A REVISION OF THE GENUS TRICHIPTERIS

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INTRODUCTION

The present work is one of a series of revisions of tree fern genera conducted under the aegis of Rolla M. Tryon, Jr. The basis for these studies is Tryon's work on the classification of the family (1970). According to his interpretation, the Cyatheaceae consists of six genera that have petiole scales and two non-scaly genera having only multicellular trichomes. The genus *Sphaeropteris,* the subject of subgeneric revisions by Tryon (1971) and Windisch (1977, 1978), has petiole scales of the unspecialized "conform" type, made up of uniform cells which are all oriented along the long axis of the scales. Two lines of specialization are recognized in *Sphaeropteris:* one in which the petiole scales have dark apical setae and a second with the petiole scales lacking setae. The remainder of the genera with scales have "marginate" petiole scales, made up of a central portion and a specialized margin of cells different in size and orientation, and usually in shape and color. Two of these genera *(Alsophila* and *Nephelea)* have setate petiole scales, and three *(Trichipteris, Cyathea,* and *Cnemidaria)* have asetate petiole scales. Gastony's data on sporangium size and spore number per sporangium (1974) supports Tryon's view that the setate and asetate groups are natural. *Trichipteris* is interpreted by Tryon (1970) as the least specialized of the asetate group of genera, since it has neither an indusium nor anastomosing veins. *Trichipteris* differs from *Cnemidaria* in stem habit, venation, leaf architecture, and spore morphology. Recognition of the exindusiate *Trichipteris* and the indusiate *Cyathea* as distinct genera is based on evidence that each is an independent evolutionary line.

HISTORY

"Differt hoc genus ab affini Polypodio praesentia indusii, ab affini Aspidio indusio e pilis copiosis implexis constante et persistente. Nomen derivatum a τριχος et πτερος."

With these words, Presl distinguished the new genus *Trichipteris* in his *Deliciae Pragensis,* published in 1822. Presl speaks of the genus as indusiate, the indusium consisting of copious, persistent, interwoven hairs. In the modern sense, Presl's genus is exindusiate. The paraphyses, prominent in the Brazilian plants that constitute the type species of the genus, remain an important morphological and taxonomic feature, although they are no longer considered to be indusia. Martius (1834) treated *Trichipteris* with *Chnoöphora* Kaulfuss as part of the genus *Alsophila.* Hooker

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(1844) recognized *Trichipteris* as a subgenus of *Alsophila* but did not treat *Chnoöphora.* Copeland (1947) recognized *Trichipteris* as a genus. Tryon (1970) redefined the genus *Trichipteris* on the basis of characters of the petiole scales to include the majority of the New World species previously ascribed to *Alsophila.*

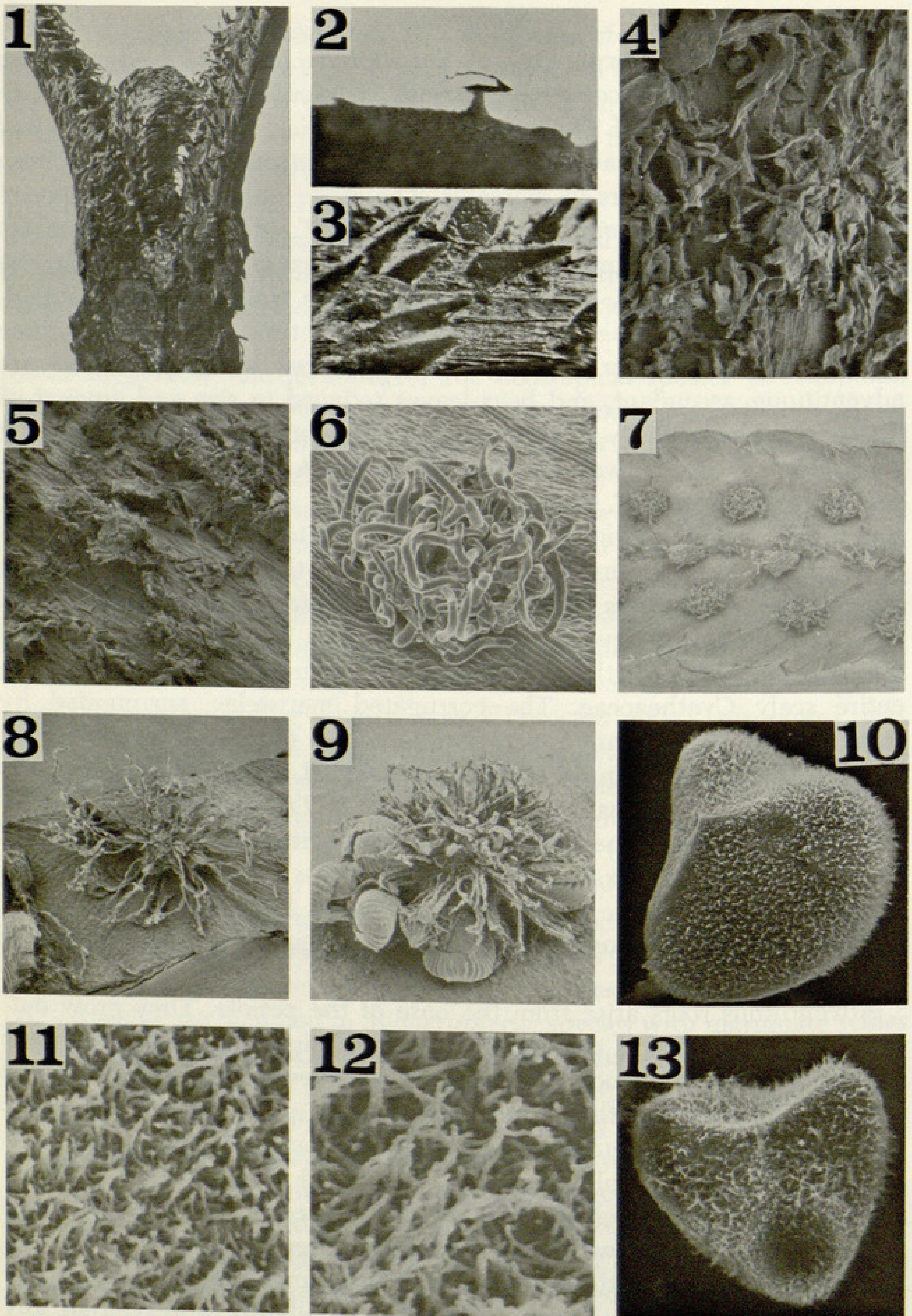
The genus *Alsophila* was recognized as such by Robert Brown in 1810. Until Tryon's reclassification, *Alsophila* included all exindusiate species of the Cyatheaceae with petiole scales. The indusiate species were included in *Hemitelia* and *Cyathea.* Martius (1834), on the basis of his observations on exindusiate Cyatheaceae in Brazil, produced an essentially sound subgeneric classification for the neotropical species of *Alsophila.* The first of his three subgenera is *Chnoöphora,* a name first used by Kaulfuss (1824). *Chnoöphora* Kaulfuss was set up as a genus of one species, now called *Trichipteris villosa* (Willd.) Tryon. The distinctive tomentum of contorted trichomidia characteristic of the species probably inspired the generic name (χνοῦς, tangled hair or cotton; φορα, bearing). Martius used the name *Chnoöphora* for a subgenus of three species. Two of those are included here in *Trichipteris corcovadensis* (Raddi) Copel and the third is now recognized as *Metaxya rostrata* (HBK) Presl. Martius described the two remaining subgenera on the basis of venation. Subgenus *Haplophlebia,* including what is now *T. procera* and *T. atrovirens,* was characterized by simple veins. Subgenus *Dicranophlebia,* characterized by veins forking at the sori, included eight of the species of *Trichipteris* recognized in this treatment and one species now included in *Sphaeropteris.* Maxon (1922) associated 13 species of *Alsophila* including *Alsophila armata* on the basis of the structure of the petiole scales, and provided a systematic treatment of the 13 species that he recognized. Tryon (1970) segregated the American species of *Alsophila* into three groups, based on characters of the petiole scales: species with conform petiole scales are included in *Sphaeropteris;* species with marginate scales bearing dark, apical setae are maintained in the genus *Alsophila;* and species with marginate petiole scales but lacking the dark, apical setae he has associated with *Trichipteris corcovadensis* (Raddi) Copel.

Trichipteris includes species and species groups that demonstrate modern concepts in the evolution of ferns. The biogeographical evidence for their integrity is most convincing. However, it would be unwise to interpret the evolutionary history of the genus based only on the information fully worked out in this study. Ten of the 55 species are based on one or two collections. The Guayana Highlands will probably yield several species that are presently unknown. The Brazilian species, which appear to be a group of morphologically variable populations only partially isolated evolutionarily, present taxonomic problems that must await work in the field to be resolved. The present monograph serves as a basis for further investigation of the biology and evolution of *Trichipteris.*

Morphology

Stem. The stem morphology of *Trichipteris* is variable. Diminutive species, such as *T. falcata,* have a small, fasciculate rhizome similar to that of many species of *Thelypteris.* Other species, such as *T. Williamsii* and *T. borinquena,* have more substantial rhizomes measuring from three to five centimeters in diameter. The stems of a number of species are ascendant: *T. procera, T. sagittifolia,* and *T. frigida* have ascendant stems reaching a maximum of about one meter in height. Among the arborescent species, *T. pubescens* is the least well-developed and although the stem reaches a height of three meters, it is at most three centimeters in diameter. The branches produced by *T. pubescens* are adventitious, ascendant, and bear leaves reduced in size and amount of dissection. The majority of the species in the genus have an arborescent stem (Fig. 1) up to twelve meters in height. A number of arborescent species, for example *T. Schiedeana* of Central America, have stems of small girth, ranging from three to five centimeters in diameter. A stem of five to ten centimeters in diameter and over three meters in height is typical of most species of the genus. *Trichipteris microdonta* and *T. pubescens* have well-developed lateral branches. The stems have a dictyostelic siphonostele with abundant sclerenchyma characteristic of the entire scaly Cyatheaceae. The corrugated meristeles, surrounded by sclerenchyma sheaths, are apparent in any stem cross section. Medullary bundles were present in all species examined. Lucansky (1974) reports cortical vascular systems in the two species of *Trichipteris* he examined. The stem anatomy of the diminutive species is little known. However, *T. borinquena* has been examined and shows a less condensed form of the dictyostelic siphonostele typical of the family. Meristeles are typically limited to three per cross section, and the vasculature of the petiole is less ramified.

Adventitious roots arise from the base of the petiole. They grow outward and downward as the stem increases in height. The entangled mass of dark, lignified roots near ground level provides a portion of the stem's support. Characters of the mature stem surface are of limited taxonomic importance for *Trichipteris.* The pattern of scars, abraded scales, and pneumatodes (small, hollow cavities in the stem surface), typical of the family Cyatheaceae, does not prove useful in discerning species relations. Stem habit is variable within species and is often the result of environment rather than genetic or ecotypic segregation. The anatomy of the petiole, and consequently the pattern of vasculature observed in any petiole scar, becomes more complex with size, but no pattern of variation that correlates with characters of established evolutionary significance is discernable. By contrast, the indument (epidermal structures) of the petiole, including spines, trichomes, scales, and scurf, is crucial to the taxonomy of *Trichipteris.* This indument is nonfunctional when the leaf is fully expanded. The petiole scales and scurf are a protective coating



FIGS. 1–13. FIG. 1, Stem apex, *Trichipteris Cyclodium* (*Maguire & Politi 27541*, NY). 2, Scale subtended by spine, *T. microdonta* (hort. Harvard University, propagated by G. J. Gastony). 3, Cretaceous scale border, *T. Cyclodium* (same as 1). 4, Petiole scurf, × 28, *T. Schiedeana* (*Barrington 405*, GH). 5, Petiole scurf, × 28, *T. gibbosa* (*Steyermark 91731*, GH). 6, Young sorus with paraphyses enveloping sporangia, *T. microdonta* (same as 2). 7, Ultimate segment with young sori, *T. microdonta* (same as 2). 8, Sorus with soral squamulae, *T. gibbosa* (same as 5). 9, Sorus with sporangia, *T. Lechleri* (*Buchtien 5298*, F). 10, Spore, × 680, *T. nigripes* var. *nigripes* (*Barrington 499*, GH). 11, Detail of Fig. 10, × 4000. 12, Detail of Fig. 13, × 4000. 13, Spore, × 640, *T. villosa* (*Duarte 10683*, HB).

for the crozier from the time it is differentiated from the stem apex through vernation.

Petiole spines. Petiole spines are undeveloped in the croziers of all *Trichipteris* species. They are variously developed on mature petioles, and are of the corticinate type described by Tryon (1970). I have used four terms to describe the development of spines on mature petioles. Petioles may be inermous: without any spines. Petioles with blunt protuberances, morphologically homologous to spines, are tuberculate. Muricate petioles bear short, conical protuberances with sharp tips. Petioles with any sort of long, fully developed spines are aculeate. In all cases the protuberances of the petioles are the points of attachment of petiole scales (Fig. 2). Species of *Trichipteris* vary considerably with respect to the size and density of spines. Young plants and plants of diminutive species usually have inermous petioles. The best development of spines is among species related to *T. corcovadensis*. However, closely allied species such as *T. villosa* have tuberculate or inermous petioles. Species allied to *T. armata* have unusually long, sharp spines. There is a tendency toward muricate and tuberculate petioles in the Andean species, but they cannot be distinguished as a group on the basis of petiole spines. Spines are noticeably altered when pressed and long, thin spines are especially susceptible to breakage. The color of the spines may differ from that of the petiole as a result of differential drying.

Petiole Scales. The petiole scales of *Trichipteris* lack the apical setae characteristic of *Nephelea, Alsophila,* and some species of *Sphaeropteris*. These scales are of the structurally marginate type (Tryon, 1970), with the central portion consisting of elongated cells appearing on the long axis of the scale. The margin consists of shorter, broader cells oriented more nearly transverse to the axis of the scale (Fig. 3). The development of the scale margin is highly variable. *Trichipteris borinquena* is characterized by petiole scales with a few rows of slightly differentiated cells forming an indistinct margin. *Trichipteris mexicana* has a broad margin of cells which differ from those of the central portion of the scale in shape and orientation. The scale margin in all species is fragile and easily abraded once the leaf has expanded. Collections of *T. phalerata* from Brazil often appear to have emarginate scales, but close examination of intact scales reveals a well-developed margin. Scales of the adaxial part of the base of the petiole commonly lack margins. Emarginate scales have been found in this particular part of the petiole in all species of marginate Cyatheaceae so far examined.

The color of the petiole scales on croziers and mature leaves of *Trichipteris* is of taxonomic importance. Cretaceous petiole-scale borders characterize the species related to *T. procera*, although they are present in species such as *T. costaricensis* as well. Some species related to *T. armata* also have cretaceous petiole-scale borders. The cretaceous border may extend into the structural central portion of the scale. In *T. Dombeyi* some of the cells of the cretaceous border are darkened. In numerous species allied to *T. armata,* dark setae line the edges of the scales. A number of species have concolorous or nearly concolorous scales (the borders may be slightly lighter in color). The coloration of the petiole scales is sometimes highly variable within a species. *Trichipteris dichromatolepis,* of southern Brazil, has petiole scales ranging from bicolorous with a cretaceous border to concolorous. Two species of *Trichipteris* (*T. villosa* and *T. atrovirens*) have petiole scales that are contorted helically when dried.

Petiole Scurf. In many species of *Trichipteris,* the petiole scurf forms a dense, appressed indument covering the surface of the petiole (Figs. 4 & 5). The structural components are trichomidia (small trichomes) and squamulae (small scales), as defined by Tryon (1970). The petiole scurf is useful as a taxonomic character. Large squamulae characterize species such as *T. microphylla* and *T. decomposita.* A scurf consisting of persistent squamulae is characteristic of species such as *T. procera* and *T. aspera.* Most Brazilian species lack a persistent, well-developed petiole scurf, but *T. Gardneri,* a species of the Campo Limpo area of Brazil, has a scurf of persistent squamulae. Petiole scurf becomes abraded with maturity, so that species with scurfy croziers may have glabrous petioles. Diminutive species of *Trichipteris,* even those allied to more robust species with dense, well-developed petiole scurf, usually lack it completely.

Trichomes. The petioles of some species of *Trichipteris,* especially those allied to *T. armata,* are pubescent with long, stiff trichomes. *Trichipteris Gardneri,* a species of Brazil related to *T. phalerata,* has pubescent petioles. Species with stiff, multicellular trichomes on the petioles were considered primitive by Riba (1969) in his work on the species related to *T. armata.*

Lamina Indument. The indument of the petiole often extends upward along the abaxial surface of the lamina axes, and its composition and distribution is taxonomically important. Scales are often present along the rachis. They may differ in color and in the development of the margin from the scales of the petiole base. The scurf along the axes of the lamina is often different from the petiole scurf in both composition and development. In most species, the indument found on the abaxial surface of the costae and costules is considerably different from that of the major axes and the petiole. Flattish to bullate squamulae are often prominent along the costae and costules. The two types of squamulae are usually found on the same costae, in which case the flattish squamulae are proximal and the bullate squamulae are distal along the axes. Trichomes and trichomidia are common on the abaxial surface of the lamina, especially in the species allied to *T. armata.* In a few species (*T. frigida, T. Schlimii,* and *T. Hodgeana*) the axes are covered abaxially with a scurfy tomentum similar in composition to that of the petiole scurf. The basal parts of the pinna-rachises and costae in many species bear a close-packed group of squamulae similar to those scattered along the remainder of the axes. Large, filiform squamulae are borne near the bases of the axes of many species.

The adaxial surface of the axes in *Trichipteris* is glabrous or has stiff, multicellular, arcing trichomes. Squamulae, trichomidia, and scales are not found on the adaxial surface. Because the adaxial indument is so uniform, I have limited my descriptions and discussions of lamina indument to that of the abaxial surface.

The indument of the axes, like that of the petioles, is functional only during the vernation of the leaf. The structures remaining on mature leaves represent only a portion of the original indument. The rest is lost in maturation.

The following terms, which I have used to describe the color of the leaf axes and indument, are based on Stearn's color terms (Stearn, 1966): *atropurpureous*-dark purple; *castaneous*-dark, reddish brown; *cretaceous*-the color of chalk (white with a faint, yellowish tinge); *diaphanous*-translucent; *ferruginous*-reddish brown; *fulvous*-golden brown or light brown; *fuscous*-dark brown; *nigrescent*-blackish.

Lamina. The lamina of *Trichipteris* species varies considerably in degree of dissection. Species with 1-pinnate leaves have evolved at least twice in the genus, and there is a 3-pinnate-pinnatifid species from Venezuela. In *T. demissa* and *T. borinquena*, fertile leaves can be either 1-pinnate-pinnatifid or 2-pinnate-pinnatifid. *Trichipteris corcovadensis*, of southern Brazil, includes both 2-pinnate plants with large, oblong-lanceolate, entire pinnules and 2-pinnate-pinnatifid plants with diminutive, linear-lanceolate, deeply lobed pinnules. I have not considered differences in leaf dissection alone to be evidence of speciation in *Trichipteris*. However, a number of cases exist in which speciation has included a change in the dissection of the lamina. Incipient speciation in *T. demissa* is recognizable in *T. demissa* var. *thysanolepis*, based on plants differing from the putative parent population in both petiole scale morphology and leaf dissection. *Trichipteris decomposita* differs from *T. procera* in its petiole scurf as well as in the dissection of the lamina.

There are young plants which produce fertile leaves less dissected than those typical of older plants of the same species. They occasionally have been recognized as species (*Alsophila Gleasoni*, a synonym of *Trichipteris procera*). Occasionally, damaged plants continue to grow, producing foliage that is reduced in complexity. Unusually small plants and damaged plants have the indument and soral characteristics of more typical plants.

The leaf texture of *Trichipteris* plants often varies with insolation. Those species (e.g., *T. Gardneri* and *T. villosa*) of drier, sunnier areas have revolute, coriaceous leaves, while most of the forest species have flattish, papyraceous to chartaceous leaves. The leaves of the forest species found growing in open areas, for example *T. pauciflora* from the páramo areas of Venezuela, are revolute and coriaceous. Although I have included the texture of the leaves in the species descriptions, it varies enough to be a character of only limited value.

The shape of the leaf apex is often of taxonomic value in *Trichipteris*. In a few species, the apex of the leaf is an articulated pinna conforming in shape and size to the medial pinnae of the lamina. In other species, the width of the leaf near its apex is abruptly reduced. Gradually reduced and acute apices are characteristic of a number of species. The remainder have a gradually reduced and acuminate leaf apex, which I interpret as intermediate between leaves with abruptly reduced apices and those with gradually reduced acute apices. In the intermediates, the apex is drawn out into a long tip, as in the pinna-like leaves, but there is no abrupt reduction in the size of the pinnae. *Trichipteris Schiedeana* and *T. nigripes* are species with a gradually reduced acuminate apex. There is some variation in the leaf apex within species.

Pinnules. The length of the petiolules of the pinnules is of some taxonomic importance in *Trichipteris*. In species such as *T. Kalbreyeri*, the petiolules are unusually long. By contrast, species related to *T. procera* commonly have sessile pinnules. In *T. nigripes* there is considerable variation in petiolule length. For example, although the pinnules of *T. nigripes* var. *nigripes* are petiolulate, those of *T. nigripes* var. *brunnescens* are sessile. In the taxonomic section, the described length of the petiolules is relative to the width of a single ultimate segment in pinnatifid species. Short-petiolulate describes petiolules shorter than the width of one lobe; petiolulate describes petiolules of about the same length; and long-petiolulate describes petiolules longer than the width of one lobe.

The shape of the pinnules (pinnae of 1-pinnate species) is not a reliable taxonomic character. Both attenuate and obtuse pinnules are common in some species, such as *T. procera*, *T. Schiedeana*, and *T. atrovirens*. Also, there is a tendency for the pinnules of the basal pinnae of most species to be obtuse, though those of more apical parts of the lamina may be acuminate or attenuate. Unfortunately, the shape of the pinnules imparts a characteristic appearance to specimens, and numerous species have been described based on variations in shape alone.

However, the dissection of the pinnules is often a useful taxonomic character. In my descriptions, the depth to which the penultimate segments are dissected is relative. Shallowly pinnatifid pinnules are dissected about one-quarter the distance to the costae. Pinnatifid pinnules are dissected about one-half the distance to the costae. Deeply pinnatifid pinnules are dissected about three-quarters of the distance to the costae. I have defined the tip of the pinnules as distinct from the apex. The shape of the apex is ordinarily useful as a taxonomic character. In some cases, the dissection of the tips of the pinnules (pinnae of 1-pinnate species) is also helpful. The shape and dissection of the lobes (ultimate segments) has been included in my descriptions. Occasionally, distinctive cutting of the lobes is diagnostic, as in *T. Kalbreyeri*.

Veins. Venation is closely correlated with dissection of the penultimate segments. In typical 2-pinnate-pinnatifid species of *Trichipteris,* the pinnules are deeply lobed, and each lobe is supplied with a costule bearing several simple or forked free veins. Venation of 1-pinnate-pinnatifid species is similar. Two-pinnate-pinnatifid species of *Trichipteris* with crenate or entire pinnules have veins that arise from an indistinct costule and are concurrent to the leaf margin. In several 1-pinnate-pinnatifid species with entire pinnae, the concurrent veins are casually anastomosing. Although venation varies from simple to forked in *T. procera, T. dichromatolepis, T. nigripes,* and others, most species are characterized by one, but not both, venation states. Simple veins can be found distally on leaves of many *Trichipteris* species characterized by forked veins, so description and analysis of venation must be from the more typical medial parts of the leaves. Damaged plants often have aberrant veins. Venation states are of taxonomic value in *Trichipteris.* Martius (1832) established two subgenera of *Alsophila* (substantially modern-day *Trichipteris*) based on venation states. Simple venation characterizes the closely related group of species including *T. procera.* Forked veins are characteristic of all but a few scattered species in the remainder of the genus.

Sori. The sori are borne on the veins of the abaxial leaf surface and not on the margin. *Trichipteris praecincta* and *T. nanna* have submarginal sori. *Trichipteris procera* has sori that vary in position from submarginal to subcostal. In the remaining species of the genus, the sori are near the middle of the veins on which they are borne. In 2-pinnate specimens of *T. corcovadensis,* the sori are in a single row along each side of the costae. In *T. Williamsii* and *T. Cyclodium* they are in two or three rows along each side of the costae. The unusual distribution of sori in these species can be related to the dissection of the lamina.

The sorus (Fig. 7) consists of an expanded receptacle on which paraphyses and sporangia are borne. No indusium of tissue derived from the proximal part of the receptacle and adjacent vein is present. The length of the paraphyses has been measured relative to the length of the sporangium and its stalk. *Trichipteris procera* and its relatives have paraphyses that are shorter, if not much shorter, than the sporangia. The remaining species have paraphyses normally as long as, or longer than, the sporangia. The mass of paraphyses gives the receptacle a specific appearance dependent on their length. The receptacle may be described as puberulent, hirsute, pilose, or villous. Variation in the structure of the paraphyses has not proved to be an important character. Uniseriate, multicellular paraphyses are typical of the genus. In species such as *T. dichromatolepis,* some specimens have multiseriate paraphyses. *Trichipteris nesiotica,* endemic to Cocos Island, has unusually short, thick paraphyses. They are, like the petiole scales and scurf, functional only during vernation (Fig. 6). The structures seen on specimens of mature leaves are remnants, which become more and more abraded in older material. Since the length of the paraphyses is of major diagnostic importance, newly mature specimens with intact paraphyses are necessary for critical determination.

The genus *Trichipteris* is by definition exindusiate. The sori are more or less enveloped by soral squamulae in six of the species (Fig. 8). The soral squamulae differ from hemitelioid (partial) indusia in their structure and attachment. Soral squamulae are translucent and attached at the base of the receptacle by a narrow base and may be attached all around the receptacle. In contrast, indusia are opaque, thickened structures attached by a broad base to the proximal side, if not the entire perimeter, of the receptacle. *Trichipteris sagittifolia* and *T. Steyermarkii* have a number of broad, dark squamulae surrounding the sori, forming a complete covering. *Trichipteris costaricensis* has several pale squamulae nearly enveloping the sori; *Trichipteris gibbosa* has one or more associated with the sori; in *T. aspera* the soral squamulae vary from numerous, broad and dark to single, biseriate, and nearly diaphanous. Four of the six species with soral squamulae are found in the area of Golfo de Paría, Venezuela. Soral squamulae constitute a useful character in *Trichipteris.*

Sporangia and spores. The sporangia in *Trichipteris* are borne on a short stalk of four cells (Fig. 9). The sporangium has an oblique, complete annulus that is interrupted laterally by a stomium of thin-walled cells. The sporangia are relatively large, and contain either 32 or 64 spores (Gastony, 1974), having a perine, the surface features of which are nearly uniform throughout the genus (Figs. 10–13). The typical perine bears numerous minute cilia more or less developed into a dense tomentum. The exine is psilate in the species I have examined. Preliminary work on the perine morphology of *Cyathea* and work on the spore morphology in *Cnemidaria* (Stolze, 1974) indicate that spore morphology could be a useful generic character for the Cyatheaceae with asetate, marginate scales. Species relations in *Trichipteris* are not corroborated by variation in surface features of the spores. Walker (1966) reported a chromosome number of $n = 69$ for *Trichipteris armata.*

Geography and Ecology

Geographic data have often been the basis for initial interpretation of little known and biologically unstudied groups of ferns such as *Trichipteris.* Recent revisionary work in the Cyatheaceae (Gastony, 1973; Stolze, 1974; Tryon, 1971 & 1976) includes geographic distributions that substantiate conclusions drawn from morphological data. The small size of windborne spores results in frequent long-distance dispersal of ferns. Uniformity in geographically widely separated populations of a species is common, e.g., the large number of arctic ferns occurring on all the northern continents (Hultén, 1964). At the same time, it is geographic isolation that is often the most significant in the evolution of the pteridophytes. Interference with regular long-distance dispersal results in genetic isolation and morphological discontinuity of geographically isolated populations.

The center of distribution for the genus *Trichipteris* is the Andes, a mountain range presenting diverse barriers to long-distance dispersal. Of the 55 species in the genus, 23 are found in the continental South American Andes. Another 19 are from mountain ranges continuous geographically, if not geologically, with the Andes (the mountains of Central America and the Antilles). These regions include altogether about 75% of the species in the genus.

All of the genera of the Cyatheaceae with petiole scales are represented in the Andes. Four of the six genera with scales are restricted to the New World, and are most diversified in the mountains of the New World tropics. The stem anatomy of the known species of the scaly Cyatheaceae is surprisingly uniform (Lucansky, 1974). Other structures uniform throughout the group, such as sporangia, suggest that it is monophyletic. The typical cyatheaceous stem anatomy is to be seen in fossils from the Jurassic (Ogura, 1927) to the late Tertiary (Bancroft, 1932). Apparently plants of the Cyatheaceae have been in existence since the Mesozoic and have moved into the Andes as the mountains were uplifted. Present diversity may be the result of successful exploitation of habitats created during the Andean uplift.

Trichipteris is interpreted as a relatively unspecialized genus in the family Cyatheaceae (Tryon, 1970). Although it is well-represented in wet forests at high altitudes, 11 of the 42 species, or 26.2%, are restricted to low elevations (below 1000 m.), with another 18 extending below 1000 meters. Thus, two thirds of the genus is found growing below 1000 meters. The montane or cloud forest habitat typical of the vast majority of cyatheaceous species does not extend down to 1000 meters. The adaptation of *Trichipteris* to low altitudes is reflected in the unusual Amazonian distribution of two species and the diversification of the genus in southern

TABLE 1. ALTITUDINAL RANGE*

Altitude	No. of species	% of total species (42)
0–1000 m.	11	26.2
0–2000 m.	13	31.0
0–3000 m.	4	9.5
0–4000 m.	1	2.4
1000–2000 m.	6	14.3
1000–3000 m.	3	7.1
1000–4000 m.	0	0
2000–3000 m.	1	2.4
2000–4000 m.	1	2.4
3000–4000 m.	0	0
Unknown	1	2.4

*Excluding *T. armata* and allies

TABLE 2. HABITATS*

Habitat	No. of species	% of total species (42)
Original forest	28	66.2
Secondary forest	1	2.4
Open situations	1	2.4
Páramo	0	0
Original & secondary forest	3	7.1
Original & secondary forest, open situations	2	4.7
Original forest & páramo	2	4.7
Secondary forest & open situations	3	7.1
Unknown	2	4.7

*Excluding *T. armata* and allies

Brazil. The possibility exists that the Cyatheaceae in modern times have undergone adaptive radiation primarily in the wet forests at higher altitudes, and that evolutionarily older groups such as *Sphaeropteris* and *Trichipteris* are the only genera diversified at lower altitudes.

The genus *Trichipteris* is unique among the genera of the family in its adaptation to mesic and subxeric environments and its tolerance to full sun (Table 2). Maxon (1914) describes the ecology of *Trichipteris costaricensis* as follows:

> "The original specimens . . . have the appearance of being decidedly xerophilous for a tree fern; and it is interesting to note that the Guatemalan specimens cited below are all from the drier, western part of that country, and that the Santa Rosa specimens in particular, which in their lesser size perfectly match the original, are from a region which, in fact, may even be called semiarid. Few tree ferns are able to exist in such surroundings."

Trichipteris villosa has a similar ecology and consequently a distinctive geographical distribution. It is characterized by a tomentum of small, contorted trichomes, which is found to be more dense with increased exposure to sunlight. There is a tendency toward revolute, coriaceous segments. It has been collected in dry washes, open savannas and grasslands throughout South America, commonly in full sun. Several other species *(T. atrovirens, T. corcovadensis, T. dichromatolepis, T. Gardneri,* and *T. phalerata)* are adapted to drier areas with greater insolation.

Two, and possibly three, species of *Trichipteris* occur in the alpine areas (páramos) of South America. They are characterized by many of the same specialized features as the "xeric" species. *Trichipteris frigida* of the northern Andes is largely confined to the páramos. It has segments that are revolute and coriaceous, the axes of the lamina are covered with a dense tomentum of pale trichomidia, and the costae bear finely laciniate squamulae. *Trichipteris demissa,* a species with rigidly coriaceous leaves, is found on open summits of tepuís in the Guayana Highlands. The adaptation of species of *Trichipteris* to alpine areas is unique in the family. Although *Trichipteris* is a relatively unspecialized and theoretically old genus of the Cyatheaceae, it has the broadest tolerance for reduced

TABLE 3. REGIONALISM AND ENDEMISM*†

Geographic Region	Species Numbers	Number (%)	No. endemic (% for region)
Mexico and Central America	*8*,10,*12*,*18*,*26*,*28*,*39*,40,*42*, *44*,45,*47*,*53*,*54*,55	15 (27.3)	11 (73.4)
Andes, Pacific	*7*,*9*,15,26,40,*45*,*46*	7 (12.7)	4 (57.2)
Andes, Atlantic	1,*2*,*3*,*4*,*6*,*11*,*14*,15,*16*, 17,*20*,*21*,*22*,*23*,27,28, 40,45,46,*52*	20 (36.4)	12 (60.0)
Caribbean	1,*5*,*13*,*25*,26,*35*,*43*,*48*,*49*	9 (16.4)	7 (77.8)
Guayana Highlands	1,10,17,22,27,28,*36*,*37*,*38*	9 (16.4)	3 (33.3)
Amazon Basin	1,*19*,26	3 (5.5)	1 (33.3)
Brazil, Campo Limpo	1,28,30,*31*,50	5 (9.1)	1 (20.0)
Brazil, Serro do Mar	26,*29*,30,*32*,*33*,*34*,*41*,50,*51*	9 (16.4)	6 (66.7)

*Including *T. armata* and allies

†Numbers refer to species numbers used in this revision, endemic species in italics.

moisture and increased sunlight, including the exposure inherent in alpine habitats, of any genus in the family.

There are a number of distinctive geographic relationships involving regionalism and endemism in the genus *Trichipteris* (Table 3). I have discussed the unique presence of *Trichipteris* in the Amazon Basin, indicating the adaptation of the genus to low altitudes. Although each genus of the scaly Cyatheaceae is found in southern Brazil, *Trichipteris* is the only one represented by a large, confusing group of species suggesting adaptive radiation. Eleven species in the genus are found in Brazil; of these, nine are endemic. The majority of these species are polymorphic (a situation fostering a plethora of specific epithets). The success of *Trichipteris* in Brazil can, in part, be correlated with its adaptation to the drier climate of the Campo Limpo area in the states of Goyas, Minas Gerais, and Matto Grosso. Species of *Trichipteris* are also found in secondary forests, shrubby situations, and original forests in the Serra do Mar. One species, *T. phalerata,* occurs in both the Campo Limpo and the Serra do Mar regions. The complex variability found in the Brazilian species may have resulted in part from modern fluctuations in the climates of the Campo Limpo and Serra do Mar, and the episodic isolation of populations in secondary forest and open situations.

The Guyana Highlands are a geologically old formation of isolated tepuís (mesas) with a highly endemic angiosperm flora. The endemism among the ferns is not as common as in the angiosperms: only *Pterozonium* (Lellinger, 1967) and *Hymenophyllopsis* (Lellinger, pers. comm.) have a significant number of endemic species there and are essentially limited to that area. *Trichipteris* is one of the smaller number of genera with species endemic to the region. Three of the nine species found in the Guyana Highlands are endemic. The polymorphic *T. demissa* and the related *T. Cyclodium* are evidence that endemic species in the Guayana Highlands are presently evolving, although they are highly isolated in the genus. Another species, *T. villosa,* occurs in the open savanna areas of the Guayana region, not in association with the tepuís: it is not endemic.

In the Caribbean, the genus *Trichipteris* is characterized by broadly distributed, as well as locally endemic, species. *Trichipteris aspera, T. microdonta,* and *T. procera* are widespread. In contrast, three species are endemic to single islands in the West Indies. *Trichipteris borinquena* of Puerto Rico and *T. Hodgeana* of Dominica have no close relatives in the genus. *Trichipteris sagittifolia,* endemic to Trinidad, is a member of a close-knit group of three species (including *T. Steyermarkii* and *T. cordata*).

The distribution of most *Trichipteris* species in the Andes conforms to one of two patterns: Pacific or Atlantic drainage. Species with distributions along the Atlantic drainage commonly reach the Sierra de Perija and consequently are included in early collections from Colonia Tovar in the Venezuelan Andes. The Atlantic drainage species, *T. pubescens* and *T. Lechleri,* also grow in the Guayana Highlands. The Amazonian *T. nigra* is related to *T. Schlimii,* a species of the Atlantic slopes of the Andes. Endemism among species of this geographic alliance is the most common in Venezuela. In the Andes of Venezuela, the Penísula de Paria, and in Trinidad there are five species of *Trichipteris* with ranges of less than 300 miles. Species of the Atlantic drainage of the Andes extend southward as far as Bolivia. Species 11 to 26 form a morphologically cohesive group almost entirely confined to the Atlantic drainage.

The Pacific drainage association of species is much smaller. Most important are two 1-pinnate-pinnatifid species *(T. falcata* and *T. phalaenolepis)* endemic to the Dagua Valley of Colombia, growing at altitudes below 1000 meters. *Trichipteris ursina,* a Central American species closely related to *T. phalaenolepis,* is similar in habitat but has a more extensive geographic range. *Trichipteris microdonta,* a broad-ranging species of low altitudes, is also present in the Dagua Valley. There are no species found in the more southern parts of the Andean Pacific drainage because of the extreme aridity.

Among the species of *Trichipteris* (excluding the group of *T. armata,* revised by Riba in 1967) only *T. nigripes* and *T. pilosissima* occur on both the Atlantic and Pacific slopes of the Andes. In *T. nigripes,* the plants from the Pacific drainage are morphologically distinct, especially at lower altitudes, from those of the Atlantic drainage. No vicarious species pairs have been found that are from the opposite slopes of the Andes. The mountain range is apparently a significant barrier to migration. A seemingly impossible disjunct distribution between the mountains of Panama and the Guayana Highlands is reported for *T. Williamsii*. This disjunction is recorded for a number of angiosperms, for example the Chrysobalanaceae (Prance, 1974) and Myristicaceae (Gentry, 1975). The isolated position of *T. Williamsii* in the genus suggests that its distribution is a relict of a formerly continuous range more recently disrupted by the Andean uplift.

The ranges of the species in *Trichipteris* are generally limited. Over 35% have a range of less than 300 miles, while in contrast, only about one-third have ranges exceeding 750 miles (Table 4).

Geographic ranges, when correlated with morphological data, provide insight into the evolution of *Trichipteris* species. The number, their morphological similarity, and divergent populations suggest that there has been substantial evolution in the genus within the recent past. Speciation via peripheral isolation (Tryon, 1972b) is best seen in *T. aspera* and *T. gibbosa*. *Trichipteris gibbosa* is a continental species, which apparently has become isolated in the recent past from the closely allied Antillean species *T. aspera*. *Trichipteris gibbosa* has undergone enough modification of the indument of the costae, costules, and paraphyses to suggest that it is isolated genetically from *T. aspera*. The vicarious species pair, *T. sagittifolia* (endemic to Trinidad) and *T. Steyermarkii* (from Sucre and Monagás, Venezuela), also suggests that species on the Caribbean islands can become isolated from those on the adjacent mainland. Incipient speciation resulting from peripheral isolation is apparent in Pacific coastal populations of *T. nigripes*. *Trichipteris atrovirens* has apparently been derived from Brazilian elements of *T. villosa* through isolation at the southern periphery of *T. villosa*'s range. A change in environmental adaptation toward a secondary forest niche has accompanied this evolution.

Long-distance dispersal, as a precursor to speciation, can be seen in *T. ursina* and *T. phalaenolepis*. The two are morphologically close, differing only in the coloration and distribution of the petiole scales. They are separated geographically by the distance between Costa Rica and southern Colombia. One species apparently has been derived from the other after successful long-distance dispersal. Two varieties of a single species endemic to the Guayana Highlands provide an excellent example of

TABLE 4. RANGE EXTENT*

Range extent	No. of species	% of total species (42)
0–100 mi.	16	29.2
100–300 mi.	5	9.1
300–750 mi.	12	21.8
750–1500 mi.	12	21.8
1500–3000 mi.	8	14.5
3000–5000 mi.	2	3.6

*Including *T. armata* and allies

long-distance dispersal. *Trichipteris demissa,* a variable species, includes an atypical population from the isolated Cerro Duida. In at least one case, isolation of disjunct populations has not resulted in morphological differentiation. The range of *T. villosa* consists of four isolated populations (Guyana Highlands, Atlantic drainage of the northern Andes, Bolivian Andes, and the Brazilian Campo Limpo). Reduction in the geographic extent of the dry, open habitat in which *T. Villosa* is found may have been the cause. Lack of change in the environment of the isolated populations may have made lack of morphological change possible.

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NOMENCLATURE

Format of the nomenclature follows Tryon (1970, 1976) and Gastony (1973). The citation of type collections in this treatment includes only the information in the original descriptive literature for the species. Any additional information from materials of the type collection or other literature sources is included in parentheses.

SYSTEMATIC TREATMENT

TRICHIPTERIS PRESL

Trichipteris Presl, Delic. Prag. 1:172. 1822. (Altered to *Trichopteris* by Schott, Gen. Fil., t. 5. 1834, and others, but Art. 73, Internat. Code Bot. Nomencl., XIIth Internat. Bot. Congress removes all reasons for accepting the altered spelling.) TYPE SPECIES: *Trichipteris excelsa* Presl = *Trichipteris corcovadensis* (Raddi) Copeland.

Chnoöphora Kaulfuss, Enum. Fil. 250. 1824. TYPE SPECIES: *Chnoöphora Humboldtii* Kaulf. *nom. superfl.* for *Cyathea villosa* Willd. = *Trichipteris villosa* (Willd.) Tryon.

Alsophila pro parte auct. pl., e.g., Martius, Icon. Plant. Crypt. Brasil, 62–75. 1834.

Hemitelia pro parte Kuhn, Linnaea 36:159. 1865.

Cyathea pro parte Domin, Pteridophyta 262–263. 1929.

Stem creeping to erect, unbranched or rarely with adventitious branches, to ca. 10 cm. in diameter and 12 m. in height; externally with numerous close-set, oblong to rotund leaf scars composed of numerous bundle scars, subtended by one or more pneumatodes; the intercalary stem surface with the remains of epidermal scales and heavily lignified roots; the roots developed downward in arborescent species into a buttress-like system supporting the base of the stem; the remains of the petioles variously persistent toward the upper portion of the stem; internally with a simple to condensed dictyostelic siphonostele separated by the leaf gaps into corrugated meristeles, more or less enclosed in a sheath of schlerenchyma, the stele often accompanied by series of medullary and cortical bundles. *Croziers* arising from the stem apex in a tight spiral; without well-developed spines; with densely matted, brownish or white to green and photosynthetic scales, the cells of the marginal part of the scales different in orientation, size and usually in shape from those of the central portion; trichomes present in some species; often with a well-developed, closely appressed and usually dark-colored scurf of large to small squamulae and trichomidia; segments of developing leaves revolute, enclosed by scales and scurf, the developing sori more or less enclosed in a layer of paraphyses, and in some species also enclosed in a layer of soral squamulae. *Fully expanded leaves* petiolate, petiole up to 2 m. long, inermous to aculeate; the marginate petiole scales concolorous, or with a paler border more or less corresponding to the structural margin of the scale, lacking dark terminal setae, but sometimes with dark denticulae along the edges; petiole sometimes pubescent with stiff trichomes; persistent petiole scurf variously composed of large to small squamulae and trichomidia, or absent. *Lamina* simply 1-pinnate- to 3-pinnate-pinnatifid; axes with trichomes adaxially; abaxially glabrous or with an indument of trichomidia, trichomes, squamulae, and scales. *Sori* with mature sporangia round, exindusiate, borne on the abaxial surface of the lamina on forking or simple, free or rarely anastomosing veins; sori with short to long paraphyses; receptacle puberulent to villous, occasionally with one or more soral squamulae.

KEY TO THE SPECIES

A. Typical leaves of adult, fertile plants no more than 1-pinnate-pinnatifid. . . Part 1.

A. Typical leaves of adult, fertile plants at least 2-pinnate (fertile specimens from extreme environments rarely dwarfed). . . . . B.

B. Leaf axes with stiff, multicellular trichomes, petiole scurf absent, sinuses between segments often polygonal to subquadrate, petiole scales often with dark denticulae, plants of open habitats with pale green foliage. . . . . Part 2.

B. Leaf axes lacking stiff, multicellular trichomes (except in *Trichipteris Gardneri* and *T. pilosissima*), petiole scurf absent or variously developed, sinuses between segments acute, petiole scales without dark denticulae, plants of diverse habitats. . . . . C.

C. Petiole scales bicolorous, with a darker central portion and a cretaceous border, fertile veins simple, paraphyses shorter than the sporangia. . . . . Part 3.

C. Petiole scales concolorous or bicolorous, rarely with a cretaceous border, fertile veins usually forked at the sori, paraphyses usually as long or longer than the sporangia. . . . . Part 4.

PART 1

1. Petiole scales fuscous with a cretaceous border, fertile veins simple. . . . . 2.
2. Pinnae entire to crenate, the conform apical pinna articulated to the rachis, abaxial surface of the lamina with prominent veins. . . . . 3.
3. Pinnae acute, tips of the pinnae entire. . . . . 37. *T. Cyclodium* (p. 75).
3. Pinnae acuminate, tips of pinnae serrate. . . . . 10. *T. Williamsii* (p. 35).
2. Pinnae crenate to deeply pinnatifid, apex of blade gradually reduced, without a conform apical pinna articulated to the axis, abaxial surface of the lamina with immersed veins. . . . . 4.
4. Pinnae deeply pinnatifid, truncate at the base. . . . . 5.
5. Axes of pinnae nearly glabrous (with only a few diaphanous squamulae), sori submarginal. . . . . 38. *T. nanna* (p. 75).
5. Axes of pinnae with trichomidia and squamulae, sori medial. . . . . 6.
6. Scales of rachis crowded, fuscous (Central America). . . . . 8. *T. ursina* (p. 34).
6. Scales of rachis scattered, cretaceous (Colombian Andes). . . . . 9. *T. phalaenolepis* (p. 35).
4. Pinnae crenate to pinnatifid, cordate-hastate at the base (Colombia). . . . . 7. *T. falcata* (p. 33).
1. Petiole scales nearly concolorous, the border fulvous or darker, fertile veins forked at the sori. . . . . 7.
7. Abaxial surface of the lamina glabrous, pinnae sessile or long-petiolulate. . . . . . 8.
8. Pinnae long-petiolulate (Colombia). . . . . 24. *T. latevagans* (p. 54).
8. Pinna sessile (Guayana Highlands). . . 36b. *T. demissa* var. *thysanolepis* (p. 74).
7. Abaxial surface of the lamina with trichomes, pinnae sessile. . . . . 9.
9. Rachis densely coated with fuscous scales, petiole aculeolate. . . . . 23. *T. phegopteroides* (p. 53).
9. Rachis without scales, petiole inermous. . . . . 22. *T. pubescens* (p. 52).

PART 2

1. The bicolorous petiole scales without dark denticulae, sinuses acute (Panama to Ecuador). . . . . 40. *T. pilosissima* (p. 76).
1. The variously pigmented scales with or without dark denticulae, sinuses polygonal (tropical America). . . . . 2.
2. Veins of the fertile segments simple or once-forked near the border of the segment, sori borne proximal to the fork in the vein (Jamaica). . . . . 43. *T. Estelae* (p. 80).
2. Veins of the fertile segments medially forked at least once, sori borne on the fork in the vein. . . . . 3.
3. Petiole abundantly pubescent, the trichomes sometimes deciduous and then leaving a hard, elevated base and a scabrous surface (smooth in *T. Swartziana* of the Greater Antilles). . . . . 4.
4. Paraphyses turgid, persistent, dark red, shorter than the sporangia (Cocos Island). . . . . 44. *T. nesiotica* (p. 80).
4. Paraphyses slender, deciduous or persistent, longer than the sporangia. . . . . 5.
5. Adaxial surface of the segments with abundant trichomes on the costules, veins, and lamina surface. . . . . 6.
6. Margin of the petiole scales with dark denticulae throughout, apex of pinnules long-attenuate, often falcate, axes of lamina with or without appressed trichomidia (Costa Rica to Ecuador). . . . . 45. *T. trichiata* (p. 80).
6. Margin of the petiole scales inermous or with a few dark denticulae apically, apex of the pinnules acuminate, nearly straight, axes of lamina with appressed trichomidia (Venezuela and Colombia to Bolivia). 46. *T. Tryonorum* (p. 81).
5. Adaxial surface of the segments glabrous or with trichomes only on the costules and veins. . . . . 7.
7. Adaxial surface of the veins with trichomes (when deciduous the bases

evident), mature pinnules with few or no bullate squamulae along the costae abaxially (Mexico to Honduras). . . . . 47. *T. scabriuscula* (p. 81).

7. Adaxial surfaces of veins without trichomes (or rarely with only a few trichomes), mature pinnules with abundant bullate squamulae along the costae abaxially (a flattish squamule nearly always present between the costule and the fork in the vein) (Jamaica and Hispaniola). . . . . . . 48. *T. armata* (p. 81).

3. Petiole glabrous or sparsely pubescent, the trichomes sometimes deciduous and then leaving a prominent scar and a nearly smooth surface. . . . . 8.

8. Pubescence of the abaxial surface of the costae and costules only of abundant flexuous, catenate, ferruginous trichomes (eastern Cuba). 49. *T. strigillosa* (p. 81).

8. Pubescence of the abaxial surface of the costae and costules principally of abundant stiff, terete trichomes. . . . . 9.

9. Petiole scales cretaceous, or cretaceous with a darkened basal streak. . . . . 10.

10. Petiole scales without dark denticulae, rachis and pinna-rachises with flabellate, cretaceous scales (Mexico and Central America). . . . . 42. *T. mexicana* (p. 79).

10. Petiole scales with dark denticulae, rachis and pinna-rachises without scales (southeastern Brazil). . . . . 11.

11. Rachis glabrous, aculeate with sparse, slender spines; slightly hirsute at apex, segments lanceolate and acute, fertile and sterile veins once-forked. . . . . 50. *T. hirsuta* (p. 81).

11. Rachis pubescent or subglabrous, inermous, segments linear, rotund to acute, fertile and sterile veins with one or two pinnate pairs of veinlets. . . . . 51. *T. rufa* (p. 81).

9. Petiole scales, or most of them, cretaceous with a narrow to broad dark central streak. . . . . 12.

12. Edge of the petiole scales smooth or with a few dark denticulae apically, or with a few marginal cells slightly darker than the others, veins impressed above (Colombia to Bolivia). . . . . 52. *T. conjugata* (p. 81).

12. Edge of the petiole scales with dark denticulae throughout. . . . . 13.

13. Rachis inermous or barely muricate, abaxial surface of costules with flexuous trichomes, adaxial surface of costules and veins with thin and flexuous trichomes (Costa Rica and Panama). . . . . 53. *T. stipularis* (p. 81).

13. Rachis aculeolate, abaxial surface of costules with stiff trichomes, adaxial surface of costules and veins glabrous or glabrescent. . . . . 14.

14. Petiole scales with continuous dark denticulae along the margin and a broad, dark central streak (Guatemala). . . . . . 54. *T. pansamalana* (p. 81).

14. Petiole scales with cretaceous cells between the dark denticulae along the margin and a narrow, dark, central streak; at least at the base (Mexico). . . . . 55. *T. bicrenata* (p. 81).

PART 3

1. Pinnules cordate-hastate, crenate to shallowly pinnatifid. . . . . 2.

2. Sori lacking subtending soral squamulae (Venezuela). . . . . 4. *T. cordata* (p. 30).

2. Sori with several fuscous soral squamulae investing the sporangia. . . . . 3.

3. Stem erect, to 4 m. tall, petiole aculeate, costae with flattish and bullate squamulae (Trinidad). . . . . 5. *T. sagittifolia* (p. 30).

3. Stem ascendant, to ca. 0.5 m. tall, petiole inermous to muricate, costae with flattish squamulae only (Venezuela). . . . . 6. *T. Steyermarkii* (p. 32).

1. Pinnules truncate, pinnatifid to pinnatisect. . . . . 4.

4. Lamina 3-pinnate-pinnatifid, scurf of large cretaceous squamulae. . . . . 3. *T. decomposita* (p. 28).

4. Lamina 2-pinnate-pinnatifid, scurf variable. . . . . 5.

5. Petiole scurf bicolorous (fuscous and cretaceous) cretaceous border of petiole scales with occasional darkened cells. . . . . 2. *T. Dombeyi* (p. 27).

5. Petiole scurf concolorous, petiole scale border without darkened cells. . . . . . . 6.

6. Petiole scurf of large cretaceous squamulae (Colombia and Venezuela). . . . . 11. *T. microphylla* (p. 37).

6. Petiole scurf of fuscous squamulae (widespread species). 1. *T. procera* (p. 23).

PART 4

1. Pinnules entire to pinnatifid, the conform apical pinnules often articulated to the pinna-rachis (southern Brazil). .... 33. *T. corcovadensis* (p. 68).
1. Pinnules mostly pinnatifid to pinnatisect, no conform apical pinnules present. . . 2.
2. Sori subtended by squamulae (multiseriate processes attached at or near the base of the receptacle). .... 3.
3. Petiole scales fuscous with a cretaceous border, petiole scurf absent. ....
.... 39. *T. costaricensis* (p. 76).
3. Petiole scales fuscous, border fuscous to fulvous (not cretaceous), petiole scurf variously developed. .... 4.
4. Costae farinose with cretaceous trichomidia, paraphyses longer than the sporangia (Venezuela). .... 14. *T. gibbosa* (p. 40).
4. Costae usually lacking cretaceous trichomidia, paraphyses shorter than or equalling the sporangia (West Indies). .... 13. *T. aspera* (p. 39).
2. Sori without subtending squamulae. .... 5.
5. Petiole scurf developed into a close-fitting persistent indument of trichomidia and/or squamulae. .... 6.
6. Axes of lamina covered by a dense, matted tomentum more or less similar to the petiole scurf. .... 7.
7. Indument cretaceous, costal squamulae fimbriate. .... 21. *T. frigida* (p. 51).
7. Indument fulvous or fuscous, costal squamulae entire. .... 8.
8. Squamulae fuscous, pinnules sessile, paraphyses longer than the sporangia (Venezuela). .... 17. *T. Schlimii* (p. 46).
8. Squamulae fulvous, pinnules petiolulate, paraphyses shorter than the sporangia (Dominica only). .... 25. *T. Hodgeana* (p. 56).
6. Axes of lamina without a dense, matted tomentum. .... 9.
9. Petiole scales fuscous or nigrescent, leaf apex abruptly reduced and pinna-like to gradually reduced and long-acuminate. .... 10.
10. Paraphyses longer than the sporangia, receptacle villous. .... 11.
11. Pinna-rachises with a scurf of squamulae and trichomes, costae and costules without trichomes (Costa Rica and Panama). ..... 18. *T. Wendlandii* (p. 46).
11. Pinna-rachises without appreciable scurf, costae and costules with fulvous trichomes (Amazon River Basin). .... 19. *T. nigra* (p. 47).
10. Paraphyses shorter than the sporangia, receptacle pilose to hirsute. .... 12.
12. Pinnules very long-petiolulate, lobes acute to acuminate, serrate (Colombia to Bolivia). .... 16. *T. Kalbreyeri* (p. 44).
12. Pinnules sessile to petiolulate, lobes rotund, entire to crenulate. .... 13.
13. Costal squamulae flattish and sparse, petiole tuberculate to aculeate, petiole scurf including squamulae, apex gradually reduced and long-acuminate (Costa Rica to Peru). .... 15. *T. nigripes* (p. 41).
13. Costal squamulae bullate and dense, petiole aculeate, petiole scurf lacking squamulae, apex abruptly reduced and pinna-like to gradually reduced and long-acuminate (Mexico to Panama). .... 12. *T. Schiedeana* (p. 38).
9. Petiole scales fulvous or lighter, leaf apex gradually reduced and acute to acuminate. .... 14.
14. Pinnules sessile or subsessile (broad-ranging species). .... 15.
15. Petiole with abundant trichomes, petiole scurf of squamulae, lobes revolute and pubescent (Campo Limpo area of Brazil). .... 31. *T. Gardneri* (p. 66).
15. Petiole without trichomes, petiole scurf of trichomidia and squamulae, lobes flattish to revolute and variously hirsute, not pubescent. .... 16.
16. Trichomes on surface of lamina minute, costal squamulae entire and more or less appressed (Amazon Basin and coastal regions of tropical America).
.... 26. *T. microdonta* (p. 56).
16. Trichomes on surface of lamina stiff, costal squamulae erose and more or less erect (Andes of Venezuela and Colombia). ... 20. *T. pauciflora* (p. 50).
5. Petiole scurf scattered, inconspicuous, deciduous, or absent. .... 17.
17. Petiole scales bicolorous with a cretaceous border or uniformly cretaceous. 18.
18. Sori submarginal (known only from Brazil). .... 34. *T. praecincta* (p. 71).
18. Sori medial. .... 19.

19. Lamina coriaceous, essentially glabrous, pinnules (or lobes of pinnatifid pinnae) obtuse (Guyana Highlands). . . 36a. *T. demissa* var. *demissa* (p. 74).
19. Lamina papyraceous to chartaceous, with an indument, pinnules acuminate to attenuate (southeastern Brazil). . . . . 20.
20. Scales entirely cretaceous, lobes of pinnules serrate. . . . . 41. *T. leucolepis* (p. 77).
20. Scales bicolorous, lobes of pinnules entire. . . . . 32. *T. dichromatolepis* (p. 66).
17. Petiole scales concolorous and fulvous or bicolorous and the border fulvous. . . . . 21.
21. Petiole inermous to muricate, abaxial surface of the lamina glabrous (Andes, Guayana Highlands, Puerto Rico). . . . . 22.
22. Veins simple, paraphyses longer than the sporangia (Andes and Guayana Highlands). . . . . 27. *T. Lechleri* (p. 59).
22. Veins forked, paraphyses shorter than the sporangia. . . . . 23.
23. Petiole scales barely marginate, lobes of pinnules coriaceous and flattish (Puerto Rico). . . . . 35. *T. borinquena* (p. 72).
23. Petiole scales broadly flabellate, lobes of pinnules rigidly coriaceous and revolute (Guayana Highlands). . . . . . . 36a. *T. demissa* var. *demissa* (p. 74).
21. Petiole aculeate, abaxial surface of lamina glabrous or more often with a well-developed indument of trichomes, trichomidia and squamulae. . . . . 24.
24. Petiole scales helically twisted, abaxial surface of lamina more or less villous with minute, contorted trichomes, veins forked at the sori (Panama to Brazil). . . . . 28. *T. villosa* (p. 60).
24. Petiole scales usually flat, abaxial surface of lamina without minute, contorted trichomes, veins simple or forked at the sori (southern Brazil, Paraguay, Argentina). . . . . 25.
25. Petiole scales often bicolorous, large cretaceous squamulae common on the abaxial surface of the costae and costules, paraphyses often multiseriate at least at tip. . . . . 32. *T. dichromatolepis* (p. 66).
25. Petiole scales uniformly fulvous, indument of lamina axes variable, paraphyses uniseriate. . . . . 26.
26. Veins simple, pinnae inserted at an acute angle on the rachis. . . . . 29. *T. atrovirens* (p. 62).
26. Veins forked at the sori, pinnae inserted at a right angle on the axis. . . . . 30. *T. phalerata* (p. 63).

1. **Trichipteris procera** (Willd.) Tryon

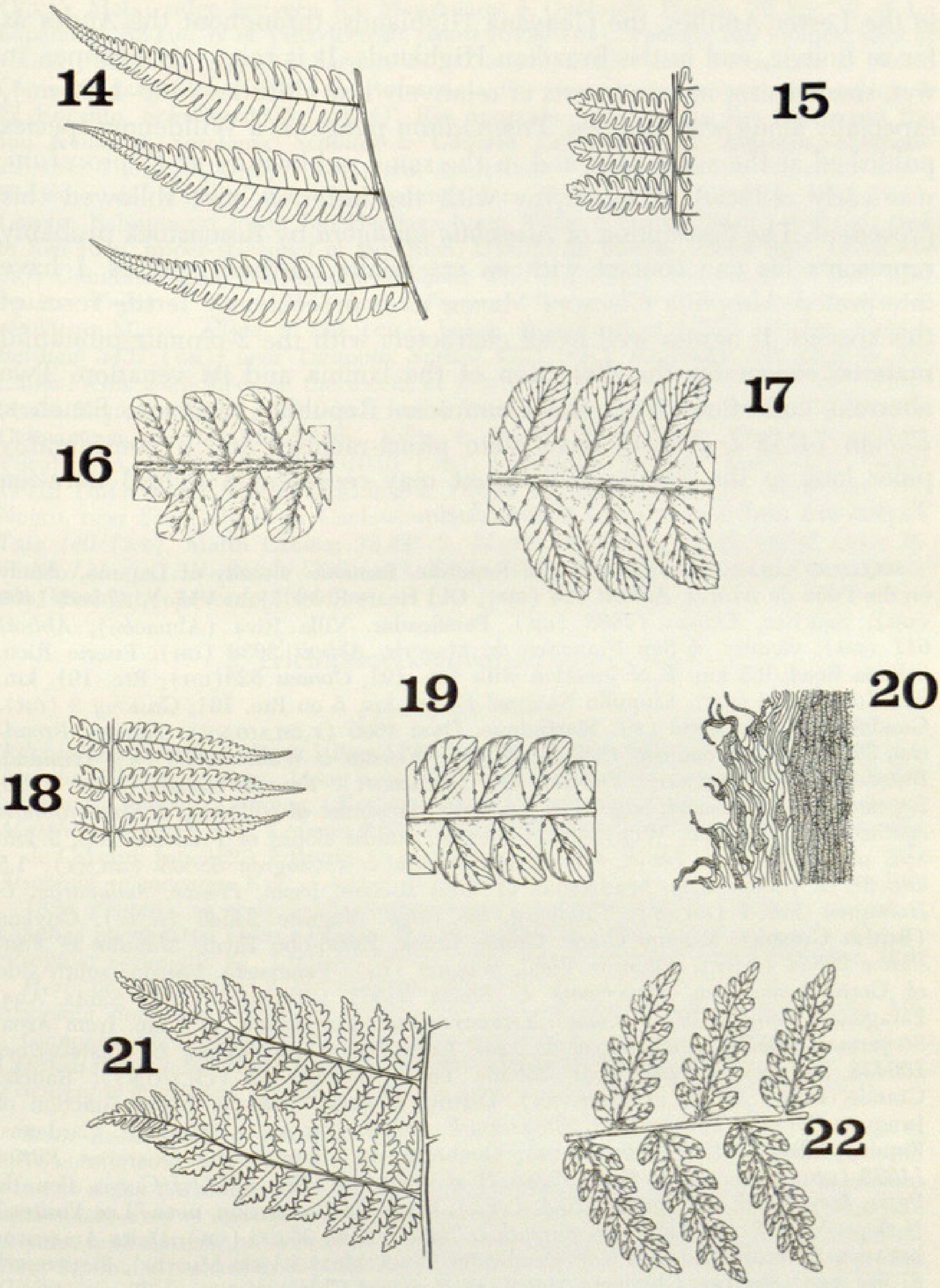
FIGS. 14–17. MAP 1.

Trichipteris procera (Willd.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Polypodium procerum Willd., Sp. Pl. ed. 4. **5**(1):206. 1810. HOLOTYPE: Brasilia, *Hoffmannsegg*, fragment ex B, NY! (Herb. Willd. No. 19717).
Alsophila procera (Willd.) Desv., Mém. Soc. Linn. Paris **6**:319. 1827.
Alsophila procera (Willd.) Presl, Tent. Pterid. 61. 1836.
Polypodium pungens Willd., Sp. Pl. ed. 4. **5**(1):206. 1810. HOLOTYPE: Brasilia, *Hoffmannsegg*, fragment ex B, NY! fragment B, US! (Herb. Willd. No. 19716).
Alsophila pungens (Willd.) Presl, Tent. Pterid. 61. 1836.
Cyathea pungens (Willd.) Domin, Pteridophyta 263. 1929.
Trichipteris pungens (Willd.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila infesta Kze., Linnaea **9**:98. 1834. HOLOTYPE: Peruviae ad Miss. Tocache fluv. Huallagae vicinam, *Poeppig*, LZ presumably destroyed. ISOTYPES: B! fragment ex B, BM!
Cyathea infesta (Kze.) Domin, Acta Bot. Bohem. **9**:125. 1930.
Trichipteris infesta (Kze.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila subaculeata Splitgerber, Tijdschr. Nat. Gesch. (Leiden) **4**:430. 1840. HOLOTYPE: Canawappibo, Surinam, *Splitgerber*, L not seen. ISOTYPES: NY! fragment ex P, NY! fragment ex P, US!
Alsophila oblonga Kl., Linnaea **18**:540. 1844. LECTOTYPE (chosen herewith): British

Guiana, *Schomburgk 1125,* B not seen. ISOLECTOTYPE: P!
Cyathea oblonga (Kl.) Domin, Pteridophyta 263. 1929.
Trichipteris oblonga (Kl.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila platyphylla Presl, Epimel. Bot. 29. 1851. HOLOTYPE: in Gujana gallica, *Perrotet,* PR not seen, fragment ex PR, NY!
Alsophila obtusa Kl., Allgem. Gartenzeit 20(6):41. 1852. HOLOTYPE: Venezuela, *Wagener,* B!
Trichipteris obtusa (Kl.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila pterorachis Baker, Syn. Fil. ed. 2. 456. 1874. HOLOTYPE: Tarapoto, Peru, *Spruce 4717,* K! fragment ex K, NY!
Cyathea pterorachis (Baker) Domin, Pteridophyta 263. 1929.
Alsophila Eatoni Jenm., Journ. Bot. Brit. & For. 25:98. 1887, ex. char. HOLOTYPE: Maraccus, Trinidad, *Sherring.*
Cyathea Eatoni (Jenm.) Domin, Acta Bot. Bohem. 9:112. 1930.
Trichipteris Eatoni (Jenm.) Tryon, Contrib. Gray Herb. 200:44. 1970.
Alsophila pastazensis Hieron., Hedwigia 45:232., t 12. f. 4. 1906. SYNTYPES: between Baños and Jivaría de Píntuc, Río Pastaza Valley, Cañelos, etc. Ecuador (all numbers), *Stübel 876a,* B not seen. *Stübel 975,* B not seen. *Stübel 988,* B! *Stübel 995a,* B!
Cyathea pastazensis (Hieron.) Domin, Pteridophyta 263. 1929.
Trichipteris pastazensis (Hieron.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila Gleasoni Maxon, Am. Fern Journ. 15:55. 1925. HOLOTYPE: near Rockstone, British Guiana, *Gleason 830,* US 1059473!
Cyathea Gleasoni (Maxon) Domin, Acta Bot. Bohem. 9:119. 1930.
Alsophila bulligera Rosenst., Fedde Repert. Spec. Nov. 25:57. 1928. TYPE COLLECTION: Bolivia, Mapiri, San Carlos, *Buchtien 288,* B! GH! S!
Cyathea bulligera (Rosenst.) Domin, Acta Bot. Bohem. 9:101. 1930.
Trichipteris bulligera (Rosenst.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Cyathea obtusata Domin, Pteridophyta 263. 1929. *nom. nov.* for *Alsophila obtusa* Kl., not *Cyathea obtusa* Domin, Pteridophyta 264. 1929.
Cyathea Klotzschiana Domin, Acta Bot. Bohem. 9:128. 1930. *nom. nov.* for *Cyathea obtusata* Domin, 1929, not *Cyathea obtusata* Rosenst., 1917.
Cyathea Willdenowiana Domin, Acta Bot. Bohem. 9:171. 1930. *nom. nov.* for *Polypodium procerum* Willd. not *Cyathea procera* Brause, Engl. Jahrb. 56:50. 1920.

Stem decumbent to erect, 0.3–7.5 m. tall. *Petiole* 0.5–1.5 m. long; fuscous, aculeate; scales fuscous with a cretaceous border or occasionally uniformly fuscous; scurf of dense fuscous squamulae; indument of leaf axes of stramineous to fuscous squamulae, trichomes, and trichomidia. *Lamina* 0.9–2.0 m. long, 2-pinnate-pinnatifid, papyraceous to chartaceous, apex abruptly reduced and pinna-like; pinnae sessile to stalked; pinnules sessile, pinnatifid, base truncate to cuneate, apex obtuse to acuminate; lobes rotund to acute, entire; fertile veins simple or rarely forked at the sori, sterile veins simple or rarely forked. *Sori* marginal to supramedial or varying along a single costule; paraphyses much shorter than the sporangia, receptacle pilose.

Although the shape of the leaf segments in *Trichipteris procera* is variable, the species is characterized throughout its range by the cretaceous petiole-scale border, pinna-like leaf apex, and short paraphyses. The foliage has a dusky look. Variability in this species is extreme: most apparent is the shape of the pinnule apices, which varies from obtuse to acuminate. Collections of *T. procera* with obtuse pinnules are found throughout the range of the species. The indument of the pinna-rachises and costae varies according to location. Pale costal squamulae are characteristic of plants from the area of Santa Marta, Colombia. Fuscous, bullate squamulae are characteristic of the Trinidad plants, and there is variation in the angle of insertion of the lobes on the pinnules of plants from Venezuela and the Guianas. The Willdenow epithet "pungens" has been applied to specimens with acute insertion of segments.



FIGS. 14–22. FIGS. 14–17, *Trichipteris procera:* 14, central pinnules of a central pinna (acuminate form), × 1/3 (*Britton, Britton & Freeman 2140*, GH); 15, central pinnules of a central pinna (obtuse form), × 1/3 (*Maguire 24543*, A); 16, central part of a typical pinnule, × 4/3 (*Broadway 5818*, GH); 17, central part of a pinnule, robust specimen, × 4/3 (*Wurdack 1825*, GH). FIGS. 18–20, *T. Dombeyi:* 18, central pinnules of a central pinna, × 1/3; 19, central part of a typical pinnule, × 4/3 (both *Killip & Smith 24541*, GH); 20, petiole scale border with darkened cells, × 16 (*Mexia 8293*, MO). FIGS. 21 & 22, *T. decomposita:* 21, two pinnules from a central pinna, × 1/3; 22, central part of a pinnule, × 1 (both *Vareschi & Pannier 1132*, VEN).

Trichipteris procera is found in Hispaniola, Puerto Rico, occasionally in the Lesser Antilles, the Guayana Highlands, throughout the Andes as far as Bolivia, and in the Brazilian Highlands. It is relatively common in wet, shaded sites in rain forests at relatively low altitudes (100–1400 m.), especially along watercourses. *Polypodium pungens*, a Willdenow species published at the same time and in the same publication as *P. procerum*, was early reduced to synonymy with the latter. I have followed this precedent. The description of *Alsophila bulligera* by Rosenstock probably represents his one contact with an essentially northern species. I have interpreted *Alsophila Gleasoni* Maxon as a precociously fertile form of this species. It agrees well in all characters with the 2-pinnate-pinnatifid material except for the dissection of the lamina and its venation. Two aberrant collections from the Dominican Republic (Samaná, Sanchez, *Ekman 14752 & 14824*) have alate pinna-rachises and a considerably paler look to the foliage. This plant may represent a hybrid between *T. procera* and a species of *Cnemidaria*.

SELECTED COLLECTIONS. **Dominican Republic. Samaná:** vicinity of Laguna, chiefly on the Pilón de Azúcar, *Abbott 424* (GH); Old Heart River (Jato Viejo), *Abbott 1409* (GH); Sanchez, *Ekman 14688* (GH). **Pacificador.** Villa Riva (Almacén), *Abbott 611* (GH); vicinity of San Francisco de Macorís, *Abbott 2030* (GH). **Puerto Rico.** Sabana Road, 0.5 km. E of junction with Rte. 191, *Conant 628*(GH); Rte. 191, km. 5.2, *Conant 634* (GH); Luquillo National Forest, km. 6 on Rte. 191, *Gastony 9* (GH). **Guadeloupe.** *Duss 3882* (F). **Martinique.** *Duss 4600* (F,GH,MO,NY). **Tobago.** *Broadway 3007* (MO); *Broadway 4222* (F,GH,MO); *Webster & Walker 9869* (A). **Trinidad.** *Broadway 5818* (GH,MO); *Fendler 112* (GH,MO,NY). **French Guiana.** May, 1836, *Leprieur* (GH); Karouany, *Sagot 726* p.p. (NY) (remainder of collection is *Sphaeropteris cyatheoides*). **Surinam.** Wilhelmina Gebergte, middle slopes of Frederik Top, 3 km. SSE of Juliana Top, *Irwin, Prance, Soderstrom & Holmgren 55005* (GH,NY); 1.5 km. SE of Juliana Top, headwaters of West Riviere, *Irwin, Prance, Soderstrom & Holmgren 55075* (GH,NY); Tafelberg, SE ridge, *Maguire 24543* (A,NY). **Guyana (British Guiana).** Kamuni Creek, Groete Creek, Essequibo River, *Maguire & Fanshawe 22854* (A,NY); Atkinson Field, *Wagner* (US). **Venezuela. Falcón:** south side of Cerro Santa Ana, *Steyermark & Braun 94663* (GH,VEN); Cerro Santa Ana, Paraguaná, *Famayo 107* (US,VEN). **Yaracuy:** Quebrada Honda, 17.3 km. from Aroa, *Steyermark 105395* (GH); Sierra de Aroa, Cerro Negro, *Steyermark & Wessels-Boer 100438* (GH,NY). **Aragua:** near Colonia Tovar, *Fendler 55* (GH,MO,NY); Rancho Grande, *Pittier 13876* (F,NY,US,VEN). **Distrito Federal:** 6–8 mi. below junction of Junquito-Colonia Tovar Road, *Steyermark 94779* (GH,VEN). **Miranda:** Cárdenas, Siquire Valley, *Pittier 7090* (GH,US); Quebrada de Turumo, near Guarenas, *Pittier 11272* (GH,NY,US). **Sucre:** Cerro Patao, N of Puerto de Hierro, NE of Guiria, Pen. de Paria, *Steyermark & Agostini 91000* (VEN); Cerro do Río Arriba, near "Los Positos," N slope, W of Cerro Humo, *Steyermark & Rabe 96290, 96406* (GH). **Delta Amacuro:** between Amacuro and mouth of Deadwater Creek Moat (Agua Muerto), *Steyermark 87399* (VEN). **Bolívar:** Chimantá Massif, W slopes of Chimantáentepuí (Torono-tepuí), *Steyermark 75598* (F,GH,NY,VEN); Cerro Venamo, SW part, *Steyermark & Dunsterville 92753* (GH,VEN); Cerro Uananapan, S of Uei-tepuí, between Luepa & Cerro Venamo, *Steyermark & Nilsson 754* (US,VEN). **Amazonas:** Cerro Huachamacari, Río Cunucunuma, *Maguire, Cowan & Wurdack 29929* (GH,NY,US). **Colombia. Magdalena:** Santa Marta, *H. H. Smith 2224* (F,GH,MO,NY,US); *H. H. Smith 2229* (F,GH,NY,US). **Antióquia:** Barbosa, Medellín, *Henri-Stanislas 1708* (US). **Norte de Santander:** region of Sarare, valley of the Río Margua, Quebrada del Río Negro, *Cuatrecasas 12921* (F,US). **Santander:** vicinity of Barranca Bermeja, Magdalena Valley, between Sogamoso & Colorado Rivers, *Haught 1422* (GH,US). **Valle:** Valley of the Río Sanguinini, left side, La Laguna, *Cuatrecasas 15608* (F,US). **Tolima:** El Fresno, *Cuatrecasas 9379* (F,US). **Meta:** ridge between Río Manzanares & Quebrada Playón, 30 km. W of La Esperanza, 52 km. W of Villavicencio, *Grant 10126* (US). **Vaupés:** Río Vaupés, Mitú & vicinity, *Schultes, Raffauf & Soejarto 24400, 24401, 24404* (GH). **Putumayo:** at Puerto Ospina, *Cuatrecasas 10578* (F). **Amazonas:** Río Caraparaná, between the outlets & El Encanto, *Schultes 3835* (GH,US); Río Apoporis, between the Río Pacoa and the Río Kananarí, Sorotama, *Schultes & Cabrera 12805* (GH,US). **Ecuador. Santiago-Zamora:** Yunguaza, *Crespi* (US). **Peru. Amazonas:** Valley of the Río Marañón, above Cascadas de Mayasi, near Campamento Ste. Montenegro, *Wurdack 1825* (GH). **Loreto:** Balsapuerto, lower Río Huallaga basin, *Killip & Smith 28522* (F,GH,US); trail to San Juan, upper streamlet of San Juan, Distrito de Iquitos, *Mexia 6497* (F,GH,MO, US); Gamitanacocha, Río Mazán, *Schunke 269* (F,GH,NY); Río Itaya, 10 km. S of Iquitos, *Tryon & Tryon 5173* (GH); *Tryon & Tryon 5182* (F,GH). **San Martín:** E of Tingo María, *Allard 21426* (GH); below English Evangelical Mission, Lamas, *Belshaw 3437* (GH); near Tarapoto, *Spruce 4323* (GH). **Huánuco:** SW slope of Río Llulla-Pichis watershed, on the ascent of Cerros del Sira, *Dudley 13280* (GH); Tingo María, *Tryon & Tryon 5220* (GH). **Junín:** Puerto Yessup, *Killip & Smith 26238* (GH); Cahuapanas on the Río Pichis, *Killip & Smith 26746* (GH). **Cuzco:** Cordillera Vilcabamba, *Dudley 10063, 10105B* (GH); Cosñipata-Pilcopata, Santa Inés, *Vargas 11318* (GH). **Puno:** Hacienda Palmora, *Vargas 16145* (GH). **Brazil. Amazonas:** Rio Negro, near São Gabriel da Cachoeira, *Spruce 2115* (US); Rio Negro, São Gabriel, *Tate 140* (NY). **Matto Grosso:** 12.49° S, 51.46° W, *Harley et al. 10768* (US); *H. Smith 111* (US); *H. Smith 1336* (NY). **Goiás:** Mun. Jataí, *Macedo 1518* (US); Queixada, Mun. Jataí, *Macedo 2184* (US).

2. **Trichipteris Dombeyi** (Desv.) Barr.

FIGS. 18–20. MAP 2.

Trichipteris Dombeyi (Desv.) Barr., Rhodora **78**(813):3. 1976.
Alsophila Dombeyi Desv., Mém. Soc. Linn. Paris **6**:320. 1827 (as *A. Dombei*). HOLOTYPE: in Peruvia, *Dombey,* (Cochero, Herb. Desv.) P! ISOTYPE: P!
Alsophila armigera Kze., Linnaea **9**:98. 1834. HOLOTYPE: mountains of Peru, Ventanilla de Cassapi, July 1829, *Poeppig,* LZ presumably destroyed. ISOTYPES: MO! P!
Alsophila pycnocarpa Kze., Linnaea **9**:97. 1834. HOLOTYPE: Pampayacu, Peru, July 1829, *Poeppig,* LZ presumably destroyed. ISOTYPE: (*Poeppig 201*) B!
Cyathea pycnocarpa (Kze.) Domin, Pteridophyta 263. 1929.
Alsophila peruviana Kl., Linnaea **20**:441. 1847. HOLOTYPE: ad Tarma Peruviae, *Ruiz Herb. 66*, fragment ex B, GH! fragment ex B, NY!
Alsophila floribunda Hook. & Baker, Syn. Fil. ed. 2. 458. 1874. HOLOTYPE: Mt. Campana, Peru, *Spruce 4715,* K not seen. ISOTYPE: P!
Cyathea floribunda (Hook. & Baker) Domin, Pteridophyta 262. 1929.
Trichipteris floribunda (Hook. & Baker) Tryon, Contrib. Gray Herb. 200:45. 1970.

Stem decumbent to erect, 0.1–2.4 m. tall. *Petiole* 0.3–0.6 m. long; fuscous to fulvous, muricate to aculeate; scales fuscous with a cretaceous border, the border with a few to many darkened cells; scurf of cretaceous to fuscous trichomidia and bicolorous squamulae; axes of lamina with an indument similar to the petiole scurf, costae and costules with flattish, bicolorous or bullate, cretaceous squamulae. *Lamina* 1.0–2.5 m. long, 2-pinnate-pinnatifid, papyraceous, apex abruptly reduced and pinna-like; pinnae sessile; pinnules sessile or sub-sessile, crenate to deeply pinnatifid, base truncate to cuneate, apex acute to acuminate; lobes rotund, entire; fertile veins simple, sterile veins simple or forked. *Sori* apically subcostal to basally medial; paraphyses as long as the sporangia, receptacle hirsute.

Trichipteris Dombeyi is allied to *T. procera* but differs in having bicolorous squamulae on the petiole. The darkened cells or groups of cells along the edge of the cretaceous border are unusual for the genus. The number of darkened cells in the petiole scale border is variable. In addition, the costal and costular squamulae vary in color. The costules are much more prominent than the adjacent veins, and the distal sori of a lobe are closer to the costule. *Trichipteris Dombeyi* could be interpreted as part of the widespread and variable *T. procera.* I have chosen to maintain *T. Dombeyi* as a species because of its distinctive indument and peripheral geographic range. *Trichipteris Dombeyi* is confined to the eastern slopes of the Andes in Peru, where it is found in dense rain forests at low to middle altitudes (650–1700 meters). The choice of the Dombey collection and its basionym for this species is tentative, because it lacks material of the petioles. The type collection of *Alsophila floribunda* Baker, *Spruce 4715* (P), is mixed, containing material of *T. Dombeyi* and *T. procera.* Christensen considered this species a synonym for *T. procera* in his *Index Filicum.*

SELECTED COLLECTIONS. **Peru. Loreto:** Pampayacu, *Kanehira 177* (GH,US). **Huánuco:** near confluence of Río Cayumba with Huallaga, *Mexia 8293* (F,GH,MO,NY,US); Tingo María, *Tryon & Tryon 5256* (F,GH). **Junín:** Río Pinedo, N of La Merced, *Killip & Smith 23640* (F,NY,US); Schunke Hacienda, above San Ramón, *Killip & Smith 24541* (F,GH,NY,US); *Killip & Smith 24645* (F,NY). **Cuzco:** Cordillera Vilcabamba, *Dudley 11436* (GH).

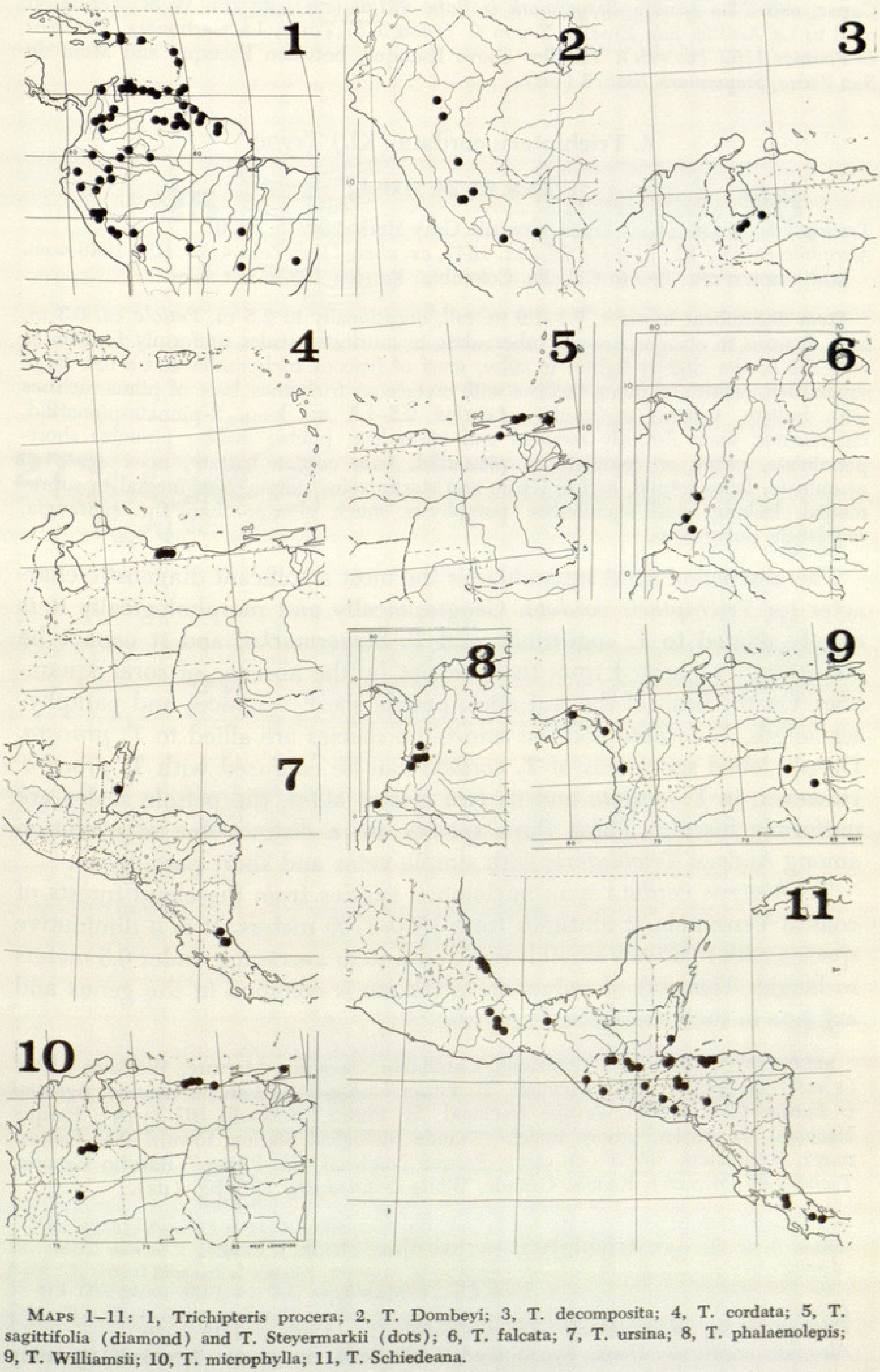
3. Trichipteris decomposita (Karst.) Tryon

FIGS. 21, 22. MAP 3.

Trichipteris decomposita (Karst.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila decomposita Karst., Fl. Columb. 2:185, t. 198. 1869. HOLOTYPE: from Cordillera Meridensis, Colombia, 1500 m., (*Engel 129*) fragment ex B, GH!
Cyathea decomposita (Karst.) Domin, Pteridophyta 262. 1929.
Alsophila oligocarpa Fée, Mém. Fam. Foug. 5 (Genera Filicum):346. 1852. *nom. nud.* COLLECTION CITED: Venezuela, *Funck & Schlim 1002,* P not seen. *Funck & Schlim 978,* fragment ex P, NY! is this species.

Stem erect, 1–3 m. tall. *Petiole* ca. 1 m. long, cretaceous to stramineous, aculeate; scales fulvous with a cretaceous border, scurf of large, cretaceous squamulae; rachis and pinna-rachises glabrous or with a few squamulae especially toward the base; costae and costules with trichomidia and fuscous, flattish and erose to bullate squamulae. *Lamina* 2.0–3.0 m. long, 3-pinnate-pinnatifid, papyraceous, apex gradually reduced, acuminate; pinnae stalked; pinnules subsessile, fully pinnate; penultimate segments sessile, pinnatifid, base truncate, apex obtuse to acute, lobes rotund and entire; fertile and sterile veins simple. *Sori* medial, paraphyses shorter than the sporangia, receptacle pilose.

Trichipteris decomposita is the only species with a 3-pinnate-pinnatifid lamina in the genus. The large, cretaceous petiole squamulae separate this species from all others of *Trichipteris* except *T. microphylla.* It can be confused with species of the genus *Ctenitis,* which is characterized by narrow, transparent-celled, and often toothed scales on the leaf axes and polypodiaceous sporangia. *Trichipteris decomposita* is morphologically similar to the other species of the group of *T. procera.* It is less specialized than related species in having relatively undifferentiated petiole scurf. *Trichipteris decomposita* is geographically confined to the Venezuelan Andes in the area of Lake Maracaibo, where it is found in undisturbed rain forest and cloud forest from 1300–2800 meters.



MAPS 1–11: 1, Trichipteris procera; 2, T. Dombeyi; 3, T. decomposita; 4, T. cordata; 5, T. sagittifolia (diamond) and T. Steyermarkii (dots); 6, T. falcata; 7, T. ursina; 8, T. phalaenolepis; 9, T. Williamsii; 10, T. microphylla; 11, T. Schiedeana.

SELECTED COLLECTIONS. **Venezuela. Mérida:** forêts humides, 5500′, 1842, *Linden 517* (P); Cerro San Isidro, above La Carbonera, *Steyermark 56029* (F,GH,MO,US); Río Capaz, above La Azulita, *Steyermark & Rabe 97120* (GH); 22 km. W of Mérida on road to La Azulita, San Euselia, *Tryon & Tryon 5767* (GH); La Carbonera, *Vareschi & Pannier 1132* (US,VEN). **Trujillo:** above Escuque, between Escuque and Mesa de San Pedro, *Steyermark 104676* (GH).

4. Trichipteris cordata (Kl.) Tryon

FIGS. 23, 24. MAP 4.

Trichipteris cordata (Kl.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila cordata Kl., Linnaea **20**:441. 1847, *ex. char.* (Bot. Zeit. **4**(7):104. 1846 *nom. nud.*) HOLOTYPE: Puerto Cabello, Colombia, *Karsten 168* B, not seen.

Stem decumbent to erect, 0.1–1.0 m. tall, occasionally to 2.5 m. *Petiole* ca. 0.3 m. long, fuscous to atropurpureous, tuberculate to muricate; scales uniformly fuscous or with the border slightly lighter in color, scurf of fuscous trichomidia and a few large squamulae; rachis and pinna-rachises with cretaceous trichomes, base of pinna-rachises with bullate, fuscous squamulae. *Lamina* 0.5–1.5 m. long, 2-pinnate-pinnatifid, chartaceous, apex abruptly reduced and pinna-like; pinnae sessile; pinnules short-petiolulate, entire or crenulate to pinnatifid, base cordate-hastate, apex acute to acuminate; lobes rotund, entire; fertile and sterile veins simple. *Sori* medial to supramedial, lacking soral squamulae; paraphyses much shorter than the sporangia, receptacle puberulous.

The absence of soral squamulae is the most significant diagnostic character for *Trichipteris cordata.* Geographically and morphologically it is closely related to *T. sagittifolia* and *T. Steyermarkii,* and it cannot be consistently separated from them except by the absence of soral squamulae. On the basis of the leaf apex, petiole scurf, venation, and paraphyses length, *T. cordata* and the associated species are allied to *T. procera.* Deeply lobed specimens of *T. cordata* can be confused with *T. procera.* However, in *T. cordata* and its two closest allies, the petiole scales are uniformly fuscous. These three species are a distinct line of evolution among Andean *Trichipteris* with simple veins and short paraphyses.

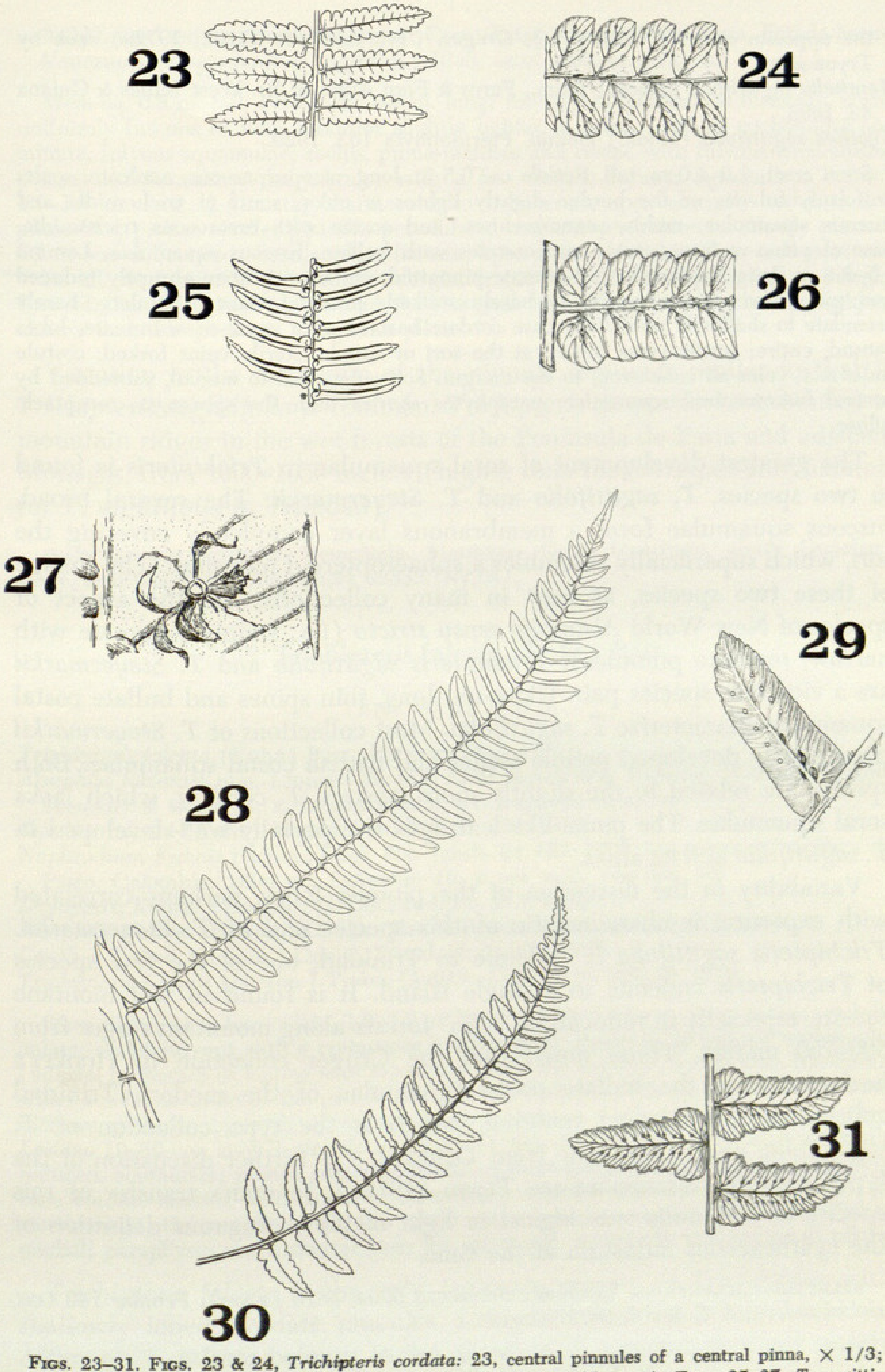
Trichipteris cordata is an uncommon species from the cloud forests of coastal Venezuela at altitudes from 1500–1700 meters. It is a diminutive species with relatively small leaves and a stem averaging under 0.5 meters in height. This sort of reduction in stature is common in the genus and extreme in such species as *T. falcata.*

SELECTED COLLECTIONS. **Venezuela. Carababo:** Hacienda Marturé, *Williams 11014* (F,VEN). **Aragua:** Parque Nacional "H. Pittier," bosque de Rancho Grande, *Agostini & Fariñas 92* (US,VEN); Parque Nacional "H. Pittier," *Sermolli 161* (VEN); Parque Nacional "H. Pittier," above Rancho Grande Biological Station, toward Pico Guacamayo, *Steyermark 89785* (GH,VEN); Parque Nacional "H. Pittier," Rancho Grande, *Tschudi 90* (US,VEN); Rancho Grande, *White & Lucansky 1970126* (US).

5. Trichipteris sagittifolia (Hook.) Tryon

FIGS. 25–27. MAP 5.

Trichipteris sagittifolia (Hook.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila sagittifolia Hook., Syn. Fil. ed. 1. 37. 1866. HOLOTYPE: Trinidad? (possibly



FIGS. 23–31. FIGS. 23 & 24, *Trichipteris cordata:* 23, central pinnules of a central pinna, × 1/3; 24, central part of a pinnule, × 4/3 (both *Agostini & Fariñas 92*, VEN). FIGS. 25–27, *T. sagittifolia:* 25, central pinnules of a central pinna, × 1/3 (*Britton et al. 1355*, GH); 26, base of a pinnule, × 4/3 (*Broadway 5810*, F); 27, soral squamulae, sporangia removed, × 10 (*Fendler 142*, GH). FIGS. 28 & 29, *T. Steyermarkii:* 28, central pinna, × 1/3; 29, central pinnule, × 1 (both *Steyermark 94923*, VEN). FIGS. 30 & 31, *T. falcata:* 30, apical portion of a leaf, × 1/3; 31, three central pinnae, × 1 (both *Lehmann 16*, US).

the opposite coast of Venezuela), *Cruger*, (Trinidad! see Tryon, 1972a) seen by Tryon at K.

Hemitelia sagittifolia (Hook.) Jenm., Ferns & Fern Allies of Br. West Indies & Guiana 43. 1898.

Cyathea sagittifolia (Hook.) Domin, Pteridophyta 163. 1929.

Stem erect, 1.0–4.0 m. tall. *Petiole* ca. 0.5 m. long, atropurpureous, aculeate; scales uniformly fulvous or the border slightly lighter in color; scurf of trichomidia and fuscous squamulae; rachis, pinna-rachises, and costae with cretaceous trichomidia, base of pinna-rachises, costae and costules with bullate, fuscous squamulae. *Lamina* 1.5–2.3 m. long, 2-pinnate to 2-pinnate-pinnatifid, coriaceous, apex abruptly reduced and pinna-like; pinnae sessile to barely stalked; pinnules short-petiolulate, barely crenulate to shallowly pinnatifid, base cordate-hastate, apex acute to acuminate; lobes rotund, entire; fertile veins forked at the sori or simple, sterile veins forked, costule indistinct, veins all concurrent to the margin. *Sori* submedial to medial, subtended by several fuscous soral squamulae; paraphyses shorter than the sporangia, receptacle pilose.

The greatest development of soral squamulae in *Trichipteris* is found in two species, *T. sagittifolia* and *T. Steyermarkii.* The several broad, fuscous squamulae form a membranous layer completely covering the sori, which superficially resembles a sphaeropteroid indusium. The foliage of these two species, at least in many collections, has the aspect of species of New World *Alsophila sensu stricto* (i.e., simply 2-pinnate with narrow, revolute pinnules). *Trichipteris sagittifolia* and *T. Steyermarkii* are a vicarious species pair. Close-set, long, thin spines and bullate costal squamulae characterize *T. sagittifolia.* Most collections of *T. Steyermarkii* have poorly developed petiole spines and flattish costal squamulae. Both species are related to the slightly more western *T. cordata,* which lacks soral squamulae. The pinna-like leaf apex is especially well-developed in *T. sagittifolia* and its allies.

Variability in the dissection of the pinnule lobes, perhaps correlated with exposure, is characteristic of this species and of *T. Steyermarkii. Trichipteris sagittifolia* is endemic to Trinidad, one of the few species of *Trichipteris* endemic to a single island. It is found in wet montane forests, especially in reduced or "elfin" forests along mountain ridges from 500–750 meters. Tryon noted that the Cruger collection in Hooker's herbarium has the bullate costal squamulae of the modern Trinidad collections. The Cruger material, which is the type collection of *T. sagittifolia,* must have come from Trinidad. For further discussion of the typification of this species see Tryon (1972a). Jenman's transfer of this species of *Hemitelia* was logical in light of the ambiguous definition of the cyatheaceous indusium at the time.

SELECTED COLLECTIONS. Trinidad: *Broadway 5294, 5810* (F,MO); *Fendler 142* (GH, MO,NY,US,VT); *A. C. Smith 10027* (US).

6. Trichipteris Steyermarkii Tryon

FIGS. 28, 29. MAP 5.

Trichipteris Steyermarkii Tryon, Rhodora 74:446, f. 11, 12. 1972. HOLOTYPE: Cerro de Humo, Península de Paria, Estado Sucre, Venezuela, *Steyermark & Agostini*

94923, VEN! ISOTYPE: GH! PARATYPE: Cerro Patao, Península de Paria, Estado Sucre, Venezuela, *Steyermark & Agostini 91048*, VEN! ISOPARATYPE: US!

Stem ca. 0.5 m. tall. *Petiole* ca. 0.5 m. long; fulvous, tuberculate to muricate, scales uniformly fuscous or with a border slightly lighter in color; scurf of trichomidia and minute, fulvous squamulae; rachis, pinna-rachises and costae with fulvous trichomidia; costae and sometimes the costules with a few flattish fulvous squamulae. *Lamina* 1.0–1.5 m. long, 2-pinnate, chartaceous to coriaceous, apex abruptly reduced and pinna-like; pinnae sessile; pinnules petiolulate, serrate to crenulate (shallowly pinnatifid in one collection), base cordate-hastate, apex acute; costules often indistinct and veins all concurrent to the pinnule margin, fertile and sterile veins forked or simple. *Sori* inframedial to medial, subtended by several fuscous soral squamulae; paraphyses shorter than the sporangia, receptacle pilose.

Variation in the dissection of the pinnule segments similar to that in *Trichipteris sagittifolia* is common. *Trichipteris Steyermarkii* is limited to mountain ridges in the wet forests of the Península de Paria and adjacent Monagas, from 1000–1650 meters (higher than the corresponding habitats for *T. sagittifolia* in Trinidad).

SELECTED COLLECTIONS. **Venezuela. Monagas:** Cerro Guácharo, above Guácharo Cave, near Guácharo, *Steyermark 62332* (NY,US).

7. **Trichipteris falcata** (Kuhn) Barr.

FIGS. 30, 31. MAP 6.

Trichipteris falcata (Kuhn) Barr., Rhodora **78**:3. 1976.
Alsophila falcata Kuhn, Linnaea **36**:155. 1869. HOLOTYPE: Panama, (Gorgona Island, Seeman) B! ISOTYPES: K! fragment ex K, NY! fragment ex K, US!
Cyathea falcata (Kuhn) Domin, Pteridophyta 262. 1929.
Nephrodium Kuhnii Hieron., Engl. Bot. Jahrb. **34**:440. 1904. HOLOTYPE: Cordillera de Pasto, Colombia, 1000 m., *Lehmann 16*, K not seen. ISOTYPE: US!
Dryopteris Kuhnii (Hieron.) C. Chr., Ind. Fil. 273. 1905.
Alsophila Kuhnii (Hieron.) C. Chr., Fedde Repert. Spec. Nov. **10**:213. 1911.
Cyathea Kuhnii (Hieron.) Domin, Pteridophyta 262. 1929.
Trichipteris Kuhnii (Hieron.) Tryon, Contrib. Gray Herb. 200:45. 1970.

Stem diminutive, fasciculate, 1.0–3.0 m. long. *Petiole* 8–18 cm. long, fulvous, tuberculate; scales fulvous with a cretaceous border; scurf absent or of minute trichomidia (adaxial trichomes of lamina axes extending down the petiole); rachis with bicolorous scales similar to those of the petiole and flattish, fimbriate, fulvous squamulae; pinna-rachises glabrous or with occasional minute, fulvous trichomidia and squamulae. *Lamina* 10–50 cm. long, 1-pinnate to 1-pinnate-pinnatifid, papyraceous, apex gradually reduced, acuminate; pinnae adjacent, sessile or short-petiolulate, crenate to pinnatifid, base cordate-hastate, apex acute to acuminate; costules indistinct and the veins all concurrent to the margin, fertile and sterile veins forked or simple. *Sori* inframedial to medial; paraphyses much shorter than the sporangia, receptacle puberulous to pilose.

Trichipteris falcata is the only 1-pinnate species of *Trichipteris* with shallowly lobed, cordate pinnules. Complete material is unmistakable. Although *T. falcata* belongs in the group of *T. procera*, it is not closely related to any single species. Perhaps it is a more southern representative of the line that gave rise to the three species including *T. sagittifolia*. Variability in *T. falcata* is most pronounced in the size of the plant.

Trichipteris falcata is confined to southern Colombia. All of the three known collections are from the Pacific coast and adjacent islands from sea level to 1000 meters. Interpretation of the type is based wholly on the Haught collection from Buenaventura. The type from Berlin (according to Hooker and Baker (1874)), collected by Seeman on Gorgona Island, represents the upper part of a 1-pinnate leaf. However, without the Haught collection, interpretation of the portion as a part of a pinna was entirely plausible. The third collection of this species, *Lehmann 16,* has been placed in five genera. Nevertheless, it is a *Trichipteris* with marginate, asetate cyatheaceous scales, cyatheaceous sporangia, paraphyses, and no indusium.

SELECTED COLLECTIONS. **Colombia. Valle:** Punta Magdalena, near sea level, *Haught 5585* (US).

8. **Trichipteris ursina** (Maxon) Tryon

FIGS. 32, 33. MAP 7.

Trichipteris ursina (Maxon) Tryon, Contrib. Gray Herb. 200:44. 1970.
Alsophila ursina Maxon, Journ. Washington Acad. Sci. 34:48. 1944. HOLOTYPE: Antelope Ridge, Stann Creek Valley, British Honduras (Belize), *Gentle 3197,* US 1791403! 1791404!

Stem diminutive, fasciculate, to 5 cm. long. *Petiole* ca. 15 cm. long, fuscous, tuberculate; scales fuscous with a narrow cretaceous border; scurf absent; rachis and pinna-rachises tuberculate, scales similar to those of the petiole or uniformly fuscous; scurf of minute trichomidia cretaceous on the rachis and darker on the pinna-rachises. *Lamina* ca. 1 m. long, 1-pinnate-pinnatifid, chartaceous, apex gradually reduced, acuminate; pinnae adjacent, sessile, pinnatifid to pinnatisect, base truncate to cuneate, apex obtuse to acute; lobes rotund, tip crenulate or the entire lobe crenulate; fertile veins simple, sterile veins forked or simple. *Sori* medial to supramedial, paraphyses much shorter than the sporangia, receptacle puberulous.

Among the species of *Trichipteris* with cretaceous petiole scale borders, only this species and *T. phalaenolepis* are characterized by 1-pinnate leaves with scaly rachises and obtuse, deeply dissected pinnae. *Trichipteris ursina* is distinguished from *T. phalaenolepis* on the basis of rachis scales. *Trichipteris ursina* has fuscous scales crowded along the lower part of the rachis, but *T. phalaenolepis* has fewer, paler scales. The two are a vicarious species pair isolated through long-distance dispersal. In *T. ursina* there is variability in the dissection and size of the pinna lobes. Robust specimens approach 1-pinnate-pinnatisect with the lobes of the pinnae pinnatisect. *Trichipteris ursina* occurs from Belize to Costa Rica, where it is found in wet places in tall lowland forests from sea level to 100 meters in altitude.

SELECTED COLLECTIONS. **Nicaragua.** Río San Juan at "El Relos," halfway between El Castillo and Delta de San Juan, *Bunting & Licht 788* (F,GH). **Costa Rica. Heredia:** Río Puerto Viejo, 2 km. upstream from confluence of the Río Sarapiquí, (Finca La Selva of L. R. Holdridge), *Burger & Stolze 5877* (GH,US); Finca of L. R. Holdridge, on the Río Puerto Viejo, near the junction with Río Sarapiquí, *Scamman 7438* (GH).

9. Trichipteris phalaenolepis (C. Chr.) Tryon

Figs. 34, 35. Map 8.

Trichipteris phalaenolepis (C. Chr.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila phalaenolepis C. Chr., Fedde Repert. Spec. Nov. **10**:213. 1911. HOLOTYPE: Prov. Esmeraldas, Ecuador, *Sodiro* in 1904, Herb. Sodiro not seen. ISOTYPE: P!
Cyathea phalaenolepis (C. Chr.) Domin, Pteridophyta 263. 1929.

Stem creeping to erect, reaching ca. 10 cm. *Petiole* 20–40 cm. long, fuscous to fulvous, tuberculate; scales fuscous with a cretaceous border or uniformly cretaceous distally along the petiole; scurf of cretaceous squamulae; trichomes present; all axes with trichomidia; rachis and pinna-rachises with cretaceous trichomes; rachis with cretaceous scales similar to those of the upper part of the petiole, pinna-rachises with a few flattish, cretaceous squamulae. *Lamina* 0.5–1.2 m. long, 1-pinnate-pinnatifid, papyraceous to chartaceous, apex gradually reduced and acuminate; pinnae adjacent, sessile to short-petiolulate, deeply pinnatifid, base cordate to truncate, apex obtuse to acute; lobes rotund, serrate at the tip; fertile veins simple or rarely forked at the sori, sterile veins forked or simple. *Sori* basally medial to apically inframedial; paraphyses much shorter than the sporangia, receptacle puberulous.

The close-set, obtuse pinnae are characteristic of *Trichipteris phalaenolepis* and the closely allied *T. ursina.* The occasional cretaceous scales on the rachis serve to distinguish *T. phalaenolepis* from *T. ursina. Trichipteris phalaenolepis* is a species of the Pacific coastal plain of northern South America from Colombia to Ecuador. Ecologically similar to *T. ursina,* it is found in dense forests and swamps near sea level (5–300 meters).

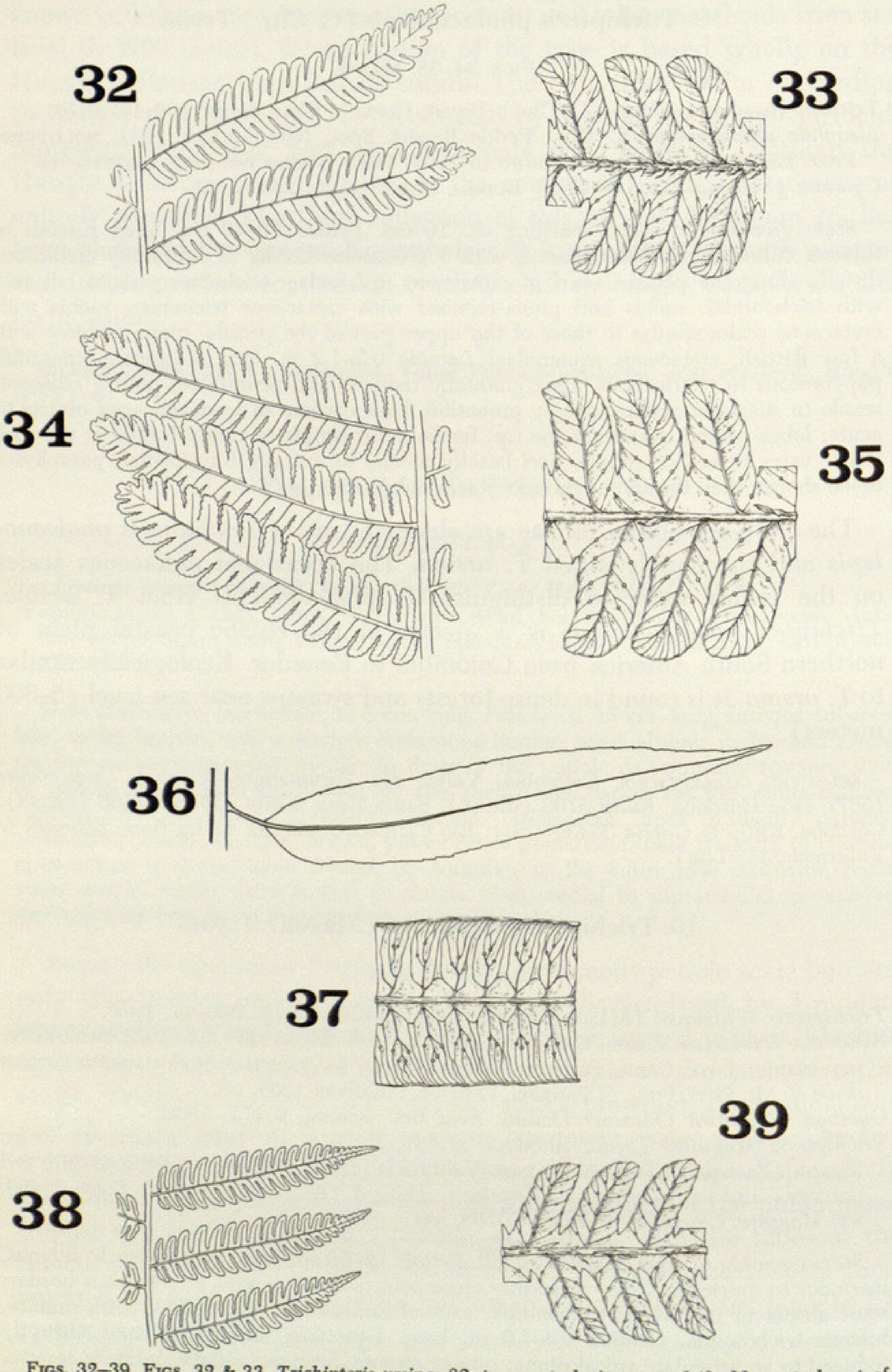
SELECTED COLLECTIONS. **Colombia. Valle:** Río Yurumangui, Veneral, *Cuatrecasas 15877* (F); Córdoba, *Killip 5103* (GH,NY); Santa Rosa, *Killip 11528, 11566* (GH,NY); Córdoba, *Killip & Garcia 33430* (GH); Río Calima, Quebrada de La Bréa, *Schultes & Villarreal 7355* (GH).

10. Trichipteris Williamsii (Maxon) Tryon

Figs. 36, 37. Map 9.

Trichipteris Williamsii (Maxon) Tryon, Contrib. Gray Herb. 200:44. 1970.
Alsophila Williamsii Maxon, Contrib. U.S. Nat. Herb. **24**(2):46 t. 17. 1922. HOLOTYPE: mountains above Cana, Panama, *Williams 850,* US! ISOTYPE: NY! PARATYPE: east slope of Mt. Pirri, Prov. of Panama, Panama, *Goldman 1968,* US!
Cyathea Williamsii (Maxon) Domin, Acta Bot. Bohem. 9:171. 1930.
Trichipteris Maguirei Tryon, Rhodora **74**:447, f. 15 & 16. 1972. HOLOTYPE: Cerro Sipapo (Paráque), Terr. Amazonas, Venezuela, 1948, *Maguire & Politi 27597,* NY! ISOTYPES: GH! US! PARATYPES: *Maguire & Politi 27752,* NY! *Maguire & Politi 28493,* NY! *Maguire, Cowan & Wurdack 30188,* NY!

Stem creeping to erect, 0.1–1.5 m. tall. *Petiole* 15–50 cm. long, castaneous to fulvous, inermous to muricate; scales uniformly cretaceous or fulvous with a cretaceous border; scurf absent or of fulvous trichomidia; axes of lamina and leaf surface with minute, fulvous trichomidia. *Lamina* 0.4–1.0 m. long, 1-pinnate, coriaceous, apex abruptly reduced to an articulate apical pinna; pinnae remote, long-petiolulate, entire to serrate, sterile pinnae sometimes irregularly crenate, base long-cuneate, apex attenuate, tip serrate; costules indistinct, veins all concurrent to the margin, fertile and sterile veins anastomosing, often forming one if not two rows of areolae, fertile veins undivided at the sori. *Sori* in one to three medial rows, subtended by evanescent soral squamulae; paraphyses shorter than the sporangia, receptacle pilose.



FIGS. 32–39. FIGS. 32 & 33, *Trichipteris ursina:* 32, two central pinnae, × 1/3; 33, central part of a pinna, × 1 (both *Scamman 7438,* GH). FIGS. 34 & 35, *T. phalaenolepis:* 34, three central pinnae, × 1/3; 35, central part of a pinna, × 1 (both *Killip & Garcia 33430,* GH). FIGS. 36 & 37, *T. Williamsii:* 36, a central pinna, × 1/3 (*Williams 850,* US); 37, central part of a pinna, × 2/3 (*Lellinger & de la Sota 258,* US). FIGS. 38 & 39, *T. microphylla:* 38, three central pinnules from a central pinna, × 1/3; 39, basal part of a pinnule, × 4/3 (both *Fendler 53,* GH).

Trichipteris Williamsii is one of two species in the genus with simply 1-pinnate leaves. It has attenuate, serrate pinna tips in contrast to *T. Cyclodium,* which has blunt, entire pinna tips. There is some variation within *T. Williamsii* in size of the plant and coloration of the petiole scales. Geographically *T. Williamsii* comprises two disjunct populations: one in Panama and the other in the Guayana Highlands of Venezuela (including Cerro Autana; Steyermark, 1974). In both areas it is found in wet forests at middle elevations (1350–1900 meters). Similar disjunct distributions are known for *Trichipteris villosa,* the Chrysobalanaceae (Prance, 1974), and the Myristicaceae (Gentry, 1975).

SELECTED COLLECTIONS. **Panama. Canal Zone:** 6 mi. above Goofy Lake on the road to Cerro Jefe, *Croat 15211* (NY); summit of Cerro Jefe, *Dwyer, Durkee & Castillon 5043* (NY). **Colombia. Chocó:** trail along ridge from the confluence of the Río Mutatá and the Río Dos Bocas to the top of Alto de Buey, *Lellinger & de la Sota 258* (US). **Venezuela. Amazonas:** Cerro Huachamacari, Río Cunucunuma, *Maguire, Cowan & Wurdack 30200* (US).

11. Trichipteris microphylla (Kl.) Tryon

FIGS. 38, 39. MAP 10.

Trichipteris microphylla (Kl.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila microphylla Kl., Linnaea 18:541. 1844. HOLOTYPE: Caracas, *Moritz 281b,* B.
Alsophila squamata Kl., Linnaea 18:541. 1844. HOLOTYPE: Caracas, *Moritz 110* B! (Tryon noted in 1969 that *Moritz 110* and *Moritz 281b* at B were the same species.)
Alsophila caracasana Kl. var. *Fendleriana* Domin, Pterid. Dominica 95. 1929. HOLOTYPE: Venezuela, near Colonia Tovar, *Fendler 53* annotated *A. leucolepis,* K not seen. ISOTYPES: F! GH! MO! NY!
Cyathea microphyllodes Domin, Pteridophyta 263. 1929, *nom. nov.* for *Alsophila microphylla* Kl., Linnaea 18:541. 1844, not *Cyathea microphylla* Mett., Fil. Lechl. 1:23 t. 3 f. 1–6. 1856.

Stem 0.5–3.0 m. tall. *Petiole* 0.4–1.2 m. long fulvous to stramineous, tuberculate to muricate; scales fuscous with a cretaceous margin; scurf of large, cretaceous squamulae; axes of lamina with minute trichomidia, large flattish fulvous squamulae and bullate cretaceous squamulae. *Lamina* 1.0–2.0 m. long, 2-pinnate-pinnatifid, papyraceous, apex gradually reduced and acute; pinnae stalked; pinnules short-petiolulate, pinnatisect, base truncate to cordate, apex acuminate; lobes rotund, entire to crenate; fertile veins forked at the sori, sterile veins forked or simple. *Sori* medial; paraphyses much shorter than the sporangia, receptacle puberulous.

Large cretaceous squamulae distinguish *Trichipteris microphylla* from the remainder of the 2-pinnate-pinnatifid species of the genus. *Trichipteris microphylla* is most easily confused with exindusiate species of *Sphaeropteris,* which lack marginate petiole scales. It is an unspecialized species, judging from the petiole scurf. Geographically *T. microphylla* is confined to the Atlantic slopes of the Cordillera Oriental in northern Colombia and the coastal ranges in Venezuela and perhaps Trinidad. It is a forest species, occurring between 1800 and 3000 meters in altitude.

SELECTED COLLECTIONS. **Trinidad.** Port of Spain, *Anonymous* in 1874 (NY). **Venezuela. Distrito Federal:** Colonia Tovar & vicinity, *Moritz* (possibly isotype material) (NY); between Agua Negra & El Junquito, *Pittier 13807, 13825* (F,NY,VEN). **Miranda:**

Galipan, near crest of Cerro de Avila, *Pittier 6212* (NY,VEN). **Colombia. Norte de Santander:** region of Sarare, between Alto del Loro & Alto de Santa Ines, 1800–2200 m, *Cuatrecasas, Schultes & Smith 12513* (F,GH,US). **Santander:** vicinity of Las Vegas, 2600–3000 m, *Killip & Smith 15968* (GH,US); southern slope of Mt. San Martin near Charta, 2000–2500 m, *Killip & Smith 19173* (GH,US); *Killip & Smith 19188* (GH,NY,US). **Cundinamarca:** La Palma, Cordillera de Helicona, 10 km SE of Gachala, *Grant 10322* (GH,US).

12. Trichipteris Schiedeana (Presl) Tryon

FIGS. 40, 41. MAP 11.

Trichipteris Schiedeana (Presl) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila Schiedeana Presl, Tent. Pterid. 62. 1836, based on a description of a *Polypodium* without binomial in Schlecht. & Chamisso, Linnaea 5:609. 1830. HOLOTYPE: inter Huitamalco et Cuapa regionis calidae. Mex., *Schiede*, fragment ex B, *(Schiede 757)* GH! fragment ex B,US! ISOTYPE: fragment probably ex P,F!
Cyathea Schiedeana (Presl) Domin, Pteridophyta 263. 1929.
Alsophila chnoödes Christ, Bull. Herb. Boiss. II. 4:958. 1904. HOLOTYPE: Costa Rica, *Werklé*, (Herb. Christ) P! ISOTYPES: A! NY! US!
Cyathea chnoödes (Christ) Domin, Pteridophyta 262. 1929.
Trichipteris chnoödes (Christ) Tryon, Contrib. Gray Herb. 200:44. 1970.
Alsophila crassifolia Christ, Bull. Herb. Boiss. II. 6:184. 1906. HOLOTYPE: Luna, Pulanca Quebrada, Costa Rica, *Wercklé*, (Herb. Christ) P! ISOTYPE: US!
Cyathea crassifolia (Christ) Domin, Pteridophyta 262. 1929.
Trichipteris crassifolia (Christ) Gastony, Am. Journ. Bot. **61**(6):673. 1974.

Stem to 7.0 m. tall. *Petiole* 0.3–0.7 m. long, fuscous to stramineous, aculeate; scales fuscous; scurf of congested, fuscous to cretaceous trichomidia; indument of lamina axes of trichomidia, trichomes, and flattish to bullate, fuscous squamulae. *Lamina* 1.0–2.0 m. long, 2-pinnate-pinnatifid, papyraceous, apex abruptly reduced and pinna-like to gradually reduced and acuminate; pinnae sessile; pinnules sessile, deeply pinnatifid to pinnatisect, base truncate to cuneate, apex obtuse to attenuate; lobes rotund, entire to crenulate; fertile veins simple or forked at the sori, sterile veins simple or forked. *Sori* medial, paraphyses shorter than the sporangia, receptacle pilose.

Trichipteris Schiedeana is best determined on the basis of its lustrous, fuscous petiole scales, petiole scurf of fuscous, contorted trichomidia, and bullate costal squamulae. It may be confused with *T. nigripes*, which has a petiole scurf consisting predominantly of squamulae, petiolulate pinnules, and often flattish rather than bullate costal squamulae. *Trichipteris Schiedeana* is a highly variable species. In the southern part of the range the leaf apex is often acuminate, and the veins undivided. A few specimens have petiole scales with narrow cretaceous borders. There is also some variation in the composition of the petiole scurf in plants from Costa Rica and Panama.

Trichipteris Schiedeana is found from Mexico to Panama. It grows in wet forests (especially along streams), in dwarfed forests along mountain crests, and as a weedy plant of wet, secondary forests. At least in Mexico it is an abundant species.

SELECTED COLLECTIONS. **Mexico. Veracruz:** 8 km. S of Misantla, *Barrington 405* (GH); Córdoba, *Bourgeau 1834, 1835, 1836* (GH,MO,NY). **Oaxaca:** between Puerto Eligio & Comaltepec, km. 149 from Tuxtepec to Oaxaca San Juaréz, *Calderón 423* (F,GH,US); Distrito Choapam, Yaveo, above Arroyo de Culebras, *Mexia 9185* (F,GH, MO,NY). **Chiapas:** Cacahuatan, *Fisher 35390* (F,MO,NY); Finca Mexiquito, *Purpus 6713* (GH). **Guerrero:** Río Petetlán, *Langlassé 663* (GH). **Guatemala. Huehuetenango:** between Ixcan and Río Ixcan, Sierra de los Cuchumatanes, *Steyermark 49282, 49287* (F,GH). **Quiché:** Finca Chailá Zona Reyna, *Skutch 1790* (GH). **Alta Verapaz:** S of Cubilquitz, *Steyermark 44537* (F,US); Cerro de Agua Tortuga, vicinity of Cubilquitz, *Steyermark 44601* (F,US). **Izabal:** quebradas, *Pittier 8578* (NY); Cerro San Gil, along Río Frío, *Steyermark 39973* (F,GH,US). **Quezaltenango:** between Finca Pirineos & Finca Soledad, S slopes of Volcán Santa María, *Steyermark 33544* (US). **Belize (British Honduras).** Hummingbird Highway, Stann Creek District, *Gentle 8257* (F,NY); Temash River, *Schipp S–922* (GH). **El Salvador. Chalatenango:** E slope of Los Esesmiles, *Tucker 1129* (F,GH,MO,US). **Morazán:** Finca Gen. J. T. Calderón, Montes de Cacaguatique, *Tucker 788* (F,US). **Honduras. Atlántida:** Lancetilla Valley, near Tela, *Standley 52722* (F,GH); slopes of Mt. Cangrejal, vicinity of La Ceiba, *Yuncker, Koepper & Wagner 8815* (MO,NY). **Comayagua:** Barranco Trincheras, 20 km. N of Siguatepeque, *Morton 7588, 7591* (US); Trincheras, N of Siguatepeque, *Steves & Ray 480* (GH). **Cortés:** mountains, N side of Lake Yojoa, *Morton 7618* (US); N of Lake Yojoa, *Ray 2122* (A,GH). **Costa Rica. Alajuela:** near Zapote on the road to Villa Quesada, *Scamman 7589* (F,GH). **Limón:** 35 km. NE of Turrialba toward Siquirres, *Gastony & Gastony 782* (GH); above Siquirres, *Ulloa 4* (GH). **San José:** vicinity of El General, *Skutch 2891* (GH,MO). **Cartago:** Finca Navarro, *Maxon 631, 634* (NY); San Juan del Norte, *Scamman 7588* (GH). **Puntarenas:** 5 km. S of San Vito de Java, *Wilson & Wilson 69–332* (NY). **Panama. Chiriquí:** valley of the Río Caldera, from El Boquete to the Cordillera, *Killip 5476* (F,US). **Bocas del Toro:** hills behind Fish Creek, vicinity of Chiriquí Lagoon, *von Wedel 2211* (GH,MO).

13. Trichipteris aspera (L.) Tryon

FIGS. 42, 43. MAP 12.

Trichipteris aspera (L.) Tryon, Contrib. Gray Herb. 200:44. 1970.
Polypodium asperum L., Sp. Pl. **2**:1093. 1753, based on Petiver, Pterigraphia Amer. 47, t. 4 f. 7, *ex icone,* based on a specimen collected by Plumier in Haiti.
Cyathea aspera (L.) Sw., Schrad. Journ. **1800**:93. 1800.
Alsophila aspera (L.) Sprengel, Systema Vegetab. ed. 16. **4**:124. 1827.
Disphenia aspera (L.) Presl, Abh. Bohm. Ges. **5**(5):349. 1848.
Hemitelia aspera (L.) Fée, Mém. Fam. Foug. **5** (Genera Filicum):350. 1852.
Cyathea muricata Willd., Sp. Pl. ed. 4. **5**:497. 1810, based on Plumier, Tractatus 5 t. 4 and Petiver, Pterigraphia Amer. 48, t. 4 f. 8.
Alsophila muricata (Willd.) Desv., Mém. Soc. Linn. Paris **6**:319. 1827.
Disphenia muricata (Willd.) Presl, Abh. Bohm. Ges. **5**(5):349. 1848.
Hemitelia muricata (Willd.) Fée, Mém. Fam. Foug. **5** (Genera Filicum):350. 1852.
Polypodium alsophilum Link, Hort. Berol. **2**:106. 1833, *ex char.* HOLOTYPE: hort. Berlin, originally from Jamaica.
Cyathea alsophilum (Link) Domin, Pteridophyta 262. 1929.
Alsophila nitida Kze. in Ettingsh., Farnkr. 222, t. 154 f. 4, 8 t. 155 f. 1, 7. 1865. HOLOTYPE: Martinique, (*Perrotet* in 1851, orig. Herb. Vindob.) W not seen. ISOTYPE: B!

Stem erect, 1.0–9.0 m. tall. *Petiole* 0.4–0.9 m. long, atropurpureous to fulvous, tuberculate to aculeate, scales uniformly fuscous to fulvous or with a slightly lighter border; scurf of cretaceous to fulvous congested trichomidia and appressed to erect squamulae; rachis, pinna-rachises, and costae tuberculate to muricate, axes of lamina often with cretaceous trichomidia, costae and sometimes pinna-rachises with flattish, erose, fuscous squamulae and bullate, cretaceous squamulae. *Lamina* 1.5–2.5 m. long, 2-pinnate-pinnatifid, papyraceous to coriaceous, apex gradually reduced and long-acuminate; pinnae stalked; pinnules short-petiolulate, pinnatifid to pinnatisect, base cordate to truncate, apex acuminate to a crenulate tip; lobes acute, entire to crenate; fertile veins forked at the sori or simple, sterile veins usually forked. *Sori* medial to supramedial, subtended by evanescent, biseriate to persistent, multiseriate fuscous soral squamulae; paraphyses shorter than to as long as the sporangia, receptacle hirsute.

Trichipteris aspera usually lacks the minute, cretaceous trichomidia on the costae and costules that are characteristic of *T. gibbosa,* and it has shorter paraphyses. Further collections may reveal that the two species are part of one morphological continuum.

Maxon notes on a collection of *Trichipteris aspera* from Martinique *(Dusen 1603),* "This is *A. aspera,* but the locality is certainly to be doubted!" *Alsophila aspera* has traditionally been interpreted as a species of the Greater Antilles, and *Alsophila muricata* as a species of the Lesser Antilles. However, plants with several fuscous soral squamulae, traditionally *A. muricata,* and plants with one cretaceous squamule, traditionally *A. aspera,* can be found throughout the range of *T. aspera* from Cuba to Grenada. A variety of intermediates have been collected. The mosaic distribution of both intermediates and extremes leads me to interpret these plants as members of a single, polymorphic species. *Trichipteris aspera* occurs in rain forests and cloud forests, often along watercourses, and along mountain crests in "elfin" forests. It is also found in secondary vegetation persisting after cutting of the original forest. The species occurs at up to 1500 meters in Jamaica, but generally grows at about 750 meters in the rest of the Antilles (150–1500 meters). It is common throughout its range, but has not been collected from Puerto Rico.

SELECTED COLLECTIONS. **Cuba. Las Villas (Sta. Clara):** SE of Cumanayagua, Sierra de San Juan, *Senn 229* (GH,MO); Trinidad Mts., El Provenir, *Britton & Wilson 5324* (NY). **Oriente:** Santa Ana, ca. 6 mi. N of Jaguey, Yateras, *Maxon 4181* (GH,NY). **Jamaica. Trelawney:** Troy (or Tyre), Cockpit Country, *Underwood 3306* (NY). **St. Ann:** NE slope of Mt. Diablo, *Howard & Proctor 15161* (A). **St. Mary:** valley of the Flint River, 1 mi E of cascade, *Proctor 4914* (MO). **Portland:** Seamen's Valley, *Maxon & Killip 11* (F,GH,NY); trail from Morces Gap to Vinegar Hill, *Maxon & Killip 680* (F,GH,NY). **St. Thomas:** Mansfield, near Bath, *Maxon 2405* (GH,US). **St. Andrew:** Cooper's Hill, Red Hills, *Proctor 9901* (MO). **Manchester:** Blue Mt., *Gilbert* (MO,NY). **St. Elizabeth:** Wallenford, *Harris 7280* (NY). **Haiti. Dept. du Sud:** Massif de la Hotte, Tiburon, western group, Morne Citadelle, *Ekman 10544* (NY); Massif de la Hotte, western group, N slope of Morne Vandervelde, *Ekman 5215* (F). **St. Kitts.** *Proctor 19642* (A). **Nevis.** *Proctor 19477* (A). **Montserrat.** *Proctor 18869* (A). **Guadeloupe.** *Proctor 19997* (A); *Proctor 20348* (A). **Dominica.** *Wilbur 7549* (GH,NY). **Martinique.** *Duss 1602* (F,NY). **St. Lucia.** *Howard 11690* (A,GH,NY). **St. Vincents.** *H. H. Smith 696* (NY). **Grenada.** *Sherring 25* (NY).

14. Trichipteris gibbosa (Kl.) Barr.

FIGS. 44, 45. MAP 13.

Trichipteris gibbosa (Kl.) Barr., Rhodora 78(813):3. 1976.
Alsophila gibbosa Kl., Linnaea 18:542. 1844. HOLOTYPE: in British Guiana, *Schomburgk 1124,* fragment ex B, GH! fragment ex B, NY! ISOTYPE: P!
Cyathea gibbosa (Kl.) Domin, Pteridophyta 262. 1929.
Sphaeropteris gibbosa (Kl.) Tryon, Contrib. Gray Herb. 200:20. 1970.
Alsophila farinosa Mett., Ann. Sci. Nat. Bot. V. 2:262. 1864. *nom. nud.*
Alsophila farinosa Karst., Fl. Columb. 2:163 t. 186. 1869. HOLOTYPE: prope Colonia Tovar, Caracas, Venezuela, 1500 m, 1849, *Karsten,* fragment ex B, GH!
Cyathea farinosa (Karst.) Domin, Pteridophyta 262. 1929.

Stem to 5 m. tall. *Petiole* ca. 0.5 m. long, fulvous, muricate; scales fulvous with a lighter border; scurf of a few trichomidia and a dense covering of fulvous squamulae; costae and costules with cretaceous trichomidia and flattish to bullate, fulvous squamulae. *Lamina* ca. 1.0 m. long, 2-pinnate-pinnatifid, chartaceous to coriaceous, apex gradually reduced and acuminate; pinnae stalked; pinnules petiolulate, pinnatifid to deeply pinnatifid, base truncate, apex acuminate, tip crenulate; lobes rotund to acute, entire; fertile veins forked at the sori or simple especially at the base of the segments, sterile veins forked or simple. *Sori* medial, with large, fuscous soral squamulae (sometimes abraded in older material); paraphyses longer than the sporangia, receptacle villous.

Trichipteris gibbosa is closely related to *T. aspera,* from which it differs in several respects noted under the former species. It is found in Venezuela and Guyana (British Guiana) from 2100 to 2200 meters.

SELECTED COLLECTIONS. **Venezuela. Aragua:** prope coloniam Tovar, *Fendler 54* (GH,MO,US); *Pittier 9995* (GH,US). **Distrito Federal:** mountains near Galipan, *Pittier 111* (NY,US,VEN); between El Junquito & Colonia Tovar, *Steyermark 91731* (GH,VEN).

15. **Trichipteris nigripes** (C. Chr.) Barr.

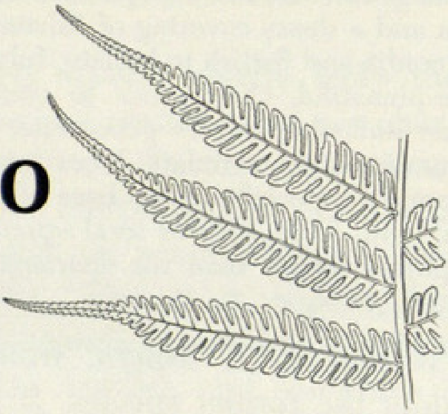
Both varieties of this species have a dark aspect, a composite of the atropurpureous petioles and petiole scales and the dark green foliage. In Costa Rica and Panama, *Trichipteris nigripes* can be confused with *T. Wendlandii,* a species in which the pinna-rachises are clothed with bullate, fuscous squamulae and the paraphyses are longer than the sporangia. *Trichipteris Schiedeana,* a central American species, has close-set, bullate and not remote, flattish costal squamulae. There is some variation in the costal indument and in the development of the petiole spines in *T. nigripes.* In addition, the fertile veins vary from simple to forked on plants throughout the range of *T. nigripes.* Some pinnae have almost no forked fertile veins. The species is found in rain forests and cloud forests (especially on slopes and crests) from sea level to 2200 meters. The two varieties of *T. nigripes* make up a single variable species ranging from Costa Rica to Peru. The combination *Alsophila furcata* Christ, which pertains to *Nephelea mexicana* (Schlecht. & Cham.) Tryon, is occasionally applied to specimens of *T. nigripes* from Costa Rica.

15a. **Trichipteris nigripes** (C. Chr.) Barr. var. **nigripes**

FIGS. 46, 47. MAP 14.

Trichipteris nigripes (C. Chr.) Barr., Rhodora 78(813):4. 1976.
Alsophila nigripes C. Chr., Ind. Fil. 45. 1905, *nom. nov.* for *Alsophila melanopus* Hook., Syn. Fil. ed. 1. 37. 1866, not *A. melanopus* Hassk., Journ. Bot. (Hooker's) 7:325. 1855.
Cyathea nigripes (C. Chr.) Domin, Pteridophyta 263. 1929.
Alsophila melanopus Hook., Syn. Fil. ed. 1:37. 1866, not Hassk., 1855. LECTOTYPE (chosen herewith): Chimborazo, Ecuador, *Spruce 5742,* K! ISOLECTOTYPE: P! LECTOPARATYPE: Mt. Canelos, Ecuador, *Spruce,* K not seen.

Stem 2.0–8.0 m. tall. *Petiole* 0.3–1.5 m. long, nigrescent to fuscous or rarely stra-



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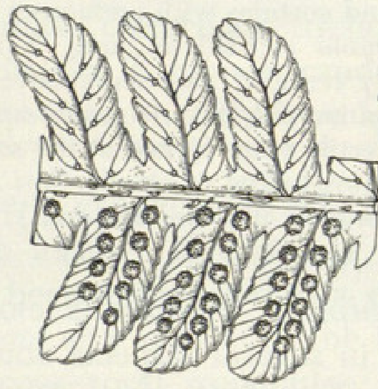

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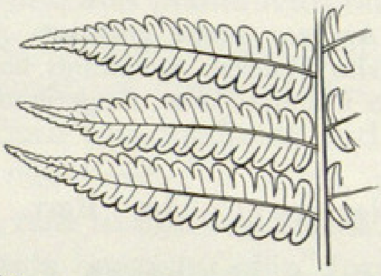

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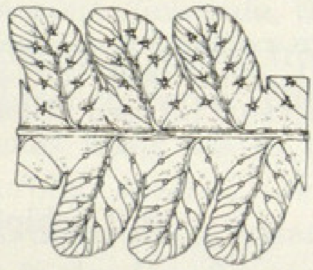

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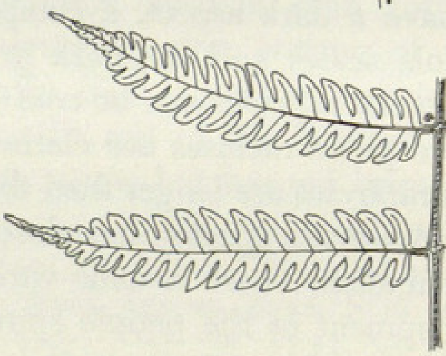

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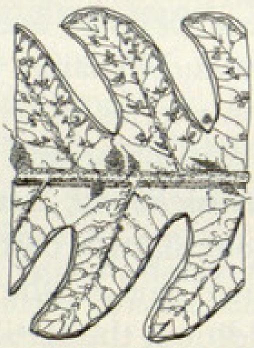

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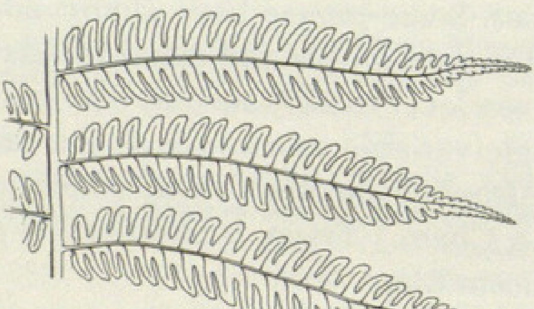

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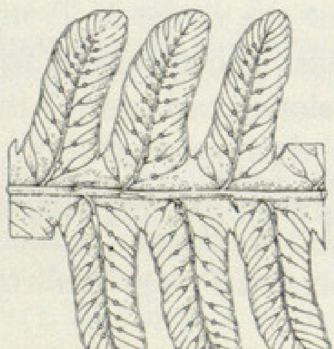

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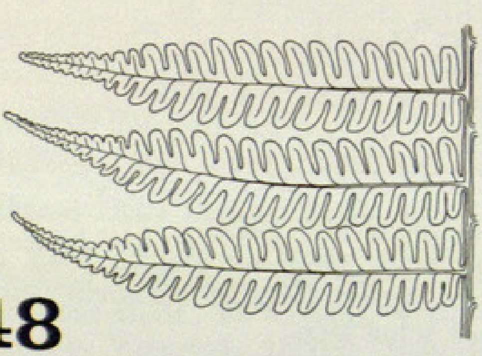

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mineous, tuberculate to aculeate; scales uniformly fuscous; scurf usually of congested, fuscous trichomidia and squamulae; rachis and pinna rachises often tuberculate to muricate, with trichomidia and trichomes; costae with a few cretaceous trichomidia and flattish, deltoid, fuscous squamulae. *Lamina* 1.5–3.0 m. long, 2-pinnate-pinnatifid, chartaceous, apex gradually reduced and long-acuminate; pinnae sessile to stalked; pinnules petiolulate to long-petiolulate, deeply pinnatifid to pinnatisect, base subcordate to truncate, apex acuminate to attenuate, tip crenulate; lobes rotund to acute, entire to crenulate; fertile veins forked at the sori or simple, sterile veins forked or occasionally simple. *Sori* subcostal to medial, paraphyses shorter than the sporangia, receptacle pilose.

SELECTED COLLECTIONS. **Costa Rica. Alajuela:** near Zapote, road to Villa Quesada, *Scamman 7594* (GH). **San José:** 17 km. N of San Isidro el General, *Gastony 754* (GH); La Palma & vicinity, 15 km. NE of San José, *Gastony 769* (GH). **Cartago:** valley of the Río Grande del Orosi, 20 km. S of Cartago, *Tryon & Tryon 7026* (GH); 4.5 km. from bridge at Tapantí, *White & Lucansky 1968120* (GH,US). **Province indet:** *Werckle* (some of the specimens det. *Alsophila furcata,* i.e., US *1903366, 1316805*). **Panama. Darién:** Cerro de Garagará, Sambú Basin, *Pittier 5641* (US). **Colombia. Valle:** km. 19 on road from Cali to Buenaventura, *Barrington 499, 501* (GH); El Cairo, between Darién & Mediacanoa, Río Calima valley, *Cuatrecasas 13930* (F,GH,US). **Nariño:** Mun. Ricaurte, El Palmar, bank of the Quiza River, *Soejarto 1445* (GH). **Ecuador. Pichincha:** Santo Domingo de los Colorados, Rancho Brahman, on the road to Esmeraldas, *Sparre 14072* (GH); Toáchi, confluence of Río Pilatón & Río Toáchi, road from Aloag to Sto. Domingo, *Sparre 18484* (GH). **Cotopaxi:** Cacaoal, *Bell 918* (GH); 5 km. S of Palmar, road from Quevado to Latacunga, *Lockwood 835* (GH).

15b. **Trichipteris nigripes** (C. Chr.) Barr. var. **brunnescens** Barr.

FIGS. 48, 49. MAP 15.

Trichipteris nigripes (C. Chr.) Barr. var. *brunnescens* Barr., Rhodora 78(813):4 t. 1 f. 6. 1976. HOLOTYPE: Río Yurumanguí, Veneral, 5–50 m., Valle, Colombia, 1944, *Cuatrecasas 16155–C,* U.S. Nat. Herb. 1853473–6, US! ISOTYPE: GH! PARATYPE: Agua Clara, highway from Buenaventura to Cali, 100 m., Valle, Colombia, 1944, *Killip & Cuatrecasas 38884,* F! ISOPARATYPES: GH! US!

Stem 1.5–6.0 m. tall. *Petiole* ca. 0.3 m. long, fuscous, tuberculate to aculeate; scales uniformly fuscous; scurf of congested fuscous to fulvous trichomidia or squamulae; axes of lamina with trichomidia, cretaceous trichomes and flattish to bullate squamulae. *Lamina* 1.0–1.3 m. long, 2-pinnate-pinnatifid, chartaceous to coriaceous, apex gradually reduced and long acuminate; pinnae sessile to stalked; pinnules sessile to petiolulate, pinnatisect, base truncate to cuneate, apex obtuse to acuminate, tip crenulate; lobes rotund to truncate, entire to crenulate; fertile veins forked at the sori, sterile veins forked or simple. *Sori* subcostal to supramedial; paraphyses shorter than the sporangia, receptacle hirsute.

Trichipteris nigripes var. *brunnescens* differs from typical plants of the species in having well-developed spines, sessile pinnules, and trichomes on the abaxial surface of the leaf axes. *Trichipteris nigripes* var.

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FIGS. 40–49. FIGS. 40 & 41, *Trichipteris Schiedeana:* 40, three central pinnules from a central pinna, × 1/3; 41, central part of a pinnule, × 4/3 (both *Standley 52722,* F). FIGS. 42 & 43, *T. aspera:* 42, three central pinnules from a central pinna, × 1/3; 43, central part of a pinnule, × 4/3 (both *Howard & Proctor 15161,* A). FIGS. 44 & 45, *T. gibbosa:* 44, two central pinnules from a central pinna, × 1/3; 45, central part of a pinnule, × 4/3 (both *Steyermark 91731,* GH). FIGS. 46–49, *T. nigripes:* 46, var. *nigripes,* three central pinnules from a central pinna, × 1/3; 47, var. *nigripes,* central part of a pinnule, × 4/3 (both *Sodiro* in 9/1892, NY). 48, var. *brunnescens,* three central pinnules from a central pinna, × 1/3; 49, var. *brunnescens,* central part of a pinnule, × 4/3 (both *Cuatrecasas 16155–C,* US).

brunnescens is in general a Pacific coast population from Colombia. A few plants of this variety have been collected at higher altitudes and on Atlantic slopes in Ecuador.

SELECTED COLLECTIONS. **Colombia. Chocó:** Río Negro, between Quibdó & Tutunendo, *Cuatrecasas & Llano 24215* (GH,US); near Istmina, road to Cértegui, *Garcia-Barriga 11180* (US). **Valle:** Río Cajambre, San Isidro, *Cuatrecasas 17297* (F,GH,US). **Nariño:** Quebrada La Toma, Río Telembi, between Río Pimbi & Río Cuembi, above Barbacoas, *Ewan 16860* (US). **Putumayo:** Río San Miguel, between Quebrada de Sipenae & Quebrada de Churruyaco, *Cuatrecasas 10953* (US); Uchupayaco, plain between Urcusique & Umbria, banks of the Río Uchupayaco, *Schultes 3299, 3365* (GH,US). **Ecuador. Napo:** Cerro Antisana, between Río Napo & Tena, 8 km. SE of Tena, *Grubb et al. 1657* (GH,NY). **Zamora-Chinchipe:** between Yacuambi & Supaca, near confluence of Río Yacuambi & Río Zamora, *Sparre 16426* (GH).

16. Trichipteris Kalbreyeri (Baker) Tryon

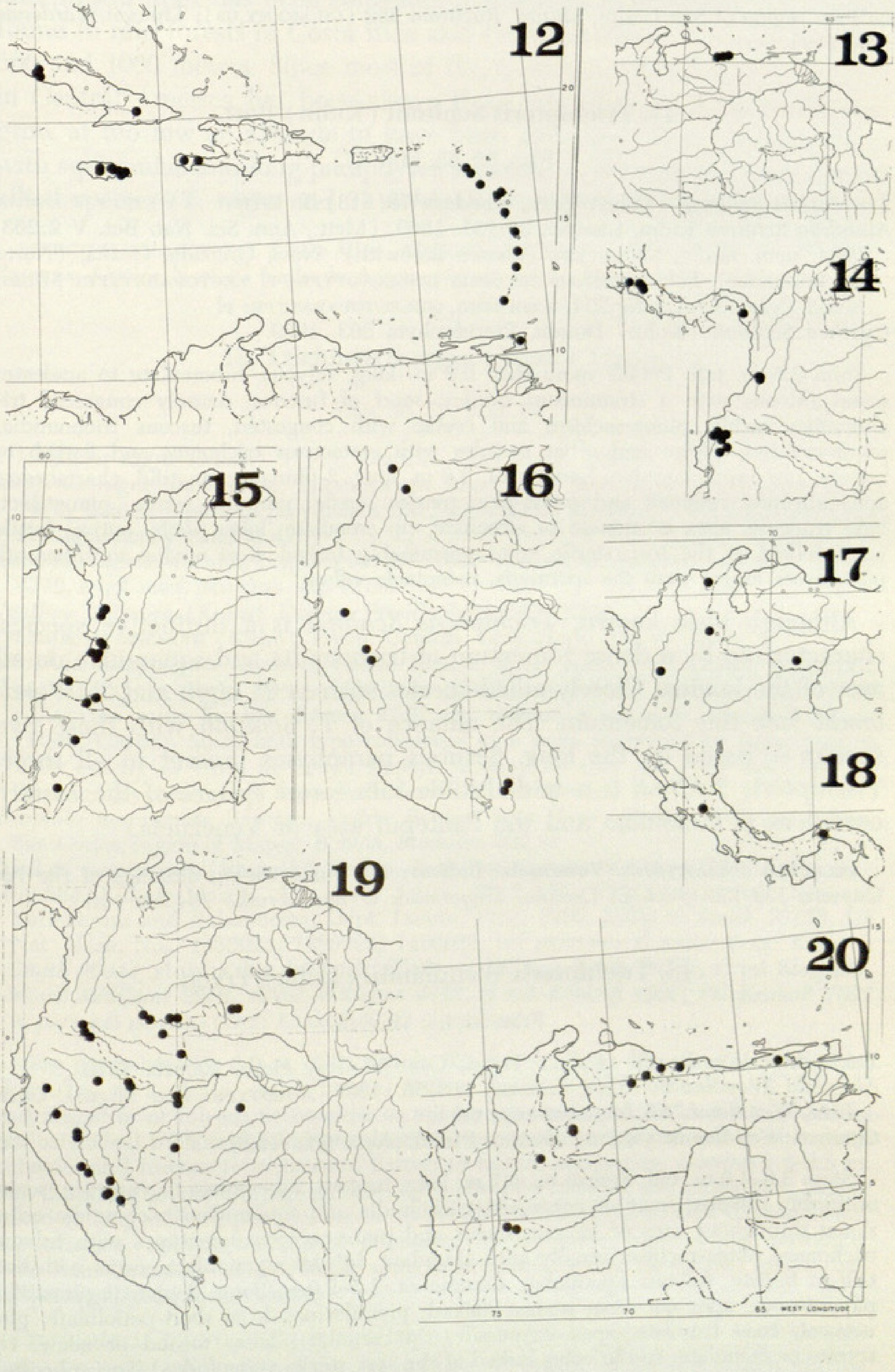
FIGS. 50, 51. MAP 16.

Trichipteris Kalbreyeri (Baker) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila Kalbreyeri Baker, Summary New Ferns 9. 1892, *nom. nov.* for *Alsophila podophylla* Baker, Journ. Bot. Brit. & For. 19:202. 1881, not *A. podophylla* Hook., Journ. Bot. 9:334. 1857.
Alsophila Kalbreyeri C. Chr., Ind. Fil. 44, 1905, *nom. nov.* for *Alsophila podophylla* Baker, Journ. Bot. Brit. & For. 19:202. 1881, not *A. podophylla* Hook., Journ. Bot. 9:334. 1857. (Christensen was apparently unaware of Baker's earlier and identical *nom. nov.* Tryon (1970) published the combination *Trichipteris Kalbreyeri* (C. Chr.) Tryon based on Christensen's *nom. nov.* and not Baker's. I have corrected this bibliographic error in accordance with the argument of Nicolson, 1975.
Cyathea Kalbreyeri (Baker) Domin, Pteridophyta 262. 1929.
Alsophila podophylla Baker, Journ. Bot. Brit. & For. 19:202. 1881, not *A. podophylla* Hook., Journ. Bot. 9:334. 1857. HOLOTYPE: forests, 500 ft., Colombia, *Kalbreyer 1375*, K not seen. ISOTYPE: (Antioquia) fragment ex B, GH!

Stem 3.5–4.0 m. or more tall. *Petiole* more than 0.3 m. long, atropurpureous, tuberculate to aculeate; scales atropurpureous with a fuscous border; scurf of occasional trichomidia and fulvous squamulae, large squamulae and small scales; axes of lamina with occasional trichomidia and small, flattish, fulvous squamulae. *Lamina* ca. 4.0 m. long, 2-pinnate-pinnatifid, coriaceous, apex gradually reduced and acuminate; pinnae long-stalked; pinnules long-petiolulate, pinnatisect to deeply pinnatifid, base truncate and inequalateral, apex acute to attenuate, tip serrate; lobes acute to acuminate, serrate at least at the tip; fertile veins forked at the sori, sterile veins forked. *Sori* inframedial to medial; paraphyses shorter than the sporangia, receptacle hirsute.

Trichipteris Kalbreyeri is nearly glabrous and has long petiolules and acuminate, serrate lobes. Although difficult to confuse with any other species of *Trichipteris, T. Kalbreyeri* is very close in leaf architecture to *Cyathea divergens* Kze. var. *divergens*. A careful check of the sori is necessary for critical determination. The size and dissection of the pinnules varies without relation to geography. *Trichipteris Kalbreyeri* is found in rain forests from 500 to 1400 meters in the eastern cordillera of the Andes in Colombia, and on the eastern slopes of the Andes from Ecuador to Bolivia.

SELECTED COLLECTIONS. **Colombia. Cundinamarca:** near Muzo, *Stübel 535* (B,NY).



Maps 12–20: 12, Trichipteris aspera; 13, T. gibbosa; 14, T. nigripes var. nigripes; 15, T. nigripes var. brunnescens; 16, T. Kalbreyeri; 17, T. Schlimii; 18, T. Wendlandii; 19, T. nigra; 20, T. pauciflora.

Ecuador. Zamora-Santiago: Bomboiza, S of Gualaquiza, Misión Salesiana, *Sparre 19269* (GH). **Peru. San Martín:** Mt. Campana, near Tarapoto, *Spruce 4330* (NY). **Bolivia. La Paz:** region of San Carlos, Mapiri, *Buchtien 289* (GH,MO,NY,US); Tipuani, *Cárdenas 1283* (US).

17. Trichipteris Schlimii (Kuhn) Barr.

FIGS. 52, 53. MAP 17.

Trichipteris Schlimii (Kuhn) Barr., Rhodora 78(813):5. 1976.
Alsophila Schlimii Kuhn, Linnaea 36:157. 1869. (Mett., Ann. Sci. Nat. Bot. V 2:263. 1864. *nom. nud.*). LECTOTYPE (chosen herewith): Nova Grenada, Ocaña, (Norte de Santander). *Schlim 223,* B not seen. ISOLECTOTYPE: P! LECTOPARATYPE: Minas, Muzo, Colombia, *Lindig 254,* B not seen. ISOLECTOPARATYPE: P!
Cyathea Schlimii (Kuhn) Domin, Pteridophyta 263. 1929.

Stem 3.5 m. tall. *Petiole* more than 0.3 m. long, fulvous, tuberculate to aculeate; scales fulvous with a stramineous border; scurf of fuscous, densely congested trichomidia; rachis, pinna-rachises and costae with congested, fuscous trichomidia; pinna-rachises, costae and often costules with cretaceous trichomes and flattish to bullate, fuscous squamulae. *Lamina* ca. 3.0 m. long, 2-pinnate-pinnatifid, chartaceous, apex abruptly reduced and pinna-like; pinnae sessile; pinnules sessile, pinnatisect, base truncate, apex acuminate to attenuate, tip crenulate; lobes acute, entire; fertile veins forked at the sori, sterile veins presumably forked. *Sori* medial to subcostal, paraphyses longer than the sporangia, receptacle villous.

Although little known, *Trichipteris Schlimii* is a distinctive species, characterized by a dense tomentum of trichomidia and squamulae on all axes of the lamina. Closely allied species such as *T. nigra* and *T. Wendlandii* lack this tomentum. The alliance of *T. Schlimii* with these two species is based on the long, flexuous paraphyses present in all three. *Trichipteris Schlimii* is a mid-altitude rain forest species of the eastern cordillera in Colombia and the Pantepuí area of Venezuela.

SELECTED COLLECTIONS. **Venezuela. Bolívar:** Río Huacawa-kú, drainage of the Río Cuyuní, 139 km. S of El Dorado, *Steyermark & Dunsterville 104380* (GH).

18. Trichipteris Wendlandii (Kuhn) Tryon

FIGS. 54, 55. MAP 18.

Trichipteris Wendlandii (Kuhn) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila Wendlandii Kuhn, Linnaea 36:158. 1869. HOLOTYPE: San Miguel, Costa Rica, *Wendland 761,* fragment ex B, US!
Cyathea Wendlandii (Kuhn) Domin, Pteridophyta 263. 1929.

Stem 3.0–4.0 m. tall. *Petiole* ca. 0.7 m. long, fuscous, tuberculate to muricate; scales uniformly fulvous; scurf of congested trichomidia and squamulae; trichomidia occasional throughout axes of lamina; rachis and pinna-rachises sometimes with fulvous trichomes; pinna-rachises usually with abundant, fulvous squamulae; costae with flattish to bullate, fulvous squamulae. *Lamina* ca. 1.5–2.0 m. long; 2-pinnate-pinnatifid, papyraceous, apex not seen; pinnae stalked; pinnules sessile to short-petiolulate, pinnatisect, base truncate, apex acuminate, tip crenulate; lobes rotund or acute, tip serrate or crenulate; fertile veins forked at the sori, sterile veins forked. *Sori* subcostal; paraphyses longer than the sporangia, receptacle villous.

The adequate definition of *Trichipteris Wendlandii* as a species must await new, complete collections. No complete petioles are available, and no leaf apex has been collected. *Trichipteris Wendlandii* is a species found in rain forests in Costa Rica and Panama, where it occurs between 500 and 1000 meters. Since most of the intensive collecting of tree ferns in Central America has been above these altitudes, *T. Wendlandii* may grow at too low an altitude to have been collected often. Pinna-rachises with squamulae and long paraphyses separate *T. Wendlandii* from closely allied species *(T. nigra* and *T. Schlimii)* and from *T. nigripes.*

SELECTED COLLECTIONS. **Costa Rica. Alajuela:** La Marina, *Nisman 73, 75, 77* (GH). **Panama. Coclé:** N of El Valle de Anton, vicinity of La Mesa, *Allen 2873* (GH,US).

19. **Trichipteris nigra** (Mart.) Tryon

FIGS. 56, 57. MAP 19.

Trichipteris nigra (Mart.) Tryon, Contrib. Gray Herb. 200:46. 1970.

Alsophila nigra Mart., Icon. Plant. Crypt. Bras. 71 t. 30 f. 5, 6, t. 47. 1834. HOLOTYPE: flumen Japurá in provincia a Rio Negro dicta, *Martius,* M not seen. ISOTYPES: B! fragments ex B and K, NY!

Alsophila lasiosora Kuhn, Linnaea 36:157. 1869. HOLOTYPE: Peruviae orientale, *Spruce 4349,* B not seen. ISOTYPES: GH! P! US!

Cyathea lasiosora (Kuhn) Domin, Pteridophyta 262. 1929.

Trichipteris lasiosora (Kuhn) Tryon, Contrib. Gray Herb. 200:45. 1970.

Alsophila tarapotensis Rosenst., Fedde Repert. Spec. Nov. 7:291. 1909. HOLOTYPE: near Tarapoto, Peru, *Spruce 4349 (an 4249),* S not seen. ISOTYPES: GH! P! US! PARATYPE: same locality, *Spruce 4249* var. *videtur,* S not seen. ISOPARATYPE: P! (Herb. Christ). Since both type collections at P were annotated by Rosenstock in 1909 exactly as cited in Fedde Repert., it may be that the Paris materials are the originals from which Rosenstock described this species.

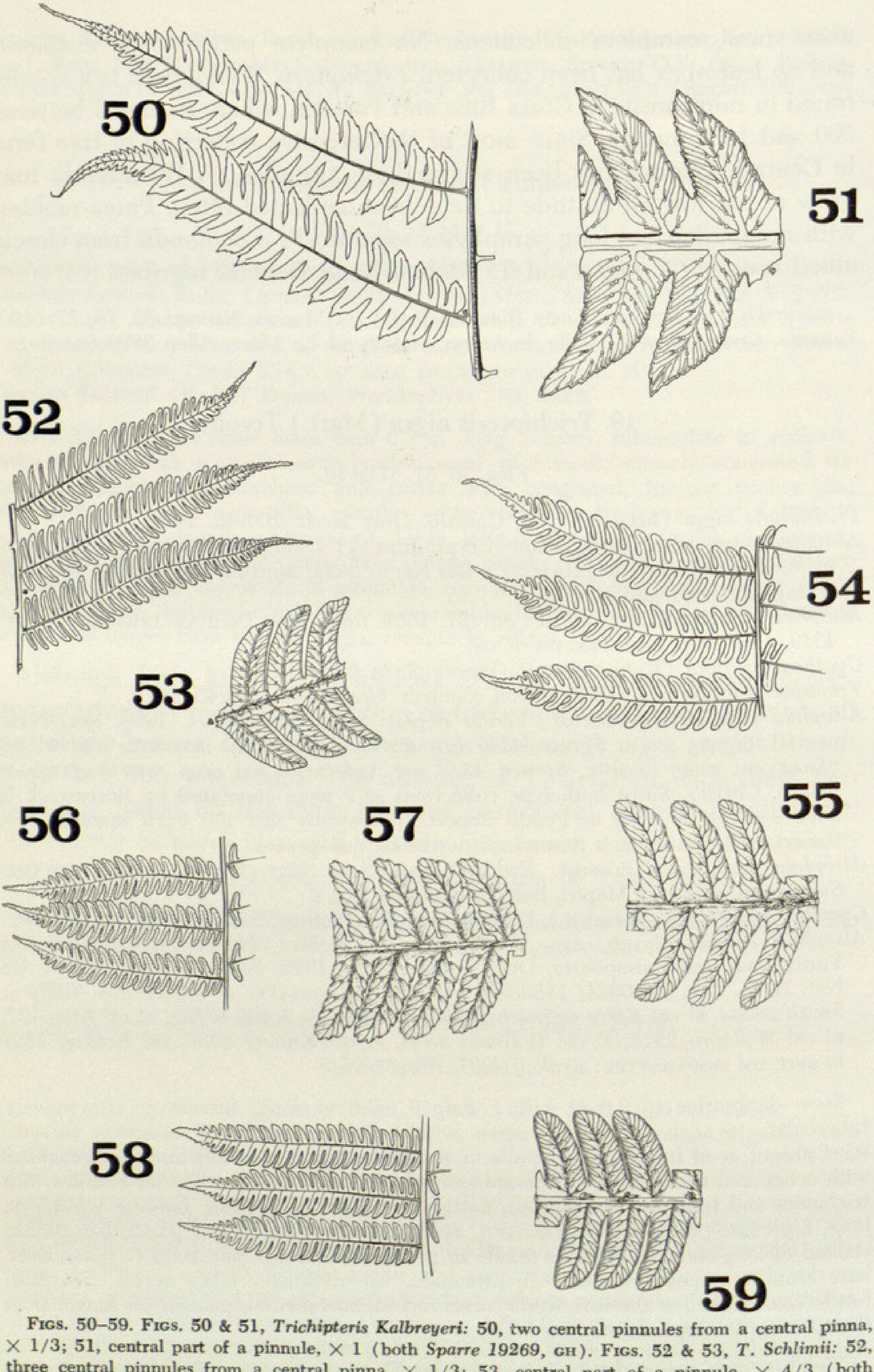
Alsophila mapiriensis Rosenst., Fedde Repert. Spec. Nov. 25:57. 1928. HOLOTYPE: San Carlos, region of Mapiri, Bolivia, *Buchtien 292,* S!

Cyathea mapiriensis (Rosenst.) Domin, Acta Bot. Bohem. 9:134. 1930.

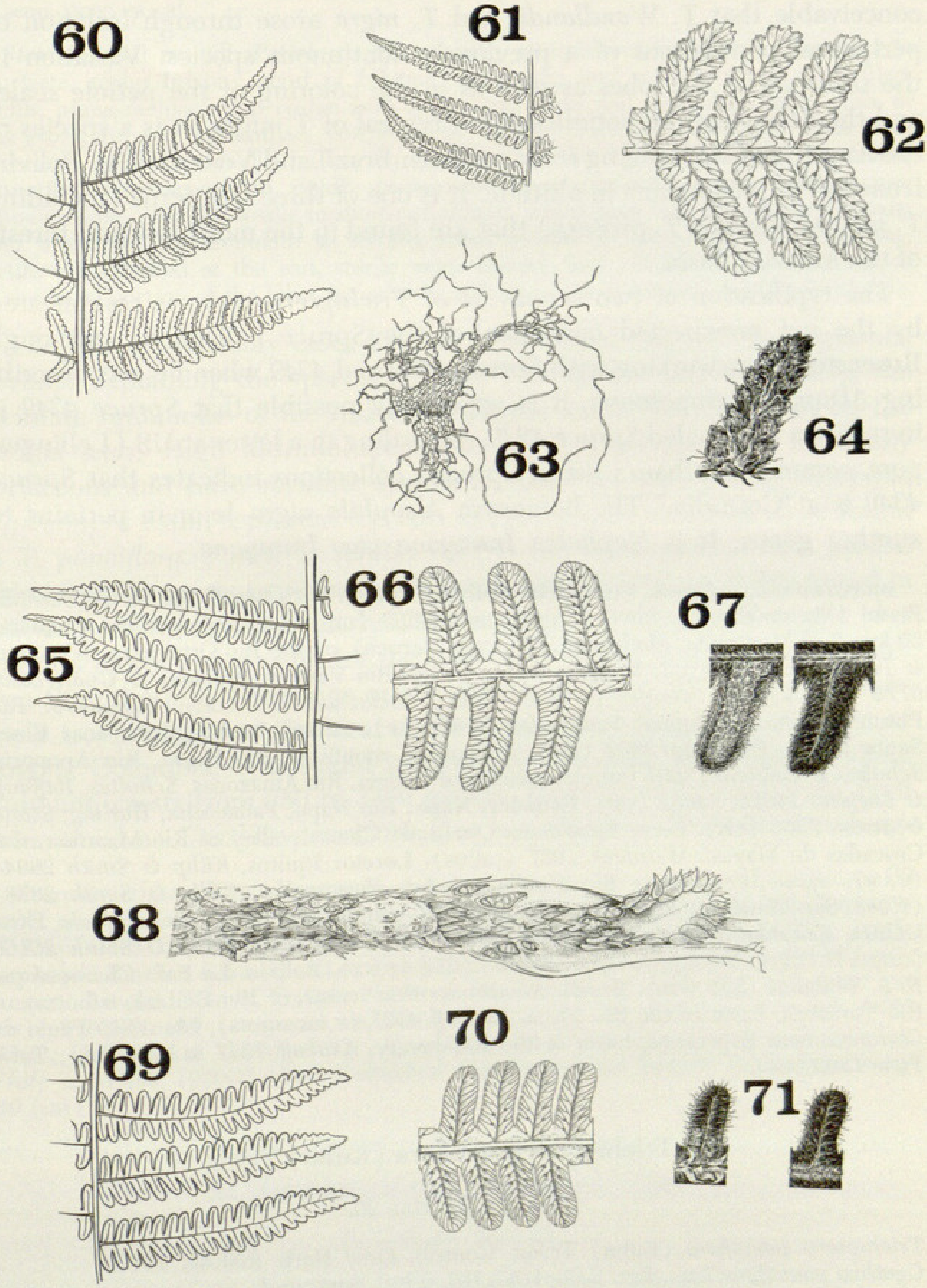
Alsophila Killipii Maxon, Am. Fern Journ. 32(2):58. 1942. HOLOTYPE: between Yurimaguas and Balsapuerto, Dept. Loreto, Peru, 1929, *Killip & Smith 28133,* US Nat. Herb. Nos. 1480024; 1480025; 1480026, US! ISOTYPE: F! PARATYPES: *Killip & Smith 26944,* F! US! *Killip & Smith 26989,* US! *Killip & Smith 28781,* F! US! *Klug 177,* F! US! *Williams 2918,* F! US! *Williams 4848,* F! US! *Krukoff 4937,* US! *Krukoff 7527 in part,* US! ISOPARATYPE: *Krukoff 4937,* F! GH! MO!

Stem diminutive to 6.0 m. tall. *Petiole* 0.3–0.6 m. long, fuscous to stramineous, tuberculate to aculeate; scales fuscous with a lighter margin or uniformly fulvous; scurf absent or of fulvous trichomidia or minute squamulae; rachis and pinna-rachises with occasional trichomidia and prominent fulvous trichomes; costae and costules with trichomes and fuscous to cretaceous, flattish to bullate squamulae. *Lamina* 1.2–2.5 m. long, 2-pinnate-pinnatifid, papyraceous, apex abruptly reduced and pinna-like; pinnae stalked to long-stalked; pinnules sessile to petiolulate, deeply pinnatifid to pinnatisect, base truncate, apex acuminate to attenuate, tip crenulate; lobes acute, crenulate; fertile veins forked at the sori, sterile veins forked. *Sori* medial; paraphyses longer than the sporangia, receptacle villous.

Trichipteris microdonta is similar to *T. nigra* in superficial appearance and geographical distribution. However, *T. nigra* lacks the sharp spines found on the pinna-rachises of *T. microdonta. Trichipteris microdonta* also lacks the pinna-like leaf apex characteristic of *T. nigra. Trichip-*



FIGS. 50–59. FIGS. 50 & 51, *Trichipteris Kalbreyeri:* 50, two central pinnules from a central pinna, × 1/3; 51, central part of a pinnule, × 1 (both *Sparre 19269*, GH). FIGS. 52 & 53, *T. Schlimii:* 52, three central pinnules from a central pinna, × 1/3; 53, central part of a pinnule, × 4/3 (both *Steyermark & Dunsterville 104380*, GH). FIGS. 54 & 55, *T. Wendlandii:* 54, three central pinnules from a central pinna, × 1/3; 55, central part of a pinnule, × 4/3 (both *Nisman 77*, GH). FIGS. 56 & 57, *T. nigra:* 56, three central pinnules from a central pinna, × 1/3; 57, central part of a pinnule, × 4/3 (both *Schultes & Cabrera 12798*, GH). FIGS. 58 & 59, *T. pauciflora:* 58, three central pinnules from a central pinna, × 1/3; 59, central part of a pinna, × 4/3 (both *Tschudi 169*, VEN).



FIGS. 60–71. FIGS. 60–64, *Trichipteris frigida:* 60, three central pinnules from a central pinna, × 1/3 (*Tryon & Tryon 5914*, GH); 61, three central pinnules from a central pinna typical of plants from lower altitudes, × 1/3 (*Weberbauer 2272*, USM); 62, central part of a pinnule, × 4/3 (same as 60); 63, a costal squamule, × 12 (*Cuatrecasas 5604*, F); 64, a single lobe of a pinnule, × 4/3 (same as 60). FIGS. 65–68, *T. pubescens:* 65, three central pinnae, × 1/3 (*Buchtien 5304*, GH); 66, central part of a pinnule, × 4/3 (*Ferreyra 16678*, GH); 67, abaxial and adaxial surfaces of a single lobe, × 4/3 (same as 66); 68, stem apex, × 2/3 (*Maguire 27729*, NY). FIGS. 69–71, *T. phegopteroides:* 69, three central pinnae, × 1/3 (*Spruce 4020*, US); 70, central part of a pinna, × 4/3 (*Spruce 4028*, GH); 71, abaxial and adaxial surfaces of a single lobe, × 4/3 (same as 70).

teris nigra is most closely allied to *T. Wendlandii* and *T. Schlimii.* It is conceivable that *T. Wendlandii* and *T. nigra* arose through isolation of peripheral populations of a previously continuous species. Variation in the serration of the lobes as well as in the coloring of the petiole scales and the density of the petiole scurf is typical of *T. nigra.* It is a species of the Amazon Basin, ranging from northern Brazil and Venezuela to Bolivia, from 100 to 1000 meters in altitude. It is one of three tree ferns (including *T. microdonta* and *T. procera*) that are found in the moist lowland forests of the Amazon Basin.

The typification of two synonyms of *Trichipteris nigra* is complicated by the not unexpected confusion of the Spruce collections. Although Rosenstock was working with *Spruce 4249* and *4349* when he was describing *Alsophila tarapotensis,* it is apparently possible that *Spruce 4349* is in reality a mislabeled *Spruce 4249.* According to a letter at US (Lellinger, pers. comm.) Bentham's list of Spruce's collections indicates that *Spruce 4349* is a "Cornidia." The homonym *Alsophila nigra* Jenman pertains to another genus. It is *Nephelea Imrayana* var. *Imrayana.*

SELECTED COLLECTIONS. **Venezuela. Bolívar:** frontier with Brazil, NE of the Serranía Piasoi (Pia-shauhy, Pia-Savi), *Steyermark 90662* (GH,NY,VEN). **Colombia. Caquetá:** 20 km. S of Montanita, *Madison 1185* (GH); Hetuchá, on the Río Orteguaza, *Woronow & Juzepczuk 6129* (US). **Vaupés:** Mitú, on the Río Vaupés, *Arbeláez & Cuatrecasas 6776* (GH,US); Río Vaupés to Cerro Mitú, *Lockwood 610* (GH). **Putumayo:** Río Putumayo, Puerto Ospina, *Cuatrecasas 10579* (F); 13 km. S of Umbria, near Finca Santa Marta, *Plowman 2073* (GH). **Amazonas:** mouth of Río Pacoa, Río Apoporis, *Schultes & Cabrera 13091* (GH,US); vicinity of Letícia, Río Amazonas, *Schultes, Raffauf, & Soejarto 24025, 24062* (GH). **Ecuador. Napo:** Río Napo, Panacocha, *Harling, Storm & Ström 7566* (GH). **Peru. Amazonas:** Quebrada Chuivi, valley of Río Marañón near Cascadas de Mayasi, *Wurdack 1927* (GH,US). **Loreto:** Iquitos, *Killip & Smith 26944* (F,US); Santa Rosa, lower Río Huallaga below Yurimaguas, *Killip & Smith 28781* (F,US). **San Martin:** Tingo María, *Allard 20607* (GH,US); SE of Nuevo Progresso, Dtto. Uchiza, *Schunke 3152* (GH). **Junín:** Pichis trail, Santa Rosa, *Killip & Smith 26169* (GH,NY); Puerto Yessup, *Killip & Smith 26374* (F,NY). **Bolivia. La Paz:** Charopampa, *R. S. Williams 1336* (GH). **Brazil. Amazonas:** near mouth of Rio Embira, tributary of Rio Tarauccá, basin of the Rio Jurua, *Krukoff 4937* (F,GH,MO,US); Mun. São Paulo de Olivenca, near Esperança, basin of the Rio Javary, *Krukoff 7527* in part (US); Tefé, *Piers 1299* (US).

20. Trichipteris pauciflora (Kuhn) Tryon

FIGS. 58, 59. MAP 20.

Trichipteris pauciflora (Kuhn) Tryon, Contrib. Gray Herb. **200**:46. 1970.
Cyathea pauciflora Kze., Bot. Zeit. **4**(6):101. 1846. *nom. nud.*
Alsophila pauciflora Presl, Gefässbündel Stipes der Farrn 35. 1847. (preprint from Abh. Bohm. Ges. **5**(5):343. 1848) *nom. nud.* COLLECTION CITED: Pl. Columb. Exsiccatae, *Karsten,* B!
Alsophila pauciflora Kuhn, Linnaea **36**:156. 1869. HOLOTYPE: Puerto Cabellos, *Karsten 185,* B! ISOTYPE: fragment ex PR, NY!
Alsophila hypolampra Kuhn, Linnaea **36**:158. 1869. SYNTYPES: Merida, *Funck & Schlim 1571,* B! Río Tocarema, Nova Grenada, *Lindig 243,* B!
Cyathea hypolampra (Kuhn) Domin, Pteridophyta 262. 1929.
Alsophila novagranadensis Domin, Pterid. Dominica 97 t. 10 f. 13–15. 1929. HOLO-

TYPE: in New Grenada, Tocarema, Andes of Bogotá, alt. 2200 m, *Lindig 243,* K not seen. ISOTYPE: B!

Stem 1.2–9.0 m. tall. *Petiole* to 0.7 m. long, stramineous to fulvous, inermous to muricate; scales fulvous; scurf of fulvous trichomidia and small to large squamulae; rachis, pinna-rachises, and costae with sparse trichomes and spreading, erect, more or less erose, fulvous squamulae; costules with bullate, fulvous squamulae; veins with trichomes and occasionally bullate squamulae. *Lamina* 1.0–3.5 m. long, 2-pinnate-pinnatifid, papyraceous to rigidly coriaceous, apex gradually reduced and acute; pinnae sessile; pinnules sessile to short-petiolulate, pinnatisect, base cordate to truncate, apex attenuate, tip crenulate to serrate; lobes rotund to acute, entire to crenulate; fertile veins forked at the sori, sterile veins forked. *Sori* inframedial, often confined to the basal portion of the lobe, paraphyses as long as the sporangia, receptacle hirsute.

The sori are in many cases limited to the basal third of the segments, perhaps explaining the species epithet. *Trichipteris pauciflora* lacks the laciniate squamulae of the related *T. frigida* and it has trichomes on the lamina axes. High altitude specimens of *T. pauciflora* are extremely coriaceous and have revolute segments. The two syntypes of *Alsophila hypolampra* Kuhn represent the two morphological extremes to be found in *T. pauciflora. Funck & Schlim 1571* is the basal portion of a medial pinna from a vigorous specimen with coriaceous leaves, probably found in full sun. *Lindig 243* is a nearly complete pinna from near the apex of a leaf of a more typical plant for the species, probably growing in a shadier area than the last. The range of the species includes the Andes of Venezuela from Aragua to Tachira, and a single collection from the area of Bogotá, Colombia. It is found in cloud forests and "elfin" forests along mountain crests from 750 to 3350 meters. Poeppig collections from Peru determined as *Cyathea pauciflora* Kze. are *Cyathea Delgadii* Sternberg.

SELECTED COLLECTIONS. **Venezuela. Lara:** Distrito Palavecino, S of Terepaima, 20 km. S of Cabudare, *Steyermark, Delascio & Dunsterville 103334* (GH,NY). **Yaracuy:** El Amparo to Candelaria, 7 km. N of Salom, *Steyermark 106209, 106780* (GH). **Carababo:** Río San Gián, E of Los Tanques, S of Borburata, *Steyermark 95396* (GH). **Aragua:** Rancho Grande, Parque Nacional "H. Pittier," *Tschudi 135* (fragment US, VEN); *Tschudi 169* (fragment US,VEN). **Táchira:** Po. El Batallon, *Vareschi 5386* (VEN); about 5 km. down road to Queniquea from road intersection at Zumbador, *White & White 197068* (US). **Colombia. Cundinamarca:** Bogotá, 2700 m., *Lindig 240* (GH).

21. Trichipteris frigida (Karst.) Tryon

FIGS. 60–64. MAP 21.

Trichipteris frigida (Karst.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila frigida Karst., Fl. Columb. 1:61 t. 30. 1859. HOLOTYPE: Andes of Bogotá, Colombia, 2600 m., *Karsten,* fragment ex B, NY!
Cyathea frigida (Karst.) Domin, Pteridophyta 262. 1929.

Stem creeping or ascending, to 4 m. tall. *Petiole* ca. 0.8 m. long, fuscous to atropurpureous, tuberculate; scales fuscous with a fulvous border, or rarely fulvous with a cretaceous border; scurf of long, contorted, cretaceous trichomidia and squamulae; axes of lamina covered with a dense tomentum of contorted, cretaceous trichomidia and a few scales similar to those of the petiole, or the tomentum of trichomidia sparse to absent on the costae and costules and the scales and squamulae deeply fimbriate and contorted into a tomentum. *Lamina* ca. 0.5–2.0 m. long, 2-pinnate-pinnatifid, coriaceous, apex gradually reduced and acute; pinnae sessile to stalked; pinnules sessile to short-petiolulate, pinnatisect to pinnatisect and deeply divided, base truncate, apex attenuate, tip entire and obtuse; lobes rotund, entire to deeply crenate, revolute; fertile veins forked at the sori, sterile veins forked. *Sori* inframedial to medial; paraphyses shorter than the sporangia or the same length, receptacle pilose to hirsute.

Trichipteris frigida is a species that varies considerably with altitude and exposure, but can be distinguished throughout its range by the light-colored tomentum of contorted trichomidia (occasionally replaced entirely by fimbriate squamulae on the costae and costules). In addition, it lacks the trichomes typical of *T. pauciflora,* its nearest ally. The color of the petiole-scale border, the development of the tomentum, the dissection of the squamulae, and the coriaceousness and revoluteness of the segments are all variable. The size and dissection of the segments is also variable. *Trichipteris frigida* occurs in the Venezuelan Andes, the eastern cordillera of Colombia, the Andes of Ecuador, and the Atlantic slopes of the Andes in Peru, always at extremely high altitudes (2500–3500 meters). It is found occasionally in cloud forests, but more often in shrubby situations, "paramillo," and shrubby páramo. An herbarium name honoring Weberbauer has been applied to less coriaceous, less revolute leaves from lower altitudes. No other species of *Trichipteris* is commonly found in the páramos.

SELECTED COLLECTIONS. **Venezeula. Tachira:** just below Páramo de Tama, near the Colombian-Venezuelan border, *Steyermark & Dunsterville 98617* (GH). **Colombia. Cundinamarca:** Macizo de Bogotá, Quebrada de las Delicias, *Cuatrecasas 5604* (F, GH); Montserrate, above Valle de Bogotá, *Ewan 16898* (GH,US). **Valle:** Cordillera Occidental, Los Farallones, extremo N, vertiente NW, entre Alto del Buey y Quebrada de los Ramos, *Cuatrecasas 18032* (F,US). **Ecuador. Azuay:** between Huagrarancha & Loma de Galápagos, *Steyermark 53461* (F). **Peru. Huánuco:** Cerros al Sudoeste de Monzón, *Weberbauer 3389* (USM). **Junín:** cerros al oeste de Huacapistana, entre Tarma y San Ramón, *Weberbauer 2272* (P,USM).

22. Trichipteris pubescens (Baker) Tryon

FIGS. 65–68. MAP 22.

Trichipteris pubescens (Baker) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila pubescens Baker, Syn. Fil. ed. 1. 449. 1868. LECTOTYPE (chosen herewith): Peru, *Spruce 4712,* fragment ex K, NY! ISOLECTOTYPES: GH! NY! P! LECTOPARATYPES: Peru, *Lechler 2190,* fragment ex K, NY! New Grenada, *Purdie,* fragment ex K, NY! ISOLECTOPARATYPES: *Lechler 2190,* fragments ex B & P, NY!
Alsophila bipinnatifida Baker, Syn. Fil. ed. 2. 456. 1874. HOLOTYPE: British Guiana, *Appun 1032,* fragment ex K, NY! ISOTYPE: P! (with *Glaziou 12375*).
Polypodium bipinnatifidum (Baker) Jenm. Ferns Brit. W. Ind. Guiana 281. 1908, not Baker 1890.
Cyathea bipinnatifida (Baker) Domin, Pteridophyta 262. 1929.
Cyathea pubens Domin, Pteridophyta 263. 1929. *nom. nov.* for *Alsophila pubescens* Baker, not *Cyathea pubescens* Kuhn, Linnaea 36:164. 1869.

Stem 0.6–4.0 m. tall. *Petiole* 20–30 cm. long, stramineous to fulvous, inermous;

scales fulvous with a lighter border; scurf of cretaceous trichomidia and squamulae; rachis and pinna-rachises with cretaceous trichomidia, trichomes, and minute fulvous squamulae; costae and costules with cretaceous trichomidia and bullate, fulvous squamulae; veins and leaf surface with trichomes. *Lamina* to 1.0 m. long, 1-pinnate-pinnatifid, papyraceous to chartaceous, apex gradually reduced and acute to acuminate; pinnae adjacent, sessile to petiolulate, base truncate, apex acuminate to attenuate, tip entire; lobes rotund, serrulate to entire; fertile veins forked at the sori or simple, sterile veins forked or simple. *Sori* inframedial to subcostal; paraphyses as long as the sporangia, receptacle hirsute.

Trichipteris pubescens is an unusually broad-ranging diminutive species. It is the only species in which adventitious buds develop into branches. The stems, which are approximately 3 cm. in diameter, are thin in relation to their height. This species is most closely related to the little-known *T. phegopteroides* of eastern Peru. It is tentatively possible to associate *T. pubescens* with *T. nigripes* and similar species on the basis of venation, paraphyses and geography. The pubescence of the lamina is highly variable within the species. In the area of Puno, Peru, the plants collected are densely pubescent. Nearly glabrous plants have been found in the northern part of the range and in Bolivia. Hieronymus established a variety, named in honor of Spruce, for specimens of *Alsophila pubescens* Baker with scant pubescence. However, variation in pubescence is not correlated with geography sufficiently to merit the recognition of infra-specific taxa. *Trichipteris pubescens* occurs in the Guayana Highlands and the Atlantic slopes of the Andes from Colombia to Bolivia. It is found in talus slope forests, cloud forests, and mossy, wet montane, or "elfin" forests from 1200 to 2500 meters.

SELECTED COLLECTIONS. **Venezuela. Bolívar:** Cerro Venamo, SW part, frontier of Guyana, *Steyermark 92720* (GH,VEN); Chimantá Massif, Toronótepuí, *Steyermark & Wurdack 1078, 1242* (GH,NY,US,VEN). **Amazonas:** Serranía Parú, Río Parú, Caño Asisa, Río Ventauri, *Cowan & Wurdack 31391* (GH,NY,US); Serranía Yutaje, Río Manapiare, *Maguire & Maguire 35297* (GH,NY,US); Cerro Sipapo (Paráque), *Maguire & Politi 27729* (NY,US). **Colombia. Huila:** SW of Alejandría at Río Sauza, *Little 8496* (US). **Ecuador. Napo-Pastaza:** between Baños & Jivaría de Píntuc, valley of the Río Pastaza, *Stübel 996* (fragment NY, B). **Peru. Loreto:** near La Divisoria, between Tingo María & Pucallpa, *Ferreyra 1071* (GH,USM). **Huánuco:** SW slope of Río Llulla Pichis watershed, on the ascent of Cerros del Sira, *Dudley 13019, 13026, 13046, 13371, 13413* (GH). **Junín:** Schunke Hacienda, above San Ramón, *Killip & Smith 24871* (F,US); Pichis Trail, Yapas, *Killip & Smith 25554* (US). **Cuzco:** Cordillera Vilcabamba, *Dudley 10452, 10455* (GH). **Ayachucho:** E massif of Cordillera Central, opposite Cordillera Vilcabamba, *Dudley 11941* (GH). **Puno:** valle del Alto Tambopata, near San Juan del Oro, *Ferreyra 16678, 16701, 16704* (GH). **Bolivia. La Paz:** Hacienda Simaco, on the trail to Tipuani, *Buchtien 5304* (F,GH,MO); *Buchtien 5305* (NY,US). **Cochabamba:** Yungas, *Bang 563* (GH,NY); Kuriloma, near San Onofre, *Steinbach 9331* (F,GH,MO,NY,US).

23. Trichipteris phegopteroides (Hook.) Tryon

FIGS. 69–71. MAP 23.

Trichipteris phegopteroides (Hook.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila phegopteroides Hook., Syn. Fil. ed. 1. 32. 1865. HOLOTYPE: Peru, Tarapoto, *Spruce 4020*, K not seen. ISOTYPES: P! US!
Cyathea phegopteroides (Hook.) Domin, Pteridophyta 263. 1929.

Stem unknown. *Petiole* 3–6 cm. long, fuscous to atropurpureous, tuberculate to muricate; scales fuscous with a fulvous border; scurf of cretaceous trichomes (absent from the petiole base); axes of lamina with a dense indument of cretaceous trichomes, rachis and pinna-rachises with small scales and large, flattish squamulae similar in color to the petiole scales. *Lamina* ca. 0.5 m. long, 1-pinnate-pinnatifid, chartaceous, apex gradually reduced and acute; pinnae adjacent, sessile, deeply pinnatifid to pinnatisect, base truncate, apex attenuate; lobes rotund and entire; fertile veins forked at the sori, sterile veins forked. *Sori* medial; paraphyses shorter than the sporangia, receptacle pilose.

Trichipteris phegopteroides differs from *T. pubescens* in having spines on the petiole and numerous fuscous scales on the rachis. The two can be associated with the group of *T. nigripes* on the basis of petiole scale coloration, paraphyses length, and geography. The type collection and the other known collection were both made by Spruce at about 350 meters on the eastern slopes of the Andes in northern Peru.

SELECTED COLLECTIONS. **Peru. San Martín:** Mt. Guayrapurima, near Tarapoto, *Spruce 4028* (GH,NY). **Province unknown:** *Lechler* (F).

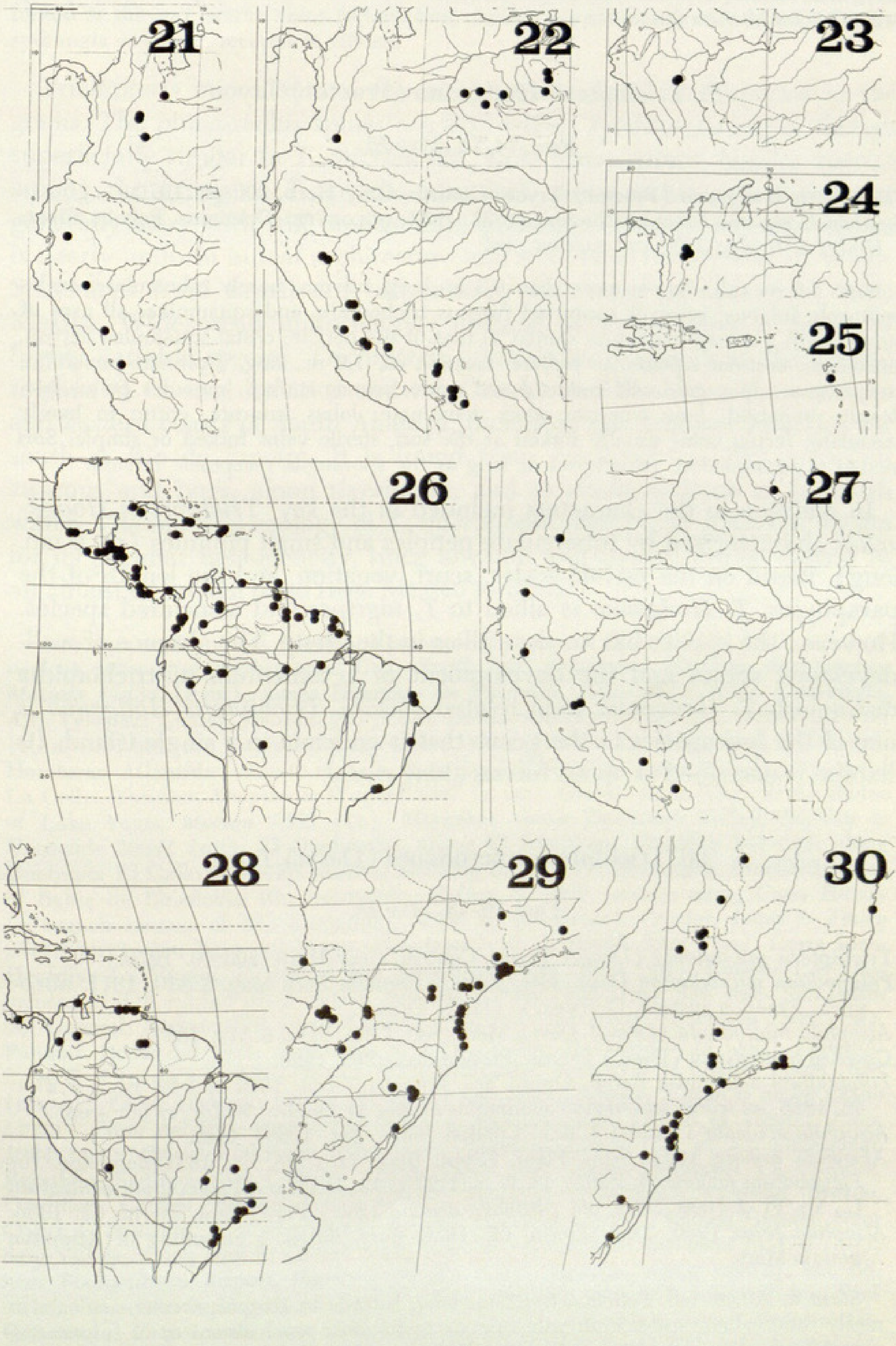
24. **Trichipteris latevagans** (Baker) Tryon

FIGS. 72, 73. MAP 24.

Trichipteris latevagans (Baker) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila latevagans Baker, Journ. Brit. & For. **19**:203. 1881, *ex char.* HOLOTYPE: open forests, 6700′, Antioquia, Colombia, *Kalbreyer 1327*, K not seen.
Cyathea latevagans (Baker) Domin, Pteridophyta 262. 1929.

Stem fasciculate, to 10 cm. tall, often creeping. *Petiole* 20–35 cm. long, atropurpureous, inermous to tuberculate; scales fuscous with a fulvous border; scurf absent; pinna-rachises occasionally with flattish or bullate fulvous squamulae, axes of lamina normally glabrous. *Lamina* to 1.0 m. long, 1-pinnate-pinnatifid, chartaceous to coriaceous, apex gradually reduced and long-acuminate; pinnae remote, long-petiolulate, pinnatisect, base truncate or subcordate, apex acuminate, tip entire; lobes acute, entire or serrulate; fertile veins forked at the sori, sterile veins forked. *Sori* inframedial to subcostal; paraphyses shorter than the sporangia, receptacle pilose.

Trichipteris latevagans is distinguished by its atropurpureous axes and long-stalked, deeply pinnatifid pinnae with entire lobes. I have tentatively placed this species with the group of *T. nigripes,* based on venation and paraphyses characters. There is some variation in the size of the pinna segments. *Trichipteris latevagans* is interesting because of its endemic and atypical distribution. It is found in cloud forests and pastures cleared from cloud forest, only in the upper part of the Río Cauca valley, between the Cordillera Central and the Cordillera Occidental, in Colombia (from 1800 to 2000 meters). *Trichipteris* in Colombia is represented by species with either Pacific coastal or eastern cordilleran distributions. The intermontane valley distribution of *T. latevagans* is as unusual as its morphology. Baker included a question mark before "latevagans" in his description of the species, apparently because the species was so atypical of the Alsophilas known to him.



MAPS 21–30: 21, Trichipteris frigida; 22, T. pubescens; 23, T. phegopteroides; 24, T. latevagans; 25, T. Hodgeana; 26, T. microdonta; 27, T. Lechleri; 28, T. villosa; 29, T. atrovirens; 30, T. phalerata var. phalerata.

SELECTED COLLECTIONS. Antioquia: Ventanas (Camino a Valdivia), *Bro. Daniel 3398* (US); near Amalfi, *Lehmann 35* (GH,NY,US); 19 km. N of Yaramul, *Madison 816* (GH); Tolima? *Schmidtchen* (US).

25. Trichipteris Hodgeana (Proctor) Tryon

FIGS. 74, 75. MAP 25.

Trichipteris Hodgeana (Proctor) Tryon, Contrib. Gray Herb. 200:44. 1970.
Cyathea Hodgeana Proctor, Rhodora 63:31. 1961. HOLOTYPE: Dominica, Pegoua River, *Hodge & Hodge 3420*, GH! ISOTYPE: US!

Stem 4.5 m. tall. *Petiole* more than 0.3 m. long, fulvous, barely tuberculate; scales uniformly fulvous; scurf of contorted fulvous trichomidia and squamulae; all axes of lamina with a scurfy tomentum similar to that of the petiole; costal squamulae flattish, lanceolate; costular squamulae bullate. *Lamina* ca. 1.0 m. long, 2-pinnate-pinnatifid, papyraceous, apex gradually reduced and acute; pinnae stalked; pinnules petiolulate, deeply pinnatifid, base truncate, apex acuminate; lobes truncate, entire to barely crenulate; fertile veins usually forked at the sori, sterile veins forked or simple. *Sori* medial to supramedial; paraphyses as long as the sporangia, receptacle hirsute.

In addition to the characters included in the key, *Trichipteris Hodgeana* is characterized by tuberculate petioles and small pinnules (ca. 6 cm. long). Based on the petiole scales, scurf, venation, and the length of the paraphyses, *T. Hodgeana* is allied to *T. nigripes* and associated species. However, the species has no close allies in the group. The absence of well-developed spines and the development of a tomentum of trichomidia distinguish *T. Hodgeana* from related species. *Trichipteris Hodgeana* is one of the few species in the genus that is endemic to a single island. Its habitat is described as moist forests along rivers.

26. Trichipteris microdonta (Desv.) Tryon

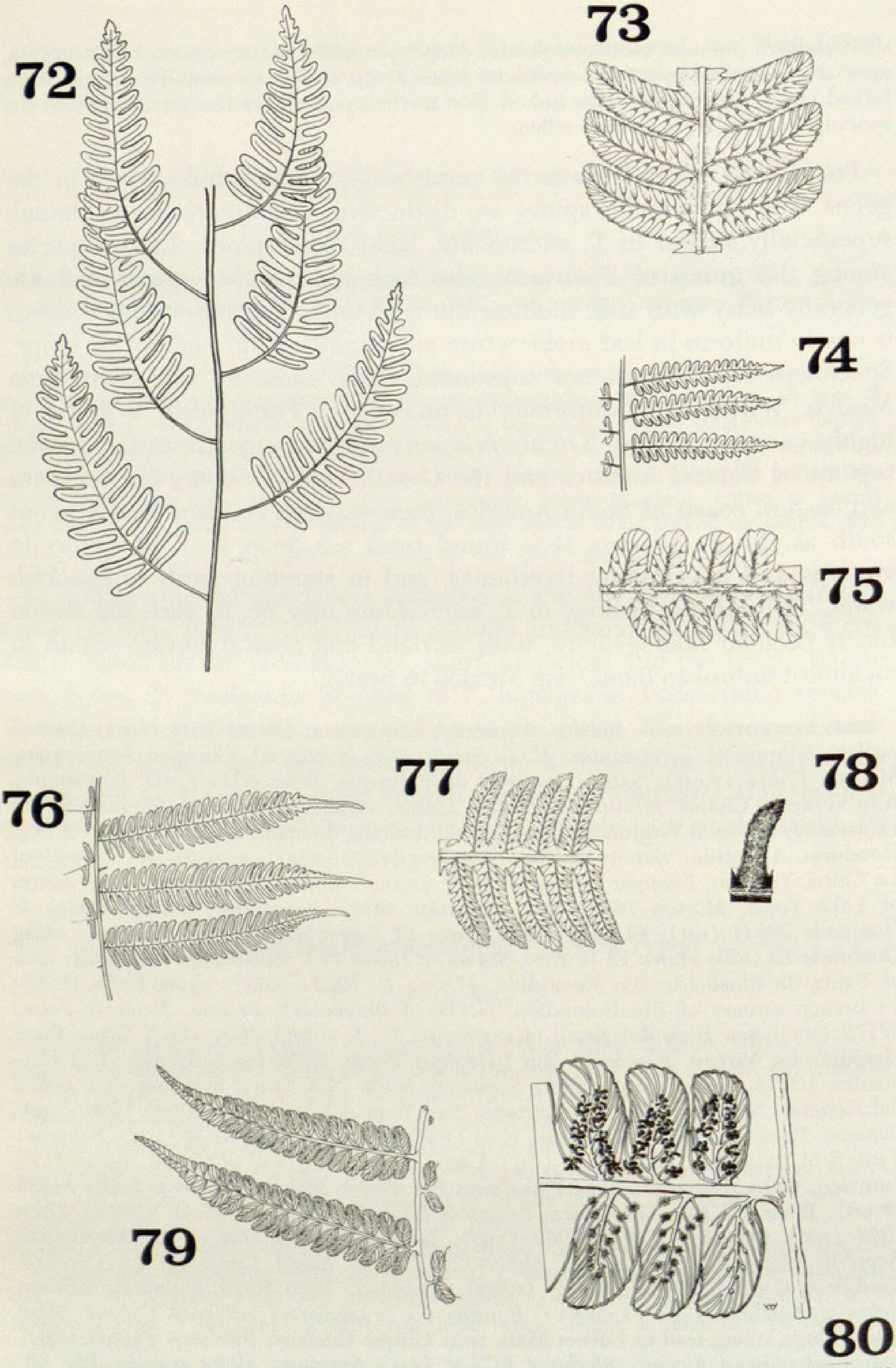
FIGS. 76–78. MAP 26.

Trichipteris microdonta (Desv.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Polypodium microdonton Desv., Ges. Naturf. Freunde Berl. Mag. 5:319. 1811. HOLOTYPE: America australi, *Desvaux*, P! (Herb. Desv.).
Alsophila microdonta (Desv.) Desv., Mém. Soc. Linn. Paris 6:319. 1827.
Cyathea microdonta (Desv.) Domin, Pteridophyta 263. 1929.
Polypodium aculeatum Raddi, Opusc. Sci. Bologna 3:288. 1819 and Pl. Bras. 1:27 t. 42. 1825, *ex icone*. HOLOTYPE: mountains of Rio de Janeiro, *Raddi*, FI not seen.
Alsophila aculeata (Raddi) J. Sm., London Journ. Bot. 1:667. 1842.
Alsophila armata Mart., Icon. Plant. Crypt. Bras. 72 t. 28, 48. 1834 *nom. nov.* for *Polypodium aculeatum* Raddi, Pl. Bras. 1:27 t. 42. 1825, not *Polypodium aculeatum* L., Sp. Pl. 2:1090. 1753, not *Alsophila armata* (Sw.) Presl, Tent. Pterid. 62. 1836.
Alsophila ferox Presl, Tent. Pterid. 62. 1836, *nom. illegit.* a renaming of *Alsophila armata* Mart.

Stem to 6.0 m. tall. *Petiole* 0.6–1.8 m. long, fulvous to atropurpureous, aculeate or rarely tuberculate; scales uniformly fuscous to fulvous; scurf absent or of fulvous trichomidia; rachis and pinna-rachises aculeolate, rachis glabrous or with trichomidia; pinna-rachises, costae, and costules with flattish to bullate, cretaceous to fuscous squamulae; veins glabrous or with a few trichomidia. *Lamina* 1.0–2.5 m. long, 2-pinnate-pinnatifid, papyraceous, apex gradually reduced, acute to acuminate; pinnae short-stalked; pinnules short-petiolulate, deeply pinnatifid to pinnatisect, base truncate, apex attenuate, tip serrate to crenulate; lobes acute, serrate to crenulate; fertile veins forked at the sori, sterile veins forked. *Sori* medial; paraphyses the same length as the sporangia or longer, receptacle villous.

Trichipteris microdonta is the most widely distributed species in the genus. The pinna-rachis spines are distinctive. *Trichipteris nigra,* though superficially similar to *T. microdonta,* lacks these spines. Similar species among the group of *T. armata* also lack pinna-rachis spines and are generally hairy with stiff, multiseriate trichomes. *Trichipteris microdonta* is nearly uniform in leaf architecture and indument throughout its range. Specimens from Brazil are substantially the same as specimens from Mexico. Widespread uniformity is unusual in *Trichipteris,* a genus of highly variable species. *Trichipteris microdonta* ranges from the coastal regions of Central America and the Greater Antilles along the northern and eastern coasts of South America, including the Amazon Basin, as far south as Rio de Janeiro. It is found from sea level to 1700 meters in swamps and bogs, along riverbanks, and in standing fresh or brackish water. The unusual ecology of *T. microdonta* may be, in part, the reason for its peculiar homogeneity, since lowland and coastal forests extend in an almost unbroken band from Mexico to Brazil.

SELECTED COLLECTIONS. **Mexico. Veracruz:** Chinameca, *Orcutt 3194* (MO); Coatzacoalcos, isthmus of Tehuantepec, *C. L. Smith 2095* (F,GH,MO). **Chiapas:** Acacoyagua, *Matuda 17434* (F,GH); Santo Domingo de Palenqué, *Seler 5515* (GH). **Guatemala. Alta Verapaz:** Chama, *Johnson 953* (F,GH). **Izabal:** vicinity of Quiriguá, *Standley 23785* (F,GH,MO); between Virginia & Lago Izabal, Montaña de Mico, *Steyermark 38785* (F). **Honduras. Atlántida:** vicinity of Tela, *Standley 54722* (F,GH); near Salado, vicinity of La Ceiba, *Yuncker, Koepper & Wagner 8347* (F,MO). **Cortés:** Agua Azul, on the shores of Lake Yojoa, *Morton 7602* (US). **Morazán:** above Zamorano Valley, *Barkley & Hourcade 39641* (GH); El Quebracho, above El Zamorano, *Standley 343* (F); along Quebrada El Gallo above El Jicarito, *Standley 22464* (F). **Nicaragua. Bluefields:** area of Bahía de Bluefields, Río Escondido, *Molina R. 1809* (F,GH); along Caño Hendy (a branch estuary of Río Escondido, NNW of Bluefields), *Proctor, Jones & Facey 27179* (NY). **San Juan del Norte (Greytown):** *C. L. Smith 2034* (GH). **Costa Rica. Herédia:** La Virgen, E side of Río Sarapiqui, *Stone 2076* (GH). **Limón:** Los Diamantes, USDA rubber plant station, *Scamman 5889, 7008* (GH). **San José:** San Isidro del General, *Nisman 176* (GH). **Cartago:** San Juan del Norte, *Scamman 7590* (GH). **Panama. Bocas del Toro:** Almirante, N of Dos Millas, *McDaniel 5134* (MO). **Panama:** 2 mi. E of Juan Díaz, *Killip 2540* (GH). **Canal Zone:** 5 mi. NW of Cocoli, *Tyson 1618* (GH,MO). **Cuba. Habana:** Isle of Pines, near San Pedro, *Britton, Wilson & Selby 14329* (F,GH). **Pinar del Río:** Herradura, *Barser & Dinnoch 4849* (F); S of Viñales, *Eiten 1024* (NY). **Oriente:** *Wright 1062* (MO). **Jamaica:** *Smith* (GH ex K). **Dominican Republic. Samaná:** Las Cañitas, *Abbott 2683* (GH). **Santo Domingo:** La Cumbre, Cordillera Central, *Ekman 11497* (F,GH). **Trinidad.** Toco Road, Valencia, *Britton, Coker & Rowland 1774* (F,GH,NY); *Fendler 60* (F,GH,MO,NY). **French Guiana.** Near Saül Village, along trail to Carbet Mais, near Crique Cochow, *Bierhorst FG105* (GH); near Rochambeau Airport, *Bierhorst FG124* (GH). **Surinam.** Along railway, km. 68, vicinity of sectie 0, *Maguire & Stahel 24992* (A,F,NY); near Waneweg, 25 km. S of Paramaribo, *Tryon & Kramer 5597* (GH,NY). **Guyana (British Guiana).** Penal settlement, *Hitchcock 17157* (GH,NY); Kurupung, *Lang & Persaud 187* (F). **Venezuela. Zulia:** Sierra de Perijá, vicinity of Quebrada Koshida, S. of Misión de Los Angeles de Tokuku, SW of Machiques, *Steyermark 99928* (GH). **Delta Amacuro:** Ibaruma, *Tamayo 3618* (VEN). **Barinas:** 32 km. SW of Santa Barbara, 15 km. NE of Punta de



FIGS. 72–80. FIGS. 72 & 73, *Trichipteris latevagans:* 72, central part of the lamina, × 1/3; 73, central part of a pinna, × 1 (both *Daniel 3398,* US). FIGS. 74 & 75, *T. Hodgeana:* 74, three central pinnules from a central pinna, × 1/3; 75, central part of a pinnule, × 4/3 (both *Hodge 3420,* GH). FIGS. 76–78, *T. microdonta:* 76, three central pinnules from a central pinna, × 1/3 (*Ekman 11497,* GH); 77, central part of a pinnule, × 4/3; 78, abaxial surface of a single lobe, × 4/3 (both *Tryon & Tryon 5162,* GH). FIGS. 79 & 80, *T. Lechleri:* 79, two central pinnules from a central pinna, × 1/3; 80, basal part of a pinnule, × 4/3 (both *Harling, Storm & Ström 10217,* GH).

Piedra, *Steyermark & Rabe 96257, 96587* (GH). **Apure:** reserva forestal San Camilo, Río Nulita, N of San Camilo (El Nula), *Steyermark, Bunting & Blanco 101334, 101806* (GH). **Bolívar:** 5 km. from Hato de Nuria, E of Miamo, Altiplanacie de Nuria, *Steyermark 88351* (VEN). **Colombia. Valle:** road from Buenaventura road to Río Calima, *Barrington 503* (GH); Buenaventura, Quebrada de Santa Ana, El Tambo, *Cuatrecasas 21050* (F). **Meta:** along stream near Villavicencio, *Barkley & Mullen 38C026* (GH); Los Llanos, Villavicencio, *Cuatrecasas 4534* (F). **Caquetá:** 20 km. S of Montañita, *Madison 1188* (GH–sheets 2 & 3 of 3: Sheet 1 = *Trichipteris nigra* (Mart.) Tryon, probably mixed from *Madison 1185*). **Nariño:** Gorgonilla Island, *Killip & Garcia 33066* (US). **Amazonas:** Río Amazonas, vicinity of Letícia, *Schultes, Raffauf & Soejarto 24094* (GH). **Peru. Loreto:** Mishuyacu, near Iquitos, *Killip & Smith 29876* (F,GH,NY); near Iquitos, *Tryon & Tryon 5162, 5172, 5183* (F,GH). **San Martín:** near Tarapoto, *Spruce 4726* (NY). **Cuzco:** 15 mi. from Río Negro, *Vargas 15340* (GH). **Brazil. Amapá:** Rio Oiapoque area, Rio Pontanari, *Irwin, Egler & Pires 47263* (GH,NY,VEN). **Amazonas:** Manáos, *Killip & Smith 30062* (NY). **Ceará:** base of Serra do Araripe, *Duarte 1345* (MO,NY). **Pará:** Taperinha, near Santarem, *Ginzberger 486* (F); Flores, *Lützelburg 21328* (NY). **Goiás:** Mun. Puerto Nacional, *Macedo 3918* (MO). **Bahia:** São Bento, *Lützelburg 342* (F); Ilheos, *Martius* (GH,NY). **Rio de Janeiro:** *Burchell 950* (NY); Maná, in restinga, *Dusén 1938* (F,GH,NY).

27. Trichipteris Lechleri (Mett.) Tryon

FIGS. 79, 80. MAP 27.

Trichipteris Lechleri (Mett.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila Lechleri Mett., Fil. Lechl. 2:28. 1859, not *Cyathea Lechleri* Mett., Fil. Lechl. 2:32. 1859. HOLOTYPE: Tatanara, Peru, *Lechler (2532)*, B! (Herb. Mett.)
Alsophila Ulei Christ, Hedwigia 44:367. 1905. HOLOTYPE: Cerro de Ponasa, Amazonas, Peru, 1300 m., 1903, *Ule 6901*, P not seen. ISOTYPE: B!
Cyathea Ulei (Christ) Domin, Acta Bot. Bohem. 9:168. 1930.
Trichipteris Ulei (Christ) Tryon, Contrib. Gray Herb. 200:46. 1970.
Cyathea subtropica Domin, Pteridophyta 263. 1929. *nom. nov.* for *Alsophila Lechleri* Mett., Fil. Lechl. 2:28. 1859, not *Cyathea Lechleri* Mett., Fil. Lechl. 2:32. 1859.

Stem to 12 m. tall. *Petiole* to 2 m. long, atropurpureous, tuberculate to muricate; scales fuscous with a broad, flabellate, fulvous border; scurf absent; leaf axes stramineous to atropurpureous, glabrous or with a few trichomidia and bullate, fulvous squamulae. *Lamina* 0.5–1.5 m. long, 2-pinnate-pinnatifid, chartaceous, apex abruptly reduced and pinna-like; pinnae stalked; pinnules petiolulate, crenate to pinnatifid, base cuneate to truncate, apex acuminate to attenuate; lobes truncate, tip serrate; fertile veins simple, basal veins of the lobes connivent at the sinuses, sterile veins simple (the basal veins of the lobes sometimes dividing and rejoining at the sinuses). *Sori* apically subcostal to basally medial; paraphyses longer than the sporangia, receptacle villous.

Trichipteris Lechleri is best characterized as a species of Brazilian affinities with an Andean distribution. In addition to the characters of the key, *T. Lechleri* is best distinguished by the basal veins of the segments which are connivent at the sinuses. The species lacks any abaxial indument. The pinnules vary from crenate to shallowly pinnatifid and from papyraceous to coriaceous. *Trichipteris Dombeyi* is superficially similar, but it has an indument of squamulae on the costae and petiole scales with cretaceous borders. *Trichipteris Lechleri* has been collected in the Guayana Highlands and on the eastern slopes of the Andes in Colombia, Ecuador, Peru, and Bolivia. Its habitat is rain forests, especially near watercourses and lakes, from 450 to 1450 meters.

SELECTED COLLECTIONS. **Venezuela. Bolívar:** Cerro Venamo, ca. British Guiana, *Steyermark & Dunsterville 92700* (GH,US,VEN). **Colombia. Huila:** SW of Alejandría at Río Sauza, *Little 8498* (GH,US). **Ecuador. Pastaza:** Mera, *Harling, Storm & Ström 10217* (GH). **Peru. Amazonas:** valley of the Río Marañon above Cascadas de Mayasi, *Wurdack 1868* (GH). **Huánuco:** SW slope of Río Llulla Richis watershed, on the ascent of Cerros del Sira, *Dudley 13047, 13214, 13220* (GH). **Bolivia. La Paz:** Hacienda Simaco, on the road to Tipuani, *Buchtien 5298* (GH); *Buchtien 5300* (F,GH); *Buchtien 5301* (MO).

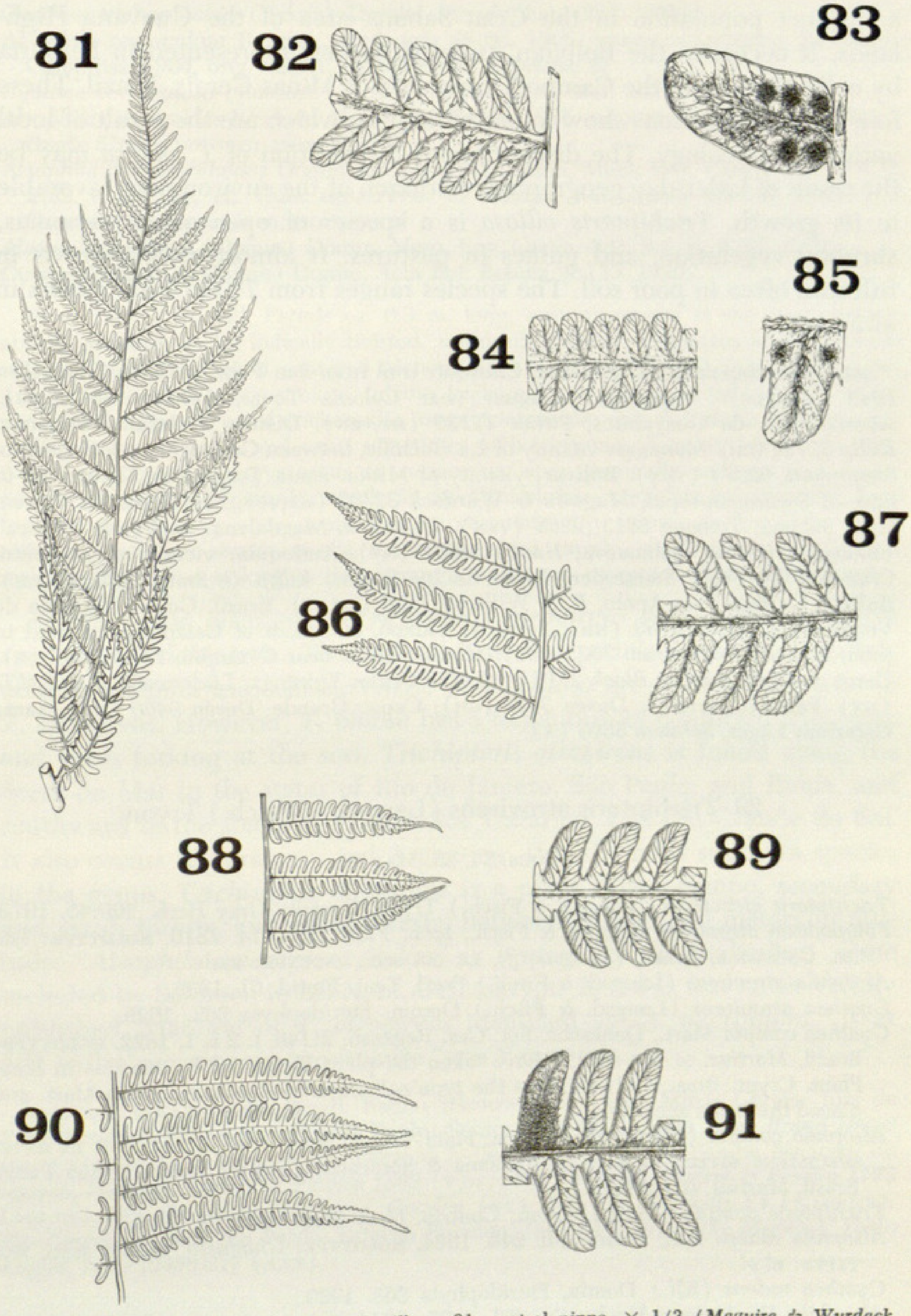
28. Trichipteris villosa (Willd.) Tryon

FIGS. 81–83. MAP 28.

Trichipteris villosa (Willd.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Cyathea villosa Willd., Sp. Pl. ed. 4. 5(1):495. 1810. HOLOTYPE: America meridionale, ad St. Crucem & ad Caracas (Sucre, Venezuela), *Humboldt 436*, B (Herb. Willd. No. 20175–2) not seen, Tryon photo GH! ISOTYPES: F! P!
Alsophila villosa (Willd.) Desv., Mém. Soc. Linn. Paris 6:319. 1827.
Chnoöphora villosa (Willd.) Link, Erkenn. Gew. 3:35. 1833.
Chnoöphora Humboldtii Klf., Enum. Fil. 250. 1824, *illegit. nom. superfl.* for *Cyathea villosa* Willd., 1810.
Alsophila Humboldtii (Klf.) Kze., Linnaea 23:220. 1850.
Alsophila rigidula Mart., Icon. Crypt. Vasc. Bras. 74, t. 51. 1834, *ex icone.* HOLOTYPE: crescit in sylvis provinciae S. Pauli, *Martius*, M not seen.
Alsophila vernicosa Kuhn, Linnaea 36:155. 1869. HOLOTYPE: Venezuela, *Fendler 344*, B not seen. ISOTYPES: GH! MO! fragment ex K, NY!
Cyathea vernicosa (Kuhn) Domin, Pteridophyta 263. 1929.
Trichipteris vernicosa (Kuhn) Tryon, Contrib. Gray Herb. 200:46. 1970.

Stem to 1.5 m. tall. *Petiole* ca. 0.2–0.5 m. long, fulvous to ferruginous, tuberculate to aculeate; scales helically twisted, uniformly fulvous to fulvous with a narrow, diaphanous border; scurf absent; pinna-rachises, costae, and often costules attached at acute angles; rachis glabrous; pinna-rachises, costae, costules, veins, and leaf surfaces villous with scarce to abundant, minute, contorted trichomidia; costae and costules with flattish to bullate, cretaceous squamulae. *Lamina* ca. 1 m. long, 2-pinnate-pinnatifid, chartaceous to coriaceous, apex gradually reduced and acute; pinnae sessile to stalked; pinnules sessile to short-petiolulate, pinnatisect, base cordate, apex attenuate, tip crenulate to entire, obtuse; lobes truncate to acute, entire to crenulate; fertile veins forked at the sori or rarely simple, sterile veins forked or simple. *Sori* medial; paraphyses contorted, larger than the sporangia, receptacle villous.

The minute, contorted trichomes found on the costae, costules and veins of this species distinguish it from the rest of the genus. In addition, the attachment of the lamina axes and the usually short, revolute segments of the pinnules are diagnostic. The petiole spines are poorly developed, and the petiole scales are helically twisted. *Trichipteris atrovirens*, the closest species, usually lacks minute, contorted trichomes and has simple veins. *Trichipteris villosa* is one of a group of species centered in the Serra do Mar and Campo Limpo areas of southern Brazil. The petiole scales of some collections of *T. villosa* have narrow, diaphanous borders. The density of the contorted trichomes varies, apparently with exposure to direct sunlight. The veins are occasionally forked at the sori. *Trichipteris villosa* has a remarkably discontinuous distribution. It has been found in Panama and the Andes of Colombia and Venezuela. It occurs as



Figs. 81–91. Figs. 81–83, *Trichipteris villosa:* 81, central pinna, × 1/3 (*Maguire & Wurdack 33783*, US); 82, base of pinnule, × 4/3 (*Fendler 344*, GH); 83, a single pinnatisect lobe, × 8/3 (*Fendler 47*, GH). Figs. 84 & 85, *T. atrovirens:* 84, part of a medial pinnule, × 4/3 (*Tryon & Tryon 6576*, GH); 85, abaxial surface of a single lobe, × 8/3 (*Brade 35015*, MO). Figs. 86–89, *T. phalerata:* 86, var. *phalerata*, three central pinnules from a central pinna, × 1/3; 87, var. *phalerata*, central part of a pinnule, the trichomes omitted above, × 4/3 (both *Smith & Brade 2234*, GH); 88, var. *Iheringii*, three central pinnules from a central pinna, × 1/3; 89, var. *Iheringii*, central part of a pinnule, × 4/3 (both *Brade 10853*, F). Figs. 90 & 91, *T. Gardneri:* 90, four central pinnules from a central pinna, × 1/3; 91, central part of a pinnule, × 4/3 (both *Mexia 4882*, F).

a disjunct population in the Gran Sabana area of the Guayana Highlands. It occurs in the Bolivian Andes. It is best represented in herbaria by collections from the Campo Limpo area of Minas Gerais, Brazil. These four basic populations show minor variations, which are the result of local variation in ecology. The discontinuous distribution of *T. villosa* may be the result of latter-day geographic restriction of the environment favorable to its growth. *Trichipteris villosa* is a species of open areas, savannas, shrubby vegetation, and gullies in pastures. It almost always grows in full sun, often in poor soil. The species ranges from 780 to 1800 meters in altitude.

SELECTED COLLECTIONS. **Panama. Chiriquí:** trail from San Felix to Cerro Flor, *Allen 1940* (F,GH,US). **Venezuela. Aragua:** near Colonia Tovar, *Fendler 492* (GH); sabanas altas de Guayabitos, *Pittier 12136* (NY,VEN). **Distrito Federal:** Turmerito, *Killip 37724* (GH). **Monagas:** vicinity of La Cuchilla, between Guanaguana & Guacharo, *Steyermark 62274* (VEN). **Bolívar:** vicinity of Misión Santa Teresita de Kavanayén to base of Sororopan-tepuí, *Maguire & Wurdack 33783* (NY,US); Sta. Elena de Uairen, Gran Sabana, *Tamayo 2813, 2968* (VEN). **Colombia. Magdalena:** trail from "Africa" (Sierra Perijá) to Villanueva, *Haught 4531* (NY). **Antioquia:** vicinity of Medellín, *Charetier 14* (US). **Santander:** Mesa de los Santos, *Killip & Smith 15309* (GH). **Bolivia. La Paz:** near Apolo, *R. S. Williams 1290* (GH,US). **Brazil. Goiás:** Chapada de Veadeiros, *Duarte 10683* (HB); Serra do Caiapó, 50 km. S of Caiaponia on road to Jataí, *Irwin & Soderstrom 7375* (NY). **Minas Geraís:** near Caxambú, *Pabst 4047* (F); Cerro de Cipó, *Pires & Black 2715* (US). **São Paulo:** Ypiranga, *Lüderwaldt 900, 22137* (NY). **Paraná:** Serrinha, *Dusén 3437* (GH); Capao Grande, *Dusén 9466* (NY). **Santa Catarina:** Lages, *Sehnem 5503* (A).

29. **Trichipteris atrovirens** (Langsd. & Fisch.) Tryon

FIGS. 84, 85. MAP 29.

Trichipteris atrovirens (Langsd. & Fisch.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Polypodium atrovirens Langsd. & Fisch., Icon. Filic. 12, t. 14. 1810. HOLOTYPE: Isla Sta. Catharina, Brazil, *(Langsdorff)*, LE not seen. ISOTYPE: BM!
Alsophila atrovirens (Langsd. & Fisch.) Presl, Tent. Pterid. 61. 1836.
Cyathea atrovirens (Langsd. & Fisch.) Domin, Pteridophyta 262. 1929.
Cyathea compta Mart., Denkschr. Bot. Ges. Regensb. 2:146, t. 2 f. 1. 1822. HOLOTYPE: Brazil, *Martius*, M not seen. I have taken the plant illustrated by Martius in Icon. Plant. Crypt. Bras. t. 41. 1834, as the type collection of *Cyathea compta* Mart. and placed the name accordingly.
Alsophila compta (Mart.) Mart., Icon. Plant. Crypt. Bras. 1:66, t. 41. 1834, *ex icone*. SPECIMENS CITED: vicinity of Ipanema & Sorocaba, (Rio de Janeiro), São Paulo, Brasil, *Martius*, M not seen.
Trichipteris compta (Mart.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila radens Klf., Enum. Fil. 248. 1824. HOLOTYPE: *Chamisso*, LE not seen. ISOTYPES: B! P!
Cyathea radens (Klf.) Domin, Pteridophyta 263. 1929.
Alsophila Hookeriana Hook., Sp. Fil. 1:39. 1844. HOLOTYPE: south Brazil, *Sellow*, fragment ex K, NY! ISOTYPE: B! *(Sellow 727)*. PARATYPE: Sta. Catarina, Brazil, *Lay & Collie*, K not seen.
Alsophila leptocladia Fée, Crypt. Vasc. Brés. 1:161, t. 55 f. 1. 1869. HOLOTYPE: Brasilia fluminensi, *Glaziou 2299*, P! (Herb. Cosson).
Cyathea leptocladia (Fée) Domin, Pteridophyta 262. 1929.
Alsophila trichophlebia Baker, Ann. Bot. 5:189. 1891. HOLOTYPE: Paraguay, *Balansa 306*, Herb. de Candolle, P not seen. ISOTYPE: P! (E of Cordillera de Villa Rica).

Cyathea trichophlebia (Baker) Domin, Pteridophyta 263. 1929.
Alsophila verruculosa Rosenst., Hedwigia **46**:66. 1906. TYPE COLLECTION: São Paulo, Campinas, 1904, orig. det. *A. radens* Mett., *Ulbricht,* B!
Cyathea verruculosa (Rosenst.) Domin, Pteridophyta 263. 1929.
Alsophila proceroides Rosenst., Hedwigia **56**:356. 1915. HOLOTYPE: São Paulo, Ribeira, *Brade 5106,* S not seen. ISOTYPE: NY!
Alsophila dryopteridoides Domin var. *fallacina* Domin, Mem. Roy. Czech. Soc. Sci. II, **2**:89, t. 9 f. 11, 12. 1929. HOLOTYPE: in Brasilia, Rio Grande do Sul, *Reineck & Czermak 36,* PR not seen. ISOTYPE: P!
Alsophila fallacina (Domin) Domin, Mem. Roy. Czech. Soc. Sci. II, **2**:85. 1929.
Cyathea fallacina (Domin) Domin, Acta Bot. Bohem. **9**:115. 1930.

Stem 1.0–6.0 m. tall. *Petiole* ca. 0.3 m. long, atropurpureous at the base, fulvous above, aculeate; scales helically twisted, uniformly fulvous or fuscous with a fulvous margin; scurf absent or of scattered trichomidia; axes often attached at an acute angle; pinna-rachises with a few minute, fulvous trichomidia or glabrous; indument of costae and costules absent, or of trichomidia, or of trichomidia and flattish to bullate squamulae; costae, costules, and veins sometimes with trichomes. *Lamina* 1.0–2.0 m. long, 2-pinnate-pinnatifid, papyraceous to coriaceous, apex gradually reduced and acute; pinnae short-stalked; pinnules sessile to short-petiolulate, crenulate to pinnatifid, base truncate to cuneate, apex acuminate to attenuate, tip serrate to crenulate; lobes truncate, entire or serrate at the tip; fertile veins simple, sterile veins simple. *Sori* medial; paraphyses as long as the sporangia or longer, receptacle hirsute to villous.

Simple veins distinguish *Trichipteris atrovirens* from other Brazilian species of *Trichipteris.* The helically twisted petiole scales and acutely attached lamina axes characteristic of *T. villosa* are occasionally seen in *T. atrovirens.* However, *T. villosa* has a tomentum of contorted trichomes and veins forking at the sori. *Trichipteris atrovirens* is found along the Serra do Mar in the states of Rio de Janiero, São Paulo, and Bahía, and southward to the states of Paraná, Sta. Catarina, and Rio Grande do Sul. It also occurs in Paraguay and Argentina. It is the most southern species in the genus. *Trichipteris atrovirens* is a plant of the campo, secondary and scrub forests, and taller forests, between 35 and 900 meters in altitude. "*Alsophila microptera* Baker" is apparently an herbarium name included by Salomon in his Nom. Gefässkrypt. 29. 1883, but never validly published. Material of *T. atrovirens* identified as "*A. microptera,*" is at NY, with the erroneous provenance "von Venezuela."

SELECTED COLLECTIONS. **Brazil. Bahía:** *Blanchet 2286* (F). **Minas Gerais:** Juiz de Fóra, *Brade 15902* (F,MO,US). **São Paulo:** Santos, *Ball* (GH); Villa Ema, *Brade 16052* (MO,NY). **Rio de Janeiro:** Mana, *Glaziou 2–7945* (NY). **Paraná:** Parque Nacional do Iguacú, Palmital, *Duarte & Pereira 1693* (F,US); Rio São João, *Duarte & Pereira 1772* (MO,NY). **Sta. Catarina:** Blumenau, *Gooden* (NY); Joinville, *Schmalz 64* (F,MO,NY). **Rio Grande do Sul:** Rio Pardo, Estevão Reseada, *Jürgens* (MO); Villa Manresa, Porto Alegre, *Leite (2456)217* (A,US).

30. **Trichipteris phalerata** (Mart.) Barr.

Trichipteris phalerata is a highly variable species without consistently useful diagnostic features. The Brazilian *Trichipteris* with flat, concolorous petiole scales, little development of petiole scurf, forked veins, and long paraphyses is in general assignable to *T. phalerata.* Similar species include *T. dichromatolepis,* in which specimens with uniformly fulvous petiole scales are occasional. Long, attenuate pinnules with a dusky aspect and tendencies toward multiseriate paraphyses and unforked fertile veins distinguish *T. dichromatolepis. Trichipteris Gardneri,* a species of the Campo Limpo, has petioles with trichomes and squamulae and long, attenuate pinnules with revolute segments. *Trichipteris villosa* has a lamina indument of minute, contorted trichomes, and *T. atrovirens* has simple veins. I have recognized two extreme variants of *T. phalerata* as varieties. *Trichipteris phalerata* var. *Iheringii* includes a series of plants from the Serra do Mar having nearly glabrous, cordate pinnules and paraphyses about as long as the sporangia. *Trichipteris phalerata* var. *phalerata* comprises a series of plants from interior, more northern areas, with an abaxial indument of trichomes and squamulae, truncate pinnules, and paraphyses longer than the sporangia.

The overall range of the species includes the states of Matto Grosso and Bahía south to Rio Grande do Sul. The species is found in advanced, secondary forest and wet, scrubby campo, especially along creek banks. The range of altitude for the species is from 35 to 1300 meters. In some specimens the differentiated scale margin is abraded early so that the scales appear emarginate as in *Sphaeropteris.* Exindusiate *Sphaeropteris* from Brazil has short paraphyses and long, flexuous trichomes borne at the base of the receptacle.

30a. **Trichipteris phalerata** (Mart.) Barr. var. **phalerata**

FIGS. 86, 87. MAP 30.

Trichipteris phalerata (Mart.) Barr., Rhodora 78(813):5. 1976.

Cyathea phalerata Mart., Denkschr. Bot. Ges. Regensb. **2**:146, t. 2, f. 3. 1822. HOLOTYPE: Brazil, *Martius,* M not seen. ISOTYPES: B! BM! NY! fragment ex NY, US! (*Martius* 392).

Alsophila phalerata (Mart.) Mart., Icon. Plant. Crypt. Bras. 67, t. 30 f. 1, t. 42. 1834.

Alsophila paleolata Mart., Icon. Plant. Crypt. Bras. 68, t. 43. 1834. SYNTYPES: Prov. S. Pauli, *Martius,* M not seen. Sebastionopolis (Paraná), *Martius,* M not seen. Bahía, *Martius,* M not seen. ISOSYNTYPE: Bahía, *Martius,* B!

Cyathea paleolata (Mart.) Copel., Univ. Calif. Publ. Bot. **17**:30. 1932.

Trichipteris paleolata (Mart.) Tryon, Contrib. Gray Herb. 200:46. 1970.

Alsophila Blanchetiana Presl, Epimel. Bot. 28. 1849. HOLOTYPE: Bahía, *Blanchet 77,* PR not seen. ISOTYPE: BM!

Cyathea Blanchetiana (Presl) Domin, Acta Bot. Bohem. **9**:98. 1930.

Alsophila Blancheti Trevisan, Atti Ist. Veneto II, **2**:165. 1851, *nom. nud.* COLLECTION CITED: *Blanchet 77,* BM!

Alsophila contracta Fée, Crypt. Vasc. Brés. **1**:167, t. 59 f. 2. 1869. SYNTYPES: Brasilia fluminensi (both numbers), *Glaziou 2288,* P! (Herb. Cosson); *Glaziou 2296,* P! (Herb. Cosson).

Cyathea contracta (Fée) Domin, Pteridophyta 262. 1929.

Alsophila eriocarpa Fée, Crypt. Vasc. Brés. **1**:162, t. 56 f. 1. 1869. SYNTYPES: Corcovado, Brazil (both numbers), *Glaziou 987,* P! (Herb. Cosson) fragment ex P, NY! *Glaziou 1706,* P! (Herb. Cosson) fragment ex P, NY! ISOSYNTYPE: *Glaziou 1706,* US!

Alsophila ludoviciana Fée, Crypt. Vasc. Brés. **1**:169, t. 60 f. 2. 1869. HOLOTYPE: Saint Louis, Brazil, Serra do Orgãos, *Glaziou 1785,* P! (Herb. Cosson).

Alsophila scrobiculata Fée, Crypt. Vasc. Brés. 1:157, t. 53 f. 1. 1869. SYNTYPES: Brasilia fluminensi (all numbers), *Glaziou 378*, P! (Herb. Cosson) *Glaziou 2293*, P! (Herb. Cosson) fragment ex P (Herb. Cosson) NY! *Glaziou 2294*, P (Herb. Cosson) not seen. *Glaziou 2295*, P! (Herb. Cosson). ISOSYNTYPES: *Glaziou 2294*, A! fragment NY!
Alsophila unguis-cati Fée, Crypt. Vasc. Brés. 1:165, t. 58 f. 2. 1869. HOLOTYPE: San Ludovico, Brazil, *Glaziou 2297*, P! (Herb. Cosson) fragment ex P (Herb. Cosson) NY!
Alsophila goyazensis Christ, in Schwacke Plant. Nov. Mineiras 2:33. 1900. HOLOTYPE: plateau de Goyaz, *Glaziou 22630*, P not seen. ISOTYPE: NY!
Alsophila paulistana Rosenst., Hedwigia 46:67. 1906. HOLOTYPE: Campinas, Est. São Paulo, *Ulbricht 141*, S!
Cyathea paulistana (Rosenst.) Domin, Pteridophyta 263. 1929.

Stem 0.5–10.0 m. tall. *Petiole* 0.4–ca. 1.0 m. long; scales uniformly fulvous; scurf absent or of occasional, minute, fulvous trichomidia; indument of lamina axes consisting of trichomes, trichomidia, and squamulae. *Lamina* to ca. 2.0 m. long, 2-pinnate-pinnatifid; pinnae stalked; pinnules short-petiolulate, deeply pinnatifid to pinnatisect, base truncate, apex acute to attenuate; lobes entire to crenulate, acute to rotund; fertile veins forked at the sori, sterile veins forked. *Sori* medial; paraphyses as long as or longer than the sporangia, receptacle hirsute to villous.

SELECTED COLLECTIONS. **Brazil. Matto Grosso:** *H. Smith 10618* (US). **Goiás:** Goiania, *Brade 15347* (F,MO,NY); Planalto, Chapada dos Veadeiros, ca. 20 km. W of Veadeiros, *Irwin, Grear et al. 12485* (GH). **Minas Gerais:** Caldas, *Regnell 648* (GH); São Tomas de Aquinho, Fazenda Fortaleza do Dr. Luiz Pimenta Neves, *Teodoro 910* (F); *Teodoro 912* (GH). **São Paulo:** Mun. Moji-Guaçu, Campos das Sete Lagôas, N of Rio Moji-Guaçu. 6 km. NW of Moji-Mirim, *Eiten & Eiten 2128* (GH); Campinas, *Ulbricht* (US). **Rio de Janeiro:** Serra dos Orgãos, Corrego Beija-flôr, *Brade 16644* (F,MO); Tijuca, *Smith & Brade 2234* (F,GH). **Paraná:** Porto de Cima, *Dusén 7021* (GH). **Santa Catarina:** Blumenau, Passo Mansa, *Haerchen* (MO); Mun. Florianópolis, Morro Itacorubí, Ilha de Santa Catarina, *Smith & Reitz 6156* (GH,MO,US). **Rio Grande do Sul:** Pelotas, *Brauner 22* (F).

30b. Trichipteris phalerata (Mart.) Barr. var. Iheringii (Rosenst.) Barr.

FIGS. 88, 89. MAP 31.

Trichipteris phalerata (Mart.) Barr. var. *Iheringii* (Rosenst.) Barr., Rhodora 78(813):5. 1976.
Alsophila Iheringii Rosenst., Hedwigia 56:358. 1915. LECTOTYPE (chosen herewith): Serra do Mar, Alto da Serra, *Lüderwaldt 1036*, S or SP not seen. ISOLECTOTYPES: B! NY! LECTOPARATYPES: *Brade 5828* not seen; *Brade 5829* not seen; *Edwall 4972* not seen.
Cyathea Iheringii (Rosenst.) Domin, Pteridophyta 262. 1929.
Alsophila Guinleorum Brade & Rosenst., Bol. Mus. Nac. Rio Janeiro 7:140, t. 2 f. 3, t. 4 f. 1, t. 6 f. 1. 1931. HOLOTYPE: Serra do Cavalo, vicinity of Teresopolis, Rio de Janeiro, Brazil, *Brade 9842*, HB not seen. ISOTYPE: NY!
Alsophila Roquettei Brade & Rosenst., Bol. Mus. Nac. Rio Janeiro 7:139 t. 2 f. 2, t. 3 f. 2, t. 5 f. 1. 1931. SYNTYPES: Serra do Cavalo, vicinity of Teresopolis, Rio de Janeiro, Brazil (both numbers). *Brade 9569*, HB not seen; *Brade 9836*, HB not seen. ISOSYNTYPE: *Brade 9569*, B!
Alsophila Portoana Brade, Arch. Inst. Biol. Veg. Rio de Janeiro 1:223, t. 1 f. 1, 1935, *ex icones*. HOLOTYPE: Itatiaia, *Brade 10235*, HB not seen.
Trichipteris Portoana (Brade) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila Pabstii Brade, Arquiv. Jard. Bot. Rio de Janeiro 18:26, t. 1 f. 1. 1965, *ex icone*. HOLOTYPE: Brasil, Região da nova Capital, Brasília, *Pabst 4935* & *Pereira 4608* (HB 7223) HB not seen.

Stem 1.0–2.0 m. tall. *Petiole* 0.4–0.5 m. long; scales fulvous with a slightly lighter border; scurf absent; axes of lamina nearly or quite glabrous. *Lamina* 0.6–1.2 m. long, 2-pinnate-pinnatifid; pinnae stalked; pinnules deeply pinnatifid to pinnatisect, base cordate, apex acute to attenuate; lobes entire, acute; fertile veins forked at the sori, sterile veins forked. *Sori* medial; paraphyses shorter than the sporangia, receptacle pilose.

SELECTED COLLECTIONS. **Brazil. Bahía:** *Blanchet 2286* (F); São Bento, *Lützelburg 101* (US). **São Paulo:** Paranapiacaba, linha São Paulo-Santos, *Handro 2210* (GH); near Alto da Serra, *Tryon & Tryon 6587* (GH). **Rio de Janeiro:** Itatiaia, *Brade 14009* (MO); Itatiaia, Rio Bonito, 3 picos, *Brade 15887* (MO,NY). **Sta. Catarina:** *Haerchen 234* (MO).

31. **Trichipteris Gardneri** (Hook.) Tryon

FIGS. 90, 91. MAP 32.

Trichipteris Gardneri (Hook.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila Gardneri Hook., Sp. Fil. 1:40. 1844. LECTOTYPE (chosen herewith): San Gaetano, Brazil, *Gardner 5330*, K not seen. ISOLECTOTYPES: BM! fragment ex P, F! P! US! LECTOPARATYPE: south Brazil, *Sellow*, not seen. ISOLECTOPARATYPE: fragment ex B, NY!
Cyathea Mexiae Copel., Univ. Calif. Publ. Bot. 17(2):30, t. 4. 1932. HOLOTYPE: Viçosa, SE of the Agricultural College, *Mexia 4882*, UC 466093–466096 not seen. ISOTYPES: F! GH! MO!
Alsophila Mexiae (Copel.) C. Chr., Ind. Fil. Suppl. 3:22. 1934.
Trichipteris Mexiae (Copel.) Tryon, Contrib. Gray Herb. 200:45. 1970.

Stem 1.0–4.0 m. tall. *Petiole* 0.6–1.0 m. long, stramineous to fuscous, aculeate; scales uniformly stramineous to fulvous; trichomes long, cretaceous; scurf of a few fulvous squamulae; all axes of lamina pubescent with long, multicellular, cretaceous trichomes; rachis, pinna-rachises and costae with minute, cretaceous trichomidia; costae and costules with long-lanceolate, flattish, fulvous squamulae and bullate, cretaceous squamulae; lamina surface with long, cretaceous trichomes. *Lamina* ca. 2.0–3.0 m. long, 2-pinnate-pinnatifid, chartaceous, apex gradually reduced and acute; pinnae stalked, often long-stalked; pinnules sessile to short-petiolulate, deeply pinnatifid to pinnatisect, base truncate to subcordate, apex attenuate; lobes rotund, entire, revolute; fertile veins forked at the sori, sterile veins forked. *Sori* medial; paraphyses longer than the sporangia, villous.

The petiole is critical to the determination of *Trichipteris Gardneri*, since the foliage appears similar to some of the more densely indumented plants of *T. phalerata*. *Trichipteris Gardneri* is a species of the Campo Limpo of Minas Gerais and surrounding states. It is related to *T. phalerata* and perhaps derived from it. *Trichipteris Gardneri* varies in the degree of pubescence and the revoluteness of the lobes. It is known from secondary forests and drainage ditches, from 700 to 1000 meters, in the states of Matto Grosso, Rio de Janeiro, São Paulo, and Minas Gerais, Brazil.

SELECTED COLLECTIONS. **Brazil. Matto Grosso:** *Smith 109* (US). **Minas Gerais:** Viçosa, Agricultural College, *Mexia 4902* (F,GH,MO,NY); *Mexia 5175* (F,GH,MO,NY). **São Paulo:** Bananal, Serra da Bocaina, *Brade 15180* (MO,NY). **Rio de Janeiro:** Mt. Itatiaia, *Brade 15043* (F,MO,NY); Nova-Friburgo, *Leite 4231* (MO).

32. **Trichipteris dichromatolepis** (Fée) Tryon

FIGS. 92, 93. MAP 33.

Trichipteris dichromatolepis (Fée) Tryon, Contrib. Gray Herb. 200:45. 1970.

Alsophila dichromatolepis Fée, Crypt. Vasc. Brés 1:164, t. 57 f. 2. 1869. HOLOTYPE: Serra do Orgãos, Brasil, *Glaziou 1786*, P! (Herb. Cosson).
Cyathea dichromatolepis (Fée) Domin, Pteridophyta 262. 1929.
Alsophila arbuscula Baker, Fl. Bras. 1(2):322. 1870. SYNTYPES: Rio, Orgaos, Tijuca, etc. (all numbers), *Gardner 114, Gardner 5673, Sellow, Glaziou 981, Glaziou 2155, Glaziou 2300, Glaziou 2301,* all K not seen. ISOSYNTYPES: *Gardner 114,* fragment F! P! *Sellow,* P! *Glaziou 981,* P! *Glaziou 2155,* P! *Glaziou 2301,* P!
Cyathea arbuscula (Baker) Domin, Pteridophyta 262. 1929.
Trichipteris arbuscula (Baker) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila aperta Fée, Crypt. Vasc. Brés. 1:158, t. 54 f. 2. 1869. HOLOTYPE: Brasilia fluminensi, *Glaziou 2301,* P! (Herb. Cosson).
Cyathea aperta (Fée) Domin, Pteridophyta 262. 1929.
Alsophila Ceropteris Fée, Crypt. Vasc. Brés. 1:163, t. 57 f. 1. 1869. SYNTYPES: Brasilia fluminensi, *Glaziou 981,* P! (Herb. Cosson) Serra do Couto, *Glaziou 3169,* P! (Herb. Cosson).
Alsophila corcovadensis Fée, Crypt. Vasc. Brés. 1:163, t. 56 f. 2. 1869, not *Alsophila corcovadensis* (Raddi) C. Chr., Ind. Fil. 41. 1905. SYNTYPES: Brasilia fluminensi ad montem Corcovado (both numbers), *Glaziou 985,* P! (Herb. Cosson), *Glaziou 1710,* P! (Herb. Cosson).
Alsophila Glaziovii Fée, Crypt. Vasc. Brés. 1:160, t. 55 f. 2. 1869, not Baker, 1870. SYNTYPES: Serra do Couto (both numbers), *Glaziou 2155,* P! (Herb. Cosson), *Glaziou 3167,* P! (Herb. Cosson).
Cyathea Glaziovii (Fée) Domin, Pteridophyta 262. 1929.
Trichipteris Glaziovii (Fée) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila guimariensis Fée, Crypt. Vasc. Brés. 2:81, t. 103 f. 2. 1872–1873. HOLOTYPE: Brasilia fluminensi, *Glaziou 5252,* P! (Herb. Cosson).
Cyathea guimariensis (Fée) Domin, Pteridophyta 262. 1929.
Alsophila pallida Rosenst., Hedwigia 56:356. 1915. TYPE COLLECTION: São Paulo, Rais da Serra, 1909, *Wacket 225,* B!
Cyathea pallida (Rosenst.) Domin, Pteridophyta 263. 1929.
Alsophila dryopteridoides Domin, Kew Bull. 1929:218. 1929. HOLOTYPE: Minas Gerais, *Gardner 5331,* K!
Cyathea mesocarpa Domin, Acta Bot. Bohem. 9:136. 1930, *nom. nov.* for *Alsophila dryopteridoides* Domin, 1929, not *Cyathea dryopteridoides* Maxon, 1925 (as *dryopteroides*).
Alsophila mesocarpa (Domin) C. Chr., Ind. Fil. Suppl. 3:22. 1934.

Stem 1.0–4.0 m. tall. *Petiole* ca. 0.3–0.4 m. long, stramineous to fuscous, aculeate; scales fulvous to fuscous with a cretaceous border or uniformly fulvous; scurf absent or of minute, fulvous trichomidia; trichomidia occasional on lamina axes; costae and costules with bullate, cretaceous squamulae; lamina otherwise glabrous. *Lamina* ca. 1.3 m. long, 2-pinnate to 2-pinnate-pinnatifid, papyraceous, apex gradually reduced and acute; pinnae short-stalked; pinnules short-petiolulate, entire to pinnatifid, base truncate, cuneate, or subcordate, apex attenuate, tip entire; lobes acute, entire; fertile veins forked at the sori or simple, sterile veins forked or simple. *Sori* inframedial to supramedial; paraphyses shorter than the sporangia, receptacle pilose.

The species epithet refers to the broad, cretaceous petiole-scale border present in most collections of this species. Petiole scales of some specimens have darkened borders. In a few cases the scales are uniform in color. Long-attenuate pinnules of a dark green color, bullate cretaceous costal squamulae, and a tendency toward multiseriate paraphyses also characterize *Trichipteris dichromatolepis*. Noticeable variability in the dissection of the pinnules, especially toward the apex of the leaf, and variation in the venation are characteristic of the species. *Trichipteris dichromatolepis* is found in wet, secondary forests in the coastal ranges of southern Brazil, at altitudes from 800 to 2000 meters.

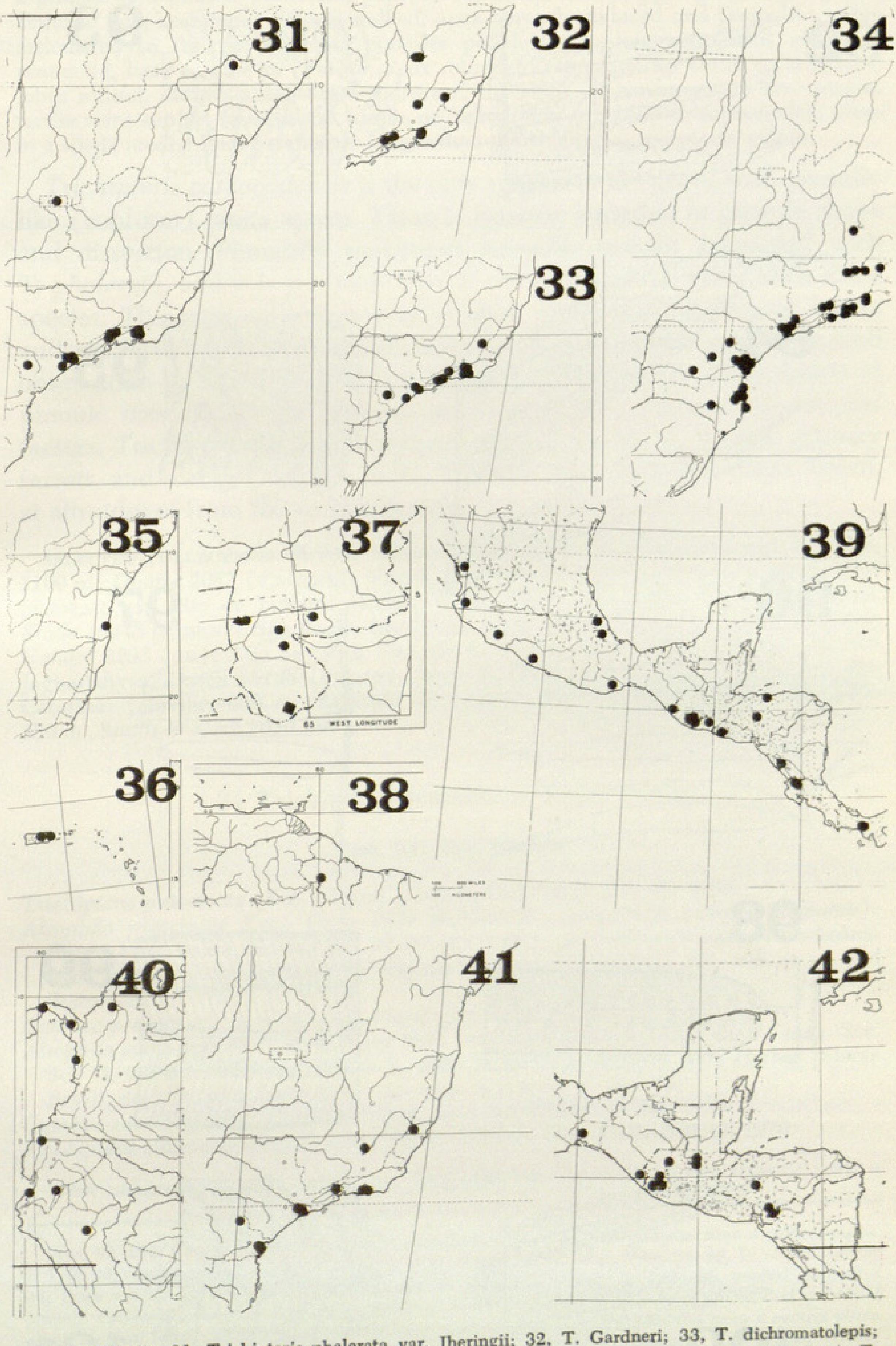
SELECTED COLLECTIONS. **Brazil. Minas Gerais.** Serra do Caparão, *Brade 16939* (GH). **São Paulo:** Serro do Itatius, Mun. Iguape, *Brade 8255* (US); Paranapiacaba, Estação Biológica, *Handro 1231* (GH,US). **Rio de Janeiro:** Estrada Redentor, km. 11, *Brade 16831* (F,MO,NY,US); SE side of Mt. Itatiaia, Riberão Campo Belo, km. 8 beyond Maromba, *Tryon & Tryon 6662* (GH).

33. Trichipteris corcovadensis (Raddi) Copel.

FIGS. 94–99. MAP 34.

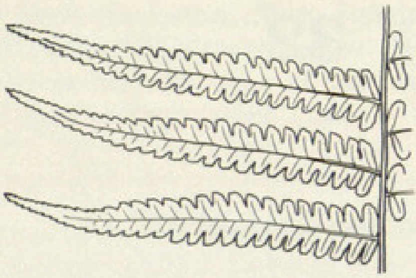
Trichipteris corcovadensis (Raddi) Copel., Gen. Fil. 97. 1947.
Polypodium corcovadense Raddi, Opusc. Sci. Bol. 3:288. 1819. HOLOTYPE: Brazil, *Raddi*, FI not seen. ISOTYPE: P! (in vertiu montis Corcovado).
Alsophila corcovadensis (Raddi) C. Chr., Ind. Fil. 41. 1905.
Cyathea corcovadensis (Raddi) Domin, Pteridophyta 262. 1929.
Polypodium Taenitis Roth, Nov. Pl. Spec. pr. Ind. Orient. 394. 1821, *ex char.* HOLOTYPE: E Rio Janeiro . . . communicavit . . . Mertens, not seen.
Alsophila Taenitis (Roth) Kze., Linnaea 9:90. 1834.
Trichopteris Taenitis (Roth) Hook., Sp. Fil. 1:35. 1844.
Trichipteris excelsa Presl, Del. Prag. 1:172. 1822. HOLOTYPE: in monte Corcovado ad Rio-Janeiro Brasiliae, *Raddi*, FI not seen. ISOTYPE: P!
Alsophila excelsa (Presl) Mart., Icon. Plant. Crypt. Bras. 63, t. 29 f. 1, 2 t. 37. 1834.
Chnoöphora excelsa (Presl) Mart., Icon. Plant. Crypt. Bras. t. 27. 1834. This combination appears only in t. 27.
Alsophila elegans Mart., Icon. Plant. Crypt. Bras. 63, t. 38. 1834, *ex icone*, not *Cyathea elegans* Hew., 1838. SYNTYPES: crescit in Prov. S. Pauli et Minarum Generalium sylvis, *Martius*, not seen.
Trichipteris elegans (Mart.) Presl. Tent. Pterid. 59. 1836.
Alsophila Miersii Hook., Sp. Fil. 1:38. 1844. SYNTYPES: Rio de Janeiro, Organ Mts., Brazil, *Gardner 117*, K not seen. Tejuco (Tijuca), *Miers*, K not seen. ISOSYNTYPES: *Gardner 117*, P! *Miers* (Rio de Janeiro), P!
Cyathea Miersii (Hook.) Domin, Pteridophyta 263. 1929.
Trichipteris Miersii (Hook.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila Glaziovii Baker, Fl. Bras. 1(2):592. 1870, not *A. Glaziovii* Fée, 1869. HOLOTYPE: Orgãos, Brazil, *Glaziou 3582*, K not seen. ISOTYPE: B!
Alsophila decipiens Fée, Crypt. Vasc. Brés. 2:81, t. 103 f. 1. 1872–1873. SYNTYPES: Itatiaia, *Glaziou 7032*, P! (Herb. Cosson) *Glaziou 5244*, P! (Herb. Cosson).
Alsophila Feeana C. Chr., Ind. Fil. 42. 1905, *nom. nov.* for *Alsophila Glaziovii* Baker, 1870, not *A. Glaziovii* Fée, 1869.
Cyathea Feeana (C. Chr.) Domin, Pteridophyta 262. 1929.
Trichipteris Feeana (C. Chr.) Copel., Gen. Fil. 97. 1947.
Cyathea Sternbergii Domin, Pteridophyta 263. 1929, *nom. nov.* for *Alsophila elegans* Mart., not *Cyathea elegans* Hew. 1838, not *Cyathea Sternbergii* Sternb., 1820.
Cyathea elegantula Domin, Acta Bot. Bohem. 9:113. 1930, *nom. nov.* for *Alsophila elegans* Mart., 1834, not *Cyathea elegans* Hew., 1838.
Alsophila Damazioi Brade, Arquiv. Jard. Bot. Rio Janeiro 11:23, t. 3 t. 6 f. 11. 1951. HOLOTYPE: Serra de Sacramento, *Damazio*, HB!
Alsophila Hoehneana Brade, Arquiv. Jard. Bot. Rio Janeiro 11:24, t. 4 t. 6 f. 6. 1951. HOLOTYPE: São Paulo, Parque do Estado, *Hoehne*, HB! ISOTYPE: NY!
Alsophila Mello-barretoi Brade, Arquiv. Jard. Bot. Rio Janeiro 11:22, t. 2 t. 5 f. 4. 1951. HOLOTYPE: Serro do Cipó, *Mello-Barreto 512*, HB not seen. PARATYPE: *Barreto & Brade 14389*, HB not seen. ISOPARATYPE: MO!
Trichipteris Mello-barretoi (Brade) Tryon, Contrib. Gray Herb. 200:45. 1970.

Stem 0.3–0.6 m. tall. *Petiole* 0.4–0.8 m. long, stramineous to atropurpureous, tuberculate to aculeate; scales uniformly fulvous to fuscous; scurf absent or of fulvous trichomidia; axes of lamina glabrous or with cretaceous to fulvous trichomidia; costae with cretaceous to fulvous, flattish to bullate squamulae. *Lamina* 1.3–2.5 m. long,



MAPS 31–42: 31, Trichipteris phalerata var. Iheringii; 32, T. Gardneri; 33, T. dichromatolepis; 34, T. corcovadensis; 35, T. praecincta; 36, T. borinquena; 37, T. demissa var. demissa (dots), T. demissa var. thysanolepis (diamond) and T. Cyclodium (triangle); 38, T. nanna; 39, T. costaricensis; 40, T. pilosissima; 41, T. leucolepis; 42, T. mexicana.

92



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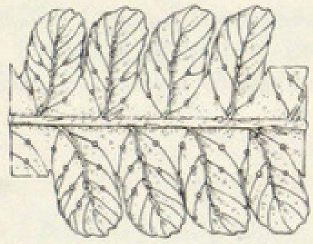

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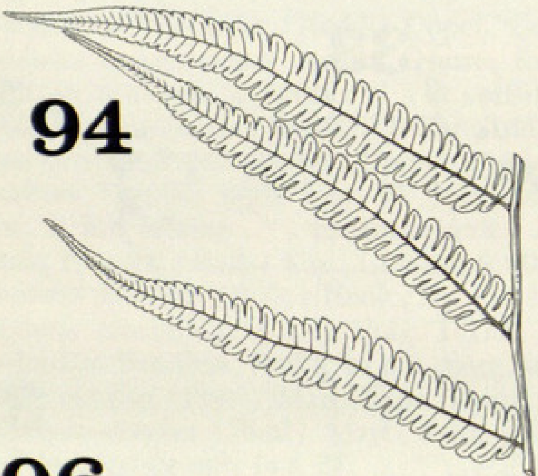
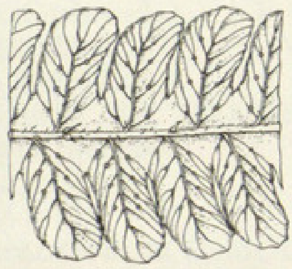


95



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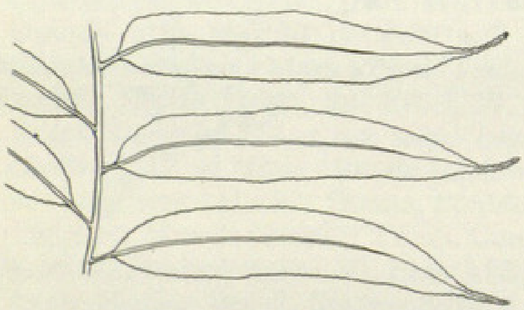

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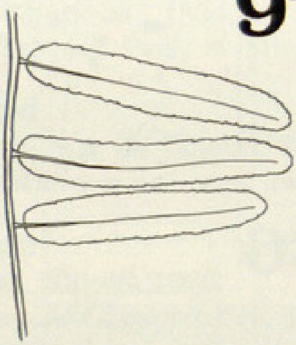
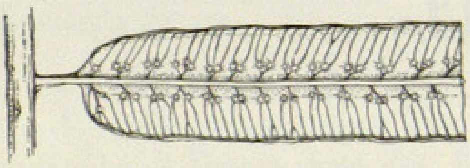
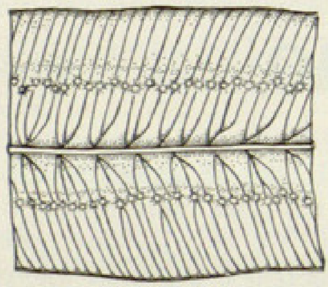
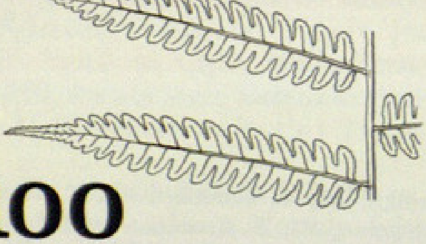


98

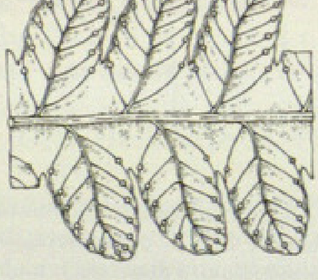


99





100



101

2-pinnate to 2-pinnate-pinnatifid, papyraceous to coriaceous, apex gradually reduced, acute to long-acuminate; pinnae stalked, apex abruptly reduced and pinna-like, often articulated to the pinna-rachis; pinnules petiolulate to long-petiolulate, entire to pinnatifid, base cordate to cuneate, apex rotund to attenuate, tip entire to crenulate; lobes rotund, entire; costae often indistinct, the veins all concurrent to the margin; fertile veins simple, sterile veins simple or forked. *Sori* subcostal to supramedial, often in a single medial line; paraphyses longer than the sporangia; receptacle villous.

Trichipteris corcovadensis is the only species in the genus with pinnule-like (conform) pinna apices. There is extreme variation in pinnule shape and dissection. Pinnatifid specimens resemble species associated with *T. phalerata*, and it is probable that *T. corcovadensis* is allied with these species. The type collection is of a plant with simple 2-pinnate leaves and conform, articulate apical pinnules. Some careful collecting and observation by Paulo Windisch indicates that there is some correlation of pinnule dissection with exposure to sunlight and other environmental factors. *Trichipteris corcovadensis* is found in secondary forests, primary forests, and scrubby campos in the Serra do Mar area of southern Brazil, at altitudes of from 250 to 2100 meters.

SELECTED COLLECTIONS. **Brazil. Minas Gerais:** Serra do Cipó, km. 131—Palacio—1100 m., *Duarte 2087* (F,MO,NY); Viçosa, road to São Miguel, near km. 4, *Mexia 4634* (F,GH,MO,NY). **Rio de Janeiro:** Itatiaia, *Brade 15556* (F,GH,NY); Serra dos Orgãos, *Brade 16445* (F,GH,NY). **São Paulo:** São Paulo, Agua Funda, nativa no Jardim Botanico, *Handro 2203* (GH); Sitio São José, Campos do Jordão, *Leite 3572* (A,GH,US). **Paraná:** Jaguariahyva, *Dusén 15148* (GH,MO); Serra da Prata, *Dusén 15300* (F,GH,MO). **Sta. Catarina:** Joinville, 300 m., *Schmalz 51* (F,MO); Mun. Ibirima, Ibirima, alt. 250–350 m., *Smith & Klein 7580* (US).

34. Trichipteris praecincta (Kze.) Tryon

FIGS. 100, 101. MAP 35.

Trichipteris praecincta (Kze.) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila praecincta Kze., Flora 1839 Beiblatt:53. LECTOTYPE (chosen herewith): Ilheus, Prov. Bahía, *Martius 391*, B! ISOLECTOTYPES: MO! NY! LECTOPARATYPE: *Lusch-nath*, not seen. Presumably the original specimen of *Martius 391* was at LZ and destroyed.
Cyathea praecincta (Kze.) Domin, Pteridophyta 263. 1929.
Alsophila submarginalis Domin, Kew Bull. 1929:217. 1929, & Mem. Roy. Czech. Soc. Sci. II, 2:88, t. 9 f. 4–8, t. 17 f. 2. 1929. HOLOTYPE: *Martius 391*, Herbar. Florae Brazil, det. "A. praecincta Kze." not seen. ISOTYPES: B! MO! NY!
Cyathea submarginalis (Domin) Domin, Acta Bot. Bohem. 9:163. 1930.
Trichipteris submarginalis (Domin) Tryon, Contrib. Gray Herb. 200:46. 1970.

Stem unknown. *Petiole* ca. 35 cm. long, fuscous, muricate; scales fulvous with a

FIGS. 92–101. FIGS. 92 & 93, *Trichipteris dichromatolepis:* 92, three pinnules from a central pinna, × 1/3; 93, central part of a pinnule, × 4/3 (both *Brade 14384*, MO). FIGS. 94–99, *T. corcovadensis:* 94, three central pinnules from a central pinna (pinnatifid form), × 1/3; 95, central part of a pinnule (pinnatifid form, × 4/3 (both *Smith & Brade 2233*, GH); 96, three pinnules of a central pinna (typical form), × 1/3 (*L. B. Smith 5676*, GH); 97, three central pinnules from a central pinna (obtuse form), × 1/3 (*Duarte 2087*, F); 98, basal part of an entire pinnule, × 4/3 (*Brade 16445*, GH); 99, part of an entire pinnule, × 1, (*Glaziou*, GH). FIGS. 100 & 101, *T. praecincta:* 100, two central pinnules from a central pinna, × 1/3; 101, central part of a pinnule, × 4/3 (both *Martius 391*, NY).

cretaceous border; scurf absent; costae and costules with flattish to bullate, cretaceous to fulvous squamulae; axes of lamina otherwise glabrous. *Lamina* length unknown, 2-pinnate-pinnatifid, papyraceous, apex unknown; pinnae stalked; pinnules petiolulate, pinnatifid to deeply pinnatifid, base subcordate to cuneate, apex acuminate to attenuate, tip serrate; lobes rotund to acute, entire; fertile veins forked at the sori or simple. *Sori* submarginal; paraphyses much shorter than the sporangia, receptacle puberulous.

There is not enough material to adequately define *Trichipteris praecincta* as a species. There are no modern collections, and the extant collections include only scanty material of petiole scales. This species is the only one in the genus with acuminate pinnules and submarginal sori. Because of the lack of material, affinities are unclear. I have tentatively placed *T. praecincta* with the Brazilian species group. It is possible, however, that *T. praecincta* represents a coastal species derived from ancestors resembling *T. procera,* which is basically Andean in distribution. The known collections are all from the coastal part of Bahía.

SELECTED COLLECTIONS. **Brazil. Bahía:** *Hohenacker* (GH). **State undetermined:** *Riedel* (GH,US).

35. Trichipteris borinquena (Maxon) Tryon

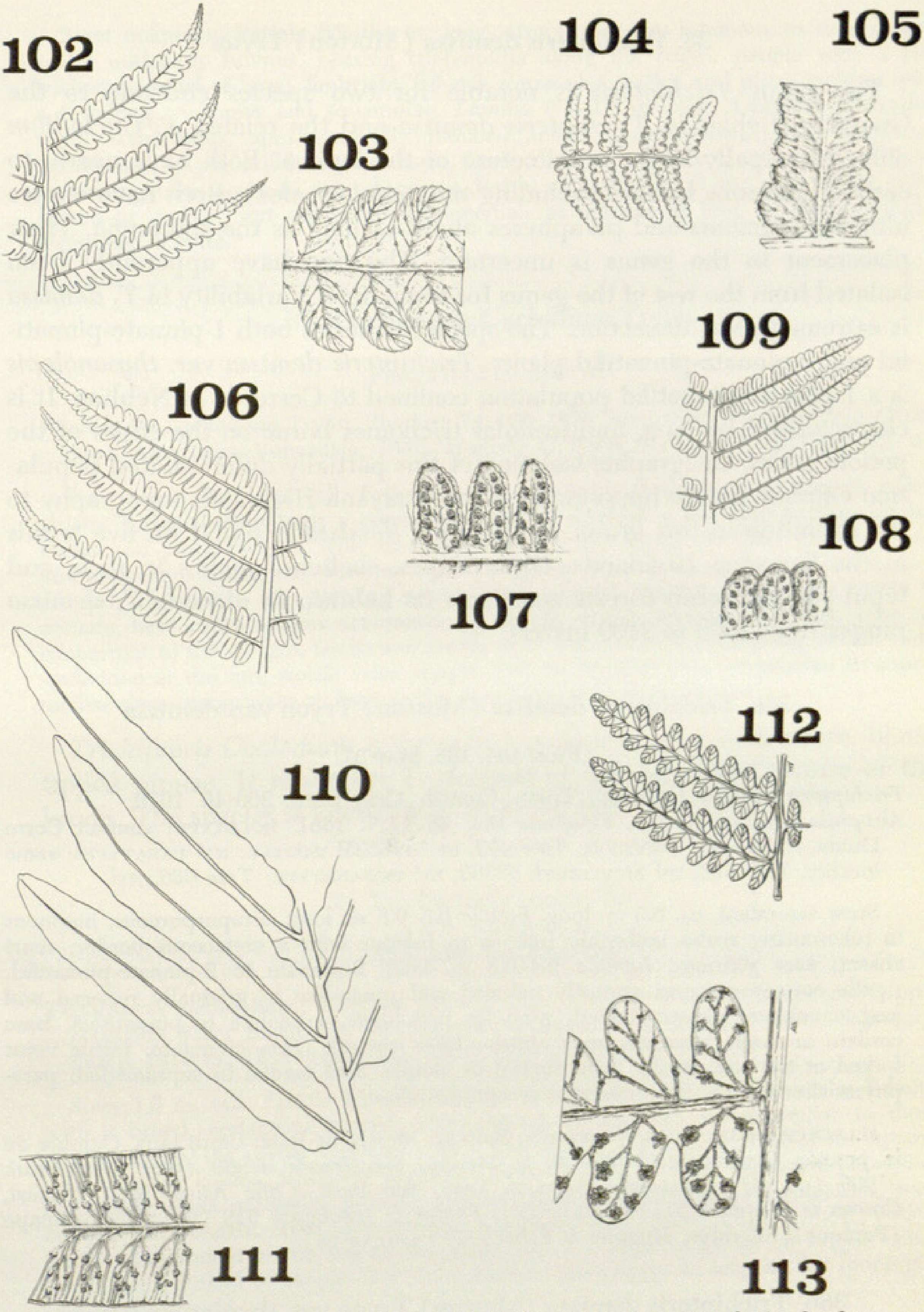
FIGS. 102, 103. MAP 36.

Trichipteris borinquena (Maxon) Tryon, Contrib. Gray Herb. 200:44. 1970.
Alsophila borinquena Maxon, Am. Fern Journ. **15**(2):56. 1925. HOLOTYPE: Luquillo Mts., Puerto Rico, *Britton & Brauner 7571,* US 1145551!
Cyathea borinquena (Maxon) Domin, Acta Bot. Bohem. **8**:99. 1930.

Stem creeping to ascendant, to ca. 1 m. long. *Petiole* 0.3–0.8 m. long, fulvous, tuberculate to aculeate; scales uniformly fulvous, the structural margin indistinct; scurf absent; costae and costules with flattish to bullate, fulvous squamulae; axes of lamina otherwise glabrous. *Lamina* to ca. 2.0 m. long, 1-pinnate-pinnatifid or 2-pinnate-pinnatifid, coriaceous, apex gradually reduced and long-acuminate; pinnae stalked, remote in 1-pinnate-pinnatifid plants; pinnules short-petiolulate to petiolulate, deeply pinnatifid (pinnae of 1-pinnate specimens often pinnatisect and approaching 2-pinnate), base cordate to cuneate, apex acuminate, tip entire; lobes rotund to truncate, entire to serrulate (lobes of 1-pinnate plants often acute and crenulate); fertile veins usually forked at the sori or occasionally simple, sterile veins forked or simple. *Sori* medial; paraphyses shorter than the sporangia, sometimes multiseriate, receptacle pilose.

Trichipteris borinquena lacks both soral squamulae and petiole scurf. The lack of petiole scurf and the uniformly pigmented petiole scales suggest that this highly isolated species of the West Indies is allied to Brazilian species such as *T. phalerata. Trichipteris borinquena* varies in the dissection of the lamina and the habit of the stem. It is endemic to Puerto Rico, where it is found in wet, montane forests from 500 to 1000 meters. The margin of the petiole scale is poorly differentiated, suggesting that this species may be one of the least differentiated in the genus.

SELECTED COLLECTIONS. **Puerto Rico.** Monte Cerrote, near Adjuntas, *Britton & Brown 5441* (F,NY); Sierra de Luquillo, in monte Jimenes, *Sintenis 1754* (F,GH,NY).



Figs. 102–113. Figs. 102 & 103, *Trichipteris borinquena:* 102, three central pinnules from a central pinna, × 1/3; 103, central part of a pinnule, × 4/3 (both *Scamman 6515*, GH). Figs. 104–109, *T. demissa:* 104, var. *demissa*, central pinnules from a central pinna, × 1/3; 105, var. *demissa*, basal part of a pinnule, × 4/3 (both *Maguire & Politi 27779*, GH); 106, var. *thysanolepis*, three central pinnae, × 1/3; 107, var. *thysanolepis*, three lobes of a pinna, × 1 (both *Maguire, Wurdack & Bunting 37291*, GH); 108, var. *thysanolepis*, three lobes of a pinna, × 1; 109, var. *thysanolepis*, three pinnae, × 1/3 (both *Maguire, Wurdack & Bunting 37100*, US). Figs. 110 & 111, *T. Cyclodium:* 110, three central pinnae, × 1/3; 111, part of a fertile pinna, × 2/3 (both *Maguire & Politi 27541*, NY). Figs. 112 & 113, *T. nanna:* 112, two central pinnae, × 1/3; 113, basal part of a pinna, × 4/3 (both *Tillet, Tillet & Boyan 45119*, US).

36. **Trichipteris demissa** (Morton) Tryon

The genus *Trichipteris* is notable for two species endemic to the Guayana Highlands. *Trichipteris demissa* and the related *T. Cyclodium* differ principally in the architecture of the lamina. Both have nearly to entirely glabrous leaves (excluding the petiole scales). Both have obtuse ultimate segments and paraphyses about as long as the sporangia. Their placement in the genus is uncertain. The two have apparently been isolated from the rest of the genus for some time. Variability in *T. demissa* is extreme in leaf dissection. The species includes both 1-pinnate-pinnatifid and 2-pinnate-pinnatifid plants. *Trichipteris demissa* var. *thysanolepis* is a 1-pinnate-pinnatifid population confined to Cerro de la Neblina. It is characterized by long, multicellular trichomes borne on the edges of the petiole scales. Geographic isolation of this partially differentiated population emphasizes the importance of the Guayana Highlands topography to the evolution in this group. *Trichipteris demissa* is found on five tepuís in the Guayana Highlands. Open slopes, sheltered niches in rock, and tepuí summit scrub forests constitute its habitat. In altitude *T. demissa* ranges from 1500 to 2100 meters.

36a. **Trichipteris demissa** (Morton) Tryon var. **demissa**

FIGS. 104, 105. MAP 37.

Trichipteris demissa (Morton) Tryon, Contrib. Gray Herb. 200:46. 1970.
Alsophila demissa Morton, Fieldiana Bot. **28**(1):7. 1851. HOLOTYPE: summit Cerro Duida, Amazonas, Venezuela, *Tate 402,* US 1498535! ISOTYPE: NY! PARATYPES: same locality, *Tate 626,* US! *Steyermark 58308,* US! ISOPARATYPE: *Tate 626,* NY!

Stem ascendant, ca. 0.3 m. long. *Petiole* 0.3–0.5 m. long, atropurpureous, inermous to tuberculate; scales uniformly fulvous to fulvous with a cretaceous border; scurf absent; axes glabrous. *Lamina* 0.4–0.8 m. long, 2-pinnate to 2-pinnate-pinnatifid, rigidly coriaceous, apex abruptly reduced and pinna-like to gradually reduced and long-acuminate; pinnae stalked; pinnules petiolulate, crenulate to pinnatisect, base cordate or rarely truncate, apex obtuse; lobes rotund, often crenulate; fertile veins forked at the sori, sterile veins forked or simple. *Sori* medial to supramedial; paraphyses shorter than the sporangia, receptacle pilose.

SELECTED COLLECTIONS. **Venezuela. Bolívar:** Meseta de Jaua; Cerro Jaua, Cumbre de la porción Central-Occidental de la Meseta, *Steyermark 97989* (GH), *Steyermark 97900* (GH,NY). **Amazonas:** Serranía Parú, Río Parú, Caño Asísa, Río Ventauri, *Cowan & Wurdack 31126* (GH,NY,US); *Phelps & Hitchcock 519* (US); Cerro Sipapo (Paráque), SE ridge, *Maguire & Politi 27779* (GH,NY,US).

36b. **Trichipteris demissa** (Morton) Tryon var. **thysanolepis** Barr.

FIGS. 106–109. MAP 37.

Trichipteris demissa (Morton) Tryon var. *thysanolepis* Barr., Rhodora **78**(813): 1 t. 1 f. 1, 2. 1976. HOLOTYPE: Venezuela, Territorio de Amazonas, summit, Cerro de la Neblina, Río Yatua, January 15, 1954, *Maguire, Wurdack & Bunting 37291,* NY! ISOTYPES: GH! US! PARATYPES: Venezuela, Territorio de Amazonas, Cerro de la Neblina, Río Yatua, *Maguire, Wurdack & Maguire 42346,* US!; *Maguire, Wurdack & Bunting 37100,* US!

Stem unknown. Petiole 0.2–0.4 m. long, atropurpureous, inermous to tuberculate; scales uniformly fulvous, bearing trichomidia along the edges; petiole with a few trichomes; scurf of large, fimbriate, fulvous squamulae; rachis and pinna-rachises with a few long trichomes and squamulae. *Lamina* 0.3–0.6 m. long, 1-pinnate-pinnatifid, rigidly coriaceous, apex gradually reduced and long-acuminate; pinnae adjacent, sessile, deeply pinnatifid to pinnatisect, base cordate to truncate, apex attenuate, tip crenulate; lobes acute to rotund, entire; fertile veins forked at the sori, sterile veins forked or simple. *Sori* medial to supramedial; paraphyses as long as the sporangia, receptacle hirsute.

37. Trichipteris Cyclodium Tryon

FIGS. 110, 111. MAP 37.

Trichipteris Cyclodium Tryon, Rhodora **74**:446. 1972. HOLOTYPE: Cerro Sipapo (Paráque), Amazonas, Venezuela, 1948, *Maguire & Politi 27451*, NY! ISOTYPES: GH! US!

Stem erect, 5–15 cm. tall. *Petiole* ca. 80 cm. long, atropurpureous, barely tuberculate; scales fuscous with a cretaceous border; scurf of a few minute trichomidia; rachis and pinna-rachises with some bicolorous scales similar to those of the petiole and cretaceous squamulae. *Lamina* ca. 0.7 m. long, 1-pinnate, rigidly coriaceous, apex abruptly reduced to an articulate apical pinna; pinnae adjacent, petiolulate, entire to crenate, base cuneate, apex acuminate, tip obtuse, entire; costules indistinct, veins all concurrent to the margin, fertile and sterile veins sometimes anastomosing, fertile veins undivided at the sori, sterile veins simple. *Sori* in three to four inframedial to supramedial rows; paraphyses as long as the sporangia, receptacle hirsute.

Trichipteris Cyclodium is the only 1-pinnate species with entire, blunt-tipped pinnae. It resembles *T. demissa* in indument and texture of the leaves. The species is known only from the type collection.

38. Trichipteris nanna Barr.

FIGS. 112, 113. MAP 38.

Trichipteris nanna Barr., Rhodora **78**(813):3, t. 1 f. 3, 4. 1976. HOLOTYPE: upper Mazaruni River Basin, Mt. Ayanganna, on shoulder of E flank, about Thompson Camp, 1418 m., 12 August 1960, *Tillet, Tillet & Boyan 45119*, US!

Stem 1.0 m. tall. *Petiole* 13 cm. long, atropurpureous, tuberculate; scales fulvous with a broad, cretaceous border; scurf absent; rachis with scales similar to those of the petiole; the costae sometimes with trichomidia and flattish, cretaceous squamulae; axes of lamina otherwise glabrous. *Lamina* 40 cm. long, 1-pinnate-pinnatifid, coriaceous, apex gradually reduced and acuminate; pinnae sessile, pinnatifid, base cuneate to truncate, apex acuminate, tip obtuse and entire; lobes rotund, entire; fertile veins forked at the sori or the basal sori of a segment borne on simple veins, sterile veins forked or simple. *Sori* submarginal; paraphyses as long as the sporangia, receptacle hirsute.

Trichipteris nanna superficially resembles *T. phalaenolepis* and *T. ursina*. It differs from those two species in having submarginal sori and normally dichotomous veins. *Trichipteris nanna* is a morphologically derived species, possibly related to *T. demissa*, which has similar petiole scales, ultimate segments, lamina indument, and paraphyses. The one collection is from a mid-elevation crest forest.

39. **Trichipteris costaricensis** (Kuhn) Barr.

FIGS. 114, 115. MAP 39.

Trichipteris costaricensis (Kuhn) Barr., Rhodora 78(813):1. 1976.
Hemitelia costaricensis Mett., Ann. Sci. Nat. V. 2:265. 1864, *nom. nud.*
Hemitelia costaricensis Kuhn, Linnaea 36:159. 1869. LECTOTYPE (chosen herewith): Costa Rica et Varagua, *Warscewicz 36*, B! fragment ex B, NY! fragment ex B, US! LECTOPARATYPE: Panama, *Sutton-Hayes*, fragment ex B, NY! ISOLECTOPARATYPE: P!
Cyathea costaricensis (Kuhn) Domin, Acta Bot. Bohem. 9:107. 1930.

Stem 0.5–7.5 m. tall. *Petiole* ca. 0.5 m. long, fuscous to fulvous, inermous to tuberculate; scales fulvous with a cretaceous border; scurf absent or consisting of a few fulvous trichomidia and cretaceous squamulae; rachis and pinna-rachises glabrous; costae and costules glabrous or with cretaceous trichomidia and cretaceous to fuscous squamulae; veins with cretaceous trichomidia. *Lamina* ca. 2.5 m. long, 2-pinnate-pinnatisect, papyraceous, apex gradually reduced and acute; pinnae short-stalked; pinnules short-petiolulate, pinnatisect, base truncate, apex attenuate, tip crenulate; lobes acute, serrate to crenulate; fertile veins forked at the sori, sterile veins forked. *Sori* inframedial to medial, subtended by several cretaceous soral squamulae; paraphyses shorter than the sporangia, receptacle pilose.

Trichipteris costaricensis is the only Central American species with soral squamulae. It has no close relatives in the genus. The development of the trichomidia on the costae and costules is variable. The soral squamulae closely resemble an indusium, but consist of several closely appressed, bullate squamulae extending over the sorus. *Trichipteris costaricensis* is found in arroyos, canyons, and grassy slopes in Mexico. The more southerly collections are from stream banks, deep quebradas, and cool, moist canyon floors. The species extends as far south as Chiriquí Province in Panama. It grows from 400 to 1400 meters in altitude.

SELECTED COLLECTIONS. **Mexico. Nayarit:** Rancho Cora, Sierra San Juan, *Gentry, Barclay & Arguelles 19480* (GH). **Jalisco:** Arroyo de la Cordoncillera, a little S of Puerto Vallarta, *Philipps* (F,GH,MO). **Michoacán:** Aquila-Coahuayana, Coalcoman, *Hinton et al. 16262* (F,MO). **Guerrero:** Pasion, Montes de Oca, *Hinton et al. 10793* (GH,MO,NY). **Veracruz:** Vallée de Cordova, *Bourgeau 1454* (GH,NY); near Tlapocoyan, on road from Tezuitlan, *Riba, Tryon & Tryon 309* (GH,NY). **Oaxaca:** Pluma Hidalgo, 1200 m., *Hernandez X. 3320* (US). **Chiapas:** Cacahuatan, 1800′, *Fisher 35396* (F,MO, NY,US); Finca Mexiquito, *Purpus 6712* (F,MO,NY). **Guatemala. Quezaltenango:** Colomba, *Skutch 1340* (GH). **Retalhuleu:** San Felipe, *Donnell Smith 2718* (GH,MO, NY); vicinity of San Felipe, *Maxon & Hay 3532* (NY). **Esquintla:** Panaleon, *Tonduz & Rojas 1* (GH,MO,NY); San Andres Osuna, *Seler & Seler 2548* (GH). **Santa Rosa:** Santa Rosa, *Donnell Smith 3219* (GH,MO,NY); Aguacaliente, *Kellerman 7793* (F). **El Salvador. San Salvador:** Tonacatepeque, *Calderón 212* (GH,NY); vicinity of Tonacatepeque, *Standley 19434* (F,GH,MO,NY). **Honduras. Atlántida:** vicinity of La Ceiba, *Yuncker, Koepper & Wagner 8750* (F,GH,MO,NY). **Comayagua:** vicinity of Siguatepeque, *Standley 56189* (GH); hills E of Siguatepeque, *Yuncker, Dawson & Youse 6352* (GH,MO,NY). **Nicaragua.** Managua, *Garnier A-1223, 1414* (GH). **Costa Rica. Alajuela:** entre Liberia y Guachipelín, *Brenes 15514* (F,NY). **Panama. Chiriquí:** near Remedios, *Allen 2683* (GH).

40. **Trichipteris pilosissima** (Baker) Barr., comb. nov.

FIGS. 116, 117. MAP 40.

Alsophila pilosissima Baker, Syn. Fil. ed. 2. 457. 1874. HOLOTYPE: Mt. Campana, East Peru, *Spruce 4322,* K!
Cyathea pilosissima (Baker) Domin, Pteridophyta 262. 1929.

Stem 0.5–2.0 m. tall. *Petiole* 0.5 m. long, fulvous, muricate to aculeate; scales fuscous with a cretaceous border (the border often abrading with age); scurf of minute, appressed trichomidia and sometimes cretaceous squamulae; trichomes when present cretaceous; long, cretaceous to fulvous trichomes present on all axes; pinna-rachises, costae, and costules with cretaceous to fulvous, flattish to bullate squamulae. *Lamina* ca. 1.5 m. long, 2-pinnate-pinnatifid, chartaceous, apex gradually reduced and long-acuminate to abruptly reduced and somewhat pinna-like; pinnae sessile; pinnules sessile to short-petiolulate, pinnatifid to pinnatisect, base truncate, apex obtuse to attenuate; lobes rotund, serrate; fertile and sterile veins forked or less commonly simple. *Sori* medial to supramedial; paraphyses longer than the sporangia, villous; one or two soral squamulae sometimes associated with the sorus.

Trichipteris pilosissima is a species of uncertain affinity within the genus. The variability in development of the scurf and in the venation makes certain placement impossible. A possible relation may be to *T. costaricensis* of Central America, which has similar petiole scales and a similar association of squamulae with the sorus (although poorly developed in *T. pilosissima.*) Interpretation of this species as allied to *T. Gardneri,* on the basis of the long, cretaceous trichomes, is not supported by any correlation with other characters. *Trichipteris pilosissima* can be confused with *Sphaeropteris senilis* (Kl.) Tryon, which has emarginate petiole scales. Species such as *T. hirsuta* and *T. rufa* are characterized by a lighter aspect to the foliage and the dark marginal setae of the petiole scales. *Trichipteris pilosissima* is a species of Panama and the Pacific coast of South America. It is found in rain forests, especially along watercourses, from sea level to 800 meters. A few of the collections from Peru apparently come from regions with Atlantic drainage.

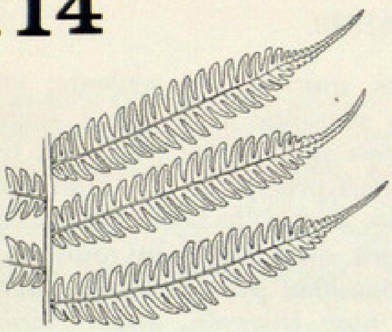
SELECTED COLLECTIONS. **Panama. Canal Zone:** plain of Sperdi, near Puerto Obaldía, San Blas coast, near sea level, *Pittier 4356* (US). **Darién:** summit of knoll above Cana, alt. 2500′, *Stern et al. 529* (GH,MO,US). **Colombia. Chocó:** Acandí, along the Río Monomacho (tributary of the Río Guale) in the foothills of the Serranía de Darién ca. 10 km. W of Acandí, moist, muddy, and rocky riverbank, ca. 150 m. elev., *Lellinger 698* (US); Río Truando, between La Nueva and La Esperanza, *Duke 9906(2)*. **Bolívar:** Norosi-Tiquisio trail, Lands of Loba, altitude 150–600 m., *Curran 126* (F,GH,US). **Ecuador. Manabi-Esmeraldas:** vicinity of Quininde, altitude 100 m., *Holdridge 1677* (US). **Morona-Santiago:** Bomboiza, S of Gualaquiza, Misión Salesiana, 700–800 m., *Sparre 19105* (GH). **Peru. Tumbes:** Ciro Alegría, *Canchaya 5169* (GH).

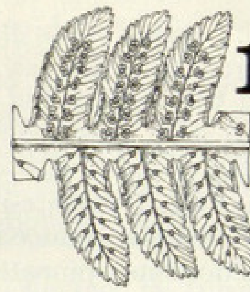
41. **Trichipteris leucolepis** (Mart.) Tryon

FIGS. 118, 119. MAP 41.

Trichipteris leucolepis (Mart.) Tryon, Contrib. Gray Herb. 200:45. 1970.
Alsophila leucolepis Mart., Icon. Plant. Crypt. Bras. 70 t. 46. 1834, *ex icone.* HOLOTYPE: ad Mariana & alibi in Prov. Minarum Generalium, Brazil, *Martius,* not seen.
Polypodium axillare Raddi, Opusc. Sci. Bol. 3:288. 1819 & Pl. Bras. 1:27 t. 41. 1825, not *P. axillare* Aiton, 1789. HOLOTYPE: in montibus, Rio de Janeiro, Brazil, *Raddi,* FI not seen. ISOTYPES: B! P!
Alsophila axillaris (Raddi) Moore, Ind. Fil. 48. 1857.

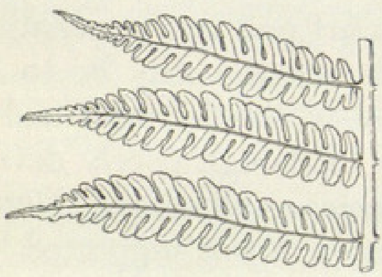
114



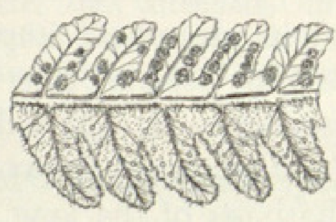


115

116

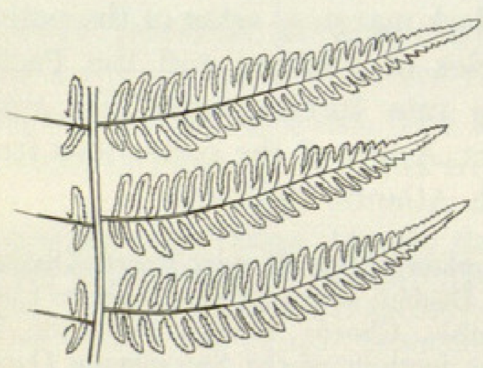


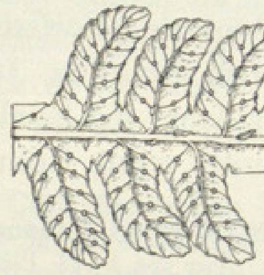
117

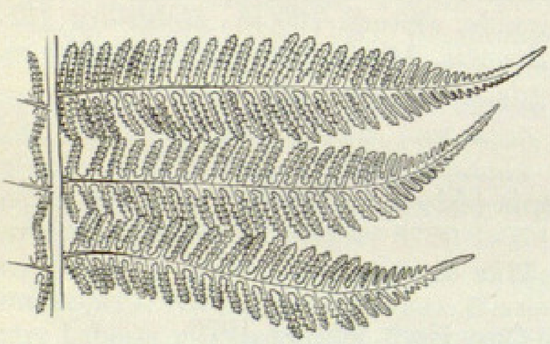


118

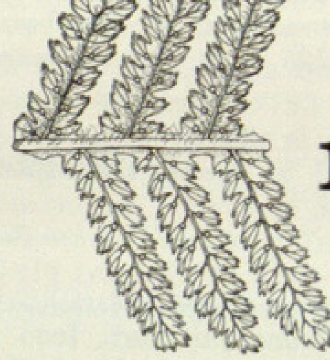
119







121



120

Alsophila glumacea Fée, Crypt. Vasc. Brés. 1:170, t. 61 f. 2. 1869. HOLOTYPE: Brasilia fluminensi, *Glaziou 2290*, P! (Herb. Cosson).
Alsophila nigrescens Fée, Crypt. Vasc. Brés. 1:170, t. 54 f. 1. 1869. HOLOTYPE: Brasilia fluminensi, *Glaziou 2289*, P! (Herb. Cosson). ISOTYPE: P!
Alsophila pectinata Fée, Crypt. Vasc. Brés. 1:168, t. 60 f. 1. 1869. HOLOTYPE: circa Tijuca, *Glaziou 1704*, P! (Herb. Cosson). ISOTYPE: P!
Alsophila fumata Hook., Sp. Fil. 1:42. 1844. *nom. nud.* in syn.
Alsophila fumata Salomon, Nom. Gefässkrypt. 28. 1883. *nom. nud.*
Cyathea leucofolis Domin, Pteridophyta 262. 1929, *nom. nov.* for *Alsophila leucolepis* Mart., 1834, not *Cyathea leucolepis* Mett., 1863.
Cyathea albidopaleata Copel., Univ. Calif. Publ. Bot. 17:25 t. 2. 1932. HOLOTYPE: Viçosa, Corriga Reberró, *Mexia 4868*, MICH or UC not seen. ISOTYPES: F! GH! MO! PARATYPE: same locality, *Mexia 4893*, MICH or UC not seen. ISOPARATYPES: F! GH! MO! US!
Alsophila albidopaleata (Copel.) C. Chr., Ind. Fil. Suppl. 3:20. 1934.
Trichipteris albidopaleata (Copel.) Tryon, Contrib. Gray Herb. 200:44. 1970.

Stem ca. 1.0 m. tall. *Petiole* to 1.0 m. long, fuscous to stramineous, aculeate; scales uniformly cretaceous to fulvous or cretaceous with a central, fuscous streak; scurf of sparse trichomidia or absent; all axes of lamina with trichomidia; costae and costules with flattish to bullate, cretaceous squamulae; pinna-rachises with cretaceous scales. *Lamina* to 2 m. long, 2-pinnate-pinnatifid, chartaceous, apex gradually reduced and acute to long-acuminate; pinnae stalked to long-stalked; pinnules short-petiolulate, deeply pinnatifid to pinnatisect, base truncate, apex attenuate, tip crenulate; lobes rotund to acute, serrate at least at the tip to crenulate; fertile veins forked at the sori or simple, sterile veins forked or simple. *Sori* medial; paraphyses much shorter than the sporangia, receptacle puberulent.

Trichipteris leucolepis is a Brazilian species characterized by cretaceous petiole scales and serrate pinnule lobes. The costae bear cretaceous, bullate squamulae. Morphologically the species is isolated in the genus. The combination of short paraphyses and cretaceous petiole scales is unique. *Trichipteris leucolepis* occasionally has petiole scales with an indistinct, fulvous streak, but the scales are predominantly cretaceous. There is some variation in the serration of the segments as well. *Trichipteris leucolepis* grows in original forests along the Serra do Mar in southern Brazil from 40 to 1000 meters in altitude.

SELECTED COLLECTIONS. **Brazil. Espírito Santo:** Santo Jatiboca, Mun. de Itaguassú, *Brade & Apparicio 18244* (MO,NY). **São Paulo:** Morro das Pedras, Iguape, *Brade 7722* (NY); Serra do Mar, 1000 m., 1908, *Wacket* (MO,NY). **Rio de Janeiro:** *Regnell 2154* (NY); *Glaziou 3583* (US). **Paraná:** Serra da Prata, *Dusén 15331* (GH); Tacarehý, *Dusén 17115* (F,GH,MO,NY).

42. Trichipteris mexicana (Mart.) Tryon

FIGS. 120, 121. MAP 42.

Trichipteris mexicana (Mart.) Tryon, Contrib. Gray Herb. 200:44. 1970.
Alsophila mexicana Mart., Icon. Plant. Crypt. Bras. 70 t. 45. 1834. HOLOTYPE: San

FIGS. 114–121. FIGS. 114 & 115, *Trichipteris costaricensis:* 114, three central pinnules from a central pinna, × 1/3; 115, central part of a pinnule, × 4/3 (both *Skutch 1340*, GH). FIGS. 116 & 117, *T. pilosissima:* 116, three pinnules from a central pinna, × 1/3 (*Canchaya 5169*, GH); 117, central part of a pinnule, × 1 (*Curran 126*, GH). FIGS. 118 & 119, *T. leucolepis:* 118, three central pinnules from a central pinna, × 1/3; 119, central part of a pinnule, × 4/3 (both *Mexia 4893*, GH). FIGS. 120 & 121, *T. mexicana:* 120, three central pinnules from a central pinna, × 1/3; 121, central part of a pinnule, × 4/3 (both *von Türchkheim 1655*, GH).

Pablo de Teoxomulco, Oaxaca, Mexico, *Karwinski*, not seen. ISOTYPE: fragment ex P (Herb. Jeanpert), F!

Alsophila Godmani Hook., Syn. Fil. 1:36. 1866. HOLOTYPE: Cobán, Guatemala, *Salvin & Godman*, seen by Tryon at K and said to be synonymous with *T. mexicana*.

Cyathea valdecrenata Domin, Pteridophyta 263. 1929. *nom. nov.* for *Alsophila mexicana* Mart., 1834, not *Cyathea mexicana* Schlecht. & Cham., 1930.

Stem to 10 m. tall. *Petiole* ca. 1.0 m. long, fuscous or more commonly fulvous to stramineous, tuberculate to muricate; scales uniformly cretaceous or with a darker central streak; scurf of cretaceous trichomidia and fulvous squamulae; trichomes present; axes of lamina with similar indument, the scales lacking from the costae, costules, and veins; costules and veins sometimes glabrous. *Lamina* 1.0–2.0 m. long, 2-pinnate-pinnatifid, chartaceous, apex gradually reduced and acuminate; pinnae sessile to stalked; pinnules sessile, pinnatisect, base truncate, apex attenuate, tip crenulate; lobes acute, crenulate to pinnatisect; fertile veins forked at the sori or the basal veins of a fertile lobe simple, sterile veins forked. *Sori* inframedial; paraphyses longer than the sporangia, receptacle villous.

Trichipteris mexicana has distinctive, broad, flabellate, cretaceous petiole scales that extend upward along the rachis. The petiole and leaf-blade bear stiff trichomes throughout. On the basis of the petiole scales, trichomes, and leaf architecture *T. mexicana* is closely related to species of the group of *T. armata*. *Trichipteris mexicana* varies in the dissection of the pinnules and in the color of the petiole scales. The variation typical of the species is often visible in a single collection. *Trichipteris mexicana* has been found from Mexico to Honduras in wet forests and cloud forests, especially along watercourses, from 800 to 3000 meters.

SELECTED COLLECTIONS. **Mexico. Chiapas:** Sierra de Soconusco, from El Triunfo to Finca Liquidambar, *Hernandez X. & Sharp X–462* (US); Acacoyagua, *Matuda 17435* (F). **Guatemala. Alta Verapaz:** Quebradas Secas, *Johnson 956* (F,GH,NY); Pansamalaná, *Tuerckheim 1007* (GH,NY, fragment ex K,NY,US). **Huehuetenango:** vicinity of Maxbal, 17 mi. N of Barillas, Sierra de los Cuchumatanes, *Steyermark 48857* (F,GH,US). **Quezaltenango:** El Pocito, S of San Martín Chile Verde, road to Colomba, *Standley 84971* (F,US). **San Marcos:** Barranco Eminencia, road between San Marcos & San Rafael Pie de la Cuesta, *Standley 86460* (F,US); between San Rafael at NE portion of Volcán Tacaná and Guatemala–Mexico line, Río Vega, *Steyermark 36295* (F,US). **Honduras. Comayagua:** above El Achote and the plains of Siguatepeque, *Yuncker, Dawson & Youse 6015* (F,GH,MO,NY,US). **Morazán:** region of Agua Amarilla, above El Zamorano, *Standley, Molina & Chacon 5053* (F); above San Juancito, San Juancito Mts., *L. O. Williams 17553* (F,GH,MO,US).

The following species, which I refer to as the group of *Trichipteris armata*, are the subject of careful revisionary studies by Riba (1967 and 1969). Complete treatment of these species, then included in *Alsophila*, should be sought in these works.

43. **Trichipteris Estelae** (Riba) Tryon, Contrib. Gray Herb. 200:44. 1970. *Alsophila Estelae* Riba, Rhodora 69:67. 1967. Portland and St. Thomas Parishes, Jamaica.

44. **Trichipteris nesiotica** (Maxon) Tryon, Contrib. Gray Herb. 200:44. 1970. *Alsophila nesiotica* Maxon, Contrib. U.S. Nat. Herb. 24:43. 1922. Cocos Island, Costa Rica.

45. **Trichipteris trichiata** (Maxon) Tryon, Contrib. Gray Herb. 200:44. 1970. *Alsophila trichiata* Maxon, Contrib. U.S. Nat. Herb. 24:44. 1922.

From sea level in Costa Rica, through Panama and northern Venezuela, to 100 meters in Ecuador.

46. **Trichipteris Tryonorum** (Riba) Tryon, Contrib. Gray Herb. 200:46. 1970. *Alsophila Tryonorum* Riba, Rhodora 69:66. 1967. High mountain forests of northern Venezuela and the Andes of Colombia and Ecuador, from sea level to 2800 meters.

47. **Trichipteris scabriuscula** (Maxon) Tryon, Contrib. Gray Herb. 200:44. 1970. *Alsophila scabriuscula* Maxon, Proc. Biol. Wash. 23:125. 1919. Mexico, Guatemala, and Honduras; in the shade of humid tropical forests.

48. **Trichipteris armata** (Sw.) Tryon, Contrib. Gray Herb. 200:44. 1970. *Polypodium armatum* Sw. Prod. Veg. Ind. Occ. 134. 1788. *Alsophila Swartziana* Mart. Icon. Pl. Crypt. Brasil. 73. 1834. Jamaica and Hispaniola.

49. **Trichipteris strigillosa** (Maxon) Tryon, Contrib. Gray Herb. 200: 44. 1970. *Alsophila strigillosa* Maxon, Contrib. U.S. Nat. Herb. **24**:37. 1922. Eastern Cuba.

50. **Trichipteris hirsuta** (Presl) Tryon, Contrib. Gray Herb. 200:45. 1970. *Cyathea hirsuta* Presl, Delic. Prag. 190. 1822. *Alsophila hirsuta* (Presl) Kze. Linnaea 9:98. 1834. Minas Gerais, Rio de Janeiro, and São Paulo, Brazil.

51. **Trichipteris rufa** (Fée) Tryon, Contrib. Gray Herb. 200:46. 1970. *Alsophila rufa* Fée, Crypt. Vasc. Brés. 1:165. 1869. Minas Gerais, Rio de Janeiro, and São Paulo, Brazil.

52. **Trichipteris conjugata** (Hook.) Tryon, Contrib. Gray Herb. 200:45. 1970. *Alsophila conjugata* Hook., Syn. Fil. 37. 1866. Damp forests, ravines, creeks, and along streams; 650–2800 meters. Colombia to Bolivia.

53. **Trichipteris stipularis** (Christ) Tryon, Contrib. Gray Herb. 200:44. 1970. *Alsophila stipularis* Christ, Bull. Herb. Boiss. II, 4:958. 1904. Mountainous regions of Costa Rica and Panama, between 1000 and 2000 meters.

54. **Trichipteris pansamalana** (Maxon) Tryon, Contrib. Gray Herb. 200:44. 1970. *Alsophila pansamalana* Maxon, Contrib. U.S. Nat. Herb. **24**:40. 1922. Guatemala, 1000–2000 meters.

55. **Trichipteris bicrenata** (Liebm.) Tryon, Contrib. Gray Herb. 200: 44. 1970. *Cyathea bicrenata* Liebm. Vid. Selsk. Skr. V, 1:289. 1849. *Alsophila bicrenata* (Liebm.) Fourn. Mex. Pl. Crypt. 134. 1872. In the shade of humid tropical forest, 1000–2000 m; Mexico from Veracruz and Guerrero south to Chiapas.

NOMINA INCERTAE SEDIS

A number of names, although apparently representing species of *Trichipteris*, are based on material inadequate for critical determination and taxonomic decision.

Alsophila crassa Karst., Flora Columb. 2:187 t. 199. 1869. TYPE COLLECTION: wet, cold, montane forests, Mérida, 1859, *Engel (136)*, B! The lamina portions included in the type resemble species of *Trichipteris*. There are no modern collections that I can associate with the Engel type, which lacks petiole material.

Alsophila pinnula Christ, Prim. Flor. Costaric. 3:43. 1901. No type was cited in the original publication. Authentic material, probably that which Christ used to describe the species, is from Río La Matina (Limón), *Pittier 10267*, P! fragment ex P, NY! US! The lamina axes of this material have a distinctive tomentum of erose squamulae. Though *Pittier 10267* may represent a *Trichipteris*, lack of petiole material and modern collections makes certain assignment treacherous.

Alsophila Sodiroi Baker, Ann. Bot. **5**:149. 1891, *nom. nov.* for *Alsophila alata* Sodiro, Recensio 19. 1883, not *Alsophila alata* Fourn., Ann. Sci. Nat. V. **18**:349. 1873. SYNTYPES: Volcán Cotacachi and the forests of Los Colorados, (Prov. Pichincha) Ecuador, *Sodiro*, Herb. Sodiro not seen. AUTHENTIC MATERIAL: *Sodiro*, fragment ex K, NY! The Sodiro fragment appears to be a *Trichipteris*.

Alsophila Stübelii Hieron., Hedwigia **45**:235, t. 15 f. 7. 1906. HOLOTYPE: inter Baños & Jivaría de Pintúc in valle Río Pastaza, *Stübel 995*, B! The holotype lacks petioles and leaf apices. I have seen no additional collections comparable to the type. A small soral squamula is associated with most of the sori. The indument and lamina form are those of *Trichipteris*.

The following names may represent species of *Trichipteris*. I have not seen the types and am unable to make inferences from illustrations or text.

Cyathea chamaedendron Copel., Univ. Calif. Publ. Bot. **17**:31 t. 5. 1932. TYPE COLLECTION: Brasil, *Mexia 5855a*.

Cyathea furcinervia Domin, Acta Bot. Bohem. **9**:117. 1930, *nom. nov.* for *Alsophila polyphlebia* Domin, Kew Bull. **1929**:218. 1929 & Mem. Roy. Czech. Soc. Sci. II. **2**:96 t. 10, f. 9, 10. 1929, not *Alsophila polyphlebia* Baker, 1876. TYPE COLLECTION: Ilhios, Brasiliae, Moricand.

Alsophila flexuosa Fée, Crypt. Vasc. Brés. **1**:159. 1869. TYPE COLLECTION: circa Saint-Paul, Brasil, without collector.

Alsophila latisecta Christ, Bull. Boiss. II. **6**:185. 1906. TYPE COLLECTION: valle del Río Navarro, (Prov. Cartago) Costa Rica, *Wercklé 16767*. (Described from sterile material.)

Alsophila monosticha Christ, Bull. Soc. Bot. Belg. **33**(2):94. 1894. TYPE COLLECTION: British Guiana, 1889, *Goebel*.

Alsophila mucronata Christ, Bull. Soc. Bot. Belg. **35**:178. 1896. TYPE COLLECTION: Costa Rica, *Pittier 7484*. A specimen of *Pittier 7484* at US is *Nephelea polystichoides* (Christ) Tryon according to Lellinger (pers. comm.).

Alsophila ramisora Domin, Mem. Roy. Czech. Soc. Sci. II, **2**:97, t. 10. f. 11, 12. 1929. TYPE COLLECTION: Demerara, Guyana, *Parker*.

Alsophila Sprengeliana Mart., Icon. Plant. Crypt. Bras. 75. 1834. TYPE COLLECTION: in Dominicae & Guadeloupe insulis, *Bertero*.

The following names of uncertain identity include *nomina nuda* and names, mostly from the horticultural literature, impossible to associate with a type collection.

Trichipteris Aberti Anon., Hort. Rev. Belg. **1905**:275, *nom. hort.*

Disphenia aculeata Presl, Tent. Pterid. 56. 1836, *nom. nud.*

Alsophila aculeata Hook., Sp. Fil. **1**:49. 1844, *nom. nud.*

Alsophila acuminata J. Sm., Journ. Bot. (Hook.) **1**:667. 1842, *nom. nud.*

Alsophila adspersa Kze., Bot. Zeit. **1844**:314, *nom. nud.*

Alsophila alata Fée, Mém. Fam. Foug. **5** (Genera Filicum):346. 1850–1852, *nom. nud.*

Alsophila alutacea Kze., Bot. Zeit. **1844**:327, *nom. nud.*

Alsophila amazonica Linden, Cat. 1871, *nom. hort.*

Alsophila arbuscula Presl, Tent. Pterid. 61. 1836, *nom. nud.* applied to some collections of *Trichipteris dichromatolepis* (Fée) Tryon.

Alsophila articulata Moore & Houlst., Gard. Mag. Bot. 3:332, f. 81. 1852, *nom. hort.*

Hemitelia atrovirens Trevisan, Atti Ist. Veneto II, **2**:164. 1851, *nom. nud.*

Alsophila brevis J. Sm., Journ. Bot. (Hook.) **1**:667. 1842, *nom. nud.*

Alsophila crenata Kze., Bot. Zeit. **1844**:312, *nom. nud.* in syn. applied to some collections of *T. corcovadensis* (Raddi) Copel.

Alsophila crenata Fée, Crypt. Vasc. Brés. **1**:175. 1869, *nom. nud.* applied to some collections of *T. corcovadensis* (Raddi) Copel.

Trichipteris denticulata Presl, Tent. Pterid. 59. 1836, *nom. nud.*

Alsophila echinata Moore, Ind. Fil. cv. 1857, *nom. nud.* applied to some collections of *T. procera* (Willd.) Tryon.
Alsophila humilis J. Sm., Journ. Bot. (Hook.) **1**:667. 1842, *nom. nud.*
Alsophila latebrosa J. Sm., Journ. Bot. (Hook.) **1**:667. 1842, *nom. nud.*
Alsophila lepifera J. Sm., Journ. Bot. (Hook.) **1**:667. 1842, *nom. nud.*
Alsophila Marshalliana Linden, Gard. Chron. III, **15**:663. 1894, *nom. hort.*
Alsophila mollissima Kze., Bot. Zeit. **1844**:328, *nom. nud.*
Alsophila munita Presl, Tent. Pterid. 62. 1836, *nom. nud.*
Alsophila nitens J. Sm., Journ. Bot. (Hook.) **1**:667. 1842, *nom. nud.* applied to older collections of *T. procera* (Willd.) Tryon.
Alsophila serrata J. Sm., Journ. Bot. (Hook.) **1**:667. 1842, *nom. nud.*
Alsophila tomentosa Presl, Tent. Pterid. 62. 1836, *nom. nud.*

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LIST OF SPECIES

1. Trichipteris procera (Willd.) Tryon; **2.** T. Dombeyi (Desv.) Barr.; **3.** T. decomposita (Karst.) Tryon; **4.** T. cordata (Kl.) Tryon; **5.** T. sagittifolia (Hook.) Tryon; **6.** T. Steyermarkii Tryon; **7.** T. falcata (Kuhn) Barr.; **8.** T. ursina (Maxon) Tryon; **9.** T. phalaenolepis (C. Chr.) Tryon; **10.** T. Williamsii (Maxon) Tryon; **11.** T. microphylla (Kl.) Tryon; **12.** Trichipteris Schiedeana (Presl) Tryon; **13.** T. aspera (L.) Tryon; **14.** T. gibbosa (Kl.) Barr.; **15.** T. nigripes (C. Chr.) Barr.; **15a.** var. nigripes; **15b.** var. brunnescens Barr.; **16.** T. Kalbreyeri (Baker) Tryon; **17.** T. Schlimii (Kuhn) Barr.; **18.** T. Wendlandii (Kuhn) Tryon; **19.** T. nigra (Mart.) Tryon; **20.** T. pauciflora (Kuhn) Tryon; **21.** T. frigida (Karst.) Tryon; **22.** T. pubescens (Baker) Tryon; **23.** T. phegopteroides (Hook.) Tryon; **24.** T. latevagans (Baker) Tryon; **25.** T. Hodgeana (Proctor) Tryon; **26.** T. microdonta (Desv.) Tryon; **27.** T. Lechleri (Mett.) Tryon; **28.** T. villosa (Willd.) Tryon; **29.** T. atrovirens (Langsd. & Fisch.) Tryon; **30.** T. phalerata (Mart.) Barr.; **30a.** var. phalerata; **30b.** var. Iheringii (Rosenst.) Barr.; **31.** T. Gardneri (Hook.) Tryon; **32.** T. dichromatolepis (Fée) Tryon; **33.** T. corcovadensis (Raddi) Copel.; **34.** T. praecincta (Kze.) Tryon; **35.** T. borinquena (Maxon) Tryon; **36.** T. demissa (Morton) Tryon; **36a.** var. demissa; **36b.** var. thysanolepis Barr.; **37.** T. Cyclodium Tryon; **38.** T. nanna Barr.; **39.** T. costaricensis (Kuhn) Barr.; **40.** T. pilosissima (Baker) Barr.; **41.** T. leucolepis (Mart.) Tryon; **42.** T. mexicana (Mart.) Tryon; **43.** T. Estelae (Riba) Tryon; **44.** T. nesiotica (Maxon) Tryon; **45.** T. trichiata (Maxon) Tryon; **46.** T. Tryonorum (Riba) Tryon; **47.** T. scabriuscula (Maxon) Tryon; **48.** Trichipteris armata (Sw.) Tryon; **49.** T. strigillosa (Maxon) Tryon; **50.** T. hirsuta (Presl) Tryon; **51.** T. rufa (Fée) Tryon; **52.** T. conjugata (Hook.) Tryon; **53.** T. stipularis (Christ) Tryon; **54.** T. pansamalana (Maxon) Tryon; **55.** T. bicrenata (Liebm.) Tryon.

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