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The Inventory of Ferns (*Pteridophyta*) in East Citorek Village, Lebak Regency, Banten Province

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Abstract

*East Citorek Village in Lebak Regency has a beautiful, cold, and lush environment that is abundant with springs. These conditions support the growth of various types of ferns. However, the residents of East Citorek Village were unaware of their area's diverse types of this species. With the development plan for the region as a tourist destination involving the construction of facilities and improved accessibility, there was a potential threat to reduce and possibly annihilate fern vegetation. Accordingly, this study aimed to identify the types of ferns (*Pteridophyta*) and determine the abiotic factors influencing them in East Citorek Village, Lebak Regency. This research incorporated a qualitative approach employing the cruise method, which involved direct observation and exploration of representative sites with fern vegetation. Each type of fern was sampled, identified, and collected as part of a dry herbarium. As a result, the researchers identified 19 species, 12 families, and 7 orders of ferns in the area. The most common type of fern found belongs to the* Polypodiaceae *family, while the dominant species at the study site was* Dicranopteris linearis*. Measurements of environmental abiotic factors in East Citorek Village demonstrated that the conditions were suitable for the survival of ferns, with an average temperature of 28°C, air humidity of 76.3%, and soil pH of 6.*

Keywords: Identification, Fern, *Pteridophyta*, Herbarium

Introduction

Indonesia has a high biodiversity level, including a rich variety of *Pteridophyta*, or ferns (Bulawan et al., 2022). Ferns have the general characteristics of coiled or cylindrical buds and spotted leaves, which are actually spores or sporangium used for reproduction (Dewanti et al., 2020). *Pteridophyta* are cormophyte plants with spores, meaning their bodies can be divided into three parts: roots, stems, and leaves, but they do not produce seeds (Tjitrosoepomo, 2014).

Ferns play an essential role in ecological balance, contributing to forest ecosystems by mixing litter to form soil and serving as ground cover vegetation. Additionally, ferns have economic functions, as they can be used as ornamental plants, a source of food, and medicine (Mowata et al., 2020).

Based on their habitat, ferns are divided into terrestrial ferns (ground ferns), epiphytic ferns (attached to other plants), and water ferns (Tjitrosoepomo, 2014). Ferns thrive in damp areas, such as around water sources. A spring is a natural point where groundwater appears on the surface and is the initial source of river flow (Yunita et al., 2022). The presence of springs creates moist soil conditions that support the growth of ferns.

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Several areas in Indonesia, including the Lebak Regency, have many springs. One of the lush and green places in the Lebak region is East Citorek Village, which covers an area of 400.9641 km^2. Most East Citorek Village residents work in agriculture and animal husbandry, such as rice cultivation and fish farming (Akbar et al., 2021). Based on observations and surveys, the area has cold environmental conditions, high humidity, and many springs the local community uses for daily needs such as drinking water, cooking, washing, irrigation of rice fields, fish farming, and more. These environmental conditions support the growth of several types of ferns. The local community also consumes vegetable fern (*Diplazium esculentum*), but they are unfamiliar with other types that can be utilized.

East Citorek Village also has a new tourist destination, namely Mount Kendeng, which offers a blend of nature, agriculture, customs, and culture. However, it is still under development, including the creation of agricultural land. Mariati et al. (2023) explain that Mount Kendeng is a tourist attraction in East Citorek Village, offering a natural view with clusters of clouds. It was developed independently by the village community and is in the process of providing facilities for better accessibility. Several horticultural plants are also being planted, which is expected to increase agrotourism for tourists. There is a concern that activities from the development process and the creation of agricultural land might reduce or annihilate fern vegetation, making it necessary to identify the diversity of ferns. Correspondingly, one of the reasons this research was carried out was to record the inventory of ferns in East Citorek Village through an identification process.

The identification of ferns is crucial due to their significant roles in preventing erosion, maintaining soil moisture, and supporting forest ecosystems (Karliana, 2021). Despite their importance, many people are unaware of the diversity of ferns. Likewise, the development of agricultural land and the creation of tourist destinations, such as Mount Kendeng, have reduced fern diversity in these areas. Hence, this research aimed to identify ferns (*Pteridophyta*) in East Citorek Village, Lebak Regency, Banten, and provide an additional reference for studying lower plants (*Cryptogamae*), particularly within the *Pteridophyta* division. The present study became the first to examine the diversity of ferns in the East Citorek area, hoping that it could serve as a reference for developing and preserving ethnobotanically significant plants, especially within the lower plant division.

Research Methods

This research was conducted in East Citorek Village, Lebak Regency, Banten Province, from May to December 2023. The tools and materials employed included stationery, observation tables, a digital camera, relevant guidebooks, and essential reference books for determining low-level plants in the division *Pteridophytes*. The samples in this study were ferns found in the area of East Citorek Village, Cileler District, Lebak Regency, Banten Province. Data collection employed the cruise method, which involved directly observing and exploring each area considered representative of the types of ecosystems or fern vegetation under investigation (Hartini, 2011). The present research utilized a qualitative approach, with data collected in words or images, thus placing no emphasis on numbers (Sugiyono, 2014). Plant identification was conducted by observing the morphological characteristics, including leaves (leaf color, length, and width) and stems (stem shape and typical morphological features). Specimens were collected and made into a herbarium (when possible), then identified using references such as the Tjitrosoepomo (2014) reference book and a scientific article by Efendi and Iswahyudi (2019). Data analysis was performed qualitatively and descriptively by sampling, documenting, and identifying (Ulfa, 2017). Additionally, supplementary information was gathered from interviews with residents.

Research Results and Discussion

Based on the research results, 17 species were found in the collection, with 2 species documented, comprising 19 genera, 12 families, and 7 orders. The species found at

the research location in East Citorek Village were predominantly from the *Polypodiales* order, with 11 species. The other findings included 2 species from the *Schizaeales* order, 1 species from the *Lycopodiales* order, 1 species from the *Salviniales* order, 2 species from the *Gleicheniales* order, 1 species from the *Selaginellales* order, and 1 species from the *Cyatheales* order (see Table 1).

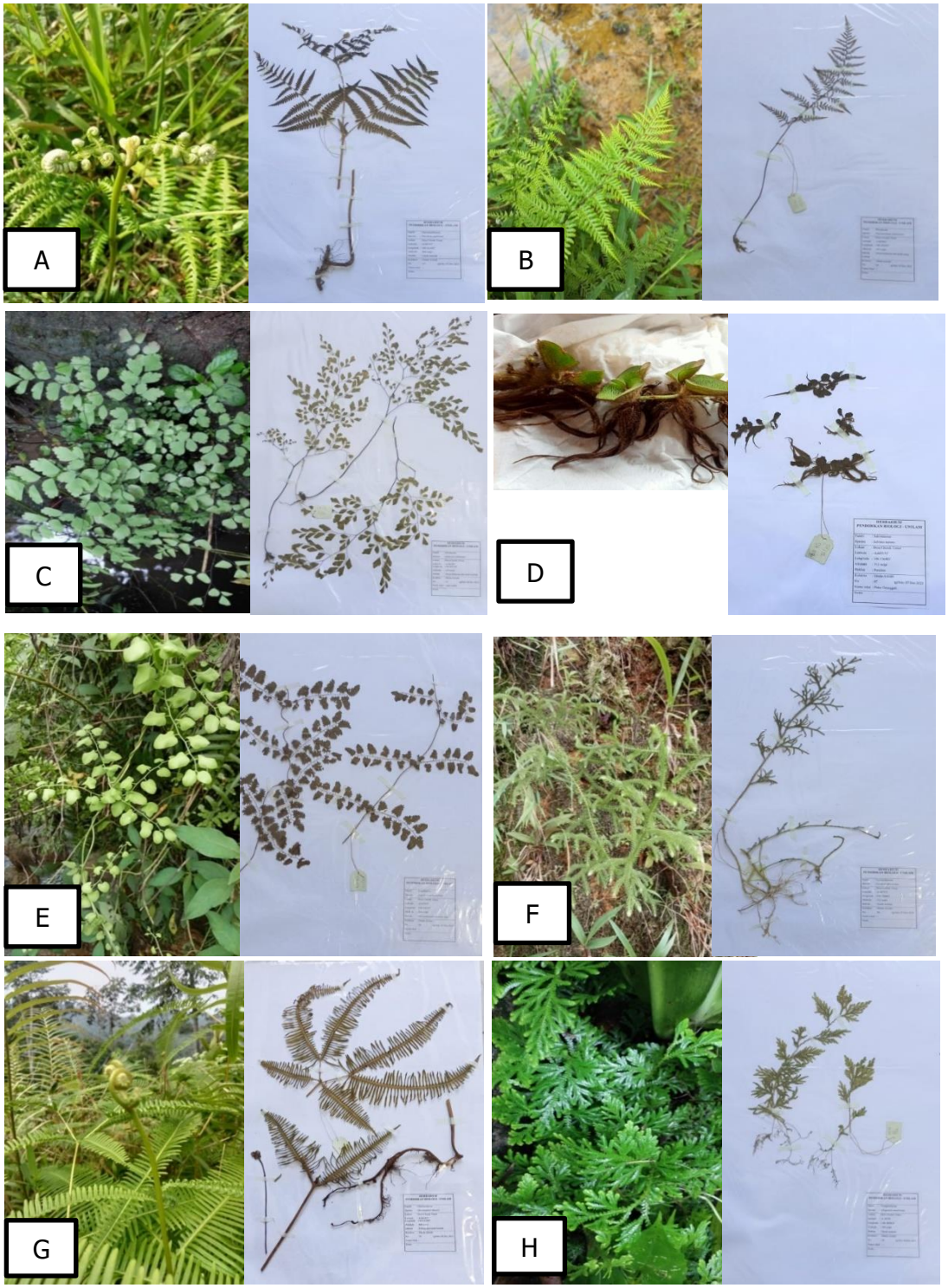
Research data indicated that the *Polypodiaceae* family had the highest genus and species composition compared to other families. In contrast, the families with the lowest genus and species composition were *Dryopteridaceae*, *Lindsaeaceae*, *Lycopodiaceae*, *Salviniaceae*, *Selaginellaceae*, and *Cyatheaceae*.

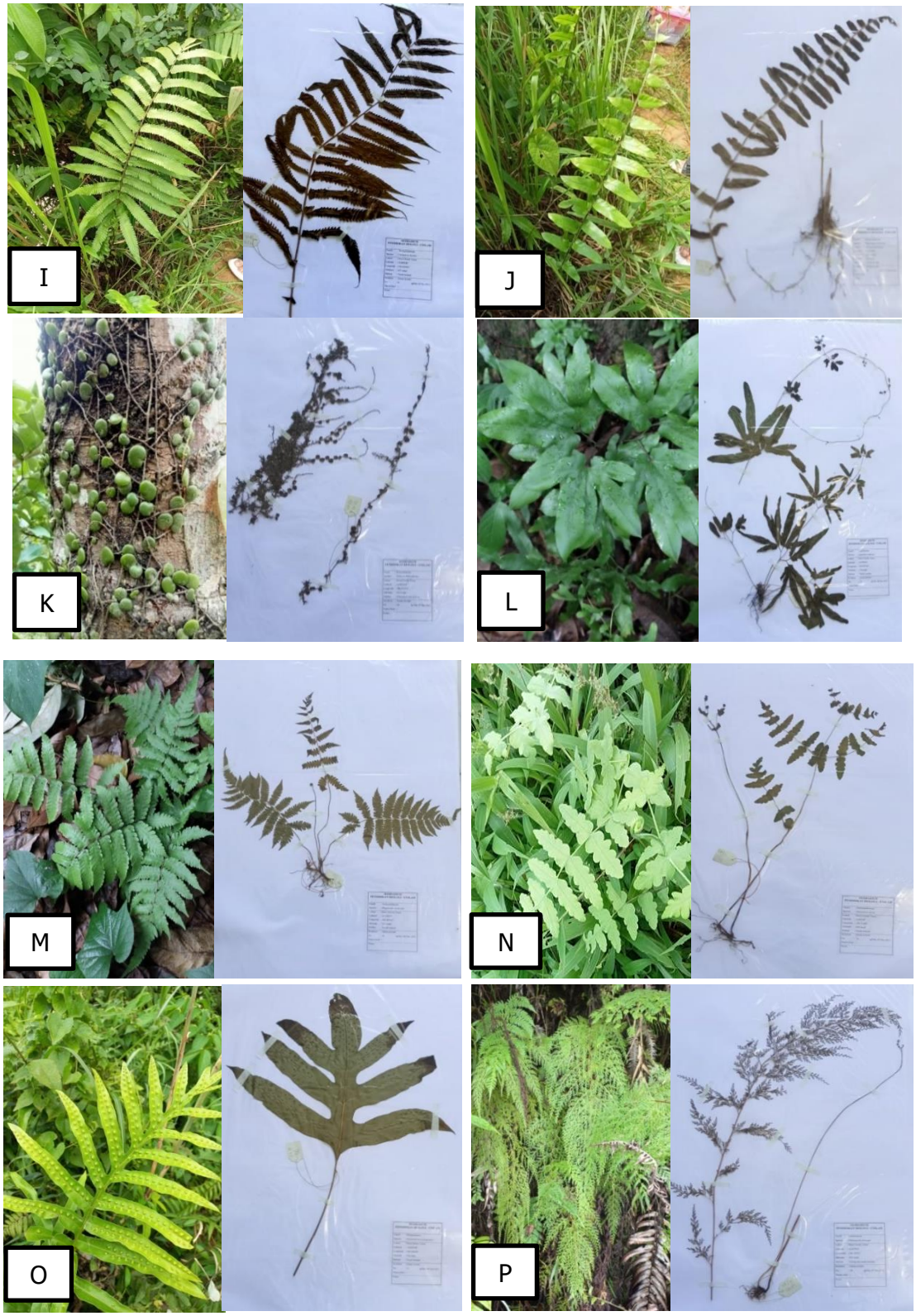
Environmental abiotic factors were measured to determine whether the exixting environmental conditions were still in accordance with the ideal requirements. The measurement results of environmental abiotic factors at the research location revealed that the conditions were still suitable for the survival of ferns. Specifically, temperature measurements showed an average of 28°C, air humidity of 76.3%, and soil pH of 6. Ideally, ferns can grow and develop well in locations with air temperatures between 21-27°C, humidity between 60-90%, and pH values from 5.5-8.0 (Saputro & Utami, 2020). Similarly, Janna et al. (2020) propose that the growth and development of ferns normally occur at soil moisture of 60-90%, environmental temperatures of 27°-28°C, and substrate pH of around 7-8.

Table 1
*Ferns (*Pteridophyta*) Diversity at East Citorek Village, Lebak Regency, Banten Province*

No	Order	Family	Genus	Species Name
1.	*Polypodiales*	*Thelypteridaceae*	*Thelypteris*	*Thelypteris dendata*
			Phegopteris	*Phegopteris connectilis*
		Dryopteridaceae	*Nephrolepis*	*Nephrolepis biserrata*
		Pteridaceae	*Pityrogamma*	*Pityrogramma calomelanos*
			Adiantum	*Adiantum raddianum*
		Polypodiaceae	*Pyrrosia*	*Pyrrosia Pilloselloides*
			Phymatosorus	*Phymatosorus scolopendria*
			Diplazium	*Diplazium esculentum*
		Lindsaeaceae	*Odontosoria*	*Odontosoria chinensis*
		Dennstaedtiaceae	*Pteridium*	*Pteridium aquilinum*
			Histiopteris	*Histiopteris incisa*
2.	*Schizaeales*	*Lygodiaceae*	*Lygodium*	*Lygodium microphyllum*
			Lygodium	*Lygodium venustum*
3.	*Lycopodiales*	*Lycopodiaceae*	*Lycopodiella*	*Lycopodiella cernua*
4.	*Salviniales*	*Salviniaceae*	*Salvinia*	*Salvinia natans*
5.	*Gleicheniales*	*Gleicheniaceae*	*Sticherus*	*Sticherus brackenridgei*
			Dicranopteris	*Dicranopteris linearis*
6.	*Selaginellales*	*Selaginellaceae*	*Selaginella*	*Sellaginela tamariscina*
7.	*Cyatheales*	*Cyatheaceae*	*Cyahtea*	*Cyathea arborea*

Figure 1. *Diversity of ferns (*Pteridophyta*) in East Citorek Village, Lebak Regency, Banten Province: (A)* Pteridium aquilinum*, (B)* Pityrogramma calomelanos*, (C)* Adiantum raddianum*, (D)* Salvinia natans*, (E)* Lygodium microphyllum*, (F)* Lycopodiella cernua*, (G)* Dicranopteris linearis*, (H)* Sellaginela tamariscina*, (I)* Thelypteris dendata*, (J)* Nephrolepis biserrate*, (K)* Pyrrosia Pilloselloides*, (L)* Lygodium venustum*, (M)* Phegopteris connectilis*, (N)* Histiopteris incisa*, (O)* Phymatosorus scolopendria*, (P)* Odontosoria chinensis*, (Q)* Sticherus brackenridgei*, (R)* Diplazium esculentum*, and (S)* Cyathea arborea*.*

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Based on the data obtained, the environment in East Citorek Village was suitable for the survival of the 19 species of ferns found at the research location (see Figure 1). Ferns can grow in various places with different temperatures, pH levels, and humidity. Efendi and Iswahyudi (2019) note that ferns can grow in diverse habitats such as damp places, under trees, river banks, mountain slopes, attached to trees, walls, rocks, or ground. Ferns can also grow in various climates, from tropical to subtropical areas, except in eternal snow or deserts. However, they typically require moist environments to grow. Apriyanti, Santri, and Madang (2017) also report that ferns can live in various habitats, preferring damp and shaded places, although some species thrive in open areas. Ferns can also grow well in temperate climates and can be found in forests, damp grasslands, along roadsides, and near rivers.

Description of each species of Fern (*Pteridophyta*) in East Citorek Village, Lebak Regency, Banten Province (Figure 1)

A. *Pteridium aquilinum*

Pteridium aquilinum is a terrestrial fern. It is found in highlands or mountains, particularly in open areas directly exposed to sunlight. Generally, this species grows in groups and coexists with bushes, grass, weeds, and other low plants. It can grow on the ground or rocky terrain. *Pteridium aquilinum* has an upright growth structure with an erect stalk. The lower surface of the stalk is usually not covered with fine hairs. On one side of the surface, an indentation forms a brown longitudinal line to the tip, while green longitudinal lines extend to the tip on the two sides.

According to Efendi and Iswahyudi (2019), *Pteridium aquilinum* has leaves classified as pinnate compound leaves, with the arrangement of the leaflets alternating until they are parallel on both sides. The leaves have a thin but firm texture, dark green on the upper surface, while the lower surface is whitish-green. The sori are elongated lines located on the edge of the leaf along the leaf lobe.

B. *Pityrogramma calomelanos*

Pityrogramma calomelanos is a terrestrial fern that grows on the ground, rock surfaces, or walls. It has short, erect rhizomes and slender stalks that are dark brown to black when mature and green when young. The leaves are classified as compound, with the leaflets arranged alternately or nearly parallel on both sides. These leaves have a thin but firm structure, green on the upper surface and white on the lower surface due to a white powder that leaves a white mark when handled. The sporangia are located along the leaf veins on the lower surface of the leaf (Efendi & Iswahyudi, 2019).

C. *Adiantum raddianum*

Adiantum raddianum is a terrestrial fern found in both shaded and open areas. It often grows on rocky surfaces, soils, and slopes, frequently in conjunction with other plants. This species forms dense clumps, and its young leaf shoots are yellowish-red. It does not have hairs, either on the tips of the shoots or on the stems. It has short, erect rhizomes and black stalks with a smooth, slippery

surface. The leaf stalks are branched, leading to further branching, which classifies the leaves as compound. These leaves have a thin texture and are yellowish-green. The leaf veins are free and extend to the edge of the leaf, bifurcating multiple times. The kidney-shaped sori are located on the lower leaf edges, appearing white or green when young and turning brown when mature (Efendi & Iswahyudi, 2019).

D. *Salvinia natans*

According to Efendi and Iswahyudi (2019), *Salvinia natans* is a water fern commonly found floating in flooded rice fields. This species has long, green to yellowish rhizomes with fine yellowish-white hairs. The roots grow from the rhizomes in the form of fibers; these roots are brownish-red and float in water. The leaves of *Salvinia natans* are yellowish-green, round to oval in shape, with a slit or indentation in the middle. They have a thick texture and a rough surface due to the hairs on their surface. The sori are located beneath the submerged leaves.

E. *Lygodium microphyllum*

Lygodium microphyllum is a terrestrial fern with fibrous roots and small, round stems. It has stalks that branch in a creeping direction and are light green. The leaves are compound, with an alternate arrangement of leaf stalks. The sori are located on the lower surface of the leaf, precisely at the edge of the leaf, which tapers outward. This species is commonly found along riverbanks and other springs (Yunita et al., 2022).

F. *Lycopodiella cernua*

Lycopodiella cernua is a terrestrial fern with microphyllous leaves (small leaves with only one leaf vein). The numerous leaves are arranged tightly in a spiral line. Sporophylls are slightly different from trophophylls and are usually clustered into a series of grain-shaped sporophylls at the tip of the stem. Each sporophyll has a large sporangium on the underside of the leaf. This fern has wire-like stems that grow upright or parallel to branches that rise upwards, with roots that branch out into forks (Tjitrosoepomo, 2014).

G. *Dicranopteris linearis*

Dicranopteris linearis is a terrestrial fern that usually grows on the cliffs of mountain roads. It has rhizomes that spread long, thick, and dense. The stem is upright and has two branches, with two leaves growing on each branch. The young shoots are curled, branched, and covered with fine hairs, which disappear as they grow and develop. The leaves are classified as compound, pinnate, and have tapered tips. The sori are round and located on the lower surface of the leaves (Efendi & Iswahyudi, 2019).

H. *Selaginella tamariscina*

Selaginella tamariscina is a terrestrial fern that grows in moist soil. It has compound leaves classified as microphyllous, with tapered tips arranged alternately. The stems are prostrate and upright, with forked branches, and do not exhibit secondary thickening growth. It grows in clumps and creeps. The small leaves are arranged in four rows on the stem, each with a single central vein and no branching. There is a scale called a ligule on the lower surface of the leaf, which functions as a water-absorbing device. Roots, known as supporting roots, appear on the leafless parts of the stem. In addition, this species is heterosporous (Tjitrosoepomo, 2014).

I. *Thelypteris dentata*

According to Manora (2023), *Thelypteris dentata* is a terrestrial fern with short, spreading rhizomes and brown roots. The leaf stalks are brown, smooth, and grooved. The leaves are compound, with rounded bases, tapered tips, and curved edges. They have pinnate veins, smooth surfaces, and tiny hairs on the leaf surface. The leaflets are arranged parallel, and the leaves are thin and dark green. The sori are located on the lower surface of the leaves and are dark brown.

J. *Nephrolepis biserrata*

Nephrolepis biserrata is a fern living terrestrially. It has brown roots and short, brownish, erect rhizomes. The leaf stalks are green and have fine white hairs. The leaves are of the compound type, green in color, with smooth surfaces, flat edges, flat bases, tapered tips, and alternate leaflets. The sori are located on the underside of the leaf surface, round, and lined up near the edge of the leaf (Manora, 2023).

K. *Pyrrosia piloselloides*

Pyrrosia Piloselloides is a fern that lives epiphytically, attaching and propagating on branches or trees. It has a long, spreading, and branching rhizome covered with brownish

hairs and very short leaf stalks that grow on the rhizome. The leaves are classified as single leaf type, usually with two types of leaves: fertile and sterile. Fertile leaves are longer, while sterile leaves are almost round. These leaves have a thick, fleshy texture and are green to yellowish with flat edges. The sori are located on the underside of the leaf surface, precisely along the edge of the leaf (Azizah, 2016).

L. *Lygodium venustum*

Lygodium venustum is a terrestrial fern that lives in open places and usually grows wrapped around other plants. It has an upright, short rhizome that is dark brown with fibrous roots. It has a thin, brown, and branched stalk, with each branch bearing two leaves. The leaves are green and have fingered spines, flat edges, and tapered tips (Hidayah et al., 2021).

M. *Phegopteris connectilis*

Phegopteris connectilis is a terrestrial fern with a short spreading rhizome and fibrous roots. It has a greenish-brown stalk covered with fine or white hairs. The young leaves are light green with rolled tips. These leaves are compound, with double pinnate veins, serrated edges, tapered tips and bases. The surface is hairy or covered with fine white hairs. The sori are located on the underside of the leaf surface; young sori are white, round, and arranged in parallel rows. When mature, the sori turn brown (Listiyanti et al., 2022).

N. *Histiopteris incisa*

Histiopteris incisa is a terrestrial fern that grows in open places exposed to direct sunlight, typically found in grasslands or mountain slopes. It has spreading rhizomes and an upright stalk that is round, hard, smooth, and shiny, with a blackish-purple color. The leaves are arranged oppositely and have curved edges. The young leaves are light green and curly. The sori are usually located on the underside of the leaf surface, in the curve of the leaf edge (Khasanah, 2020).

O. *Phymatosorus scolopendria*

Phymatosorus scolopendria is commonly found growing with other grassland plants and can also grow epiphytically on tree trunks. It has spreading rhizomes with tiny hairs and spreading fibrous roots. The leaves are green with pinnate veins running parallel on both sides. The leaf surface is smooth, with a tapered tip and a flat leaf edge. The sori are located on the lower surface of the leaves, are round, and have a yellowish-brown color. The sori line up along the edge of the leaf (Efendi & Iswahyudi, 2019).

P. *Odontosoria chinensis*

Odontosoria chinensis is a terrestrial fern found on mountain cliffs, often growing alongside other ferns. It has reddish-brown spreading rhizomes with fibrous roots. The stalk is upright, reddish-green, smooth, and slippery. The young leaves are curled and light green, belonging to the compound type with alternate leaflets. The leaflets are small, thin, and green. The sori are located at the tip of the leaf vein on each leaf lobe (Efendi & Iswahyudi, 2019).

Q. *Sticherus brackenridgei*

Sticherus brackenridgei is a terrestrial fern that grows with grass and other plants. It belongs to the same family as *Dicranopteris linearis* and can also be found on the cliffs of mountain roads. Like *D. linearis*, this species has a spreading rhizome and an upright, hard stem that branches into two, with each further dividing. Each branch of the stem has two leaves growing beneath it. The young leaf shoots are curled and covered with fine hairs between branches. The leaves are compound, thin, green, pinnate, with flat edges, and shorter than those of *D. linearis*. The sori are round and located on the lower surface of the leaf, near the leaf vein (Efendi & Iswahyudi, 2019).

R. *Diplazium esculentum*

According to Riastuti, Sepriyaningsih, and Ernawati (2018), *Diplazium esculentum* is a terrestrial fern with erect, dark, fleshy rhizomes and creeping fibrous roots. The stems are upright, green, and covered with fine brownish hairs. The compound leaves have young, curled tips, pinnate vein arrangements, serrated edges, sharp tips, blunt bases, and paired leaflets. The young leaf shoots of this fern are used as food or vegetables by the people of East Citorek Village.

S. *Cyathea arborea*

Cyathea arborea is a terrestrial fern characterized by its large and tall stature, upright brownish stem, and traces of leaves on the stem. The surface of the stem is

covered with brownish hairs, and rough fibrous roots are at its base. The leaf stalks are thorny and rough, growing upward and to the side. The fern has compound leaves with leaflets that alternate almost parallel. The leaves have a thin texture, are green in color, and have young shoots that are curled and completely covered with brownish feathers. The sori are found on the lower surface of the leaf, round, and located between the leaf veins (Efendi & Iswahyudi, 2019).

In this research, various types and families of ferns were found in East Citorek Village, Lebak Regency. Based on Table 1, the most common types of ferns belonged to the *Polypodiaceae* family, with three types identified. The fern vegetation that dominated the research location was *Dicranopteris linearis* from the *Gleicheniaceae* family. This was due to the homogeneous conditions of air temperature, air humidity, and soil pH at the research location, which enabled ferns to thrive. Wijayanto et al. (2019) also propose that *Dicranopteris linearis* can grow at an air temperature of around 22°C, air humidity of 78%, and soil pH of 6.2. These conditions are similar to the measurements of abiotic factors in East Citorek Village, as detailed in Appendix 3, resulting in *Dicranopteris linearis* fern vegetation dominating the research site.

Conclusion

Based on the research conducted in East Citorek Village, Lebak Regency, Banten Province, 19 species of *Pteridophyta* belonging to 12 families were identified. These families included 1) *Thelypteridaceae* (*Thelypteris fineta* and *Phegopteris connectilis*), 2) *Dryopteridaceae* (*Nephrolepis biserrata*), 3) *Pteridaceae* (*Pityrogramma calomelanos* and *Adiantum raddianum*), 4) *Polypodiaceae* (*Pyrrosia piloselloides, Phymatosorus scolopendria*, and *Diplazium esculentum*), 5) *Lindsaeaceae* (*Odontosoria chinensis*), 6) *Lygodiaceae* (*Lygodium microphyllum* and *Lygodium venustum*), 7) *Dennstaedtiaceae* (*Pteridium aquilinum* and *Histiopteris incisa*), 8) *Lycopodiaceae* (*Lycopodiella cernua*), 9) *Salviniaceae* (*Salvinia natans*), 10) *Gleicheniaceae* (*Sticherus brackenridgei* and *Dicranopteris linearis*), 11) *Selaginellaceae* (*Sellaginela tamariscina*), and 12) *Cyatheaceae* (*Cyathea arborea*). Another type of fern, *Diplazium esculentum*, often used by the community as food or vegetables, was also found.

This research can be a scientific reference for studying lower plants (*Cryptogamae*), particularly within the *Pteridophyta* division. Besides, the people around East Citorek Village are expected to understand ferns better and work towards their preservation. Further research can examine the diversity of ferns (*Pteridophyta*) in the East Citorek area and specifically explore the potential of ferns on an ethnobotanical basis.

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