

STUDIES ON COLOMBIAN CRYPTOGRAMS

IIb. HEPATICAE - OIL BODY STRUCTURE AND ECOLOGICAL
DISTRIBUTION OF SELECTED SPECIES
OF TROPICAL ANDEAN JUNGERMANNIALES

BY

S. R. GRADSTEIN, A. M. CLEEF and M. H. FULFORD

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Colura patagonica Jovet-Ast (fig. 12)

Oil bodies 7-12 in upper leaf cells, 10-20 in elongated basal leaf cells; globose to ellipsoid, 3-7(-10) × 3-5 μm; colourless, coarsely segmented, consisting of c. 15-30 aggregated droplets (Colombia, Boyacá, páramos NW of Belén, Cabeceras Q. El Toral, 3765 m, Cleef 2292e; Ecuador, páramos de El Angel, 17 km. S. of Tulcán, 3350 m, Gradstein, Lanier & Weber s.n.).

The presence of segmented oil bodies in *Colura patagonica* is remarkable because previous studies of living *Colura* (from Japan) reported homogeneous oil bodies (cf. Schuster & Hattori 1954; Inoue 1974).

Distribution and ecology :

Jovet-Ast (1976), who identified this specimen, noted the interesting geographical distribution of this rare species, which according to a recent publication by Solari (1976) was only known from a few localities in the southern tip of Chile (Punta Arenas, I. Desolación) and Argentina (Staten I., Pt. Vancouver). In the tropical Andes the species occurs epiphytically at about 3350-3750 m on tiny twigs of shrubs in the lower páramos, e.g. on *Polylepis* sp. and *Hypericum* sp., and often grows associated with *Dicranolejeunea nitidiuscula*. The present records of *Colura patagonica* from the neotropical páramos constitute a remarkable, yet not unexpected extension of its geographical range (compare e.g. *Pseudocephalozia quadriloba*), and adds a new taxon to the list of subantarctic elements in the páramo flora.

Dicranolejeunea axillaris (Nees & Mont.) Schiffn.

Oil bodies in median leaf cells 12-15 per cell, towards leaf base up to 20 per cell, small, c. 4-5 × 2-2,5 μm, ellipsoid to subglobose, finely granulose-papillose, becoming homogeneous on age (Galapagos Is., Santa Cruz, Mt. Crocker area, Gradstein, Lanier & Weber H 23).

Gradstein (1975) stated that *Dicranolejeunea* (Spruce) Schiffn. has homogeneous oil bodies, based on observations in material of *D. phyllorhiza* from Brazil. Now we find segmented oil bodies in *D. axillaris*, which is the

type species of the genus *Dicranolejeunea*. Since the observations in *B. axillaris* were made on fresh material in the field, whereas the Brazilian specimens were studied about one week after having been collected, no doubt the oil bodies in *Dicranolejeunea* are segmented rather than homogeneous.

Distribution and ecology :

According to Evans (1914) *Dicranolejeunea axillaris* is common throughout the mountains of Mexico, Central America, the West Indies and the Andes southwards to Chile. It is also common on the Galapagos Islands. In the Colombian Andes this species is widely distributed in the humid Subandean and Andean forests between about 1500 (1200 ?) and 2700 m, growing both terrestrial and epiphytic.

Dicranolejeunea lozensis (Gott.) Steph.

Oil bodies similar to those in *D. axillaris*, but slightly more numerous towards leaf base (20–25 per cell) (Galapagos Is., Santa Cruz, Mt. Crocker area, Gradstein, Lanier & Weber H69).

Distribution and ecology :

The species has been recorded from Venezuela, Colombia and Peru. This is the first report of the Galapagos Islands, where it was found occasionally on stems of trees and shrubs in the upper woodland zone on the island Santa Cruz. We have no information on its ecology in Colombia.

Drepanolejeunea navicularis Steph. (fig. 13)

Oil bodies in leaves 2–6 per cell, globose, 4–6 μm , colourless, finely granulose-papillose. Leaves with 2 ocelli in a row at leaf base (Colombia, Cauca, volcán Puracé, 3315 m, Cleef 550b).

Distribution and ecology :

Drepanolejeunea navicularis is only known from the extreme humid timberline forests from the Colombian Central and Eastern Cordillera between 3000 and 3500 m., over decaying bamboos of the lower subpáramo, in deep shade together with *Harpalejeunea* sp., *Lepidozia* sp., *Riccardia* sp. and *Leptoscyphus obcordatus*.

According to Bischler (1964: 173), *Drepanolejeunea navicularis* is one of 4 species of *Drepanolejeunea* endemic to the high Andes of Colombia and Ecuador. Three of them, *D. aurita*, *D. navicularis* and *D. andina*, are taxonomically closely related and probably evolved from a common ancestor within the isolated tropical high Andean biota.

Frullania lobato-hastata Steph.

Oil bodies 1–4 in upper and median leaf cells, 3–6 in elongated leaf-base cells; ellipsoid to globose, 6–12 \times 5–7 μm ; colourless, coarsely granulose-papillose. Stylus 3 cells long, capped by a large slime papilla, the cells each containing 4 small, globose, segmented oil bodies (Colombia, Cundinamarca, Cleef 285b).

Distribution and ecology :

This epiphytic liverwort is only known from the Eastern Cordillera of the Colombian Andes, where it is recorded from the Subandean forest at 1800 m, the Andean *Weinmannia* and *Quercus* forest and from the shrubby subpáramo at 3480 m.

Frullania riojaneirensis (Raddi) Aongstr.

Oil bodies in leaves large, 4–7 per cell, globose to ellipsoid, 5–13 × 5–7 μm , finely granulose (Colombia, Cundinamarca, subpáramo tree epiphyte, 3500 m, Florschütz 4463).

The specimens studied represent a rather robust mountain form of this species, characterised by the ventral leaf-lobe margin being more or less undulate.

Distribution and ecology :

According to Clark & Svihla (1945) this species is common and widespread throughout tropical America. In Colombia the species has been recorded from the Central and Eastern Cordillera and the Sierra Nevada de Santa Marta, occurring from the base of the mountains at about 600 m up to the páramos at 3700 m (Winkler 1976).

Gongylanthus granatensis (Gott.) Steph. (fig. 14)

Oil bodies small in comparison to the very large leaf cells, present in all cells, generally 3–6 per cell, in elongated leaf-base cells up to 12 per cell; (sub)globose, 6–10 μm in diam.; finely granulose-papillose (Colombia, Tolima, van der Hammen & Jaramillo 3324, det. R. Grolle).

The specimens studied were deeply green, all cells containing chlorophyll and oil bodies in contrast with specimens of *G. liebmannianus*, which are usually pale-hyaline having most leaf-cells a-chlorophyllose and without oil bodies. *G. granatensis* and *G. liebmannianus* seem to differ essentially by the leaves, which are strongly concave-involute in *G. liebmannianus* and \pm flattened in *G. granatensis* (R. Grolle, in litt.). The latter species is also somewhat larger in size.

Distribution and ecology :

A rare, rather large, dark-greenish species reported only from the Colombian Andes, ca. 3200–3400 m.

We have seen material from the Eastern Cordillera, where it was found in shrubby subpáramo near Bogotá, and from the South slope of the volcano Nevado del Tolima in the Central Cordillera, where the species occurs in humid *Weinmannia* cloud forest at 3300 m.

Gongylanthus liebmannianus (Lindenb. & Gott.) Steph. (fig. 15)

Oil bodies only present in green leaf cells containing chlorophyll, absent from colourless cells, 1–8 per cell, variable in size, becoming increasingly smaller when more

numerous; globose to subellipsoid; colourless, finely granulose-papillose. Measurements: 8–15 × 8–12 μm (Cleef 55c), 4–10 × 4–6 μm or 10–12 × 8–10 μm (Cleef 287c), 4–10 × 3–5 μm (Cleef 3428a) (Colombia, Cundinamarca, Cleef 55c (det. R. Grolle), 287c & 3428a).

A similar oil body distribution pattern is found in the genus *Stephaniella* (see below). Differences with *G. granatensis* are discussed under the latter species.

Distribution and ecology:

Gongylanthus liebmannianus is a terrestrial liverwort, only known from high elevations in Mexico, Central and South America.

In Colombia it is mainly a páramo species, extending from 3280 m up to about 4250 m in the superpáramo in the Sierra Nevada del Cocuy. We have only one collection from the humid upper Andean *Weinmannia* cloud forest. In the páramos of the Eastern Cordillera *G. liebmannianus* is quite common. It often grows associated with *Stephaniella paraphyllina*, but generally *G. liebmannianus* prefers more shadow and humidity than *Stephaniella*. It is found in a variety of humid vegetation types such as *Sphagnum* bogs, damp soil on banks along streams, dense *Espeletia* stands, *Diplostephium revolutum* dwarf forest and rock outcrops bearing a thin layer of soil.

Harpalejeunea ancistrodes (Spruce) Schiffn. (fig. 16)

Oil-bodies in leaves 4–8 per cell; ellipsoid to subglobose, 5–9 × 2–4 μm ; rather finely granulose. Leaves with two ocelli in a row at leaf base (Colombia, Cundinamarca, Cleef 398c).

Distribution and ecology:

This species is geographically distributed along the northern tropical Andes.

In Colombia *Harpalejeunea ancistrodes* has been collected in the Eastern Cordillera between 3200 and 3765 m in the upper Andean forest belt and the páramo. The species prefers protected sites with an equable humid microclimate, growing either epiphytically or terrestrial.

Herbertus limbatus (Steph.) Herz. (fig. 17)

Oil bodies in leaves averaging 10–20 per cell: in small upper leaf lobe cells only 5–10 per cell, in elongated vitta cells up to 35 per cell; ellipsoid to subglobose, 4–8 × 4–6 μm ; colourless, faintly granulose-papillose (Colombia, Cauca, Cleef 666a; *ibid.*, Cundinamarca, Cleef 779).

Distribution and ecology:

According to Fulford (1963) *Herbertus limbatus* is known from Costa Rica (900–2800 m) and the tropical Andes of Colombia and Ecuador (2400–4000 m).

In Colombia this robust reddish-brown liverwort has been collected in

the Central and Eastern Cordillera, in the humid Andean *Weinmannia* forests and in the páramos, up to 3835 m.

It grows on trees and shrubs, and in sheltered places also on boulders and on soil. In the páramos *H. limbatus* occurs in several vegetation-types: e.g. as conspicuous plants on stony slopes in the shrubby, atmospherically superhumid subpáramo and in the grasspáramo as a common element of the boggy *Swallenochloa* vegetation.

Herbertus oblongifolius (Steph.) Gradst. & Cleef *comb. nov.* (*Schisma oblongifolium* Steph., Spec. Hep. 4: 11. 1909)

Oil bodies present in all leaf cells, along leaf margin 5–8 per cell, in vitta cells 7–14 per cell; globose to bluntly subellipsoid, 5–7 × 6–10 μm ; colourless, finely and rather faintly papillose, becoming almost homogeneous on age. Cuticle densely striate-papillose (Colombia, Cleef & Van der Hammen 10382).

Herbertus oblongifolius is one of the smallest species of the genus *Herbertus*. The plants are dull greenish-brown to blackish, and the stems are very slender, usually broken or sparingly branched with long, ventral-intercalary branches. Stems and branches are often flagelliform with scalelike leaves, while rhizoids are lacking. Leaves resemble underleaves and are only 0.5–0.7 mm (!) long and bifid (rarely trifid) to $\frac{1}{2}$ – $\frac{2}{3}$ with erect, narrow triangular lobes. Also characteristic are the bluntish to subacute leaf tips (apex consisting of only one cell), the very wide vitta, which covers $\frac{2}{3}$ – $\frac{3}{4}$ of the lobe bases and bifurcates near the sinus, and the straight to very weakly auriculate leaf bases, which bear 1–2 short, hyaline cilia. The Colombian plants differ somewhat from the type (Brazil, Ule 448, G 18848-holotype!) by the more densely imbricated leaves and the more rigid stems, which might be an adaptation to the aquatic habitat.

Herbertus subnivalis Winkler (isotype in U!), recently described from the páramo of the Sierra Nevada de Santa Marta in Colombia (Winkler 1976), superficially resembles *H. oblongifolius*, but differs by the distinctly auriculate leaf bases, the much narrower vitta ($\frac{1}{4}$ – $\frac{1}{3}$ × lobe bases) which bifurcates near leaf base, and the acuminate (often broken!) leaf tips with uniseriate apex of 4–7 cells long. *H. subnivalis* might be a small form of *H. subdentatus* (Steph.) Fulf. [S.R. G. & A.M. C.].

Distribution and ecology:

The discovery of *H. oblongifolium* in the Colombian Andes is of considerable phytogeographic interest, because previously the species was only known from the Sierra Itatiaia in eastern Brazil, where it was collected at 2400 m on rocks in a gorge.

Our material came from the southern end of the Sierra Nevada del Cocuy in the Eastern Cordillera, where it was gathered in March 1977 from a shallow lake (Laguna El Amarillal) at 4065 m in the upper grass-páramo in the headwaters of Río Casanare. *Herbertus oblongifolius* was growing here in great abundance submerged over *Isoetes* sp., together with *Ditrichum*

submersum and a few plants of *Isotachis serrulata*. The submerged habitat is very unusual in the genus *Herbertus* and is not encountered in any other Andean species of this genus.

Isotachis lindigiana Gott. (fig. 18)

Oil bodies in leaves 2(-4) per cell; ellipsoid to globose, 6-10 × 4-6 μm ; colourless to grayish, finely granulose-papillose (Colombia, Cauca, Cleef & Fernandez 490a).

Distribution and ecology :

According to Fulford (1963) this rare species is known from the tropical Andes of Colombia, Ecuador and Bolivia at high elevations. Like other species of the genus *Isotachis* it always grows terrestrial.

In Colombia this green-reddish liverwort is known by a few records from the Andean forest and subpáramo belt of the Central and Eastern Cordillera. The specimen cited above (Cleef & Fernandez 490a) came from the upper Andean *Weinmannia* forest belt of the vulcano Puracé, where it was found on the shaded, damp walls of a trench dug by men in a forest clearing at 3470 m, associated with the liverworts *Clasmatocolea vermicularis*, *Riccardia* sp. and *symphyogyna* sp.

Isotachis multiceps (Lindenb. & Gott.) Gott.

Oil bodies 2 in all leaf cells (Grabandt 290a; Vital 9, 10) or 2-3 in upper and median leaf cells and 4-7 in basal leaf cells (Cleef 1887a, 3230); ellipsoid and 10-18 × 5-9 μm , or globose and 5-12 μm in diam.; colourless, finely to coarsely granulose-papillose, upon degeneration falling apart into numerous minute droplets (Colombia, Boyacá, Cleef 1887a; ibid., Cundinamarca, Cleef 3230; ibid., Grabandt & Idrobo 290a; Brazil, Mt. Itatiaia, Vital 3635 & 3659).

Distribution and ecology :

This reddish-green liverwort is widely distributed at high altitudes in the mountains of tropical America (Fulford 1963).

In Colombia *Isotachis multiceps* is very common in the open subpáramo and grasspáramo of the Eastern Cordillera, but it has also been collected in the Subandean and Andean forest of the Central and Eastern Cordillera, including the Sierra Nevada de Santa Marta. The species ranges in altitude from about 1250 to 4100 m!

In the páramos *I. multiceps* prefers humid and boggy vegetation types, e.g. *Swallemochloa* sward and dense *Espeletia* stands. It abounds in the *Sphagnum* bogs and was always found growing terrestrial. The species only penetrates the superpáramo if locally a condensation zone is present, e.g. on the Cerro Nevado de Sumapaz where it was gathered at 4070 m in the shelter of *Senecio vernicosus* shrub.

Isotachis serrulata (Sw.) Gott. *sensu lato*

Oil bodies in leaves 2-3 per cell; ellipsoid to subglobose, 8-16 × 6-10 μm ; colourless, finely to rather coarsely granulose-papillose (Colombia, Cundinamarca, Cleef 337b, 377 & 735; ibid., Grabandt & Idrobo 272).

Hatcher (1961) pointed out the close relationship of *I. serrulata* (Sw.) Gott. to *I. haematodes* (Lehm. & Lindenb.) Gott. and *I. madida* (Hook. & Tayl.) Mitt. Since it proved very difficult to distinguish between these species in our material, we have provisionally named all material *I. serrulata*, this being the oldest name [S.R. G. & A.M. C.).

Distribution and ecology:

Isotachis serrulata is distributed all over tropical America, at high altitudes. *I. madida*, however, occurs mainly in temperate South America. Distribution data are given by Hatcher (1960) and Fulford (1963).

In Colombia *I. serrulata* is a large and polymorphic species, very common in humid and wet places in the páramos and humid Andean forests of the Eastern and Central Cordillera, as well as in the Sierra Nevada de Santa Marta, ranging between 1800 and 4450 m from the Subandean forest up into the lower zone of the superpáramo. *I. serrulata* generally grows in big reddish clumps on bare soil, but it was also collected in boggy páramo.

In addition, the species is reported here for the first time from various aquatic habitats: 1) from shallow streamlets where it grows abundantly on mineral soil, 2) from a lake in the grass páramo at 3600 m, where it was found deeply submerged as greenish plants, and 3) from a lake covered by floating cushions of *Distichia* (Juncaceae) at 4100 m in the Sierra Nevada del Cocuy, where *I. serrulata* forms conspicuous reddish mats amongst the *Distichia* cushions.

Jamesoniella rubricaulis (Nees) Grolle

Oil bodies 2–5 in median leaf cells, up to 15 in elongated basal leaf cells; ellipsoid to globose, 9–15 × 7–10 μm; colourless, finely granulose-papillose (Colombia, Cundinamarca, Cleef 759a; *ibid.* Grabandt & Idrobo 344).

Distribution and ecology:

Grolle (1971) reported this species from the tropical mountains of South America and the Azores, at altitudes of about 1400 to 4000 m.

In the Colombian Eastern and Central Cordillera this conspicuous, reddish liverwort was commonly found between about 2900 and 3950 m, growing on soil, rocks and on wood. The lowermost records came from humid *Weinmannia* and *Quercus* cloud forests. At higher elevations in the subpáramo and the grass-páramo *Jamesoniella rubricaulis* abounds, especially in the atmospherically humid bamboo páramos. Here the species occurs in a variety of vegetation types, with a preference for grassy or shrubby vegetation on boulders and stony slopes.

Jungermannia sphaerocarpa Hook. (fig. 19)

Oil bodies 3–7 in upper and median leaf cells, 6–10 in basal leaf cells; ellipsoid to subglobose, 6–10 × 4–6 μm; colourless, very finely granulose with almost smooth surface (Colombia, Cundinamarca, Cleef 380a & 746a, det. J. Vaña).

The oil bodies fit the description of North American material of the species by Schuster (1969).

Distribution and ecology :

This inconspicuous, bright-greenish liverwort, holarctic in distribution, is in tropical America only known from high elevations. Vaña (1974) recorded the species from Mexico, Costa Rica, Colombia and Ecuador, at about 2400–4100 m.

In Colombia *Jungermannia sphaerocarpa* is known from the Central and Eastern Cordillera between 2380 and 4100 m. The species occurs frequently on open places in the humid Andean cloud forest belt and is probably common too in the páramos at higher elevations. It grows usually on wet, sandy and often gravelly soil, often near wet rocks.

Kurzia capillaris (Sw.) Grolle
(*Microlepidozia capillaris* (Sw.) Fulford)

Oil bodies are lacking in this and other species of the genus *Kurzia* (Colombia, Santander, Cleef, Garcia & Jaramillo 3512a).

Distribution and ecology :

According to Fulford (1966) *Kurzia capillaris* is the “most widespread species of *Microlepidozia* in Latin America”, occurring in the humid forests from the base of the tropical mountains up to the upper forest line.

In Colombia a few records are available from the upper *Weinmannia* and *Quercus* Andean forest in the Central and Eastern Cordillera between 2800 and 2900 m. The species grows mainly epiphytic in dense compact cushions on stems; occasionally it is found terrestrial or epilithic.

Kurzia verrucosa (Steph.) Grolle
(*Microlepidozia verrucosa* (Steph.) Fulford)

Oil bodies lacking (cf. *K. capillaris*!). The species is easily recognised by the strongly papillose outicle (Colombia, Cundinamarca, Cleef 106b).

Distribution and ecology :

According to Fulford (1966) *Kurzia verrucosa* has a distribution more or less similar to *Kurzia capillaris*, but is less common.

There are many records from Brazil. Most collections are from humid woods, where it grows on soil, logs and tree bases. Up to now there were no reports from páramos.

In Colombia we have seen *K. verrucosa* in bogs at 3600 m in the open grasspáramo near Bogotá, where the species grows in great quantity, associated with *Sphagnum* sp., *Racocarpus purpurascens*, *Riccardia* sp., *Odontoschisma falcifolium* and *Adelanthus lindenbergianus*. We have numerous additional collections of *Kurzia* from páramo bogs of the Colombian Eastern Cordillera. We would not be surprised if most of this material belongs to *K. verrucosa*.

Lejeunea flava (Sw.) Nees

Oil bodies 2-5 per cell throughout leaves and underleaves, ellipsoid with rather sharp, narrow points or, more rarely, globose; $7-14 \times 2-4 \mu\text{m}$ when ellipsoid, $2-4 \mu\text{m}$ when globose; finely papillose, colourless; in the stem cortex (10-)15-20(-25) per cell, smaller and \pm globose (Colombia, Santander, Cleef, Garcia & Jaramillo 3514).

This material disagrees with specimens of *Lejeunea flava* from the south-eastern U.S., which according to Schuster (1957) have more numerous, (3-) 5-12 oil bodies per cell. More over the oil bodies in the U.S. material are shorter, 3-10 μm in length. Since *L. flava* is a polymorphic species in which several geographic races have been distinguished by Schuster (l.c.) and Jones (1968), variation in characters of the oil bodies is not surprising.

Distribution and ecology :

A widely distributed, pantropical liverwort species, which penetrates into oceanic portions of the northern and southern hemisphere.

In Colombia it is a common forest hepatic, altitudinally distributed from near sea level up to the upper Andean forest line at about 3000 m. It was collected in humid as well as in rather dry Andean forest types.

Herzog (1955) identified an epiphyllic specimen from a Subandean forest at 1400 m on the Pacific slope of the Colombian Western Cordillera.

Lepidozia caespitosa Spruce (fig. 20)

Oil bodies in leaves 2-6 per cell; subglobose to ellipsoid, sometimes fusiform, $3-5 \times 2-3 \mu\text{m}$; grayish, finely granulose-papillose (leaf cells thick-walled, strongly striate-papillose) (Colombia, Cauca, Cleef 666c).

Distribution and ecology :

The distribution area of *Lepidozia caespitosa* as given by Fulford (1966) comprises the tropical mountains of Central and South America, ranging from Guatemala to Bolivia. The species seems to be most common in Colombia and Venezuela, between about 1500 and 3500 m.

In Colombia this small, hygrophytic liverwort was collected between 1700 and 3500 m in the Sierra Nevada de Santa Marta, in the Eastern and Central Cordillera and in the Serranía de la Macarena. This species occurs mainly in the Subandean and Andean *Weinmannia* forests, and grows on all kinds of substrates: soil, rocks and on other plants.

Lepidozia macrocolea Spruce (fig. 21)

Oil bodies 1-4 per cell throughout leaves and underleaves; irregularly globose to ellipsoid, $4-8 \times 2-4 \mu\text{m}$; colourless, coarsely granulose: each oil body consisting of (3-)5-10(-12) clustered droplets; in stem cortex cells oil bodies few, rather inconspicuous (Colombia, Cundinamarca, Cleef 96a, 286, 310a).

Distribution and ecology :

Fulford (1966) listed collections of this species from the Andes of northern

South America, from about 1200 m up into the páramos, occurring on similar substrates as *Lepidozia caespitosa*.

In Colombia *Lepidozia macrocolea* is known from the Eastern and Central Cordillera, including the Sierra Nevada de Santa Marta, ranging between about 1500 and 4000 m, except for one record at much lower elevation from the warm Amazonian forests in Vaupés (fide Fulford l.c.).

The species apparently prefers humid vegetation types, e.g. *Weinmannia* cloud forest and bamboo páramo. In the páramos it abounds in the *Sphagnum* bogs, associated with *Riccardia* spp. and *Swallenochloa* sp. We have no ecological information on reports from localities below 2900 m.

Leptoscyphus cleefii Fulford (fig. 22)

Oil bodies in leaves 2–5(–8) per cell; ellipsoid to globose, 5–13 × 4–7 μm ; colourless, finely granulose-papillose; in stem cortex cells globose and more numerous, 10–20 (–30) per cell (Colombia, Cundinamarca, Cleef 46c, 1565a, 1613, 3410a, 4064; ibid., Cauca, Cleef 668).

The oil bodies in *L. cleefii* agree with those reported in other species of the genus (Grolle 1962) except for their slightly greater length.

Distribution and ecology:

Leptoscyphus cleefii is a terrestrial, medium-sized, brownish to reddish-brown liverwort, up till now only known from the Colombian Central and Eastern Cordillera between 3220 and 4100 m. The species is a characteristic element of humid páramos and is particularly common in the atmospherically humid bamboo páramos. It is generally found on boggy slopes covered with *Swallenochloa* vegetation, in humid *Diplostephium revolutum* dwarf forest and in *Spagnum* – *Espeletia* bogs, frequently growing on organic debris or over decaying *Sphagnum*. As a rule the species grows associated with a lot of other hygrophytic bryophytes characteristic for open, cold habitats: e.g. *Sphagnum magellanicum*, *Breutelia* spp., *Riccardia* spp., *Campylopus dicnemioides* (C.M.) Par. (= *C. cucullatifolius* Herz., fide J. P. Frahm in litt.), *Lepidozia macrocolea*, *Cephalozia dussii*, *Isotachis multiceps*, *Odontoschisma* sp., *Kurzia* cf. *verrucosa* etc. *L. cleefii* penetrates the lower zone of the superpáramo on the Cerro Nevado de Sumapaz (4100 m) where favourable moisture conditions prevail in the local condensation zone. Here a few specimens were collected under *Senecio vernicosus* shrub. The lowermost collection of *L. cleefii* came from a clearing in the humid upper Andean *Weinmannia* cloud forest at 3220 m.

Leptoscyphus porphyrius (Nees) Grolle

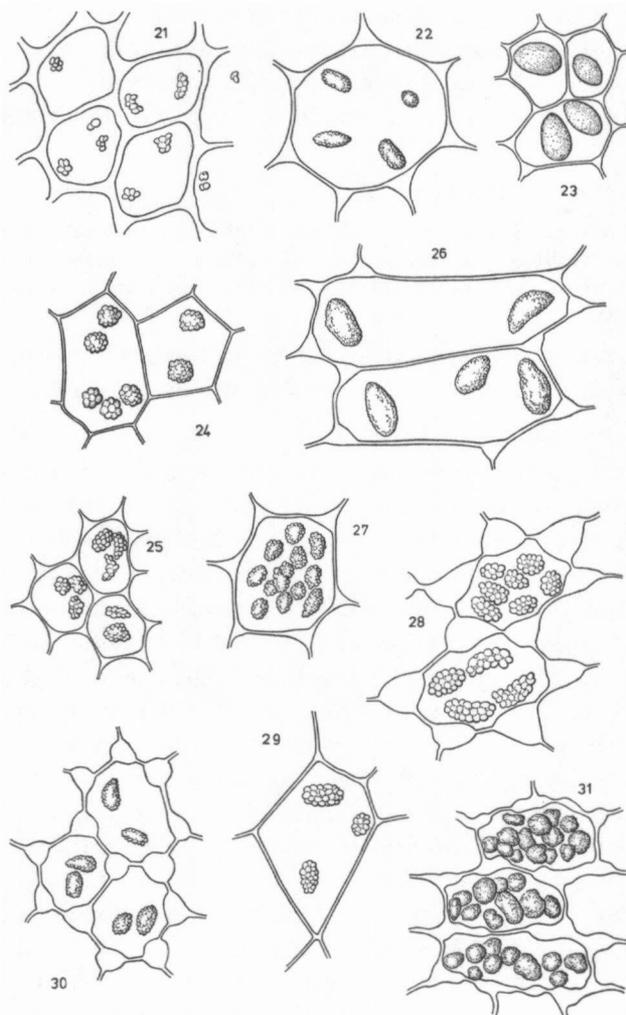
Oil bodies (degenerating!) in leaves 4–8 per cell; globose to short ellipsoid; colourless, coarsely granulose (when fresh probably more finely granulose!) (Colombia, Tolima, van der Hammen & Jaramillo 3377).

Distribution and ecology:

According to Fulford (1976) this species is widespread in tropical America,

but lacking in the West Indies; it occurs in many different plant formations from the base of the mountains up to 4300 m.

Terrestrial and epiphytic growing *Leptoscyphus porphyrius* is common throughout the Colombian Andes from 1700 m (Subandean forest) up to the superpáramo at 4300 m. Most records came from the superhumid



(PLATE 5) Oil bodies in Andean Jungermanniales. — 21. *Lepidozia macrocolea* Spruce, degenerating oil bodies, Cleef 96a (500×). 22. *Leptoscyphus cleefii* Fulf., Cleef 668 (500×). 23. *Lethocolea glossophylla* (Spruce) Grolle, Cleef 1560b (350×). 24. *Lophocolea coadunata* (Sw.) Nees, Cleef 679b (500×). 25. *Microlejeunea colombiana* Bischler, Cleef 398d (350×). 26. *Neesioscyphus* sp., van der Hammen 3326 (500×). 27. *Odontoschisma longiflorum* (Tayl.) Steph., Cleef 3410d (500×). 28. *Omphalanthus filiformis* (Sw.) Nees, Cleef s.n. (500×). 29. *Pseudocephalozia quadriloba* (Steph.) Schust., Cleef 2923 (500×). 30. *Syzygiella integerrima* Steph., van der Hammen 3278 (500×). 31. *Herbertus oblongifolius* (Steph.) Gradst. & Cleef, Cleef & van der Hammen 10382 (500×).

Weinmannia rollotii forests, especially in the headwaters of Río Casanare along the eastern slopes of the Eastern Cordillera. Additional material came from *Alnus jorullensis* forest at 3100 m and from an isolated *Gynoxys* dwarf forest in the grass-páramo at 3630 m. Though mainly occurring in the humid Andean forests, the species penetrates the páramos and even reaches the superpáramo if favourable humidity conditions are present. The highest sample (4300 m) was collected in a protected site near a streamlet on lava outcrops in the superpáramo of the Nevado del Ruiz.

Lethocolea glossophylla (Spruce) Grolle (fig. 23)

Oil bodies in leaves 1–2 per cell; usually large and bluntly ellipsoid, $15\text{--}20 \times 8\text{--}10 \mu\text{m}$, sometimes smaller and globose; brownish, minutely papillose (Colombia, Cundinamarca, Cleef 1560b; Ecuador, Páramo de Cotopaxi, Gradstein, Sipman & de Vries 2).

First report of oil bodies in *Lethocolea*. The large, brownish, very finely papillose oil bodies in *L. glossophylla* are very different from those in other species of liverworts described in this paper, but according to Dr. H. Inoue (pers. comm.) they are similar to oil bodies in the Asiatic genus *Jackiella* (Inoue 1974: 133).

Distribution and ecology:

A conspicuous, whitish-green liverwort from the South American Andes (Grolle 1965), in Colombia always growing in shaded places in the upper Andean *Weinmannia* forest and the lower páramos, either terrestrial or epilithic. Although not many records are known, the species is probably fairly common in the Colombian Eastern and Central Cordillera and its extension southwards into Ecuador. Records are from 2700–3750 m on wet rocks and damp soil. Winkler (1969, 1976) described a related terrestrial species, *L. repens*, from the subpáramo at 3300 m of the Sierra Nevada de Santa Marta.

Leucosarmentum portoricense Fulford

Cells of leaves and underleaves \pm hyaline, without distinct oil bodies (Colombia, Cundinamarca, Cleef 55e).

Within the Jungermanniales, absence of oil bodies has so far been found almost exclusively in genera belonging to Cephaloziaceae and Lepidoziaceae (Schuster 1966). Thus the absence of oil bodies in *Leucosarmentum* does not contradict the opinion of Crandall-Stotler (1974), who suggested to place the genus *Leucosarmentum* (Paracromastigaceae) in the Lepidoziaceae.

Distribution and ecology:

In her treatment of the genus *Leucosarmentum* Fulf., Fulford (1968) recorded only 2 collections of *L. portoricense*: from Puerto Rico and from Guatamala. A second species, *L. bifidum* (Steph.)Fulf. is known from

Guadeloupe and Martinique. The Colombian material reported here apparently represents the first South American record of the genus.

Leucosarmentum portoricense was collected in the Colombian Eastern Cordillera near Bogotá between 2850 and 3270 m, where it was growing in the subpáramo belt on damp soil along a streamlet, and on boulders in a clearing of the upper Andean forest.

The species seems to be restricted to deeply shaded habitats. Outside Colombia, the species has been collected only at much lower altitudes (c. 1000 m)!