



(RESEARCH ARTICLE)



Terrestrial Ferns (*Pteridophyta*) in the Bancea nature tourism park area

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Abstract

Bancea Nature Tourism Park (NTP) is a protected area with an abundance of various types of plants. Endemic plants, primarily terrestrial ferns, have not been identified in this area. Therefore, qualitative descriptive research was conducted using exploratory and free-collection sampling techniques. The study was conducted in the NTP Bancea area in October-December 2023. There were 40 types of terrestrial ferns found, which were divided into three classes and 18 tribes consisting of 1 type of *Gleicheniaceae*, two types of *Aspleniaceae*, two types of *Blechnaceae*, three types of *Nephrolepidaceae*, six types of *Pteridaceae*, two types of *Cyatheaceae*, 1 type of *Hymenophyllaceae*, 1 type of *Thelypteridaceae*, five types of *Dryopteridaceae*, 1 type of *Davaliaceae*, eight types of *Polypodiaceae*, two types of *Schizaeaceae*, 1 type of *Equisetaceae*, 1 type of *Dipteridaceae*, 1 type of *Lygodiaceae*, 1 type of *Selaginellaceae*, 1 type of *Athyriaceae* and *Lycopodiaceae* 1 type.

Keywords: Bancea Natural Park; Endemic Plants; Terrestrial ferns; Tropical Forest

1. Introduction

Indonesia's tropical climate conditions are ideal for ferns to thrive. The microclimate conditions suitable for the Palu plant are air temperatures between 21-27 °C, relative humidity between 60-90%, pH between 5.5-8.0, and good light intensity at 200-600 Cd [3]. This condition is evidenced by the high distribution of fern species, around 1,250-1,500 species spread across Indonesia's tropical forests [5].

2. Approach

This study aims to identify ferns, primarily terrestrial ferns. Terrestrial ferns live on the soil's surface and thrive in humid and tropical environments [4]. Terrestrial ferns usually. The identified ferns are located in the Bancea Nature Tourism Park (NTP) Area, which is located at coordinates 122° 30' - 122° 24' E and 0 7' - °36' S and covers an area of ± 5000 Ha. This park is in Bancea Village, South Pamona District, Poso Regency [2]. The climate conditions of the Bancea NTP are in the ideal climate range for ferns, namely a temperature of 26.9 °C and a relative humidity of 72%.

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Figure 1 Research coordinates

2.1. Methods

This qualitative descriptive study describes or depicts conditions that apply the exploration method and sampling using free collection [1]. The data collection site is the Bancea Village Nature Tourism Park, South Pamona District, Poso Regency, Central Sulawesi Province. The time of data collection is in October-December 2023. The subjects of this study are the types of terrestrial ferns found in the Bancea Nature Tourism Park Area, with a research area of 10% of the research area of 500 hectares.



Figure 2 Research area

2.2. Tools and materials

This study uses two primary materials, namely (1) terrestrial fern samples and (2) HVS paper. The tools used in this study are presented in Table 1 below:

Table 1 Tools used and their functions

No	Tools	Data which measured
1.	Thermohygrometer	Temperature and humidity
2.	Lux meter	Light intensity
3.	GPS	Coordinate
4.	pH meter	Soil's pH
5.	<i>Phosphate</i>	0,0040-0,0044
6.	Camera	Sample's documentation

**Figure 3** Color Stadium Change

2.3. Procedure

The research stages consist of observation, preparation of tools and materials, observation, and data collection. The data collection processes are below:

- Observation of the location using the exploration method.
- Recording the initial coordinates of sampling, along with documentation of terrestrial ferns, measuring temperature, humidity, light intensity, and soil pH at that point.
- Sampling using accessible collections.
- Identification of types of terrestrial ferns in the research area.
- Description of types of terrestrial ferns based on the morphology of roots, stems, leaves, and sori. Then, the association of classifications based on literature. Tools used and their functions.

3. Results and discussion

3.1. Research Location Observation

The research location is in the Bancea Nature Tourism Park (NTP) in Bancea Village, South Pamona District, Poso Regency, at coordinates 122° 30' - 122° 24' East Longitude and 07' - 036' South Latitude. The research area is 500 Ha, which is 10% of the area of the Bancea NTP. The results of measurements of the physical and chemical conditions of the environment obtained data on temperature 26.9°C, humidity 72%, light intensity 212 Cd, and soil pH six, which is included in the acid category.



Figure 4 The documentation of chemical-physical environment

3.2. Identification and Description of Terrestrial Ferns

The overall observation results inventory 40 types of terrestrial ferns consisting of 3 classes and 18 families. Data on ferns found in NTP based on class can be seen in Tables 2, 3, and 4.

Table 2 Types of Terrestrial Ferns of the *Pteropsida* Class

Tribe	Species	Coordinates
<i>Gleicheniaceae</i>	<i>Dicranopteris linearis</i> Burm. f.	S 01° 58.995' E 120° 34. 790'
<i>Aspleniaceae</i>	<i>Asplenium nidus</i> Linn	S 01° 58.996' E 120° 34. 788'
<i>Blechnaceae</i>	<i>Stenochlaena palustris</i> (Burm,f)Bedd	S 01° 58.985' E 120° 34.794'
<i>Nephrolepidaceae</i>	<i>Nephrolepis radicans</i> (Burm.f.)Kuhn	S 01° 58.978' E 120° 34. 804'
<i>Pteridaceae</i>	<i>Taenitis blechnoides</i> (Willd.) Sw.	S 01° 58.972' E 120°34. 805'
<i>Cyatheaceae</i>	<i>Cyathea gigantean</i> (Wall. Ex Hook) Holtt.	S 01° 58.968' E 120° 34. 807'
<i>Hymenophyllaceae</i>	<i>Hymenophyllum tunbrigense</i> (L.) Sm.	S 01° 58.966' E 120° 34. 809'
<i>Thelypteridaceae</i>	<i>Christella dentata</i> Forssk.	S 01° 58.964' E 120° 34. 810'
<i>Dryopteridaceae</i>	<i>Didymochlaena lunulata</i> Desv	S 01° 58.962' E 120° 34. 813'
<i>Davaliaceae</i>	<i>Davallia denculata</i> (Burm.f) Mett. Ex Kuhn	S 01° 58.958' E 120° 34. 820'
<i>Pteridaceae</i>	<i>Pityrogramma calomelanos</i> (L.) Link	S 01° 58.949' E 120° 34. 825'
<i>Pteridaceae</i>	<i>Adiantum lunulatum</i> Burm. F.	S 01° 58.947' E 120° 34. 830'
<i>Pteridaceae</i>	<i>Pteris multifida</i> Poir.	S 01° 58.943' E 120° 34. 839'

<i>Polypodiaceae</i>	<i>Diplazium esculantum (Retz.) Sw.</i>	S 01° 58.943' E 120° 34. 846'
<i>Schizaeaceae</i>	<i>Lygodium Flexuosum (L.) Sw</i>	S 01° 58.945' E 120° 34. 847'
<i>Polypodiaceae</i>	<i>Drynaria sparsisora Moore</i>	S 01° 58.945' E 120° 34. 853'
<i>Nephrolepidaceae</i>	<i>Nephrolepis biserrata (Sw.) Schott</i>	S 01° 58.945' E 120° 34. 866'
<i>Cyatheaceae</i>	<i>Cyathea contaminans Hook</i>	S 01° 58.942' E 120° 34. 877'
<i>Dryopteridaceae</i>	<i>Arachnoides aristata (G.Forst.) Tindale</i>	S 01° 58.933' E 120° 34.873'
<i>Polypodiaceae</i>	<i>Microsorium scolopendria (Burm. f.)</i>	S 01° 58.926' E 120° 34.872'
<i>Schizaeaceae</i>	<i>Schizaea dichotoma (L.) J. Sm.</i>	S 01° 58.925' E 120° 34.862'
<i>Dryopteridaceae</i>	<i>Rumohra adiantiformis (G.Forst.) Ching</i>	S 01° 58.922' E 120° 34.851'
<i>Dryopteridaceae</i>	<i>Cyrtomium falcatum (L.f.) C.Presl</i>	S 01° 58.919' E 120° 34.834'
<i>Polypodiaceae</i>	<i>Lepisorus bicolor (Takeda) Ching</i>	S 01° 58.861' E 120° 34.948'
<i>Nephrolepidaceae</i>	<i>Nephrolepis Hirsutula (G.Forst.) C.Presl</i>	S 01° 58.909' E 120° 34.818'
<i>Polypodiaceae</i>	<i>Drynaria quercifolia (L.) J. Sm.</i>	S 01° 58.896' E 120° 34.933'
<i>Dipteridaceae</i>	<i>Dipteris conjugate Reinw</i>	S 01° 58.915' E 120° 34.807'
<i>Lygodiaceae</i>	<i>Lygodium circinatum (Burm. F.) Sw</i>	S 01° 58.945' E 120° 34. 859'
<i>Polypodiaceae</i>	<i>Polypodium trilobum Houtt</i>	S 01° 58.924' E 120° 34.835'
<i>Aspleniaceae</i>	<i>Asplium normale D.Don</i>	S 01° 58.917' E 120° 34.823'
<i>Pteridaceae</i>	<i>Vittaria elongate Sw. A.</i>	S 01° 58.857' E 120° 34. 951'
<i>Polypodiaceae</i>	<i>Polypodium aureum L.</i>	S 01° 58.944' E 120° 34. 872'
<i>Athyriaceae</i>	<i>Diplazium proliferum (Lam.) Kaulf.</i>	S 01° 58.921' E 120° 34.906'
<i>Dryopteridaceae</i>	<i>Tectaria heracleifolia (Willd.) Underw.</i>	S 01° 58.919' E 120° 34. 834'

<i>Polypodiaceae</i>	<i>Drynaria coronans</i> (Wall. ex Mett.) J.Sm	S 01° 58.854' E 120° 34.976'
<i>Blechnaceae</i>	<i>Sadleria cyatheoides</i> Kaulf.	S 01° 58.894' E 120° 34.929'
<i>Pteridaceae</i>	<i>Pteris cretica</i> L.	S 01° 58.925' E 120° 34.903'

Table 2 shows 39 types of terrestrial ferns with the *Pteropsida* class found in NTP Bancea. Furthermore, the types of terrestrial ferns with the *Lycopsida* class can be seen in Table 3.

Table 3 Types of Terrestrial Ferns of the *Lycopsida* Class

Tribe	Species	Coordinates
<i>Selaginellaceae</i>	<i>Selaginella intermedia</i> (Bl.) Spring	S 01° 58.945' E 120° 34.844'
<i>Lycopodiaceae</i>	<i>Lycopodium cernuum</i> L.	S 01° 58.918' E 120° 34.910'

There are two types of terrestrial ferns with the *Pteropsida* class found in the Bancea NTP based on Table 3. Furthermore, the types of terrestrial ferns with the *Shenopsida* class can be seen in Table 4.

Table 4 Types of Terrestrial Ferns of the *Shenopsida* Class

Tribe	Species	Coordinates
<i>Equisetaceae</i>	<i>Equisetum ramosissimum</i> Var. <i>Debile</i>	S 01° 58.926' E 120° 34.865'

There is only one type of terrestrial fern of the *Shenopsida* class found in NTP Bancea based on Table 4. The total number of ferns found based on class is 39 species of the *Pteropsida* class, two species of the *Lycopsida* class, and one species of the *Shenopsida* class. Furthermore, the percentage of the distribution of terrestrial ferns based on class can be seen in the diagram in Figure 2 below.

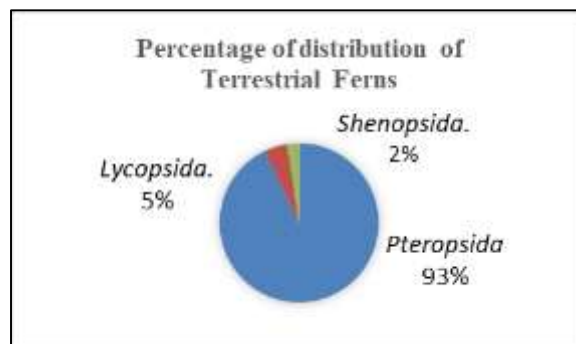


Figure 5 Percentage of distribution of terrestrial ferns by class.

3.3. Evaluation of findings

The results of observations conducted in the Bancea Nature Tourism Park (NTP) obtained 40 types of terrestrial ferns consisting of 3 classes and 18 families. The types of terrestrial ferns found came from the *Pteropsida*, *Lycopsida*, and *Shenopsida* classes which came from 18 families consisting of 1 type of *Gleicheniaceae*, two types of *Aspleniaceae*, two types of *Blechnaceae*, three types of *Nephrolepidaceae*, six types of *Pteridaceae*, two types of *Cyatheaceae*, 1 type of *Hymenophyllaceae*, 1 type of *Thelypteridaceae*, five types of *Dryopteridaceae*, 1 type of *Davaliaceae*, eight types of

Polypodiaceae, two types of *Schizaeaceae*, 1 type of *Equisetaceae*, 1 type of *Dipteridaceae*, 1 type of *Lygodiaceae*, 1 type of *Selaginellaceae*, 1 type of *Athyriaceae* and 1 type of *Lycopodiaceae*.

Equisetinae class (horsetail fern), where in previous studies, no types of ferns were found in these 76 classes; in this study 1 type of terrestrial fern was found from the *Equisetinae* class, namely *Equisetum ramosissimum*, where this class only has one genus, namely *Equisetum*. This aligns with the opinion by [6], where the name horsetail fern refers to a small group of ferns of which only about 20 species are included in the genus *Equisetum*. Its members can be found throughout the world except Antarctica. Only one natural species, including Indonesia, is found in Southeast Asia, namely *E. Ramosissimum* Var. *Debile*.

The measurements of the physical and chemical conditions of the environment show that the Bancea NTP Area is one of the suitable habitats for terrestrial ferns. This is because this area has high humidity with relatively low temperatures, according to the results of measurements of the physical and chemical conditions of the environment, to find out that terrestrial ferns in the research area grow in supportive environmental conditions. Data from measurements of the physical and chemical conditions of the environment in the Bancea NTP area were obtained for a temperature of 26.9 °C, humidity of 72%, light intensity of 212 Cd, and soil pH of 6. [3] believe that ferns can grow and develop well in locations with air temperatures ranging from 21-27 ° C, humidity from 60-90%, and pH from 5.5 - 8.0. Fern growth can also grow at good light intensity ranging from 200-600 Cd. Where terrestrial ferns can grow and develop in the Bancea NTP area are ferns that can adapt to the physical and chemical conditions in that environment.

4. Conclusion

This study observed terrestrial ferns in the Bancea Nature Tourism Park (NTP), which has physical and chemical environmental conditions indicating that the Bancea NTP Area is one of the suitable habitats for terrestrial ferns. Thus, 40 types of terrestrial ferns were found, which are included in 18 families consisting of 1 type of *Gleicheniaceae*, two types of *Aspleniaceae*, two types of *Blechnaceae*, three types of *Nephrolepidaceae*, six types of *Pteridaceae*, two types of *Cyatheaceae*, 1 type of *Hymenophyllaceae*, 1 type of *Thelypteridaceae*, five types of *Dryopteridaceae*, 1 type of *Davalliaceae*, eight types of *Polypodiaceae*, two types of *Schizaeaceae*, 1 type of *Equisetaceae*, 1 type of *Dipteridaceae*, 1 type of *Lygodiaceae*, 1 type of *Selaginellaceae*, 1 type of *Athyriaceae* and 1 type of *Lycopodiaceae*.

The data of this study can support conservation efforts, especially in endemic terrestrial fern species. In addition, this study contributes to botanical science and becomes a reference for further studies on biodiversity, especially in the study of *Pteridophyta*.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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