Edukasi
Vol. 18, No. 2 (2024): 143-150

p-ISSN 0852-0240| e-ISSN 2746-4016
https://journal.unnes.ac.id/journals/edukasi

Identification of Phanerogamae and Cryptogamae in the Campus Environment and Their Utilization as Learning Resources in the Plant Diversity Course

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Article info:
Submitted: March 15, 2024. Revised: Juny 19, 2024. Accepted: July 26, 2024.
Publish: November 17, 2024.

Abstract

Identification is the basis for grouping living things. Identification can be done by observing the morphological characteristics of a specimen. This research was conducted to identify the diversity of Phanerogamae and Cryptogamae plant species in the Bina Bangsa University Campus environment and their use as a learning resource for students in plant diversity courses. The research methodology used is an exploratory, descriptive survey method, which collects plant data and observes the morphology of the plants. The research results show two types of plants, namely higher plants (phanerogamae) and lower plants (cryptogamae). Two sub-divisions are found in higher plants, namely the Angiospermae and Gymnospermae sub-divisions. In the Gymnospermae sub-division, 1 class with one order was found, while in the Angiospermae division, two classes were found, namely monocotyledoneae and dicotyledoneae. In the monocotyledoneae, five orders were found with five families, while in the dicotyledoneae class, 12 orders were found with 14 families. In lower plants, the bryophyta and pteridophyta groups were found. The bryophyta division was found to be 1 class with three orders, while the pteridophyta division was two classes with three orders. The diversity of plants in the area also contributes to the development of a green and pleasant environment, while the resources obtained from these plants can support learning processes, particularly in biology education.

Keywords: identification, diversity, phanerogamae, cryptogamae

Recommended citation:
Rahayu, M., Ginanjar, G., & Firmasyah, F. (2024). Identification of Phanerogamae and Cryptogamae in the Campus Environment and Their Utilization as Learning Resources in the Plant Diversity Course. *Edukasi, 18*(2). 143-150. https://doi.org/10.15294/edukasi.v18i2.16957

INTRODUCTION

Diversity is a term often used to describe various living creatures, such as plants, animals, and microorganisms. Diversity can be seen based on the living creatures' morphology, anatomy, and physiology. The diversity of plant species is one of the most extensive indicators used in ecosystem management (Kardgar et al., 2025). Plant morphology is a branch of biology that studies plants' body structure and shape. It is divided into external and internal morphology, known as anatomy. Plant

morphology can be observed in several main parts: leaves, stems, roots, flowers, and fruit. These plant parts can provide in-depth studies to study the overall structure of the plant body because plant morphology includes basic studies in studying certain plant groups as a basis for identifying plant groups. The morphology of a plant type is one of the characteristics that is easy to observe (Şavkan & Türkmen, 2023; Nimas & Shofwan, 2024). Identification is the basis for grouping living things, both animals and plants. Identification can be done by observing the morphological characteristics of a specimen (Ulfa et al., 2023).

Plants in the Bina Bangsa University campus environment have different characteristics, such as higher plants (phanerogamae) and lower plants (cryptogamae). Higher plants (Phanerogamae) are a group of plants that have seeds and reproduce sexually (Ulfa et al., 2023). Phanerogamae is said to be a higher plant because it is an actual cormus plant. Kormus plants are a group of plants that can be differentiated into roots, stems, and leaves. This is also known as the Spermatophyta plant (Tjitrosoepomo, 2020). Phanerogamae plants are classified as plants with the highest level of phylogenetic development because they have seeds. Higher plants (Phanerogamae) can be divided into two sub-divisions, namely open-seed plants (Gymnospermae) and closed-seed plants (Angiospermae) (Hartono et al., 2020). Gymnosperms are a sub-division of seed plants that have ovules with one open integument so that fruit leaves do not protect the fruit, while angiosperms are a group of plants whose seed ovule is always covered by the ovary (Cao et al., 2023).

Lower plants are a group of plants with simple structures, such as roots, stems, and leaves, that still need to be distinguishable between roots, stems, and leaves (Masing & Sila, 2023). Moreover, they do not have vascular bundles and reproduce using spores rather than seeds. The body organs in this plant are not yet perfect (in the form of a thallus); however, some are differentiated between roots, stems, and leaves, namely in ferns (Pteridophyta). Generally, this plant is found in damp places, rocks, soil, and river banks and lives as an epiphyte on trees (Ding et al., 2022). Ferns are included in plants with an accurate vascular system and cormus, meaning roots can distinguish their bodies, stems, and leaves. However, pteridophytes do not produce seeds for sexual reproduction (Tjitrosoepomo, 2020). This group of plants releases spores as a means of generative reproduction, resembling groups of organisms such as mosses and fungi.

This research aims to identify the diversity of plant species in the Bina Bangsa University environment, both higher plants (phanerogamae) and lower plants (cryptogamae), because previously, plant identification has never been carried out in the campus environment and their use as a learning resource in diversity courses. Plant. Apart from that, it provides information on various types of plants in the Bina Bangsa University campus environment

METHOD

This research is a type of exploratory, descriptive research using the exploratory method. Exploratory method is a method carried out by walking around the observation area, and any bird sighthings during the observation are recorded (Romero-Jara et al., 2023). This research was conducted in August 2023 on the Bina Bangsa University campus. The samples in this study were higher plants and lower plants. The tools used in the research include writing instruments, plant taxonomy guidebooks and identification keys, observation tables, laptops, and digital cameras. Data analysis was conducted in a biology laboratory by observing the characteristics of leaves (leaf color, leaf length, and leaf width), stems (stem shape and stem size), and flowers by referring to literature and taxonomy books.

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The data collection technique is carried out using the roaming method or exploration, namely by walking along the corner of the location that has been designated as the research object. In this case the Bina Bangsa University environtment, as well as calculating the number of samples plants encountered during travel to the research location. The samples are then identified and documented as physical evidence. Analyze data obtained from the research location to determine the valu diversity, namely quantitative descriptive. Data is processed using formulas diversity index, then the calculation results are analyzed descriptively in under discussion. The diversity index formula uses the Shannon-Weiner Index formula (H'), the value ranges from 1.5 – 3.5 and is very rarely more than 4. The higher H' value, the higher the diversity value (Rozak, 2020).

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

Information:
H' : Shannon-Wiener Diversity Index
S: Number of species
Pi: Number of individuals of a species / total number of individuals of all species.
Ni: Number of individuals of species-i
N : Total number of individuals.

RESULTS AND DISCUSSION

Based on the research conducted, it can be concluded that the diversity of lower-level plants (Cryptogamae) and higher-level plants (Phanerogamae) found in the environment of Universitas Bina Bangsa can be observed in Table 1 and Table 2.

Research Data Description

Table 1: Classification of Higher Plants (Phanerogamae)

Sub divisi	Kelas	Ordo	Famili	Spesies
Gymnospermae	Coniferae	Araucariales	Araucariaceae	Cemara (*Araucaria sp.*)
Angiospermae	Monocotyledoneae	Liliales	Liliaceae	Lidah buaya (*Aloe vera*), lidah mertua (*Sansevieria roxburghiana*), hanjuang (*Cordyline fructiosa*)
Angiospermae	Monocotyledoneae	Aracales	Araceae	Keladi hias (*Caladium bicolor*), kuping gajah (*Anthurium sp.*)
Angiospermae	Monocotyledoneae	Zingiberales	Zingiberaceae	Lengkuas (*Alpinia galangal*), jahe (*Zingiber officinale*), kunyit (*Curcuma domestica*)
Angiospermae	Monocotyledoneae	Poales	Poaceae	Bambu (*Bambusa sp.*), sereh (*Andropogan nardus*), ilalang (*Imperata cylindrical*),
Angiospermae	Monocotyledonae	Arecales	Arecaceae	Talas(*Colocasia esculenta*)
Angiospermae	Dicotyledoneae	Urticales	Moraceae	Nangka (*Artocarpus integra*)

Angiospermae	Dicotyledoneae	Myrtales	Myrtaceae	Pucuk merah (*Syzygium oleana*), jambu monyet (Syzygium *malaccense*), jambu air (*Syzygium aqueum*), jambu biji (*Psidium guajava*)
Angiospermae	Dicotyledoneae	Parietales	Caricaceae	Papaya (*Carica papaya*)
Angiospermae	Dicotyledoneae	Apocynales	Apocynaceae	Kamboja (*Plumeria acuminate*)
Angiospermae	Dicotyledoneae	Rubiales	Rubiaceae	Bunga soka (*Ixora grandifora*), goletrak (*Borreria latifolia*), mengkudu (*Morinda citrifolia*)
Angiospermae	Dicotyledoneae	Caryopyhllales	Cactaceae Nyctaginaceae	Kaktus (*Opuntia vulgaris*) Bougenville (*Bougainvillea spectabilis*)
Angiospermae	Dicotyledoneae	Rosales	Leguminosae	Putri malu (*Mimosa pudica*), petai cina (*Leucaena sp.*)
Angiospermae	Dicotyledoneae	Euphorbiales	Euphorbiaceae	Singkong (*Manihot utilissima*),
Angiospermae	Dicotyledoneae	Malvales	Muntingiaceae Sterculiaceae	Ceri (*Muntingia calabura*) Kakao (*Theobroma cacao*)
Angiospermae	Dicotyledoneae	Geraniales	Oxsalidaceae	Belimbing wuluh (*Averrhoa bilimbi*)
Angiospermae	Dicotyledoneae	Magnoliales	Annonaceae	Sarikaya (*Annona squamosa*)
Angiospermae	Dicotyledoneae	Ericates	sapotaceae	Sawo (*Manilkara sp.*)

Based on the research conducted by exploring the campus environment of Universitas Bina Bangsa, it was found that the campus area contains a diverse range of plants, consisting primarily of higher-level plants (Phanerogamae). This diversity is detailed in Table 1. The higher-level plants in the campus area are quite varied, comprising two subdivisions: open-seed plants (Gymnospermae) and closed-seed plants (Angiospermae).

In the Gymnospermae subdivision, only the Coniferae class was identified, specifically the Araucariaceae family, which includes pine trees. Pine trees are a familiar type of plant. They belong to the Coniferae class and are considered primitive plants that have existed for over 300 million years. These plants have adapted to various environmental conditions and are known for providing a sense of coolness (Zhou et al., 2023). Pine trees are classified as higher-level plants with a taproot system. Coniferae is a class of plants characterized by cone-shaped crowns and needle-like leaves. Pine trees are evergreen plants, meaning they remain green year-round and are not prone to shedding their leaves (Tjitrosoepomo, 2020). On the Universitas Bina Bangsa campus, several pine trees can be found, often used by students as a place to take shelter, providing a sense of comfort and coolness.

In the Angiospermae subdivision within the Universitas Bina Bangsa environment, two classes of plants were identified: Monocotyledonae (single-seed leaf plants) and Dicotyledonae (double-seed leaf plants). In the Monocotyledonae class, five orders with five families were found. The identified orders include Liliales, Aracales, Zingiberales, Poales, and Arecales, with the corresponding families being Liliaceae, Araceae, Zingiberaceae, Poaceae, and Arecaceae.

Zingiberales species were predominantly found in the backyard area of Universitas Bina Bangsa. Examples of species identified include galangal (Alpina galangal), ginger (Zingiber officinale), and

p-ISSN 0852-0240| e-ISSN 2746-4016
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turmeric (Curcuma domestica). The Zingiberaceae family comprises rhizome plants with potential medicinal benefits due to their alkaloid content, which can enhance the immune system (Andini *et al*., 2020). These plants are widely traded for their beneficial properties and are easy to cultivate, making them readily available (Magday et al., 2023).

Other frequently found species within the Monocotyledonae class include bamboo (*Bambusa* sp.) and cogon grass (*Imperata* sp.), which belong to the *Poaceae* family, as well as taro (*Colocasia esculenta*) from the *Arecaceae* family. These plants are abundant on the Universitas Bina Bangsa campus due to their rapid spread, facilitated by lightweight seeds easily dispersed by the wind. This aligns with the findings of Plaza-Rojas et al. (2023), which state that the *Poaceae* family has a high adaptability, can grow in both dry and waterlogged soils, and has a wide distribution. Meanwhile, plants from the Arecaceae family are often used as ornamental plants, which explains their prevalence on campus.

In the Dicotyledonae class, 12 orders with 15 families were identified, including *Sapindales, Urticales, Myrtales, Parietales, Apocynales, Rubiales, Caryophyllales, Rosales, Euphorbiales, Malvales, Geraniales, Magnoliales*, and *Ericales.* The most commonly found families include *Anacardiaceae*, *Moraceae, Caricaceae, Rubiaceae*, and *Euphorbiaceae.*

The *Euphorbiaceae* family is often used for medicinal purposes due to its secondary metabolite content, including essential oils, alkaloids, and tannins. This family is also characterized by its white sap and its distribution in tropical areas, making it one of the most abundant species. In addition to *Euphorbiaceae,* the *Rubiaceae* family is also frequently used for medicinal purposes. This is supported by research conducted by Hartono *et al*., (2020), which confirmed the pharmacological effects of Rubiaceae through phytochemical analysis.

Apart from higher-level plants (Phanerogamae), lower-level plants (Cryptogamae) are also present in the Universitas Bina Bangsa environment. The Cryptogamae found on campus are detailed in Table 2.

Table 2: Classification of Lower Plants (Cryptogamae)

divisi	Kelas	Ordo	Famili	Genus	Spesies
Bryophyta	Bryopsida	Bryales	Bryaceae	Bryum	*Bryum gemmiferum*
		Bryopceales	Bryopceae	Bryopsida	*Bryopsida* sp.
		Funariales	Funariaceae	Funaria	*Funaria hygrometrica*
Pteridophyta	Filicopsida	Polypodiales	Pteridaceae	Adiantum	*Adiantum* sp.
		Filicinae	Athyriaceae	Diplazium	*Diplasium esculentum*
	Leptosporongiopsida	Filicales	Cyatheaceae	Cyathea	*Cyathea gigantea*

Based on the research results presented in Table 2, which identifies lower-level plants (Cryptogamae) in the campus environment, two groups of lower-level plants were identified: Bryophyta and Pteridophyta. The Bryophyta group comprises three species: *Funaria hygrometricum*, Bryopsida sp., and Bryum gemmiferum. Meanwhile, the Pteridophyta group also includes three species: *Adiantum* sp., *Diplazium esculentum*, and *Cyathea gigantea*.

Ferns (Pteridophyta) are considered primitive plants. These plants are also referred to as transitional plants (Chlorophyta) because they possess vascular tissues and true organs. Ferns thrive in environments where several factors, particularly temperature, support their growth. Ferns can

adapt to and survive in humid locations with temperatures ranging from 13°C to 21°C (Ocloo et al., 2023). Additional factors influencing their growth include soil pH, air quality, soil moisture, and humidity. Ferns reproduce asexually through spores, which are typically located on the underside of their leaves. These spores contain genetic material essential for the development of gametophytes (Anderson 2021). Several fern species have been observed growing on trees in area at Universitas Bina Bangsa.

Mosses (Bryophyta) represent the second-largest plant group after higher-level plants. Their diversity varies depending on environmental conditions. Mosses are classified as epiphytic plants that can be found on dead wood, soil, rocks, and tree trunks with adequate humidity and sunlight. Morphologically, mosses have root-like structures called rhizoids, which function to absorb water and anchor the plant to substrates such as soil, rocks, or trees (Parmila, 2022). Unlike vascular plants, Bryophyta lack distinguishable roots, leaves, and stems and do not have xylem or phloem tissues. Instead, they possess small rhizoids that allow them to attach to soil. Mosses typically grow in moist, shaded areas and are considered transitional plants between cormophytes (Chlorophyta) and thallophytes (Thallophyta) (Li et al., 2023).

Like Pteridophyta, Bryophyta undergoes metagenesis, experiencing an alternation of generations. Both Pteridophyta and Bryophyta serve as pioneer plants. The plants found on campus, whether Phanerogamae or Cryptogamae, can be utilized in classroom learning and biology practical sessions. Students can observe plant structures (morphology) and other features directly. This hands-on, contextual learning approach allows students to study and identify plants within the campus environment, providing a positive impact on their learning process (Andayani et al., 2021). By observing real-life objects, students gain a deeper understanding of the material. This aligns with research conducted by Muhartini *et al*., (2023), which states that contextual learning enables students to derive meaningful knowledge and skills while flexibly applying previously acquired concepts to solve real-world problems. Therefore, conservation education is urgent to be learned in school. The purpose of this study was to observe the responses of elementary school students and teachers in studying nature conservation concepts. Apart from helping to get to know various types of plants, this activity can also build a person's sense of concern for environmental conservation by getting to know various types of plants. In accordance with research conducted by Sri & Astari (2021), it is important to introduce conservation education to students in a simple way.

CONCLUSION

Based on the data obtained, it can be concluded that the environment of Universitas Bina Bangsa is home to a variety of plants, including higher-level plants (Phanerogamae) and lower-level plants (Cryptogamae). Several of these plants have potential for utilization in various aspects. This highlights the importance of implementing cultivation efforts to promote conservation activities and significant resource utilization. The diversity of plants in the area also contributes to the development of a green and pleasant environment, while the resources obtained from these plants can support learning processes, particularly in biology education. This study aimed to identify the diversity of plant species present in the Universitas Bina Bangsa environment, as no prior research had been conducted to identify plants on campus. Therefore, it is recommended that future researchers further investigate the distribution of plant diversity and explore the potential utilization of higher- and lower-level plants on the Universitas Bina Bangsa campus as valuable resources.

p-ISSN 0852-0240| e-ISSN 2746-4016
https://journal.unnes.ac.id/journals/edukasi

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