Jurnal Biodjati 7(2):331–342, November 2022
e-ISSN : 2541-4208
p-ISSN : 2548-1606

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

Orchid (Orchidaceae) Inventory in Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, South Sumatra

Felia Melinda. H[1]*, Harmida[2], Nita Aminasih[3]

Received: 21 July, 2022
Revise from: 25 July, 2022
Accepted: 19 September, 2022

DOI: 10.15575/biodjati.v7i2.19271

[1,2,3]Department of Biology, Faculty of Mathematics & Natural Sciences, Universitas Sriwijaya, Jl. Raya Palembang-Prabumulih km 32, South Sumatera, Indonesia, 30128

e-mail:
*[1]*feliamelinda01229@gmail.com*
[2]*harmidaharmida18@gmail.com*
[3]*nitaaminasih@yahoo.co.id*

**Corresponding author*

Abstract. *Orchidaceae is one of the plant families which occupies 7-10% of the total flowering plants in the world. Of the 25,000 species of orchids in the world, 6,000 species are found in various forests in Indonesia, including Sumatra. South Sumatra save high diversity of orchid and one of them is in Isau-Isau Wildlife Conservation. This area has various types of plants, including orchids. Diversity orchids in the area have not gotten any attention, so the data regarding orchids in the Isau-Isau Wildlife Conservation, especially in Resort Conservation Area IX Lawang Agung Village, Mulak Ulu District, Lahat Regency, South Sumatra still limited and not well documented, so that need further research to know types of orchids in the area. The research found 22 species, consisting of 21 epiphyte orchids and 1 terrestrial orchid. Many orchids were found in the secondary forest of 16 species. An endemic orchid of South Sumatra was found in this research, it is Vanda foetida. Host plants found were 11 plants, 7 can identify and 4 not can be identified.*

Keywords: *Orchid, exploration, host, isau-isau wildlife, Vanda foetida*

Citation
Melinda, H. F., Harmida, Aminasih, N. (2022). Orchid (Orchidaceae) Inventory In Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, South Sumatra. *Jurnal Biodjati*, 7(2), 331–342.

INTRODUCTION

Orchidaceae is one of the plant families that occupy 7-10% of the total flowering plants in the world (Fandani et al., 2018). Of the 25,000 species of orchids in the world, 6,000 species are found in various forests in Indonesia, including Sumatra (Lianarti, 2019). According to Setiaji et al. (2018), orchids are divided into two, namely species orchids and hybrid orchids. Species orchids or known as natural orchids are orchids that can be found in nature and have not been crossed with other orchids. Natural orchids are often used as the main ingredient to produce hybrid orchids for trade.

The number of orchids in Sumatra that have been identified is 1,118 species, with 139 genera of orchids and there may still be 10% of other orchid species that have not been identified. Of the total Sumatra orchid species, 24% can be found in Thailand, Peninsular Malaysia 38%, Java 39%, and Kalimantan 38%, while 41% are endemic identified (Comber, 2001; Pratidina & Nengsih, 2018).

According to Danarto (2019), the orchid population in nature is decreasing, because the rate of deforestation in Indonesia is relatively high, this is caused by pressure from illegal logging activities, land clearing for settlements, plantations, agriculture, and mining. Hilmiah et al. (2018) also stated that there is

Jurnal Biodjati 7(2):331–342, November 2022

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

the continuous taking of orchids from nature without considering their sustainability which may cause many orchids to become extinct before they can be identified or documented.

One of the efforts that need to be made to save orchids in nature from extinction is by conducting exploration. Exploration is an activity of searching, collecting, and researching certain types of germplasm to save them from extinction. Orchid exploration is carried out with the aim that orchids in an area can be identified (Febriandito & Lita, 2019).

South Sumatra has the potential for a high diversity of orchid species, especially in highland areas with suitable living characteristics for orchid growth and development. Around 300 species of orchids have been recorded with distribution in the forests of Muara Enim Regency, Lahat Regency, and Pagaralam City (Setiawan et al., 2020). One area in South Sumatra that is expected to hold a lot of potential for orchids is the Isau-Isau Wildlife Reserve. Isau-Isau Wildlife reserve has an area of 16,742.92 ha which is located in Lahat Regency and Muara Enim Regency, South Sumatra with an altitude between 600-1,400 m above sea level. In this area, there are various types of plants in it, including orchids. Until 2021, the type of orchid that has been successfully released in the Isau-Isau wildlife reserve area is *Vanda foetida*.

The diversity of orchids in this area has not received much attention so data on orchids in the Isau-Isau Wildlife Reserve area, especially in the Conservation Resort Area IX, Lawang Agung Village, Mulak Ulu District, Lahat Regency, South Sumatra as a whole is still limited and not well documented. Further research is needed to determine the types of orchids found in the area.

MATERIALS AND METHODS

This research had done from January until March 2022 in Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, Mulak Ulu District, Lahat Regency, South Sumatra (Figure 1)

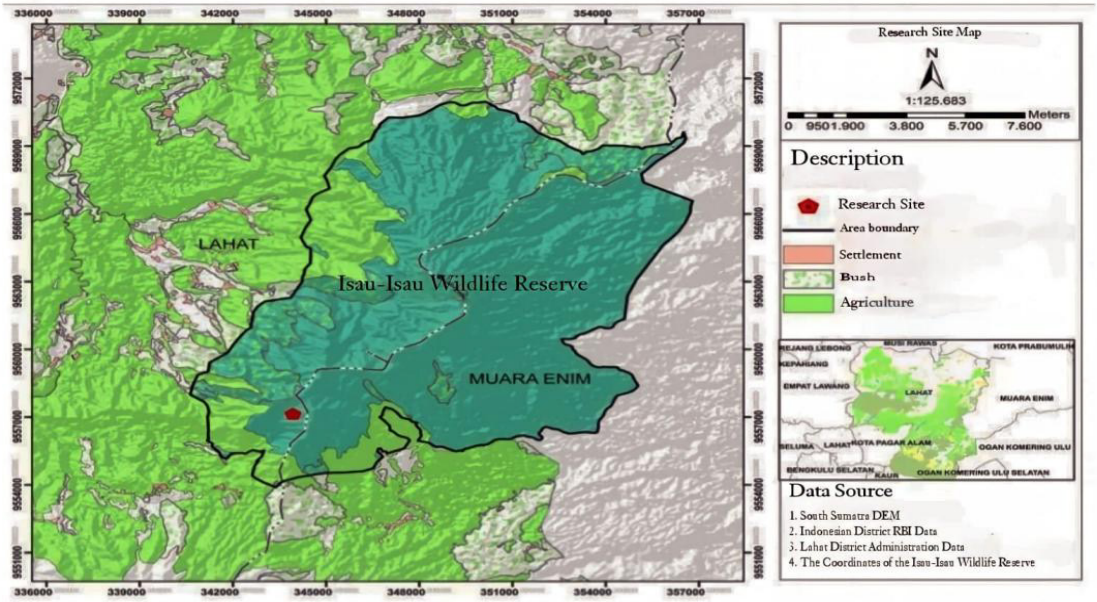


Figure 1. Research site map (Isau-Isau Wildlife)

Jurnal Biodjati 7(2):331–342, November 2022

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

Data Retrieval

This research was conducted with the method of exploration (cruising) based on altitude. The research was conducted at 3 locations, namely Location I (plantation area with an altitude of 620-720 m asl), Location II (secondary forest area with an altitude of 720-820 m asl), and Location III (primary forest area with an altitude of 820-920 m asl). The determination of the height of the place used the purposive sampling method, which was determined intentionally by considering the situation in the field and extracting information from the field guide. The data recorded includes the name of the species (scientific name), the name of the host plant (if an epiphytic orchid), the coordinates of the orchid species found, morphology, and life characteristics.

Identification

Orchid Identification

Identification of orchids was carried out at the species level. Identification of the species level requires observation of flower morphology. Most flowerless orchids can only be identified at the genus level. The identification method used was literature study by browsing the literature related to the research objectives, either through previous research reports, internet sites (orchid.unibas.ch, orchidroots.com, \powo.science.kew.org, and monaconatureencyclopedia.com), e-books [*Mengenal Anggrek Wisata Bukit Kaba* (Pratidina dan Nengsih, 2018) and *Buku Flora Potensi Hias Merbabu* (Wahyudi, 2015)], and orchid identification books [*Orchid of Sumatra* (Comber, 2001), *Orchid of Indonesia* (Frankie Handoyo, 2019), *Anggrek dari Benua ke Benua* (Tom Gunadi, 1986), *1001 Spesies Anggrek yang Tumbuh di Indonesia* (Assagaf, 2012)].

Identification of the Orchid Host

Identification of orchid hosts was done by searching related literature and information obtained from field guides. Identification was carried out by comparing photos taken in the field with the identification book used. Identification by literature study using books Flora (Dr. C.G.G.J. Van steenis), *100 Spesies Pohon Nusantara* (Gunawan et al.) and *Panduan Lapangan Identifikasi Jenis Pohon Hutan* (Andri Thomas). In addition, the local name of the tree can be known based on information from the field guide.

Observation Variable

The orchids found in the field were observed for their morphology (including stems, leaves, flowers, and fruit), living characteristics, and host plants. In addition, environmental factors such as altitude, light intensity, air humidity, air temperature, altitude, and soil pH were also measured.

Data Analysis

Observational data are presented in tabular form (consisting of species, types of living traits, and hosts) and documentation that describes the morphological characteristics of observations of the orchids studied, and then the data were analyzed descriptively.

RESULTS AND DISCUSSION

Research conducted in Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, Mulak Ulu District, Lahat Regency, South Sumatra found 22 species of orchids consisting of 14 genera in different locations (including plantations, secondary forest and primary forest) and different host plants (This means that the same orchid species can grow on different hosts). The orchid

Jurnal Biodjati 7(2):331–342, November 2022

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

species found at the research site can be seen in Table 1.

Table 1. Results of orchid exploration in Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, South Sumatra

Species	Generative Organ	Location			Habit Growth
		I	II	III	
Acriopsis liliifolia (Koen)	Flower	√	-	-	E
Appendicula ovalis (Schltr.) J.J. Sm.	Flower	-	√	-	E
Bulbophyllum apodum Hook. f.	Flower & fruit	-	√	-	E
Bulbophyllum biflorum Teijsm & Binn	-	-	√	-	E
Bulbophyllum flavescens (Blume) Lindl.	-	-	√	-	E
Calanthe triplicata [Willemet] Ames	Fruit	-	√	√	T
Cymbidium bicolor Lindl.	-	-	√	-	E
Cymbidium finlaysonianum Lindl.	-	-	√	-	E
Dendrobium aloifolium (Blume) Rchb. f.	-	-	-	√	E
Dendrobium crumenatum Swartz	Flower	√	√	-	E
Dendrobium indivisum (Blume) Miq.	Flower	√	√	-	E
Dendrobium kentrophyllum Hook. f.	Flower	√	-	-	E
Dendrobium uncatum Lindl.	Flower	√	√	-	E
Grammatophyllum stapeliiflorum J.J. Sm.	-	-	√	-	E
Liparis condylobulbon Rchb. f.	Flower	-	√	-	E
Microsaccus sumatranus J.J. Sm.	-	-	√	-	E
Polystachya penangensis Ridl.	Flower	√	-	-	E
Pholidota imbricata (Roxb.) Lindl.	Flower	-	√	-	E
Thecostele alata Parish & Rchb. f.	-	-	√	-	E
Thelasis micrantha (Brongn.) J.J. Sm.	Flower	-	-	√	E
Vanda foetida J.J. Sm.	Flower	-	-	√	E
Vanda helvola Blume	-	-	√	-	E

Note: I : plantation (620-720 m asl) II: secondary forest (720-820 m asl) III: primary forest (820-920 m asl). √ : found - : not found E: epiphyte T: terrestrial

Based on Table 1, Bulbophyllum and Dendrobium are the genera with the most species found in the research location with 3 and 5 orchid species, respectively, followed by Cymbidium and Vanda with 2 orchid species, Acriopsis, Appendicula, Grammatophyllum, Liparis, Microsaccus, Polystachya, Pholidota, Thecostele, and Thelasis each comprise one species of orchid. From the data in Table 1, it can be seen that Dendrobium orchids have an even distribution in the Isau-Isau Wildlife because they can be found at every research location, this shows that Dendrobium has a better adaptation rate than other genera. The results of the orchid exploration research can be seen in Figure 2.


Acriopsis liliifolia


Appendicula ovalis


Bulbophyllum apodum


Bulbophyllum biflorum


Bulbophyllum flavescens


Calanthe triplacata


Cymbidium bicolor


Cymbidium finlaysonianum


Dendrobium aloifolium


Dendrobium crumenatum


Dendrobium indivisum


Dendrobium kentrophyllum


Dendrobium uncatum


Grammatophyllum stapeliiflorum


Liparis condylobulbon

Jurnal Biodjati 7(2):331–342, November 2022

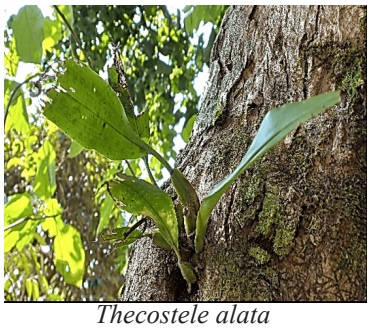
JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati


Microsaccus sumatranus


Polystachya penangensis


Pholidota imbricata


Thecostele alata


Thelasis micrantha


Vanda foetida


Vanda helvola

Figure 1. The results of the orchid exploration research

Off all orchids found, there are 13 species of orchids that are in flower and 3 species of which are in fruiting (Table 1). The existence of orchids that are found in a state of flowering and not flowering due to seasonal factors. Observations were made in the middle of the rainy season (in January) so that several species of orchids can flower and bloom during that season. This is in accordance with the statement of Sadili & Siti (2017) who said that the state of the season is predicted to greatly affect the growth of flowers. According to Apriani et al. (2020), there is a species of orchid that has a flowering period throughout the year without being influenced by the season as in *Dendrobium crumenatum*. Miswarti et al. (2021) said that factors that can affect the flowering process include genes, endogenous hormones, plant age, sunlight, temperature, humidity, nutrient availability, and external induction of phytohormones.

From the results of the study, it was found that the endemic orchid of South Sumatra, *Vanda foetida*. This species has a unique light purple flower that distinguishes this species of orchid from other Vanda species which have brown flowers. *Vanda foetida* at the time of the study was found at an altitude of 827 m asl. Metusala & Ridesti (2016) said that *Vanda foetida* is an orchid endemic to South Sumatra and according to the South Sumatra BKSDA (2021). *Vanda foetida* is only found

in the highland landscape of South Sumatra with cold living characteristics, good air circulation, and direct sunlight.

The percentage rate of discovery of epiphytic orchids based on Table 1 is higher than that of terrestrial orchids. The percentage of epiphytic and terrestrial orchids found was 91%:9% with 21 species of epiphytic orchids and 1 species of terrestrial orchids. Epiphytic orchids are more commonly found because the research area is a tropical forest area that is dominated by trees. Most of the epiphytic orchids found were of the sympodial stem type, while the genus Vanda had a monopodial stem type.

Lithophytic orchids and saprophytes were not found during the study, this is because the research area includes tropical forests which are dominated by trees and very few rocks. According to information from related agencies, at the research site, there is jewel orchid (*Anoechochilus reinwardtii*) which is a saprophytic orchid, but at the time of the study, it was not found because the orchid has a color similar to that of dry leaves, making it difficult to identify.

Epiphytic orchids can be found attached to trees, usually on large trees because they have a rough bark that allows the orchid to attach its roots. Lukitasari (2018) says that moss can support the life of other organisms because it can bind water to maintain environmental humidity and support nutritional needs so that other plants can live well.

The terrestrial orchid found at the research site is *Calanthe triplicata*. Terrestrial orchids mostly need shade for growth and development, so it was not found in plantation areas that have open vegetation, while *Calanthe triplicata* can be found in primary forests with dense vegetation so that the environmental conditions are shaded so that it is supportive for Calanthe to grow in that location. Sadili & Siti (2017) said that there are several species of terrestrial orchids that can live without shade such as *Sphatoglottis plicata* and *Arudina graminifolia*, but at the time of the study they were not found. *Calanthe triplicate* at the time of the study was found in secondary and primary forests with a soil pH of 7.2, meaning that the pH was suitable for Calanthe to grow well. Brower et al. (1998) said that terrestrial orchids can grow and develop with soil pH ranging from 4.5 to 8.0.

Orchid species in different locations have different numbers. In the secondary forest with an altitude of 720-820 m asl is the location where the most orchids are found, namely 16 species. Environmental abiotic factors can be a limiting factor for the spread of orchid species because of the different growth conditions and adaptability of each orchid species. These factors include elevation, air temperature, air humidity, light intensity, and soil pH. According to Lianarti (2019), the differences in the composition of orchids are due to the structure and diversity of tree stands at the study site, which also affects the diversity of existing orchid species.

Table 2. Results of orchid exploration in Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, South Sumatra

Observation Location	Elevation (m asl)	Light Intensity (lux)	Air Humidity (%)	Air Temperature (ºC)	pH
Plantation	620-720	14.731	72	28.3-24.3	7.9
Secondary forest	720-820	10.340	81	24.3-23.0	7.2
Primary forest	820-920	967	87	23.0-22.7	7.2

Jurnal Biodjati 7(2):331–342, November 2022

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

The air temperature at the research site ranged from 22.7ºC-28.3ºC. The air temperature in the Isau-Isau Wildlife is the optimum temperature for orchid growth, as evidenced by the presence of orchids found in each research location. According to Darmono (2003), the required temperature for orchids is around 21ºC at night and 27ºC-30ºC during the day.

The highest air temperature was in the plantation area, namely 28.3ºC-24.3ºC with an altitude of 620-720 m asl, air humidity was 72% and high light intensity because open canopy cover in this area. This location consists of coffee and rubber plantations. Rudianto et al. (2018) said that the environmental conditions that are shaded by trees but not tightly so that sunlight can enter through the forest floor. The high intensity of sunlight causes the ambient air temperature to be high. Meanwhile, environmental humidity is also included in the humid category.

The air temperature in the secondary forest was 24.3ºC-23.0ºC with an altitude of 720-820 m asl, the humidity is 81% with semi-open canopy cover . This environmental condition indicates an increase in the number of orchid species found in the previous location. This shows that many species of orchids grow well in these environmental conditions. The soil pH of 7.2 supports Calanthe growing at this location. The secondary forest has a tree canopy cover that is not too dense so that the intensity of sunlight reaches the ground surface and this location is slightly shaded. According to the Kementrian Pertanian Holtikultura Republik Indonesia (2012), many orchids grow at an altitude of 0-1,500 m asl, with air temperatures ranging from 20ºC-30ºC, the light intensity of 50%-100%, and humidity not less than 70%.

The air temperature in the primary forest ranged from 23ºC-22.3ºC with an altitude of 820-920 m asl, air humidity 87% with closed canopy cover. This is due to condition of the primary forest that have many large and tall trees so the conditions are shaded but sunlight still through the forest floor. At this location, fewer orchid species were found than in the previous location. Soil pH at this location was the same as soil pH in the secondary forest so it also supports Calanthe orchids growth. According to Rudianto et al. (2018), environmental conditions that are shaded by dense trees prevent sunlight from entering directly it also affects the low ambient air temperature and high air humidity.

The higher number of orchids found in the secondary forest was due to environmental abiotic factors that are suitable for orchids for orchid growth. The trees in this location are not too tall so it is easy to observe when several fallen trees that are overgrown by epiphytic orchids. Whereas the primary forest is dominated by tall trees with large trunk diameters, few branches and far from the ground, making it difficult to observe. According to Febriandito and Lita (2019), epiphytic orchids are often found on fallen trees, and according to research by Effendi et al. (2019), trees with a trunk diameter of less than one meter were found to have 1-3 species of orchids consisting of 1-45 individuals, while in trees with a diameter of more than one meter only one individual orchid was found. Orchids are found in many branches and are rarely found in the branch-free zone.

Based on Table 3, it is known that there are 12 plants that become host plants of epiphytic orchids which are grouped based on the plant family. Of the 12 plant species that were identified, they were from the families Apocynaceae, Euphorbiaceae, Fabaceae, Lauraceae, Malvaceae, Myrtaceae, and Rubiaceae. The host plant can be seen in Figure 3.

Jurnal Biodjati 7(2):331–342, November 2022

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

Table 3. The host plant of epiphytic orchids in Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, South Sumatra

Family	Species	Local Name	Genus/Species of Orchid
Apocynaceae	*Alstonia scholaris*	Pulai	*Dendrobium crumenatum*
			Dendrobium indivisum
Bombacaceae	*Durio zibethinus*	Durian	*Dendrobium uncatum*
			Grammatophyllum stapeliiflorum
			Acriopsis liliifolia
			Dendrobium indivisum
Euphorbiaceae	*Hevea brasiliensis*	Karet	*Dendrobium kentrophyllum*
			Dendrobium uncatum
			Polystachya penangensis
Fabaceae	*Gliricidia sepium*	Gamal	*Dendrobium crumenatum*
Lauraceae	-	Medang	*Thelasis micrantha*
Myrtaceae	*Syzygium malaccense*	Jambu bol	*Cymbidium fynlaysonianum*
			Thecostele alata
Rubiaceae	*Coffea robusta*	Kopi	*Dendrobium crumenatum*
*Unidentified**		-	*Liparis condylobulbon*
Unidentified		Pasang	*Bulbophyllum flavescens*
			Appendicula ovalis
			Bulbophyllum apodum
			Bulbophyllum biflorum
*Unidentified**	-	-	*Dendrobium aloifolium*
			Microsaccus sumatranus
			Pholidota imbricata
			Vanda helvola
Unidentified	-	-	*Vanda foetida*
*Unidentified**	-	-	*Cymbidium bicolor*

Note: * = host plant was dead

Some of the host plants could not be identified, this was because there were dead plants such as the host plant *Cymbidium bicolor.* Some others had died and experienced weathering so that the stem structure could not be identified, such as the host plant of *Liparis condylobulbon.* In addition, there were host plants that have a very high canopy make the morphology of the leaves, flowers, fruit, and branches was not clear, and difficult to identify, such as the host plant *Bulbophyllum flavascens*, *Vanda foetida*. For the host plant, *Bulbophyllum flavascens*, the local name is known based on information from the local community, the Pasang tree, so that it can be used as additional information.

Epiphytic orchids were most commonly found in fallen and dead trees, but could not be identified because there were no leaves, flowers, or fruit in the field and 7 species of orchids were found on the tree. The number of orchids found on the host plant was because there were several fallen trees, the fallen condition made it easier to find them because they were not obstructed by visibility and the possibility of the tree before falling there were

many orchids. Besi et al. (2019) stated that there was an abundance of epiphytic orchids found on fallen trees, but this did not indicate that disturbance to the orchid habitat could increase the abundance of epiphytic orchids.

Demena et al. (2020) said that epiphytic orchids tend to stick to different host trees because some epiphytic orchids have a high tolerance, for example, orchids from Dendrobium and Bulbophyllum. Dendrobium and Bulbophyllum are able to tolerate and attach to different host trees, this can be seen in Table 2 where *Dendrobium crumenatum* can grow on pulai (*Alstonia scholaris*), gamal (*Gliricidia sepium*), and coffee (*Coffea robusta*) trees.

CONCLUSION

The results of research found 22 species of orchids consisting of 21 epiphytic orchids and 1 terrestrial orchid. *An endemic orchid of south sumatra was found in this research, it is Vanda foetida.* Orchids are found growing on *Durio zibethinus* and *Hevea brasiliensis*.

Further research is needed on orchids in the Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, South Sumatra at different locations and times so that other types of orchids are found and the data obtained is more complete and further research is needed regarding orchid host plants in the Isau-Isau Wildlife Conservation Resort Area IX Lawang Agung Village, South Sumatra**.**

AUTHOR CONTRIBUTION

All authors designed the research, collected and analyzed data, supervising all processes, and wrote the manuscripts.

ACKNOWLEDGMENTS

This research could not be completed properly without the help of various parties. The author would like to thank the supervisor, Harmida and Nita Aminasih for their guidance, direction, advice, advice, and patience during the research and writing of this reseacrh. The author also thanks to South Sumatra Natural Resources Conservation Center who provided facilities and infrastructure as well as time and energy in this research, Pungky Nanda Pratama and Mr. Ursal have helped, guided, and provided input while in the field and the Isau-Isau Team, Selamat Robinsa and Septra Tri Andika for giving their time and energy in the field.

CONFLICT OF INTEREST

This study uses personal funds so data collection in the field is not optimal due to the limitations of the tools used and the short data collection time so the data obtained is less diverse.

REFERENCES

Andri, T. (none). *Panduan Lapangan Indentifikasi Jenis Pohon Hutan.* Jakarta. Retrived from http://simlit.puspijak.org/files/buku/Tree_ID_Field_Guide.pdf.

Apriani, E., Triyanti, M. & Harmoko. (2020). Pengembangan Booklet Berbasis Inventarisasi Anggrek (Orchidaceae) di Kecamatan Purwodadi Kabupaten Musi Rawas. *Jurnal Ilmiah Pendidikan Biologi*, 6(4), 526-540. DOI: 10.22437/bio.v6i4.8845.

Assagarf, M. H. (2011). *1001 Spesies Anggrek yang Tumbuh dan Berbunga di Indonesia.* Jakarta: Kataelha.

Besi, E. E., Nikong, D., Mustafa, M. & Go, R. (2019). Orchid Diversity in Anthropogenic-Induced Degraded Tropical Rainforest, an Extrapolation To-

wards Conservation. *Lankesteriana*, 19(2), 107-124. DOI: 10.15517/lank.v19i2.38775.

BKSDA Sumatera Selatan. (2014). *Suaka Margasatwa Isau-Isau.* Retrived from http://www.balaiksdasumsel.org/halaman/detail/isau-isau.

BKSDA Sumatera Selatan. (2021). *Menilik Keindahan Anggrek Endemis Sumatera*.. Retrived from http://www.balaiksdasumsel.org/menilik-keindahan-anggrek-endemis-sumatra.

Brower, J. E., Zar, J. H. & Ende, C. V. (1998). *Field and Laboratory Methods for Genusl Ecology.* WCB McGraw-Hill.

Comber, J. B. (2001). *Orchids of Sumatera*. England: Royal Botanic Gardens, Kew.

Danarto, S. A. (2019). Peran Masyarakat dalam Konservasi Anggrek: Studi Kasus di Kampung Empas, Kutai Barat, Kalimantan Timur. Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia. Kutai Barat, Maret 2019. pp. 199-204.

Effendi, S., Nunik, S. A. & Tatik, C. (2019). Keragaman dan Kelimpahan Anggrek Epifit di Kaki Gunung Liangpiran Kalimantan Timur. *Berita Biologi*, 18(3), 305-314. DOI: 10.14203/beritabiologi.v18i3.3709.

Fandani, H. S., Mallomasang, S. N. & Korja, I. N. (2018). Keanekaragaman Jenis Anggrek pada beberapa Penangkaran di Desa Ampera dan Desa Karunia Kecamatan Palolo Kabupaten Sigi. *Jurnal Warta Rimba*, 6(9), 14-20.

Frankie, H. (2019). *Orchids of Indonesia.* Bekasi: A self-published book.

Febriandito, P. D. & Lita, S. (2019). Eksplorasi Keanekaragaman Anggrek Epifit di Kawasan Konservasi Wilayah II Senduro, Blok Ireng-Ireng, Taman Nasional Bromo Tengger Semeru, Jawa Timur. *Journalo of Agricultural Science*, 4(1), 66-76. DOI: 10.21776/ub.jpt.2019.004.1.8.

Gunawan, H., Sugiarti, Marfuah, W. & Nina, M. (2019). *100 Spesies Pohon Nusantara*. Bogor: IPB Press.

Handoyo, F. (2019). *Orchids of Indonesia.* Bekasi: A self-published book.

Hilmiah, H. (2018). Eksplorasi dan Inventarisasi Anggrek di Desa Tompobulu Resort Balocci Taman Nasional Bantimurung Bulusaraung. *Bionature*, 18(2), 163-174. DOI: 10.13057/biodiv/d200421.

Kementrian Pertanian Holtikultura Republik Indonesia. (2012). *Anggrek Spesies Indonesia*. Jakarta.

Lianarti. (2019). Identifikasi Anggrek Alam di Hutan Bonehau Desa Bonehau Kabupaten Mamuju Sulawesi Barat. *Thesis*. Makassar: Universitas Negeri Makassar.

Lukitasari, M. (2018). *Mengenal Tumbuhan Lumut (Bryophyta) Deskripsi, Klasifikasi, Potensi, dan Cara Mempelajarinya*. Magetan: Media Grafika.

Metusala, D. & Ridesti, R. (2016). Inventarisasi Jenis Anggrek dan Tumbuhan Umum Serta Perbandingan Sifat hidup Gunung Dempo dan Padiampe, Hutan Lindung Pagar Alam, Sumatera Selatan. Prosiding Seminar Nasional II. Malang, 26 Maret 2016. Hlm 435-449.

Miswarti, Calista, I., Putra, W E. & Octavia, Y.. (2020). Morphology Characteristic of Orchids Species in Bukit Barisan Bengkulu Province. *Earth Environmental Science,* 653(012149), 1-10. DOI: 10.1088/1755-1315/653/1/012149.

Nugroho, A., Endah, R. & Ulfah, M. (2018). *Manajemen Konservasi Anggrek Gunung Ungaran Berbasis Masyarakat Sebagai Laboratorium Alam Pembelajaran Biologi*. Laporan Penlitian dan Pengabdian Kepada Masyarakat. Semarang: Universitas PGRI Semarang.

Paramitha, P. G. A. A. (2011). Keanekarag-

aman Anggrek Epifit di Kawasan Taman Wisata Alam Danau Buyan. *J. Metamorfosa,* 1(1), 11-16.

Pratidina, H., & Nengsih, N. Y. (2018). *Mengenal Anggrek Taman Wisata Alam Bukit Kaba*. Bengkulu: BKSDA Bengkulu. Retrived from https://bksdabengkulu.id/assets/filepublikasi/1/dokpublik_1525678997.pdf.

Rudianto, Ary, S. N. & Anas, M .D. (2018). Karakteristik Sifat hidup Anggrek Terestrial di Resort Kopeng Taman Nasional Gunung Merbabu Provinsi Jawa Tengah. Prosiding Seminar Nasional Sains dan Enterpreneurship V, Semarang, 30 Agustus 2018. pp. 236-240.

Sadili, A. & Siti, S. (2017). Keanekaragaman, Sebaran, dan Pemanfaatan Je nis-Jenis Anggrek (Orchidaceae) di Hutan Bodogol, Taman Nasional Gede Pangrango, Jawa Barat. *Widyariset*,3(2), 95-106. DOI: http://dx.doi.org/10.14203/widyariset.3.2.2017.95-106.

Setiaji, A., Muna, A., Jati, F. P., Putri, F. & Semiarti, E. (2018). Keanekaragaman Anggrek di Daerah Istimewa Yogyakarta. Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia, 4(1), 63-68. DOI: 10.13057/psnmbi/m040110.

Setiawan, D., Ina, A., Guntur, P., Winda, I. & Rio, F. S. (2020). Inventarisasi Anggrek di Kawasn Hutan Desa Tanjung Sakti Kecamatan Tanjung Sakti Pumi Kabupaten Lahat Sebagai Data Dasar dalam Upaya Introduksi Anggrek di Semambu Edu-Land Desa Pulau Semambu Kabupaten Ogan Ilir. *Sriwijaya Bioscientia,* 1(2)*,* 5-9. DOI: 10.24233/sribios.1.2.2020.197.

Tom, G. (1986). *Anggrek dari Benua ke Benua*. Bandung: Angkasa.

Vugt, R. V. (2011). *Grammatophyllum stapeliiflorum. Closer.* Retrived from https://www.pbase.com/rogiervanvugt/image/137767019.

Wahyudi, J. (2015). *Buku Flora Potensi Hias Merbabu.*Boyolali: Balai Taman Nasional Gunung Merbabu. Retrived from http://biologi.fkip.uns.ac.id/wp-content/uploads/2020/05/Buku-Flora-Anggrek-TNGMb-2015.pdf

https://powo.science.kew.org/.

https://orchidroots.com/.

https://orchid.unibas.ch/index.php/en/

https://monaconatureencyclopedia.com/.