

Morphological Characteristics of The Fern *Nephrolepis biserrata* (Sw.) Schott

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Abstract: Ferns (*Pteridophyta*) have distinctive characteristics in the form of roots, stems, and leaves equipped with spores as a means of reproduction. One type of fern is the sword fern (*Nephrolepis biserrata*) which thrives in the UGM Wisdom Park area. This study aims to analyze the morphological characteristics of the sword fern (*Nephrolepis biserrata*) in the UGM Wisdom Park area. This type of research is qualitative with observation methods (direct observation) and literature studies. Data analysis was carried out on December 24, 2024 by observing and recording the morphology of the roots, stems, leaves, and spores of the sword fern (*Nephrolepis biserrata*). The results of this study showed that the sword fern (*Nephrolepis biserrata*) has brown fibrous roots, upright rhizome-shaped stems covered in hair, compound leaves in the form of lanceolate (pinnate) with serrated edges, and spores arranged in sori under the leaves. This plant is more commonly found in shady places and moist soil.

Keywords: *Nephrolepis biserrata*, Sword Fern, Morphology, Identification, Wisdom Park UGM.

Introduction

Ferns (*Pteridophyta*) are distinguished by the presence of true roots, stems, and leaves equipped with vascular bundles composed of xylem and phloem. In addition to these structural characteristics, ferns reproduce through spores and undergo a metagenetic life cycle involving the alternation of sporophytic and gametophytic generations. Ferns may inhabit terrestrial environments, grow epiphytically, or employ both strategies simultaneously depending on ecological conditions (Tjitrosoepomo, 2001). Within this group, the sword fern (*Nephrolepis biserrata*) holds considerable ecological importance, functioning as a microhabitat for small fauna, contributing to soil stabilization and erosion prevention, and serving as a biological indicator of environmental quality. As an epiphyte, *Nephrolepis biserrata* facilitates the availability of shelter and food resources for various insects and other invertebrates, thereby supporting local biodiversity (Setiawan et al.,

2019). The following presents the fern classification of *Nephrolepis biserrata*:

Kingdom: Plantae

Subkingdom: Tracheobionta

Divisi: Pteridophyta

Kelas: Pteridopsida

Subkelas: Polypoditae

Ordo: Polypodiales

Famili: Polypodiaceae

Genus: *Nephrolepis*

Spesies: *Nephrolepis biserrata* (Sw.) Schott

(Mudin N, 2025)

Research focusing on the morphological characteristics of *Nephrolepis biserrata* generally includes the examination of its root system, stem structure, leaf morphology, and spore arrangement. Previous comparative studies on *Nephrolepis biserrata* and *Nephrolepis exaltata* in the Universitas Tanjungpura area revealed notable morphological variation between the two species (Aini et al., 2022). Such variation is often attributed

to environmental factors such as light intensity, moisture availability, and soil conditions as well as genetic influences. This indicates that investigations conducted in different ecological settings have the potential to yield novel insights regarding the adaptive strategies of *Nephrolepis biserrata*. Riastuti et al. (2018) further reported that *Nephrolepis biserrata* can thrive even in locations exposed to direct sunlight, exhibiting upright roots, densely arranged linear-lanceolate leaves with tapered bases, and leaf stalks covered with brown scales.

Typically, *Nephrolepis biserrata* grows optimally in shaded and moist environments with sufficient nutrient availability. However, environmental conditions within Wisdom Park UGM vary considerably in terms of sunlight exposure, soil moisture, and microhabitat diversity. These variations may influence the physiological performance, morphological expression, and overall growth of *Nephrolepis biserrata*. Plant adaptation mechanisms often result in morphological modifications that enhance survival within specific environmental contexts (Aini et al., 2022). Given these considerations, the present study aims to analyze the morphological characteristics of *Nephrolepis biserrata* inhabiting Wisdom Park UGM. The novelty of this research lies in its contribution of detailed morphological information specific to the *Nephrolepis biserrata* population within this particular ecological setting, thereby enriching existing botanical and ecological literature.

Materials And Methods

This study employed a qualitative approach using direct observation and literature review as the primary methods for data collection. The observational method was conducted to obtain an accurate description of the morphological characteristics of *Nephrolepis biserrata*, while the literature review was utilized to reinforce the findings through comparisons with previous research. The fieldwork was carried out on December 24, 2024, with an observation duration of 60 minutes, from 10:00 to 11:00 a.m. WIB. This

timeframe was selected to ensure stable environmental conditions during data collection. The research was conducted in the Wisdom Park UGM area as the designated site for systematically observing and documenting the morphological characteristics of the sword fern (*Nephrolepis biserrata*). It is located on the eastern side of the main campus, precisely on Jl. Prof. Dr. Notonagoro, Karang Malang, Caturtunggal, Depok District, Sleman Regency, Yogyakarta Special Region.



Figure 1. Wisdom Park UGM Area

The subject of this study is the morphological characteristics of the sword fern (*Nephrolepis biserrata*) found in the Wisdom Park UGM area. Data collection was conducted through direct observation of the plant's visible structures, allowing the information obtained to accurately represent the actual morphological conditions in the field. Data analysis involved observing, measuring, and documenting the morphological characteristics of the roots, stems, leaves, and spores of *Nephrolepis biserrata*, resulting in a systematic and well structured morphological description. To support the observation process, several tools and materials were utilized, including writing instruments, white manila paper, a ruler, a smartphone macro lens, a mini microscope, and handphone. The primary object of this research was the sword fern (*Nephrolepis biserrata*), which was examined directly at the research site to ensure that the collected data were accurate and reflective of real field conditions.

Results And Discussion

Results

The present study was conducted using a qualitative approach through direct observation of the morphology of the sword fern (*Nephrolepis biserrata*). The findings presented in Table 1 provide a comprehensive overview of the root, stem, leaf, and spore structures. These observations aim to facilitate a better understanding of the morphological characteristics of *Nephrolepis biserrata*. In addition, the results of the study may also be presented in the form of images, as shown in Figure. The figure should be referenced and described within the article using its corresponding figure number.

Table 1. Observation results of the morphological characters of the sword fern (*Nephrolepis biserrata*)

Character	Description
Leaves	A total of 78 leaves are present, arranged alternately, compound without a sheath, petiolate, lanceolate in shape, with a smooth surface, green in color, and approximately 3.2 cm in length.
Spore	The spores are spherical in shape, located on the underside of the leaves, and arranged in parallel along the margins and lower surface.
Stem	Located above the soil surface, the stem is rhizomatous, smooth with brown trichomes, erect, and branched, measuring 38 cm in length, with a petiole diameter of 0.1 cm.
Roots	The roots are fibrous, cylindrical in shape, and equipped with root hairs on the lateral branches, measuring 24.6 cm in length and 1.1 cm in thickness, with a dark brown to greenish white coloration.

Next are the pictures morphological of the sword fern (*Nephrolepis biserrata*) in the form of leaves, spore, stems, and root:



Figure 2. Leaves of the *Nephrolepis biserrata*

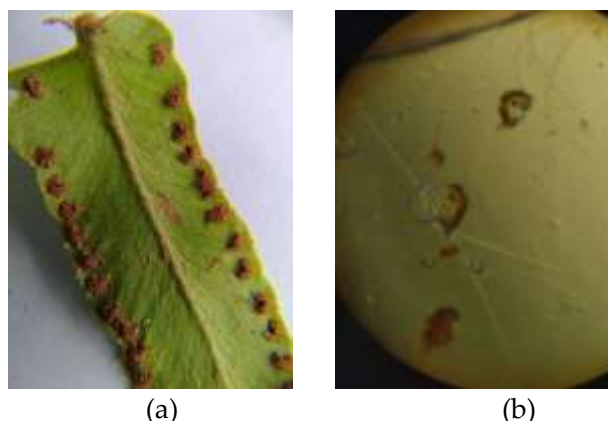


Figure 3. (a) Sori, (b) Sporangium of the *Nephrolepis biserrata*



Figure 4. Stem of the *Nephrolepis biserrata*



Figure 5. Roots of the *Nephrolepis biserrata*

Discussion

The investigation of *Nephrolepis biserrata* was carried out in the Wisdom Park area of Universitas Gadjah Mada (UGM). The sword fern (*Nephrolepis biserrata*) was predominantly observed growing in shaded microhabitats with sufficiently moist soil conditions, which provide an optimal environment for its physiological processes. As noted by Hoshizaki and Robbin (2001), fern species generally require a moderate level of water availability neither excessive nor insufficient in order to sustain their life cycle and maintain normal metabolic activities. The findings of this study revealed distinct morphological characteristics of *Nephrolepis biserrata*, particularly in relation to its root system, stem structure, leaf arrangement, and spore formation.

Leaves

The leaves of *Nephrolepis biserrata* are arranged in an alternate, pinnate compound pattern, supported by petioles and lacking leaf sheaths. The leaf surface is smooth, with an average length of approximately 3.2 cm. The leaves are lanceolate in shape, characterized by serrated margins and acuminate apices (Listiyanti et al., 2022). The petioles are flattened with a hairy surface, and the green leaf coloration reflects the plant's adaptation to photosynthesis.

Spore

The fern *Nephrolepis biserrata* possesses spore structures arranged in clusters known as sorus (Nasution et al., 2024). The sorus of *Nephrolepis biserrata* are circular in shape and are located on the underside of the fronds, arranged in parallel along the margins called sori. The sori contain sorus that are distributed along the edges of the pinnulae, and the sporangia cluster together to form sori which are protected by an indusium (Apriyanti, 2017).

Stem

The stem of *Nephrolepis biserrata* is located above the soil surface and exhibits an upright rhizome structure covered with brown colored hairs. The stem surface displays fine pubescence with a greenish-brown hue, while the rhizome functions

in water and nutrient absorption as well as serving as a means of vegetative propagation (Lestari & Indriyani, 2023). In general, the stem of *Nephrolepis biserrata* possesses a slightly fibrous texture with a smoother outer surface, which supports structural stability and facilitates the transport of nutrients throughout the plant body.

Roots

The root system of *Nephrolepis biserrata* consists of brown fibrous roots, which function primarily in the absorption of water and essential nutrients from the surrounding substrate. This fibrous configuration provides the species with a greater surface area for resource uptake, thereby enhancing its efficiency in acquiring the materials necessary to support growth and metabolic processes (Apriyanti, 2017). Furthermore, *Nephrolepis biserrata* is frequently found growing as an epiphyte, particularly on the surfaces of trees or other host structures in humid environments. In such ecological conditions, the presence of a well developed fibrous root system becomes even more critical, as it enables the plant to anchor securely while simultaneously facilitating nutrient absorption from accumulated organic debris, moisture, and mineral particles present on the host surface (Sofiyanti, 2013).

Conclusions

Based on the results of the morphological examination of the sword fern (*Nephrolepis biserrata*) in the Wisdom Park UGM area, it can be concluded that *Nephrolepis biserrata* possesses fibrous brown roots that function effectively in absorbing water and nutrients from the soil. Its stem is an upright rhizome covered with brown hairs, serving as an organ for absorption and food storage. The leaves are arranged in alternate pinnate compounds, supported by petioles, lacking leaf sheaths, with smooth surfaces, serrated margins, and acuminate tips, indicating well adapted features for photosynthetic activity. The spores are arranged in rounded sori located on the underside of the fronds, aligned along the margins of the pinnae and protected by an indusium. The

habitat of *Nephrolepis biserrata* tends to be shaded with moist soil conditions, aligning with its water requirements to support its life cycle. In addition to enriching morphological knowledge, this study also highlights the ecological importance of *Nephrolepis biserrata*, particularly as a provider of microhabitats for other organisms and as a contributor to improved air quality through photosynthesis, thereby supporting biodiversity within its environment

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Conflict of Interest: The authors declare that this study is entirely free from any conflicts of interest throughout its execution, analysis, and reporting processes. All procedures involving observation, data collection, and interpretation of the morphological characteristics of the sword fern (*Nephrolepis biserrata*) were carried out with full independence and objectivity, without any financial, personal, or professional influences that could compromise the integrity or outcomes of the research.

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