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The genus Calypogeja Raddi in Central and South America
II. Subgenus Calypogeja, subgroups 1, 2 and 3 [1]

by

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3. SUBGENUS **Calypogeja**

Stems variable in length. Cortical cells slightly to strongly elongated. *Leaves* as long as wide to 1,5 times longer than wide, bidentate or bilobed, more rarely entire, and then rounded, pointed or apiculate. Leaf margins usually not distinct, or composed of a layer of elongated cells, never more than 5 times longer than wide, not overlapping. Leaf cells usually thin walled and with small to medium sized trigones. *Underleaves* variable in size, decurrent or not decurrent, very variable in shape, but always bilobed to 3/10-9/10 of their length. Outer edges usually bearing rounded protuberances or pointed teeth. Underleaf margins indistinct. Underleaf cells hardly elongated, often bearing small or medium sized trigones. *Cuticle* smooth, striate or papillose.

TYPE SPECIES: Calypogeja fissa (L.) Raddi.

OBS.: The subgenus *Calypogeja* is extremely polymorphous. Its type however corresponds exactly to its centre of variability. Around it are grouped; firstly species with few but very variable distinctive features, then species with more stable and numerous ones, and towards the outer limits of the subgenus a few stable and well characterised species.

The species of the subgenus can be separated into five subgroups. No phylogenetic relationship is claimed for any of them, the principal aim being ease in handling. They are purely utilitarian, and would serve to make more clear the limits between the species and give a general idea of the composition of the subgenus. They have no comparable value and no recognised hierarchic rank.

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[1] The terms used in this paper are in accordance with the definitions given in the previous paper; citation of specimens and bibliography are to be found at the end of the 3rd paper.

Subgroup 1.

Underleaves decurrent, 2-3 times the width of the stem. Cortical stem cells short.

C. peruviana Nees & Mont.
C. heterophylla (Steph.) Steph.
C. muscicola Steph.
C. lophocoleoides Steph.
C. subintegra (Gottsche, Lindenb. & Nees) Bischler
C. andicola Bischler
C. oblata Herzog
C. biapiculata (Spruce) Steph.

Subgroup 2.

Underleaves decurrent, 3-5 times the width of the stem. Cortical stem cells short.

C. grandistipula (Steph.) Steph.
C. puiggarii Steph.

Subgroup 3.

Underleaves decurrent, 2-3 times the width of the stem. Cortical stem cells elongated.

C. tenax (Spruce) Steph.

Subgroup 4.

Underleaves not decurrent, 1-2 times the width of the stem. Cortical stem cells short.

C. lechleri (Steph.) Steph.
C. rhombifolia (Spruce) Steph.

Subgroup 5.

Underleaves not decurrent, 1-2 times the width of the stem. Cortical stem cells elongated.

C. amazonica (Spruce) Steph.
C. miquelii Mont.
C. falcata Bischler
C. laxa Gottsche, Lindenb. & Nees
C. uncinatula Herzog

Analytical key to the subgroups of subgenus Calypogeja

The key for the subgroups of subgenus *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 (eleven in all). The subgroups and their typical formulae are

listed in a table at the end of the key. A given specimen will belong to the subgroup to which formula its own formula corresponds most closely.

Numbers represent variants within the subgroups.

A 1. Leaves imbricate, convex, usually not decurrent, with arched insertion. They do not overlap the stem on the dorsal face.
2. Leaves very strongly imbricate, strongly convex, not decurrent, with strongly arched insertion. They overlap the stem on the dorsal face.
3. Leaves not imbricate, adjacent or distant, plane, decurrent, insertion not arched. They do not overlap the stem on the dorsal face.

B 1. Leaves bilobed ot bidentate, rarely entire and then as long as wide or slightly elongate (ratio: length/width = 1,4-1/1).
2. Leaves entire, with rounded or truncate apex, elongate (ratio: length/width = 1,6-2,5/1).

C 1. Leaf apex not ascendant. Leaf margins not crenulate.
2. Leaf apex ascendant. Leaf margins crenulate.

D 1. Leaves bilobed or bidentate, with pointed, narrow lobes and rounded or pointed sinus, or entire, but then not strongly imbricate.
2. Leaves bilobed, with rounded lobes and sinus, or entire, always very strongly imbricate.

E 1. Underleaves 2-3 times the width of the stem.
2. Underleaves 3-5 times the width of the stem.
3. Underleaves 0,5-2 times the width of the stem.

F 1. Underleaves decurrent.
2. Underleaves not decurrent.

G 1. Underleaves with erect lobes, bearing on their outer edges 1-2 rounded protuberances (rarely teeth), which can occasionally be lacking on one or both sides; or with rounded outer edges without protuberances or teeth.
2. Underleaves with divergent lobes and bearing on each outer edge a 1-3 celled tooth, which is never lacking.

H 1. Stems fleshy, more than 200 μ wide.
2. Stems not fleshy, rather flexuose, 100 to 200 μ wide.

I 1. Cortical cells of stem slightly elongated, 50 to 100 μ long on adult stems.
2. Cortical cells of stem strongly elongated, 100 to 150 μ long on adult stems.

K 1. Stem cross section composed of cells of the same size.
2. Stem cross section composed of cells of the same size, with the exception of the lateral one on each side which is distinctly larger.

L 1. Leaf and underleaf cells small, at base of leaf 40-80 μ long, in the centre of underleaf 30-60 μ long.
2. Leaf and underleaf cells large, at base of leaf 70-150 μ long, in the centre of underleaf 60-100 μ long.

	A	B	C	D	E	F	G	H	I	K	L
Subgroup 1	1	1	1	1	1 (3)	1	1	1 (2)	1	1	1 (2)
Subgroup 2	2	1	1	2	2	1	1	1	1	1	1
Subgroup 3	3	2	1	1	1	1	1	1	2	1	2
Subgroup 4	3	1	2	1	3	2	1	2 (1)	1	1	1
Subgroup 5	3	1	1	1	3	2	2	2	2	2	2

Note: Subgroups 4 and *5* will be treated in the next paper.

Dichotomous key to the subgroups of subgenus Calypogeja

Underleaves always decurrent, reaching usually 2-5 times the width of the stem. Stems fleshy, usually more than 200 μ wide. Leaves with arched insertion, usually imbricate, convex, and not, or slightly, decurrent. Leaf margins always indistinct

Leaves usually imbricate, convex, not or slightly decurrent, with an arched insertion. Apex entire, bilobed or bidentate. Leaves as long as wide, or slightly elongated (ratio : length/width = 1-1,6/1). Leaf and underleaf cells usually rather small, at the base of the leaves 40-80 μ long, in the centre of the underleaves 30-60 μ long. Stems with short cortical cells, 50-100 μ long

Leaves imbricate, but without a basal auricle, not overlapping the stem on the dorsal face. Leaf apices entire, bilobed or bidentate, in the latter cases always with pointed and narrow lobes or teeth. Leaf cells with small to medium sized trigones. Underleaves 2-3 times the width of the stem. Plants of dark green, olive or yellowish colour . . . . . *Subgroup 1*

Leaves very strongly imbricate, very strongly convex and overlapping the stem on the dorsal face. They often have a basal auricle. Leaf apices entire, bilobed or bidentate, in the latter cases with rounded lobes and sinus. Leaf cells with conspicuous, often nodulose, trigones. Underleaves 3-5 times the width of the stem. Plants of a whitish colour . . . . . *Subgroup 2*

Leaves usually not imbricate, plane, often decurrent, with a nearly straight insertion. Apex entire, largely rounded or nearly truncate. Leaves strongly elongated (ratio : length/width = 1,6-2,5/1). Leaf and underleaf cells large, at the base of the leaves 70-150 μ long, in the centre of the underleaves 60-100 μ long. Stems with elongated cortical cells, 100-150 μ long . . . . . *Subgroup 3*

Underleaves never decurrent, reaching usually 1-2 times the width of the stem. Stems not fleshy, usually from 100 to 200 μ wide. Leaves with a nearly straight insertion, not imbricate, adjacent or distant, plane, and often quite strongly decurrent. Leaf margins frequently composed of elongated, transparent cells

Leaves usually with crenulate margins. Leaf apices ascendant, entire and apiculate or bilobed-bidentate. Leaf and underleaf cells usually small, at the base of the leaves 40-80 μ long, in the centre of the underleaves 30-60 μ long. Stems with short cortical cells, 50-100 μ long. Underleaves with erect lobes, bearing often on each outer edge a rounded protuberance . . . . . *Subgroup 4*

Leaves without crenulate margins. Leaf apices not ascendant, always bilobed or bidentate. Leaf and underleaf cells usually large, at the base of the leaves 70-150 μ long, in the centre of the underleaves 60-100 μ long. Stems with elongated cortical cells, 100-150 μ long. Underleaves with divergent lobes, bearing on each outer edge a 1-3 celled, pointed tooth . . . . . *Subgroup 5*

Subgroup 1.

Analytical key to the species, varieties and forms.

The characters are numbered and grouped as in the previous analytical keys. A formula of figures will be obtained after analysis. The species, varieties and forms and their typical formulae are listed in a table at the end of the key. The formula obtained after 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 represent known variants within the unities.

A 1. Stems not fleshy, 140-210 μ wide.
2. Stems very thin and flexuose, often climbing, 100-140 μ wide.
3. Stems fleshy, 210-350 μ wide.

B 1. Leaves slightly elongated, ratio: length/width = 1,4-1,2/1.
2. Leaves mostly as long as wide, ratio: length/width = 1,1-1/1-1,1.
3. Leaves wider than long, ratio: length/width = 1/1,1-1,4.
4. Leaves much longer than wide, ratio: length/width = 1,5-1,6/1.

C 1. Leaves bilobed in majority, with a rounded, 40-140 μ deep sinus.
2. Leaves entire in majority, only rarely bidentate, and then with a rounded, only 35-40 μ deep, sinus.

D 1. Leaf cells not distinctly smaller at the apex than at the base of the leaves.
2. Leaf cells distinctly smaller at the apex than at the base of the leaves.

E 1. Trigones of the leaf cells smaller towards the top of the leaves or of equal size than at their base.
2. Trigones of the leaf cells distinctly more conspicuous towards the top of the leaves than at their base.
3. Leaf cells with very thin walls and without trigones.

F 1. Underleaves decurrent, from 60 to 140 μ.
2. Underleaves strongly decurrent, from 140 to 385 μ.

G 1. Underleaves 1,6-2,5 times the width of the stem.
2. Underleaves 2,5-5 times the width of the stem.

H 1. Underleaves small, 260 μ to maximum 500 μ wide.
2. Underleaves large, at least 450 μ wide, but usually 500 to 1400 μ wide.

I 1. Underleaves slightly wider than long, ratio: length/width = 1/1,2-1,5.
2. Underleaves much wider than long, ratio: length/width = 1/1,5-1,8.
3. Underleaves nearly as wide as long, ratio: length/width = 1/1-1,1.
4. Underleaves longer than wide, ratio: length/width = 1,1-1,4/1.

K 1. Underleaves bearing on their outer edges a protuberance or a tooth.
2. Underleaves bearing on their outer edges no protuberances or teeth.
3. Underleaves bearing on their outer edges two or three protuberances or teeth, and often one inside the sinus.

	A	B	C	D	E	F	G	H	I	K	L	M
C. peruviana	1	1 (2)	1	1	1	1	1	1	1 (2)	1	1	1
C. heterophylla	3	1	1	2	2	1 (2)	1	2	1 (3)	1	2	1
C. heterophylla f. abnormis	1	2	1	2	2	1	1	2	2	1	1 (2)	1
C. heterophylla var. subrotunda	3	2	1	2	2	1	1	2	1	1	1	1
C. muscicola	2	4	1	1	2	1	1	1	2	1	1	1
C. lophocoleoides	1 (3)	1	1	1	1	1	1	1 (2)	4	1	2	2
C. subintegra	1	2 (1)	2	1	1	1	1	1	3	2 (1)	2	1
C. subintegra var. *dussiana*	1	2	2	1	1	1	1	2	2	1	2	1
C. andicola	3	2	2	2	1	1	1	2	1	2	2	1
C. oblata	3 (1)	3	1	1	3	2	2	2	1	2	1	1
C. biapiculata	3	1 (2)	1	1	1	2	2 (1)	2	1 (2)	3	2 (1)	1

L 1. Underleaf cells small, in the centre of the organ, maximum 55 μ long.
2. Underleaf cells larger, in the centre of the organ from 55 to 102 μ long.

M 1. Underleaf cells slightly elongated, in the centre of the organ less than twice longer than wide. Leaves not falcate.
2. Underleaf cells elongated, in the centre of the organ at least twice longer than wide. Leaves often falcate.

Dichotomous key to the species, varieties and forms of subgroup 1.

Underleaves 1,5-2,5 times the width of the stem, usually decurrent (from 60-140 μ). Outer edges of the underleaves bearing a rounded protuberance or a tooth, or without appendage. Stems fleshy or not fleshy. Leaves bilobed, bidentate or entire

Leaves bilobed in majority, with usually rounded, 40-140 μ deep sinus. Leaves as long as wide to elongated. Underleaves always with a rounded protuberance or a tooth on each outer edge. Underleaf cells small to medium sized

Leaves often, but only in minority on a stem, with entire apices. Sinus of the bilobed or bidentate leaves 35-105 μ deep. Leaves as long as wide or elongated. The stems have often numerous lateral branches and flagelliform ones. Underleaves as long as wide or wider than long (ratio: length/width = 1/1,1-1,8). Underleaf cells medium sized or small, not or only slightly elongated, in the centre of the organ never more than two times longer than wide

Stems more than 140 μ wide. Leaves often imbricate and more or less convex, slightly elongated (ratio: length/width = 1,3-1/1). Leaf cells often distinctly smaller towards the top than at the base of the leaves. Underleaves small or larger, with usually erect, rounded or pointed lobes and a protuberance on each outer edge. Underleaf cells small or medium sized

Stems not fleshy, 140-221 μ wide. Lateral branches numerous. Leaves usually slightly elongated (ratio: length/width = 1,4-1/1). Leaf cells not distinctly smaller towards the top than at the base of the leaves, the trigones are too of nearly equal size from top to base. Underleaves small, 280-400 μ wide. Underleaf cells small, in the centre of the organ 50 μ long . . . 1. **C. peruviana** Nees & Mont.

Stems usually fleshy, from 200 to 315 μ wide. Lateral branches numerous or rare. Leaves elongated or as long as wide. Leaf cells always distinctly smaller towards the top than at the base of the leaves. The trigones are more conspicuous at the top than at the base. Underleaves large, 450-665 μ wide. Underleaf cells medium sized or small . . . . . 2. **C. heterophylla** (Steph.) Steph.

Stems fleshy, 245-315 μ wide. Lateral branches numerous, flagelliform branches frequent. Leaves usually imbricate, convex, slightly elongated (ratio: length/width = 1,3/1). Underleaves slightly wider than long (ratio: length/width = 1/1,1-1,5), with pointed lobes and rounded sinus. Underleaf cells in the centre to 85 μ long. Plants usually dark green

C. heterophylla (Steph.) Steph. f. **heterophylla.**

Stems 200-315 μ wide. Lateral branches rare. Leaves as wide as long (ratio : length/width = 1-1,1/1). Underleaves much wider than long (ratio : length/width = 1/1,4-1,7), with usually rounded lobes and rounded sinus. Underleaf cells in the centre 51-60 μ long. Plants light or yellowish green

Stems 200-245 μ wide. No flagelliform branches. Leaves only slightly imbricate, plane. Plants growing on damp soil

C. heterophylla (Steph.) Steph. f. **abnormis** (Angstr.) Bischler

Stems 230-315 μ wide. Flagelliform branches are frequent. Leaves imbricate and usually strongly convex. Plants growing on bark and rotten wood

C. heterophylla (Steph.) Steph. var. **subrotunda** (Steph.) Bischler

Stems very flexuose and thin, 126 μ wide. Leaves not imbricate, often decurrent, plane, elongated (ratio : length/width = 1,5-1,6/1). Leaf cells not distinctly smaller towards the top than at the base of the leaves. Underleaves small, maximum 315 μ wide, with spreading, pointed lobes and a 1-2 celled tooth on each outer edge. Ratio : length/width = 1/1,6-1,7. Underleaf cells small, in the centre 42 μ long. Plants growing from medium to high altitudes

3. **C. muscicola** Steph.

Leaves always bilobed, with a 70-140 μ deep sinus, slightly elongated (ratio : length/width = 1,3-1,2/1). Lateral branches rare. No flagelliform branches. Underleaves longer than wide on the adult stems (ratio : length/width = 1,4-1,1/1). Underleaf cells elongated, 60-85 μ long in the centre, at least two times longer than wide. Plants growing at low altitudes only

4. **C. lophocoleoides** Steph.

Leaves entire in majority, rarely bidentate, but then with a rounded, 35-40 μ deep sinus. Leaves usually as wide as long, or only slightly elongated. Underleaves often without protuberance or tooth on the outer edges. Underleaf cells medium sized, in the centre 50-76 μ long

Plants 1,7-3,2 mm wide. Stems not fleshy, 140-210 μ wide. Leaf cells not distinctly smaller towards the top than at the base of the leaves. Underleaves with or without protuberances or teeth on their outer edges, with rounded or pointed lobes and sinus. Plants light or yellowish green, growing at low or medium altitudes.

5. **C. subintegra** (Gottsche, Lindenb. & Nees) Bischler

Leaves usually slightly elongated (ratio : length/width = 1,3-1/1). Underleaves small, 250-315 μ wide, mostly as long as wide (1/1-1,1), often without protuberances or teeth. Plants growing on damp soil

C. subintegra (Gottsche, Lindenb. & Nees) Bischler var. **subintegra.**

Leaves usually as long as wide. Underleaves larger, 500 μ wide, much wider than long (ratio : length/width = 1/1,6), always with protuberances or teeth on their outer edges. Plants growing on bark

C. subintegra (Gottsche, Lindenb. & Nees) Bischler var. **dussiana** (Steph.) Bischler

Plants 3-4,4 mm wide. Stems fleshy, 250-350 μ wide. Leaf cells distinctly smaller towards the top than at the base of the leaves. Underleaves without protuberances or teeth, and rounded lobes and sinus. Plants dark green, growing at high altitudes only
6. **C. andicola** Bischler

Underleaves 2,5-5 times the width of the stem, strongly decurrent, from 140-385 μ. Outer edges bearing two protuberances or teeth on each side or none at all. Stems usually fleshy, 210-350 μ wide. Leaves bilobed or bidentate

Underleaves without protuberances or teeth on their outer edges, with small cells, to 50 μ long in the centre. Leaves wider than long (ratio: length/width = 1/1,1-1,4), bidentate, the sinus being 45-70 μ deep. Leaf cells thin walled, without any trigones. Plants from high altitudes
7. **C. oblata** Herzog

Underleaves with 2-3 protuberances on each outer edge. Cells in the centre 51-102 μ long. Leaves mostly as wide as long (ratio: length/width = 1,3-1/1-1,2), bilobed, the sinus being 70-175 μ deep. Leaf cells with medium sized to conspicuous trigones at the base of the leaves. Plants from low altitudes . . 8. **C. biapiculata** (Spruce) Steph.

1. — **Calypogeja peruviana** Nees & Mont. in Mont. *Ann. Sci. Nat. Paris* ser. 2, **9**:47. Jan. 1838 = *Kantia peruviana* (Mont.) Trev. *Mem. R. Ist. Lombardo* ser. 3, Cl. Sci. **4**:425. 1877 = *Kantia portoricensis* Steph. *Hedwigia* **27**: 280. 1888 = *Calypogeja portoricensis* (Steph.) Evans, *Bryologist* **10**:30. 1907 = *Calypogeja dussiana* Steph. *p.p.* (excl. Duss nº 508), *Spec. Hep.* **3**:404. Jul. 31,1908.

Icones: This paper, fig. 17; Stephani, *Hedwigia* **27**:280, tab. 11, fig. 1-3. 1888; Stephani, *Icones Hepaticarum* ined. in hb G nº 1267, 1275, 1276.

Stems creeping, rigid, often creased in appearance when dry, 1-8 cm long, 1,3-4 mm broad (leaves included). Stem width 136-221 μ. Cortical cells thin walled (rarely slightly thickened), with small trigones or none at all. Cell dimensions: 51-102 × 17-34 μ. *Rhizoides* usually numerous, variable in length, hyaline, brownish or reddish, often branched. *Lateral branches* fairly numerous. Flagelliform branches, and branches with smaller, deeply bilobed leaves, have been observed. *Leaves* imbricate or distant, often slightly convex, 1000-1955 μ long, 805-1725 μ wide. Ratio: length/width = 1,4-1/1. Dorsal edge curved. Ventral edge curved, usually, but variably, decurrent. Leaf insertion slightly arched. Leaf apex bilobed or bidentate with narrow, pointed, lobes, which can be erect, divergent, or slightly converging. Sinus wide and rounded, rarely pointed, 34-105 μ deep. Leaves with entire and rounded, or pointed, apices can occur, but only very rarely. Leaf margins indistinct. Leaf cells thin walled, with usually small trigones from top to base. The trigones can occasionally be lacking or be medium sized. Cell dimensions: marginal 25-60 × 22-34 μ, apical 25-42 × 20-34 μ, central 34-68 × 25-42 μ, basal 51-85 × 25-51 μ. *Underleaves* 1,6-2,1 times the width of the stem, 175-420 μ long, 280-525 μ wide. Decurrent, from 40 to 140 μ. Ratio: length/width = 1/1,2-1,8. Outer edges rounded or nearly straight, bearing on each side, or at least on one, a rounded protuberance or a broad, 1-3 celled, pointed tooth. Apex divided to 4/10-7/10 of the underleaf length into two broad, rounded or pointed lobes, which are erect or slightly divergent. Sinus usually wide, rounded or pointed, 50-150 μ deep. Underleaf cells

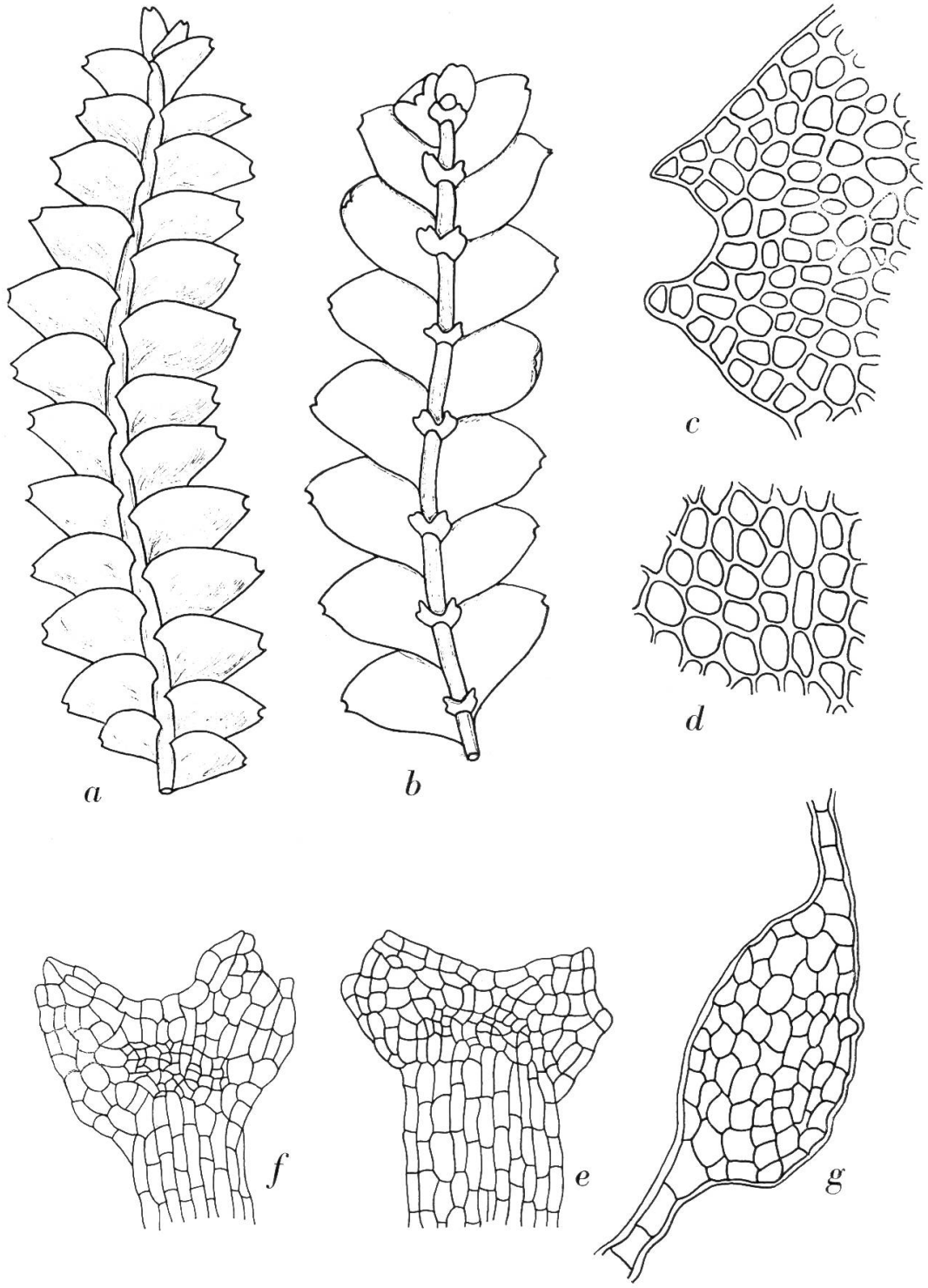

FIG. 17. — *Calypogeja peruviana* Nees & Mont. (type).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100 – *f*, underleaf, × 100 – *g*, stem cross section, × 150.

thin walled, rarely with slightly thickened walls, and small trigones. Cell dimensions: marginal 25-51 × 17-34 μ, central 25-51 × 15-34 μ. *Inflorescences* monoicous; ♂ with six pairs of strongly convex, imbricate, bi- or trilobed bracts. Bracteole bilobed to 4/10 of its length, with a rounded protuberance on each outer edge; ♀ with strongly imbricate, convex, bi- or trilobed bracts. Marsupia cylindrical, 2 cm long, bearing rhizoides. *Cuticle* smooth.

Hab.: C. peruviana forms lax, usually olive or dark green mats on damp soil, rarely on bark or rotten wood. Frequently it is associated with other Bryophyta. It has been gathered from sea level up to 3000 m, but seems to prefer medium ranges of altitude, from 1000 m to 2000 m. Fructifications are very rare.

Type: Peru, Inter Chupé et Yanacachu, s.d., *D'Orbigny s.n.* (G nº 1840).

Distr.: South America: Brazil, Colombia, Peru, Venezuela. Central America: Dominica, Guatemala, Jamaica, Mexico, Portorico.

Other material studied: Brazil: prov. Minas Geraes, Caldas, Ribeirão dos Bugnes, Aug. 20, 1873, *Mosén s.n.* (G nº 1828); Blumenau, 1889, *Ule 174 p. p.* (G). Colombia: Bogotà, Penna, 3000 m, Aug. 1858, *Lindig s.n.* (G nºs 1835, 1839); Andes de Bogotà, 2500 m, s.d., *Apollinaire 114* (G); Bogotà, s.d., *Apollinaire 1861* (FH); Huila, Macizo Colombiano, Hoya del Magdalena, San Agustin, k. 17. carr. a Santa Rosa, « La Candela », 2420 m, Aug. 27, 1958, *Bischler 601* (G); Boyacà, Bosques de Arcabuco, 2700-2900 m, Nov. 7, 1959, *Bischler 1914* (G); Cundinamarca, Salto del Tequendama, 2500 m, Apr. 27, 1959, *Bischler 2273 E, 2287 E* (G); Santander del Norte, Catatumbo, Petrolea y alrededores, 250-350 m, May 20, 1959, *Bischler 2644* (G); Cundinamarca, Laguna Pedro-Palo, 2000 m, Aug. 5-7, 1959, *Bischler 3022 G, 3031 F* (G). Peru: s.d., *s.col. 75-204* (P). Venezuela: Caracas, Galipan, 1845, *Funck & Schlim 360* (G). Central America: s.d., *Goebel s.n.* (G nº 1836). Dominica: s.d., *Elliott 1888, 2138, 2147* (G). Guatemala: Chicoyonito bei Coban, 4400', Dec. 1885, *Türckheim 1* (G); Alta Vera Paz, Pansamala, 3800', Jan. 30, 1886, *Türckheim 12 et s.n.* (G nºs 1837, 1838, 1841). Jamaica: Marce's Gap, Aug. 30, 1906, *Nichols 468* (FH). Mexico: Trapiche de la Concepción, s.d., *Liebmann 239 b* (W); Mirador, March 1842, *Liebmann 243, 409 b* (W); Chistla, s.d., *Liebmann 447* (W). Portorico: Prope Adjunctas in sylvis, Apr. 2, 1886, *Sintenis 58* (G); s.d., *Schwanecke (?) s.n.* (BM).

Obs.: C. peruviana was first published in Jan. 1838 by Montagne. He attributed the species to himself and Nees. Nees also published it the same year (*Naturg. Europ. Leberm.* **3**:26. 1838), attributing it only to himself. But his description is probably posterior to that of Montagne. For this reason the names of both authors have been kept with the species, not that of Nees alone, as do Gottsche, Lindenberg & Nees in their *Synopsis Hepaticarum* and Stephani in the *Species Hepaticarum.*

The type of *C. portoricensis* (Steph.) Evans corresponds in all features to that of *C. peruviana* Nees & Mont., and its name is therefore considered as a synonym of this species. In the past, probably nobody had examined the type of *C. portoricensis* and the species has thus been confused with *C. biapiculata* (Spruce) Steph. and its synonym *C. vincentina* (Wright) Steph. SPRUCE for instance cites it as a synonym of the latter species (*Journ. Linn. Soc. Bot.* **30**:355. 1894). But the type specimens are very different. In the Geneva herbarium, of the 17 specimens of *C. portoricensis* (Steph.) Evans present, nine belong to *C. biapiculata* (Spruce) Steph., three to other species and only five of them, including the type, are *C. portoricensis* (Steph.) Evans = *C. peruviana* Nees & Mont.

STEPHANI (*Spec. Hep.* **3**:411. 1908) cites *C. peruviana* from Guadeloupe (leg. *L'Herminier*). The specimen seems to be lost.

C. peruviana is one of the most frequently gathered and widely distributed species of *Calypogeja* in tropical America. Its appearance is very like that of the european and north american *Calypogeja fissa* (L.) Raddi, and it grows in similar places. Its usually smaller size, its less fleshy stems and less imbricate, but more decurrent leaves, and smaller, decurrent underleaves distinguish it from the latter species.

From *C. muscicola* Steph., *C. peruviana* is separated by its larger stems, its less elongated leaves and its larger underleaves in comparison to the stem. From *C. heterophylla* (Steph.) Steph. by its less fleshy stems, its less imbricate and more decurrent leaves and its smaller underleaves. From *C. subintegra* (Gottsche, Lindenb. & Nees) Bischler by its bilobed or bidentate leaves and its underleaves which always bear a rounded protuberance or a tooth on each outer edge.

2. — **Calypogeja heterophylla** (Steph.) Steph., *Spec. Hep.* **3**:407. Aug. 31, 1908 (non *Spec. Hep.* **6**:448. Jan. 30, 1924) = *Kantia heterophylla* Steph. *Hedwigia* **34**:35. 1895.

Stems creeping, rarely ascending other Bryophyta, fleshy and fairly rigid, 1-6 cm long, 2,8-4 mm broad (leaves included). Stem width 200-315 μ. Cortical cells thin walled or slightly thickened. Trigones small or absent. Cell dimensions: 51-102 × 17-34 μ. *Rhizoides* fairly numerous, variable in length, often branched, hyaline or brownish. *Lateral branches* usually numerous, but occasionally lacking. Flagelliform branches are quite frequent. *Leaves* usually imbricate, convex and with their tops often folded towards the ventral side, 1270-1955 μ long, 1150-1840 μ wide. Ratio: length/width = 1-1,3/1. Dorsal edge strongly curved. Ventral edge slightly curved, usually few or not decurrent. Leaf insertion arched. Leaf apex very variable, on the same stem can be observed entire, rounded, pointed or apiculate leaves, and bilobed ones. But in majority they are bilobed or bidentate, with usually narrow, pointed lobes, which occasionally are wider, triangular and rounded. They are erect or slightly convergent or divergent. Sinus usually wide and rounded, rarely pointed, 12-105 μ deep. Leaf margins indistinct. Leaf cells thin walled, at the top with large to medium sized trigones, at the base with medium sized or small ones. The cells seem to be much smaller at the top than at the base of the leaves.

Cell dimensions: marginal 34-60 × 17-42 μ, apical 25-42 × 20-34 μ, central 34-68 × 25-42 μ, basal 51-85 × 25-51 μ. *Underleaves* 1,6-3 times the width of the stem, 280-630 μ long, 450-665 μ wide. Decurrent, from 70 to 210 μ. Ratio: length/width = 1/1,1-1,8. Outer edges rounded, bearing on each side, or at least on one side, a rounded protuberance or, more rarely, a broad and pointed, 1-5 celled tooth. Apex divided to 4/10-8/10 of the underleaf length into two broad and rounded, rarely pointed, lobes which are erect or slightly divergent. Sinus wide, usually rounded, rarely pointed, 70-266 μ deep. Underleaf cells thin walled or slightly thickened, trigones small to conspicuous. Cell dimensions: marginal 25-68 × 20-34 μ, central 42-85 × 17-42 μ. *Sterile. Cuticle* smooth, occasionally slightly papillose.

Hab.: C. heterophylla forms dense mats, frequently in association with other Bryophyta. It is of a dark green, more rarely light green or yellowish, colour and grows on damp soil, shaded rocks, rotten wood and bark. It has been gathered from 1000 m up to 2500 m.

Type: Brazil: Mte Pao d'Assucar, 1885, *Ule 44* (G).

Distr.: South America: Brazil, Bolivia, Colombia. Central America: Costarica, Dominica, Guadeloupe, Jamaica, Mexico.

Obs.: Stephani described two *C. heterophylla*, the first, from Brazil, in 1895 (sub *Kantia*, *Hedwigia* **34**:53), the second, from Japan, in 1924 (*Spec. Hep.* **6**:448). Beauverd, when he revised the sixth volume of *Stephani's Species Hepaticarum*, discovered the error and changed the name of the latter species to *C. stephaniana* Beauverd (*Spec. Hep.* **6**: 572. Jan. 30, 1924). Hattori found this latter species to be a synonym of *C. sendaica* Steph. (*Journ. Hattori Bot. Lab.* **10**:35. 1953).

C. heterophylla (Steph.) Steph. from 1895 and *C. heterophylla* Steph. from 1924 are not synonyms. In the *Icones Hepaticarum*, G nº 1265 corresponds to the first, nº 1198 to the latter.

C. heterophylla is a quite widely distributed species, which was often confused with *C. peruviana* Nees & Mont. [= *C. portoricensis* (Steph.) Evans] and with *C. biapiculata* (Spruce) Steph. But its fleshy stems and imbricate leaves, its very variable leaf apices and its large and strongly decurrent underleaves bearing only one protuberance or tooth on each outer edge separate it well from these species.

Forms and Varieties

C. heterophylla (Steph.) Steph. var. **heterophylla** f. **heterophylla.**

Icones: This paper, fig. 18; Stephani, *Icones Hepaticarum* ined. in hb G nº 1265.

Stems fleshy, robust, 245-315 μ wide. Cortical cells often with slightly thickened walls. *Lateral branches* fairly numerous. Flagelliform branches occur. *Leaves* imbricate, convex, slightly elongated. Ratio: length/width = commonly 1,3/1. Leaf apex bilobed, bidentate or entire. These different apices can be present on a

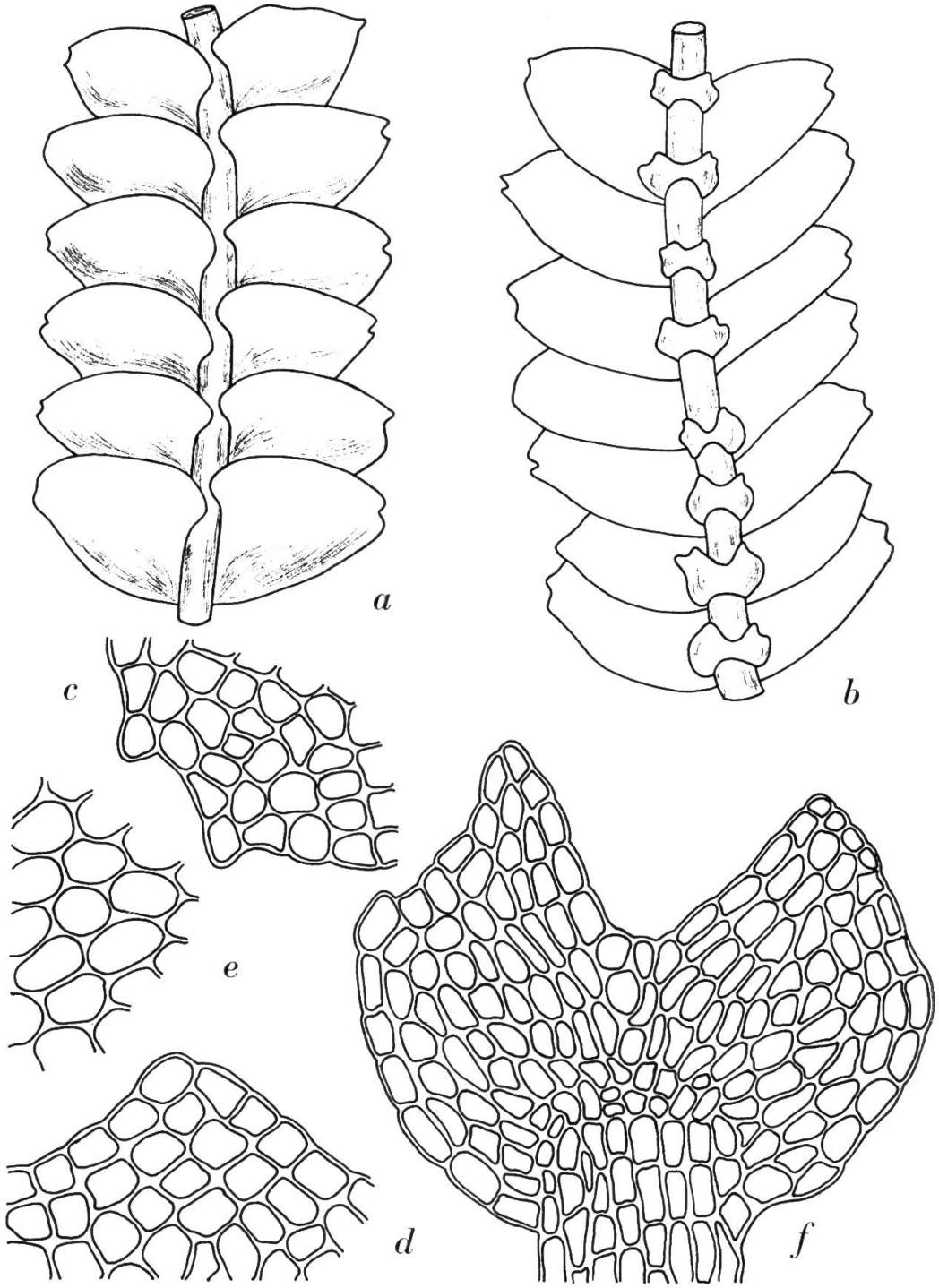

FIG. 18. — *Calypogeja heterophylla* (Steph.) Steph. var. *heterophylla* f. *heterophylla* (type).

a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, leaf apex, × 150 – *e*, cells in the basal region of the leaf, × 150 – *f*, underleaf, × 100.

same stem. *Underleaves* usually 2-3 times the width of the stem, 315-630 μ long, 455-665 μ wide. Ratio: length/width = 1/1,1-1,5 usually. Outer edges rounded, bearing on each side a rounded protuberance or a pointed tooth. Apex usually divided to 4/10-6/10 of the underleaf length into two mostly pointed lobes by a pointed or rounded sinus. *Sterile.*

Hab.: Corresponds to that of the species.

Distr.: South America: Brazil, Colombia. Central America: Costarica, Dominica, Guadeloupe, Jamaica.

Other material studied: Brazil: Apiahy, s.d., *Puiggari 766 p.p.* (G); Caraça, s.d., *Wainio 39 p.p.* (G); Caraça, Minas Geraes, 1885, *Wainio s.n.* (G nº 1815). Colombia: Macizo Colombiano, Hoya del Magdalena, San Agustin, k. 17 carretera a Santa Rosa, « La Candela », 2420 m, Aug. 27, 1958, *Bischler 600* (G); Santander del Norte, Catatumbo, Cerro del Tirador, cerca de Las Mercedes, 1000 m, May 18, 1959, *Bischler 2584 B, 2669 A* (G). Costarica: Marais de La Palma, 1550 m, Dec. 18, 1888, *Pittier 6018 a* (G). Dominica: s.d., *Elliott 937* (G). Guadeloupe: s.d., *Duss 167* (G). Jamaica: 1000 m, 1903, *Rehder s.n.* (G nº 1802).

C. heterophylla (Steph.) Steph. var. **heterophylla** f. **abnormis** (Ångstr.). Bischler comb. nov. = *Calypogeja abnormis* Ångstr. *Öfv. Kongl. Vet. Ak. Förh.* **33, 7**:80. 1876.

Icones: This paper, fig. 19.

Stems slightly fleshy, slender, 200-245 μ wide. Cortical cells thin walled. *Lateral branches* rare or absent. No flagelliform branches. *Leaves* slightly imbricate, quite plane, not elongated. Ratio: length/width = 1/1 usually. Leaf apex bilobed, bidentate or entire. These different leaf apices occur on the same stem. *Underleaves* 2-2,3 times the width of the stem, 280-300 μ long, 450-500 μ wide. Ratio: length/width = 1/1,5-1,7. Outer edges rounded, bearing on each side a rounded protuberance. Apex divided to 6/10-7/10 of the underleaf length into two, usually rounded, lobes by a rounded or pointed sinus. *Sterile.*

Hab.: F. *abnormis* forms yellowish mats on damp soil.

Type: Brazil: Caldas, s.d., *Wildgren s.n.* (S-PA, portion in hb G nº 1843).

Distr.: South America: Brazil.

Obs.: C. abnormis Ångstr. was found to be a more slender form of *C. heterophylla*, with less fleshy stems and smaller leaves and underleaves. Its leaves are less elongated. Its underleaves are deeply bifid and much wider than they are long.

The drawing Stpehani made of *C. abnormis* Ångstr. (*Icones Hepaticarum* ined. in hb G nº 1258) does not correspond to the type of this species. Stephani probably did not see it, and his figures are an interpretation of the very poor original diagnosis of the plant.

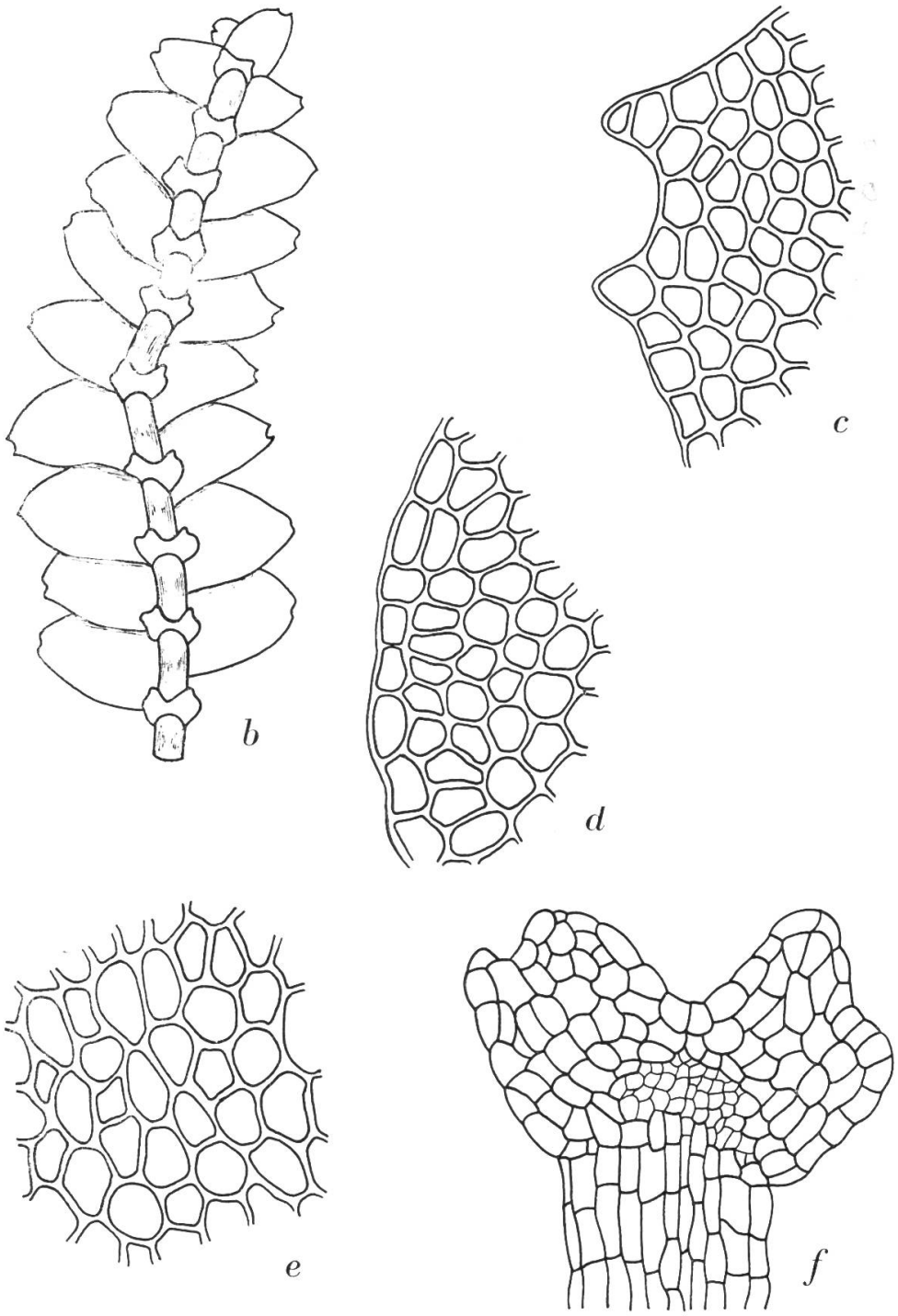

FIG. 19. — *Calypogeja heterophylla* (Steph.) Steph. var. *heterophylla* f. *abnormis* (Ångstr.) Bischler (type).

b, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, leaf apex, × 150 – *e*, cells in the basal region of the leaf, × 150 – *f*, underleaf, × 100.

Like f. *heterophylla*, the f. *abnormis* shows beside the bilobed and bidentate leaves often entire ones. The underleaves have in f. *abnormis* usually more rounded lobes and protuberances and rounded sinus, in f. *heterophylla* the lobes are often pointed, the sinus and the teeth on the outer edges, also.

Var. *subrotunda* has the same leaf shape, but its leaves are usually more imbricate and strongly convex, and always bilobed or bidentate. Its underleaves are of the same size, as those of f. *abnormis*, but always with rounded lobes, protuberances and sinus, and they are usually less deeply bilobed and smaller in comparison to the stem width.

C. heterophylla (Steph.) Steph. var. **subrotunda** (Steph.) Bischler comb. nov. = *Calypogeja subrotunda* Steph. *Bibl. Bot.* **87**:223. 1916.

Icones: This paper, fig. 20; Stephani, *Bibl. Bot.* **87**:222. fig. 163 a. 1916; Stephani, *Icones Hepaticarum* ined. in hb G nº 1279.

Stems fleshy, robust, 230-315 μ wide. Cortical cells thin walled. *Lateral branches* rare or absent. Flagelliform tips of the stems have often been observed. *Leaves* imbricate, strongly convex, not elongated. Ratio: length/width = 1,1/1 commonly. Leaf apex always bilobed or bidentate, never entire. *Underleaves* usually 1,7-2 times the width of the stem, 350-455 μ long, 470-600 μ wide. Ratio: length/width = 1/1,4-1,5. Outer edges bearing on each side a rounded protuberance, which can occasionally be lacking on one or both sides. Apex divided usually to 4/10-6/10 of the underleaf length into two broad, rounded lobes by a rounded sinus. *Inflorescences* dioecious? ♂ with 4-5 pairs of convex bracts, which are bilobed to 1/2, with pointed lobes and sinus.

Hab.: Var. *subrotunda* forms dense, light or yellowish green mats on bark, rotten wood or damp soil.

Type: Bolivia: Tablas, 1800 m, s.d., *Herzog 4587* (G).

Distr.: South America: Bolivia, Brazil. Central America: Costarica, Mexico.

Other material studied: Brazil: s.d., *Ule 396* (G). Costarica: Sta. Maria de Dota, s.d., *Standley 48694* (hb. Herzog). Mexico: 1860, *Sumichrast s.n.* (G nº 1803).

Obs.: Var. *subrotunda* is very closely related to var. *heterophylla*. It can be separated from it by its leaves, which are always bilobed or bidentate, mostly as long as wide, its less ramified stems, and its smaller underleaves which are much wider than they are long, with rounded lobes, sinus and protuberances.

F. *abnormis* is a more slender form of *C. heterophylla* and can easily be distinguished from var. *subrotunda* by its less imbricate, often entire, not convex, leaves, and its more deeply bilobed underleaves which are larger in comparison to the stem width.

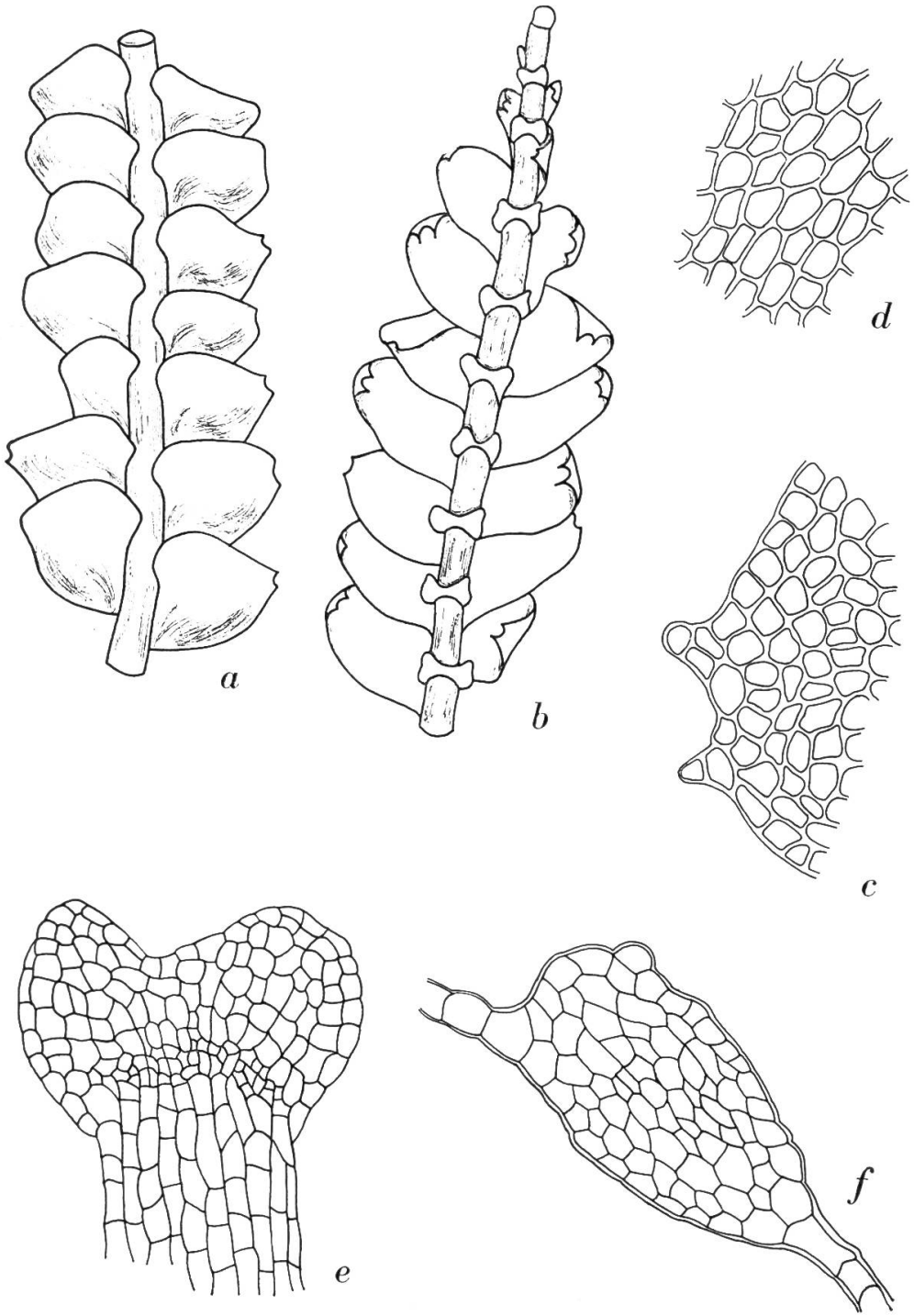

FIG. 20. — *Calypogeja heterophylla* (Steph.) Steph. var. *subrotunda* (Steph.) Bischler (type).

a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100 – *f*, stem cross section, × 150.

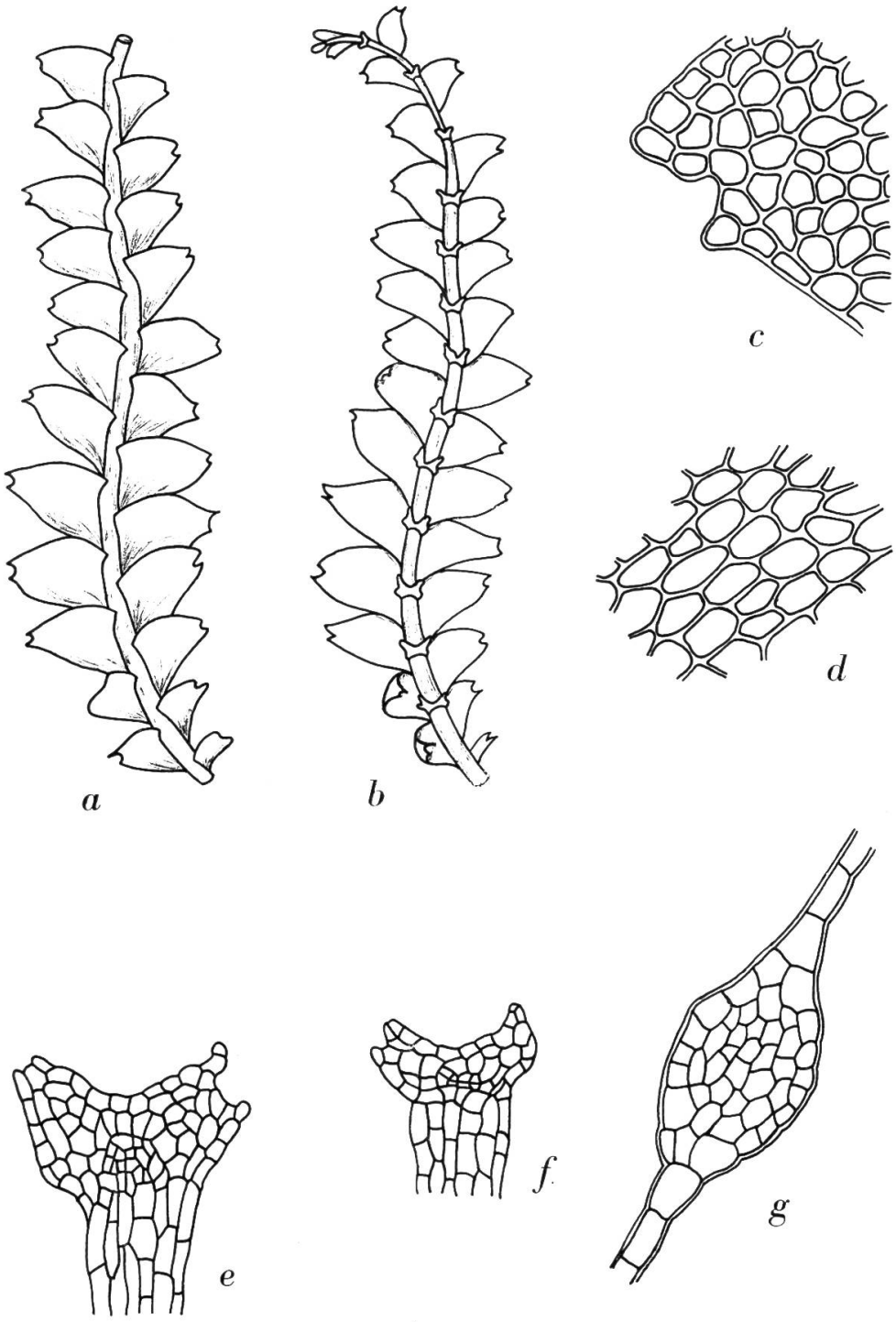

FIG. 21. — *Calypogeja muscicola* Steph. (type).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100, – *f*, underleaf, × 100 – *g*, stem cross section, × 150.

3. — **Calypogeja muscicola** Steph. *Bibl. Bot.* **87**:223. 1916.

Icones: This paper fig. 21; Stephani, *Bibl. Bot.* **87**:222, fig. 163 b. 1916; Stephani, *Icones Hepaticarum* ined. in hb G nº 1274.

Stems creeping, or climbing, flexuose, 1-2 cm long, 2,4 mm broad (leaves included). Stem width 126 μ. Cortical cells thin walled. Trigones absent. Cell dimensions: 51-68 × 17-20 μ. *Rhizoides* usually numerous, short, hyaline, frequently branched. *Lateral branches* usually numerous. Occasional flagelliform branches have been observed. *Leaves* hardly imbricate, or distant, often slightly convex, 840-1035 μ long, 525-690 μ wide. Ratio: length/width = 1,5-1,6/1. Dorsal edge curved. Ventral edge slightly curved and usually decurrent. Leaf insertion fairly arched. Leaf apex bidentate or bilobed, with narrow, usually pointed, erect lobes or teeth. Sinus broad, rounded, rarely pointed, 70 μ deep. Leaf margin indistinct. Leaf cells thin walled, with small to medium sized trigones, which are usually slightly more conspicuous towards the apex. Cell dimensions: marginal 34-42 × 25 μ, apical 25 × 25 μ, central 42 × 34 μ, basal 51-68 × 34-51 μ. *Underleaves* 1,8-2,5 times the width of the stem, 175 μ long, 280-315 μ wide. Decurrent, from 50 to 70 μ. Ratio: length/width = 1/1,6-1,7. Outer edges nearly straigth, bearing on each side a rounded protuberance or a 1-2 celled tooth. Apex divided to 1/2 of the underleaf length into two, usually pointed, divergent lobes which can be narrow or broad. Sinus rounded, wide, 85 μ deep. Underleaf cells thin walled. Trigones small or absent. Cell dimensions: marginal 34 × 17 μ, central 42 × 22 μ. *Sterile. Cuticle* smooth.

Hab.: C. muscicola grows frequently on other Bryophyta. The plant is yellowish or dark green. It seems to be a species of high tropical mountains.

Type: Bolivia: Cordillera de Santa Cruz, 1913, *Herzog 3892* (G).

Distr.: South America: Bolivia.

Obs.: C. muscicola has in general outline the aspect of the *Calypogeja's* belonging to subgroup 5. However, its underleaves are not bisbifid, also they are only slightly decurrent. Its leaf and underleaf cells are smaller, and the stem section shows clearly that it belongs to subgroup 1.

The species shows within the subgroup 1 most similarity to *C. peruviana* Nees & Mont. from which it is separated by its smaller stems, its more elongated leaves, and its smaller underleaves.

4. — **Calypogeja lophocoleoides** Steph. *Spec. Hep.* **3**:409. Aug. 31, 1908. = *Calypogeja suringarii* Steph. *Spec. Hep.* **6**:451. Jan. 30. 1924.

Icones: This paper fig. 22; Stpehani, *Icones Hepaticarum* ined. in hb G nos 1271, 1272.

Stems creeping, fleshy, 1-5,5 cm long, 2,7-4,1 mm broad (leaves included). Stem width 160-260 μ. Cortical cells thin walled. Trigones small or absent. Cell dimensions: 76-136 × 17-25 μ. *Rhizoides* usually few, variable in length, hyaline or brownish. *Lateral branches* rare, long. No flagelliform branches. *Leaves* usually

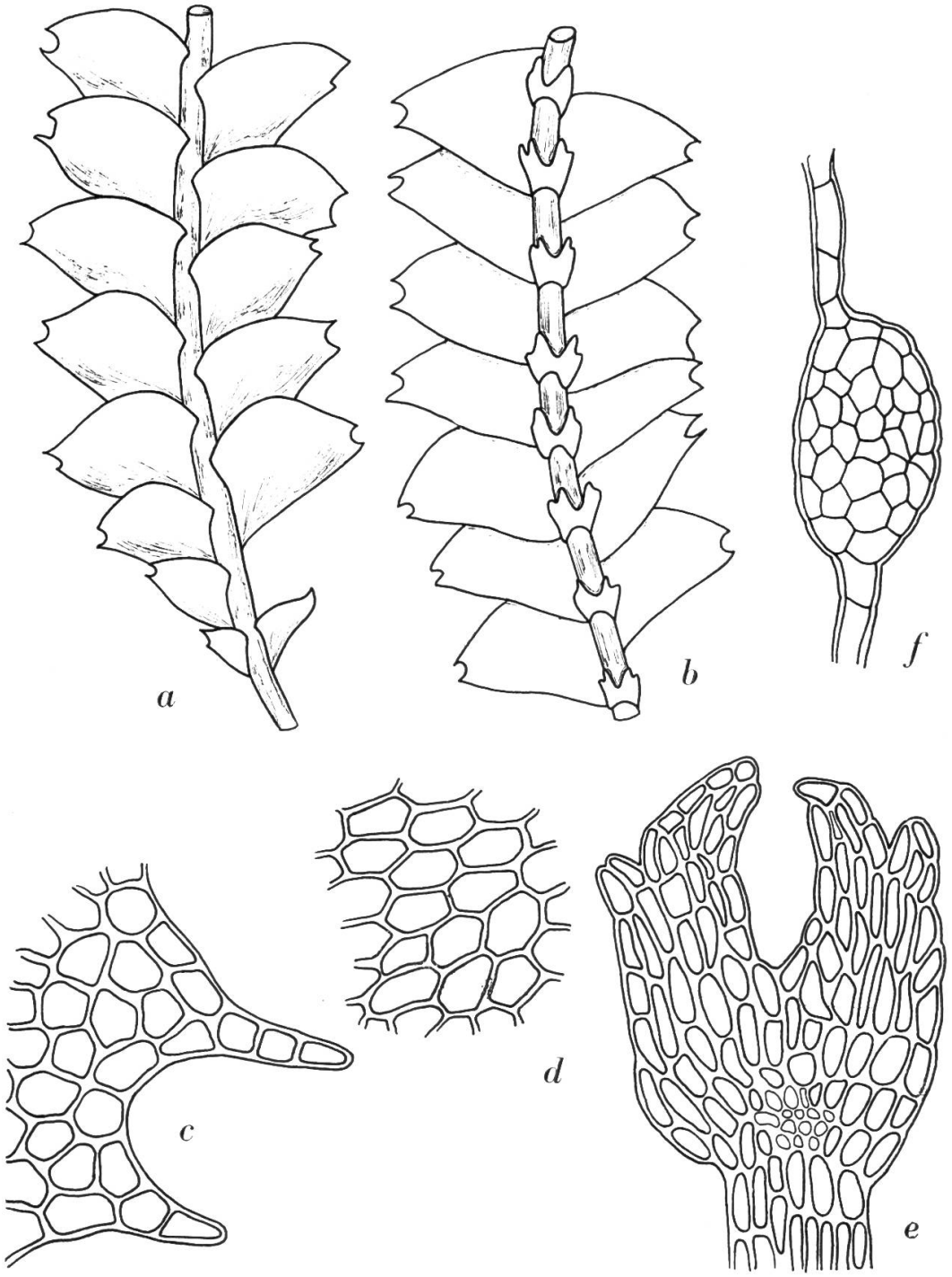

FIG. 22. — *Calypogeja lophocoleoides* Steph. (lectotype).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100 – *f*, stem cross section, × 150.

imbricate, slightly convex, 1500-2070 μ long, 1150-1500 μ wide. Ratio: length/width = 12-1,4/1. Dorsal edge strongly and regularly curved. Ventral edge almost straight, at times concave, variably decurrent. The leaves thus appear often falcate. Leaf insertion arched. Leaf apex bilobed, with lobes of variable length, usually narrow, pointed, 2-3 celled, erect, divergent or slightly converging. Sinus broad, rounded, usually about 140 μ deep, but variable from 140 to 70 μ. Leaf margins indistinct. Leaf cells thin walled, with small or medium sized trigones from top to base. Cell dimensions: marginal 34-60 × 25-42 μ, apical 25-42 × 25-34 μ, central 51-60 × 34-42 μ, basal 68-93 × 30-51 μ. *Underleaves* 1,6-2,5 times the width of the stem, 280-455 μ long, 329-525 μ wide. Decurrent, from 70 to 120 μ. Ratio: length/width = 1,1-1,4/1 usually, occasionally 1/1-1,2, for underleaves with widely spreading lobes, which occur on the oldest stems. Outer edges rounded or nearly straight, bearing on each side, at 2/3 up from the base, or more, a pointed, 1-3 celled tooth. Occasionally it can be lacking on one side or be replaced by a rounded protuberance. Apex divided to 4/10-7/10 of the underleaf length into two pointed lobes which can be erect, divergent or convergent. Sinus usually rounded, rarely pointed, narrow, 70-280 μ deep. Underleaf cells elongated, usually at least twice as long as wide, always well visible in the central part of the underleaf. They have slightly thickened walls. Trigones small or absent. Cell dimensions: central 60-85 × 25-34 μ, marginal 42-76 × 25-30 μ. *Inflorescences* dioecious. ♀ with small, strongly convex bracts which are 2-3 lobed. Lobes narrow and pointed, Marsupia cylindrical, bearing rhizoides. Elaters bispiraled, 400 μ long. Spores brown, 13-15 μ in diameter. *Cuticle* smooth or slightly papillose.

Hab.: C. lophocoleoides Steph. usually forms dense, dark green or yellowish mats on damp soil or bark. It is frequently associated with other Hepaticae. Ithas been gathered at low altitude.

Lectotype: Dominica, s.d., *Elliott 1136* (G).

Distr.: South America: Dutch Guiana. Central America: Dominica, Guadeloupe, Martinique.

Other material studied: Dutch Guiana: Insula Saba, 1889, *Suringar 119* (G). Dominica: s.d., *Elliott 1183, 1820* (G). Guadeloupe: s.d., *L'Herminier s.n.* (G n° 1824). Martinique: 700 m, s.d., *Duss 27* (G).

Obs.: One of the specimens of *C. lophocoleoides* kept in the Geneva herbarium, *Elliott 1136*, bears on it the indication: " Steph. n. sp." and drawings of an underleaf and a leaf apex. The same specimen was drawn by Stpehani in his *Icones*, it is therefore to be considered as the type of the species.

C. suringarii Steph. has the same type of underleaves as *C. lophocoleoides*. These are longer than wide, with a pointed tooth on each side on their outer edges, and composed of very elongated cells. This latter characteristic can not be found in any other species of the subgenus *Calypogeja*. *C. suringarii* and *C. lophocoleoides* differ however by their leaf apices which are very deeply bilobed in the type of *C. lophocoleoides*, less in that of *C. suringarii*, but this characteristic is in general outline very variable in all species of subgroup 1. The two are therefore considered to be conspecific.

STEPHANI attributes to *C. suringarii* non decurrent, bifid underleaves with apiculate, connivent lobes and without teeth on their outer edges. He draws it thus in the *Icones* (G nº 1242). On examining the type specimen it was observed that such underleaves occur, but very rarely, and on very young stems only. They have to be considered as abnormal. The common underleaf type is decurrent, bilobed, with pointed lobes and well developped teeth on their outer edges.

C. lophocoleoides is related to *C. peruviana* Nees & Mont. and *C. heterophylla* (Steph.) Steph., from which it is separated by its leaf shape and its underleaves which are longer than wide, composed of elongated cells at least twice as long as wide.

5. — **Calypogeja subintegra** (Gottsche, Lindenb. & Nees) Bischler, comb. nov. = *Calypogeja peruviana* Nees & Mont. var. *subintegra* Gottsche, Lindenb. & Nees, *Syn. Hep.*: 712. 1847.

Stems creeping, flexuose, 1-3 cm long, 1,7-3,2 cm broad (leaves included). Stem width 136-210 μ. Cortical cells thin walled with small trigones or none at all. Cell dimensions: 47-85 × 17-34 μ. *Rhizoides* numerous, variable in length, hyaline. *Lateral branches* rare. Flagelliform branches and branches with very small, always bilobed leaves, have been observed. *Leaves* fairly imbricate, slightly convex or plane, 630-1610 μ long, 480-1600 μ wide. Ratio: length/width = 1-1,3/1. Dorsal edge curved. Ventral edge curved and not, or slightly, decurrent. Leaf insertion slightly arched. Leaf apex usually entire, rounded, pointed, or, rarely, apiculate, or, on isolated leaves only, bidentate with triangular, short, quite narrow, pointed teeth which are erect or slightly divergent. Sinus usually broad and rounded, 35-40 μ deep. Leaf margin indistinct. Leaf cells thin walled, with medium sized or small trigones from top to base. Cell dimensions: marginal 34-51 × 25-42 μ, apical 25-42 × 20-34 μ, central 42-73 × 30-42 μ, basal 54-76 × 25-42 μ. *Underleaves* 1,6-2,1 times the width of the stem, 231-350 μ long, 266-500 μ wide. Decurrent, from 90 to 105 μ. Ratio: length/width = 1/1,1-1,6. Outer edges rounded or nearly straight, bearing on each side a rounded protuberance or a broad, pointed tooth. The protuberances or teeth can be lacking on one or on both sides. Apex divided to 4/10-6/10 of the underleaf length into two triangular, rounded or pointed lobes which can be erect or divergent. Sinus rounded or pointed, 84-175 μ deep. Underleaf cells thin walled, usually with small trigones. Cell dimensions: central 51-60 × 25-34 μ, marginal 34-51 × 25-30 μ. *Sterile*. *Cuticle* smooth.

HAB.: C. subintegra forms lax, light or yellowish green or brownish mats on damp soil or bark. It is often associated with other Bryophyta and has been gathered at medium and low altitudes.

TYPE: MEXICO: Huatasco, March 1842, *Liebmann 375 p.p.* (W, sub *C. peruviana* Nees & Mont. var. *integrifolia*).

DISTR.: SOUTH AMERICA: Venezuela. CENTRAL AMERICA: Cuba, Guadeloupe, Mexico.

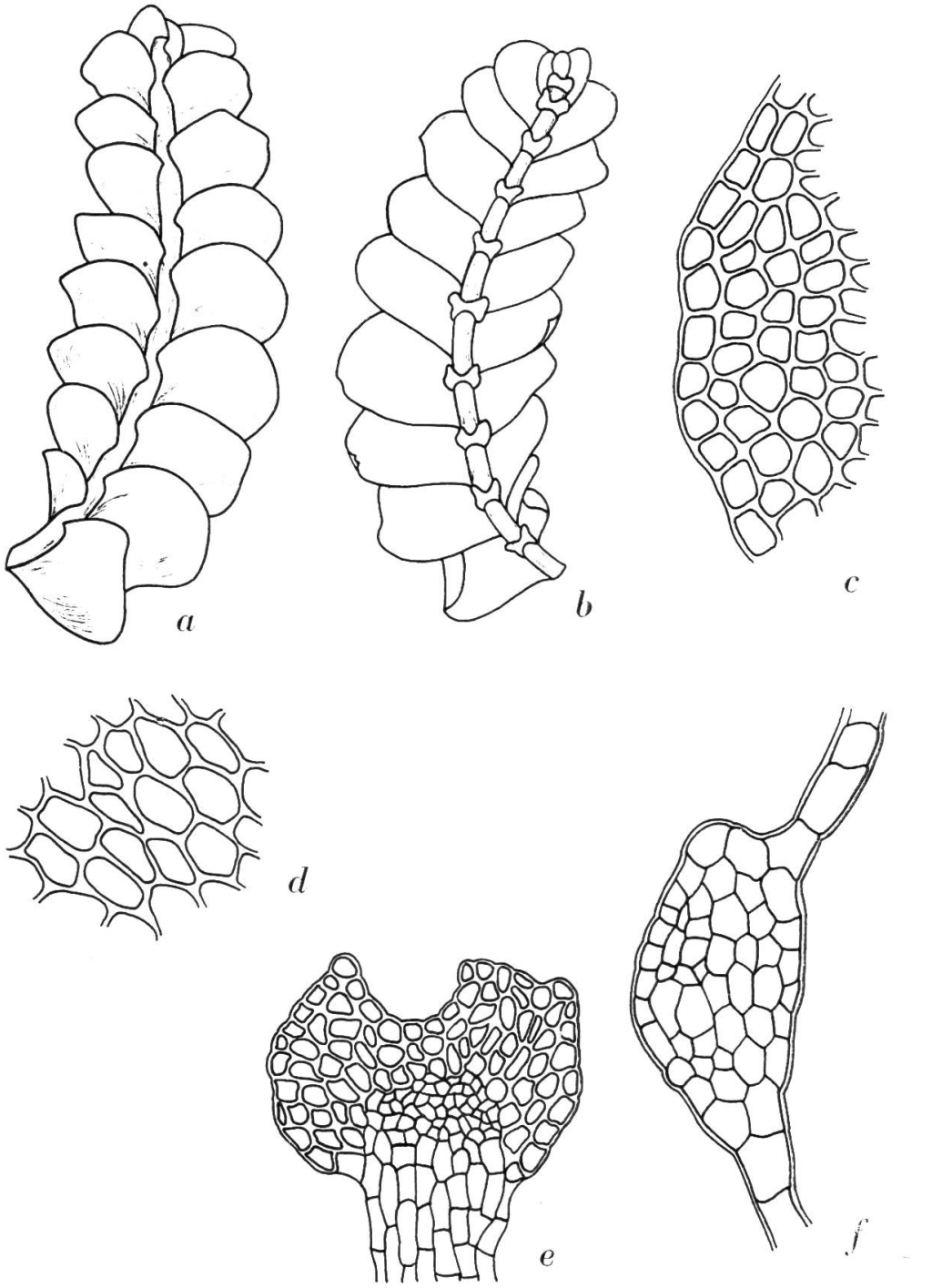

FIG. 23. — *Calypogeja subintegra* (Gottsche, Lindenb. & Nees) Bischler var. *subintegra* (type).

a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100 – *f*, stem cross section, × 150.

Obs.: The type of the species, kept in the Lindenberg collection, is a specimen which contains also the type of *C. laxa* Gottsche & Lindenb. It bears a herbarium name: " var. integrifolia."

C. subintegra can be distinguished from the related *C. peruviana* Nees & Mont. by its entire leaves and its underleaves, where on their outer edges often show neither teeth nor protuberances. From *C. heterophylla* (Steph.) Steph. it is separated by its less fleshy stems and less imbricate leaves, and its smaller underleaves. From *C. andicola* Bischler it can be distinguished by its smaller size, its less fleshy stems, its slightly smaller leaf and underleaf cells and its smaller underleaves.

Varieties

C. subintegra (Gottsche, Lindenb. & Nees) Bischler var. **subintegra.**

Icones: This paper, fig. 23.

Leaves fairly imbricate, 630-1610 μ long, 480-1380 μ wide. Ratio: length/width = 1-1,3/1. *Underleaves* 231-350 μ long, 266-315 μ wide. Ratio: length/width = 1/1,1. Outer edges rounded, with or without rounded protuberances. Apex divided usually to 4/10 of the underleaf length into two rounded or pointed, usually erect, lobes. Sinus rounded, 84-110 μ deep.

Hab.: Var. *subintegra* forms light green or yellowish mats on damp soil.

Distr.: South America: Venezuela. Central America: Cuba, Mexico.

Material studied: Venezuela: s.d., *Fendler s.n.* (G nº 1826). Cuba: s.d., *Wright s.n.* (G nº 1827).

C. subintegra (Gottsche, Lindenb. & Nees) Bischler var. **dussiana** (Steph.) Bischler, comb. nov. = *Calypogeja dussiana* Steph. *p.p.* (excl. *Funck & Schlim nº 360*), *Spec. Hep.* **3**:404. Jul. 31, 1908.

Icones: This paper, fig. 24; Stephani, *Icones Hepaticarum* ined. in hb G nºs 1262, 1263.

Leaves slightly imbricate, 1600 μ long, 1600 μ wide. Ratio: length/width = 1/1. *Underleaves* 322 μ long, 500 μ wide. Ratio: length/width = 1/1,6. Outer edges rounded, generally with rounded protuberances or broad, pointed teeth. Apex divided to 6/10 of the underleaf length into two rounded or pointed, erect or divergent lobes. Sinus rounded or acute, 175 μ deep.

Hab.: Var. *dussiana* forms lax, brownish mats on bark.

Lectotype: Guadeloupe: s.d., *Duss 508* (G).

Distr.: Central America: Guadeloupe.

Obs.: Stephani described his *C. dussiana* based upon two specimens: *Duss nº 508*, which is sterile, labelled " Original " and figures in the *Icones*

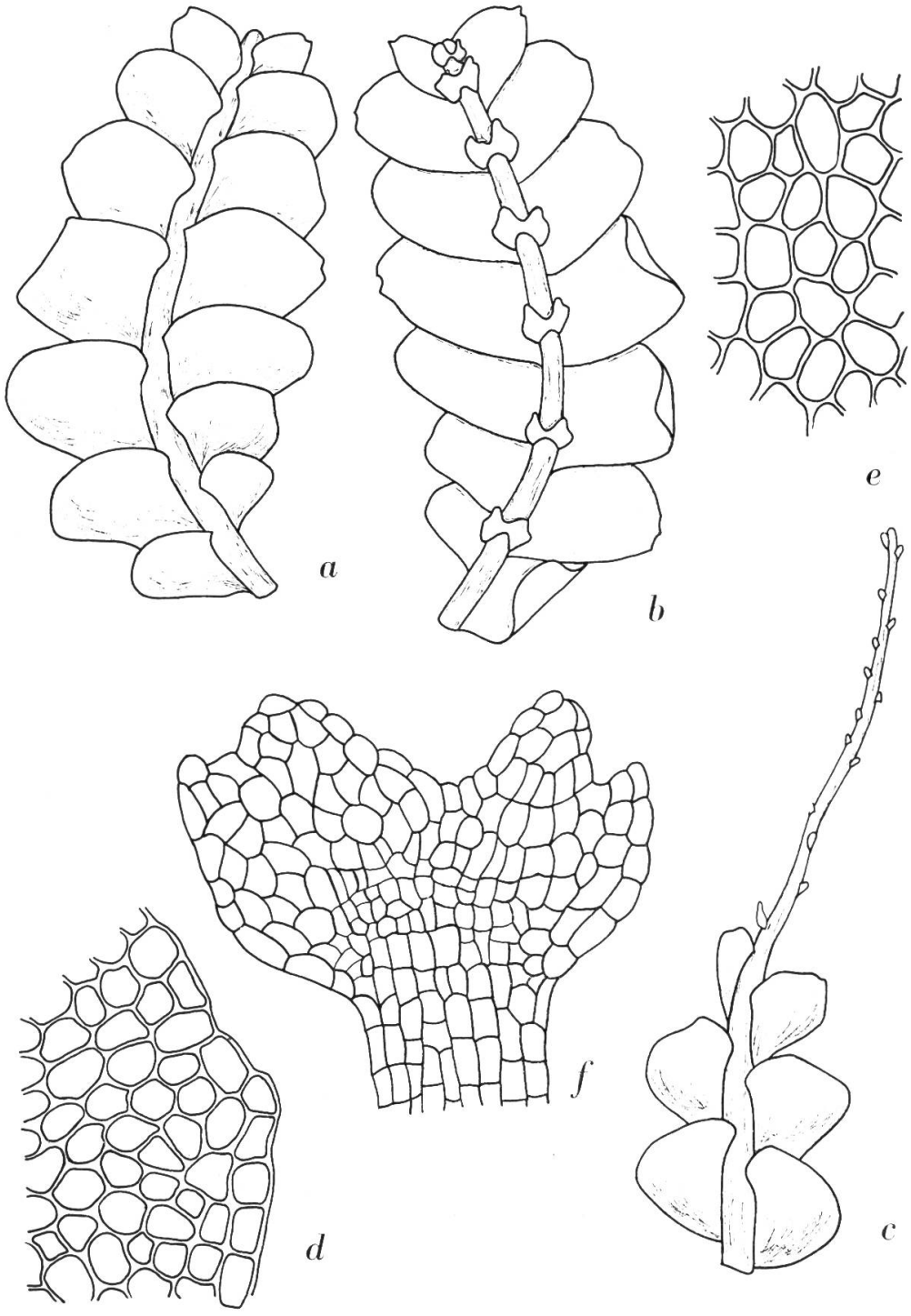

FIG. 24. — *Calypogeja subintegra* (Gottsche, Lindenb. & Nees) Bischler var. *dussiana* (Steph.) Bischler (lectotype).

a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, flagelliform branch, × 15 – d, leaf apex, × 150 – *e*, cells in the basal region of the leaf, × 150 – *f*, underleaf, × 100.

Hepaticarum; Funck & Schlim n° 360, which is a fertile plant. The first is without doubt to be considered as the type. The second belongs to *C. peruviana* Nees & Mont. But STEPHANI included in his original description also the features of the fructifications, taken from this latter specimen. His description of *C. dussiana* is thus composite. To define really *C. dussiana*, the characteristics of the specimen *Funck & Schlim n° 360* have to be excluded.

Var. *dussiana* can be distinguished from var. *subintegra*, to which it is very closely related, by its leaves which are nearly as long as wide, by its wider underleaves, nearly always bearing protuberances or teeth on their outer edges. They are more deeply bilobed and pointed lobes and sinus are of frequent occurence.

6. — **Calypogeja andicola** Bischler spec. nov.

ICONES: This paper, fig. 25.

Caules prostrati, carnosi, parum ramosi, 250-350 μ lati, cellulis corticalibus elongatis. *Folia* imbricata, concava, tam lata quam longa, rotundata, apice integra late rotundata rarius acuta vel apiculata, rarissime bidentula, dentibus acutis sinu lato rotundato, in basi non decurrentia. Cellulae parietibus tenuibus trigonis saepe magnis instructis, apice multo minoribus quam basi, apicales 34-42 × 25-42 μ, basilares 68-85 × 34-51 μ. *Amphigastria* 1,3-2,6 × latiora quam caulis, longe decurrentia, rotundata, latiora quam longa, apice ad 4/10-8/10 bilobata lobis rotundatis sinu rotundato acutove. Cellulae magnae, parietibus tenuibus, trigonis saepe magnis instructis, centrales 51-76 × 34-51 μ. *Sterilis. Cuticula* laevis.

Stems creeping, fleshy, 1-5 cm long, 3-4,4 mm broad (leaves included). Stem width 250-350 μ. Cortical cells thin walled. Trigones small or absent. Cell dimensions: 68-102 × 25-30 μ. *Rhizoides* fairly numerous, variable in length, hyaline. *Lateral branches:* rare. No flagelliform branches. *Leaves* usually imbricate, slightly convex, 1380-2070 μ long, 1380-2070 μ wide. Ratio: length/width = 1,1-1/1-1,1. Dorsal edge curved. Ventral edge more slightly curved and usually not decurrent. Leaf insertion arched. Leaf apex entire, rounded, rarely pointed. Apiculate or bidentate leaves, the latter with narrow, pointed and erect teeth separated by a wide, rounded sinus (maximum 40 μ deep), occur occasionally. Leaf margin indistinct. Leaf cells thin walled. Trigones medium sized to large. The cells appear to be distinctly smaller at the top of the leaves than at the base. Cell dimensions: marginal 51-68 × 25-42 μ, apical 34-42 × 25-42 μ, central 51-68 × 34-51 μ, basal 68-85 × 34-51 μ. *Underleaves* 1,3-2,6 times the width of the stem, 350-525 μ long, 420-770 μ wide. Ratio: length/width = 1/1,2-1,5. Decurrent, from 70 to 140 μ. Outer edges rounded, without teeth or protuberances. Apex divided to 4/10-8/10 of the underleaf length into two triangular lobes, usually rounded, rarely pointed, erect. Sinus rounded or pointed, fairly broad, 105-210 μ deep. Underleaf cells thin walled or slightly thickened. Trigones medium to large, occasionally absent. Cell dimensions: marginal 51-68 × 25-42 μ, central 51-76 × 34-51 μ. *Sterile. Cuticle* smooth.

HAB.: C. andicola forms dark green mats on damp soil and rotten wood in shaded places. It is frequently associated with other Bryophyta. It has been gathered from 2300-3500 m.

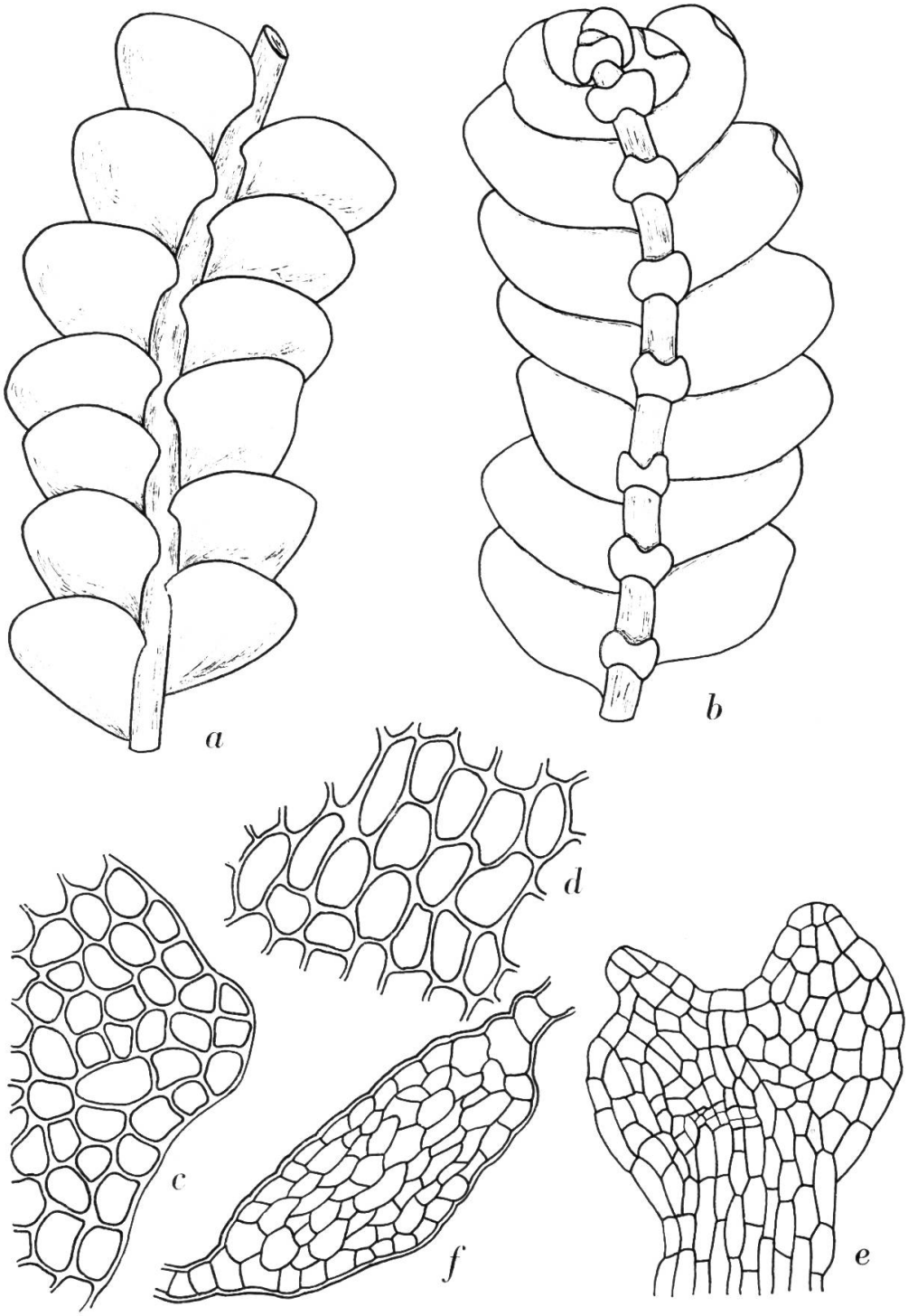

FIG. 25. — *Calypogeja andicola* Bischler (type).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100 – *f*, stem cross section, × 150.

TYPE: COLOMBIA, Cundinamarca, Paramo de Choachi, 3000 m, Apr. 19, 1959, *Bischler 2201* (G).

DISTR.: SOUTH AMERICA: Colombia, Ecuador.

Other material studied: COLOMBIA: Tolima, Route du Quindio, du côté d'Ibagué, 3200 m, 27 juillet 1958, *Bischler 528, 530* (G); Cauca, Macizo Colombiano, Paramo de las Papas, entre el Boqueron y La Hoyola, 3200-3500 m, 7-27 sept. 1958, *Bischler 738* (G); Cundinamarca, Camino real Bojaca-Tena, 2800-2300 m, Nov. 8, 1958, *Bischler 1149 B* (G). ECUADOR: Quito, s.d., *Jameson s.n.*, (G nº 1805).

OBS.: C. andicola is closely related to the european and north american species *C. trichomanis* (L.) Corda and *C. mülleriana* (Schiffn.) Müller. From the first, it can be separated by its decurrent underleaves which are wider than they are long and have rounded lobes and sinus. From the latter it can be distinguished by its more deeply divided, and smaller, underleaves which are not imbricate in the stem tops, and its wider underleaf cells.

The existence of a near relative of a temperate zone *Calypogeja* in the tropical high Andes mountains can be explained by the similarity of habitats and climate between these regions. The occurence of the same species, however, would be very improbable. Up till now, no leafy Hepaticae of the northern temperate zone have been discovered in the high Andes of tropical America.

The undivided leaves of *C. andicola* suggest some relationship with *C. subintegra* (Gottsche, Lindenb. & Nees) Bischler, from which it is separated by its wider underleaves, devoide of teeth or protuberances on their outer edges, and its greater leaf and underleaf cell dimensions.

C. andicola seems to be a typical representative of the " paramos " flora. The " paramos " are regions situated in the Andes of Colombia and Ecuador between 2800 and 4000 m. Their vegetation is very peculiar and is characterised by the dominant presence of plants of the genus *Espeletia* (Compositae).

7. — **Calypogeja oblata** Herzog, *Svensk Bot. Tidskr.* **51**:189. 1957.

ICONES: This paper fig. 26; HERZOG, *Svensk Bot. Tidskr.* **51**:190. fig. 2. 1957.

Stems creeping, 1-3 cm long, 2,8-3,6 mm broad (leaves included). Stem width 170-280 μ. Cortical cells thin walled, trigones absent. Cell dimensions: 51-102 × 17-20 μ. *Rhizoides* few in number, long, hyaline. *Lateral branches* absent. No flagelliform branches.

Leaves strongly imbricate, slightly convex, 1380-1955 μ long, 1500-2645 μ wide. Ratio: length/width = 1/1,1-1,4. Dorsal edge strongly curved, overlapping the stem dorsally. Ventral edge curved, slightly or non decurrent. Leaf insertion strongly arched. Leaf apex usually bidentate, with 1-3 celled, pointed, erect teeth. Sinus rounded, 45-70 μ deep. The leaf apex can be entire (rarely), pointed or apiculate. Leaf margin indistinct. Leaf cells thin walled, trigones lacking. Cell dimensions: marginal 34-51 × 22-30 μ, apical 25-29 × 25 μ, central 51 × 34-42μ, basal 60-68 × 34-42 μ. *Underleaves* 3,5-3,7 times the width of the stem, 490-770 μ long, 630-980 μ

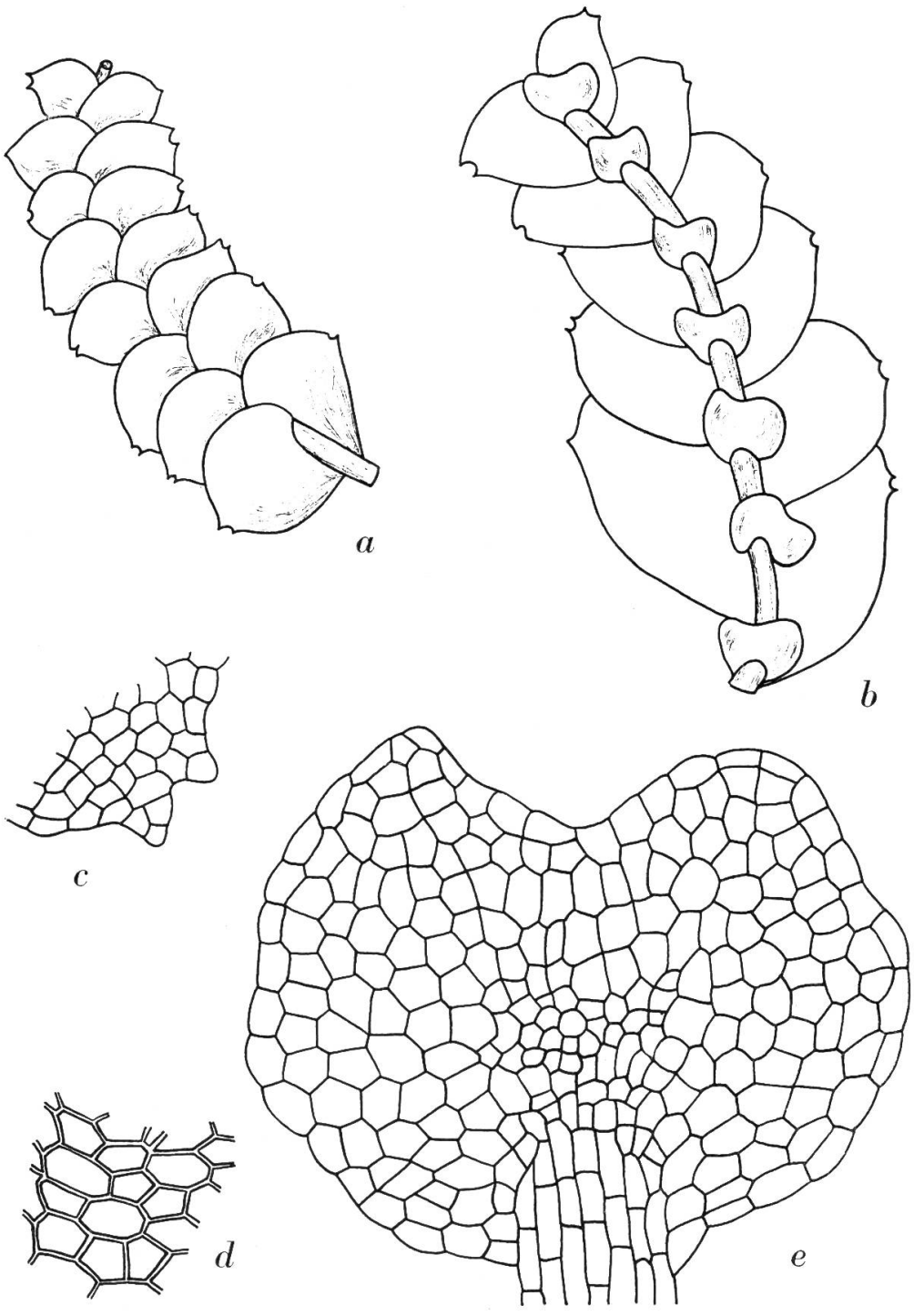

FIG. 26. — *Calypogeja oblata* Herzog (type).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100.

wide. Strongly decurrent, from 140 to 315 μ. Ratio: length/width = 1/1,3. Outer edges rounded, without teeth or protuberances. Apex divided to 3/10 of the underleaf length into two broad, rounded, erect lobes. Sinus broad, rounded, 119-140 μ deep. Underleaf cells thin walled, without trigones. Cell dimensions: marginal 51 × 20-34 μ, central 51 × 30-34 μ. *Sterile*. *Cuticle* smooth.

HAB.: C. oblata forms dark green, slightly translucent mats on damp soil, frequently associated with other Hepaticae. It has been gathered at 3500-3800 m.

TYPE: ECUADOR: Tungurahua, Cordillera de Llanganates, near Las Torres, 3500 m, Nov. 22, 1939, *Asplund s.n.* (S-PA).

DISTR.: SOUTH AMERICA: Ecuador.

Other material studied: ECUADOR: Cordillera de Llanganates, prov. Tungurahua, zwischen Herberta pensilis, 3800 m, Nov. 22, 1939. *Asplund s.n.* (hb Herzog).

OBS.: HERZOG attributes to this species entire leaves. Examination of the available material shows a great majority of leaves with clearly bidentate leaf apices.

C. oblata is a very peculiar *Calypogeja*, who's leaves are wider than they are long. The cells never have thickened walls nor trigones, and the strongly decurrent underleaves have entire outer edges and rounded lobes and sinus. These characteristics separate the species from all other tropical american representatives of the genus.

8. — **Calypogeja biapiculata** (Spruce) Steph. *Spec. Hep.* **3**:403. Jul. 31, 1908. = *Kantia biapiculata* Spruce, *Trans. Proc. Bot. Soc. Edinburgh* **15**:414. Nov. 1885 = *Kantia vincentina* Wright, *Journ. Bot.* **29**:107. 1891 = *Calypogeja vincentina* (Wright) Steph. *Spec. Hep.* **3**:411. Aug. 31, 1908 = *Calypogeja gigantea* Steph. *Spec. Hep.* **3**:409. Aug. 31, 1908 (non *Calypogeja gigantea* Steph. *Spec. Hep.* **6**:447. Jan. 30, 1924).

ICONES: This paper, fig. 27; STEPHANI, *Icones Hepaticarum* ined. in hb G nos 1260, 1281.

Stems creeping, fleshy, 2-10 cm long, 2,3-5 mm broad (leaves included). Stem width 210-350 μ. Cortical cells thin walled with small trigones or none at all. Cell dimensions: 51-136 × 17-34 μ. *Rhizoides* variable in number and length, frequently branched, hyaline or yellowish. *Lateral branches* few, usually long. Flagelliform branches have been observed. *Leaves* usually imbricate, quite strongly convex, and folded towards the substratum, 1150-2415 μ long, 1150-2185 μ wide. Ratio: length/width = 1,3-1/1-1,2. Dorsal edge curved. Ventral edge hardly curved, occasionally nearly straight, slightly or not decurrent. Leaf insertion arched. Leaf apex bilobed, with narrow, pointed lobes which are usually erect, but can also be slightly convergent or divergent. Sinus broad, rounded, rarely pointed, 70-175 μ deep. Leaf margin indistinct. Leaf cells thin walled or slightly thickened. Trigones

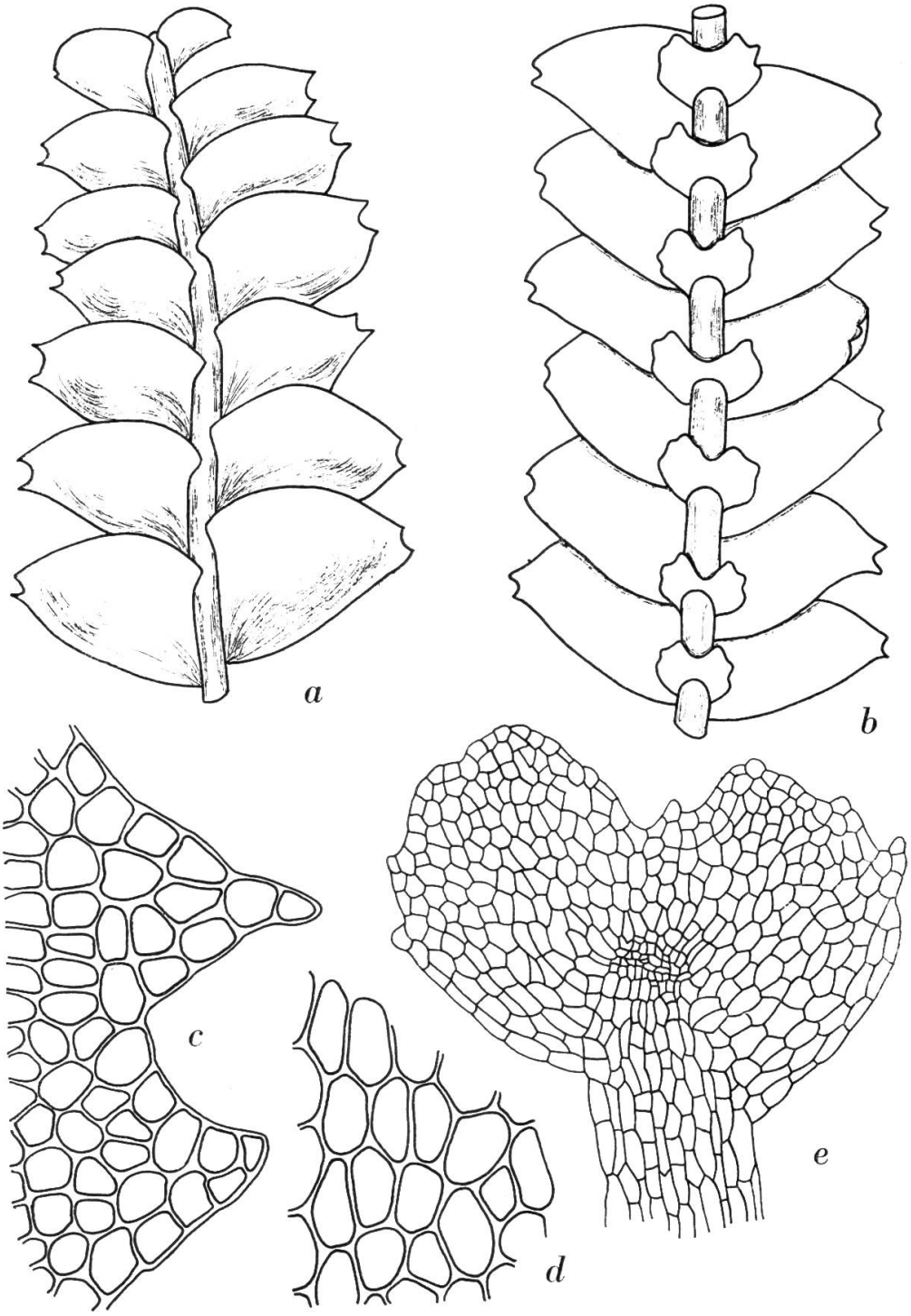

FIG. 27. — *Calypogeja biapiculata* (Spruce) Steph. (neotype).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150
d, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 60.

small or medium sized at the top, at leaf base usually more conspicuous. Cell dimensions: marginal 42-68 × 25-42 μ, apical 34-51 × 25-42 μ, central 34-85 × 25-51 μ, basal 51-110 × 34-51 μ. *Underleaves* 2,4-5,8 times the width of the stem, 385-989 μ long, 490-1380 μ wide. Strongly decurrent, from 105-385 μ. Ratio: length/width = 1/1,2-1,7. Outer edges rounded, bearing on each side, or at one side at least, two (rarely three or one) rounded protuberances, 3-5 cells wide, or two broad, pointed teeth. On some specimens they can become very indistinct. Apex divided to 3/10-6/10 of the underleaf length into two broad, usually rounded, or rarely pointed, lobes which are erect or slightly divergent. Sinus broad, rounded, bearing frequently on one or both sides a protuberance or a tooth, 84-266 μ deep. Underleaf cells thin walled or slightly thickened. Trigones small or medium sized. Cell dimensions: central 51-102 × 25-42 μ, marginal 42-68 × 25-42 μ. *Sterile. Cuticle* smooth.

Hab.: C. biapiculata forms dense mats, of yellowish, olive or dark green colour, on bark, rotten wood, damp soil or shaded rocks. Frequently it is associated with other Hepaticae. It has been gathered from sea level up to 1000 m.

Neotype: Guadeloupe, s.d., *L'Herminier s.n.* (G nº 1801).

Distr.: South America: Brazil, Peru. Central America: Dominica, Guadeloupe, Martinique, St. Vincent.

Other material studied: Brazil: Apiahy, s.d., *Puiggari 766 a* (G). Dominica: s.d., *Elliott 1137, 1627, 1699, 1867, 1883, 1904, 1988, 2117, 2195, 2248, 2276 p.p., 2293, 2305* (G); *1922* (G, M). Guadeloupe: s.d., *Duss 1032* (G); s.d., *Marie s.n.* (G nº 1822); s.d., *Duss s.n.* (G nº 1825); s.d., *L'Herminier s.n.* (G nº 1823). Martinique: s.d., *Duss 18, 26* (G). St. Vincent: s.d., *Smith s.n.* (G nº 1830).

Obs.: The type of *C. biapiculata* seems to be lost. The choice of a neotype was therefore unavoidable. Due to the fact that fertile plants are very rare, it was not possible to find a specimen with inflorescences. But Spruce's original description fits the vegetative parts of the chosen neotype very well; it is representative of the most common aspect of the species.

According to Spruce, *C. biapiculata* is dioecious, the female inflorescences being composed of strongly convex, imbricate and quadrifid bracts.

Much confusion existed around *C. biapiculata*, probably its type was lost quite a time ago. Stephani in any case did not see it. Thus he included in the species specimens from Colombia, Mexico and Jamaica which belong to *C. heterophylla* (Steph.) Steph. or *C. peruviana* Nees & Mont. thus confusing the general picture.

Stephani, when he was confronted with specimens of the true *C. biapiculata*, proceeded in different ways: some he described as a new species: *C. gigantea* Steph. The type is a robust plant, with strongly imbricate leaves and strongly decurrent, large underleaves with rounded lateral protuberances which can become indistinct. But without doubt it belongs to *C. biapiculata.*

In the original description however, STEPHANI speaks of bilobed underleaves, *lobis triangulatis porrectis acutis interdum bifidis*. In the *Icones* (G nº 1264), he made a drawing of the type *(Elliott 1137)* with such underleaves. But the analysis of the specimen shows its perfect concordance with *C. biapiculata*. The relative part of the underleaves in the original description and the drawings of them correspond neither to the type specimen of *C. gigantea* Steph., nor to any of the three other gatherings of the species kept in STEPHANI's collection. They all belong to *C. biapiculata*.

STEPHANI described later another *C. gigantea* Steph. (*Spec. Hep.* **6**:447. Jan. 30, 1924), from New Guinea. BEAUVERD, when he revised STEPHANI's sixth volume of the *Species Hepaticarum*, gave it a new name: *C. ledermannii* Beauverd (*Spec. Hep.* **6**:760. June 15, 1925). This species is not a *Calypogeja*, as is shown clearly also in the *Icones* (G nº 1195).

Others STEPHANI confused with *C. portoricensis* (Steph.) Evans, but the type of this species is very different from *C. biapiculata* (Spruce) Steph.

C. vincentina (Wright) Steph. is a synonym of *C. biapiculata*. Its type is a smaller plant with less imbricate and slightly decurrent leaves, and underleaves with pointed, broad teeth on their outer edges, but these features are not constant, and the species can therefore not be separated from *C. biapiculata* SPRUCE *(Journ. Linn. Soc. Bot.* **30**:355. 1894) and EVANS (*Bryologist* **10**:30. 1907) thought *C. vincentina* (Wright) Steph. to be a synonym of *C. portoricensis* (Steph.) Evans. But they surely did not see the type of the latter species, which is different by its smaller cell dimensions, and its smaller and less decurrent underleaves which bear only a single protuberance or tooth on their outer edges.

However, *C. biapiculata* is a quite polymorphous species. It is always large and robust, with fleshy stems, and its leaves always retain their typical shape, but are variable as regards the degree of imbrication and decurrence. The underleaves are always large and strongly decurrent, but the teeth or protuberances on their outer edges are variable. They can be rounded, or pointed, and conspicuous, or become very indistinct. This feature is very variable also in the underleaves of a same specimen, and all intermediates exist. It is therefore impossible to distinguish varieties or forms.

C. biapiculata can easily be distinguished from the other *Calypogeja* by its very peculiar underleaf shape. No other neotropical species of the genus have two or more appendages on the outer edges of their underleaves.

Subgroup 2.

Analytical key to the species

A 1. Leaves without auricle or protuberance at their base.
2. Leaves with an auricle or a protuberance at their base.

B 1. Ratio: length/width of the leaves = 1,4/1.
2. Ratio: length/width of the leaves = 1/1.

C 1. Leaf apex usually entire, when bidentate, the sinus is not more than 10 μ deep.
2. Leaf apex bilobed, with a sinus 70-140 μ deep.

D 1. Cells small. Leaf cells at the base of the leaves 60 × 34 μ. Underleaf cells in the centre of the underleaves 42 × 42 μ. Trigones medium sized to large, not nodulose.
2. Cells larger. Leaf cells at the base of the leaves 68 × 42 μ. Underleaf cells in the centre of the underleaves 68 × 42 μ. Trigones often nodulose.

E 1. Underleaves with spreading lobes, divided to 6/10-7/10 of the underleaf length.
2. Underleaves with overlapping lobes, divided to 9/10 of the underleaf length, and forming a longitudinal fold at their base.

	A	B	C	D	E
C. grandistipula	1	1	1	1	1
C. puiggarii	2	2	2	2	2

Dichotomous key to the species

Leaves without auricle or protuberance at their base. Ratio: length/width = 1,4/1. Leaf apex entire, rounded or pointed, rarely bidentate, with unicellular teeth and rounded, 10 μ deep sinus. Cells small, the basal cells of the leaves 60 × 34 μ, with medium sized or large, but not nodulose, trigones. Underleaves divided to 6/10-7/10 of their length, with spreading lobes. Underleaf cells small, in the centre of the underleaves 42 × 42 μ . . . . . 9. **C. grandistipula** (Steph.) Steph.

Leaves usually with an auricle or a protuberance at their base. Ratio: length/width = 1/1. Leaf apex bilobed, with rounded lobes and rounded, 70-140 μ deep sinus. Cells at the base of the leaves 68 × 42 μ, frequently with nodulose trigones. Underleaves divided to 9/10 of their length; lobes overlapping at their base and thus forming a longitudinal fold. Underleaf cells in the centre 68 × 42 μ . . 10. **C. puiggarii** Steph.

9. — **Calypogeja grandistipula** (Steph.) Steph. *Spec. Hep.* **3**:401. Jul. 31, 1908 = *Kantia grandistipula* Steph. *Hedwigia* **34**:52. 1895.

Icones: This paper fig. 28; Stephani, *Icones Hepaticarum* ined. in hb G nº 1223.

Stems creeping, fairly rigid, 1-1,5 cm long, 3 mm broad (leaves included). Stem width 210 μ. Cortical cells thin walled. Trigones lacking. Cell dimensions: 51 × 25 μ. *Rhizoides* few in number, variable in length, hyaline. *Lateral branches* rare. No flagelliform branches. *Leaves* strongly imbricate, convex, 1610 μ long, 1150 μ wide. Ratio: length/width = 1,4/1. Dorsal edges slightly irregular, quite strongly curved, the leaf overlapping the whole stem dorsally. Ventral edge curved, usually without a protuberance or an auricle at its base, not decurrent. Leaf insertion strongly arched. Leaf apex usually entire, rounded or pointed, rarely with two unicellular teeth separated by a rounded, 1-2 cells wide, sinus, maximum 10 μ deep. Leaf margins indistinct. Leaf cells thin walled. Trigones at the apex medium sized, towards the base becoming more conspicuous. Cell dimensions: marginal 42 × 25 μ, apical 34 × 34 μ, central 51 × 34 μ, basal 60 × 34 μ. *Underleaves* 3-4 times the width of the stem, 420 μ long, 630 μ wide. Strongly decurrent, from

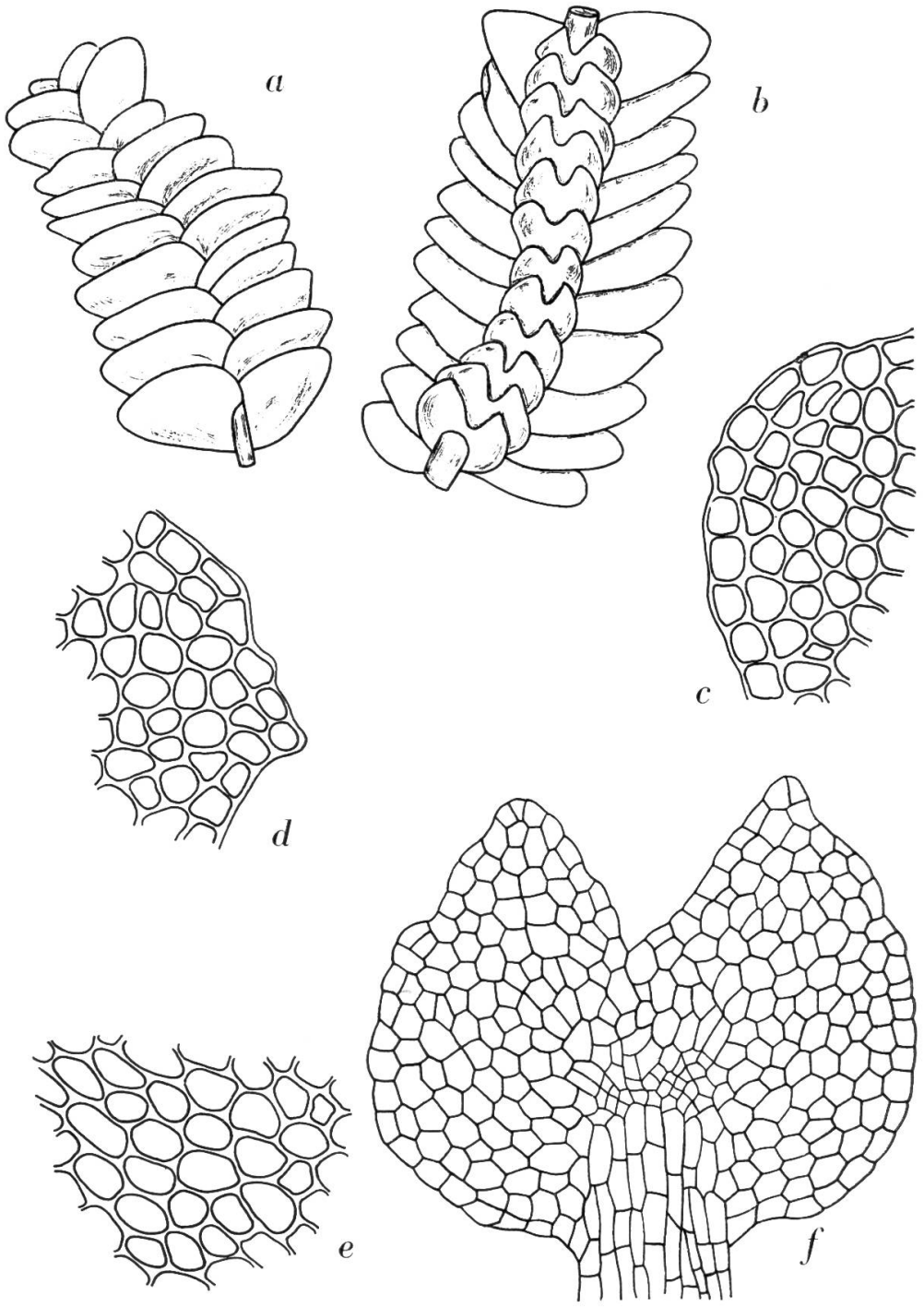

FIG. 28. — *Calypogeja grandistipula* (Steph.) Steph. (type).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex × 150 – *d*, leaf apex, × 150 – *e*, cells in the basal region of the leaf, × 150 – *f*, underleaf, × 100.

70 to 105 μ. Ratio: length/width = 1/1,5. Outer edges rounded, bearing usually on each side a more or less conspicuous, rounded protuberance. Apex divided to 6/10-7/10 of the underleaf length into two rounded or pointed, triangular, erect or slightly divergent lobes. Sinus rounded or pointed, 210-300 μ deep. Underleaf cells thin walled. Trigones medium sized to large. Cell dimensions: marginal 34 × 34 μ, central 42 × 42 μ. *Sterile*. *Cuticle* smooth.

Hab.: C. grandistipula (Steph.) Steph. forms whitish mats on damp soil. It is frequently associated with other Hepaticae, and has been gathered at low altitudes only.

Type: Brazil, Sitio, s.d., *Wainio 66* (G).

Distr.: South America: Brazil.

Obs.: C. grandistipula is a very peculiar plant, its general aspect being that of a whitish worm. Its leaves are so strongly imbricate and its underleaves overlap so completely that the stem is not visible.

By its strongly imbricate leaves and large underleaves the species bears some resemblance to *C. puiggarii* Steph. But its usually entire leaf apices, its distinct underleaf shape, and its slightly smaller cell dimensions separate it very clearly from the latter species.

C. grandistipula seems to be very rare, only one gathering being known until now. Its distribution is probably limited to the hot tropical zone.

10. — **Calypogeja puiggarii** Steph. *Spec. Hep.* 3:405. Aug. 31, 1908.

Icones: This paper, fig. 29; Stephani, *Icones Hepaticarum* ined. in hb G nº 1277.

Stems creeping, rigid an fleshy, 1-1,5 cm long, 2,5 mm broad (leaves included). Stem width 350 μ. Cortical cells thin walled, without trigones. Cell dimensions: 85-102 × 25-30 μ. *Rhizoides* numerous, long, hyaline. *Lateral branches* rare or absent. No flagelliform branches. *Leaves* strongly imbricate, convex, 1610 μ long, 1610 μ wide. Ratio: length/width = 1/1. Dorsal edges slightly irregular and strongly curved, overlapping the whole stem. Ventral edge curved, at the base with an auricle or a rounded protuberance, not decurrent. Leaf insertion strongly arched. Leaf apex bilobed, with triangular, usually rounded, rarely pointed, lobes. Sinus rounded, rarely pointed, 70-140 μ deep. Leaf margin indistinct. Leaf cells thin walled, with conspicuous, often nodulose, trigones from top to base. Cell dimensions: marginal 42 × 25 μ, apical 40 × 25-34 μ, central 60 × 34 μ, basal 68 × 42 μ. *Underleaves* 3-4 times the width of the stem, 630 μ long, 840 μ wide. Strongly decurrent, up to 200 μ. Ratio: length/width = 1/1,3. Outer edges rounded, bearing usually on each side a rounded protuberance. Apex divided to 9/10 of the underleaf length into two triangular, pointed or rounded, erect lobes. Sinus very narrow, pointed, 385 μ deep. The lobes overlap slightly at their base and the underleaf seems thus to have a longitudinal fold. Underleaf cells thin walled. Trigones large, rarely medium sized. Cell dimensions: marginal 37 × 34 μ. central 68 × 42 μ. *Inflorescences* dioecious. ♀ with small, bifid bracts. Marsupia 1 cm long, bearing rhizoides. *Cuticle* slightly papillose or smooth.

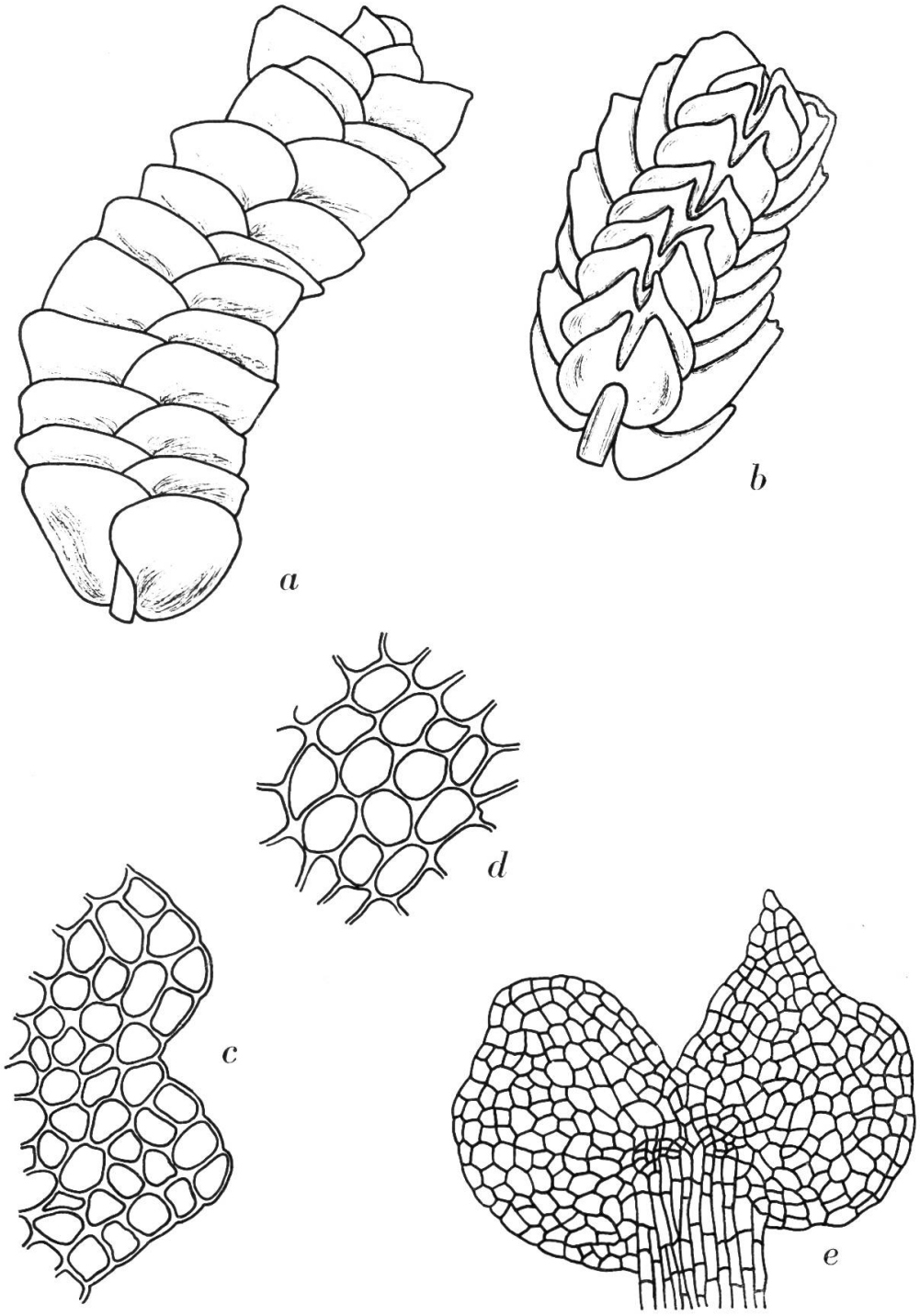

FIG. 29. — *Calypogeja puiggarii* Steph. (type).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 60.

HAB.: C. puiggarii Steph. forms yellowish or light green mats on damp soil or bark. It is frequently associated with other Hepaticae. It has been gathered at low altitude.

TYPE: BRAZIL. Apiahy. *Puiggari s.n.* [G nº 1829 (sub *C. puiggariana* Steph.)].

DISTR.: SOUTH AMERICA: Brazil.

OBS.: C. puiggarii has its leaves so strongly imbricate and its underleaves overlapping each other, that the stem, which is very fleshy, can not be seen. Its general aspect is vermiform. The most similar tropical american species is *C. grandistipula* (Steph.) Steph., which has the same appearance. But its auricled leaves, its bilobed leaf apices and its folded, very deeply divided, underleaves distinguish it from the latter species and from all other *Calypogeja*, assigning to it a quite isolated position in the genus.

Subgroup 3.

11. — **Calypogeja tenax** (Spruce) Steph. *Spec. Hep.* **3**:396. Jul. 31, 1908. = *Kantia tenax* Spruce, *Trans. Proc. Bot. Soc. Edinburgh* **15**:416. Nov. 1885.

ICONES: This paper fig. 30; STEPHANI, *Icones Hepaticarum* ined. in hb G nº 1215.

Stems creeping, 1-7 cm long, 4,4-5,3 cm broad (leaves included). Stem width 186-280 μ. The leaves become distinctly smaller towards the apex of the stems. Cortical cells thin walled, with often slightly sinuose walls. Trigones absent. Cell dimensions: 93-136 × 17-34 μ. *Rhizoides* usually numerous, variable in length, hyaline or yellowish. *Lateral branches* variable in number. No flagelliform branches. The stems are often asymmetrical. *Leaves* quite strongly imbricate, at times nearly opposite, 2100-3220 μ long, 910-1840 μ wide. Ratio: length/width = 1,6-2,5/1. The leaves towards the apex of the stems are smaller. Dorsal edge curved. Ventral edge slightly curved and hardly decurrent. The edges of the leaves are frequently folded over, giving to the stems a creased aspect. Leaf insertion arched. Leaf apex entire, largely rounded, at times truncate. Leaf margin indistinct. Leaf cells thin walled. Trigones small to medium sized. Cell dimensions: marginal 34-85 × 25-34 μ, apical 34-51 × 25-34 μ, central 51-76 × 25-42 μ, basal 68-153 × 34-42 μ. *Underleaves* 1,5-2,3 times the width of the stem, 231-455 μ long, 315-560 μ wide. Decurrent, from 60 to 170 μ. Ratio: length/width = 1/1-1,7. Outer edges rounded, bearing neither teeth nor protuberances. Apex divided to 7/10-8/10 of the underleaf length into two triangular, pointed or rounded, divergent lobes. Sinus rounded or pointed, 140-280 μ deep. Underleaf cells thin walled, trigones small or lacking. Cell dimensions: marginal 34-85 × 17-34 μ, central 51-85 × 25-34 μ. *Inflorescences* dioecious. ♀ opposite, with convex, strongly imbricate, rounded bracts which are smaller than the leaves. Bracteoles shortly bilobed. *Cuticle* smooth or slightly striate.

HAB.: C. tenax forms dense, green or olive mats on damp soil or rotten wood. It has been gathered exclusively in the tropical forests of the amazonian basin.

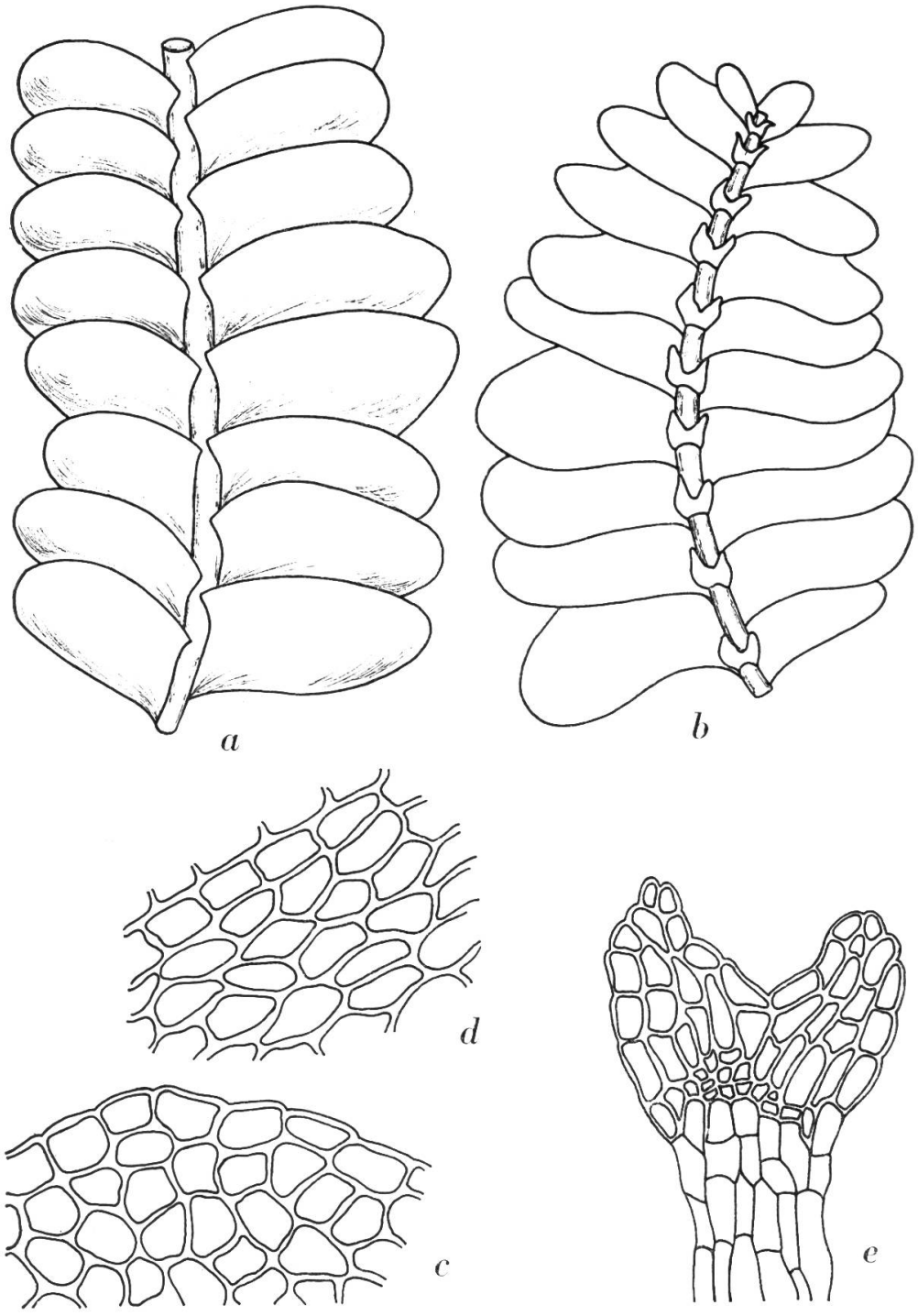

FIG. 30. — *Calypogeja tenax* (Spruce) Steph. (lectotype).
a, stem, dorsal aspect, × 15 – *b*, stem, ventral aspect, × 15 – *c*, leaf apex, × 150 – *d*, cells in the basal region of the leaf, × 150 – *e*, underleaf, × 100.

Lectotype: Brazil-Venezuela: San Carlos et fl. Uaupes, s.d., *Spruce s.n.* (MANCH).

Distr.: South America: Brazil, Venezuela.

Other material studied: Brazil: Fl. Uaupes, s.d., *Spruce s.n.* (MANCH). Brazil-Venezuela: *Hepaticae Spruceanae, Amazonicae et Andinae*, Silva Amazonica, San Carlos et fl. Uaupes, s.d., *Spruce s.n.* (G nos 1812, 1814, BM, LD, M). Venezuela: San Carlos, s.d., *Spruce s.n.* (G no 1813).

Obs.: Three original localities are cited by Spruce: Umirisal, Panure and " fl. Negro et Uaupes ". Unfortunately only the specimens corresponding to the third are kept in the collection of Spruce, the others seeming to be lost. It does not correspond to a localized region, San Carlos and the Uaupes river being more than 300 km apart and belong today to two different countries. But the choice of this specimen, which corresponds perfectly to Spruce's original description of *C. tenax* (Spruce) Steph. as the lectotype could not be avoided.

C. tenax seems to be an endemic species, located in the upper amazonian basin. Its leaf shape reminds one of the species included in subgenus *Caracoma* Bischler, from which it is separated by its different cell structure and its underleaves which are deeply bilobed and decurrent. *C. tenax* has thus a quite isolated position in the subgenus *Calypogeja*, being the only species with entire, elongated, largely rounded or truncate leaves.