

# Diversity of *Selaginella* in the Province of Banten, Western Java

## Keanekaragaman *Selaginella* di Provinsi Banten, bagian barat Jawa

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**Abstrak.** Setyawan AD. 2015. *Diversity of Selaginella in the Province of Banten, Western Java. Pros Sem Nas Masy Biodiv Indon 1: 1810-1816.* *Selaginella* merupakan salah satu genus lycophyta yang umum ditemukan pada habitat tropis lembab karena memerlukan ketersediaan air yang cukup untuk pertumbuhan dan fertilisasi. Provinsi Banten yang terletak di bagian barat Pulau Jawa, Indonesia, memiliki bentang alam yang beragam mulai dari wilayah pesisir, dataran rendah, kawasan pertanian, hingga perbukitan dan hutan pegunungan bawah yang lembab sehingga berpotensi mendukung keanekaragaman spesies *Selaginella*. Penelitian ini bertujuan untuk mengidentifikasi keanekaragaman *Selaginella* di Provinsi Banten, bagian barat Pulau Jawa, Indonesia. Eksplorasi lapangan dilakukan pada April–Mei 2013 di wilayah Lebak, Pandeglang, Serang, dan Cilegon pada ketinggian 0–1000 m dpl. Spesimen representatif dikoleksi sebagai bahan herbarium dan koleksi hidup, serta dilakukan pengamatan tambahan terhadap spesimen herbarium yang tersimpan di Herbarium Bogoriense (BO). Sebanyak 88 spesimen herbarium berhasil dikoleksi dari 47 titik pengamatan. Sebanyak sepuluh spesies *Selaginella* berhasil diidentifikasi, yaitu *S. alutacea*, *S. ascendens*, *S. biformis*, *S. ciliaris*, *S. intermedia*, *S. involvens*, *S. ornata*, *S. plana*, *S. subalpina*, dan *S. willdenowii*. Sebagian besar spesies ditemukan pada habitat lembab seperti tebing sungai, saluran irigasi, lereng berbatu, tebing teduh, dan hutan sekunder. *Selaginella ciliaris* dan *S. plana* merupakan spesies yang paling umum dan memiliki sebaran paling luas di wilayah penelitian, terutama pada habitat terganggu dan kawasan pertanian. Penelitian ini memberikan tambahan informasi floristik mengenai keanekaragaman dan distribusi *Selaginella* di bagian barat Pulau Jawa, Indonesia.

**Kata kunci:** Banten, biodiversitas, *Selaginella*

**Abstract.** Setyawan AD. 2015. *Diversity of Selaginella in the Province of Banten, Western Java. Pros Sem Nas Masy Biodiv Indon 1: 1810-1816.* *Selaginella* is one of the lycophyte genera commonly found in humid tropical habitats because water availability is essential for growth and fertilization. Banten Province, located in the western part of Java Island, Indonesia, possesses diverse landscapes ranging from coastal lowlands and agricultural areas to humid hills and lower montane forests that potentially support various *Selaginella* species. This study aimed to identify the diversity of *Selaginella* in Banten Province, western Java, Indonesia. Field exploration was conducted from April to May 2013 in Lebak, Pandeglang, Serang, and Cilegon regions at elevations ranging from 0 to 1000 m asl. Representative specimens were collected as herbarium materials and living collections, and additional observations were conducted on herbarium specimens preserved at Herbarium Bogoriense (BO). A total of 88 herbarium specimens were collected from 47 sampling localities. Ten species of *Selaginella* were successfully identified, namely *S. alutacea*, *S. ascendens*, *S. biformis*, *S. ciliaris*, *S. intermedia*, *S. involvens*, *S. ornata*, *S. plana*, *S. subalpina*, and *S. willdenowii*. Most species were found in humid habitats such as riverbanks, irrigation canals, rocky slopes, shaded cliffs, and secondary forests. *Selaginella ciliaris* and *S. plana* were the most common and widely distributed species in the study area, particularly in disturbed habitats and agricultural landscapes. The present study provides additional floristic information on the diversity and distribution of *Selaginella* in western Java, Indonesia.

**Keywords:** Banten, biodiversitas, *Selaginella*

## INTRODUCTION

Banten is the most western province on the island of Java, Indonesia. Banten lies between 5°7'50 "and 7°1'11" S and 105°1'11 "and 106°7'12" E; bordering the Java Sea in the north, the Sunda Strait in the west, the Indian Ocean in the south, as well as Jakarta and West Java provinces in the east (BPS Prov. Banten 2013). The province was once part of West Java Province, but became a separate province in 2000 (Indonesian Law No. 23/2000). The province has an area of 9,662.92 km<sup>2</sup> (BPS 2014), with the highest peak of Mount Karang (1778 m asl), near the northwestern coast (Smithsonian Institution 2013). Approximately 65% of Banten classified as flat, 21% were classified as undulating

with the steepness of the slope between 2-15%, while the remaining 13% were classified as steep with a slope of more than 15%. Banten is officially estimated population of 11,834,087 at the beginning of 2014, an increase of over 10.6 million during the 2010 census (BPS Prov. Banten 2013). Banten has a different culture than the rest of Java. The southern Banten is inhabited by Sundanese, while the northern is inhabited by Javanese, who migrated from the north coast of Central Java. Sundanese of south Banten have different customs and language to the rest of Sundanese, because this region was never occupied by the Sultanate of Mataram from Central Java (Lombard 2005). In the recent years, the northern region, particularly areas near Jakarta and Java Sea coast, has experienced a rapid rise in development,

population and urbanization, while the southern region, especially the Indian Ocean coast, maintaining the traditional character (Dhyatmika and Atmanti 2013).

*Selaginella* Beauv. is an ancient group of lycophytes widely distributed in tropical and subtropical regions, particularly in humid forests and mountainous ecosystems (Jermy 1990; Korall and Kenrick 2002). Members of this genus generally grow in moist habitats such as riverbanks, cliffs, forest floors, irrigation canals, rocky slopes, and shaded secondary vegetation. Several species are capable of surviving in disturbed habitats and open environments, while others are more restricted to humid montane ecosystems. In tropical forests, *Selaginella* often constitutes an important component of understorey vegetation and contributes to local microhabitat diversity.

In Indonesia, *Selaginella* has long been recognized as a useful plant for traditional medicine and local daily purposes. Several communities, particularly Sundanese people in western Java, utilize *Selaginella* for treating wounds, menstrual disorders, postpartum recovery, and other traditional remedies. Previous studies also reported that several species contain bioactive compounds with antioxidant, anti-inflammatory, antimicrobial, and anticancer potential (Setyawan 2011; Chikmawati et al. 2015). In addition, some species are occasionally used as ornamental plants because of their attractive foliage morphology and metallic coloration.

Ecologically, *Selaginella* is strongly associated with humid environmental conditions because water is required during fertilization and vegetative growth. Species occurrence is therefore influenced by humidity, canopy cover, substrate characteristics, and water availability. Some species exhibit adaptive responses to environmental stress, such as leaf curling during dry conditions and reopening under humid conditions. Consequently, the presence of *Selaginella* may reflect environmental quality and microclimatic stability in tropical ecosystems (Tryon and Tryon 1982).

Although Java possesses relatively high pteridophyte diversity, floristic information regarding *Selaginella* in western Java remains limited. Previous studies in Java mainly focused on general fern diversity or mountain ecosystems, whereas specific inventories of *Selaginella* from Banten Province are still scarce. The diverse landscapes of Banten, ranging from coastal lowlands to humid upland forests, potentially support relatively high *Selaginella* diversity. Therefore, this study aimed to identify and document the diversity of *Selaginella* in Banten Province, western Java, Indonesia.

## MATERIALS AND METHODS

### Study area and field exploration

Field surveys were conducted from April to May 2013 in several regions of Banten Province, western Java, Indonesia, including Lebak District, Pandeglang District, Serang

District, and Cilegon City, at elevations ranging from 0 to 1000 m asl. The study area covered various habitat types, including secondary forests, plantations, agricultural fields, riverbanks, irrigation canals, rocky cliffs, roadside slopes, and humid shaded environments (Figure 1).

Field exploration was carried out through direct surveys in habitats potentially supporting the growth of *Selaginella*. The presence of all *Selaginella* species encountered during field observation was recorded, and representative specimens were collected as herbarium materials and living collections. Ecological information associated with each specimen, including locality, habitat type, elevation, and substrate condition, was recorded following standard herbarium collection procedures.

Living collections were maintained in the experimental garden in Wonosobo, Central Java, Indonesia (768 m asl), for further observation of vegetative characteristics and growth habits. Herbarium specimens collected during field surveys were deposited at Herbarium Soloense (SO), Sebelas Maret University, Surakarta, Indonesia. Selected duplicate specimens were also prepared and deposited at Herbarium Bogoriense (BO), Indonesian Institute of Sciences, Cibinong-Bogor, Indonesia.

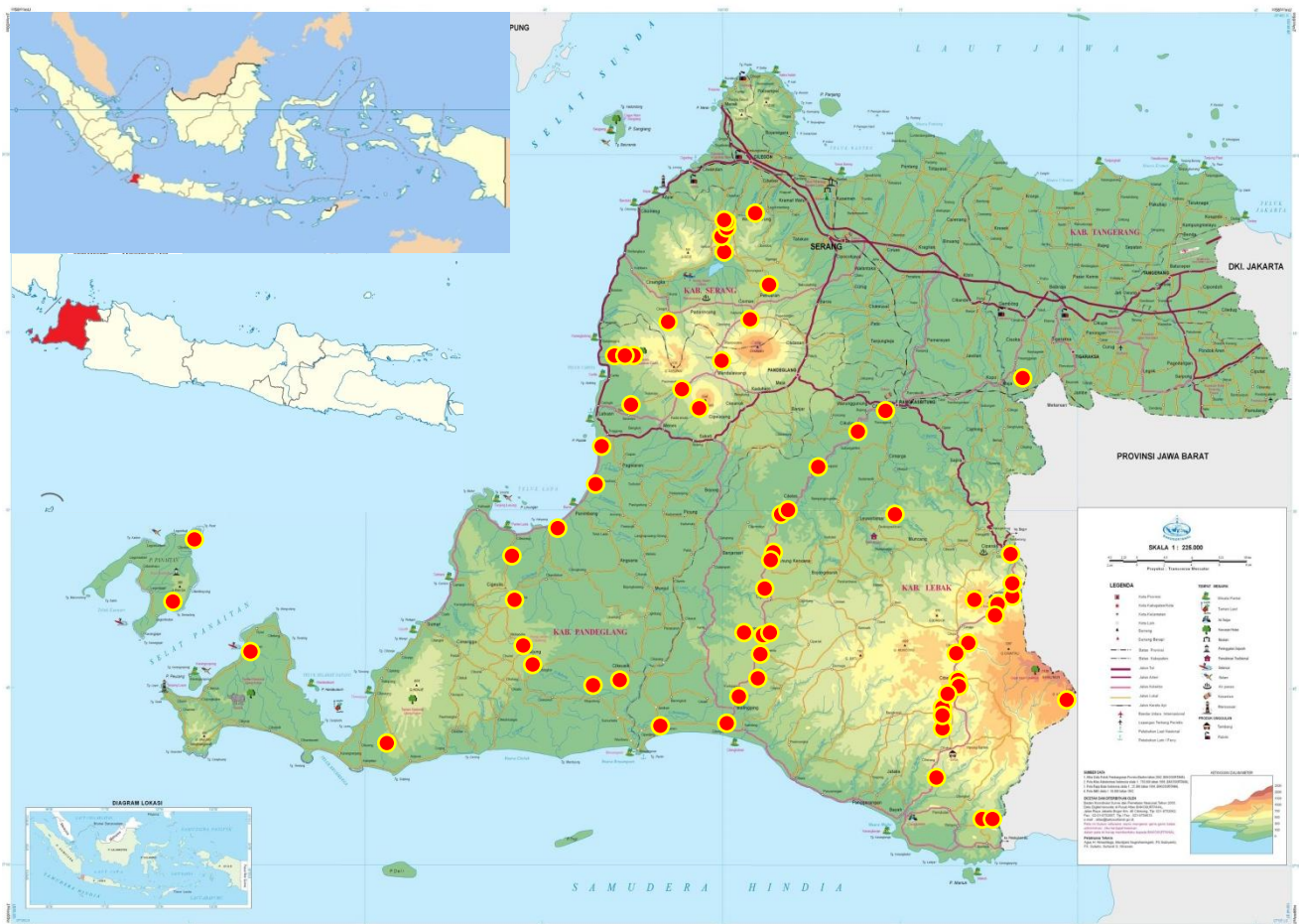
A total of 88 herbarium specimens were collected from 47 sampling localities during field exploration. Additional observations were conducted on 13 *Selaginella* specimens from 10 localities preserved at Herbarium Bogoriense (BO), including several taxa not encountered during field surveys. These herbarium observations complemented field collections and assisted taxonomic verification of several species.

### Species identification

Species identification was conducted through examination of both living collections and herbarium specimens. Morphological characters observed included stem habit, branching pattern, rhizophore position, leaf dimorphism, leaf margin characteristics, strobilus morphology, and sporophyll arrangement.

Identification and taxonomic verification were performed using classical and contemporary references on *Selaginella* from the Malay Archipelago and adjacent regions. Principal references included Alderwereld van Rosenburgh (1915a,b, 1916, 1917, 1918, 1920, 1922) and Alston (1934a, 1935a,b, 1937, 1940). Additional references included Wong (1982, 2010), Tsai and Shieh (1994), Li and Tan (2005), Chang et al. (2012), Setyawan et al. (2012, 2013), and Zhang et al. (2013).

Specimens were also compared with authenticated collections preserved at Herbarium Bogoriense (BO), particularly specimens previously identified by A.G.H. Alston. Herbarium observations were important for confirming several taxa and documenting additional species not encountered during field exploration. Synonyms and global distribution data mainly followed Hassler and Swale (2002) and Chang et al. (2012). Locality information was arranged according to sub-district administrative divisions.



**Figure 1.** Study area map of *Selaginella* diversity survey in Banten Province, western Java, Indonesia. ●: Red dots indicate sampling localities.

## RESULTS AND DISCUSSION

### Diversity and distribution of *Selaginella* in Banten Province

Field exploration and herbarium observations documented relatively high diversity of *Selaginella* in Banten Province, western Java, Indonesia. A total of 88 herbarium specimens were collected from 47 sampling localities during field surveys conducted between April and May 2013. Additional examination of 13 herbarium specimens preserved at Herbarium Bogoriense (BO) supplemented the field observations and assisted taxonomic verification.

Ten species of *Selaginella* were successfully identified in the study area, namely *S. alutacea*, *S. ascendens*, *S. bififormis*, *S. ciliaris*, *S. intermedia*, *S. involvens*, *S. ornata*, *S. plana*, *S. subalpina*, and *S. willdenowii*. Most species were associated with humid habitats such as riverbanks, irrigation canals, moist cliffs, rocky slopes, forest margins, and secondary vegetation. Several species, particularly *S. ciliaris* and *S. plana*, were commonly encountered in disturbed habitats including plantations, roadside embankments, agricultural fields, and cemetery areas. In

contrast, *S. intermedia*, *S. involvens*, and *S. subalpina* were more restricted to humid upland habitats with relatively dense vegetation cover.

The diversity of habitats in Banten Province strongly influenced the occurrence and distribution of *Selaginella*. Environmental humidity, canopy cover, stable water availability, and rocky substrates appeared to be important ecological factors supporting species occurrence. Most species were found in shaded and moist environments, reflecting the ecological dependence of *Selaginella* on humid microclimatic conditions. Similar ecological preferences have also been reported from other regions of Java and Southeast Asia (Wong 2010; Setyawan et al. 2012).

Among the recorded species, *S. ciliaris* and *S. plana* exhibited the broadest ecological amplitudes and widest distribution ranges. Both species occurred from lowland agricultural landscapes to humid upland habitats and were frequently associated with disturbed environments. In contrast, species such as *S. ascendens*, *S. intermedia*, *S. involvens*, and *S. subalpina* were relatively less common and generally confined to humid forest margins, steep slopes, and shaded upland habitats.

**Table 1.** Species of *Selaginella* recorded in Banten Province, western Java, Indonesia

Species	Habitat and ecology	Elevation (m asl)	Main locality	Voucher source
<i>Selaginella alutacea</i>	Humid rocky slopes, roadside cliffs, moist forest floor near small waterfalls	798-903	Cibeber (Lebak)	ADS collections
<i>S. ascendens</i>	Humid cliffs, wet roadside slopes, shaded forest margins	710-903	Cibeber (Lebak)	ADS collections
<i>S. biformis</i>	Humid waterfall margins, shaded rocky substrates, moist slopes	ca. 798	Cibeber (Lebak)	ADS collections
<i>S. ciliaris</i>	Irrigation canals, cemetery mounds, roadside cliffs, agroforestry areas, plantations, disturbed humid habitats	0-1000	Lebak, Serang, Cilegon	ADS and BO collections
<i>S. intermedia</i>	Humid upland habitats, shaded cliffs, riverbanks, secondary vegetation	ca. 700-1000	Southern Banten	ADS collections
<i>S. involvens</i>	Humid forest floor, shaded slopes, secondary forest habitats	400-900	Pandeglang	BO collections
<i>S. ornata</i>	Irrigation canals, humid cliffs, forest edges, shaded slopes	200-1000	Pandeglang, Lebak	ADS and BO collections
<i>S. plana</i>	Plantations, home gardens, riverbanks, agroforestry systems, roadside habitats	0-1000	Lebak, Serang, Cilegon	ADS and BO collections
<i>S. subalpina</i>	Humid montane habitats with dense vegetation cover	700-1000	Upland areas of Lebak	ADS collections
<i>S. willdenowii</i>	Humid valleys, shaded forest margins, dense secondary vegetation	300-700	Serang, Cilegon	ADS and BO collections

**Identification key to the species of *Selaginella* in Banten Province, western Java, Indonesia**

- 1a. Plants robust, scandent, climbing, or pendulous; branches elongate; leaves with distinct metallic bluish-green iridescence in shaded habitats ..... *S. willdenowii*
- 1b. Plants creeping, ascending, or suberect; leaves without metallic iridescence ..... 2
- 2a. Main stems robust and clearly flattened; leaves on lower stem nearly monomorphic, becoming dimorphic toward branchlets; lateral leaves broad with translucent margins ..... *S. plana*
- 2b. Leaves consistently dimorphic throughout stems and branches ..... 3
- 3a. Leaf margins distinctly ciliate or long-laciniate, especially on lateral leaves ..... 4
- 3b. Leaf margins serrulate, denticulate, or nearly entire, never distinctly ciliate ..... 5
- 4a. Plants small and delicate; stems creeping to ascending; lateral leaves small; cilia conspicuous along leaf margins; commonly occurring in disturbed open habitats ..... *S. ciliaris*
- 4b. Plants larger and more membranous; stems ascending; leaves broader; occurring mainly in humid upland habitats .....  
.....*S. intermedia*
- 5a. Plants creeping; stems slender and delicate; leaves thin, membranous, and relatively soft; forming loose mats on humid forest floors .....  
.....*S. involvens*
- 5b. Plants ascending, suberect, or compact; stems not forming loose creeping mats ..... 6
- 6a. Stems slender and ascending; branching delicate; leaves relatively narrow and thin; humid cliffs and forest margins .....  
..... *S. ascendens*
- 6b. Stems more robust or compact; leaves broader or relatively rigid ..... 7
- 7a. Stems brittle and fragile; leaves aristate, acuminate, or distinctly denticulate; coloration often brownish-green .....  
.....*S. ornata*
- 7b. Stems not brittle; leaves ovate to lanceolate without aristate appearance .....  
.....8

- 8a. Plants compact; branches short and dense; occurring mainly in humid montane habitats above ca. 700 m asl. .... *S. subalpina*
- 8b. Plants slender to moderately robust; occurring in lowland to middle elevations .....  
.....9
- 9a. Plants slender with delicate branching; leaves relatively narrow and loosely arranged; stems thin and creeping .....  
..... *S. biformis*
- 9b. Plants relatively compact with denser branching; leaves broader and more closely arranged ..... *S. alutacea*

**Species accounts**

***Selaginella alutacea* Spring**

Small creeping to ascending species with compact branching and dimorphic leaves arranged in four rows. Leaves ovate to lanceolate with acute apices and finely serrulate margins. Strobili terminal and relatively compact.

**Habitat and ecology:** Found on humid forest floors, moist rocky slopes, shaded cliffs, and humid secondary forests at middle elevations. Usually associated with stable humidity and dense canopy cover.

**Distribution:** Peninsular Malaysia, Sumatra, Java, and Christmas Island.

**Specimens examined:** ADS 654, ADS 659, ADS 664.

**Taxonomical note:** This species resembles several small creeping *Selaginella* species in western Java but differs in its compact habit and relatively dense leaf arrangement. Herbarium collections from Java remain relatively limited.

***Selaginella ascendens* Spring**

Small to medium-sized species with slender ascending stems and dimorphic leaves. Leaves ovate-lanceolate with serrulate margins and acute apices. Branching relatively delicate with terminal strobili.

**Habitat and ecology:** Found on humid cliffs, shaded slopes, forest margins, and moist secondary vegetation. Usually occurred in humid habitats associated with streams and rocky substrates at middle elevations.

**Distribution:** Southeast Asia, including Java and several regions of Malesia.

**Specimens examined:** ADS 658, ADS 665.

**Taxonomical note:** *Selaginella ascendens* is morphologically similar to *S. intermedia*, particularly in general habit and habitat preference. However, it differs in its more slender stems, narrower leaves, and smaller vegetative structures. The taxonomic boundaries between both species remain difficult in several herbarium collections from Java.

#### *Selaginella biformis* A. Braun ex Kuhn

Slender creeping species with delicate branching and dimorphic leaves. Leaves ovate-lanceolate with serrulate margins and acute apices. Stems relatively thin and loosely branched.

**Habitat and ecology:** Occurred on moist riverbanks, shaded forest margins, humid slopes, and rocky substrates with relatively stable humidity.

**Distribution:** China, Ryukyu Islands, Southeast Asia, Java, Sumatra, Sulawesi, Flores, and New Guinea.

**Specimens examined:** ADS 661.

**Taxonomical note:** *Selaginella biformis* is characterized by slender stems and relatively narrow leaves. The species may resemble juvenile forms of other creeping species but differs in its delicate branching pattern and smaller foliage.

#### *Selaginella ciliaris* (Retz.) Spring

**Basionym:** *Lycopodium ciliare* Retz.

Small annual to perennial species with creeping or ascending stems and strongly dimorphic leaves. Leaf margins ciliate to serrulate, especially near the base. Considerable variation in coloration and growth form was observed among populations.

**Habitat and ecology:** One of the most common species in the study area. Found in irrigation canals, roadside walls, rocky cliffs, cemetery areas, agricultural fields, plantations, and disturbed open habitats from lowland to upland areas.

**Distribution:** Tropical Asia, Australia, Micronesia, and several Pacific islands. In Indonesia distributed in Java, Sulawesi, and Moluccas.

**Specimens examined:** ADS 641, ADS 643, ADS 646, ADS 660, ADS 674, ADS 676, ADS 790, ADS 791, ADS 792, ADS 795, ADS 798, ADS 802, ADS 803, ADS 806, ADS 810, ADS 811, ADS 812, ADS 813, ADS 814, ADS 816, ADS 817, ADS 819, ADS 821, ADS 822, ADS 823, ADS 824, ADS 825, ADS 827, ADS 830, ADS 833, ADS 836, ADS 837, ADS 838, ADS 841, ADS 652 cf., ADS 662 cf.

**Taxonomical note:** This species exhibits substantial morphological variation in habit, leaf coloration, and branching structure. Individuals growing in the same habitat may appear markedly different, especially in coloration ranging from bright green to dark brownish-green. Such

variation has frequently caused taxonomic confusion within the *S. ciliaris* complex.

#### *Selaginella intermedia* (Blume) Spring

**Basionym:** *Lycopodium intermedium* Blume.

Perennial herb with ascending stems, pale green membranous leaves, and loose quadrangular strobili. Leaves dimorphic with lateral leaves larger than median leaves.

**Habitat and ecology:** Commonly found on steep humid cliffs, shaded riverbanks, and moist upland habitats with dense bamboo or secondary vegetation cover.

**Distribution:** India, Myanmar, Sri Lanka, Thailand, Vietnam, Malaysia, Java, Sumatra, and Sulawesi.

**Specimens examined:** ADS 657

**Taxonomical note:** This species is distinguished by its ascending habit, broad membranous leaves, and relatively loose strobili. The species is characteristic of humid upland habitats and appears relatively uncommon compared with lowland species such as *S. plana* and *S. ciliaris*.

#### *Selaginella involvens* (Sw.) Spring

**Basionym:** *Lycopodium involvens* Sw.

Small to medium-sized creeping species with slender branched stems and dimorphic leaves. Leaves ovate to lanceolate with serrulate margins and acute apices. Branches relatively delicate, forming loose mats on humid substrates.

**Habitat and ecology:** Usually found in humid shaded habitats such as moist forest floors, riverbanks, rocky slopes, and secondary forests with stable humidity and moderate canopy cover.

**Distribution:** Tropical and subtropical Asia, including China, Taiwan, Japan, mainland Southeast Asia, and Malesia. In Indonesia recorded from Java and several western Indonesian islands.

**Specimens examined:** JA McDonald 3434 (BO!).

**Taxonomical note:** *Selaginella involvens* is characterized by its slender creeping habit and delicate dimorphic leaves. The species may resemble juvenile forms of several creeping *Selaginella* species but differs in its finer branching pattern and relatively thin membranous leaves. The species was only observed from herbarium material and was not encountered during field exploration in Banten Province.

#### *Selaginella ornata* (Hook. & Grev.) Spring

**Basionym:** *Lycopodium ornatum* Hook. & Grev.

Creeping to ascending species with brittle stems and dimorphic leaves. Leaves denticulate to dentate with aristate or acuminate apices. Coloration varied from green to brownish-green.

**Habitat and ecology:** Found around irrigation canals, humid cliffs, forest edges, roadside slopes, and shaded upland habitats with relatively high humidity.

**Distribution:** Cambodia, India, Malaysia, Thailand, Vietnam, Java, Sumatra, Bali, Flores, and Lombok.

**Specimens examined:** CA Backer 1843 (BO!), ? (BO!).

**Taxonomical note:** *Selaginella ornata* shows substantial variation in vegetative morphology and coloration. Several specimens exhibited unusual rounded trophophylls and variable leaf shapes that may represent

local morphological variants. The brittle stems and aristate leaves are useful diagnostic characters.

***Selaginella plana* (Desv. ex Poir.) Hieron.**

**Basionym:** *Lycopodium planum* Desv. ex Poir.

Robust perennial species with ascending stems, broad dimorphic leaves, and terminal tetragonal strobili. Leaf margins entire and translucent.

**Habitat and ecology:** Widely distributed in disturbed habitats including plantations, home gardens, irrigation canals, roadside cliffs, agricultural fields, and riverbanks from lowland to middle elevations.

**Distribution:** Southeast Asia and widely introduced to several tropical regions. In Indonesia distributed in Java, Sumatra, Sulawesi, Lesser Sunda Islands, and Moluccas.

**Specimens examined:** ADS 644, ADS 650, ADS 670, ADS 675, ADS 793, ADS 796, ADS 799, ADS 804, ADS 807, ADS 809, ADS 815, ADS 839, ADS 842; AGL Adelbert 463 (BO!), AGL Adelbert 445 (BO!), AGL Adelbert 441 (BO!), CA Backer 1152 (BO!), P. Buwalda 2793 (BO!), AGL Adelbert 278 (BO!).

**Taxonomical note:** *Selaginella plana* is one of the most widespread and morphologically stable species in Java. It is easily recognized by its robust habit, broad leaves with translucent margins, and wide ecological tolerance.

***Selaginella subalpina* Alderw.**

Small to medium-sized species with compact creeping to ascending stems and ovate dimorphic leaves with finely serrulate margins.

**Habitat and ecology:** Restricted to humid upland habitats with cool environmental conditions and dense vegetation cover.

**Distribution:** Endemic to Java.

**Specimens examined:** ADS 656, ADS 663, ADS 671.

**Taxonomical note:** *Selaginella subalpina* is a montane species with relatively narrow ecological preference. Its compact habit and occurrence in humid upland habitats distinguish it from lowland congeners.

***Selaginella willdenowii* (Desv. ex Poir.) Baker**

**Basionym:** *Lycopodium willdenowii* Desv. ex Poir.

Robust scandent or climbing species with large branching fronds and metallic bluish-green iridescent leaves in shaded habitats. Leaves distinctly dimorphic with transparent margins.

**Habitat and ecology:** Occurred in humid valleys, forest margins, and densely shaded slopes with high humidity and relatively undisturbed vegetation.

**Distribution:** Southeast Asia, including Java, Sumatra, Lesser Sunda Islands, and mainland tropical Asia.

**Specimens examined:** ADS 640, ADS 642, ADS 645, ADS 647, ADS 649, ADS 651, ADS 653, ADS 655, ADS 666, ADS 667, ADS 669, ADS 672, ADS 673, ADS 794, ADS 797, ADS 800, ADS 801, ADS 805, ADS 808, ADS 818, ADS 820, ADS 826, ADS 828, ADS 829, ADS 831, ADS 834, ADS 835, ADS 840, ADS 843; P. Buwalda 2834 (BO!), CA Backer 1188 (BO!), AGL Adelbert 1954 (BO!), AGL Adelbert 272 (BO!).

**Taxonomical note:** This species is easily distinguished from other Javanese *Selaginella* by its scandent habit and

metallic bluish-green iridescent foliage. The large fronds and climbing stems make it one of the most morphologically distinctive species in the genus.

**Discussion**

The present study demonstrated that Banten Province supports relatively high diversity of *Selaginella* distributed across various habitat types ranging from coastal lowlands and agricultural landscapes to humid upland forests and rocky slopes. The occurrence of ten species in Banten Province indicates that western Java still provides suitable environmental conditions for the persistence of lycophyte diversity, particularly in humid and shaded habitats. Environmental humidity, stable water availability, canopy cover, and substrate characteristics appeared to be the principal ecological factors influencing species occurrence and distribution.

Most recorded species were associated with moist habitats such as riverbanks, irrigation canals, humid cliffs, shaded slopes, and secondary forests. These habitats provide relatively stable microclimatic conditions necessary for vegetative growth and fertilization in *Selaginella*. Similar ecological preferences have also been reported from other tropical regions where *Selaginella* species commonly occur in environments with high humidity and relatively low light intensity (Tryon and Tryon 1982; Wong 2010).

Among the recorded taxa, *Selaginella ciliaris* and *S. plana* were the most common and widely distributed species. Both species occurred in a broad range of habitats, including disturbed environments such as plantations, roadside embankments, agricultural fields, cemetery walls, and irrigation canals. Their broad ecological tolerance suggests strong adaptability to environmental disturbance and fluctuating habitat conditions. Similar observations have also been reported from Central Java and several other regions in Southeast Asia where both species frequently dominate secondary and disturbed habitats (Setyawan et al. 2012).

In contrast, *S. intermedia*, *S. involvens*, and *S. subalpina* were more restricted to humid upland habitats with relatively dense vegetation cover and lower environmental disturbance. These species were generally found on shaded slopes, humid cliffs, forest floors, and forest margins at middle to higher elevations. Such ecological restriction indicates narrower environmental tolerance compared with more widespread lowland species. Similar elevational preferences have also been documented in montane ecosystems of Java and Malesia (Alston 1935a; Wong 1982).

Several species exhibited considerable morphological variation, particularly *S. ciliaris* and *S. ornata*. Variations were observed in leaf coloration, branching structure, and growth form among populations growing under different environmental conditions. In some localities, individuals of the same species displayed markedly different vegetative morphology despite occurring within similar habitats. Such variation may reflect phenotypic plasticity, environmental influence, or taxonomic complexity within several species groups. Morphological variability in tropical *Selaginella* has

frequently caused difficulties in species delimitation and herbarium identification (Korall and Kenrick 2002).

Compared with several previous studies from Central Java and West Java, the diversity of *Selaginella* in Banten can be considered relatively moderate but floristically important because the province contains diverse habitat gradients from coastal ecosystems to humid upland forests. The additional record of *S. involvens* from herbarium observations also indicates that historical collections remain important for improving regional floristic inventories. The present study therefore provides additional floristic information for western Java, where detailed inventories of *Selaginella* remain limited. Further exploration in protected forests, mountainous regions, and poorly surveyed humid habitats may reveal additional taxa or undocumented morphological variation in the future.

In conclusion, ten species of *Selaginella* were identified in Banten Province, western Java, Indonesia, based on field exploration and herbarium observations. Most species were associated with humid habitats such as riverbanks, irrigation canals, moist cliffs, shaded slopes, and secondary forests. *Selaginella ciliaris* and *S. plana* were the most common and widely distributed species, while several taxa, including *S. intermedia*, *S. involvens*, and *S. subalpina*, were more restricted to humid upland habitats. The present study provides additional floristic information on the diversity and distribution of *Selaginella* in western Java and highlights the importance of further exploration and herbarium studies in humid tropical ecosystems of Indonesia.

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