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EXPLORING THE ORCHIDACEA FAMILY: UNVEILING THE DIVERSITY LEVELS IN THE KORAN RIVER AREA OF SEBANGAU NATIONAL PARK, CENTRAL KALIMANTAN

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ABSTRACT

This study aimed to explore the diversity levels of the Orchidaceae family in the Koran River area of Sebangau National Park, Central Kalimantan. The research was conducted over a period of 8 months, from August 2021 to March 2022, and involved preparing research proposals, data collection, analysis, and result preparation, research result seminars, and final exams/thesis. The research tools and materials used included a camera, meter, writing tools, machete, compass, computer, calculator, location map, orchid literature book, and tali rapia. Primary data was collected through direct visits to the research location and analyzing orchid plants with the assistance of four field workers. Secondary data was obtained from the people of Central Kalimantan. Sampling of orchid plants was done using the Purposive Sampling technique, and the research plot was carried out using the path method. The study found three genera of orchids, namely *Bulbophyllum*, *Dendrobium*, and *Eria*, in the research area. Four types of orchids were found in the naturally overgrown path (line 1), and nine types of orchids were found in the orchid cultivation route (line 2). The variable data taken were types of terrestrial and epiphytic orchids. This study provides valuable information on the diversity of orchids in Sebangau National Park's Koran River area and highlights the importance of preserving this valuable natural resource.

KEY WORDS

Orchidaceae family, diversity, Sebangau National Park, Koran River, Central Kalimantan, *bulbophyllum*, *dendrobium*, *eria*, purposive sampling, path method.

Indonesia is a country consisting of a group of islands with a tropical climate and is located between two continents (Asia and Australia) and two oceans (Indian and Pacific). There are 17,500 islands in Indonesia with a coastline of 95,181 km. The area of Indonesia is around 9 million km², of which 2 million km² is land and the rest is water area. Under these conditions, Indonesia is a country rich in flora and fauna. Indonesia has a total flora of about 25%, namely in the form of flowering plant species that exist throughout the world. This makes the country of Indonesia ranked seventh in the world which has a total flora of up to 20,000 species. Indonesia has around 40% endemic flora and the plant family that has the most members is the Orchidaceae Family (Orchidaceae), which is around 4,000 species (Kong et al., 2003; Kusmana & Agus, 2015; Prapitasari, 2020; Pammai et al., 2022; Della et al., 2022; Siregar et al., 2022; Yani et al., 2022; Jayanthi, 2023).

Orchids are one of the very unique plants, because the flowers have a variety of colors and shapes that attract the attention of many people. Compared to other flowering plants, orchids have the most species in nature. Orchid habitat is spread from the lowlands to the highlands. Worldwide, the number of orchids is estimated to be 20,000 to 30,000 species belonging to about 700 genera (Shuttleworth et al., 1970; Groombridge, 1992).

Diversity is a combination of species richness and evenness in a single value (Ludwig, 1988). According to Wirakusumah (2003); Magurran et al., (2010); Kembel et al., (2012); Maury & Poggiale, (2013); Chao et al., (2014); McGill et al., (2015); Carmona et al., (2012); Malone et al., (2018), diversity is a measure of biological community integration by calculating and considering the number of populations that make it up with their relative abundance. Diversity will tend to be lower in physically controlled ecosystems and higher in



biologically regulated ecosystems. Diversity will tend to be lower in physically controlled ecosystems and higher in biologically regulated ecosystems (Odum, 1996; Crooks, 2002; Gibert & Deharveng, 2002; Swift et al., 2004; Ramirez-Llodra et al., 2010; Carpenter et al., 2011; Mace et al., 2012; Duru et al., 2015).

Biodiversity (biological diversity or biodiversity) is a term used to describe the diversity of ecosystems and the various forms and variability of animals, plants and microorganisms in the world (Hasan and Ariyanti, 2004). According to the World Wildlife Fund in Mochamad Indrawan et al (2007), Biodiversity is the millions of plants, animals and microorganisms including those they own and the complex ecosystems they form into the environment. Indonesia is very rich with a variety of flora and fauna diversity. Of the 40,000 types of flora that grow in the world, 30,000 of them are plants that live in Indonesia (Sukur, and Hernani 2001; Indriwati & Suhadi, 2018; Cahyaningsih et al., 2021; Husaini et al., 2022). According to Ramono (2004); Ansari et al., (202); Rajagukguk et al., (2022); Agus et al., (2022), one of Indonesia's natural wealth includes 27,500 species of flowering plants (10% of all plant species in the world) that grow in forests.

Species diversity is basically composed of two components. The first is the number of species in an area, which ecologists define as species richness. The second component is evenness (species evenness). Furthermore, an index is developed which seeks to combine species richness and evenness into a single value called the species abundance index.

- *Richness of Types*. Species richness was first put forward by McIntosh in 1967. The concept put forward regarding species richness is the number of species in a community. Kempton (1979) in Santosa (1995) defines species richness as the number of species in a certain number of individuals.
- *Evenness of Types*. This concept shows the degree of even distribution of individual abundance between each species. The measure of evenness first put forward by Lloyd and Ghelardi (1964) in Magurran (1988) can also be used as an indicator of dominance symptoms among each species in a community.
- *An abundance of types*. The term heterogeneity was first put forward by Good (1953), referred to in Krebs (1989). Another term for this concept is abundance or species abundance (Magurran 1988). As previously stated, this concept is a single index combining species richness and species evenness. So species abundance is a qualitative parameter that reflects the relative distribution of species of organisms in a community, which is related to density based on qualitative estimates. According to Indriyanto (2006), qualitative assessment, abundance can be grouped into five namely very rarely, sometimes or rarely, often or not much, a lot or abundant and very much.

In relation to forest communities, species diversity varies from one forest type to another. Diversity varies according to land conditions. Bruenig (1995) stated that species diversity consistently decreased from deep to shallow podsol humus content according to studies of several forest types (Dipterocarpaceae mixed-crystalline hill grouper forest) in Sarawak, Brunei and southern China, as well as Bana Amazone region. Species richness relates to and is limited to soil conditions where there is a root zone, soil aeration and moisture, nutrient content and humus quality.

METHODS OF RESEARCH

This research was conducted in the Sebangau National Park area in the Koran River, SPTN Region I, Palangka Raya, Central Kalimantan Province, Sebangau District. The required research time is ± 8 (eight) months, namely from August to March 2022, which includes the stages of preparing research proposals, Proposal seminars, data collection, data analysis and preparation of results, research results seminars and final exams/thesis. The tools and materials used in this research activity are: Photo camera for documentation, Meter to measure the length of the field, Writing tools, Machete for pioneering, Compass to determine the direction of azimuth, Computer and calculator as calculating tools. Location Map as research reference, Orchid Literature Book, Tali rapia to make sample plots. The



data used in this study include primary data and secondary data. Primary data is direct data obtained through direct visits to research locations by analyzing orchid plants. Data collection in the field was assisted by 4 (person) field workers, where 2 people served as pioneers, 1 person was an orchid species identifier, and 1 person was in charge of taking notes. While secondary data is data obtained from the people of Central Kalimantan related to the area which contains the research location, the size of the research area. Sampling of orchid plants was carried out using the Purposive Sampling technique, which means determining places where orchid samples can be found in the Sebangau National Park area. That is, the data collected includes the collection location, the scientific name of the species in the Koran River, the Sebangau National Park, Palangka Raya. Specimens will be identified using the literature book "Types of Orchid" and can also bring in local staff to introduce some of the unique types of orchids in local languages. The research plot was carried out using the path method, the observation plots were made as many as 2 lanes. Route 1 is where orchids grow naturally and lane 2 is where orchids are cultivated. With a lane width of 20 m each and a lane length of 500 m each, the distance between the lanes is 1,573 m, the area of the sample plots made is 20 m x 500 m x 2 lanes = 20,000 m² or 2 ha, the variable data taken is type terrestrial and epiphytic orchids. Vegetation Data Analysis, Species Diversity (H'), Species Diversity which also shows the level of stability of the species level, then the species diversity formula is used.

Shannon (1949) in Odum (1996), species diversity can be determined:

$$H' = - \sum_{i=1}^s \left(\frac{1}{2}\right) \ln \left(\frac{ni}{N}\right)$$

Where: H' = Diversity Index; ni = Number of Individuals of Each Type; N = Total Number of Individuals of All Kinds; s = Number of Types; ln = Natural logarithm.

The magnitude of the diversity index will be compared between growth levels, a higher value indicating higher stability.

The H' value or diversity index ranges from 1.50-3.50; <1.50: Low Diversity; 1.50-3.50: Moderate Diversity; 3.50: High diversity (Dharmawan, 2005:124).

RESULTS AND DISCUSSION

The results of the calculation of the data obtained index of species diversity and evenness of orchids presented in Table 1.

Table 1 – Indices of Diversity and Evenness in the Natural Growth Paths and Orchid Cultivation in the Sebangau Sungai Koran National Park, Central Kalimantan

Path 1 Orchids that Grow Naturally				
No	Species name	S	H'	E
1	<i>Bulbophyllum lepidum</i>	21		
2	<i>Bulbophyllum beccarii</i>	11		
3	<i>Eria lobate</i>	6	1,07	0,77
4	<i>Bulbophyllum lyriforme</i>	1		
Total		39		
Path 2 Orchids That Have Been Cultivated				
No	Species name	S	H'	E
1	<i>Dendrobium aloifolium</i>	16		
2	<i>Bulbophyllum lyriforme</i>	10		
3	<i>Bulbophyllum lepidum</i>	6		
4	<i>Bulbophyllum lasiantum</i>	5		
5	<i>Dendrobium pacyphyllum</i>	2	1,83	0,83
6	<i>Bulbophyllum anceps</i>	2		
7	<i>Bulbophyllum sp</i>	2		
8	<i>Bulbophyllum membranaceum</i>	2		
9	<i>Bulbophyllum beccarii</i>	1		
Total		46		



The species diversity index (H') is used to determine the level of species diversity. According to Indriyanto (2006) suggests that ecosystems can be used to measure community stability. Species diversity is also a unique characteristic of the community level of a biological organization that expresses community structure.

Based on the results of the species diversity index (H') calculation, the species diversity of orchids in lane 1 (the naturally grown lane) is 1.07, which is included in the low category, while the species diversity (H') of orchids in lane 2 (the cultivated lane) is 1.83 is included in the low category, namely the value of the diversity index of vegetation species ≤ 2 . This is because the number of species found is low where in path 1 only 4 species of orchids are found. Meanwhile, in line 2, 9 species of orchids were found, with the number of individuals of each type having a large enough variation. A community is said to have high species diversity if the number of individual species of each species in the community is in the same or nearly the same number. Conversely, if the community is composed of only a few species or only a few species with high density and no other species, then the community is said to have low species diversity (Budhi, 2006 dalam Rizkiyah dkk 2013).

According to Alikodra (1990) in Rizkiyah et al (2013) suggests that species diversity can be found in biodiversity which is an expression of the fact that there are various forms, appearances, numbers and characteristics that can be seen at the ecosystem level, species level and genetic level. The species diversity index (H') is influenced by environmental factors such as temperature, pH, and altitude. The altitude has a significant impact on the diversity of orchid species because there are several species of orchids that are found at certain altitudes.

The results of the recapitulation can be seen that the evenness index value (E) in the natural path and the orchid cultivation path uses the Evenness Index formula. The evenness value (E) in lane 1 (Natural growing lane) of orchids is 0.77 which is included in the high category, while the evenness value (E) in lane 2 (cultivated lane) of orchids is 0.83 which is included in the high category. According to Odum (1993) who stated that the evenness index value is strongly influenced by the species diversity index and the number of species. The evenness index will have a high value if the species diversity index is high. In general, the level of evenness of vegetation types for each type of orchid is > 0.6 , this illustrates that there are certain types of vegetation that dominate so that other types of vegetation are not evenly distributed.

According to Santosa (2008) in Romdhani et al (2016) the evenness index can be used to determine the evenness of each species in a community, the evenness index can also be used as an indicator of the presence of symptoms of species dominance in a community. Species evenness index values can describe the stability of a community. The evenness value of a species is determined by the distribution of each species in each plot evenly. The more evenly distributed a species is in an ecosystem/forest vegetation type, the higher the evenness value.

The results of the calculation for the species evenness index are the same as the species diversity index because the species diversity value affects the species evenness value, the results of the field data show that the abundance is different even though it looks at the number of individuals. This shows the high ability of this type to adapt to the surrounding environment and can compete with other types.

Based on the results of the study, *Bulbophyllum lepidum* was found in lanes 1 and 2, namely the natural growth path and the orchid cultivation path, as many as 27 individuals, in lane 1, 21 individuals were found, while in lane 2, only 6 individuals were found. The host trees where the orchids attach are the guava tree (*Bellucia axinantha*), the Night Wood tree (*Diospyros maingayi*) and the Kambasira tree (*Ilex cymosa*), the height of the orchid growing on each tree varies. On line 1 (Naturally grown) orchids grow to a height of ± 2 m, while on line 2 (Cultivation) some are at chest height and around $\pm 2-2.5$ m.

Bulbophyllum lepidum is a small orchid species characterized by oval-shaped leaves between 8-11 cm long with rounded bulging petioles. Perfect flowers will form a fan-shaped arrangement with various colors depending on the habitat in which they grow. In general, this orchid flower is maroon to red at the base with whitish yellow edges. Adult orchids will form



large clumps that can cover the entire surface of tree trunks or rocks where they live. *Bulbophyllum lepidum* will flower at the turn of the season and will produce flowers on each bulb or flower stem which can be very large in number, this is what makes the Fan Orchid Dewi Venus much collected by hobbyists and orchid lovers both at home and abroad (Suryowinoto, 1998).



Figure 1 – *Bulbophyllum lepidum*

Based on the results of the study, *Dendrobium aloifolium* was only found in line 2, namely in the orchid cultivation route of 16 individuals. The host trees for this orchid attachment are Ehang trees (*Litsea resinosa*), Jelutung trees (*Dyera costulata*) and Bintangur trees (*Calophyllum tetrapterum*). The height of the orchid growth on each tree varies in lane 2 (Cultivation) some are as high as the chest and some are only ± 1.3 m.

This orchid includes orchids that live in the lowlands, besides that this orchid likes a shady place and usually grows on mossy trees, but doesn't need too much sun. This orchid lives as an epiphyte, is sympodial, grows tightly, has short small stems, only one leaf grows on each stalk. The roots are attached to the tree or where it grows, white, hollow and soft. Slightly flattened stem covered with rows of leaves and 17-20 cm long. The leaves of this orchid are braid-shaped, the leaves are also fleshy, the leaf edges are flat, the upper and lower leaf surfaces are rough, with blunt leaf tips, and are green in color, leaves 1.9-2.9 cm long and 1.0-1.5 cm wide. The flowers are white and light green when small buds emerge from the tips of the bulbs (Suryowinoto, 1998).



Figure 2 – *Dendrobium aloifolium*



Based on the results of the study, *Bulbophyllum beccarii* was found in lanes 1 and 2, namely the natural route and the orchid cultivation route, as many as 12 individuals, in lane 1, 11 individuals were found, while in lane 2, only 1 individual was found. Host trees for orchids are guava trees (*Bellucia axinanthera*), Nyatoh trees (*Palaquium rostratum*) and Sand trees (*Stemonurus secundiflorus*). The height of growing orchids on each tree varies. On line 1 (Naturally growing) orchids grow to a height of ± 1.5 m, while on line 2 (Cultivation) some are at chest height and around ± 1.5 -2 m.

Bulbophyllum beccarii is a perfect climber and belongs to the epiphytes. Rhizome pseudo-stem tuber diameter reaches 2.5-20 cm, fat, climbs in a spiral shape on the tree. Many roots along the rhizome with a diameter of 1-3 mm. The pseudobulbs are 18-19 cm long separately. The leaves can reach 26-50 x 18.5-38 cm in length. Flower stalks 12-43 x 7-14 cm long, decorated with many dense flowers. Flowers 2 x 1.5 cm with a bad smell, blackish purple. The fruit will be 2-3 cm long. The central petal is 1.2 x 0.4-0.45 cm long. Petal left side 1.5-1.6 x 0.5-0.7 cm long triangular-ovate. The flower crown is 0.9-1 x 0.25-0.3 cm long. Flower lip 0.5-0.6cm, 0.3 wide at base (Pranata, S.A. 2005).



Figure 3 – *Bulbophyllum beccarii*

Based on the results of the study, *Bulbophyllum lyriforme* was found in lanes 1 and 2, namely the natural route and the orchid cultivation route, as many as 11 individuals, in lane 1, 1 individual was found, while in lane 2, only 10 individuals were found. The host trees where the orchids attach are the Ketiau trees (*Dioscorea hispida*) and Ehang trees (*Litsea resinosa*). The height of growing orchids on each tree varies, which is around ± 2 m.

Bulbophyllum lyriforme is found in Kalimantan in lowland forests at an altitude of 14 to 18 meters above sea level, as an epiphyte spiraling up tree trunks. The plant is very similar to *Bulbophyllum macranthum* and sometimes also physically similar to the plant from *Bulbophyllum patens*, except that the tips of the leaves of *Bulbophyllum* are blunter than *Bulbophyllum lyriforme*. It has hairy roots that are not closely spaced, all tubers are oval-ovate in shape, and there is a single leaf that is dark green in color, stretches straight, and is slightly pointed at the end.

Flowers: Single, very fragrant, always in a state of imperfect bloom. Dorsal sepals (crown of dorsal fins) 6.5 mm wide and 3 cm long anteriorly. Petals 3 mm wide and 3 cm long extending laterally then forwards Sepal lateris (crown of ribs) 3 cm long forward. The dorsal sepals and petals have a white base color with dark red to purple blotches. But the lateral sepals are yellow/orange and white. This color difference is very contrasting, it can be seen that the bottom half is yellow and the other half is white. Like *Bulbophyllum macranthum*, the people in Central Kalimantan are called "Orchid Agarwood", they say that its strong fragrance smells like resin (Indrawati, dkk 2017).

Based on the results of the study, *Eria lobata* was only found in line 1, namely the natural growth path of 6 individuals of orchids. The host trees for this orchid attachment are Ehang trees (*Litsea resinosa*) and guava trees (*Bellucia axinanthera*). At each height the orchid grows very varied starting around ± 2 -3 m.



Figure 4 – *Bulbophyllum lyriforme*

Epiphytic orchid with an oval bulb the size of the thumb, leaves each bulb as many as 2 strands 25-35 cm long and 5 cm wide. Panicle-shaped flowers elongated 25-30 cm with small flowers 1 cm wide emerging from the bulb part of the orange flower color with a pale yellow tongue. Grows predominately in forests with shade on low stems. Flowers 1-2 stalks compound. The fruit is formed evenly after the inflorescence size is 2 x 1 cm and its spread is very easy. It is assumed that it is easy to reproduce itself other than by bulb (vegetatively) or by seeds from fruit.



Figure 5 – *Eria lobata*

Based on the results of the study, *Bulbophyllum lasiantum* was only found in line 2, namely in the orchid cultivation route of 5 individuals. The host tree where this orchid attaches is the Sand-sand tree (*Stemonurus secundiflorus*), the Medang tree (*Litsea resinosa*) and there are also dead trees. Each individual orchid has a height of about \pm 2-3 m each.

Bulbophyllum lasiantum is found in Java, Sumatra, Kalimantan and Malaysia in lowland and low mountain forests at sea level elevations up to 1200 meters in shady moist forests on trees and rocks as epiphytes or lithophytes which grow hot to cold small in size with 4 to between 4 each, slightly flattened, bulb cylindrical with single leaf, apical, elliptical, obtusely pointed, summer-blooming leaves erect, stout, 4 to 17 cm long, covered at base with numerous spiky midribs, up to 15cm inflorescence bearing a fetid odor, doesn't open properly. Very similar to *adelphidium B* but this one differs in longer inflorescences, looser racemes and larger flowers.

Based on the results of the study, *Bulbophyllum membranaceum* was only found in line 2, namely in the orchid cultivation route of 2 individuals. The host tree where this orchid is attached is the guava tree (*Bellucia axinanthera*), the height of the orchid grows \pm 1.5 m.



Figure 6 – *Bulbophyllum lasiantum*

This species is also part of the Asparagales order. The species *Bulbophyllum membranaceum* is part of the genus *Bulbophyllum*. Pseudo tubers are small, carry one egg-shaped leaf with a pointed tip. This orchid seems to prefer a shady place. No flowers found. Spread in Sumatra, Sulawesi, Peninsular Malaysia.



Figure 7 – *Bulbophyllum membranaceum*

Based on the results of the study, *Bulbophyllum anceps* was only found in line 2, namely in the orchid cultivation route with 2 individuals. The host tree where this orchid is attached is the Meranti tree (*Shorea* spp.), the height of the orchid grows ± 1.5 m.

This typical Borneo orchid lives as an epiphyte on trees that inhabit lowland forests to hilly highlands with an elevation of 50 m. This orchid has a very flat bulb which is different from the other *Bulbophyllum* because it has a pseudobulb shape like a piece of jengkol fruit so that some call it the jengkol orchid. An orchid plant with a plant height of 25 cm which flowers has a size of 2-3 on the leaves and has 3-5 bulbs that are neatly arranged and live on a small tree trunk so that the tree trunk becomes covered by it. The flower stalk appears at the base of the pseudo bulb which supports 2 flowers. The flower stalk has several branches which contain 2-3 flowers. Yellow flowers with red stripes on the petals and red blotches on the three sepals, red short labellum and easily wavy. This orchid has oval-shaped leaves and is rather stiff/hard. This orchid can be planted in pots made of clay with fern, coir, charcoal, kadaka and moss media. This orchid grows at a temperature of 23-31°C and requires a light intensity of 50%. This orchid flowers from January to May and September to December.



Figure 8 – *Bulbophyllum anceps*

Based on the results of the study, *Bulbophyllum* sp was only found in line 2, namely in the orchid cultivation route with 2 individuals. The host tree where this orchid is attached is the Rengas tree (*Gluta aptera*), the height of which grows about ± 1.3 m.

The type of *Bulbophyllum* sp orchid is an orchid that is epiphytic and can be recognized by its round bulb shape and has one leaf with a length of 2 - 26 cm and a leaf width of 1 - 4 cm. The leaf shape is smooth and the opal-shaped tip is rounded and tapered (Siregar et al, 2005).



Figure 9 – *Bulbophyllum* Sp

Based on the results of the study, *Dendrobium pachyphyllum* was only found in line 2, namely in the orchid cultivation route with 2 individuals. The host tree where this orchid is attached is the Kumpang tree (*Knema latericia*), the height of the orchid plant is around $\pm 1.5-2$ m.

Dendrobium pachyphyllum is native to Assam, Bangladesh, Myanmar, Thailand, Malaysia, Vietnam, Sumatra, Java, Borneo and the Philippines. On Java, they grow at altitudes from sea level to 1000 m, on Borneo they occur at 600-2100 m. They grow low in the branches of trees in marshes, in gardens, in open spaces and along roads. They rarely appeared in primeval forests and never in places with low light levels. It is a small epiphyte, growing hot to cold, up to 10 cm, sometimes only 4 cm, with a shiny, thin base, apical swelling, 1-5 cm long, rarely 8 cm, 2-stemmed stem, succulent, erect to spreading, thick, fleshy, oval, glossy, yellow green, leaves 1-5 cm long with red tips.



Figure 10 – *Dendrobium pacyphyllum*

Thick-leaved *Dendrobium* blooms in a short opening up to 1 cm, axillary, successively or together, multiple inflorescences bearing short-lived, occasionally fragrant flowers that emerge from between the leaves and occur in spring. Flowers that may not open fully are roughly the same size as the pseudobulbs or leaves. The broad flakes of the outer whorl and the narrow flakes of the inner whorl may be white, cream or yellow, usually with purple streaks. Lips are usually cream in color. It may have red veins and dark spots at the top of the central patch, or it may be white with a greenish-yellow spot in the center.

CONCLUSION

The types of orchids (Orchidaceae) found at the research site are located in the Sebangau National Park area, to be precise, in the Koran River area, there are 3 (three) genera, namely *Bulbophyllum*, *Dendrobium* and *Eria*. At the time of the study, 2 research lines were used, namely line 1 (the path naturally overgrown with orchids). There were 4 (four) types of orchids, namely: *Bulbophyllum lepidum*, *Bulbophyllum beccarii*, *Eria lobata* and *Bulbophyllum lyriforme*. Whereas in Line 2 (Orchid cultivation route) found 9 (nine) types of orchids namely: *Dendrobium aloifolium*, *Bulbophyllum lyriforme*, *Bulbophyllum lepidum*, *Bulbophyllum lasiantum*, *Bulbophyllum membranaceum*, *Bulbophyllum anceps*, *Bulbophyllum* sp. and *Dendrobium pacyphyllum* and *Bulbophyllum beccarii*.

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