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Pteridophyta Diversity and Sorus Variation in The Pasmah Riverbank Central Bengkulu

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ABSTRACT
Pteridophyta plants as plant communities in biodiversity have important ecological functions in rivers and human life. One of the habitats for ferns in the upper reaches of the river in Bengkulu is the Pasmah River. The Pasmah River is a source of water for the people of Bengkulu and its surroundings. To maximize the role of the river, it is necessary to make an inventory of plants around the river, one of which is ferns. This study aims to determine the diversity of types and variations of pteridophyta sorus. A sampling of ferns was carried out on the banks of the Pasmah River, Central Bengkulu. Purposive sampling was used in this study to pinpoint the location, and the cruising (cruise method) was used to collect sample data. The results showed that there were 15 types of ferns where 12 types of ferns were found with sorus, 6 types of ferns were round, 4 were elongated, 1 was in line, 1 was strobili and 3 species had no sorus.

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1. INTRODUCTION

Indonesia has the highest plant biodiversity in the world, one of which is ferns (Pteridophyta) (Ekoyani, 2007). According to Loveless (1999) about 10,000 species of ferns exist today, of which 3,000 species grow in Indonesia. This is because Indonesia has a humid tropical climate, making it very suitable for ferns (Tjitrosoepomo, 2005). Ferns are corms plants whose bodies are real, that is, you can see the difference which is divided into three parts, namely leaves (folium), stem (caulis), and roots (radix). Dhamma (2021). Ferns (Pteridophyta) are plants that can live in a variety of habitats both as epiphytes, terrestrial and in water and live in watersheds (Ayatusa'adah & Dewi, 2018). According to some of these definitions, ferns can be understood as plants that grow in moist regions like riverbanks, can discriminate between their roots, stems, and leaves, and can exist in a variety of settings. Ferns play a significant role in the ecological, economic, and educational spheres as well.

In terms of ecology, ferns serve as a soil buffer for watersheds, preserve soil moisture, produce humus, and stop soil erosion (Arini & Kinho, 2012). One of the habitats for ferns in the upper reaches of the river in Bengkulu is the Pasmah River. The Pasmah River is a source of water for the people of Bengkulu and its surroundings. To maximize the role of the river, it is necessary to make an inventory of plants around the river, one of which is ferns. Ferns (Pteridophyta) is a division that has a corpus, meaning that the body can be distinguished from three main parts, namely roots, stems, and leaves. However, ferns do not yet produce seeds, and their main means of reproduction are spores (Tjitrosoepomo, 2014).

Collections of sorus are called sori. Sorus has an important role to protect the spore boxes until the spores are ready to be released (Tjitrosoepomo, 2005: 223). Many types of Pteridophyta plants have varying sorus characteristics. Characteristics of the sorus in the form of shape, location of the sorus, color, presence/absence of annulus on the sporangium, and presence/absence of indusium are very important identifying features. This can affect the spread of sorus in each type of Pteridophyta(Mardiyah *et al*., 2016). The location and shape of the sorus in various types of Pteridophyta plants are different. The location of the sorus can be seen on the edge or near the edge of the leaf, it can also be in the veins, in the form of a line, elongated and round (Gebong, 2007).

Based on the results of observations that have been made, one of the places that have become a habitat for ferns is the banks of the Pasmah River, where many palm trees provide opportunities for epiphytic plants to settle terrestrially. The Pasmah River is a place that has the potential for a diversity of ferns. Ferns can be found easily

along riverbanks and also on palm tree trunks. Judging from the many differences in the morphological forms of the root's stems, leaves, and sorus arrangement, it shows that the ferns around this area are in various conditions. Therefore, research on the diversity of pteridophytes in the Pasmah River basin of Central Bengkulu needs to be carried out.

2. RESEARCH METHOD

This research was conducted in the Pasmah River, Central Bengkulu. The tools used in this study were scissors, label paper, plastic samples, stationery, camera cell phones, and identification books. In this study, determining the location using the Purposive Sampling technique, which is based on the presence of ferns which are considered to represent the place (Fachrul, 2007). Cruising (also known as the cruise method) was used for the sample methodology. In this exploration, every fern found in the river area will be taken and collected, but there are exceptions if the same fern is found, it will not be taken again. The place of research is on the banks of Pasmah Bengkulu Tengah.

Figure 1. Research location Pasmah river, Central Bengkulu (Source: Google Earth, 2023)

3. RESULT AND DISCUSSION

Based on the results of research on fern species found on the banks of the Pasmah River, Central Bengkulu, 15 species have been found. Sorus was found in 12 types of ferns and 3 species without sorus. Based on the inventory results, there are 3 types of nails whose sorus location and shape have not been found, namely: *Stenochlaena palustris*. Sporangium is arranged in groups, located between the ribs, in the form of fine brown powder and easily separated. These nails can be used as medicine(Sari & Bayu, 2019); *lygodium microphyllum* this species has morphological characteristics Sorus is found along the edge of the leaflets and forms indentations, sorus has a clustered oval shape, sorus is green when it is young, and when it is ripe the sorus will turn brown. *Davallia trichomanoides* has a sorus that is positioned at the end of the leaf, making it difficult to find (Nasution, 2018). Spores on this fern are only produced by fertile leaves (sporophyll) alone (Andayaningsih, 2013). Table 1 lists the several fern varieties found in the Pasmah River.

Table 1. Nail plants on the banks of the Pasmah river, Central Bengkulu.

No	Nail Type	Shape and Location
1.	*Gleichenia linearis*	Sorus is round and located on each leaflet and its distribution is limited along the veins.
2.	*Nephrolepis biserrata*	Sori are round and located on the edge of the leaf
3.	*Blechnum orientale L*	The sori are elongated and located along the veins
4.	*Cyclosorus sp*	Sori are round and located spread behind the leaves
5.	*Lycopodiella cernua*	The sporangium forms a strobilus and is located at the ends of the branches
6.	*Cyclosorus interruptus*	Sori are round and located spread behind the leaves
7.	*Goniophlebium percussum*	Sorus is round and located under the surface of the leaf, and is located between the leaf veins
8.	*Asplenium nidus*	The sori are line-shaped and are located under the leaf surface and are in the leaf veins
9.	*Adiantum sp*	The sorus is elongated and the sorus is on the edge of the leaf which surrounds the upper and lower surfaces of the leaf

No	Nail Type	Shape and Location
10.	*Asplenium pellucidium lam*	The sori are elongated and located under the leaf surface, and are located between the leaf veins
11.	*Vittaria elongata Sw*	The sorus is elongated and is located under the leaf surface and is located on the edge of the leaf
12.	*Nephrolepis falcata*	Sorus is round and located under the surface of the leaf, and is located between the leaf veins

Based on the results of the study showed that the number of types of ferns (Pteridophyta) found on the banks of the Pasmah River in Central Bengkulu amounted to 15 species of ferns. From the results of the research conducted, 12 of them could be found with sorus, while the other 3 were not, because the plants were still young. The sorus form found in the Pterydophyta plant on the Pasmah Riverbanks in Central Bengkulu consists of four forms. Which can be seen as shown below.

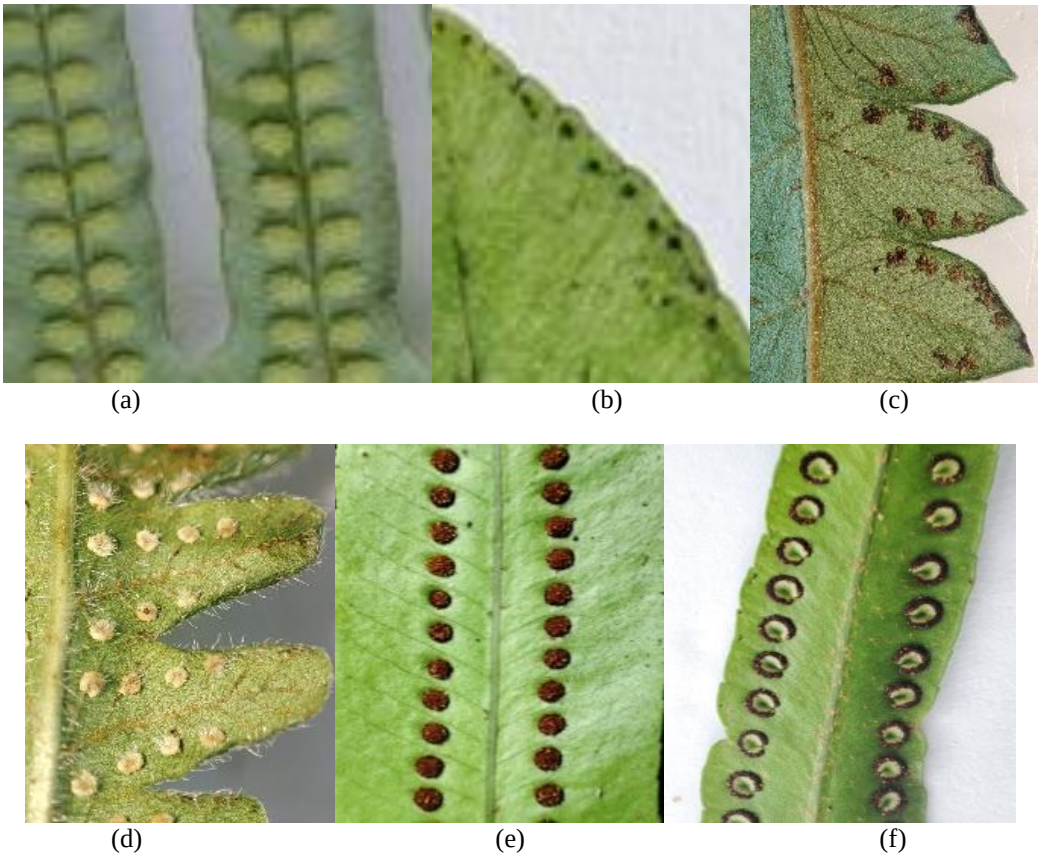

Figure 2. Morphology of sorus dari genus Pteridophyta (a) *Gleichenia lineara* (b) *Nephrolepis biserrata* (c) *Cyclosorus sp* (d) *Cyclosorus interrupted* (e) *Goniophlebium percussum* (f) *Nephrolepis falcata*
(Source: Personal documents, 2023)

The most common sorus shape is a spherical shape with a total of six species of pterydophyta plants. From the results of this study can be seen that the location and shape of the sorus of the *Gleichenia linearis* spike round, located on each leaflet, and its distribution is limited along the veins because it does not have indusia (spore box). The sorus is yellow in color, has only a few sporangia without a stalk, and opens with a longitudinal slit(Mardiyah *et al*., 2016); *Nephrolepis biserrata* sorus has a fern-like shape and is situated on the leaf's edge; it is brown in color(Abadiyah *et al*., 2019) ; *Cyclosorus sp*. sorus shaped spikes spherical and spread out beyond the leaves; sori are made of two rows on each pinna and are also known as spores (Puspita, 2017); *Cyclosorus interruptus* sorus is spherical and can be found spreading behind the leaves. Brown and organized in a zigzag pattern to match the curve of the leaf margins, the sori are(Nurinayah *et al.,* 2016); Round, below the leaf surface, and between the leaf veins, generally 2-3 in the apical row, are the *Goniophlebium percussum* spikes (Rolla & Alice, 1982); *Nephrolepis falcata* sorus is a spherical, brown, between the bones and fern-shaped plant that is embedded beneath the leaf's surface (Majid *et al.,* 2022)

Figure 3. Morphology of *Asplenium nidus* sorus (Source: Personal documentation, 2023)

the second is a line shape with the number of one type of Pterydophyta plant, namely *Asplenium nidus*. The *Asplenium nidus* sorus nails are in the form of a line, the sorus is at the bottom leaf surface, located in the leaf veins, and the brown sorus (Mardiyah *et al*., 2016)

(a) (b) (c) (d)

Figure 4. Morphology of sorus dari genus Pteridophyta (a) *Blechnum orientale L* (b) *Adiantum sp* (c) *Asplenium pellucidium lam* (d) *Vittaria elongata Sw* (Source: Dokumentasi pribdi, 2023)

The third has an extended form and four different pterydophyta plant species. The spikes of *Blechnum orientale L*. Sorus are 1-2 mm wide, elongated, and found towards the margin of the leaf veins (Hartini, 2009); Paku *Adiantum sp* sorus elongated and Sori are on the edge of the leaf that surrounds the upper and lower surfaces of the leaf; *Asplenium pellucidium lam* sorus ferns are elongated, the sorus is located below the surface of the leaf and its location between the leaves. Spores have an average length of 0.5 cm (Arini & Kinho, 2012); According to Rolla and Alice (1982), the Paku *Vittaria elongata Sw* sorus is long and exactly situated at the leaf edge.

Figure 5. Morphology of *Lycopodiella cernua* sorus (Source: Personal documentation, 2023)

The fourth is a strobilus with *Lycopodiella cernua*, one of the Pterydophyta plant species. The branch's tip, which is arranged in the shape of strobili, contains sporangium. Strobili grow at the end of the branching. These strobili are upright and shaped like a roof (Steenis, 2005).

This matter is according to Mardiyah's statement, (2016: 220) which states that the sorus form exists 3 namely line (build line), round and elongated. While the location of the sorus is found in different types of plants Pterydophyta. Some are near the edge of leaves, some are found at the end of the base of the stem, and some are found between the veins and attached to the leaf veins. This is appropriate Mardiyah statement, (2016: 220) which states the location of the sorus is on the edge or near the edge of the leaf, and can also be on the veins leaf. The results of this study that including epiphytic nails namely; *Nephrolepis falcata, Vittaria elongata Sw, Asplenium pellucidium lam, Asplenium nidus, Goniophlebium percussum* and nails terrestrial namely*; Adiantum sp, Cyclosorus interruptus, Lycopodiella cernua, Cyclosorus sp, Blechnum orientale L, Nephrolepis biserrata, Gleichenia linearis.* True nails and non-nails truly make up two categories out of the 15 varieties of Pterydophyta that have been discovered. Which is a type of nail not true is *Lycopodiinae* (wire nails) because the leaves are small (microphyll), not stalked, and always have one bone, while the other 14 nails are true nails because they have true roots, stems, and leaves. Stem can be in the form of a stem (rhizome) or stem above ground level. In general, leaves are big with branching leaf bones. The peculiarity of juvenile leaves is that they develop in rolls (circinnatus).

4. CONCLUSION

Based on the study's findings, it can be said that the Pasmah River in Central Bengkulu is home to the following varieties of ferns: *Gleichenia linearis, Stenochlaena palustris, Nephrolepis biserrata, Blechnum orientale L, Cyclosorus sp, Lycopodiella cernua, Lygodium microphyllum, Cyclosorus interruptus, Goniophlebium percussum, Davallia trichomanoides, Asplenium nidus, Adiantum sp, Asplenium pellucidium lam, Vittaria elongata Sw,* and *Nephrolepis falcata*. The results showed that there were 15 different species of ferns, 12 of which were discovered to have sorus, and 3 of which did not. Six of the 12 varieties of ferns with sorus were round, four were elongated, one was in line, one was strobili, and three species had no sorus.

5. REFERENCES

Abadiyah, A. S., Wahidah, B. F., & Hariz, A. R. (2019). Identifikasi Tumbuhan Paku di Hutan Penggaron Kecamatan Ungaran Kabupaten Semarang. *Al-Hayat: Journal of Biology and Applied Biology*, *2*(2), 80. https://doi.org/10.21580/ah.v2i2.4668

Andayaningsih, D., Chikmawati, T., & Sulistijorini, S. 2013. Keanekaragaman Tumbuhan Paku Terestrial di Hutan Kota DKI Jakarta. Berita Biologi, 12(3), 297-305.

Arini, D. I. D., & Kinho, J. (2012). The pteridophyta diversity in Gunung Ambang Nature Reserve North Sulawesi. *Info BPK Manado*, *2*(1), 17–40.

Ayatusa'adah, A., & Dewi, N. A. (2018). Inventarisasi Tumbuhan Paku (Pteridophyta) Di Kawasan Kampus Iain Palangka Raya Sebagai Alternatif Media Pembelajaran Materi Klasifikasi Tumbuhan. *Edu Sains: Jurnal Pendidikan Sains & Matematika*, *5*(2), 50. https://doi.org/10.23971/eds.v5i2.729

Dhima, A. P. 2021. Modul Akar Pada Tumbuhan Dan Rencana Pembelajaran Semester (Rps) Pendidikan Biologi (Doctoral dissertation, UIN Raden Intan Lampung).

Ekoyani. 2007. Keanekaragaman Jenis Paku-Pakuan (Pteridophyta) di Kawasan Hutan Lindung Gunung Bawang Kabupaten Bengkayang, Skripsi, Fakultas Kehutanan, Universitas Tanjungpura Pontianak.

Fachrul, M. F. 2007. Metode Sampling Bioekologi. Jakarta: Bumi Aksara.

Hartini, S. 2009. Keanekaragaman Tumbuhan Paku di Lokasi Calon Kebun Raya Samosir, Sumatera Utara. Warta Kebun Raya, 9(1), 48-54.

Loveless, A.R. 1999. Prinsip-prinsip Biologi Tumbuhan untuk Daerah Tropik 2. Jakarta (ID): PT. Gramedia.

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

Mardiyah, A., Hasanuddin, & Eriawati. (2016). Karakteristik Warna Sorus Tumbuhan Paku di Kawasan Gunung Paroy Kecamatan Lhoong Kabupaten Aceh Besar. *Prosiding Seminar Nasional Biotik 2016*, *4*, 220–228. https://jurnal.ar-raniry.ac.id/index.php/PBiotik/article/view/2573

Nurinayah, M. H., Soendjoto, M. A., & Dharmono. (2016). Jenis Tumbuhan Paku di Kawasan Rawa Sungai Lumbah, Kabupaten Barito Kuala. *Prosiding Seminar Nasional Lahan Basah*, *1*(1), 141–145. http://eprints.ulm.ac.id/1729/%0Ahttp://eprints.ulm.ac.id/1729/1/SNLB-1601-141-145 Nurinayah *et al*. ULM.pdf

Puspita, E. 2017. Keanekaragaman Tanaman Paku (Pteridophyta) Di Jalur Ciwalen Taman Nasional Gunung Gede Pangrango, Jawa Barat. Biosfer: Jurnal Biologi dan Pendidikan Biologi, 2(2), 29-35.

Rolla, M Tryon., & Alice, F Tryon. Ferns and Allied Plants With Special Reference to Tropical America. New York: Springer, 1982.https://doi.org/https://doi.org/10.1007/978-1-4613-8162-4.

Sari, H., & Bayu, H. M. (2019). Keanekaragaman Tumbuhan Paku (Pteridophyta) di Kawasan Hutan Desa Banua Rantau Kecamatan Batang Alai Selatan Kabupaten Hulu Sungai Tengah. *Jurnal Pendidikan Hayati*, *5*(3), 107–114.

Steenis, Vn, CGGJ. 2005. Flora. Jakarta: Pradnya Paramita.
Tjitrosoepomo, G.1994. Taksonomi Tumbuhan. Yogyakarta: Gajah Mada University Press.
Tjitrosocpomo, Gembong. 2005. Taksonomi Tumbuhan Schizophyta, Thallophyta, Bryophyta, Pteridophyta. Yogyakarta: Gadjah Mada University Press.