and clumps. It has fibrous roots, average root length of 15

cm, brownish white. Sympodial trunk, cylindrical, yellow, average stem length of 55 cm. Sword-shaped leaves, pointed leaf tip shape, flat leaf edge, smooth leaf surface, average leaf length 15 cm, average leaf width 1.7 cm, leaf arrangement alternate, leaf veins parallel. It grows on the trunks of the *Rhizophora mucronata* Lamarck tree, with a height of 1 m from the ground.



Figure 20. *Dendrobium* sp13

Table 1. Types of orchids found

| Family | Species Name | Orchid Type | Number of Individuals | Habitats |
|-------------|--|-------------|-----------------------|---|
| Orchidaceae | <i>Dendrobium antennatum</i> Lindl | Epifit | 24 | <i>Rhizophora mucronata</i> Lamarck dan <i>Rhizophora stylosa</i> Griff |
| Orchidaceae | <i>Dendrobium</i> sp1 | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp2 | Epifit | 6 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp3 | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp4 | Epifit | 2 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium smilliae</i> F.Muell | Epifit | 2 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp5 | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium antennatum</i> 1 | Epifit | 5 | <i>Rhizophora mucronata</i> Lamarck dan <i>Avicennia alba</i> |
| Orchidaceae | <i>Dendrobium</i> sp6 | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium litoreum</i> F.M.Baylei | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp7 | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp8 | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium controides</i> (T.E.Hunt) | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp9 | Epifit | 2 | <i>Rhizophora mucronata</i> Lamarck |
| Orchidaceae | <i>Dendrobium</i> sp10 | Epifit | 4 | <i>Rhizophora stylosa</i> Griff |
| Orchidaceae | <i>Dendrobium</i> sp11 | Epifit | 2 | <i>Avicennia</i> sp |
| Orchidaceae | <i>Dendrobium</i> sp12 | Epifit | 6 | <i>Avicennia officinalis</i> |
| Orchidaceae | <i>Dendrobium</i> sp13 | Epifit | 1 | <i>Rhizophora mucronata</i> Lamarck |

Structure and Composition

According to (Fernando, 2012) Vegetation is a group of living things that includes various types of plants dominated by trees as well as various types of animals and microorganisms in a habitat, so that a reciprocal relationship arises between one organism and another and the surrounding environment.

Based on the results showed that there were 18 species of *Dendrobium* orchids consisting of 62 individuals. *Dendrobium antennatum* Lindl consisted of (24 individuals), *Dendrobium* sp2 (6 individuals), *Dendrobium* sp12 (6 individuals), *Dendrobium*

antennatum (5 individuals), and *Dendrobium* sp10 (4 individuals). The high number of individuals is thought to be caused by the large number of individuals of a kind. The prolific growth of *Dendrobium* species at the study site is thought to be caused by suitable physical environmental factors such as hosts. *Dendrobium* orchids are able to grow on a variety of hosts (Darmawati et al., 2021) argues that the growth of orchids will grow well if supported by the quality or character of the host. Tekstur batang atau percabangan *Rhizophora mucronata* Lamarck diduga to be one of the factors of the abundance of individual orchids. The bark of *Rhizophora mucronata* Lamarck is gray to black and

the young ones have gray skin, while the bark on old trees gradually turns black with very clear cracks. The rough texture of the skin with cracks allows the *Dendrobium* orchid species to stick tightly to obtain food and water sources.



Figure 21. Figure 1. Stem texture of *Rhizophora mucronata* Lamarck

Generally, orchid species prefer host trees that have rough bark surface characteristics, such as cracks,

flaking, grooves and so on. (Fardhani et al., 2019) argues that the rough bark will make it easier for orchids to attach or attach their roots to the surface of the trunk or branches of the tree. The characteristics of the rough bark or branches are highly favored by orchids.

From the results of observations, in general the *Dendrobium* orchids were found alive or attached to various mangrove hosts with different stem textures and *Dendrobium* orchids were preferred. The preferred host types for *Dendrobium* orchids are shown in Table 2. The trees or hosts where these *Dendrobium* orchids grow are generally large trees, with rough bark. *Dendrobium* orchids do not stick to any host but certain trees.

Epiphytic orchids live attached to a host tree. The host tree is one of the basic requirements for light and good air circulation for epiphytic orchids (Besi et al., 2023). This is because the host tree species generally have thick, soft skin, rough surface, the skin does not flake and fall off, the crown is lush and does not drop all the leaves during the dry season so that it can provide a more suitable microclimate for orchids in this region. (Sujalu et al., 2021).

Table 2. Total K, KR, F, FR, INP and H'

| Family | Latin name | Amount | K | KR (%) | F | FR (%) | INP (%) | H' |
|-------------|---|--------|-------|--------|------|--------|---------|-------|
| Orchidaceae | <i>Dendrobium antennatum</i> Lindl | 24 | 10,00 | 38,71 | 0,12 | 11,76 | 50,47 | 0,34 |
| Orchidaceae | <i>Dendrobium sp1</i> | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium sp2</i> | 6 | 2,50 | 9,68 | 0,12 | 11,76 | 21,44 | 0,23 |
| Orchidaceae | <i>Dendrobium sp3</i> | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium sp4</i> | 2 | 0,83 | 3,23 | 0,03 | 2,94 | 6,17 | 0,10 |
| Orchidaceae | <i>Dendrobium smilliae</i> | 2 | 0,83 | 3,23 | 0,06 | 5,88 | 9,11 | 0,14 |
| Orchidaceae | <i>Dendrobium sp5</i> | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium antennatum 1</i> | 5 | 2,08 | 8,06 | 0,12 | 11,76 | 19,83 | 0,22 |
| Orchidaceae | <i>Dendrobium sp6</i> | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium litoreum</i> F.M.Baylei | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium sp7</i> | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium sp8</i> | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium controides</i> (T.E.Hunt) | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Orchidaceae | <i>Dendrobium sp9</i> | 2 | 0,83 | 3,23 | 0,03 | 2,94 | 6,17 | 0,10 |
| Orchidaceae | <i>Dendrobium sp10</i> | 4 | 1,67 | 6,45 | 0,12 | 11,76 | 18,22 | 0,218 |
| Orchidaceae | <i>Dendrobium sp11</i> | 2 | 0,83 | 3,23 | 0,03 | 2,94 | 6,17 | 0,10 |
| Orchidaceae | <i>Dendrobium sp12</i> | 6 | 2,50 | 9,68 | 0,12 | 11,76 | 21,44 | 0,23 |
| Orchidaceae | <i>Dendrobium sp13</i> | 1 | 0,42 | 1,61 | 0,03 | 2,94 | 4,55 | 0,08 |
| Amount | | 62 | 25,83 | 100 | 1 | 100 | 200 | 2,51 |

Density (Density)

The highest relative density was 38.71% for the type of *Dendrobium antennatum* Lindl, the second type was *Dendrobium sp2* of 9.68%, the third type was *Dendrobium sp12* 9.68%, the fourth type was *Dendrobium antennatum* by 8.06%, the fifth type was *Dendrobium sp10* by 6.45%. the high density value of a plant species is influenced by birth and mortality. The

difference in the density value of each species is due to differences in the ability to reproduce, spread and adapt to the environment. The density value of a species indicates the number of individuals of the species concerned in a certain unit area, so the density value is an illustration of the number of these species in the study area (Zhan et al., 2022).

Frequency

Frekuensi kehadiran suatu jenis organisme di suatu habitat menunjukkan keseringhadiran jenis tersebut di habitat ini (Mou et al., 2020). Dari frekuensi kehadiran dapat tergambar penyebaran jenis tersebut in habitat, species that have high relative frequency values also have high densities and tend to occupy large areas. The frequency values found in *Dendrobium antennatum* Lindl, *Dendrobium* sp2, *Dendrobium* sp12, *Dendrobium antennatum*, and *Dendrobium* sp10 have the same frequency value of 11.76%. The high value of the relative frequency of *Dendrobium* species is probably caused by environmental factors that support this species to survive and thrive (Kurniawan et al., 2020). In addition, the seeds of the *Dendrobium* type orchid are very large, small and light in size so that their distribution becomes very wide (Hariyanto et al., 2020).

Important Value Index (INP)

Based on table data, the highest Importance Value Index (IVI) was found in *Dendrobium antennatum* Lindl (50.47%), *Dendrobium* sp2 (21.44%), *Dendrobium* sp12 (21.44%), *Dendrobium antennatum* (19.83%) and *Dendrobium* sp10 (18.22%). The magnitude of the important value index indicates the role of the species in the community or at the research location. The high value comes from the relative density and relative frequency, each of which has a very high value. In general, plants with the highest important value index (INP) have better adaptability, competitiveness and reproductive capacity compared to other plants in a particular area.

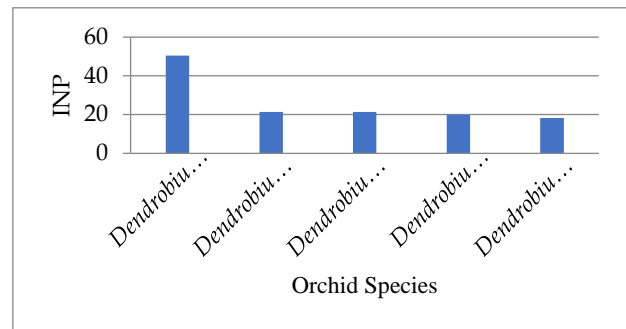


Figure 2. Five *Dendrobium* Orchid Species with the Highest IVI

The magnitude of the important value index indicates the role of the species in the community or at the research location. The type of *Dendrobium antennatum* Lindl is the dominant species in the mangrove forest ecosystem type in Kampung Nubuai because it has an important value index. The high IVI in an orchid community indicates that the orchid has a role or level of importance in the community. These orchids have the ability to adapt to habitat and wide tolerance to environmental conditions. Species that have a large (dominant) role in the community will have a high IVI. Figure 2 shows that the type of *Dendrobium antennatum* Lindl has the highest IVI and role compared to other types.

Diversity Index (H') Shanon-Wiener

The types of orchids found in the Nubuai village forest can be shown in Table 4. Based on these data it shows that the Shannon-Wiener species diversity index (H') is in the medium category (2.51). Species diversity index (H') is a vegetation parameter to compare various plant communities (Hasibuan et al., 2021), The higher the value of species diversity indicates the better the condition of the community. This also shows the suitability of the habitat for the presence of orchids. High species diversity indicates that a community has high complexity because the interactions that occur within the community are very high.

Table 3. Orchid Host Trees

| Host | Orchid Type |
|------|------------------------------------|
| | <i>Dendrobium antennatum</i> Lindl |
| | <i>Dendrobium</i> sp1 |
| | <i>Dendrobium</i> sp2 |
| | <i>Dendrobium</i> sp3 |
| | <i>Dendrobium</i> sp4 |

Rhizophora mucronata Lamarck

Avicennia alba

Avicennia sp

Avicennia officinalis

Rhizophora stylosa Griff

Dendrobium smilliae

Dendrobium sp5

Dendrobium sp6

Dendrobium litoreum F.M.Baylei

Dendrobium sp7

Dendrobium sp8

Dendrobium controides (T.E.Hunt)

Dendrobium sp9

Dendrobium sp13

Dendrobium antennatum 1

Dendrobium antennatum 1

Dendrobium sp11

Dendrobium sp12

Dendrobium antennatum Lindl

Dendrobium sp10

Table 3 shows that there are 5 types of host trees where orchids live and the most dominant is *Rhizophora mucronata* Lamarck, where there are 15 types of orchids *Dendrobium antennatum* Lindl, *Dendrobium* sp1, *Dendrobium* sp2, *Dendrobium* sp3, *Dendrobium* sp4, *Dendrobium smilliae*, *Dendrobium* sp5, *Dendrobium* sp6, *Dendrobium litoreum* F.M.Baylei, *Dendrobium* sp7, *Dendrobium* sp8, *Dendrobium controides*, *Dendrobium* sp9, *Dendrobium* sp13,

Dendrobium antennatum 1. *Rhizophora stylosa* Griff which was grown by 2 species of *Dendrobium antennatum* Lindl and *Dendrobium* sp10, *Avicennia alba* which was grown by 1 species of *Dendrobium antennatum* 1, *Avicennia* sp which was grown by 1 species of *Dendrobium* sp11, and *Avicennia officinalis* which was grown by 1 species of *Dendrobium* sp12.

According to (Chen et al., 2022) stated that no specific host tree was found as a place to grow orchids. This is in accordance with the results found at the research location, namely the type of *Dendrobium* sp orchid is found in all types of host trees or in other words there are no host tree species that are specifically grown by orchids.

Based on the results of research conducted on 4 observation plots, it can be seen that tree species from the species *Rhizophora mucronata* Lamarck are more dominant as orchid attachment sites. This is because the Euphorbiaceae species has a relatively better physical condition of the bark than other types so that the orchids are able to live and reproduce.

(Seshadri et al., 2021) stated that the diversity of epiphytic orchids on various tree species, growth rates and parts of the host tree was due to their dependence on the microclimatic conditions of the forest stand. This causes the existence of a number of epiphytic orchids that can only be found on certain tree species or on certain parts of the tree, whereas other epiphytes can be found on every tree type and on every part of the tree.

The life of epiphytic orchid species is also influenced by the intensity of sunlight (Zhang et al., 2018) Sunlight provides energy for the ecosystem, which supports the photosynthesis process to work properly, because of its dependence on the microclimatic conditions of the forest stand. That matter causing the existence of a number of epiphytic orchids that can only be found on certain types or parts of trees.

Conclusion

From the results of this study, the researchers concluded that there were 18 species of *Dendrobium* orchids with a total of 62 individuals in the mangrove forest of Kampung Nubuai, Urei Faisei District, Waropen Regency.

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