

THE NEW WORLD SPECIES OF TRICHOMANES SECT. DIDYMOGLOSSUM AND MICROGONIUM

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INTRODUCTION

From the many misidentifications in herbaria and the contradictions between the descriptions of many authors it became evident that the species of *Trichomanes* included by Desvaux, Presl, van den Bosch and Copeland under the generic name *Didymoglossum* and those included by Presl, van den Bosch and Copeland under the name *Microgonium* were particularly poorly understood. A complete revision of this group has never been undertaken. LINDMAN's paper (1903) is incomplete, being based only on the study of about 30 herbarium sheets; moreover, his conclusions are based on misinterpretation of several species. The treatments in local floras, as, e.g. STURM's (1859) and MAXON's (1926) are very good, but only a small number of species are involved.

The name *Didymoglossum* was used for the first time by DESVAUX (1827); it was taken up by PRESL (1843), and COPELAND (1938), all on the generic level. *Microgonium* was established as a genus by PRESL (1843). VAN DEN BOSCH (1861) and COPELAND (1938) maintained it as a separate genus.

Didymoglossum may be characterized as follows:

Small-sized epiphytic ferns. Rhizome slender, filiform, wide-creeping, densely brown- to black-radiculose; fronds sessile or stipitate; stipes also covered with rhizoids; lamina very variable, bipinnatifid, pinnatifid or often entire; margin ciliate with simple, geminate, or stellate hairs; venation pinnate or flabellate with many longitudinal spurious veinlets, often non-connected in the leaf-tissue; sori few to several, marginal in the distal part of the frond; involucre with a more or less funnel-shaped tube and two distinct lips; lips usually with a border of dark cells; receptacle eventually exerted. Type species: *Trichomanes muscoides* Sw. = *Trichomanes hymenoides* Hedw.

Microgonium ranks very near to *Didymoglossum* and has been confused many times with it. Differences are found in the margin and involucre. The margin of *Microgonium* fronds is hairless and there is a "marginal vein", i.e. a spurious veinlet parallel to the margin,

which connects the radially arranged veins. In *Didymoglossum* there is never a "marginal vein" and the margin is always ciliate. The involucre in *Microgonium* is wholly immersed and without lips; the border of dark cells is also wanting. Type species: *Trichomanes cuspidatum* Willd.

Species of *Didymoglossum* and *Microgonium*, as mentioned above, have often been confused. New species have even been illustrated as having simultaneously a "marginal vein" and stellate hairs. This certainly does not occur; the error is probably due to a mixed collection resulting in a "mixed" illustration. Collections consisting of tufts of species from both groups growing completely intermingled do occur; in such cases it is often very difficult to distinguish the separate rhizomes among the densely matted rhizoids.

The question whether *Didymoglossum* and *Microgonium* should be treated as genera or not will not be discussed in the following. Having studied only the New World species of two sections, the author does not feel competent to reach a conclusion on this much discussed problem. In the present study the genus *Trichomanes* is treated in its conservative, inclusive circumscription and *Didymoglossum* and *Microgonium* are regarded as sections, following LINDMAN (1903) for *Didymoglossum* and PRANTL (1875) for *Microgonium*, but the latter treated it as a section of the genus *Hemiphlebium*. Usually *Didymoglossum* and *Microgonium* are combined in one section, *Hemiphlebium* (type species: *Trichomanes pusillum* Sw.), within the genus *Trichomanes*.

MORPHOLOGY AND ANATOMY

There is no recent publication dealing with the morphology and anatomy of the *Hymenophyllaceae* in general. Very detailed, but now partly antiquated accounts were given by PRESL (1848), METTENIUS (1865), and PRANTL (1875).

The observations on morphology reported here have been based on slides made of whole, unstained fronds. The fronds were boiled in water, immersed during 25 hours in gradually more concentrated aqueous glycerine solutions and mounted in glycerine-jelly. To study the venation, the leaves were cleared in dilute KOH and stained with safranin. The anatomical observations have been based on sections prepared from herbarium specimens and from material of *Trichomanes punctatum* from Suriname, kindly fixed in F.A.A. in the field by Dr. K. U. Kramer. The sections were prepared by hand with a razor-blade on a substrate of elder-pith; some were made with the help of a microtome, but this resulted in many damaged sections, because the blade tends to tear out the silicified elements. Better results were obtained by sectioning leaves desilicified after SASS (1958). The fresh material, fixed in F.A.A., is transferred directly from F.A.A. to hydrofluoric acid diluted with twice its volume of 95 % alcohol. After 24 hours it is washed with five changes at at least four-hour intervals in 50 % alcohol and simultaneously stained with safranin.

The rhizome

The slender thread-like wide-creeping rhizomes have a very primitive anatomical structure (Fig. 1). Approximately central in the rhizome a few (1–5) tracheids are present, surrounded by a layer of phloem which in its turn is surrounded by 4–6 layers of parenchymatous cortex-cells. The outermost layer of this cortex is sclerenchymatous, consisting of rather small cells with dark brown walls. The peripheral layer of irregular, more or less vesicular cells, which constitutes the epidermis of the rhizome, bears the dark brown to black rhizoids. These are long papillose outgrowths—simple, or rarely forked at the end—of the epidermal cells with only a single cross-wall. Such rhizoids are also present on the stipe and often on the costa and the lower surface of the fronds. Roots are wanting in all species.

The petiole

The length of the petiole varies much; especially in young leaves it may be virtually absent, but in well-developed fronds it is much

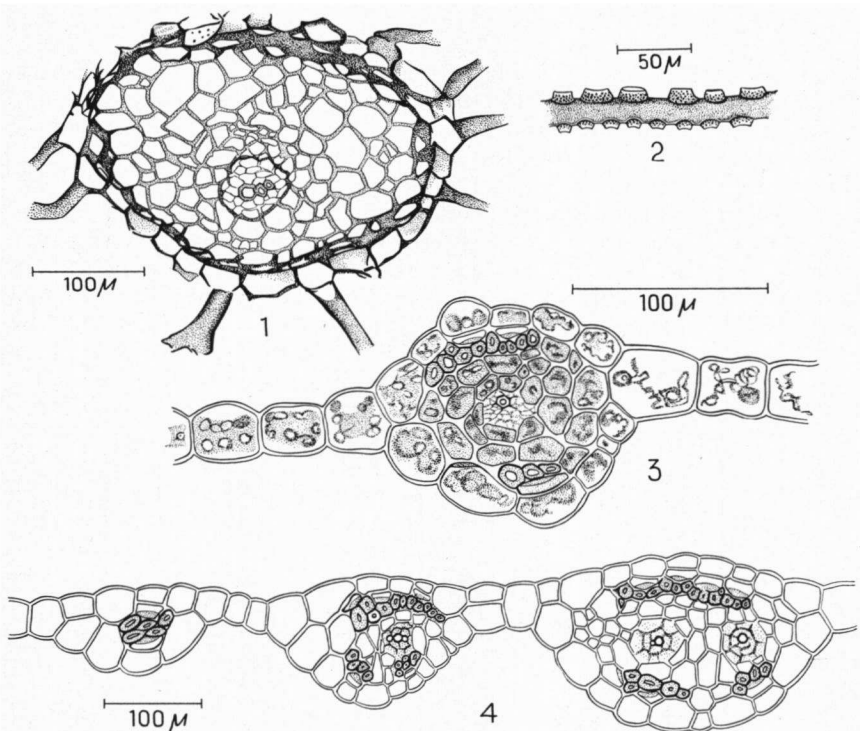


Fig. 1. *Trichomanes krausii* (Proctor 11592); cross-section of a rhizome. — Fig. 2. *Trichomanes curtii* (Brade 398a); sclereid with the silicified swellings of the stigmata in a cleared frond, cellwalls invisible. — Fig. 3. *Trichomanes krausii* (Proctor 11592); cross-section of a true vein. — Fig. 4. *Trichomanes lineolatum* (Wright 952); cross-section of two true veins and one spuriously veinlet (left).

longer, sometimes as long as the blade, e.g. in *T. petersii*. The stipe is usually densely covered with rhizoids, as is the rhizome. In many species the upper part is winged by the long-decurrent and gradually narrowed leaf-base. The anatomy is in close agreement with the rhizome, but at the outer side of the cortex groups of sclereids are present and between this sclerenchymatous sheet and the epidermis silicified elements, peculiar to the family, are found: tapetal cells, first described by Mettenius as "Deckzellen" or stegmata. These tapetal cells are thickened and silicified at the wall bordering the sclereids in a very characteristic way (Fig. 2). A swelling occupies only the central part of the inner wall. These swellings are more or less horseshoe-shaped and granulated, concave in the centre; the margin is the thickest. They can be separated by maceration, but are fire-resistant, insoluble in acetic acid and hydrochloric acid, soluble in hydrofluoric acid, but only partly, the cellulose not being affected. After this treatment the swellings are no longer fire-resistant. In whole stained fronds these stegmata can be observed as strands of regular cubic cells.

The lamina

The lamina is very variable in shape and size, not only in the different species, but also within the same tuft, and then the extremes may be taken easily for distinct species. The fronds are entire, crenate, lobed, or (bi-)pinnatifid. The venation shows also much variation. The simplest condition is seen in fertile fronds of *T. nummularium*: only a single costa without any side-veins. In many cases the venation is flabellate with more or less crowded, repeatedly forked veins. Larger pinnatifid species as e.g. *T. krausii* and *T. gourlianum* have a pinnate venation with a distinct costa and dichotomously branched sideveins. In *Microgonium* the endings of the veins are connected by a marginal false vein. This vein runs unbroken or with considerable gaps parallel to the margin, just at the inner side of the outermost row of leaf-tissue cells. The false veinlets in *T. godmanii* form a true network.

The anatomy of the veins (Fig. 3, 4) is quite similar to that of the stipe: a few spiral tracheids surrounded with phloem, one to three cell-layers of the parenchymatous cortex with at the upper and under side a sheet of sclereids. The sclereids are bordered by strands of silicified stegmata and an epidermis. In none of the true veins there are more than two or three tracheids present; there is no correlation between the number of tracheids present in cross-section and the thickness of the vein nor the place in the leaf. Beside veins with this normal structure false veinlets occur. These are arranged like true veins or unconnected, wholly free in the leaf-tissue. They represent strands of sclereids and stegmata, covered with an epidermis and always without a stele. It is theoretically possible to distinguish three types of spurious veins:

1. only sclereids present,

2. sclereids present, which are covered with stigmata,
3. only stigmata present.

In all specimens studied the type mentioned under two was met: a central strand of sclereids with at the upper and under side a row of stigmata covered with an epidermis. These false veinlets function as supporting tissue and are arranged in a pattern characteristic for the species; e.g. in *T. lineolatum* they diverge towards the margin, in *T. pinnatinervium* and *T. angustifrons* they are parallel, in *T. godmanii* reticulate, in *T. reptans* and *T. melanopus* partly non-connected and very short. The lamina is, except of course in the veins and spurious veinlets, only a single cell-layer thick. The side walls, perpendicular to the leaf-plane, are more or less thickened and thicker than the free walls. These swellings are especially present at the meeting-points of cells. In the cells many granules can be observed; in recently collected specimens these can be seen to contain chlorophyll, but in older material it has disappeared through discoloration.

The development of the frond is very peculiar and unexpected, not with a single growing-point or initial cell, but with a large border of meristematic tissue along the whole margin of the blade or at least the apical part (Fig. 5). In *Microgonium* these dividing cells are situated immediately behind the outermost series of cells (Fig. 6). This last-mentioned row of cells seems to be excluded from the general division. These cells are much larger than the underlying meristematic ones and approximately equal to the cells of the full-grown fronds; only a tangential division is observed. In species of sect. *Didymoglossum* full-grown marginal hairs are already present in very early stages of leaf-development, as are the marginal "veins" in *Microgonium*. The veins and spurious veinlets seem to be formed in the meristematic zone in the same way as the medulla rays by the cambium in the xylem of Angiosperms, but it seems that occasionally strands of sclereids and stigmata are formed secondarily between the cells of the leaf-tissue in young full-grown leaves. Mettenius has described this very strange mechanism, but the present writer has been unable to confirm it with absolute certainty.

The description and diagrams given by Prantl of the development of the fronds and the ramifications of the veins with a single initial cell which divides with a tangential and a radial wall in one inner and two marginal cells, summarized as a division, only apply to very young leaf-primordia; as soon as the frond has some extension the growth occurs in all directions in the upper part, as described above.

Dermal appendages

The fronds are sometimes densely covered on the lower surface with rhizoids. This, however, is not found in all species, and even where it occurs, it does not occur in all specimens. These rhizoids are usually present in *T. nummularium*, *T. pinnatinervium*, *T. gourlianum*, and occasionally in *T. kapplerianum*.

In *Didymoglossum* the margin is ciliate with simple, geminate or

stellate hairs. These hairs originate in a marginal cell (Fig. 23b) or, in the case of geminate and stellate hairs, in a cluster of marginal cells (Fig. 7). For this reason, the stellate hairs are not true hairs,

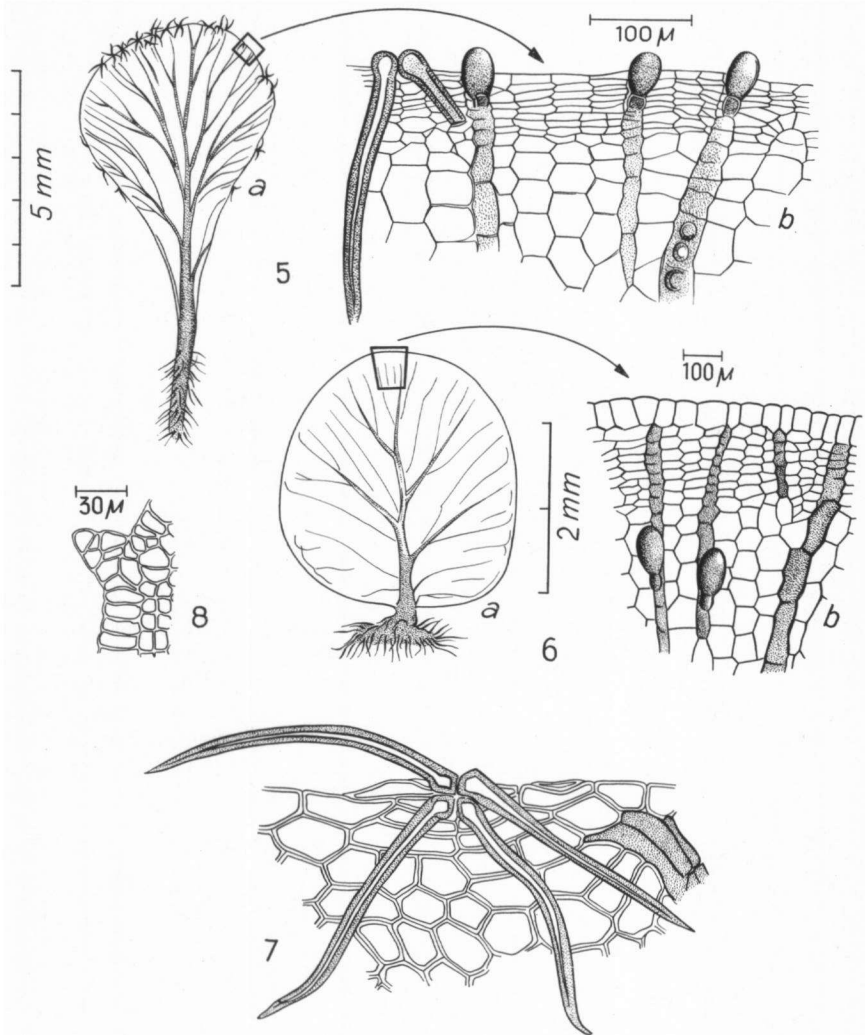


Fig. 5. *Trichomanes punctatum* ssp. *floridanum* (Small s.n.); a young frond, b the border of meristematic cells. - Fig. 6. *Trichomanes kapplerianum* (Tutin 367); a young frond, b the border of meristematic tissue, situated behind a series of cells excluded from the general division. - Fig. 7. *Trichomanes lineolatum* (Ekman H 12573); papillose outgrowths of a cluster of marginal cells forming a stellate hair. - Fig. 8. *Trichomanes punctatum* ssp. *floridanum* (Small 7422); cluster of marginal cells on a leaf-primordium which give off the protuberances, forming the stellate hairs.

but the papillose outgrowths of several cells together (Fig. 8). Each of these cells bears an undivided protuberance. The number, length and thickness of the rays is characteristic for the species.

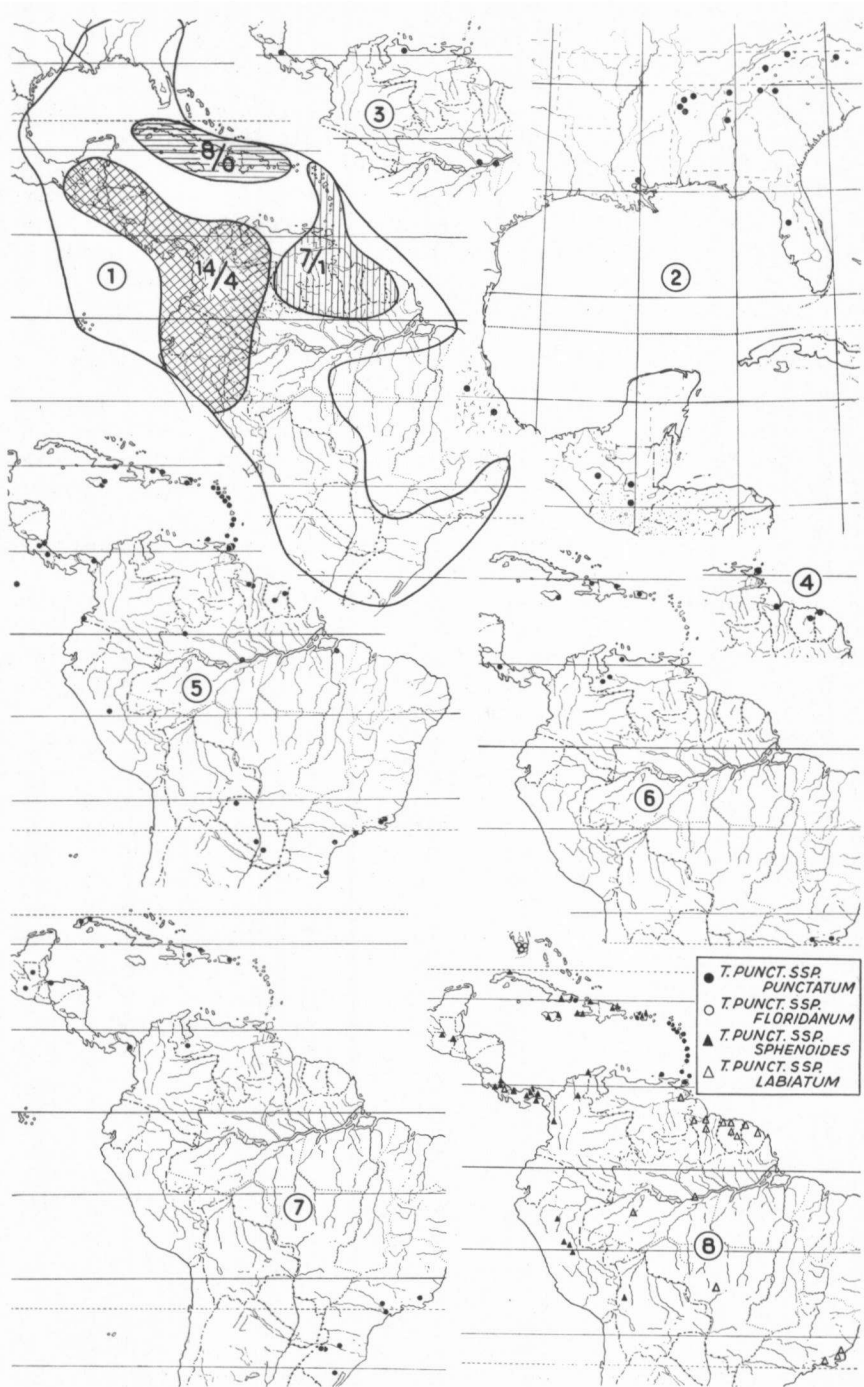
Another kind of hairs will be found by very close inspection with a high-power magnifying-glass, namely two-celled glandular hairs. They are most readily seen in young fronds on the lower surface along the veins and on the involucre and consist of a small stalk-cell and a larger cylindrical top-cell.

The sorus

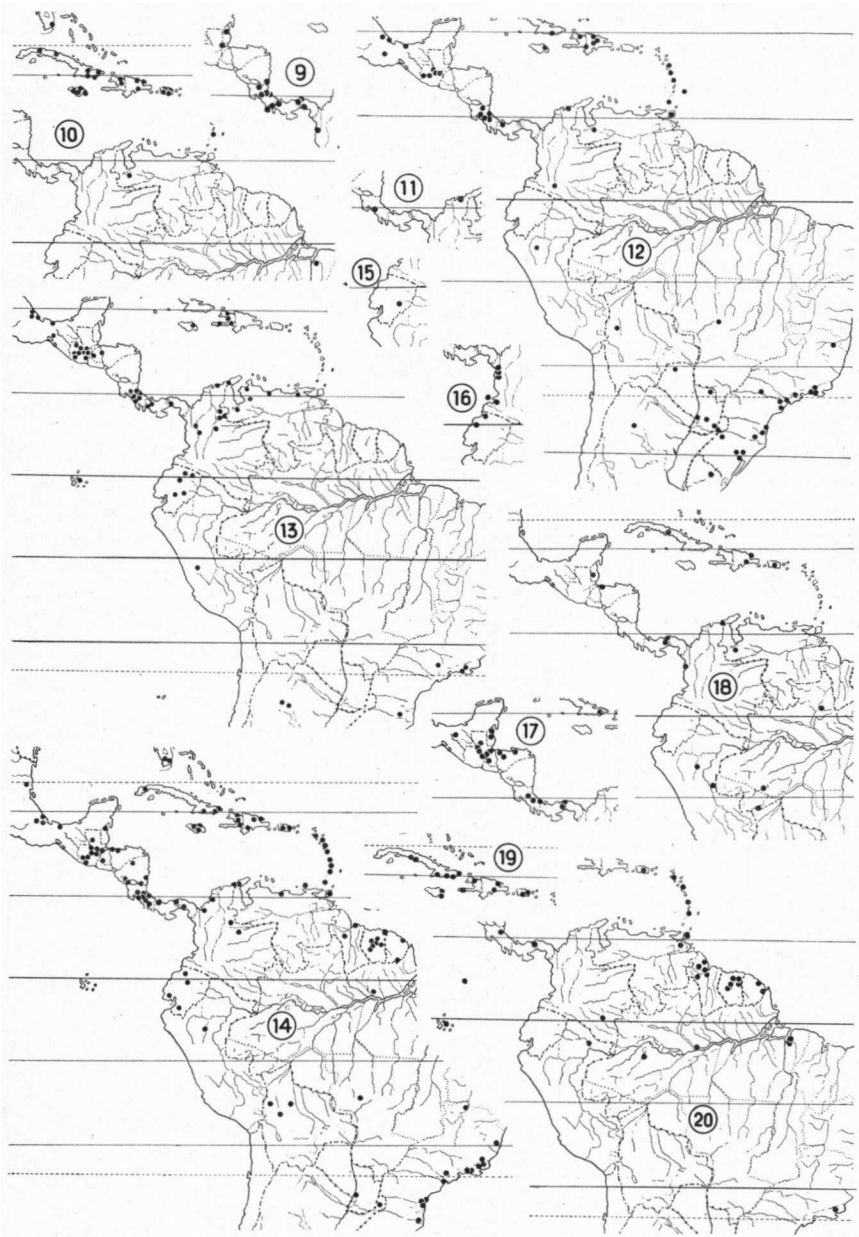
The sori are borne terminally on the veins. The vein is terminated by a columella or receptacle on which the sporangia are borne. The sporangia are arranged in a spiral on the receptacle. They are sessile, biconvex discs with a percurrent oblique annulus with a weakly differentiated stomium. Paraphyses are always wanting. The columella is the continuation of the soriferous vein as is the surrounding tubular involucre. When young the receptacle grows indefinitely at the base and the sporangia develop from the top towards the base; when older, growth stops and the sporangia drop, so that a long and naked receptacle exceeds the involucre. The central part of the soriferous vein, i.e. the tracheids, phloem, and parenchyma, runs into the columella, but the sclereids and stegmata separate and dilate into the more or less funnel-shaped tubular involucre. The parenchyma of the veins increases considerably at the transition into the columella. The sclereids and stegmata are equally distributed in the indusia of *Didymoglossum*; in the sect. *Microgonium* they are assembled into spurious veinlets which are easily distinguished in unstained fronds with the help of a high-power magnifying-glass. To the right and left of the sorus in both *Didymoglossum* and *Microgonium*, at the border of indusium and lamina, two true veins are present; the crurae according to Mettenius's terminology. These crurae are wanting if the involucre is quite exerted and wholly free or only narrowly winged. Sometimes, but rather rarely, in cleared and stained sori tracheal elements may be seen in the involucre; therefore, true veins must occasionally also be present.

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY

Didymoglossum and *Microgonium* are pantropical sections, with a few species occurring outside the tropics. In the New World they are distributed from south-western Mexico, Cuba and Florida in the North to Bolivia, Paraguay, north-eastern Argentina and Uruguay in the South. In the south-eastern part of the United States occurs a very peculiar species: *T. petersii*, also known from the states of Vera Cruz (Huatusco) and Chiapas in Mexico and Guatemala. Six of the species occurring in the New World can be called widespread, namely, *T. angustifrons*, *T. ovale*, *T. punctatum*, *T. hymenoides*, *T. krausii*, and *T. reptans*. The others are more or less restricted in their range.



Map 1. Distribution of *Trichomanes* section *Didymoglossum* in the New World. Cross-hatched lines primary centre of species concentration with 14 species of which 4 endemic; horizontal lines secondary centre with 8 species and vertical lines secondary centre with 7 species of which 1 endemic. — Map 2. Distribution of *Trichomanes petersii*. — Map 3. *T. nummularium*. — Map 4. *T. pinnatinervium*. — Map 5. *T. angustifrons*. — Map 6. *T. pusillum*. — Map 7. *T. ovale*. — Map 8. *T. punctatum*.



Map 9. *T. curtii*. - Map 10. *T. lineolatum*. - Map 11. *T. rhipidophyllum*. - Map 12. *T. hymenoides*. - Map 13. *T. reptans*. - Map 14. *T. krausii*. - Map 15. *T. melanopus*. - Map 16. *T. gourlianum*. - Map 17. *T. godmanii*. - Map 18. *T. ekmanii*. - Map 19. *T. hookeri*. - Map 20. *T. kapplerianum*.

A few, often very peculiar species are only known from one to very few collections and usually from rather small areas. The centre of species-concentration is in Central America and the Andes in the adjacent part of north-western South America (map 1). From the states of Vera Cruz, Tabasco and Chiapas in Mexico to Panama 11 species of *Didymoglossum* and 3 of *Microgonium* are known; only *T. godmanii* is endemic. Many of these are also found in the mountains of north-western South America; Sierra Nevada de Santa Marta, Cordillera de Mérida, and the Andes of Colombia, Ecuador, and Peru. Of the 15 *Didymoglossum* species recognized in this paper 14 are present throughout this centre; 4 of them are endemic, namely, *T. curtii*, *T. rhipidophyllum*, *T. melanopus*, *T. gourlianum*, and the already mentioned *T. (Microgonium) godmanii*; 6 are widespread, and 4 are known by a single or a few records and have their main distribution elsewhere. The Greater Antilles may be called a secondary centre with 8 species, without endemics, but two have their main distribution there. Another secondary centre is situated in the Lesser Antilles and the Guiana shield from south-eastern Colombia to French Guiana and northern Brazil; here 7 species are found, 1 of them, *T. pinnatinervium*, is endemic, besides the subspecies *T. punctatum* ssp. *punctatum*. Four species and 1 subspecies known from the Greater Antilles do not occur on the Lesser Antilles and the Guiana shield, and of *T. lineolatum*, also a species from the Greater Antilles, only a small fragment is known, said to have been collected in St. Vincent. Two species from the Lesser Antilles and Guiana are wanting in the Greater Antilles. Two *Microgonium* species are also present here, of which 1 is endemic in the Greater Antilles; a different species of this section is the only one recorded from the Lesser Antilles. Puerto Rico seems to be the transition between the two secondary centres. A last region with a high record rate is in the southern part of Brazil, Uruguay, Paraguay, and northern Argentina, with 7 *Didymoglossum* species and 1 *Microgonium* species, but somewhat surprisingly, none of them is endemic to this region. All these species, except for *T. pusillum* and *T. kapplerianum*, are widespread and seem to be able to maintain themselves by a rather broad ecological amplitude. They extend from northern South America along the Andes, across Bolivia and Paraguay into south-eastern Brazil. In the interior part of the Brazilian shield *Didymoglossum* and *Microgonium* are wanting or extremely rare, but perhaps more intense collecting will reveal the presence of some species.

Most species inhabit moist dense forests at lower and middle elevations. They are epiphytic or growing on moss-covered rocks, but always in dense shade. *T. petersii* in the south-eastern United States is reported to grow on densely shaded and wet sandstone rocks, except for Florida, where it grows on limestone rocks, and for Louisiana, where it is epiphytic, as in Mexico and Guatemala. In general *Didymoglossum* and *Microgonium* seem to be epiphytic in very wet and moist places. *T. lineolatum*, mainly known from the Greater Antilles, has always been collected on limestone rocks.

TAXONOMY

The present revision is based on the study of about 2500 herbarium sheets, consisting of the material from the following herbaria:

- B Botanisches Museum, Berlin-Dahlem, Germany.
 Ed Royal Botanic Garden, Edinburgh, Scotland (types).
 G Conservatoire et Jardin Botaniques, Genève, Switzerland.
 GH The Gray Herbarium of Harvard University, Cambridge, Mass.
 K The Herbarium, Royal Botanic Gardens, Kew, England.
 L Rijksherbarium, Leiden, Netherlands.
 M Botanische Staatssammlung, München, Germany.
 MO Missouri Botanical Garden, St. Louis, Mo.
 P Herbarium Général, Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, Paris, France.
 PRC Botanical Institute of the Charles University, Praha, Czechoslovakia.
 R Divisão de Botânica do Museu Nacional, Rio de Janeiro, Brazil.
 S Botanical Department, Naturhistoriska Riksmuseum, Stockholm, Sweden.
 S-PA Paleobotaniska Avdelningen, Naturhistoriska Riksmuseum, Stockholm, Sweden.
 U Botanisch Museum & Herbarium, Utrecht, Netherlands.
 UC Herbarium of the University of California, Berkeley, Cal.
 US United States National Herbarium, Smithsonian Institution, Washington, D.C.
 W Naturhistorisches Museum, Wien, Austria.

The writer is greatly indebted to the directors and curators of the herbaria who generously put their material at his disposal.

The key to the species is partly artificial. The characters used can only be distinguished with certainty with the help of a high-power magnifying-glass, or with a low-power microscope, provided slides of several fronds per collection are available. Most species are very variable, not only as to the collections from different localities, but also as to the leaves in the same tuft and even on the same rhizome. For this reason combinations of several characters have been employed here as a rule. It is not necessary that all these characters are observed in every frond, but at least most of them should be present. It is hoped that most specimens may be keyed out in a satisfactory way. In most cases it will be difficult or impossible to determine sterile specimens or single detached leaves.

The distribution-maps have been compiled from the specimens examined; literature-records have not been included. The map on which the distribution of *T. petersii* is shown, the only North American species, is from Goode's Series of Base Maps, published by the University of Chicago Press.

The citations of literature with the synonyms have been restricted to the principal and most readily accessible publications. Because of the widespread misinterpretation of many species there would be little use in endeavouring to give an almost complete list of citations.

Key to the sections

- A. Fronds with marginal hairs and without a submarginal false vein; involucre usually with two distinct, dark-edged lips. 1. *Didymoglossum*

- B. Fronds with a submarginal false vein and without marginal hairs; involucre wholly immersed, without lips and not dark-edged.
 2. *Microgonium*

Key to the American species of the sect. *Didymoglossum*¹⁾

1. a. Involucres without dark-edged lips; fronds small, entire (< 1 cm). 2
- b. Involucres with dark-edged lips; fronds mostly larger than 1 cm. 4
2. a. Stipe as long as the frond; involucre wholly immersed. 1. *T. petersii* (s. United States, C. Am.)
- b. Fronds nearly sessile; involucre only with the base immersed. 3
3. a. Involucres with two distinct lips; fronds approximately circular with very few (1-4) side-veins. 2. *T. nummularium* (c. and n. S. Am.)
- b. Involucres without lips; fronds ovate with pinnately arranged veins. 3. *T. pinnatinervium* (Trin., Venezuela, Gui.)
4. a. Venation flabellate; costa wholly wanting or not extending beyond the middle. 5
- b. Venation distinctly pinnate; costa percurrent. 10
5. a. Fronds 2-6 mm wide, 3-8 mm long; usually a single terminal sorus; leaf-tissue very thin and translucent. 6. *T. ovale* (widespread)
- b. Fronds much larger; often several sori present; leaf-tissue firmly membranous. 6
6. a. Marginal hairs stellate; veins and veinlets crowded; not more than 5 rows of cells between two veinlets. 7
- b. Marginal hairs simple or bifid; veins not so crowded; often more than 12 rows of cells between two veinlets. 9
7. a. Sori numerous, often six, seven or even more per lamina; involucre exserted, not between lobes or in sinuses; fronds fissile. 8. *T. curtii* (C. America)
- b. Sori few, rarely five or six; involucre usually partly immersed, placed between lobes or in sinuses; few fronds with only a single split. 8
8. a. Veinlets thin, not enlarged towards the margin. 7. *T. punctatum* (widespread)
- b. Veinlets very thick, enlarged towards the margin. 9. *T. lineolatum* (Greater Antilles)
9. a. Fronds entire or only slightly crenate; leaf-tissue cells strongly radially lengthened; at the margin one row of

¹⁾ For the diagnose of the sect. *Didymoglossum* see page 277.

- tangentially lengthened cells. 10. *T. rhipidophyllum* (Colombia, Costa Rica)
- b. Fronds distinctly lobed or pinnatifid; leaf-tissue cells isodiametrical, the marginal cells hardly different. 11. *T. hymenoides* (widespread)
10. a. Fronds entire or in the upper part irregularly lobed; stellate hairs on the whole margin. 11
- b. Fronds pinnatifid or bipinnatifid; stellate hairs mainly in the sinuses and simple or bifid hairs on the margin. 13
11. a. Lips of the involucre with only a single row of dark cells; involucre immersed to the lips. 4. *T. angustifrons* (widespread)
- b. Lips of the involucre with several rows of dark cells; involucre immersed to the lips or partly free. 12
12. a. Fronds 2-4 mm wide, 3-8 mm long; usually a single terminal sorus; dark border of the lips brown. 6. *T. ovale* (widespread)
- b. Fronds larger; often several sori present; dark border of the lips black. 5. *T. pusillum* (Gr. Ant., C. and n. S. Am.)
13. a. Involucral lips two or more \times longer than wide. 15. *T. gourlianum* (w. Colombia and Ecuador)
- b. Involucral lips nearly circular or broader than long. 14
14. a. Sori exserted; few unconnected false veinlets; false veinlets usually not parallel to the margin. 15
- b. Sori more or less immersed; nearly all spurious veinlets non-connected; false veinlets partly parallel to the margin. 13. *T. krausii* (widespread)
15. a. No or only a very few and short non-connected false veinlets present in the leaf-tissue; lobes strongly crisped. 14. *T. melanopus* (Ecuador)
- b. Free and non-connected false veinlets present in the leaf-tissue; lobes not crisped. 16
16. a. Lips of the involucre rather long; leaf-tissue cells elongate parallel to the veins; usually many false veinlets; sori not closely together. 12. *T. reptans* (widespread)
- b. Lips of the involucre short and broad; leaf-tissue cells isodiametrical; a few false veinlets present; several sori often closely together at the end of the costa. 11. *T. hymenoides* (widespread)

1. **Trichomanes petersii** A. Gray, Sillim. Am. Jo. Sci. Arts, Ser. 2. 15:326. 1853; Hooker, Century of Ferns, tab. 86. 1854; van den Bosch, Ned. Kruidk. Arch. 4:355. 1859; Hooker & Baker, Syn. Fil., ed. 2:74. 1874; D. C. Eaton, Ferns N. Am., 1:183, tab. 24 f. 2. 1878; Giesenhagen, Flora, 73:438, tab. XVII f. 21. 1890;

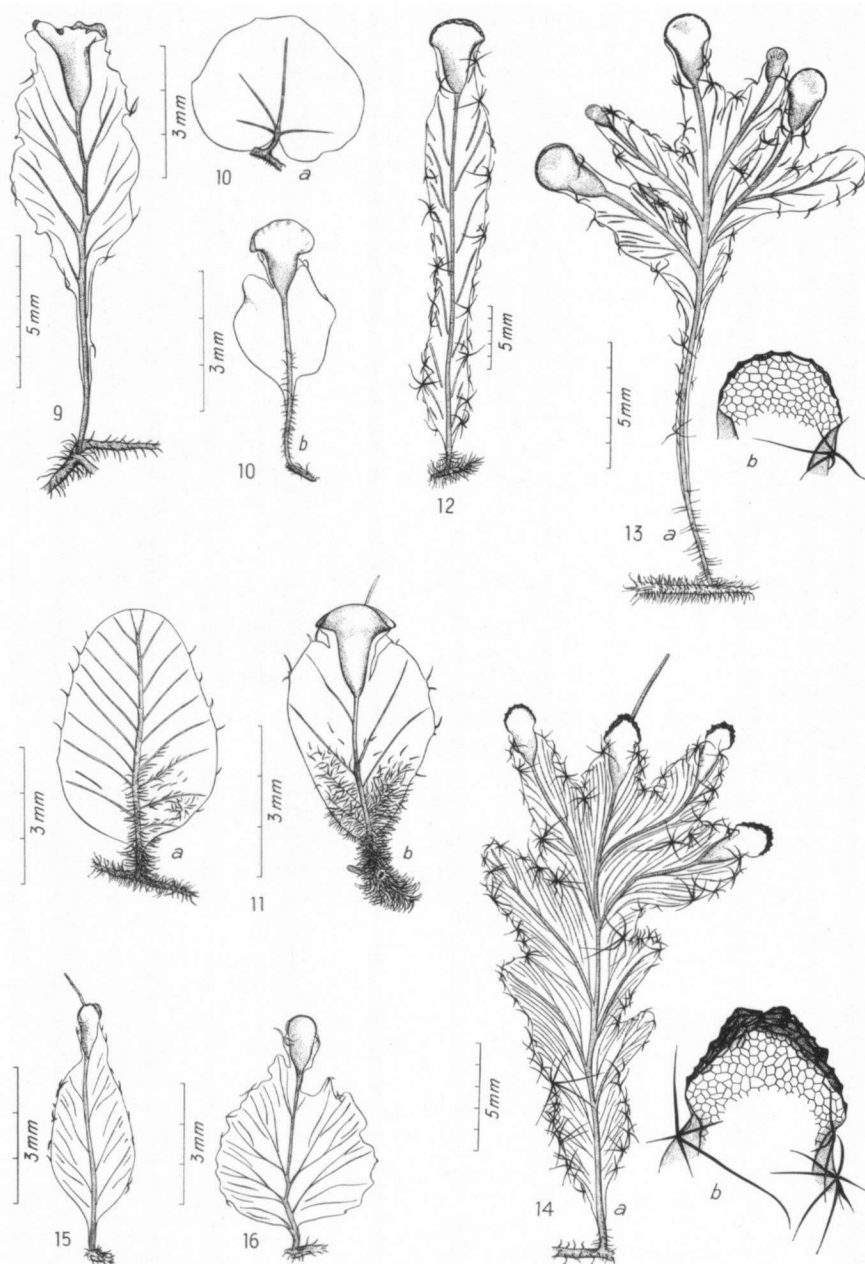


Fig. 9. *Trichomanes petersii* (Hardin, Humphrey & Duncan 13849). – Fig. 10. *Trichomanes nummularium* (Spruce s.n.); a sterile, b fertile. – Fig. 11. *Trichomanes pinnatinervium* (Lanjouw & Lindeman 2557); a sterile, b fertile. – Fig. 12. *Trichomanes angustifrons* (Ekman H 11458). – Fig. 13. *Trichomanes angustifrons* (Daniels & Jonker 1147); a frond, b lip of the involucre. – Fig. 14. *Trichomanes pusillum* (Fendler 24); a frond, b lip of the involucre. – Fig. 15. *Trichomanes ovale* (Fendler 25), type collection. – Fig. 16. *Trichomanes ovale* (Jürgens & Stier 207).

Chapman, Flora s. U.S., ed. 3:635. 1897; Christ, Farnkr. d. E., 26, f. 43. 1897; Sadebeck in Engler & Prantl, Nat. Pfl., 1 (4):105. 1902; Small, Flora SE. US., 3. 1903; Slosson, Bull. Torr. Bot. Cl., 41:307, pl. 7 f. 2-4. 1914; Broun, Index N. Am. Ferns, 162. 1938.

Type: T. M. Peters s.n., collected Dec. 1852 or Jan. 1853, from Hancock County, near Sipsey River, Alabama (not seen, not present in GH).

Homotypic synonyms: *Microgonium petersii* (A. Gray) van den Bosch, Verh. Kon. Acad. Wetensch. Amsterdam, 9 (6):7. 1861; *Hemiphlebium petersii* (A. Gray) Prantl, Hymenoph., 46. 1875; *Didymoglossum petersii* (A. Gray) Copeland, Philipp. Jo. Sci., 67:78. 1938.

Heterotypic synonym: *Trichomanes schaffneri* Schlechtendal, Linnaea, 26:368. 1853; *Didymoglossum schaffneri* (Schltdl.) van den Bosch, Ned. Kruidk. Arch., 4:380. 1859. Type: Schaffner s.n., from Huatusco, Mexico (B).

Fig. 9

Fronde ovate, stipe as long as the frond. Costa present. The geminate marginal hairs are placed on small teeth. Sori solitary. Involucre wholly immersed, without lips.

Fronde in the diverse collections of rather equal shape and size, ovate to oblong-lanceolate, about 1 cm long and 0.4 cm wide; the apex rounded, the base narrowly and abruptly decurrent; entire or sublobate. On the margin geminate, sometimes simple or ternate hairs placed on small teeth. Stipes slender, as long as or longer than the lamina. A costa present with a few, very oblique, parallel, usually unbranched side-veins and a number of non-connected ones. Sorus solitary at the end of the costa. Involucres wholly immersed; tube cylindrical, abruptly and broadly expanded at apex, without lips and veinlets, not dark-edged, the rim more or less irregularly lobed.

Distribution: South-eastern United States and Central America to Guatemala (map 2). In the s. e. U. S. on shaded and wet sandstone rocks, in Florida on limestone rocks, and on tree-trunks in Louisiana, Mexico and Guatemala.

Representative specimens:

TENNESSEE: Blount Co., near Tremont, Benedict 3475 (US); *ibid.*, Jennison, Sharp & Bishop 501 (F, G, GH, MO, P, PRC, S-PA, UC, US); Blount Co., near Margaret Townsend Camp, Jennison 3359 (MO, UC); Sevier Co., Meigs Creek trail, Jennison 2753 (US); Sevier Co., Underwood 430 (L).

NORTH CAROLINA: Graham Co., edge of Calderwood Lake, Shield & Sharp 4640 (GH, US), 4641 (MO, GH, US), 4642 (GH, US).

SOUTH CAROLINA: Oconee Co., near Jocassee, Anderson 7296 (UC, US); Pickens Co., Correll & Wherry 11000 (MO, US); Pickens Co., Clausen & Kezer 5645 (UC).

FLORIDA: Citrus Co., near road leading into "the Cooc", Edw. P. St. John s.n. (US); near Brooksville, Edw. P. St. John s.n. (GH, US).

GEORGIA: near Tallulah Falls, Seymour s.n. (GH, U, UC, US); Walker Co., near Lafayette, Hardin, Humphrey & Duncan 13849 (GH, MO, U, UC, US).

ALABAMA: Winston Co., Mobile, Mohr 1 (MO, US), 4720 (US); Winston Co., Moulton, along Sipsey River, Peters s.n., various collections from the same locality, all without number (B, F, G, GH, K, L, MO, UC, US); Cleburne Co., near Heflin, Correll 8340 (GH, MO, US); Marian Co., near Hamilton, H. H. Smith s.n. (GH, US); Lawrence Co., King Core, Harvill & Segars 5450 (GH, MO, U, US); Lamar Co., Stuck's Spring, Crawford & Harvill 406 (US); Franklin Co., near Hackleburg, Crawford & Segars 384 (US); Etowah Co., near Blackcreek

Falls, Pollard & Maxon 353 (GH, MO, S-PA, UC, US); Marshall Co., Graves s.n. (B, GH, P, S-PA).

MISSISSIPPI: Saragota, Tracy 8303 (B, F, G, GH, MO, US, W).

LOUISIANA: near Covington, Sulphur Springs, Arsène 14396 (US), 14764 (GH, US).

MEXICO: Chiapas, near Huixtan, Xolocotzi & Sharp X-651 (US); *ibid.*, Sharp 451021 (US); near Huauchinango, Puebla, Sharp 45321 (US).

GUATEMALA: Baja Verapaz, near Patal, Sharp 45275 (US); Alta Verapaz, Cerro Chinaja, Steyermark 45623 (F).

The holotype could not be traced; the specimen in the Gray Herbarium, marked as the type, was collected on June 1st, 1853. From the correspondence of Gray and Peters it is clear that the original specimen was collected in December, 1852, or at the latest January, 1853. Many herbaria contain topotypes collected by Peters.

T. petersii and *T. schaffneri* are quite identical and both were published in papers dated 1853. Gray's description appeared actually in May, 1853; Schlechtendal's in August, 1854. Hence *T. schaffneri* is a synonym of *T. petersii* and not, as has often been stated, of *T. hymenoides*. *Microgonium schaffneri* Fée, based on another specimen collected by Schaffner, belongs to *T. hymenoides*.

The present writer has closely examined the specimens of *T. hymenoides* collected by von Türckheim number 3066 from the Dominican Republic, in which, according to Slosson (1914) specimens of *T. petersii* were present as an admixture, but none could be found. There are no other collections of *T. petersii* known from the West Indies.

2. ***Trichomanes nummularium*** (van den Bosch) C. Christensen, *Index Filicum*, 645. 1906.

Basionym: *Didymoglossum nummularium* van den Bosch, *Ned. Kruidk. Arch.*, 5:135. 1863.

Type: Spruce s.n., from Barra, along Rio Negro, State of Amazonas, Brazil (L).

Heterotypic synonym: *Trichomanes goebelianum* Giesenhagen, *Flora*, 76:179, f. 3 A & B. 1892; Christ, *Farnkr. d. E.*: 25, f. 41. 1897; Sadebeck in Engler & Prantl, *Nat. Pfl.*, 1 (4):104. 1902; Copeland, *Philipp. Jo. Sci.*, 67:79. 1938. Type: Goebel s.n., from Paradiso, near San Esteban, Venezuela (B).

Fig. 10a, b

Fronds very small, 2,5–3 mm long, round or broadly elliptic, with a short stipe. Sterile fronds palmately veined. Involucre obconic, half-immersed, with broad, unbordered lips.

Fronde circular with a heart-shaped base or broadly elliptic, only 2,5–3 mm long¹⁾ the "smallest of all ferns"), short-petioled or subsessile. Margin of the frond entire with a few, rather long hairs. Sterile fronds palmately veined; fertile fronds with a prominent costa, which runs to the solitary terminal sorus, without false veinlets²⁾. Involucre obconic, half-immersed or placed in a small sinus. The two lips broader than long and unbordered.

¹⁾ According to GIESENHAGEN (1892) and COPELAND (1938).

²⁾ The only species of the sections under consideration with dimorphic fronds.

Distribution: Northern South America and Costa Rica; apparently uncommon (map 3). On tree-trunks at lower elevations.

Specimens seen:

COSTA RICA: near Siquirres, Kupper 470 p.p. (M).

VENEZUELA: near San Esteban, Goebel s.n. (B).

BRAZIL: Amazonas, Furo de Uraria, Spruce 1096 (B); near Manaos, Spruce s.n. (L).

This very characteristic species cannot be confused with any other. The specimens collected by Spruce and those of Goebel and Kupper are quite identical. The species is probably much more widespread, but was overlooked because of its small size. The specimen from Costa Rica was collected accidentally, as it was found in a tuft of *T. curtii*.

3. ***Trichomanes pinnatinervium*** Jenman, Gard. Chron. ser. 2. 25:787. 1886; Jenman, West Ind. Gui. F., 17. 1898.

Type: Jenman 2126 from region of Mt. Russel, British Guiana (K).

Fig. 11a, b

Fronds small, 5–8 mm long, usually ovate. Stipe, costa, and veins dark tomentose. Margin entire, with geminate hairs. Involucres immersed to the rather large, expanded, unbordered rim.

Fronds ovate to ovate oblong, rounded at top and base, or the base more or less cordate, 5–8 mm long, 3–5 mm wide, short-petioled. The stipe 0.5–2 mm long. Petioles dark-tomentose as are also the costa, the veins, and sometimes the leaf-tissue itself on the lower surface. Margin entire with simple or usually binate hairs, one hair much longer than the other. Venation pinnate, the veins simple or the lower ones occasionally forked from the base; costa continuous to the top. Fertile fronds with a single sorus. Involucres expanding at the top into a distinct rim rather than lips, though the rim mostly is not quite circular, but more or less sub-bilabiate; edge not darkened.

Distribution: Trinidad, Venezuela, and Guiana (map 4). In moist forests on tree-trunks at middle elevations.

Specimens seen:

TRINIDAD: Mora forest, e. of Sangre Grande, E. G. Britton 2850, 2851 p.p. 2852 (US).

BRITISH GUIANA: Region of Mt. Russel, Jenman 2126 (K); Bartica Grove, Cuyuni River, Jenman 2353 (B, K).

SURINAME: Nassau Mts., Lanjouw & Lindeman 2557 (U).

FRENCH GUIANA: Acarouany, Sagot s.n. (G).

4. ***Trichomanes angustifrons*** (Fée) W. Boer in Kramer, Fl. Neth. Ant. I (Pterid.): 17, 1962.

Basionym: *Didymoglossum angustifrons* Fée, 11 Mém., 113, tab. 28 f. 5. 1866.

Type: L'Herminier s.n. from Guadeloupe (not seen).

Heterotypic synonyms: *Trichomanes setiferum* Baker in Jenman, Jo. Bot., 19:52. 1881; Jenman, Bull. Bot. Dept. Jamaica, 20:6. 1890;

Jenman, West Ind. Gui. F., 17. 1898. Type: Jenman 14, from Jamaica (K). *Trichomanes mosenii* Lindman, Ark. f. Bot., 1:46, f. 25 D & E, f. 26. 1903; *Didymoglossum mosenii* (Lindman) Copeland, Philipp. Jo. Sci., 67:78. 1938. Type: Mosén 3810, from São Paulo, near Santos, Brazil (S-PA).

Misapplied names: *Trichomanes pusillum* auct. non Swartz; Grisebach, Flora Brit. West Ind., 656. 1864; Jenman, Bull. Bot. Dept. Jamaica, 20:7. 1890; Jenman, West Ind. Gui. F., 20. 1898; Duss, Flore Crypt. Ant. Fr., 12. 1904; Urban, Symb. Antill., 9:282. 1925; Maxon, Pterid. Porto Rico & Virgin Isl., 497. 1926; Domin, Pterid. Dominica, 47. 1929; Hodge, Lloydia 17:59. 1954. *Trichomanes sphenoides* auct. non Kunze; Lindman, Ark. f. Bot., 1:36, f. 22–25, f. 28 C. 1903, exclusive of synonyms.

Fig. 12, 13a, b

Fronds linear or cuneate-oblong. Margin with stellate hairs. Sori terminal. Involucres immersed. Lips dark-edged with only one row of dark cells, broader than the tube.

Fronds presenting a great variety of shapes, often linear to linear-oblong, 0.5–1.5 cm long, 0.1–0.3 cm wide, entire or nearly so, or well-developed fronds cuneiform, in the upper part irregularly pinnatifid, or sometimes—mostly in sterile fronds—irregularly circular with a cordate base; lamina thin and translucent. Stipes short, upwards narrowly winged. Margin ciliate with 1–4— or more—rayed stellate hairs. Costa percurrent. Each of the strong secondary veins forms a costule for the distinct lobes. In the lobes numerous, partly branched and mostly unconnected lateral veinlets. Sori solitary in the apical lobes. Involucres immersed to the large, semiorbicular lips. The involucres not contracted at the neck; the lips broader than the tube and with only one (never more) row of dark cells.

Distribution: Central America, West Indies and South America to Paraguay and South Brazil (map 5). On rocks and trees in moist forests, at lower and middle elevations, up to 1600 m, often mixed with *T. kapplerianum*.

Representative specimens:

COSTA RICA: prov. of Limón, Dodge & Goerger s.n. (US); near El Cairo, Nevermann s.n. (US).

COCOS ISLAND: Howell 10164 (GH).

CUBA: Oriente, Yateras, Maxon 4292a (GH, US); without locality, Wright 915 (S-PA), 1836 (B, G, K, S-PA, W), 3942 (GH, US).

JAMAICA: near Moras Gap, Jenman 14 (K); Portland, Mill Bank, Maxon 9317 (US).

HISPANIOLA: Dominican Republic: La Cumbre, Ekman H 11458 (B, G, GH, S, U, UC, US).

PUERTO RICO: near Cidra, Britton 8383 (US).

ST. EUSTATIUS: Suringar s.n. (L).

ST. KITTS: Britton & Cowell 778 (US); Proctor 19525 (GH).

NEVIS: Proctor 19475 (GH, US).

MONTSERRAT: Proctor 18948 (GH, U, US); Shafer 376 (US), 784 (US).

GUADELOUPE: Duss 4447 (US); Husnot 417 (G, K, P, S-PA); Questel 907 (US), 910 (US), 986 (US), 1131 (US), 1946 (US).

DOMINICA: Hodge 2998 (GH, US); Lloyd 545 (US).

ST. LUCIA: Proctor 17911 (GH, US), 18079 (US).

ST. VINCENT: H. H. & G. W. Smith 425 (GH, US).

- GRENADA: Broadway 3773 (US); Eggers 6064 (P).
 VENEZUELA: Island of Margarita, Johnston 174 (GH).
 TRINIDAD: Broadway 10006 (US); Crüger s.n. (L).
 TOBAGO: Broadway 4568 (US).
 BRITISH GUIANA: Bartica Grove, Jenman 2348 (US); Moraballi Creek, near Bartica, Richards 222 (US).
 SURINAME: Emma Range, Daniels & Jonker 943 p.p. (U), 1048 (U), 1147 (U); Nassau Mts., Lanjouw & Lindeman 2318 (U).
 FRENCH GUIANA: without locality, Leprieur 207 p.p. (U).
 BRAZIL: Para: Rio Acara near Belem, Spruce s.n. (G, US).
 Amazonas: Rio Negro, near São Gabriel, Spruce 2161 (B, G, GH, W); near Manaus, Spruce 1703 (G).
 Rio de Janeiro: Serra de Friburgo, Kuhlmann s.n. (R); Sta. Maria Magdalena, Santos Lima 13 (R), 14 (R).
 São Paulo: Sororocaba near Santos, Mosén 3810 (P, R, S, S-PA, US).
 Santa Catarina: near Blumenau, Ule 276 (US); Isl. São Francisco, Ule 88 (B).
 PERU: dept. San Martín, Tingo Maria, Allard 21383a (US).
 PARAGUAY: Cerro Leon, e. of Pirayu, Balansa 2822 p.p. (L); Cordillera de Mbatobi, Balansa 4460 (B, G, L, S-PA, US, W); near Caacupé, Hassler 101 (G).

Since Grisebach *T. angustifrons* has been treated as a synonym of *T. pusillum*, but it is a distinct species, though closely allied to the latter, where the differences are discussed.

5. ***Trichomanes pusillum*** Swartz, Prod., 156. 1788; Hedwig, Fil. Gen. Spec., tab. 4 f. 5. 1799; Swartz, Flora Ind. Occ., 3: 1729. 1806; Sturm, Flora Bras., 1 (2):278. 1859; Lindman, Ark. f. Bot., 1:33, f. 19-21. 1903.

Type: Swartz s.n., from Jamaica (S-PA).

Homotypic synonyms: *Didymoglossum pusillum* (Sw.) Desvaux, Mém. Soc. Linn. Paris, 6:330. 1827; van den Bosch, Ned. Kruidk. Arch., 4:380. 1859; Copeland, Philipp. Jo. Sci., 67:77. 1938; *Hemiphlebium pusillum* (Sw.) Presl, Abh. böhm. Ges. Wiss., 5:117, tab. IX. 1843; Abh. böhm. Ges. Wiss., 5:336, tab. V f. 14. 1848.

Fig. 14a, b

Fronds linear or obovate, firm, not translucent, with a distinct costa, also in the lobes. Veinlets crowded. Involucral lips oblong and mucronulate, with a broad border of dark cells.

Fronds linear sublobate or obovate, the upper part irregularly pinnatilobed, 1.5-2.5 cm long, 0.4-1.2 cm wide, the base narrowly cuneiform. Margin with many 5-10-rayed stellate hairs. Stipe short, 0.1-0.5 cm. Lamina firm, not transparent. Between two veinlets only 2-5 rows of leaf-tissue cells. Lamina and lobes with distinct costae and numerous, very oblique, parallel, branched side-veins, many of them unconnected. Sori few, 1-5, solitary on the apical lobes at the end of the costule. Involucres immersed to the lips. Lips longer than wide, often toothed, with a broad border of black cells. Receptacle very long-exserted.

Distribution: Costa Rica and Venezuela, Greater Antilles and South Brazil (map 6). Apparently quite rare. Collected at the bases of tree-trunks, at middle elevations.

Specimens seen:

COSTA RICA: between Cartago and San Isidro de El General, Scamman 5857 (GH).

JAMAICA: St. Thomas, Maccasucker Bumb, Maxon 9568 (US); without locality, Swartz s.n. (G, M, PRC, S-PA).

HISPANOLIA: Haiti: St. Louis du Nord, E. C. & G. M. Leonard 14588 (GH, MO, UC, US); Santo Domingo: Samana, Rio Tito, Ekman H15297 (S).

PUERTO RICO: Las Cruces, Sintenis 4230 (B); Audubo, Sintenis 4646 pp. (GH).

VENEZUELA: Merida, Moritz 391 (B, GH, M); near Tovar, Fendler 24 (B, G, GH, L, MO, S, US); *ibid.*, Karsten 54 (B, G); San Esteban, Goebel s.n. (B).

BRAZIL: Rio de Janeiro; Therezopolis, Brade 9798A (R); Itatiaya, Brade 15342 (R); Sto. Antonio de Imbé, Brade & Santos Lima 11598 (R).

This species was misinterpreted several times, first by PRESL (1843), who described the species as *Hemiphlebium pusillum* with a marginal vein and stellate hairs. As the combination of a marginal vein and stellate hairs is never observed, it seems likely that he had a mixture of *T. pusillum* and a *Microgonium* species and combined the characters of these two.

Another mistake was made by Hooker & Baker who gave a description of *T. reptans* under the name of *T. pusillum*. This error was perpetuated by Hooker in all his publications, and also by CHRIST (1897) and SADEBECK (1902).

Lindman's description and beautiful illustrations are based on Swartz's original specimen from Jamaica but, without being acquainted with the closely related *T. angustifrons*, he made it a synonym of *T. pusillum*. Another specimen, Mosén 3810, from São Paulo, near Santos, Brazil, without any doubt belonging to *T. angustifrons* was described by him as a new species, *T. mosenii*.

T. pusillum is of the same general appearance as *T. angustifrons*, from which it may be easily distinguished by the oblong, broad, dark-edged involucre lips (*T. angustifrons* never has more than one row of dark cells), the firmer leaves with crowded veinlets, and the larger number of marginal hairs.

6. *Trichomanes ovale* (Fournier) W. Boer, nov. comb.

Basionym: *Didymoglossum ovale* Fournier, Bull. Soc. Fr., 19:240. 1872.

Type: Fendler 25, from Tovar, Venezuela (P).

Heterotypic synonyms: *Trichomanes solitarium* Jenman, Gard. Chr., ser. 3. 16:592. 1894; Jenman, West Ind. Gui. F., 18. 1898. Type: Syme s.n., from Jamaica (a scrap at K). *Trichomanes fontanum* Lindman, Ark. f. Bot., 1:44, f. 24 D & F, f. 25 C, f. 26, 1903; *Didymoglossum fontanum* (Lindman) Copeland, Philipp. Jo. Sci., 67:77. 1938. Type: Lindman A 1043, from Santo Angelo, Rio Grande do Sul, Brazil (S-PA). *Trichomanes sphenoides* Kunze var. *minor* Rosenstock, Hedwigia 46:75. 1906. Type: Jürgens & Stier 207, from mun. Rio Pardo, Rio Grande do Sul, Brazil (S-PA).

Fig. 15, 16

A minute fern. Fertile and many sterile fronds with a costa. A single sorus. Involucre partly or wholly immersed, often contracted at the neck. Lips small with few rows of dark cells.

Shape of the frond variable, about circular, obovate, or even lanceolate but always minute, 0,3–0,8 cm long, 0,2–0,4 cm wide, broadest at the base. Margin entire or slightly crenate with geminate or stellate hairs. Stipe 0,1–0,4 cm long. Fertile fronds costate, the costa running to the single apical sorus. Sterile fronds also with a costa or with fine, flabellate venation. Veinlets pinnately arranged, partly free in the thin and translucent leaf-tissue. Sori usually single, rarely two or three. Involucre more or less exserted but the lower part of the tube always immersed, the free part narrowly winged with stellate hairs and contracted at the mouth, or sometimes the tube funnel-shaped. Lips small and short, with few rows of not very dark brown cells.

Distribution: South Brazil; rare in Central America, the West Indies and Venezuela (map 7). Probably the species will prove to be more common, having been overlooked through its small size.

On wet deeply shaded rocks and trunks of trees.

Specimens seen:

GUATEMALA: dept. of Petén, Vaxactun, Bartlett 12715 (GH, MO, UC, US); Chilion, near Mazatenango, Bernoulli 427 (B, G).

HONDURAS: Lancetilla, Tela area, Steeves & Ray 388 (GH, U); *ibid.*, Standley 55777 (F, US).

PANAMA: Chiriquí, Hart 41 (K); Barro Colorado Isl., Seaverns 36 (F); Darien prov., Punta Guayabo Chiquita, Stern & Chambers 199 (GH).

CUBA: prov. Pinar del Rio, near Certamisa, Ames & Leavitt 31 (MO); Habana, Tapaste, Eén s.n. (S-PA).

JAMAICA: without locality, Syme s.n. (K).

HISPANIOLA: Dominican Republic: Samaná, Ekman H14958 (S); Cordillera Central, Boca del Infierno, Ekman H 15424 (G, S).

PUERTO RICO: Sierra de Luquillo, Blauner 319 (B, G); Mt. El Yunque, Wagner s.n. (GH).

VENEZUELA: Tovar, Fendler 25 (B, G, GH, P, MO).

BRAZIL: Guanabara; Corcobada Mt., Mosén 2719½ (S, S-PA, US); São Antonio do Imbé, Santos Lima s.n. (M, R).

São Paulo: Itapicirica, Wettstein & Schiffner s. n. (W); Cerqueira Cesar, Wettstein & Schiffner s.n. (W).

Sta. Catarina: Laranjeira Mt., Ule 87 (B).

Rio Grande do Sul: Sta. Cruz, Serra de Leão, Jürgens 209 (Rosenst. Fil. austrobras. exsicc. 278, L, P, S, S-PA, U, UC, US, W), 207 (*ibid.* 279, B, P, S, UC, US, W); Santo Angelo, Lindman A 1043 (B, G, S, S-PA, US); Serra de Melo, Rio Pardo, Jürgens & Stier 207 (S-PA); Mt. Dois Irmãos, Leite 3160 (GH).

This very small species ranks near *T. punctatum* var. *sphenoides* but is distinguished by the much smaller and often costate fronds. It approaches in outline also the small form of *T. angustifrons* but may be separated by the shape of the only partly immersed involucre and the more than one row of dark cells in the lips. LINDMAN (1903) figured it well under the name *T. myrioneuron*. Lindman's collection agrees exactly with the type-collection of *T. ovale*, notwithstanding the widely separated collecting localities. It is not quite certain that *T. solitarium* belongs here, the available type material being very poor.

7. ***Trichomanes punctatum*** Poiret in Lam., Enc. Méth. Bot., 8:64. 1808; Hooker & Greville, Icon. Fil., 2: tab. 236. 1831; Kunze, Farrnkr., 1:216. 1840; Hooker, Spec. Fil., 1:116. 1846; Kunze, Bot. Zeit., 5:278. 1847; Sturm, Flora Bras., 1 (2):276. 1859; Lindman, Ark. f. Bot., 1:51, f. 30 A, f. 31 A–C. 1903.

Type: Without collector, s.n., from Martinique, in herbarium Lamarck (P).

Homotypic synonyms: *Didymoglossum punctatum* (Poiret) Desvaux, Mém. Soc. Linn. Paris, 6:330. 1827; Presl, Abh. böhm. Ges. Wiss. 5:115. 1843; Copeland, Philipp. Jo. Sci., 67:77. 1938. *Hemiphlebium punctatum* (Poiret) Prantl, Hymenoph., 46, tab. II f. 18. 1875.

Fig. 17, 18, 19, 20

Fronds of variable shape. Venation flabellate, the veins not dilated towards the stellate-ciliate margin. Sori few to several but never more than six, placed in sinuses or between lobes. Involucres often partly immersed.

Fronds roundish, reniform, broadly ovate or rarely linear-oblong, 0.5–1.5 cm wide and 1–2 cm long, the base usually cuneate, sometimes rounded, coarsely crenate or with several obovate to linear obtuse lobes which are 1–4 mm long. Stipe absent to circa 1 cm long. Costa wanting or present to about the middle. Venation flabellate; veins crowded, unequal in thickness, the larger veins running to the lobes or sori. Margin with stellate hairs. Young fronds bearing two-celled glandular hairs (as in all species under consideration) contrasting by their yellowish colour¹). Sori one to several, placed in sinuses or between lobes. Indusia immersed about halfway or exserted.

Trichomanes punctatum consists of four more or less clear-cut subspecies, which may be distinguished as follows:

1. *a.* Interspaces much broader than the veinlets; well-developed fronds pinnatilobed. 2
- b.* Interspaces between two veinlets narrow, about twice as broad as the veins; fronds roundish, in the upper part crenate or with a few lobes. 3
2. *a.* Involucres usually free, the large circular lips with a very broad dark-brown edge; leaves thin and translucent.
 *a* ssp. *punctatum* (Lesser Antilles)
- b.* Involucres more or less immersed, the lips more narrowly dark-edged; leaves firmly membranous, not transparent.
 *b* ssp. *floridanum* (Florida)
3. *a.* Sori few to several, involucres usually immersed, the small lips about as broad as the tube, narrowly dark-edged; often long and narrow lobes between the sori.
 *c* ssp. *sphenoides* (C. and n.w. S. Am., Gr. Ant.)
- b.* Sori few, 1(–4); involucres in an incision, free, the lips broader than the tubes, broadly dark-edged; fronds often rounded, crenate above.
 *d* ssp. *labiatum* (Guiana, Brazil)

7a. ***Trichomanes punctatum* Poiret ssp. *punctatum*.**

Heterotypic synonyms: *Didymoglossum hookeri* Presl, Abh. böhm.

¹) Though they are often impossible to find, the name *punctatum* is derived from these hairs.

Ges. Wiss., 5:115. 1843, based on: *Trichomanes reptans* auct. non Swartz, Hooker & Greville, Icon. Fil., tab. 32. 1831; Hooker, Spec. Fil., 1:116. 1846; Hooker & Baker, Syn. Fil., ed. 2:74. 1874; not *Trichomanes hookeri* Presl. Type: Guilding s.n., from St. Vincent (Ed). *Didymoglossum laceratum* Fée, 11 Mém., 113, tab. 32 f. 1. 1866. Type: L'Herminier s.n., from Guadeloupe (not seen).

Fig. 17

Fronds when young and unexpanded usually orbicular and entire, subsessile, later obovate or linear-oblong, 1–1.5 cm long and 0.5–1 cm wide, crenate, dentate, or obliquely lobed, the lobes often short, 1–2 mm long but sometimes up to 9 mm long; base of the lamina acute. Venation subflabellate, the veins of unequal thickness; the thicker ones forming the costae of the lobes with more or less pinnately arranged false veinlets. Interspaces between two veinlets rather broad, of 5 or more rows of cells. Sori few, usually single, placed in a deep sinus, or two or three borne on apical lobes. Involucres wholly free, narrowly winged, the wings bearing stellate hairs. Involucres relatively large, with large orbicular dark-edged lips.

Distribution: Puerto Rico, Lesser Antilles and Trinidad (map 8). On trees, rocks, and in wet forest ravines at middle elevations, ca. 300–900 m alt.

Representative specimens:

PUERTO RICO: between Morovis and Corozal, N.L. & E. G. Britton & Boynton 8434 (US); Sierra de Naguabo, J. R. Johnston 1627 (US); Barrio de Maizales, Britton & Cowell 2158 (S, US), 2197 (US); El Yunque, Wagner s.n. (GH).

St. EUSTATIUS: Suringar s.n. (L).

St. KITTS: Brautel s.n. (PRC); Proctor 19276 (GH, U, US).

NEVIS: Proctor 19406 (GH), 19437 (GH).

MONTSERRAT: Proctor 18961 (GH); Shafer 781 (US), 782 (US).

GADELOUPE: Duss 949 (P), 4441 p.p. (F), 4442 (US); Husnot 421 (B, G); Proctor 20124 (GH, U); Questel 977 (US), 1837 (US), 1993 (US).

DOMINICA: Hodge 1564 (US), 2720 (GH), 3355 (GH, US).

MARTINIQUE: without collector (in herb. Lamarck P, photographs in GH, U, US); Hahn 1164 p. p. (B); Perrottet s.n. (L).

St. LUCIA: Proctor 17699 (GH), 17880 (GH).

St. VINCENT: Guilding s.n. (Ed); H. H. & G. W. Smith 412 (G), 1080 (GH, US).

GRENADA: Broadway 2528 (MO), 3782 (US); Buysman 2862 (U); Fraser s.n. (S-PA); Sherring s.n. (B, US).

TOBAGO: Broadway 3025 (F, G, GH, L, MO, U, US), 4587 (F, GH).

TRINIDAD: Broadway 3749 (MO).

VENEZUELA: Island of Margarita, J. R. Johnston 174 pp. (GH).

7b. *Trichomanes punctatum* Poiret ssp. *floridanum* W. Boer, nov. ssp.

Type: Eaton 561, from Dade Co., Large Hammock east of Brown's, Florida (GH).

Misapplied name: *Trichomanes sphenoides* auct. non Kunze, Eaton, Bull. Torr. Bot. Cl., 33:460. 1906.

Fig. 18a, b, c

Recedit a ssp. *punctatum* foliis firmioribus, minus translucetibus, involucrisque plerumque usque ad labia immersis, labiis minoribus, minus late atromarginatis.

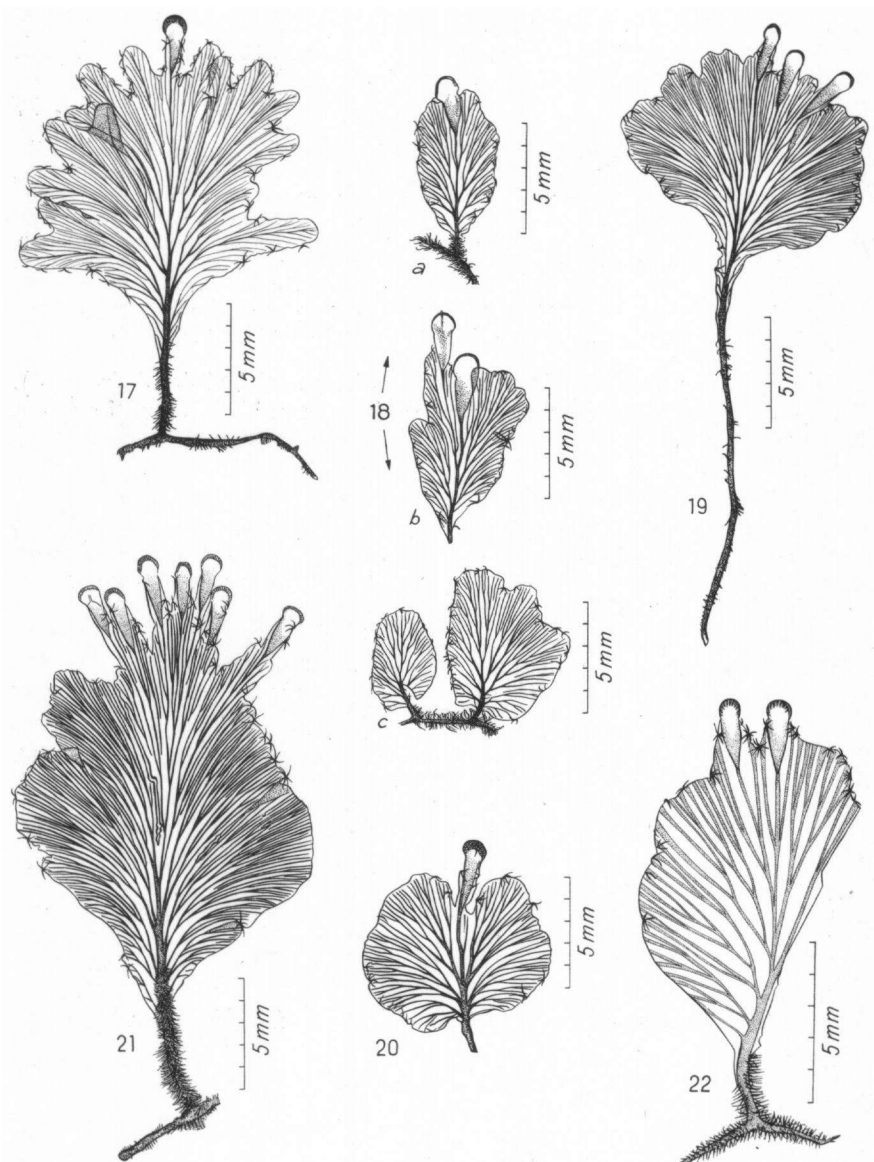


Fig. 17. *Trichomanes punctatum* ssp. *punctatum* (Proctor 19276). — Fig. 18. *Trichomanes punctatum* ssp. *floridanum* (Small & Carter s.n.); a, b, c. — Fig. 19. *Trichomanes punctatum* ssp. *sphenoides* (Ekman H 10252). — Fig. 20. *Trichomanes punctatum* ssp. *labiatum* (Lanjouw & Lindeman 1859). — Fig. 21. *Trichomanes curtii* (Cufodontis 219). — Fig. 22. *Trichomanes lineolatum* (Ekman H 12573).

Fronds variable as to shape and cutting, oblong, oblanceolate or linear-oblanceolate, when young orbicular, 0.5–1.5 cm long, 0.5–1 cm wide, subsessile to long-petiolate; stipe 0.1–2 cm long, radiculose below and often winged above. Leaves firmly membranous, not very translucent, irregularly lobed. Margin stellate-ciliate. Venation flabellate; veins unequal in thickness, in the lobes more or less pinnately arranged. Sori few to several, 1–6. Involucres usually immersed to the lips, these smaller than in ssp. *punctatum* and less broadly and less distinctly dark-edged.

Distribution: Florida (map 8). In hammocks, in limesinks, and on tree-trunks.

Representative specimens:

FLORIDA: Dade Co., Royal Palm Hammock, Small & Carter s.n. (F, GH, MO, US); Ross's Hammock, near Silver Palm School, Small & Carter 2379a p.p. (F, GH, MO, S-PA, US); s. of Cutler, Eaton 1962 (F, GH), 561 (GH), 264 (US); Hattie Bauer Hammock, Small & Mosier 5942 (MO, US); *ibid.*, Small 7422 (GH, MO, US); *ibid.*, Correll 6025 (MO, US); Sykes Hammock, near Homestead, Brass 25192 (GH); Snapper Creek, s. of Coconut Creek, Small & Nash s.n. (GH, US).

The ssp. *floridanum* is intermediate between ssp. *punctatum* and ssp. *sphenoides*. The venation and the incised leaves place it near ssp. *punctatum* but in the shape of the rather thick fronds and the often immersed involucres it resembles ssp. *sphenoides*.

7c. **Trichomanes punctatum** Poirlet ssp. **sphenoides** (Kunze) W. Boer, nov. stat.

Basionym: *Trichomanes sphenoides* Kunze, Farrnkr., 216, tab. 88 f. 2. 1840; Kunze, Linnaea, 9:102. 1843; Sturm, Flora Bras. 1 (2):277. 1859 (partly); Maxon, Pterid. Porto Rico & Virg. Isl., 496. 1926; *Didymoglossum sphenoides* (Kunze) Presl, Abh. böhm. Ges. Wiss., 5:115. 1843; Copeland, Philipp. Jo. Sci., 67:77. 1938.

Type: Poeppig s.n., from Cuchero, Peru (W).

Fig. 19

Young and sterile fronds orbicular with a cordate or truncate base; full-grown and fertile fronds often more broadly oblong or obovate with a cuneate base, subsessile to stipitate; stipe to 1 cm long. Venation flabellate, the veins crowded, nearly equal in thickness, only a few stronger veins running to sori or lobes. The upper part of the lamina sometimes with a few irregular, more or less linear lobes, or regularly crenate. Margin with long stellate hairs. Sori few to several, placed between lobes, usually immersed about halfway, the involucres contracted in the neck, their circular lips narrowly dark-edged, as broad as the tube.

Distribution: Central America, Greater Antilles, and n.w. South America (map 8). On tree-trunks and in very wet forest ravines, at lower and middle elevations.

Representative specimens:

GUATEMALA: Alta Verapaz, Chama, Johnson 493 (US); along Rio Sebol, Steyermark 45803 (F); dept. Izabal, Rio Perdonalis, Johnson 1251 (US); without locality, Salvin & Godman s.n. (K).

COSTA RICA: Peralta, Lankester 594 (US).

PANAMA: Laguna de Chiriquí, Bocas del Toro, Hart 28 (US), 63a (US); above Penonome, Williams 473 (US); Canal Zone, Rio Chagres, Steyermark & Allen

16799 (MO); prov. de Colón, on top of Tumba Vieja, Dodge, Steyermark & Allen 16950 (MO, US); Juan Diaz, Killip 2519 (US); San José Island, Perlas Archipelago, Johnston 102 (MO), 116 (GH, UC).

CUBA: La Prenda, Guantánamo, Hioram & Maurel 4999 (GH, US); Yateras, Maxon 4492 (US); Sierra de Nipe at Rio Piloto, Ekman 2581 (G, S, UC); Habana, Tapaste, Ecn s.n. (S-PA).

JAMAICA: Portland, near Trafalgar, Maxon & Killip 759 (F, GH, US); St. Thomas, above House Hill, Maxon 8864 (GH, US), 9128 (GH, US); St. Elisabeth, Ginger Hill, Kramer 1747 (U).

HISPANIOLA: Dominican Republic: Samaná, H 15121 (S); Cordillera Central, Lagunas de Cenobi, Ekman H 12957 (F, G, S, US). Haïti: Massif du Nord, St. Louis du Nord, Ekman H 3868 (S, US); Massif de la Hotte, Jérémie, Ekman H 10252 (F, G, GH, S, US); Aux Cayes, Ekman H 96 (S).

PUERTO RICO: Luquillo Mts., P. Wilson 248 (US); *ibid.*, Sintenis 1759 (B); Pueblo Viego near San Juan, Hioram s.n. (U, US).

COLOMBIA: Santa Marta, H. H. Smith 1102 (B, F, G, GH, MO, S-PA, UC, US); dept. Santander, near Barranca Bermeja, Haught 1565 (GH, UC, US); dept. El Valle, Rio Digua Valley, Killip 34885 (US); El Chocó, Andagoya, Killip 35050 (US).

VENEZUELA: near Tovar, Fendler 452 (B, G, GH, MO).

PERU: dept. Loreto, Puerto Aturo, Killip & Smith 27788 (US); Santa Rosa, Killip & Smith 28872 (GH, US); dept. San Martín, Tingo María, Allard 21910 (GH, US); prov. Huánuco, near confluence of R. Cayumba and R. Huallaga, Mexía 8275 (B, F, G, GH, MO, S, S-PA, U, UC, US); dept. Junín, Rio Paucartambo Valley, Killip & Smith 25309 (US); Puerto Bermudez, Killip & Smith 26592 (US); Cuchero, Poeppig s.n. (B, MO, W).

BOLIVIA: Isapuri, Williams 1223 (US), 1224 (US, W).

Kunze described and illustrated *T. sphenoides* with immersed sori. Lindman based his interpretation of *T. sphenoides* on this figure and determined many specimens of *T. angustifrons*, a species which has the sori immersed to the lips, as *T. sphenoides*. The illustration shows, however, the involucre and marginal vein of the *Microgonium* section and stellate hairs of *Didymoglossum*. The drawing was probably prepared from a mixed collection.

The differences between *T. sphenoides* and *T. punctatum* are only slight; particularly young, undeveloped fronds are quite similar. Therefore they are not maintained here as distinct species but, since they are sufficiently clear-cut and geographically exclusive, they have been treated as subspecies of *T. punctatum*, with ssp. *floridanum* and ssp. *labiatum*.

7d. ***Trichomanes punctatum* Poiret ssp. *labiatum* (Jenman) W. Boer, nov. stat.**

Basionym: *Trichomanes labiatum* Jenman, Gard. Chr., ser. 2. 24:7. 1885; Jenman, West Ind. Gui. F., 18. 1898.

Type: Jenman 2109, from Bartica Grove, Essequibo River, British Guiana (K).

Heterotypic synonyms: *Trichomanes fruticosum* Jenman, Gard. Chr., ser. 3. 15:71. 1894; Jenman, West Ind. Gui. F., 18. 1898. Type: Jenman 2351, from Mazaruni River, British Guiana (K). *Trichomanes myrioneuron* Lindman, Ark. f. Bot., 1:48, f. 28 A-C. 1903. Type: Sagot 847 (partly), from French Guiana (S-PA).

Fig. 20

Fronds, also when full-grown, circular or reniform, 0.6–1.2 cm long and wide, sessile or shortly stipitate, the base rounded or cordate, rarely shortly cuneate, the apex rounded, in fertile fronds with a cleft, the margin entire or crenate above. Venation flabellate with a costa extending approximately to the middle. Veins rather close, regularly forked and equal in thickness; all veinlets connected. Sori few, usually single, placed in a sinus. Involucres free or rarely immersed at the base, the large circular lips with a broad border of dark cells which are radially arranged.

Distribution: Costa Rica, Venezuela, Guiana, and Brazil (map 8). In forests on trunks of trees and on rocks, mostly at lower elevations.

Representative specimens:

COSTA RICA: prov. of Cartago, Rio Reventazon, Holm & Iltis 31 (MO, US).
 VENEZUELA: Lower Orinoco, Santa Catalina, Rusby & Squires 456 (K, US).
 BRITISH GUIANA: Bartica Grove, Essequibo River, Jenman 2105 (K), 2109 (K, S), 2151 (K); Essequibo River near mouth of Onoro Creek, A. C. Smith 2795a (F, K, MO, S-PA, U, US); Mazaruni River, Ruins Kyke over all, Jenman 2351 (K, S); Upper Demerara River, Great Falls, Jenman 3985 (B, K).
 SURINAME: Tibiti savanna, in forest, Lanjouw & Lindeman 1859 (U); Plantage Berlijn, Wullschlägel 1206 (W); Upper Nickerie River, Jonker 414 (U); Toso Creek, Florschütz 471 (U); near Ebba Peak, Florschütz 1352 (U); Nassau Mts, Lanjouw & Lindeman 2943 (U, US).
 FRENCH GUIANA: Acarouany, Sagot 847 pp. (B, G, P, S-PA, W); near Cayenne, Broadway 871 (GH, S, US); Charvein, Benoist 468 (P); without locality, Leprieur 207 p.p. (GH, L).
 BRAZIL: Amazonas: Manaus, Schwacke III 538 (B); Rio Juruá, near Marary, Ule 5317 (B, G).
 Matto Grosso: Macoco, Poaia, Lindman A 2903 (S, S-PA).
 Rio de Janeiro: without locality, Glaziou 587 (P), 9309 (P), 14413 (B).
 Without locality, Burchell 10102 (B, GH); id., Riedel s.n. (G, US).

8. *Trichomanes curtii* Rosenstock, Rep. Spec. Nov., 22:5. 1925; Copeland, Philipp. Jo. Sci., 67:78. 1938.

Type: A. & C. Brade 398a, from Costa Rica, Litorale Atlanticum, Finca Gebr. Hundrieszer (S-PA).

Fig. 21

Fronds ovate, entire or with short lobes, fissile when dry. Veins flabellate, very crowded. Sori many, 6–10 or even more, free. Involucres with small oblong lips.

Fronds firm, dark green, roundish-oblong, ovate, or obovate, 1.5–2 cm long, 1–1.5 cm wide, usually rounded, sometimes cuneate at the base, the apex rounded, more or less irregularly lobed. Stipes short, 0.1–0.3 cm, radiculose. Margin densely stellate-ciliate. Young unexpanded fronds with an apical dark brown fringe of hairs. Lamina firmly membranous, not translucent, bright green, lustrous. Fronds in drying often strongly split. Costa wanting. Venation very densely flabellate, interspaces of 2–6 rows of cells; veins of unequal thickness. Sori many, 6–10 or more, often on small, short lobes, or sometimes with the base slightly immersed. Involucres narrowly winged, their lips are longer than wide and as wide as the winged tube, with a broad border of black cells.

Distribution: Central America (map 9). On the lower parts of tree-trunks and on rocks on lower elevations, from sea-level to ca 300 m.

Representative specimens:

BRITISH HONDURAS: Tamash River, Schipp S. 934 (GH).

GUATEMALA: dept. Izabal, Rio Chacon, Johnson 1208 (US); without locality, Hatch & Wilson 83 (US).

NICARAGUA: Indian River, near San Juan del Norte, C. L. Smith 2032 (GH, MO, UC); dept. Zelaya, near El Recreo, Standley 19434 (F).

COSTA RICA: Finca Hundrieszer, Brade 398a (M, S-PA, UC, W); Peninsula Osa, near Puerto Jimenez, Cufodontis 219 (G, W); Limón prov., Finca Hamburg, Dodge & Goerger 9511 (MO, US); prov. of Alajuela, near Guatuso de San Rafael, Holm & Iltis 844 (MO, US); prov. of Heredia, on the Rio Puerto Viejo, Scamman 7430 (GH); near Paraiso, Skutch 9 (US).

PANAMA: prov. Bocas del Toro, Isla de Colón, Woodson, Allen & Seibert 1940 (GH, MO, US); Canal Zone, n. of Frijoles, Standley 27543 (US); Rio Indio de Gatun, Maxon 4787 (GH), 4878 (US); Chagres, Stevens 1287 (US); prov. of Colón, near Porto Bello, Maxon 5737 (US).

COLOMBIA: Cape Corrientes, Chocó, Taylor 1262 (US).

A clear-cut, yet not very distinctive species; the closest relative is *T. punctatum* ssp. *sphenoides*. It is distinguished by the larger, not translucent leaves with very dense venation and many stellate marginal hairs and more or less oblong, black-edged involucre lips. *T. curtii* differs from *T. lineolatum* in the shape of the lamina and its larger size, having more numerous, free sori with oblong lips, and in the veins not becoming dilated towards the margin.

9. ***Trichomanes lineolatum*** (van den Bosch) Hooker in Hooker & Baker, Syn. Fil., 73. 1867; ed. 2:73. 1874; Lindman, Ark. f. Bot., 1:54, f. 30 B, f. 31 D & E. 1903; Urban, Symb. Ant., 9:28. 1925; Maxon, Pterid. Porto Rico & Virg. Isl., 497. 1926.

Basionym: *Didymoglossum lineolatum* van den Bosch, Ned. Kruidk. Arch., 5:136. 1863; Copeland, Philipp. Jo. Sci., 67:78. 1938.

Type: March 133, from Jamaica, without locality (L).

Fig. 22

Fronds obovate, the base cuneate. Margin with short thick stellate hairs. Venation flabellate, the veins enlarged towards the margin. Involucres immersed to the lips.

Fronds variable; small ones more or less orbicular with a cordate base, well-developed ones obovate or spatulate, 1–3 cm long and 0.5–1.8 cm wide, the base long-cuneate, the apex of young, unexpanded fronds rounded and hairy, when older more or less split into segments and irregularly lobed; margin with rather short and thick stellate hairs, these deciduous with age, then the margin erose-denticulate. Stipes of very variable length, often 1–2 cm long. Costa only present in the lower part of the lamina or wanting. Veins flabellate, repeatedly branched, with narrow interspaces, dilated towards the margin, prominent in drying. Sori few, 1–5, usually placed on very short terminal lobes. Involucres immersed to the lips, only rarely wholly or partly free, their small circular lips broadly dark-edged and about as wide as the tube.

Distribution: Florida and the Greater Antilles; also one record from Venezuela, Brazil, and St. Vincent each (map 10). On wet rocks, usually on limestone rocks and on trunks of trees at lower and middle elevations.

Representative specimens:

FLORIDA: s. of Cutler, Eaton 721 (GH); Silver Palm School, Small & Carter 2379 (F, GH, MO, S-PA, US).

CUBA: Oriente, near Monte Verde, Wright 915 (B, G, GH, L, MO, S-PA, US), 952 p.p. (B, G, GH, L, MO, P, S-PA, UC, US); near Baracoa, Pollard, E. & W. Palmer 233 (S-PA), 234a (F, US); *ibid.*, Underwood & Earle 774 (S, US); Yateras, near Jaguey, Maxon 4159 (GH, US), 4405 (US), 4441 (G, GH, US); Sierra Maestra, Loma del Gato, Hioram & Clement 6507 (UC, US); *ibid.*, Leon, Clement & Roca 10263 (US); between Sevilla and Baire, Ekman 10345 (S); Armenie, Clement 758 (P, U, US); Tapaste, Lomas de la Jaula, Ekman 1339 (S).

JAMAICA: Hartford, near Priestman's River, Maxon 2515 (S, US); Mansfield, near Bath, Maxon 2397 (S, US), 2473 (S, US), 2474 (S, US); near Rowlands field, Webster & Proctor 5548 (GH); above Moore Town, Clute 263 (F, K, MO, US); Fern Gully, St. Ann, Maxon 10349 (GH, US), 10358 (GH, US), 10363 (GH, US), 10372 (GH, US), 10391 (GH, US); Somerset, n.w. of Mandeville, Proctor 17458 (MO); Darliston, Westmoreland, Orcutt 6224 (G, MO, UC, US); Newmarket at Fords Pen, Orcutt 7373 (B, G, GH, MO, P, S-PA, UC, US, W).

HISPANIOLA: Haïti: Massif du Nord, St. Louis du Nord, Ekman H 3792 (G, MO, S, US); *ibid.*, E. C. & G. M. Leonard 14246 (GH, US), 14578 (GH, MO, UC, US). Dominican Republic: Samaná Peninsula, near Sanchez, Abbott 200a (US); near Samaná, Ekman H 14957a (G, S, UC, US), H 14957b (GH, S); Sto. Domingo, Eggers 2505a (F), 2638 (B); Cordillera Septentrional, Colonia de Jamao, Ekman H 12573 (G, GH, S, U, UC, US); Sosúa, Jaguanucha, Ekman H 14575 (S); Loma Isabel de Torre, Eggers 2753 (B, G, K, L, US).

PUERTO RICO: Gully above Carozal, Britton 8358 (US); The Caves Aguas Buenas, Blomquist 12009 (UC); near Utuado, Britton & Cowell 993 (US), 1039 (US); near Arecibo, Britton & Cowell 1996 (GH, US); *ibid.*, Britton 5101 (GH, MO, S, US); near Florida, N. L. & E. G. Britton & Boynton 8180 (US); near Hatillo, Sintenis 6193 (B, S-PA).

ST. VINCENT: Guilding s.n. (GH); without collector, ex herb. Hooker (P).

VENEZUELA: near Tovar, Fendler 454 (B, G, GH, MO).

BRAZIL: Pará, Tauau, Spruce 60 p.p. (B).

When Suringar published van den Bosch's posthumous diagnose of *T. lineolatum*, he cited two collections without collection-numbers. In the original manuscript, now at Leiden, are quoted from Cuba: Wright 915, Wright 911 p.p. and Wright 952 and from Jamaica: March 126, March 133, and Wilson s.n.; the Jamaican specimens all in herbarium Hooker. In the Leiden herbarium there is a sheet of *T. lineolatum* collected by March, number 133 ex herb. Hooker, from Jamaica; this is chosen here as lectotype.

This species occurs mainly in the Greater Antilles. In South America only the records from Venezuela (Fendler 454) and Brazil (Spruce 60) proved to be correct; other records are due to misidentifications.

Didymoglossum laceratum from Guadeloupe is not a synonym of *T. lineolatum* as is often stated, but of *T. punctatum*. Fée's plate shows clearly that the veins are not dilated and the involucre are wholly free with large lips.

Lindman confused *T. lineolatum* with *T. punctatum*. The differences with the latter are: the more crowded, dilated veins, prominent in drying, and the shorter and thicker stellate hairs, deciduous with age.

10. ***Trichomanes rhipidophyllum*** Slosson, Bull. Torr. Bot. Cl., 40:687, pl. 26 f. 1-3. 1913.

Type: Herbert H. Smith 2445, from Santa Marta, near Onaca, Colombia (NY).

Fig. 23a, b

Fronds circular, margins irregularly sublobate, with a few simple or binate hairs. Leaf-tissue cells radially lengthened, the marginal cells tangentially. Involucres free, in a sinus. Lips short and broad.

Fronds orbicular or almost semicircular, 0,7–1,5 cm long and wide, at base heart-shaped or more or less cuneate, with a cleft at the top. Margin irregularly undulate or sublobate; marginal hairs few, simple or binate. Venation flabellate; veins usually twice forked. In fertile fronds with only a single terminal sorus a flexuose costa present; non-connected spurious veinlets few, very short. Leaf-tissue cells strongly radially lengthened with thick sidewalls, perpendicular to the leaf, the outermost two rows of cells tangentially lengthened. Sori few, 1–2, placed in sinuses. Involucres free or only at the base somewhat immersed, with short lips, about as broad as the mouth of the tube.

Distribution: Only known from two localities: Costa Rica at 1000 m alt. and Colombia on a tree in damp forest, alt. 760 m (map 11).

Specimens seen:

COSTA RICA: Juan Vinas, Reventazon Valley, Cook & Doyle 236 (US).

COLOMBIA: Santa Marta, near Onaca, H. H. Smith 2445 (F, G, GH, MO, S-PA, US), 2449 (B).

The species ranks very near to *T. hymenoides* and is perhaps not a distinct species but only a subspecies of the latter. Marked by its rounded, never pinnatifid, not more than sublobate fronds without stellate hairs and the very peculiar leaf-tissue structure, it is not likely to be mistaken for any other.

11. ***Trichomanes hymenoides*** Hedwig, Fil. Gen. Spec., tab. 3, f. 3. 1799; Lindman, Ark. f. Bot., 1:12, f. 1–3, f. 6. 1903; Rosensstock, Hedwigia, 46:75. 1906; Urban, Symb. Antill., 9:281. 1925, partly; Domin, Pterid. Dominica, 46. 1929; Hodge, Lloydia, 17:59. 1954.

Type: As a type specimen could not be found, Hedwig's plate should be regarded as the type.

Homotypic synonyms: *Didymoglossum hymenoides* (Hedwig) Desvaux, Mém. Soc. Linn. Paris, 6:330. 1827; van den Bosch, Ned. Kruidk. Arch., 4:380. 1859; *Hemiphlebium hymenoides* (Hedwig) Prantl, Hymenoph., 46. 1875.

Heterotypic synonyms: *Trichomanes muscoides* Swartz, Schrad. Jo., 1800 (2):95. 1801; Swartz, Flora Ind. Occ., 3:1726. 1806; Swartz, Syn. Fil., 141. 1806; Müller, Bot. Zeit., 12:735. 1854; Sturm, Flora Bras., 1 (2):278. 1859; *Didymoglossum muscoides* (Swartz) Desvaux, Mém. Soc. Linn. Paris, 6:330. 1827; Presl, Abh. böhm. Ges. Wiss., 5:115. 1843; *Hemiphlebium muscoides* (Swartz) Prantl, Hymenoph., 46, tab. IV f. 59 A. 1875. Type: Swartz s.n., from Jamaica (S-PA). *Trichomanes apodum* Hooker & Greville, Icon. Fil., 1: tab. 117. 1831;

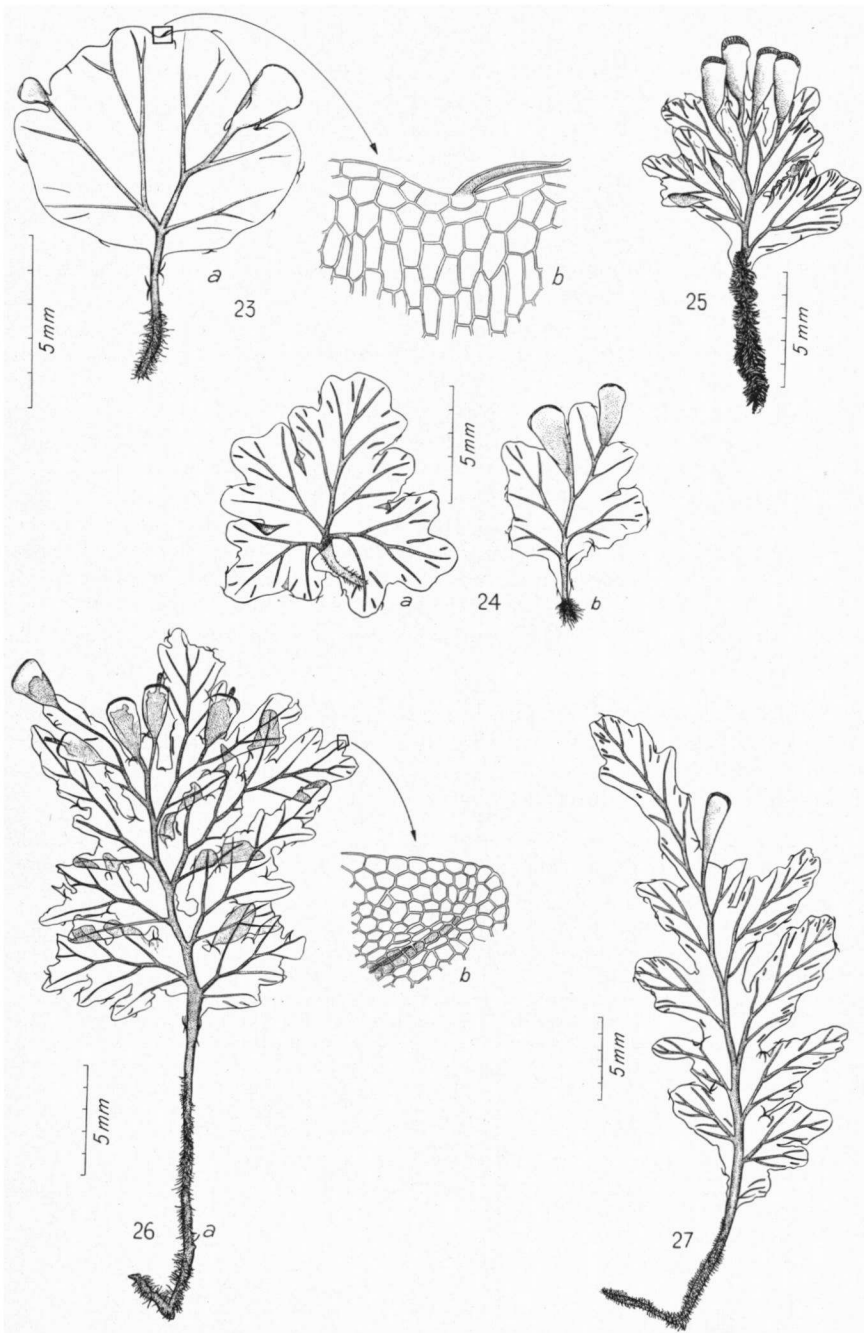


Fig. 23. *Trichomanes rhipidophyllum* (Smith 2449); a frond, b leaf-tissue at the margin.
 - Fig. 24. *Trichomanes hymenoides* (Lindman A 397b); a sterile, b fertile. - Fig. 25.
Trichomanes hymenoides (Swartz s.n.), type collection of *T. muscoides*. - Fig. 26.
Trichomanes hymenoides (Steiermark 37345); a frond, b leaf-tissue at the margin.
 - Fig. 27. *Trichomanes hymenoides* (Liebman s.n.).

Grisebach, *Flora Brit. West Ind.*, 657. 1864; Hooker & Baker, *Syn. Fil.*, ed. 2:75. 1874; Jenman, *West Ind. Gui. F.*, 19. 1898. Type: Parker s.n., from Barbados. *Trichomanes pabstianum* C. Müller, *Bot. Zeit.*, 12:738. 1854; Sturm, *Flora Bras.*, 1 (2):279. 1859; *Didymoglossum pabstianum* (C. Müller) van den Bosch, *Ned. Kruidk. Arch.*, 4:380. 1859. Type: Pabst 267, from Santa Catarina, Brazil (B). *Microgonium schaffneri* Fée, 9 *Mém.*, 38. 1857. Type: Schaffner s.n., from Huatusco, Mexico (not seen); not *Trichomanes schaffneri* Schlechtendal. *Didymoglossum sociale* Fée, *Crypt. Vasc. Brés.*, 2:85, tab. 85 f. 3. 1873; *Trichomanes sociale* (Fée) Lindman, *Ark. f. Bot.*, 1:17, f. 4-6. 1903. Type: Glaziou 5242, from Tijuca, Rio de Janeiro, Brazil (P). *Trichomanes orbiculare* Christ, *Bot. Jahrb.*, 19 *Beibl.* 47:26. 1894; *Farnkr. d. E.*, 25. 1897; Schwacke, *Pl. Nov. Mineiras*, 2:16. 1900; *Bull. Boiss.*, ser. 2. 2:326. 1902; Sadebeck, in Engler & Prantl, *Nat. Pfl.*, 1 (4):104. 1902. Type: Moeller s.n., from Blumenau, Sta. Catarina, Brazil (not seen). *Trichomanes fraseri* Jenman, *Gard. Chron.*, ser. 3. 20:266. 1896; Jenman, *West Ind. Gui. F.*, 19. 1898. Type: Fraser s.n., from Grenada (K). *Trichomanes hymenoides* Hedwig forma *pseudo-reptans* Rosenstock, *Hedwigia*, 46:75. 1906; *Trichomanes pseudo-reptans* (Rosenstock) Sehnem, *Sellowia*, 7:313. 1956. Type: Jürgens & Stier 140, from Serra de João Rodriguez, Rio Grande do Sul, Brazil (S-PA).

Fig. 24, 25, 26a, b, 27

Fronds oblong, oval or rounded-quadrangular. Venation subflabellate with a costa percurrent to the top. Lobes with a regularly pinnate costule. Sori few to several, usually closely together at the top. Involucres free, with short dark-edged lips.

Fronds very variable and polymorphous, even the fronds in one tuft and on the same rhizome. The shape varies from oblong to more or less reniform, broadest in the lower part; base cordate, rounded or cuneate. Stipe 0,1-0,6 cm long, upwards glabrous, veins also without rhizoids. Lamina more or less regularly lobed or freely pinnatifid; lobes obtuse with uniformly branched and ramifying veins. Venation subflabellate with a distinct costa percurrent to the top. Veins bearing regularly pinnately arranged, alternating sideveins and free false veinlets between them. Marginal hairs simple or binate, only in the sinuses occasionally stellate hairs present. Sori one to several, 1-6, confined to the top, closely together and at the same level. Involucres free or only at the base somewhat immersed, urceolate, with short lips, these at length opening and forming a nearly circular rim, but not recurved.

Distribution: Central America, West Indies and South America to Bolivia, Paraguay, northern Argentina and Uruguay (map 12). On rocks and tree-trunks in wet mountain forests at middle and higher elevations. In the southernmost part of the area at sea-level.

Representative specimens:

MEXICO: Vera Cruz, Jalapa, Pringle 10.809 (GH, US); Zacuapan, Purpus 2929 (GH, MO, UC, US); Mirador, Liebman s.n. (G, GH, S-PA, US); *ibid.*, Purpus 156 (US), 158 (G, US); Oaxaca, Galeotti 6995 (P).

GUATEMALA: Alta Verapaz, near Coban, von Türckheim 847 (US); *ibid.*, Johnson 710 (US); *ibid.*, Salvin & Godman s.n. (K); near Patal, Sharp 45274 (US); Solola, Atitlan Volcano, Hatch & C. L. Wilson 366 (US); San Marcos, volcan Tajumulco, Steyermark 37345 (US).

- BRITISH HONDURAS: Camp 35, Schipp S-778 (GH).
- COSTA RICA: Guanacaste, Tilaran, Standley & Valerio 45831 (US); Cartago, El Muñeco, Standley & Torres 51041 (US); near Turrialba, Holm & Iltis 55 (F, MO, US); San José, near Sta. Maria, Standley & Valerio 43228 (US); La Palma, Valerio 132 (US); Tablazo, Brade 645 (Rosenstock Fil. costaricensis exsicc. 225, M, S-PA, UC, W).
- PANAMA: Chiriquí, near El Boquete, Maxon 5012 (GH, US), 5191 (S, US).
- CUBA: Oriente, Wright 914 (B, G, GH, K, L, MO, US); La Prenda, Hioram & Maurel 4998 (US).
- JAMAICA: John Crow Peak, Maxon 1318 (S, US); without locality, Swartz s.n. (S-PA, US).
- HISPANIOLA: Haiti: near St. Louis du Nord, E. C. & G. M. Leonard 14496 (US), 14497 (US); *ibid.*, Ekman H 4674 (S, US), H 4740 (G, K, S, US); Ennery, Morne Basile, Ekman H 8472 (G, S); Dominican Republic: near Puerta Plata, Eggers 1590 (B, L); near Constanza, von Türkheim 3066 (G, GH, L, S, US, W); *ibid.*, Ekman H 13995 (S); Bonao, Ekman H 16447 (S); Moncion, near junction of Rio Cenobi with Cenobicitio, Ekman H 12889 (G, GH, S, U, UC, US), H 12890 (G, GH, K, S, US); San José de Ocoa, Bejucal, Ekman H 11812 (S, US).
- GUADELOUPE: Duss 4300 (US), 4459 (GH, MO, US), 4440 (US); Questel 1129 (US), 1999 (US); L'Herminier s.n. (L, MO).
- DOMINICA: Hodge 140 (GH), 2372 (GH, US).
- MARTINIQUE: Duss 1536 (US); Hahn 1151 (B), 1164 (B).
- BARBADOS: Parker s.n. (Ed, K).
- GRENADA: Fraser s.n. (K).
- COLOMBIA: Santa Marta, H. H. Smith 2217 (U), 2253 (F, GH, L, MO, S-PA, U, US); Caquetá, Sucre, Woronow & Juzepczuk 5869 (US).
- VENEZUELA: Merida, Moritz 342 (B, PRC, S-PA, W).
- TRINIDAD: Crüger s.n. (L).
- PERU: Sierra del Pongo, Mexía 6289b (GH, US).
- BOLIVIA: near Atén, Williams 1232 (GH, US).
- PARAGUAY: Cerro Leon e. of Pirayu, Balansa 2822 pp. (G, L, W); Sierra de Amambay, Hassler 11997 (G); Cordillera de Altos, Hassler 29 (G, S-PA); San Bernardino, Hassler 46 (G); *ibid.*, Osten & Rojas 8686 (S, S-PA); near Sapucay, Hassler 12251d (G); Pirapo, Lindman A 1803 (S, S-PA).
- ARGENTINA: Misiones, Posadas, Ekman 77 (S, S-PA, W); Rimas de Loreto, Niederlein 23 (B).
- URUGUAY: dept. de Tacuarembó, Gruta Helechos, Herter 1232 (B, G, GH, MO, S, S-PA, U, UC, US); without locality, Valetae 5299z3 (B).
- BRAZIL: Rio Grande do Sul: Porto Alegre, Canoas, Lindman A 397 (G, S, US); Viamão, Herter 20852 (B); São Leopoldo, Dutra 163 (R); Serra de João Rodriguez, Jürgens & Stier 140 (S-PA, UC); Mun. Venancio Aires, Jürgens 141 (S-PA); Cruz Alta, Lindman A 397b (S, S-PA); Sta. Cruz, Fazenda Leitão, Jürgens & Stier 141 (Rosenstock, Fil. austrobras. exsicc. 160, B, F, P, S, S-PA, U, UC, US, W); Sta. Cruz, Boa Vista, Jürgens & Stier 295 (S).
- Santa Catarina: near Desterro, Pabst 267 (B, L), 961 (P); near Lages, Spannagel 61 (S-PA, US); near Blumenau, Schwacke IV 193 (R); São Francisco, Pão d'Asengar, Ule 82 (B, US).
- São Paulo: near Salto Grande, Rio Paranapanema, Wettstein & Schiffner s.n. (W); Ribeira, Pariquerá, Brade 5168 (S-PA); Serra Paranapiacaba, Brade 8372 (S-PA); Campinas, Heiner 614 (S).
- Rio de Janeiro: Pico de Tijuca, Brade 18278 (R, UC), 20607 (R, UC); Tijuca, Glaziou 5242 (B, P, S, S-PA, U, US); Theresopolis, Brade 9288 (R), 9685 (R); *ibid.*, Patschke 74 (B).
- Minas Gerais: Ouro Preto, Damazio 1104 (R).
- Matto Grosso: Sta. Anna da Chapada, Malme 2483 (S).

Specimens of *T. hymenoides* have been described and named many times as new species because of the polymorphism of the lamina. Rosenstock pointed out already that all the different forms are connected by intermediate stages and reduced these species to forms of

T. hymenoides. But, since the different stages are present on the same rhizome and it is impossible to find a geographical segregation, there is no reason at all to distinguish these different taxa.

In general there is a trend towards a morphological series within the distribution range: the specimens from Central America, adjacent northern South America and sometimes also from the West Indies have rather large, deeply pinnatifid or bipinnatifid fronds and larger, more rounded involucre lips (Fig. 26a, 27); in herbaria they are often named *T. montanum*; the typical West Indian plants have small obovate pinnatilobed fronds and short involucre lips (Fig. 24a, b), extremely so in, e.g., Parker s.n. from Barbados, the type collection of *T. apodum*; in the southernmost part of the area the leaves are rounded or reniform and palmatifid or palmatilobed, and the involucre lips are also very short, e.g. Pabst 267 from Santa Catarina, the type of *T. pabstianum*, and Glaziou 5242 from Tijuca, Rio de Janeiro, the type of *D. sociale*. This, however, is only a tendency and does not hold consistently. For this reason *T. rhipidophyllum* is treated here as a distinct species, because rounded, undivided or undissected leaves may be expected as a natural transition in South Brazil, although so far they have not been found there, but not in Colombia and Costa Rica. *T. rhipidophyllum* has also very characteristic leaf-tissue.

12. ***Trichomanes reptans*** Swartz, Prod., 136. 1788; Hedwig, Fil. Gen. Spec., tab. 3 f. 4. 1799; Swartz, Flora Ind. Occ., 3:1727. 1806; Swartz, Syn. Fil., 141. 1806; Sturm, Flora Bras., 1 (2):279, tab. 18 f. 3. 1859; Jenman, Bull. Bot. Dept. Jamaica, 20:7. 1890; Jenman, West Ind. Gui. F., 20. 1898; Lindman, Ark. f. Bot., 1:30, f. 17-19. 1903; Hieronymus, Bot. Jahrb., 34:419. 1904; not of Hooker & Greville, Icon. Fil., tab. 32. 1831; Grisebach, Flora Brit. West Ind., 657. 1864; Hooker & Baker, Syn. Fil., ed. 2:74. 1874.

Type: Swartz s.n., from Jamaica (S-PA).

Homotypic synonyms: *Didymoglossum reptans* (Swartz) Presl, Abh. böhm. Ges. Wiss., 5:115. 1843; *Didymoglossum hedwigii* Presl, Abh. böhm. Ges. Wiss., 5:335. 1848.

Heterotypic synonyms: *Trichomanes quercifolium* Hooker & Greville, Icon. Fil., tab. 115. 1829; Hooker, Spec. Fil., 1:120. 1844; Lindman, Ark. f. Bot., 1:20. 1903; *Didymoglossum quercifolium* (Hooker & Greville) Presl, Abh. böhm. Ges. Wiss., 5:115. 1843; *Trichomanes reptans* Swartz var. *quercifolium* (Hooker & Greville) Jenman, Bull. Bot. Dept. Jamaica, 20:7. 1890. Type: Jameson s.n., from Esmeraldas, Colombia (Ed). *Trichomanes montanum* Hooker, Icon. Plant., tab. 187. 1837. Type: Jameson s.n., from Esmeraldas, Colombia (K). *Trichomanes pusillum* Swartz var. *macropus* Christ in Schwacke, Pl. Nov. Minairas, 2:15. 1900. Type: Tonduz 12250, from Santa Rosa du Copey, Costa Rica (G).

Misapplied name: *Trichomanes pusillum* auct. non Swartz, Hooker, Spec. Fil., 1:117. 1844; Hooker & Baker, Syn. Fil., ed. 2:77. 1874; Christ, Farnkr. d. E., 26. 1897.

Fig. 28

Fronds oblong or lanceolate, deeply pinnatifid, the lobes with many (short) false veinlets. Sori several in the apical part of the frond, mostly wholly exserted. Involucres with long rounded lips.

Fronds irregular in outline, oblong or lanceolate-oblong, narrowed to the base, broadest above, lobed or pinnatifid, 3–6 cm long and 1.5–3 cm wide, the top generally abrupt and the upper part often with irregular lobes to 2 cm long, which are again cut into irregular segments. Costules of the lobes with many side-veins and non-connected false veinlets. Margin of the frond with rather long and thin simple or bifid hairs; in the sinuses often stellate hairs. Stipes short, to 1 cm. Sori several, in the apical part of the lamina where the leaf-tissue is sometimes more or less suppressed. Involucres free and even short-stalked or rarely partly immersed, narrowly winged. Lips conspicuous, rounded, dark-edged, at first closed, when older recurved; receptacle long-exserted.

Distribution: Central and northern South America, Greater Antilles and also South Brazil and northern Argentina (map 13). Epiphytic, particularly on tree-roots, also on trunks and very wet rocks, at high altitudes, mostly 2000–3000 m but some records from lower elevations.

Representative specimens:

MEXICO: Vera Cruz: Mirador, Sartorius s.n. (B, F, W); Vera Cruz, Purpus 155 (US); Chiapas, without locality, Ghiesbreght 611 (G, GH).

GUATEMALA: dept. Huehuetenango, near Maxbal, Steyermark 48873 (US); dept. Alta Verapaz, Pansamala, von Türkheim 916 (B, GH, UC, US); Coban, von Türkheim II 1850 (US); Cerro Sobre, Hatch & Wilson 145 (US); Sepacuité, Cook & Doyle 123 (US); dept. San Marcos, Tajumulco volcano, Steyermark 37445 (US); dept. Zacapa, Sierra de las Minas, Steyermark 29988 (US); dept. Quetzaltenango, volcan de Zunil, Standley 65391 (US).

HONDURAS: Siguatepeque, Yuncker, Dawson & Youse 6195 (US); dept. Morazan, San Juancito Mts., Morton 7398 (US); *ibid.*, L. O. Williams 17510 (US).

NICARAGUA: without locality, Lévy 1480 (GH, P).

COSTA RICA: Vara Blanca, Maxon & Harvey 8371 (US); *ibid.*, Skutch 3268 (GH, MO, S-PA, US); Desengano, Wendland 855 (W); San Jeronimo, Wercklé 548 (US); prov. Limon, Rio Banano, Gutierrez 195 (F); Tablazo, Brade 644 (UC); *ibid.*, Valerio 308 (US); near Turrialba, Hatch 102 (F); El General, Skutch 2284 (S-PA, US).

PANAMA: Chiriquí, Monte Lirio, Seibert 291 (MO); El Boquete, Maxon 5727 (GH, S, US); *ibid.*, Cornman 825 (US), 943 (US), 1019 (US), 1029 (US), 1174 (US), 1246 (US), 1277 (US), 1324 (US); Rio Huebrada Valley, Killip 5130 (GH, US).

JAMAICA: near Portland Gap, D. S. Johnson s.n. (US); *ibid.*, Skutch s.n. (US); Latimer River, D. S. Johnson s.n. (US); Catherine's Peak, Webster & Goldberg 107 (US); without locality, Swartz s.n. (S-PA).

HISPANIOLA: Haïti; Massif de la Hotte, Torbec, Ekman H 7450 (S, US); near Furcy, Leonard 4787a (US); *ibid.*, Ekman H 1301 (S, US); Massif du Nord, Ennery, Ekman H 8471 (G, S, US); Guimbi Galata, Holdridge 3101 (US).

COLOMBIA: Santa Marta, H. H. Smith 2254 (GH, L, MO, US); Rio Hacha, Schlim 862 (B, G, L, W); Ocaña, Schlim 630 (B, G, K, L, W); dept. Norte de Santander, Pamplona, Killip & Smith 19984 (GH, S, US); Charta, Killip & Smith 18977 (GH, US), 19153 (B, GH, US), 19162 (US); Surata, Killip & Smith 16658 (GH, S-PA, US); Esmeraldas, Jameson s.n. (K); Quindio, Las Cruces, André 2276 (GH, S-PA, U, US).

VENEZUELA: State of Sucre, Cerro Turumuquire, Steyermark 62536 (S, US), 62736 (GH, MO, S, US); state of Monagas, near Guacharo, Steyermark 62337 (GH, MO, US); state of Lara, Humocaro Alto, Steyermark 55527 (US); Sierra Nevada de Mérida, El Rincon, Pannier 180 (MO, US); near Tovar, Fendler 23 (B, G, GH, MO, US); *ibid.*, Karsten s.n. (G, W); *ibid.*, Moritz 265 (G, K, L, S-PA, W).

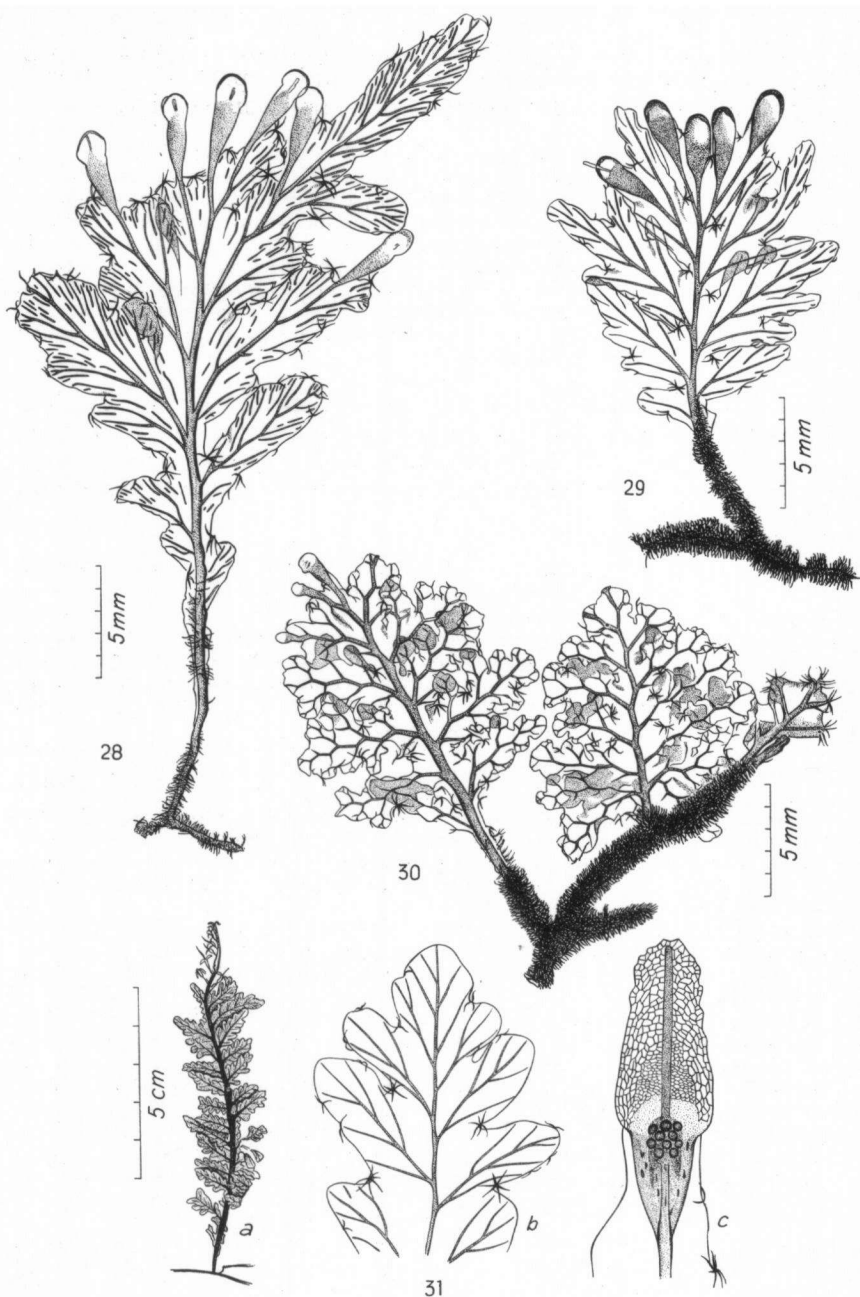


Fig. 28. *Trichomanes reptans* (Fendler 23). – Fig. 29. *Trichomanes kraussii* (Proctor 19247). – Fig. 30. *Trichomanes melanopus* (Spruce 5354), type collection. – Fig. 31. *Trichomanes gourlianum* (Mexia 8450); a frond, b pinna showing venation and marginal hairs, c sorus.

ECUADOR: prov. of Imbabura, volcan Cotocachi, Ownbey 2619 (US); prov. Pichincha, near La Campiña, Holmgren 669 (B, S, S-PA, US); Quito, Jameson 110 (G, GH); Rio Verde, Spruce 5353 (G, GH, W); prov. Chimborazo, Huigro, Camp E 3438 (F, US).

PERU: Mito, Bryan 392 (F).

ARGENTINA: prov. Tucumán, dept. Chichigasta, Las Povas, Venturi 6395 (GH); Caspichango, Castillon 40819 (GH, U).

BRAZIL: Santa Catarina; Lages, Spannagel 151 (S-PA, UC).

Rio de Janeiro: Rio de Janeiro, Glaziou 7532 (G, UC); Serra dos Orgãos, Glaziou 3352 (P, S, S-PA); Theresopolis, Brade 9928 (R, UC); Serra do Itatiaia, Maromba, Brade 10341 (R).

Minas Gerais: near Caldas, Regnell III 1490 (B, R, S, S-PA, US); *ibid.*, Lindberg 653b (B).

Neither *T. quercifolium* nor *T. montanum* can be separated from *T. reptans*; the type collections of the two first-named are more irregular and variable in shape than that of *T. reptans* but all intermediate forms are present. The collection of Robinson from Natal, South Africa, described as *T. robinsonii* by BAKER, *Jo. Linn. Soc.*, 9: tab. 8 f. B. 1867, agrees also quite well with *T. reptans*, the only differences being found in the shape of the lamina and of the involucre. Nevertheless, in the present author's opinion it is not certain that the two are conspecific.

Hooker and some other authors misapplied the name *T. pusillum*, applying it to *T. reptans* and identifying specimens of *T. punctatum* as *T. reptans*.

13. **Trichomanes krausii** Hooker & Greville, *Icon. Fil.*, tab. 149. 1831; Hooker, *Spec. Fil.*, 1:120. 1844; Schlechtendal, *Linnaea* 26:367. 1853; Sturm, *Flora Bras.*, 1 (2):280. 1859; Grisebach, *Flora Brit. West Ind.*, 656. 1864; Hooker & Baker, *Syn. Fil.*, ed. 2: 77. 1874; Jenman, *Bull. Bot. Dept. Jamaica*, 20:7. 1890; Sodiro, *Crypt. Vasc. Quit.*, 8. 1893; Jenman, *West Ind. Gui. F.*, 21. 1898; Sadebeck in Engler & Prantl, *Nat. Pfl.*, 1 (4): 105. 1902; Lindman, *Ark. f. Bot.*, 1:24, f. 11-14. 1903; Duss, *Flore Crypt. Ant. Fr.*, 13. 1904; Eaton, *Bull. Torr. Bot. Cl.*, 33:460. 1906; Urban, *Symb. Antill.*, 9:282. 1925; Maxon, *Pterid. Porto Rico & Virg. Isl.*, 497. 1926; Domin, *Pterid. Dominica*, 48. 1929; Alston, *Kew Bull.*, 1932: 306. 1932; Hodge, *Lloydia*, 17:59. 1954 (often misspelled *kraussii*).

Type: Kraus s.n., from Dominica (Ed).

Homotypic synonyms: *Didymoglossum krausii* (Hooker & Greville) Presl, *Abh. böhm. Ges. Wiss.*, 5:115. 1843; Underwood, *Bull. Torr. Bot. Cl.*, 33:201. 1906; Copeland, *Philipp. Jo. Sci.*, 67:77. 1938; *Hemiphlebium krausii* (Hooker & Greville) Prantl, *Hymenophyll.*, 46, tab. II f. 21. 1875.

Heterotypic synonyms: *Didymoglossum fructuosum* Fée, 11 *Mém.*, 112, tab. 28 f. 3. 1866. Type: L³Herminier s.n., from Guadeloupe (not seen). *Trichomanes acrocarpon* Fée, *Crypt. Vasc. Bras.*, 1:188, tab. 70 f. 1. 1869. Type: Glaziou 2248, from Rio Grande do Arriro, Brazil (not seen, isotype in P).

Fronds oblong or lanceolate-oblong, pinnatifid or bipinnatifid. False veinlets few, partly parallel to the margin. Sori with more or less immersed involucre and dark-edged semi-orbicular lips.

Fronds extremely variable, broadly oblong to lanceolate-oblong, 2.5–4(–9) cm long and 1.5–2.5 cm wide, broadest in the middle, pinnatifid or bipinnatifid nearly to the rachis, the wing of the rachis hardly 1 mm. Pinnae linear, 1 mm broad or less, unequal, separated by broad open sinuses with a large stellate hair on a tooth at the bottom; marginal hairs simple or bifid. Stipe short 0.5–1.5 cm, densely tomentose like the lower part of the costa on the underside of the frond. The costules in the pinnae almost without connected sideveins, false veinlets few and distant, partly parallel to the margin. Sori several, solitary in the upper and terminal lobes. Involucre partly immersed or at least winged; lips semi-orbicular, broader than the tube and narrowly dark-edged.

Distribution: Florida, Central America, West Indies and South America southward to Bolivia, Paraguay, and South Brazil (map 14). On wet shaded rocks and on twigs and tree-trunks in moist forests at lower and middle elevations; from sea-level up to 1350 m, the highest record from Hispaniola.

Representative specimens:

FLORIDA: south of Cutler, Eaton s.n. (F, S, US); near Silver Palm, Correll 6102 (MO, US); near Camp Longview, Small & Wilson 1500 (F, GH, MO, US); Everglade Keys, Nixon Lewis Hammock, Small & Mosier 5882 (GH, MO, S-PA, US).

MEXICO: Tamaulipas, Cerro del Tigre, Sharp 50202 (US); Vera Cruz, Ilacozintla, Purpus 8333 (GH, MO, UC, US); Vera Cruz, Wetlac River, Copeland 11 (P, UC); near Orizaba, Schaffner s.n. (K); Mirador, Liebmann s.n. (B).

BRITISH HONDURAS: near Honey Camp, Meyer 51 (US).

GUATEMALA: Dept. of Petén, Vaxactun, Bartlett 12525 (F, MO, UC, US); dept. Izabal, near Quirigua, Standley 72444 (F, US); Mts. e. of Tactic, Standley 71102 (F, US); dept. Solola, volcan Atitlan, Steyermark 47906 (US); dept. Suchitepequez, Muenschler 12132 (F, US).

HONDURAS: dept. of Atlantida, near Tela, Standley 54858 (F, US); near La Ceiba, Yunker, Koepper & Wagner 8766 (G, GH, MO).

NICARAGUA: dept. Jinotega, Cerro de la Cruz, Standley 10977 (F); Castillo, Shimek & Smith s.n. (F, MO).

COSTA RICA: San Pedro de San Ramon, Benez 15078 (F).

PANAMA: Laguna de Chiriquí, Hart 9 (US); Canal Zone, westerly arm of Quebrada Salamanca, Dodge, Steyermark & Allen 17001 (G, MO, S, US); Canal Zone, Barro Colorado Isl., Bailey 545 (US); prov. of Panamá, near Juan Diaz, Killip 2621 (S-PA, US).

CUBA: Oriente, El Yunque, Ekman 3906 (G, S, S-PA, US); El Perú, Ekman 14861 (GH, S, US); Cahobas, Poeppig s.n. (W); without locality, Wright 953 (G, GH, MO, UC).

JAMAICA: Mansfield, near Bath, Maxon 1857 (S, US); Seaman's Valley, Portland, Maxon & Killip 78 (GH, US); Venegar Hill, Watt 121 (S-PA, U, US); Windsor Estate, Trelawny, Proctor 15592 (GH, U).

HISPANIOLA: Haïti: dept du Nord, near Dondon, Leonard 8706 (GH, UC, US); near St. Louis du Nord, Leonard 14207 (GH, MO, UC, US); *ibid.*, Ekman H 4738 (G, S, U, US); Massif des Cahas, las Caobas, Ekman H 5554 (GH, S, US). Dominican Republic: Samaná, Ekman H 14959 (GH, S, UC); near Piedra Blanca, Allard 17960 (GH, U); Jarabacoa, Ekman H 14185 (G, S).

PUERTO RICO: Sierra de Naguabo, near la Florida, Shafer 3793; near Utuado, Britton 5222 (GH, MO, US); Mayaguez, Britton & Hess 2726 (GH, MO, US); Cayey, Sintenis 2181 (GH, US).

- ST. KITTS: Britton & Cowell 158 (US); Proctor 19247 (GH, U, US).
 ANTIGUA: Box 241 (US).
 GUADELOUPE: Duss 947 (P), 4292 (MO); L'Herminier s.n. (G, U, W); Questel 1082 (US).
 DOMINICA: Eggers 596 (G, L, S-PA, U, W); Hodge 1597 (GH, L, MO, S-PA, U, US); Kraus s.n. (Ed); Lloyd 539 (S, US).
 MARTINIQUE: Belanger s.n. (F); Duss 1538 (US), 4160 (US); Stehlé 4983 (US), 7235 (US).
 ST. LUCIA: Box 432 (R, US); Proctor 17867 (GH, US).
 ST. VINCENT: Guilding s.n. (GH); H. H. & G. W. Smith 573 (GH, US).
 GRENADA: Broadway 3776 (US), 4713 (US), 5961 (MO, US).
 COLOMBIA: Santa Marta, H. H. Smith 1103 (F, G, GH, L, MO, S, S-PA, U, UC, US); Comisaria Goajira forest, near Carraipia, Haught 4275 (F, US); dept. of Santander, near Barranca Bermeja, Haught 1921a (S, US).
 VENEZUELA: near Caracas, Balfour s.n. (Ed); Nueva Esparta, Matasieta, Gines s.n. (US).
 TRINIDAD: Britton 2165 (US), 2548 (GH, US); Fendler 128 (GH).
 BRITISH GUIANA: Potaro River, Sheenabowa, Jenman 1363 (K); without locality, Schomburgk 440 (G, L, PRC, U, US, W).
 SURINAME: between Wia-Wia bank and Grote Zwiebelzwamp, Lanjouw & Lindeman 1217 (U, US), 1267 (U, US); Emma Range, Daniels & Jonker 719a (U); Tafelberg, Maguire 24339 (F, GH, MO, U, US).
 FRENCH GUIANA: Cayenne, Leprieur 40 (G, L, U), 218 (S, US); along River Erepeoussinghe, Leprieur 219 (GH).
 ECUADOR: prov. Guayas, Cerro Cimalon, Haught 2900 (GH, S, UC, US); Andes, near Quito, Spruce 5670 (G, W), 5671 (G, P); near San Miguel, Sodiro 1774 (G, K).
 PERU: near Tarapoto, Spruce 3991 (G, W).
 BOLIVIA: Isapuri, Williams 1211 (GH, US); Antahuacana, Espiritu Santo River, Buchtien 2188 (B, F, G, GH, L, S-PA, US); North Yungas, Buchtien 3566 (S-PA, US).
 PARAGUAY: San Bernardino, Lindman A 2207½ (G, S, S-PA, US).
 ARGENTINA: Misiones, Salto del Iguazu, Osten & Rojas 7257 (S, S-PA).
 BRAZIL: Santa Catarina: São Francisco do Sul, Smith & Reitz 5720 (GH, MO, R, U, US); Pirabeiraba, Joinville, Schmalz 89 (F, MO, S-PA, UC).
 Paraná: Guaratuba, Dusén 13735 (S, S-PA).
 São Paulo: near Santos, Mosén 3112 (R, S, S-PA, US); *ibid.*, Burchell 3069 (B, L, S, US, W); Jaragua, Brade 5208 (S-PA, UC).
 Rio de Janeiro: Sta. Maria Magdalena, Santos Lima 10 (R); without locality, Burchell 937 (B, GH, L, W).
 Espiritu Santo: Rio Doce, von Lützelburg 2705 (S-PA).
 Minas Gerais: Fazenda do Retiro, Damazio 1840 (B, R, S-PA).
 Matto Grosso: Angelim, Lindman A 3261 (S, S-PA); Serro do Itapirapuan, Alfonso, Lindman A 2207½ (S).
 Pará: along River Erepecuru, Spruce s.n. (W).

T. krausii is a very variable but clear-cut species, easily distinguished by its venation; the costule of the lobes is almost without connected sideveinlets and the false veinlets are partly parallel to the margin. The insertion of a stellate hair on a tooth at the bottom of the sinus and the partly immersed involucre with semiorbicular lips are also characteristic.

A large form was described and illustrated by LINDMAN, Ark. f. Bot., 1:27, f. 11 C. 1903 as forma *longissima*, based on a specimen collected by Mosén, number 3112, from Santos, São Paulo. Many other collections agree exactly with this collection but all intermediate stages are present, even growing intermingled together and it seems impossible to hold up the forma *longissima*.

14. **Trichomanes melanopus** Baker in Hooker & Baker, Syn. Fil., ed. 2:465. 1874; Lindman, Ark. f. Bot., 1:28, f. 15, f. 16. 1903.

Type: Spruce 5354, from the Andes, near Rio Verde, Ecuador (K).

Homotypic synonyms: *Trichomanes krausii* Hk. & Grev. var. *crispatum* Hooker & Baker, Syn. Fil., ed. 1:77. 1867; Sodiro, Crypt. Vasc. Quit., 9. 1893; *Didymoglossum melanopus* (Baker) Copeland, Philipp. Jo. Sci., 67:78. 1938.

Fig. 30

Fronds bipinnatifid. Lobes much crisped. Costules of the lobes zigzag. Sori exserted. Involucre with broad, black-edged lips.

Fronds bi- to tripinnatifid, oblong or rounded, 2–6 cm long, 1.5–2.5 cm wide. Stipes variable, 0.5–1.5 cm long, the lower part dark-tomentose, upwards more or less glabrous and winged. Primary segments almost at right angles with the costa, sometimes considerably lengthened. Pinnules many, crowded, overlying each another, much crisped. Margin with geminate hairs and in the sinuses large, up to 10-rayed stellate hairs. The venation is quite peculiar. The costules are flexuose and on the convex side of each angle a sidevein is given off approximately at right angles with the costule. Some false veinlets very short and unconnected. Sori few, 1–4, terminal, all at the same level; involucre free, the tube funnel-shaped with broad, black-edged, rounded lips.

Distribution: Only known from the type collection (map 15):

ECUADOR: Andes, Canelos Mts. near Rio Verde, Spruce 5354 (B, K, S-PA, US).

In its cellular structure and sori this species resembles *T. hymenoides* but is well distinguished by its crisped fronds and peculiar venation.

15. **Trichomanes gourlianum** Greville in Smith ex Seemann, Bot. Voy. Herald, 240. 1854.

Type: Gourlie s.n., from prov. Darien, Panama (not seen, not present in Ed).

Heterotypic synonym: *Trichomanes lehmannii* Hieronymus, Bot. Jahrb., 34:420. 1904; *Didymoglossum lehmannii* (Hieron.) Copeland, Univ. Calif. Publ. Bot., 19:296, pl. 49. 1941. Type: Lehmann 8918, from Rio Timbiqui, Colombia (B).

Fig. 31a, b, c

Fronds rather large, bipinnatifid. Rachis narrowly winged and densely tomentose. Lamina fertile in the upper part with numerous sori. Involucre with a slender tube, immersed to the very long lips.

Fronds lanceolate, rather large, 4–12 cm long, 1.5–3 cm wide, in the lower part bipinnatifid and sterile, in the upper part pinnatifid and fertile; pinnae pinnately lobed. False veinlets nearly all connected, only a few free. Fronds sessile or short-petioled, rachis narrowly winged. Petioles densely dark-tomentose like the costa and the veins on the lower surface of the frond. Margin with a border or small rounded cells. In the sinuses between two lobes brown-black stellate hairs, on the margin also simple or binate hairs. The soriferous part with suppressed leaf-tissue. Involucre immersed to the lips, these more than twice as long as broad, ca. 1.5 mm long and 0.5 mm wide, with a more or less mucronulate, broad dark edge.

Distribution: Colombia and Ecuador (map 16). In dense moist forests on trees. All records from under 100 m alt.

Specimens seen:

COLOMBIA: Bahía Solano, along Quebrada Jellita, Killip & García 35690 (US); Cape Corrientes, Taylor 1263 (US), 1268 (UC, US); Port Utria, Taylor 1283 (US), 1284 (US); Gorgona Island, Killip & García 33197 (US); along Rio Timbiqui, Lehmann 8918 (B, F).

ECUADOR: Parroquia de Concepcion, Playa Rica, Mexía 8476a (U, UC, US), 8450 (U, UC, US); vicinity of Quininde, Holdridge 1647 (US).

Though the type of *T. gourlianum* could not be found, the description makes it clear that *T. lehmannii* is conspecific. It is a very distinctive species and differs from all large pinnatifid forms in the lips of the involucre being much longer than in all other species. Two specimens collected by Taylor, the numbers 1263 and 1284, are aberrant and depauperate; the fronds of the first are only 0,8–1,5 cm long, entire or irregularly lobed and with a single sorus; the very long involucreal lips are, however, characteristic. There is also a much larger, pinnatifid, 2,2 cm long leaf on the same rhizome; number 1284 is intermediate between 1263 and the typical form.

Key to the American species of the sect. *Microgonium* ¹⁾.

- 1. *a.* Venation reticulate; well-developed fertile fronds more or less orbicular. 16. *T. godmanii* (C. Am. and Cuba)
- b.* Cross-veins wanting; full-grown fronds oblong or more elongate. 2
- 2. *a.* Base of the frond always acute; cells to the outside of the submarginal false vein radially lengthened. 18. *T. hookeri* (Greater Antilles)
- b.* At least some fronds with a roundish base; marginal cells cubical or tangentially lengthened. 3
- 3. *a.* Submarginal vein continuous, on the outside bordered by a row of cubical cells; upper part of the frond irregularly lobed. 17. *T. ekmanii* (C. and n.w. S. Am., Gr. Ant.)
- b.* Young fronds often circular or cordate; submarginal vein partly wanting; marginal cells more or less tangentially lengthened; fronds only little lobed. 19. *T. kapplerianum* (n. S. Am., Lesser Ant.)

16. **Trichomanes godmanii** Hooker in Baker, Jo. Linn. Soc., 9:337, tab. 8 f. A. 1866; Hooker & Baker, Syn. Fil., ed. 2:74. 1874; Hemsley, Biol. Centr. Am., 3:602, tab. 106 A. 1886; Sadebeck, in Engler & Prantl, Nat. Pfl., 1 (4):104. 1902.

Type: Salvin & Godman s.n. (1862), from Guatemala, without locality (K). Fig. 32a, b

¹⁾ For the diagnose of the sect. *Microgonium* see pages 277-278.

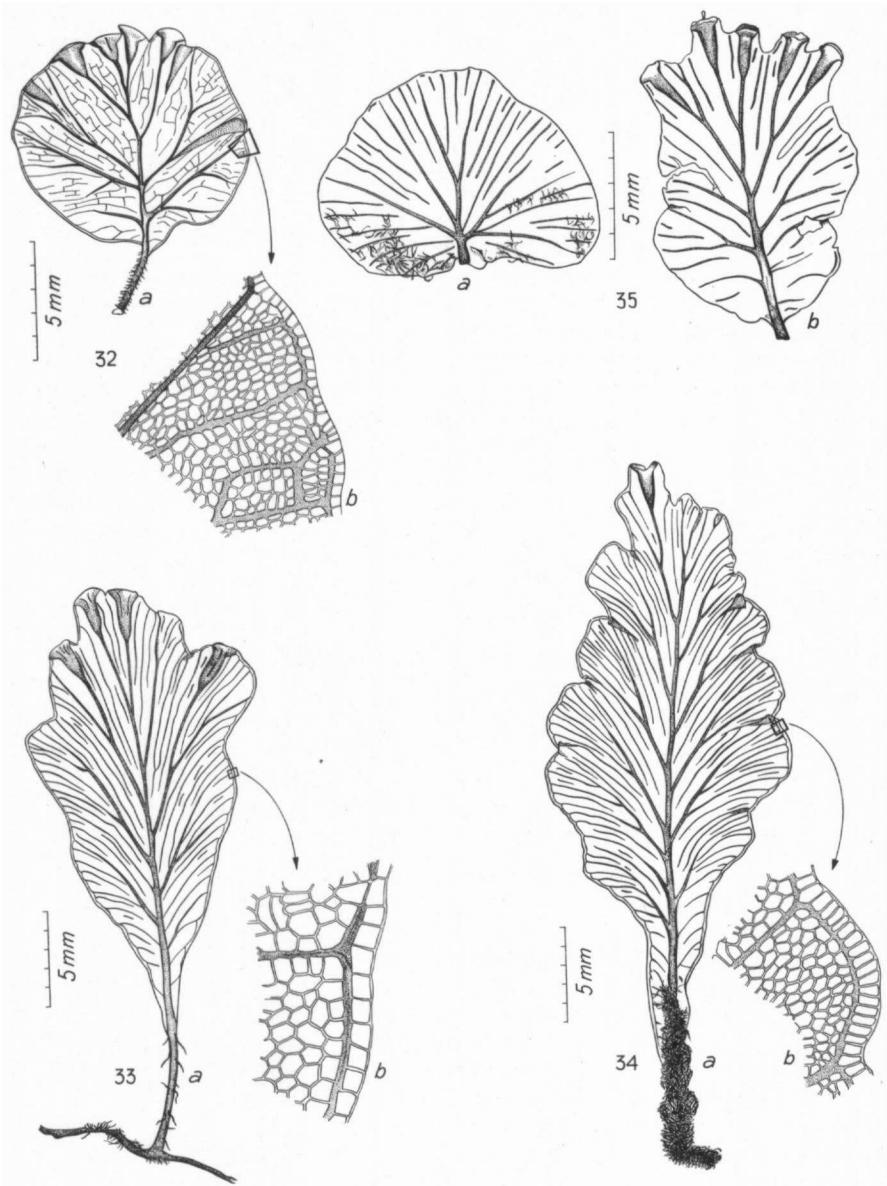


Fig. 32. *Trichomanes godmanii* (Salvin & Godman s.n.); a frond, b leaf-tissue with submarginal false vein. – Fig. 33. *Trichomanes ekmanii* (Ekman H 14342), type collection; a frond, b leaf-tissue with submarginal false vein. – Fig. 34. *Trichomanes hookeri* (Wright 912); a frond, b leaf-tissue with submarginal false vein. – Fig. 35. *Trichomanes kapplerianum* (Lanjouw & Lindeman 2301); a sterile, b fertile.

Fronds orbicular or obovate. Venation reticulate; a continuous submarginal vein present.

Fronds orbicular or obovate, narrowed towards the base, circa 1–2 cm long and wide, petiolate; petioles 0.4–1 cm long. Margin entire or slightly lobed. The lower part of the frond with a distinct costa and pinnate veins, these repeatedly forked; upper part with flabellate venation. Venation reticulate by transverse false veinlets. A continuous submarginal vein present, bordered at the outside by regular cubical cells. In the upper part of the frond 1–9 sori. The obconic involucre wholly immersed, their mouth much dilated, entire, without lips; involucre with false veinlets. Receptacle long-exserted.

Distribution: Central America and Cuba (map 17). On the bases of tree-trunks.

Representative specimens:

MEXICO: Tabasco, mun. de Teapa, Sanchez 284 (US).

BRITISH HONDURAS: El Cayo distr., Valentin, Lundell 6187 (US); Honey Camp, Meyer 34 (US).

GUATEMALA: dept. Petén, Vaxactun, Bartlett 12249 (US); Tikal National Park, Lundell 15643 (US), 15842 (US); Monte Santa Teresa, Lundell 2726 (US); dept Izabal, Los Amantes, Hatch & Wilson 29 (US); between Virginia and Lago Izabal, Steyermark 38739 (US); Cerro San Gil, Steyermark 39945 (F, GH, US); without locality, Salvin & Godman s.n. (K); dept. Alta Verapaz, Cerro Chinaja, Steyermark 45547 (US); Cubilquitz, von Türckheim 1446 (US), 8350 (US).

HONDURAS: Lancetilla Valley, near Tela, Standley 52762 (F, US); dept. of Copan, Quebrada Majanales, Blake 7483 (US); dept. of Yoro, Guaymas, Ames 133 (US); along Rio Esperanza, Wilson 268 (GH, MO, US), 595 (GH, MO, US).

COSTA RICA: Livingston on River Reventazon, Rowlee & Stork 583 (US); prov. of Limón, La Colombiana Farm, Standley 36815 bis (US), 36817 (US); prov. of Heredia, La Selva on the Rio Puerto, Scamman & Holdridge 6969 (GH), 7836 (GH); *ibid.*, Scamman 7426 (GH).

PANAMA: Canal Zone, Barro Colorado Island, Aviles 18 (F); *ibid.*, Prescott & Caylor 16 (US); *ibid.*, Standley 31371 (S, US); Coco Solo, Wagner s.n. (GH); Vicinity of Fort Sherman, Standley 31033 (S, US); Headwaters of Rio Chinilla, Maxon 6866 (UC, US), 6867 (GH, UC, US), 6871 (GH, MO, US); without locality, Hayes 33 (B, GH, K, US).

CUBA: Macunjes, Poeppig s.n. (B); without locality, Wright 3945 (B, GH, S-PA, US).

Hooker cited two collections with his description: Hayes 33 from Panama and Salvin & Godman s.n. from Guatemala. The latter should be regarded as the holotype. The species is very characteristic by the reticulate venation and does not at all resemble *T. punctatum*, as stated by Hooker; this error is apparently due to an admixture of *T. punctatum* with the type material. Sadebeck claims incorrectly in "Die Natürlichen Pflanzenfamilien" that groups of marginal hairs occur in *T. godmanii*.

17. *Trichomanes ekmanii* W. Boer, nov. spec.

Type: Ekman H 14342, from La Cumbre, Cordillera Central, Dominican Republic, Hispaniola (U). Isotypes in F, G, GH, MO, S, UC, US¹⁾. Fig. 33a, b

¹⁾ Attention is called to the fact that not all specimens of Ekman H 14342 are isotypes. Duplicate sheets in F and GH belong to *T. hookeri*.

Folia obovata vel oblonga, firma, paulum pellucida. Lamina basi rotundata vel sensim angustata et in petiolum decurrente, parte superiore irregulariter lobata. Nervus submarginalis continuus, extra serie cellularum regularium quadratarum limbatus. Sori plures, 5 ad 9 in quoque folio. Involucrum totum immersum, haud bilabiatum.

Fronde obovate or oblong, 1.5–3 cm long, 0.5–1.5 cm wide, especially the upper part irregularly lobed; the base rounded or decurrent onto the narrowly winged stipe. Lamina firmly membranous, usually not translucent. Stipe short, 0.3–0.7 cm long, sparsely tomentose. Costa present, bearing pinnately arranged, branched sideveins. False veinlets numerous, very delicate, parallel to the true veins but mostly unconnected, excurrent into the continuous submarginal vein, this on the outside bordered by a single row of cubic cells. Sori several, 5–9, together in the apical part or solitary on apical lobes. Involucres wholly immersed, the tube cylindrical, broadly expanded at the apex. False veinlets present in the involucre.

Distribution: Central America, northern South America, and Greater Antilles (map 18). On tree roots and bases of tree trunks in dense and wet forests, often along watercourses.

Specimens seen:

BRITISH HONDURAS: Middlesex, Schipp 324 (B, F, G, GH, MO, S-PA, UC, US).

HONDURAS: dept. of Atlantida, near Tela, Standley 54197 (F).

PANAMA: Canal Zone, Barro Colorado Isl., Prescott & Caylor 76 (US); Rio Indio de Gatun, Maxon 4881 (US); Coco Solo, Wagner s.n. (US).

CUBA: Trinidad Mts., Los Cocos, Britton & Wilson 5140 (US).

HISPANIOLA: Dominican Republic, Samaná, Ekman H 14985 (G, S); Cordillera Central, La Cumbre, Ekman H 14342 (F, G, GH, MO, S, U, UC, US).

COLOMBIA: Santa Marta, H. H. Smith 2700 (GH, S-PA); West coast, Cape Corrientes, Taylor 1267 (S-PA, UC, US).

VENEZUELA: near Tovar, Fendler 455 (B, G, GH, L, MO, US).

BRAZIL: Amazonas, Fortaleza, Ule 5317b (B, L); Rio Acre, Kuhlman 808 (R); Alto Purus, Porto Alegre, Huber 41381 (G).

PERÚ: near Tarapoto, Spruce 4762 (W); dept. San Martín, Tingo Maria, Allard 20912 (US); near Sangavan, Lechler 2297 (B, G, L, W).

BOLIVIA: Rio Acre, near Cobija, Ule 9137 (B).

This species ranks very near to *T. hookeri* as to size and venation but the frond is broadest near the distal end and irregularly lobed; some leaves have a rounded base; the marginal cells are cubic, not radially lengthened; the leaf-tissue structure is firmer and not as transparent as in *T. hookeri*. There are some collections with a somewhat irregularly and partly double submarginal vein, e.g. Taylor 1267; in a few other collections a small number of cross-veins are present between two veinlets, e.g. Schipp 324.

18. **Trichomanes hookeri** Presl, Abh. böhm. Ges. Wiss., 5:108. 1843; van den Bosch, Ned. Kruidk. Arch., 4:354. 1859, partly; Sadebeck, in Engler & Prantl, Nat. Pfl., 1 (4):105. 1902; Maxon, Pterid. Puerto Rico & Virg. Isl., 498. 1926; Domin, Pterid. Dominica, 46. 1929 (only the variety *major*).

Based on: *Trichomanes muscoides* auct. non Swartz; Hooker & Greville, Icon. Fil., 2:179. 1831; Grisebach, Flora Brit. West Ind., 657. 1864; Hooker & Baker, Syn. Fil., ed. 2:75. 1874, partly; Jenman, Bull. Bot. Dept. Jamaica, 20:7. 1890 (only the variety *major*); Duss, Flore Crypt. Ant. Fr., 11. 1904.

Type: Wiles & Hegson s.n., from Jamaica (Ed).

Homotypic synonyms: *Microgonium hookeri* (Presl) Presl, Abh. böhm. Ges. Wiss., 5:335. 1848; Copeland, Philipp. Jo. Sci., 67:62. 1938. *Hemiphlebium hookeri* (Presl) Prantl, Hymenoph. 46, Taf. II f. 19. 1875; not of Presl, 1848.

Heterotypic synonym: *Microgonium berterooanum* Presl, Abh. böhm. Ges. Wiss., 5:111, tab. VI f. B. 1843. Type: Bertero s.n., from Dominican Republic, Hispaniola (PRC).

Fig. 34a, b

Fronds linear or lanceolate-elliptic, base long-cuneate, margin with broadly rounded lobes. Submarginal vein present and continuous, bordered on the outside by a row of radially lengthened cells.

Large fronds linear or lanceolate-elliptic to oblanceolate, 2–6 cm long, 0.6–1.2 cm wide, the top rounded, the base long-cuneate, the margin with more or less broadly rounded lobes; lamina broadest below the middle. Stipe short, ca. 0.5 cm, densely tomentose. Costa present, giving off once or twice branched, pinnately arranged side-veins; non-connected false veinlets excurrent into a continuous submarginal vein, on the outside bordered by usually a single row of radially lengthened cells. Sori few, 1–5, solitary on the apical lobes. Involucres wholly immersed, the tube cylindrical with a much dilated mouth, without lips. False veinlets present in the involucre.

Distribution: Greater Antilles (map 19). On wet shaded rocks and on the bases of tree-trunks and tree-ferns, up to 1000 m.

Representative specimens:

CUBA: Trinidad Mts., N. L. & E. G. Britton 5022a (U, US); *ibid.*, E. G. Britton 5180 (US); prov. Sta. Clara, Lomas de Bañias, Ekman 16293 (G, S, S-PA); prov. Oriente, Sierra Maestra, Ekman 14714 (GH, S, US); Monte de la Prenda, Eggers 5263 (US); Monte Verde, Yateras, Maxon 4290 (GH, UC, US), 4330 (GH, US); near Baracoa, Pollard, E. & W. Palmer 234 (GH, MO, US); Pinar del Rio, source of Rio Taco-taco, Morton 4400 (GH, UC, US); without locality, Wright 912 (B, G, GH, L, MO, P, S-PA, UC, US, W), 913 (B, G, GH, L, MO), 952, partly (S-PA, US), 3000 (B).

JAMAICA: near Hollymount, Maxon 2275 (US); near Mill Bank, Maxon 9312 (GH, US); Trafalgar, Perkins 1173 (B, G, GH); near Bath, Maxon 1809 (S, US); St. Thomas, Maxon 10550 (US); without locality, Wiles & Hegson s.n. (Ed).

HISPANIOLA: Haiti: St. Louis du Nord, Ekman H 3791 (G, S, US); Jérémie, Ekman H 10211 (S); Dominican Republic: Cordillera Central, La Cumbre, Ekman H 12385 (G, S, US); Samaná Peninsula, Abbott 1385 (GH, US); *ibid.*, Ekman H 15277 (S); without locality, Bertero s.n. (PRC).

PUERTO RICO: Sierra de Lares, Sintenis 6252 (S-PA); near Utuado, Sintenis 6435b (B), 6441 (B); near Jabucoa, Sintenis 5023 (G, GH, K, S-PA, US), 5172 (B).

This is a very clear-cut species, easily distinguished by the more or less linear, crenate fronds and the marginal row of radially length-

ened cells. This last-named character is not found in any other *Microgonium* species of the New World. In the literature nearly all *Microgoniums* from America have been called *T. hookeri*, e.g. by COPELAND (1947), who, because of the alleged presence of only one species in the Western Hemisphere doubted the correctness of its inclusion in the present section. As demonstrated in the key, four species are readily distinguishable among the New World *Microgoniums*.

19. ***Trichomanes kapplerianum*** Sturm, Flora Bras., 1 (2):276. 1859; Maxon, Pterid. Porto Rico & Virg. Isl., 499. 1926.

Type: Kappler 1760, from Suriname River, near Station Victoria, Suriname (W).

Homotypic synonym: *Hemiphlebium kapplerianum* (Sturm) Prantl, Hymenoph., 46. 1875.

Heterotypic synonyms: *Didymoglossum cordifolium* Fée, 11 Mém., 113, tab. 28 f. 4. 1866; Copeland, Philipp. Jo. Sci., 67:77. 1938; *Trichomanes muscoides* Swartz var. *cordifolium* (Fée) Jenman, Bull. Bot. Dept. Jamaica, 20:8. 1890; Jenman, West Ind. Gui. F., 22. 1898; *Trichomanes hookeri* Presl var. *cordifolium* (Fée) Bonaparte, Notes Ptérid., 7:337. 1918; Domin, Pterid. Dominica, 46. 1929; *Trichomanes cordifolium* (Fée) Alston, Kew Bull., 1932:306. 1932. Type: Mlle. Rivoire s.n., from Martinique (not seen). *Trichomanes muscoides* Swartz var. *minor* Jenman, Bull. Bot. Dept. Jamaica, 20:8. 1890; Jenman, West Ind. Gui. F., 22. 1898; *Trichomanes hookeri* Presl var. *minor* (Jenman) Domin, Pterid. Dominica, 47. 1929. Type: no specimen cited.

Fig. 35a, b

Young fronds often circular or cordate, when older ovate or oblong; base rounded or acute. Leaves but little lobed. Submarginal vein partly wanting. Marginal cells more or less tangentially lengthened.

Young fronds circular, cordate or oblong to linear, older ones ovate to oblong, 0.5–2 cm long and wide, the base rounded to cordate or acute, the apex rounded or with small lobes in which the sori are immersed. Fronds almost sessile or with a short stipe. The lower part of the lamina with a distinct costa and pinnately arranged, once or twice branched side-veins; the upper part with flabellate venation. False veinlets near the margin deflexed into the discontinuous submarginal vein, this bordered on the outside by a simple or sometimes a double row of marginal cells which are tangentially lengthened. Sori several (1) 3–7 (17) together in the apical part or on small lobes, involucre wholly immersed, the mouth much dilated, the receptacle exceeding the involucre.

Distribution: Lesser Antilles, Guiana, and the Amazon region (map 20). Forming mats on tree-trunks and moist shaded rocks, up to 800 m.

Representative specimens:

COSTA RICA: Finca Hundrieszer, Brade 398 (Rosenstock Fil. costaricensis 221, M, S-PA, UC, W); Cocos Isl., Svenson 344 (GH, MO, UC, US).

PANAMA: Canal Zone, Barro Colorado Isl., Seaverns 7 (F); *ibid.*, Wilson 87 (GH).

PUERTO RICO: Rio Piedras, J. R. Johnson 1477 (US); Arroyo de los Corchos, Britton, Cowell & Brown 5272a (S, US).

- ST. KITTS: Proctor 19269 (GH, US).
 GUADELOUPE: L'Herminier s.n. (B, G, L, MO); Duss 4303 (US), 4441 (US).
 DOMINICA: Hodge 2891 (GH, US), 3584 (GH, US).
 MARTINIQUE: Duss 4689 (US).
 ST. VINCENT: Guilding s.n. (Ed, GH); H. H. & G. W. Smith 711 (GH, K, US).
 COLOMBIA: Vaupés, Rio Apaporis, Schultes & Cabrera 13092 (U, US).
 PERÚ: dept. Loreto, San Antonio on Rio Itaya, Killip & Smith 29522 (GH, S, US).
 TRINIDAD: Broadway 5746 (F), 6823 (MO, S), 6878 (MO, S, US); Fendler 145 (B, G, GH, MO, S, UC, US).
 BRITISH GUIANA: Essequibo River, near Bartica, Richards 28 (K); Cuyuni River, Tutin 367 (U, US), 408 (U, US); Potaro River, below the Kaieteur, Jenman 1375 (K); Potaro River Gorge, Maguire & Fanshawe 23532 (US); Pomeroun, Jenman 2124 (K); Macouria River, Jenman 2347 (K).
 SURINAME: Suriname River near Station Victoria, Kappler 1760 (B, L, W); Jodensavanne — Mapane Creek area, Lindeman 3701 (U); Coppename River Headwaters, Maguire 24168 (GH, U, US); between Paka-Paka and Ebbatop, Florschütz 1248 (U), 1353 (U); Emma Range, Daniels & Jonker 831 (U), 943 (U); Tafelberg, Maguire 24622 (F, GH, U, US); Nassau Mts., Lanjouw & Lindeman 2301 (U), 2318 (U, US), 2955 (U); without locality, Focke s.n. (U).
 FRENCH GUIANA: near Cayenne, Leprieur 207 (L, P, U), 208 (L.); along River Oyapock, Leprieur 221 (B, P, US); along River Gabaret, Leprieur s.n. (GH); without locality, Richard s.n. (P).
 BRAZIL: Pará; Tauau, Spruce s.n. (G, W), 61 (B), 64 (B); Amazonas; mouth of River Solimões, Spruce 1641 (G, GH); Rio de Janeiro; near Sta. Maria Magdalena, Santos Lima 12 (R), 37 (R).

This species has been confused many times with *T. hookeri*, but may be easily distinguished by the discontinuous submarginal vein, the tangentially lengthened marginal cells and the rounded leaf-bases of many, particularly young, fronds. *T. kapplerianum*, best known from the Lesser Antilles and Guiana, extends in disjunct localities westward to Costa Rica and southward to Rio de Janeiro. These collections from separate areas may prove to represent distinct taxa but in the absence of more representative material it seems best to place them with *T. kapplerianum*.

IMPERFECTLY KNOWN SPECIES.

Trichomanes bryoides Goldmann, Nov. Act. Leop. Carol., 19: 467. 1843.

Type: F. J. F. Meyen s.n., from Corcovado, South Brazil (not seen).

The author was unable to recognize any plant by the short and incomplete original description.

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