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Inventory of Wild Orchids in Kuri Hill Ketapang West Kalimantan

Inventarisasi Anggrek Liar di Bukit Kuri Kabupaten Ketapang Kalimantan Barat

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Abstract. Forest orchids are orchids that grow wild in forest areas. Orchids are unique in the form of beautiful labellum with various colours and shapes. Records of wild orchid species growing in the forests of West Kalimantan are still limited. This study aims to determine the species of orchids in hill Kuri, Ketapang Regency, West Kalimantan. The research was conducted using the cruising method. Morphological characters both qualitative and quantitative were observed and analysed descriptively. Fifteen species of orchids in Bukit Kuri were identified, namely *Anoectochilus reinwardtii*, *Aphyllorchis maliauensis*, *Bulbophyllum anceps*, *Bulbophyllum* sp1., *Bulbophyllum* sp2., *Bulbophyllum* sp3., *Callostylis pulchella*, *Cylindrolobus* sp., *Dendrobium crumenatum*, *Dendrobium crumenatum*, *Flickingeria* sp., *Liparis elegans*, *Micropera fuscolutea*, *Plocoglottis lowii*, *Spathoglottis aurea*, and *Thrixspermum centipeda*. Based on their mode of growth, the orchids found in Bukit Kuri consist of one terrestrial orchid, five lithophytic orchids, and nine epiphytic orchids. One of the 15 orchid species found was a new record for West Kalimantan, Indonesia, namely *Aphyllorchis maliauensis*.
Keywords: Orchidaceae; epiphytes; identification; lithopytes; terrestrial

Abstract. *Anggrek hutan ialah anggrek yang secara liar tumbuh pada area hutan. Anggrek memiliki keunikan berupa bibir bunga yang indah dengan warna dan beragam bentuk. Catatan mengenai jenis anggrek liar yang tumbuhan di hutan Kalimantan Barat sampai saat ini masih terbatas. Penelitian ini bertujuan untuk mengetahui jenis-jenis anggrek di Bukit Kuri, Ketapang, Kalimantan Barat. Penelitian dilakukan dengan metode jelajah. Karakter morfologi baik kualitatif maupun kuantitatif diamati dan dianalisis secara deskriptif. Lima belas jenis anggrek di Bukit Kuri berhasil diidentifikasi, yaitu Anoectochilus reinwardtii, Aphyllorchis maliauensis, Bulbophyllum anceps, Bulbophyllum sp1., Bulbophyllum sp2., Bulbophyllum sp3., Callostylis pulchella, Cylindrolobus sp., Dendrobium crumenatum, Flickingeria sp., Liparis elegans, Micropera fuscolutea, Plocoglottis lowii, Spathoglottis aurea, dan Thrixspermum centipeda. Berdasarkan cara tumbuhnya, anggrek yang dijumpai di Bukit Kuri terdiri dari satu anggrek terestrial, lima anggrek litofit, dan sembilan anggrek epifit. Satu dari 15 jenis anggrek yang ditemukan merupakan catatan baru untuk Kalimantan Barat, Indonesia, yaitu Aphyllorchis maliauensis.*
Keywords: *Orchidaceae; epifit; identifikasi; litofit; terestrial*

INTRODUCTION

Orchids are flowering plants in *the Orchidaceae* family. Forest orchid is an orchid species that usually lives naturally in forests and has not been crossed with other orchid plants (Paramitha *et al*., 2012). Orchid plants have various colors and flower shapes (Gerry *et al*., 2020). The uniqueness of orchids is an attraction for plant hunters to take them from their natural habitat in the forest, but this can cause a scarcity of orchids (Putra and Fitriani, 2019). Orchid exploration activities to find out types of wild orchids need to be carried out.

Type research orchids in West Kalimantan are still limited. Hasanah *et al*. (2022) found eight types of orchid plants in the forest area of Pasir Mayang Beach, Sukadana, North Kayong. Lestari *et al*. (2019) found 12 types of orchid plants in the Bukit Kelam Nature Tourism Park, Sintang. Purnama *et al*. (2016) found 12 types of orchids in the Bukit Luncit Anjongan Forest, Mempawah. Amalia *et al*. (2015) found 10 types of orchids in the Natural Forest of Beginjan Village, Tayan Hilir, Sanggau.

The known orchid habitats are generally terrestrial, epiphytic and lithophytic (Hilmiah *et al*., 2017). Research by Lestari *et al*. (2019), obtained terrestrial orchids, namely *Arundina graminifolia*, *Bromheadia finlaysoniana*, *Corybas pictus*, *Ceologyne kelamensis*, *Dendrobium lobii*, *D. olivaceum*, *Dipodium*

pictum, *Liparis* sp., *Paphiopedilum bullenianum*, *Plocoglottis lowii*, *Spatholottis kimballiana* and *Thrixspermum amplexicaule* in the Taman area Tourism Alam Bukit Kelam, Sintang. Research by Damanik *et al*. (2018) the epiphytic orchids found were *Appendicula cornuta*, *Appendicula alba*, *Bulbophyllum vaginatum*, *Bulbophyllum purpurascens*, *Bulbophyllum macranthum*, *Bulbophyllum lepidum*, *Bulbophyllum patens*, *Bulbophyllum* sp., *Ceologyne pandurata*, *Ceologyne asperata, Dendrobium crumenatum*, *Dendrobium lampongense*, *De ndrobium* sp., *Flickingeria auriloba*, *Renanthera matutina* and *Trichoglottis retusa* on Wangkang Hill, Kubu Raya. Research by Zed *et al*. (2019), succeeded in identifying lithophytic orchids, namely *Agrostophyllum bicuspidatum*, *Appendicula anceps*, *Liparis balanse* and *Podochilus lucescens* in the Gunung Raya Protected Forest, Temajuk Village, Paloh, Sambas.

Kuri Hill including one of the areas with large and tall tree vegetation. There is no research on various species of orchids in this area. Records about native orchids in the forests of West Kalimantan are currently still very limited. Therefore, it is necessary to carry out research on wild orchid species. The aim of this research is to determine the species of orchids found on Kuri Hill, Ketapang.

MATERIALS AND METHODS

This research was conducted from December 2022 to March 2023, in the Kuri hill area, Ketapang Regency, West Kalimantan. This research activity includes preparation of tools, materials, identification and data analysis. The equipment used was stationery, *Global Positioning System* (GPS) application, *digital calipers*, *thermohygrometer*, black cloth, camera, *luxmeter*, sewing meter, and *soiltester*. The materials used include 70% alcohol and samples of orchid plants in the field. Orchid observations were carried out along the climbing route to the top of Kuri Hill (Figure 1) with an elevation of between 32-429 meters above sea level (masl).

Orchid sampling in the Kuri Hill area, Ketapang Regency was carried out using the cruise method, namely exploring Kuri Hill by crossing existing routes and collecting orchid samples found (Tjitrosoepomo, 1998). Sampling is carried out by collecting every orchid found, the orchid samples found are recorded and given a label (stick-on label) containing information regarding the sample code, growing habitat, altitude and location of discovery. Documentation of orchids found in the field includes growing habitat, vegetative organs (roots, stems, *pseudobulbs* and leaves) and generative organs (flowers, fruit and seeds) if found.

Measurement of environmental factor parameters measured at the location where the orchid was found, namely: light intensity using *a luxmeter*, soil pH using *a soiltester*, air temperature and air humidity using *a thermohygrometer*. Soil pH is measured by making a hole in the soil around the roots of the terrestrial orchid plant and inserting *a soil tester* into the soil. Measurement of light intensity, air temperature and air humidity by placing sensors around orchid plants.

Characterizing the orchid plants found at the research location, descriptions of each species of orchid were made according to their characteristics. Characterization was carried out by observing the habitat, morphology of stems, leaves, roots, pseudobulbs, flowers and fruit (if any) found on each orchid. The qualitative characters observed included root type, root color, growth characteristics, stem shape, stem color, stem surface, stem growth direction, pseudobulb shape, pseudobulb color, pseudobulb characteristics, pseudobulb surface, leaf color, leaf surface, leaf shape, leaf edge, leaf base, leaf tip, leaf spines, flower color (labellum color, petals and sepals), fruit shape and fruit color. Orchid morphometry observed was stem length, pseudobulb length, leaf length, leaf width, inflorescence stalk length, flower stalk length, sepal length, sepal width, petal length, petal width, labellum length, labellum width, and fruit length (if found).

The species of orchids found were identified using the books of Comber (2001), Siregar *et al*. (2005), Vermeulen *et al*. (2015), Gerry *et al*. (2020) and journal. Some identifications were carried out at the species level and some were only carried out at the genus level. The determination key was created using a dichotomous key. This was done by arranging plant characters into two guiding lines containing opposing characters or two different traits in one point by arranging plant characteristics from general to specific. Each word was given a number, while each guide was marked using a letter (Tjitrosoepomo, 1998).

Orchid plants found at the research location that could not be directly identified in the field were collected by making an herbarium. Orchid plant samples were made into wet hebarium by placing the vegetative or generative parts in a sample bottle, then adding 70% alcohol until all parts of the sample are submerged and tightly closed. Wet herbarium containers were also affixed to labels or sticky labels containing information on the sample serial number, name of the collector, place of sampling and habitat (Tjitrosoepomo, 1998). The qualitative and quantitative data on the types of

orchids and their morphological characteristics that have been obtained were presented in the form of pictures and tables which were analyzed descriptively. Identification of orchids using the book Comber (2001), Siregar *et al*. (2005), Vermeulen *et al*. (2015), Gerry *et al*. (2020) and journal articles about orchids.

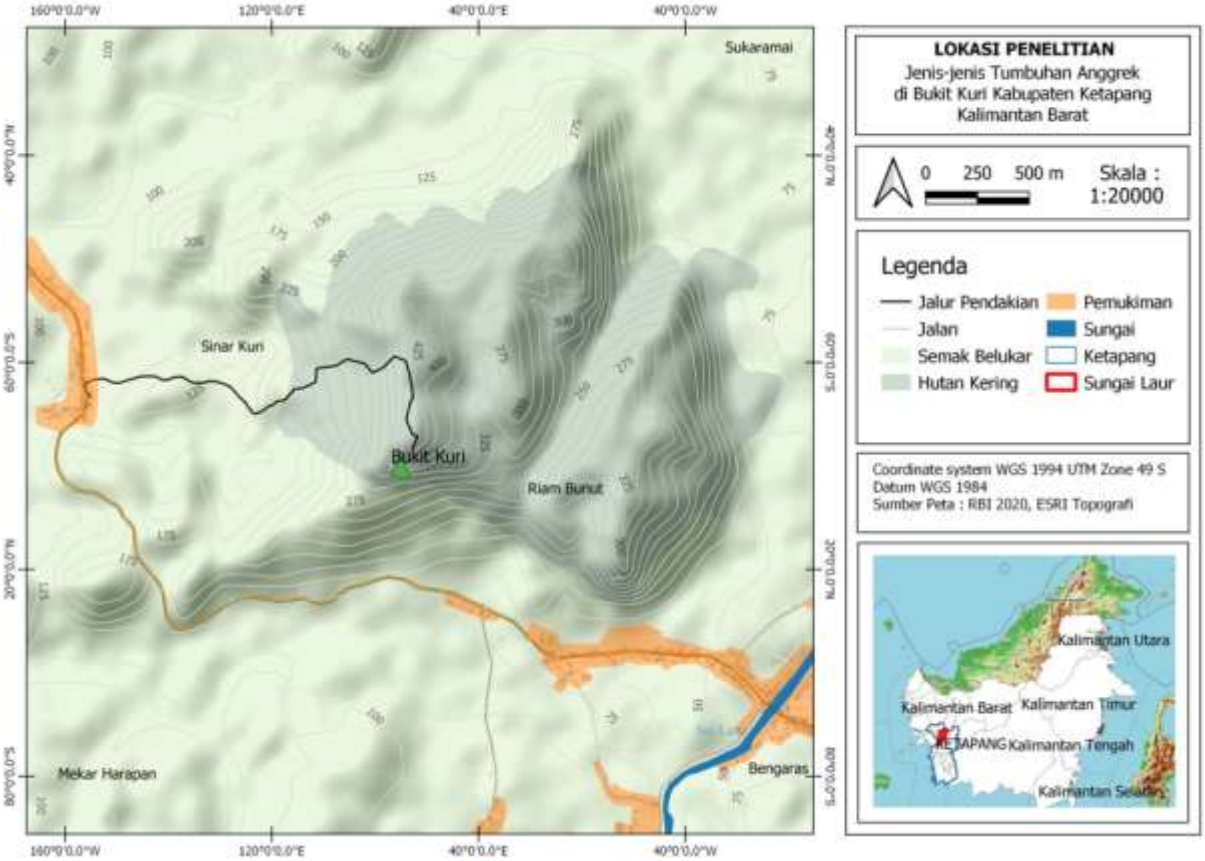

Figure 1. Wild orchid inventory research location in Kuri hil, Ketapang Regency, West Kalimantan.

RESULTS

The species of orchid plants that have been identified in Kuri hill, Ketapang, West Kalimantan were 12 genera with 15 species. Based on their way of life, the orchids found included one terrestrial orchid, five lithophytic orchids and nine epiphytic orchids (Table 1).

Table 1. Types of orchid plants in Kuri Hill, Ketapang Regency, West Kalimantan

No.	Genus	Species of Orchids	How to Grow & Growth Patterns	Growing Zone
1.	*Anoectochilus*	*Anoectochilus reinwardtii* Blume.	Lithophytes and Monopodials	-
2.	*Aphyllorchis*	*Aphyllorchis maliauensis* Reichenbach.	Terrestrial and Monopodial	-
3.	*Bulbophyllum*	*Bulbophyllum anceps* Rolfe.	Epiphytes and Sympodials	2
		Bulbophyllum sp1.	Epiphytes and Sympodials	2
		Bulbophyllum sp2.	Lithophytes and Sympodials	-
		Bulbophyllum sp3.	Epiphytes and Sympodials	2
4.	*Callostylis*	*Callostylis pulchella* Lindl.	Epiphytes and Sympodials	2
5.	*Cylindrolobus*	*Cylindrolobus* sp.	Epiphytes and Monopodials	1
6.	*Dendrobium*	*Dendrobium crumenatum* Sw.	Epiphytes and	3

No.	Genus	Species of Orchids	How to Grow & Growth Patterns	Growing Zone
			Sympodials	
7.	*Flickingeria*	*Flickingeria* sp.	Epiphytes and Sympodials	1
8.	*Liparis*	*Liparis elegans* Lindl.	Lithophytes and Sympodials	-
9.	*Micropera*	*Micropera fuscolutea* (Lindl.) Garay.	Epiphytes and Monopodials	2
10.	*Plocoglottis*	*Plocoglottis lowii* JJSm.	Lithophytes and Sympodials	-
11.	*Spathoglottis*	*Spathoglottis aurea* Lindl.	Lithophytes and Sympodials	-
12.	*Thrixspermum*	*Thrixspermum centipeda* Lour.	Epiphytes and Monopodials	3

Description: Zone 1 = base of tree (1/3 main stem), Zone 2 = main stem to first branch, Zone 3 = basal branch, Zone 4 = middle branch, Zone 5 = outermost branch

The key to determining the species of orchids in Kuri Hill was as follows;

1. a. How to grow terrestrial or grow on the ground..... (3)
   b. How lithophytes grow or stick to rocks……..(3)
2. a. How epiphytes grow: they have *pseudobulbs* ……..…… (3)
   b. Epiphytic growth method does not have *pseudobulbs* ……..……...(3)
3. a. Sympodial growth pattern…….……...……..(4)
   b. Monopodial growth pattern ……..…...……..……(5)
4. a. Properties of heteroblastic *pseudobulbs* ……..…….. (9,10,11)
   b. Characteristics of homoblastic *pseudobulbs* ……(***Dendrobium crumenatum***)
5. a. Direction of growth of upright stem (*erectus*)…….. ……(6)
   b. The direction of growth of the stem is upright (*erectus*) to hanging (*dependent*)……..……(6)
6. a. Properties of hard stems……..…… (7)
   b. Characteristics of soft stems……(***Anoectochilus reinwardtii***)
7. a. Green stem color has leaves……..…… (8,11)
   b. The stem is white with purplish spots and has no leaves…..…(***Aphyllorchis maliauensis***)
8. a. Leaves grow along the stem with alternate leaf layout…… (15)
   b. The leaves grow at the end of the stem with the leaves facing opposite…(***Cylindrolobus* sp**.)
9. a. The shape of *the pseudobulb* is round and flat, has an elongated leaf shape (*oblungus*) which is dark green on the top of the leaf and light green on the bottom of the leaf, the tip of the leaf is split (*retusus*) and the base of the leaf is blunt (*obtusus*)……...(***Bulbophyllum anceps***)
   b. The shape of the javelin's *pseudobulb (cuff*), the color of the purple *pseudobulb* has dark green leaves on the top and dark purple on the bottom of the leaves..…….....(***Plocoglottis lowii***)
10. a. Oval *pseudobulb* shape, green *pseudobulb color* ……...……...……..(12)
    b. The shape of *the pseudobulb* is oval, the color of *the pseudobulb* is green to yellow..(***Callostylis pulchella***)
11. a. The shape of *the pseudobulb* is oval……..…….. (13)
    b. *pseudobulb* shape ……..……..……...(***Flickingeria* sp**.)
12. a. The surface of *the pseudobulb* is wrinkled, has an oblong leaf shape (*ovalis*), the flesh of the leaf is thin and not stiff, light green in color…...……...……...(***Bulbophyllum* sp1**.)
    b. The surface of *the pseudobulb* is grooved, has an ovate leaf shape (*ovatus*), the leaf flesh is thick and stiff, dark green in color……..……...…(***Bulbophyllum* sp2**.)
13. a. The color of *the pseudobulb* is light green with the surface *of the pseudobulb* not wrinkled and smooth……...(14)
    b. The color of *the pseudobulb* is green to purple with the surface *of the pseudobulb* not

wrinkled and smooth, the inflorescence appears from the side *of the pseudobulb* and has lanceolate leaves (*lanceolatus*) with a smooth surface, has yellow flowers with a spatula-like *labellum* with a red spot in the middle *of the labellum* .....(***Spathoglottis aurea***)

14. a. It has inverted lanceolate leaves (*oblanceolatus*) with thin and not stiff leaf flesh, each *pseudobulb* consists of two leaves with inflorescences emerging from the tip of *the pseudobulb* and the fruit is oval in shape……...…..(***Liparis elegans***)
    b. It has an elongated leaf shape (*oblungus*) with thick and stiff leaf flesh, each *pseudobulb* consists of one leaf……...…(***Bulbophyllum* sp3**.)
15. a. It has lanceolate petals (*lanceolatus*) in color, *the labellum* is elliptical in shape, yellowish white……..…….…(***Micropera fuscolutea***)
    b. Having a sword petal shape (*ensiformis*), *the labellum* is an inverted egg-shaped yellow-brown color with red and white spots at the tip of *the labellum*…(***Thrixspermum centipeda***)

Anoectochilus reinwardtii, which was found in this study, grows on lithophytes or on watery rocks covered with moss and lots of litter, at an altitude of 184 meters above sea level. (Figure 2.A). Attached roots brown. Stems were round and was soft, white-brown in color, smooth stem surface, stem length 3-3.9 cm, stem growth direction was upright, monopodial and does not have pseudobulbs. Leaves ovate blackish green on top and purplish on the bottom of the leaves, smooth leaf surface, flat edges, pointed base, pointed tip, curved leaf spines and red. Leaves are 2-3.2 cm long and 1-2.9 cm wide. The environmental parameters at the time of the research found for *A. reinwardtii* were air temperature 27.9 ℃, air humidity 99%, and light intensity 1,299lux. This orchid was found not to be flowering at the time of the research.

The Aphyllorchis maliauensis found in this study grows terrestrially, *mycoheterotrophy* was at an altitude of 242 meters above sea level, monopodial and has no leaves (Figure 2.B). Has a brown taproot. Stem shape was round, white with purple spots, smooth stem surface, The length of the stem was 4-5 cm and the direction of growth of the stem was upright. *A. maliauensis* has elongated to lanceolate *bractea* Cream or paleyellow color on the front part and cream or paleyellow color on the back part with purple spots, smooth surface, flat edges, ragged or flat base, pointed tip, and parallel spines. 1-2.3 cm long and wide 0.5-0.8 cm. Compound flowers in long bunches of lower inflorescence stalk or peduncle 115-118 cm ivory yellow purple spots or spots, the length of the pedicel was 30-34 cm, and the length of the pedicel was 2-2.5 cm. It has an egg-shaped labellum, the edges of the labellum were white and yellow, from the base to the middle of the labbelum it was white to purple, the length of the labellum is 10-10.8 mm and the width of the labellum was 4-5.8 mm. Petals were lanceolate in shape with flat edges, white with a purple line in the middle and white on the back of the petal, petal length 10-10.8 mm with width 1-2 mm. The dorsal sepals were narrowly ovate to lanceolate in shape, have flat edges, were white and have a purple spot on the back of the dorsal sepals, the length of the dorsal sepals is 14-15.5 mm with a width of 2-4 mm. Lateral sepals narrow ovate to lanceolate, flat margins, white with purple spots on the back of the lateral sepals, 11-12.4 mm long and 3-4.5 mm wide. The environmental parameters at the time of the study found *A. maliauensis*, namely air temperature 27.8 ℃, air humidity 93%, light intensity 144lux, and soil pH 6.5. Orchids are found in places where there was a lot of litter shaded by large trees around it. Orchids likely get nutrition by means of a mutualistic symbiosis between their roots and mycorrhizal fungi.

The Bulbophyllum anceps found in this study grows epiphytically on trees, at an altitude of 379 meters above sea level (Figure 2.C). The attached roots were white. The pseudobulb was round and flat, the pseudobulb was heteroblastic, the surface of the pseudobulb was smooth green, the length of the pseudobulb was 4-5 cm and the growth pattern was sympodial. The elongated leaves were dark green above and light green below, have a smooth surface, flat edges, blunt base, split tip, and parallel spines. The leaves emerge from the pseudobulb. Each pseudobulb consists of 1 leaf. Leaf length was 15-19.1 cm and leaf width were 5-7.3 cm. The environmental parameters at the time of the research were found to be *B. anceps*, namely air temperature 30.1 ℃, air humidity 83%, and light intensity 324lux. This orchid was found not to be flowering at the time of the research.

Bulbophyllum sp1. found in this study grew epiphytes, at an altitude of 346 meters above sea level (Figure 2.D). Attached roots-green to white. The shape of the pseudobulb was oval, heteroblastic, the surface of the pseudobulb was wrinkled and smooth green, 1-2.4 cm long, the growth pattern was

sympodial. Jorong green leaves, smooth surface, tapered leaf base, flat edges, tapered leaf tips with parallel spines. Leaves emerge from pseudobulbs, each pseudobulb consists of 1 leaf. Leaves were 10-13 cm long and 3-4.4 cm wide. This orchid was found not flowering. Environmental parameters during research on *Bulbophyllum* sp1. namely air temperature 29.6℃, air humidity 93%, and light intensity 298lux.

Bulbophyllum sp2. which was found growing lithophytes at an altitude of 381 meters above sea level (Figure 2.E). Chocolate sticky root. oval pseudobulb, heteroblastic, the surface of the pseudobulb was smooth green, the length of the pseudobulb was 1-1.6 cm, the growth pattern was sympodial. Dark green ovate leaves, upper part of the leaf, light green lower part of the leaf, smooth leaf surface, flat edges, tapered base, split ends with parallel bones. The leaves emerge from the pseudobulb. Each pseudobulb consists of 1 leaf. Leaf length was 3-4 cm and leaf width were 1-2.4 cm. This orchid was found not flowering. The environmental parameters at the time of the research were found to be *Bulbophyllum* sp2., namely air temperature 29.7 ℃, air humidity 89%, and light intensity 843lux.

Bulbophyllum sp3. found growing epiphytes on dead trees that were overgrown with moss, at an altitude of 381 meters above sea level (Figure 2.F). The attached roots were brown to white. The pseudobulb was oval in shape, the nature of the pseudobulb was heteroblastic, the surface of the pseudobulb was smooth green, the length of the pseudobulb was 1-2 cm and the growth pattern was sympodial. Jorong leaves were green, have a smooth surface, pointed base, flat edge, split tip, and parallel spines.-The leaves emerge from the pseudobulb. Each pseudobulb consists of 1 leaf. Leaves were 9-11.8 cm long and 2-3.3 cm wide. This orchid was found not to be flowering at the time of the research. Environmental parameters at the time of the research found *Bulbophyllum* sp3. namely air temperature 29.6℃, air humidity 83%, and light intensity 3,103lux.

Callostylis pulchella, which was found growing epiphytically on trees, was at an altitude of 367 meters above sea level (Figure 2.G). The attached roots are brown. This orchid has a sympodial growth pattern, green to yellow flat oval pseudobulbs, heteroblastic pseudobulbs, grooved and smooth pseudobulb surface, tapered base, flat edges, split tip, and pseudobulb length 5-7.2 cm. Lanceolate leaves were green, smooth surface, parallel spines. Leaf length 13-15.1 cm wide 2-3.4 cm. The leaves emerge from the pseudobulb and each pseudobulb consists of 1-2 leaves. This orchid was found without flowers during research. The environmental parameters at the time of the study found *C. pulchella*, namely air temperature 29.3 ℃, air humidity 96%, and light intensity 4,771lux.

Cylindrolobus sp. Epiphytes grow at the base of trees found at an altitude of 367 meters above sea level, do not have monopodial pseudobulbs (Figure 2.H). Brown fibrous attached roots. Green round stems, smooth stem surface, stem growth direction upright to hanging (*dependent*), and stem length 7-9 cm. The lanceolate leaves were green, the surface of the leaf was smooth, the base of the leaf was tapered, the edges were flat, the tip of the leaf was tapered, the leaf bones were parallel, the length of the leaf was 13-16.9 cm and the width was 1-2.7 cm. This orchid was found not flowering. Environmental parameters at the time of the study found *Cylindrolobus* sp. namely air temperature 29.3 ℃, air humidity 96%, and light intensity 4,771lux.

Dendrobium crumenatum, which was found as an epiphyte at the basal branch, was sympodial, and was located at an altitude of 32 meters above sea level (Figure 2.I). White adhesive root. Pseudobulb lanceolate, homoblastic, green pseudobulb surface wrinkled, smooth, and grooved. Pseudobulb length 12-14.5 cm. The stem emerges from a brownish green pseudobulb, round stem, smooth stem surface, stem length 20-29 cm. The direction of growth of the stem was upright to hanging. Elongated oval leaves, green with a smooth surface, blunt base, flat edge, split tip, parallel spines. Leaf length 5-8.5 cm wide 2-3.4 cm. Compound flower clusters, inflorescence stalk length 30-34.5 cm, pedicel length 0.5-1 cm. The triangular flower lips were narrow, white with a yellow center. Long labellum 14-15.4 mm, width 4-5.4 mm. Petals were ovate with flat edges and white. Petal length 12-13.2 mm with width 4-5.8 mm. Dorsal sepals lanceolate with white flat margins. Dorsal sepals 14-15.7 mm long, 4-5 mm wide, lateral sepals elongated with flat edges and white. Lateral sepals were 11-12.8 mm long and 5-6.2 mm wide. The environmental parameters at the time of the research were found to be *D. crumenatum*, namely air temperature 32.2 ℃, air humidity 64%, and light intensity 1,152lux.

Flickingeria sp. which was found growing epiphytes at the base of trees, at an altitude of 390 meters above sea level (Figure 2.J). White adhesive root. Pseudobulbs were elongated, heteroblastic green, smooth surface, 4-5.8 cm long. Round green stems, smooth stem surface, hanging stem growth direction and stem length 20 cm. Leaves oblong to lanceolate, green, smooth surface, tapered base, flat edges, split tip, parallel spines. Leaf length 10-13.3 cm wide 1-2.4 cm. Leaves emerge from

pseudobulbs and each pseudobulb consists of 1 leaf. This orchid was found not flowering. Environmental parameters when found *Flickingeria* sp. namely air temperature 29.5 °C, air humidity 92%, and light intensity 237lux.

Liparis elegans grows lithophyte at an altitude of 374 meters above sea level (Figure 2.K). Green to white attached roots. The pseudobulb was oval, heteroblastic, the surface of the pseudobulb was smooth green, the length of the pseudobulb was 2-4.4 cm sympodial. Inverted lanceolate leaves were green, smooth surface, flat edges, tapered base, pointed tip, parallel spines. Leaves were 15-18.8 cm long and 2-3.8 cm wide. The leaves emerge from the middle of the pseudobulb and each pseudobulb consists of 1-2 leaves. At the time of the research, it was thought that this orchid had finished its flowering period, because when it was found it did not have flowers but had fruit. The fruit is on the inflorescence stalk, the length of the inflorescence stalk was 30-35 cm. Fruit oval, green to brown, fruit length 2-3.4 cm, fruit stalk length 0.2-0.3 cm. The environmental parameters at the time of the research found *L. elegans*, namely air temperature 30.4 °C, air humidity 82%, and light intensity 2,747lux.

Micropera fuscolutea on tree branches, at a height of 32 meters above sea level, does not have monopodial pseudobulbs (Figure 2.L). Green to white attached roots. The green stem was round, the surface of the stem was smooth, the direction of growth of the stem was upright to hanging, the length of the stem was 30-36 cm. The leaves were elongated to lanceolate, green with a smooth leaf surface, flat leaf edges, pointed leaf base, split leaf tips, and parallel leaf veins. The length of the leaves was 12-14 cm, while the width was 0.5-1.8 cm. Compound flower clusters, inflorescence stalk length 20-28.6 cm, flower stalk length 0.8-1 cm. The flower lips were elliptical, yellowish white. Long lip of flower 5-7.1 mm, while the width was 1-2.3 mm. Petals lanceolate with flat edges, yellow-brown. Petal length 3-4.3 mm width 0.8-1 mm. The dorsal sepals were oblong with flat edges and were yellow-brown in color. The length of the dorsal sepals was 3-4.3 mm with a width of 0.5-1.2 mm, while the lateral sepals have an oval shape, flat edges and were yellow-brown in color. The lateral sepals were 2-3.1 mm long and 0.5-1.5 mm wide. The young green fruit was elongated and 3-4.7 cm long. The environmental parameters at the time of the research found *M. fuscolutea*, namely air temperature 30.8 °C, air humidity 64%, and light intensity 1,152lux.

Plocoglottis lowii was found growing lithophytes on the side of a cliff, at an altitude of 288 meters above sea level (Figure 2.M). The brown attached roots have fine white root hairs. This orchid was sympodial, the pseudobulb was purple javelin-shaped, the pseudobulb was heteroblastic, the pseudobulb surface was smooth and the pseudobulb was 5-8 cm long. The leaves were oblong to lanceolate, dark green on the top of the leaf and dark purple on the bottom of the leaf, smooth surface, tapered base, flat edges, tapered tip with parallel spines. Leaf length 25-30.4 cm, width 5-8.4 cm. The leaves emerge from the pseudobulb consisting of a single leaf blade. This orchid was found not flowering. The environmental parameters at the time of the research were found to be *P. lowii*, namely air temperature 27.9 °C, air humidity 99%, and light intensity 1,299lux.

Spathoglottis aurea grows as a lithophyte or sticks to rocks that were heavily overgrown with moss, located on a hill cliff at an altitude of 404 meters above sea level (Figure 2.N). Purple roots with an attached root type and there were fine white root hairs. The pseudobulb was ovoid like an onion, heteroblastic, the surface of the pseudobulb was smooth, 1-2.5 cm long, green to purple, the growth pattern was sympodial. The lanceolate leaves were green, the leaf surface was slightly folded, the base was pointed, the edge was flat, the tip was tapered, and the bones are parallel. The petiole emerges from the middle of the pseudobulb, each petiole consists of 2-3 leaves. Leaf length 70-85 cm width 5-7.4 cm. Clusters of compound flowers, inflorescence stalk emerges from the side of the pseudobulb, 85-99 cm long, pedicel 1-2.2 cm long. The spatula-like labellum was yellow with red spots in the middle of the labellum. The length of the labellum was 14-16.3 mm while the width was 0.8-1.5 mm. The petals were oval-shaped with flat edges, and were yellow. Petals 18-21 mm long with a width of 10-13.1 mm. The dorsal sepal was oblong in shape, with a flat yellow edge. Dorsal sepal length 20-23.5 mm width 8-11.2 mm. Lateral sepals' oblong, margin flat. Lateral sepals 18-21.8 mm long and 8-10.8 mm wide. Oval purple fruit 2-3.4 cm long, fruit stalk 1-1.8 cm long. The environmental parameters at the time of the study found *S. aurea*, namely air temperature 29.6 °C, air humidity 87%, and light intensity 2,268lux.

Thrixspermum centipeda was found at an altitude of 32 meters above sea level, grows epiphytically at the basal branches, the direction of growth of the stem was upright to hanging monopodial and has no pseudobulbs (Figure 2.O). The attached roots were green to white. Stems were flat, green, smooth, stem surface and stem length 15-17 cm. Jorong leaves were green with a smooth leaf surface, blunt base, flat edge, split tip, parallel spines. Leaf length 8-10.8 cm wide 1-2.4 cm.

Compound flowers, inflorescence stalk 10-15 cm long and pedicel 0.8-1 cm long. The flower lip was inverted egg-shaped, yellow-brown with red and white spots at the end of the flower lip. Long lip of flower 5-7.9 mm, width 1-1.8 mm. The petals were sword-shaped with flat edges and were yellow-brown in color. Petals 23-25 mm long with a width of 1-1.6 mm. The dorsal sepal was sword-shaped, the edges were flat yellow-brown. Dorsal sepal length 26-28.1 mm wide 1-2.3 mm. The lateral sepals were sword-shaped-flat yellow brown. Lateral sepals 25-29 mm long and 1-2.5 mm wide. The green fruit was oval in shape, 3-6 cm long. The environmental parameters at the time of the research found *T. centipeda*, namely air temperature 32.2 °C, air humidity 64%, and light intensity 1,152 lux.

Figure 2.A. ***Anoectochilus reinwardtii***: a. Habitus, b. Overall view, c. Root, d. Stem, e. Leaf.

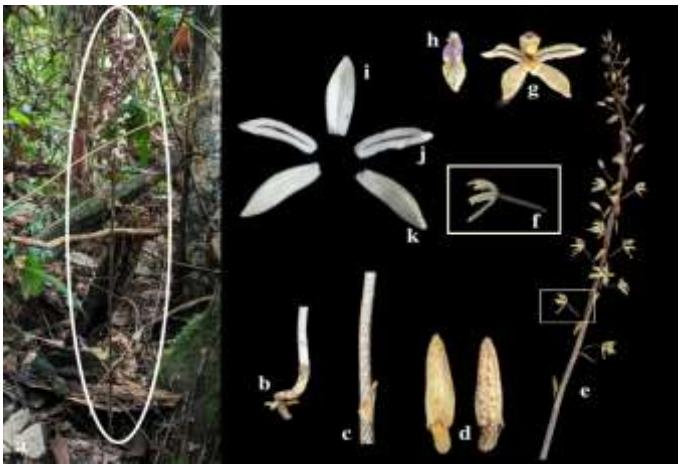

Figure 2.B. *Aphyllorchis maliauensis*: a. Habitus, b. Root and stem, c. Peduncle, d. Bractea, e. Rachise, f. Pedicel, g. Flower, h. Labellum, i. Dorsal sepal, j. Petal, k. Lateral sepals.

Figure 2.C. *Bulbophyllum anceps*: a. Habitus, b. Overall view, c. Root, d. Pseudobulb, e. Leaf.

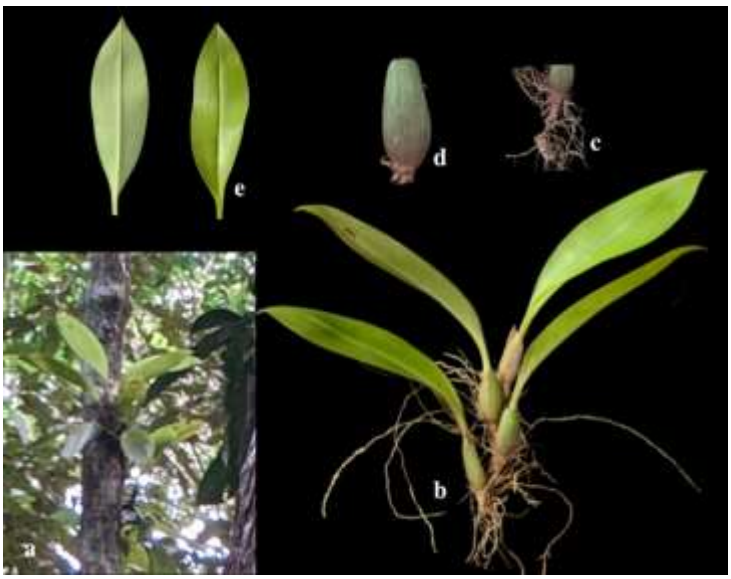

Figure 2.D. *Bulbophyllum* sp1.: a. Habitus, b. Overall view, c. Root, d. Pseudobulb, e. Leaf.

Figure 2.E. *Bulbophyllum* sp2.: a. Habitus, b. Overall view, c. Root, d. *Pseudobulb*, e. Leaf.

Figure 2.F. *Bulbophyllum* sp3.: a. Habitus, b. Overall view, c. Root, d. *Pseudobulb*, e. Leaf.

Figure 2.G. *Callostylis pulchella*: a. Habitus, b. Overall view, c. Root, d. *Pseudobulb*, e. Leaf.

Figure 2.H. *Cylindrolobus* sp.: a. Habitus, b. Overall view, c. Root, d. Stem, e. Leaf.

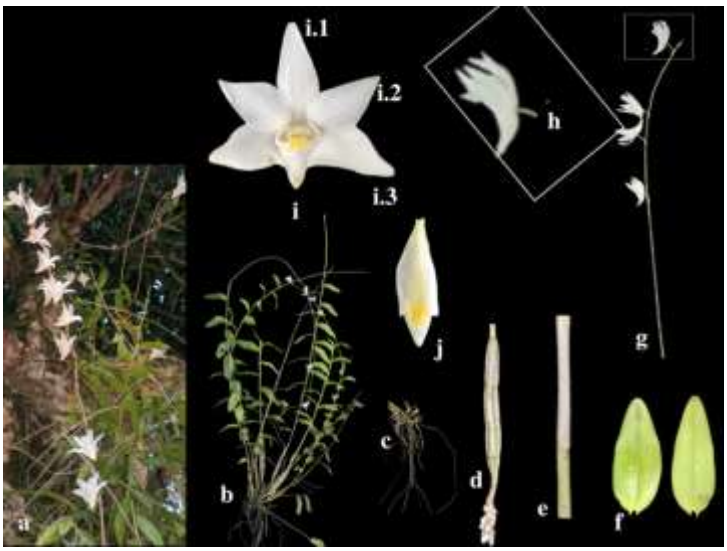

Figure 2.I. *Dendrobium crumenatum*: a. Habitus, b. Overall view, c. Root, d. *Pseudobulb*, e. Stem, f. Leaf, g. Inflorescence stalk, h. Pedicel, i. Flowers, i.1. Dorsal sepal, i.2. Petals, i.3. Lateral sepals, j. *labellum*.

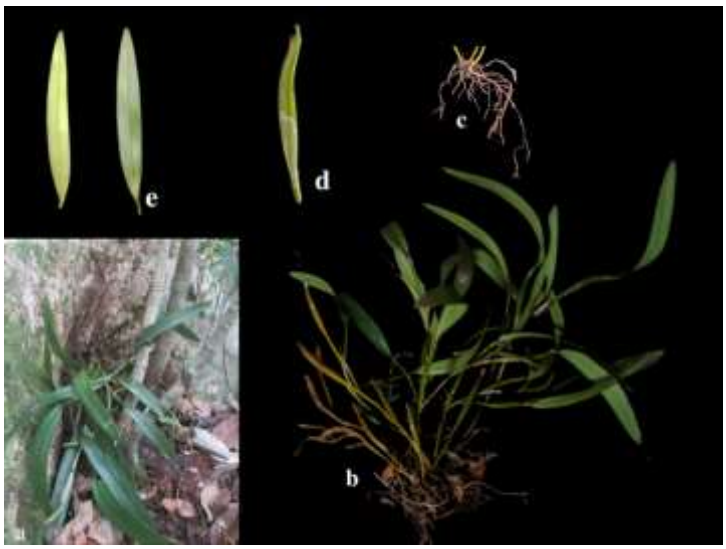

Figure 2.J. *Flickingeria* sp.: a. Habitus, b. Overall view, c. Root, d. *Pseudobulb*, e. Leaf.

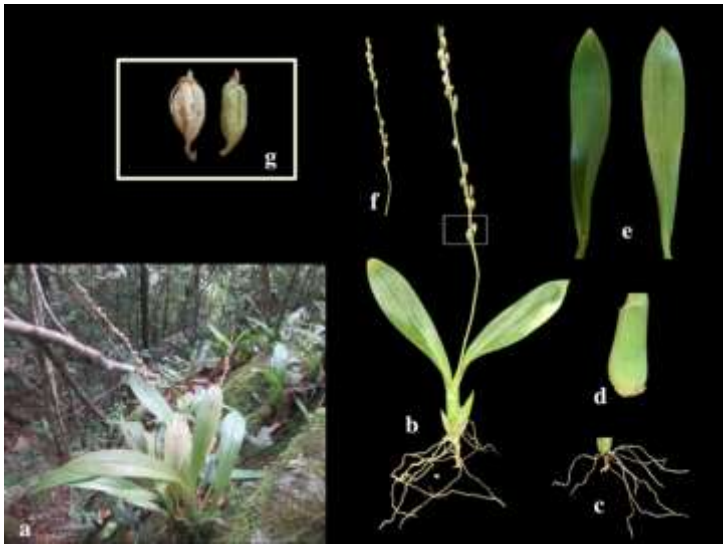

Figure 2.K. *Liparis elegans*: a. Habitus, b. Overall view, c. Root, d. *Pseudobulb*, e. Leaf, f. Inflorescence stalk, g. Fruit.

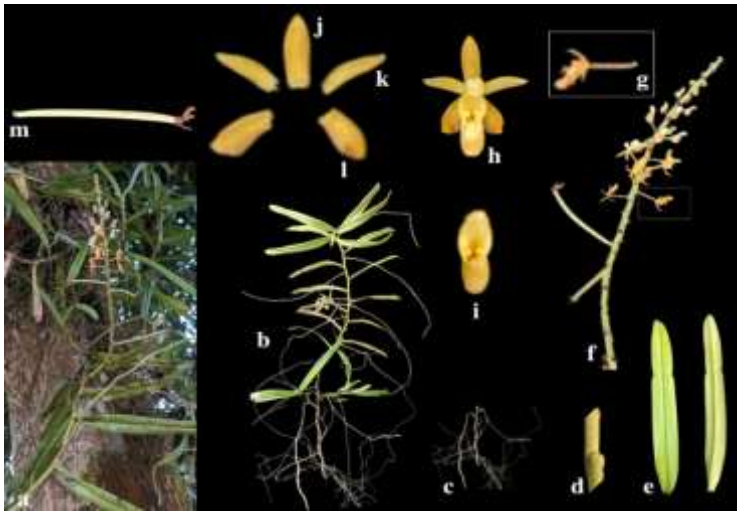

Figure 2.L. *Micropera fuscolutea*: a. Habitus, b. Overall view, c. Root, d. Stem, e. Leaf, f. Inflorescence stalk, g. Flower stalk, h. Flowers, i. *labellum*, j. Dorsal sepal, k. Petals, l. Lateral sepals, m. Fruit.

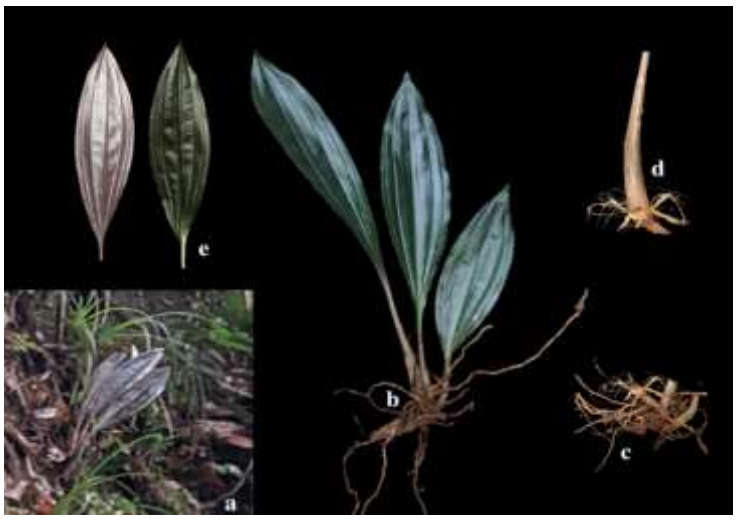

Figure 2.M. *Plocoglottis lowii*: a. Habitus, b. Overall view, c. Root, d. *Pseudobulb*, e. Leaf.

Figure 2.N. *Spathoglottis aurea*: a. Habitus, b. Root, c. *Pseudobulb*, d. Leaf, e. Inflorescence stalk, f. Flower stalk, g. Flowers, p. labellum, i. Dorsal sepal, j. Petals, k. Lateral sepals, l. Fruit.

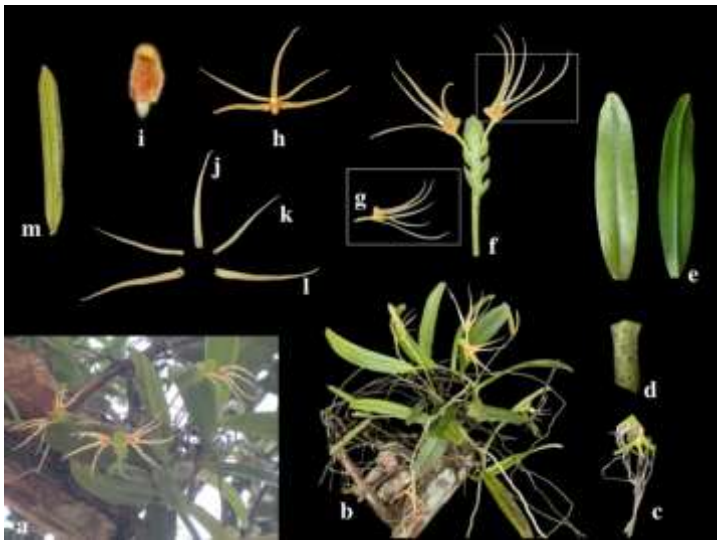

Figure 2.O. *Thrixspermum centipeda*: a. Habitus, b. Overall view, c. Root, d. Stem, e. Leaf, f. Inflorescence stalk, g. Pendulum, h. Flowers, i. labellum, j. Dorsal sepal, k. Petals, l. Lateral sepals, m. Fruit.

DISCUSSION

There were 15 species of orchid plants found on Kuri Hill, namely *Anoectochilus reinwardtii*, *Aphyllorchis maliauensis*, *Bulbophyllum anceps*, *Bulbophyllum* sp1., *Bulbophyllum* sp2., *Bulbophyllum* sp3.,

Callostylis pulchella, *Cylindrolobus* sp., *Dendrobium crumenatum*, *Flickingeria* sp., *Liparis elegans*, *Micropera fuscolutea*, *Plocoglottis lowii*, *Spathoglottis aurea*, and *Thrixspermum centipeda*. There were more species of orchids found in Kuri Hill (15 species) than the orchids found in the Pasir Mayang Sukadana Beach Forest area (8 species) (Hasanah *et al*., 2022). Differences in the number of orchid species in the area, influenced by environmental conditions and vegetation in each different forest. This was in accordance with research by Amalia *et al*. (2015), the number of orchid species found in each region varies.

Kuri Hill was secondary tropical rainforest vegetation with most of it having dense canopy cover. There were only a few orchids found that were flowering, namely *A. maliauensis*, *D. crumenatum*, *M. fuscolutea*, *S. aurea*, and *T. centipeda*. When observing in the field, the shape and color of the flowers on each orchid varied and had a beautiful labellum. Gerry *et al*. (2020) stated that orchids have a variety of colors and flower shapes, there were some orchids that were plain colored, but many also have varied or beautiful color patterns.

A. maliauensis was discovered during research on terrestrial growth methods, *mycoheterotrophyc* does not have leaves. These orchids were found in areas that have a lot of litter and were shaded by large trees surroundings. This orchid gets nutrition by means of a mutualistic symbiosis between roots and soil fungi (mycorrhiza). These mycorrhizae were beneficial for growing mycoheterotrophic orchids. Sugiyarto *et al*. (2016), stated that mycorrhizal fungi absorb organic substances from humus and convert them, then provide them for orchid growth. According to Suetsugu *et al*. (2018), *A. maliauensis* can carry 20-30 *bractea* and was a mycoheterotrophic plant. Comber (2001), stated that the genus *Aphyllorchi*s does not have leaves and the stem grows in an upright direction. Dressler (1981), that orchids reach long distances because orchid seeds are carried by the wind.

Based on the results obtained during the research, it was found that the way orchids grow in Kuri Hill consists of 3 ways of growing, namely terrestrial, lithophyte and epiphyte. The results in Table 1 show that 1 species of terrestrial orchid was found, 5 species of lithophyte orchids and 9 species of epiphyte orchids. The terrestrial orchid found was *A. maliauensis*, the lithophyte orchids found were *A. reinwardtii*, *Bulbophyllum* sp2., *L. elegans*, *P. lowii*, and *S. aurea*. The epiphytic orchids found in this study were B. anceps, *Bulbophyllum* sp1., *Bulbophyllum* sp3., *C. pulchella*, *Cylindrolobus* sp., *D. crumenatum*, *Flickingeria* sp., *M. fuscolutea* and *T. centipeda*. This shows that the species of orchid plants in Kuri Hill have different habitats and the Kuri hill forest has the potential to store many orchid plants suitable for growing orchids. According to Lasa *et al*. (2021), stated that good forest conditions make orchids grow well and adapt well.

The species of orchids that were mostly obtained in this study were orchids from the genus *Bulbophyllum*. In this study, the species of *Bulbophyllum* found were *B. anceps*, *Bulbophyllum* sp1., *Bulbophyllum* sp2., and *Bulbophyllum* sp3. One of them grows a lithophyte, namely *Bulbophyllum* sp2., while the other was an epiphyte. This shows that the *Bulbophyllum orchid* species has the ability to adapt to its habitat and adapt well. According to Siregar *et al*. (2005), stated that the orchid species in the genus *Bulbophyllum* were species of orchids that were able to adapt well to the place where they grow, even though there was a lack of water. Species of orchids from the genus *Bulbophyllum* were often found in other areas of West Kalimantan. In the Gunung Melintang Nature Tourism Park Area, Sambas, orchids from the genus *Bulbophyllum* were most commonly found, namely *B. signatum*, *B. macranthum*, *B. cirlihanensis*, *B. bakoense*, *B. macrochilum* and *B. lepidium* (Abdilah *et al*., 2022). Apart from that, in the Pasir Mayang Sukadana Beach Forest Area, North Kayong orchids from the genus *Bulbophyllum* were also often found, namely *B. vaginatum*, *B. medusa* and *B. purpurascens* (Hasanah *et al*., 2022). This was in line with the statement of Jannah *et al*. (2022), *Bulbophyllum* was a group of orchids that was very diverse and widely distributed.

Based on how they grow, the types of orchids that are often found on Kuri Hill were 9 species of epiphytic orchids. This was due to the condition of the Kuri hill forest with host trees that were suitable for growing epiphytic orchids. Most of the epiphytic orchids found were found on host trees which have a characteristic rough-textured bark surface. This was in accordance with the opinion of Purwati *et al*. (2021), epiphytic orchids grow on host tree species with the surface of the bark having a cracked, hard texture and thick, grooved skin. The species of epiphytic orchids found vary. This was influenced by environmental factors and habitat conditions. The growing zone of epiphytic orchids and vegetation conditions also influence orchid growth (Hasanah *et al*., 2022). The growing zones for epiphytic orchid types in Kuri hill were zone one, zone two, zone three, and the most commonly found was zone two. Zone two was the main stem to the first branch. It was suspected that zone two

was able to receive direct light intensity, and was able to store nutrients and water to a greater extent than in other zones. Tirta *et al*. (2010), in Purnama *et al*. (2016), believes that zone two was the zone where orchids grow the most, because the lighting was sufficient for orchid growth. According to Gravendeel *et al*. (2004), more than 70% of orchid species are epiphytic orchids.

CONCLUSION

Based on the results of the research carried out, it can be concluded that there were 15 species of orchid plants in Kuri hill, Ketapang Regency, West Kalimantan, namely *Anoectochilus reinwardtii*, *Aphyllorchis maliauensis, Bulbophyllum anceps*, *Bulbophyllum* sp1., *Bulbophyllum* sp2., *Bulbophyllum* sp3., *Callostylis pulchella*, *Cylindrolobus* sp., *Dendrobium crumenatum*, *Flickingeria* sp., *Liparis elegans*, *Micropera fuscolutea*, *Plocoglottis lowii, Spathoglottis aurea*, and *Thrixspermum centipeda*.

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