

DIVERSITY OF FERN SPECIES (PTERIDOPHYTA) IN KEBUN RAYA BANUA BANJARBARU, SOUTH KALIMANTAN PROVINCE

Muhammad Abdi Gusti*¹, Opik Prasetyo¹, Alifia Puspita Sari¹

¹Department of Biology Education, Faculty of Teacher Training and Education, Lambung Mangkurat University, Indonesia.

*Corresponding author: 2310119210010@mhs.ulm.ac.id

Received: November 06th, 2025

Accepted: January 10th, 2026

Abstract

Ferns (Pteridophyta) are a group of Cryptogamae plants that play an important role in maintaining ecosystem balance and have the potential to be a source of biodiversity learning. This study aims to determine the diversity and evenness of fern species in the Kebun Raya Banua, Banjarbaru City, South Kalimantan Province, and to analyze the environmental factors that influence their existence. The research was conducted using an exploratory survey method with purposive sampling techniques at three observation stations. Diversity analysis was performed using the Shannon–Wiener Index (H') and the evenness index (E). The results showed that there were 8 species of ferns belonging to 5 families, namely *Asplenium nidus*, *Gleichenia linearis*, *Nephrolepis biserrata*, *Lygodium circinnatum*, *Davallia denticulata*, *Drynaria quercifolia*, *Adiantum raddianum*, and *Microsorium scolopendria*, with a total of 62 individuals. The diversity index value $H' = 1.894$ is classified as moderate, while the evenness index value $E = 0.56$ indicates that species distribution is also moderate. These values indicate that the environmental conditions at Kebun Raya Banua are still relatively stable and support the growth of various types of ferns, with temperature, humidity, soil pH, and light intensity as important factors that influence diversity variation between observation stations.

Key words: *Kebun Raya Banua; Pteridophyta; Species diversity,*

INTRODUCTION

Biodiversity is an important indicator that reflects the complexity and stability of an ecosystem, including the variation of organisms, biotic communities, and ecological processes that occur within it (Darmansyah *et al.*, 2024). Indonesia is known as one of the megadiverse countries because it has a very high diversity of flora and fauna, supported by its geographical location in the tropics and stable climatic conditions throughout the year. In terms of plant diversity, Indonesia ranks third in the world (Akbar *et al.*, 2023). This condition is driven by the vastness of tropical rainforests that serve as habitats for various endemic and unique species (Fau, 2020).

One group of plants that plays an important role in the structure and function of tropical ecosystems is ferns (Pteridophyta). This group exhibits high ecological adaptability and can be found in almost all types of habitats, from lowlands and humid valleys to mountain forests (Affandi, 2025). Pteridophyta are known as spore bearing cormophytes because they have true roots, stems, and leaves, but reproduce using spores (Setyawan, 2023).

Although Indonesia has very high biodiversity, scientific studies on the diversity of ferns still show a research gap. Most previous studies have focused on Java and Sulawesi, such as the research by Haribowo *et al.* (2023), which reported 34 species in Gunung Gede Pangrango National Park, and Bulawan *et al.* (2022), which found 29 species in the Gunung Mambuliling Waterfall area, West Sulawesi. In contrast, information on fern diversity on the island of Kalimantan, especially in South Kalimantan, is still very limited.

This condition shows that the potential biodiversity of ferns in the region has not been widely documented scientifically. Oleh karena itu, kajian mengenai keanekaragaman jenis pakis di Kebun Raya Banua Banjarbaru, Provinsi Kalimantan Selatan, menjadi penting sebagai dasar pengelolaan dan konservasi keanekaragaman hayati secara berkelanjutan.

Ecologically, Kalimantan Island has environmental characteristics that are very conducive to the growth and spread of ferns, including high rainfall, relatively stable air humidity, and extensive tropical forest cover (Majid *et al.*, 2022). One area that has the potential to be a habitat for various types of Pteridophyta is the Kebun Raya Banua in Banjarbaru City. This area functions as an ex situ conservation center for Kalimantan's unique flora as well as a facility for environmental research and education. However, to date, there has been no scientific study specifically documenting the diversity of fern species in this area. The absence of this data creates an important information gap that needs to be filled in order to support conservation efforts, biodiversity management, and the development of a scientific database on the flora of South Kalimantan.

Based on the urgency and research gap, this study was conducted to document the composition and level of diversity of fern species in the Kebun Raya Banua, South Kalimantan. Previous relevant studies generally focused on species identification in different locations (Nabila *et al.*, 2021; Ifadatin, 2023; Meliasa *et al.*, 2025), while this study presents a novelty in the form of preliminary mapping of Pteridophyta diversity in artificial conservation areas in South Kalimantan. In addition, this study integrates the analysis of the Shannon–Wiener diversity index and the evenness index to assess community stability, which has not been widely applied in similar studies in this region.

Thus, this study aims to identify the types and levels of fern (Pteridophyta) diversity in the Banua Botanical Garden, Banjarbaru City, both in terms of species diversity and ecosystem diversity. The analysis of the relationship between fern composition and environmental factors in this study was conducted using descriptive ecology, by comparing species occurrence patterns with variations in abiotic conditions at each observation station. This study did not use multivariate analyses such as *Principal Component Analysis* (PCA), *Canonical Correspondence Analysis* (CCA), or *Detrended Correspondence Analysis* (DCA) due to limitations in the number of species, sample units, and exploratory data collection design.

Therefore, the interpretation of the relationship between ferns and the environment focuses on a descriptive approach based on relevant ecological literature. The results of this study are expected to provide a scientific basis for local biodiversity management and conservation efforts, support the educational function of the Banua Botanical Garden as a means of environmental biology learning, and enrich the literature on biodiversity in South Kalimantan.

RESEARCH METHOD

This research was conducted using an exploratory survey approach through direct field observation to identify and document the diversity of fern species (Pteridophyta). Dalam penelitian ini, pengambilan data dilakukan dengan metode survei eksploratif menggunakan transek sabuk (*Belt transect*), di mana peneliti menjelajahi area pengamatan dengan lebar pengamatan tertentu untuk mencatat seluruh individu tumbuhan pakis yang ditemukan., which is the deliberate selection of observation locations based on certain criteria, such as the potential for the existence of ferns in various types of habitats (epiphytic and terrestrial) as well as differences in environmental conditions, including temperature, air humidity, pH and soil moisture, light intensity, and wind speed (Soerianegara & Indrawan, 1988). This approach enabled the collection of data that was representative of the ecological variation at each observation station.

This research was conducted in September–October 2025 in the Kebun Raya Banua, Banjarbaru City, South Kalimantan Province. This area of approximately 100 hectares serves as an ex situ conservation area and a collection of flora unique to Kalimantan. In general, the area has a humid tropical climate with environmental conditions that support the growth of various types of ferns. The observation locations were determined at several points that were considered representative of the entire research area, taking into account the variation in potential habitats for the existence of ferns, both epiphytic and terrestrial. The stations were divided into 3 points as shown in **Figure 1**



Figure 1. Sample locations

Source: Personal documentation, 2025

Station 1 (Kebun Raya Banua Entrance Gate)

Located in the entrance area and plant collection greenhouse, with dense vegetation and a high tree canopy that creates a shady and humid environment.

Station 2 (Kebun Raya Banua Pond Area)

Located around the pond area, it has sparse vegetation and a more open environment, allowing sunlight to penetrate more easily.

Station 3 (Kebun Raya Banua Cafeteria Area)

Located around the canteen and visitor garden area, with moderate to dense vegetation creating a semihanded and relatively humid environment.

This study used several field tools to support exploration and measurement of environmental factors in the Kebun Raya Banua area of Banjarbaru. The tools used included a Global Positioning System (GPS) to accurately determine the coordinates of each observation station, a digital camera to document the morphology of ferns, and rulers and writing instruments to measure morphological parts such as leaf length and record field data. Environmental conditions were measured using a digital thermometer to record air temperature, a soil tester to measure soil moisture and pH, and a Four in One environmental meter to measure sunlight intensity (lux) and wind speed (m/s) at the research site.

The research material observed consisted of fern specimens (Pteridophyta) found directly in the field and documented through photographs and recording of their morphological characteristics. Sampling was carried out non destructively, only through observation and visual documentation without damaging the plants or their habitat, so that all data obtained preserved the ecosystem in the Kebun Raya Banua conservation area.

Sampling was carried out exploratively at the three observation stations. Researchers conducted direct field surveys to find and record all types of ferns encountered on various natural substrates, such as soil, tree trunks, rocks, and rhizomes. Each specimen was identified based on vegetative morphological characteristics (leaf, stem, and rhizome shape) and generative characteristics (sporangium and spores). Identification was carried out in the field and confirmed in the laboratory using fern identification key literature (Azmi *et al.*, 2025; Nabila *et al.*, 2021). Sampling was conducted non destructively, namely through recording and visual documentation without damaging the natural population in the conservation area.

The observation data were analyzed descriptively based on the number of fern individuals in each family and species. Diversity analysis was performed using the Shannon–Wiener diversity index (H'), the evenness index (E), and the species richness index (R) to assess the fern community structure at each observation station.

a) Indeks keanekaragaman (H') Shannon Wiener (Mangguran, 1988).

$$H' = - \sum_{i=1}^s Pi \ln Pi$$

Keterangan:

H' = Shannon-Wiener diversity index

Pi = n_i/N

N_i = number of individuals of a species

N = total number of individuals

S = number of species

The results of the species diversity index calculation can be categorized in **Table 1**

Table 1. Species diversity index categories

Category	H' Value Range	Ecological Interpretation
Low	$H' < 1$	Low diversity, dominated by a few spesies
Moderate	$1 \leq H' \leq 3$	Moderate diversity, relatively balanced community
High	$H' > 3$	High diversity, even distribution of individual

b) Spesies Evenness Index (E) (Soerianegara & Indrawan, 1988)

$$E = \frac{H'}{\ln(S)}$$

Keterangan:

H' = Shannon-Wiener diversity index

S = Number of each spesies

E' = Species evenness index

The results of the species evenness index calculation can be categorized in **Table 2.**

Table 2. Species evenness index categories

Nilai E	Kategori	Interpretasi Ekologis
$E < 0,4$	Low	The community is dominated by only a few spesies
$0,4 \leq E \leq 0,7$	Moderate	Individual composition begins to even out
$E > 0,7$	High	Stable and balanced community

RESULTS AND DISCUSSION

Diversity of Fern Species

The diversity of fern species is determined by observing the number of fern species found in three different zones. These ferns consist of 62 individuals comprising 8 fern species, including 3 terrestrial and 5 epiphytic fern species found in the Kebun Raya Banua in Banjarbaru, as shown in **Table 3.**

Table 3. Types of ferns found in the Kebun Raya Banua in Banjarbaru

No	Family	Species name	Amount			Form of life
			1	2	3	
1.	Davalliaceae	<i>Devallia denticulata</i>	-	-	5	Epiphyte
2.	Aspleniaceae	<i>Asplenium nidus L.</i>	-	-	12	Epiphyte
3.	Polypodiaceae	<i>Platyserium sp.</i>	-	-	2	Epiphyte
4.	Polypodiaceae	<i>Pyrrosia piloselloides</i>	1	1	4	Epiphyte
5.	Nephrolepidaceae	<i>Nephrolepis cordifolia</i>	-	10	2	Terrestrial
6.	Gleicheniaceae	<i>Gleichenia linearis</i>	-	15	-	Terrestrial
7.	Polypodiaceae	<i>Drynaria quercifolia</i>	1	2	5	Epifit
8.	Aspleniaceae	<i>Pityrogramma calomelanos</i>	-	2	-	Terrestrial
Total			2	30	30	
				62		

Data analysis was conducted to determine the diversity of fern species at the Kebun Raya Banua, as presented in **Table 4**.

Table 4. Diversity Index (H') Values of Ferns at the Kebun Raya Banua in Banjarbaru

No.	Spesies	H'		
		1	2	3
1	<i>Davallia denticulata</i>	-	-	0.299
2	<i>Asplenium nidus</i>	-	-	0.367
3	<i>Platyserium sp.</i>	-	-	0.181
4	<i>Pyrrosia piloselloides</i>	0.347	0.113	0.269
5	<i>Nephrolepis cordifolia</i>	-	0.347	0.181
6	<i>Gleichenia linearis</i>	-	0.366	-
7	<i>Drynaria quercifolia</i>	0.347	0.181	0.299
8	<i>Pityrogramma calomelanos</i>	-	0.181	-
	Total H'	0.693	1.187	1.593
	Average		1.894	

The results of the Shannon–Wiener diversity index (H') calculation show that the H' value per station ranges from 0.693 to 1.593. Meanwhile, the overall H' calculation for the Banua Botanical Garden area based on the accumulation of all species and individual data produced an H' value of 1.894, which is higher than the H' values at each station. This value indicates that the diversity of fern species in the Banua Botanical Garden area is moderate, with a relatively stable community structure but still dominated by certain species, such as *Asplenium nidus* and *Gleichenia linearis*, while other species have fewer individuals.

In addition to the diversity value, the level of individual distribution between species was also calculated to determine the balance of the fern community at each observation location. This value was analyzed using the evenness index (E). The results of the evenness index calculations at three observation locations in the Kebun Raya Banua are presented in **Table 5**.

Table 5. Fern Diversity Index (E) Values at Kebun Raya Banua, Banjarbaru, South Kalimantan Province

Location	H'	$\ln(S)$	$E = H'/\ln(S)$	Evenness Category
1	0.693	2.079	0.33	Low
2	1.187	2.079	0.57	Medium
3	1.593	2.079	0.77	High
	Average		0.56	Moderate

The results of the species evenness index (E) calculation at three observation locations in the Kebun Raya Banua averaged 0.56, which falls into the moderate uniformity category ($0.4 < E \leq 0.7$). This value indicates that the distribution of fern individuals between species in the area is fairly balanced, although there is still dominance by certain species.

In addition to biotic aspects, abiotic factors such as air temperature, humidity, light intensity, and soil pH were also measured to determine their relationship with the distribution and growth of ferns at the study site. The data from the measurement of environmental parameters at each observation point are presented in **Table 6**.

Table 6. Measurement of environmental parameters

No	Parameter Lingkungan	Stasiun 1	Stasiun 2	Stasiun 3	Rentang Pengukuran
1	Suhu udara ($^{\circ}\text{C}$)	31,6	34,43	34,6	30,9 – 35
2	Suhu tanah ($^{\circ}\text{C}$)	5,7	6,37	6,07	5,1 – 6,9
3	pH tanah	5,67	6,33	6,07	5,1 – 6,9
4	Kelembapan udara (%)	71,93	64,37	59,97	57,4 – 74,2
5	Intensitas cahaya (Lux)	3.282 – 9.087	5.153 – 15.090	3.509 – 9.673	1.366 – >20.000
6	Kecepatan angin (m/s)	0,0 – 1,1	0,0 – 1,13	0,0 – 1,0	0,0 – 1,4

Measurements of environmental factors at three observation points in the Kebun Raya Banua area show variations in microhabitat conditions that could potentially affect the growth and distribution of ferns. The ambient temperature ranged from 30.9 to 35 $^{\circ}\text{C}$, with an average of 33.54 $^{\circ}\text{C}$. Air humidity ranged from

59–72%, while measured light intensity varied between 3,282–15,090 lux. Soil pH values at the three points ranged from 6.0–6.5, which is classified as near neutral.

Diversity of Fern Species in the Kebun Raya Banua Banjarbaru

The study found eight species of ferns belonging to five families, namely *Davalliaceae*, *Aspleniaceae*, *Polypodiaceae*, *Nephrolepidaceae*, and *Gleicheniaceae*, with a total of 62 individuals spread across three observation points in the Kebun Raya Banua. Fern species from the Polypodiaceae family were the most dominant at the study site. This is consistent with research conducted by Nabila *et al.* (2021) in the Bogor Botanical Garden, which found seven species of epiphytic ferns, with the Polypodiaceae family being the most abundant. In addition, Gunawan *et al.* (2020) added in their study in the Sultan Adam Mandiangin Forest Park area of South Kalimantan that they found eight types of epiphytic ferns, with the most numerous family being Polypodiaceae.

The difference in the number of fern species at each research location was due to several factors, namely the environment, species diversity, and vegetation. This is in line with the research conducted by Ningsih *et al.* (2024), which found that ferns are influenced by environmental factors such as temperature, humidity, vegetation in an area, and species diversity. The Shannon–Wiener diversity index (H') value of 1.894 indicates a moderate level of diversity at the Kebun Raya Banua site. This condition indicates that the fern community at the Kebun Raya Banua has a relatively stable community structure, but there is still dominance by certain species. The level of species diversity can be determined by the number of species and the number of individuals of each species, as well as environmental factors (Khotimperwati & Murningsih, 2021).

The evenness index value ($\bar{E} = 0.56$) indicates that the distribution of individuals among fern species in the Kebun Raya Banua is not yet completely even. This condition illustrates that there are species that are more ecologically dominant than others. Species such as *Asplenium nidus* and *Gleichenia linearis* have a larger number of individuals, indicating a high adaptability to variations in environmental factors such as light intensity, temperature, and humidity. This is in line with the research by Nabila *et al.* (2021) that *Asplenium nidus* and *Gleichenia linearis* are species with high tolerance to fluctuations in humidity and temperature, allowing both to grow in semi-open habitats.

The environmental factors observed were temperature, air humidity, light intensity, and soil pH. These five components are the main abiotic variables that greatly influence the growth, distribution, and dominance of fern species in their habitat. This is in line with the research by Widiyanti *et al.* (2022) that fern growth is determined by air temperature, air humidity, and nutrient availability. Table 6 shows that temperature plays a role in the growth of ferns in the Kebun Raya Banua, with temperatures ranging from 31 to 34°C. The results of research conducted by Rafael *et al.* (2023) show that at temperatures ranging from 30 to 33°C not many ferns (Pteridophyta) can grow well. Based on Table 3, there are fern species that do not grow in one location, indicating that temperature greatly influences the growth of fern species in a region.

Light intensity also affects the abundance of ferns. In areas with low light intensity, such as locations 1 and 3, the number of fern individuals found tends to be lower, with a dominance of epiphytic species such as *Asplenium nidus* and *Drynaria quercifolia*, which are able to adapt to limited light and high humidity conditions. Based on research by Windari *et al.* (2021), sufficient light is essential for ferns because it affects photosynthesis and sporophyll formation. At location 2, the number of individuals and species of ferns increased, especially from terrestrial groups such as *Gleichenia linearis* and *Nephrolepis cordifolia*, because location 2 had a light intensity of 15,090 lux. Research by Naiym & Munir (2024) concurs that air humidity and light intensity are important factors, with a range of 1370–1650 lux.

Soil pH and soil moisture, ranging from 5.1 to 6.9 and 3.8% respectively dimana kelembapan tanah diukur menggunakan *soil tester* analog yang menunjukkan skala kelembapan relatif 1–8. Skala tersebut merepresentasikan tingkat kelembapan tanah dari kondisi sangat kering hingga sangat lembap secara semi-kuantitatif, dan tidak secara langsung dikonversi ke dalam satuan persentase. Oleh karena itu, nilai kelembapan tanah dalam penelitian ini disajikan sebagai skala relatif alat untuk membandingkan kondisi kelembapan antar stasiun pengamatan have a significant effect on the growth and distribution of ferns in the Kebun Raya Banua. The pH conditions close to neutral support root growth and optimal nutrient absorption, thereby supporting the vegetative development of ferns, especially terrestrial species such as *Nephrolepis cordifolia* and *Gleichenia linearis*. Research by Majid *et al.* (2022) adds that the optimum

humidity for fern growth is around 50%-80%. Soil moisture is determined by rainfall and soil type Haribowo *et al* (2023).

Environmental factors greatly influence the composition and distribution of ferns. The average temperature at the Kebun Raya Banua ranges from 30.9 to 35°C, indicating that the temperature and humidity are moderate to high, creating conditions typical of tropical forests that are suitable for fern growth. Research by Ifadatin (2023) adds that ferns living in tropical areas thrive in temperatures ranging from 21 to 27°C, while the relative humidity suitable for fern growth ranges from 60 to 80%. The varying light intensity between stations affects the dominance of certain species; areas with high light tend to be inhabited by terrestrial ferns such as *Gleichenia linearis*, while shady areas with high humidity are ideal habitats for epiphytic ferns such as *Asplenium nidus*. This shows that adaptation to light and humidity is key in determining the distribution of ferns in the field.

Overall, the relationship between the diversity index ($H' = 1,894$) and evenness index ($\bar{E} = 0.56$) with environmental conditions shows that temperature, light intensity, air humidity, soil pH, and soil moisture are the main factors determining the distribution and growth patterns of ferns in the Kebun Raya Banua. The relatively balanced microhabitat conditions with tropical temperatures ranging from 30.9 to 35°C, air humidity of 59 to 72%, and soil pH close to neutral 5.1 to 6.9 support the existence of both terrestrial and epiphytic fern species, resulting in a community with moderate and stable diversity.

Identification of Fern Species

Based on observations conducted at three locations in Kebun Raya Banua, there were 62 individuals comprising eight fern species, including three terrestrial fern species and five epiphytic fern species, **Figure 2**:

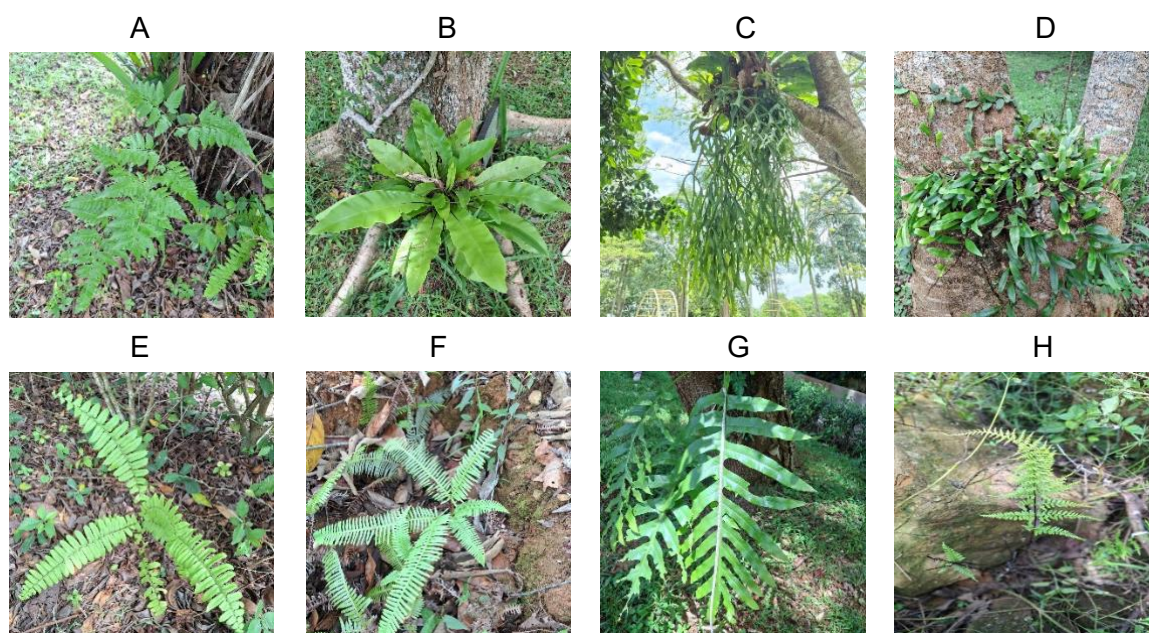


Figure 2. Types of ferns (Pterydophyta) in Kebun Raya Banua **A.** *Devallia denticulata*; **B.** *Asplenium nidus*; **C.** *Platycerium bifurcatum*; **D.** *Pyrrosia piloselloides*; **E.** *Nephrolepis cordifolia*; **F.** *Gleichenia linearis*; **G.** *Drynaria quercifolia*; **H.** *Pityrogramma calomelanos*

A. Paku Kaki Kelinci (*Davallia denticulata*)

Classification

Kingdom	: Plantae
Divisi	: Pteridophyta
Class	: Pteridopsida
Order	: Polypodiales
Family	: Polypodiaceae
Genus	: <i>Davallia</i>
Species	: <i>Davallia denticulata</i>

The squirrel's foot fern (*Davallia denticulata*) is an epiphytic fern because it is found attached to tree trunks or other plants and grows together with bird's nest ferns or other types of ferns. This fern has green leaves with a creeping rhizome root system that is elongated, with a tightly packed, brownish red scaly surface. The leaf stalks reach a length of 13.8 cm and are two toned, light brown in front and black behind. The leaves are triple pinnate, triangular in shape with pointed tips and blunt bases, serrated edges, thin texture, and green color. Spores are found at the tips of the leaflets (Azmi *et al.*, 2025).

B. Paku Sarang Burung (*Asplenium nidus*)

Classification

Kingdom	: Plantae
Division	: Pteridophyta
Class	: Pteridopsida
Order	: Polypodiales
Family	: Aspleniaceae
Genus	: <i>Asplenium</i>
Species	: <i>Asplenium nidus</i>

Bird's nest fern (*Asplenium nidus*) is an epiphytic fern because it is found attached to trees or other substrates. This fern has long leaves with a glossy green color and clearly visible black midribs. The sori are arranged in parallel rows on both sides of the midrib. *Asplenium nidus* has morphological characteristics in the form of fibrous roots with upright rhizomes. It can be found growing on the ground or attached to tree trunks (Majid *et al.*, 2022). The leaf stalks are blackish brown and round in shape. The leaves are green, with a smooth surface, wavy edges, and blunt tips. The leaves are arranged in a rosette, with pointed bases.

C. Paku Tanduk Rusa (*Platycerium bifurcatum*)

Classification

Kingdom	: Plantae
Division	: Pteridophyta
Class	: Pteridopsida
Order	: Polypodiales
Family	: Polypodiaceae
Genus	: <i>Platycerium</i>
Species	: <i>Platycerium bifurcatum</i>

Staghorn ferns are found attached to trees as their habitat, thus classified as epiphytic ferns. This fern has two types of leaves: sterile leaves shaped like shields attached to the substrate and fertile leaves that hang down and branch out like deer antlers. The leaves are grayish green with a thin waxy coating. Sporangia are located at the tips of the fertile leaf branches. *Platycerium bifurcatum* has fibrous roots with creeping rhizomes. The leaf stalks are flat and green in color. The leaves of *Platycerium bifurcatum* are green with a rough surface and smooth edges. The tips of the leaves are blunt and fused at the base. The leaves are dichotomous and attached to the tree trunk (Tirani. 2022).

D. Paku Sisik Naga (*Pyrrosia piloselloides*)

Classification

Kingdom : Plantae
 Division : Pteridophyta
 Class : Polypodiopsida
 Order : Polypodiales
 Family : Polypodiaceae
 Genus : *Pyrrosia*
 Species : *Pyrrosia piloselloides*

Dragon scale fern is a small epiphytic fern that grows on trees, with thick dark green leaves approximately 9 cm long. The underside of the leaves is covered with fine golden brown hairs. The rhizome creeps along the bark of trees. Sori are scattered on the underside of the leaves without indusium. The morphology of dragon scale ferns growing on tree trunks and branches includes long, small, creeping, scaly rhizomes, 5 - 22 cm long, and strongly attached roots. The leaves grow close together. The leaves have short petioles, are thick and fleshy, oblong or elongated oblong in shape, with blunt or rounded tips, pointed bases, flat edges, and mature leaves are glabrous or sparsely hairy on the underside, and green to green brown in color. Some leaves are sterile and some bear spores. Fertile leaves have short stalks or are sessile, elongated oval, 1-5 cm long, 1-2 cm wide. The size of the round to oblong leaves is almost the same as small coins, hence the name picisan. Dragon scales can be propagated by spores and root division (Azmi *et al.*, 2025).

E. Paku Sepat (*Nephrolepis cordifolia*)

Classification

Kingdom : Plantae
 Division : Pteridophyta
 Class : Polypodiopsida
 Order : Polypodiales
 Family : Nephrolepidaceae
 Genus : *Nephrolepis*
 Species : *Nephrolepis cordifolia*

This fern grows on the ground near dry leaf litter, so it is classified as a terrestrial fern. This fern has long, pinnate leaves, with a dark green color on top and a light green color underneath. This fern has fine hairs along its stem, and its roots are dark brown and spread under the soil surface. *Nephrolepis Cordifolia* (fern) is a terrestrial plant that grows near futsal fields with brown fibrous roots. It is 100 cm tall, with a green stem covered in fine hairs. The leaves are pinnate, with an even number of leaflets, opposite leaflets, young leaves are green with curls, leaf stalks are hairy, 11 cm long and 18 cm wide. The leaf surface is smooth, the leaf margin is straight, and the leaf tip is sharp. The sori are located on the margins and center of the leaf and are round in shape. *Nephrolepis cordifolia* has potential as a medicinal and food ingredient (Renjana *et al.*, 2021).

F. Paku Resam (*Gleichenia linearis*)

Classification

Kingdom : Plantae
 Division : Pteridophyta
 Class : Polypodiopsida
 Order : Gleicheniales
 Family : Gleicheniaceae
 Genus : *Gleichenia*
 Species : *Gleichenia linearis*

Gleichenia linearis (Paku Resam) has compound leaf stalks forming forks, each fork forming another fork, with transverse leaves. The sori are circular, located beneath the leaves, consisting of 2 to 12 sporangia that are sessile or short stalked, without a covering membrane, enclosed by a horizontal circle and opening longitudinally. The leaves are deeply lobed or pinnate, branched in a pinnate or forked pattern (Majid *et al.*, 2022).

G. Drynaria quercifolia

Classification

Kindom : Plantae
 Division : Pteridophyta
 Class : Polypodiopsida

Order : Polypodiales
Family : Polypodiaceae
Genus : *Drynaria*
Species : *Drynaria quercifolia*

Drynaria quercifolia belongs to the Polypodiaceae family. *Drynaria quercifolia*, known as Squirrel's Head Fern, has thick, round rhizomes. The rhizomes are covered with dark brown scales, which can fall off over time, leaving marks where the scales have fallen on some parts of the rhizome. The stem is round, brown, and has a smooth surface. This species has round supporting leaves with serrated edges and smooth green surfaces, as well as broad supporting leaves. (Rachaman *et al.*, 2025).

H. *Pityrogramma calomelanos*

Classification

Kindom : Plantae
Division : Pteridophyta
Class : Polypodiopsida
Order : Polypodiales
Family : Pteridaceae
Genus : *Pityrogramma*
Species : *Pityrogramma calomelanos*

The leaf stalks of this fern are dark brown in color with a rounded shape. The leaves of this fern are light green and smooth. The edges of the leaves are serrated with pointed tips and tapered bases. The leaves of *Pityrogramma calomelanos* are arranged alternately and the reproductive organs are located under the leaves. This fern is found on the ground. *Pityrogramma calomelanos* has upright, brown scaled rhizomes. Ental bipinnatus penatifid, slit edges, alternate leaf arrangement, forked veins, abaxial leaves covered with white scales. This fern can be found on cliffs and in open areas (Majid *et al.*, 2022).

CONCLUSION

The diversity of ferns (Pteridophyta) in the Kebun Raya Banua is moderate with a Shannon–Wiener index ($H' = 1.158$) and evenness ($E = 0.56$), indicating a relatively stable community dominated by *Asplenium nidus* and *Gleichenia linearis*. Environmental conditions temperature 30.9–35°C, humidity 59–72%, soil pH 5.1–6.9, and light intensity 3,282–15,090 lux still support the growth of epiphytic and terrestrial ferns. These environmental factors are the main determinants of species distribution between stations. These results confirm that ferns have the potential to serve as ecological indicators of microclimate in tropical conservation areas. This study is still limited to morphological identification, so further studies using molecular analysis and long term monitoring are recommended to support fern conservation efforts in South Kalimantan.

REFERENCES

- Azmi, S. F., Situmorang, R. R., Tanjung, A. A., Gunawan, R., & Faisal, M. (2025). Identifikasi Tumbuhan Paku (Pteridophyta) Di Universitas Negeri Medan Sumatera Utara. In *Communnity Development Journal*. 6 (1).
- Tirani, A. (2022). *Identifikasi Pterydophyta Epifit Pada Hutan Kecamatan Baturaja Barat Kabupaten Ogan Komering Ulu Skripsi Diajukan Untuk Melengkapi Tugas-Tugas Dan Memenuhi Syarat-Syarat Guna Dapat Memperoleh Gelar Sarjana S1 Dalam Pendidikan Biologi Oleh Aprilia Tirani Npm: 1711060147*.
- Ifadatin, S. (2023). *Keanekaragaman Jenis Tumbuhan Paku Epifit (Pteridophyta) Di Kecamatan Sukadana Kabupaten Kayong Utara Provinsi Kalimantan Barat* (Vol. 12, Issue 2).
- Khotimperwati Dan Murningsih, L. (2021). *Keanekaragaman Jenis Tumbuhan Paku (Pteridophyta) Di Kawasan Wisata Air Terjun Jurang Nganten Kabupaten Jepara Diversity Of Fern (Pteridophyta) Species In The Jurang Nganten Waterfall Tourism Area, Jepara Regency* (Vol. 23, Issue 2).
- Majid, A., Ajizah, A., & Amintarti, S. (2022). Keragaman Tumbuhan Paku (Pteridophyta) Di Taman Biodiversitas Hutan Hujan Tropis Mandiangin. *Jurnal Al-Azhar Indonesia Seri Sains Dan Teknologi*, 7(2), 102. <https://doi.org/10.36722/Sst.V7i2.1117>.

- Magurran, A. E. (1988). Diversity indices and species abundance models. In *Ecological diversity and its measurement* (pp. 7-45). Dordrecht: Springer Netherlands.
- Naiym, J., & Munir, A. (2024). Eksplorasi Tumbuhan Paku (Pteridophyta) Pada Tiga Daerah Topografi Berbeda Di Kawasan Taman Wisata Alam Tirta Rimba Baubau. *Jurnal Penelitian Inovatif*, 4(1), 159–164. <https://doi.org/10.54082/Jupin.284>.
- Ningsih, W. A., Hadiprayitno, G., & Handayani, B. S. (2024). Keanekaragaman Pteridophyta Di Tahura Nuraksa Kabupaten Lombok Barat. *Bioscientist: Jurnal Ilmiah Biologi*, 12(2), 2608. <https://doi.org/10.33394/Bioscientist.V12i2.13014>.
- Rafael, A., Daud, Y., & Hingu, O. (2023). Inventarisasi Jenis Tumbuhan Paku Di Hutan Watumbolo, Kabupaten Sumba Barat Daya. *Jurnal Ilmu Pertanian Indonesia*, 28(3), 482–490. <https://doi.org/10.18343/Jipi.28.3.482>.
- Rama Haribowo, D., Anggita Ramadhani, L., Khairiah, A., Faraidlika Fadly, I., Fuady Surya Putra, A., Wulandari, A., Hindrayani, W., Aminudin, I., & Reza Vahlevi, R. (2023). *Keanekaragaman Dan Potensi Pemanfaatan Tumbuhan Paku Di Kawasan Tapos, Taman Nasional Gunung Gede Pangrango Diversity And Potential Use Of Ferns In Tapos Area, Gunung Gede Pangrango National Park*. 25(2).
- Renjana, E., Nikmatullah, M., Rifqi Firdiana, E., Wige Ningrum, L., & H. Angio, M. (2021). Potensi *Nephrolepis* Spp. Sebagai Tanaman Obat Koleksi Kebun Raya Purwodadi Berdasarkan Kajian Etnomedisin Dan Fitokimia. *Buletin Plasma Nutfah*, 27(1), 1. <https://doi.org/10.21082/Blpn.V27n1.2021.P1-10>.
- Soerianegaral, Indrawan A. 1988. Ekologi Hutan Indonesia. Bogor (ID): Departemen Manajemen Hutan Fakultas Kehutanan IPB.
- Widianti, B., Hariyono, D., & Fajriani, S. (2022). Studi Pertumbuhan Pada Tiga Jenis Tanaman Alpukat (*Persea Americana* Mill). *Plantropica: Journal Of Agricultural Science*, 007(1), 48–53. <https://doi.org/10.21776/Ub.Jpt.2022.007.1.6>.