Orchids diversity at RPH Ngebel, Ponorogo, East Java

N D Yulia and E E Ariyanti

Purwodadi Botanic Garden, Research Center for Plant Conservation and Botanic Gardens-LIPI
E-mail: ninadwiyulia@gmail.com; estimudiana@yahoo.com

Abstract. The research on the diversity of orchids at the Ngebel - Ponorogo RPH area, precisely in the Ringin Putih and Gunung Picis Forest Reserve was done. The results showed that there were 20 orchid species were consisting of 15 epiphytic orchids that belonged to 10 genera and 5 terrestrial orchids that belonged to 5 genera. Epiphytic orchids found in the area grow on host trees such as Coffea trees, Ficus and Litsea.

Keywords: Ngebel, orchid diversity, Ponorogo

1. Introduction

Orchids get higher attention than other plants because of the unique shape and color of their flowers. According to Puspitaningtyas [1] [2], although orchids are considered only as ornamental plants and not classified as staple plants in human needs, the level of concern for the extinction of this plant family is quite high. This is because the destruction of forests as a natural habitat for these orchids is increasing. Currently, the condition of the existence and diversity of orchids in their natural habitat has changed a lot. One way of being alert or the existence of an area in an area is by recording the species of orchids in their natural habitat. Forest areas on the island of Java have undergone a lot of conversion into settlements or plantations, threatening the orchid population in nature. This can lead to the extinction of orchid species before they have been properly documented or described. The presence of epiphytic species such as epiphytic orchids in natural forests can also be used as a bioindicator of the condition of a forest area because these species need a foothold in the shade of tree stands as a shelter, take nutrition, and regenerate [3] [4]. Epiphytic orchid species are the most dominant group among other vascular epiphytic groups, with different levels of population, spatial structure, and distribution in each forest ecosystem, therefore it is important to know or study [5] [6]. The condition of the orchid population will be even worse if there is a serious and extreme change in habitat by eliminating the condition of the standing vegetation of trees in the surrounding natural forest. This situation will threaten the population and life of epiphytic orchids as well as ground orchids as a whole [7].

In 1990 Comber had recorded 731 orchid species in Java; 231 of them were endemics to Java and as many as 390 species were geographically distributed in East Java [8]. One of the forest areas that has a fairly high diversity of plants in East Java is Mount Wilis. One study stated that the diversity of medicinal plants in Mount Wilis was very high in which approximately 61 medicinal plant species were recorded in the eastern part of Wilis slope at Purut, Parang village, District of Kediri. Several medicinal plants are Sataata (Androgaphis paniculata), putty lelet (Glochidion molle), kuwalot (Brucea javanica), gempur watu (Borreria hispida), forest gambier (Jasminum multi florum and Jasminum pubescens) [9]. In 2011 Yulia and Pai [10] recorded 3 species of terrestrial orchids in Gunung Manyutan Forest Reserve, Mt Wilis; while the other study resulted that there were 29 species...
of epiphytic orchids in that area state by Yulia and Budiharta [4]. However, natural forest in Mount Wilis was destructed by various causes such as illegal logging, forest fires, and landslide. Inevitably, these processes have threatened the biological diversity of the area, and particular to orchid species, illegal harvesting also contributes significantly to its population decline (Perhutani’s forest rangers, pers. comm.).

Thus, research on orchid diversity needs to be carried out, especially in East Java to save natural orchids from extinction and to monitor the presence of orchids in their natural habitat. In this research, one of the areas in Mt. Wilis, namely RPH (Forest Management Resort) Ngebel with consideration of suitable forest conditions as a natural habitat for various types of orchids was selected. This area is included in the BKPH (Forest Management Unit Section) Wilis Barat, which is managed under the Lawu Ds Forest Management Unit (KPH) Lawu Ds. Perum Perhutani Kesatuan Pemangkuan Hutan (KPH) Lawu Ds is one of the management units in the East Java Regional Division with a working area of 52,256.40 ha, of which 3,026.52 ha are Special Purpose Forest Areas (KHDTK) managed by Forestry Research and Development since 2003 according to Minister of Forestry Decree No. 290 / KptsII / 2003 dated 26 August 2003. KPH Lawu Ds is located at 07° 30’ 00” to 08° 10’ 00” South Latitude and 110° 58’ 27” to 111° 48’ 27” East Longitude [11]. This study aims to see the diversity of orchids in Ngebel RPH and their current habitat conditions.

2. Methods
The activity was carried out in April 2019 in the area of RPH Ngebel especially Ringin Putih and Gunung Picis Forest Reserve area. This research was conducted with an exploratory method by exploring the forest area in the study site through several available roads or pathways so that they could represent different habitat conditions. The location of the RPH Ngebel and observation areas was shown in Figure 1 below.

Each species of orchid found at the research location was recorded and completed with a record of the host tree species for epiphytic orchids and associated plants around the terrestrial orchids found. Identification of orchid species found in the field will be carried out up to species level (if individual orchids were in flowering stage) and only to genus level (for individuals who were not flowering). For orchid, identification activities used orchid literature as a guide [8].

Recording environmental data was also carried out in each observation area. Environmental data recorded included: light intensity, air temperature, humidity, soil acidity / pH, and altitude. Garmin GPS type eTrex Vista HGx was used to document and mark geographical positions in the field; Yenaco type SH-121 digital Thermo hygrometer was used to measure air temperature and humidity conditions; Krisbowtype KW light meter 06-28B for measuring light intensity; and Portable Soil pH Meter was used to measure soil acidity.

![Figure 1. Location of RPH Ngebel and observation areas (-7.8022785, 111.6000303,11498) (Source: Google Map, 2019)](image-url)
3. Results and Discussion

The condition of the forest was still good and had quite dense vegetation with altitudes ranging from 1,118 - 1,403 m above sea level, relative humidity ranged from 71% - 89%, temperatures of 21.3 °C - 27.6 °C, soil pH 4.6 - 5. The locations visited were shaded places to open areas, with light intensity ranging from 16.6 - 5,750 lux. The location point was at S7° 48' 06.4" - S7° 48' 23.4" and E111° 39' 54.9" - E111° 40' 28.1". Forests were dominated by pine trees, puspa (*Schima wallichii*), coffee, *Litsea*, *Ficus*. Other plants that were also often found include banana cici, *Cyathea* spp., *Zingiber spectabile*, *Elatostema* spp., and *Ageratum conyzoides*.

![Image](image_url)

Figure 2. The condition of forest vegetation in the research location

The results showed that 20 orchid species consisting of 15 epiphytic orchids (were in 10 genera) and 5 terrestrial orchids (were in 5 genera) were found in this area. Detail of the orchids species is described in Tables 1 and 2.

| No | Species name      | Host tree        | Habitat notes                                                                 |
|----|-------------------|------------------|------------------------------------------------------------------------------|
| 1. | *Vanda tricolor*  | *Coffea* sp.     | Ringin Putih Forest reserve and G. Picis; temperature 26.1-26.3°C, 415 – 1190 lux, soil pH 4.7, humidity 80-81%, altitudes 1231 – 1281 m asl. |
| 2. | *Pholidota* sp.   | *Coffea* sp.     | Ringin Putih Forest reserve; temperature 26.3°-27.5°C, humidity 73-80%, soil pH 4.7, light intensity 415-704 lux, altitudes 1231 – 1256 m asl. |
| 3. | *Liparis* sp.1    | *Coffea* sp.     | Ringin Putih Forest reserve; altitudes 1231 m asl., temperature 26.3°C, humidity 80%, light intensity 415 lux, soil pH 4.7 |
| 4. | *Dendrobium* sp.1 | *Coffea* sp.     | Ringin Putih Forest reserve; altitudes 1256 m asl., temperature 27.5°C, humidity 73%, light intensity 704 lux, soil pH 4.7 |
| 5. | *Coelogyne* speciosa | *Litsea* sp.     | Tree stump. Forest reserve Ringin Putih; altitudes 1337 m asl., temperature 25.2°C, humidity 88%, light intensity 51.9 lux, soil pH 4.7 |
| 6. | *Pinalia* flavescens | *Litsea* sp.     | Tree stump. Forest reserve Ringin Putih; altitudes 1379 m asl., temperature 24.4°C, humidity 84%, light intensity 1086 lux, soil pH 4.7 |
| No | Species name      | Host tree   | Habitat notes                                                                 |
|----|-------------------|-------------|------------------------------------------------------------------------------|
| 7  | *Vanda* sp.       | *Litsea* sp.| Tree stump Forest reserve Ringin Putih; altitudes 1379 m asl., temperature 24.4°C, humidity 84%, light 1086 lux, soil pH 4.7 |
| 8  | *Rhynchoystis retusa* | *Litsea* sp.| Tree stump. Forest reserve Ringin Putih; altitudes 1379 m asl., temperature 24.4°C, humidity 84%, light intensity 1086 lux, soil pH 4.7 |
| 9  | *Liparis* sp.2    | *Litsea* sp.| Tree stump Forest reserve Ringin Putih; altitudes 1379 m asl, temperature 24.4°C, humidity 84%, light intensity 1086 lux, soil pH 4.7 |
| 10 | *Bulbophyllum* sp.| *Litsea* sp.| Tree stump. Forest reserve Ringin Putih; altitudes 1379 m asl, temperature 24.4°C, humidity 84%, light intensity 1086 lux, soil pH 4.7 |
| 11 | *Dendrobium* sp.2 | “Pupu ketek” tree | Gunung Picis; 1403 m asl, temperature 22.9°C, humidity 82%, soil pH 4.6, light intensity 941 lux |
| 12 | *Coelogyne flexuosa* | *Coffea* sp. | Ringin Putih Forest reserve; temperature 26.1°C, humidity 81%, light intensity 1190 lux, soil pH 4.7, altitudes 1281 m asl |
| 13 | *Dendrobium eriiflorum* | *Coffea* sp. | Magersari, near residential areas, temperature 23-25°C, light intensity 5750 lux, humidity 75-80%, soil pH 4-5, altitude 1121 m asl |
| 14 | *Appendicula* sp. | *Litsea* sp. | Ringin Putih, altitude 1337 m asl., temperature 25.2°C, humidity 88%, light intensity 51.9 lux, soil pH 4.7 |
| 15 | *Pteroceras compressum* | *Coffea* sp. | Ringin Putih, 1231 m asl., temperature 26.3°C, humidity 80%, light intensity 415 lux, soil pH 4.7 |

**Table 2.** List of terrestrial orchids in Ngebel RPH, Ponorogo

| No | Species name                | Habitat notes                                                                 | Other notes                              |
|----|-----------------------------|-----------------------------------------------------------------------------|------------------------------------------|
| 1  | *Corymborkis veratrifolia*  | Ringin Putih Forest reserve; altitude 1281 m asl.; temperature 26.1°C, humidity 81%, light intensity 1190 lux, soil pH 4.7 | asosiation plants: dadap (*Erythrina*), *Coffea*, *Elatostema* spp, *Litsea* sp., *Urtica* sp. |
| 2  | *Nervilia punctata*         | Ringin Putih Forest reserve, altitude 1366 m asl, temperature 24.4°C, humidity 83%, light intensity 1417 lux, soil pH 4.7 | growing among the leaf litter, shaded, asosiation plants: *Laportea*, *Elatostema*, *Syzygium* |
| 3  | *Calanthe* sp.              | Ringin Putih Forest reserve, 1379 m asl., temperature 24.4°C, humidity 84%, light intensity 1086 lux, soil pH 4.7 | asosiation plants: *Laportea*, *Elatostema*, *Syzygium* |
| No | Species name         | Habitat notes                                           | Other notes                                      |
|----|----------------------|--------------------------------------------------------|-------------------------------------------------|
| 4. | *Arundina graminifolia* | Gunung Picis, open slope; 1238 m asl, temperature 24.1°C, humidity 81%, light intensity 1456 lux, soil pH 4.7 | under “Puspa” (*Schima wallichii*) tree          |
| 5. | *Spathoglottis plicata* | Gunung Picis, altitude 1243 m asl, temperature 27.6°C, humidity 71%, light intensity 1747 lux, soil pH 4.8 | association plants: *Elatostema* and Fern          |

All orchid species recorded at the study site (Table 1 and 2) are known as cosmopolite orchids (kind of orchids that are usually adaptable to various types of environment and has wide-ranging geographic distribution), and therefore they are not classified as endemics. Even though the altitude at Ringin Putih and Gunung Picis Forest Reserve is relatively high (1200 – 1400 m as.l) the richness and diversity of orchid at this site can be categorized as enough. Steenis (1972) in Puspitangingtyas et al. [12] mentioned that in general, orchid species are well suited at an altitude ranging from 500 – 1500 m asl and its diversity tends to be descending at the location out of this range. In previous studies of orchid diversity in Mount Wilis showed that there were 29 orchid species in Gunung Manyutan Forest Reserve and 19 orchid species in Gunung Bunder [4]. While at a higher altitude, Cemoro Sewu hiking pathway (3000 m asl) has low diversity in terms of epiphytic orchid species (8 orchid species) [6].

### 3.1. Epiphytic orchids

There were fifteen of epiphytic orchids (in 10 genera) in this area. The epiphytic orchids need a host tree to grow. There were 5 host tree species at the study site and can be categorized as low. The host tree such as *Coffea* sp., *Litsea* sp., *Nauclea* sp., and “kupu ketek” tree. On Litsea tree trump many epiphytic orchids were found. All four trees are species that are commonly found in sub-montane and montane ecosystem types. The four host trees at the study site have rough barks that made them ideal for orchids to attach their roots. Usually, the host tree for epiphytic orchids has certain characteristics such as thick, moist, and rough bark which peeled off easily. This character makes it easier for orchids to get water and nutrients [13]. Ecologically, each epiphytic orchid prefers a particular habitat and host tree to grow [14].
Vanda tricolor is a widely cultivated epiphytic orchid. Naturally, this species can be found in Java and Bali in small numbers and separated [15]. In this study, this species was found in Ringin Putih Forest Reserve and G. Picis at 1231 – 1281 m asl. with temperature ranged 26.1-26.3°C, light intensity 415 – 1190 lux, soil pH 4.7 and relative humidity 80-81%. The host trees were Coffea sp. Litsea sp. and Nauclea sp.

The Coelogyne orchid genus consists of 200 species scattered throughout Southeast Asia with centers of diversity. Most of them are epiphytes, which can be found growing in tropical lowlands and mountain rainforests [16]. In this location, there were two species of Coelogyne found, i.e. C. speciosa and C. flexuosa. C. speciosa was found on the tree stump of Litsea sp. in Ringin Putih Forest Reserve at altitudes 1337 m asl. with temperature 25.2°C, humidity 88%, light intensity 51.9 lux, soil pH 4.7; while C. flexuosa was found at Ringin Putih Forest Reserve with temperature 26.1°C, relative humidity 81%, light intensity 1190 lux, soil pH 4.7 at altitudes 1281 m asl.

Pinalia flavesescens is naturally distributed in Malaya, Java, and Sumatra in wet montane forests at 1200 to 2100 m asl. [17]. This species was found on a tree stump of Litsea sp. in Ringin Putih FR at altitudes 1379 m asl. with temperature 24.4°C, relative humidity 84%, light intensity 1086 lux, and soil pH 4.7. Rhynchostylis retusa, Liparis sp., and Bulbophyllum sp. were also found growing on the same host with P. flavesescens.

Dendrobium eriiflorum is an epiphytic orchid that grows in humid forests, generally grows on trees and shrubs, and also sometimes on open rocks, at 800 - 2100 m asl. This species was reported to be found in Nepal, India, Bhutan, Myanmar [18]. In this study it was found on Coffea sp. in Magersari, near residential areas, with temperature 23-25°C, light intensity 5750 lux, humidity 75-80%, soil pH 4.5 at altitude 1121 m asl.

Pteroceras compressum is a native species to Jawa, Malaya, Sumatera, Thailand [19]. This research activity found that this species growing on Coffea tree in Ringin Putih, at 1231 m asl., temperature 26.3°C, relative humidity 80%, light intensity 415 lux and soil pH 4.7.
Other orchids were not flowering at the time of research, therefore they could not be identified to the level of species yet. One collection had produced fruit, namely *Appendicula* sp.; however, it was still difficult to identify to species level because it was not flowering when found.

3.2. Terrestrial Orchids

There were five species of terrestrial orchids in this area. The habitats were shaded, humus soil and small rocky with soil pH 4.6 – 4.7. Some plants association around the terrestrial orchids were *Laportea, Elastotema, Syzygium, Erythrina*, and ferns.

*Corymborkis veratrifolia* mostly grows in a shaded and wet place, especially in humus soils. Its distribution area is quite wide from India, Southeast Asia to the Pacific Islands. In Indonesia, this species can be found growing in Sumatra, Java, Kalimantan, Lombok to Sulawesi. It naturally grows at an altitude of 0–1100 m asl. [20]. However, in this research, this species was found at a slightly higher altitude in Ringin Putih Forest reserve at 1281 m asl. with temperature 26.1 °C, relative humidity 81%, light intensity 1190 lux, and soil pH 4.7. Other plants found around it among others were *dadap* (*Erythrina*), *Coffea, Elastotema spp, Litsea sp., Urtica sp.*

*Nervilia punctata* generally found in areas with an altitude of 1100-1500 m asl. [12]. In this activity, this terrestrial orchid was found at 1366 m asl. in Ringin Putih Forest reserve with temperature 24.4°C, relative humidity 83%, light intensity 1417 lux, and soil pH 4.7. It was growing among the leaf litter, shaded with association plants such as *Laportea, Elastotema, Syzygium*.

Previous research of terrestrial orchids in Gunung Picis found *Arundina graminifolia* and *Spathoglottis plicata* were abundant [10]. Associated plants around terrestrial orchids look well conditioned and supportive for growth for these orchids. In this study, *A. graminifolia* was found in Gunung Picis, at 1238 m asl, with temperature 24.1°C, relative humidity 81%, light intensity 1456 lux, and soil pH 4.7. It was growing under *Schima wallichii*. Whereas *S. plicata* was found in Gunung Picis at altitude 1243 m asl., temperature 27.6°C, humidity 71%, light intensity 1747 lux and soil pH 4.8. It was growing near *Elatostema* spp. and some ferns.

The only terrestrial orchid found that was still identified at genus level was *Calanthe* sp. It had not flowering yet. It was found in Ringin Putih Forest reserve at 1379 m asl., with temperature 24.4°C, relative humidity 84%, light intensity 1086 lux and soil pH 4.7. Other plants found around it were *Laportea, Elastotema, Syzygium*.

![Figure 4. Terrestrial orchids: a. Corymborkis veratrifolia, b. Nervilia punctata and c. Calanthe sp.](image)

In this research activity, the living collection of orchids found at the location was also collected for ex-situ conservation purposes. They were then planted at Purwodadi Botanic Garden after the fieldwork was done.
Figure 5. The living collection of orchids from RPH Ngebel were packed to be transported to Purwodadi Botanic Garden

4. Conclusion
The forest area in the Ringin Putih forest reserve and Gunung Picis, Ngebel is one of the orchid habitats that still exist in East Java. This was based on the presence of orchid species, which were still commonly found growing naturally in that location. There were fifteen species of epiphytic orchids and five species of terrestrial orchids found in this forest area. The epiphytic orchids namely: Coelogyne speciosa, Coelogyne flexuosa, Dendrobium eritiflorum, Pinalia flavescens Pteroceras compressum, Rhynchostylis retusa, Vanda tricolor, Appendicula sp., Bulbophyllum sp., Dendrobium sp.1, Dendrobium sp.2, Liparis sp.1, Liparis sp.2., Pholidota sp., and Vanda sp. The terrestrial orchids namely: Arundina graminifolia, Corymborchis veratrifolia, Nervilia punctata, Spathoglottis plicata and Calanthe sp.

Research on the diversity of orchids at that location should be conducted in the following years (2 or 3 years from now), to evaluate the presence of orchids in their natural habitat.

Acknowledgments
The authors thank the staff and managers of RPH Ngebel and the Perum Perhutani KPH Lawu Ds and also members of the flora exploration team of Purwodadi Botanic Garden.

References
[1] Puspitaningtyas D M 2005 Study on orchids diversity in Gunung Simpang Wildlife Sanctuary West Java Biodiversitas 6 103-107
[2] Puspitaningtyas D M 2007 Inventory of orchids and their host trees in Meru Betiri National Park East Java Biodiversitas 8 210-214
[3] Cardelus C L, Mack M C 2010 The nutrient status of epiphytes and their host trees along an elevational gradient in Costa Rica Plant Ecology 207 25–37
[4] Yulia N D, Budiharta S 2011 Epiphytic orchids and host trees diversity at Gunung Manyutan Forest Reserve Wilis Mountain Ponorogo East Java Biodiversitas 12 22-27
[5] Kromer T, Kessler M, Gradstein S R, Acebey A 2005 Diversity patterns of vascular epiphytes along an elevational gradient in the Andes. Journal of Biogeography 32 1799–1809.
[6] Yulia N D, and Budiharta S 2010 The diversity of epiphytic orchid and its host trees along Semoro Sewu hiking pathway Lawu Mountain District Magetan East Java Indonesia Journal of Nature Studies 10 26-31
[7] Sadili A 2019 Struktur sebaran dan tata ruang anggrek epifit (Orchidaceae) di Hutan Pantai Cagar Alam Pulau Sempu Malang Jawa Timur Jurnal Ilmu Kehutanan 13 38 – 47
[8] Comber J B 1990 Orchid of Java. Kew: Royal Botanic Gardens
[9] Tyas K N, Hadiah J T and Soejono 1999 A study on medicinal plants at Parang village Grogol districts of Kediri East Java Prosiding Seminar Perbitra Fakultas Farmasi Universitas Indonesia

[10] Yulia N D and Pa’i 2011 Asosiasi dua jenis anggrek tanah (Arundina graminifolia dan Spathoglottis plicata) di sebagian kawasan cagar alam gunung Picis Pegunungan Wilis Jawa Timur Berkala Penelitian Hayati Edisi Khusus 5A 137-140

[11] Perum Perhutani 2019 KPH Lawu Ds available at http://www.perhutani.co.id/kph-lawu-ds/

[12] Puspitaningtyas D M, Mursidawati S, Sutrisno, Asikin D 2003 Wild orchid in conservation areas in Java Island. Bogor Botanic Garden – LIPI. Bogor

[13] Tirta I G 2004 Keanekaragaman dan habitat anggrek epifit di Kebun Raya Eka Karya Bali BioSMART 6 113-116

[14] Wisnugroho 1998 Fakultas Pertanian Universitas Cendrawasih Manokwari. [on line] http://mti.ugm.ac.id/~brianadi/data/ana/SPESIES%20MIKORIZA%20RHIZOCTONIA-masalah%20khusus.pdf

[15] Gardiner LM 2007 Vanda tricolor Lindl. Conservation in Java, Indonesia: Genetic and Geographic Structure and History Lankesteriana 7 272-280

[16] Gravendeel B, Chase M W, de Vogel E F, Roos M C, Mes T H M and Bachmann K 2001 Molecular phylogeny of Coelogyne (Epidendroideae; Orchidaceae) based on plastid RFLPS, matK, and nuclear ribosomal its sequences: evidence for polyphyl American Journal of Botany 88 1915-1927

[17] Pfahl J 2020 Internet Orchid Species Photo Encyclopedia: Eria flavescens (Blume) Lindl. 1830 Section Pinalia available at http://www.orchidspecies.com/eriaflavescens.htm

[18] UNEP-WCMC (2013). Review of Significant Trade: Species selected by the CITES Plants Committee following CoP15 and retained in the review following PC20

[19] POWO 2019 Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; http://www.plantsoftheworldonline.org/ Retrieved 4 October 2020

[20] Astuti I P and Dharma I D P 2010 Keanekaragaman Aggrek Tanah di Kawasan Hutan Lindung Lemor, Lombok Timur Nusa Tenggara Barat Berkala Penelitian Hayati 15 187–190