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# The genus *Calypogeja* Raddi in Central and South America

## I. Introduction and subgenera *Mnioloma* and *Caracoma*<sup>1</sup>

by

Hélène BISCHLER

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Shortly after having completed a study of the swiss representatives of the genus (BISCHLER, *Candollea* **16**: 9-76. 1957) the author was able to collect material in tropical America. It was therefore decided to make a monographic study of the species found in that area.

The typification and nomenclature of the genus, as well as a detailed description thereof, having been dealt with in the previous paper it is not proposed to go into these any further. Moreover, until the genus has been studied on a world basis, it can not be considered justified to subdivide the taxon into subordinate groups of recognised hierarchic rank, bar two exceptions: two particularly clear-cut and distinctive subgenera.

Both SPRUCE (*Trans. Proc. Bot. Soc. Edinburgh* **15**: 410-411. Nov. 1885) and STEPHANI (*Hedwigia* **34**: 55-56. 1895; *Spec. Hep.* **3**: 389-391. 1908) grouped their species according to characters which, as more material became available, proved very variable and thus unreliable: the species have been regrouped, the principal aim being ease in handling. No phylogenetic relationship is claimed for any of these groupings. They are purely utilitarian.

The author wishes to express her thanks and gratitude to the "Fonds National Suisse de la Recherche Scientifique" for having provided her with the means for undertaking this study; to Prof. Ch. BAEHNI, director of the Conservatoire Botanique of Geneva for placing at her disposal the many facilities available at the Institute; to Dr. C. E. B. BONNER, curator of the Cryptogamic Collections, for his help, his suggestions and criticism and for the revision and translation of the manuscript; to the late Prof. Th. HERZOG of Jena for the loan of specimens from his private collection, and to the directors, keepers and curators of the following Institutes, who were kind enough to send material on loan:

Botanical Museum, The University, Lund (Sweden); Botanische Staatssammlung, München; British Museum, London; Herbarium of The University,

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<sup>1</sup> Citation of specimens and bibliography are to be found at the end of the 3rd paper.

Manchester; Muséum National, Laboratoire de Cryptogamie, Paris; Naturhistorisches Museum, Vienna; Royal Botanical Gardens, Kew; Swedish Museum of Natural History, Stockholm.

*Glossary of terms used.*

(Cf. fig. 4 and 5)

**Stems:**

flagelliform: a branch is referred as being flagelliform when the leaves are reduced to small scales or totally devoid of leaves. A normal stem may bear a flagelliform top.

asymmetrical: stem with leaves reduced to scales on one side only.

**Organs:**

insertion arched: the line of insertion is distinctly curved.

insertion not arched: the line of insertion is straight or nearly so.

imbricate: leaves or underleaves overlapping like the tiles of a roof.

distant: adjacent leaves or underleaves not or hardly touching.

decurrent: the lower edges of a leaf or underleaf are said to be decurrent when they run down the sides of the stem. In the case of a non decurrent organ, the lower edges join the stem almost perpendicularly.

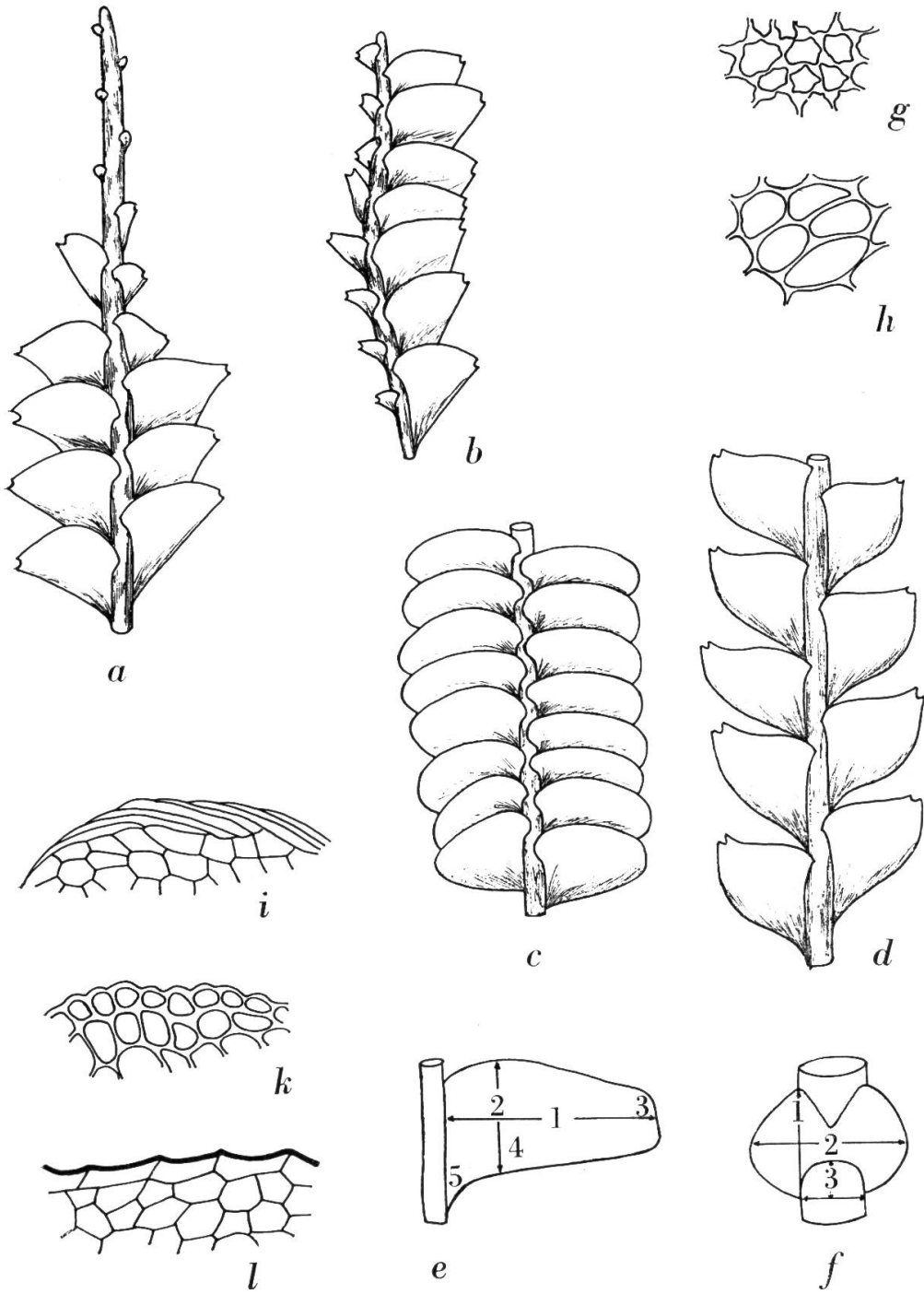
lobe: pluricellular appendage of an organ having a pluricellular base. A lobe is usually longer than it is wide, and may be rounded or pointed.

protuberance: pluricellular appendage on a broad pluricellular base. A protuberance is rounded and much broader than it is long.

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FIG. 4. — Definition of the terms used.

- a* Flagelliform branch.
- b* Asymmetrical stem.
- c* Stem with imbricate, non decurrent leaves with an arched insertion.
- d* Stem with distant, decurrent leaves, an almost straight leaf insertion and ascendent leaf apices.
- e* Leaf measurements employed: 1. Length. 2. Width. 3. Apical cells. 4. Central cells. 5. Basal cells.
- f* Measurements on the underleaves: 1. Length. 2. Width. 3. Decurrence. An underleaf insertion is considered to be decurrent when the measurement is of the order of 60  $\mu$  or more. It is considered to be not decurrent if the value is below 40  $\mu$ .
- g* Tissue of cells with large, nodulose trigones.
- h* Tissue of cells with small, non nodulose trigones.
- i* Leaf margin composed of very elongated cells overlapping each other over the greater part of their length.
- k* Leaf margin composed of small rectangular cells with much thickened walls.
- l* Leaf margin composed of adjoining elongated cells.





tooth: appendage of an organ composed of one or few cells, the base being few celled. A tooth is usually pointed, and longer than it is wide.

ascendant apex: leaf apex situated above the highest point reached by the leaf insertion.

entire: apex without teeth, protuberances or lobes.

entire, pointed: apex ending in a single cell.\*

entire, rounded: apex ending in a row of 2-4 cells.

entire, truncate: apex ending in a row of 5 or more cells.

apiculate: apex ending in a paucicellular \* tooth.

notched: apex rounded or truncate, with a slightly pointed or rounded incision.

bifid: a leaf or underleaf divided into two lobes or teeth, the depth of the division being equal to a half or more of the total length of the organ.

hemiactinomorphic: a sinus, the margin of which is composed of cells whose longer axes all converge towards the centre.

dentate: equipped with unicellular, pointed teeth.

crenulate: margins composed of cells with strongly convex outer walls.

#### Cells : \*

cuticle: the outer layer of the outer walls of the cells. It can be smooth or covered with minute, rounded (papillaceous) or elongated (striate) projections.

trigones: thickenings of the cell walls at the corners.

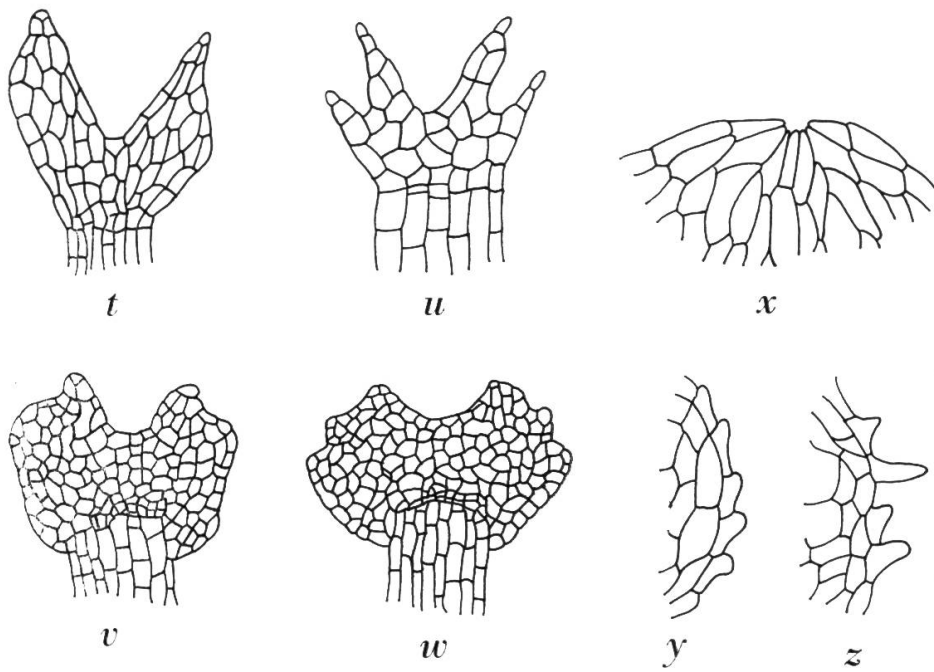
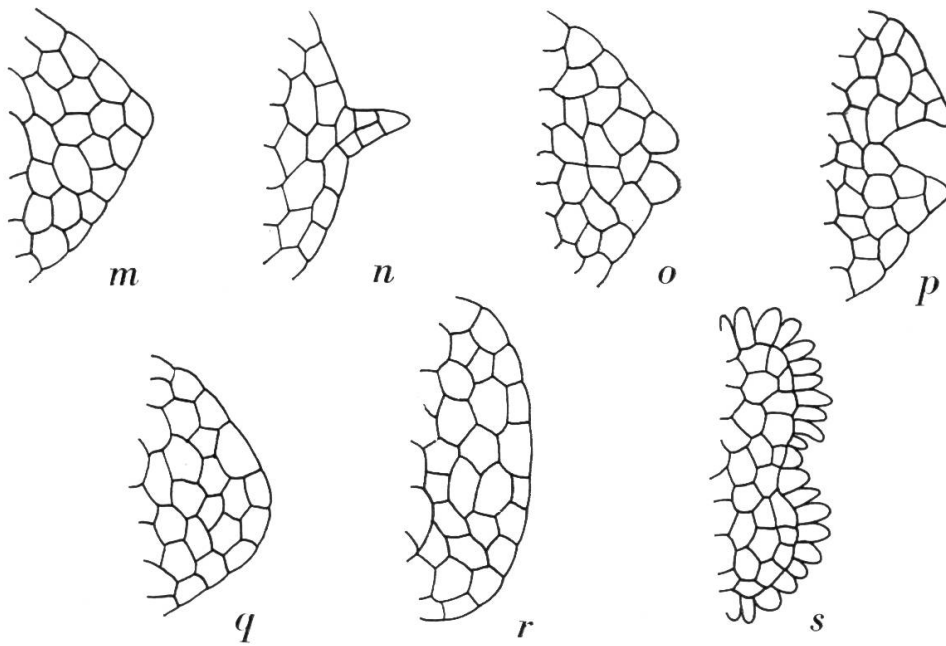
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\* The term " cell " is used here as a unit of comparison for a medium range of measurements.

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FIG. 5. — Definition of the terms used (*contd.*)

- m* Entire, pointed leaf apex.
- n* Apiculate leaf apex.
- o* Bidentate leaf apex.
- p* Bilobed leaf apex.
- q* Entire, rounded leaf apex.
- r* Entire, truncate leaf apex.
- s* Notched leaf apex with a crenulate margin.
- t* Bilobed or bifid underleaf with non decurrent insertion.
- u* Bisbifid underleaf with non decurrent insertion.
- v* Bilobed underleaf with decurrent insertion, bearing a protuberance on each outer edge.
- w* Bilobed underleaf with decurrent insertion, bearing two protuberances on each outer edge.
- x* Hemiactinomorphic sinus of an underleaf.
- y* Crenulate margin of an underleaf.
- z* Dentate margin of an underleaf.



*Analysis of the subgenera of Calypogeja Raddi.*

*Calypogeja* species are polymorphous and vary greatly according to their habitat. It is only possible to define them in terms of a group of characteristics, all of which are variable individually, but which nevertheless allow one to define a species when combined. In short, a species is recognisable through a group of variable characters and but rarely from any single stable feature. This is equally the case for the subgenera.

A dichotomous key makes use of only a restricted number of characteristics, and these are allotted a hierarchic value which may be misleading owing to the artificiality of such a key when applied to a group of variable entities such as those displayed within the genus *Calypogeja*.

A different form of analysis has therefore been devised which permits of an easy identification of a taxon. It has three main features:

- a) a relatively high number of characters are involved;
- b) all the features taken into consideration are of equal weight, there is no hierarchy;
- c) specimens need not display all the features listed. So long as a majority of the items are represented, it is possible to classify the specimen under a particular subgenus or species without much difficulty.

Dichotomous keys have also been included for comparative purposes.

The key for the subgenera of *Calypogeja* is composed of lettered groups of features. Each feature bears a number and is comparable to the others of its group. On the analysis of a specimen a number will be obtained for each group (six in all). Each number corresponds to a subgenus and the specimen will belong to a particular subgenus when its number is revealed in the majority of its letter groups. (i.e. at least four of the six groups must bear its number). It will be noticed that certain features bear two numbers. That one will be chosen which will contribute to an uniform formula.

- A 1. Leaf apex apiculate.  
2. Leaf apex rounded, truncate or rarely notched.  
3. Leaf apex distinctly bilobed or bidentate.
- B 1. Leaf margin formed of a distinct layer of elongated cells (length/width greater than 10/1) overlapping as do the tiles of a roof.  
2. Leaf margin composed of a layer of narrow, isodiametric or rectangular cells with much thickened walls.  
3. Leaf margins indistinct or occasionally made up of a layer of elongated cells (length/width never exceeding 5/1). These cells never overlap.
- C 1. Underleaves divided to a maximum of 1/5 of their length, and having a margin composed of much elongated cells.  
2. Underleaves as in 1. but without any distinct margin.  
3. Underleaves divided from 3/10 to 9/10 of their length, with no distinct margins.
- D 1. or 2. Underleaves neither decurrent nor bisbifid.  
3. Underleaves decurrent, or not decurrent but then bisbifid.

- E 1. or 3. Leaves as long as broad or not more than 1,5 times as long as broad.  
 2. Leaves 1,5-2,5 times longer than broad.
- F 1. or 3. Apical cells of leaves having small non nodulose trigones.  
 2. Apical cells of leaves equipped with large nodulose trigones.

Formulae containing a majority of:

- 1 = Subgenus *Mnioloma* (Herzog) Bischler.  
 2 = Subgenus *Caracoma* Bischler.  
 3 = Subgenus *Calypogeja*.

*Dichotomous key to the subgenera of Calypogeja Raddi*

Leaves and underleaves bearing a margin of much elongated, overlapping cells (length/width 10/1 or more). Leaves apiculate. Underleaves not decurrent, divided to a maximum of  $\frac{1}{5}$  of their length . . . . . 1. Subgen. **Mnioloma** (Herzog) Bischler

Leaves and underleaves with no distinct margin or with a margin of small cells (smaller than those in the subapical region of the leaf) with strongly thickened walls, or with a margin of elongated cells (not more than 5 times longer than wide), which do not overlap.

Leaves usually 1,5-2,5 times longer than wide. Leaf margins often composed of narrower, isodiametric or rectangular cells with thickened walls. Underleaves not decurrent, divided to  $\frac{1}{5}$  of their total length, with no distinct margin. Apical cells of leaves often nodulose . . . . . 2. Subgen. **Caracoma** Bischler

Leaves usually bilobed or bidentate, rarely entire or apiculate, generally not exceeding 1,5 times as long as wide, usually as long as wide or even wider. Leaf margin indistinct, or composed of elongated cells (length/width not more than 5/1), adjacent to each other but never overlapping. Underleaves strongly decurrent, more rarely not decurrent, but then usually bisbifid. Underleaves divided for  $\frac{3}{10}$  to  $\frac{9}{10}$  of their total length. Apical leaf cells usually with only small trigones.

3. Subgen. **Calypogeja**

1. SUBGENUS **Mnioloma** (Herzog) Bischler = *Mnioloma* Herzog, *Ann. Bryol.* 3:119 1930

Leaves apiculate, as long as broad to 1,5 times longer than broad. Leaf margin distinct, composed of a layer of very long, sinuous cells (at least ten times longer than wide) overlapping each other as do the tiles of a roof. Subapical cells of the leaves, thin walled and with small trigones. Underleaves large (2,5 to 3 times the width of the stem), rounded, not decurrent, divided to  $\frac{1}{5}$ th of their length to form two obtuse lobes separated by a hemiactinomorphic sinus. The margin of the underleaves composed of elongated cells similar to those of the leaves. Cells of the underleaves are all elongated, sinuous and translucent.

TYPE SPECIES: *Calypogeja rhynchophylla* (Herzog) Bischler.

OBS.: *Mnioloma* Herzog has not been retained as an independant genus. The subgenus *Caracoma* Bischler is very closely related. Its species have the

same general aspect, a similar cellular composition and the same type of underleaves. *Mnioloma* is distinct only in its leaf shape and in the very distinctive leaf and underleaf margins.

1. — ***Calypogeja rhynchophylla*** (Herzog) Bischler = *Mnioloma rhynchophylla* Herzog, *Ann. Bryol.* 3:119. 1930.

*ICONES*: This paper, fig. 6; HERZOG, *l.c.*: 116-118, fig. 1-4.

*Stems* creeping, 1,5-2,5 cm long, up to 3,8 mm wide (leaves included). Stem width 210  $\mu$ . Cortical cells  $85 \times 30 \mu$ , thick walled and with distinct trigones. *Rhizoides* few in number, long and hyaline. *Lateral branches* rare, long. No flagelliform branches. *Leaves* slightly imbricate, 1500  $\mu$  long, 1150  $\mu$  wide, length/width = 1,3/1. Dorsal edge almost straight, ventral edge strongly curved and decurrent. Leaf insertion only slightly arched. Leaf apex apiculate, the apiculus composed exclusively of marginal cells. The leaf margin composed of a single layer of much elongated yellowish and transparent cells with thickened walls arranged obliquely and overlapping each other over the greater part of their length. Leaf cells thin walled, trigones small near the apex, rather larger near the base. Cell dimensions: marginal  $144-153 \times 10-13 \mu$ , apical  $20 \times 17 \mu$ , central  $37 \times 22 \mu$ , basal  $68 \times 25 \mu$ . *Underleaves* 2,5 to 3 times the width of the stem, 630  $\mu$  long, 560  $\mu$  wide, not decurrent. Wings rounded and slightly crenulate. Apex with a very shallow, rounded, hemiactinomorphic sinus, about 17  $\mu$  deep. The lobes on either side are broad and rounded, erect or converging, sometimes overlapping and thus completely masking the sinus. Margins of the underleaves composed of elongated cells, arranged in a fashion similar to that of the leaves. Underleaf cells transparent, yellowish, elongated and sinuous, thin walled and without trigones. Cell dimensions: marginal  $153 \times 9 \mu$ , central  $93 \times 17 \mu$ . *Inflorescence* dioecious? ♂ single or in pairs, composed of several pairs of strongly imbricate bracts. Antheridia on short pedicels.

*HAB.*: *Calypogeja rhynchophylla* forms yellowish green or olive coloured tufts on the bark of trees. It appears to grow at a height of about 1000 m.

*TYPE*: COSTA RICA, province of Cartago, vicinity of Orosi, March 30, 1924, *Standley 39843* (hb Herzog, portion in hb G).

*DISTR.*: CENTRAL AMERICA: Costa Rica.

*OBS.*: HERZOG, in his description, speaks of leaf margins composed of two to three layers of elongated cells. In fact there is only a single layer of cells but arranged obliquely and overlapping each other over the greater part of their length.

The distinctive margins distinguish the species from all others in the genus.

## 2. SUBGENUS ***Caracoma*** Bischler subgen. nov.

*Folia* integra, rotundata truncatave, rarius emarginata lobis rotundatis, saepius  $1,5 \times$  longiora quam lata. Foliorum marginales cellulae crebro parvae, subquadratae vel rectangulares, parietibus crassis, limbum distinctum formantes.

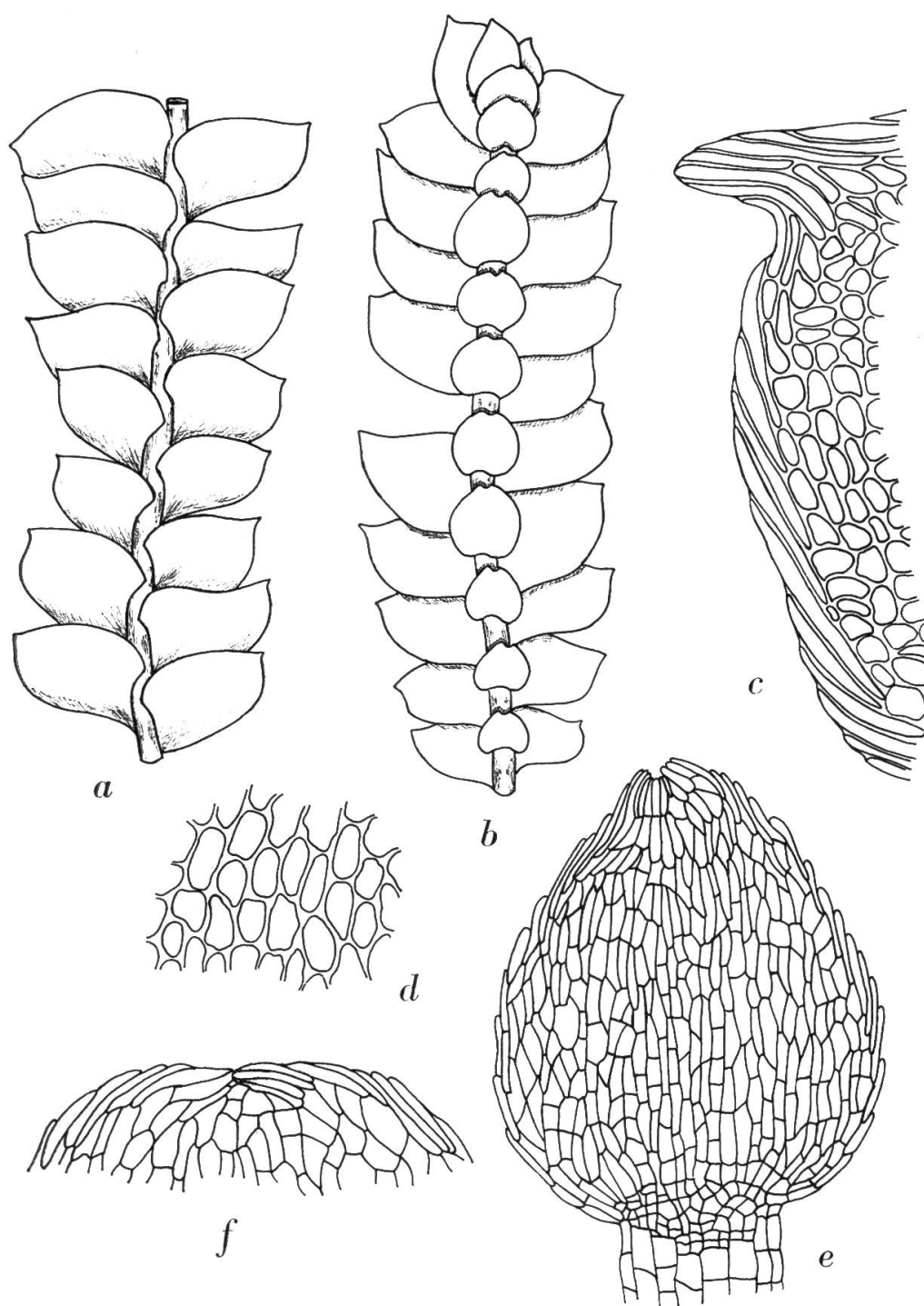


FIG. 6. — *Calypogeja rhynchophylla* (Herzog) Bischler (type).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region  
of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, under-  
leaf,  $\times 85$  — *f*, apex of an underleaf,  $\times 130$ .

Cellulae subapicales parietibus tenuibus, saepe magnis nodulosis trigonis instructis. *Amphigastria* 1,5-3  $\times$  quam caulis latiora, rotundata, recte inserta, plerumque usque ad  $\frac{1}{5}$  longitudinis bilobata, sine margine.

*Stems* usually creeping. Cortical cells usually thin walled and without trigones, 40-100  $\times$  10-30  $\mu$ . *Rhizoides* usually few in number, long and hyaline. *Lateral branches* generally few in number. Flagelliform branches are occasionally present. *Leaves* hardly imbricate, often much elongated. Leaf apex rounded or truncate, rarely notched. Leaf insertion usually markedly decurrent. Leaf margins, when distinct, composed of a layer of small, narrower, isodiametric or rectangular cells with strongly thickened walls. Their outer walls frequently bulge outwards giving a crenulate appearance to the margin. Leaf cells are relatively small. Nodulose trigones are often present, throughout the leaves. Cell dimensions: apical 22-40  $\times$  17-34  $\mu$ , basal 34-90  $\times$  17-40  $\mu$ . *Underleaves* 1,5 to 3 times the width of the stem. Insertion not decurrent. Apex generally divided to a maximum of  $\frac{1}{5}$  of the total length of the underleaf, forming two broad, rounded, lobes separated by a hemiactinomorphic sinus. Margins of the underleaves frequently crenulate. Underleaf cells usually much elongated, thin walled and without trigones. Mean measurements of those in the centre 50-100  $\times$  10-35  $\mu$ . *Cuticle* usually papillose.

*HAB.*: Species of this subgenus are generally corticolous.

*TYPE SPECIES*: *Calypogeja caespitosa* (Spruce) Steph.

*OBS.*: *C. caespitosa* (Spruce) Steph. does not represent the most primitive species in the subgenus, but rather, the taxon around which all the species included in the subgenus bear a maximum of affinity.

The ten species included in *Caracoma* can be arranged in four subgroups:

#### *Subgroup 1*

Leaf margin crenulate. Underleaves divided to a maximum of  $\frac{1}{5}$ , length/width 1/1.

- C. cellulosa* (Spreng.) Steph.
- C. retusa* Bischler
- C. crenulata* Bischler

#### *Subgroup 2*

Leaf margin not crenulate. Margin distinct or indistinct. Underleaves divided to a maximum of  $\frac{1}{5}$ , length/width 1/1 or slightly longer.

- C. cyclostipa* (Spruce) Steph.
- C. caespitosa* (Spruce) Steph.
- C. elliottii* Steph.

#### *Subgroup 3*

Leaf margin not crenulate. Underleaves divided to a maximum of  $\frac{1}{5}$ , reniform in shape, wider than long.

- C. nephrostipa* (Spruce) Steph.
- C. mastigophora* (Spruce) Steph.



*Subgroup 4*

No distinct leaf margin. Underleaves divided from 3/10 to 6/10, about equal in length and width.

*C. fissistipula* Bischler

*C. parallelogramma* (Spruce) Steph.

*Analytical key of the species of subgenus Caracoma Bischler.*

The characters are numbered and grouped as in the previous key. A formula composed of ten figures will be obtained after analysis. The species and their typical formulae are listed in a table at the end of the key. The formulae obtained from the analysis of a given specimen is compared with those in the table and the species to which that specimen belongs will be that corresponding to the closest formula. Numbers in brackets represent known variants within the species.

- A 1. Leaves much longer than wide. Length/width 1,5-2,5/1.  
Apex rounded or truncate.
- 2. Leaves slightly wider than long. Length/width 1/1-1,3. Apex notched.
- 3. Leaves only slightly longer than wide. Length/width 1,1-1,5/1.  
Apex rounded or truncate.
- B 1. Underleaves about as long as wide. Length/width 1,3-1/1-1,3.
- 2. Underleaves distinctly longer than wide. Length/width 1,3-1,5/1.
- 3. Underleaves distinctly wider than long. Length/width 1/1,3-1,5.
- C 1. Underleaves divided to a maximum of  $\frac{1}{5}$  of their length. Sinus rounded.
- 2. Underleaves divided from 3/10 to 6/10 of their length. Sinus pointed (V-shaped).
- D 1. Leaf margin distinct, composed of one or more layers of cells.
- 2. Leaf margin indistinct.
- E 1. Leaf margin not crenulate.
- 2. Leaf margin crenulate.
- F 1. Underleaf cells elongated, 2-5/1.
- 2. Underleaf cells hardly elongated, 1-2/1.
- G 1. Underleaves 2-3,5 times width of the stem.
- 2. Underleaves 1-1,5 (-2) times width of the stem.
- H 1. Trigones of apical leaf cells medium to small.
- 2. Trigones of apical leaf cells large and nodulose.
- K 1. Underleaves with rounded or pointed lobes.
- 2. Underleaf lobes with long apiculae.
- L 1. Outer edges of underleaves smooth or crenulate.
- 2. Outer edges of underleaves toothed.



|                                     | A | B | C | D     | E | F | G | H | K | L |
|-------------------------------------|---|---|---|-------|---|---|---|---|---|---|
| <i>C. cellulosa</i> . . . . .       | 3 | 1 | 1 | 1     | 2 | 1 | 2 | 1 | 1 | 1 |
| <i>C. retusa</i> . . . . .          | 2 | 1 | 1 | 1     | 2 | 1 | 1 | 1 | 1 | 1 |
| <i>C. crenulata</i> . . . . .       | 3 | 1 | 1 | 1     | 2 | 1 | 1 | 2 | 1 | 1 |
| <i>C. cyclostipa</i> . . . . .      | 3 | 1 | 1 | 2     | 1 | 1 | 1 | 2 | 1 | 1 |
| <i>C. caespitosa</i> . . . . .      | 1 | 1 | 1 | 1 (2) | 1 | 1 | 1 | 1 | 1 | 1 |
| <i>C. elliotii</i> . . . . .        | 3 | 2 | 1 | 1     | 1 | 1 | 1 | 2 | 1 | 1 |
| <i>C. nephrostipa</i> . . . . .     | 1 | 3 | 1 | 1     | 1 | 2 | 1 | 2 | 1 | 1 |
| <i>C. mastigophora</i> . . . . .    | 1 | 3 | 1 | 1     | 1 | 2 | 2 | 1 | 1 | 1 |
| <i>C. fissistipula</i> . . . . .    | 1 | 1 | 2 | 2     | 1 | 1 | 1 | 2 | 1 | 1 |
| <i>C. parallelogramma</i> . . . . . | 1 | 1 | 2 | 2     | 1 | 1 | 1 | 2 | 2 | 2 |

#### DICHOTOMOUS KEY TO THE SPECIES OF SUBGENUS CARACOMA BISCHLER.

Underleaves divided to maximum  $\frac{1}{5}$  of their length. Sinus rounded, often hemiactinomorphic. Underleaf cells without trigones. Leaves usually with a margin

Underleaves never reniform, usually equal in length and width or longer. Sinus usually hemiactinomorphic. Cells of underleaves elongate, 2-5/1. Stems symmetrical

Underleaves about as wide as long (ratio length/width 1,3-1/1-1,3). Leaf margin not distinct, or formed of a single layer of isodiametric or rectangular cells with much thickened walls

Leaves hardly elongate, sometimes wider than long (ratio length/width 1,5-1/1-1,3). Stems relatively narrow, 85-186  $\mu$  wide. Plants creeping

Leaf margin distinct, composed of cells with much thickened walls. The outer walls are very convex giving a crenulate appearance to the margin

Plants small, 0,3-2,0 cm long, 0,7-2,0 mm wide. Leaves rounded or truncate.

Leaf cells with small or medium sized trigones. Underleaves 1,5-2 times width of stem . . . . . 1. **C. cellulosa** (Spreng.) Steph.

Plants medium sized, 2-10 cm long, 1,7-3,3 mm wide. Underleaves 2,1-3,3 times stem width

Plants 1,7 mm wide. Leaf apex notched. Leaves rather wider than long. Leaf cells with medium or small not nodulose trigones. Underleaves up to 2,1 times stem width. Stems branched

2. **C. retusa** Bischler.

Plants 2,1-3,3 mm wide. Leaf apex rounded. Leaves very slightly longer than wide. Leaf cells with large nodulose trigones throughout. Underleaves at least 2,5 times the stem width. Stems but little branched

3. **C. crenulata** Bischler.

Leaf margin indistinct and not crenulate. Robust plants with but little-branched stems . . . . . 4. **C. cyclostipa** (Spruce) Steph.

Leaves much elongated (ratio length/width 1,5-2,5/1). Leaf margin distinct or indistinct, not crenulate. Leaf cells with small or medium sized trigones. Stems broad, fleshy, 200-230  $\mu$  wide. Plants frequently erect

5. **C. caespitosa** (Spruce) Steph.

Underleaves longer than wide (ratio length/width 1,5-1,3/1). Underleaves 2,2-3,4 times width of the stem. Leaves hardly elongated. Leaf margin composed of two layers of rectangular cells with very thick walls. The second layer is often discontinuous. Stems with but little branching

6. **C. elliottii** Steph.

Underleaves much wider than long, reniform (ratio length/width 1/1,3-1,5). Sinus never hemiactinomorphic. Underleaf cells not elongated (ratio 1-2/1). Leaves much longer than broad. Leaf margin always distinct. Stems often asymmetrical

Plants 1,5-6 cm long, 2,5-3,3 mm wide. Stems fleshy, rigid, much branched. Leaves imbricate, insertion hardly decurrent. Underleaves up to 1,5-2,6 times stem width . . . . . 7. **C. nephrostipa** (Spruce) Steph.

Plants 1-1,5 cm long, 1,3-1,6 mm wide. Stems not fleshy, sinuose, little branched. Leaves distant, insertion strongly decurrent. Underleaves 1,4-1,5 times width of stem . . . . . 8. **C. mastigophora** (Spruce) Steph.

Underleaves divided to 3/10-6/10 of their length. Sinus narrow and pointed. Leaves very long (ratio length/width 1,5-2,5/1). Leaves with no distinct margin

Plants yellowish green or olive in colour. Stems flexuose, branched. Cuticle smooth. Underleaves with rounded or pointed, but never apiculate lobes. Outer margins of underleaves never toothed. Cells of underleaves with well developed trigones . . . . . 9. **C. fissistipula** Bischler

Plants dark green or black in colour. Stems rigid with but few branches. Cuticle papillose. Underleaf lobes with long apiculae. Outer margins of underleaves toothed. Underleaf cells without trigones

10. **C. parallelogramma** (Spruce) Steph.

1. — **Calypogeja cellulosa** (Spreng.) Steph. *Spec. Hep.* 3:398. Jul. 31, 1908 = *Jungermannia cellulosa* Spreng. *Syst. Veg.* 4:232. 1827 = *Mastigobryum cellulosum* (Spreng.) Lindenb. in Gottsche, Lindenberg & Nees, *Syn. Hep.* 217. 1845 = *Kantia cellulosa* (Spreng.) Spruce, *Trans. Proc. Bot. Soc. Edinburgh* 15:412. Nov. 1885.

*ICONES*: This paper, fig. 7; LINDENBERG, *Spec. Hep.* fasc. 8-11, tab. 3, fig. 1-5. 1851.

*Stems* creeping, spindly, 0,3-2 cm long, 0,7-2 mm broad (leaves included). Stem width 85-154  $\mu$ . Cortical cells thin walled, 68-102  $\times$  17-25  $\mu$ . Trigones absent or small. *Rhizoides* few in number, long, hyaline. *Lateral branches* very numerous. Occasional flagelliform branches have been observed. *Leaves* distant or slightly imbricate, 350-910  $\mu$  long, 280-690  $\mu$  wide, ratio length/width 1,2-1,4/1. Dorsal edge curved, ventral edge almost straight and strongly decurrent. Insertion only slightly arched. Leaf apex rounded or truncate, rarely slightly notched on an occasional leaf. Leaf margin distinct, composed of narrower, thick walled, isodiametric or rectangular cells with bulging outer walls. The leaf margin appears thus to be strongly crenulate. Leaf cells thin walled. Trigones usually medium to small.

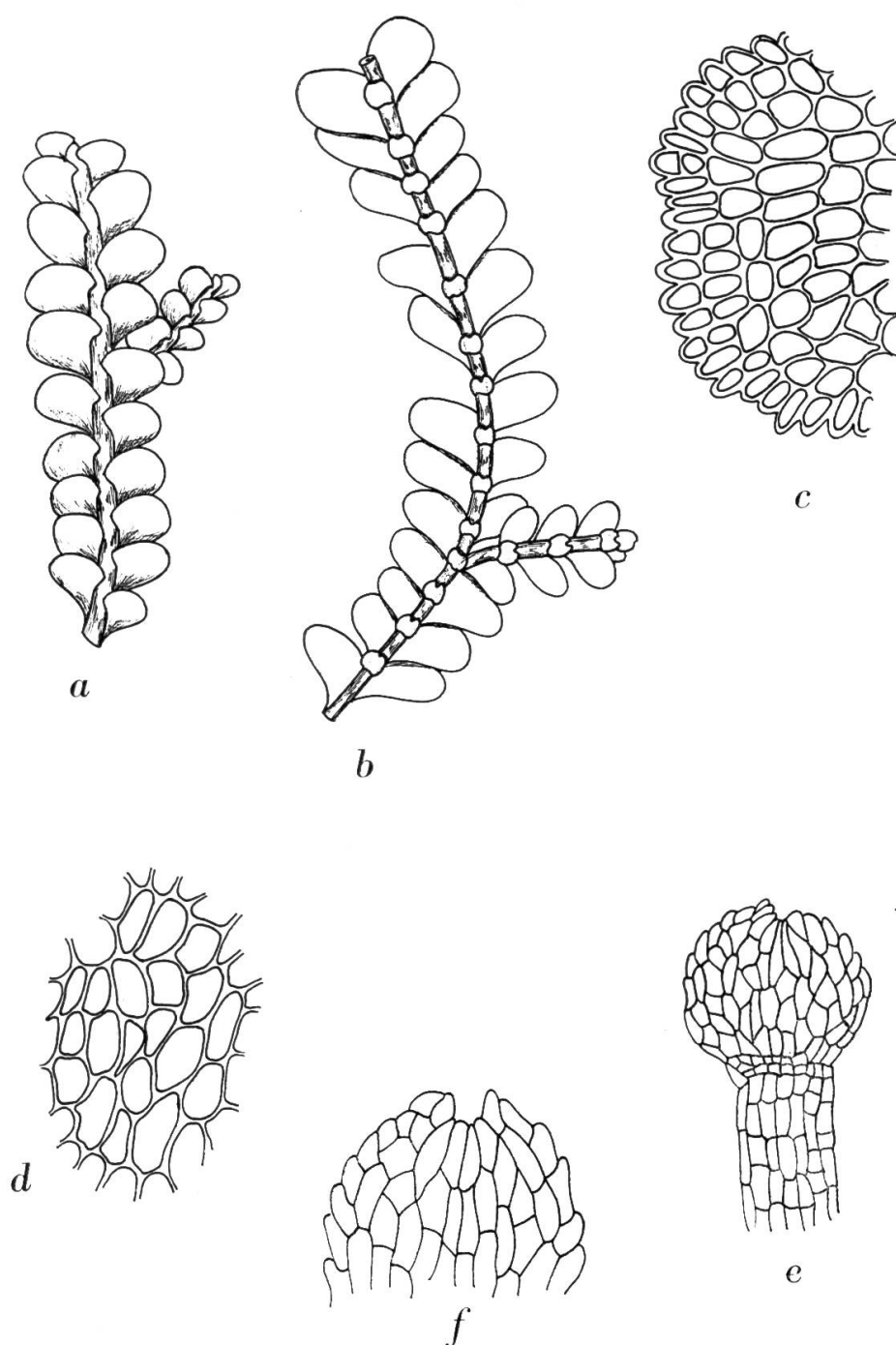


FIG. 7. — *Calypogeja cellulosa* (Spreng.) Steph. (lectotype).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region  
of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, under-  
leaf,  $\times 85$  — *f*, apex of an underleaf,  $\times 130$ .

Cell measurements: marginal  $25-42 \times 10-25 \mu$ , apical  $25-30 \times 17-25 \mu$ , central  $37-60 \times 25-34 \mu$ , basal  $60-85 \times 22-34 \mu$ . *Underleaves* 1,5-2 times the width of the stem,  $170-266 \mu$  long,  $170-245 \mu$  wide. Not decurrent. Ratio length/width 1,1-1/1-1,1. Outer edges rounded, often slightly crenulate. Apex divided by a shallow sinus to form two broad, rounded lobes. The shape of the sinus is variable but it is usually shallow and rounded,  $17-34 \mu$  deep, and hemiactinomorphic. The lobes may be straight or connivent, at times completely masking the sinus. The cells of the underleaves are thin walled with an occasional small trigone. *Cell measurements*: marginal  $34-60 \times 12-25 \mu$ , central  $42-68 \times 10-34 \mu$ . *Inflorescences* dioecious? ♀ solitary or in pairs. *Bracts*: 4 pairs, bidentate, with shallow sinus and crenulate margins. *Cuticle* strongly papillose.

*HAB.*: *C. cellulosa* forms fairly dense olive or yellowish green mats on the bark of trees or on rotting wood. It is found chiefly at low altitudes, around 500 m.

*LECTOTYPE*: GUADELOUPE, s.d., *Perrin s.n.* (G. n° 1844, sub *Jungermannia brachiata* Sw.).

*DISTR.*: CENTRAL AMERICA: Guadeloupe, Jamaica.

Other material studied: GUADELOUPE, s.d., *Perrin s.n.* (G n° 1846); s.d., *s.col.*, *s.n.* (G n°s 1845, 1848); s.d., *s.col.*, *s.n.* (MANCH). JAMAICA: s.d., *s.col.*, *s.n.* (G n° 1847).

*OBS.*: The type of this species was chosen from amongst several specimens from GUADELOUPE collected by PERRIN. It is not only an abundant collection but agrees perfectly with the original description.

*C. cellulosa* is very closely related to *C. crenulata* Bischler and *C. retusa* Bischler, all three having strongly crenulate margins. It is distinct from the former by its smaller and weaker stems and from the latter by its generally rounded or truncate leaves, except very occasionally, on single leaves, slightly notched.

## 2. — *Calypogeja retusa* Bischler spec. nov.

*ICONES*: This paper, fig. 8.

*Caules* jacentes, ramosi. *Folia* parum imbricata, apice retusa, lobis rotundatis, sinu rotundato, paulo latiora quam longa, in basi decurrentia, margine crenulata. *Cellulae* marginales parvae, prominentes, parietibus crassis. *Interiores* parietibus tenuibus, trigonis parvis instructis, apicales  $34 \times 25 \mu$ , basiales  $51 \times 42 \mu$ . *Amphigastria*  $2 \times$  latiora quam caulis, recte inserta, rotundata, margine paulum crenulata, apice parum bilobata, lobis rotundatis, sinu rotundato. *Cellulae* parietibus tenuibus, sine trigonis, centrales  $51 \times 25 \mu$ . *Sterilis*. *Cuticula* verruculosa.

*Stems* creeping, 3-5 cm long, 1,7 mm broad (leaves included). Stem width  $170 \mu$ . Cortical cells thin walled,  $102 \times 25 \mu$ . Trigones small. *Rhizoides* abundant, very long, hyaline. *Lateral branches* numerous, short. Occasional flagelliform branches. *Leaves* slightly imbricate,  $805 \mu$  long,  $910 \mu$  wide. Ratio length/width 1/1,1. Dorsal

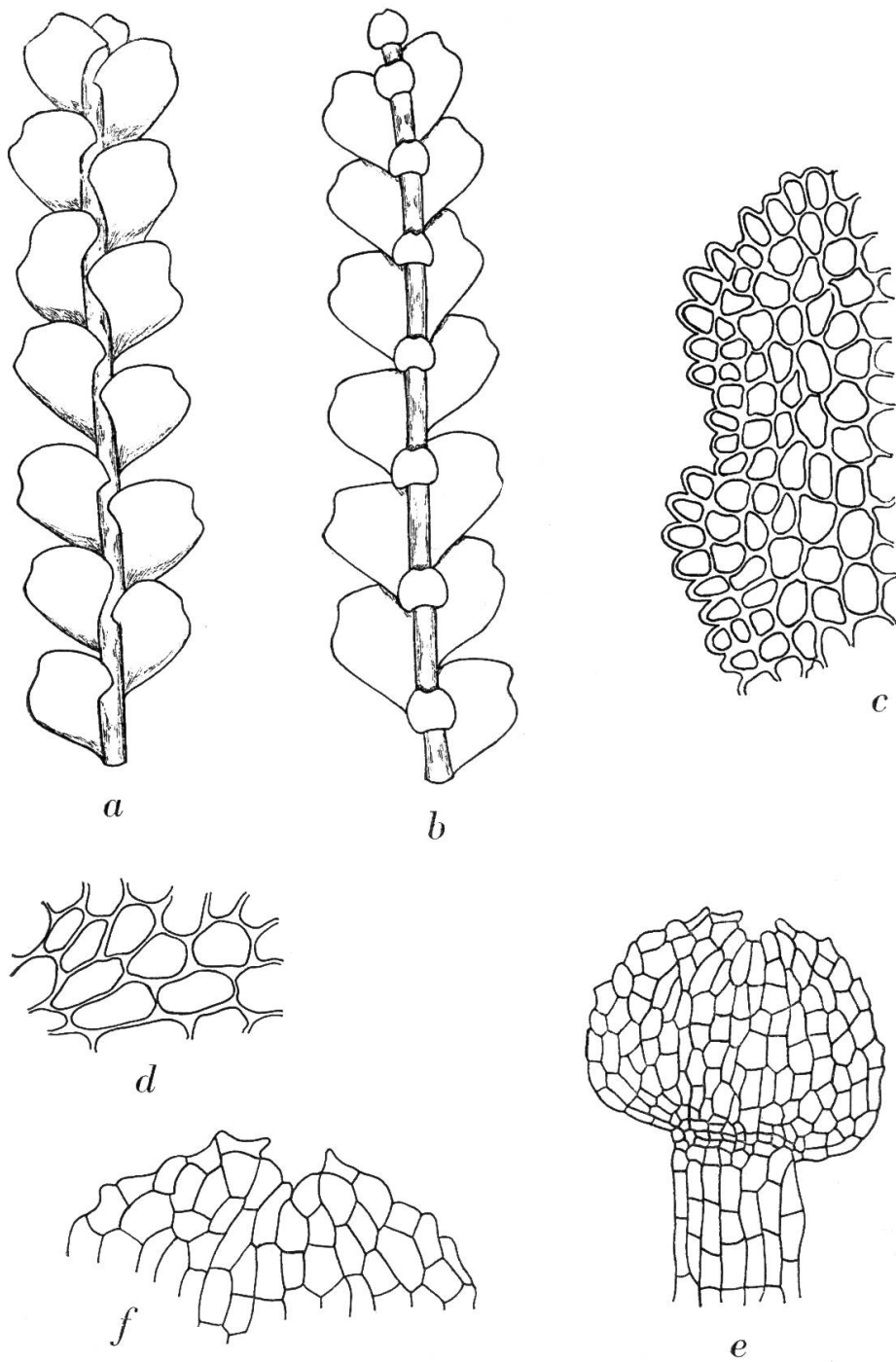


FIG. 8. — *Calypogeja retusa* Bischler (type).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, underleaf,  $\times 85$  — *f*, apex of an underleaf,  $\times 130$ .

edge very slightly curved. Ventral edge more or less curved and strongly decurrent. Insertion arched. Leaf apex broadly rounded and notched, with two broad rounded lobes separated by a rounded sinus, about  $34\ \mu$  deep. Leaf margin, distinct and strongly crenulate, composed of small, isodiametric or slightly rectangular cells with very thick walls. Leaf cells thin walled. Trigones medium sized, not nodulose. Cell dimensions: marginal  $25 \times 17\text{--}20\ \mu$ , apical  $34 \times 25\ \mu$ , central  $42 \times 34\ \mu$ , basal  $51 \times 42\ \mu$ . *Underleaves* 2,1 times width of stem,  $300\ \mu$  long,  $364\ \mu$  wide. Not decurrent. Ratio length/width 1/1,2. Outer edges rounded, slightly crenulate. Apex divided into two broad, rounded, erect lobes by a shallow, rounded, frequently hemiactinomorphic, sinus,  $34\ \mu$  deep. Cells thin walled. No trigones. Cell dimensions: central  $51 \times 25\ \mu$ , marginal  $42 \times 17\ \mu$ . *Sterile*. *Cuticle* papillose.

*HAB.*: *C. retusa* forms yellowish green mats on bark. Appears to grow at an altitude of about 1000 m.

*TYPE*: PERU: St. Gavan, Jul. 1854, *Lechler s.n.* [G n° 1851 sub *C. cellulosa* (Spreng.) Steph.].

*DISTR.*: SOUTH AMERICA: Peru.

*OBS.*: This species can be distinguished from the others in the subgenus *Caracoma* by its notched leaves which are wider than they are long. Its crenulate margins places it close to *C. cellulosa* (Spreng.) Steph. and to *C. crenulata* Bischler.

3. — ***Calypogeja crenulata*** Bischler spec. nov. = *Mastigobryum cellulosum* (Spreng.) Lindenb. var.  $\beta$  Lindenb. in Gottsche, Lindenb. & Nees, *Syn. Hep.*: 217. 1845.

*ICONES*: This paper, fig. 9; STEPHANI, *Icones Hepaticarum* ined. in hb G n° 1188.

*Caules* jacentes, paulum ramosi. *Folia* parum imbricata, apice rotundata, paulo longiora quam lata, in basi decurrentia, margine crenulata. Cellulae marginales prominentes parietibus crassis, interiores parietibus tenuibus, magnis nodulosisque trigonis instructis, apicales  $25\text{--}34 \times 25\text{--}34\ \mu$ , basiales  $51\text{--}85 \times 30\text{--}42\ \mu$ . *Amphigastria* 2-3,5  $\times$  latiora quam caulis, recte inserta, rotundata, margine paulum crenulata, apice parum bilobata, lobis rotundatis, sinu angusto rotundato. Cellulae parietibus tenuibus, sine trigonis, centrales  $45\text{--}93 \times 17\text{--}25\ \mu$ . *Sterilis*. *Cuticula* verruculosa.

*Stems* creeping, 2-10 cm long, 2,1-3,3 mm wide (leaves included). Stem width  $136\text{--}170\ \mu$ . Cortical cells thin or thick walled,  $68\text{--}110 \times 20\text{--}25\ \mu$ . Trigones absent. *Rhizoides* not abundant, long and hyaline. *Lateral branches* few. No flagelliform branches. *Leaves* hardly imbricate,  $910\text{--}1400\ \mu$  long,  $680\text{--}1000\ \mu$  wide. Ratio length/width 1,2-1,5/1. Dorsal edge more or less curved, ventral edge slightly curved or almost straight, decurrent. Insertion generally distinctly arched. Leaf apex broadly rounded or slightly truncate. Leaf margin distinct, composed of narrower isodiametric or rectangular cells with very thick walls, the outer ones being strongly convex. Leaf cells thin walled. Trigones large and nodulose from apex to base.

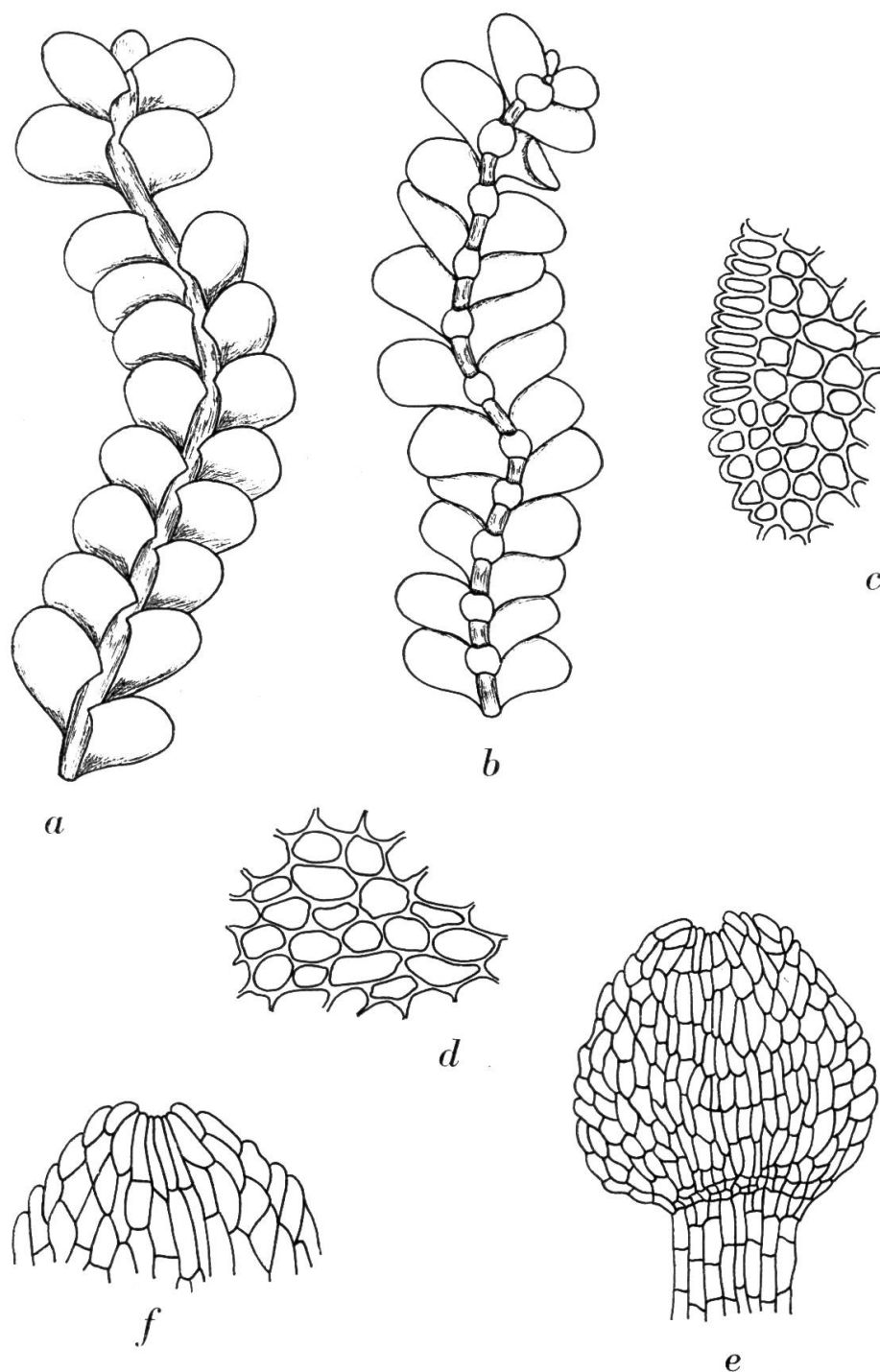


FIG. 9. — *Calypogeja crenulata* Bischler (type).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, underleaf,  $\times 85$  — *f*, apex of an underleaf,  $\times 130$ .



Cell dimensions: marginal  $25-51 \times 12-25 \mu$ , apical  $25-34 \times 25-34 \mu$ , central  $42-51 \times 25-42 \mu$ , basal  $51-85 \times 30-42 \mu$ . *Underleaves* 2,1-3,3 times the width of the stem, 300-480  $\mu$  long, 315-480  $\mu$  wide. Not decurrent. Ratio length/width 1-1,1/1-1,3. Outer edges rounded, frequently slightly crenulate. Apex divided to form two broad rounded lobes separated by a shallow, rounded, hemiactinomorphic sinus 17-34  $\mu$  deep. Underleaf cells thin walled without trigones or with very small ones. *Cell dimensions*: central  $45-93 \times 17-25 \mu$ , marginal  $34-60 \times 17-20 \mu$ . *Sterile*. *Cuticle* strongly papillose.

*HAB.*: *C. crenulata* forms yellowish green or olive mats on rotten wood, bark, or on damp soil. It is found most generally at low altitudes.

*TYPE*: ST. CHRISTOPHER; s.d., *Breutel s.n.* (G, S-PA).

*DISTR.*: CENTRAL AMERICA: Dominica, Guadeloupe, St. Christopher. SOUTH AMERICA: Brazil.

Other material studied: DOMINICA: s.d., *Elliott 1110, 1111, 2276, p.p.*, 2290 (G). GUADELOUPE: [1862] *L'Herminier 59* (G); s.d., *L'Herminier s.n.* (G n<sup>os</sup> 1849, 1850). BRAZIL: Caraça, s.d., *Wainio 39, p.p.* (G).

*OBS.*: This species can be distinguished from *C. cellulosa* (Spreng.) Steph. by its more robust and less branched stems; from *C. retusa* Bischler by its non notched leaves.

4. — *Calypogeja cyclostipa* (Spruce) Steph. *Spec. Hep.* 3:396. Jul. 31, 1908 = *Kantia cyclostipa* Spruce, *Trans. Proc. Bot. Soc. Edinburgh* gr. 15: 411. Nov. 1885.

*ICONES*: This paper, fig. 10; STEPHANI, *Icones Hepaticarum* ined. in hb G n<sup>os</sup> 1191, 1192.

*Stems* creeping, 1-5 cm long, 1,3-3,2 mm wide (leaves included). Stem width 102-186  $\mu$ . Cortical cells thin walled. Trigones usually lacking. Cell dimensions:  $42-102 \times 12-25 \mu$ . *Rhizoides* few in number, long or short, hyaline. *Lateral branches* generally few in number. Flagelliform branches have only been observed on very rare occasions. *Leaves* generally imbricate, 690-1725  $\mu$  long, 644-1380  $\mu$  wide. Ratio length/width 1,1-1,5/1. Dorsal edge curved. Ventral edge nearly straight and usually strongly decurrent. Leaf insertion arched. Leaf apex broadly rounded, rarely truncate. Leaf margin composed of rather smaller cells with only slightly thickened walls, forming a discontinuous and rather indistinct layer. Leaf cells thin walled but with large nodulose trigones, from tip to base. Cell dimensions: marginal  $17-42 \times 12-20 \mu$ , apical  $25-34 \times 17-34 \mu$ , central  $34-60 \times 20-34 \mu$ , basal  $34-68 \times 17-34 \mu$ . *Underleaves* 2-3,5 times width of stem, 161-525  $\mu$  long, 235-600  $\mu$  wide. Not decurrent. Ratio length/width 1/1-1,5. Outer edges rounded, often slightly crenulate. Apex briefly divided into two broad, rounded, erect lobes by a rounded, shallow, hemiactinomorphic sinus 10-25  $\mu$  deep. Underleaf cells, thin walled and without trigones. Cell dimensions: central  $25-85 \times 12-25 \mu$ , marginal



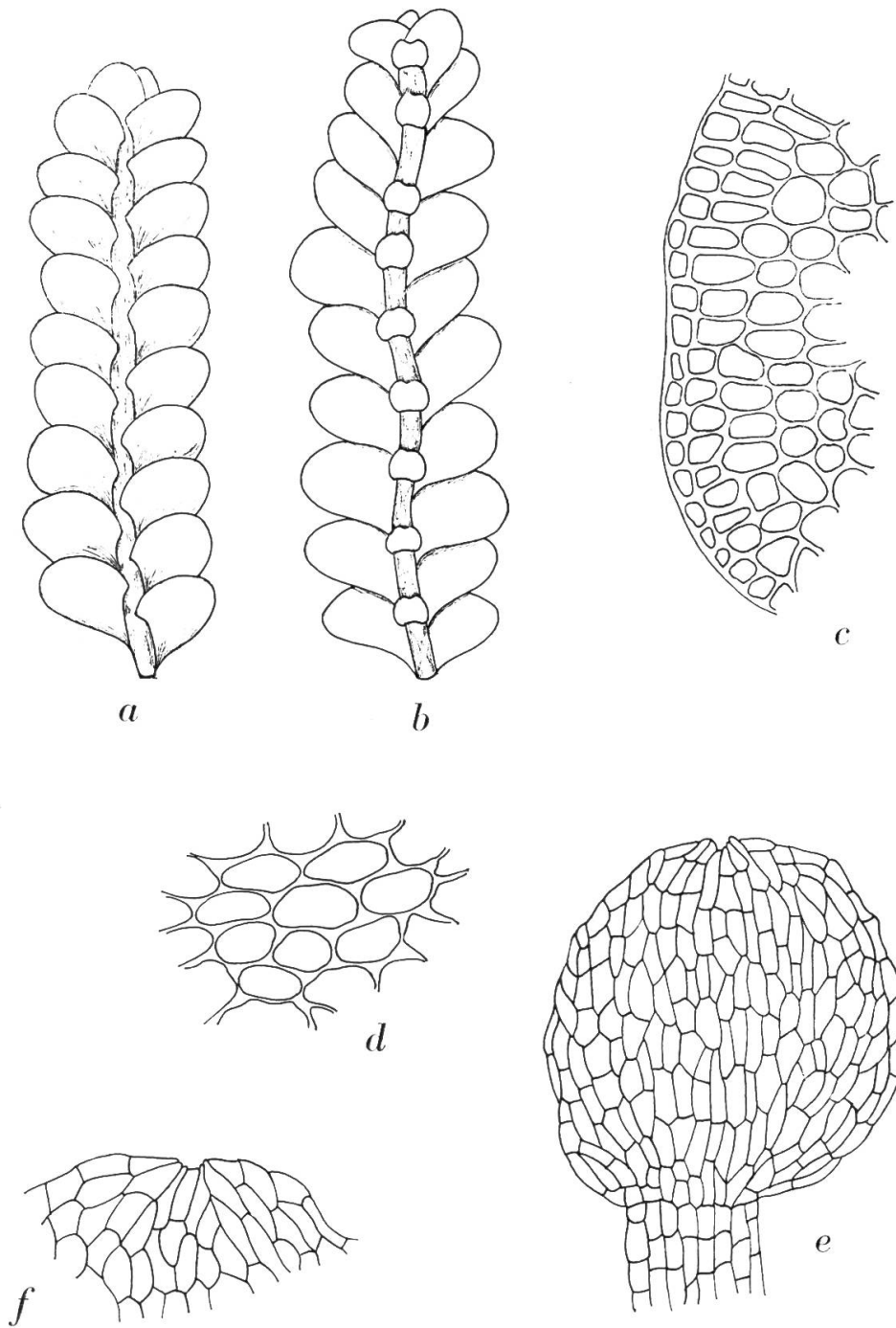


FIG. 10. — *Calypogeja cyclostipa* (Spruce) Steph. (neotype).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region  
of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, under-  
leaf,  $\times 85$  — *f*, apex of an underleaf,  $\times 130$ .

25-60 × 13-25  $\mu$ . *Inflorescences* dioecious. ♀ solitary. Bracts imbricate, concave, bilobed to  $\frac{1}{2}$  their length, lobes and sinus pointed. Marsupia 3 mm long, brown, bearing rhizoides. ♂ solitary, composed of six pairs of concave bilobed bracts. Crenulate bracteoles. *Cuticle* papillose.

*HAB.*: *C. cyclostipa* forms dense, deep green or olive mats on damp soil, bark or, more rarely on living leaves (epiphyllous). It is found at medium and low altitudes, 0-1300 m.

*NEOTYPE*: ECUADOR: Tunguragua, s.d., *Spruce s.n.* (MANCH).

*DISTR.*: SOUTH AMERICA: Bolivia, Colombia, Ecuador, Peru, Venezuela.

Other material studied: BOLIVIA: Songo, s.d., *Bang 899, p.p.* (MANCH). COLOMBIA: s.d., *Moriz s.n.* (G n° 1831). PERU: s.d., *D'Orbigny s.n.* (G n° 1832); Rio Huallaga, Cerro de Escaler, 1200 m, 1903, *Ule 595* (G). VENEZUELA: s.d., *Fendler s.n.* (G n° 1833, 1834).

*OBS.*: SPRUCE cites the following locality for his type: "Peru Mt. Campana. 1000 m." This specimen was not found in the SPRUCE herbarium. However, there was one from Ecuador in his collections which agrees with SPRUCE's description and is sufficient in quantity to serve as a neotype.

SPRUCE (*l.c.*: 411) describes a variety to this species, var. *celluloso-serrata* Spruce, without any indication as to its origin. No specimen thus labeled has been seen from his herbarium. It would differ from the type by its crenulate leaf margins. It might possibly be therefore the same as *C. crenulata* Bischler.

BESCHERELLE (*Journ. de Bot.* 7:188. 1893) cites *C. cyclostipa* (Spruce) Steph. from Guadeloupe. The specimen in question has not been found.

5. — *Calypogeja caespitosa* (Spruce) Steph. *Spec. Hep.* 3:397. Jul. 31, 1908 = *Kantia caespitosa* Spruce, *Trans. Proc. Bot. Soc. Edinburgh* 15:412. Nov. 1885.

*ICONES*: This paper, fig. 11; STEPHANI, *Icones Hepaticarum* ined. in hb G n° 1187.

*Stems* creeping or erect, fairly rigid, 1,5-8 cm long, 2,9-4,6 mm wide (leaves included). Stem width 175-280  $\mu$ . Cortical cells thin walled and without trigones. Cell dimensions: 60-119 × 25-37  $\mu$ . *Rhizoides* few, usually long, hyaline. *Lateral branches* rare. No flagelliform branches. *Leaves* hardly imbricate, 1380-2185  $\mu$  long, 805-1276  $\mu$  wide. Ratio length/width 1,5-1,9/1. Dorsal edge slightly curved. Ventral edge almost straight and decurrent. Leaf insertion slightly arched. Leaf apex broadly rounded or truncate. Leaf margin well differentiated, composed of rectangular, thick walled cells. The margin can be occasionally discontinuous and thus become indistinct. Leaf cells, thin walled without trigones. Small or medium sized trigones are occasionally present but they are never nodulose. Cell dimensions: marginal 25-51 × 13-30  $\mu$ , apical 23-34 × 22-30  $\mu$ , central 42-60 × 25-34  $\mu$ , basal

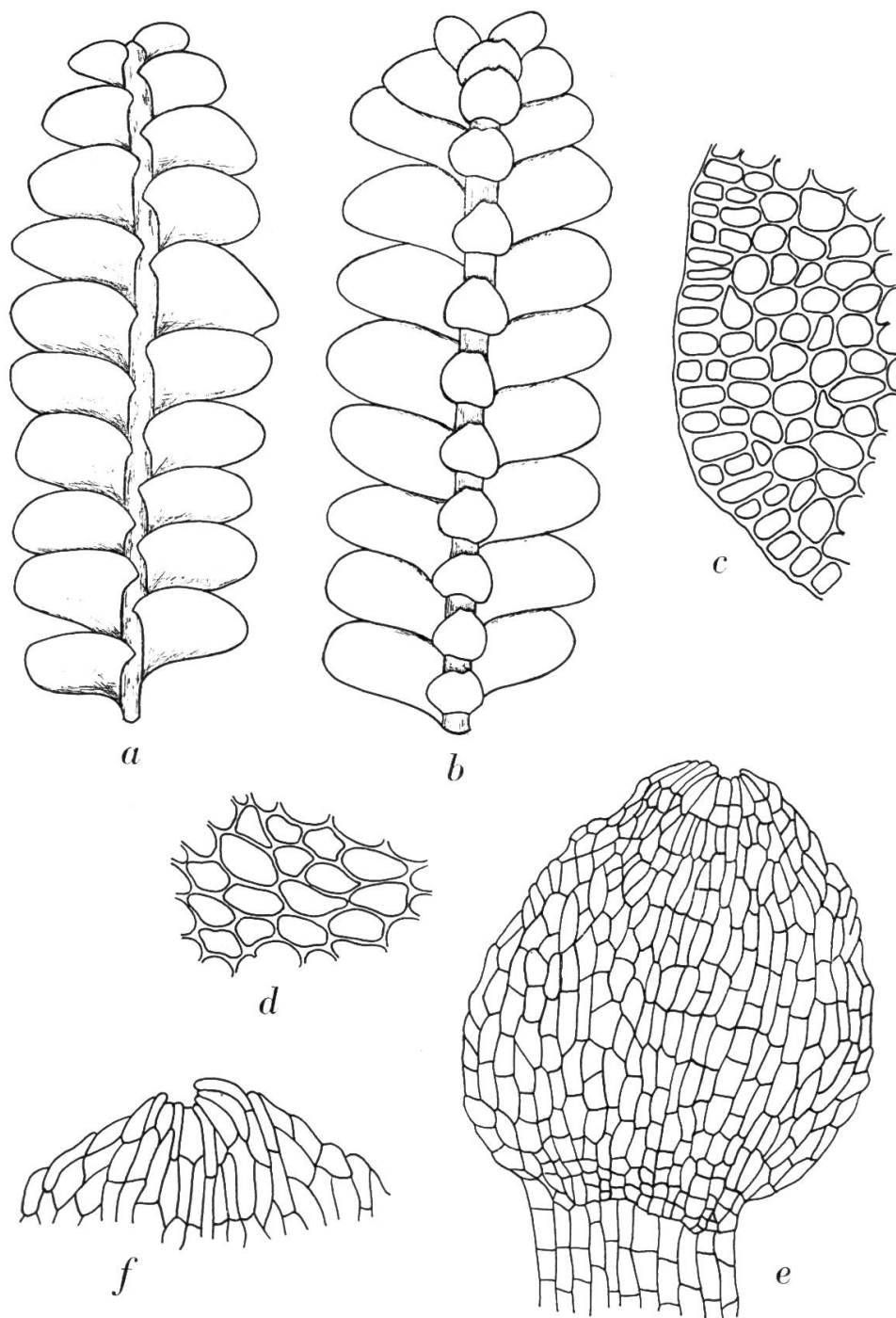


FIG. 11. — *Calypogeja caespitosa* (Spruce) Steph. (type.)  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region  
of the leaf apex,  $\times 130$  — *d* cells in the basal region of the leaf,  $\times 130$  — *e*, under-  
leaf,  $\times 85$  — *f*, apex of an underleaf,  $\times 130$ .

60-93  $\times$  25-34  $\mu$ . *Underleaves* 2-3,3 times width of stem, 350-910  $\mu$  long, 420-840  $\mu$  wide. Not decurrent. Ratio length/width 1,3-1/1-1,2. Outer edges rounded, frequently slightly crenulate. Apex divided to form two rounded lobes, which may be erect or converging, separated by a rounded, hemiactinomorphic sinus 10-40  $\mu$  deep. The cells of the underleaves are elongated, thin walled, translucent and yellowish. They lack trigones. Cell dimensions: central 42-85  $\times$  12-34  $\mu$ , marginal 34-75  $\times$  10-34  $\mu$ . *Inflorescences* dioecious. ♀ with 2-5 pairs of very concave, imbricate bracts, each one divided to form two short, unequal lobes. *Cuticle* finely papillose.

*HAB.*: *C. caespitosa* forms extensive, dense mats on bark. These colonies are frequently of a fine olive green colour. It appears to favour medium altitudes.

*TYPE*: ECUADOR: Canelos, 1000 m, s.d., *Spruce s.n.* (MANCH).

*DISTR.*: SOUTH AMERICA: Brazil, Bolivia, Colombia, Ecuador.

Other material studied: BRAZIL: ad flumen Uaupes prope Panure, s.d., *Spruce s.n.* (MANCH). BOLIVIA: Yungas de La Paz, s.d., *Buchtien s.n.* (hb Herzog). COLOMBIA: à 49 km de Buenaventura, parois de rochers au bord de la route Cali, Buenaventura, 600 m, Aug. 3, 1958, *Bischler 443 A* (G); Santander del Norte, Catatumbo, Cerro del Tirador, cerca de Las Mercedes, 1000 m, May 18, 1959, *Bischler 2573, 2591 A, 2669 B* (G). ECUADOR: *Hepaticae Spruceanae, Amazonicae et Andinae*, Andes Quitenses, Canelos, 1000 m, s.d., *Spruce s.n.* (G n<sup>os</sup> 1856, 1857).

*OBS.*: The leaf margins of this species vary enormously. All stages from a distinct margin through a discontinuous one to a completely indistinct margin have been observed.

## 6. — *Calypogeja elliottii* Steph., *Spec. Hep.* 3:395. Jul. 31, 1908.

*ICONES*: This paper, fig. 12; STEPHANI, *Icones Hepaticarum* ined. in hb G n<sup>o</sup> 1193.

*Stems* creeping, 2-5 cm long, 2,6-3,6 mm wide (leaves included). Stem width 120-210  $\mu$ . Cortical cells thin walled, usually with small trigones. Cell dimensions: 60-102  $\times$  17-30  $\mu$ . *Rhizoides* few, long, hyaline. *Lateral branches* few. No flagelliform branches. *Leaves* only slightly imbricate, 1276-1610  $\mu$  long, 1035-1276  $\mu$  wide. Ratio length/width 1,2-1,3/1. Dorsal edge more or less curved. Ventral edge almost straight and decurrent. Leaf insertion only slightly arched. Leaf apex broadly rounded, more rarely, truncate. Leaf margin composed of narrow, rectangular, cells with very thick walls forming a distinct and continuous layer under which is a second similar layer frequently interrupted by the presence of isolateral cells. Leaf cells thin walled with large nodulose trigones, from tip to base of the leaf. Cell dimensions: marginal 34-68  $\times$  12-22  $\mu$ , apical 34-51  $\times$  34-42  $\mu$ , central 42-68  $\times$  25-42  $\mu$ , basal 51-85  $\times$  25-42  $\mu$ . *Underleaves* 2,2-3,4 times the width of the

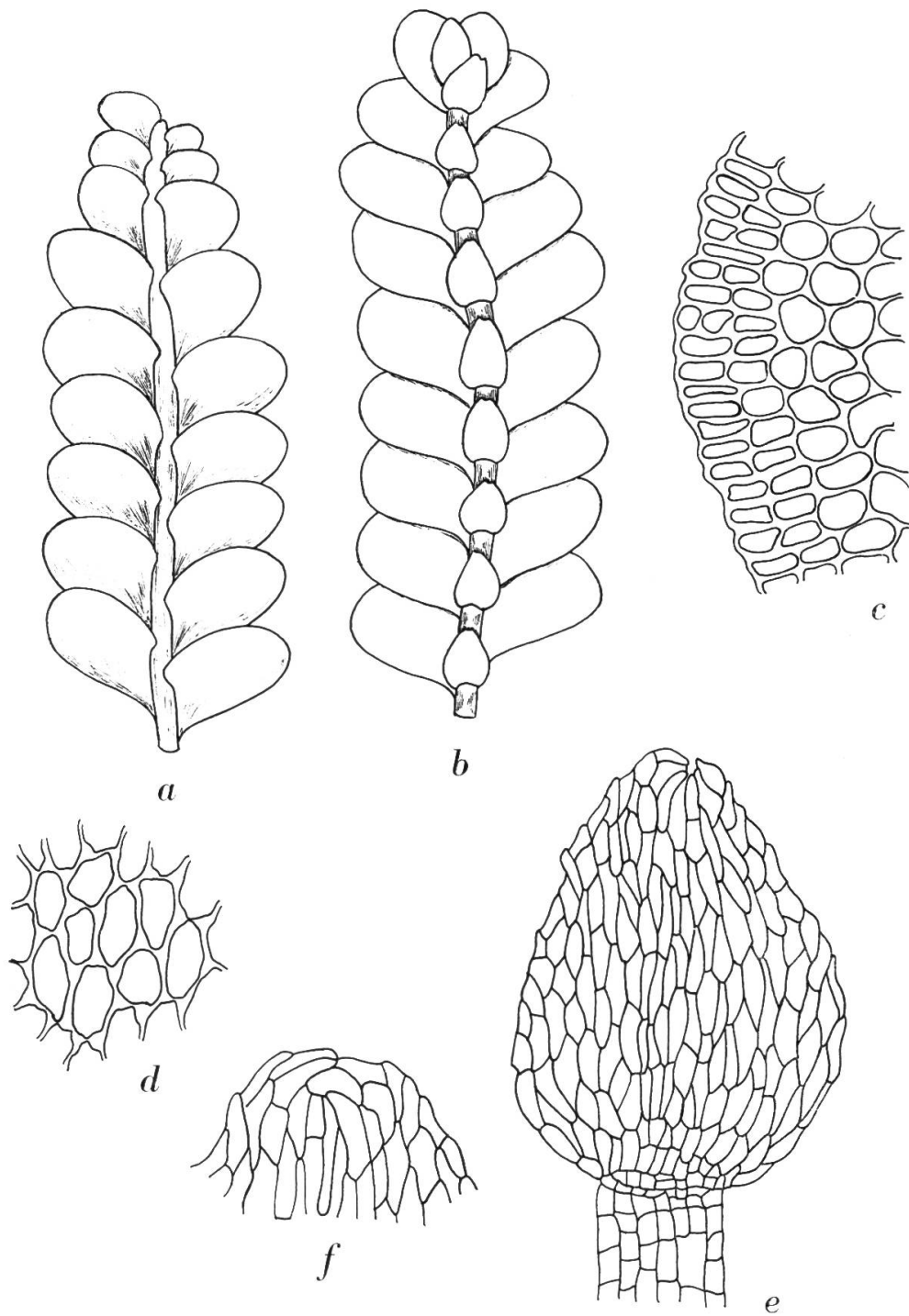


FIG. 12. — *Calypogeja elliottii* Steph. (lectotype).  
 a, stem, dorsal aspect,  $\times 13$  — b, stem, ventral aspect,  $\times 13$  — c, margin in the region  
 of the leaf apex,  $\times 130$  — d, cells in the basal region of the leaf,  $\times 130$  — e, under-  
 leaf,  $\times 85$  — f, apex of an underleaf,  $\times 130$ .

stem, 385-600  $\mu$  long, 350-560  $\mu$  wide. Not decurrent. Ratio length/width 1,3-1,4/1. Outer edges rounded, often crenulate. Apex shortly divided to form two broad rounded lobes, by a rounded, hemiactinomorphic sinus 17-25  $\mu$  deep. Lobes erect or converging, at times completely masking the sinus. Underleaf cells thin walled, translucent, yellowish, elongated and without trigones. Cell dimensions: marginal 34-85  $\times$  15-20  $\mu$ , central 60-119  $\times$  17-25  $\mu$ . *Sterile*. *Cuticle* papillose.

*HAB.*: *C. elliottii* forms dense brownish or olive mats on bark, frequently associated with other Hepaticae, *Plagiochila* in particular. It has only been found at low altitudes.

*LECTOTYPE*: DOMINICA: s.d., *Elliott 1139* (G, M sub *C. cellulosa*)

*DISTR.*: CENTRAL AMERICA: Dominica.

Other material studied: DOMINICA: s.d., *Elliott 1117, 1901, 2236* (G).

*OBS.*: Four gatherings of this species are kept in the STEPHANI collections. One of these bears pencilled notes on cell dimensions which agree with those given by STEPHANI in his original description. This specimen has therefore, in the absence of any other data, been chosen as the lectotype.

7. — *Calypogeja nephrostipa* (Spruce) Steph. *Spec. Hep.* 3:397. Jul. 31, 1908 = *Kantia nephrostipa* Spruce, *Trans. Proc. Bot. Soc. Edinburgh* 15:412. Nov. 1885.

*ICONES*: This paper, fig. 13.

*Stems* creeping, fairly fleshy, frequently asymmetrical, 1,5-6 cm long, 2,5-3,3 mm wide (leaves included). Stem width 136-210  $\mu$ . Cortical cells thin walled. No trigones. Cell dimensions: 76-119  $\times$  17-30  $\mu$ . *Rhizoides* few, frequently branched, long, hyaline or brownish. *Lateral branches* numerous. No flagelliform branches. *Leaves* imbricate, gathered on the dorsal side in pairs, 1276-1725  $\mu$  long, 805-1035  $\mu$  wide. Ratio length/width 1,5-1,7/1. Dorsal edge curved. Ventral edge almost straight, decurrent. Leaf insertion more or less arched. Leaf apex obtusely rounded or truncate, rarely notched. Leaf margin distinct, composed of small isodiametric cells with very thick walls. Leaf cells thin walled with large, nodulose trigones throughout. Cell dimensions: marginal 17-34  $\times$  17-25  $\mu$ , apical 25-34  $\times$  25-34  $\mu$ , central 42-60  $\times$  25-42  $\mu$ , basal 60-76  $\times$  25-34  $\mu$ . *Underleaves* 1,5-2,6 times width of stem, 210-245  $\mu$  long, 315-350  $\mu$  wide. Not decurrent. Ratio length/width 1/1,4-1,5. Outer edges rounded. Apex divided into two broad, rounded, erect lobes by a V-shaped or rounded sinus 30-40  $\mu$  deep. Cells, thin walled with small trigones or non at all. Cell dimensions: central 42-51  $\times$  20-30  $\mu$ , marginal 20-34  $\times$  17-25  $\mu$ . *Inflorescences* dioecious. ♀ solitary or in pairs. Bracts, 3-4 pairs, strongly imbricate, concave and asymmetrically bifid. ♂ composed of ten pairs of concave, bifid bracts. Bracteoles smaller and notched. *Cuticle* papillose.

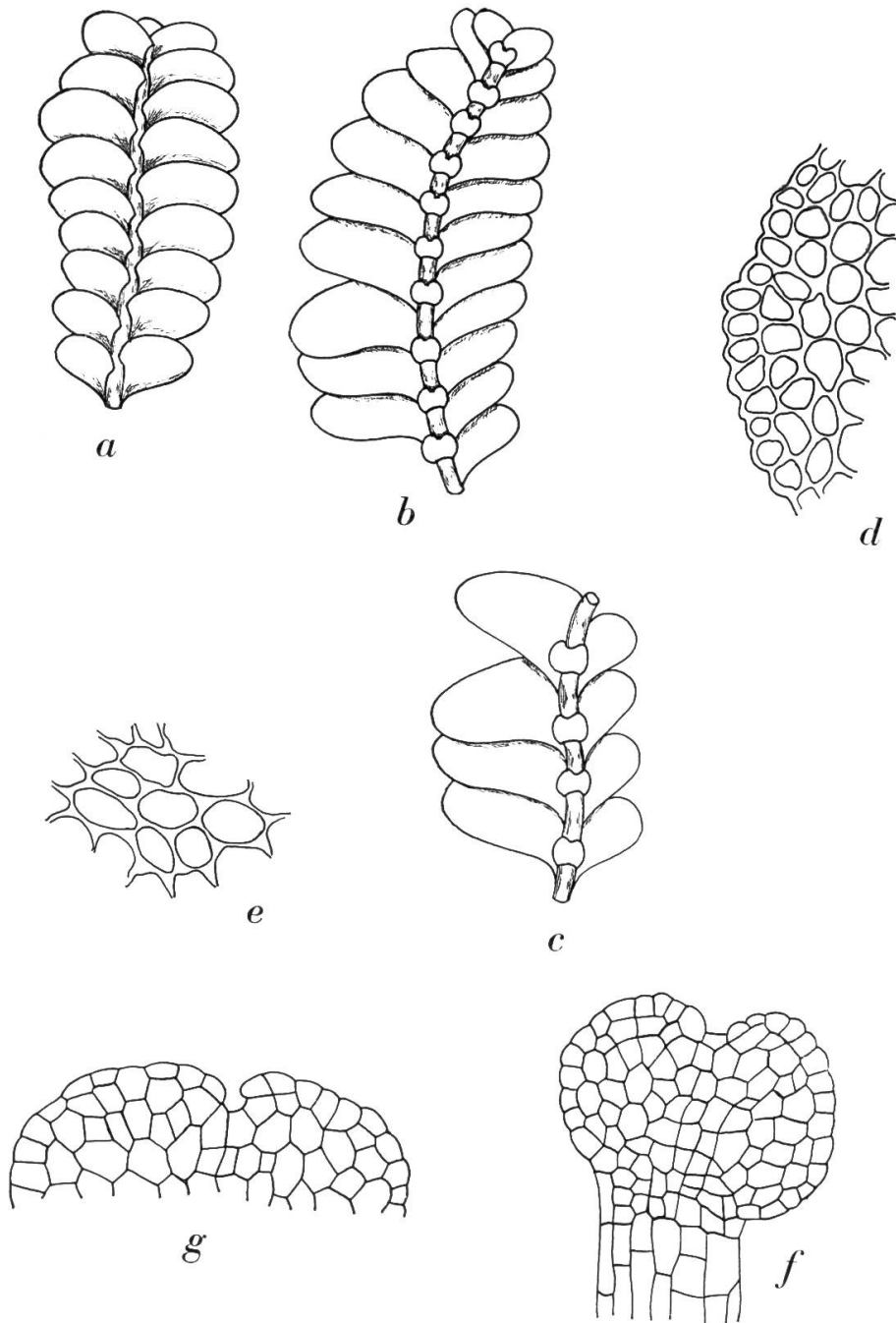


FIG. 13. — *Calypogeja nephrostipa* (Spruce) Steph. (lectotype).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, asymmetrical stem,  $\times 13$  — *d*, margin in the region of the leaf apex,  $\times 130$  — *e*, cells in the basal region of the leaf,  $\times 130$  — *f*, underleaf,  $\times 85$  — *g*, apex of an underleaf,  $\times 130$ .

**HAB.:** *C. nephrostipa* grows in lax mats, yellowish or olive green in colour, on rotting wood, bark, or more rarely on damp soil. Usually found mixed with other Bryophyta. Appears to grow only at low altitudes.

**LECTOTYPE:** VENEZUELA: Silva Amazonica, San Carlos, s.d., *Spruce s.n.* (MANCH).

**DISTR.:** SOUTH AMERICA: Venezuela.

Other material studied: VENEZUELA: *Hepaticae Spruceanae, Amazonicae et Andinae*, Silva Amazonica, San Carlos, s.d., *Spruce s.n.* (G n° 1858, BM, LD, M).

**OBS.:** With his original description SPRUCE cites two localities: San Carlos and Javita. The specimen from the latter locality was not found in the SPRUCE collections. The one from the former locality has therefore been chosen as the lectotype for this species.

*C. nephrostipa* (Spruce) Steph. can be distinguished from *C. mastigophora* (Spruce) Steph. by its more robust habit and its fleshy stems. It differs from the other species of the subgenus *Caracoma* in its frequent asymmetrical stems and its reniform underleaves.

8. — **Calypogeja mastigophora** (Spruce) Steph. *Spec. Hep.* 3:399. Jul. 31, 1908 = *Kantia mastigophora* Spruce, *Trans. Proc. Bot. Soc. Edinburgh* 15:413. Nov. 1885.

**ICONES:** This paper, fig. 14; STEPHANI, *Icones Hepaticarum* ined. in hb G n°s 1203, 1204.

*Stems* creeping, or climbing amongst other Bryophyta, flexuose, 1-1,5 cm long, 1,3-1,6 mm wide (leaves included). Stem width 102-126  $\mu$ . Cortical cells with fairly thick walls. No trigones. Asymmetrical stems are frequent. Cell dimensions: 60-102  $\times$  17-25  $\mu$ . *Rhizoides* variable in number, fairly long, hyaline. *Lateral branches* rare or absent. Flagelliform endings to the main stems are frequent. *Leaves* distant, 560-910  $\mu$  long, 280-500  $\mu$  wide. Ratio length/width 1,8-2,0/1. Dorsal edge slightly curved. Ventral edge nearly straight and strongly decurrent. Leaf insertion only slightly arched. Leaf apex broadly rounded or truncate. Margin distinct, composed of a single layer of small cells with very thick walls, the outer being slightly convex. Leaf cells thin walled with, generally, small trigones and, at times large ones. Cell dimensions: marginal 25-34  $\times$  17-25  $\mu$ , apical 25-30  $\times$  25-30  $\mu$ , central 42-51  $\times$  25-34  $\mu$ , basal 68-76  $\times$  34-42  $\mu$ . *Underleaves* 1,4-1,5 times the width of the stem, 119-140  $\mu$  long, 153-175  $\mu$  wide. Not decurrent. Ratio length/width 1/1,3. Outer edges rounded, frequently crenulate. Apex divided into two broad, rounded, erect or converging lobes, by a narrow, usually rounded sinus 25-34  $\mu$  deep. Cells thin walled. Trigones nil. Cell dimensions: marginal 34  $\times$  17  $\mu$ , central 34-37  $\times$  17-23  $\mu$ . *Inflorescences* dioecious. ♀ solitary or in pairs, composed of several pairs of very concave, bifid bracts. *Cuticle* papillose.



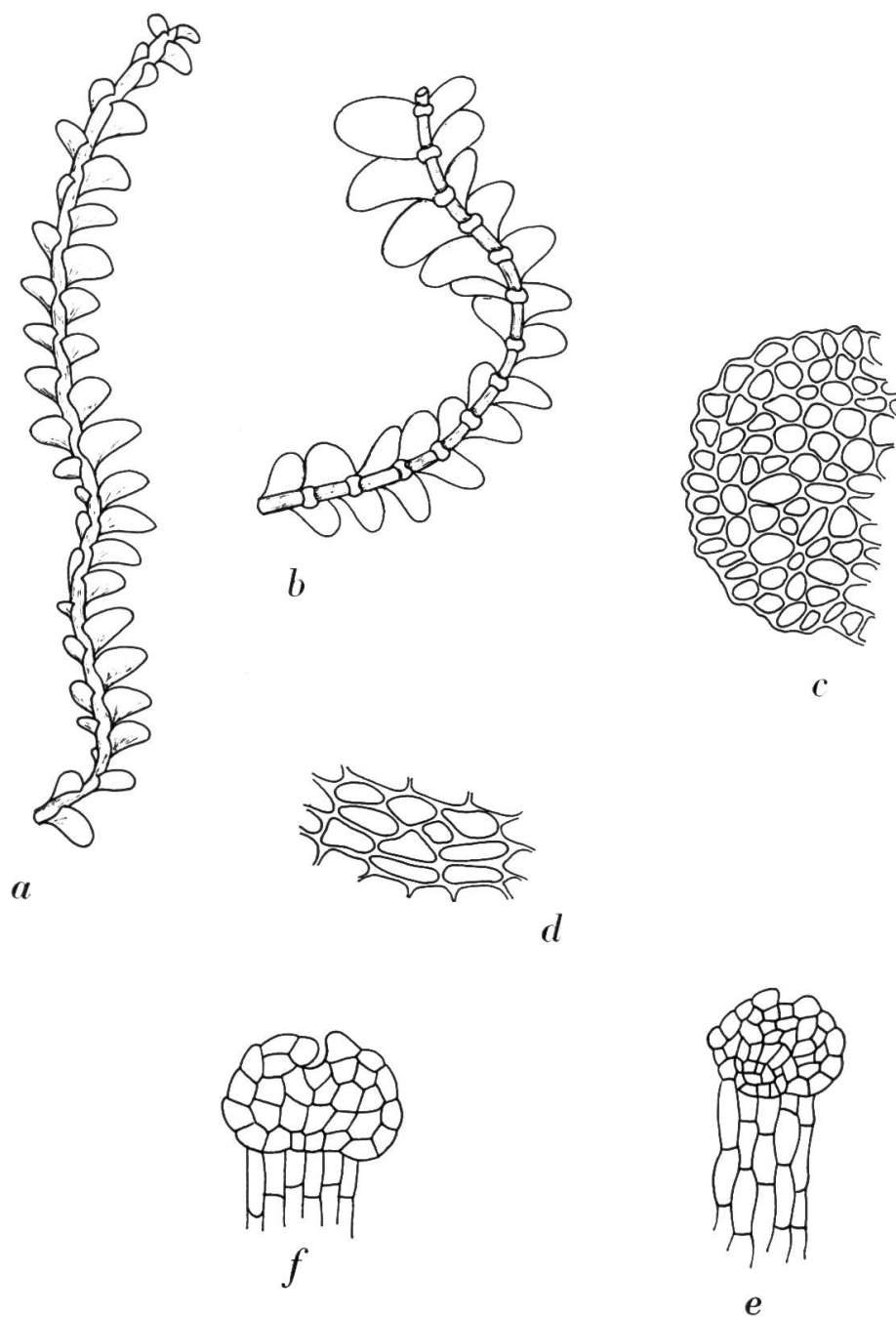


FIG. 14. — *Calypogeja mastigophora* (Spruce) Steph. (neotype).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region  
of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, under-  
leaf,  $\times 85$  — *f*, underleaf,  $\times 130$ .

*HAB.*: *C. mastigophora* grows on rotting wood or bark, forming pale, or olive green colonies. It has been gathered from low altitudes only.

*NEOTYPE*: BRAZIL: Rio Negro, inter *Alobiellam*, s.d., *Spruce s.n.* (G n° 1819).

*DISTR.*: SOUTH AMERICA: Brazil. CENTRAL AMERICA: Cuba.

Other material studied: CUBA: s.d., *Wright s.n.* (G n° 1821).

*OBS.*: The type locality cited by SPRUCE is "Rivulum Cauapuna juxta San Carlos del Rio Negro". This gathering does not seem to be represented in his collections. The only SPRUCE specimen available was a single sterile stem, possibly a fragment of the type, in the Geneva herbarium. In the absence of better material this has been considered to be a neotype.

*C. mastigophora* can be distinguished from *C. nephrostipa* (Spruce) Steph. by its smaller habit, its flexuose stems and its distant and more decurrent leaves. It is distinct from the other species of the subgenus by its frequently asymmetric stems and its broad, reniform underleaves which are wider than long.

9. — *Calypogeja fissistipula* Bischler spec. nov. = *Calypogeja nephrostipa* Steph., p.p. (non *Kantia nephrostipa* Spruce) *Spec. Hep.* 3:397. Jul. 31, 1908.

*ICONES*: This paper, fig. 15; STEPHANI, *Icones Hepaticarum* ined. (G n° 1207)

*Caules* jacentes, flexibiles ramosique. *Folia* parum imbricata, integra, apice rotundata truncatave, quasi duplo longiora quam lata, in basi decurrentia. *Cellulae* parietibus tenuibus trigonis magnis nodulosis instructis, marginales  $25-34 \times 17-30 \mu$ , apicales  $25-34 \times 17-34 \mu$ , basiales  $42-68 \times 25-34 \mu$ . *Amphigastria* 2-2,5  $\times$  latiora quam caulis, recte inserta, rotundata, margine paulum crenulata, ad mediam longitudinem bilobata, lobis triangulis rotundatis acutisve, sinu angusto acuto. *Cellulae* parietibus tenuibus, trigonis magnis instructis, centrales  $34-60 \times 17-30 \mu$ . *Sterilis*. *Cuticula* laevis.

*Stems* creeping, 1-2 cm long, 1,7-3,5 mm broad (leaves included). Stem width  $153-175 \mu$ . Cortical cells thin walled with small trigones or with none at all. Cell dimensions:  $42-68 \times 17-25 \mu$ . *Rhizoides* fairly numerous, long or short, hyaline. *Lateral branches* numerous. No flagelliform branches. *Leaves* slightly imbricate,  $1150-1610 \mu$  long,  $700-910 \mu$  wide. Ratio length/width 1,6-2/1. Dorsal edge strongly curved. Ventral edge only slightly curved and usually very decurrent. Leaf insertion arched. Leaf apex broadly rounded or truncate. Leaf margin composed of isodiametric cells hardly smaller than those beneath and forming thus but an indistinct layer. Leaf cells thin walled, with large nodulose trigones throughout. Cell dimensions: marginal  $25-34 \times 17-30 \mu$ , apical  $25-34 \times 17-34 \mu$ , central  $34-51 \times 25-34 \mu$ , basal  $42-68 \times 25-34 \mu$ . *Underleaves* 1,9-2,5 times the width of the stem,  $280-455 \mu$  long,  $315-420 \mu$  wide. Not decurrent. Ratio length/width 1,2-1/1-1,1. Outer edges rounded, often slightly crenulate. Apex divided 1/5-1/2 of the total length of the

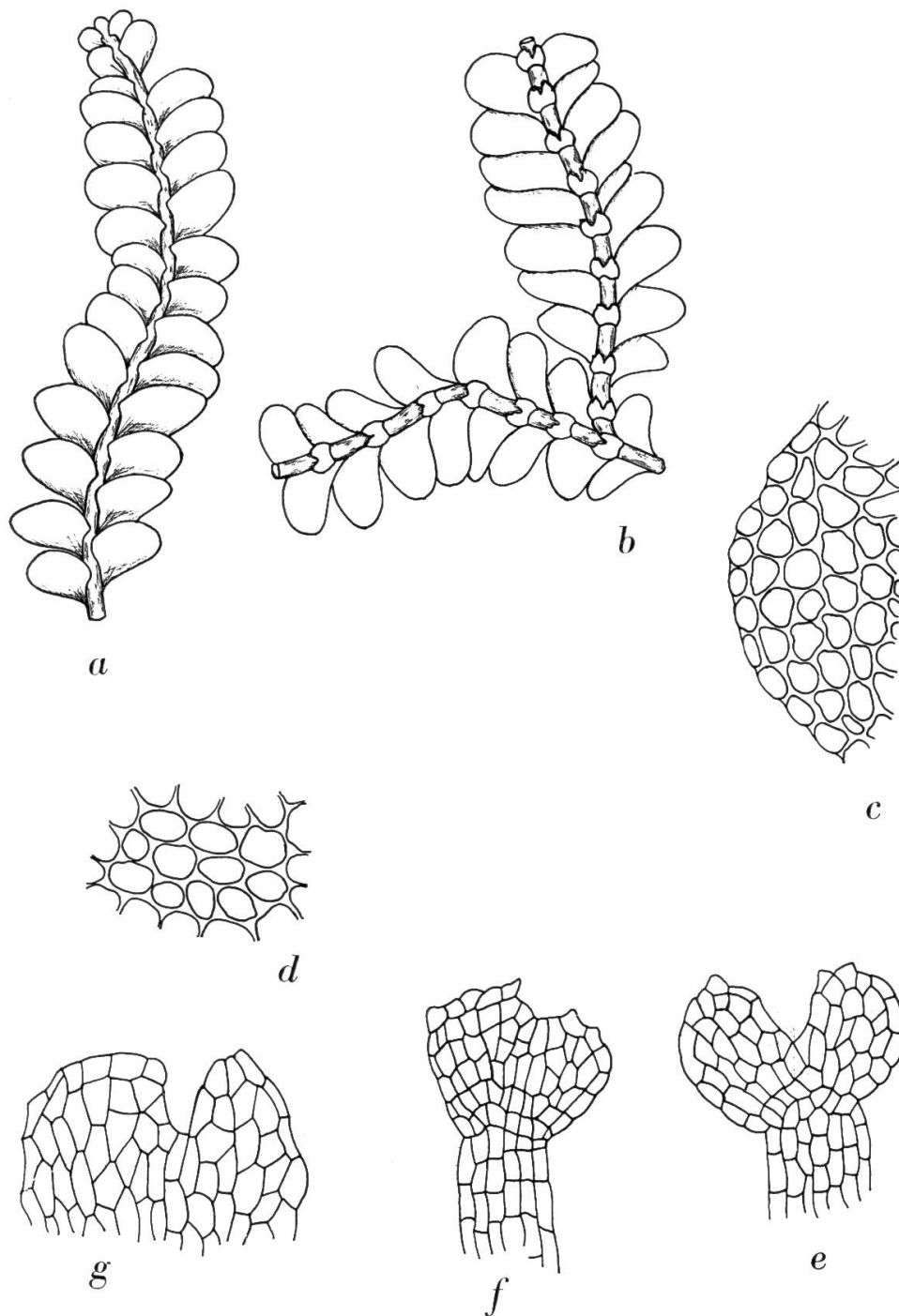


FIG. 15. — *Calypogeja fissistipula* Bischler (type).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, underleaf,  $\times 85$  — *f*, underleaf,  $\times 85$  — *g*, apex of an underleaf,  $\times 130$ .

underleaf into two broad, rounded and erect lobes separated by a narrow, usually pointed, more rarely rounded, sinus  $42-175\ \mu$  deep. Underleaf cells thin walled, usually with large, nodulose trigones. Cell dimensions: marginal  $34-51 \times 17-25\ \mu$ , central  $34-60 \times 17-30\ \mu$ . *Sterile*. *Cuticle* smooth.

*HAB.*: *C. fissistipula* forms dense mats of a yellow green becoming brown, on bark or rotting wood. Has been gathered only from low altitudes.

*TYPE*: VENEZUELA: s.d., *Fendler s.n.* [G n° 1861, sub *C. nephrostipa* (Spruce) Steph.].

*DISTR.*: SOUTH AMERICA: Venezuela.

Other material studied: VENEZUELA, s.d., *Fendler s.n.* (G n°s 1859, 1860); s.d., *Fendler s.n.* (M).

*OBS.*: In his description of *C. nephrostipa* (Spruce) Steph., STEPHANI speaks of underleaves "ad medium biloba". The true *Kantia nephrostipa* Spruce has kidney shaped underleaves divided at the most to  $\frac{1}{5}$  of their length. His description of the fruit bodies however agrees with that of SPRUCE. STEPHANI's diagnosis therefore is considered to encompass two distinct species. The name *fissistipula* has therefore been given to that with underleaves "ad medium biloba".

*C. fissistipula* is distinguished from the other species in the subgenus by the large nodulose trigones of the cells of its underleaves.

10. — *Calypogeja parallelogramma* (Spruce) Steph. *Spec. Hep.* 3:396. Jul. 31, 1908 = *Kantia parallelogramma* Spruce, *Trans. Proc. Bot. Soc. Edinburgh* 15:413. Nov. 1885.

*ICONES*: This paper, fig. 16; STEPHANI, *Icones Hepaticarum* ined. in hb G n° 1209.

*Stems* creeping, 1-5 cm long, 2-3 mm broad (leaves included). Stem width  $140-190\ \mu$ . Cortical cells with fairly thick walls but without trigones, giving a hard rigid consistency to the stem. Cell dimensions:  $51-85 \times 17-30\ \mu$ . *Rhizoides* few, often branched, usually short, hyaline or brownish. *Lateral branches* very rare. Occasional flagelliform stems, bearing rhizoides, have been observed. *Leaves* more or less imbricate,  $910-1276\ \mu$  long,  $506-700\ \mu$  wide. Ratio length/width 1,6-2,3/1. Dorsal edge only slightly curved, ventral edge nearly straight and strongly decurrent. Leaf insertion arched. Leaf apex broadly rounded, or truncate, at times slightly notched. Leaf margin composed of isodiametric cells hardly smaller than the ones beneath and thus forming no distinct margin. Leaf cells thin walled with large, nodulose trigones throughout. Cell dimensions: marginal  $20-42 \times 17-25\ \mu$ , apical  $25-34 \times 17-30\ \mu$ , central  $34-42 \times 20-34\ \mu$ , basal  $42-68 \times 25-34\ \mu$ . *Underleaves* 2,2-3 times the width of the stem,  $350-455\ \mu$  long,  $350-455\ \mu$  wide. Not decurrent. Ratio

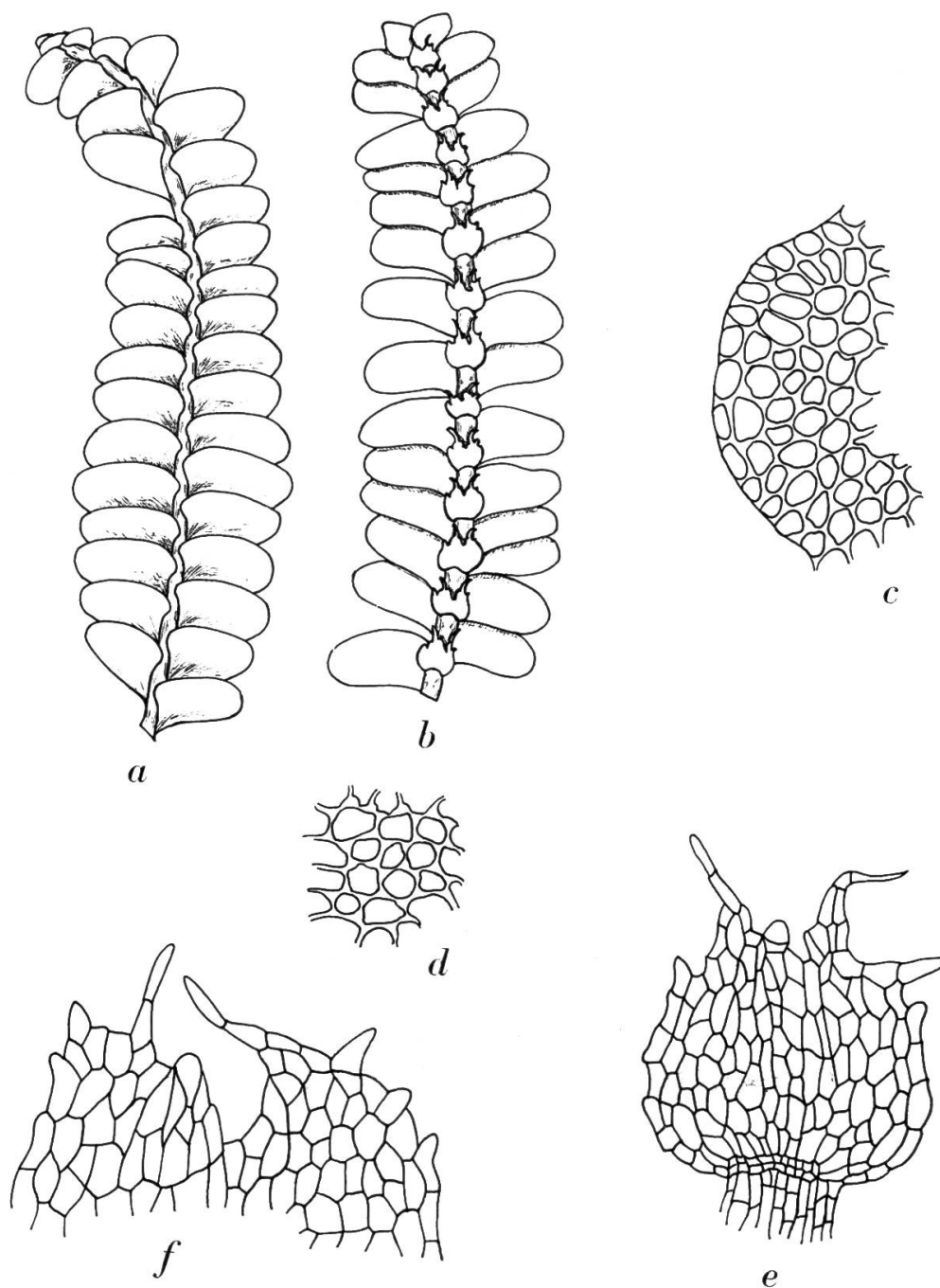


FIG. 16. — *Calypogeja parallelogramma* (Spruce) Steph. (type).  
*a*, stem, dorsal aspect,  $\times 13$  — *b*, stem, ventral aspect,  $\times 13$  — *c*, margin in the region of the leaf apex,  $\times 130$  — *d*, cells in the basal region of the leaf,  $\times 130$  — *e*, underleaf,  $\times 85$  — *f*, apex of an underleaf,  $\times 130$ .

length/width 1,2-1/1-1,3. Outer edges rounded, bearing one or more sharp, and often recurved teeth. Apex divided 3/10 to 6/10 of the total length of the underleaf into two straight or converging lobes the tips of which have long apicula. Each apiculum is composed of two or three hyaline cells the last one being the longest ( $51-60 \times 13-17 \mu$ ). The sinus is V-shaped and narrow, 70-210  $\mu$  deep. Cells thin walled, with small trigones or none at all, very elongated. Cell dimensions: central  $51-85 \times 17-34 \mu$ , marginal  $34-68 \times 17-25 \mu$ . *Inflorescences* dioecious. ♂ composed of several pairs of very concave, imbricate bracts. *Cuticle* papillose.

*HAB.*: *C. parallelogramma* forms dark green or blackish mats on shaded rocks, damp soil or totting wood. It has only been gathered at low altitudes.

*TYPE*: BRAZIL: Panure, flumen Uaupes, s.d., *Spruce s.n.* (MANCH).

*DISTR.*: SOUTH AMERICA: Brazil.

Other material studied: BRAZIL: *Hepaticae Spruceanae, Amazonicae et Andinae*, Silva Amazonica, Panure, fl. Uaupes, s.d., *Spruce s.n.* (G n<sup>os</sup> 1807, 1808, 1809, 1820, BM, K, LD, M).

*OBS.*: *C. parallelogramma* is distinguished from *C. fissistipula* Bischler by its dark colour and by the underleaf cells with, at the most, only small trigones.

