

Cryptogams of the Reserva Biológica San Francisco (Province Zamora-Chinchipec, Southern Ecuador) III. Bryophytes – Additions and new species

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Abstract – The second contribution on the bryophytes of the Reserva Biológica San Francisco, Zamora-Chinchipec province, Southern Ecuador, adds 194 liverworts and mosses to the local bryophyte florula. Two species, *Fuscocephaloziaopsis subintegra* Gradst. & Vána and *Cyclodictyon provectum* W.R. Buck are described as new to science; the latter species is illustrated with line drawings and SEM photographs. Twenty-five species (21 liverworts and 4 mosses) are first records for Ecuador. The additional records bring the local bryophyte florula to 499 bryophytes (313 liverworts; 183 mosses; 3 hornworts), the highest species number ever recorded from a relatively small area (1,000 ha) in the tropics.

Bryophytes / chorotypes / Ecuador / liverworts / mosses / Neotropics / new descriptions / tropical mountain rain forest

INTRODUCTION

The multidisciplinary research project “Functionality in a tropical mountain forest: diversity, dynamic processes and use-potential under ecosystem aspects” in the Reserva Biológica San Francisco and neighbouring areas in southern Ecuador, funded by the German Research Society (DFG: FOR-402), has a strong focus on cryptogams, which are being studied jointly by research groups of the Freie Universität Berlin, the Universität Göttingen and the Staatliches Museum für Naturkunde, Stuttgart. First floristic catalogues of the bryophyte (Nöske *et al.*, 2003) and lichen flora (Nöske & Sipman, 2004) of the Reserva Biológica San Francisco have already been published, along with an ecosociological account of the (trunk) epiphytic bryophyte vegetation of the study area (Parolly & Kürschner,

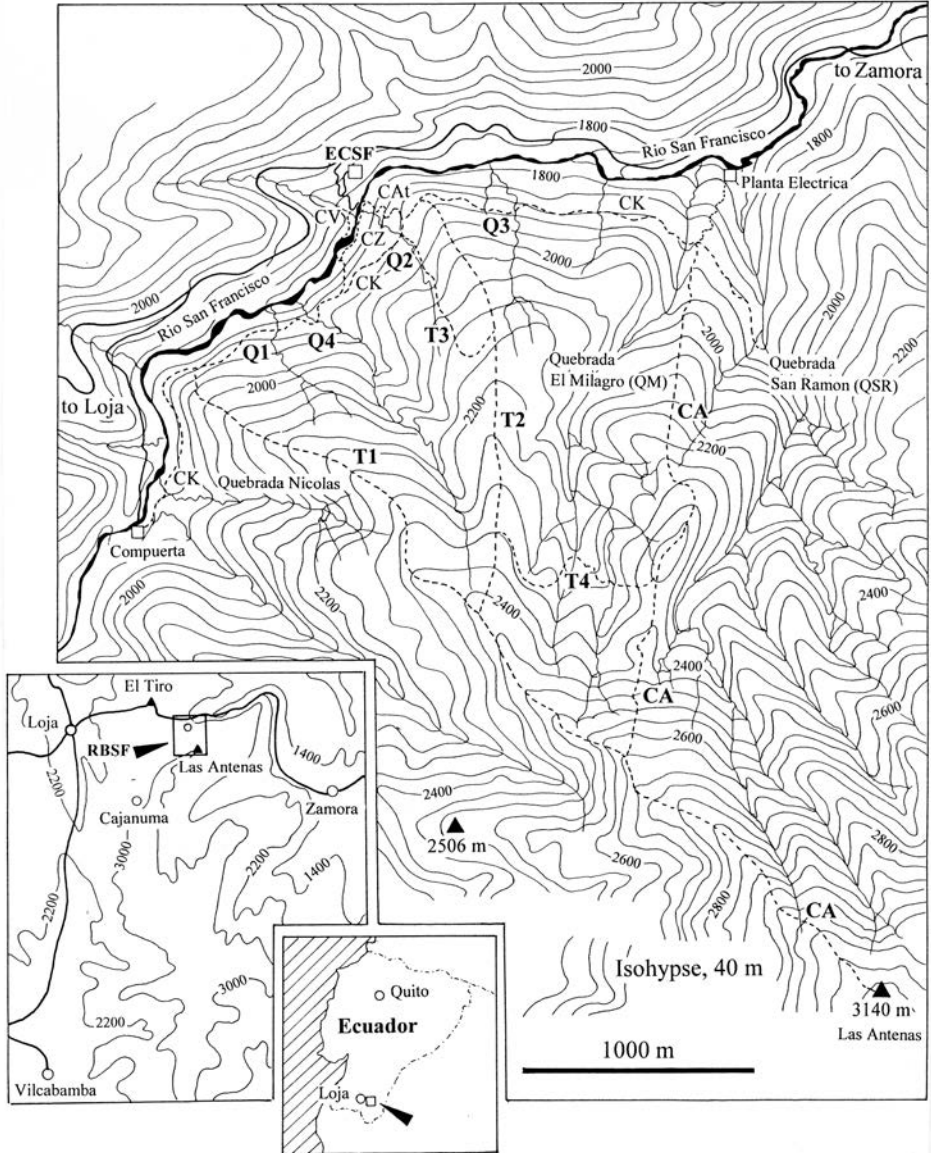


Fig. 1. Reserva Biológica San Francisco. Study site (after Parolly & Kürschner, 2004a).

2004a, b). For a survey of the still poor knowledge on the bryophyte flora and vegetation of Ecuador and a description of the study area see the papers cited above.

The Reserva Biológica San Francisco is situated in the Cordillera Real de Loja (or Nudo de Sabanilla, Eastern Cordillera), at the northern limit of the Parque Nacional Podocarpus (PNP; 146,280 ha) in the southern Ecuadorian province of Zamora-Chinchipec (Fig. 1). Ranging between 1800 and 3140 m, the

area preserves some 1,000 ha of virgin or disturbed evergreen mountain rain-forests and (sub)páramo vegetation. The high topographic relief with steep and instable slopes, resulting in the frequent occurrence of landslides even in intact forest stands, is a characteristic feature of the reserve. The vegetation of the study area has been described physiognomically and phytosociologically by Bussmann (2001, 2002), who recognized four elevational vegetation belts: 1) the Lower Montane Forest (1800-2150 m, in quebradas up to 2300 m; Bosque Montaña Bajo, *Ocotea-Nectandra* forest, *Alzateetalia verticillatae*), 2) the Upper Montane Forest (2150-2650 m; Bosque Montaña Alto, *Purdiaea nutans-Myrica pubescens-Myrsine andina* forest, *Purdiaetalia nutantis*), 3) the subalpine “Jalca” formation (2650-3050 m; dwarf forest, Bosque Subalpino, Ceja Andina, *Clusio ellipticae-Weinmannietalia cochensis*), and 4) the treeless sub-páramo above the timberline (3050-3140 m; *Neurolepidio-Puyetalia*), forming small patches and at somewhat lower elevation merging into or even replacing the subalpine Jalca thickets.

Our ongoing fieldwork has yielded many species new to the reserve, including several that are new to Ecuador and some that are even new to science, viz. the moss *Cyclodictyon provectum* W.R. Buck (this paper) and the liverworts *Diplasiolejeunea erostrata* and *D. grandirostrata* (Schäfer-Verwimp, 2004), *Fuscocephaloziopsis subintegra* Gradst. & Vána (this paper), *Physotheca autoica* (Engel & Gradstein, 2003), and *Plagiochila cucullifolia* var. *anomala* (Heinrichs *et al.*, 2003). This third contribution to our knowledge of the cryptogamic flora of the Reserva Biológica San Francisco adds 194 species to the local bryophyte flora, bringing the total number of bryophytes species recorded from the reserve to 499 (3 hornworts, 313 liverworts, 183 mosses).

Abbreviations

Localities (cf. Fig. 1) : **CA** Camino Antenas; **CAt** Camino Atajo; **CK** Camino Kanal; **CV** Camino Vado; **CZ** Camino ‘Zigzag’; **ECSF** Estación Científica San Francisco; **Q1, Q2, Q3, Q4** Quebrada 1-4; **QM** Quebrada El Milagro; **QSR** Quebrada San Ramón; **RSF** Rio San Francisco; **T (1-4)** Transect (1-4).

Zonal vegetation: **CW** Jalca (Ceja Andina; *Clusio ellipticae-Weinmannietalia cochensis* Bussmann 2002); **M-P** *Myrica andina-Purdiaea nutans* forest (*Purdiaetalia nutantis* Bussmann 2002); **O-N** *Ocotea-Nectandra* forest (*Alzateetalia verticillatae* Bussmann 2002); **SP** Sub-páramo (*Neurolepidio-Puyetalia* Bussmann 2002).

Sites: **c** concrete, mortar; **d** decaying wood, rotten logs; **dw** wet decaying wood, wet rotten logs; **e** epiphytic (trunks, if not otherwise indicated); **el** epiphyllous; **h** humus (soil); **r** rocks; **r(w)** water-trickled rocks or shaded rocks close to water-courses (submerged); **s** loamy/silty soil, raw soils; **stb** tree-bases and roots in rain-shaded positions.

Chorotypes: **A** Andean; **C** Central American and/or Caribbean; **End** endemic (Ecuador); **End loc** local endemic; **G** Guyana Highland; **nA** northern Andean (Costa Rica to northern Peru); **Neotrop** Neotropical; **Neotrop-Afr** Neotropical - tropical Africa; **nT** northern Temperate; **Pantrop** pantropical; **sT** southern Temperate, **Subcos** subcosmopolitan, **T** wide Temperate.

Selected vouchers: **Gr** = leg. S. R. Gradstein, **Kü** = leg. H. Kürschner & G. Parolly, 2001 with Goda Simone Sporn, 2002 with Dorothea Wagner; **Nö** = leg. N. Nöske; **SV** = leg. A. Schäfer-Verwimp & M. Preussing. – * = new to Ecuador. Unless otherwise indicated, voucher specimens are kept at B, GOET or STU with duplicates in LOJA and QCA.

RESULTS AND DISCUSSION

HEPATICOPSIDA

Acrobolbaceae

Acrobolbus sp. – 2200-2500 m, M-P, e, *Gr 10130*.

Tiny sterile or male plants growing scattered on trunks together with *Mytilopsis albifrons* in the *Myrica andina-Purdiaea nutans* forest, gynoecea not seen.

Aneuraceae

Riccardia aberrans (Steph.) Gradst. – nA – T1, 2090 m, O-N, dw, *Kü 02-551*.

Riccardia amazonica (Spruce) Schiffn. ex Gradst. & Hekking – Neotrop-Afr – T2, 2010 m, O-N, dw, *Kü 02-488*; T1, 2000 m, O-N, dw, *Kü 02-543a*; T2, 2200 m, O-N/M-P, dw, *Kü 02-656*.

Riccardia digitiloba (Spruce ex Steph.) Pagán – Neotrop – ECSF, 1800 m, near the river, dw, *Gr 10118*.

Riccardia plumaeformis (Spruce) Meenks – A – T2, 2010 m, O-N, dw, *Kü 02-493*; Q2, 1960 m, O-N, dw, *Kü 02-752*.

Riccardia spec. – Q4, 1800 m, O-N, r, *Kü 02-538*.

Arnelliaceae

Gongylanthus liebmannianus (Lindenb. & Gottsche) Steph. – Neotrop – CK, 1870 m, O-N, r, *SV 23218*, det. J. Vána.

Aytoniaceae

Asterella macropoda (Spruce) A. Evans – Neotrop – Q2, 1890-1900 m, O-N, s, *SV 23463, 23466*.

Balantiopsidaceae

Isotachis lopezii (R.M. Schust.) Gradst. – nA – CA, 2800-2900 m, C-W, s, *Gr 10096*.

Isotachis multiceps (Lindenb. & Gottsche) Gottsche – Neotrop – CA, 3100 m, C-W, s, *Kü 02-579*, det. S. R. Gradstein; *ibid.*, 2800-2900 m, *Gr 10093*; QSR, cascade, 1930 m, O-N, r (w: submerged), *Kü 02-621*; 1850 m, along trail, s, *Gr*; CK, 1860 m, O-N, r, *SV 23527*, conf. J. Vána.

Isotachis serrulata (Sw.) Gottsche – Neotrop – ECSF, 1850 m, s, *Gr 10110*.

Calypogeiaceae

* *Calypogeia grandistipula* (Steph.) Steph. – Neotrop – CK, 1850 m, O-N, s, *SV 23444*.

Mnioloma caespitosa (Spruce) R.M. Schust. – Neotrop – T1, 1980 m, O-N, s, *SV 23357*.

Cephaloziaceae

Fuscocephaloziopsis subintegra Gradst. & Vána **sp. nov.** – End loc

Type: Ecuador. Prov. Zamora-Chinchipe: Reserva Biológica San Francisco, trail to summit (“Camino Antenas”), 2600 m, on rotten wood in upper montane elfin woodland dominated by *Purdiaea nutans*, on rotten wood in deep shade together with *Riccardia* sp. and *Cephalozia crassifolia*, 30 September 2002, S. R. Gradstein & N. Nöske 10092 (holotype GOET, isotype LOJA).

A. F. pulvinata differt foliis apice usque ad 1/10 bidentatis, segmentis conniventibus.

This new species is a member of the neotropical genus *Fuscocephalozia* Fulf. (= *Cephalozia* subgen. *Macrocephalozia* R.M. Schust.) because of its convex leaves made up of very large cells (60–100 × 50–85 µm in leaf middle) and the absence of terminal branching. The new species differs from *F. pulvinata* (Steph.) Fulf. (= *F. biloba* (Herz.) Fulf., fide J. Vána, in litt. = *Cephalozia infuscata* R.M. Schust.), the only other species known in the genus *Fuscocephalozia*, by the much more shallowly bilobed leaves, being retuse to 1/10 of leaf length, with connivent and sometimes overlapping, tiny lobes formed mostly by only one triangular cell. The type material is rather scanty and has young, immature gynoecea. Additional, better developed material should be searched for. *Fuscocephalozia pulvinata* has been recorded from West Indies and Colombia (Fulford, 1968, Gradstein *et al.*, 2001), in rain forests below 1000 m. **The genus is new to Ecuador** and is for the first time recorded from montane forest.

* *Nowellia curvifolia* (Dicks.) Mitt. – nT – CA, SP, 3100 m, Nö 84; *ibid.*, 3000 m, s, SV 23500.

Erroneously reported as *N. evansii* Grolle in Nöske *et al.* (2003).

Odontoschisma falcifolium Steph. – Neotrop – CK, 1900 m, O-N, s, SV 23234/B, det. J. Vána.

Cephalozellaceae

Kymatocalyx dominicensis (Spruce) Vána – Neotrop-Afr – ECSF, 1800, on boulder in the river, r, Gr 10084.

Geocalyceae

Heteroscyphus contortuplicatus (Nees & Mont.) Grolle – Neotrop – QSR, 1930 m, O-N, r, Kü 02-631.

Heteroscyphus marginatus (Steph.) Fulf. – Neotrop – T2, 2010 m, O-N, dw, Kü 02-497a; T4, 2280 m, M-P, h, Kü 02-696c.

Lophocolea connata (Sw.) Nees – Neotrop – T1, 2100 m, O-N/M-P, dw, Kü 02-558; QSR, cascade, 1930 m, O-N, dw, Kü 02-642; T2, 2200 m, O-N/M-P, dw, Kü 02-655.

Lophocolea liebmannaiana Gottsche – Neotrop – CK, 1900 m, O-N, e, Kü 01-1202.

Lophocolea martiana Nees – Neotrop-Afr – ECSF, 1800 m, along river, dw, Gr 10119.

Lophocolea polychaeta Spruce – End – 2200-2500 m, M-P, d, Gr 10139.

Physotheca autoica Engel & Gradst. – End loc – SP, 2800-3000 m, on twigs, Gr 10089, 10090, Kü 01-1005, Torracchi JSTC 85; CA, 2760-2950 m, SP, e on shrub, SV 23492, 23498.

This new, monotypic genus constitutes a new subfamily of the Geocalyceae, subfam. Physothecoideae Engel & Gradst. *Physotheca autoica* is thus far only known from the Reserva Biológica San Francisco and from Parque Nacional Podocarpus (Cajanuma), and occurs on twigs of isolated shrubs (Melastomataceae, *Clusia*, etc.) in the subpáramo at 2760-3100 m. The species is very common in this habitat in the Reserva Biológica San Francisco. In view of its local abundance, it is surprising that the species remained thus far undescribed (Engel & Gradstein, 2003).

Jubulaceae

Frullania dusenii Steph. – Neotrop – Q4, 1850 m, O-N, e, Kü 01-542b.

Frullania cf. *ecuadoriensis* Steph. – A – CA, 2150 m, M-P, e, Kü 02-888; CA, 2350 m, M-P, e, Kü 02-925, both det. S. R. Gradstein.

Frullania pittieri Steph. – Neotrop – CK (Planta Electrica), 1890 m, O-N, e, *Kü 01-781*; T2, 2470 m, M-P, e, *Kü 01-845*; CA, 3080 m, C-W, e, *Kü 02-593*; T4, 2280 m, M-P, e, *Kü 02-691*; CA, 2150 m, M-P, e, *Kü 02-887*; CA, 2350 m, M-P, e, *Kü 02-917*.
Frullania sp. 1 (subgen. *Diastaloba*) – T1, 2100 m, O-N, el, *Kü 01-1278x*, det. T. Pócs.

Frullania sp. 2 (subgen. *Diastaloba*) – *Kü 01-831c*, *01-899*

Neotropical *Frullania* sect. *Diastaloba* is unrevised and the taxonomy of the species still unclear.

Jungermanniaceae

Anastrophyllum tubulosum (Nees) Grolle – Neotrop – CK, 1900 m, O-N, s, *SV 23234/A*; -, r, *SV 23518*, both det. J. Vána.

* *Jungermannia hyalina* Lyell – nT – CK (Planta Electrica), 1900 m, O-N, r(w), *Kü 02-596*; 1800 m, in river, r, *Gr 10072*.

Lophozia cf. *laxifolia* (Mont.) Grolle – A – ECSF, 1850 m, O-N, s, *Gr 10116*.

Lejeuneaceae

Aphanolejeunea azorica (V. Allorge & Ast) Bernecker & Pócs – Neotrop-Afr – T1, 2180 m, O-N, el, *SV 23364/B*, det. T. Pócs.

Aphanolejeunea camillii (Lehm.) R.M. Schust. – Neotrop – T2, 2000 m, O-N, el, *Kü 02-480*, det. T. Pócs.

Aphanolejeunea cingens Herzog – Neotrop – T2, 2000 m, O-N, el, *Kü 02-480b*; det. T. Pócs.

* *Aphanolejeunea ephemerooides* R.M. Schust. – C – T2, 2050 m, O-N, el, *Kü 02-507*, det. T. Pócs.

Aphanolejeunea gracilis Ast – Neotrop – T2, 2000 m, O-N, el, *Kü 02-480c*, det. T. Pócs.

Aphanolejeunea kunertiana Steph. – Neotrop – T1, 1930 m, O-N, el, *SV 23351*; CK, 1850 m, O-N, el, *SV 23537/B*.

Ceratolejeunea laetefusca (Austin) R.M. Schust. – Neotrop – T1, 2470 m, M-P, e, *Kü 01-852b*; T1, 2110 m, O-N, e, *Kü 01-1104c*; T1, 2180 m, M-P, e, *Kü 01-1119b*.

Cheilolejeunea adnata (O. Kunze) Grolle – Neotrop – CA (to T2), 1830 m, O-N, e, *SV 23514/A*.

Cheilolejeunea holostipa (Spruce) Grolle & R.-L. Zhu [*Cyrtolejeunea holostipa* (Spruce) A. Evans] – Neotrop – Q2, 1930 m, O-N, e, *Kü 02-726*.

Cheilolejeunea trifaria (Reinw. et al.) Mizut. – Pantrop – T1 - Compuerta, 1850-1910 m, O-N, r, *Kü 02-835*.

* *Cololejeunea bischleriana* P. Tixier – Neotrop – Q2, 1900 m, O-N, el, *SV 23467/A*, det. T. Pócs.

Cololejeunea minutissima (Sm.) Schiffn. subsp. *myriocarpa* (Nees & Mont.) R.M. Schust. – Pantrop – CZ, RSF, 1800 m, O-N, e, *SV 23206/A*; CK, 1840 m, O-N, e, *SV 22534*.

* *Cololejeunea subcardiocarpa* P. Tixier – Neotrop – CA, 1860 m, O-N, el, *SV 23237/C*; Q2, 1900 m, O-N, el, *SV 23467/A* p.p., both det. T. Pócs.

* *Cololejeunea verwimpii* P. Tixier – Neotrop – Q2, 1900 m, O-N, el, *SV 23467/B*, det. T. Pócs.

Cyclolejeunea accedens (Gottsche) A. Evans – Neotrop – T2, 2050 m, O-N, el, *Kü 02-507c*, det. T. Pócs.

Cyclolejeunea angulistipa (Steph.) A. Evans – Neotrop – T2, 2100 m, O-N, e, *Kü 01-922a*; T1, 2010 m, O-N, e, *Kü 01-1039*; T2, 2200 m, O-N/M-P, dw, *Kü 02-658b*; Q2, 1960 m, O-N, dw, *Kü 02-757d*.

Cyclolejeunea luteola (Spruce) Grolle – Neotrop – CA, 3050 m, C-W, e, *Kü 02-575c*, det. S. R. Gradstein; Q2, 1950 m, O-N, e, *Kü 02-749a*; T1, 1980 m, O-N, d, *SV 23356*; *ibid.*, 1970 m, el, *SV 23354/B* p.p., det. A. L. Ilkiu-Borges.

Diplasiolejeunea alata Ast – Neotrop – T1, 2000-2100 m, O-N, el, *Kü 01-1277r*, det. T. Pócs; CA, 2870 m, M-P, e, *SV 23495*; *ibid.*, 2750 m, M-P, e, *SV 23491*; *ibid.*, 2510 m, M-P, e, *SV 23479*; CZ, 1850 m, O-N, e, *SV 23217/A*; RSF, 1790 m, O-N, e, *SV 23435/B*.

Diplasiolejeunea brunnea Steph. – Neotrop – T1, 2000-2100 m, O-N, el, *Kü 01-1276s*, *Kü 01-1279g*; T2, 2000 m, O-N, el, *Kü 02-480d*; Q2, 1960 m, O-N, el, *Kü 02-758*, all det. T. Pócs; T1, 1890 m, O-N, el, *SV 23349/A*; Q2, 1900 m, O-N, el, *SV 23467/D*; CA, 1860 m, O-N, el, *SV 23237/A*.

Diplasiolejeunea caribea P. Tixier – Neotrop – T1, 2000-2100 m, O-N, el, *Kü 01-1107k*, *Kü 01-1276q*, both det. T. Pócs; T1, 2180 m, O-N, el, *SV 23364/A*.

Diplasiolejeunea cavifolia Steph. – Pantrop – T1, 2000-2100 m, O-N, el, *Kü 1176s*; T2, 2050 m, O-N, el, *Kü 02-507d*, both det. T. Pócs; CA, 1860 m, O-N, el, *SV 23237/B*; Q4, 1900 m, O-N, el, *SV 23230/A*.

Diplasiolejeunea erostrata Schäf.-Verw. – End loc – CA, 2800-3000 m, SP, e, *Gr 10088*; CA, 2600 – 3000 m, SP, e, *SV 23481*, *23494*, *23506*.

Diplasiolejeunea grandirostrata Schäf.-Verw. – End loc – CA, 3000 m, SP, e, *I. Holz EC 01-560B*.

* *Diplasiolejeunea papilionacea* R.M. Schust. – nA – CZ, 1850 m, O-N, e, *SV 23216/B*.

Diplasiolejeunea pellucida (Meissn.) Schiffn. – Neotrop – T1, 1890 m, O-N, el, *SV 23349/B*; Q2, 1900 m, O-N, el, *SV 23467/D* p.p.

Diplasiolejeunea pocsii Reyes – C – T2, 2000-2100 m, O-N, el, *Kü 01-599f*, det. T. Pócs.

Diplasiolejeunea replicata (Spruce) Steph. – Neotrop – CA, 2900 m, SP, e, *SV 23496/B*.

Drepanolejeunea araucariae Steph. var. *araucariae* – Neotrop – T2, 2000-2100 m, O-N, el, *Kü 01-575l*, det. T. Pócs; CZ, 1850 m, O-N, e, *SV 23217/B*; CK, 1850 m, O-N, e, *SV 23536/D*; CA, 2750-2900 m, SP, e, *SV 23490/A*, *23496/C*.

* *Drepanolejeunea aurita* Bischler – nA – T1, 2180 m, O-N, e, *SV 23365/B*.

Drepanolejeunea campanulata (Spruce) Steph. – Neotrop – T2, 2050 m, O-N, el, *Kü 02-507e*, det. T. Pócs.

* *Drepanolejeunea crassiretis* A. Evans – Neotrop – Q4, 1880 m, O-N, e, *SV 23229*; T1, 2180 m, O-N, e, *SV 23365/A*.

Drepanolejeunea inchoata (Meissn.) Steph. var. *roraimae* (Steph. ex Zwickel) Bischler – Neotrop – T1, 2180 m, O-N, el, *SV 23364/B* p.p., det. T. Pócs.

Drepanolejeunea lichenicola (Spruce) Steph. – Neotrop – T1 & T2, 2000-2100 m, O-N, el, *Kü 01-575u*, *Kü 01-599h*, *Kü 01-1276v*, *Kü 01-1277e*, *Kü 01-1279e*, all det. T. Pócs.

Drepanolejeunea mosenii (Steph.) Bischler – Neotrop – QSR, 1930 m, O-N, el, *Kü 02-644a*; Q2, 1960 m, O-N, el, *Kü 02-758b*, both det. T. Pócs.

Drepanolejeunea orthophylla (Nees & Mont.) Bischler – Neotrop – QSR, 1930 m, O-N, el, *Kü 02-644b*, det. T. Pócs; T1, 2180 m, O-N, el, *SV 23364/D*.

* *Drepanolejeunea urceolata* R.M. Schust. – nA – T1, 2000-2100 m, O-N, el, *Kü 01-1278q*, det. T. Pócs.

Harpalejeunea ancistrodes (Spruce) Schiffn. – nA – CK, 1870 m, O-N, e, SV 23219/C; *ibid.*, 1860 m, O-N, e, SV 23528/B; T1, 1970 m, O-N, el, SV 23354/B, all. det. A.L. Ilkiu-Borges.

Lejeunea capensis Gottsche (« s. l. ») – Neotrop-Afr – RSF, 1800 m, O-N, e, SV 23206/B.

Lejeunea cerina (Lehm. & Lindenb.) Gottsche *et al.* – Neotrop – Q2, 1960 m, O-N, dw, Kü 02-753.

Lejeunea controversa Gottsche – Neotrop – Q4, 1900 m, O-N, e, Kü 02-817.

Lejeunea deplanata Nees – Neotrop – CK, 1850 m, O-N, e, SV 23542, det. M.E. Reiner-Drehwald.

* *Lejeunea grossitexta* (Steph.) E. Reiner & Goda – Neotrop – Q2, 1960 m, O-N, dw, Kü 02-757c; Q2, 1890 m, O-N, d, SV 23460, det. M.E. Reiner-Drehwald.

* *Lejeunea inflexiloba* Jack & Steph. – nA – CA, 3000 m, SP, e, SV 23506/A, det. M.E. Reiner-Drehwald.

* *Lejeunea intricata* Jack & Steph. – nA – QSR, cascade, 1930 m, O-N, dw, Kü 02-641, det. M.E. Reiner-Drehwald, Kü 02-646b; T1, 1970 m, O-N, el, SV 23354/A, det. M.E. Reiner-Drehwald.

Lejeunea megalostipa Spruce – nA – RSF, 1800 m, O-N, e, SV 23206/C, det. M.E. Reiner-Drehwald.

Lejeunea monimiae (Steph.) Steph. – Neotrop – Q4, 1880 m, O-N, el, SV 23226/A, det. M.E. Reiner-Drehwald.

Lejeunea smaragdina Besch. & Spruce – Neotrop – CK, 1880 m, O-N, el, SV 23526, det. M.E. Reiner-Drehwald.

Lepidolejeunea ornata (H. Rob.) R.M.Schust. – Neotrop – Q4, 1850 m, O-N, e, Kü 01-550.

Lepidolejeunea spongia (Spruce) B. Thiers – Neotrop – T1, 2350 m, M-P, e, SV 23373.

Leucolejeunea unciloba (Lindenb.) A. Evans – Neotrop-Afr – Q2, 1900 m, O-N, e, SV 23469/A.

Macrolejeunea lancifolia (Steph.) Herzog – A – Q4, 1900 m, O-N, e, Kü 02-807, det. M. E. Reiner-Drehwald.

Macrolejeunea pallescens (Mitt.) Schiffn. – nA – RSF, 1800 m, O-N, r, SV 23201; Q3, 1850 m, O-N, s, SV 23533.

* *Microlejeunea colombiana* Bischler – nA – T1, 2000-2100 m, O-N, el, Kü 01-1276m, Kü 01-1279f, both det. T. Pócs; T2, 2100 m, O-N, e, Kü 01-826a.

* *Microlejeunea epiphylla* Bischler – Neotrop – T2, 1800 m, O-N, e, Kü 01-633b; Q4, 1880 m, O-N, e, Kü 01-955; RSF, 1840 m, O-N, e, SV 23214/B; *ibid.*, 1790 m, el, SV 23436; CZ, 1850 m, O-N, e, SV 23217/C; CK, 1850 m, O-N, e, SV 23536/A; *ibid.*, O-N, el, SV 23537/A; the SV-collections all det. A.L. Ilkiu-Borges.

Microlejeunea stricta (Gottsche *et al.*) Steph. – Neotrop – Q4/T1, 1900 m, O-N, dw, Kü 02-799d.

Neurolejeunea breutelii (Gottsche) A. Evans – Neotrop – T2, 2230 m, M-P, e, Kü 01-831a; T2, 2200 m, O-N/M-P, dw, Kü 02-662.

Pycnolejeunea densistipula (Lehm. & Lindenb.) Steph. – Neotrop – T1, 2280 m, O-N, e, SV 23368.

Rectolejeunea berteriana (Gottsche) A. Evans – Neotrop – CA, 1830 m, O-N, e, SV 23514/B.

Taxilejeunea sulphurea (Lehm. & Lindenb.) Schiffn. – Neotrop – T1, 2000 m, O-N, dw, Kü 02-543b, det. S.R. Gradstein; CK, 1855 m, O-N, s, SV 23551.

Lepidoziaceae

Arachniopsis diacantha (Mont.) M.A. Howe – Neotrop-Afr – 2200-2500 m, dw, M-P, *Gr s.n.*; T2, 2370 m, M-P, s, *SV 23379*.

Bazzania spruceana Steph. – Neotrop – T2, 1980 m, O-N, stb, *Kü 03-251*.

Micropterygium trachyphyllum Reimers – Neotrop – T2, 2010 m, O-N, dw, *Kü 02-487*; T1, 2030 m, O-N, h, *Kü 02-548*.

Paracromastigum pachyrrhizum (Nees) Fulf. [= *P. bifidum* (Steph.) R.M.Schust.] – Neotrop – CK, 1850-1900 m, O-N, s, *S, 23516, SV 23452, 23552*, all det. or conf. J. Vána (as *P. bifidum* and *P. dominicensis*).

Metzgeriaceae

Metzgeria australis Steph. – Pantrop – CK, E Planta Electrica, 1860 m, O-N, e, *Kü 01-770*.

* *Metzgeria bischlerae* Kuwah. – nA – Q4, 1800 m, O-N, r, *Kü 02-515*.

* *Metzgeria chilensis* Steph. – sT (Neotrop-Chile-New Zealand) – CA, 3050 m, C-W, e, *Kü 02-571*.

The distribution of this species is unusual and may be erroneous. It needs further study.

Metzgeria consanguinea Schiffn. – Pantrop – CA, 3130 m, SP, e (on *Puya nitida*), *Kü 02-591*.

Metzgeria fruticola Spruce – Neotrop – CK (Planta Electrica), 1900 m, O-N, dw, *Kü 02-598*.

Pallaviniaceae

Jensenia difformis (Nees) Grolle – Neotrop – QSR, cascade, 1930 m, O-N, submerged, *Kü 02-619*.

Pallavicina lyellii (Hook.) Carruth. – Pantrop / T – T2, 2050 m, O-N, dw, *Kü 02-508*.

Symphogyna marginata Steph. – nA – 2200-2500 m, M-P, s, *Gr 10137*.

Plagiochilaceae

Plagiochila alternans Lindenb. & Gottsche – A – QSR, cascade, 1930 m, O-N, r, *Kü 02-619, Kü 02-638*.

* *Plagiochila cucullifolia* Jack & Steph. var. *anomala* J.Heinrichs & Gradst. – End loc – CA, 2800-3000 m, SP, on twigs, *Gr 10091 (type), Gr 10090A.*; CA, 2670 m, M-P, e, *SV 23485*.

This new variety differs from typical *Plagiochila cucullifolia* (= *Szweykowskia cucullifolia* (Jack & Steph.) Gradst. & E. Reiner) by the rather flat leaves, which are not saccate (Heinrichs *et al.* 2003).

Plagiochila cf. *distinctifolia* Lindenb. – Neotrop – T2, 1800 m, O-N, e, *Kü 01-642*, det. S. R. Gradstein.

Plagiochila exigua Tayl. – Pantrop – 1800, along the river, r, *Gr 10076*.

Plagiochila fuscolutea Tayl. – A – T2, 2400 m, M-P, e, *Kü 01-680*; T2, 2320 m, M-P, e, *Kü 01-706*; 2200-2500 m, M-P, e, *Gr 10133*.

* *Plagiochila longiramea* Steph. – A – T2, 2400-2470 m, M-P, e, *Kü 01-691, Kü 01-865*.

Plagiochila longispina Lindenb. & Gottsche – Neotrop – Q4, 1850-1880 m, O-N, e, *Kü 01-554, Kü 01-952*.

Plagiochila superba (Nees ex Sprengel) Mont. & Nees var. *macrotricha* (Spruce) J. Heinrichs – nA – T2, 2150 m, O-N, h, *Kü 01-646*; T2, 2100 m, O-N, e, *Kü 01-917*; T2, 2010 m, O-N, e, *Kü 01-1035*; T2, 2000 m, O-N, e, *Kü 02-481*.

Plagiochila superba (Nees ex Sprengel) Mont. & Nees var. *superba* – Neotrop – T2, 2020-2100 m, O-N, e, *Kü 01-748*, *Kü 01-751*, *Kü 01-909*; QSR, 1880 m, O-N, r, w, *Kü 01-799*; Q2, 2050 m, O-N, h, *Kü 02-775*.

Porellaceae

Porella acanthota Spruce – End – Q2, 1900 m, O-N, e, *SV 23470/A*, det. M. L. So.

Porella swartziana (Weber) Trevis. – Neotrop – Q2, 1950 m, O-N, e, *Kü 03-272*.

Radulaceae

Radula antilleana Castle – Neotrop – T2, 1850 m, O-N, e, *Kü 01-718*, *Kü 01-734a*; T1, 2010 m, O-N, e, *Kü 01-1022*; Q2, 1930 m, O-N, e, *Kü 02-719*; Q4/T1, 1900 m, O-N, dw, *Kü 02-800*; Q4, 1900 m, O-N, e, *Kü 02-814*, 820.

**Radula cubensis* K. Yamada – Neotrop – RSF, 1800 m, O-N, r, *SV 23203*, *23203/A*; CK, 1850 m, O-N, e, *SV 23532*, both det. K. Yamada.

Radula falcifolia Steph. – Neotrop – T2, 1850 m, O-N, e, *Kü 01-716*.

Radula frondescens Steph. – nA – T2, 1850 m, O-N, e, *Kü 02-474a*; Q4, 1800 m, O-N, e, *Kü 02-529*.

* *Radula tenera* Mitt. – Neotrop – SP, 2800-3000 m, on twigs, *Gr 10095*; CA, 3030 m, SP, e, *SV 23502*, *23503*, conf. K. Yamada.

Radula saccatiloba Steph. – C – Q4, 1850 m, O-N, e, *Kü 01-514*, *Kü 01-541*.

Radula subinflata Lindenb. & Gottsche – Neotrop – CA, 2850 m, C-W, e, *Kü 01-1010*.

* *Radula yanoella* R.M. Schust. – Neotrop – T2, 2100 m, O-N, el, *Kü 01-572c*, det. T. Pócs; Q4, 1880 m, O-N, el, *SV 23226/C*, conf. K. Yamada.

Ricciaceae

Riccia stenophylla Spruce – Neotrop – CV, 1800 m, O-N (river bank), rw, *Kü 03-295*.

Trichocoleaceae

Trichocolea flaccida (Spruce) Jack & Steph. – Neotrop – Q4, 1800 m, O-N, r(w), *Kü 02-519*; CA, 3100 m, C-W, e, *Kü 02-581c*; CA, 2300 m, M-P, e, *Kü 02-934*; Q4, 1880 m, O-N, r(w), *SV 23227*.

BRYOPSIDA

Bartramiaceae

Breutelia tomentosa (Sw. ex Brid.) A. Jaeg. – Neotrop-Afr – T4, 2350 m, M-P, h, *Kü 02-666*; CA, 3030 m, SP, s, *SV 23505*.

Philonotis elongata (Dism.) H. Crum & Steere – Neotrop – CA, 1830 m, O-N, s, *SV 23513*.

Philonotis hastata (Duby) Wijk & Marg. – Pantrop – CK, 1880 m, O-N, r(w), *SV 23523/B*.

Philonotis sphaerocarpa (Hedw.) Brid. – Neotrop – Compuerta, 1850-1910 m, O-N, r, *Kü 02-840*.

Brachytheciaceae

Brachythecium ruderales (Brid.) W.R. Buck (= *B. stereopoma* Spruce) – Subcos – CK, 1850 m, c, *SV 23545/A*.

Platyhypnidium aquaticum (A. Jaeg.) M. Fleisch. – Neotrop – CV, 1800 m, O-N (river bank), s, *Kü 03-283*, *Gr 180086*.

Rhynchostegium scariosum (Tayl.) A. Jaeg. – Neotrop – Q1, 1860 m, O-N, dw, *Kü 02-825*.

Rhynchostegium serrulatum (Hedw.) A. Jaeg. – Pantrop – CV, 1800 m, O-N (river bank), s, *Kü 03-277*; CK (Planta Electrica), 1900 m, O-N, r(w), *Kü 02-612*; Q2, 1890 m, O-N, stb, *SV 23468*.

Bryaceae

Anomobryum conicum (Hornsch.) Broth. – Neotrop – CK, 1880 m, O-N, r, *SV 23522/A*.

Bryum limbatum Müll. Hal. – Neotrop – CV, 1800 m, O-N (river bank), s, *Kü 03-281*; RSE, 1790 m, O-N (river bank), r, *SV 23431*.

Orthodontium pellucens (Hook.) Bruch & Schimp. – sT – T1, 2340 m, M-P, d, *SV 23372*.

Pohlia papillosa (A. Jaeg.) Broth. – Neotrop – ECSF, 1850 m, s, *Gr 10113*.

Catagoniaceae

Catagonium brevicaudatum Müll. Hal. ex Broth. – Neotrop – CK, 1840 m, O-N, s, *SV 23439*.

Daltoniaceae

Calypstrochaeta sp. – Q5, 1900 m, O-N, dw, *Gr 10123*.

Daltonia pulvinata Mitt. – nA – CA, 3130 m, SP, e, *Kü 02-591*.

Daltonia stenophylla Mitt. – Neotrop – T1, 2290 m, e, *SV 23370*.

* *Leskeodon auratus* (Müll. Hal.) Broth. – Neotrop – T2, 2400 m, M-P, e, *SV 23376*.

Dicranaceae

Campylopus asperifolius Mitt. – nA – CA, 3050 m, C-W, e, *Kü 02-570*; CA, 2800 m, C-W, e, *Kü 02-594*; CA, 2960 m, SP, e, *SV 23499*, det. J.-P. Frahm.

Campylopus cuspidatus (Hornsch.) Mitt. var. *dicnemioides* (Müll. Hal.) J.-P. Frahm – Neotrop – T1, 2360 m, M-P, e, *SV 23375/B*, conf. J.-P. Frahm.

Campylopus flexuosus (Hedw.) Brid. – Subcos – 1800 m, on boulder in the river, s, *Gr 10083b*.

* *Campylopus huallagensis* Broth. var. *weberbaueri* (Broth.) J.-P. Frahm – nA – T2, 2240 m, M-P, e, *SV 23390*, det. J.-P. Frahm.

Campylopus jamesonii (Hook.) A. Jaeg. – Neotrop-Afr – CK, 1850 m, s, *SV 23442*.

Campylopus pilifer Brid. – Pantrop / warm-T – CV, 1800 m, O-N (river bank), r, *Kü 03-282b*; 1800 m, on boulder in the river, s, *Gr 10083a*.

Dicranella sp. – ECSF, 1850 m, along trail, s, *Gr 10064a*, *10112*; CK, 1880 m, O-N, s (over rock), *SV 23522/C*.

Pilopogon longirostratus Mitt. – nA – CV, 1800 m, O-N (river bank), c, *Kü 03-282a*.

Ditrichaceae

Ceratodon stenocarpus Bruch & Schimp. – Subcos – CA, 3140 m, SP, s, *Kü 02-590*; r, *Kü 02-592*.

Fissidentaceae

Fissidens crispus Mont. – Neotrop – 1800 m, along trail and on rock in the river, r, s, *Gr 10079, 10080*, det. A. Schäfer-Verwimp; RSF, 1800 m, d, *SV 23205*, conf. R.A. Pursell.

Fissidens pellucidus Hornsch. var. *pellucidus* – Pantrop – CK, 1880 m, O-N, r, *SV 23450/B*, det. R.A. Pursell.

Fissidens steerei Grout – Neotrop – Q2, 2010 m, O-N, e, *Kü 02-775*; Q4/T1, 1900 m, O-N, dw, *Kü 02-799c*.

Funariaceae

Funaria hygrometrica Hedw. – Subcos – ECSF, 1850 m, along trail, s, *Gr s.n.*; CK, 1880 m, s, *SV 23522/B*.

Hedwigiaceae

Hedwigidium integrifolium (P. Beauv.) Dix. ex C. Jens. – Pantrop – CV, 1800 m, O-N (river bank), e, *Kü 03-276*.

Hypnaceae

Ctenidium malacodes Mitt. – Neotrop – CK, 1850 m, c, *SV 23545*, det. L. Hedenäs.

Ectropothecium leptochaeton (Schwägr.) W.R. Buck – Neotrop – Q2, 1960 m, O-N, dw, *Kü 02-753, Kü 02-763f*; Q1, 1860 m, O-N, dw, *Kü 02-825b*; Q4, 1880 m, O-N, r, *SV 23225/B, 23228*.

Isopterygium tenerum (Sw.) Mitt. – Neotrop – CK (Planta Electrica), 1900 m, O-N, dw, *Kü 02-604b*; Q2, 1960 m, O-N, dw, *Kü 02-755*; Q2, 2020 m, O-N, dw, *Kü 02-779*; CK, 1900, O-N, e, *SV 23235*.

Mittenothamnium reduncum (Mitt.) Ochyra [= *Hygrohypnum reduncum* (Mitt.) Nishim.] – Neotrop – CK, Q3, 1880 m, O-N, r(w), *SV 23525*.

Leskeaceae

Leskea plumaria Mitt. – nA – CZ, 1840 m, O-N, e, *SV 23214/A*.

Leucobryaceae

* *Leucobryum albidum* (Brid. ex P. Beauv.) Lindb. – nA – T2, 2010 m, O-N, dw, *Kü 02-490*.

Not in Ecuador according to Churchill *et al.* (2000).

Leucomiaceae

Leucomium strumosum (Hornsch.) Mitt. – Pantrop – Q2, 1860 m, O-N, d, *SV 23457/B*.

Macromitriaceae

Macromitrium podocarpi Müll. Hal. – Neotrop – Q4, 1850 m, O-N, e, *Kü 01-534a*; Q2, 1930 m, O-N, e, *Kü 02-730*; CA, 2150 m, M-P, e, *Kü 02-884, 889*; CA, 2350 m, M-P, e, *Kü 02-920*.

Erroneously reported as *M. guatemalense* Müll. Hal. in Nöske *et al.* (2003).

Schlotheimia tecta Hook. & Wils. – Neotrop – T2, 2300 m, M-P, e, *SV 23383*.

Meteoriaceae

Meteorium deppei (Müll. Hal.) Mitt. (incl. *M. illecebrum* Sull.) – Neotrop – Q4, 1850 m, O-N, e, *Kü 01-543*; Q2, 1960 m, O-N, dw, *Kü 02-771*.

This species was reported from the study area as *M. illecebrum* by Nöske *et al.* (2003).

* *Orthostichella hexasticha* (Schwägr.) W.R. Buck – Neotrop – Q2, 1960 m, O-N, e, *Kü 03-268b*.

Squamidium livens (Schwägr.) Broth. – Neotrop – CK, 1870 m, O-N, e on shrub, *SV 23232*.

Pilotrichaceae

Brymela sp. – QSR, cascade, 1930 m, O-N, dw, *Kü 02-640*.

Callicostella pallida (Hornsch.) Ångst. – Neotrop – Q2, 1960 m, O-N, dw, *Kü 02-763c*; CK, 1880 m, r, *SV 23450/A*.

Crossomitrium patrisiae (Mitt.) Müll.Hal. – Neotrop – Q4, 1880 m, el, *SV 23226/B*; Q2, 1900 m, el, *SV 23467/G*.

Cyclodictyon provectum W. R. Buck, **sp. nov.** – End loc (Figs. 2, 3).

Type: Ecuador. Prov. Zamora-Chinchipec: Cordillera Oriental, Cordillera Numbala between Loja and Zamora, Reserva Biológica San Francisco, Quèbrada 4, 1900 m; lower montane broadleaved *Ocotea-Nectrandra* forest, epiphytic on tree trunks, 30 September 2002, *H. Kürschner, G. Parolly & D. Wagner 02-804* (holotype NY, isotype B).

Inter species parvicellularia *Cyclodictyi foliis lanceolatis vel oblongo-lanceolatis abrupte contractis ad acumen ca 1/4 folii limbidio 3-5-cellulari cellulisque folii elongatis distalibus ad apices costae differt.*

Plants yellow-green, in small, dense, fairly flat mats. Stems dark red, creeping, *ca* 5–6 cm long, regularly pinnately branched with branches mostly 5–6 mm long, to irregularly bipinnate with 2 branches very short, in cross-section with a unistratose hyalodermis subtended by 2(–3) rows of small, dark, thick-walled cells, becoming \pm abruptly larger internally, gradually thinner-walled, central strand none; axillary hairs 2-celled, *ca* 37 μ m long, with a quadrate pale brown basal cell and an elongate hyaline apical cell; pseudoparaphyllia foliose, small. Branch and stem leaves similar but stem leaves smaller (1.1–1.4 mm long), not or obscurely complanate, erect-spreading moist or dry, slightly crispate when dry, branch leaves broadly lanceolate to oblong-lanceolate, somewhat to strongly concave, 1.3–1.5 mm long, 0.35–0.5 mm wide, abruptly long-acuminate, the acumen *ca* 1/4 the leaf length; margins irregularly and narrowly recurved, minutely serrulate above, entire below, limbate in 3–5 rows; costa double, extending *ca* 1/2 – 2/3 the leaf length, but usually with elongate laminal cells above costal apices and thus the costae appearing longer, the two forks gradually divergent from the insertion or subparallel above, sometimes projecting as a minute prickle; laminal cells firm-walled, not or somewhat porose, elongate-rhomboidal to \pm hexagonal, *ca* (17–)20–28(–37) \times (5.7–)8.5–11.5 μ m, 15–20 between costal apices, thicker-walled, porose and elongate in 3–5 rows at margin, those distal to costal apices \pm the same length as those of the limbidium but typically *ca* 3 mm wide and the costae thus appearing to extend to the limbidium at the base of the acumen, cells of the acumen elongate, similar to those of the limbidium, basally becoming somewhat larger and subrectangular. ?Autoicous (not synoicous). Inner perichaetial leaves pale, broadly oblong, *ca* 1.6 \times 0.5 mm, \pm gradually long-acuminate; margins minutely serrulate to subentire above, entire below, plane to irregularly recurved, 4–5-limbate; costa double, \pm parallel throughout, extending *ca* 1/2 the leaf length;

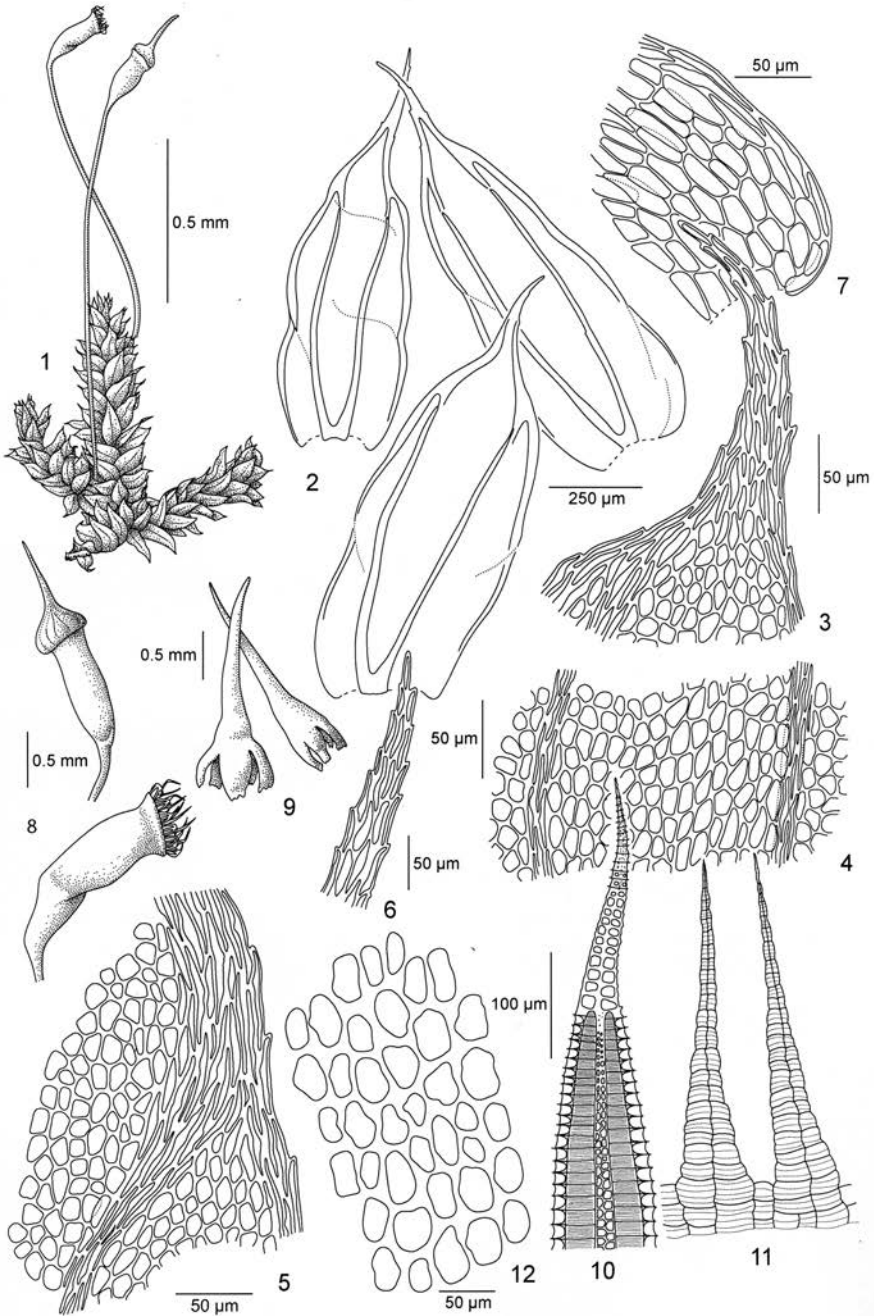


Fig. 2. *Cyclodictyon provectum* W.R. Buck (Type, Ecuador, Kürschner *et al.* 02-804). **1** Habit; **2** leaves; **3** leaf apex; **4** laminal cells between costae; **5** leaf border, showing costal apex and elongate laminal cells above costal apices; **6** leaf tip; **7** leaf base; **8** capsules; **9** calyptrae; **10** portion of exostome; **11** portion of endostome; **12** exothecial cells.

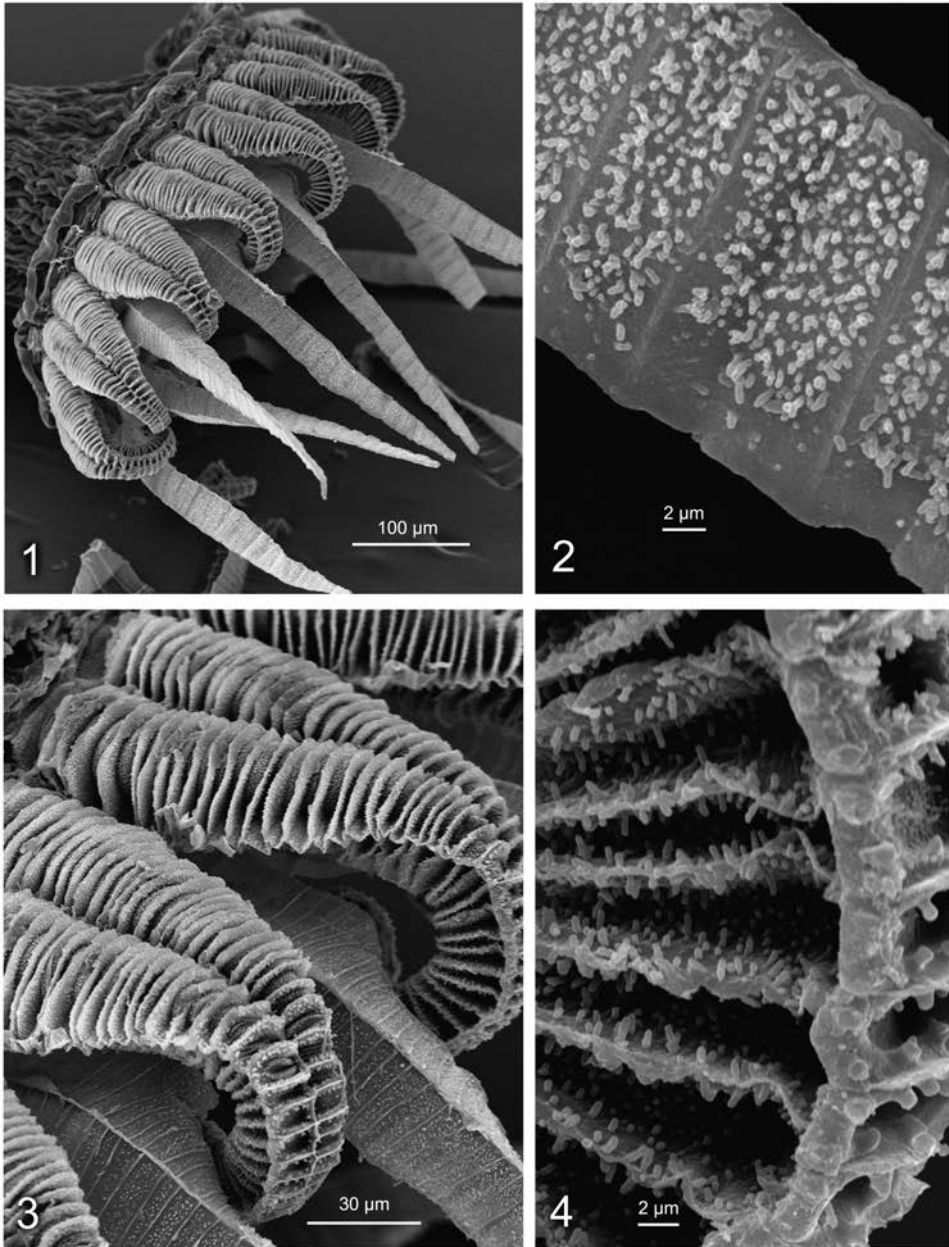


Fig. 3. *Cyclodictyon provectum* W.R. Buck (Type, Ecuador, Kürschner *et al.* 02-804, SEM photographs). **1** Peristome; **2** ornamentation of endostome segments; **3**, **4** ornamentation of exostome teeth.

laminal cells long-hexagonal, *ca* 5:1, thin-walled, elongate and firm-walled in 4–5 rows at margin. Setae reddish, 1.5–2 cm long, smooth; vaginula naked; capsules horizontal, cylindrical, *ca* 2 mm long; exothecial cells short-rectangular, firm-walled, collenchymatous, becoming smaller, thick-walled and broadly oblate in 3–5 rows; annulus not differentiated; operculum long-rostrate, *ca* 1 mm long; exostome teeth on front surface strongly furrowed with a zig-zag center line down furrow, cross-striolate below, strongly trabeculate with the trabeculae finely papillose, coarsely papillose above, trabeculate and finely papillose at back; endostome finely papillose throughout, basal membrane high, segments keeled, not or scarcely perforate, with baffle-like cross-walls across the keel, about as long as the teeth, cilia none. Spores green, 17–25 mm in diameter, almost smooth. Calyptrae mitrate, lobed at base, naked, smooth.

Etymology: from the Latin, *provectus*, meaning extended or carried forward, in reference to the elongate supracostal laminal cells that appear to extend the costa.

Most Andean species of *Cyclodictyon* are large-celled, with laminal cells usually *ca* 30 mm wide and with mostly 7–9 cells between the costal apices. There are only a couple of small-celled species in which the laminal cells are *ca* 10–15 mm wide and with at least 15 cells between costal apices. Among these are *C. caespitosum* (Mitt.) Kuntze of Ecuador and *C. obscurum* Herzog of Bolivia. *C. caespitosum* is probably the most closely related species to *C. provectum*. It differs in having more flaccid and contorted leaves, a limbidium only 1–2(–3) cells wide, a much more serrate laminal margin, and no differentiation of elongate laminal cells distal to the costal apices. *C. obscurum* has much broader leaves, shorter and more serrate acumina (*ca* 1/8 the leaf length), and the lack of elongate laminal cells distal to the costal apices.

Cyclodictyon roridum (Hampe) O. Kuntze – Neotrop – Q4, 1850 m, O-N, r, *Kü 01-559*, *Kü 01-560*; Q4, 1800 m, O-N, r, *Kü 02-536*; Q2, 1900 m, O-N, dw, *Kü 02-706*.

Cyclodictyon rubrisetum (Mitt.) O. Kuntze – Neotrop – CK, 1840–1850 m, O-N, r(w), *SV 23440*, *23547*; *ibid.*, dw, *SV 23531*; Q2, 1860 m, O-N, h, *SV 23458/A*; RSF, 1800 m, O-N, r, *SV 23202*;

Cyclodictyon shillicatense (Mitt.) O. Kuntze – nA – QSR, 1920–1930 m, O-N, r, *Kü 02-623*, det. W. R. Buck.

Hypnella pilifera (Hook. f. & Wils.) A. Jaeg. – Neotrop – T2, 2050 m, O-N, dw, *Kü 02-506*; QSR, cascade, 1930 m, O-N, dw, *Kü 02-642*.

Lepidopilum amplirete (Sull.) Mitt. – Neotrop – Q2, 1890 m, O-N, e, *SV 23459/A*.

Lepidopilum longifolium Hampe – Neotrop – CK, 1830 m, O-N, e, *SV 23437*.

Lepidopilum scabrisetum (Schwägr.) Steere – Neotrop – T2, 1850 m, e, *Kü 02-473b*; CA_t, 1870 m, O-N, e, *SV 23236/A*.

Pilotrichum bipinnatum (Schwägr.) Brid. – Neotrop – Q4, 1800 m, O-N, e, *Kü 02-526*; QSR, cascade, 1930 m, O-N, r, *Kü 02-632*; Q4, 1900 m, O-N, r(w), *Kü 02-810*.

Trachyxiphium guadalupense (Horns.) A. Jaeg. – Neotrop – CK (Planta Electrica), 1900 m, O-N, dw, *Kü 02-610a*; T2, 2200 m, O-N/M-P, dw, *Kü 02-658*; Q2, 1960 m, O-N, dw, *Kü 02-757b*; Q4/T1, 1900 m, O-N, dw, *Kü 02-799b*; Q4, 1880 m, O-N, d, *SV 23225* p.p.; T1, 2350 m, M-P, d, *SV 23375*; Q2, 1860 m, O-N, d, *SV 23457/B* p.p.

Plagiotheciaceae

Plagiothecium novogranatense (Hampe) Mitt. – Neotrop – Q2, 1890 m, O-N, h, *SV 23464*.

Polytrichaceae

Pogonatum campylocarpum (Müll. Hal.) Mitt. – Neotrop – Q El Milagro, O-N, 2250 m, s, *Kü 02-697*; CK, 1850 m, s, *SV 23530*.

Pogonatum pennsylvanicum (Hedw.) P. Beauv. – Neotrop – ECSE, 1850 m, along trail, s, *Gr 10069*; CK, 1850 m, s, *SV 23541* p.p.

Pogonatum semipellucidum (Hampe) Mitt. – nA – Q El Milagro, O-N, 2250 m, s, r, *Kü 02-698*.

Pogonatum tortile (Sw.) Brid. – Neotrop – ECSE, 1850 m, s, *Gr 10115*.

Polytrichadelphus aristatus (Hampe) Mitt. – nA – CA, 3100 m, C-W, s, *Kü 02-578*.

Steelebryon subulirostrum (Schimp.) G.L.Smith – Neotrop – Q4, 1880 m, O-N, s, *SV 23222*; CK, 1850 m, O-N, s, *SV 23541*.

Pottiaceae

Barbula arcuata Griff. – Pantrop – RSF, 1800 m, on boulder in the river, s, *Gr 10048*.

Barbula indica (Hook.) Spreng. – Pantrop – ECSE, 1850 m, s, *Gr 10080a* (as *B. cf. indica*, det. H. Kürschner & G. Parolly); CK, 1850 m, c, *SV 23540/B*.

Bryoerythrophyllum campylocarpum (Müll. Hal.) H. Crum – Subcos – QSR, cascade, 1930 m, O-N, r, *Kü 02-633*; RSF, 1800 m, on boulder in the river, s, *Gr 10077, 10081*, det. H. Kürschner & G. Parolly.

Tortella humilis (Hedw.) Jenn. – Subcos – RSF, 1800 m, on boulder in the river, s, *Gr 10047*, det. H. Kürschner & G. Parolly.

Weissia controversa Hedw. – Subcos – CK (Planta Electrica), 1900 m, O-N, r, *Kü 02-615*.

Pterobryaceae

Calyptothecium duplicatum (Schwägr.) Broth. – Pantrop – Q2, 2010 m, O-N, e, *Kü 02-777*.

Sematophyllaceae

Sematophyllum subpinnatum (Brid.) E.Britton – Neotrop-Afr – Q2, 1930 m, O-N, e, *Kü 02-721*; Q2, 1950 m, O-N, e, *Kü 02-744*; CV, 1800 m, O-N (river bank), s, *Kü 03-278, 280, Gr 10074, 10075*.

Splachnaceae

Tayloria scabriseta (Hook.) Mitt. – nA – CA, 3020 m, SP, on dead organic material, *SV 23504*.

Thamnobryaceae

Porotrichum longirostre (Hook.) Mitt. – Neotrop – Q4, 1800 m, O-N, e, *Kü 02-521*
Thamnobryum fasciculatum (Hedw.) I.Sastre – Neotrop – QSR, cascade, 1930 m, O-N, r, *Kü 01-801*, det. S. R. Gradstein, as *Porotrichum korthalsianum* in Nöske *et al.* (2003).

Thuidiaceae

Thuidium peruvianum Mitt. [*T. delicatulum* (Hedw.) Bruch & Schimp var. *peruvianum* (Mitt.) H.Crum] – Neotrop – Q4, 1900 m, O-N, r(w), *Kü 02-809*.

GENERAL DISCUSSION

The present paper lists 198 taxa from the Reserva Biológica San Francisco at specific or subspecific level. One hundred ninety four of them are new additions to the local florula, while four represent altered identifications or taxonomic concepts. The additions bring the total bryophyte inventory of the Reserva close to an amazing 500 taxa mark: 499 bryophytes, including 313 liverworts (62.9%), 183 mosses (36.5%) and – unchanged – three hornworts (0.6%). The number of species is probably the highest ever recorded from a relatively small area (1,000 ha) in the tropics. Twenty-five species (21 liverworts and four mosses, 11%) represent first records for the bryophyte flora of Ecuador and six are new to science, viz. *Cyclodictyon provectum*, *Fuscocephaloziopsis subintegra* (both described in this paper), *Diplasiolejeunea erostrata*, *D. grandirostrata* (Schäfer-Verwimp, 2004), *Physotheca autoica* (Engel & Gradstein, 2003) and *Plagiochila cucullifolia* var. *anomala* (Heinrichs *et al.*, 2003).

These extensive additions do not alter the phytogeographical make-up of the bryophyte flora of the reserve as described by Nöske *et al.* (2003), except for the percentage of Ecuadorian endemics which has now risen to 2% (previously <1%). The rise of percent endemism in the reserve is due to the records of *Lophocolea polychaeta* and *Porella acanthota* and the six species new to science (see above). The bulk of the species newly recorded (69%) are widespread ones, belonging to the neotropical element (55.6% / 110 taxa) or wide-tropical element (pantropical chorotype: 8.1% / 16 taxa; neotropical-African chorotype: 5.1% / 10 taxa). The second important group is the Andean element (16.2% / 32 taxa), which includes 13.1% of taxa with a northern Andean distribution. Subcosmopolitan (3.5%) and temperate elements include many mosses and occur, as expected, mainly at the higher elevations. For an interpretation of the distribution patterns reference is made to the first paper in this series (Nöske *et al.*, 2003).

This study impressively underlines that the montane forests of the northern Andes are one of the world's main hotspots of biodiversity. As far as bryophytes are concerned, the importance of the Reserva Biológica San Francisco as a bryological hotspot can hardly be overemphasized. Indeed, we expect that the flow of additional records and species new to Ecuador or even new to science will continue. Judging from the gatherings made in the neighbouring Parque Nacional Podocarpus (Parolly & Kürschner 2004a, b), which include many species not recorded from the reserve, we expect that the bryophyte flora of the PNP may well include some 700 species. This local diversity is unique, even in the diverse tropics.

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