



Checklist of Ferns in Mt. Mariveles, Bataan, Philippines

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ABSTRACT

A checklist of fern species in Mt Mariveles, Bataan was provided in two trails, Tarak Ridge and Pantingan Peak from 400 masl to 1000 masl with information on their growth forms, endemism, and conservation status. The collected specimens were identified and evaluated based on their conservation status. There were 28 taxa, and 20 genera in 14 families of ferns observed at Mt. Mariveles Bataan. Among the 14 families, Aspleniaceae has the most numbered species consisting of 5 taxa. There are 20 taxa of ferns, 14 genera in 10 families that are found in Tarak of Mt Mariveles while 11 taxa and 9 genera in 10 families were recorded in the Pantingan of Mt Mariveles. More ferns were observed in Papaya River in Tarak and 800 to 1000 masl in Pantingan. Mid-elevation forests had the highest maximum fern richness. It results from high humidity, precipitation, and moderate temperatures. The growth form of collected ferns is mostly epiphytic. Based on their conservation status two species are Least Concern (LC) these are *Pteridium aquilinum* and *Dicranopteris linearis* while *Angiopteris evecta* of Marattiaceae was considered as Other threatened species (OT).

RESUMO

Uma lista de verificação de espécies de samambaias no Monte Mariveles, Bataan foi fornecida em duas trilhas, Tarak Ridge e Pantingan Peak de 400 msnm a 1000 msnm com informações sobre suas formas de crescimento, endemismo e status de conservação. Os espécimes coletados foram identificados e avaliados com base em seu status de conservação. Havia 28 táxons e 20 gêneros em 14 famílias de samambaias observadas no Monte Mariveles Bataan. Entre as 14 famílias, Aspleniaceae tem as espécies mais numeradas, consistindo de 5 táxons. Existem 20 táxons de samambaias, 14 gêneros em 10 famílias que são encontrados em Tarak do Monte Mariveles, enquanto 11 táxons e 9 gêneros em 10 famílias foram registrados no Pantingan do Monte Mariveles. Mais samambaias foram observadas no Rio Papaya em Tarak e de 800 a 1000 msnm em Pantingan. As florestas de altitude média tiveram a maior riqueza máxima de samambaias. Ela resulta de alta umidade, precipitação e temperaturas moderadas. A forma de crescimento das samambaias coletadas é principalmente epífita. Com base em seu status de conservação, duas espécies são de menor preocupação (LC), são *Pteridium aquilinum* e *Dicranopteris linearis*, enquanto *Angiopteris evecta* de Marattiaceae foi considerada como outra espécie ameaçada (OT).

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Introduction

Ferns are seedless vascular plants that are the primary food source within the food chain that maintains the nature's balance. Additionally, among all vascular plants, they are the oldest and most varied group. (Mabberley, 2008; Qian et al., 2021a). Most fern species are spore bearing plants that prefer moist, shaded environments but some fern species can withstand intense sunlight in extremely dry conditions (Alcala et al., 2019). They have an important role in the environment and man's life as a source of income because of their ornamental purpose (Catapang et al., 2012). There are 12,000 species of ferns worldwide (Hassler, 2004-2021). Alcala et al., (2019) cited that there are about 1,100 species of Pteridophytes known to exist in the Philippines, divided into 144 genera and 39 families.

Ferns are more widely distributed and in balance with the climate compared to other groups of vascular plants (Qian, 2023). The richness of fern species differs globally (Weigand et al., 2020) because of various environmental factors (Kreft et al., 2010; Khine et al., 2019). Based on the study of Kreft et al., (2010), Weigand et al., (2020), Suissa, Sundue, and Testo (2021), mountains are the global centers of diversity of ferns. Fern's diversity pattern is correlated to climatic conditions where local and regional fern diversity peaks in habitats with moderate temperature, high air humidity and high precipitation (Kreft et al., 2010; Kessler et al., 2011b; Weigand et al., 2020). According to Suryana et al. (2018), socioeconomic status, institutional management of forest areas, and species conservation are the main factors contributing to the threat of fern extinction, including the tree ferns. Ferns make life better for the locals, as evidenced by the fact that many communities harvest tree ferns for ornamental purposes or as a supplemental source of income.

The species richness of ferns increased due to newly discovered species (Smith et al. 2008; Barcelona et al. 2013; Amoroso et al. 2016). But according to the study of Alcala et al., (2019), there were few studies of pteridophytes flora of Philippine mountains. Mount Mariveles Bataan, one of the highest mountains in Central Luzon has two peaks, the Tarak Ridge Trail in Mariveles and Pantingan Peak in Bagac. Studies of ferns have not yet conducted on the said mountain but a study on the preliminary checklist of vascular plants done by Vidallon and Arriola (2021) in Tarak Ridge Trail of Mariveles, Bataan recorded some of the ferns on the said trail. Nonetheless there are no published studies about the checklist of ferns in Mt. Mariveles so this study is a must.

Materials and Methods

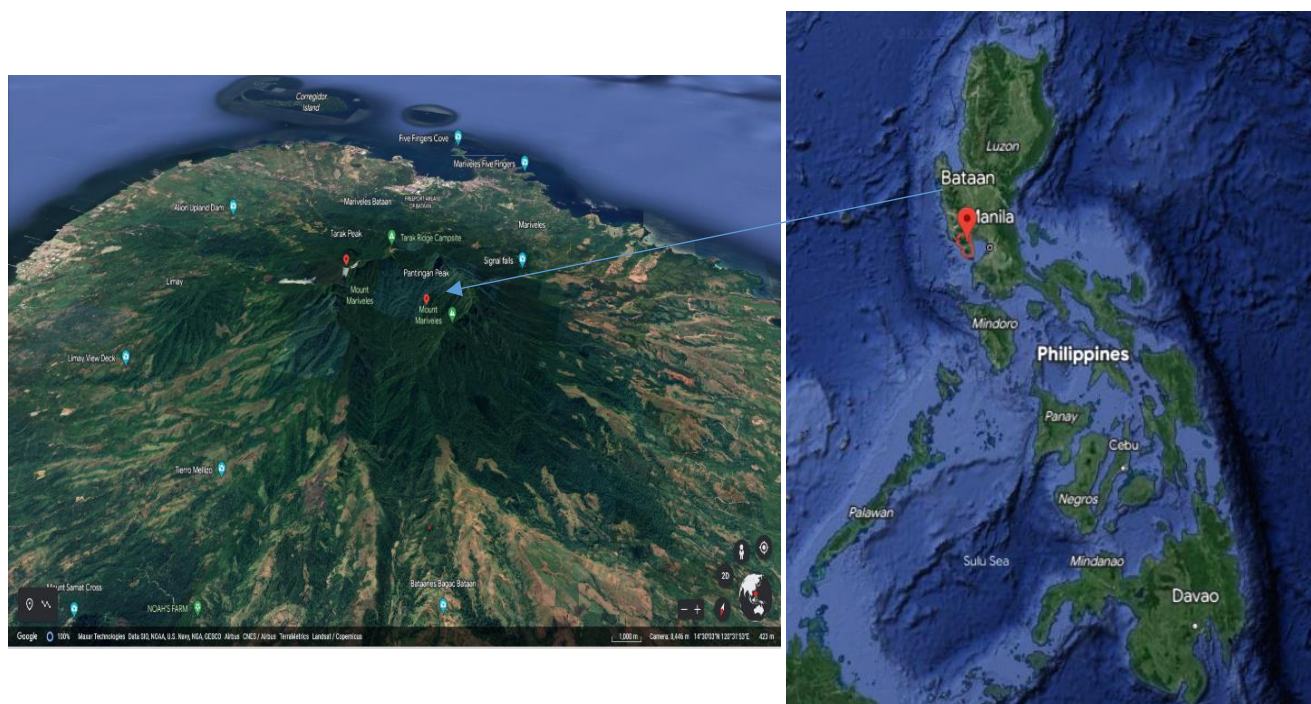
Study Site

The study was conducted in two trails in Mt. Mariveles, Bataan, the Tarak Ridge Trail in Brgy. Alasasin Mariveles and Pantingan Peak in Bagac Bataan with an elevation range from

400 to 1000 meters above sea level (masl). An opportunistic sampling was done also. See Figure 1.

Figure 1

Map of the Philippines displaying the location of Mt. Mariveles in the province of Bataan. Red markers indicate Pantingan Peak and Mt. Mariveles' Tarak Ridge (Philippines and Mt. Mariveles map, <http://earth.google.com>)



Processing of Permit, Survey, Fern Collection and Identification

The Gratuitous permit (GP) was secured to the Department of Environment and Natural Resources (DENR) Region III before the plant collection. The fern species were collected through a series of field visits that took place between October 2019 and May 2022. The process involved uprooting the entire plant, removing any earthy matter, and pressing the specimens. Voucher specimens were sent to the University of Santo Tomas Herbarium (USTH) after the specimens were prepared for the herbarium. Since there isn't a database covering the ferns of Bataan, the specimens were compared and identified using Co's Digital Flora of the Philippines. The identity of the ferns was verified by an expert. Moreover, the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species 2024–1 was consulted in addition to Co's Digital Flora of the Philippines, which served as a baseline for comparing the conservation status of ferns. The following categories applied to the listed species: LC = least concern, V = vulnerable, NE = not evaluated, DD = data deficient, OT = other threatened species, EN = endangered, and CR = critically endangered. Additionally, endemism was noted as follows: N = non-endemic, E = Philippine endemic.

Results and Discussion

Species Richness

The total collected ferns belong to 28 taxa, 20 genera in 14 families (Table 1) (Figure 2). Aspleniaceae has the most numbered of species consisting of five (5) species followed by Dryopteridaceae, and Pteridaceae with 4 species each. Most of the collected ferns were epiphytic. In terms of their conservation status, two species are Least Concern (LC), *Pteridium aquilinum* and *Dicranopteris linearis* based on IUCN 2024. *Angiopteris evecta* of Marattiaceae was considered as Other threatened species (OT) based on Co's digital flora.

There are 20 taxa of ferns, 14 genera in 10 families that are found in Tarak of Mt Mariveles these are: *Pleocnemia* sp. of Dryopteridaceae, *Drynaria* sp. of Polypodiaceae and *Pteris ensiformis* of Pteridaceae that were collected at 400 masl. *Angiopteris evecta* of Marattiaceae, *Pteridium aquilinum* of Dennstaedtiaceae, *Bolbitis rhizophylla* and *Bolbitis* sp. of Dryopteridaceae and *Displazium* sp of Athyriaceae, *Odontosoria chinensis* of Lindsaceae and *Lygodium circinnatum* Lygodiaceae that were found at 600 masl. More ferns were found at Papaya River and these are: *Microsorum longissimum* of Polypodiaceae, *Antrophyum callifolium* of Pteridaceae, *Asplenium* sp., *Asplenium* sp.2 and *Asplenium horridum* of Aspleniaceae, *Adiantum philippense*, and *Adiantum diaphanum* of Pteridaceae. *Lygodium flexuosum* of Lygodiaceae, *Adiantum diaphanum* of Pteridaceae and *Nephrolepis* sp. of Nephrolepidaceae were observed at 800 masl. *Pteridium aquilinum* of Dennstaedtiaceae was also observed at 1000 masl (Figure 3).

Ferns that were observed at Pantingan Peak of Mt Mariveles were consists 11 taxa and 9 genera in 10 families. These are: *Angiopteris evecta* of Marattiaceae which was observed at 100 masl, *Pleocnemia* sp. of Dryopteridaceae which was observed at 200 masl, *Pteridium aquilinum* of Dennstaedtiaceae was observed at 400 masl, *Asplenium horridum* of Aspleniaceae, *Ampelopteris prolifera* and *Christella* sp. of Thelypteridaceae that were all collected at 800 masl. In 1000 masl the ferns that were observed are: *Dipteris conjugata* of Dipteridaceae, *Asplenium nidus* of Aspleniceae, *Davalia* sp. of Davalliaceae, *Dicranopteris linearis* of Gleicheniaceae and *Pleocnemia irregularis* of Dryopteridaceae. At the peak of Pantigan Peak in 1300 masl, *Selliguea taeniata* of Polypodiaceae was observed (Figure 4).

More ferns were observed at the Papaya River of Tarak in Mt. Mariveles and 800 to 1000 masl in Pantingan Peak. Many factors influence species richness, which includes area sampled size, geographical location, types of soil and condition of the climate (Kessler, 2010). Mid-elevation forests had the highest maximum fern richness. (Umair et al., 2023). Additionally, ferns have more vertical habitats in montane forests compared to lowland forests (Acebey et al., 2017) because of the effect at mid-elevations of rainfall, high humidity and moderate temperatures at mid-elevations (Klug, et. al., 2006).

Table 1

The checklist of fern species in Mt. Mariveles Bataan. (Growth forms, E: epiphytes; T: Terrestrial) (Endemicity: E: Endemic, NE: Not Endemic)

Family	Species	Endemicity	Growth Form
Aspleniaceae	<i>Asplenium cuneatum</i>	NE	E
	<i>Asplenium horridum</i>	NE	E
	<i>Asplenium nidus</i>	NE	E
	<i>Asplenium sp.1</i>	NE	E
	<i>Asplenium sp.2</i>	NE	E
Athyriaceae	<i>Displazium sp.</i>	NE	E
Davaliaceae	<i>Davallia sp.</i>	NE	E
Dennstaedtiaceae	<i>Pteridium aquilinum</i>	NE	T
Dipteridaceae	<i>Dipteris conjugata</i>	NE	T
Dryopteridaceae	<i>Bolbitis rhizophylla</i>	NE	E
	<i>Bolbitis sp.</i>	NE	E
	<i>Pleocnemia sp</i>	NE	T
	<i>Pleocnemia irregularis</i>	NE	T
Gleichineaceae	<i>Dicranopteris linearis</i>	NE	T
Lindsaceae	<i>Odontosoria chinensis</i>	NE	E
Lygodiaceae	<i>Lygodium flexuosum</i>	NE	T
	<i>Lygodium circinnatum</i>	NE	T
Marattiaceae	<i>Angiopteris evecta</i>	NE	T
Nephrolepidaceae	<i>Nephrolepis sp.</i>	NE	E
Polypodiaceae	<i>Drynaria sp.</i>	NE	E
	<i>Microsorium longissimum</i>	NE	E
	<i>Selliguea taeniata</i>	NE	E
	<i>Adiantum diaphanum</i>	NE	T
Pteridaceae	<i>Adiantum philippense</i>	NE	E
	<i>Antrophyum callifolium</i>	NE	E
	<i>Pteris ensiformis</i>	NE	T
	<i>Ampelopteris prolifera</i>	NE	T
Thelypteridaceae	<i>Christella sp.</i>	NE	E

Table 2

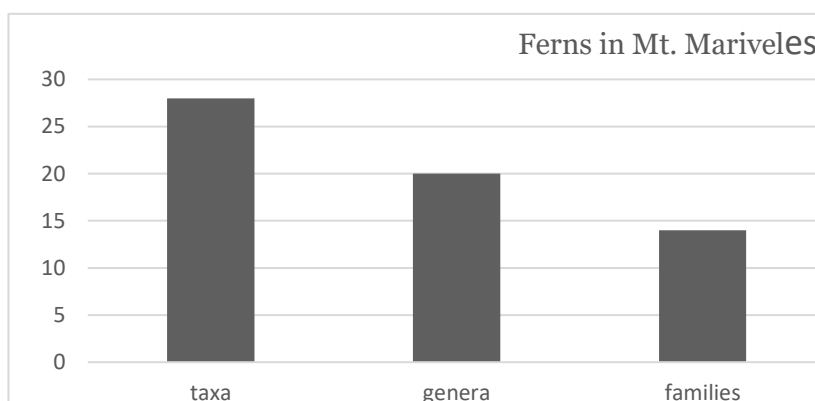
The fern species' conservation status on Mt. Mariveles, Bataan (V = vulnerable, LC = least concern, OT = other threatened species, DD = data deficient, EN = endangered, CR = critically endangered and NE=Not Evaluated)

Family	Species	Conservation Status
Aspleniaceae	<i>Asplenium cuneatum</i>	NE
	<i>Asplenium horridum</i>	NE
	<i>Asplenium nidus</i>	NE
	<i>Asplenium sp.1</i>	NE
	<i>Asplenium sp.2</i>	NE
Athyriaceae	<i>Displazium sp.</i>	NE
Davaliaceae	<i>Davallia sp.</i>	NE
Dennstaedtiaceae	<i>Pteridium aquilinum</i>	LC
Dipteridaceae	<i>Dipteris conjugata</i>	NE
Dryopteridaceae	<i>Bolbitis rhizophylla</i>	NE
	<i>Bolbitis sp.</i>	NE
	<i>Pleocnemia sp</i>	NE

	<i>Pleocnemia irregularis</i>	NE
Gleichineaceae	<i>Dicranopteris linearis</i>	LC
Lindsaceae	<i>Odontosoria chinensis</i>	NE
Lygodiaceae	<i>Lygodium flexuosum</i>	NE
	<i>Lygodium circinnatum</i>	NE
Marattiaceae	<i>Angiopteris evecta</i>	OT
Nephrolepidaceae	<i>Nephrolepis sp.</i>	NE
Polypodiaceae	<i>Drynaria sp.</i>	NE
	<i>Microsorrum longissimum</i>	NE
	<i>Selliguea taeniata</i>	NE
	<i>Adiantum diaphanum</i>	NE
Pteridaceae	<i>Adiantum philippense</i>	NE
	<i>Antrophyum callifolium</i>	NE
	<i>Pteris ensiformis</i>	NE
	<i>Ampelopteris prolifera</i>	NE
Thelypteridaceae	<i>Christella sp</i>	NE

Figure 2

Distribution of Ferns in Mt. Mariveles, Bataan



The inventory of ferns conducted at Mt Mariveles, Bataan, has recorded 28 taxa, and 20 genera in 14 families. Among the 14 families, Aspleniaceae has the most numbered of species consisting of 5 taxa. There were 20 taxa of ferns, 14 genera in 10 families that were recorded in Tarak of Mt Mariveles wherein most of the species were observed in Papaya River. Eleven (11) taxa and 9 genera in 10 families of ferns were recorded in Pantingan wherein most of the species were found in 800 to 1000 masl. Species richness in Tarak is because of moderate temperatures at mid-elevations and an optimal combination of rainfall and high humidity. Most of the species were epiphytic. Regarding the conservation status, there were 2 species that are Least Concern (LC), these are *Pteridium aquilinum* and *Dicranopteris linearis* and *Angiopteris evecta* of Marattiaceae was considered as Other threatened species (OT).

Figure 3

Ferns in Tarak of Mt. Mariveles: A-A1. Pleocnemia sp. B-B1. Drynaria sp. C. Pteris ensiformis D. Angiopteris evecta E-E1. Bolbitis rhizophylla F. Bolbitis sp. G-G1. Odontosoria chinensis H-H1. Displazium sp. I-I1. Antrophyum callifolium J-J1. Lygodium circinnatum K-K1. Adiantum Philippense L-L1. Adiantum caudatum M-M1. Adiantum diaphanum N-N1. Asplenium horridum O-O1. Asplenium sp.1 P-P1. Lygodium flexuos Q. Microsorium longissimum R-R1. Aspleium sp2. S. Nephrolepis sp. T. Pteridium aquilinum

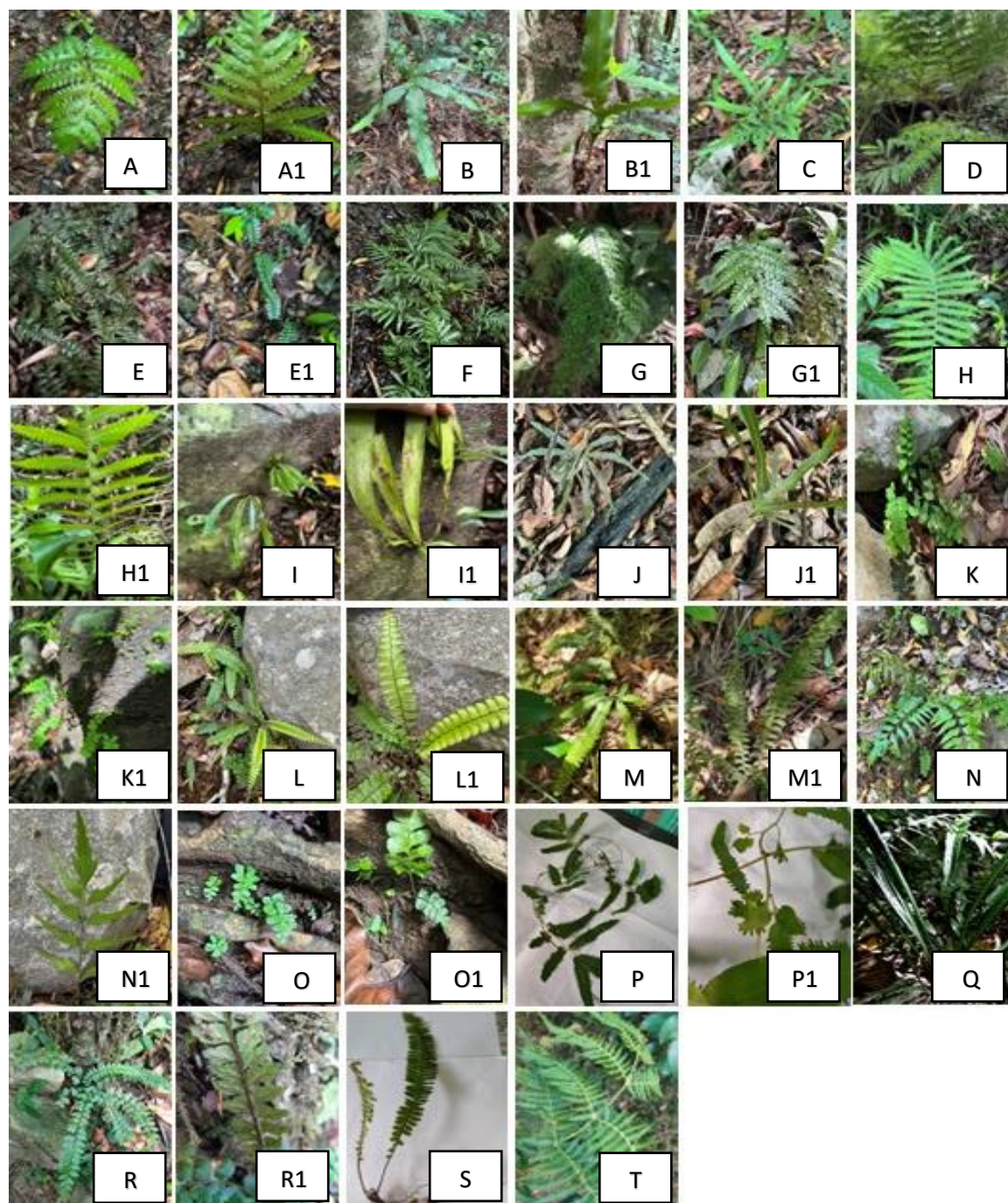
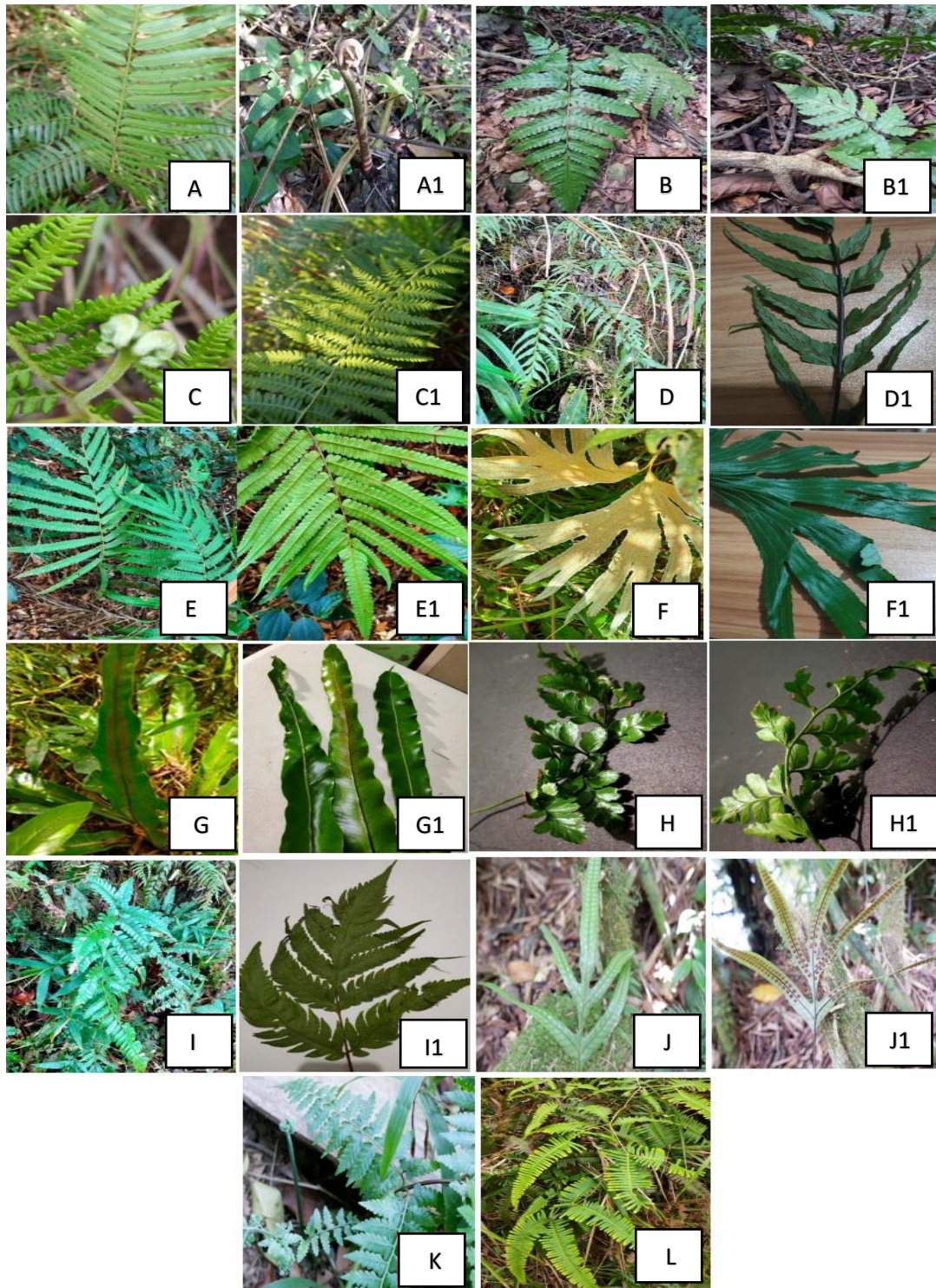


Figure 4

Ferns in Pantingan Peak of Mt. Mariveles: A-A1, *Angiopteris evecta*; B-B1, *Pleocnemia sp.*; C-C1, *Pteridium aquilinum*; D-D1, *Asplenium horridum*; E-E1, *Ampelopteris prolifera*; F-F1, *Dipteris conjugata*; G-G1, *Asplenium nidus*; H-H1, *Davallia sp.*; I-I1, *Pleocnemia irregularis*; J-J1, *Selliguea taeniata*; K, *Christella sp.*; L, *Dicranopteris linearis*



The most specious-rich genus of ferns is *Asplenium* (Lin & Viane, 2013), a diverse genus of vascular plants that bear spores found on every continent excluding Antarctica (Hassler, 2023; POWO, 2023). It belongs to a global genus where 30% of its species are found in the Neotropics, 22% in Africa, 33% in Asia, 10% in the Pacific regions which include Australia and 5% in Europe (Kramer & Viane, 1990). *Asplenium* have large numbers of epiphytic and terrestrial species. Several of the species of this genus are frequently found in the forest floor, along riverbanks, in ravines covered in montane vegetation, and on islands which frequently contain endemic species (Ohlsen et al., 2015).

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Conflict of Interest

The authors did not disclose any potential conflicts of interest

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