Field notes: terrestrial orchids in the Lappadata Forest, Bone, South Sulawesi

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Abstract. Plant exploration activities were carried out in the Lappadata Forest Area, Matirro Bulu Village, Libureng District, Bone Regency, South Sulawesi in July 2017. It was succeeded in recording as many as seven species of terrestrial orchids, namely: Eulophia nuda Lindl., Dienia ophydis (J.Koenig) Seidenf., Crepidium koordersii (J.J.Sm.) Szlach., Nervilia aragoana Comm. ex Gaudich., Nervilia plicata (Andrews) Schltr., Nervilia puntata (Blume) Makino, and Habenaria beccarii Schltr. They grew in shady and damp places on thick or humid soil. This paper will discuss the field notes of those terrestrial orchids found in Lappadata Forest Area.

1. Introduction
Plant diversity in Indonesia is very large, and even Indonesia is referred to as a mega biodiversity country. One of the large plant families, Orchidaceae, has been recorded as many as 6,000 species of orchids that have been known growing in Indonesia. This number is around 17% of the total number of orchids recorded worldwide [1]. Preliminary studies of an orchid inventory conducted by Thomas and Schuiteman (2002), in Sulawesi and Maluku recorded 820 species, which around 60% of them or 548 species have been found in Sulawesi [2].

According to Mogea et al. [3], the existence of orchids in their natural habitat has begun to be threatened. This condition is mainly caused by the destruction of its natural habitat due to forest conversion, natural disasters, forest fires, uncontrolled logging, and exploitation of forests. The level of knowledge and understanding of the diversity of orchids is not widely known by the public, but on the other hand, the pressure for habitat destruction is increasing. This is what drives the immediate efforts to conserve the diversity of orchid species in Indonesia. The Indonesian Institute of Sciences has designated the Orchidaceae group as one of the priority plant groups for which conservation efforts need to be undertaken [4].

Purwodadi Botanical Garden – LIPI (Indonesian Institutes of Sciences) as the ex-situ plant conservation organization has long been doing this. At present, 65 genera and 199 species of orchids have been conserved in the Purwodadi Botanical Garden. Most of them are epiphytic orchids, only seven genera and 19 species are terrestrial orchids have been collected [5]. The collection was mostly obtained through flora exploration activities carried out in various regions in Indonesia. Plant material collecting, documenting, and researching the diversity and natural habitat of plants in the field were done in the flora exploration activities. The plant material obtained was then managed as a collection plant in the Purwodadi Botanical Garden.

In 2017, the Purwodadi Botanical Garden with the Bogor Botanical Garden Conservation Center and the Pucak Botanical Garden conducted a flora exploration activity in the forest area of Lappadata.
Village, Libureng District, Bone Regency, South Sulawesi. One of the notes from these activities was the presence of terrestrial orchids in the forest area. This paper explains the existence of terrestrial orchids that grow in the Lappadata forest area.

2. Methods
The activity was carried out on 11-30 July 2017, located in the Lappadata Hamlet Forest Area, Mattiro Bulu Village, Libureng District, Bone Regency, South Sulawesi.

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. Collection of plant material (including terrestrial orchids) was done by taking plant material, labeling the plant's identity, recording and documenting plant characteristics, and the conditions and locations of growth in the field. Location recording was done by using GPS. The locations where the terrestrial orchid grows were then mapped using MapSource software. The identification stage was carried out using plant material, documentation of images and photographs, as well as various literature references on orchids in the Purwodadi Botanical Garden. Plantlife materials obtained were then maintained in the nursery to be registered as plant collections in Purwodadi Botanical Garden.

3. Results and Discussion
Lappadata Hamlet is located in Mattiro Bulu Village, Libureng District, Bone Regency, South Sulawesi. The location of this hamlet is close to the permanent production forest area and limited production forest area. It is located 100-500 meters above sea level, with sloping contours, bumpy to steep hilly. The location is adjacent to the production forest area, which is generally planted with forest and plantation species such as pine, candlenut, cloves, and cacao. Some areas are protected by the community because springs are found there, which are generally located at high elevations and slopes on the hills.

Humidity in Bone ranges from 77% - 86% with temperatures ranging from 24.4°C - 27.6°C. In the April-September period, the east wind blows that bring rain. On the contrary, from October to March, the West Wind blows when it experiences a dry season in Bone Regency. Some areas in Bone are included in transitional areas where the climatic conditions are a combination of the two periods of the season. The Bontocani Subdistrict and Libureng Subdistricts are transitional areas whose climate conditions partly follow the western region and partly follow the eastern region. The average annual rainfall in the Bone region varies, ranging from 0 - 638 mm, with the number of rainy days during 2014 ranging from 0 - 23 days [6].

It has been recorded and collected as many as 14 terrestrial orchid collection numbers in this research activity; it consisted of 7 species of terrestrial orchids, namely: *Eulophia nuda* Lindl., *Dienia ophrydis* (J.Koenig) Seidenf, *Crepidium koordersii* (J.J.Sm.) Szlach., *Nervilia aragoana* Comm. ex Gaudich., *Nervilia plicata* (Andrews) Schltr., *Nervilia puntata* (Blume) Makino, and *Habenaria beccarii* Schltr. The conditions in which the terrestrial orchids grow were especially in shady, damp locations and soil with thick litter and humus. The condition of the soil was brown soil with gravel and rocks and humus that was thick and moist. In general, these orchids grew spreading over a large area, especially in places that were still natural and have not been disturbed by human activity. The distribution of encounter sites with terrestrial orchids in the study area is shown in Figure 1.

Based on collection records in the Purwodadi Botanic Garden’s Registration Unit, *Eulophia nuda* Lindl., *Dienia ophrydis* (J.Koenig) Seidenf, *Crepidium koordersii* (J.J.Sm.) Szlach., *Nervilia aragoana* Comm. ex Gaudich., *Nervilia plicata* (Andrews) Schltr., and *Habenaria beccarii* Schltr. were new collections for Purwodadi Botanical Garden. Several studies related to terrestrial orchids in South Sulawesi, especially in the areas around Maros and Bone that have been conducted by researchers. Puspitaningtyas [7] recorded 18 terrestrial orchid species that were found growing in the Bantimurung-Bulusaraung National Park area, South Sulawesi. Some of them were species from the genera *Nervilia, Habenaria, Malaxis*, and *Eulophia*. This area was a conservation area that was
relatively close to Lappadata. Other research conducted by Broto and Pratama [8] recorded 21 genera from 28 species of orchids that grow in the Cani Sirenreng Nature Park. A total of 10 species of which were terrestrial orchids as tabulated in Table 1. The location of TWA Cani Sirenreng was quite close as well to Lappadata. These orchids grew mostly around the river flow, with humid and shaded environmental conditions.

![Image](South Sulawesi, Bone, Libureng, Mattiro Bula Village, Lappadata Hamlet)

![Image](Exploration path and location of terrestrial orchid data collection in the research area)

**Figure 1.** The distribution of encounter sites with terrestrial orchids at the study area.

**Table 1.** List of terrestrial orchid collections from the Lappadata Hamlet Forest Area, Mattiro Bula Village, Libureng District, Bone Regency, South Sulawesi.

| No | Collection date | Collector number | Species name            | Latitude & Longitude | Fieldnotes                                      |
|----|-----------------|------------------|-------------------------|----------------------|------------------------------------------------|
| 1. | 14-7-2017       | Deden 1523 (Deden 14) | Habenaria beccarii  | A5 S04°49′06,1″, E120°06′53,7″ | Secondary forest, 430 m asl., shaded, clay, heavy litter, rocky, soil pH 6.8-7; humidity 83-85% |
| 2. | 14-7-2017       | Deden 1524 (Deden 15) | Dienia ophrydis      | A5 S04°49′06,1″, E120°06′53,7″ | Secondary forest, 430 m asl., shaded, clay, heavy litter, rocky, soil pH 6.8-7; humidity 83-85% |
| 3. | 14-7-2017       | Deden 1525 (Deden 16) | Eulophia nuda         | A5 S04°49′06,1″, E120°06′53,7″ | Secondary forest, 430 m asl., shaded, clay, heavy litter, rocky, soil pH 6.8-7; humidity 83-85% |
| 4. | 14-7-2017       | Deden 1545 (Deden 36) | Habenaria beccarii  | A6 S04°49′06,2″, E120°06′55,5″ | Cacao plantation, 488 m asl., secondary forest, shaded, clay, |
| No | Collection date | Collector number | Species name | Latitude & Longitude | Fieldnotes |
|----|-----------------|------------------|--------------|----------------------|------------|
| 5. | 16-7-2017       | Deden 1613       | *Nervilia plicata* | C9 S04°48′09″.6″, E120°07′13″.9″ | thick, rocky, soil pH 6.8-7; humidity 83-85% |
| 6. | 16-7-2017       | Deden 1615       | *Dienia ophrydis* | C9 S04°48′09″.6″, E120°07′13″.9″ | Protected forest, 247 m asl., slope, clay with thick topsoil, dense vegetation, soil pH 6.8-7; humidity 99-100% |
| 7. | 16-7-2017       | Deden 1639       | *Habenaria beccarii* | C13 S04°48′00″.7″, E120°07′06″.9″ | Protected forest, 304 m asl., hillside, rocky clay, thick mud, thick vegetation |
| 8. | 16-7-2017       | Deden 1640       | *Nervilia aragoana* & *Nervilia punctata* | C13 S04°48′00″.7″, E120°07′06″.9″ | Protected forest, 304 m asl., hillside, rocky clay, thick mud, thick vegetation |
| 9. | 18-7-2017       | Deden 1685       | *Dienia ophrydis* | D19 S04°48′36″.3″, E120°06′38″.7″ | In the forest, 233 m asl., rocky cliffs, thick topsoil, humid and shady place |
| 10. | 18-7-2017 | Deden 1688 | *Eulophia nuda* | D20 S04°48′35″.8″, E120°06′39″.0″ | In the forest, 225 m asl., the slopes with thick topsoil, humid and shady place |
| 11. | 19-7-2017 | Deden 1698 | *Eulophia nuda* | E2 S04°48′52″.2″, E120°06′32″.5″ | Forest edges, slopes, 171 m asl., open place with thick topsoil |
| 12. | 19-7-2017 | Deden 1719 | *Crepidium koordersii* | E12 S04°48′23″.0″, E120°06′33″.4″ | In the forest, 239 m asl., shady place, clay with thick topsoil |
| 13. | 19-7-2017 | Deden 1731 | *Eulophia nuda* | E15 S04°48′16″.0″, E120°06′42″.4″ | In the forest, 230 m asl., slopes, shady and humid place, thick top soil |
| 14. | 23-7-2017 | Deden 1790 | *Eulophia nuda* | H4 S04°49′20″.1″, E120°06′55″.6″ | Riverbanks, forest edges, 168 m asl., shady and humid place, clay with thick top soil |
3.1. Eulophia nuda Lindl.
This species has synonyms, namely Eulophia spectabilis (Dennst.) Suresh. It is classified as a terrestrial orchid that can grow up to 30-65 cm tall (Figure 2). The leaves emerge from the tubers/pseudobulb which is buried in the soil, as much as 2 to 3 leaves for each tuber. Leaves were elongated with flat green edges. Flowers were arranged in a racemose inflorescence, with each inflorescence contains up to 15 flowers. Flowering stems appear from the base of the leaf. The flower color is varying, from pink-purple to dark red, brown or yellow. This species distribution includes areas in India, South China, the Asian Tropical Region, and the Western Pacific region.

Dawande and Gurav [9] stated that Eulophia nuda Lindl. planted as ornamental plants, as raw material for medicine and traditional food by several indigenous communities in India. To overcome the strong pressure due to its utilization, the seed propagation method by using the growth hormone BA and IBA (6-benzylaminopurine and Indol-3-butyric acid), can produce more plant material. Even to produce more rejuvenation through invitro, the use of a variety of growing media has also shown good results in terms of propagation of this orchid [10]. This species also has another potential as the treatments for tumors, especially for breast cancer [11].

From the 14 collection numbers, 5 of them were E. nuda (collection number Deden 1525, 1688, 1698, 1731 and 1790). It was found at elevation on 168-430 meter above sea level, mostly in shady places with heavy litter, or clay with thick topsoil.

3.2. Dienia ophrydis (J.Koenig) Seidenf
Dienia ophrydis has wide distribution, from India, Nepal, China, Japan, Indochina, Malaysia, Singapore, Philippines, Indonesia, and Australia to the Southwest Pacific Islands (Figure 3). It mostly grows in the forest, in shady areas, grassy roadside, and banks from sea level to about 1,350 meters above sea level [12].

Characteristic that is easily recognized in the field include pseudobulb that has an elongated shape or oval-shaped upward. Young shoots emerge from the base near the pseudobulb that had existed before. Plant height ranges from 20-60 cm and generally grows in groups. Leaves were elongated
oblong-shaped, light green in color. Flowering stems emerge from pseudobulb with flowering lengths that can reach 50 cm. In one flower can be composed of 20-80 flowers. Flower colors vary from yellowish-green, red, purple or a combination of these colors [13].

Form this research, this species was found in the forest at 233-430 m asl., included three collection numbers (Deden 1524, 1615 and 1685). They were mostly found growing on shady and humid places, clay with thick topsoil.

3.3. *Crepidium koordersii* (J.J.Sm.) Szlach
This terrestrial orchid is characterized by generally living scattered above the ground surface with hummus or leaf litter and in shady places. The stem (pseudobulb) elongated 11-13 cm long, green. The leaves are arranged at the base of the stem, amounting to 3-5 pieces, lancet-shaped, with a length of 13-15 cm and a width of 4-4.5 cm. The edge of the leaf is flat and slightly wavy with a pointed leaf tip. The inflorescence arises from the end of the stem, with an inflorescence length of up to 40 cm. Many flower buds in one flower, light green or yellowish-green. The fruit is arranged in the flowering area after the flowers are decayed, round/oval and brown (Figure 4).

Sulistiarini and Djarwaningsih [14], suggested that in Comber's notes [15] it was mentioned that this orchid was an endemic species in Java, but in a study conducted by Sulistiarini *et al* [16], it also has been found growing naturally in Pulu Wowoni, Southeast Sulawesi. This is a new record for the distribution of this species. This species was found in the forest, shady place, clay with thick topsoil; and only one collection number, i.e. Deden 1719.

![Figure 4. Crepidium koordersii.](image)

3.4. *Nervilia plicata* (Andrews) Schlr
As mostly genus *Nervilia*, this species was found growing in shaded areas, soil with a humid, humid area at an altitude of 120 m above sea level (Figure 5). Comber's notes [15], states that in Java this species grows in shady, humid places, inside or outside forest areas at an altitude of 40 - 1,070 m above sea level.

![Figure 5. Nervilia plicata.](image)
Leaf character is one of the characteristics that can be used to recognize this species in the field. Leaves emerge from the tubers that are embedded in the soil. The petiole is so short that it seems as if the leaf is directly emerging from the ground. The leaves are heart-shaped and somewhat kidney-shaped with a pointed tip of the leaf. The leaves are dark green or light green, with the entire top surface covered with silvery rough hair. The leaf venation is clearly visible forming lines on the surface of the leaf. This species was found in a protected forest, slope, clay with thick topsoil, dense vegetation, and the humidity was very high (99-100%); only one collection number, i.e. Deden 1613.

3.5. *Nervilia aragoana* Gaudich
Encounters with this species at the study site were quite frequent. However, only one collection number, i.e. Deden 1640, was collected; it was found in a protected forest, hillside, rocky clay, with thick mud and thick vegetation in groups with *N. punctata* (Figure 6). This species generally grow in groups in shady, shaded and damp places on the ground with abundant topsoil. Characteristics that were easily recognizable in the field include the shape of the heart-shaped leaves with pointed tips, pale green. The leaf venation is clearly visible so that the shape of the leaves seems to have folded. This species is quite widely distributed with variations in various conditions of the place to grow from the coast to the mountains with an altitude of 1,200 m above sea level. It causes this species to have a great deal of variation in its morphological character [17].

![Figure 6. Nervilia aragoana.](image)

3.6. *Nervilia punctata* (BL.) Makino
It was found growing in groups with *N. aragoana* (Deden 1640) in a shady, shaded and damp area with thick topsoil, in the protected forest area around gardens and fields. The leaves were heart-shaped, shiny green with pointed leaf tips (Figure 7). Leaf venation was visible on the leaf surface. This collection number (Deden 1640) was previously identified as *N. aragoana*; but after re-identification, there were two different species, i.e. *N. aragoana* and *N. punctata*. Comber [15, 17] suggested that, based on his research notes, this type was generally found in high altitude areas (1,200-1,500 meters above sea level), but he also stated that in other literary records, it was stated that this species was found in the lower plains area.

According to Puspitaningtyas’s record [7], three species of *Nervilia* were found growing in the Bantimurung-Bulusaraung National Park, namely *N. punctata*, *N. plicata*, and *N. aragoana*. At the research location, the three species of *Nervilia* were also found to grow naturally. The habitat was in the form of gravel, thick topsoil from leaf litter, humid and shaded environmental conditions. It grew on moist, shaded slopes. *Nervilia* orchids are not easy to recognize in their natural habitat, because they rarely flower. Besides, if you are not thorough or have not known it, its figure is difficult to distinguish from bushes and other ground cover plants. In its life cycle, *Nervilia* experiences dormancy in the form of tubers that are embedded in the soil. The dormant period lasts about 8-12 weeks after the leaves wither [18].
Silalahi and Nisyawati [19] noted that there were five species of orchids that were used as raw materials for traditional medicine used by Batak ethnic groups in North Sumatra. Two of them were the *Nervilia* genus, namely *Nervilia aragoana* Gand. and *Nervilla plicata* (Andrews) Schltr. The part that was used was the leaves and tubers, especially for fever medicines and used to increase stamina. The Tobelo Dalam people in North Maluku utilize the juice from the tubers of *Nervilia aragoana* which was pounded as eye drops [20].

![Figure 7. Nervilia punctata.](image)

### 3.7. Habenaria beccarii Schltr. (Bl.) Makino

Habenaria is one of the terrestrial orchid genera that comprises about 600 species (Figure 8). In its growth experience a seasonal life cycle that begins with growth in the form of tubers which then grows vegetative organs in the form of leaves and continued with generative organs in the form of flowers. This stage marks the end of its growth because after that it will produce fruit and seeds, plants will die and then experiences dormancy in the form of tubers. Habenaria beccarii is an endemic species of Sulawesi and Maluku Islands [7]. This collection was a new collection for Purwodadi Botanical Garden. Plant material collected in the form of tubers and has been recorded as a result of exploration at Purwodadi Botanical Garden. In observations at the research location, its presence was quite abundant and spread on the forest floor. It was found growing in shady, shaded and damp places with thick topsoil. Not only in the forest, it presence was also found in fields and gardens.

Some pollinators that play a role in the ecology of this flower included a large black butterfly i.e. *Papilio memnon* f. agent. Other pollinators were small kining butterflies and other lepidopteran families [21].

Several studies of terrestrial orchids have been carried out, some of which were conducted by Fijridiyanto and Hartini [22]. Their inventory of orchids in the Gamalama Mountain Region, Maluku showed that 21 species of orchids recorded with as many as 15 species of which were terrestrial orchids. In general, the habitat was located at an altitude above 1,500 m asl in the forest or clove and nutmeg gardens. Conditions are shaded, moist with a substrate in the form of soil with a thick litter. Astuti and Darma [23] recorded six species of terrestrial orchids in the Lemor Protected Forest Area in the Mount Rinjani Area. This area was one of the lowland tropical rain forest areas on the island of Lombok, West Nusa Tenggara. The six species were: *Corymborkis veratrifolia* (Reinw.) Bl, *Nervilia aragoana* Goud., *N. plicata* (Andrews) Schltr., *N. punctata* Bl., *Tropidia angulosa* (Lindl.) Bl., And *T. curculigoides* Lindl.

This species was found in cacao forest, protected forest and secondary forest at 304-430 m asl., shady area, humid, clay with thick topsoil and litter (3 collection numbers, i.e. Deden 1523, 1545 and 1639).
4. Conclusion

The forest area in Lappadata Hamlet, Mattiro Bulu Village, Libureng District, Bone Regency, South Sulawesi is one of the orchid habitats that still exist in South Sulawesi. This was based on the presence of terrestrial orchid species, which were still commonly found growing naturally in that location. There were seven species of terrestrial orchids found in the Lappadata forest area, namely: *Eulophia nuda* Lindl., *Dienia ophrydis* (J.Koenig) Seidenf, *Crepidium koordersii* (J.J.Sm.) Szlach., *Nervilia aragoana* Comm. ex Gaudich., *Nervilia plicata* (Andrews) Schltr., *Nervilia puntata* (Blume) Makino, and *Habenaria beccarii* Schltr. Their habitats were in shady, shaded and damp places on the ground with thick litter and humus (topsoil), at elevation 168 – 488 meters above sea level.

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