

Hepaticae of Cerro Venamo, Venezuela, collected by J. Steyermark

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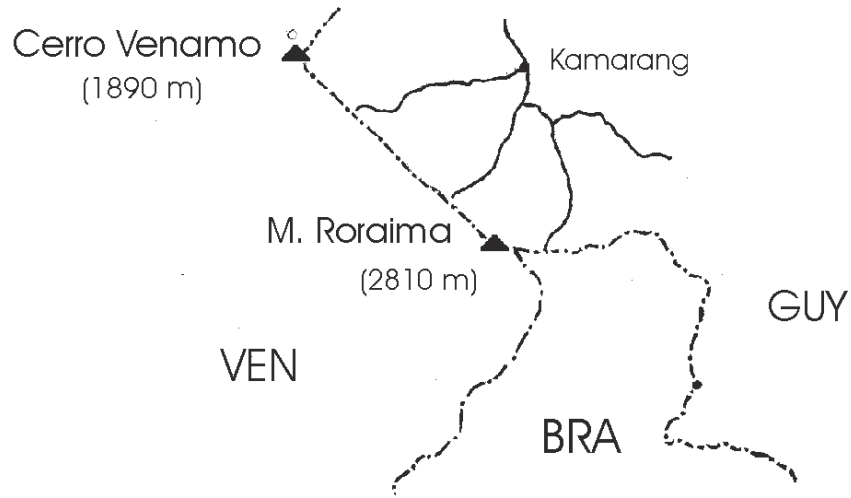
Abstract: A revision of herbarium material (NY) from Cerro Venamo, Venezuela (5°59' N, 61°23' W, 1890 m) yielded 77 hepatic species in 44 genera and 13 families. Most species have a neotropical distribution (75,32%), 6,49%, are pantropical and 9,09% are reported only from the tepuis.

This work is based on the revision of herbarium material held at the collection of The New York Botanical Garden (NY). During a visit of the authors to NY in June 2001, a series of Venezuelan hepatics collected by Julian Steyermark was left to their attention. Some of these collections were previously revised by Fulford (1972), who identified the hepatics of the Meseta of the Cerro Jaua and included species of Venamo in her successive works (Fulford 1966, 1968, 1976). We decided to review extant collections from Cerro Venamo (5°59' N, 61°23' W, 1890 m), on the border between Guyana and Venezuela in the tepui area (Figure 1a, b).

The tepuis, such as Cerro Venamo, possess a very distinctive flora typical of an "island". This flora developed as a result of the breaking up of the Pantepui into the isolate sandstone plateaus (or tepuis) and the effect of the local climate.

During the Pleistocene cyclical global climatic changes with reduction of temperature and rainfall caused plant populations to migrate in altitude (Hooghiemstra *et al.* 2002). In this area, lowland species were isolated on the cloud-forested summits, which contributed to speciation (Steyermark 1982).

In this paper 77 hepatic species in 44 genera and 13 families are reported for Cerro Venamo, Venezuela. Most of these taxa have a neotropical distribution (75.32%), few are pantropical (6.49%), while 9.09% are strictly reported from tepui areas. This hepatic flora shows the great influence of the surrounding floras (Amazonian, Andean, Caribbean), as well as the pantropical one, to the flora of the tepuis, as was confirmed by Steyermark (1982). Moreover it specifically emphasizes the high number of endemic hepatic species that occurs



1b



1a

Figure 1. Geographical location of Cerro Venamo. A. NE South America, showing area in detail.

on the tepuis, which was previously reported by Gradstein *et al.* (2001) as the second most important center of endemism for hepatics.

Major hepatic genera from montane areas such as *Plagiochila*, *Bazzania* and *Lepidozia* are far from complete in this list. An accurate account of species in those genera for Venamo awaits the completion of neotropical treatments of species that allow identification of the material to species level. Thallose taxa are also underrepresented in this list. The Lejeuneaceae are the richest family with 48% of the total species number.

The genus *Trabacellula* and *Adelanthus squarrosus* Grolle are endemic to the Guianan Planalto (Gradstein & Costa in press, Grolle 1989). Species of *Micropterygium* and *Drepanolejeunea* are particularly rich in the examined collections (8 species each). Three *Micropterygium* species are reported as endemic from tepui areas (*M. bolivarense* Fulford, *M. bialatum* Fulford and *M. grandistipulum* Fulford). About half of the species in this genus appear as endemic for the Guianan Planalto (Gradstein & Costa in press) and it makes an important contribution to the endemic component. It must be considered that the species in *Micropterygium* are very variable, and the genus is in need of revision (Schuster 2000). After revision of critical endemics, the number may be then lower than so far considered.

Further collections on top of the tepuis are needed to assess the value of the area as a center of endemism.

The arrangement of the families follows Grolle (1983) with some modifications after Gradstein *et al.* (2001). The collection numbers refer to those of Steyermark and in many cases the habitat descriptions are simply transcribed from his labels. All specimens are deposited at NY, unless otherwise specified.

HERBERTACEAE

Herbertus pensilis (Taylor) Spruce On tree trunk, 950-1400 m, 92296 p.p.; on tree trunk,

1000 m, 92277. Neotropical (Gradstein & Pinheiro da Costa in press).

Herbertus divergens (Steph.) Herzog Epiphyte on tree branch, 950-1150 m, 92432 p.p. Neotropical (Gradstein & Pinheiro da Costa in press).

TRICHOCOLEACEAE

Trichocolea tomentosa (Sw.) Gottsche On ground at base of tree along stream, 1400-1575 m, 92575. Neotropical (Fulford 1962).

LEPIDOZIACEAE

Arachniopsis diacantha (Mont.) Howe On moist rock fall of sandstone bluff, with running water below summit, 1500 m, 92560 p.p. Pantropical (Gradstein & Costa in press).

Bazzania roraimensis (Mont.) Fulford On tree trunks and branches, 950-1400 m, 92296 p.p., 92469, 92432, 92451 p.p. Neotropical (Fulford 1962).

Lepidozia macrocolea Spruce On soil, rock faces and trunks of trees, 1220-1275 m, Steyermark & Dunsterville 92373 (VEN, *fide* Fulford 1966). A species well distributed in northern South America, in middle elevations (Fulford 1966).

Micropterygium bialatum Fulford On moist soil banks and sandstone bluffs, 1500 m, Steyermark & Dunsterville 92586 p.p., 92565 p.p. (VEN, *fide* Fulford 1966). Restricted to the tepuis in Venezuela (Fulford 1966).

Micropterygium bolivarense Fulford On sandstone rocks, ledges, sandy soil along streams and on trees in dense forests, Steyermark & Dunsterville 92244 p.p., 92246 p.p., 92259 p.p., 92310 p.p. (VEN, *fide* Fulford 1966). Confined to the tepui areas of Venezuela (Fulford 1966).

Micropterygium campanense Spruce ex Reimers On sandy banks along streams, bases of trees, rocks, logs, 1000 m, Steyermark & Dunsterville 92259 p.p. (VEN, *fide* Fulford 1966). Distributed in Peru and

Venamo, 950-1400 m, Steyermark 94552 p.p. (VEN, *vide* Fulford 1968). Widely distributed species in middle elevations throughout tropical America (Fulford 1968).

Nowellia caribbeana Fulford On dead bark, 950-1150 m, 92235 p.p., 92232 p.p., 92222 p.p., 92230 p.p.; 92418 p.p., 92231 p.p., 92216, 92278. Reported from the Caribbean, Central America and Venezuela (Fulford 1968).

Trabacellula timidula Fulford On dead bark, 950 m, 92232 p.p. This genus seems to be restricted to the tepuis (Fulford 1968, Gradstein & Florschütz-de Waard 1989).

JUNGERMANNIACEAE

Cryptochila grandiflora (Lindenb. & Gottsche) Grolle In sandy soil along stream, 1400-1575 m, 92606. This is a pantropical and Southern Hemispheric species (Gradstein & Costa in press).

SCAPANIACEAE

Scapania portoricensis Gottsche On moist sandstone escarpment and base of trees below summit, 1500 m, 92562. Widespread in mountain regions of tropical America (Gradstein & Costa in press).

GEOCALYCEAE

Heteroscyphus combinatus (Nees) Schiffn. On soil and wood, Steyermark & Dunsterville 92575 (VEN, *vide* Fulford 1976). Distributed in middle and high elevations from Brazil to Mexico (Fulford 1976).

Heteroscyphus marginatus (Steph.) Fulford On trees, 950-1150, Steyermark 92369 p.p. (VEN, *vide* Fulford 1976). Montagne species occurring along the Andes from northern Bolivia to Costa Rica (Fulford 1976).

Leptoscyphus ovatus (Nees) Grolle On rocks and trees, 1000 m, Steyermark & Dunsterville 92259, 95582 p.p. (VEN, *vide* Fulford 1976). Species known from Central America, the Caribbean and northern South America (Fulford 1976).

Leptoscyphus gibbosus (Taylor) Mitt. On trees and shrubs, Steyermark & Dunsterville 92453 (VEN, *vide* Fulford 1976). This species is known from the Caribbean and northern South America (Fulford 1976).

Leptoscyphus porphyrius (Nees) Grolle On fallen palm log, 1030-1100 m, 92977 p.p.; On dead trunk of tree fern, 1000 m, 92258 p.p.; epiphyte on tree trunk, 900-1000 m, 92882 p.p. Species widely distributed in the neotropics (Fulford 1976).

Lophocolea trapezoidea Mont. Epiphyte on sheathing base of *Neurolepis*, 1395-1400 m, 92445 p.p. Also reported by Fulford (1976) from this locality, this is a widespread neotropical species.

Odontoschisma longiflorum (Taylor) Steph. On decaying logs, 1400-1575 m, Steyermark & Dunsterville 92555 p.p. (VEN, *vide* Fulford 1968). Species distributed in northern South America and the Caribbean (Fulford 1968).

PLAGIOCHILACEAE

Plagiochila cf. vincentina Lindenb. On tree trunk, 950-1400 m., 92296 p.p. Neotropical (Gradstein & Costa in press).

Plagiochila cucullifolia Jack & Steph. Epiphyte on living tree branch, 1395-1400 m, 92453 p.p. Scattered in mountain areas of central America and the northern and central Andes (Heinrichs 2002).

JUBULACEAE

Frullania ecuadoriensis Steph. Epiphyte on tree branch, 950-1150 m, 92432 p.p.; on living branch of tree, 1000 m, 92257 p.p.; on fallen palm log, 1030-1100 m, 92977 p.p.

Venezuela (Fulford 1966).

Micropterygium grandistipulum Steph. On sandstone escarpment, 1500 m, Steyermark & Dunsterville 92593 (VEN, *vide* Fulford 1966). This species appears to be restricted to the tepui areas of Venezuela and Guyana (Fulford 1966).

Micropterygium pterygophyllum (Nees) Trevisan On trees, rocks, sandstone bluffs and soil, 950 m, Steyermark & Dunsterville 92228 p.p., 92630 (VEN, *vide* Fulford 1966). Known from the Amazon basin to middle elevations in northern South America (Fulford 1966) and southeastern Brazil (Gradstein & Costa in press.).

Micropterygium tatei Reimers In dense mats of moist boulder at base of waterfall, 1220-1275 m, 92786. Known from the Andes in Venezuela (Fulford 1966).

Micropterygium trachyphyllum Reimers On logs or bases of tree trunks, 950 m, 92217, 92218 (also reported by Fulford 1966). Species widespread in the Caribbean and northeastern South America (Fulford 1966), has also been collected in Costa Rica (Dauphin in prep.).

Micropterygium tumidulum Fulford At base of sandstone bluffs, 1220-1275 m, 92758. Previously known from the Auyan Tepui and Mt. Roraima (Gradstein & Florschütz-de Waard 1989)

Mytilopsis albifrons Spruce On trunks and branches of trees, moist rocks, 1000 m, Steyermark & Dunsterville 92243 p.p., 92542 p.p. (VEN, *vide* Fulford 1966). Known from higher elevations areas in the Caribbean, the Andes and Brazil (Fulford 1966, Gradstein & Costa in press.).

CALYPOGEIACEAE

Calypogeia cellulosa (Spreng.) Steph. On moist rock fall of sandstone bluff, with running water below summit, 1500 m, 92560 p.p. Known from the Caribbean and Mt. Roraima (Gradstein & Florschütz-de Waard 1989).

Calypogeia laxa Lehm. ex Lindenb. Creeping

along tree trunk, 900-1000 m, 92855. Neotropical (Gradstein & Costa in press.).

Calypogeia miquelii Mont. Epiphyte on sheathing base of *Neurolepis*, 1395-1400 m, 92445 p.p. Neotropical (Gradstein & Costa in press.).

Calypogeia peruviana Nees & Mont. Río Venamo, 900-1150 m, Steyermark & Dunsterville 92445 p.p., 92575 p.p., 92855 p.p., Steyermark 92582 p.p. (VEN, *vide* Fulford 1968). Widely distributed, this species occurs in middle elevations throughout the neotropics (Fulford 1968).

Calypogeia rhombifolia (Spruce) Steph. Río Venamo, 1200-1275 m, Steyermark 92751, 92752 (VEN, *vide* Fulford 1968). Species distributed in middle elevations in the central and northern Andes and the Lesser Antilles (Fulford 1968).

Calypogeia venezuelana Fulford On escarpment, Steyermark & Dunsterville 92595 p.p. (VEN, *vide* Fulford 1968). Known only from the tepui areas in Venezuela (Fulford 1968).

ADELANTHACEAE

Adelanthus squarrosus Grolle Terrestrial or on moist rock fall of sandstone bluff, with running water below summit, 1400-1575 m, 92542, 92560 p.p. Described by Grolle (1989) this species was previously known from Mt. Roraima, and appears to be endemic to the tepuis.

CEPHALOZIACEAE

Alobiella husnotii (Gottsche) Steph. On sandstone bluff escarpment where water is running, 1500 m, 92586 (det. B. Thiers & G. Dauphin). Previously known from the Caribbean mountains, Fulford (1968) reported this species from Mt. Guayrapurina in Peru as *A. campanensis* Stephani (Fulford 1972). Gradstein & Florschütz-de Waard (1989) reported this taxon from Mt. Roraima.

Anomoclada portoricensis (Hampe & Gottsche) Váña On dead log, 950 m, 92235 p.p., on

mossy log, 950 m, 92228 p.p. Reported by Fulford for this locality as *A. mucosa* Spruce. Distributed in Northern South America and the Caribbean (Fulford 1968).

Cephalozia caribbeana Fulford Río Venamo, 950-1400 m, Steyermark 94552 p.p. (VEN, *vide* Fulford 1968). Widely distributed species in middle elevations throughout tropical America (Fulford 1968).

Nowellia caribbeana Fulford On dead bark, 950-1150 m, 92235 p.p., 92232 p.p., 92222 p.p., 92230 p.p.; 92418 p.p., 92231 p.p., 92216, 92278. Reported from the Caribbean, Central America and Venezuela (Fulford 1968).

Trabacellula timidula Fulford On dead bark, 950 m, 92232 p.p. This genus seems to be restricted to the tepuis (Fulford 1968, Gradstein & Florschütz-de Waard 1989).

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SCAPANIACEAE

Scapania portoricensis Gottsche On moist sandstone escarpment and base of trees below summit, 1500 m, 92562. Widespread in mountain regions of tropical America (Gradstein & Costa in press).

GEOCALYCEAE

Heteroscyphus combinatus (Nees) Schiffn. On soil and wood, Steyermark & Dunsterville 92575 (VEN, *vide* Fulford 1976). Distributed in middle and high elevations from Brazil to Mexico (Fulford 1976).

Heteroscyphus marginatus (Steph.) Fulford On

trees, 950-1150, Steyermark 92369 p.p. (VEN, *vide* Fulford 1976). Montagne species occurring along the Andes from northern Bolivia to Costa Rica (Fulford 1976).

Leptoscyphus ovatus (Nees) Grolle On rocks and trees, 1000 m, Steyermark & Dunsterville 92259, 95582 p.p. (VEN, *vide* Fulford 1976). Species known from Central America, the Caribbean and northern South America (Fulford 1976).

Leptoscyphus gibbosus (Taylor) Mitt. On trees and shrubs, Steyermark & Dunsterville 92453 (VEN, *vide* Fulford 1976). This species is known from the Caribbean and northern South America (Fulford 1976).

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Lophocolea trapezoidea Mont. Epiphyte on sheathing base of *Neurolepis*, 1395-1400 m, 92445 p.p. Also reported by Fulford (1976) from this locality, this is a widespread neotropical species.

Odontoschisma longiflorum (Taylor) Steph. On decaying logs, 1400-1575 m, Steyermark & Dunsterville 92555 p.p. (VEN, *vide* Fulford 1968). Species distributed in northern South America and the Caribbean (Fulford 1968).

PLAGIOCHILACEAE

Plagiochila cf. vincentina Lindenb. On tree trunk, 950-1400 m., 92296 p.p. Neotropical (Gradstein & Costa in press).

Plagiochila cucullifolia Jack & Steph. Epiphyte on living tree branch, 1395-1400 m, 92453 p.p. Scattered in mountain areas of central America and the northern and central Andes (Heinrichs 2002).

JUBULACEAE

Frullania ecuadoriensis Steph. Epiphyte on tree

branch, 950-1150 m, 92432 p.p.; on living branch of tree, 1000 m, 92257 p.p.; on fallen palm log, 1030-1100 m, 92977 p.p. Neotropical (Stotler 1970).

LEJEUNEACEAE

- Anoplolejeunea conferta* (Meissn.) A. Evans Epiphytic or on dead logs, 950-1150 m, 92432 p.p., 92235 p.p. Common and widespread at higher elevations in tropical America (Gradstein *et al.* 2001).
- Amphilejeunea reflexistipula* (Lehm. & Lindenb.) Gradst. On bark of living tree trunks, 950-1400 m, 92288 p.p. Widespread at rather low elevations in tropical South America (Gradstein *et al.* 2001).
- Aphanolejeunea ephemeroides* R. M. Schuster. Epiphyllous on leaves of *Tovomita*, 950-1150 m, 92338 p.p. North America (Florida), Central America and the Caribbean islands (Lücking 1995).
- Blepharolejeunea saccata* (Steph.) van Slageren & Kruijt. Epiphyte on tree trunk, 900-1000 m, 92882. Scattered in the northern Andes, Central America and the Greater Antilles (Gradstein *et al.* 2001).
- Bromeliophila helenae* Gradst. In water at base of leaves of *Brocchinia tatei*, 950-1400 m, 92312. Guayana Highland and the Lesser Antilles (Gradstein *et al.* 2001).
- Ceratolejeunea cornuta* (Lindenb.) Steph. On branches, twigs, logs and humic soil, 950-1150 m, 92394 p.p., 92737, 92233 p.p., 92238 p.p., 92418 p.p., 92292 p.p., 92432 p.p. This is a very widely distributed neotropical species (Dauphin in press).
- Ceratolejeunea filaria* (Taylor ex Lehm.) Steph. On living or dead bark, terrestrial or epipetric, 950-1000 m, 92241, 92228 pp, 92257 p.p., 92882 p.p., 92234 p.p., 92251 p.p., 92555 p.p. Species widely distributed in the in middle and high elevations in the neotropics (Dauphin in press).
- Ceratolejeunea patentissima* (Hampe & Gottsche) A. Evans On branches or rocks, 900-1400 m, 92454 p.p., 92890, 92453, 92451. Neotropical species confined to wet middle and upper elevation areas in Central America, the Caribbean and northern South America (Dauphin in press.).
- Cheilolejeunea fragrantissima* (Spruce) R. M. Schuster On trunks, 950-1400 m, 92224 p.p., 92977 p.p., 92242, 92882 p.p., 92229 p.p., 92454 p.p. Northern south America (Gradstein & Costa in press).
- Cheilolejeunea holostipa* (Spruce) Grolle & R. L. Zhu Epiphyte on small branches, 950-1150 m, 92418 p.p. Widespread in the Neotropics (Grolle *et al.* 2001).
- Cheilolejeunea inflexa* (Hampe ex Lehm.) Grolle On bark, 950-1400 m, 92256, 92257 p.p., 92418 p.p., 92251 p.p., 92454 p.p. Tropical America (Gradstein & Costa in press).
- Cheilolejeunea rigidula* (Nees & Mont.) Steph. Epiphyte on small branches, 950-1150 m, 92418 p.p. Widespread in tropical America, also tropical Africa (Gradstein & Costa in press).
- Cheilolejeunea trifaria* (Reinw. *et al.*) Mizut. Epiphyte on living tree trunk, 1220-1275 m, 92800. Pantropical (Gradstein & Costa in press).
- Colura tenuicornis* (A. Evans) Steph. Epiphyllous on fronds of *Syngramme*, 950-1400 m, 92307 p.p. Pantropical (Gradstein & Costa in press).
- Cyclolejeunea convexistipa* (Lehm. & Lindenb.) A. Evans Epiphyllous, 900-1150 m, 92338, 92865 p.p., 92236 p.p. Neotropical (Gradstein *et al.* 2001).
- Cystolejeunea lineata* (Lehm. & Lindenb.) A. Evans On living and dead bark, tree ferns and sandstone escarpments, 950-1500 m, 92245, 92246 p.p., 92258 p.p., 92229 p.p., 92234 p.p., 92296 p.p., 92582. West Indies and adjacent mainland areas of Mexico, Costa Rica, Panama, the Chocó region of Colombia and Guyana (Mt Roraima) (Gradstein *et al.* 2001).
- Diplasiolejeunea* sp. Epiphyllous on fronds of *Syngramme*, 950-1400 m, 92307.
- Drepanolejeunea campanulata* (Spruce) Steph. On dead log, 950 m, 92220 p.p. Northern Andes (Colombia, Ecuador), southeastern Brazil (Gradstein & Costa in press).
- Drepanolejeunea crucianella* (Taylor) A. Evans

- Epiphyllous or corticolous, 900-1150 m, 92394 p.p., 92865 p.p. Neotropical (Bischler 1964).
- Drepanolejeunea fragilis* Bischler On fallen log, 1030-1100 m, 92980 p.p. Neotropical (Bischler 1964).
- Drepanolejeunea inchoata* (Meissn.) Steph. Epiphyllous on leaves of *Peperomia*, 950-1400 m, 92290 p.p. Common throughout the mountains of tropical America (Gradstein & Costa in press).
- Drepanolejeunea lichenichola* (Spruce) Steph. Epiphyllous or corticolous, 950-1400 m, 92290 p.p., 92307, 92238 p.p. 92865 p.p., 92418 p.p. Tropical America (Gradstein & Costa in press).
- Drepanolejeunea palmifolia* (Nees) Steph. On living and dead bark, 950-1000 m, 92244, 92224 p.p., 92246 p.p. South America (Bischler 1964).
- Drepanolejeunea pinnatiloba* Schiffn. On dead bark, 950 m, 92222 p.p., 92237 p.p., 92230 p.p., 92258 p.p., 92236 p.p., 92220 p.p. Central America (Bischler 1964).
- Drepanolejeunea submuricata* R. M. Schuster On bark and boulders along streams, 950-1150 m, 92239, 92328, 92329, 92432 p.p.). Dominica (Schuster 1996).
- Harpalejeunea oxyphylla* (Nees & Mont.) Steph. Epiphyllous or on dead logs, 900-1100 m, 92865 p.p., 92980 p.p. Central America and South America (Lücking 1995).
- Lejeunea grossitexta* (Steph.) E. Reiner & Goda On dead bark, 950 m, 92220 p.p., 92222 p.p., 92237p.p., 92230 p.p., 92233 p.p., 92234 p.p., 92238 p.p., 92236 p.p. Southeastern Brazil, Paraguay and northern Argentina (Misiones) (Reiner-Drehwald & Goda 2000).
- Lopholejeunea subfusca* (Nees) Schiffn. On tree branch, 950-1150 m, 92394 p.p. Pantropical (Gradstein 1994).
- Microlejeunea epiphylla* Bischler On tree branch, 950-1150 m, 92394 p.p. South America, Central America and the Caribbean (Lücking 1995).
- Omphalanthus fliformis* (Sw.) Nees On living stem near tip of flowering branch of *Moronobea*, 1400 m, 92687. Throughout the mountains of tropical America (Gradstein & Costa in press).
- Prionolejeunea* sp. On bark of tree, 950-1400 m, 92291.
- Prionolejeunea* sp. On mossy ground, 950-1400 m, 92292 p.p.
- Prionolejeunea denticulata* (Weber) Schiffn. On dead bark, 950 m, 92232 p.p. Tropical America (Gradstein & Costa in press).
- Pycnolejeunea macroloba* (Nees & Mont.) Schiffn. On living tree bark, 1395-1400 m, 92449. Costa Rica, Panama, Colombia, Venezuela, Brazil, French Guiana, Guyana and Surinam (He 1999).
- Pycnolejeunea papillosa* X.-L. He On branches or fallen logs, 950-1150 m, 92418 p.p., 92977 p.p. Brazil and Venezuela (He 1999).
- Trachylejeunea aneogyna* (Spruce) Grolle On trunks and logs, 950-1150 m, 92228 p.p., 92235 p.p., 92359 p.p. Brazil and Suriname (Gradstein & Costa in press).
- Xylolejeunea aquarius* (Spruce) X.-L. He On fallen stick, 1000 m, 92231 p.p. Known from humid lowland and montane rainforests in Cuba, Puerto Rico, Venezuela and Brazil (He & Grolle 2001).

ANEURACEAE

- Riccardia fucoides* (Sw.) Schiffn. Moist place at base of waterfall spring, 1220-1275 m, 92810; on tree trunk, 950 m, 92215. Widespread in tropical America (Gradstein & Costa in press).

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