

Species diversity and distribution of pteridophytes in Mount Pangasugan

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ABSTRACT

A total of 93 species of pteridophytes belonging to 24 families and 55 genera were found in Mt. Pangasugan at elevations of 5-400 m above sea level (ASL). These comprise 22 families of ferns with 52 genera and 84 species, and 3 families of fern-allies with 3 genera and 9 species. Only 83 species were identified.

The families Polypodiaceae and Aspidiaceae are the most diverse in terms of number of genera and species. Species diversity was low (11 to 24 species) at 5-40 m ASL, increased up to 40 species at 81-100 m ASL but gradually declined to as low as 15 at 101-340 m ASL.

Majority of the pteridophytes collected are terrestrial (66.7%). The aquatic species comprise only 4.3%; the epiphytes, 16.1% and the petrophytes, 12.9%.

Selaginella engleri and *Tectaria denticulata* are the most widely adapted across different elevations followed by *Angiopteris palmiformis* and *Microsorium punctatum* and then by *Lygodium japonicum*. However, *Selaginella engleri* was best adapted at lower elevations while *Tectaria denticulata* favored higher elevations.

Herbarium specimens of the pteridophyte collections are presently kept and maintained at the ViSCA Herbarium, Dept. of Plant Breeding and Agricultural Botany, ViSCA, Baybay, Leyte, Philippines.

Keywords: Pteridophytes, ferns, fern-allies, species, herbarium

INTRODUCTION

Ferns and their allies collectively called the pteridophytes are vascular plants which do not produce seeds but reproduce through spores. They are widely distributed both in the tropic and temperate regions especially at higher elevations. Generally, they grow in moist, shaded habitats although some can grow in strong sunlight even in markedly xeric environments.

Zamora and Co (1986) reported that the Philippines is the habitat of about 930 species of ferns of which more than 50 are reported to have actual or potential economic value and 296 species are so far known to be endemic to the Philippines.

It is believed that with the continuing rapid destruction of our primary forests, whether legal or illegal, our economic and endemic species of pteridophytes will soon be completely wiped out. Without immediate and uncompromising

moves to conserve them and their habitats, they are bound to become extinct.

The pteridophyte flora of Mt. Pangasugan has not been extensively studied in the past, hence, this study.

MATERIALS AND METHODS

Selection of sampling sites

A reconnaissance survey was first conducted at various elevations in Mt. Pangasugan in order to identify representative sampling sites for each elevation. Site selection was based on relative homogeneity of vegetation and topography. Three to four sampling sites per elevation were identified.

Sampling

Sampling was done every 20 m above sea level (ASL) interval using 4 m x 4 m quadrats. Ten to 15 quadrats were used. All species intercepted in every quadrat were listed and counted.

Representative samples of each species were collected for detailed examination and for preparation into herbarium specimens. Pictures were likewise taken and illustrations were made from time to time for documentation.

Herbarium specimens of all collections are presently kept at the ViSCA Herbarium, Department of Plant Breeding and Agricultural Botany, Visayas State College of Agriculture, Baybay, Leyte.

RESULTS AND DISCUSSION

Diversity

Species composition

A total of 93 species of pteridophytes belonging to 24 families and 55 genera had been collected at various sites in Mt. Pangasugan at

Table 1. Number of genera and species of pteridophytes found in Mt. Pangasugan according to family.

| Family | Number of genera | Number of species |
|---------------------|------------------|-------------------|
| Ferns | | |
| Aspidiaceae | 8 | 11 |
| Aspleniaceae | 1 | 6 |
| Athyriaceae | 1 | 2 |
| Blechnaceae | 3 | 3 |
| Cyatheaceae | 3 | 6 |
| Davalliaceae | 4 | 4 |
| Dennstaedtiaceae | 2 | 2 |
| Gleicheniaceae | 1 | 1 |
| Grammitidaceae | 1 | 1 |
| Hymenophyllaceae | 3 | 3 |
| Lindsaeaceae | 1 | 1 |
| Marattiaceae | 1 | 1 |
| Oleandraceae | 1 | 3 |
| Parkeriaceae | 1 | 1 |
| Polypodiaceae | 8 | 10 |
| Pteridaceae | 1 | 7 |
| Salviniaceae | 2 | 2 |
| Schizaeaceae | 1 | 5 |
| Sinopteridaceae | 3 | 3 |
| Thypteridaceae | 3 | 6 |
| Vittariaceae | 3 | 6 |
| Sub-total: | 21 | 52 |
| Fern-allies | | |
| Lycopodiaceae | 1 | 1 |
| Psilotaceae | 1 | 1 |
| Selaginellaceae | 1 | 7 |
| Sub-total: | 3 | 9 |
| Grand total: | 24 | 55 |
| | | 93 |

elevations ranging from 5 m to 400 m ASL. These included 22 families of ferns with 52 genera and 84 species, and 3 families of fern-allies with 3 genera and 9 species (Table 1). Out of this collection, 83 species had been identified and classified although a few were up to the genus level only. Table 2 presents the list of pteridophyte species found in Mt. Pangasugan while Figure 1 shows one of these plants preserved as herbarium specimen.

Table 2. List of pteridophyte species in Mt. Pangasugan

| Family/ Scientific Name | Common/English Name | Family/ Scientific Name | Common/English Name |
|-----------------------------------|------------------------|---------------------------------------|------------------------|
| FERNS | | DENNSTAEDTIACEAE | |
| ASPIDIACEAE | | <i>Dennstaedtia cuneata</i> | no information |
| <i>Cyclopeltis cumingana</i> | (Fee.) C. Chr. | (J.Sm.) Moore | |
| <i>Heterogonium pinnatum</i> x | | <i>Microlepia speluncae</i> | no information |
| <i>Sterosemia aurita</i> | no information | (Bl.) Moore | |
| <i>Pleocnemia macrodonta</i> | no information | GLEICHENIACEAE | |
| (Fee.) Holtt. | no information | <i>Dicranopteris linearis</i> | Kilob |
| <i>P. presliana</i> Holtt. | no information | (Burm.) Underwood | |
| <i>Pleocnemia</i> sp. | no information | GRAMMITIDACEAE | |
| <i>Pteridys symmatica</i> | no information | <i>Scleroglossum</i> sp. | no information |
| (Willd.) C. Chu & Ching | | HYMENOPHYLLACEAE | |
| <i>Tectaria dissecta</i> (Forst.) | no information | <i>Hymenophyllum</i> sp. | Filmy fern |
| Lellinger | no information | <i>Microtrichomanes sf. digitatum</i> | |
| <i>Tectaria denticulata</i> | no information | (Swartz) Copel. | Filmy fern |
| (Burm.) Mett. | no information | <i>Trichomanes</i> sp. | Filmy fern |
| Sp. No. 1-82292 | no information | LINDSAEACEAE | |
| <i>Cyclosorus</i> sp. | no information | <i>Lindsaea obtusa</i> J. Sm. | no information |
| Sp. No. 2-82292 | no information | MARATTIACEAE | |
| ASPLENIACEAE | | <i>Angiopteris palmiformis</i> | Giant fern, |
| <i>Asplenium cuneatum</i> | no information | (Cav.) Chr. | Pakong kalabaw |
| <i>A. nidus</i> L. | Bird's nest fern | OLEANDRACEAE | |
| <i>A. tenerium</i> Forst. | no information | <i>Nephrolepis cordifolia</i> | |
| <i>A. unilaterale</i> Lam. | no information | (L.) Presl. | Common sword fern |
| <i>Asplenium musifolium</i> Mett. | no information | <i>N. hirsutula</i> (Forst.) Presl. | Lokdo-lokdo |
| <i>Asplenium</i> sp. 2 | no information | <i>N. biserrata</i> (Sw.) Schott | Bold sword fern |
| ATHYRIACEAE | | <i>N. duffii</i> Moore | Pygmy sword fern |
| <i>Diplazium esculentum</i> | | PARKERIACEAE | |
| (Retz.) Sw. | Pako | <i>Ceratopteris thalictroides</i> | |
| <i>Diplazium</i> sp. | Pako | (L.) Brongn. | Pakong Tubig |
| BLECHNACEAE | | POLYPODIACEAE | |
| <i>Blechnum orientale</i> L. | Pakong parang | <i>Colysis pothifolia</i> (Don) | no information |
| <i>Blechnum egregium</i> Copel. | no information | <i>Drynaria quercifolia</i> | |
| <i>Stenochlaena palustris</i> | | (L.) J.Sm. | Pakpak Lawin |
| (Burm.) Bedd. | Hagnaya | <i>Drynaria</i> sp. | no information |
| CYATHEACEAE | | <i>Microsorium punctatum</i> | |
| <i>Cyathea contaminans</i> | | (L.) Copel. | no information |
| (Hook) Copel. | Tree fern | <i>Microsorium</i> sp. | no information |
| <i>Cyathea</i> sp. 1 | Tree fern | <i>Pyrossia adnascens</i> | |
| <i>Cyathea</i> sp. 2 | Tree fern | (Sw.) Ching | no information |
| <i>Cyathea</i> sp. 3 | Tree fern | <i>Acrostichum aureum</i> L. | Lagolo, Leathery fern |
| Sp. no. 1-81392 | Tree fern | Sp. no. 1-81892 | no information |
| Sp. no. 1-81292 | Tree fern | Sp. no. 6-82292 | no information |
| DAVALLIACEAE | | Sp. no. 3-82092 | no information |
| <i>Davallia denticulata</i> | no information | PTERIDACEAE | |
| (Burm.) Mett. | | <i>Pteris melanocaulon</i> Fee. | no information |
| <i>Trogostolon falcinellus</i> | no information | <i>P. mutilata</i> L. | Pakong parang |
| (Presl.) Copel. | no information | <i>P. ensiformis</i> Burm. F. | Sword brake fern |
| Sp. no. 3-82292 | no information | <i>P. tripartita</i> Sw. | Giant bracket fern |
| Sp. no. 2-82092 | no information | <i>P. philippinensis</i> Fee. | no information |
| | | <i>P. vittata</i> L. | Rusty Brake |
| | | <i>Pteris</i> sp. | no information |

Table 2. cont'n...

| Family/ Scientific Name | Common/English Name |
|--|------------------------|
| SALVINIACEAE | |
| <i>Salvinia auriculata</i> Aubl. | Water fern |
| <i>Azolla pinnata</i> R. Bv. | Azolla, Mosquito fern |
| SCHIZAEACEAE | |
| <i>Lygodium circinnatum</i> (Burm.) Sw. | Nitong Puti, Aksam |
| <i>L. japonicum</i> (Thunb.) Sw. | Nitong Hapon |
| <i>L. merrillii</i> Copel. | Nito |
| <i>L. flexuosum</i> (Willd.) Alst. et Holtt. | Nito, Katak |
| <i>L. auriculatum</i> (Willd.) Alst. et Holtt. | Nito |
| SINOPTERIDACEAE | |
| <i>Adiantum philippense</i> L. | Maidenhair Fern |
| <i>Pytiogramma calomelanos</i> (L.) Link. | Silver Fern |
| <i>Amphineuron terminans</i> (Hook) Holtt. | Lokdo |
| THELYPTERIDACEAE | |
| <i>Christella</i> sp. 1 | no information |
| <i>Christella</i> sp. 2 | no information |
| <i>Macrothelypteris leucolepis</i> Presl. | no information |
| <i>M. polypodioides</i> (Hook) Holtt. | no information |
| <i>M. torresiana</i> (Gaud.) Ching | no information |
| <i>Pneumatopteris</i> sp. | no information |
| VITTARIACEAE | |
| <i>Antrophyum reticulatum</i> (Forst.) Karuf. | no information |
| <i>Antrophyum</i> sp. 1 | no information |
| <i>Antrophyum</i> sp. 2 | no information |
| <i>Vittaria</i> sp. 1 | no information |
| <i>Vittaria</i> sp. 2 | no information |
| Sp. no. 1-70492 | no information |
| FERN-ALLIES | |
| LYCOPODIACEAE | |
| <i>Lycopodium cernuum</i> L. | Club moss |
| PSILOTACEAE | |
| <i>Psilotum nudum</i> (L.) P. Beauv. | Psilotum |
| SELAGINELLACEAE | |
| <i>Selaginella aristata</i> Spring | Whisk Fern |
| <i>S. biformis</i> A. Bv. | Whisk Fern |
| <i>Selaginella willdenovii</i> (Desv. ex Poir.) J.G. Bak. | Peacock fern |
| <i>S. engleri</i> Hieron | Whisk Fern |
| <i>Selaginella</i> sp. 1 | Whisk Fern |
| <i>Selaginella</i> sp. 2 | Whisk Fern |
| <i>Selaginella</i> sp. 3 | Whisk Fern |

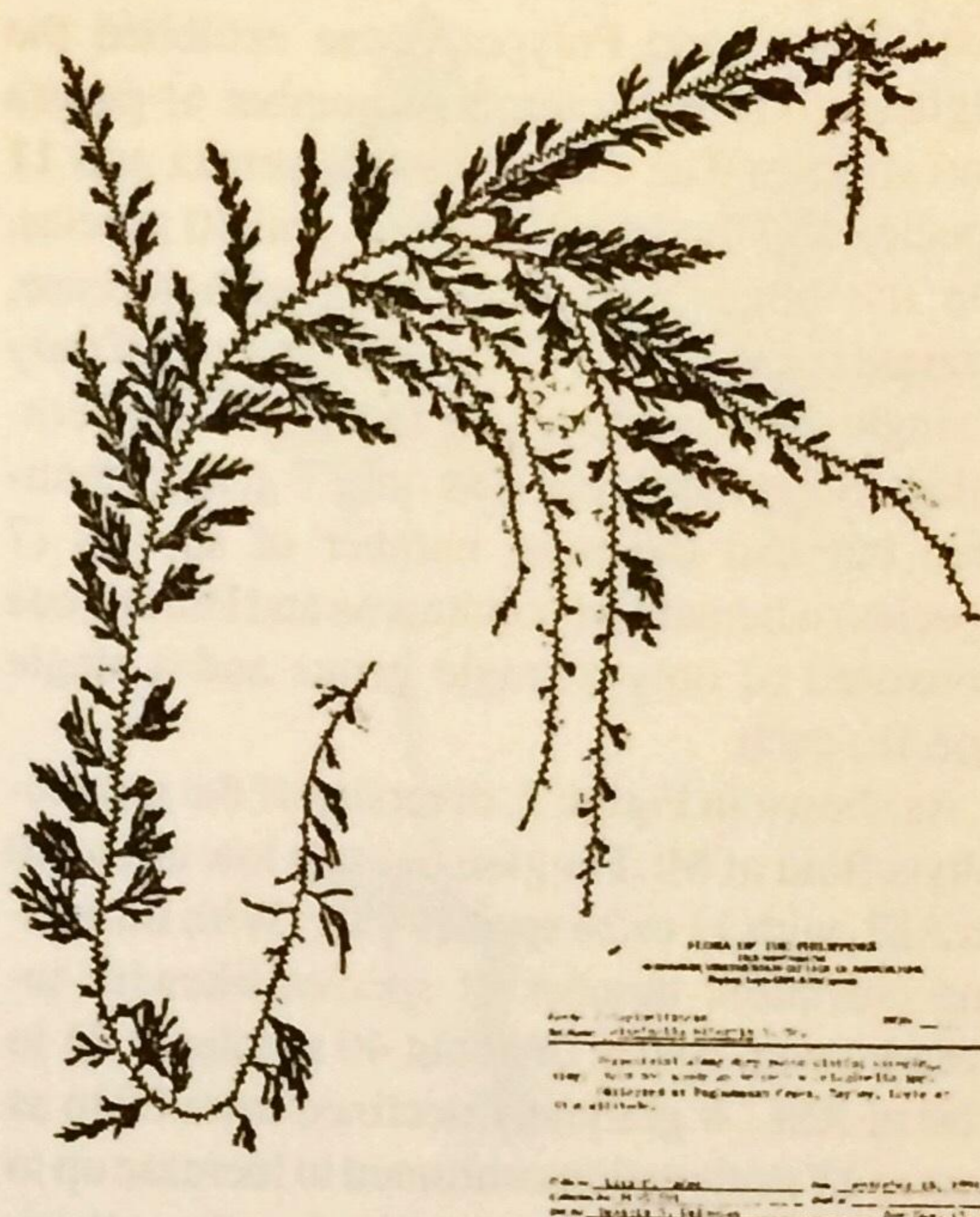


Figure 1. Herbarium specimen of *Selaginella biformis* (A.) Bv.

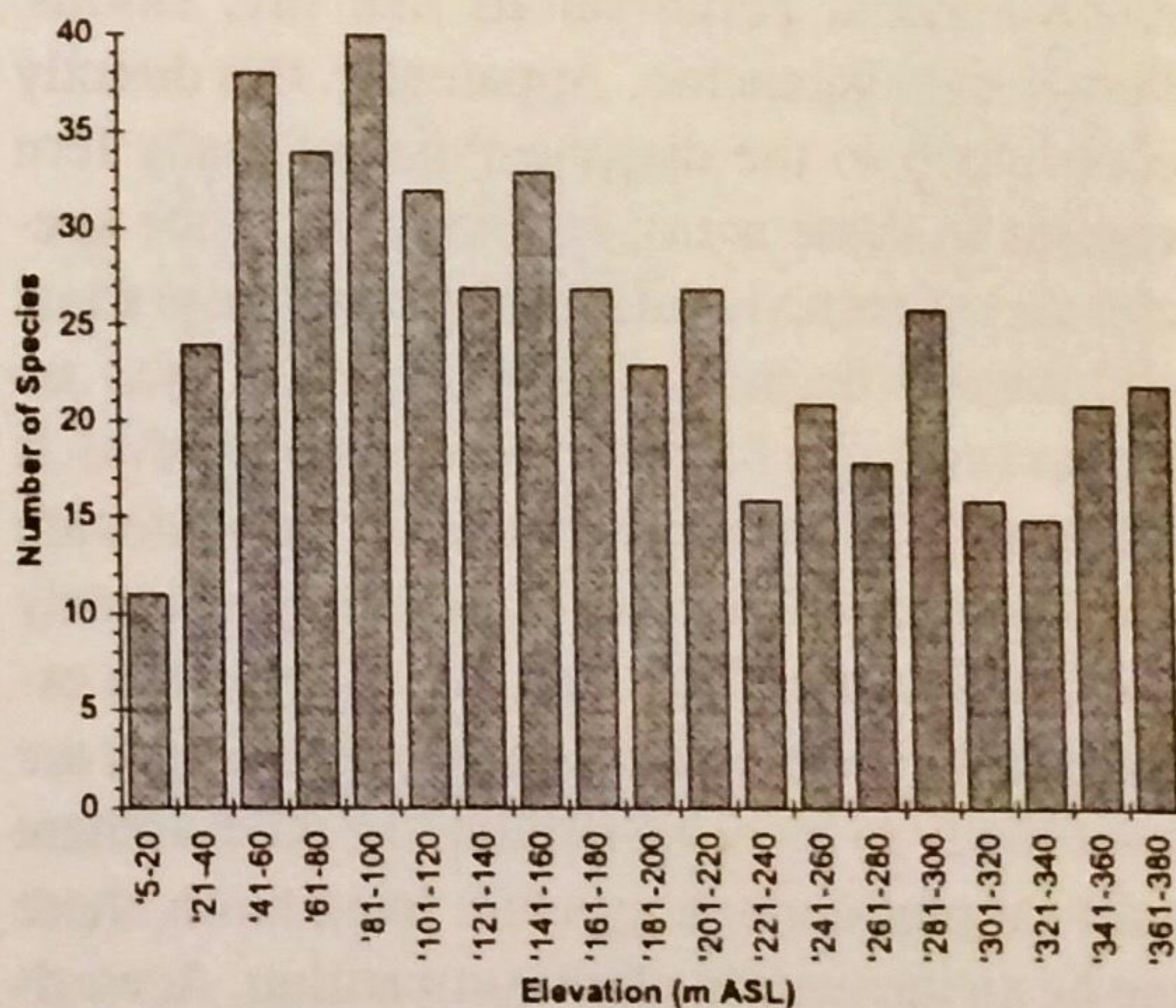


Figure 2. Species diversity of pteridophytes in Mt. Pangasugan at various elevations

Among the ferns collected, families Aspidiaceae and Polypodiaceae exhibited the highest diversity in terms of number of genera and species. The former have 8 genera and 11 species and the latter, 8 genera and 10 species. On the other hand, families Gleicheniaceae, Marattiaceae and Parkeriaceae consisted of only a single genus and a single species. Of the fern-allies, Selaginellaceae had only 1 genus identified but had the most number of species (7 species) whereas Lycopodiaceae and Psilotaceae consisted of only a single genus and a single species each.

As shown in Figure 2, diversity of the pteridophyte flora of Mt. Pangasugan was low at 5 to 40 m ASL with 11 to 24 species only. With increasing elevation, number of species likewise increased with a peak of about 40 species at 81 to 800 m ASL. It gradually declined from 30 to as low as 15 as elevation continued to increase up to about 340 m ASL. Beyond this elevation, diversity seemed to pick up again.

It was observed that along the 101 to 340 m elevation, many patches of relatively open areas occurred. Most of these were either abandoned or unabandoned "kaingin" areas whereas others were results of logging activities and recurring environmental perturbations like fire, storms, floods and avalanches. Apparently, this directly contributed to the disappearance of many fern species in these areas. Furthermore, some species that remained could have undergone gradual elimination because the environment was no longer favorable for their growth and survival. It is already well-established that pteridophytes are best adapted to conditions of low light intensity and temperature. With the sparse vegetation existing in these areas, these climatic conditions are most likely to increase making the environment unfit for pteridophyte growth. In addition, there can be an increase in plant competition. According to Mueller-Dombois et al. (1974), periodic environmental perturbations decrease the amount of resources which then leads to an increase in

plant competition. Continued competitive stress among different species with similar requirements for a limited resource results in the displacement or elimination of the weaker individuals and species.

Growth habit

Pteridophytes thrive in a wide range of habitats from open grasslands and mountain slopes to moist shaded portions of cliffs and creek embankments. They also have varied growth habits; many are terrestrial, a few are aquatic. A number of species grow well on trunks of trees as epiphytes and in the cracks and crevices of rocks and boulders as petrophytes.

Table 3 presents the number and percentage of pteridophytes collected in Mt. Pangasugan according to growth habit. It is shown that 62 species or 66.7% of the total pteridophyte collection is terrestrial and only 4 species or 4.3% is aquatic. Furthermore, 15 species or 16.1% is epiphytic on trees. The petrophytes, on the other hand, comprise 12.9% (12 species) of the total collection.

Table 3. Number and percentage of pteridophytes collected according to growth habit

| Growth Habit | Species | |
|--------------|-----------|----------------|
| | Number | Percentage (%) |
| Terrestrial | 62 | 66.7 |
| Aquatic | 4 | 4.3 |
| Epiphytic | 15 | 16.1 |
| Petrophytic | 12 | 12.9 |
| Total | 93 | 100.0 |

Figures 3a-3d show some illustrated pteridophyte species representing each growth habit.

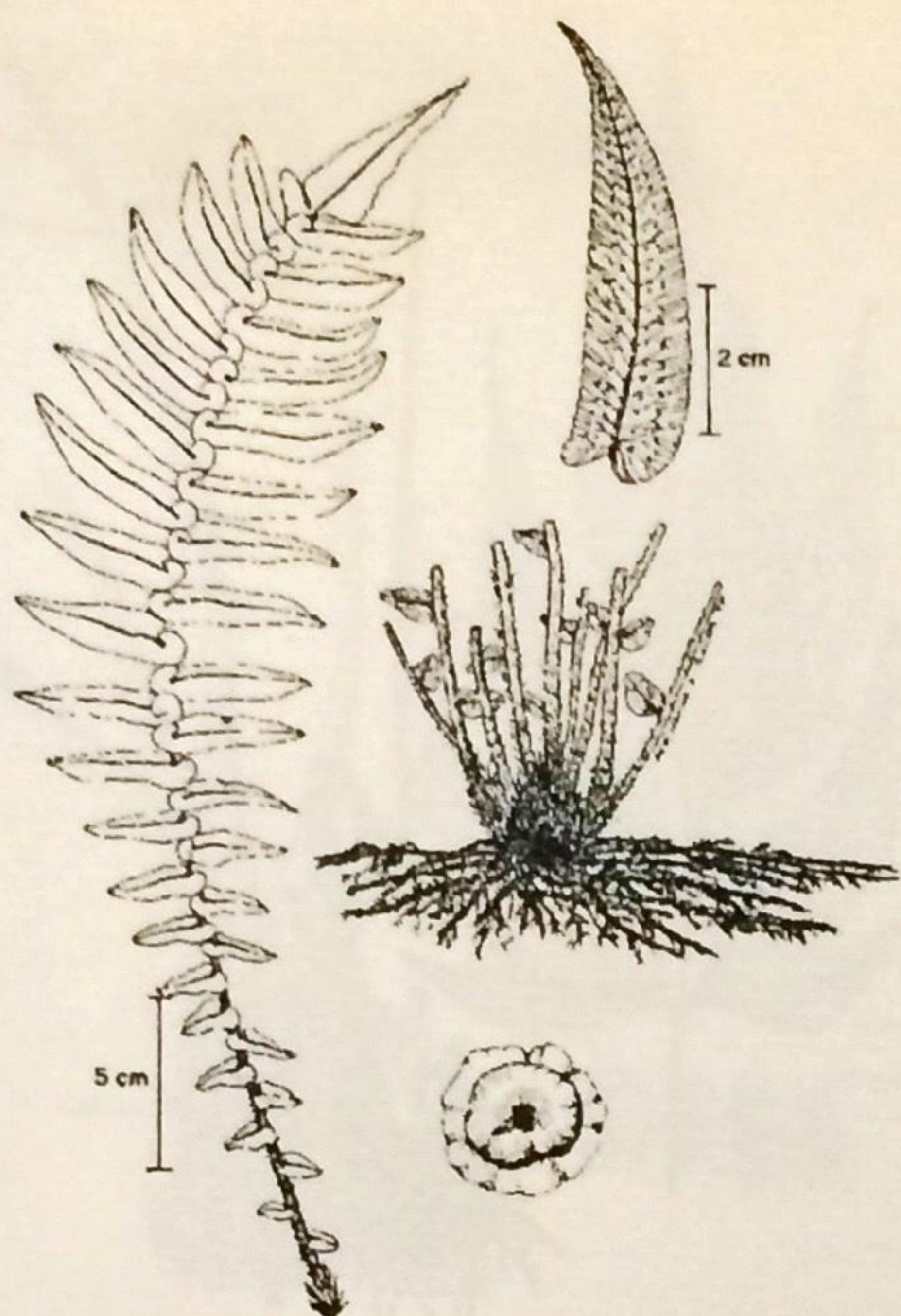


Figure 3a. *Cyclopeltis cumingana* (Fee) C. Chr., a terrestrial fern

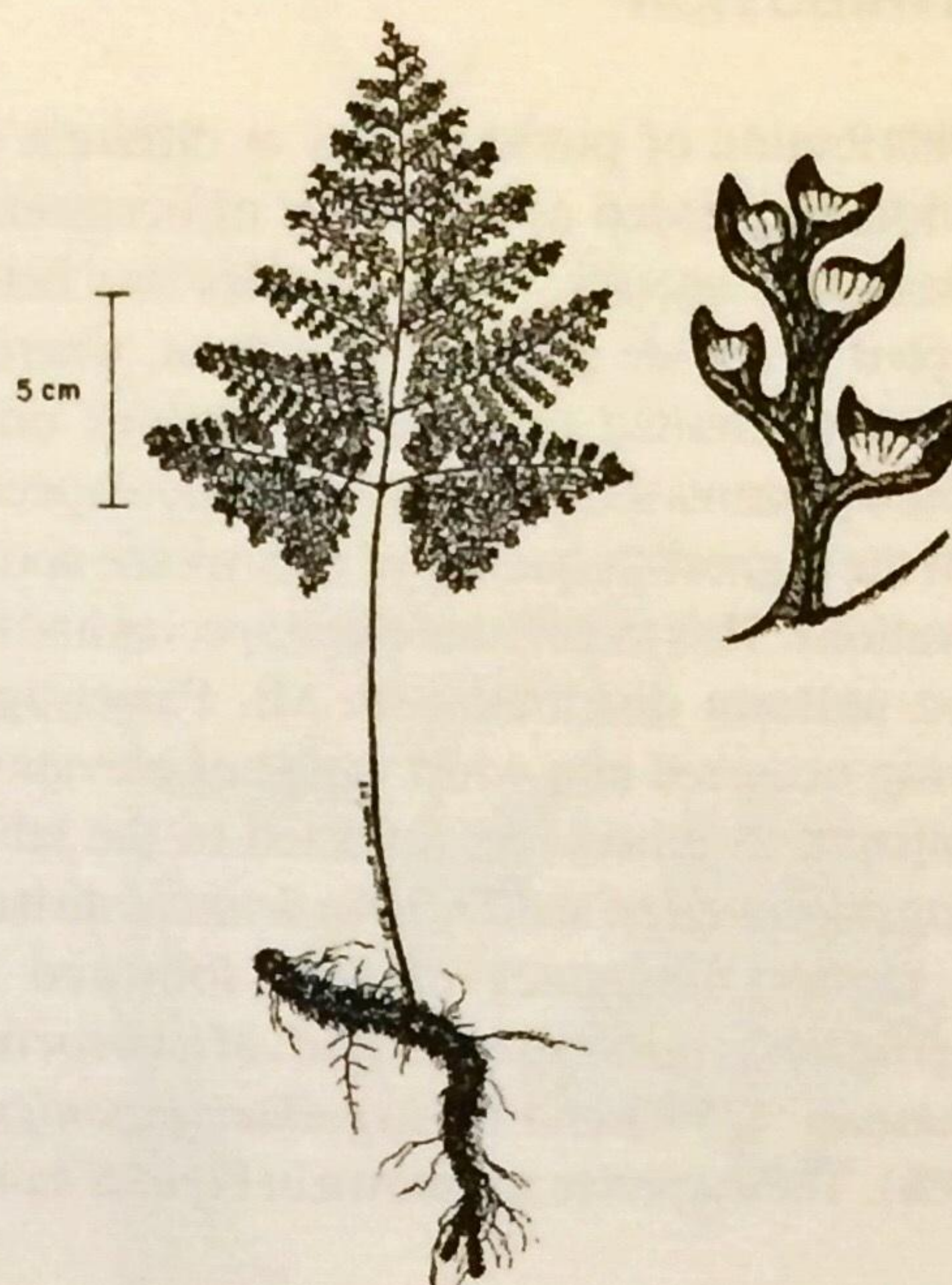


Figure 3c. *Trogestolon falcinellus* (Pres.) Copel., an epiphytic fern

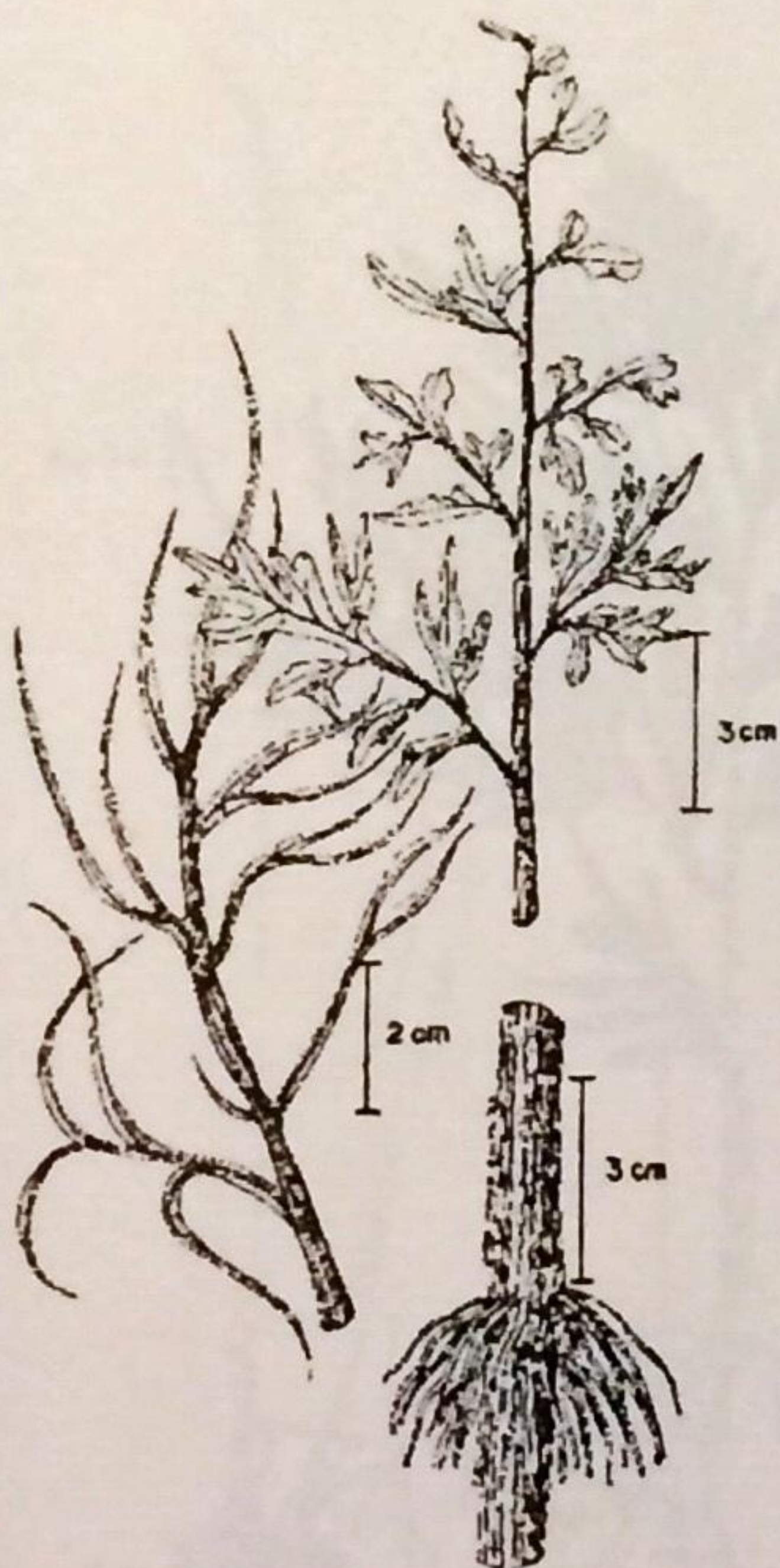


Figure 3b. *Ceratopteris thalictroides* (L.) Brongn., an aquatic fern

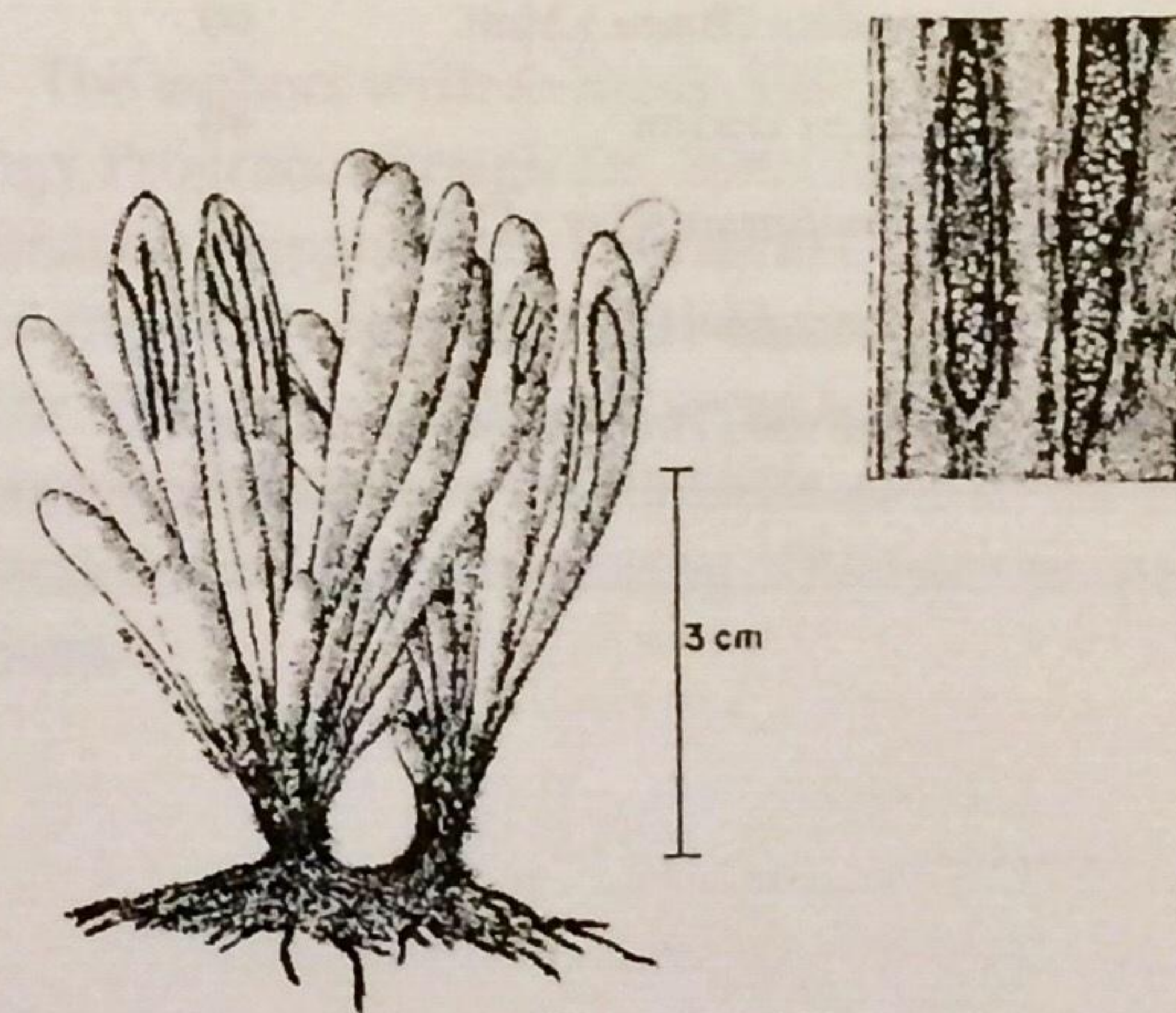


Figure 3d. *Scleroglossum* sp., a petrophytic fern

DISTRIBUTION

Distribution of pteridophytes at different elevations expressed as frequency of occurrence varied with species. Some species are better adapted to a wide range of elevations, whereas others are limited to certain elevations only. Table 4 presents the top five pteridophyte species with the highest frequency of occurrence across elevations. This means that these species had the most uniform distribution in Mt. Pangasugan having occurred at a wider range of elevations compared to others. As reflected in the table, *Selaginella engleri* and *Tectaria denticulata* have the highest frequency of 80% followed by *Angiopteris palmiformis* and *Microsorium punctatum* (75%) and by *Lygodium japonicum* (60%). These species are shown in Figures 4a-4e.

Table 4. First five (5) pteridophyte species with highest frequency of occurrence across elevations.

| Species | Frequency of Occurrence (%) |
|--|-----------------------------|
| <i>Tectaria denticulata</i> (Burm.) Mett. | 80 |
| <i>Selaginella engleri</i> Hieron | 80 |
| <i>Angiopteris palmiformis</i> (Cav.) Chr. | 75 |
| <i>Microsorium punctatum</i> (L.) Copel. | 75 |
| <i>Lygodium japonicum</i> (Thunb.) Sw. | 60 |

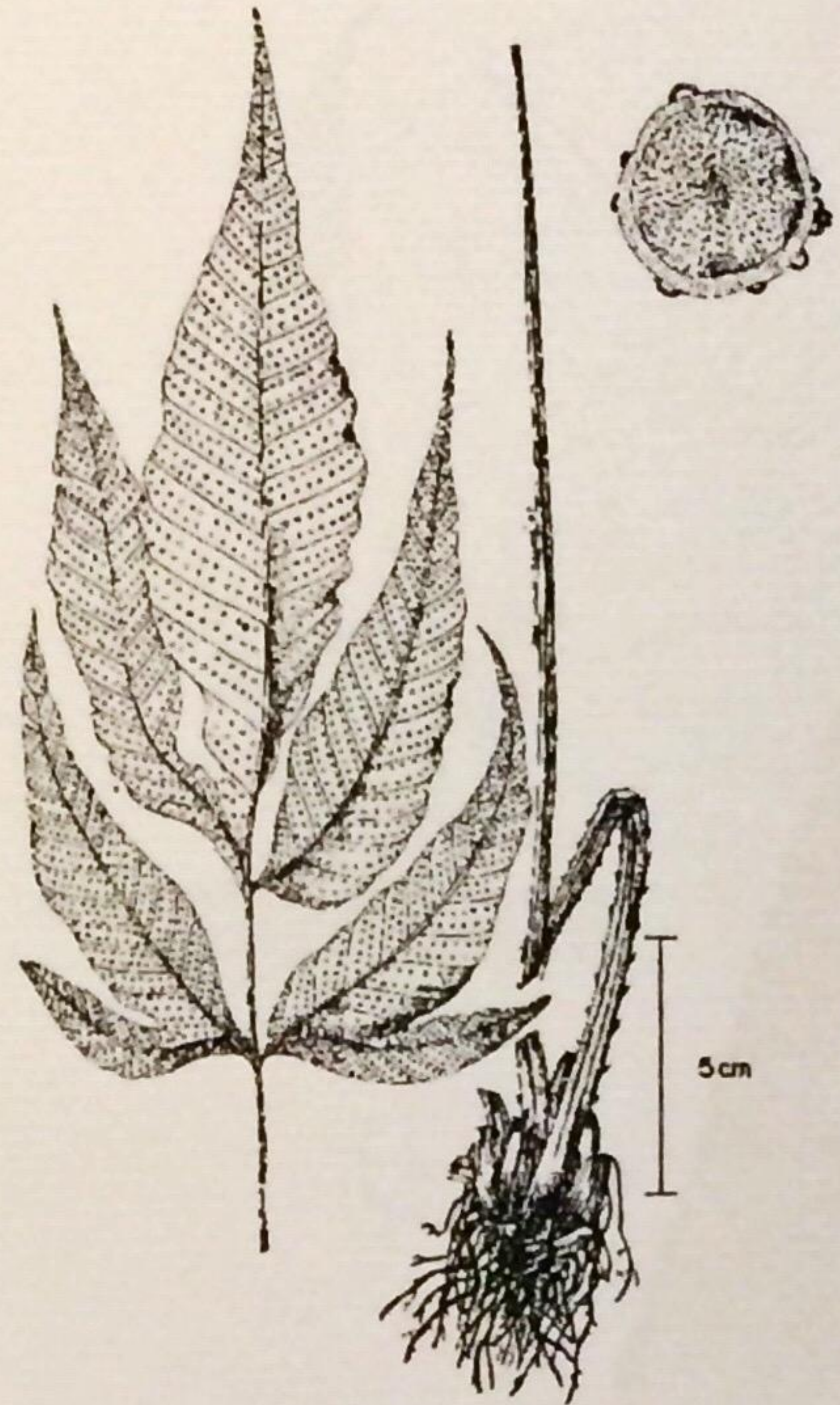


Figure 4a. *Tectaria denticulata* (Burm.) Mett.



Figure 4b. *Selaginella engleri* Hieron

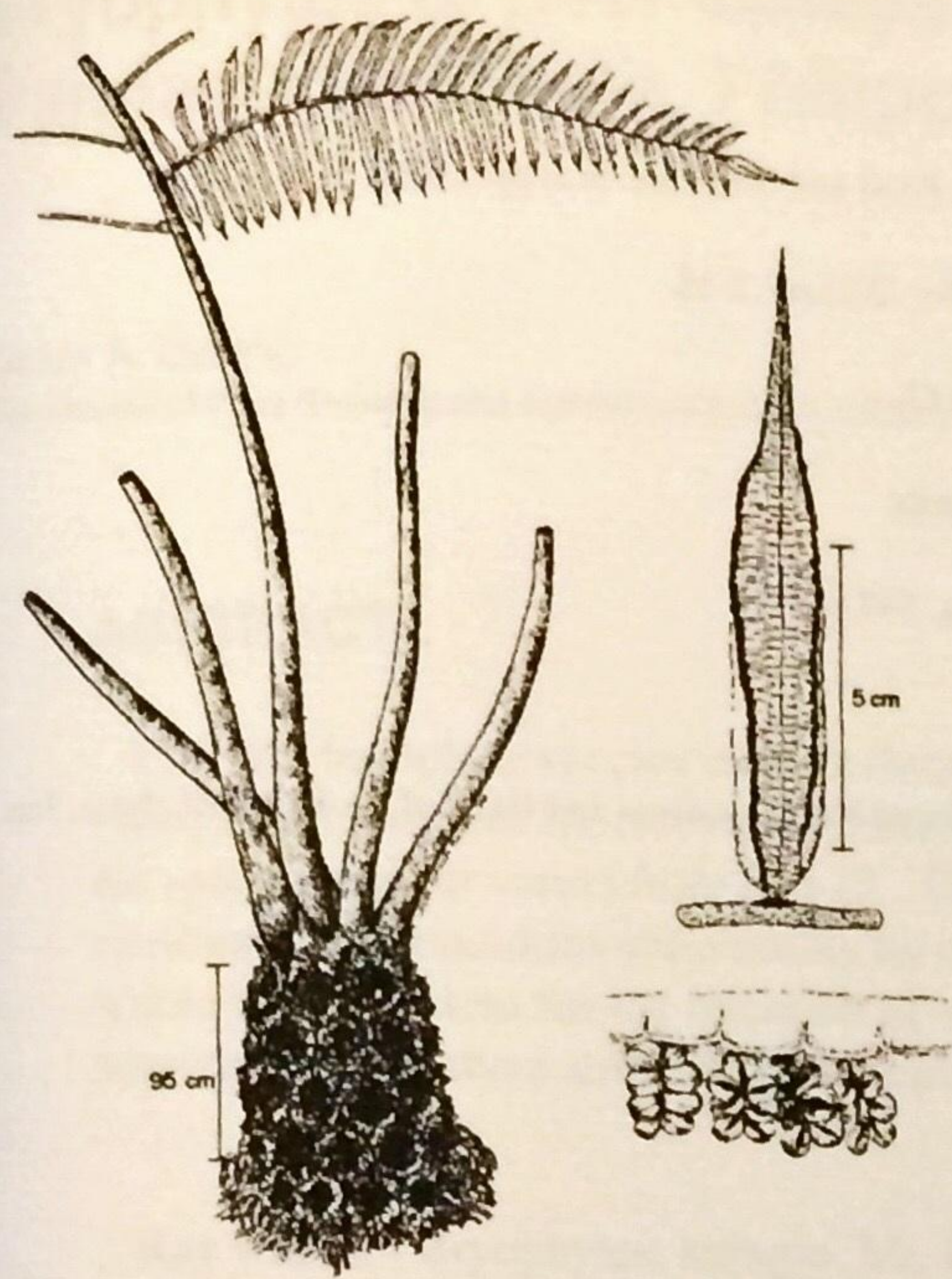


Figure 4c. *Angiopteris palmiformis* (Cav.) Chr.

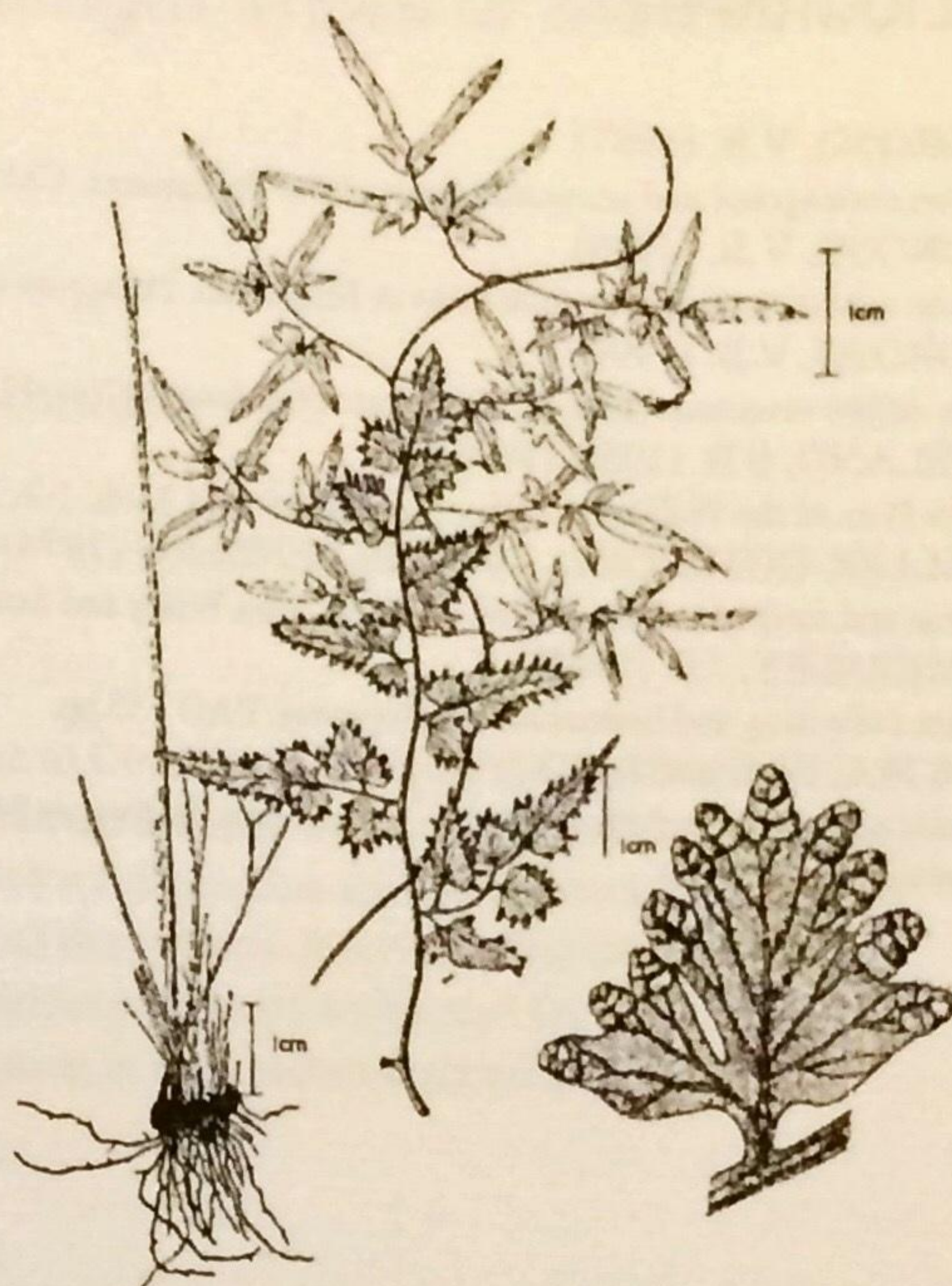


Figure 4e. *Lygodium japonicum* (Thunb.) Sw.

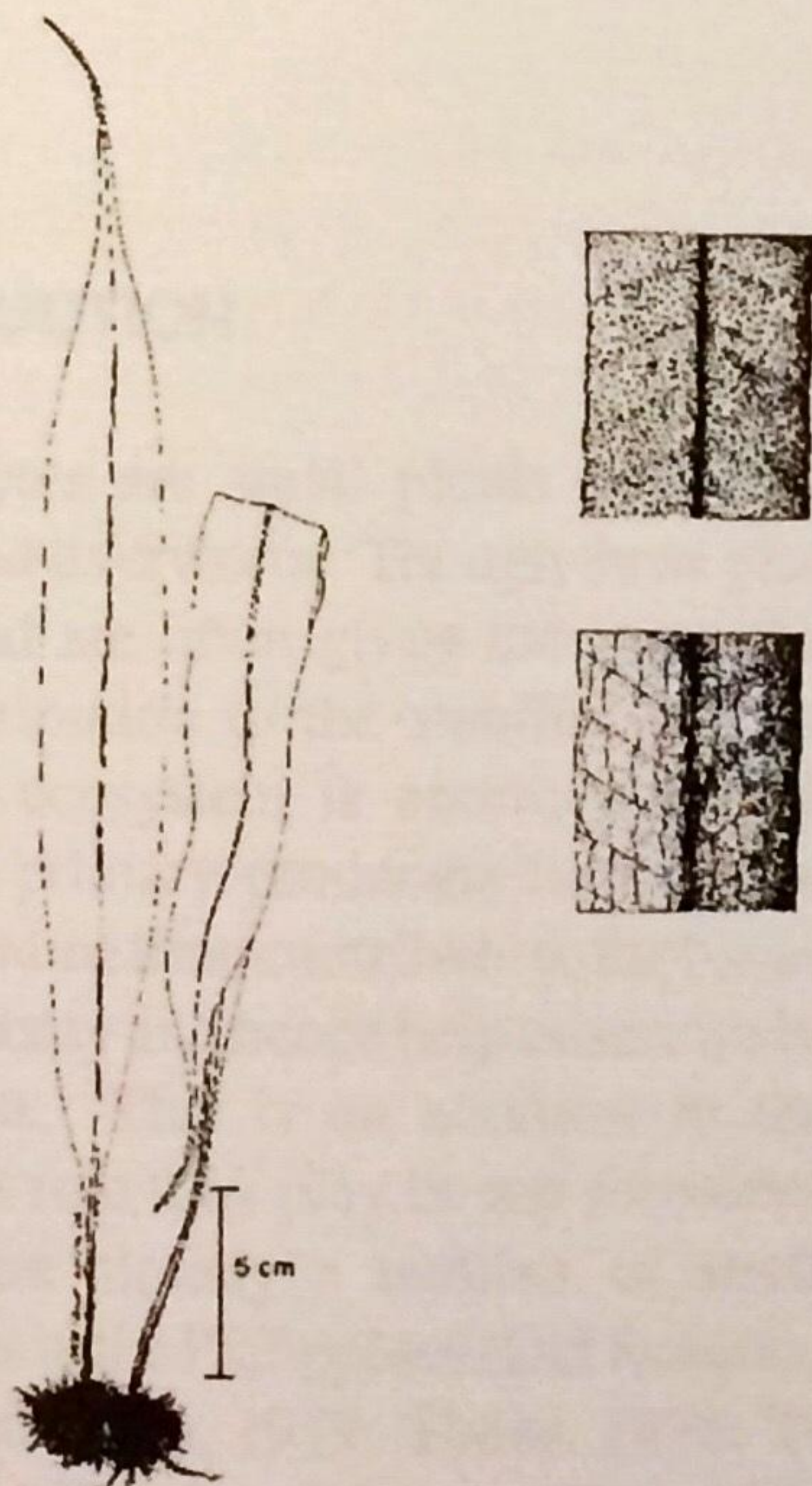


Figure 4d. *Microsorium punctatum* (L.) Copel.

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