

Research Article

Diversity of Orchid species in the Tilu Mountains Region of Indonesia and the Potential for Phytochemistry

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ABSTRACT

Orchids are one of the largest and globally distributed plant families. Indonesia has the most types of orchids, estimated around 20% from the total species across the world. Mainly orchids used as an ornamental plant. This research aimed to elucidate another potential of orchids as possibly for herbal medicine plant. The potential of orchids as herbal medicine has been known for a long time, but there is lack of well-documented research. The research method used in this research is exploration on predetermined research sites that were conducted in Mount Tilu, West Java on 2022. Observation data of orchids were collected on the sites and the analysis was carried out in a qualitative descriptive approach by describing the data from the research results and comparisons were made through a literature review. Based on the research results, we found about 31 species from 28 genera consisting of 24 epiphytic orchids and 7 terrestrial orchids in the Mount Tilu Kuningan area, West Java. There are 4 endemic species categorised in Java; *Chilochista javanica*, *Crepidium kordesii*, *Crepidium junghuhnii*, and *Taeniophyllum biocellatum*.

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INTRODUCTION

Orchids are one of the largest and globally distributed plant families (Chase et al. 2015; Christenhusz & Byng 2016; Zhang et al. 2022). Orchids are plants with a variety of shapes, colours and sizes so that these plants are very popular and are in great demand (Zhang et al. 2018; Tiwari et al. 2024). Until now the number of orchids in the world is 29,199 species that have been accepted (Govaerts et al. 2017), with several hundred new species that have been published every year, for example as many as 370 in 2013 and if estimated, the total number of orchids is about 31,000 species (Joppa et al. 2010). In Indonesia, orchid plants have the most types, namely around one fifth from the total species when compared to other types of flowering plants (Kusmana & Hikmat 2015), spread across nations including lowland and upland orchids (Yudaputra et al. 2024).

Generally, the use of orchids is usually used as an ornamental plant. In addition, orchids can also be used as decoration in the form of dried flowers and herbal medicine (De et al. 2014). The potential of orchids as herbal medicine has been known for a long time, but it is not very popular compared to ornamental plants (Sulistriarini 2008). The content of

alkaloids, flavonoids, glycosides, and other phytochemicals in orchids makes these plants have an important role as herbal medicinal ingredients (Jalal et al. 2008). Chinese society is known for the first-time using orchids as medicine. Then there is India, several countries in the Americas (Aztecs), Africa (Zulu), Europe (Greece), and Australia (indigenous people and Australian aborigines) also use orchids as medicine (Hossain 2011). The Batak Ethnic Community of North Sumatra (Karo, Simalungun, Toba) is known to also use orchids for traditional medicine (Aswandi & Kholibrina 2021).

On the island of Java, it is not known that there are publications that use orchids other than for the cultivation of ornamental plants, even though Java has many types of orchids. In the notes of Chomber (1990), states that the island has about 731 species with 231 endemics with a total spread in the West Java region of 642 species. Mount Tilu, Kuningan is an area in West Java which is known to have the potential to find orchids. The types of orchids on Mount Tilu had previously been collected by the Kuningan District Environmental Management Agency and the Indonesian Tropical Nature Institute in 2006, but only 5 species of epiphytic orchids were found (*Eria multiflora*, *Eria junghuhnii*, *Dendrochilum* sp., *Pholidota ventriculosa*, and *Appendicula pendula*).

MATERIALS AND METHODS

Research Geographical Sites

The research was conducted in the Mount Tilu Region to be precise in Cimara Village, Kuningan Regency, West Java in January 2022. Administratively, the Mount Tilu area is included in Karangkencana District and Cibingbin District. Located in the geographical position S 07° 06' 12.2"

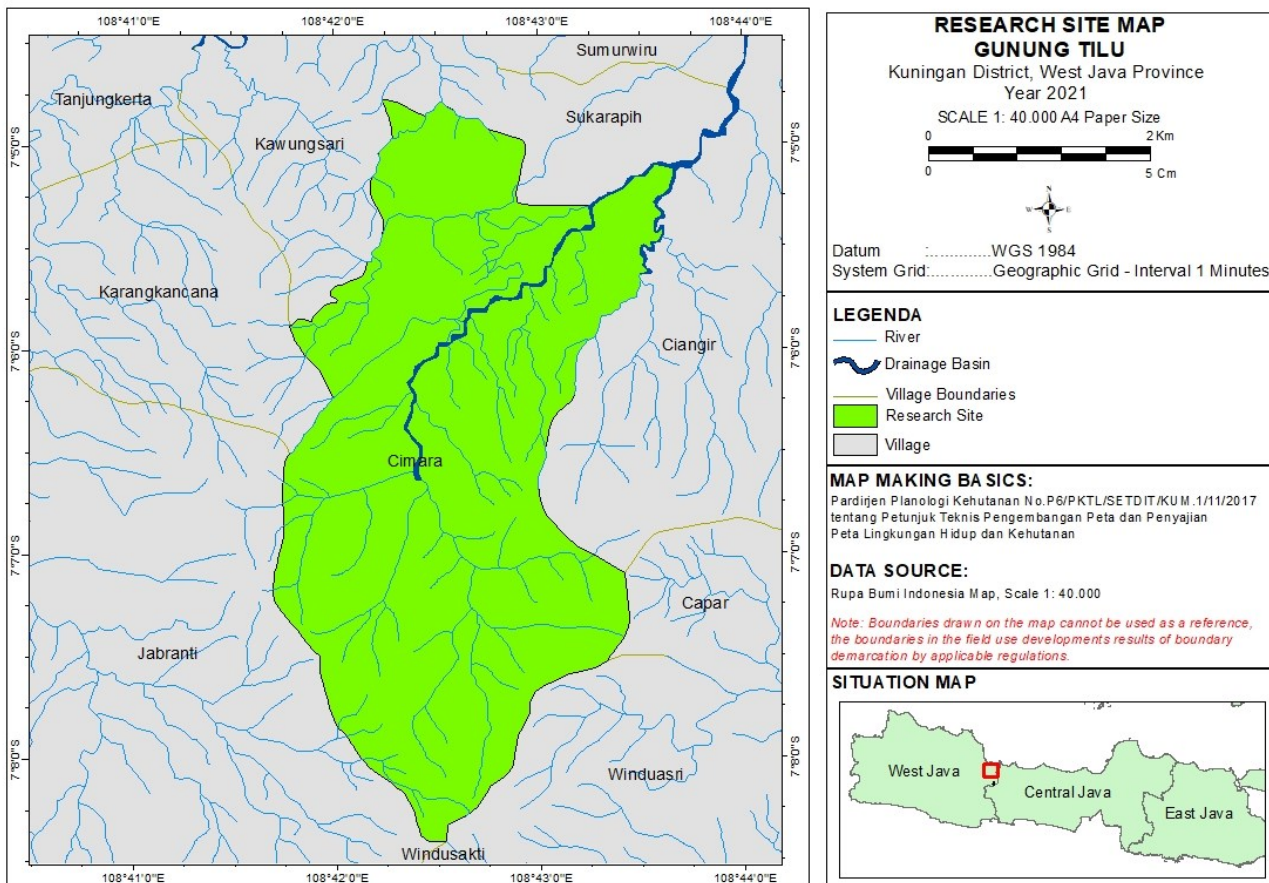


Figure 1. The research location of Mount Tilu, Cimara Village (VMJX+CM Cimara, Kuningan Regency, West Java).

and E 108° 41' 47.7" to S 07° 07' 48.1" and E 108° 41' 39.0" (Figure 1).

Mount Tilu is a group of mountains that has at least three highest peaks, namely Sukmana peak 1154 m, Mount Tilu peak 1076 m, and other peaks that are not known name 1112 m (Figure 2). The area consists of production forest (pine and teak) and secondary natural forest which is still a protected forest. Orchid data collection was carried out in both forest areas, which are production forest (Gagajahan Route) and secondary natural forest (Datarmuncang Route, Mungkal Bangkong Route, around Curug Manteng).

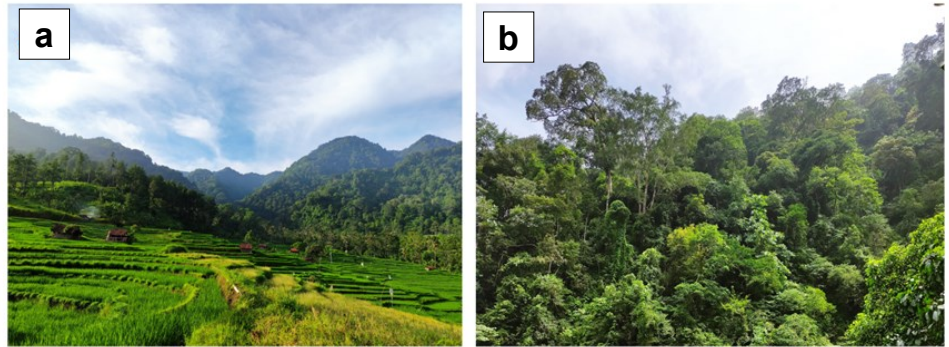


Figure 2. a). Mount Tilu have mountaintops; b). Secondary natural forest.

Materials

The tools and materials used in this research were documentation tools (Sony HX350 pro-summer camera), morphological measuring tools (ruler), GPS Locus Map, environmental parameter measuring tools (soil tester, thermometer, hygrometer, lux meter). The research exploration of orchids species in Mount Tilu were also use any equipment for human safety while tracing the mountain, such as special shoes, hat, special cloths, bag, and stick (Figure 3).

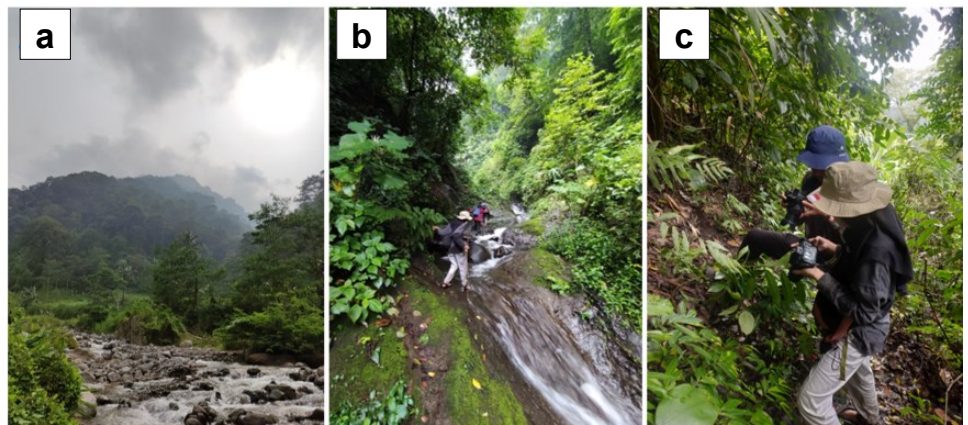


Figure 3. a) Research site around forest; b) Special wears and hat; c) Documentation tools used Sony HX350 pro-summer camera.

Methods and Data Analysis

The research method used is exploration on predetermined research paths. Data analysis was carried out in a qualitative descriptive manner by describing the data from the research results and comparisons were made through a literature review.

RESULTS AND DISCUSSION

The orchids on the Mount Tilu area

Based on the research results, there were 31 species from 28 genera con-

sisting of 24 epiphytic orchids and 7 terrestrial orchids in the Mount Tilu (Figure 4). Of all the species found, there are 4 species of orchids that fall into the endemic category of Java, namely *Chilochista javanica*, *Crepidium koordersii*, *Crepidium junghuhnii*, dan *Taeniophyllum bicelatum* (Table 1).

The results of a comparison of orchid finding data between a 2006 study by the Kuningan Regional Environmental Management Agency (BPLH) and the Indonesian Tropical Nature Institute (LATIN), the species found today are new species that have never been found before. However, 5 species of orchids (*Appendicula pendula*, *Eria junghuhnii*, *Eria multi-*

Table 1. Comparison of the findings of the types of orchids found in the Mount Tilu area.

No	Orchid Type	Habitat	2006	2022	Endemic
1	<i>Acriopsis liliifolia</i>	Epiphyte	-	1	-
2	<i>Aerides odorata</i>	Epiphyte	-	1	-
3	<i>Appendicula pendula</i>	Epiphyte	1	-	-
4	<i>Ascocentrum miniatum</i>	Epiphyte	-	1	-
5	<i>Bulbophyllum</i> sp.	Epiphyte	-	1	-
6	<i>Calanthe triplicata</i>	Terrestrial	-	1	-
7	<i>Chiloschista javanica</i>	Epiphyte	-	1	end. Java
8	<i>Coelogyne speciosa</i>	Epiphyte	-	1	-
9	<i>Coelogyne trinervis</i>	Epiphyte	-	1	-
10	<i>Cleisostoma discolor</i>	Epiphyte	-	1	-
11	<i>Dendrobium secundum</i>	Epiphyte	-	1	-
12	<i>Dendrobium setuarti</i>	Epiphyte	-	1	-
13	<i>Dendrochilum</i> sp	Epiphyte	1	-	-
14	<i>Eria junghuhnii</i>	Epiphyte	1	-	-
15	<i>Eria multiflora</i>	Epiphyte	1	1	-
16	<i>Flickingeria angulata</i>	Epiphyte	-	1	-
17	<i>Flickingeria</i> sp	Epiphyte	-	1	-
18	<i>Gastrochilus</i> sp	Epiphyte	-	1	-
19	<i>Geodorum densiflorum</i>	Terrestrial	-	1	-
20	<i>Habenaria reflexa</i>	Terrestrial	-	1	-
21	<i>Liparis barbata</i>	Terrestrial	-	1	-
22	<i>Liparis</i> sp	Epiphyte	-	1	-
23	<i>Luisia antennifera</i>	Epiphyte	-	1	-
24	<i>Crepidium junghuhnii</i>	Terrestrial	-	1	end. Java
25	<i>Crepidium koordersii</i>	Terrestrial	-	1	end. Java
26	<i>Pholidota</i> sp	Epiphyte	-	1	-
27	<i>Pholidota imbricata</i>	Epiphyte	-	1	-
28	<i>Pholidota ventriculosa</i>	Epiphyte	1	-	-
29	<i>Polystachya concreta</i>	Epiphyte	-	1	-
30	<i>Rhyncostylis retusa</i>	Epiphyte	-	1	-
31	<i>Schoenorcis juncifolia</i>	Epiphyte	-	1	-
32	<i>Spathoglotis plicata</i>	Epiphyte	-	1	-
33	<i>Taeniophyllum bicelatum</i>	Epiphyte	-	1	end. Java
34	<i>Vanda tricolor</i>	Epiphyte	-	1	-
35	<i>Zeuxine gracilis</i>	Terrestrial	-	1	-
36	<i>Zeuxine</i> sp	Epiphyte	-	1	-
Amount			5	32	4

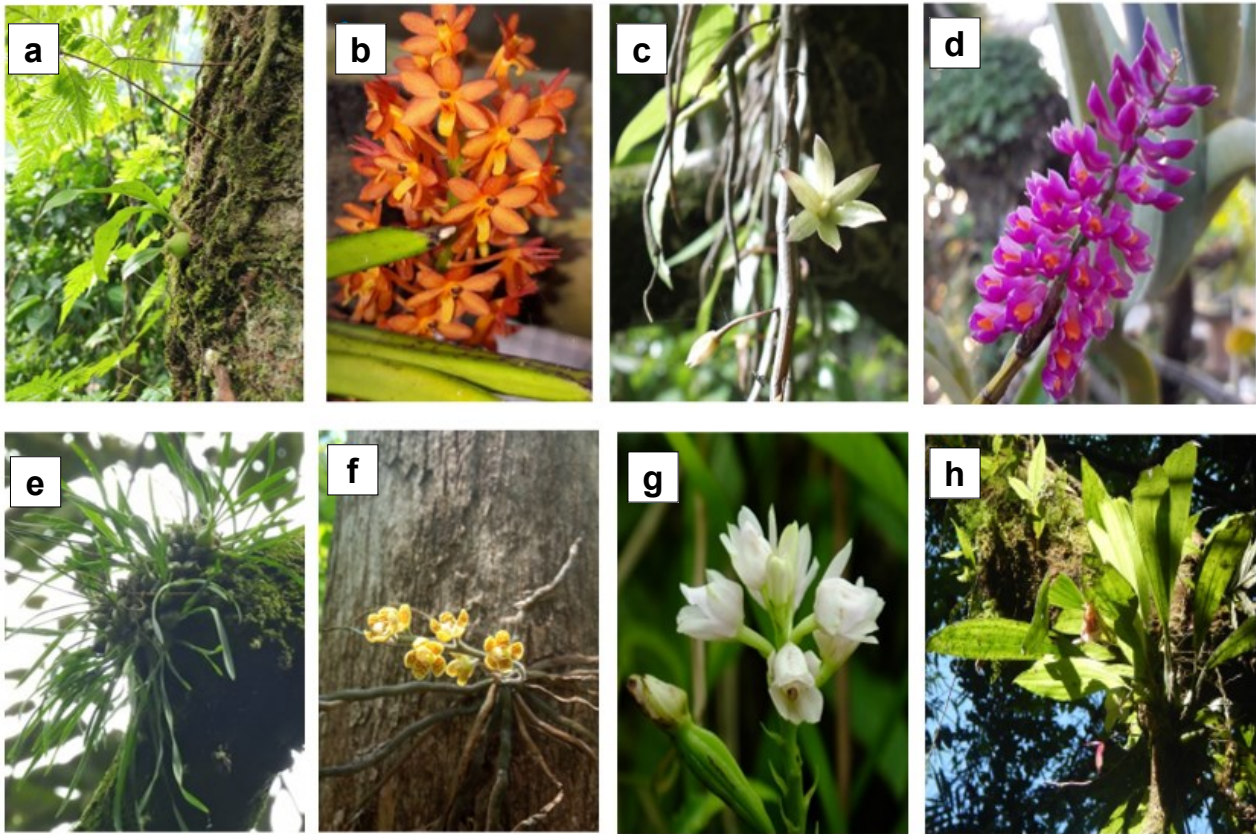


Figure 4. a). Orchids types in the Mount Tilu area; b). *Acrosentrum miniatum* c). *Dendrobium stuartii*; d). *Dendrobium secundum*; e). *Acriopsis liliifolia*; f). *Chilochista javanica*; g). *Geodorum densiflorum*; h). *Coelogyne speciosa*. (Source: Research exploration team 2022)

flora, and *Pholidota ventriculosa*) previously recorded were not found at all in the study site. This may have occurred due to differences in sampling locations (the research locations conducted by BPLH and LATIN were not specified), the observation area was not wide enough, the length of the study, or the species no longer existed at the study site.

Based on figure 5, of the 32 species of orchids found, the species that had a total count of >50 individuals, *Calanthe triplicata* (56 individuals), *Crepidium junghuhnii* (84 individuals), *Dendrobium stuartii* (67 individuals), *Flickingeria angulata* (343 individuals), *Flickingeria* sp. (64 individuals), *Pholidota* sp. (60 individuals). In addition, there are also several species that are found quite a lot like *Habenaria reflexa* (45 individuals), *Aerides odorata* (43 individuals), *Acriopsis liliifolia* (32 individuals), and *Zeuxine* sp (30 individuals). While the species with the least number of individuals were found among them *Ascocentrum miniatum*, *Chilochista javanica*, *Cleisostoma discolor*, *Coelogyne speciosa*, *Coelogyne trinervis*, *Crepidium koordeesii*, *Geodorum densiflorum*, *Liparis barbata*, *Liparis* sp, *Schoenorcis juncifolia*, and *Spathoglottis plicata*.

Figure 6 shows the plots of orchids found at the study site. The distribution of orchids in the Mount Tilu area mostly tends to be well clustered epiphytic and terrestrial orchids, although some species are randomly distributed. There are three types of ecological distribution patterns of plants, namely clustered, random, and uniform (Borregaard et al. 2009). The distribution of clusters of orchids is caused by the environment that forms a microclimate for orchids to grow and reproduce. Usually at certain locations in an area, there are orchids found in large quantities and some are not. This is due to different environmental conditions within an area. The method of reproduction of orchids is also the cause of the clustered distribution pattern. Vegetative propagation of orchids uses

rhizomes or pseudobulbs which produce large numbers of new individuals and usually grow close to their parents. Apart from that generatively, orchids also produce thousands to millions of seeds. The existence of a host tree can catch the distribution of orchid seeds, so they don't fall too far and live close together (Kurniawan & Mustika 2021).

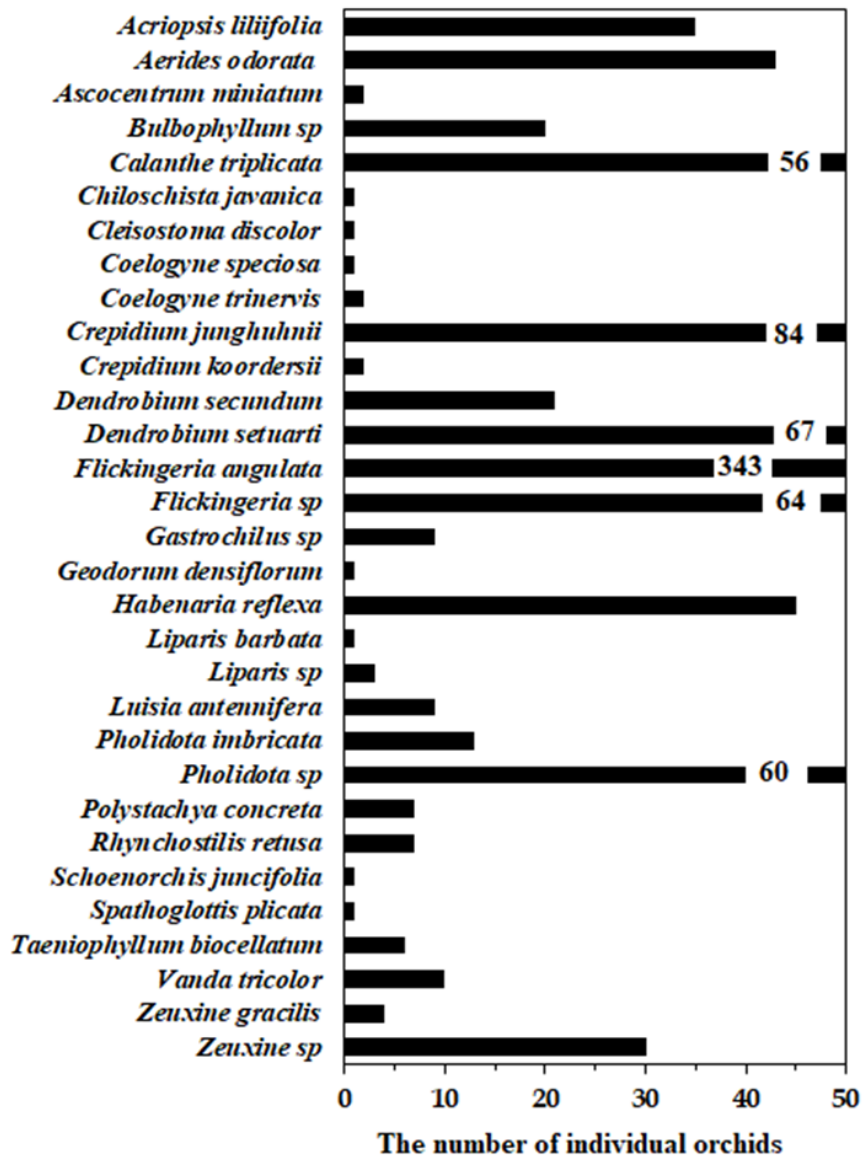


Figure 5. Number of individual orchid species in the Mount Tilu area.

When viewed based on the type of habitat, the proportion of found epiphytic orchids is greater (77%) than terrestrial orchids (23%) (Figure 7). This is because the condition of the host trees in the area has a large diameter with a dense canopy cover. Most of the epiphytic orchids are found in tree crowns, especially in large tree branches and in groups, although some are found singly. In addition, there are also those found on the main stem such *Coelogyne speciosa* dan *Dendrobium stuartii*. For other parts such as the base of the tree or the outermost branches, no epiphytic orchids were found. This is because at the base of the tree the condition is upright 90° making it difficult for the orchid to stick and get a little sunlight because it is blocked by the surrounding vegetation. Whereas the outermost branches will be exposed to high intensity direct sunlight, small branches, and the risk of being exposed to wind is also large, so they are not very suitable for orchid growth (Marsusi et al. 2001).

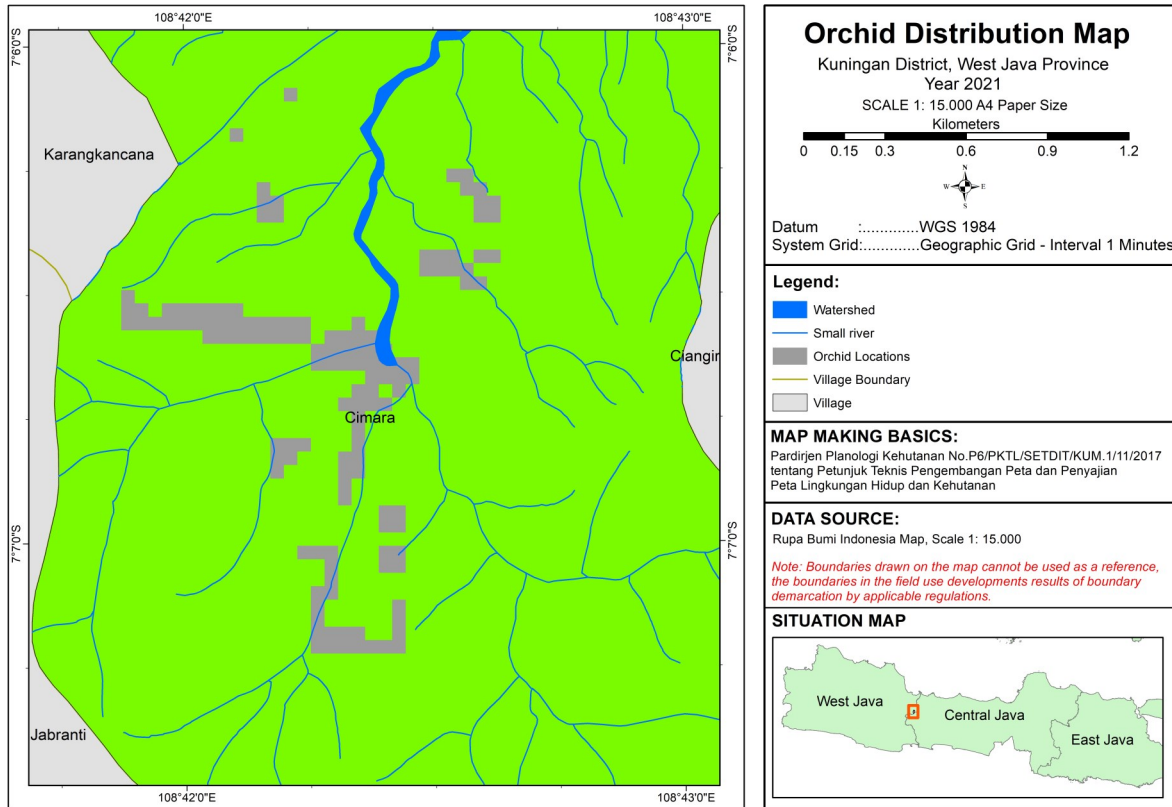


Figure 6. Map of orchid distribution findings in the Mount Tilu area, Kuningan, West Java shown with the grey colour.

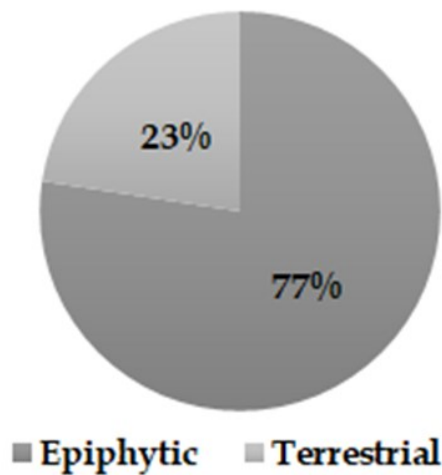


Figure 7. Comparison of the types of orchids found based on their habitat type.

The following are the types of host trees used by epiphytic orchids to grow and develop. The host trees found in the study area consisted of 10 species from 9 families (Table 2).

Each of these host trees, most of them have the characteristics of rough skin, cracks, easy to peel, and not too hard. Such tree conditions favour epiphytic orchids to grow. Rough tree bark occurs because the tree is able to hold water and humus in the cracks of the tree bark so that it becomes moist, making it suitable for the growth of orchids because these plants like high humidity. However, the roughness of tree bark is not a reference for the growth of epiphytic orchids, this is because there are several types of orchids that are able to live on smooth tree bark

(Bergstrom & Carter 2008; Yulia & Budiharta 2010). Like *Vanda tricolor* that grows on kedondong, *Acriopsis liliifolia* on durian trees, and *Pholidota imbricata* on a banyan tree. The three types of hosts at the study site appeared to have fairly smooth tree bark compared to other hosts. Then, the host trees that were found also did not have very dense canopies, so that was in accordance with the statement of Seitske et al. (2001), that orchids like trees that do not have too dense canopies so that the need for light will be fulfilled. In addition, several types of epiphytic orchids were also found on different types of hosts, indicating that these species have a high tolerance for different environments so that they are easy to adapt and grow on several types of hosts.

Table 2. Host tree species of epiphytic orchid habitat.

No	Family	Host Tree Type	Orchid Type
1	Anacardiaceae	<i>Spondias dulcis</i>	<i>Vanda tricolor</i>
2	Dilleniaceae	<i>Dillenia sp</i>	<i>Aerides odorata</i> <i>Polystachya concreta</i>
3	Flacourtiaceae	<i>Pangium edule</i>	<i>Aerides odorata</i>
4	Malvaceae	<i>Durio zibenthinus</i>	<i>Acriopsis liliifolia</i>
5	Meliaceae	<i>Swietenia mahagoni</i>	<i>Luisia antennifera</i> <i>Taeniophyllum bicelatum</i>
6	Moraceae	<i>Artocarpus heterophyllus</i>	<i>Ceologyne speciosa</i> <i>Polystachya concreta</i> <i>Rhyncostilis retusa</i>
7	Moraceae	<i>Ficus sp</i>	<i>Bulbophyllum sp</i> <i>Flickingeria angulate</i> <i>Liparis sp</i> <i>Pholidota sp</i>
8	Phyllantaceae	<i>Bischofia javanica</i>	<i>Flickingeria angulate</i> <i>Luisia antennifera</i>
9	Pinaceae	<i>Pinus merkusii</i>	<i>Aerides odorata</i> <i>Chilocista javanica</i> <i>Dendrobium stuartii</i> <i>Rhyncostilis retusa</i>
10	Verbenaceae	<i>Tectona grandis</i>	<i>Pholidota imbricata</i>

Based on data on the composition of terrestrial orchids, the number found was very small, namely 8 species (Table 3). The condition of terrestrial orchids that were flowering at the study site facilitated the identification process at the species level. Although there are many orchids *Calanthe triplicata* found that are not flowering or in a state of fruiting. In addition to orchids *Habenaria reflexa* most of them are still in a state of budding, so you need to monitor them for a few days until the flowers bloom. The abundance of individual terrestrial orchids is very high and tends to cluster in one area in particular *Calanthe triplicata*, *Crepidium junghuhnii*, *Habenaria reflexa*, and *Zeuxine sp* (Figure 1). The clustering of terrestrial orchids in close proximity is due to the presence of stolons in the soil, so that new individuals grow not far from their parents

(Puspitaningtyas et al. 2003). Even so, the spread of ground orchids in a wide scope can also be through seeds.

Table 3. Terrestrial orchid habitat in Mount Tilu area.

No	Types of Terrestrial Orchids	Habitat
1	<i>Calanthe triplicata</i>	Soil litter
2	<i>Crepidium junghuhnii</i>	Soil litter and rocks
3	<i>Crepidium kordesii</i>	Soil litter
4	<i>Liparis barbata</i>	Soil litter
5	<i>Habenaria reflexa</i>	Soil litter
5	<i>Spathoglotis plicata</i>	Soil litter
6	<i>Zeuxine gracilis</i>	Soil litter
7	<i>Zeuxine sp</i>	Soil litter

The types of terrestrial orchids that are found are mostly in the shade of trees. But there are also orchids *Spathoglotis plicata* which can live with full light or no shade (Sadili & Sundari 2017), and these orchids are found on river banks with open environmental conditions. If you look at the specific conditions of their habitat, almost all of the terrestrial orchids that were found grew on soil litter except for *Crepidium junghuhnii* growing on large rocks (Table 3). The reason for terrestrial orchids being found and growing in soil with weathered litter content is that the source of nutrition for terrestrial orchids completely comes from the soil or litter. Meanwhile, the stone used to grow terrestrial orchids has moss, which causes high humidity, because the water is stored in the moss. Humid conditions will provide good water availability for terrestrial orchids or microorganisms associated with orchids (Tirta et al. 2010).

The richness of orchid species in the Tilu Mountain area cannot be separated from environmental influences such as humidity, temperature, pH, light intensity, and altitude. Measurement of environmental parameters was carried out in the time range 07.00-15.00 WIB. Based on the results of the average measurement of environmental parameters, this location is suitable for orchid growth (Table 4).

Table 4. Average measurement results of environmental parameters.

No	Environmental Parameters	Measurement Result (Average)
1	Soil moisture (%)	53
2	Humidity (%)	72
3	Temperature (°C)	26
4	pH	5
5	Light Intensity (Lux)	2477
6	Place Altitude (m)	330-777

The average results of measuring soil moisture in the study area were 53% and 73% for air humidity. Orchids will grow optimally with 50-80% humidity (Purwanto 2016). The results of temperature measurements were 26°C. The ideal environmental temperature for orchid growth is 25-27°C, with a minimum temperature of 21-23°C. Daytime temperature 27-32°C and night temperature 21-24°C (Farokhah et al. 2018). Furthermore, for pH measurements of 5, where the ideal pH for orchids is 5-6 (Naik et al. 2014). For the measurement of light intensity

of 2,477 lux. The light requirements for orchids vary depending on the type. Some require direct light around 5000 lux, light (3000-5000 lux), medium (2000-3000 lux), and under shade (1000 lux) (Jacquemyn et al. 2007).

Based on the altitude, all types of orchids found on Mount Tilu are found at an altitude of 330-777 meters above sea level. Orchid diversity in Java is found at an altitude of 500-2000 m as much as 90%, in the lowlands 9%, and upland 1% (Yudaputra et al. 2024). Although at the research location orchid species were found at an altitude of 300 meters above sea level, these conditions indicate that orchids are not only found at an altitude of 500 meters above sea level. This is in accordance with the statement of Steenis (1975), that orchids can be found at altitudes below 500 meters above sea level or more than 2000 masl, and the diversity of orchid species will decrease. If viewed based on the influence of environmental parameters, it is clear here that these factors greatly influence the diversity of orchids.

Potential Utilisation of Orchids in the Mount Tilu Area

In Indonesia, the use of orchids is mostly for ornamental plants. Even internationally, orchids play an important role in the cut flower industry because of their attractiveness, long shelf life, high productivity, proper blooming season, easy packing and transportation. Orchids account for a large part of the global floricultural trade as cut flowers and as pot plants and are estimated to account for around 10% of the international trade in fresh cut flowers (De et al. 2014; Zhang et al. 2022).

If we look at the use of orchids as ornamental plants, these plants play a very important role in supporting the community's economy. Unfortunately, there are still many people who tend not to know the various types of natural orchids so that their use is very limited. As is the case with the local people on Mount Tilu, no one has used orchids either for economic needs, just for decoration, or for health. Communities tend to take advantage of more promising forest products such as wood, rubber latex, medicinal plants, or honey from bees. Public knowledge of natural orchids is also very minimal, this is evidenced by the fact that they do not know if there are terrestrial orchids. They know that orchids are plants that attach to host trees. But there was lack of public knowledge about orchids causes the utilization of orchids in the area is also still lacking.

Although all types of orchids in the Mount Tilu area have the potential to be ornamental plants, most of them have small flowers, the colours are not as attractive as *Acriopsis liliifolia*, *Cleisostoma discolor*, and *Polystachya concreta*. In fact, orchids must meet several criteria in order to sell well in the market to meet consumer tastes such as flower shape, size, color, resistance, number of flowers per stalk, and fragrance. Based on the results of the study, there are several types of orchids that have beautiful flowers, one of them *Vanda tricolor* (Figure 8). These orchids are very popular among lovers of ornamental plants, but now their number in nature is decreasing. While there are other types that have quite interesting flowers *Ascocentrum miniatum* popular enough to be commercialized, *CoeLOGYNE speciosa*, *Coelogyne trinervis*, *Aerides odorata*, *Rhyncostylis retusa*, and *Calanthe triplicata*. As for *Chilochista javanica* (ghost orchid), this orchid is very unique because it has no leaves and the flowers are quite beautiful even though they are small. With the beauty of the flowers from these types of orchids, it has the potential to be developed as a hybrid (hybrid) and cultivated to fulfil the demand for ornamental plants.

In fact, the use of orchids is not only limited as ornamental plants, some are used as herbal medicine. In Indonesia itself, the Batak Ethnic



Figure 8. *Vanda tricolor*. (Source: Research team 2022)

Table 5. Potency of orchids on Mount Tilu as medicine.

No	Orchid type	Used Part	Treatment	Reference
1	<i>Aerides odorata</i>	Fruit, leaves	The fruit is mashed to heal wounds, the leaves are made into juice to cure ear and nose ulcers.	Tsering et al. 2017
2	<i>Acriopsis liliifolia</i>	Pseudobulb	Pseudo tubers are used as a febrifuge in treating malaria and raising blood pressure, the juice of the bulbs is used as ear drops	Sulistiarini 2008; Hossain 2011
3	<i>Calanthe triplicata</i>	Roots, flowers, pseudobulbs	The roots and flowers are used as an analgesic for diarrheic and cavities. Pseudobulbs are used in indigestion.	Jalal et al. 2010; Yonzone et al. 2011
4	<i>Geodorum densiflorum</i>	Roots and tubers	The root paste is taken before meals to promote menstruation in women, and applied to wounds or insect bites. The tuber extract is administered orally for intermittent fever in cattle. The root powder is given orally to goats for diarrheic symptoms.	Hossain et al. 2009
5	<i>Pholidota imbricata</i>	Pseudobulb	Pseudobulb juice is applied to relieve pain in the nose, stomach and rheumatism. Pseudobulb paste is used to reduce fever, pain and swelling during arthritis. And pseudobulb powder can be used as tonic	Vaidya et al. 2000; Baral & Kurmi 2006; Yonzone et al. 2011; Panda & Mandal 2013 ; Subedi et al. 2013
6	<i>Rhyncostilis retusa</i>	Root	The root is effective against rheumatism, asthma, tuberculosis, cramps, epilepsy, vertigo, kidney stones, menstrual disorders	Tsering et al. 2017
7	<i>Spathoglottis plicata</i>	Whole plant	A decoction of the plant is used for rheumatism and relieving internal heat.	De et al. 2014

community of North Sumatra also uses orchids as medicine. This is evidenced by the discovery of types of orchids that are traded in the main markets of Karo Regency, namely the Kabanjahe and Berastagi markets such as *Annoectochilus reindwardtii* (for fever, stamina enhancer, cancer, aphrodisiac), *Macodes petola* (aphrodisiac fever), *The nerves are folded* (aphrodisiac stomach ache), *Nervilia aragoana* (boils, fever, stamina enhancer), and *Dendrobium salacense* (stomach ache). The demand for these four orchids is high (except *Dendrobium salacense*), but its supply is low except *Nervilia Aragoana* moderate supply. In Kaban Tua Village (in Karo District) and Simbou Baro Village (Simalungan District) there are 5 species of orchids that are used as medicine, namely *Annoectochilus reindwardtii* (for fever medicine, stamina enhancer, aphrodisiac), *Godyera rubicunda* (diabetes mellitus, stamina enhancer), *Nervilia Aragoana* (fever, stamina enhancer), *Nervilia plicata* (fever, aphrodisiac), and *Phaius callosus* (diabetes mellitus). Whereas in Simbou Baro Village (Simalungan Regency) there are 2 species of orchids that are used as medicine namely *Dendrobium salacense* (abdominal pain) and *Macodes petola* (cancer, fever). The same thing happened to the people of Toba, North Sumatra, who used orchids as traditional medicine (Silalahi & Nisyawati 2015; Aswandi & Kholibrina 2021). Meanwhile in Sanggau Regency, West Kalimantan, it is known that *Plocoglottis lowii* it is also used as a medicine to detoxify various poisons in the body including psychotropic poisons (Normagiat et al. 2018).

Based on the explanation above, the potential for exploiting the wealth of orchids in the Mount Tilu area is actually unlimited. Utilisation for ornamental plants also has great potential to improve the community's economy. Although most types of orchids do not meet the criteria to meet consumer tastes, advances in hybridization technology, domestication and genetic engineering can increase the number and quality of orchids (Sadili & Sundari 2017). In addition, the potential for orchids on Mount Tilu to be used as medicine needs to be taken into account even though only a few types of orchids have been proven as medicines.

Seeing the potential utilisation of orchids in Mount Tilu, conservation activities should be carried out. Although all orchid species found are not included in the IUCN, CITES, and Indonesian Law No. P. 106 on protected plants and animals. With more than 28,000 species in the world, orchids are the second largest family after the most threatened Asteraceae (Chase et al. 2003; Chase et al. 2015). To date, there are 1098 orchid species listed on the IUCN Red List, and 48.7% of these are categorised as threatened (endangered 456 species, critically endangered 259 species, extinct 6 species, and vulnerable 240 species) by IUCN. So, the threat of orchid orchids does not only occur in Indonesia but also globally.

The threat is greatest due to habitat damage and climate change, but many orchids are also threatened due to wild harvesting for horticultural, food and medicinal purposes. Therefore, we need to take a possible approach to address threats on a broad scale. According to Fay (2018), orchid conservation efforts can be done by understanding orchid biology such as: 1. Systematics and genetics studies to identify and determine conservation priorities; 2. Conservation of habitat, e.g., host trees and physical conditions of the environment; 3. Understand pollinators and orchid pollination; 4. Understand the association with mycorrhiza, for the growth of orchid seeds. In addition, it can also control illegal harvesting for trade and carry out tissue culture propagation or conventional cultivation. Documenting and collecting orchids also help in contributing databases to conservation plans. Some of these efforts can be realized well if

elements of society and government support each other to make conservation efforts so that the orchid will not become extinct in the future.

CONCLUSION

Based on this research, we found 31 species from 28 genera consisting of 24 epiphytic orchids and 7 terrestrial orchids in the Mount Tilu Kuningan area, West Java. Furthermore, regarding the potential use of orchids on Mount Tilu, conservation activities should be carried out, although all types of orchids found are not included in the red list of IUCN, CITES, and Indonesian Law No. P. 106 concerning protected plants and animals. The use of orchids should be done wisely by carrying out conservation efforts so that these orchids will not become extinct in the future.

AUTHORS CONTRIBUTION

All authors have contributed equally to complementing this research. The contributions of each author are: BP designed, writing, collected, and analysed the data. TR and MLK assisted with collecting and analysing the data. AA carried out data processing using mapping analysis. DA assisted in the collection of data. LN assisted in all the collection data, writing, revised of the manuscript.

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CONFLICT OF INTEREST

There is no conflict of interest in this research.

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