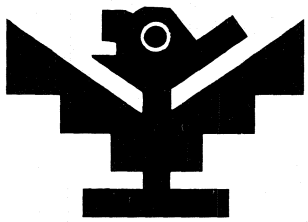
FLORA
OF THE
RIO PALENQUE
SCIENCE CENTER
LOS RIOS, ECUADOR



FLORA OF THE RIO PALENQUE SCIENCE CENTER LOS RIOS, ECUADOR

by

C. H. DODSON & A. H. GENTRY

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TIN TIN

This zoomorphic-mythological symbol of Río Palenque is found in precolombian art representing the "God of Gods" of the Huancavilca tribes of coastal Ecuador. The "Tin Tin" is said to have supernatural powers and is responsible for all manner of mysterious and unexplainable events. He may take the form of a little old man in the forests, a bat at night or a bird by day (possibly the Striped Cuckoo, *Tapera naevia,* often seen in the tops of small trees at the edge of the deep forests, whistling "tin-tín"). It is common to hear the local residents of the countryside discussing the "Tin Tin" and his whistling to the beautiful adolescent of the household during the night of the full moon:

"Hay que cuidar a la niña, porque si llega a oir el silbido del 'Tin Tin', no se resistirá a su llamado y será embarazada indefectiblemente, porque ese indescriptible y pequeñito ser que habita en los cerros y montañas, que gusta tanto de las vírgenes de ojos negros y larga cabellera, que cuando silba y es oído por su elegida ésta va hacia él y se entrega para ser poseída y embarazada. El hijo que tendrá del 'Tin Tin' será un niño malo y travieso, será horrorosamente fuerte y peligroso, dará mucho que hacer en su niñez y será el azote de las mujeres cuando grande.

" 'Tin Tin,' el temido ser de nuestros campos, el azote de las vírgenes y el consuelo de las mujeres que no pueden justificar la paternidad del niño que llevan en el vientre, aparentemente significó en lengua Mochica (a cuyas raíces pertenece el grupo de lenguas habladas en épocas de la conquista, en las provincias de Manabí, Guayas, Los Ríos, El Oro, Chimborazo, etc.), 'Dios de Dioses.' "

(From *"Tin Tin", Arte y Mitologia del Pueblo Huancavilca,* an unpublished manuscript by Miguel Wagner Velasco of Guayaquil, Ecuador).

EPIPHYLLUM RUBROCORONATUM (Kimnach) Dodson & A. Gentry

INTRODUCTION

Geography

The Río Palenque Science Center is a biological field station designed for convenient research and teaching within the tropical rain forest. It is about 65 km south of the equator in the central coastal region of Ecuador on the highway from Quito to Guayaquil, 47 kilometers south of Santo Domingo de los Colorados and 56 kilometers north of Quevedo (Fig. 1). The Science Center has become known as "Río Palenque."

The total holdings consist of 167 hectares (400 acres), 87 of which are still mature forest (Fig. 2). About 80 hectares are planted in African Oil Palm *(Elaeis guineensis)*. The east boundary of the Science Center is formed by the Río Palenque. Upstream, above Puerto Ila, this river is known as the Río Baba. Downstream, beyond Camarones, the river is known as the Río Quevedo. The Río Quevedo empties into the Río Babahoyo which, with the Río Daule, forms the Río Guayas.

The river at the Science Center is 150 meters (about 500 feet) above sea level (Fig. 2). Most of the land of the Science Center is part of a plateau with an altitude of 220 meters (about 700 feet). This differential elevation results in sheer cliffs which drop to the river, numerous ravines, creeks and waterfalls. About 40 hectares are at river level and about 80 hectares are at the plateau level. The rest of the area is composed of ravines and creek beds. The land across the river forms a broad flat valley about 2 kilometers wide, most of which is near river level and is now entirely cultivated. The Montañas de Ila (altitude about 600 meters), the first range of Andean foothills east of this valley, run north and south with the crest about 5 kilometers east of the river.

Climate and Rainfall

The Pacific coast of Ecuador lies about 130 km west of Río Palenque. The ocean is cool as a result of the Humboldt current which moves north from the Antarctic along the western shores of South America to about mid-Ecuador where the current swings westward away from the coast toward the Galapagos Islands, and with a small branch continuing up the Ecuadorian coast to Cape Pasado at 0.4° S. latitude before also moving west. The temperature of this current is reported by Wolf (Geografia y Geologia del Ecuador, 1892) to average 23° C. (72.5° F.). A fluctuating tropical current called "El Niño" moves southward from Panama and Colombia and meets the Humboldt current to the northwest of Río Palenque. The water temperature off the city of Esmeraldas at 1° N. latitude is 28° C. (82.4° F.).

The cold Humboldt current flowing up from the South, the warm Niño current moving down from the north and the presence of the Andes dictate the diverse climates of western Ecuador. To the south of Bahía de Caraquez (almost due west of Río Palenque) very little rainfall occurs along the coast. Southward the dry region expands across the plains, leaving a very narrow strip of humid conditions against the base of the Andes and on the tops of the low coastal mountains (Cerros de Colonche). North of Bahía de Caraquez humid conditions prevail.

Throughout the dry regions (consisting of dry forests and deserts) rainfall is restricted to the period from January to April. The rest of the year is characterized by a nearly constant layer of clouds whose lower edge varies

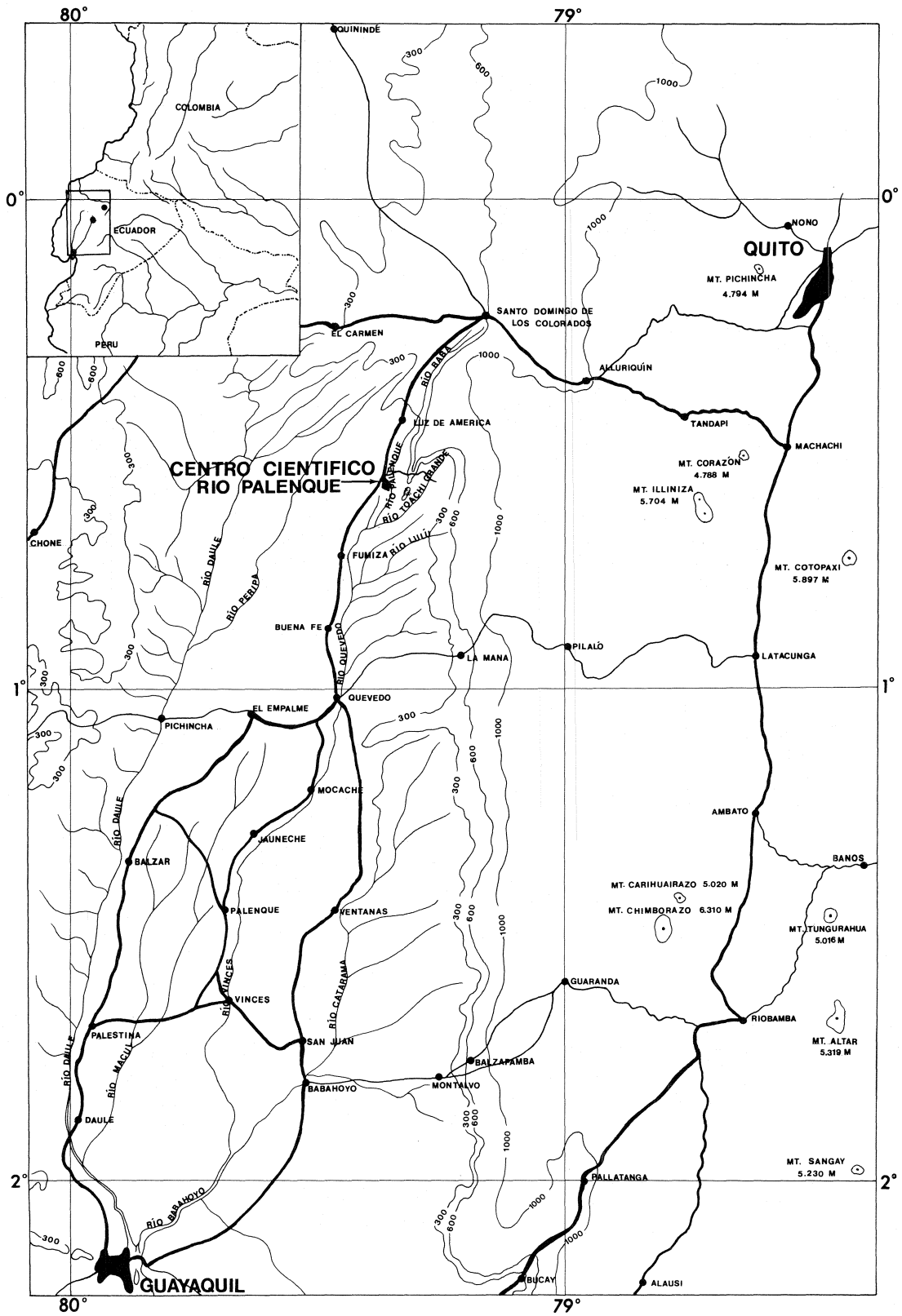

Figure 1. Map of the Río Guayas drainage system of Western Ecuador.

from 400 to 600 m above sea level. During this period the sun is seldom seen. Damp, misty conditions (called "garua") are frequent. Night temperatures drop to 17.7° C. (64° F.) while day temperatures seldom exceed 23.3° C. (74° F.) unless the sun breaks out for several hours, when the day temperature may reach 27.7° C. (82° F.). During the rainy season, the days are usually partially clear and inland they may become quite warm, reaching 35.5° C. (96° F.).

The humid regions have a longer rainy season, from December to May, and frequent night rains during the dry months. From June through November a cloud layer similar to that which occurs in the dry regions, exerts a cooling effect but it commonly breaks up at midday with the sun shining in the afternoon. During the dry cloudy period, night temperatures may drop to 17.2° C. (63° F.) and day temperatures seldom exceed 24.4° C. (76° F.). The rainy season is warmer, with minimum temperatures usually about 23.3° C. (74° F.) and maxima reaching 31.6° C. (89° F.).

At Río Palenque strong winds are rare and catastrophic storms are unknown. During the months of February and March, small weather fronts pass through, and occasional, very local, cyclonic winds may seriously damage or fell emergent trees. In 1974 and 1975, at the Science Center, only three large trees fell per year, while in 1976 twelve giants succumbed. In 1977 only one tree fell.

Annual rainfall at the Science Center is unknown. At Puerto Ila, about 8 km upriver, an annual rainfall of about 2650 millimeters (103 inches) has been measured. However, doubt exists concerning the validity of the records, which are not complete for any one year. We suspect that the rainfall at the Science Center should be higher to account for the wet forest physiognomy of the vegetation at so low an altitude so near the equator. However, the reported 2650 mm is intermediate between the 2000 mm reported at Quevedo and the 3000 mm reported at Santo Domingo. The heaviest rains occur from December through June in the warmer months. From July through November days are generally cool and dry but night rains are frequent, averaging at least 50 mm (2 inches) per month. The relatively cool temperatures and the night rains during the dry season also may account for the wet forest physiognomy.

Evidence of Pre-Colombian Occupation

The region in which the Science Center is located was occupied by the Palenque Indians at the time of the Spanish conquest. The Colorado Indians, whose tribal region now surrounds Santo Domingo, still regularly fish along the river as far south as the Science Center.

Evidence of a vast prehistoric civilization in the area is abundant. Almost any hole dug on a slight elevation above the river will reveal pottery fragments. In some areas, such as under the Dodson house, as much as 20 cm of fragments are encountered at a depth of 70 cm. As the bluffs along the river crumble, legs of tripod pots and pieces of broken pots become unearthed. Numerous man-made mounds are scattered through the region and can be identified by their prominent flat-top shape. Excavation of one of these was done in 1971 on the Hacienda San Antonio at km 37, Santo Domingo to Quevedo, and many pottery artifacts in excellent condition were retrieved.

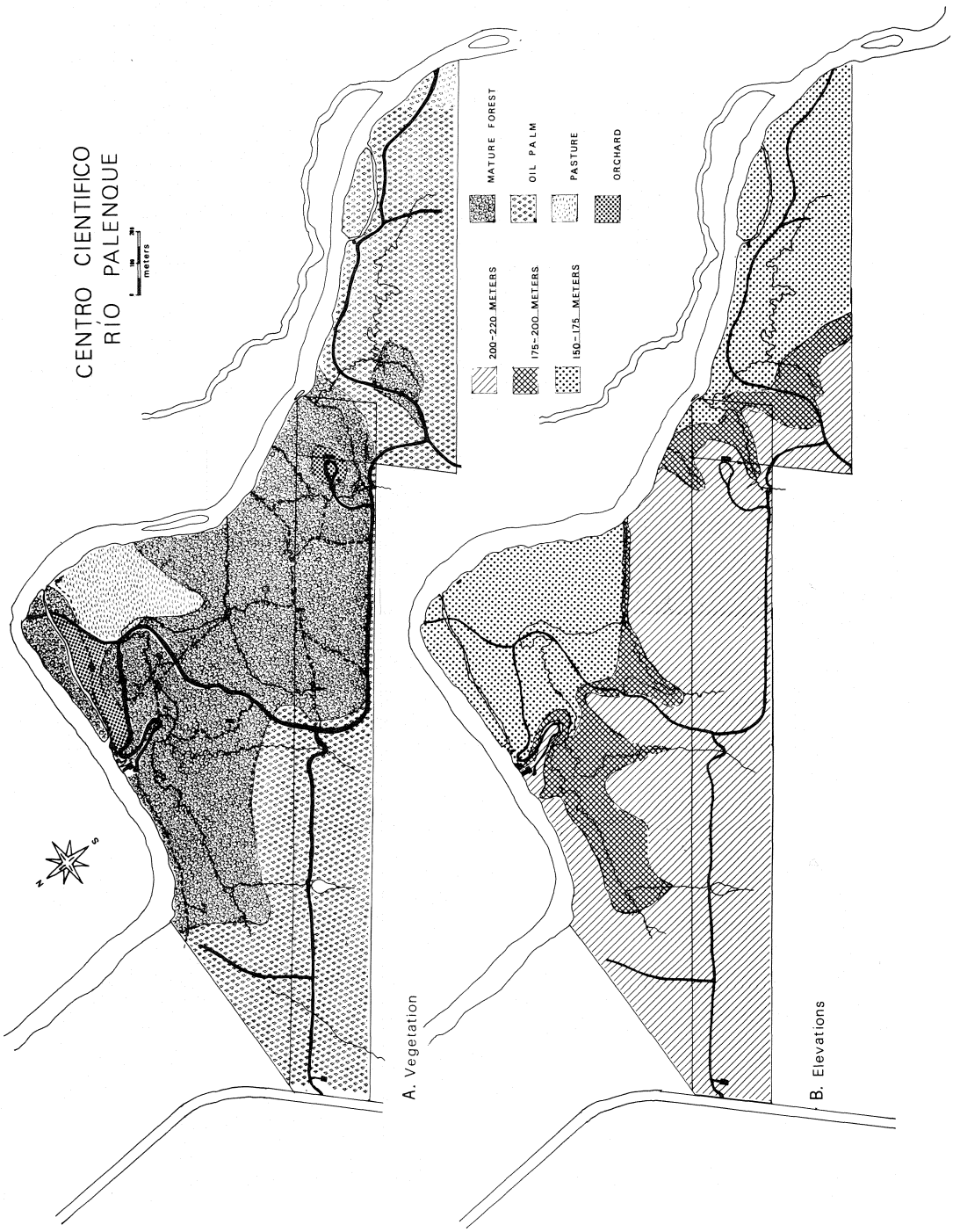

Figure 2. Vegetation and Elevations of the Río Palenque Science Center.

A particularly interesting series of mounds is found 10 km south of the Science Center on the Hacienda Cerro Chico, which belongs to Mr. Don Brainard. When Mr. Brainard cleared the forest, a large mound became obvious. Aerial photographs of the region after clearing revealed that the hill was part of a complex of mounds and moats covering several hectares. The central mound is about 30 meters high and covers more than a hectare (2.5 acres). No excavation has been done on the complex which is now covered by oil palm trees, but Mr. Brainard observes: "Judging from the quantity of potshards found, there must have been a large population here at one time whose religion consisted of making pots and then breaking them." Unquestionably, the region supported a population far in excess of that expected in tropical rain forest. The fertility of the soil in the region must have supported much more than "slash and burn" agricultural practices. The effect of this prehistory on the present vegetation of Río Palenque is unknown, but surely substantial.

Recent History

Little is known of the region surrounding the Science Center prior to 1960. No roads existed before then and only a trail from Quevedo to Santo Domingo provided land communication. Canoe traffic from Puerto Ila, about 8 km north of the Science Center, was the common form of transport until recently. A trading settlement called Bimbe was located along the river where the large breadfruit tree now stands just below the Dodson house.

Prior to the construction of the Quevedo-Santo Domingo road in 1960, the whole area surrounding the Science Center, from about 30 km north of Quevedo to the outskirts of Santo Domingo, was nearly trackless forest, except for a few clearings along the river. One of these was a large cacao plantation near Buena Fe (35 km south of the Río Palenque Science Center), bordering the river for several kilometers, which was planted and owned by the Juez family.

The general region around the Science Center was owned by the government of Ecuador and was settled along the river by Indians and a few squatters. Gradually the Indians disappeared or moved upstream until today they occupy an area around Santo Domingo. Timber cruisers passed through the area for many years removing any Caoba *(Persea theobromifolia)*, Balsa *(Ochroma lagopus)* and Colorado *(Pouteria* sp.) that were near the river or easily accessible. During the period of World War II, and perhaps earlier, rubber collectors worked the native rubber trees *(Castilla elastica)*, which occur throughout the forest, and any *Castilla* trunk with a diameter of more than 25 cm still carries the characteristically knobby rings and scars to a height of 7 m or more.

The land across the river from the center, known as Hacienda Santa Rita, was purchased from the government by Engineer Coronel and cleared. To the north of Hacienda Santa Rita, is a large hacienda known as Patricia Pilar, owned by Sr. Enrique Encalada, who acquired the land some years prior to the opening of the road.

During the late 1950's planning for the present highway began. The government-held land along the line of the future road was surveyed and was opened to colonization through cooperatives called "Colonias". The law specified that an individual could not own more than 50 hectares (127 acres) in any one cooperative.

So that the history of the specific tracts of land involved in the Río Palenque Science Center may be preserved for future reference, we provide the following details:

The Science Center is located in the "Colonia Río Manso", which consisted of 126 lots, each of 50 hectares. The Río Palenque Science Center consists of a triangular-shaped piece of land of 167 hectares. It began with lot 1 of the colony and due to its peculiar form was slightly larger than the other lots. It was registered in the name of Sr. Serifim Tacle, the brother of Sr. Raul Tacle, who obtained lot 2. Lots 24 and 25 were purchased by Major Guillermo Varilla. The front 15 hectares of lot 1, 30 hectares of lot 2, and all of lots 24 and 25 were cleared shortly before 1960. Bananas were planted on lots 1, 2 and 25. Much of lot 24 was planted in pasture. Roads were constructed and graveled. A road was built down lot 2 to about the midpoint, then across lot 1 to the river through the lowland forest. Another road was constructed from the highway through lot 5, back to lot 25 and down to the river. Gravel for the highway was obtained from the river bed.

During the early years (1950-1965) the banana was known as "oro verde" (green gold). The profits were high and investment was low. By 1970, however, labor problems, overproduction, ruinous local competition, "Panama" disease (a virus), and the later introduction of the cavendish banana (called "variedad"), with its more expensive processing, eliminated many small farms.

Serifim Tacle apparently was not interested in lot 1. He mortgaged it to the Banco de Fomento but did not keep up the payments. Sr. Raul Tacle was killed in an automobile accident in 1967 and his two sons, who inherited lot 2, also were not seriously interested in agriculture.

In 1970, the bank foreclosed on lot 1 and it was sold at public auction to Sr. Abel Palacios of Quevedo, who then sold the land to Drs. Jack Harrison, Carl McHenry, Leonard Greenfield, Earl Rich and Calaway Dodson, members of the faculty of the University of Miami. In 1971, lot 2 was sold at public auction to Sra. Piedad Marmol de Dodson. Five hectares of the northwest corner of lot 24 were sold to Calaway Dodson by Major Guerro Varilla. This piece is now known as "El Retiro" and the Dodson house is constructed there. The rest of lots 24 and 25 were purchased by Mr. Will Bates of Corpus Christi, Texas and were later sold to Sra. Dodson. Together these properties form the Río Palenque Science Center. Twenty hectares of lot 2, now designated as Hacienda El Refugio, still is forested and is contiguous with the forest of the Science Center proper (lot 1). This is sometimes referred to as the "Dodson forest."

The banana lands of Hacienda El Refugio have been planted in African oil palm *(Elaeis guineensis)*, while the forested lands are to be retained as part of the forest preserve. The forests of Río Palenque were declared a national forest preserve by President Velasco Ibarra in 1971.

The owners of lot 1 signed an agreement with the University of Miami for underwriting the cost of a science building. The University of Miami and the Universidad Catolica de Quito then signed an agreement of cooperation in the use of the Science Center.

In June of 1971 construction of a two-story concrete-block building (Fig. 3) designed to house 4 faculty members, 16 students, an administration and staff was begun. Inauguration of the building took place 10 December 1971. The building has adequate equipment, laboratory space and work

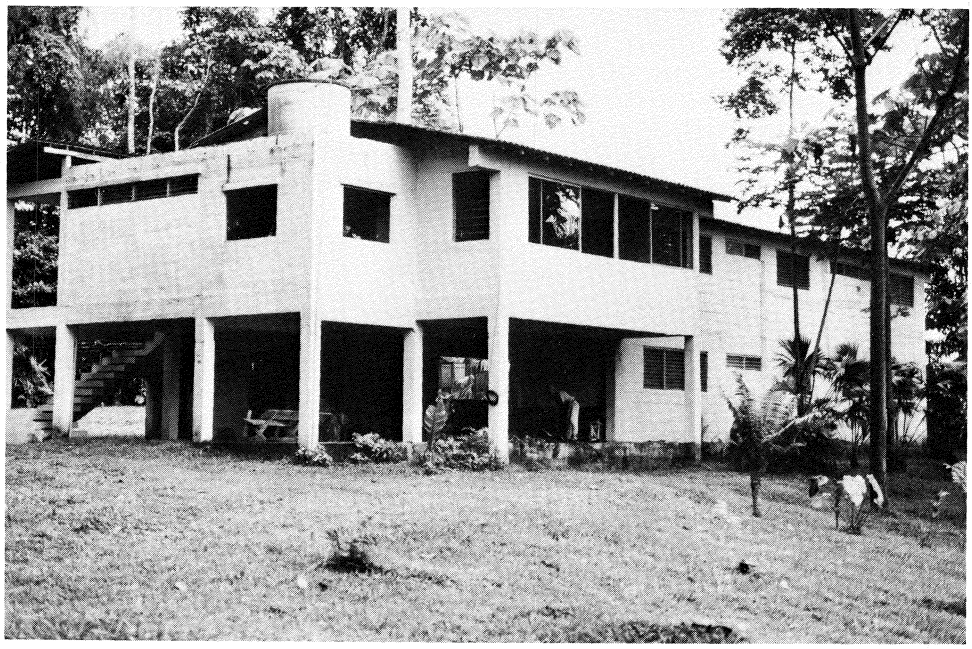

Figure 3. Laboratory building.

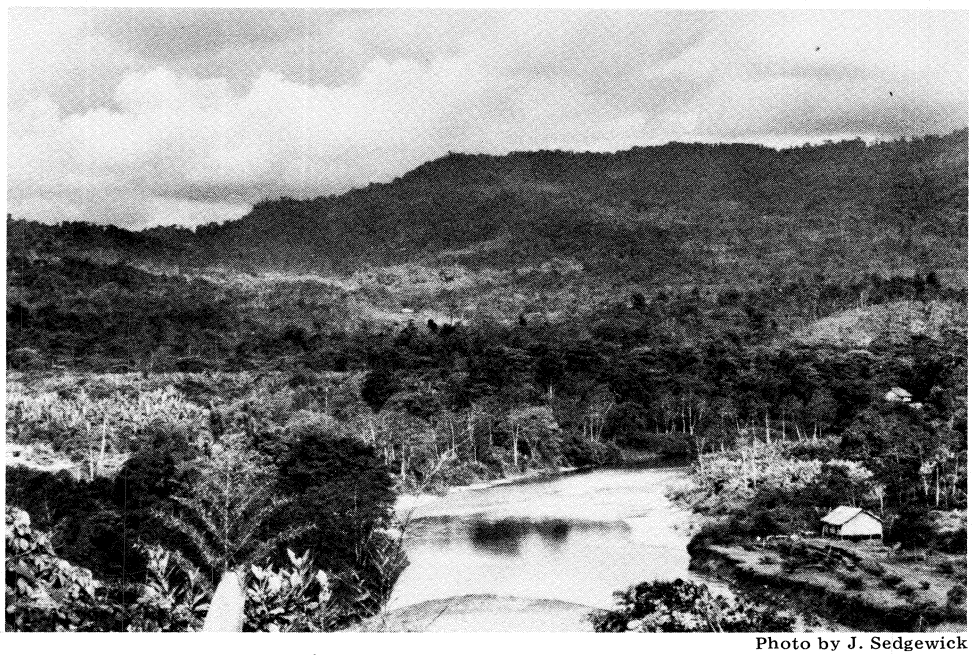

Photo by J. Sedgewick

Figure 4. View of the Río Palenque from the Dodson yard. The house in the lower right is on lot 24.

space for about 20 persons. It is conveniently located near a major paved highway with easily available transportation.

The primary mission of the Science Center is to provide a reasonably comfortable environment for teaching tropical biology. The Science Center is available for use at a nominal charge at all times.

Permanent marked trails traverse the forests. Roads, streams, islands and similar localities have been named and these are included on the map of the Science Center (Fig. 7).

THE FLORA OF ECUADOR*

Floras of Ecuador

Ecuador as a whole is floristically very rich but exceedingly poorly known as has been generally recognized: "Botanically, Ecuador is least known of any of the countries that lie along the Andes" (Standley, 1931); "Ecuador is botanically one of the least known, though one of the richest, countries of South America" (Svenson, 1945). Recent estimates of number of plant species in Ecuador range from 10,000 (Sparre, 1968) to 20,000 (Gentry, 1976b) as compared to estimates of 20,000 species for all of Central America (including southern Mexico) (Gentry, 1976b) and 25-30,000 for all the vast expanse of Brazilian Amazonia (Prance, pers. comm). Steere (1950) has suggested that Ecuador may have the greatest number of plant species per unit area of any South American country.

Despite its great botanical diversity, Ecuador is not covered by any published Flora. Publication of a Sweden-based *Flora of Ecuador* has begun in the last three years under the direction of Benkt Sparre and Gunnar Harling but only eight small families have been treated to date. Even these treatments are hampered by lack of adequate collections to provide a source of floristic knowledge. The few available sources of floristic information about Ecuador are very incomplete. Little (1969) has published a nicely illustrated compilation of "Arboles Comunes de la Provincia de Esmeraldas" which includes floristic information on trees, from a limited region in northwestern Ecuador. Acosta-Solis' various studies are similarly limited to woody plants or to a few taxa of special interest, notably grasses and their relatives. Svenson's (1945) study of the dry coastal vegetation of Pacific Ecuador and Peru is critical and scholarly but considers only the relatively few species actually collected by the author. Diels' important earlier work (1937, 1938-42) on the Ecuadorian Andes hardly does more than list and describe new species. At the local flora level little or nothing is available. The Flora of the Río Palenque Science Center is the first comprehensive listing for any site in Ecuador.

Distributional Patterns

It now appears that most tropical plant species have geographically ample but ecologically restricted distributions. In most of tropical America these distributions are much more highly correlated with the Holdridge life zone system than with any other system of ecological classification.

* Modified from Gentry, 1977, "Endangered Plant Species and Habitats of Ecuador and Amazonian Peru", in Extinction is Forever (T. Elias and G. Prance, ed.); the cited references are those given therein.

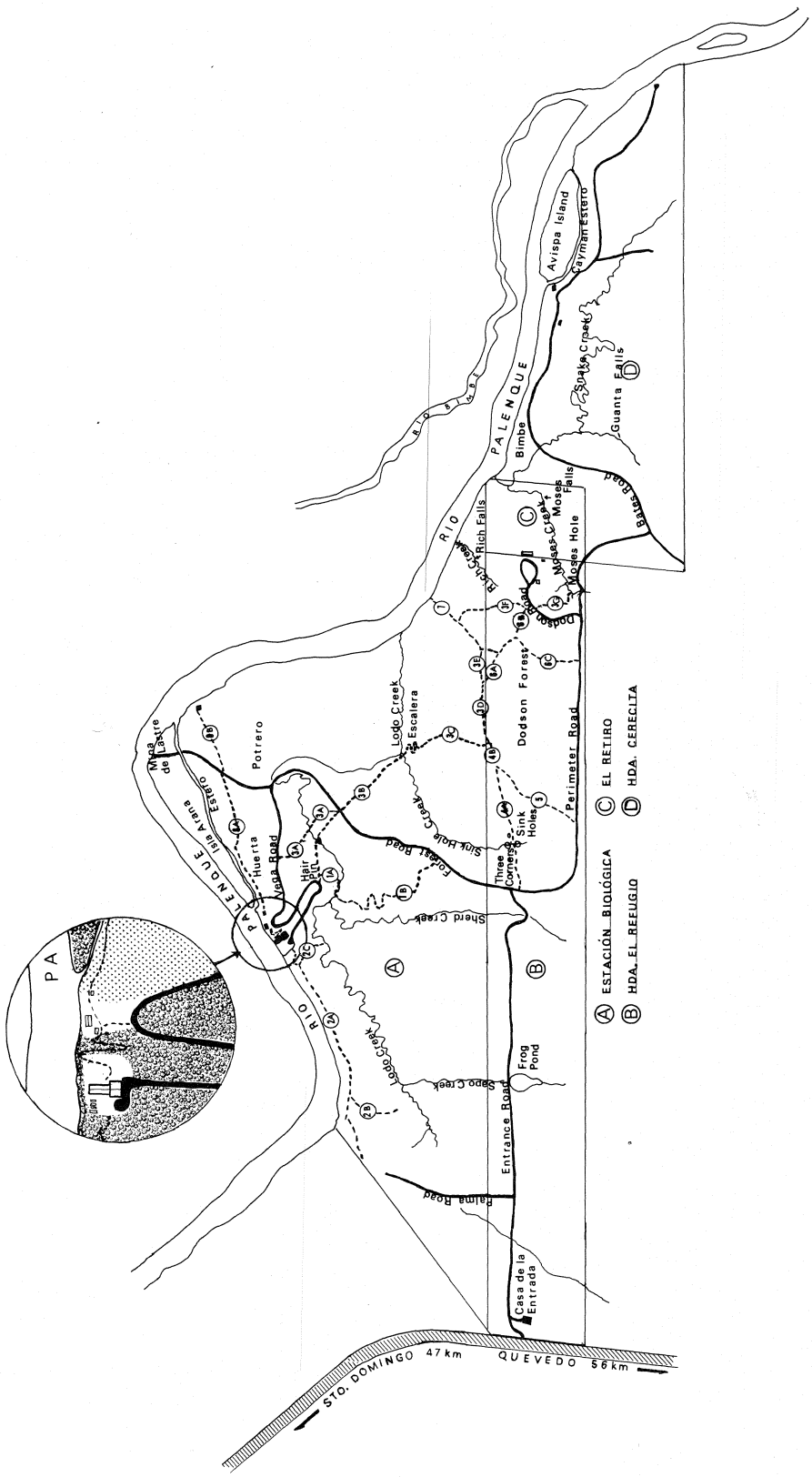

Figure 7. Trails and locations cited in the text.

Another important general consideration is that species diversity, at least for lowland plant communities, seems directly related to the amount of precipitation. A 1000 square meter sample of wet forest at Río Palenque contained 118 species of woody plants representing 49 families. A similar sample of Panamanian wet forest included 151 species, while moist and dry forest samples from a variety of sites in South and Central America gave progessively decreasing species diversities. The 1112 species (including widespread tropical weeds and 80 species of cultivated plants) recorded here from the Río Palenque Science Center (1.7 square kilometers) is probably the highest recorded plant diversity in the world. More than 800 species have been collected in the 87 hectares (0.87 square kilometers) of natural forest at Río Palenque.

The Coastal Moist and Wet Forests of Ecuador

The rich Pacific lowland forest is not the single vegetational type which is generally recognized (e.g., IUCN, 1974), but is comprised of two floristically very different vegetational units - moist forest and wet forest (in the sense of Holdridge) (Fig. 8).

The extent of this ecological specificity has been inadequately appreciated. Even between the physiognomically similar lowland moist and wet forest, which are lumped together under non-Holdridge classifications, surprisingly little species overlap occurs. Only 37% of the tree species listed by Little for Esmeraldas Province (mostly from tropical moist forest) are found at Río Palenque (wet forest), and most of the tree species which occur at Río Palenque - including many of the commoner species - are not included by Little. Only a few weeds occur both at Río Palenque and in the dry part of Pacific Ecuador only a few tens of kilometers away.

Unfortunately, both coastal moist and wet forests are poorly known floristically. The adjacent Chocó region of western Colombia, one of the rainiest regions of the world with 10,000 mm or more of annual rainfall in some places, is even more poorly known and is perhaps the least botanically known region of South America (Gentry, 1976b). Although both moist and wet forest regions in Ecuador have apparently endemic species, many more apparent endemics occur in wet than moist forest. The moist forest flora of western Ecuador is almost identical in species composition to similar regions of Panama. This flora covers a greater area in Ecuador than does the wet forest vegetation, and fairly extensive areas of it still exist in the northern region (Esmeraldas Province) which has not been penetrated by roads.

The flora of the wet forest of coastal Ecuador may be very similar to the virtually unknown Chocó flora. However, on the basis of the many species known only from the former region, one is forced to conclude that it has a very strong endemic element. The flora of this region is especially rich in epiphytes. Five of the eleven largest families at Río Palenque are entirely or predominantly epiphytic - in descending order they are: Orchidaceae (95 sp.), Araceae (53 sp.), Piperaceae (41 sp.), Gesneriaceae (23 sp.), and Bromeliaceae (19 sp.). Epiphytic ferns are also very well represented. Moraceae (39 sp.) is the most important family of canopy trees.

The narrow strip of wet forest extending south along the base of the Andes is currently the country's fastest-disappearing habitat. During the last ten or fifteen years, extensive wet forest vegetation has been converted almost completely to banana and oil palm plantations. Perhaps the only unthreatened area of this vegetation in the southern 7/8 of Ecuador is the

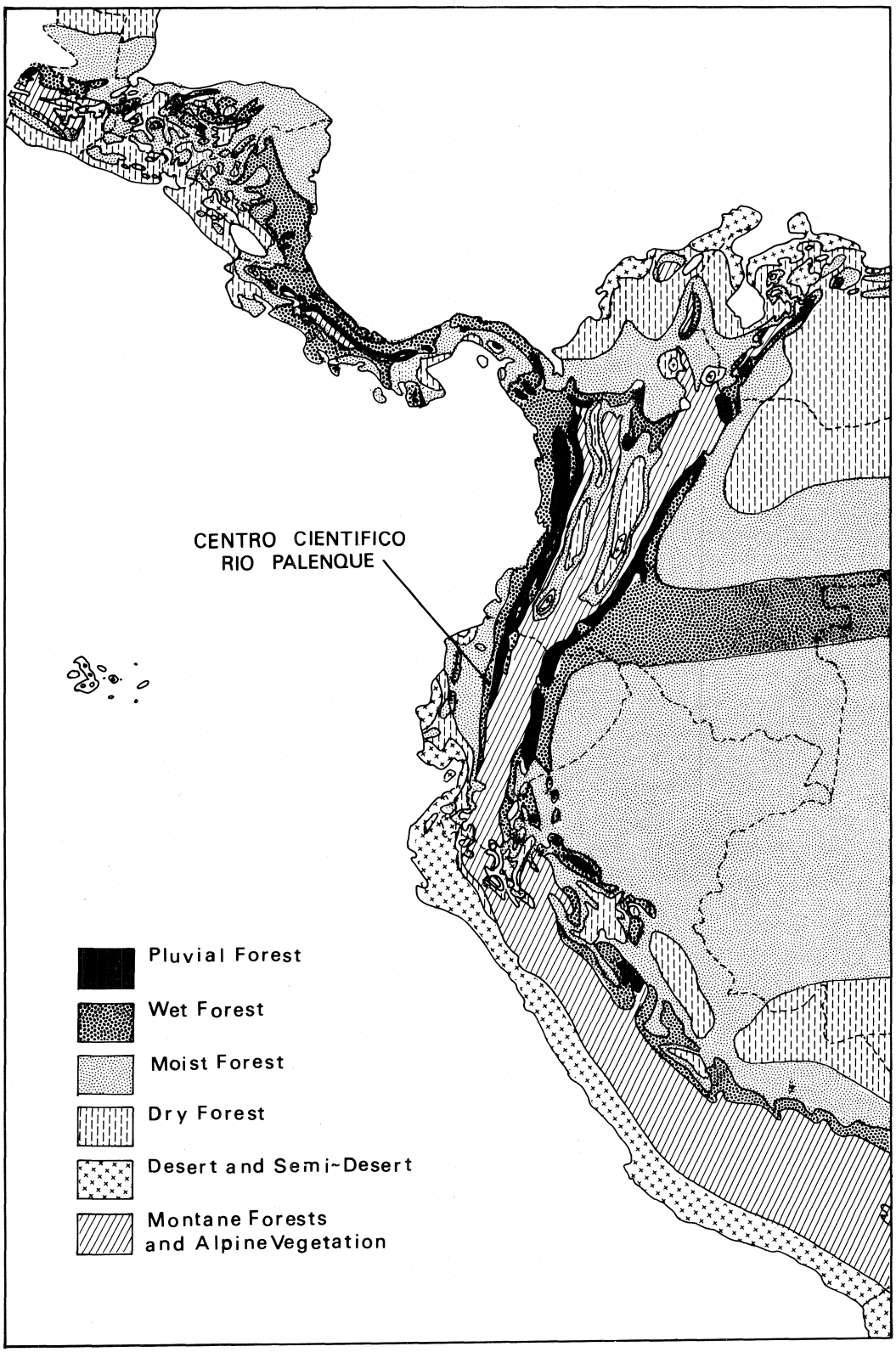

Figure 8. Vegetation types in Central and northwestern South America.

minuscule Río Palenque Science Center. At least 23 species of plants are known only from this field station (Table 1). Many of these species, now being formally described for the first time, quite possibly are already extinct elsewhere. The northern part of this wet forest strip is poorly known, but the rapidity with which southern and central regions of wet forest have disappeared renders the whole habitat an acutely threatened one. Even if these Ecuadorian wet forest endemics prove to extend north into the Chocó, they would have to be classified as extremely threatened.

In summation, the humid lowland coastal forest consists of two distinct vegetation types (moist and wet forest) which commonly have been lumped together. Both are fast disappearing and in need of protection, but the wet forest is especially endangered. This rich wet forest vegetation may contain more endemic-to-Ecuador plant species than any other habitat, and all species restricted to it are threatened. It is especially unfortunate that the most species-rich vegetation in Ecuador is currently the most endangered, a distinction shared with the ecologically similar trans-Andean region.

THE FLORA OF THE RIO PALENQUE SCIENCE CENTER

No biological collections were recorded from the region of the Río Palenque Science Center prior to 1960. Many biological collections from the area of Santo Domingo (e.g., Chapman collected birds, Lehmann, Sodiro, Mexia and Little collected plants, Buckley and Haensch collected Lepidoptera) are cited in biological literature. One of the main trails from the coast to Quito passed through Santo Domingo. Therefore, collectors of both animals and plants frequently visited that region.

The vascular plant flora of the Science Center is remarkably diverse for an area of its size. More than 1100 species from 123 plant families have been reported at the Science Center to date. A considerable number (175 or 15%) of the species are common, naturalized tropical "weeds" found throughout much of the cultivated lowland Neotropics (Table II). At the other extreme, a significant fraction (nearly 20%) of the species are local endemics, many of them known only from within the Science Center boundaries. Special emphasis has been given to the collection of epiphytes and understory plants of the forest and these are now fairly well known. The trees and vines remain poorly studied and many additional species may be anticipated. Approximately 7%(80) of the species included are cultivated and are not naturalized.

The proximity of the western slope of the Andes, 2 to 3 kilometers to the east, has undoubtedly contributed to the total number of species recorded for the Science Center. Some of the 107 species, which are rare at Río Palenque (Appendix III) are found commonly in the hills across the river or along the road approaching Santo Domingo, where the elevation gradually increases to 650 meters. Other species of rare occurence at Río Palenque are common near Quevedo at lower elevations (100-150 m). The occurence of some of these species at the Science Center may be due to chance introductions, and they may not form persisting populations.

Habitats

As a whole the region in which the Science Center is located probably should be classified as *tropical wet forest* (or possibly *premontane wet forest*) under the Holdridge system. Several distinctive habitats occur at the Center. These include the mature forest, cultivated orchards and pastures, second

TABLE I: SPECIES NEWLY DESCRIBED FROM RÍO PALENQUE

ACANTHACEAE

*Dicliptera dodsonii Wassh.
*Justicia ianthina Wassh.
*J. pectoralis var. ovata Wassh.
*J. riopalenquensis Wassh.
Ruellia riopalenquensis Wassh.

ARACEAE

Caladiopsis atropurpurea Madison
Caladium riopalenquensis Madison
*Philodendron cruentospathum Madison
*P. pogonocaulis Madison
*P. platypetiolatum Madison
*P. ventricosum Madison
P. senatocarpium Madison

ASCLEPIADACEAE

Fischeria aequatorialis Spellm.

ARISTOLOCHIACEAE

Aristolochia pichinchensis Pfeifer

BOMBACEAE

*Quararibea palenquiana Robyns

CAPPARIDACEAE

Capparis ecuadorica Iltis
Podandrogyne brevipedunculata Cochrane

CUCURBITACEAE

Cayaponia sessiliflora Wunderlin

FERN

Diplazium striatastrum Lellinger

GESNERIACEAE

Alloplectus dodsonii Wiehler
Columnea dodsonii Wiehler
*Dalbergaria rubriacuta Wiehler
Drymonia ecuadorensis Wiehler
D. laciniosa Wiehler
D. rhodoloma Wiehler
Gloxinia dodsonii Wiehler
Paradrymonia hypocerta Wiehler
Pentadenia ecuadorana Wiehler
P. zapotalana Wiehler

LAURACEAE

*Persea theobromifolia A. Gentry

LECYTHIDACEAE

Gustavia dodsonii Mori

LEGUMINOSAE

*Inga riopalenquensis A. Gentry

MARANTACEAE

*Calathea dodsonii Kennedy

MELASTOMACEAE

*Ossaea palenquiana Wurdack

MENISPERMACEAE

*Odontocarya perforata Barneby

MONIMIACEAE

Siparuna domatiata A. Gentry

MUSACEAE

Heliconia marmoliana Dodson & A. Gentry
*H. obscura Dodson & A. Gentry
H. nigripraefixa Dodson & A. Gentry
*H. riopalenquensis Dodson & A. Gentry

MYRSINACEAE

*Stylogyne gentryi Lundell

ORCHIDACEAE

Dichaea richii Dodson
*D. riopalenquensis Dodson & A. Gentry
Epidendrum ilense Dodson
E. mininocturnum Dodson
*E. pseudopaniculatum Dodson
E. williamsii Dodson
Masdevallia thienii Dodson
Pleurothallis congruens Luer
P. prolaticollaris Luer
P. quadriserrata Luer
Teuscheria integrilabia Dodson
Trigonidium riopalenquense Dodson

RUBIACEAE

Cephaelis gentryi Dwyer
Gonzalagunia dodsonii Dwyer

RUTACEAE

Erythrochiton giganteus Kaastra & A. Gentry

SAPINDACEAE

*Cupania riopalenquensis Dodson & A. Gentry

SAPOTACEAE

Pouteria capaciflora Pilz

SOLANACEAE

*Solanum palenquense D'Arcy

THYMELAEACEAE

Daphnopsis occulta Nevling

URTICACEAE

*Pilea riopalenquensis Dodson & A. Gentry
*P. selbyanorum Dodson & A. Gentry

VERBENACEAE

*Citharexylum gentryi Moldenke

**Known only from Río Palenque*

TABLE II: NOTES ON THE COMPOSITION, HABIT, HABITAT, DISTRIBUTION AND COLLECTION OF THE VASCULAR PLANTS OF RÍO PALENQUE

Total vascular plants included	1112
Not yet collected within Río Palenque boundaries	40
Cultivated plants	80
Newly described	62
Probably new but need further study	7
Identified as aff. or cf.	35
Identification to species lacking due to taxonomic difficulty	17
Insufficient material available for determination	29
Family identification lacking	1
Trees (woody, more than 3 m tall)	288
Shrubs	109
Vines	177
Herbs	538
Epiphytes	269
Aquatic plants	16
Tropical weeds	175
Dry season-rocky beach annuals	41
Broadly distributed species	769
Western Ecuador & adjacent Colombia	260
Known only from Río Palenque area	43
Species of rare occurence at Río Palenque	107
Ferns and fern allies	77
Gymnosperms	2
Monocots	332
Dicots	701

Collections

Years involved in collecting	6
Man/days of collecting	223
Specimens collected	2860

growth areas, the river margin, cliff faces along the river, seasonal ponds, river bed, and streams and esteros. Each of these habitats has species peculiar to it, while a few species are found in nearly all the available habitats.

1. Mature forest (Fig. 9 & 10)

The canopy of the mature forest at Río Palenque is closed and varies from 30 to 42 meters in height. The density of the canopy, with its consequent strong filtration of the light reaching the plants below, is the most important factor in the structuring of the mature forest. A clear stratification or layering effect is not obvious in the mature forest at Río Palenque, but most species are found within specific vertical zones.

a) *Emergent species.* - Most of the trees which emerge through the canopy belong to the family Moraceae, e.g. *Coussapoa eggersii*, *Ficus dugandii*, *F. obtusifolia* and *Pseudolmedia rigida* ssp. *eggersii*. *Ficus dugandii* becomes the largest tree at Río Palenque, 75 meters tall and with a diameter of 3 meters at a height of 8 meters above the ground, which is in the lowland forest below the hairpin turn in the entrance road. Other emergent species are *Persea theobromifolia*, (Lauraceae), *Pithecellobium macradenium*, (Leguminosae) and *Guarea cartaguenya*, (Meliaceae). Epiphytes are abundant on the limbs of emergent trees. They are the same species which are generally adapted to less humid conditions and are also found in the canopy trees.

b) *Canopy species.* - Fifty-nine canopy species of the mature forest at Río Palenque have been identified. Most of the species are rare to uncommon with some known only from a single individual. Some of the canopy species are:

Ceiba pentandra	Bombacaceae	*Castilla elastica*	Moraceae
Ochroma pyramidale	"	*Cecropia insignis*	"
Quararibea astrolepis	"	*Chlorophora tinctoria*	"
Q. palenquiana	"	*Clarisia biflora*	"
Drypetes standleyi	Euphorbiaceae	*C. racemosa*	"
Sapium peruvianum	"	*Coussapoa eggersii*	"
Hernandia stenura	Hernandiaceae	*Ficus dugandii*	"
Nectandra reticulata	Lauraceae	*F. tonduzii*	"
N. aff. *trianae*	"	*Maquira guianensis*	"
Ocotea cooperi	"	*Poulsenia armata*	"
O. ira	"	*Pourouma* cf. *guianensis*	"
O. sodiroana	"	*Virola reidii*	Myristicaceae
Persea theobromifolia	"	*V. sebifera*	"
Dussia lehmannii	Leguminosae	*Scheelea butyracea*	Palmae
Pithecellobium macradenium	"	*Triplaris cumingiana*	Polygonaceae
Carapa guianensis	Meliaceae	*Pouteria capaciflora*	Sapotateae
Guarea cartaguenya	"	*P. gigantea*	"
G. kunthiana	"	*Simarouba amara*	Simaroubaceae
		Celtis schippii	Ulmaceae

c) *Lianas.* - The canopy supports many large lianas such as:

Prestonia rotundifolia	Apocynaceae	*Cassia pendula*	Leguminosae
Aristolochia constricta	Aristolochiaceae	*Dioclea reflexa*	"
Fischeria aequatorialis	Asclepiadaceae	*Entada gigas*	"
Gonolobus albomarginatus	"	*Mucuna rostrata*	"
Amphilophium paniculatum	Bignoniaceae	*Marcgravia coriacea*	Marcgraviaceae
Anemopaegma chrysanthum	"	*Norantea sodiroi*	"
Arrabidaea verrucosa	"	*Piper brachypodon*	Piperaceae
Pithecoctenium crucigerum	"	*Paullinia fasciculata*	Sapindaceae
Cayaponia macrocalyx	Cucurbitaceae	*Solanum palenquense*	Solanaceae
Gurania spinulosa	"	*S. styracoides*	"
Omphalea diandra	Euphorbiaceae	*Cissus biformifolia*	Vitaceae
Plunkenetia volubilis	"		

d) *Middle story trees.* - There are at least seventy-four species of middle story trees from Río Palenque. In this treatment middle story trees are defined as those whose height ranges from 10 to 20 meters but do not grow to form part of the forest canopy. The trees become mature and produce flowers and fruit in the shade of the canopy trees. The more frequently encountered species are:

Rollinia mucosa	Annonaceae	*Cecropia obtusifolia*	Moraceae
Unonopsis magnifolia	"	*Cecropia* aff. *obtusifolia*	"
Quararibea coloradorum	Bombacaceae	*C.* aff. *peltata*	"
Q. grandifolia	"	*Ficus citrifolia*	"
Cordia alliodora	Boraginaceae	*F. maxima*	"
C. dwyeri	"	*F. macbridei*	"
C. panamensis	"	*F. peroblonga*	"
C. sericicalyx	"	*Maquira costaricana*	"
Jacaratia spinosa	Caricaceae	*Olmedia aspera*	"
Neosprucea pedicellata	Flacourtiaceae	*Sorocea sarcocarpa*	"
Chrysochlamys dependens	Guttiferae	*Dialyanthera gordoniaefolia*	Myristicaceae
Tovomita weddelliana	"	*D. otoba*	"
Ocotea cernua	Lauraceae	*Eugenia* cf. *dibrachiata*	Myrtaceae
Grias tessmannii	Lecythidaceae	*Astrocaryum standleyanum*	Palmae
Gustavia dodsonii	"	*Catoblastus velutinus*	"
Brownea disepala	Leguminosae	*Chamaedorea aff. woodsoniana*	"
Inga rhabdotocalyx	"	*Jessenia polycarpa*	"
I. ruiziana	"	*Phytelephas aequatorialis*	"
Erythrina cf. *edulis*	"	*Socratea hoppii*	"
Swartzia haughtii	"	*Wettinia quinaria*	"
Conostegia formosa	Melastomataceae	*Zanthoxylum tachuelo*	Rutaceae
Loreya umbellata	"	*Meliosma panamensis*	Sabiaceae
Guarea guidonia	Meliaceae	*Allophyllus nitidulus*	Sapindanceae
G. glabra	"	*Picramnia cooperi*	Simaroubaceae
Trichilia pallida	"	*Turpinia occidentalis*	Staphyleaceae

e) *Small Trees of the Mature Forest.* - Fifty-four species of small trees, which grow no taller than 3 to 9 meters, occur in the understory of the mature forest. The line between middle story trees and understory trees is very indistinct. The understory trees and treelets are:

Raimondia quinduensis ssp. *latifolia*	Annonaceae	*Piper stearnii*	Piperaceae
		Cephaelis gentryi	Rubiaceae
Bonafousia aff. *longituba*	Apocynaceae	*Gonzalagunia dodsonii*	"
Tabernaemontana amygdalifolia	"	*Hamelia macrantha*	"
Dendropanax umbellatus	Araliaceae	*Palicourea chimboracensis*	"
Capparis ecuadorica	Capparidaceae	*P. guianensis*	"
Tetrorchidium andinum	Euphorbiaceae	*P. stenostachya*	"
Lacistemma aggregatum	Lacistemmaceae	*Pentagonia grandiflora*	"
Bunchosia cornifolia	Malpighiaceae	*P. macrophylla*	"
Clidemia caudata	Melastomataceae	*Psychotria caerulea*	"
Conostegia centronioides	"	*Talisia setigera*	Sapindaceae
Leandra dichotoma	"	*Cestrum megalophylum*	Solanaceae
Miconia astroplocama	"	*C. racemosum*	"
Ossaea micrantha	"	*Cyphomandra hartwegii*	"
Siparuna domatiata	Monimiaceae	*Solanum arboreum*	"
S. eggersii	"	*S. macrotonum*	"
Ardisia longistaminea	Myrsinaceae	*Witheringia riparia*	"
Stylogyne gentryi	"	*Herrania balaensis*	Sterculiaceae
Guapira myrtiflora	Nyctaginaceae	*Schoenobiblus panamensis*	Thymeliaceae
Neea amplifolia	"	*Clavija eggersii*	Theophrastaceae
N. parviflora	"	*Nephelia cuspidata*	Fern
Heisteria cyanocarpa	Olacaceae	*Trichopteris trichiata*	"
Passiflora gigantifolia	Passifloraceae	*Zamia lindenii*	Cycadaceae
Piper augustum	Piperaceae	*Heliconia curtispatha*	Musaceae
P. carrilloanum	"	*H. longa*	"
P. imperiale	"	*H. nigripraefixa*	"
P. pseudonobile	"	*H. obscura*	"
P. reticulatum	"		

f) *Shrubs of the Mature Forest.* - Thirty-nine species of woody plants which grow no higher than 2.5 meters have been recorded. Some of the more frequently encountered species are:

Pachystachys riedeliana	Acanthaceae	*Trianaeopiper filistilum*	Piperaceae
Pseuderanthemum leptorachis	"	*T. garciae*	"
Razisea spicata	"	*T. mexiae*	"
Sanchesia parviflora	"	*Hoffmannia subauriculata*	Rubiaceae
Stenosolen eggersii	Apocynaceae	*H. tenuis*	"
Carica microcarpa ssp. *baccata*	Caricaceae	*H. woodsonii*	"
		Gonzalagunia sessilifolia	"
Xanthosoma sagittifolium	Araceae	*Hamelia axillaris*	"
Clidemia dentata	Melastomataceae	*Palicourea lugubris*	"
C. purpurea	"	*Psychotria alba*	"
C. radicans	"	*P. macrophylla*	"
C. septuplinervium	"	*P. micrantha*	"
Piper phytolaccaefolium	Piperaceae	*P. officinalis*	"
P. mexiae	"	*P. santa-rosae*	"
Pothomorphe peltata	"	*Cestrum* cf. *glabrum*	Solanaceae
		Lycianthus amatitlanensis	"

Photo by T. Dodson

Figure 5. Laboratory building seen from entrance road.

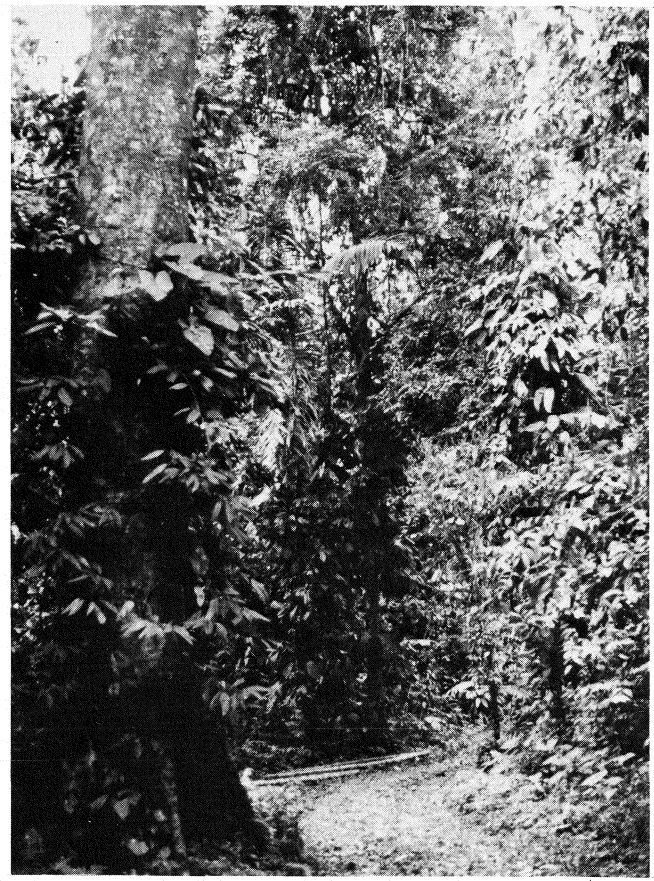

Photo by J. Sedgewick

Figure 6. Hemi-epiphytes and vines growing in reduced light on the trunks of trees in mature forest.

f) *Herbs of the Mature Forest Floor.* - About a hundred species of herbaceous plants have been collected on the forest floor at Río Palenque. Most are low plants not reaching more than a meter in height. Common species are:

Aphelandra attenuata	Acanthaceae	*Pteris altissima*	Fern
Justicia riopalenquensis	"	*Tectaria acutiloba*	"
Ruellia riopalenquensis	"	*T. nicotianifolia*	"
Urceolina grandiflora	Amaryllidaceae	*Thelypteris angustifolia*	"
Anthurium buenaventurae	Araceae	*T. dentata*	"
A. lancea	"	*T. pennata*	"
A. leoneanum	"	*T. poiteana*	"
A. leucostachyum	"	*T. torresiana*	"
A. retusum	"	*Alloplectus dodsonii*	Gesneriaceae
Caladiopsis atropurpurea	"	*A. sprucei*	"
Caladium riopalenquense	"	*Diastema eggersianum*	"
Dieffenbachia seguine	"	*D. scabrum*	"
Xanthosma daguense	"	*Gasteranthus oncogastrus*	"
Begonia semiovata	Begoniaceae	*Gloxinia dodsonii*	"
Podandrogyne brevipeduncu-lata	Capparidaceae	*Streptochaeta sodiroana*	Gramineae
		Oplismenus hirtellus	"
Campelia zanonia	Commelinaceae	*Xiphidium caeruleum*	Haemodoraceae
Dichorisandra hexandra	"	*Spigelia anthelmia*	Loganiaceae
Geognanthus rhizanthus	"	*Pavonia rosea*	Malvaceae
Sciadocephala schultzae-rhonhofiae	Compositae	*Calathea insignis*	Marantaceae
		C. inocephala	"
Asplundia cayapensis	Cyclanthaceae	*C. legrelleana*	"
A. quinindensis	"	*C. marantifolia*	"
A. vagans	"	*Ischnosiphon morlaei*	"
Carludovica palmata	"	*Triolaena barbeyana*	Melastomataceae
Cyclanthus bipartitus	"	*Erythrodes ecuadorensis*	Orchidaceae
Adiantum fructuosum	Fern	*Peperomia pellucida*	Piperaceae
A. macrophyllum	"	*P. pteroneura*	"
A. tetraphyllum	"	*Selaginella geniculata*	Selaginellaceae
Blechnum occidentale	"	*S. kunzeana*	"
Bolbitis nicotianifolia	"	*S. sylvestris*	"
Cyclopeltis semicordata	"	*Pilea selbyanorum*	Urticaceae
Danaea moritziana	"	*P. riopalenqueana*	"
Dennstaedtia cicutaria	"	*Costus geothyrsus*	Zingiberaceae
D. obtusifolia	"	*C. lima*	"
Diplazium cristatum	"	*Renealmia oligosperma*	"
Hemidictyum marginatum	"		

h) *Epiphytes.* - Two hundred and sixty-nine species of epiphytes are known from Río Palenque. The majority of these occur on the limbs and upper trunks of canopy trees; Orchidaceae is by far the best represented family among canopy epiphytes and 17 of our 19 native bromeliads are canopy plants. We have not listed the canopy epiphytes but call attention to the following:

Epiphytes adapted to the low light levels of the middle story trees are generally not found in the canopy of the forest. These include such plants as:

Anthurium dolichostachyum	Araceae	*Asplenium auriculatum*	Fern
A. interruptum	"	*A. laetum*	"
A. pallidiflorum	"	*A. pteropus*	"
A. punctatum	"	*A. serratum*	"
A. xanthostachyum	"	*Campyloneuron phyllitidis*	"
Monstera dilacerata	"	*Dicranoglossum polypodioides*	"
M. dubia	"	*Elaphoglossum herminieri*	"
M. spruceana	"	*Blakea subconnata*	Melastomataceae
Columnea dodsonii	Gesneriaceae	*Cryptarrhena lunata*	Orchidaceae
Drymonia rhodoloma	"	*Dichaea gorgonensis*	"
Guzmania hitchcockiana	Bromeliaceae	*D. richii*	"
		D. riopalenquensis	"

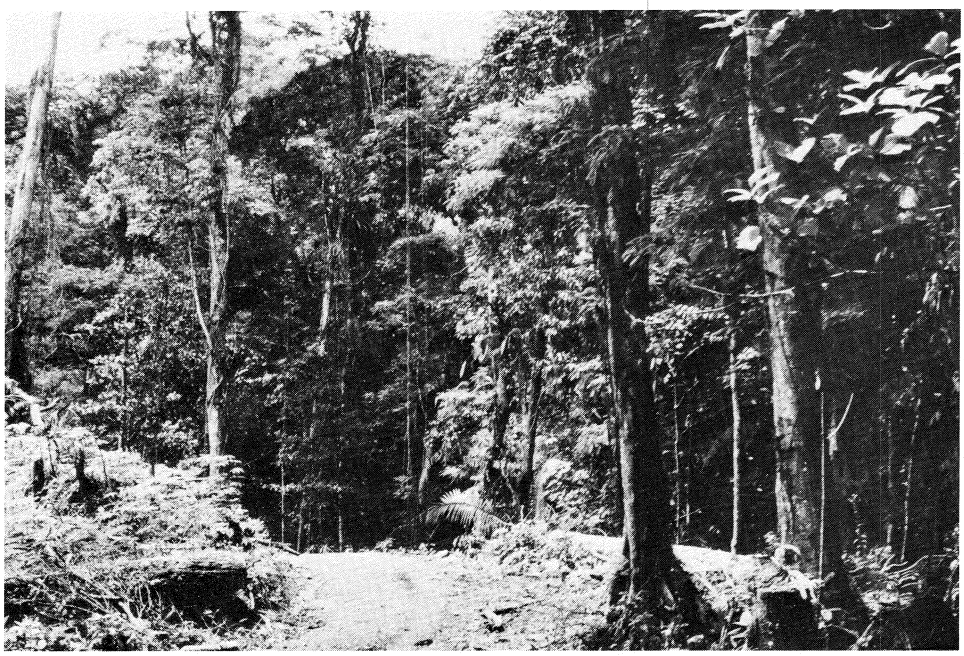

Figure 9. Mature forest.

Figure 10. The canopy of the mature forest. Epiphytes of the canopy trees are visible in the tree on the left.

Epiphytes (cont.)

Gongora quinquenervis	Orchidaceae	*Stanhopea annulata*	Orchidaceae
Macradenia brassavolae	"	*S. tricornis*	"
Pescatorea wallisii	"	*Xylobium elongatum*	"
Spiranthes cranichoides	"	*Lycianthus synanthera*	Solanaceae

Hemi-epiphytes and vines which do not grow higher than 10 meters on the trunks of trees in the mature forest are especially adapted to growing in very low light levels (Fig. 6.). Many of the species ascend the trunk of a tree to a level of 4-8 meters and then branch profusely forming a hanging shrub. Species with this habit which grow in the dark understory levels of the mature forest are:

Anthurium retusum	Araceae	*Asplundia cayapensis*	Cyclanthaceae
A. subcoerulescens	"	*A. quinindensis*	"
Heteropsis integerrima	"	*A. peruviana*	"
Philodendron acuminatissimum	"	*A. pycnantha*	"
P. cruentospathum	"	*Evodianthus funifer*	"
P. devansayeanum	"	*Anetium citrifolium*	Fern
P. inaequilaterum	"	*Campyloneurum magnificum*	"
P. karstenianum	"	*Elaphoglossum* sp. "B"	"
P. oligospermum	"	*Lomariopsis japurensis*	"
P. platypetiolatum	"	*Polybotrya osmundacea*	"
P. pogonacaulis	"	*Trichomanes collariatum*	"
P. riparium	"	*Piper brachypodon*	Piper
P. senatocarpium	"	*P. concepcionis*	"
P. sulcatum	"	*P. debilicaule*	"
P. ventricosum	"	*P. entradense*	"
P. verrucosum	"	*P. eustylum*	"
Rhodospatha latifolia	"	*P. longipilosum*	"
Syngonium reticulatum	"	*P. multiplinervium*	"
S. velozianum	"	*P. scansum*	"
Begonia glabra	Begoniaceae	*Markea ulei*	Solanaceae
Schlegelia sulfurea	Bignoniaceae		

2. Cultivated Orchards and Pasture (Fig. 11 & 12).

The largest extension of orchard, 75 hectares, consists of a palm plantation of *Elaeis guineensis*. In order to control rapid weed growth, Kudzu, *Pueraria phaseoloides* (Leguminosae), is planted as a ground cover. Even with the Kudzu, however, *Calathea legrelliana* (Marantaceae), and *Xanthosoma sagittifolium* (Araceae), persist in the shade of the palms. In open areas where large grasses *(Pennisetum purpureum* and *Panicum maximum)* have become established the Kudzu has difficulty competing. Many tropical weeds are present along the roadways, such as the entrance road, which are exposed to full sun. Some of these are:

Achyranthes aspera	Amaranthaceae	*Ipomoea ophiodes*	Convolvulaceae
Alternanthera sessilis	"	*I. trifida*	"
Cyathula achyranthoides	"	*Melothria guadalupensis*	Cucurbitaceae
Eclipta alba	Compositae	*Momordica charantia*	"
Elephantopis mollis	"	*Rytidostylis ciliata*	"
Erechtites hieracifolia	"	*Sicyos montanus*	"
Pseudelephantopus spiralis	"	*Chamaesyce hirta*	Euphorbiaceae
Schistocarpha oppositifolia	"	*Phyllanthus niruri*	"
Synedrella nodiflora	"	*P. stipulatus*	"
Wulffia baccata	"	*Adiantum macrophyllum*	Fern
Merremia umbellata	Convolvulaceae	*Dennstaedtia cicutaria*	"

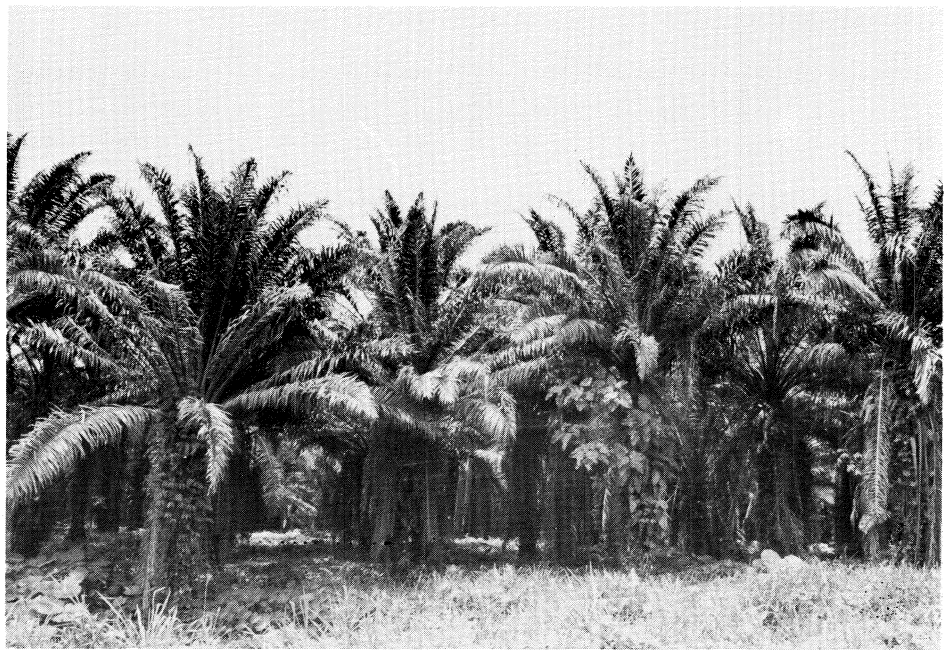

Figure 11. Cultivated African palm orchard.

Photo by J. Sedgewick

Figure 12. Pasture.

Pityrogramma calomelanos	Fern	*Desmodium adscendens*	Leguminosae
Thelypteris dentata	"	*D. axillare*	"
T. opulenta	"	*Vigna vexillata*	"
Trichopteris trichiata	"	*Cuphea carthaginensis*	Lythraceae
Cyperus diffusus	Cyperaceae	*Sida acuta*	Malvaceae
C. distans	"	*S. rhombifolia*	"
C. luzulae	"	*Urena lobata*	"
C. surinamensis	"	*Wissadula excelsior*	"
Digitaria setigera	Gramineae	*Cissampelos andromorpha*	Menispermaceae
Panicum maximum	"	*C. fasiculata*	"
P. trichoides	"	*Ludwigia octovalvis*	Onagraceae
Paspalum conjugatum	"	*Polygala paniculata*	Polygalaceae
P. paniculatum	"	*Borreria laevis*	Rubiaceae
P. virgatum	"	*Scoparia dulcis*	Scrophulariaceae
Pennisetum purpureum	"	*Browallia americana*	Solanaceae
Setaria paniculifera	"	*Solanum americanum*	"
Hyptis mutabilis	Labiatae	*Laportea aestuans*	Urticaceae
H. verticillata	"	*Urera baccifera*	"
H. obtusiflora	"	*Stachytarpheta cayennensis*	Verbenaceae

As the cultivated palms develop tall trunks, epiphytes can be expected to become established on them as has happened on neighboring farms. The most frequent epiphytes are *Nephrolepis pendula* (Fern), and various species of *Ficus* and *Coussapoa* (Moraceae).

About 5 hectares of Cacao, *Theobroma cacao*, were planted in 1970 in the lowlands along the river below the Science Center building. Much of the orchard now forms a dense canopy permitting few weeds under the trees. The persisting weeds are mostly *Xanthosoma sagittifolium*, *Sida acuta* and various species of *Calathea* and *Piper*. Other tropical fruit trees are scattered through the cacao orchard, such as: orange, tangerine and lime trees (*Citrus* spp.).

3. Second Growth Areas

The lowland area south of the pasture, Arana Island and the lowland area below Casa Dodson have extensive second growth. These areas have been intermittently cut for many years, probably even before extensive agricultural clearing began from 1958 to 1960. Clumps of "Caña" *(Bambusa guadua)* are frequent in the area. Cecropias or "Guarumos" *(Cecropia obtusifolia, C.* aff. *obtusifolia* and *C.* aff. *peltata)*, "Lulu" *(Aegiphila alba)*, "Chilco" *(Vernonia baccharoides)*, "Cordoncillos" or pipers *(Piper hispidum, P. marginatum* and *P. sancti-felicis)*, heliconias *(Heliconia curtispatha, H. longa, H. nigripraefixa*, and *H. metallica)*, calatheas or "Bijao" *(Calathea insignis, C. lutea* and *C. inocephala)*, "Sapan" *(Trema integerrima)*, Balsa *(Ochroma pyramidale)*, wild papaya *(Carica papaya)* and *Acalypha obovata* are the most frequent species. The herbaceous plants common to the mature forest are infrequent to rare in the second growth areas while weeds found also in the orchards and along roadsides are common.

Photo by J. Sedgewick

Figure 15. River Margin during the dry season.

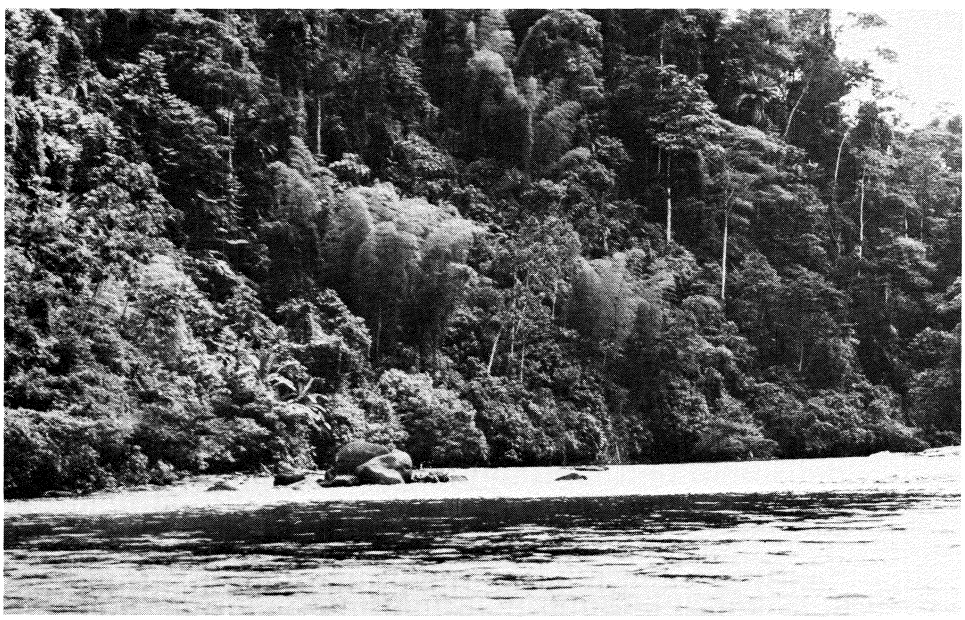

Photo by N. Williams

Figure 16. Cliff face along the river below the laboratory building.

An interesting and advanced secondary growth area occurs along trail 3, between the "staircase" and the junction with trail 4. About 5 hectares of the forest was cut in 1959, with the exception of several large trees, and planted in bananas. The project was abandoned shortly after planting. A few of the banana plants persist and produce excellent fruit. Balsa, sapan, papaya cecropias and guabas, *(Inga coruscans)*, of the Leguminosae, are the major trees with the balsas reaching 30 meters in height and 90 cm in diameter at breast height. The understory consists of dense stands of heliconias, large calatheas, *Acalypha obovata*, *A. diversifolia* (Euphorbiaceae), *Piper marginatum* and *Xanthosoma sagittifolium*. Young trees of many of the mature forest species are becoming re-established in this area. A considerable portion of the herbaceous plants found in the mature forest are also present, such as: most of the philodendrons and other aroids, ferns, cyclanths and pipers. The passage of many more years will clearly be necessary for the area to return to even a semi-mature state.

4. River Margin (Fig. 15).

The most ubiquitous tree along the river margin is *Pithecellobium longifolium*, (Leguminosae), reaching a height of 18 meters and overhanging the river. Also common is the small tree *Calliandra angustifolia* also of the Leguminosae, on the banks near the water's edge. In similar locations, in deep shade, are found *Biophytum dendroides* (Oxalidaceae), *Cuphea strigulosa* (Lythraceae), and *Ardisia romeroi* (Myrsinaceae). In the trees and creeping along the banks are many vines, but only *Monstera lechleriana* (Araceae), is restricted to this habitat.

In sunny areas along the river bank *Adenaria floribunda* and *Cuphea racemosa* of the Lythraceae, are abundant at the waters edge and are commonly inundated for part of the year. The large grass, *Hymenachne donacifolia* occurs in the same habitat with *Setaria geniculata* occuring higher up on the bank. These plants form a nearly impenetrable mass to 2 m high. The three cecropias found in second growth areas are common in such spots.

The trees of *Pithecellobium longifolium* support enormous quantities of epiphytes of considerable variety. Most of the epiphytes that are adapted to the canopy of the mature forest are also found here.

5. Seasonal Ponds

One seasonal pond, about 1 hectare in size, exists along the entrance road 700 meters from the highway. During the months from January to April it fills to a depth of 90 cm as a result of heavy rainfall. From May to June it becomes progessively dryer and does not have standing water after late July. During the dry season, a dense stand of *Sida acuta* to 1.5 m tall, often covered with the milkweed vine *Sarcostemma clausum*, blankets the area. In early January, as standing water begins to develop, the dry-season cover begins to die. When the water reaches a depth of 20 to 30 cm, usually by mid-January, incredible numbers of frogs migrate from the forest to breed in the pond. The mating calls of the 9 species which have been collected create a cacophony, even during mid-day sun. The only wet plant restricted to the pond in the rainy season is *Lemna minima*, probably introduced by the ducks, fin-foots and other aquatic birds which visit the pond.

6. Cliff Faces Along the River (Fig. 16).

Sheer cliffs occur along the river from the northern border to the generator house, a distance of about 600 meters, and from the south end of the lowland area to close to the Dodson house, a distance of about 400 meters. Only a few plants are restricted to this habitat, which is extremely dry during the dry season. The maidenhair fern, *Adiantum concinnum*, *Pitcairnia septigera* (Bromeliaceae), *Chelonanthus alatus* (Gentianaceae) and the grass *Arundinella berteroniana*, have been collected only on the cliff faces. The gesneriad *Kohleria spicata* is usually restricted to this habitat. Some plants of the mature forest are also scattered on the cliff face.

7. River Bed (Fig. 17).

During the rainy season, the river rises as much as three meters. It rushes past at speeds to 14 kilometers per hour and scours away most plants which have become established on the larger boulders and on rocky beaches which are exposed during the dry season. Only plants such as *Marathrium indifferans* (Podostemonaceae), *Paspalum standleyi* of the grasses, and *Justicia pectoralis* (Acanthaceae) are able to survive such conditions.

The plants which occur on the exposed, rocky beaches during the dry season from May to December are generally annuals, and nearly all result from germinating seed washed down from higher elevations, or brought upstream by aquatic birds. Some of the plants are also found as weeds in second growth and cultivated areas as well as along the entrance road. Plants which have been collected only on the seasonal beaches are:

Iresine celosia	Amaranthaceae	*Lindernia diffusa*	Scrophulariaceae
Blechum brownei	Acanthaceae	*Mecardonia procumbens*	"
Heliotropium rufipilum	Boraginaceae	*Torenia thouarsii*	"
Cleome pilosa	Capparidaceae	*Lycopersicon pimpinellifolium*	Solanaceae
Stellaria ovata	Caryopyllaceae	*Physalis pubescens*	"
Gnaphalium cf. *cheiranthifolium*	Compositae	*P. angulata*	"
		Solanum suaveolens	"
Ageratum conyzoides	"	*Astrephia chaerophylloides*	Valerianaceae
Salvia alvajaca	Labiatae		

8. Streams and Channels (Fig. 18).

The stream beds in the mature forest seem to have few plants restricted within them. The banks are clothed with the same plants found on the forest floor with the notable exception of *Asplundia vagans* (Cyclanthaceae) and *Triolena pustulata* (Melastomaceae), which are only found close to the stream edge.

The seasonally slow-moving back waters of the river, and the ponds in the channels (esteros) which form Arana and Avispa islands, contain plants which are not found elsewhere on the Río Palenque property. These plants are the waterlilies, (*Nymphaea ampla* and *N. blanda*), *Eichhornia crassipes* (Pontederiaceae), *Limnobium stoloniferum* (Hydrocharitaceae), and *Limnocharis flava* (Butomaceae). The seasonally dry areas between the ponds in the esteros are covered with a dense stand of *Hygrophila guianensis*, (Acanthaceae).

Photo by J. Sedgewick

Figure 17. River bed during the dry season showing the exposed rocky beaches with temporary vegetation.

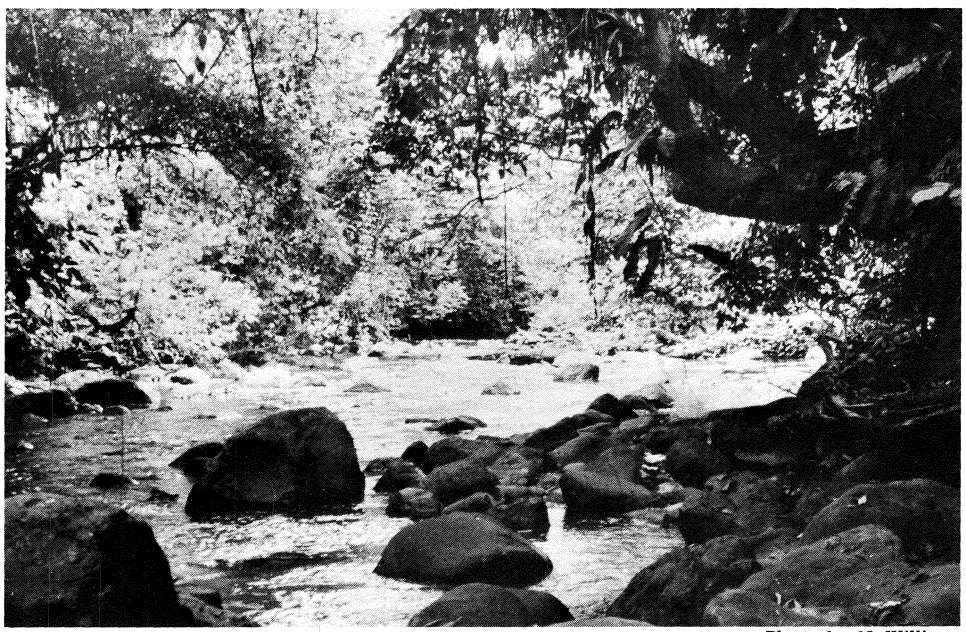

Photo by N. Williams

Figure 18. Stream bed along Arana creek.

COLLECTIONS

Nearly all the specimens cited herein were collected by the authors, about 1900 numbers by C. H. Dodson, 500 by A. H. Gentry, and 400 jointly. Special mention should be made of the ferns collected by Mrs. Jean Evoy (numbers 1-120) in 1972. Several species have not been recollected since, indicating the thoroughness of her job.

The first set of specimens is located at the Marie Selby Botanical Gardens (SEL) and the second set is at the Río Palenque Science Center (RPSC). Other sets are at the United States National Museum (US), the Missouri Botanical Garden (MO), and the Catholic University of Quito (QCA). The collection numbers of each species are listed in Appendix I.

IDENTIFICATIONS

Preliminary identification of many of the plants listed herein was provided by Dr. Richard S. Cowan and his colleagues at the Smithsonian Institution. Many of the names used here were provided or verified by authorities on specific families. These specialists and the plant groups with which they worked are listed in Appendix II. In most other groups identifications have been made or verified by A. H. Gentry, largely through comparison with the extensive Panamanian collections at the Missouri Botanical Garden. Seldom have careful comparisons been made on a large scale between the plants of South and Central America. A number of Ecuadorian species have proved to be synonymous with Central American species and vice versa.

At Río Palenque, we have encountered several instances of clearly distinct species, which have been combined by other taxonomists. For instance, there are two members of the genus *Dichorisandra* (Commelinaceae) one of which is a succulent shrub with blue flowers (*D. hexandra)* while the other is a vine several meters long with purple and white flowers (the name *D. angustifolia* is used here but may prove invalid). Floral and inflorescence details are quite distinctive and intra-specific variation is minimal. There is no question that they represent distinct species. In the herbarium considerable confusion exists concerning the species limits of *D. hexandra*, and the name has been applied to an assortment of collections showing extreme variation. Even so, at Río Palenque, there are clearly two distinct species of *Dichorisandra.* Other examples of similar species pairs for which specialists have supplied the same name are: *Maquira costaricana* and *M. guianensis* (Moraceae), *Cecropia obtusifolia* and *C.* aff. *obtusifolia*, *Tetrapteris calophylla* and *T.* cf. *crispa*, *Epiphyllum colombiense* and *E. rubrocoronatum*. When we are convinced that separate taxa exist at Río Palenque we have listed them as distinct.

In other cases, Río Palenque species appear to be distinct but only in minor details from a similar species as it occurs elsewhere. We have tended to list these cases as aff. (affinity) or cf. (refer to). Thirty-five species are listed in this manner. We feel that only through monographic studies of the groups in question will it be possible to resolve the taxonomic status of their Río Palenque representative.

In still other cases the use of cf. or aff. is due to inavailability of adequate material for satisfactory determination. For example: *Thelypteris* cf. *levyi*, *T.* cf. *tetragona* (Ferns), *Smilax* aff. *febrifuga*, *S.* cf. *spissa*, *S.* cf. *tomentosa* (Liliaceae), *Tabernaemontana* aff. *costaricensis* (Apocynaceae), *Matelea* cf. *albiflora* (Asclepiadaceae), *Gnaphalium* cf. *cheiranthifolium* (Compositae), *Clusia* cf. *rosea* (Guttiferae), *Nectandra* aff. *trianae* (Lauraceae).

We have taken the position that the primary usefulness of this work will be in facilitating identification of plants encountered at the Río Palenque Science Center. Therefore, each species has been illustrated. The illustrations emphasize those features which aid in field identification. They have been prepared from plant material collected at Río Palenque, and in those few instances where plant material from Río Palenque was unavailable, mention of the source is made in the description of the species. Consequently, even though some identifications may be incorrect, the plant material illustrated represents those plants which we have found actually to be present at Río Palenque. The majority of the illustrations were done by Wendy Zomlefer and Lisa Megahee with help from Arlee Montalvo, Mary Fallen, Sharon Boothe, Adele Getman, Felice Bartell, Bob Mack, C. A. Luer and C. H. Dodson.

ACKNOWLEDGMENTS

Publication of this work has been made possible by a grant from the William G. and Marie Selby Foundation. Support for A. H. Gentry's participation was provided by National Science Foundation Grants GB 40103 and OIP 75-18202. Gratitude is expressed to the large number of botanists who supplied identifications, read portions of the manuscript or prepared the manuscript for families of their specific interest. They are listed in Appendix II.

Specific mention is due Dr. Jerry Sedgewick for his gentle pressure and helpful suggestions for the development of the Introduction and financial support for the frontispiece. He also provided some of the habitat photographs. We thank Dr. Michael Madison for reading the entire manuscript and Drs. Carlyle Luer and Hans Wiehler for reading the first part of the manuscript.

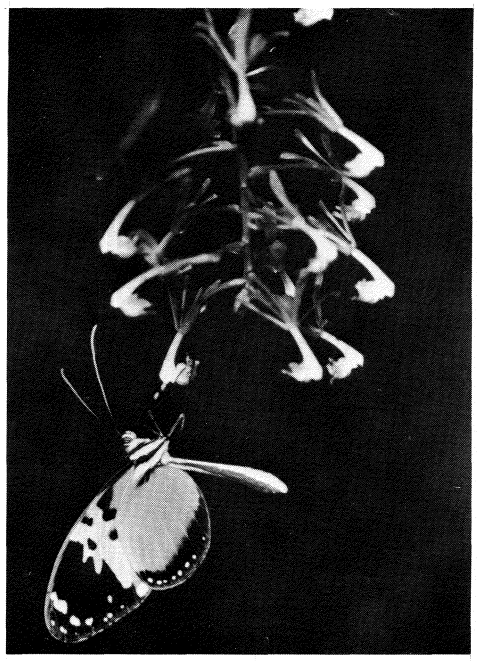

Figure 19. *Epidendrum pseudopaniculatum* Dodson being visited by one of its pollinators, *Melania idae.*

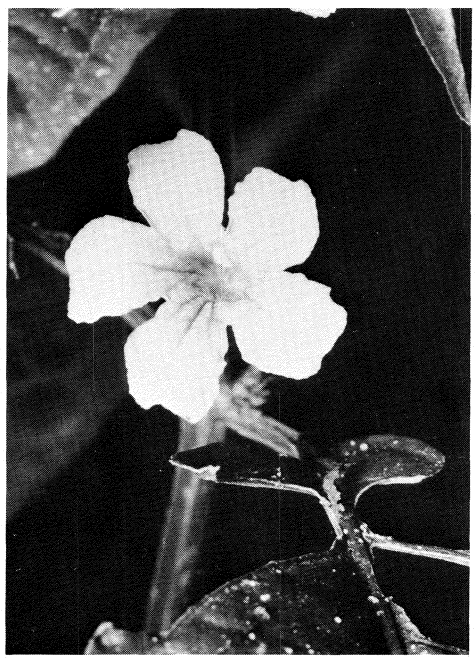

Figure 20. *Ruellia riopalenquensis* Wassh., known only from the region of the Science Center.

Figure 21. *Brassia arcuigera* Warsc., a spider mimicing orchid with one of its pollinator wasps (a spider predator) which has been captured by a real spider hiding in the flower.

Figure 22. *Dicliptera dodsonii* Wassh. Known only from a single plant found at Río Palenque.

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Los Ríos, Ecuador

We expect that the majority of persons using this treatment will not be plant taxonomists. Only botanists trained in plant classification would be expected to know a natural or phylogenetic arrangement of plant families and, in any case, there are almost as many reputedly phylogenetic systems of classification as there are phylogenists. Therefore, we have chosen to arrange the families in alphabetical order within the four major categories: PTERIDOPHYTA (Ferns and Fern Allies), GYMNOSPERMAE, MONOCOTYLEDONAE and DICOTYLEDONAE. Field biologists without extensive botanical training can generally separate plants into these categories without difficulty.

Latin names of the species found at Río Palenque precede the brief description and discussion. An illustration of each species is included and the plate number is located opposite the Latin name. Synonyms of the species which have been described from Western Ecuador are listed in italics under the Latin name. The descriptions have been kept as brief as possible. Notes on habitat, density of population and geographical distribution are included for each species. Where available, common names have been included. Those names used by long-time local residents are indicated with a plus sign (+). Other common names cited by authors, such as Little (1969) and Acosta-Solis in his various studies as being used in western Ecuador, are included but not so designated.

References to frequency are based on the following scale and apply to the Science Center only:

Very common	- more than 100 individuals per hectare
Common (Frequent)	- 20 to 100 individuals per hectare
Infrequent	- less than 20 individuals per hectare
Uncommon	- less than 1 individual per hectare
Rare	- only 1 to 3 individuals known at Río Palenque

Many plants are rare at the Science Center, yet are common nearby (see Appendix III). We have included a few plants which have not yet been found on the property, but could be expected. Most of these are plants with long-range seed dispersal mechanisms. Their status is mentioned in the descriptions.

A list of species included in this work with their collection numbers appears in Appendix I.

A list of botanists who kindly provided identifications and helped with the manuscript appears in Appendix II.

PTERIDOPHYTA

(Ferns and Fern Allies)

LYCOPODIACEAE

Epiphytic, herbaceous plants, moss-like in appearance. Stems slender with dichotomous branching. Leaves numerous, small, in close spirals. Plants homosporous; sporangia borne in axils of leaves (at Río Palenque).

Lycopodium taxifolium Sw. Plate 1-A

Plant a pendent epiphyte. Stems to 50 cm long. Leaves narrowly ovate, 4 × 0.2 cm. Sporangia in axils of distal leaves. Uncommon, in mature forest and on tree limbs overhanging river. Caribbean islands and tropical South America.

SELAGINELLACEAE

Moss-like plants. Stems abundantly dichotomously branched, tufted, creeping. Leaves arranged in spirals, with a small ligule at the base of each leaf. Plants heterosporous; sporangia borne in leaf axils; strobili formed in all species, lax or much condensed, terminal.

Key to the species.

1. Plants tree-shaped, erect, up to 40 cm tall. . . . . *Selaginella geniculata*
1. Plants not tree-shaped, prostrate or ascending, 10-30 cm long.
   2. Lateral leaves distant; roots flexible, branched, confined to the base of the plant . . . . . *Selaginella kunzeana*
   2. Lateral leaves approximate; roots stiff, unbranched, along the entire rhizome. . . . . *Selaginella silvestris*

Selaginella geniculata (Presl) Spring Plate 1-B

Terrestrial plants in deep shade. Stems erect, to 40 cm tall, from a creeping rhizome; roots branched and produced from the rhizome only. Infrequent, in mature forest. Colombia to Peru.

Selaginella kunzeana A. Braun Plate 1-C

Small moss-like plants in deep shade. Stems to 10 cm tall, from a creeping rhizome; roots much branched and produced from the basal part of the rhizome only. Infrequent, in mature forest.
Common name: "Doradilla"

Selaginella silvestris Aspl. Plate 1-D

Medium-sized plants to 30 cm tall forming dense mats. Stems creeping with long (30 cm), unbranched roots produced along the stem nearly to its apex. Uncommon, in mature forest. Mexico to Bolivia.

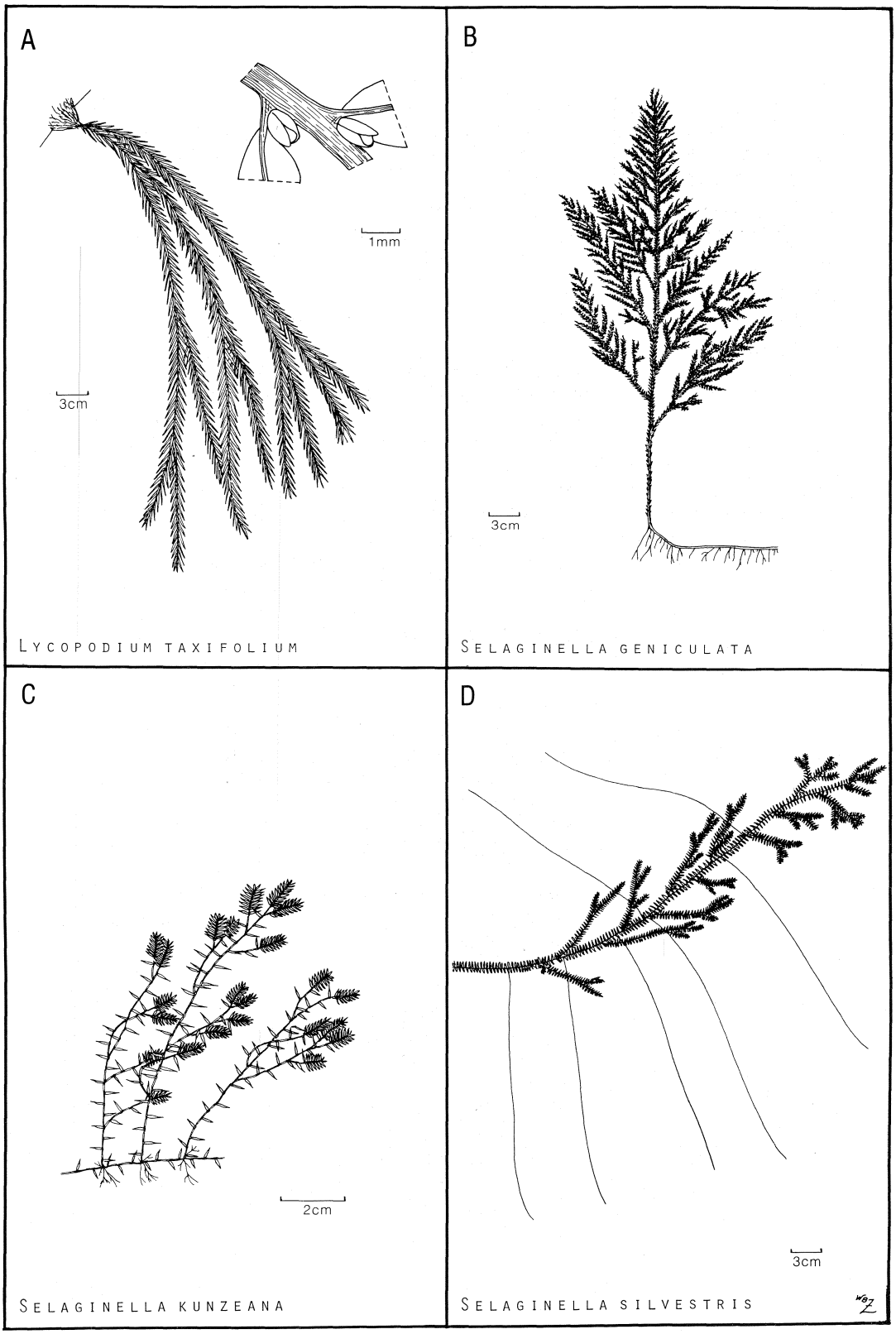
A
1mm
3cm
LYCOPODIUM TAXIFOLIUM
B
3cm
SELAGINELLA GENICULATA
C
2cm
SELAGINELLA KUNZEANA
D
3cm
SELAGINELLA SILVESTRIS

Plate 1

FERNS

Rhizomatous or basally whorled herbs, sometimes shrub- or tree-like. Leaves typically large, foliaceous, uncurling at the tips in opening, with sporangia often clustered to form sori, born marginally or on the underside, sometimes on separate fertile leaves.

No attempt has been made in this treatment to separate the ferns into families. Many of the features are technical and general agreement has not yet been reached as to subdivision of the "superfamily" Polypodiaceae.

Key to the species.

1. Plants aquatic, floating . . . . . *Ceratopteris pteridoides*
1. Plants terrestrial or epiphytic.
    2. Leaflets opposite on the leaf rachis.
        3. Rachis swollen at the junction of leaflets; rows of sporangia closely spaced . . . . . *Danaea moritziana*
        3. Rachis not swollen at the junction of leaflets; rows of sporangia widely spaced . . . . . *Hemidictyum marginatum*
    2. Leaflets alternate on the leaf rachis, or the leaf undivided.
        4. Sporangia in cupules projecting from the edge of the leaf or leaflets; leaves 1-cell thick between veins.
            5. Leaves undivided, irregularly shaped (to 4 cm long), with transverse lines . . . . . *Trichomanes membranaceum*
            5. Leaves branched to twice-pinnate, regularly shaped (8 to 40 cm long), without transverse lines.
                6. Leaves to 8 cm long. . . . . *Trichomanes krausii*
                6. Leaves to 40 cm long. . . . . *Trichomanes collariatum*
        4. Sporangia on under surface or along the margin of the leaf or leaflet, evenly spread or gathered into variously formed clusters (sori); leaves several cells thick between veins.
            7. Leaves simple, undivided into discrete leaflets.
                8. Leaf margin serrate.
                    9. Sporangia in rows parallel with the nerves of the leaves; leaf margin finely serrate . . . . . *Asplenium serratum*
                    9. Sporangia in round clusters; leaf margin broadly serrate . . . . . *Thelypteris francoana*
                8. Leaf margin entire.
                    10. Leaves at least 25 times longer than wide. (Some specimens of *Campyloneurum angustifolium* may have leaves less than 25 times longer than wide).
                        11. Sporangia evenly dispersed over the under surface of special fertile leaves. . . . . *Elaphoglossum herminieri*
                        11. Sporangia under rolled-up margins of the leaf, or in separate clusters.
                            12. Sporangia in separate clusters . . . . . *Campyloneurum angustifolium*
                            12. Sporangia under rolled-under margins of the leaf.

13. Leaves to 1 cm wide, 40 cm long; rhizome creeping . . . . . *Antrophyum lineatum*
13. Leaves to 5 mm wide, 60 cm long; rhizome short with leaves clustered . . . . . *Vittaria gardneriana*

10. Leaves not more than 12 times longer than broad.
14. Fertile leaves of an obviously different form than the sterile leaves; sterile leaves to 2 cm long. . . . . *Polypodium ciliatum*
14. Fertile leaves (if distinct) similar in form to the sterile leaves; sterile leaves more than 10 cm long.
15. Sporangia evenly dispersed over the entire under surface of the fertile leaf.
16. Rhizome short (to 5 mm between leaves); leaf leathery . . . . . *Elaphoglossum* sp. (5445)
16. Rhizome elongate (to 2 cm between leaves); leaf papery. . . . . *Elaphoglossum* sp. (5795)
15. Sporangia in round or elongate clusters, or in tiny pockets distributed along the veins.
17. Sporangia in tiny pockets along the veins distributed over the entire underside of the leaves. . . . . *Anetium citrifolium*
17. Sporangia in round or elongate clusters in 1 or several rows on the underside of the leaves.
18. Sporangia in elongate clusters along the veins . . . . *Thelypteris gigantea*
18. Sporangia in round clusters.
19. Sori in 1 row on each side of the midrib . . . . . *Polypodium percussum*
19. Sori in several clusters between each pair of lateral veins on each side of the midrib.
20. Rhizome elongate, resulting in a vine-like plant habit. . . . . *Campyloneurum serpentinum*
20. Rhizome short, resulting in a clustered, "bird-nest," plant habit. . . . . *Campyloneurum phyllitidis*

7. Leaves compound, divided into leaflets, or dichotomously forked.
21. Leaves dichotomously forked . . . . . *Dicranoglossum polypodioides*
21. Leaves divided into leaflets.
22. Sporangia forming a solid line along each side of the mid-vein of each leaflet . . . . . *Blechnum occidentale*
22. Sporangia evenly distributed on the under surface of a leaflet, in discrete patches, or along the margin of a leaflet.
23. Sporangia arranged along the margin of the leaflet.

24. Leaves to 70 cm long.
    25. Leaves twice-pinnate.
        26. Secondary divisions of the rachis 4-8, thick; leaflets rectangular, strongly oblique.
            27. Leaflets to 1.5 cm long . . . . . *Adiantum fructuosum*
            27. Leaflets more than 2.0 cm long.
                28. Leaflets to 2.5 × 0.8 cm . . . . *Adiantum tetraphyllum*
                28. Leaflets to 4 × 2 cm . . . . . *Adiantum latifolium*
        26. Secondary divisions of the rachis 10-50, fine; leaflets ovate, only some individuals oblique . . . . . *Adiantum concinnum*
    25. Leaves once-pinnate.
        29. Leaflets to 7 cm long, usually not overlapping.
            30. Leaflets to 3 cm long, 1 cm wide, margins serrate . . . . . *Adiantum petiolatum*
            30. Leaflets to 7 cm long, 3.5 cm wide, margins entire . . . . . *Adiantum macrophyllum*
        29. Leaflets to 1 cm long, 5 mm wide, densely arranged on the petiole so as to overlap the next leaflet. *Lindsaea* sp. (5353A)
24. Leaves to 2 m long.
    31. Leaflets entire to minutely serrate at the apex . . . . . *Saccoloma elegans*
    31. Leaflets deeply lobed.
        32. Lobes of the leaflets acute to acuminate . . . . . *Pteris altissima*
        32. Lobes of the leaflets blunt. . . . . *Lonchitis hirsuta*

23. Sporangia distributed evenly or in patches over the underside of the leaf.
    33. Undersides of the leaflets silver or white . . *Pityrogramma calomelanos*
    33. Undersides of the leaflets green or brown.
        34. Sporangia evenly dispersed on the undersides of special fertile leaves.
            35. Plants epiphytic; veins of the leaflets free, at a 90° angle to the mid-vein, 1 mm apart . . . . . *Lomariopsis japurensis*
            35. Plants terrestrial; veins of the leaflets reticulate, at 45-60° angle from the mid-vein, 0.7-1.0 cm apart. . . . . *Bolbitis nicotianifolia*
        34. Sporangia in discrete sori.
            36. Sporangia in elongate patches.
                37. Sporangia arranged in transverse rows, ladder-like between parallel nerves throughout the undersurface of the leaflet . . . . . *Thelypteris angustifolia*
                37. Sporangia in elongate rows along the nerves.
                    38. Leaflets very large (to 30 × 12 cm); nerves generally unbranched, parallel, at a 70° angle from the mid-vein . . . . . *Hemidictyum marginatum*
                    38. Leaflets small to medium (to 15 × 5 cm); nerves branched, at a 30°-40° angle from the mid-vein.
                        39. Leaflets obliquely rectangular, blunt at the apex . . . . . *Didymochlaena truncatula*
                        39. Leaflets acute at the apex.

40. Leaflets essentially of the same length, or shorter at both the base and apex of the leaf.
    41. Leaflets to 8 × 1.5 cm, margin subentire. . . . . *Asplenium juglandifolium*
    41. Leaflets to 4.5 × 1 cm, margin serrate to crenate.
        42. Blade of leaflet about equal on each side of the mid-vein at the base (though oblique) . . . . *Asplenium auriculatum*
        42. Blade of leaflet unequal, tapered abruptly toward base on the lower side; strongly developed on the upper side (dimidiate).
            43. Leaves to 30 cm long, 4.5 cm wide; leaflets 2 × 1 cm . . . . . *Asplenium pteropus*
            43. Leaves to 30 cm long, 8 cm wide; leaflets 4.5 × 1 cm . . . . . *Asplenium laetum*
40. Basal leaflets much longer than the apical leaflets.
    44. Leaves sub-tripinnate, division not quite reaching the mid-nerve . . . . . *Diplazium* cf. *taulahuae*
    44. Leaves pinnate, sometimes deeply pinnatifid.
        45. Margins of the leaflets subentire.
            46. Leaves to 40 cm long; leaflets 7 × 2.5 cm, obscurely erose . . . . . *Diplazium eggersii*
            46. Leaves to 1.40 m long; leaflets 15 × 5 cm, minutely crenulate . . . . . *Diplazium fraseri*
        45. Margins of the leaflets deeply dentate to subpinnatifid.
            47. Sori arranged along the primary vein of each leaflet toward base of the leaf so that not more than 1 sorus occurs for each division of the leaflet . . . . . *Diplazium cristatum*
            47. Sori arranged along the secondary veins of each leaflet throughout the leaf so that many sori occur for each division of the leaflet. . . . *Diplazium striatastrum*

36. Sporangia in round or semi-circular sori.
    48. Leaves once-pinnate.
        49. Leaves long and narrow, to 3 m long, less than 8 cm wide; sori semi-circular.
            50. Leaves pendent, to 3 m × 8 cm. . . . . *Nephrolepis pendula*
            50. Leaves erect to curved, to 80 × 5 cm . . . . . *Nephrolepis pectinata*
        49. Leaves elliptic or triangular, to 1 m long, more than 10 cm wide; sori round.
            51. Leaflets to 30 cm long by 10 cm wide, the tertiary veins connected to secondary veins, ladder-like; margins of the leaflets entire; leaves to 2 m long, petiole 1 m long. . . . . *Campyloneurum magnificum*
            51. Leaflets to 30 cm long but less than 5 cm wide, the tertiary veins branched, not ladder-like between the secondary veins; margins of the leaflets entire to deeply dentate; leaves to 1 m long, petiole to 50 cm long.
                52. Overall leaf elliptic to narrowly ovate in outline; basal leaflets regularly lobed or entire.

52. Overall leaf elliptic to narrowly ovate in outline; basal leaflets regularly lobed or entire.
    53. Margins of the leaflets entire.
        54. Bases of the leaflets slightly interconnected, the leaflets sub-opposite; petiole base glabrous . . . . . *Polypodium maritimum*
        54. Bases of the leaflets free; the leaflets clearly alternate; petiole base densely long-scaly . . . . . *Cyclopeltis semicordata*
    53. Margins of the leaflets dentate, at least at the apex.
        55. Leaflets entire except at the apex where the margins are dentate . . . . . *Stigmatopteris opaca*
        55. Leaflets dentate to deeply lobed.
            56. Lobes of the leaflets widely separated, cut to at least half of the distance from the margin to the mid-vein.
                57. Bases of the leaflets overlapping the rachis of the leaf . . . . . *Thelypteris resinifera*
                57. Bases of the leaflets not overlapping the rachis of the leaf.
                    58. Apex of the lobes of the leaflets serrate . . . . . *Stigmatopteris* sp. (41, 110)
                    58. Apex of the lobes of the leaflets entire.
                        59. Sori mostly restricted to the leaflet lobes; yellow glands along veins . . . . . *Thelypteris opulenta*
                        59. Sori throughout the leaflet next to the mid-vein; yellow glands absent . . . . . *Thelypteris dentata*
            56. Lobes of the leaflets closely appressed to overlapping, cut to less than one fourth of the distance from the margin to the mid-vein.
                60. Basal leaflets to 8 cm long by 2.5 cm wide.
                    61. Apex of the leaflet divisions acute. . . . . *Thelypteris levyi*
                    61. Apex of the leaflet divisions obtuse to truncate . . . . . *Thelypteris* cf. *tetragona*
                60. Basal leaflets to 25 cm long by 8 cm wide.
                    62. Incisions of the lobes of the basal leaflets to 1 cm deep; basal portion of the leaflet truncate. . . . . *Thelypteris pennata*
                    62. Incisions of the lobes of the basal leaflets to 3 mm deep; basal portion of the leaflet acutely tapered.
                        63. Rachis terminated by a free leaflet . . . . . *Thelypteris poiteana*
                        63. Rachis terminated by a leaflet triangular in outline, deeply lobed toward the base . . . . . *Stigmatopteris alleoptera*
52. Overall leaf triangular in outline; basal leaflets irregularly lobed.
    64. Basal lobes not cut to the rachis . . . . . *Tectaria nicotianifolia*
    64. Basal lobes cut to the rachis.
        65. Margins of the lobes irregularly undulate-serrate, some portions of the margin of the leaflet nearly entire.
            66. Basal leaflets deeply lobed at least once . . . . . *Tectaria incisa*
            66. Basal leaflets not lobed . . . . . *Tectaria antioquiana*

65. Margins of the lobes of the leaflets more or less regularly and deeply crenate or incised . . . . . *Tectaria acutiloba*

48. Leaves bi- or tripinnate.
67. Plants tree-like; petioles spiny.
68. Lobes of the leaflets serrate; sporangia in open clusters. . . . . *Trichopteris trichiata*
68. Lobes of the leaflets entire; sporangia in spherical, dehiscing packets . . . . . *Nephelea cuspidata*
67. Plants with creeping rhizomes or short stems; petioles not spiny.
69. Apex of the leaflets or divisions of the leaflets very blunt and rounded on all leaves.
70. Sori in indentations of the leaflet margin.
71. Individual leaflets to 1.5 cm long by 1 cm wide, obtuse to truncate at the apex . . . . . *Dennstaedtia obtusifolia*
71. Individual leaflets to 1 cm long by 5 mm wide, acute at the apex . . . . . *Dennstaedtia cicutaria*
70. Sori distributed along the undersurface of the leaflet . . . . . *Ctenitis subincisa*
69. Apex of the leaflets or divisions of the leaflets sharply pointed (acute) on sterile leaves.
72. Bases of the lower primary divisions sessile against the leaf rachis; terrestrial . . . . . *Thelypteris torresiana*
72. Bases of the lower primary divisions short-petiolate, not sessile; epiphytic vines with brown, woolly rhizomes.
73. Leaflets glossy, hard, light green; sori with a peltate cover . . . . . *Maxonia apiifolia*
73. Leaflets dull, soft, dark green; sori naked . . . . . *Polybotrya osmundacea*

Adiantum concinnum H. & B. ex Willd. Plate 2-A

Terrestrial. Rhizome very short. Petiole to 20 cm long; leaves to 70 cm long, bi-to tripinnate, the rachis black; leaflets ovate, often oblique, lobed toward the apex, to 2 × 1.5 cm, turning yellow with age. Sori at the tip of the lobes under rolled-under margins, in 3-11 semi-round units. Uncommon, on steep cliffs along the river bank. Widespread in tropical America.
Common name: "Culantrillo"

Adiantum fructuosum Spreng. Plate 2-B

Terrestrial. Leaves clustered on a short rhizome. Petiole to 50 cm long; leaves to 75 cm long, bipinnate; leaflets rectangular, oblique, attached at the lower corner, to 1.5 × 0.8 cm. Sori under the rolled-under margin, interrupted to form 5 curved, kidney-shaped units. Uncommon, on floor of mature forest. Costa Rica and Greater Antilles to Brazil.

Adiantum latifolium Lam. Plate 2-C

Terrestrial. Rhizome creeping, pubescent. Petiole to 30 cm long, black; leaves to 50 cm long, bipinnate; leaflets unequal in shape, elliptic, acute at the apex, oblique, to 5 × 2 cm. Sori under the rolled-under margin, interrupted to form several kidney-shaped units. Uncommon, in deep shade on stream banks in mature forest. Antilles, Central America, and northern South America.

Adiantum macrophyllum Sw. Plate 2-D

Terrestrial. Leaves clustered on a short rhizome. Petiole to 60 cm long; leaves to 90 cm long, once pinnate, the rachis black; leaflets triangular, oblique, to 6 × 3.5 cm, bright pink turning green with age. Sori unbroken, forming a complete rolled-under margin. Infrequent, in deep shade in mature forest. Widespread in tropical America.

Adiantum petiolatum Desv. Plate 3-A

Terrestrial. Leaves clustered on a short, creeping rhizome. Petiole to 15 cm long; leaves to 40 cm long, once pinnate, the rachis black; leaflets unequal in shape, narrowly ovate, acute at the apex, undersides bluish, to 4 × 1.5 cm. Sori under the rolled-under margin, interrupted to form several kidney-shaped units, each to 5 mm long. Locally infrequent, on river banks in deep shade. Widespread in tropical America.

Adiantum tetraphyllum H. & B. ex Willd. Plate 3-B

Terrestrial. Leaves clustered on a short rhizome. Petiole to 30 cm long; leaves to 50 cm long, bipinnate; leaflets more or less oblong, unequal in shape, oblique, to 2.5 × 0.8 cm. Sori under the rolled-under margin. Uncommon, in deep shade in mature forest. Tropical West Africa and widely distributed in tropical America.

Anetium citrifolium (L.) Splitg. Plate 3-C

Epiphytic. Rhizome elongate, with pendent leaves to 5 cm apart. Leaves simple, entire, oblong, obtuse, petiolate, fleshy, to 30 × 6 cm. Spore clusters widely scattered in tiny pockets along the veins on the underside of the leaves. Uncommon, low on tree trunks in mature forest. Widespread in tropical America.

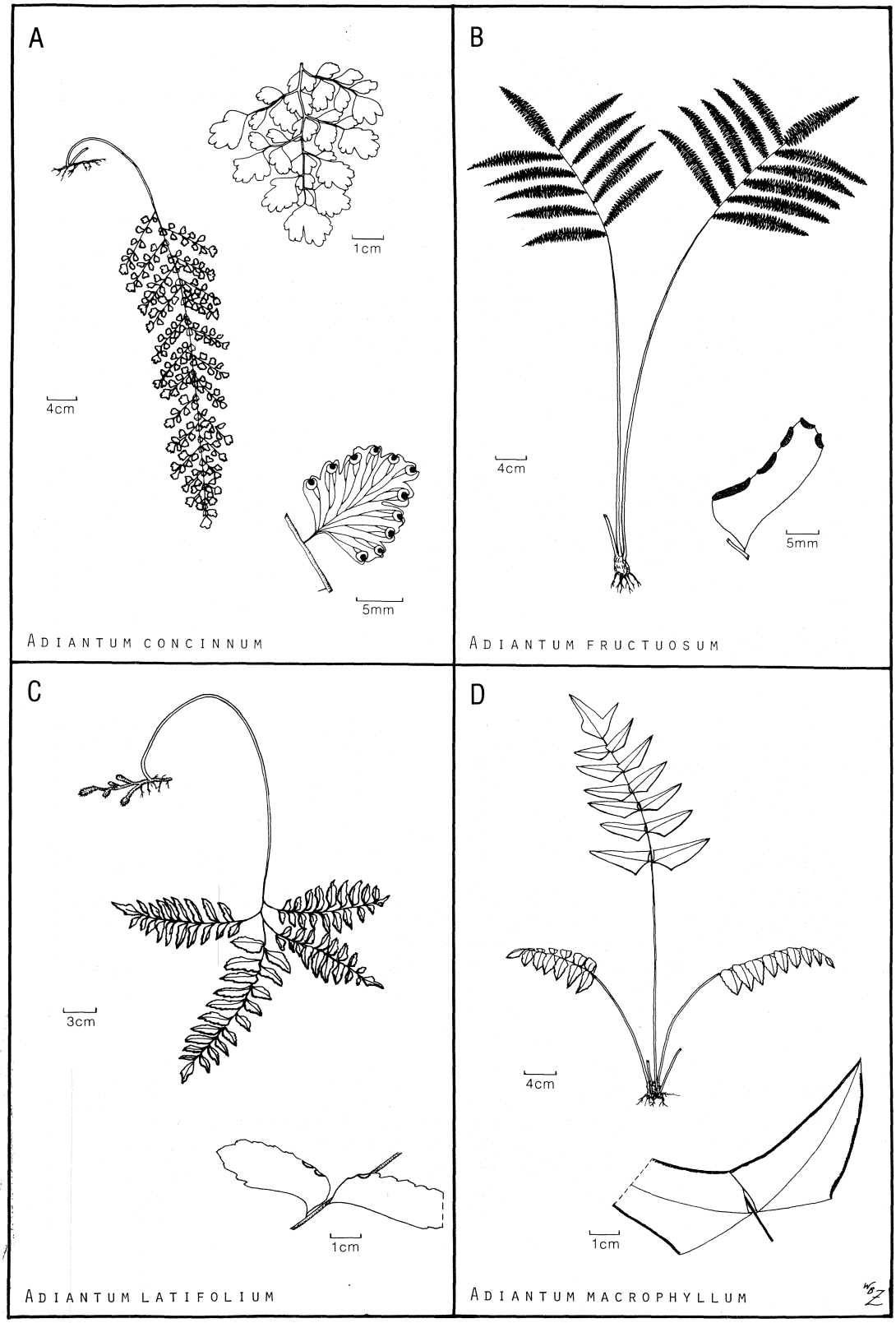
A
1cm
4cm
5mm
ADIANTUM CONCINNUM
B
4cm
5mm
ADIANTUM FRUCTUOSUM
C
3cm
1cm
ADIANTUM LATIFOLIUM
D
4cm
1cm
ADIANTUM MACROPHYLLUM

Plate 2

Antrophyum lineatum (Sw.) Kaulf. Plate 3-D

Epiphytic on tree trunks. Rhizome creeping, with pendent leaves to 1 cm apart. Leaves simple, entire, narrowly linear, acute, to 40 × 1.5 cm. Sori in rolled-up margin. Uncommon, in mature forest. Widespread in tropical America.

Asplenium auriculatum Sw. Plate 4-A

Epiphytic. Rhizome short, creeping. Petiole to 3 cm long; leaves to 15 cm long, once-pinnate; leaflets ovate, oblique, acute, to 2 × 1 cm, the margins shallowly dentate. Sori elongate, to 5 mm long, arranged along the secondary nerves. Uncommon, in shade on branches of middle story trees or lianas in mature forest. Widespread in tropical America.

Asplenium juglandifolium Lam. Plate 4-B

Epiphytic. Rhizome short. Petiole to 10 cm long; leaves to 35 cm long, once-pinnate; leaflets narrowly ovate, oblique, acute, the margins entire, 6 × 1.5 cm. Sori elongate, arranged along the secondary nerves near the margin. Rare, in mature forest. Widespread in tropical America.

Asplenium laetum Sw. Plate 4-C

Epiphytic. Rhizome short. Leaves to 45 cm long, once-pinnate, the petiole about 15 cm long; leaflets unequal in shape, oblique, acute, to 4.5 × 1.3 cm, shallowly crenulate on the margin. Sori elongate, to 7 mm long, arranged along the secondary nerves. Uncommon, in shade in mature forest. Widespread in tropical America.

Asplenium pteropus Kaulf. Plate 4-D

Epiphytic or terrestrial on creek banks. Rhizome short, creeping. Petiole to 3 cm long; leaves to 30 cm long, once-pinnate; leaflets ovate, unequal, acute, the base oblique, the margins shallowly crenulate, 2.5 × 0.8 cm. Sori elongate, to 3 mm, arranged along the secondary nerves. Uncommon, in mature forest. Widespread in tropical America.

Asplenium serratum Sw. Plate 5-A

Epiphytic. Rhizome mostly creeping. Leaves narrowly obovate, to 60 cm long, 8 cm wide, simple, the margin obscurely serrate. Spore clusters elongate, to 3 cm long, arranged chevron-like from the midrib outward along the secondary nerves. Common, on tree trunks in mature forest. Africa and tropical America.

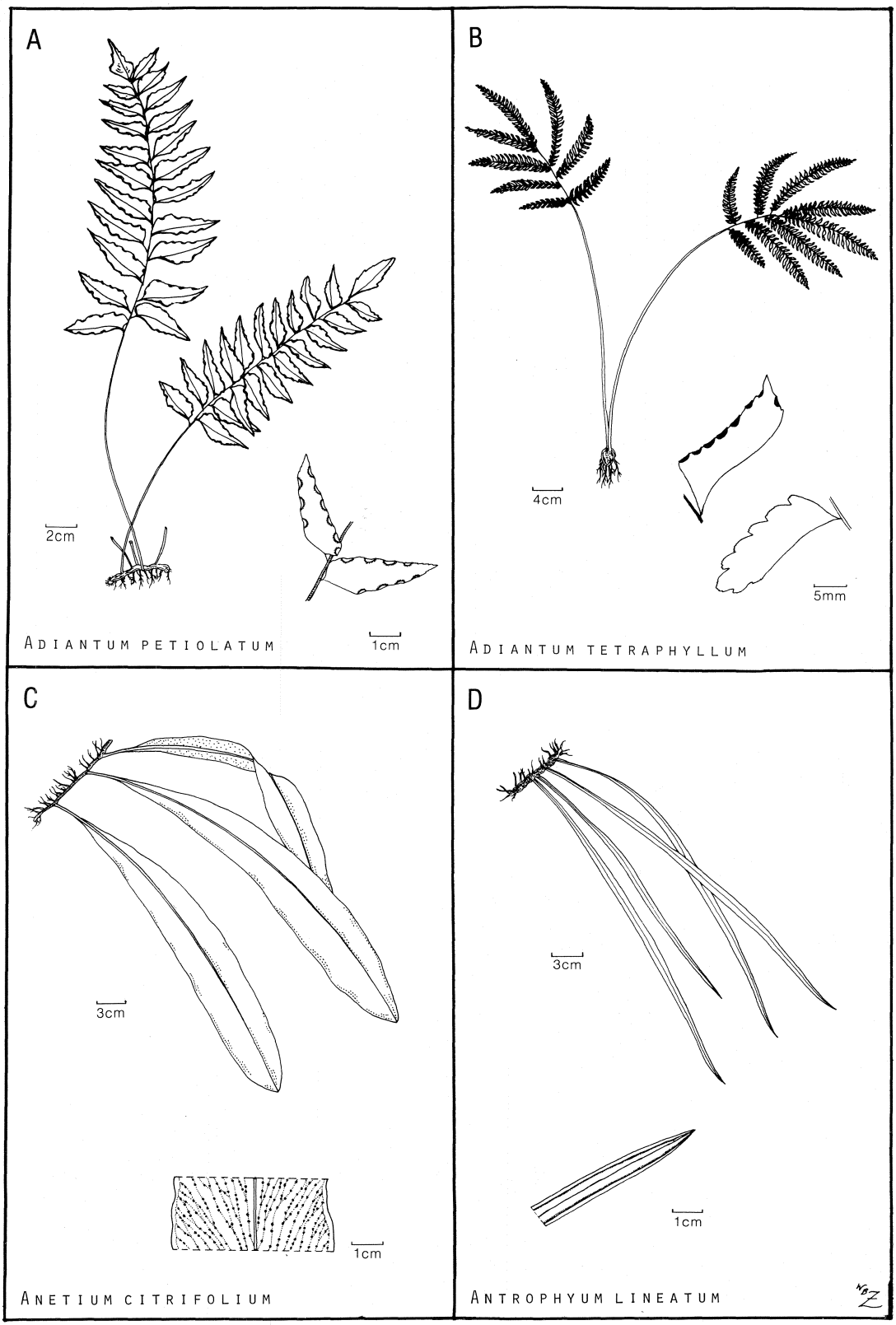
A
2cm
1cm
ADIANTUM PETIOLATUM
B
4cm
5mm
ADIANTUM TETRAPHYLLUM
C
3cm
1cm
ANETIUM CITRIFOLIUM
D
3cm
1cm
ANTROPHYUM LINEATUM

Plate 3

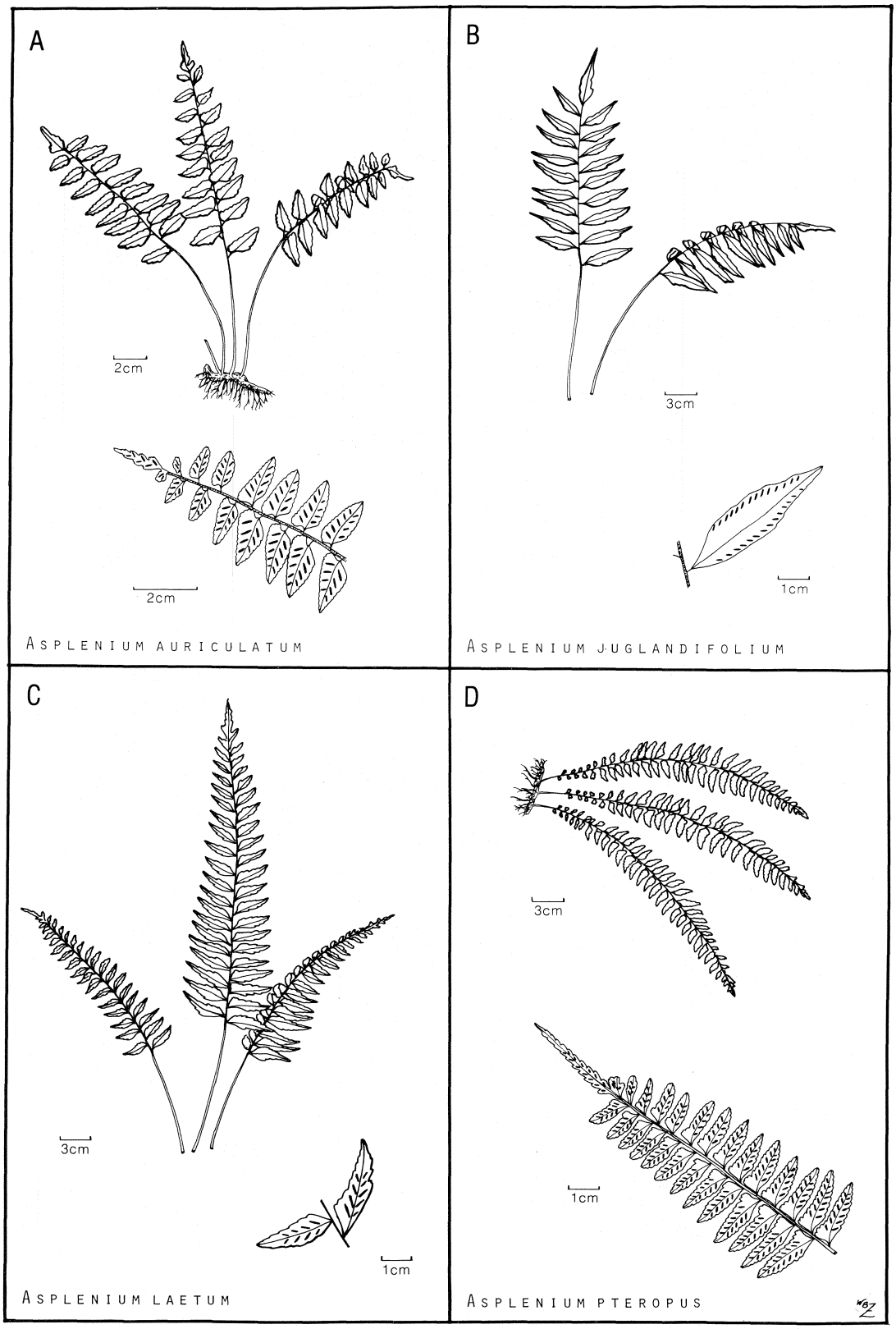
A
2cm
2cm
ASPLENIUM AURICULATUM
B
3cm
1cm
ASPLENIUM JUGLANDIFOLIUM
C
3cm
1cm
ASPLENIUM LAETUM
D
3cm
1cm
ASPLENIUM PTEROPUS

Plate 4

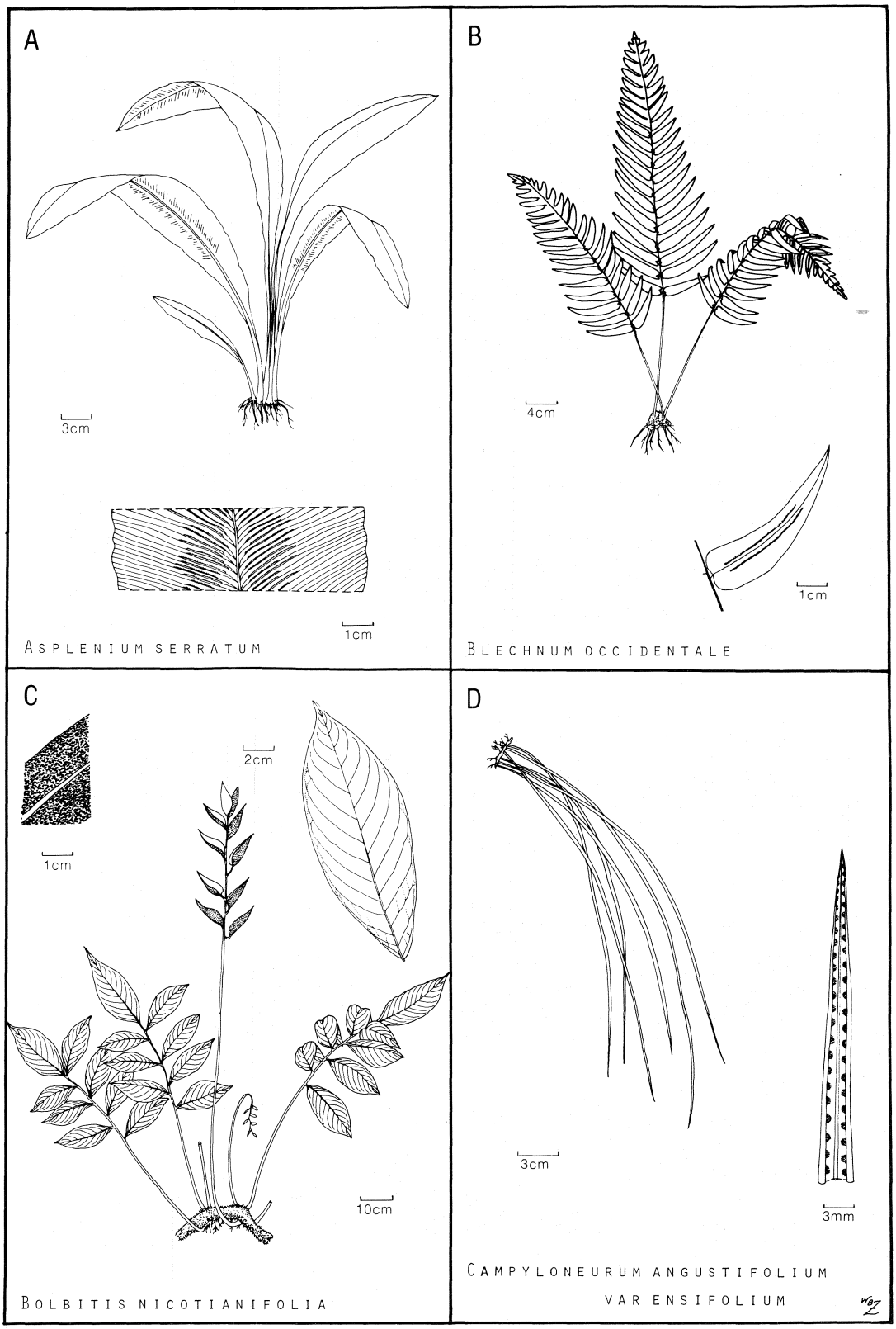
A
3cm
1cm
ASPLENIUM SERRATUM
B
4cm
1cm
BLECHNUM OCCIDENTALE
C
2cm
1cm
10cm
BOLBITIS NICOTIANIFOLIA
D
3cm
3mm
CAMPYLONEURUM ANGUSTIFOLIUM
VAR ENSIFOLIUM

Plate 5

Blechnum occidentale L. var. **occidentale** Plate 5-B

Terrestrial. Rhizome short. Leaves to 45 cm long, once-pinnate, the rachis red-brown, the young leaves pink; leaflets entire, narrowly elliptic, acute, curved upward, 8 × 2 cm. Sori arranged in a narrow strip on each side of the mid-vein from near the base to near the apex. Infrequent, along creeks. Widely distributed in tropical America.

Bolbitis nicotianifolia (Sw.) Ching Plate 5-C

Terrestrial. Rhizome creeping, short. Leaves of two kinds; sterile leaves to 50 cm long, once-pinnate, ovate in outline; leaflets entire, elliptic, subacute 15 × 6 cm; fertile leaves to 90 cm long, the leaflets ovate, acute, 9 × 2 cm. Sporangia evenly distributed on the under surface of the fertile leaflets. Uncommon, in mature forest. Jamaica, Lesser Antilles, Colombia and Ecuador.

Campyloneurum angustifolium (Sw.) Presl var. **ensifolium** (Hicken) Farw. Plate 5-D

Epiphytic. Rhizome shortly creeping. Leaves simple, entire, very narrowly linear, acute, pendent, 50 × 0.5 cm. Sori round, in a single row on each side of the midrib. Uncommon, in tree tops in mature forest and on calabash trees near river. Mexico to Ecuador.

Campyloneurum magnificum Moore Plate 6-A

Epiphytic. Rhizome creeping. Petiole to 1 m long; leaves once-pinnate, to 2 m tall; leaflets entire, elliptic, apiculate, 30 × 10 cm, the tertiary nerves connected to the secondary nerves, ladder-like. Sori round, in single rows between each set of tertiary nerves. Uncommon, low on tree trunks in mature forest. Venezuela to Bolivia.

Campyloneurum phyllitidis (L.) Presl Plate 6-B

Epiphytic. Rhizome short. Leaf linear, acute, simple, entire or undulate, to 1 m long by 13 cm wide. Sori round, dispersed evenly on the undersurface of the leaf between the secondary nerves. Common, in middle story trees of mature forest. Widely distributed in tropical America and Africa.

Campyloneurum serpentinum (Christ) Ching Plate 6-C

Epiphytic. Rhizome elongate, creeping, to 3 cm between leaves. Leaf linear, simple, undulate, to 40 cm long by 4 cm wide. Sori round, dispersed evenly on the undersurface of the leaf between the secondary nerves. Uncommon, in middle story trees of mature forest. Mexico to Peru.

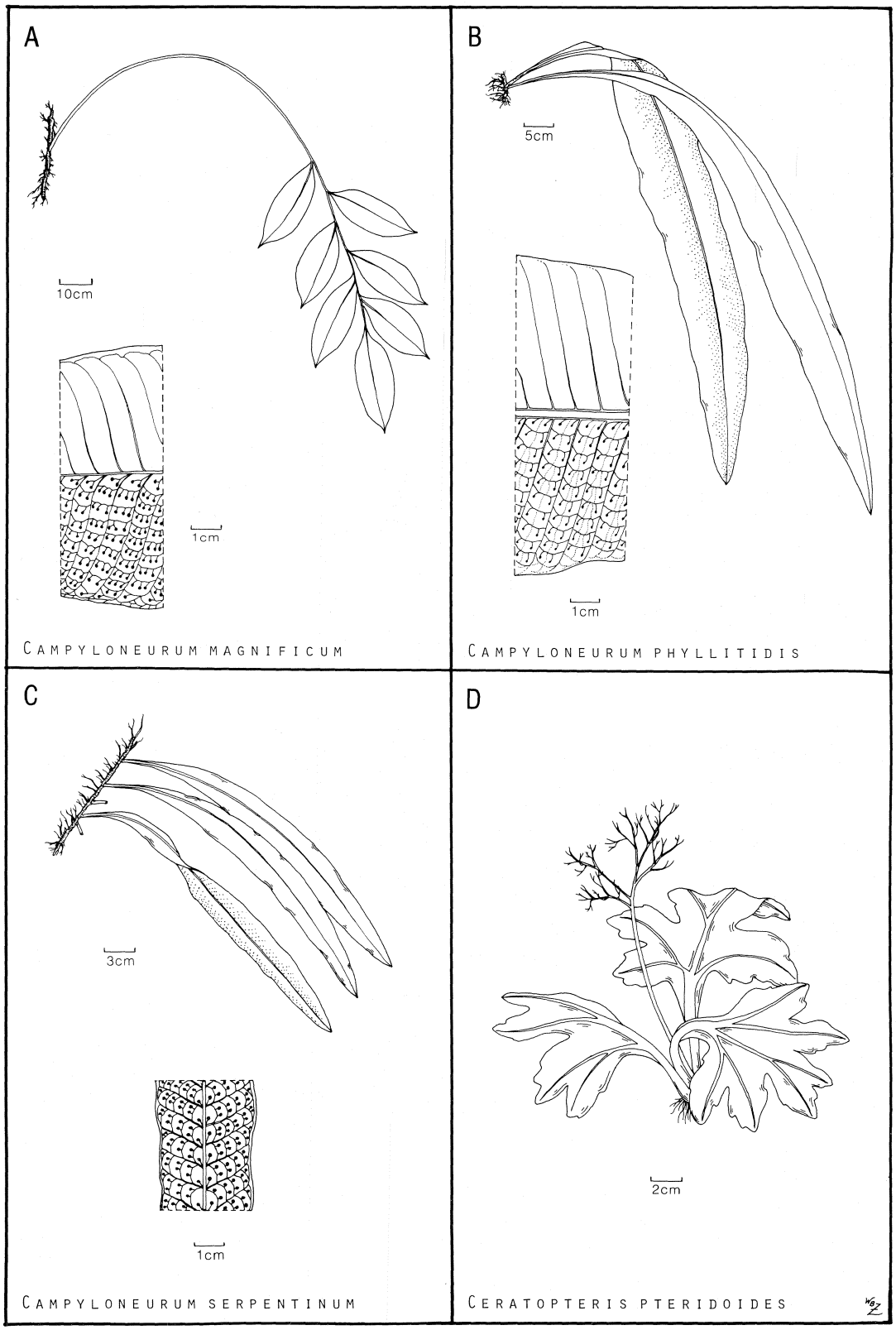
A
10cm
1cm
CAMPYLONEURUM MAGNIFICUM
B
5cm
1cm
CAMPYLONEURUM PHYLLITIDIS
C
3cm
1cm
CAMPYLONEURUM SERPENTINUM
D
2cm
CERATOPTERIS PTERIDOIDES

Plate 6

Ceratopteris pteridoides (Hook.) Hieron. Plate 6-D

Aquatic, floating. Rhizome short. Sterile leaves simple or lobed, to 15 cm long by 10 cm wide; fertile leaves to 15 cm long, much branched, the branches slender. Local and uncommon, in swampy areas near rivers. Florida through the Caribbean islands to Argentina.

Ctenitis subincisa (Willd.) Ching Plate 7-A

Terrestrial. Petiole to 60 cm; leaf to 1 m long, the base with thick brown hairs to 2 cm long, tripinnate, the leaflet divisions blunt. Sori round, dispersed in 2 rows on each leaflet. Uncommon, on embankments in shade in disturbed areas. Widespread in tropical America.

Cyclopeltis semicordata (Sw.) J. Sm. Plate 7-B

Terrestrial. Rhizome short. Leaf to 80 cm long, elliptic in outline, once-pinnate, with long (to 2 cm), thick hairs at the base; leaflets entire, narrowly elliptic, curved upward, 9 × 1.8 cm, sessile at the base, but the blade not connected to the rachis. Sori round, distributed in 4 longitudinal rows along the midvein on the undersurface of the leaflet. Except for spore arrangement, very similar to *Blechnum occidentale*. Infrequent, on steep embankments in mature forest. Widespread in tropical America.

Danaea moritziana Presl Plate 7-C

Terrestrial. Rhizome to 40 cm long, recumbent to erect, the erect portion to 20 cm long. Petiole with stipules, the base swollen, the rachis swollen at the junction with leaflets; leaf once-pinnate, to 1 m long; leaflets 15 × 3.5 cm, narrowly elliptic, acuminate, the secondary nerves parallel, 1 mm apart, at 90° angles to the midvein. Sori linear, arranged along the secondary nerves in close proximity. Infrequent, in mature forest. Venezuela to Bolivia.

Dennstaedtia cicutaria (Sw.) Moore Plate 7-D

Terrestrial. Petiole glabrous; leaves to 65 cm long, triangular in outline, twice-pinnate; leaflets crenate, subacute, 1 × 0.5 cm. Sori in the angles between the teeth of the leaflets. Uncommon, in mature forest. Widely distributed in tropical America.

Dennstaedtia obtusifolia (Willd.) Moore Plate 8-A

Terrestrial. Petiole glabrous; leaves to 2 m long, triangular in outline, twice-pinnate; leaflets crenate, blunt, 2 × 1 cm. Sori in the angles between the teeth of the leaflets. Common, in mature forest. Widely distributed in tropical America.

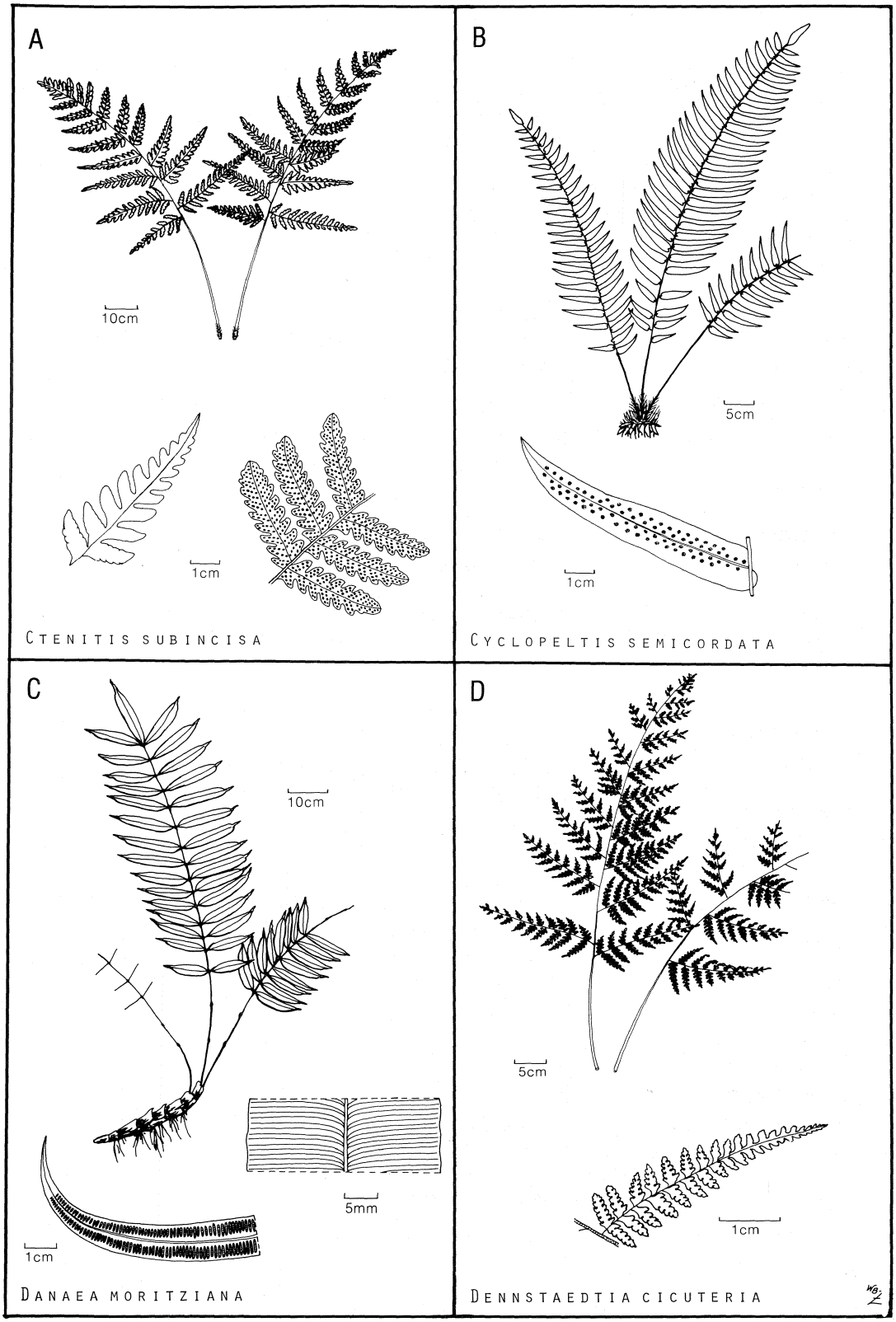
A
10cm
1cm
CTENITIS SUBINCISA
B
5cm
1cm
CYCLOPELTIS SEMICORDATA
C
10cm
5mm
1cm
DANAEA MORITZIANA
D
5cm
1cm
DENNSTAEDTIA CICUTERIA

Plate 7

Dicranoglossum polypodioides (Hook.) Lellinger Plate 8-B

Epiphytic. Leaves slender, dichotomously forked, to 30 cm long. Sori round, on each side of the midrib toward the apices of the branches. Common, at intermediate heights in mature forest. Ecuador.

Dicranopteris pectinata (Willd.) Underrw. Plate 274-B

see Addendum for description.

Didymochlaena truncatula J. Sm. Plate 8-C

Terrestrial, tree-like, with a trunk to 40 cm long. Petiole to 40 cm long, covered with red hair-like scales to 3 cm long; leaves to 1.20 m long, bipinnate; leaflets obliquely quadrate, blunt at the apex, 4 × 2 cm. Sori elongate, 1-8 per leaflet, radiating from the junction of the leaflet around the margin, to 5 mm long, 1 mm wide. Rare, in mature forest. Pantropical.

Diplazium cristatum (Desr.) Alston Plate 8-D

Terrestrial. Rhizome shortly creeping. Petiole to 25 cm long; leaf to 60 cm long, ovate in outline, once-pinnate; basal leaflets deeply dentate, the teeth serrate, 10 × 2.3 cm. Sori elongate, to 7 mm long, one for each tooth of the lower leaflets. Rare, in mature forest. Widespread in tropical America.

Diplazium eggersii (Sodiro) C. Chr. Plate 9-A

Terrestrial. Trunk short. Leaves to 40 cm long, ovate in outline, once-pinnate; leaflets shallowly crenate on the margin, 7 × 2.5 cm. Sori elongate. Rare, in mature forest. Ecuador.

Diplazium fraseri (Mett.) Hieron. Plate 9-B

Terrestrial. Trunk short, thick. Petiole to 40 cm long; leaves to 1.40 m long, once-pinnate; leaflets shallowly crenate, with sub-parallel, arched secondary veins. Sori elongate along the secondary veins. Common, on river banks. Ecuador.

Diplazium striatastrum Lellinger Plate 9-C

Terrestrial. Trunk to 1 m tall. Petiole to 40 cm long; leaves to 1 m long, elliptical in outline, once-pinnate; leaflets deeply crenate, to 15 × 3 cm, the lobes 1 × 0.8 cm. Sori elongate, chevron-like down the midveins of the lobes. Common, in mature forest. Mexico to Ecuador.

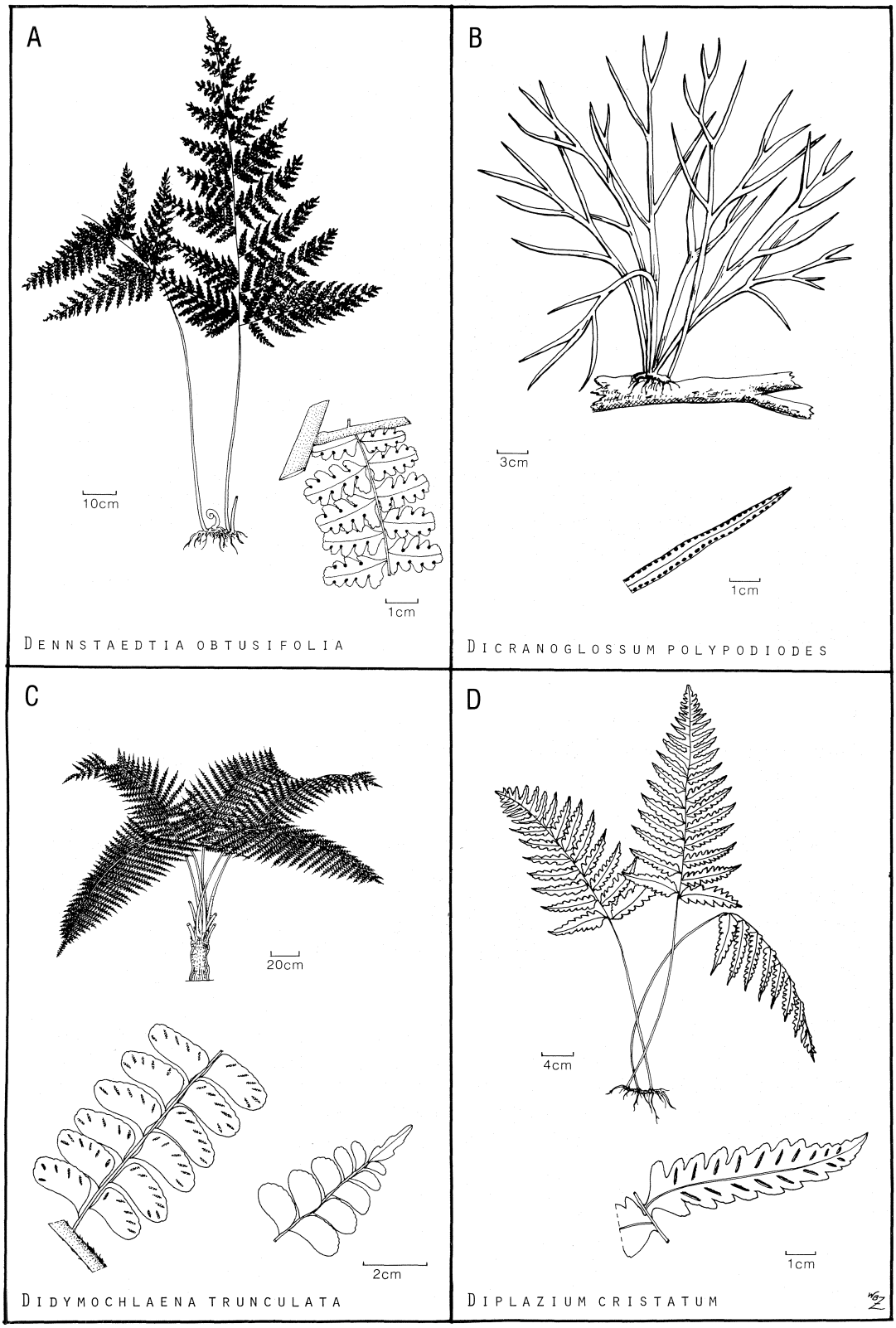
A
10cm
1cm
DENNSTAEDTIA OBTUSIFOLIA
B
3cm
1cm
DICRANOGLOSSUM POLYPODIODES
C
20cm
2cm
DIDYMOCHLAENA TRUNCULATA
D
4cm
1cm
DIPLAZIUM CRISTATUM

Plate 8

Diplazium cf. **taulahuae** C. Chr. Plate 9-D

Terrestrial. Trunk to 40 cm tall. Petiole to 40 cm long; leaves to 1 m long, ovate in outline, bi- to tripinnate; leaflets deeply incised, the lobes 1 × 0.5 cm, the spaces between the lobes to 2 mm wide. Sori elongate. Uncommon, in mature forest.

Elaphoglossum herminieri (Bory & Fée) Moore Plate 10-A

Epiphytic, pendent. Rhizome short. Sterile leaves simple, entire, elongate, 2 m long by 3 cm wide, bluish on the upper surface; fertile leaves similar, shorter. Sporangia evenly dispersed over the under surface of the fertile leaves. Uncommon, on tree trunks and limbs in mature forest. Central America, the Caribbean islands and northern South America.

Elaphoglossum sp. 'A' (5445) Plate 10-B

Epiphytic. Rhizome short. Sterile leaves simple, entire, elliptical, to 30 cm long, 5 cm wide, petiolate; fertile leaves similar, narrower. Sporangia evenly dispersed over the under surface of the fertile leaves. Uncommon, on upper tree limbs in mature forest.

Elaphoglossum sp. 'B' (5795) Plate 10-C

Epiphytic. Rhizome elongate, to 3 cm between leaves. Sterile leaves simple, entire, narrowly elliptic, to 30 × 3 cm, petiolate; fertile leaves similar, smaller. Sporangia evenly dispersed over the under surface of the fertile leaves. Rare, on tree trunks near ground level in mature forest.

Hemidictyum marginatum (L.) Presl Plate 10-D

Terrestrial. Trunk short. Petioles to about 1 m long, with broad, scale-like hairs at the base; leaves to 2.5 m long, once-pinnate; leaflets entire, 40 × 12 cm. Sori linear, to 3 cm long, arranged along the secondary veins, parallel, to 1 mm apart. Common, in mature forest. Widespread in tropical America.

Lindsaea sp. (5353A) Plate 11-A

Terrestrial. Rhizome short. Leaves slender, once-pinnate, to 40 cm long; leaflets closely arranged to overlapping, to 1 × 0.5 cm at the base, becoming smaller toward the apex, unequal in shape, oblique. Sori in the rolled up margin. Rare, on stream bank in mature forest.

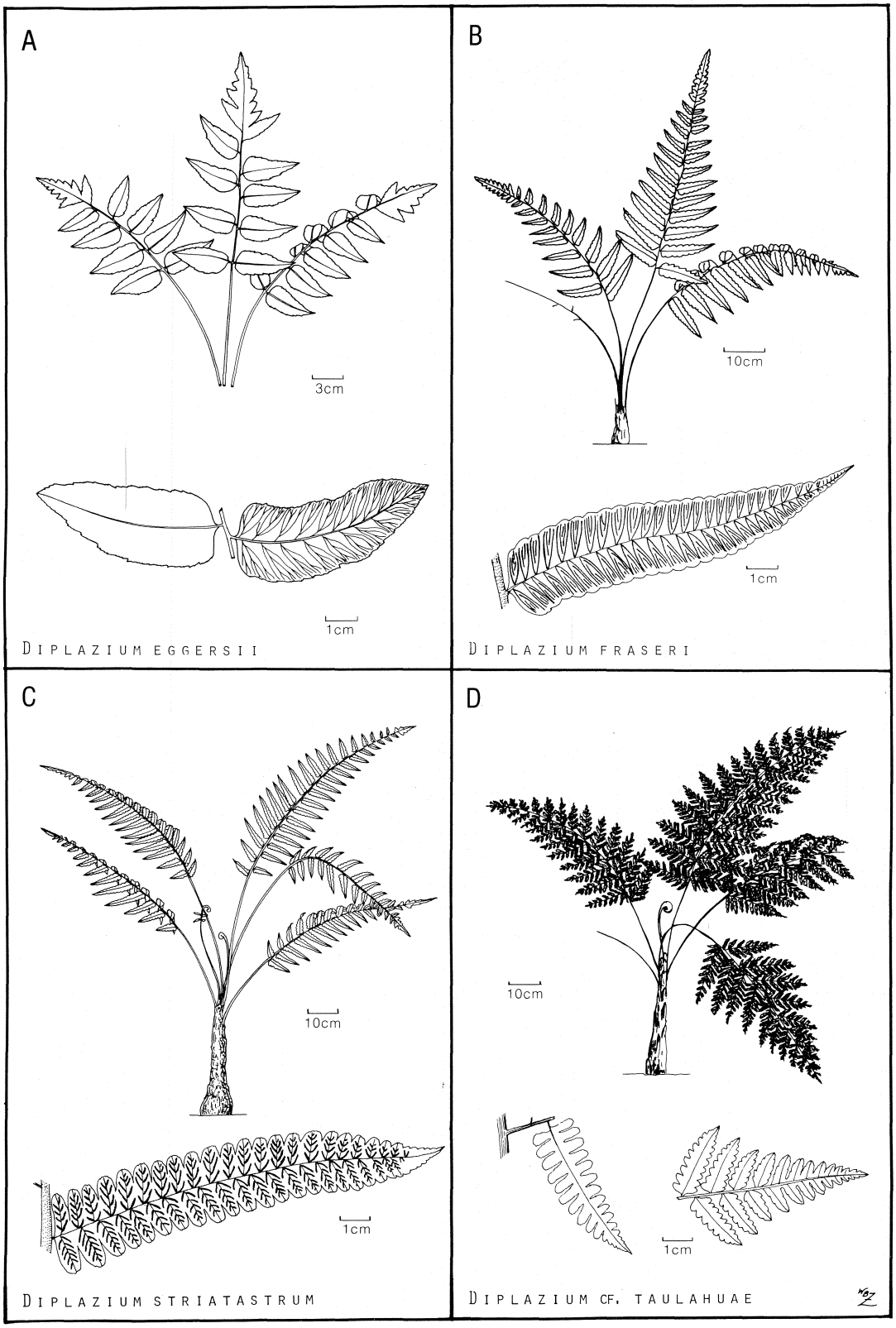
A
3cm
1cm
DIPLAZIUM EGGERSII
B
10cm
1cm
DIPLAZIUM FRASERI
C
10cm
1cm
DIPLAZIUM STRIATASTRUM
D
10cm
1cm
DIPLAZIUM CF. TAULAHUAE

Plate 9

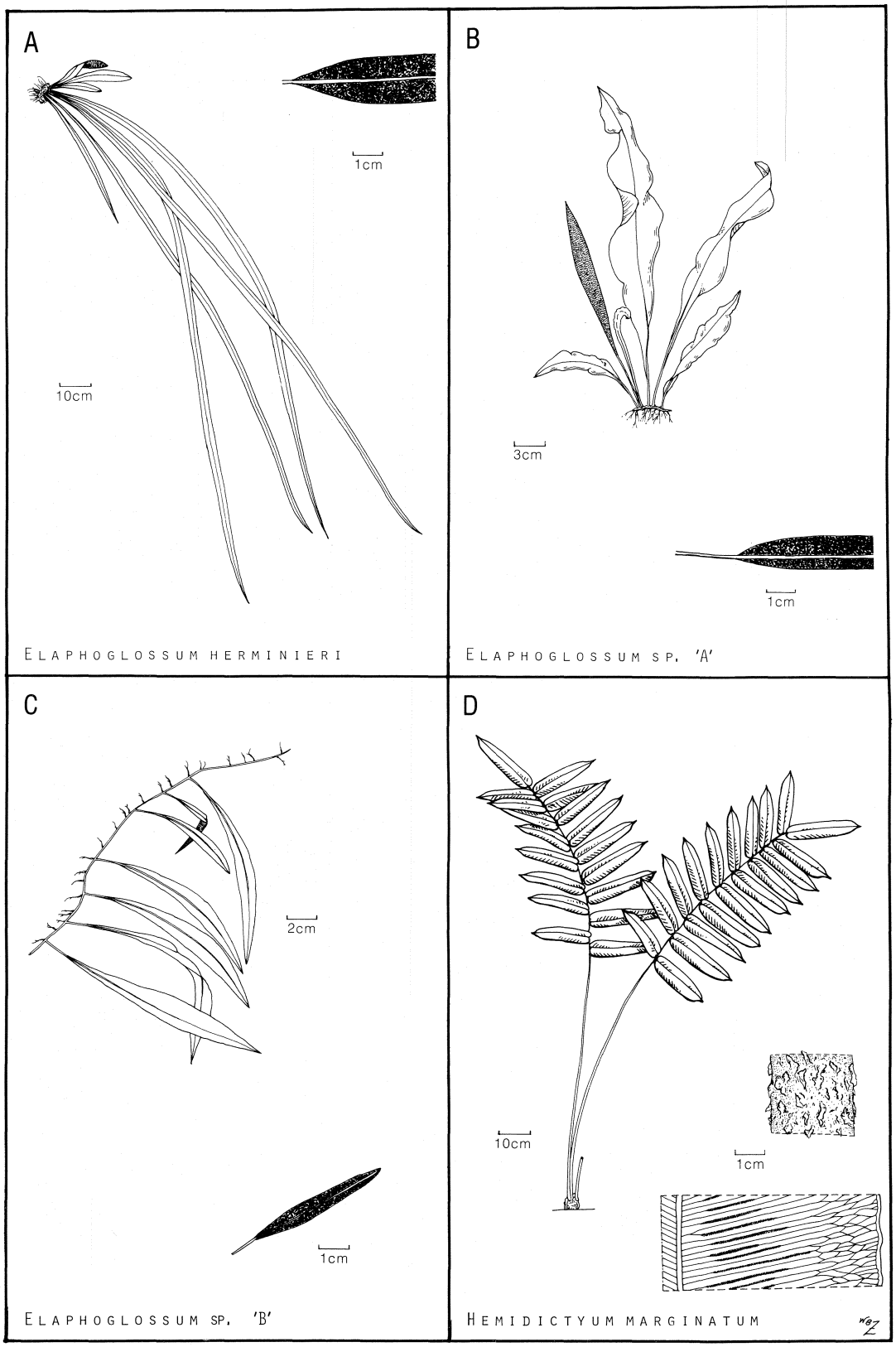
A
1cm
10cm
ELAPHOGLOSSUM HERMINIERI
B
3cm
1cm
ELAPHOGLOSSUM SP. 'A'
C
2cm
1cm
ELAPHOGLOSSUM SP. 'B'
D
10cm
1cm
HEMIDICTYUM MARGINATUM

Plate 10

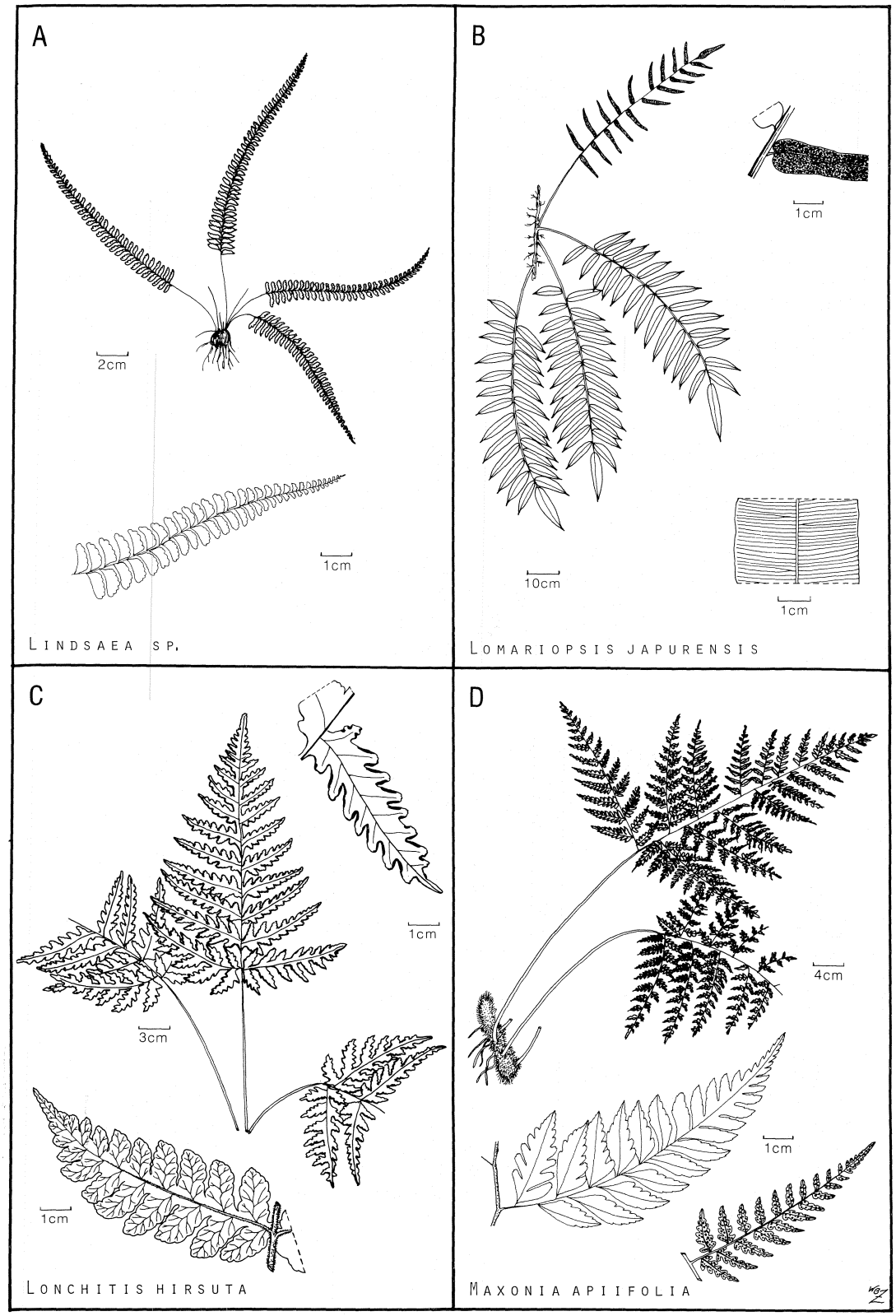
A
2cm
1cm
LINDSAEA SP.
B
1cm
10cm
1cm
LOMARIOPSIS JAPURENSIS
C
1cm
3cm
1cm
LONCHITIS HIRSUTA
D
4cm
1cm
MAXONIA APIIFOLIA

Plate 11

Lomariopsis japurensis (Mart.) J. Sm. Plate 11-B

Epiphytic. Rhizome elongate, vine-like. Sterile leaves to 90 cm long, elliptical, once-pinnate; leaflets entire, elliptical, sometimes with acuminate apices, 15 × 4 cm; fertile leaves similar but leaflets narrower. Sporangia dispersed over the entire undersurface. Common, on tree trunks near ground level in mature forest. Guatemala to Bolivia, the Guianas, and Brazil.

Lonchitis hirsuta L. Plate 11-C

Terrestrial. Rhizome creeping. Petiole elongate, pubescent; leaves to 2.5 m long, deltoid-ovate in outline, bipinnate to tripinnate; leaflets blunt tipped. Sporangia arranged in a narrow strip under the rolled-under edge of the leaflet. Rare, in mature forest. Widespread in tropical America. Illustration of fertile pinna adapted from "Flora of Venezuela".

Maxonia apiifolia (Sw.) C. Chr. Plate 11-D

Vine climbing to 3 m on tree trunks. Rhizome stout, densely wooly, brown. Leaves to 70 cm long, triangular in outline, bipinnate to tripinnate; leaflets dentate on the margin, oblique, thick, very polished, 1.5 × 0.8 cm, decreasing in size rapidly toward the apex of the leaflets. Sori on fertile leaves; round, in one row on each side of the midvein; covered by a small, peltate structure (indusium); leaflets to 1 × 0.4 cm, not dentate, shallowly lobed. Common, in mature forest. Cuba, Jamaica, Guatemala to Panama.

Nephelea cuspidata (Kunze) Tryon Plate 12-A

Terrestrial. Trunk to 3 m tall, DBH to 15 cm. Petiole to 1 m long, spiney, scaly, toward the base, hairs to 5 cm long; leaves bipinnate; to 3 m long. lower leaflets deeply incised, becoming entire toward the acuminate apex. Sori arranged on each side of the midvein of the leaflets. Uncommon, in mature forest. Nicaragua to Bolivia, Guianas to Paraguay.
Common name: "Helecho arborescente"+

Nephrolepis pectinata (Willd.) Schott Plate 274-C

Epiphytic. Rhizome short, secondary rhizomes elongate. Leaves erect, to 80 × 5 cm, once-pinnate; leaflets entire, oblique, narrowly triangular, cordate at the base, 2.5 × 1 cm. Sori semi-circular, distributed around the margin of the leaflets. Rare, in trees near the river. Pantropical.

Nephrolepis pendula (Raddi) J. Sm. Plate 12-B

Epiphytic. Rhizome short, with leaves clumped, the secondary rhizomes elongate. Leaves pendent, narrow in outline, to 3 m long, 8 cm wide, once-pinnate; leaflets entire, oblique, narrowly triangular, to 4 × 1 cm. Sori semi-circular, distributed around the margin of the leaflets. Infrequent, in tree tops in mature forest, common in old leaf bases of some palm trees. Pantropical.

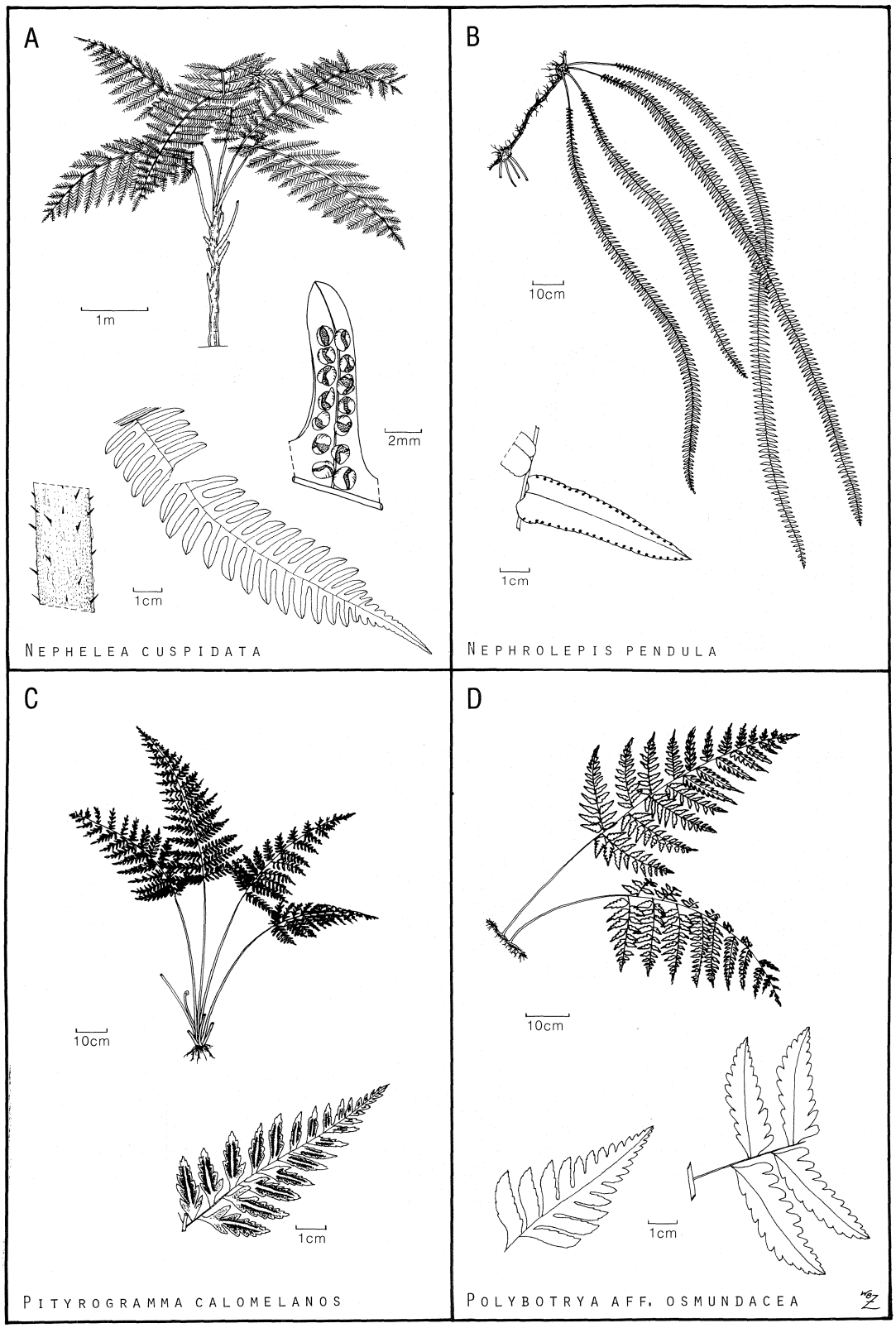
A
1m
2mm
1cm
NEPHELEA CUSPIDATA
B
10cm
1cm
NEPHROLEPIS PENDULA
C
10cm
1cm
PITYROGRAMMA CALOMELANOS
D
10cm
1cm
POLYBOTRYA AFF. OSMUNDACEA

Plate 12

Pityrogramma calomelanos (L.) Link Plate 12-C

Terrestrial. Rhizome short, with leaves clumped. Leaves erect. to 80 cm long, ovate in outline, twice-pinnate; leaflets lacerate to dentate, oblique, 2 × 0.8 cm, silver on underside. Sori distributed along either side of the midvein of the leaflets. Common, in disturbed areas and on steep river banks. Widespread in tropical America and Africa.

Polybotrya aff. **osmundacea** H. & B. ex Willd. Plate 12-D

Vine climbing to 3 m on tree trunks. Rhizome short, densely wooly, brown, about 3 cm between the leaves. Sterile leaf to 80 cm long, ovate in outline, twice-pinnate; leaflets obliquely elliptic, finely dentate, 2 × 0.6 cm. Fertile leaf more delicate; leaflets lobed, not denticulate; sori round, in one row on each side of the midvein, not covered by a peltate structure (indusium). Common, in mature forest. Widely distributed in tropical America.

Polypodium ciliatum Willd. Plate 13-A

Epiphytic. Rhizome elongate, creeping, about 1 cm long between leaves. Sterile leaves simple, finely ciliate, elliptic, to 2 cm long by 1 cm wide; fertile leaves slender, 4 cm long, 4 mm wide. Sori round closely spaced in a row on each side of the midrib. Common, in tree tops in mature forest. Central and South America.

Polypodium maritimum Hieron. Plate 13-B

Epiphytic. Rhizome elongate, creeping. Leaves to 80 cm long, ovate in outline, once-pinnate; leaflets entire, linear, 10 × 1 cm, sessile, connected to the midrib at the base. Sori round, in 2 rows on each side of the midrib. Rare, on upper limbs of trees of mature forest. Nicaragua to Ecuador.

Polypodium percussum Cav. Plate 13-C

Epiphytic. Rhizome elongate, creeping, about 1.5 cm long between leaves. Leaves simple, entire, narrowly ovate, acuminate at the apex, short-petiolate, 20 cm long, 3 cm wide. Sori round, to 1.5 mm wide, spaced to 8 mm apart in a single row on each side about midway between the midrib and margin, sterile hairs among the sporangia abundant. Uncommon, on limbs of trees of mature forest. Central and tropical South America.

Pteris altissima Poir. in Lam. Plate 13-D

Terrestrial. Trunk erect, to 50 cm tall, 25 cm in diameter. Leaves to 1 m long, bipinnate, glabrous; leaflets deeply incised with wide spaces between the lobes of the fertile leaflets, the lobes to 8 × 1 cm, the non-fertile leaflets to 40 × 15 cm, with much narrower spaces between the lobes. Sporangia in a narrow strip on the margins of lobes of the fertile leaflets. Common, in mature forest and in disturbed areas. Widely distributed in tropical America.

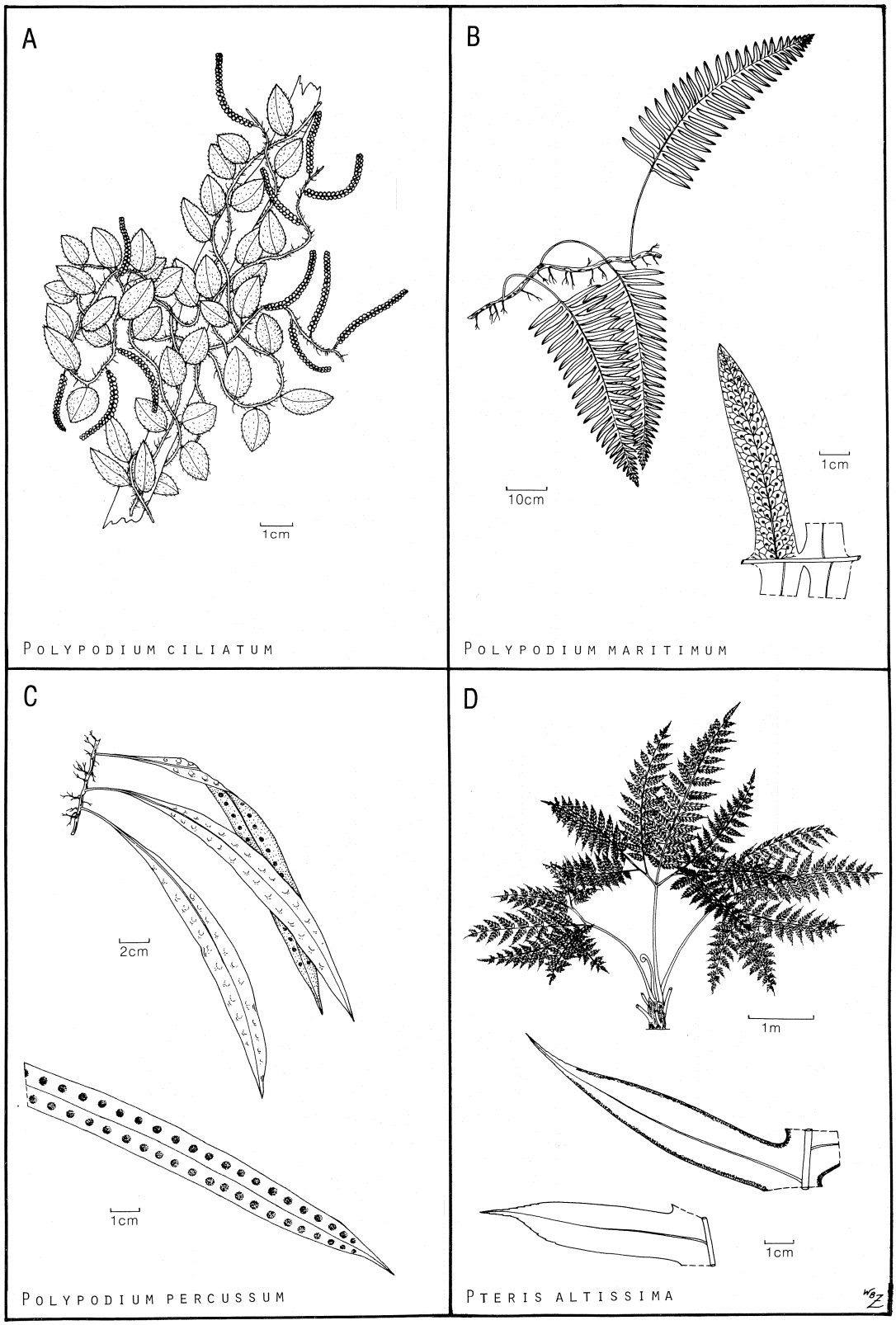
A
1cm
POLYPODIUM CILIATUM
B
10cm
1cm
POLYPODIUM MARITIMUM
C
2cm
1cm
POLYPODIUM PERCUSSUM
D
1m
1cm
PTERIS ALTISSIMA

Plate 13

Saccoloma elegans Kaulf. Plate 14-A

Terrestrial, with trunk to 40 cm tall. Petiole 90 cm long, with short, thick, fleshy hairs at the base; leaves to 2 m tall; bottom leaflets about 90 cm from the base, triangular in outline; leaflets narrowly elliptical, to 40 × 4 cm, serrate toward the apex. Sporangia along most of the margin from the base to within 6 cm of the apex. Uncommon, along the creek beds. Greater Antilles, Central America, and tropical South America.

Stigmatopteris alleoptera (Kunze) C. Chr. Plate 14-B

Terrestrial. Stem short. Leaf to 1 m long, ovate in outline, once-pinnate; leaflets entire, the margin serrate, acuminate, unequal at the base, mostly attached to the petiole, 15 × 3 cm. Sori round, in 1 or 2 irregular rows between the secondary nerves. Uncommon, in mature forest. Nicaragua to Peru.

Stigmatopteris opaca (Baker) C. Chr. Plate 14-C

Terrestrial. Leaf to 40 cm long, broadly ovate in outline, once-pinnate; leaflets undulate, margin entire for the basal three-fourths, apical one-fourth serrate, the base of the leaflets joined to the rachis. Sori round, in rows of 4-5 patches on each side of the midvein. Uncommon, in mature forest. Ecuador.

Stigmatopteris sp. (41, 110) Plate 14-D

Terrestrial. Leaf to 70 cm long, ovate in outline, once-pinnate; leaflets narrowly triangular, sessile, to 12 cm long, 2 cm wide, deeply lobed, becoming dentate at the acuminate apex, the lobes to 6 mm wide, separated by a space to 2 mm wide, the apices of the lobes obliquely truncate, serrate. Sporangia not seen. Rare, in mature forest.

Tectaria acutiloba (Hieron.) Maxon Plate 15-A

Terrestrial. Leaf to 75 cm long, broadly triangular in outline, once-pinnate; leaflets irregularly lobed, the basal leaflets with a basal division often forming a separate leaflet. Sori round, tending to be distributed on the lobes rather than on the base of the leaflets. Uncommon, in mature forest. Colombia and Ecuador.

Tectaria antioquiana (Baker) C. Chr. Plate 15-B

Terrestrial. Trunk to 20 cm high, 6 cm in diameter. Petiole to 70 cm long with short, hair-like scales at the base; leaves to 1.20 m long, once-pinnate; leaflets 7, to 40 × 10 cm, the margins entire, undulate, the apex acute, the base attached to the rachis. Sori round, 1 mm in diameter, randomly scattered over the undersurface of the leaflets. Uncommon, in mature forest. Costa Rica to Ecuador.

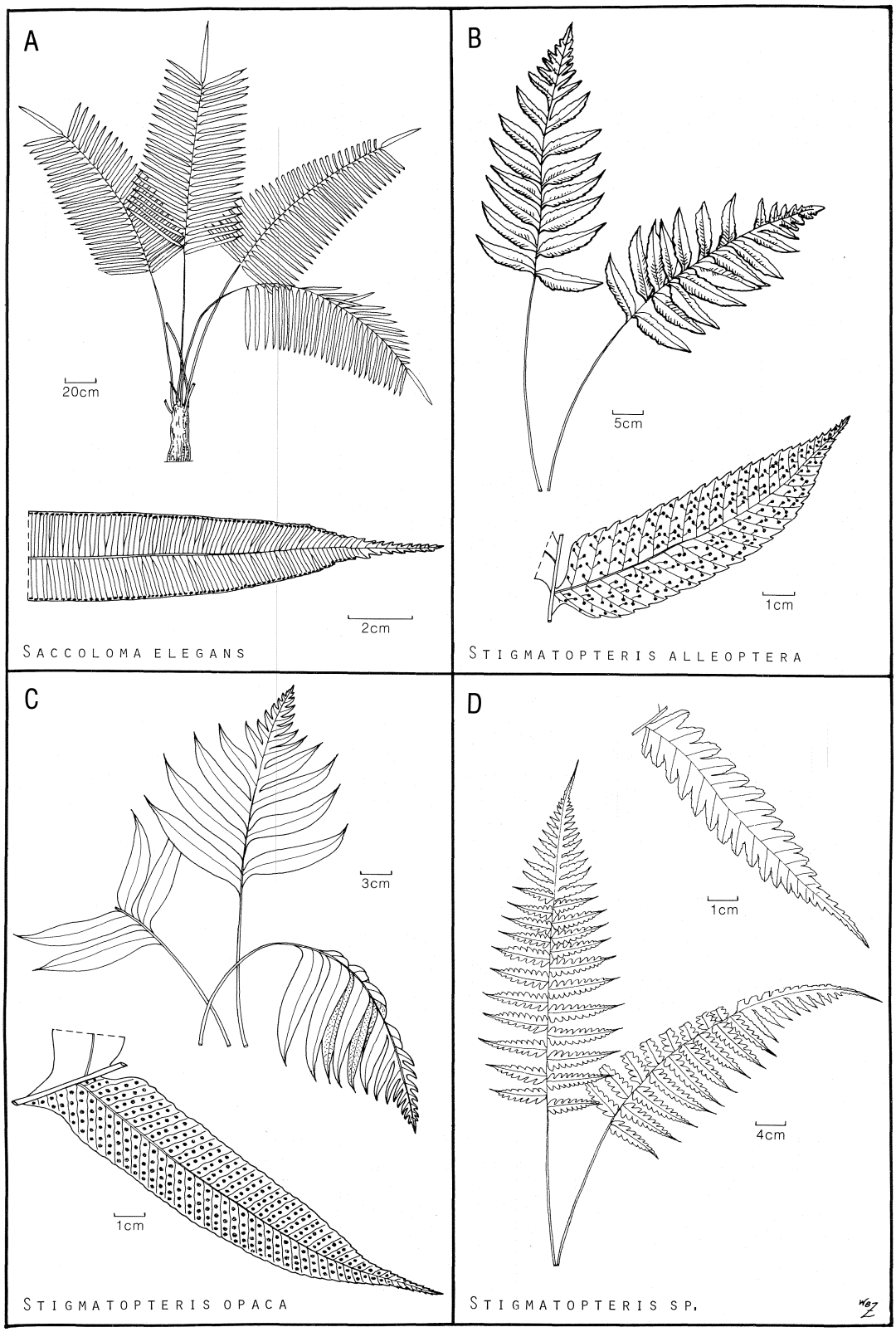
A
20cm
2cm
SACCOLOMA ELEGANS
B
5cm
1cm
STIGMATOPTERIS ALLEOPTERA
C
3cm
1cm
STIGMATOPTERIS OPACA
D
1cm
4cm
STIGMATOPTERIS SP.

Plate 14

Tectaria incisa Cav. forma **incisa** Plate 15-C

Terrestrial. Leaf to 90 cm long, once-pinnate; leaflets narrowly elliptic, irregularly lobed and incised on the margin, the apex acuminate, 20 × 5 cm, the basal leaflets sometimes divided into 2 leaflets on the lower margin. Sori round, to 4 mm in diameter, distributed irregularly over the undersurface of the leaflets. Uncommon, on river banks. Widespread in tropical America.

Tectaria nicotianifolia (Baker) C. Chr. Plate 15-D

Terrestrial. Rhizome short. Leaf to 80 cm long, 45 cm wide, broadly ovate in outline, lobed at the base almost to the midrib, with 3 irregular lobes on each side. Sori round, distributed irregularly over the undersurface of the leaf. Common, in mature forest. Mexico to Ecuador.

Thelypteris angustifolia (Willd.) Proctor Plate 16-A

Terrestrial. Rhizome creeping. Leaf to 45 cm long, elliptic in outline, once-pinnate; leaflets narrowly elliptic, acuminate, entire, 13 × 1.5 cm. Sporangia distributed along the ladder-like secondary nerves between primary nerves which are parallel and diverge from the midrib at about a 75° angle. Rare, in mature forest. Widespread in tropical America.

Thelypteris dentata (Forssk.) E. St. John Plate 16-B

Terrestrial. Leaf to 1 m long, elliptic in outline, once-pinnate; leaflets narrowly triangular, acuminate, sessile but free at the base. Sori round, 1 mm broad, distributed along each side of the midvein of the leaflet lobes. Common, in mature forest and in second growth. Widespread in tropical America.

Thelypteris francoana (Fourn.) Reed Plate 16-C

Terrestrial. Rhizome creeping. Leaf narrowly elliptic, to 15 × 1.5 cm, including the 3-7 cm long petiole, simple, margin shallowly serrate. Sori round, to 1 mm broad, distributed along the midrib. Locally common, along steep river banks. Nicaragua to Ecuador.

Thelypteris gigantea (Mett.) Tryon Plate 16-D

Terrestrial. Trunk short, the leaves produced in a whorl. Leaves entire, narrowly elliptical, round at the base, acuminate at the apex, the secondary veins nearly at right angles to the midvein, to 75 × 12 cm, with a finely and sparsely pubescent petiole to 30 cm long. Rare, along creeks in marshy areas. Costa Rica to Peru.

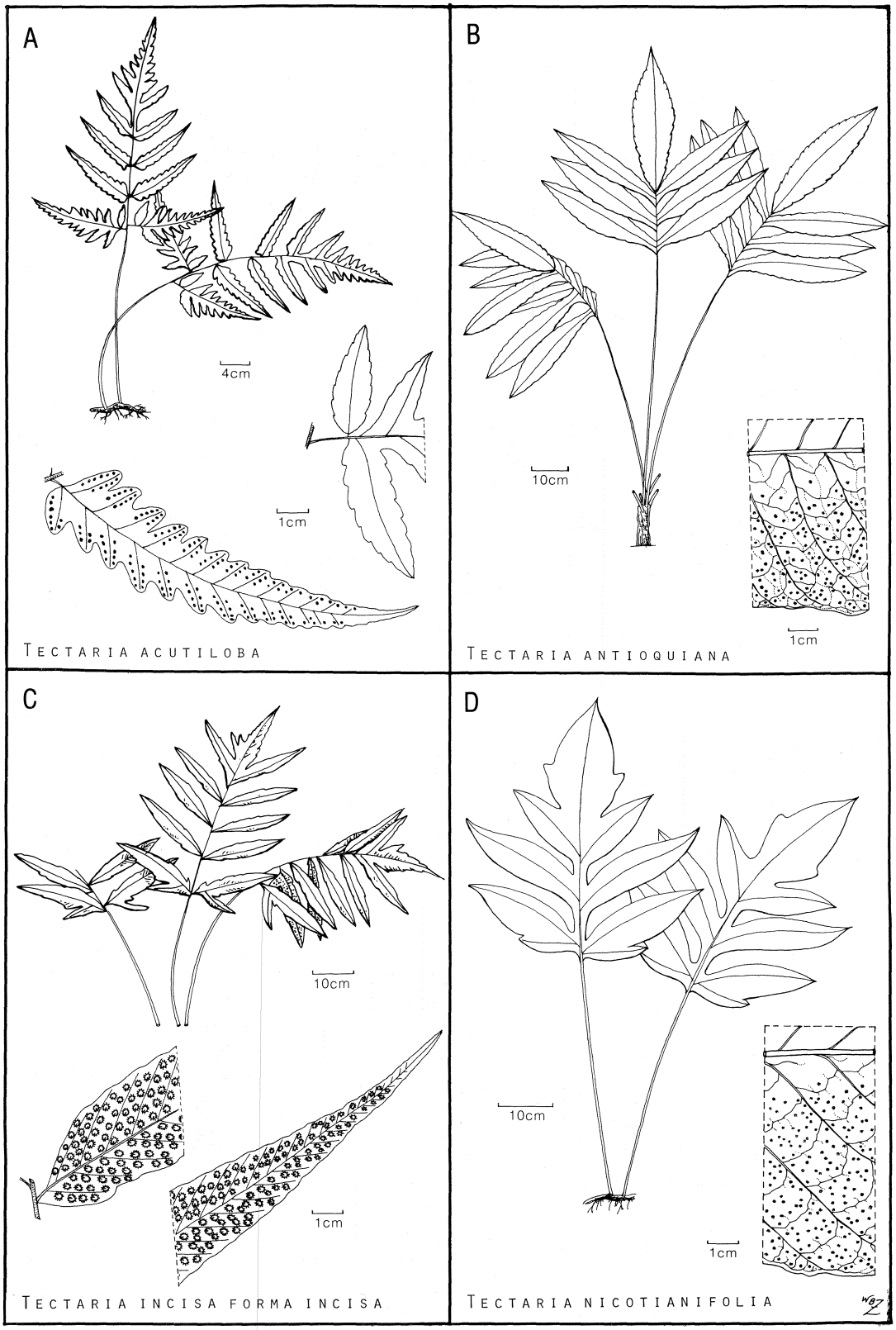
A
4cm
1cm
TECTARIA ACUTILOBA
B
10cm
1cm
TECTARIA ANTIOQUIANA
C
10cm
1cm
TECTARIA INCISA FORMA INCISA
D
10cm
1cm
TECTARIA NICOTIANIFOLIA

Plate 15

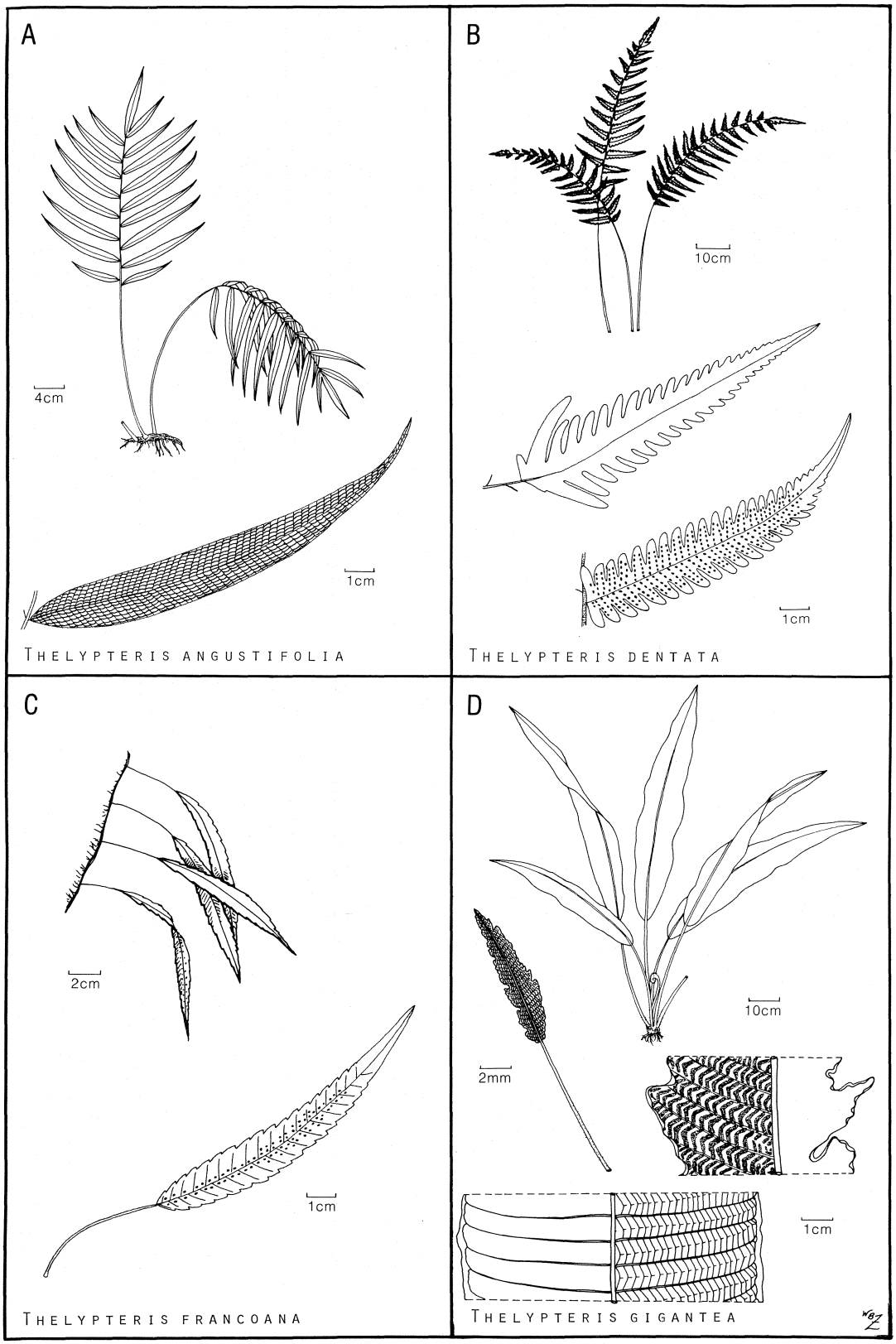
A
4cm
1cm
THELYPTERIS ANGUSTIFOLIA
B
10cm
1cm
THELYPTERIS DENTATA
C
2cm
1cm
THELYPTERIS FRANCOANA
D
10cm
2mm
1cm
THELYPTERIS GIGANTEA

Plate 16

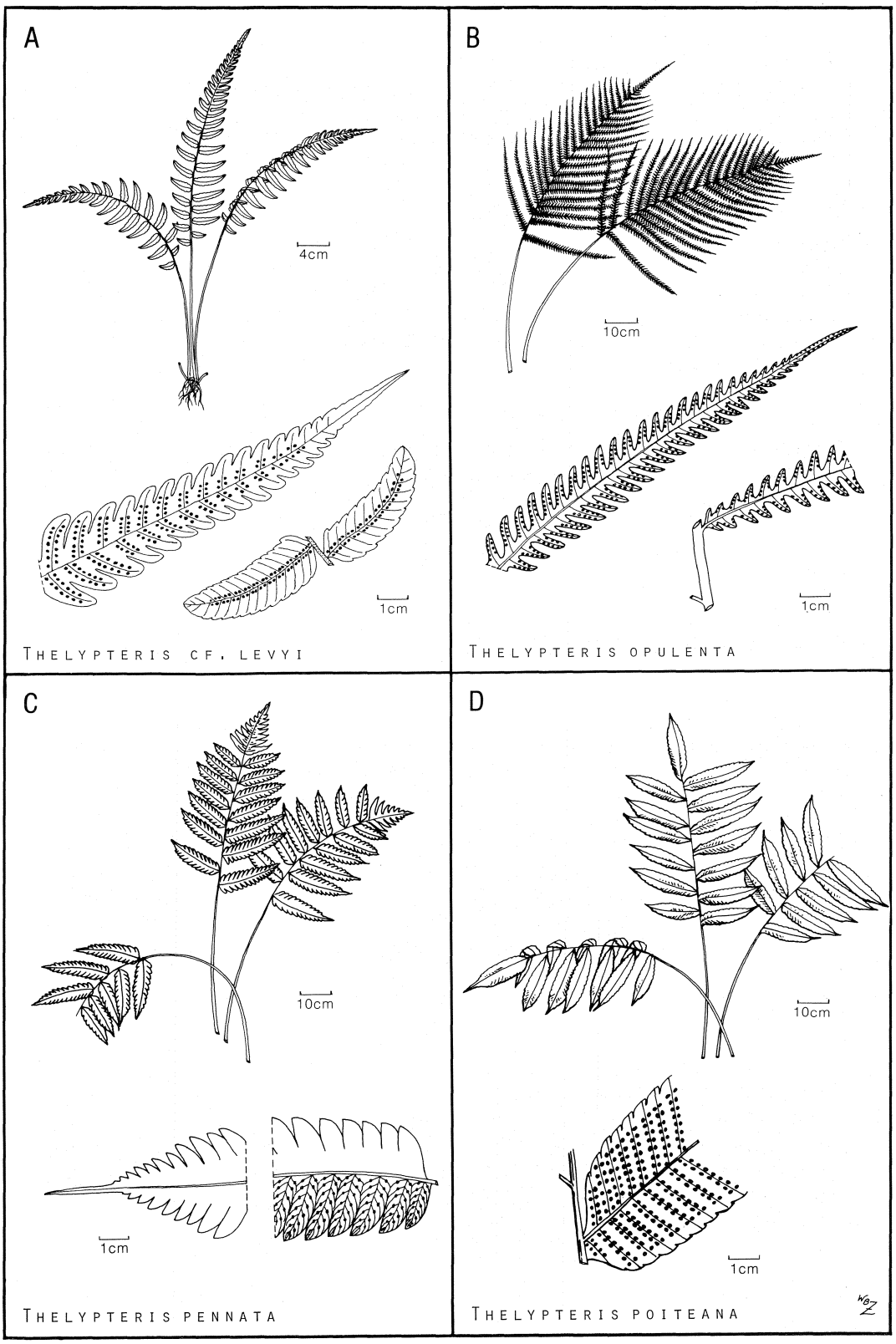
A
4cm
1cm
THELYPTERIS CF. LEVYI
B
10cm
1cm
THELYPTERIS OPULENTA
C
10cm
1cm
THELYPTERIS PENNATA
D
10cm
1cm
THELYPTERIS POITEANA

Plate 17

Thelypteris cf. **levyi** (Fourn.) Morton Plate 17-A

Terrestrial. Rhizome short. Leaf to 50 cm long, once-pinnate, elliptic in outline, the apical lobe narrowly triangular, deeply incised; leaflets obliquely elliptic, shallowly serrate, 4.5 × 1.5 cm. Sori round, arranged in a single row on each side of the midrib of the leaflet. Uncommon, on river bank. Previously known only from Nicaragua and Costa Rica.

Thelypteris opulenta (Kaulf.) Fosb. Plate 17-B

Terrestrial. Rhizome short. Leaf to 1 m long, ovate in outline, once-pinnate; leaflets narrowly elliptic, 30 × 2.5 cm, deeply serrate, the lobes to 4 mm wide, separated by a space to 3 mm wide. Sori round, in a single row along the margins of the lobes. Common, on embankments and in disturbed areas. Scattered in tropical America; Old World tropics.

Thelypteris pennata (Poir. in Lam.) Morton Plate 17-C

Terrestrial. Leaf to 90 cm long, ovate in outline, once-pinnate, apical portion triangular, broad at the base, lobed; leaflets elliptic, long-acuminate, 20 × 5 cm, serrate, the margins of the lobes overlapping, the lobes to 1 cm wide. Sori round, in a single row on each side of the midnerve of the lobes of a leaflet. Uncommon, in mature forest. Antilles and Venezuela to the Guianas and Ecuador.

Thelypteris poiteana (Bory) Proctor Plate 17-D

Terrestrial. Rhizome short. Leaf to 1 m long, ovate in outline, once-pinnate; leaflets elliptic, long-acuminate, 20 × 5 cm, shallowly serrate, lobes 0.8 cm wide, the apical leaflet similar to the other leaflets. Sori round, distributed in single rows on each side of the secondary nerves of the leaflets. Infrequent, in mature forest and in disturbed areas. Widely distributed in tropical America.

Thelypteris resinifera (Desv.) Proctor Plate 18-A

Terrestrial. Stem short. Leaf to 90 cm long, narrowly elliptic in outline, once-pinnate; leaflets narrowly ovate, 6 × 1.2 cm, deeply incised almost to the midvein, the lobes 3 mm wide, separated by a space 3 mm wide, the base of the leaflets free from the midrib but overlapping it. Sori round, in a single row on each side of the midnerves of the lobes of the leaflets. Infrequent, on embankments and in disturbed areas. Greater Antilles; Mexico to Ecuador.

Thelypteris tetragona (Sw.) Small Plate 18-B

Terrestrial. Rhizome short. Leaf to 90 cm long, ovate in outline, once-pinnate; leaflets narrowly quadrate, to 10 cm long, acuminate at the apex, sessile at the base, deeply incised, the lobes nearly overlapping, obliquely truncate at the apex, to 5 mm wide, the basal lobes larger than the rest. Sporangia not seen. Rare, in mature forest. Guatemala to Bolivia.

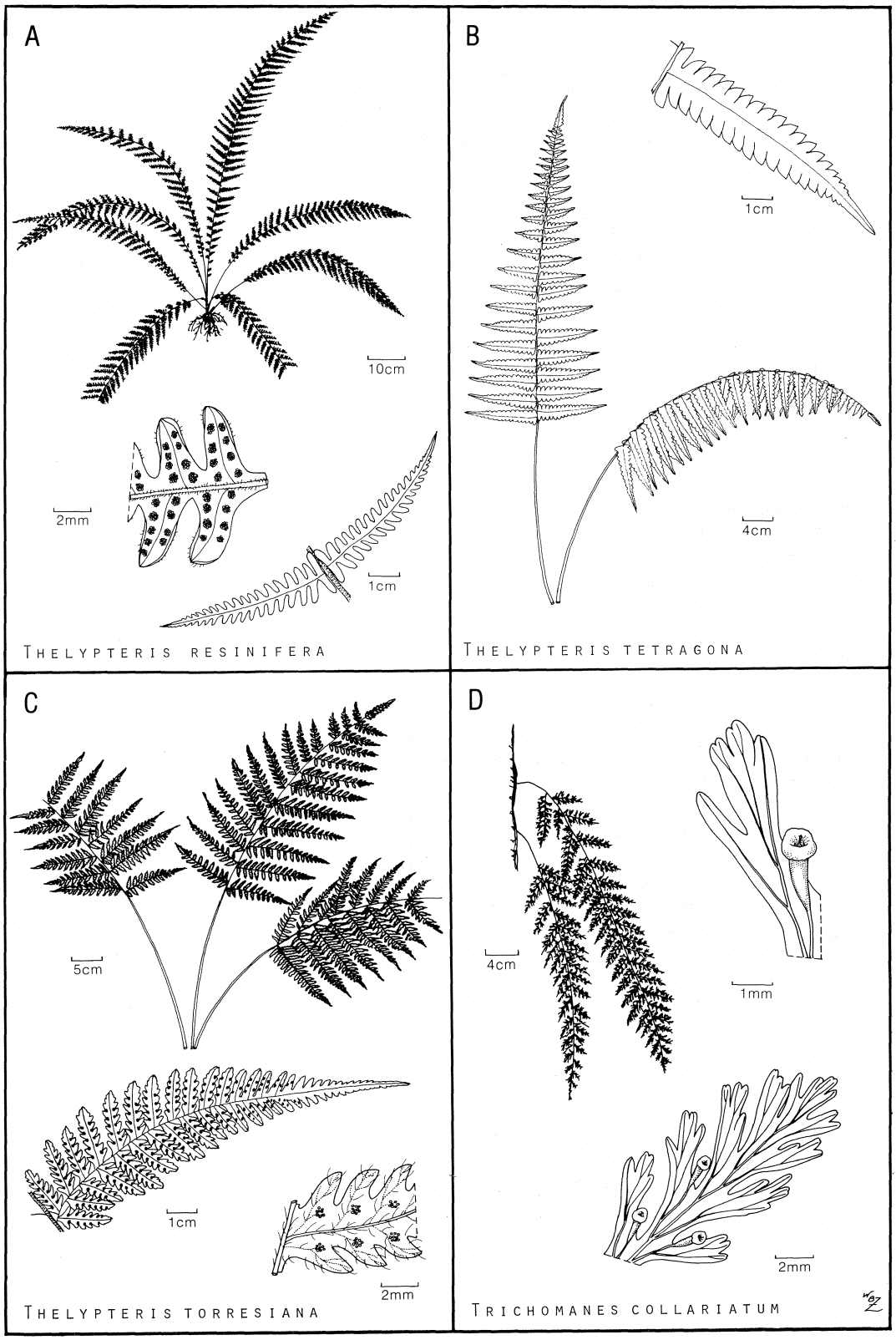
A
10cm
2mm
1cm
THELYPTERIS RESINIFERA
B
1cm
4cm
THELYPTERIS TETRAGONA
C
5cm
1cm
2mm
THELYPTERIS TORRESIANA
D
4cm
1mm
2mm
TRICHOMANES COLLARIATUM

Plate 18

Thelypteris torresiana (Gaud.) Alston Plate 18-C

Terrestrial. Rhizome short. Leaf to 90 cm long, ovate in outline, twice-pinnate; basal leaflets elliptic, acuminate 3 × 1 cm, deeply lobed, the apical lobes shallowly lobed and much smaller. Sori round, in a single row on each side of the midnerve of a leaflet near the base of each lobe. Uncommon, in mature forest. Scattered in the New World tropics.

Trichomanes collariatum v. d. Bosch Plate 18-D

Epiphytic. Rhizome elongate, vine-like. Leaves narrowly ovate in outline, to 40 cm long, twice-pinnate; leaflets irregularly, deeply divided, 2 × 1 cm, without black hairs. Sporangia arranged in cups on the extreme ends of the leaflets lobes. Common, on tree trunks at a height of 1-3 m in mature forest. Mexico to Peru and Brazil.

Trichomanes krausii Hook. & Grev. Plate 19-A

Epiphytic. Rhizome elongate, vine-like. Leaves narrowly ovate in outline, to 8 cm long, twice-pinnate, petiolate; leaflets irregularly divided, 1 × 0.4 cm, with black hairs. Sporangia in cups on the extreme ends of the leaflet lobes. Uncommon, on trees overhanging the river and in mature forest. Widespread in tropical America.

Trichomanes membranaceum L. Plate 19-B

Epiphytic. Rhizome elongate, vine-like. Leaves entire to deeply and irregularly lobed, ovate to broadly elliptic in outline, to 3 × 3 cm, the venation dichotomous. Sporangia arranged in cups inserted in the margins of the leaves. Uncommon, on tree trunks at the height of ground-level to 2 m in mature forest. Antilles, Mexico to Bolivia.

Trichopteris trichiata (Maxon) Tryon Plate 19-C

Tree-like, with a trunk to 5 m tall. Leaves to 3 m long, ovate in outline, twice-pinnate, basal leaflets deeply incised, narrowly elliptic, 12 × 12 cm, the lobes 1.5 cm × 3-4 mm, the spaces between the lobes to 3 mm. Sporangia in round clusters, in two rows on the undersurface of the leaflets under leaflet lobes. Infrequent, in mature forest, often growing in cultivated areas. Costa Rica to Ecuador.
Common name: "Helecho Arborescente"+, "Rabo de Mico"

Vittaria gardneriana Fée Plate 19-D

Epiphytic. Rhizome short. Leaves simple, entire, linear, elongate, to 70 cm long, 5 mm wide, pendent. Sporangia arranged in an uninterrupted row along the margin of the leaf. Uncommon, in trees overhanging river. Hispaniola, Costa Rica to Peru and Brazil.

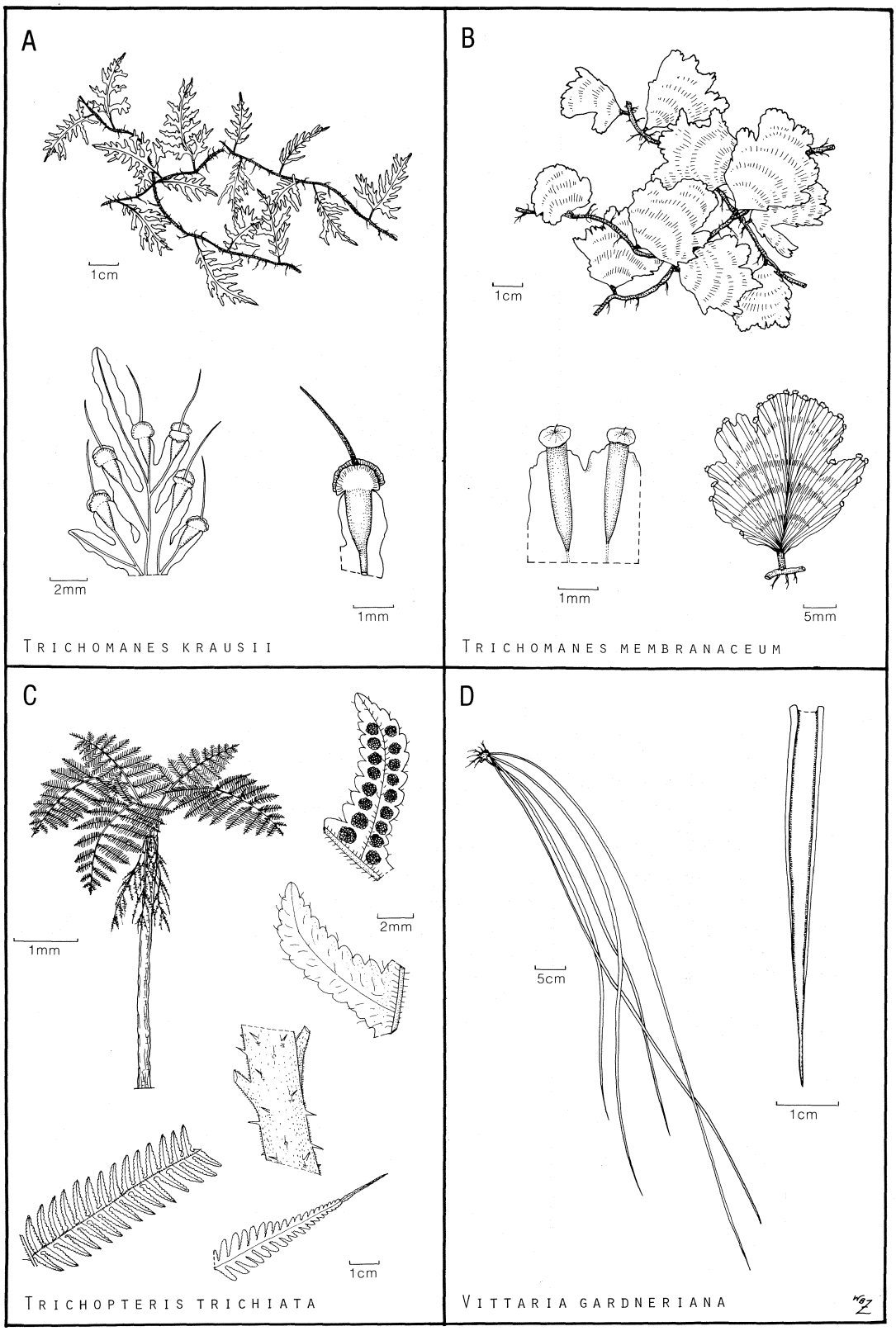
A
1cm
2mm
1mm
TRICHOMANES KRAUSII
B
1cm
1mm
5mm
TRICHOMANES MEMBRANACEUM
C
1mm
2mm
1cm
TRICHOPTERIS TRICHIATA
D
5cm
1cm
VITTARIA GARDNERIANA

Plate 19

GYMNOSPERMAE

(Cycads and Conifers)

CYCADACEAE

Woody, more or less palm-like trees or shrubs, stems thick, unbranched. Leaves in a spiral arrangement, pinnate with toothed leaflets. Reproductive structure a male or female cone.

Zamia lindenii Regel Plate 20-A

Large plant with trunk to 25 cm in diameter and 2 m tall. Leaves to 2 m long; leaflets toothed on the margin, to 25 cm long, 6 cm wide. Male cones to 20 cm long, 3 cm in diameter; female cones to 50 cm long, 18 cm in diameter. Locally infrequent, in understory of forest. Wet coastal Ecuador. Common name: "Palma de Goma"+

ARAUCARIACEAE

Tall, strict or widely branching conical trees. Leaves small, scale-like and stiff. Male cones terminal and solitary or in fascicles; female cones ovoid or globose, becoming woody, each scale with 1 seed, winged; cotyledons 4.

***Araucaria heterophylla** (Salisb.) Franco Plate 20-B

Tall, erect, pine-like trees. Plant light green, frondose, the branches drooping, covered by short, curved, sharp-pointed leaves, to 1.5 cm long. Cones globular, 10-15 cm in diameter. Cultivated around the entrance and the buildings on the Science Center. Native to Norfolk Island.
Common name: "Pino"+

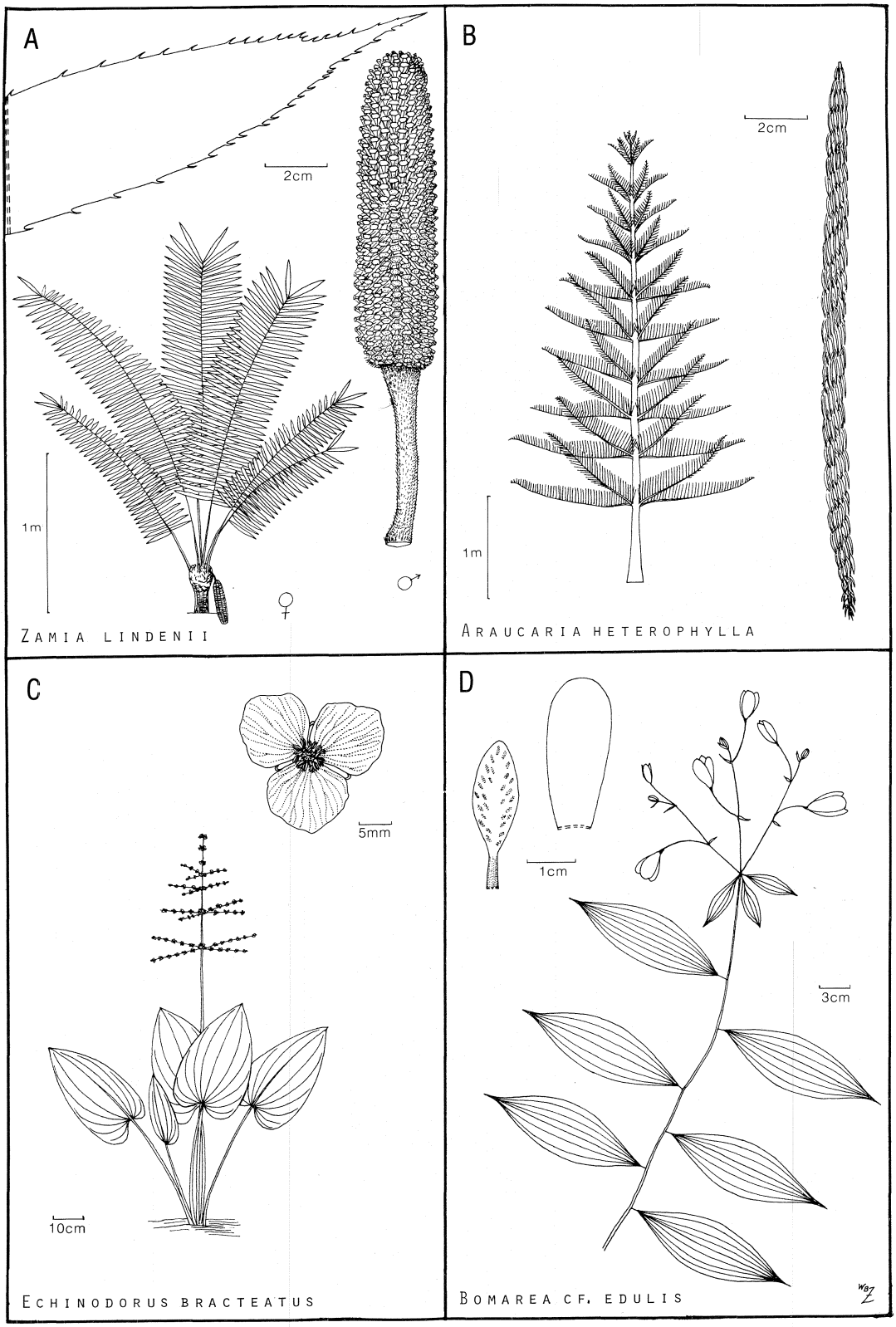
A
2cm
1m
♀
♂
ZAMIA LINDENII
B
2cm
1m
ARAUCARIA HETEROPHYLLA
C
5mm
10cm
ECHINODORUS BRACTEATUS
D
1cm
3cm
BOMAREA CF. EDULIS

Plate 20

ANGIOSPERMAE

MONOCOTYLEDONAE

AGAVACEAE

Furcraea selloa C. Koch. Plate 274-D
See Addendum for description.

ALISMATACEAE

Aquatic or semiaquatic acaulescent herbs. Leaves in a basal rosette, usually cordate or sagittate, long-petiolate, parallel-veined. Inflorescence simple or branched; sepals 3; petals 3; stamens 6 or more; carpels few to numerous.

Echinodorus bracteatus Micheli Plate 20-C

Aquatic plant. Leaves basal, broadly ovate, broadly cordate, acute at the apex, to 40 cm long, the blade shorter than the petiole, to 20 cm long. Inflorescence paniculately branched, to 1.5 m tall, each branch with a series of whorls of sessile or subsessile white flowers. Uncommon locally, in swampy areas. Panama to Ecuador; reported as endemic to Panama.

AMARYLLIDACEAE

Perennial herbs or vines, from a bulb. Inflorescence umbellate, flowers usually showy, regular or slightly zygomorphic; perianth of 6 parts, sometimes with a corona; stamens 6; ovary inferior.
Key to the species.

1. Vines with red flowers. . . . . *Bomarea* cf. *edulis*
1. Erect bulbiferous herbs with white flowers . . . . . *Urceolina grandiflora*

Bomarea cf. **edulis** (Tussac) Herb. Plate 20-D

Herbaceous vine. Leaves alternate, to 15 cm long, glabrous, narrowly elliptic. Flowers in a cluster at the apex of the stem, the sepals red, spotted with purple. Infrequent, crawling through lower story vegetation in sunny places. This species is known from Mexico, Central America, the West Indies, eastern Brazil, to Ecuador.
Common name "Papa de Venado"

Crinum amabile Donn ex Ker-Gawl. Plate 275-A
See Addendum for description.

Urceolina grandiflora (Planch. & Linden) Traub. Plate 21-A
Eucharis grandiflora Planch. & Linden

Plant bulbous. Leaves ovate, acute, to 40 cm long and 20 cm wide, petiolate. Inflorescence erect, to 50 cm. Flowers white, 7-8 cm in diameter; filaments joined to form a corona. Infrequent and local, in mature forest along trail 4. This species is known from Colombia to Amazonian Brazil and Peru. The plants of the population at Río Palenque have not produced flowers for more than 5 years. Bulbs brought into cultivation flower immediately. The horticulturally well-known genus *Eucharis* has recently been merged with *Urceolina.*
Common name: "Eucarista"

ARACEAE

Plants herbaceous, lianescent, tuberous, or epiphytic perennials, often climbing. Leaves simple or compound, alternate, petioled with a sheathing base. Inflorescence (the spadix) composed of tightly packed flowers on a central peduncle which is surrounded by or subtended by a single bract (the spathe) which may be highly colored, white or green. In some members the male and female elements are present in each flower, while in others female flowers are arranged at the base of the spadix and male flowers occur toward the apex.

Key to the species.

1. Plant a vine with rounded leaves firmly appressed to tree trunks (juvenile form) ..... *Monstera dubia*
1. Plant either not a vine or with leaves not closely appressed to tree trunks.
   2. Leaves with a spiny petiole ..... *Homalomena peltata*
   2. Leaves with a smooth or hairy petiole.
      3. Female flowers arranged together at the base of the spadix, the male flowers together at the apex.
         4. Stem an underground tuber or corm.
            5. Leaves with brightly colored spots ..... *Caladium* × *hortulanum*
            5. Leaves not spotted.
               6. Leaves peltate, blue-green ..... *Colocasia esculenta*
               6. Leaves sagittate, plain green ..... *Caladium riopalenquense*
         4. Stem vine-like or erect and trunk-like.
            7. Stem erect and trunk-like.
               8. Trunk to 3 m tall and to 20 cm in diameter; leaf blade to 2 m long ..... *Xanthosoma sagittifolium*
               8. Trunk much less developed, generally less than 1 m tall and 8 cm in diameter; leaf blade less than 1 m long.
                  9. Leaves sagittate at the base.
                     10. Leaf blade held stiffly erect, some specimens variegated ..... *Alocasia macrorhiza*
                     10. Leaf blade held laxly.
                        11. Leaves green on both sides.
                           12. Spathe white for apical portion, swollen portion green ..... *Xanthosoma daguense*
                           12. Spathe yellow .. *Caladiopsis dodsonii*
                        11. Leaves deep red on the underside ..... *Caladiopsis atropurpurea*
                  9. Leaves acute to cordate at the base.
                     13. Leaves heavily spotted with light green; cultivated ..... *Dieffenbachia maculata*
                     13. Leaves dark green with a light green midrib; native ..... *Dieffenbachia seguine*

7. Stem vine-like.
    14. Petiole obviously hairy . . . . . *Philodendron verrucosum*
    14. Petiole smooth.
        15. Leaves palmately divided into 5-9 leaflets . . . . . *Syngonium vellozianum*
        15. Leaves not dissected into leaflets.
            16. Leaf blade obviously divided into 3 lobes, with the basal lobes nearly separated into leaflets.
                17. Peduncle to 5 cm long; spathe green & cream . . . . . *Philodendron acuminatissimum*
                17. Peduncle to 30 cm long; spathe yellow . . . . . *Caladiopsis dodsonii*
            16. Leaves not conspicuously 3-lobed.
                18. Leaves large (blade more than 60 cm wide in mature leaves).
                    19. Petiole winged for basal 3/4; spadix greenish-white for the basal half . . . . . *Syngonium reticulatum*
                    19. Petiole winged for less than 1/4 of length; spadix light red for the basal half . . . . . *Philodendron devansayeanum*
                18. Leaves small to medium (less than 50 cm wide).
                    20. Petiole winged or margined for most of its length; leaves not alternating with bracts on the stem.
                        21. Plants profusely branched, semi-shrubby, mature branches cascading downward, not clinging to tree.
                            22. Base of the leaf blade truncate; some nodes without fully developed leaves on whip-like shoots.
                                23. Inflorescences 1-3 at the apex of stem branches, not subtended by the alate petiole of the apical leaf . . . . . *Philodendron karstenianum*
                                23. Inflorescences 1 at the apex of each stem branch, subtended by the alate base of the apical leaf . . *Philodendron inaequilaterum*
                            22. Base of the leaf blade acute; whip-like shoots not present . . . . . *Philodendron sulcatum*
                        21. Plants appressed to tree trunk, unbranched or hardly branched.
                            24. Leaf blade narrowly rectangular, to 90 cm long; fruiting spadix orange when ripe. . . . . *Philodendron senatocarpium*
                            24. Leaf blade broadly elliptical, to 25 cm long; fruiting spadix green when ripe . . . . . *Philodendron* sp. (5405, 5699)
                    20. Petiole not conspicuously winged or margined for most of its length; leaves alternating with bracts on the stem (bracts may be deciduous on older stems).
                        25. Leaf base sagittate or cordate; stem internodes elongate.

26. Leaf base sagittate.
    27. Inflorescence small, spathe to 8 cm long; female flowers with elongate styles. . . . . *Philodendron riparium*
    27. Inflorescence with the spathe 12-15 cm long; female flowers with sessile stigma.
        28. Stem at the base of the petiole surrounded by a persistent, net-like sheath; blade of the leaf with light green color-pattern down the midrib. . . . . *Philodendron pogonocaulis*
        28. Stem at the base of the petiole with a deciduous sheath; blade of the leaf plain green.
            29. Petiole oval in cross section, curved to the junction with the blade; spathe dirty red outside. . . . . *Philodendron cruentospathum*
            29. Petiole terete and straight to the junction with the blade; spathe greenish-white . . . . . *Philodendron ventricosum*
26. Leaf base cordate.
    30. Leaves light green on both sides.
        31. Petiole terete. . . . . *Philodendron scandens*
        31. Petiole flat and strap-shaped . . . . . *Philodendron platypetiolatum*
    30. Leaves dark green with a light green strip down the midrib (immature form) . . . . . *Philodendron pogonocaulis*
25. Leaf base narrowing at an acute angle or rounded; internodes very short . . . . . *Philodendron oligospermum*

3. Male and female elements of flowers integrated (each flower with male and female parts present), not arranged as separated units on the spadix.
    32. Mature leaves normally with holes in the blade or dissected.
        33. Blade dissected from the midrib to the margin (at least for some of the dissections in each leaf).
            34. Leaves rectangular to narrowly ovate in outline; native.
                35. Juvenile leaves changing to adult leaves high on the tree, adult leaves stiff and erect. . . . . *Monstera dilacerata*
                35. Juvenile leaves changing to adult leaves very early, adult leaves lax. . . . . *Monstera spruceana*
            34. Leaves broadly ovate in outline; cultivated . . . . . *Monstera deliciosa*
        33. Blade with holes along the midrib and not reaching the margin or dissected from the margin but not reaching the midrib. (Some leaves entire on the margin.)
            36. Blade with holes along the midrib; leaf shiny; spathe white outside . . . . . *Monstera lechleriana*
            36. Blade with holes along the margin; leaf dull; spathe pink outside . . . . . *Monstera dubia*
    32. Mature leaves normally without holes in the blade.
        37. Plant a slender epiphyte in tree tops . . . . . *Stenospermation longipetiolatum*
        37. Plant a vine on tree trunks or terrestrial.
            38. Plant a large, many branched, loosely growing vine hanging from tree trunks.

39. Leaves large (to 70 cm), petiolate, distichous; fruit on swollen but not deformed spadix . . . . . *Rhodospatha latifolia*
39. Leaves small (to 20 cm long), subsessile, loosely arranged; fruits composed of large (to 1.5 cm in dia.), yellow nutlets, deforming spadix . . . . . *Heteropsis integerrima*

38. Plant not a large, loosely growing vine, normally closely appressed to a tree trunk or limb or an erect terrestrial plant; stems infrequently branched.
40. Veins of the leaf regularly parallel; petioles winged for most of the length.
41. Leaves distichously arranged; spadix attached at the midpoint of the large, leaf-like spathe . . . . . *Spathiphyllum grandifolium*
41. Leaves spirally arranged; spadix attached at the base of the white spathe . . . . . *Rhodospatha* sp. (5662)
40. Veins of the leaf net-like; petioles not winged.
42. Leaf base conspicuously sagittate, cordate, or lobed, the blade not conspicuously longer than broad.
43. Veins on the upper surface of the leaf conspicuously protruding and knife-edged; plant terrestrial . . . . . *Anthurium lancea*
43. Veins on the upper surface of the leaf not conspicuously protruding.
44. Leaf blade 3-lobed; stem with elongate internodes . . . . . *Anthurium subcoerulescens*
44. Leaf blade cordate or sagittate but not conspicuously 3-lobed; stem with short internodes.
45. Spathe white, cup-shaped, erect; spadix pink to red . . . . . *Anthurium xanthostachyum*
45. Spathe green, flat and recurved; spadix green.
46. Leaf blade thickened on each side of the junction with the petiole; spadix elongate (20 to 90 cm) . . . . . *Anthurium dolichostachyum*
46. Leaf blade not thickened on each side of the junction with the petiole; spadix moderate (20 to 40 cm) . . . . . *Anthurium leucostachyum*
42. Leaf base narrowing at an acute angle (may have tiny cordate basal lobes), the leaf blade conspicuously longer than broad.
47. Plants with very short internodes; leaves pendent.
48. Leaf deep green; spadix pendent; nodes of the stem not obvious . . . . . *Anthurium punctatum*
48. Leaf with white midvein; spadix erect; nodes of the stem swollen . . . . . *Anthurium pallidiflorum*
47. Plants with short or long internodes but growing erect or scandent; leaves not pendent.
49. Stems not surrounded by net-like sheathes; leaves not punctate.
50. Plant with erect habit and very short internodes, sometimes terrestrial.
51. Petiole and peduncle not triangular.
52. Leaf blade to 1 m long; peduncle much shorter than the leaves. . . . . *Anthurium leoneanum*

52. Leaf blade to 40 cm long; peduncle equaling or longer than the leaves. . . . . .*Anthurium guayaquilense*
51. Petiole and peduncle triangular. . . . . *Anthurium buenaventurae*

50. Plant vine-like with long internodes.
53. Apex of the leaf blade blunt, the base tapering at an acute angle, the leaf blade to 40 cm long . . . . . *Anthurium incomptum*
53. Apex of the leaf blade tapering to a point, the base tapering at an obtuse angle, the leaf blade to 20 cm long. . . *Anthurium retusum*

49. Stem surrounded by net-like sheaths; leaves with black dots below.
54. Petioles short (to 3 cm). . . . . .*Anthurium scandens*
54. Petioles long (to 12 cm) . . . . . *Anthurium trinerve*

Alocasia macrorhiza (L.) G. Don Plate 21-B

Large terrestrial plant with creeping rhizomes and thick erect stems to 15 cm in diameter. Petiole to 1 m tall, the blade held stiffly erect, to 1 m long, 60 cm wide, usually variegated with white blotches, occasionally plain green. Growing around buildings and homesites and escaped in marshy places. Introduced from the paleotropics.

Anthurium buenaventurae Engl. Plate 21-C

Terrestrial plant with erect leaves; stem internodes very short. Petiole to 20 cm long to geniculum, triangular in cross section; blade elliptic, to 70 × 22 cm. Peduncle to 60 cm long; spathe 10 × 2.5 cm, purple; spadix dark purple-black, 9 cm long. Uncommon, in mature forest. Pollinated by *Eulaema bomboides.* Western Ecuador and Colombia.

Anthurium dolichostachyum Sodiro Plate 21-D

Epiphytic or terrestrial plant, variable in size but the largest *Anthurium* at the Science Center. Stem internodes very short. Leaf petiole to 80 cm; blade to 70 × 50 cm, the veins swollen on each side of the petiole. Peduncle to 30 cm long; spathe green, 20 × 2.5 cm; spadix 20-40 cm, growing to 90 cm long. Fruits bright red. Infrequent, in mature forest. Western Ecuador.

Anthurium guayaquilense Engl. Plate 22-A

Epiphytic plant with erect leaves and very short stem internodes. Petiole of the leaf to 10 cm long, terete (slightly canaliculate); blade elliptic, tapered acutely at both the apex and base, to 40 × 15 cm. Peduncle to 70 cm long; spathe to 10 × 1.5 cm, green; spadix to 10 cm long, 8 mm in diameter, greenish purple. Uncommon, at Río Palenque in tall trees; common, in the region of Quevedo. Western Ecuador.

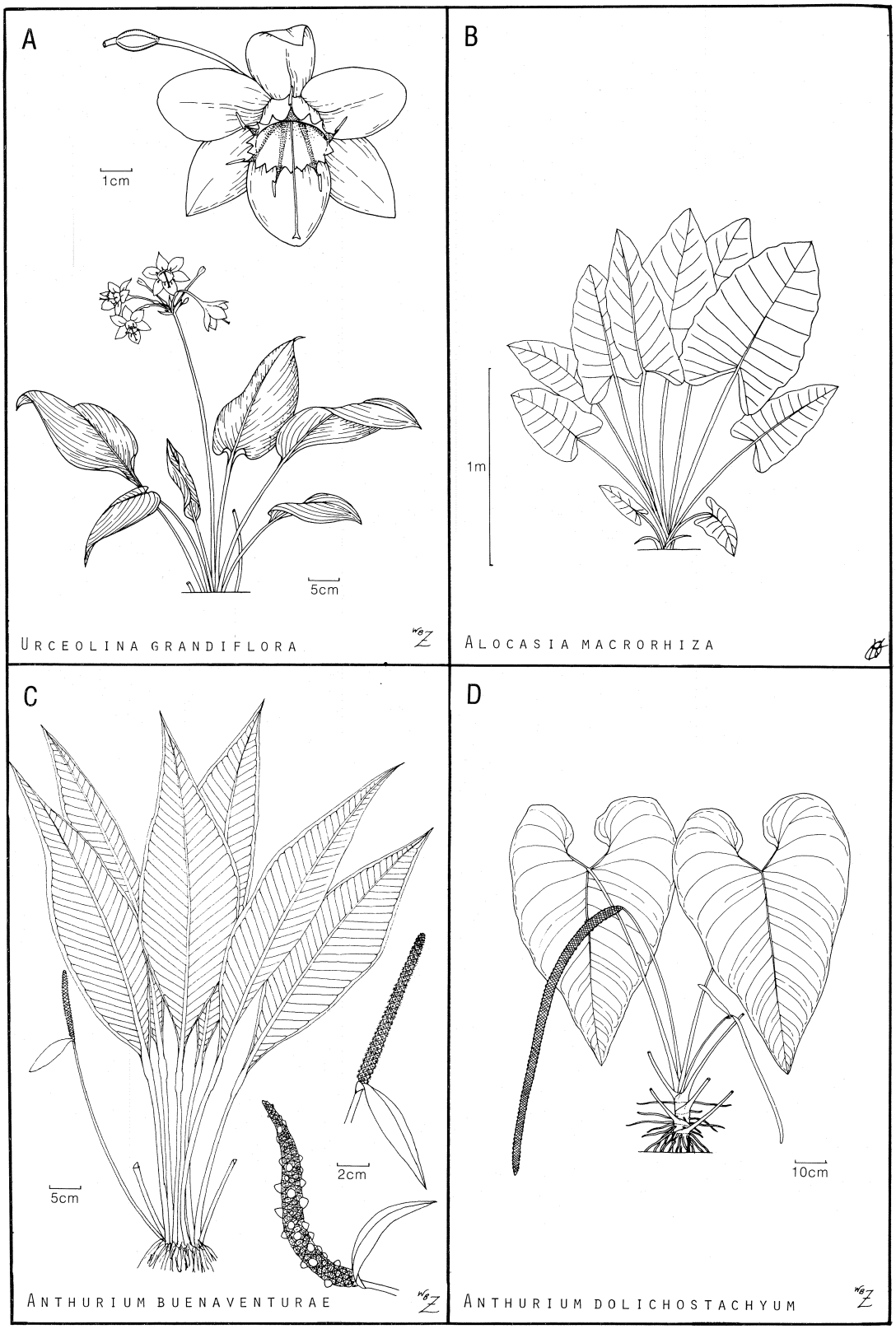
A
1cm
5cm
URCEOLINA GRANDIFLORA
B
1m
ALOCASIA MACRORHIZA
C
5cm
2cm
ANTHURIUM BUENAVENTURAE
D
10cm
ANTHURIUM DOLICHOSTACHYUM

Plate 21

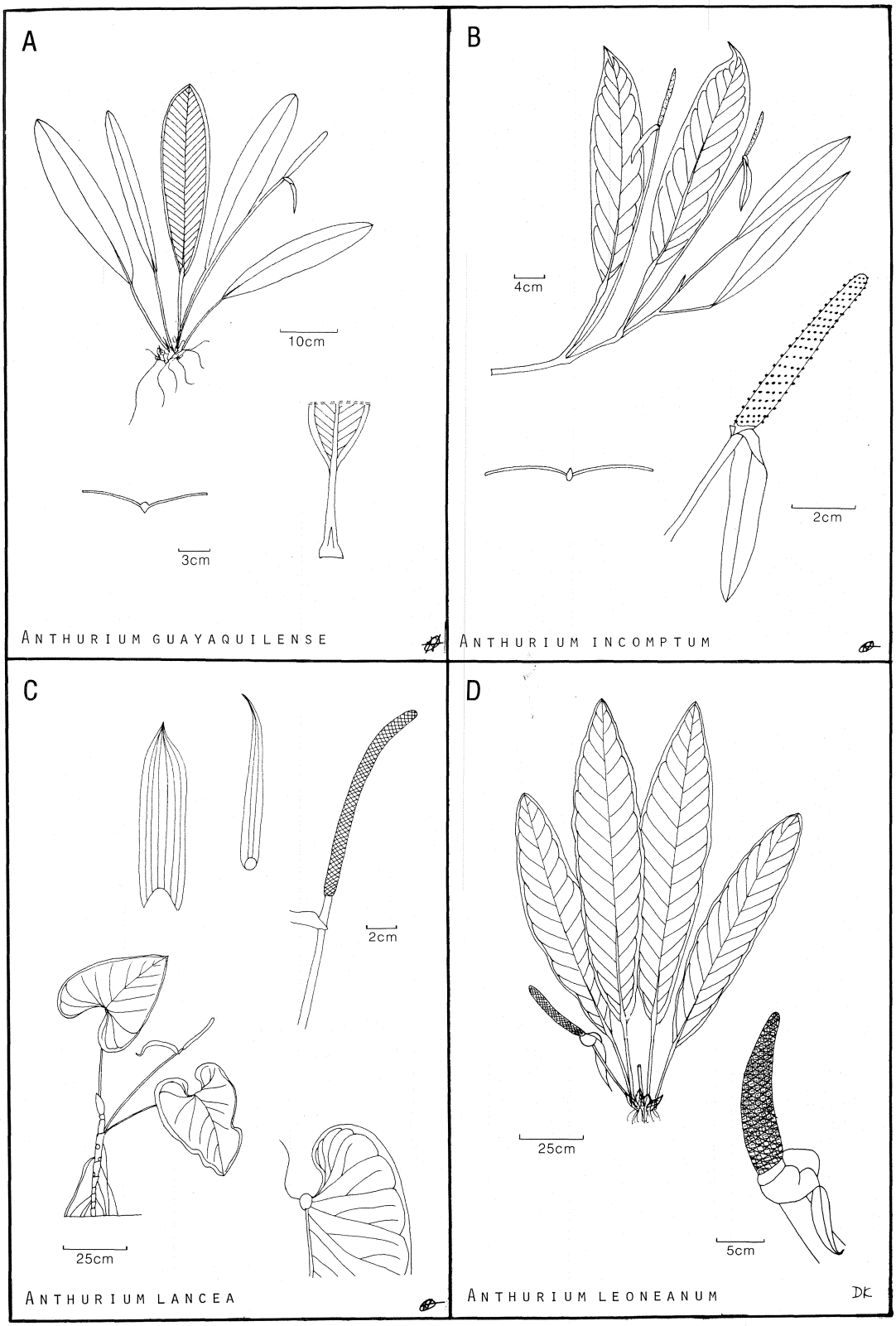
A
10cm
3cm
ANTHURIUM GUAYAQUILENSE
B
4cm
2cm
ANTHURIUM INCOMPTUM
C
2cm
25cm
ANTHURIUM LANCEA
D
25cm
5cm
ANTHURIUM LEONEANUM
DK

Plate 22

Anthurium incomptum Madison Plate 22-B

Epiphytic vine, the stem with internodes to 10 cm long. Petiole of the leaf 20 cm long, the blade rectangular, tapered obtusely at the base, about the same at the apex, to 35 × 10 cm. Peduncle to 20 cm long; spathe to 8 × 2 cm, green; spadix to 15 cm long. Fruits orange-red when ripe. One plant found along trail 3 near the Dodson road. Rare, in mature forest. Western Ecuador.

Anthurium lancea Sodiro Plate 22-C

Terrestrial herb, the stems with short internodes. Petiole of the leaf to 50 cm long, flat at the base, channeled above, the blade to 40 × 35 cm, the base subcordate to cordate, the basal lobes not overlapping, the veins conspicuous. Peduncle to 25 cm long; spathe pale yellow at anthesis, becoming green, 9 × 1.5 cm; spadix green, 10 cm long. Infrequent, in mature forest along the creeks. Western Ecuador.

Anthurium leoneanum Sodiro Plate 22-D

Plant very large, epiphytic or terrestrial, the stem with very short internodes. Leaves stiffly erect; petiole to 25 cm long, quadrate in cross section, the blade to 90 × 25 cm, widest above the middle, the base tapered to join with geniculum. Peduncle to 20 cm long; spathe green, to 15 × 5 cm; spadix purple, 20 cm long. Common, throughout mature forest. Ecuador.

Anthurium leucostachyum Sodiro Plate 23-A

Epiphytic or terrestrial, the stem internodes very short. Petiole to 80 cm long; blade ovate, to 70 × 50 cm, the veins not swollen on either side of the junction with the petiole, the basal lobes cordate and usually overlapping. Peduncle to 60 cm long; spathe green, 20 × 2.5 cm; spadix 20 cm long, growing to 40 cm long. Fruits dull green. Common, in mature forest. One of the largest species at the Science Center. Western Ecuador.

Anthurium pallidiflorum Engl. Plate 23-B

Pendent, epiphytic. Stems with short internodes, the nodes swollen, the bracts (cataphylls) disintegrating to white fibers, to 30 cm long. Petiole to 20 cm long; blade long and strap-shaped, to 2 m long by 10 cm broad, gradually tapering to the apex and base, the base with tiny, cordate lobes, with a silvery mid-vein. Peduncle to 30 cm long; spathe to 10 cm long, 1 cm wide, green; spadix erect to 10 cm long, white turning to green; berries red. Common, in mature forest. Western Ecuador.