cryptogamie
Bryologie
2022 • 43 • 9

Liverworts and hornworts of Barro Colorado Island, Panama

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art. 43 (9) — Published on 29 July 2022
www.cryptogamie.com/bryologie

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Couverture / *Cover*:
Photography of epiphylls taken by Anna Mežaka, in Barro Colorado Island, on November 12th, 2016.

Cryptogamie, Bryologie est indexé dans / Cryptogamie, Bryologie *is indexed in:*
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Cryptogamie, Bryologie est distribué en version électronique par / Cryptogamie, Bryologie *is distributed electronically by:*
– BioOne® (http://www.bioone.org)

Cryptogamie, Bryologie est une revue en flux continu publiée par les Publications scientifiques du Muséum, Paris
***Cryptogamie, Bryologie** is a fast track journal published by the Museum Science Press, Paris*

Les Publications scientifiques du Muséum publient aussi/ *The Museum Science Press also publish:* ***Adansonia, Geodiversitas, Zoosystema, Anthropozoologica, European Journal of Taxonomy, Naturae, Comptes Rendus Palevol,* Cryptogamie sous-sections *Algologie, Mycologie.***

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Tél.: 33 (0)1 40 79 48 05 / Fax: 33 (0)1 40 79 38 40
diff.pub@mnhn.fr / http://sciencepress.mnhn.fr
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ISSN (imprimé / *print*): 1290-0796 / ISSN (électronique / *electronic*): 1776-0992

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Submitted on 30 September 2021 | Accepted on 15 April 2022 | Published on 29 July 2022

Dauphin G., Gradstein S. R. & Salazar Allen N. 2022. — Liverworts and hornworts of Barro Colorado Island, Panama. *Cryptogamie, Bryologie* 43 (9): 153-165. https://doi.org/10.5252/cryptogamie-bryologie2022v43a9. http://cryptogamie.com/bryologie/43/9

ABSTRACT
Eighty-five species of liverworts and one hornwort are reported from Barro Colorado Island, Panama. About 80 % of the species are Lejeuneaceae Cavers, reflecting the predominance of members of this family in tropical lowland regions. Most of the species have wide neotropical or pantropical distributions. One species, *Lejeunea tamasii* M.E.Reiner, N.Salazar & C.Chung, is only known from Barro Colorado Island. The island is rich in epiphyllous taxa. Total bryophyte diversity (167 spp.) of the island is noteworthy given its limited surface area. *Aneura latissima* Spruce and *Lejeunea pulverulenta* (Steph.) M.E.Reiner are reported new to Central America.

KEY WORDS
Central America, tropical lowland forest, bryophytes, Anthocerotophyta, Marchantiophyta, Lejeuneaceae, floristics, new records.

RÉSUMÉ
Hépatiques et anthocérotes de l'île de Barro Colorado, Panama.
Quatre-vingt-cinq espèces d'hépatiques et une anthocérote sont répertoriées sur l'île de Barro Colorado, Panama. Environ 80 % des espèces appartiennent aux Lejeuneaceae Cavers, ce qui reflète l'importance de cette famille dans la forêt tropicale de plaine. La plupart des espèces ont une distribution néotropicale ou pantropicale. Une espèce, *Lejeunea tamasii* M.E.Reiner, N.Salazar & C.Chung, est seulement connue de l'île de Barro Colorado. L'île est riche en taxons épiphylles. La diversité totale de bryophytes sur l'île est remarquable (167 spp.), au regard de sa petite surface. *Aneura latissima* Spruce et *Lejeunea pulverulenta* (Steph.) M.E.Reiner sont signalées comme étant nouvelles en Amérique centrale.

MOTS CLÉS
Amérique centrale, forêt tropicale de plaine, bryophytes, Anthocerotophyta, Marchantiophyta, Lejeuneaceae, floristique, signalements nouveaux.

INTRODUCTION

Barro Colorado Island (BCI; 9°10'N, 79°51'W) in Gatún Lake, Panama, was formed in 1914 during the construction of the Panama Canal. The island has a surface area of about 15 km^2 and is covered by semi-deciduous tropical lowland forest. Average annual temperature is 27°C and annual rainfall about 2600 mm, most of which falls during the second half of the year. The dry season lasts about four months, from mid-December to April. The relief of the island is irregular, consisting of hills traversed by gorges and steep slopes; the highest point is about 170 m a.s.l. (Croat 1978; Salazar Allen *et al*. 1991; Sugasti & Pinzón 2020).

BCI is a nature reserve administered by the Smithsonian Tropical Research Institute (STRI), which operates a field station on the northeastern shore of the island. The station is one of the earliest tropical research facilities of its kind, where studies have been carried out for more than a hundred years. As a result, BCI is probably the most thoroughly studied area of tropical lowland forest in the world (Leigh 1999).

Mosses of BCI were studied by Salazar Allen *et al*. (1991) who reported 81 species. In addition, they mentioned the occurrence of 13 species of liverworts on the island, citing Haynes (1933) and R. Stotler (pers. comm.). Most bryophyte species were found growing on bark and rock, few occurred on soil. All of the species were widespread in the Neotropics and endemic taxa were lacking. Several works such as Marino & Salazar Allen (1991), Stotler *et al*. (1998), Dauphin *et al*. (2006) and Reiner-Drehwald *et al*. (2013), contributed to increase our knowledge of the local liverwort flora. The present paper presents the first modern list of liverwort and hornwort species recorded from the island.

MATERIAL AND METHODS

The species list has been compiled based on study of collections made randomly by the authors on Barro Colorado Island; herbarium collections deposited in the herbarium of the university of Panama (PMA); and a survey of the literature (Haynes 1933; Crum & Arzeni 1953; Marino & Salazar Allen 1991; Stotler *et al*. 1998; Dauphin *et al*. 2006; Reiner-Drehwald *et al*. 2013). Nomenclature and geographical distribution of the species are according to Söderström *et al*. (2016) and Gradstein (2021). Unless otherwise indicated, the cited specimens are kept in PMA with selected duplicates in CR, U and GOET. Authorities for taxa are cited in the alphabetic species list.

RESULTS AND DISCUSSION

A total of 85 liverwort species, in 37 genera and 12 families, and one unidentified species of hornworts (*Anthoceros* sp.) are reported from BCI. A few additional species records are excluded or are considered dubious, needing verification. As compared with Salazar Allen *et al*. (1991), in this study the number of liverwort species known from the island has increased 6.5 times and slightly exceeds that of mosses (81). Two species, *Aneura latissima* Spruce and *Lejeunea pulverulenta* (Steph.) M.E.Reiner are new records for Central America.

About 80 % of the liverwort species of BCI and *c*. 40 % of all bryophytes are members of Lejeuneaceae Cavers (67 species). The predominance of Lejeuneaceae reflects the importance of this liverwort family in tropical lowland regions (e.g. Cornelissen & Gradstein 1990; Gradstein & Ilkiu-Borges 2009; Campos *et al*. 2015). Further liverwort families include Plagiochilaceae Müll.Frib. (four spp.), Frullaniaceae Lorch (three spp.) and Radulaceae Müll.Frib. (two spp.); seven families are represented by a single species. The most important genera are *Cololejeunea* (Spruce) Steph. with 13 species and *Lejeunea* Lib. with 12 species.

Most of the liverwort species have wide, neotropical or pantropical distributions. One species, *Lejeunea tamasii* M.E.Reiner, N.Salazar & C.Chung, is only known from BCI. The species is apparently not rare on BCI and is known from several collections. Three further liverwort species are rare taxa with limited or highly disjunct ranges. They include *Fulfordianthus evansii* (Fulford) Gradst., known only from five localities in Central America, *Cololejeunea panamensis* G.Dauphin & Pócs, recorded from BCI and two localities in the Brazilian Amazon region (Brito & Ilkiu-Borges 2012), and *Kymatocalyx rhizomaticus* (Herzog) Gradst. & Váňa, known from few localities in the Chocó biogeographic region, Madagascar and a single locality in Borneo (Gradstein & Váňa 1999). The phytogeographic composition of the liverwort flora of BCI is rather similar to that of mosses, but the latter flora exclusively consists of widespread taxa and lacks endemic or rare species (Salazar Allen *et al*. 1991).

In terms of habitat preference, most liverwort species occur on bark, rock or living leaves; few grow on rotten wood or soil. Characteristic bark-inhabiting (corticolous) taxa, that are commonly seen on tree trunks, include members of the genera *Ceratolejeunea* (Spruce) J.B.Jack & Steph. (three spp.), *Cheilolejeunea* (Spruce) Steph. (three spp.), *Lejeunea* (*c*. ten spp.), *Microlejeunea* (Spruce) Steph. (two spp.), *Plagiochila* (Dumort.) Dumort. (three spp.), *Symbiezidium* Trevis. (two spp.) as well as *Radula javanica* Gottsche and *Stictolejeunea squamata* (Willd.) Schiffn.

Some of them show a preference for exposed, well-lit sites and qualify as sun epiphytes, such as the two species of *Rectolejeunea* A.Evans, *Caudalejeunea lehmanniana* (Gottsche) A.Evans, *Ceratolejeunea laetefusca* (Austin) R.M.Schust., *Dibrachiella auberiana* (Mont.) X.Q.Shi, R.L.Zhu & Gradst., *Harpalejeunea oxyphylla* (Nees & Mont.) Steph., *Lejeunea laetevirens* Nees & Mont., *L. parviloba* Ångstr., *Lopholejeunea subfusca* (Nees) Schiffn. and *Thysananthus auriculatus* (Wilson & Hook.) Sukkharak & Gradst. Others are mainly found on the bases of trunks or on roots and are shade epiphytes. They include the two species of *Prionolejeunea* (Spruce) Schiffn., *Dibrachiella parviflora* (Nees) X.Q.Shi, R.L.Zhu & Gradst., *Lophocolea liebmanniana* Gottsche, *Marchesinia bongardiana* (Lehm. & Lindenb.) Trevis., *Pictolejeunea picta* (Steph.) Grolle, *Lejeunea tamasii* and *Stictolejeunea balfourii* (Mitt.) E.W.Jones.

The latter two species also grow on rock, and *Stictolejeunea balfourii* is found near running water of creeks.

Epiphylls abound on older leaves of understory shrubs and include 22 species, all of them members of Lejeuneaceae. Nearly ¾ of the species were only found on living leaves and qualified as typical or obligate epiphylls. Marino & Salazar Allen (1991) and Mežaka *et al*. (2020) found that epiphylls on BCI are most common in closed forest or in small forest gaps, and that their community structure is strongly influenced by the microclimate, especially light and air humidity. Common epiphyllous species of BCI include members of the genera *Ceratolejeunea* (two spp.), *Cololejeunea* (11 spp.), *Diplasiolejeunea* (Spruce) Schiffn. (three spp.), *Leptolejeunea* (Spruce) Steph. (five spp.), and *Radula flaccida* Lindenb. & Gottsche. Surprisingly, the genus *Cyclolejeunea* A.Evans, one of the most common epiphyllous liverwort genera in the lowland rainforests of South America (Gradstein *et al*. 2001), is absent in BCI. Possibly, this reflects the semi-deciduous nature of the forest of BCI and the prolonged dry season (*c*. four months).

Few liverwort species are found on rotten wood and soil. Taxa of rotten wood include *Aneura latissima* Spruce, *Lejeunea glaucescens* Gottsche, *Lepidolejeunea involuta* (Gottsche) Grolle, *Prionolejeunea muricatoserrulata* (Spruce) Steph. and *Zoopsidella integrifolia* (Spruce) R.M.Schust., whereas *Calypogeia miquelii* Gottsche, Lindenb. & Nees, *Cylindrocolea rhizantha* (Mont.) R.M.Schust., *Kymatocalyx rhizomaticus*, *Riccardia regnellii* Ångstr., *Riccia weinionis* Steph., and the single hornwort seen on BCI, *Anthoceros* sp., grow on soil. Most of the terrestrial species are rare taxa of BCI.

As a result of this study, the bryophyte flora of BCI consists of 167 species (85 liverworts, 81 mosses, one hornwort). The number of species recorded is slightly higher than recorded from Jaú National Park (JNP) in the Central Amazon region of Brazil, where 150 species were reported by Sierra *et al*. (2018). The latter area was richer in liverworts (109 spp.), however, and harbored more rare species, including 20 taxa endemic to the Amazon basin. The lower species number at JNP is unexpected since its surface area is more than 1000× larger than that of BCI and is enclosed by several types of lowland forest, including evergreen and deciduous forest. The lesser bryophyte diversity at Jaú National Park is probably explained by incomplete sampling as it was calculated that nearly ⅓ of the species richness of JNP had remained undetected (Sierra *et al*. 2018).

ALPHABETICAL LIST OF GENERA AND SPECIES (** NEW RECORDS FOR CENTRAL AMERICA)

Phylum MARCHANTIOPHYTA Stotler & Crand.-Stotl.

Genus *Aneura* Dumort.

*****Aneura latissima*** Spruce

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, Shannon trail 0-2, *Dauphin 3076*.

HABITAT. — On shaded rock and rotten logs.

DISTRIBUTION. — New to Central America. Tropical America, Africa.

Genus *Bryopteris* (Nees) Lindenb.

Bryopteris filicina (Sw.) Nees

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Shannon trail 0-2, *Standley 40883* (F); *Dauphin 3065*.

HABITAT. — On trunks.

DISTRIBUTION. — Tropical America.

Genus *Caudalejeunea* Schiffn.

Caudalejeunea lehmanniana (Gottsche) A.Evans

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15071*; Wetmore trail 15-16, *Salazar Allen 5959*; Balboa trail, *Salazar Allen 4346a*; Wheeler trail 4-5, *Salazar Allen 4741*; Snyder-Molino trail, *Dauphin 3055*; *Gradstein & Salazar Allen 15097*.

HABITAT. — On branches in exposed sites.

DISTRIBUTION. — Pantropical.

Genus *Calypogeia* Raddi

Calypogeia miquelii Gottsche, Lindenb. & Nees

C. amazonica (Spruce) Steph., *Bulletin de l'Herbier Boissier* (série 2) 8: 680 (1908).

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, *Standley 40883* (F); Barbour Point, *Dauphin 3155*; Basilisk Bay, *Dauphin 3163*; Shannon 0-2, *Dauphin 3074*; Standley trail 0-5, *Dauphin 3118*; *Gradstein & Salazar Allen 15091*.

HABITAT. — On rock and moist soil along streams and at the lake shore.

DISTRIBUTION. — Northern South America, Central America, West Indies.

Genus *Ceratolejeunea* (Spruce) J.B.Jack & Steph.

Ceratolejeunea coarina (Gottsche) Steph.

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Shannon trail 0-2, *Dauphin 3072*; bay E from Gross trail 5, *Dauphin 3173*.

HABITAT. — On bark and living leaves.

DISTRIBUTION. — Tropical America, Africa.

Ceratolejeunea cornuta (Lindenb.) Steph.

C. maritima (Spruce) Steph., *Species Hepaticarum* 5: 423 (1913).

Specimens examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15072*, *15142* (GOET); Shannon creek, *Marino 9*, *32*; Lutz trail, *Shattuck 568* p.p. (Stotler *et al*. 1998); Laboratory Cove, *Dauphin 3140*; Basilisk Bay, *Dauphin 3162*.

Habitat. — On bark and living leaves.

Distribution. — Tropical America, Africa.

Ceratolejeunea cubensis (Mont.) Schiffn.

Specimens examined. — **Panama**. Barro Colorado Island, Brook trail 2, *Willis 30d*; Brook trail 3, *Willis 7c*, *54c*; Armour trail 21, *Willis 5d*; Zetek trail 4, W*illis 54f* (Stotler *et al*. 1998).

Habitat. — On bark of trees and lianas.

Distribution. — Tropical America.

Ceratolejeunea laetefusca (Aust.) R.M.Schust.

C. integrifolia A.Evans, *Bulletin of the Torrey Botanical Club* 38: 213 (1911).

Specimens examined. — **Panama**. Barro Colorado Island, *Shattuck 4*, *568* p.p. (Stotler *et al*. 1998); Fairchild trail 4, *Dauphin 3134*; Nemesia trail, *Dauphin 3103*; Snyder-Molino trail, *Dauphin 3052*; Shannon trail 0-2, *Dauphin 3075*.

Habitat. — On tree trunks in relatively dry, exposed sites.

Distribution. — Tropical America.

Genus *Cheilolejeunea* (Spruce) Steph.

Cheilolejeunea adnata (Lehm.) Grolle

Specimens examined. — **Panama**. Barro Colorado Island, laboratory area, *Salazar Allen & Chung 4728*; Miller trail 24-25, *Salazar Allen & Chung 4508* (Stotler *et al*. 1998); *Gradstein & Salazar Allen 15142a*.

Habitat. — On bark.

Distribution. — Tropical America.

Cheilolejeunea discoidea (Lehm. & Lindenb.) Kachroo & R.M.Schust.

Specimens examined. — **Panama**. Barro Colorado Island, laboratory area, *Dauphin 3231* (Dauphin *et al*. 2006).

Habitat. — On bark of *Anacardium excelsum* (Bertero & Balb. ex Kunth) Skeels.

Distribution. — Tropical America.

Cheilolejeunea rigidula (Mont.) R.M.Schust.

Specimens examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15072*, *15115*; *Shattuck 4Ch* (F); Barbour point, *Dauphin 3157*, *3159*; Miller trail 20, *Salazar Allen & Chung 4538*; van Tyne trail, *Salazar Allen & Chung 4627b*; Fairchild trail 1 and 17-18, *Salazar Allen, Chung & Santamaría 6035*, *6079* (Stotler *et al*. 1998); Gross trail 10, *Dauphin 3171*; *Gradstein & Salazar Allen 15093a*.

Habitat. — Common on tree trunks.

Distribution. — Tropical and subtropical America, Africa.

Genus *Cololejeunea* (Spruce) Steph.

Aphanolejeunea A.Evans, *Bulletin of the Torrey Botanical Club* 38: 272 (1911).

Cololejeunea antillana Pócs

Aphanolejeunea longifolia Jovet-Ast, *Revue bryologique et lichénologique* 16: 23 (1947).

Specimen examined. — **Panama**. Barro Colorado Island, Armour trail 25-26, *Dauphin 3215* (Dauphin *et al*. 2006).

Habitat. — On living leaves.

Distribution. — Tropical America.

Cololejeunea camillii (Lehm.) A.Evans

Aphanolejeunea camillei (Lehm.) R.M.Schust., *The Hepaticae and Anthocerotae of North America* 4: 1297 (1980).

Specimens examined. — **Panama**. Barro Colorado Island, Shannon trail 0-2, *Dauphin 3080*, *3087*, *3126*, *3080*, *3210*, *322* (Dauphin *et al*. 2006).

Habitat. — On living leaves.

Distribution. — Tropical America.

Cololejeunea cardiocarpa (Mont.) A.Evans

Specimens examined. — **Panama**. Barro Colorado Island, *Marino 7*, *29* (Marino & Salazar Allen 1991; Stotler *et al*. 1998).

Habitat. — On living leaves.

Distribution. — Pantropical.

Cololejeunea gracilis (Jovet-Ast) Pócs

Aphanolejeunea gracilis Jovet-Ast, *Revue bryologique et lichénologique* 16: 21 (1947).

Specimen examined. — **Panama**. Barro Colorado Island, Shannon trail 0-2, *Dauphin 3070*.

Habitat. — On living leaves.

Distribution. — Pantropical.

Cololejeunea microscopica (Taylor) Schiffn.

Aphanolejeunea microscopica (Taylor) A.Evans, *Bulletin of the Torrey Botanical Club* 38: 273 (1911).

Specimen examined. — **Panama**. Barro Colorado Island, *Salazar Allen & Gradstein 15103*.

Habitat. — Creeping over *Plagiochila disticha* (Lehm. & Lindenb.) Lehm. & Lindenb.

Distribution. — Tropical and subtropical America, Africa, western Europe.

Cololejeunea minutilobula Herzog

Specimens examined. — **Panama**. Barro Colorado Island, Fuertes Cove, *Dauphin 3113*; Shannon trail 4, *Dauphin & Moser 3129* (cf.); *Gradstein & Salazar Allen 15141* p.p.

Habitat. — On living leaves.

Distribution. — Costa Rica, Panama (Mežaka *et al*. 2020), Brazil.

Remarks

The plants stand out by leaf lobes with a few hyaline projecting cells at the apex, leaf lobules reduced or inflated, and ventral merophytes 3-4 cells wide.

Cololejeunea obliqua (Nees & Mont.) Schiffn.

Specimens examined. — **Panama**. Barro Colorado Island, Shannon creek, *Marino 4*, *37*, *38* (Marino & Salazar Allen 1991; Stotler *et al*. 1998); Shannon trail 0-2, *Dauphin 3077*, *3078*, *3186*; Shannon 4, *Dauphin & Moser 3128*.

Habitat. — On living leaves.

Distribution. — Pantropical.

Cololejeunea panamensis G.Dauphin & Pócs

Specimen examined. — **Panama**. Barro Colorado Island, at lake shore, *Dauphin s.n.* (type, Dauphin *et al*. 2006; Mežaka *et al*. 2020).

Habitat. — On bark of liana.

Distribution. — Panama (Barro Colorado Island), Brazil (Amazonia; Brito & Ilkiu-Borges 2012; Sierra *et al*. 2018).

Cololejeunea schusteri Pócs

Specimen examined. — **Panama**. Barro Colorado Island, Barbour Point, *Dauphin 3153* p.p. (Dauphin *et al*. 2006).

Habitat. — On trunk of *Clusia* sp.

Distribution. — Brazil, Panama.

Cololejeunea sicifolia (A.Evans) Pócs & Bernecker

Aphanolejeunea sicaefolia A.Evans, *Bulletin of the Torrey Botanical Club* 38: 277 (1911).

Specimens examined. — **Panama**. Barro Colorado Island, Armour, Wheeler and Zetek trails, *Marino 14*, *15*, *16*, *19*, *21*, *22*, *23*, *24*, *25*, *26*, *29* (Marino & Salazar Allen 1991; Stotler *et al*. 1998).

Habitat. — On living leaves.

Distribution. — Tropical America.

Cololejeunea submarginata Tixier

Specimens examined. — **Panama**. Barro Colorado Island, Armour trail 27, *Dauphin 3091* p.p.; Lathrop 3, *Dauphin 3098*; Basilisk Bay, *Dauphin 3166*, *3170*; bay E de Gross 5, *Dauphin 3177* p.p., *3178*.

Habitat. — On living leaves.

Distribution. — Tropical America.

Cololejeunea surinamensis Tixier

Specimens examined. — **Panama**. Barro Colorado Island, Armour trail 27, *Dauphin 3091*; Basilisk Bay, *Dauphin 3166*, *3170*; bay E of Gross 5, *Dauphin 3177*, *3178*; Lathrop 3, *Dauphin 3098*; *Marino 14*, *17*, *24*, *29*; Miller trail, *Salazar Allen & Chung 4530* (Marino & Salazar Allen 1991; Stotler *et al*. 1998 as *C. planifolia* (Evans) R.M.Schust.); *Gradstein & Salazar Allen 15141* p.p.

Habitat. — On living leaves.

Distribution. — Northern South America, Panama.

Cololejeunea verwimpii Tixier

Specimens examined. — **Panama**. Barro Colorado Island, Fuertes Cove, *Dauphin 3110*; Barbour Point, *Dauphin 3153* p.p.; Shannon 7, *Salazar Allen & Gradstein 15123*.

Habitat. — On living leaves and tree trunks.

Distribution. — Tropical America.

Genus *Colura* (Dumort.) Dumort.

Colura tortifolia (Nees & Mont.) Trevis.

Specimens examined. — **Panama**. Barro Colorado Island, Armour, Wheeler and Zetek trails, *Marino 18*, *33* (Marino & Salazar Allen 1991; Stotler *et al*. 1998); Shannon trail 0-2, *Dauphin 3079*.

Habitat. — On living leaves and bark.

Distribution. — Tropical America.

Genus *Cyathodium* Lehm.

Cyathodium spruceanum Prosk.

Specimen examined. — **Panama**. Barro Colorado Island, Donato trail to Lutz tower, *Dauphin 3084*.

Habitat. — On shaded rock at stream.

Distribution. — Central America (Costa Rica, Panama), Peru, Brazil.

Genus *Cylindrocolea* R.M.Schust.

Cylindrocolea rhizantha (Mont.) R.M.Schust

Specimens examined. — **Panama**. Barro Colorado Island, Pearson trail 12, *Dauphin 3108*; Barbour point, *Dauphin 3152*.

Habitat. — On shaded rock and soil (vertical trail banks).

Distribution. — Tropical and subtropical America.

Genus *Dibrachiella* (Spruce) X.Q.Shi, R.L.Zhu & Gradst.

Dibrachiella auberiana (Mont.) X.Q.Shi, R.L.Zhu & Gradst.

Archilejeunea auberiana (Mont.) A.Evans, *Hedwigia* 29 (3): 133 (1890).

Specimen examined. — **Panama**. Barro Colorado Island, forest edge near plantation, *Salazar Allen & Gradstein 15099* (Stotler *et al.* 1998).

Habitat. — On bark in relatively dry, exposed sites.

Distribution. — Tropical America.

Dibrachiella parviflora (Nees) X.Q.Shi, R.L.Zhu & Gradst.

Archilejeunea parviflora (Nees) Steph., *Hedwigia* 29 (3): 134 (1890).

Specimens examined. — **Panama**. Barro Colorado Island, Basilisk Bay, *Dauphin 3160*; Barbour trail 27-28, *Salazar Allen 4424b*, *4426*; *Chung & Aranda 238* (Gradstein 1994); *Gradstein & Salazar Allen 15109*; Snyder-Molino trail, *Dauphin 3059*; Lathrop-Barbour trail 3, *Dauphin 3100*.

Habitat. — On rock, trunk bases and roots, in shaded sites, often near streams.

Distribution. — Tropical America.

Genus *Diplasiolejeunea* (Spruce) Schiffn.

Diplasiolejeunea brunnea Steph.

Specimens examined. — **Panama**. Barro Colorado Island, Fuertes Cove, *Dauphin 3110*, *3114*.

Habitat. — On living leaves.

Distribution. — Tropical America.

Diplasiolejeunea pellucida (Spreng.) Schiffn.

Specimens examined. — **Panama**. Barro Colorado Island, epiphyllous, *Chickering s. n.* (Crum & Arzeni 1953; Stotler *et al.* 1998).

Habitat. — On living leaves.

Distribution. — Tropical America.

Diplasiolejeunea unidentata (Lehm. & Lindenb.) Schiffn.

Specimens examined. — **Panama**. Barro Colorado Island, *Marino 2*, *8*, *36* (Marino & Salazar Allen 1991; Stotler *et al.* 1998).

Habitat. — On living leaves.

Distribution. — Pantropical.

Genus *Drepanolejeunea* (Spruce) Steph.

Drepanolejeunea bidens (Prantl) A.Evans

Specimens examined. — **Panama**. Barro Colorado Island, *Chickering s.n.* (MICH; Crum & Arzeni 1953; Stotler *et al.* 1998).

Habitat. — On bark.

Distribution. — Tropical America.

Genus *Dumortiera* Nees

Dumortiera hirsuta (Sw.) Nees

Specimen examined. — **Panama**. Barro Colorado Island, *Chickering s.n.* (Stotler *et al.* 1998).

Habitat. — On moist, shaded soil.

Distribution. — Tropical and warm temperate regions.

Genus *Frullania* Raddi

Frullania brasiliensis Raddi

Specimen examined. — **Panama**. Barro Colorado Island, Barbour point, *Dauphin 3155*.

Habitat. — On rock at wind-exposed site.

Distribution. — Tropical America.

Frullania gibbosa Nees

Specimens examined. — **Panama**. Barro Colorado Island, lake shore close to Armour trail, *Dauphin 3093*; Laboratory Cove, *Dauphin 3146*; *Shattuck 569* p.p. (Haynes 1933; Stotler *et al.* 1998).

Habitat. — On bark and logs.

Distribution. — Tropical America.

Frullania obcordata (Lehm. & Lindenb.) Lehm. & Lindenb.

F. caulisequa auct., non (Nees) Mont., *Annales des Sciences naturelles, Botanique*, série 2, 12: 51 (1839).

Specimens examined. — **Panama**. Barro Colorado Island, Wheeler trail 5-6, *Salazar Allen & Chung 4737b* (Stotler *et al.* 1998); lake shore close to Armour trail, *Dauphin 3092*.

Habitat. — On bark.

DISTRIBUTION. — Tropical and subtropical America.

Genus *Frullanoides* Raddi

Frullanoides liebmanniana (Lindenb. & Gottsche) van Slageren

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Laboratory Cove, *Dauphin 3141*.

HABITAT. — On tree trunks.

DISTRIBUTION. — Tropical America.

Genus *Fulfordianthus* Gradst.

Fulfordianthus evansii (Fulford) Gradst.

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Shannon creek, *Salazar Allen 4300* (Stotler *et al*. 1998); *Gradstein & Salazar Allen 15094*.

HABITAT. — On tree trunks.

DISTRIBUTION. — Rare Central American species, known from about half a dozen collections (Guatemala, Belize, Costa Rica, Panama); in Panama only known from Barro Colorado Island.

Genus *Harpalejeunea* (Spruce) Schiffn.

Harpalejeunea oxyphylla (Nees & Mont.) Steph.

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Fairchild trail 4, *Dauphin 3131*.

HABITAT. — On tree trunks.

DISTRIBUTION. — Tropical America.

Harpalejeunea uncinata Steph.

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, *Shattuck 568* p.p. (Stotler *et al*. 1998).

HABITAT. — On bark.

DISTRIBUTION. — Tropical America.

Genus *Kymatocalyx* Herzog

Kymatocalyx rhizomaticus (Herzog) Gradst. & Váňa

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, Balboa trail, *Gradstein & Salazar Allen 15088*.

HABITAT. — On thin soil over limestone rock along trail on a slope near creek.

DISTRIBUTION. — Pantropical, recorded from very few localities, one in Madagascar and Borneo (type) and a few in the Chocó biogeographic region (Gradstein 2021).

Genus *Lejeunea* Lib.

Taxilejeunea (Spruce) Steph., *Hedwigia* 28: 262 (1889).

Lejeunea adpressa Nees

L. magnoliae Lindenb. & Gottsche, *Synopsis Hepaticarum*: 763 (1847).

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, *Dauphin & Moser 3127*.

HABITAT. — On living leaves and bark.

DISTRIBUTION. — Pantropical.

Lejeunea cancellata Nees & Mont.

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15090*.

HABITAT. — On tree trunks.

DISTRIBUTION. — Tropical America.

REMARKS

This species is characterized by the rounded to apiculate leaf apex, leaf cells with homogeneous oil bodies, small lobules, underleaves wider than long and *c*. 4-5× stem width, dioicy, gynoecia two in a row on short branches, and vegetative reproduction by caducous branches (Gradstein 2021).

Lejeunea controversa Gottsche

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Shannon trail 6, *Dauphin 3081*; *Gradstein & Salazar Allen 15077*.

HABITAT. — On bark.

DISTRIBUTION. — Tropical America.

Lejeunea deplanata Nees

Rectolejeunea maxonii A.Evans, *Bulletin of the Torrey Botanical Club* 39: 609 (1912).

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Drayton trail 27, *Salazar Allen & Chung 4656* (Stotler *et al*. 1998); *Gradstein & Salazar Allen 15120*.

HABITAT. — On bark.

DISTRIBUTION. — Tropical America.

Lejeunea flaccida Lindenb. & Gottsche

Taxilejeunea obtusangula (Spruce) A.Evans, *Bulletin of the Torrey Botanical Club* 38: 215 (1911).

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, *Salazar Allen & Chung 4732* (Stotler *et al*. 1998); *Gradstein & Salazar Al-*

len 15077, *15114*, *15115*; Pearson trail, *Dauphin 3106*; Shannon trail 0-2, *Dauphin 3069*.

Habitat. — On bark.

Distribution. — Tropical America.

Lejeunea glaucescens Gottsche

L. caulicalyx (Steph.) M.E.Reiner & Goda, *Journal of the Hattori Botanical Laboratory* 89: 13 (2000).

Specimen examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15085*.

Habitat. — Very common on decorticated logs, forming large, pale-green, flat mats.

Distribution. — Tropical America.

Lejeunea laetevirens Nees & Mont.

Microlejeunea laetevirens (Nees & Mont.) A.Evans, *The Bryologist* 11: 68 (1908).

Specimens examined. — **Panama**. Barro Colorado Island, Miller trails 19 and 25-26, *Salazar Allen & Chung 4519*, *4503*; *Shattuck 569* p.p. (Stotler *et al*. 1998); Fairchild trail 4, *Dauphin 3132*; laboratory area, *Dauphin 3196*, *3206*.

Habitat. — On tree trunks in exposed sites.

Distribution. — Tropical America.

Lejeunea parviloba Ångstr.

L. tapajosensis Spruce, *Transactions and Proceedings of the Botanical Society of Edinburgh* 15: 223 (1884).

Specimens examined. — **Panama**. Barro Colorado Island, Fairchild trail 4, *Dauphin 3137*; Lutz Tower, *Dauphin 3086*; Laboratory Cove, *Dauphin 3144*; Barbour Point, *Dauphin 3158*; Miller Cove, *Dauphin 3217*.

Habitat. — On bark in exposed sites, rarely on rock.

Distribution. — Tropical America.

Lejeunea phyllobola Nees & Mont.

Specimen examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen s.n.*

Habitat. — On bark.

Distribution. — Tropical America, Africa.

*****Lejeunea pulverulenta*** (Steph.) M.E.Reiner

Taxilejeunea pulverulenta Steph., *Species Hepaticarum* 5: 477 (1913).

Specimens examined. — **Panama**. Barro Colorado Island, Fairchild trail 5-10, *Dauphin 3138*.
Costa Rica. Cocos Island, "Fila entre Bahía Wafer y Chatham, sobre ladera que va hacia Bahía Weston", 5°32'54.8"N, 87°03'11.4"W, 216 m a.s.l., 27.XI.2017, *Estrada & Umaña 6135* (CR[CR4468338]! det. G. Dauphin).

Habitat. — On tree trunks.

Distribution. — New to Central America. Scattered in tropical America.

Lejeunea smaragdina Besch. & Spruce

Specimens examined. — **Panama**. Barro Colorado Island, Snyder-Molino trail, *Dauphin 3053*, *3056*; Standley trail 10, *Dauphin 3119*; Lathrop trail 3, *Dauphin 3099*; Lathrop-Barbour trail 10, *Dauphin 3176*; Standley trail 5, *Dauphin 3119*; Zetek trail 15, *Dauphin 3221*; laboratory area, *Meyer s.n.*

Habitat. — On bark and rock.

Distribution. — West Indies, Panama.

Lejeunea tamasii M.E.Reiner, N.Salazar-Allen & C.Chung

Specimens examined. — **Panama**. Barro Colorado Island, Shannon trail, *Salazar Allen 4281* (type); van Tyne trail 13, *Salazar Allen & Chung 4583*; van Tyne trail 9, *Salazar Allen & Chung 4623*; *Gradstein & Salazar Allen 15075*.

Habitat. — On rock and roots, growing in blackish-green, flat mats.

Distribution. — Only known from Barro Colorado Island.

Genus *Lepidolejeunea* R.M.Schust.

Lepidolejeunea involuta (Gottsche) Grolle

Specimen examined. — **Panama**. Barro Colorado Island, Standley trail 2, *Dauphin 3120*.

Habitat. — On rotten logs.

Distribution. — Tropical America.

Genus *Leptolejeunea* (Spruce) Steph.

Leptolejeunea elliptica (Lehm. & Lindenb.) Besch.

Specimens examined. — **Panama**. Barro Colorado Island, S*alazar Allen et al*. *5965*; Zetek trails 4-5, 18-19, 22-23, *Salazar Allen et al*. *5922*, *5906*, *5890* (Marino & Salazar Allen 1991; Stotler *et al*. 1998); *Gradstein & Salazar Allen 15113*; Shannon trail 0-2, *Dauphin 3062* p.p., 3063; Zetek trail 15, *Dauphin 3223*.

Habitat. — Very common on living leaves, occasionally on bark.

Distribution. — Tropical America.

Leptolejeunea exocellata (Spruce) A.Evans

Specimens examined. — **Panama**. Barro Colorado Island, *Marino 10*, *12*, *13*, *14*, *25*, *28*, *30* (Marino & Salazar Allen 1991); Basilisk Bay, *Dauphin 3167*; Fuertes Cove, *Dauphin 3109*.

Habitat. — On living leaves.

Distribution. — Tropical America.

Leptolejeunea jamaicensis R.M.Schust.

Specimens examined. — **Panama**. Barro Colorado Island, Shannon trail 0-1, *Dauphin 3062* p.p.; Snyder-Molino trail, *Dauphin 3051*; stairs to old dining hall, *Dauphin 3211*.

Habitat. — On living leaves.

Distribution. — Scattered in tropical America, distribution insufficiently known.

Remarks
The plants were initially identified as *L. maculata* (Mitt.) Schiffn., but the latter species occurs in Asia and is replaced in the Neotropics by *L. jamaicensis* (Gradstein 2021).

Leptolejeunea moniliata Steph.

Specimens examined. — **Panama**. Barro Colorado Island, *Marino 10*, *Salazar Allen et al. 5965* (Stotler *et al.* 1998).

Habitat. — On living leaves.

Distribution. — Tropical America.

Leptolejeunea radicosa (Mont.) Grolle

L. obovata Bischl., *Nova Hedwigia* 17: 319 (1969).

Specimens examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen s.n.* (Mežaka *et al.* 2020).

Habitat. — On living leaves.

Distribution. — Tropical America.

Genus *Lophocolea* (Dumort.) Dumort.

Lophocolea liebmanniana Gottsche

Specimens examined. — **Panama**. Barro Colorado Island, *Salazar Allen & Gradstein 15134*.

Habitats. — On roots.

Distribution. — Tropical America.

Genus *Lopholejeunea* (Spruce) Steph.

Lopholejeunea subfusca (Nees) Schiffn.

Specimen examined. — **Panama**. Barro Colorado Island, Zetek trail, *Shattuck s.n.* (Stotler *et al.* 1998).

Habitat. — On bark in exposed site.

Distribution. — Pantropical.

Genus *Marchesinia* Gray

Marchesinia bongardiana (Lehm. & Lindenb.) Trevis.

Specimens examined. — **Panama**. Barro Colorado Island, *Standley 40789* (Stotler *et al.* 1998); *Dauphin 3212*.

Habitat. — On trunk base and rock.

Distribution. — Tropical America.

Remarks
The plants were initially identified as *M. brachiata* (Sw.) Schiffn., but the latter is a montane taxon that is replaced in the lowlands by *M. bongardiana* (Gradstein 2021).

Genus *Microlejeunea* (Spruce) Steph.

Microlejeunea bullata (Taylor) Steph.

Specimens examined. — **Panama**. Barro Colorado Island, *Shattuck 569* p.p. (Stotler *et al.* 1998 as *Lejeunea ulicina* (Taylor) Gottsche, Lindenb. & Nees); Laboratory Cove, *Dauphin 3148*; Basilisk Bay, *Dauphin 3165*.

Habitat. — On bark and rock.

Distribution. — Common and widespread in tropical America.

Microlejeunea epiphylla Bischl.

Specimens examined. — **Panama**. Barro Colorado Island, Fairchild trail 4, *Dauphin 3133*; Laboratory Cove, *Dauphin 3144a*; Snyder-Molino trail 0-1, *Dauphin 3054*; at lake shore, *Dauphin 3094*; near laboratory N wing, *Dauphin 3197*.

Habitat. — On bark and logs at exposed sites.

Distribution. — Tropical and subtropical America.

Genus *Neurolejeunea* (Spruce) Schiffn.

Neurolejeunea breutelii (Gottsche) A.Evans

Specimen examined. — **Panama**. Barro Colorado Island, Zetek trail 4, *Willis 56* (Stotler *et al.* 1998).

Habitat. — On tree trunk.

Distribution. — Tropical America.

Genus *Pictolejeunea* Grolle

Pictolejeunea picta (Steph.) Grolle

Specimens examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15139*; Pearson trail 12, *Dauphin 3105*.

Habitat. — On trunk bases.

Distribution. — Tropical America.

Genus *Plagiochila* (Dumort.) Dumort.

Plagiochila disticha (Lehm. & Lindenb.) Lehm. & Lindenb.

Specimens examined. — **Panama**. Barro Colorado Island, Lake trail 2-3 and big tree trail, *Salazar Allen 4390*, *4627* (Stotler *et al.* 1998); *Gradstein & Salazar Allen 15102*.

Habitat. — On tree trunks.

Distribution. — Tropical America.

Plagiochila laetevirens Lindenb.

Specimen examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15112*.

Habitat. — On shaded rock near stream.

Distribution. — Tropical America.

Plagiochila patula (Sw.) Lindenb.

P. dubia Lindenb. & Gottsche, *Synopsis Hepaticarum*: 630 (1847).

Specimens examined. — **Panama**. Barro Colorado Island, Drayton trail, *Salazar Allen & Chung 4635* (Stotler *et al.* 1998).

Habitat. — On tree trunk.

Distribution. — Tropical and subtropical America.

Plagiochila raddiana Lindenb.

P. interjecta Gottsche, *Annales des Sciences naturelles, Botanique*, série 5, 1: 97 (1864).

Specimens examined. — **Panama**. Barro Colorado Island, Farchild trail 12-13 and Drayton trail, *Salazar Allen & Chung 4635*, *4629*, *6047* (Stotler *et al.* 1998).

Habitat. — On tree trunks and buttresses.

Distribution. — Tropical America.

Genus *Prionolejeunea* (Spruce) Schiffn.

Prionolejeunea muricatoserrulata (Spruce) Steph.

Specimens examined. — **Panama**. Barro Colorado Island, Shannon trail 0-2, *Dauphin 3065*; near Lutz tower, *Dauphin 3085*; Armour trail 18, *Dauphin 3090*; *Gradstein & Salazar Allen 15082*, *1586*, *1598*.

Habitat. — On trunk bases, logs and rotten wood.

Distribution. — Tropical America.

Prionolejeunea scaberula (Spruce) Steph.

Specimen examined. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15087*.

Habitat. — On shaded sides of buttresses.

Distribution. — Tropical America.

Remarks

This species is characterized by rounded to obtuse leaf tips, crenulate leaf margins, very small underleaves with a lateral tooth, and caducous leaf lobes (Ilkiu-Borges 2016).

Genus *Radula* Dumort.

Radula flaccida Lindenb. & Gottsche

Specimens examined. — **Panama**. Barro Colorado Island, Shannon creek, *Marino 5*, *6*, *35*, *36* (Stotler *et al.* 1998); *Gradstein & Salazar Allen 15107*; bay E of Gross trail 5, *Dauphin 3172*.

Habitat. — Common on living leaves, occasionally on bark.

Distribution. — Tropical America, Africa.

Radula javanica Gottsche

R. macrostachya Lindenb. & Gottsche, *Synopsis Hepaticarum*: 726 (1847).

Specimens examined. — **Panama**. Barro Colorado Island, Miller trail 5-6, *Salazar Allen 4414a* (Stotler *et al.* 1998); *Gradstein & Salazar Allen 15116*, *15117*, *15136*, *15138*; van Tyne trails 18, 10, *Dauphin 3082*, *3083*.

Habitat. — On bark, rock and soil.

Distribution. — Pantropical.

Genus *Rectolejeunea* A.Evans

Rectolejeunea emarginuliflora (Schiffn.) A.Evans

Specimen examined. — **Panama**. Barro Colorado Island, Shannon trail 0-2, *Dauphin 3073*.

Habitat. — On twigs.

Distribution. — Tropical South America, West Indies, Panama (new).

Remarks

This species is recognized by the presence of ocelli in leaves as well as underleaves (Reiner-Drehwald & Grolle 2012).

Rectolejeunea versifolia (Schiffn.) L.Söderstr. & A.Hagborg

R. berteroana (Gottsche) A.Evans, *Bulletin of the Torrey Botanical Club* 33 (1): 12 (1906).

Specimens examined. — **Panama**. Barro Colorado Island, Miller trail 23-24, *Salazar Allen & Chung 4529* (Stotler *et al.* 1998); Fairchild trail 4, *Dauphin 3136*; Basilisk Bay, *Dauphin 3161*.

HABITAT. — On smooth bark and twigs, common in the forest canopy, xerotolerant.

DISTRIBUTION. — Tropical America.

Genus *Riccardia* Gray

Riccardia regnellii (Ångstr.) Schiffn.

R. amazonica (Spruce) Schiffn. ex Gradst. & Hekking, *Journal of the Hattori Botanical Laboratory* 45: 129 (1979).

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Fairchild trail 18, *Dauphin 3139*; Barbour Point, *Dauphin 3154*.

HABITAT. — On moist soil and rock.

DISTRIBUTION. — Tropical America.

Genus *Riccia* L.

Riccia weinionis Steph.

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, Donato entrance, *Chung et al. 205* (Stotler *et al.* 1998).

HABITAT. — On moist soil.

DISTRIBUTION. — Tropical America.

Genus *Stictolejeunea* (Spruce) Schiffn.

Stictolejeunea balfourii (Mitt.) E.W.Jones

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, Shannon trail 11-12, *Salazar Allen 4325*; Shannon creek, *Salazar Allen & Gradstein 15078*.

HABITAT. — On shaded trunk bases and rock near creeks.

DISTRIBUTION. — Pantropical.

Stictolejeunea squamata (F.Weber) Schiffn.

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, *Salazar et al. 4384*, *4391*, *4409*, *4440*, *4457*, *4641*, *4713*, *5898*, *5899*, *5902*, *5903*, *5918* (Stotler *et al.* 1998); Shannon trail 0-2, *Dauphin 3068*, *3071*; Lathrop trail 3, *Dauphin 309*.

HABITAT. — On bark and rock.

DISTRIBUTION. — Tropical America.

Genus *Symbiezidium* Trevis.

Symbiezidium barbiflorum (Lindenb. & Gottsche) A.Evans

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, *Salazar et al. 4298*, *4375*, *4383*, *4391*, *4417*, *5912*, *5961*, *5963*, *5980* (Stotler *et al.* 1998); Snyder-Molino trail, *Dauphin 3057*, *3061*; Armour trail 18, *Dauphin 3089*; *Gradstein & Salazar Allen 1595*.

HABITAT. — On bark and rock.

DISTRIBUTION. — Tropical America, Madagascar.

Symbiezidium transversale (Sw.) Trevis.

Stotler *et al.* (1998).

HABITAT. — On bark.

DISTRIBUTION. — Tropical America.

Genus *Thysananthus* Lindenb.

Mastigolejeunea (Spruce) Steph., *Hedwigia* 30 (5): 202, 206 (1891).

Thysananthus auriculatus (Wilson & Hook.) Sukkharak & Gradst.

Mastigolejeunea auriculata (Wilson & Hook.) Steph., *Botanical Gazette* 17: 171 (1892).

SPECIMENS EXAMINED. — **Panama**. Barro Colorado Island, laboratory area, *Salazar Allen & Chung 4725* (Stotler *et al.* 1998); Lathrop trail 3, *Dauphin 3096*; Zetek trail 4, *Dauphin 3116*; Basilisk Bay, *Dauphin 3160*; *Gradstein & Salazar Allen 15096*.

HABITAT. — On bark and rock, frequently in exposed sites.

DISTRIBUTION. — Tropical America, Africa.

Genus *Zoopsidella* R.M.Schust.

Zoopsidella integrifolia (Spruce) R.M.Schust.

Z. macella (Spruce) R.M.Schust., *Bulletin of the National Science Museum, Tokyo*, new series 12: 666 (1969).

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, Barbour Point, *Dauphin 3151*.

HABITAT. — On shaded rock and rotten wood.

DISTRIBUTION. — Tropical America.

Phylum ANTHOCEROTOPHYTA Stotler & Crand.-Stotl.

Genus *Anthoceros* L.

Anthoceros sp.

SPECIMEN EXAMINED. — **Panama**. Barro Colorado Island, Koch hill, plants sterile.

HABITAT. — On soil.

Dubious and excluded records

Unidentified species, cited here as "sp.", are treated as excluded records.

Cololejeunea sp.

Specimens. — **Panama**. Barro Colorado Island, *Marino 20*, *25*, *30* (Haynes 1933 as *Leptocolea* sp.; Stotler *et al*. 1998).

Lejeunea cf. ***minutiloba*** A.Evans

Specimens. — **Panama**. Barro Colorado Island, *Marino 4*, *5*, *34*; *Wetmore 21*; *Salazar Allen & Chung 5943*.

Remarks

Identification needs confirmation; the material might belong to *L. adpressa*.

Lejeunea cf. ***sordida*** (Nees) Nees

Specimens. — **Panama**. Barro Colorado Island, *Gradstein & Salazar Allen 15111*, *15135*; Balboa trail, *Salazar Allen & Chung 4338*; *Salazar Allen et al. 6048*.

Remarks

Asiatic species; the material needs study.

Microlejeunea cf. ***capillaris*** (Gottsche) Steph.

Specimen. — **Panama**. Barro Colorado Island, *Salazar Allen 4501b* (Stotler *et al.* 1998).

Remarks

The identification of this montane species needs verification.

Plagiochila asplenioides (L.) Dumort.

Haynes (1933).

Remarks

Holarctic species; the record must therefore be erroneous and is excluded.

Prionolejeunea sp.

Specimen. — **Panama**. Barro Colorado Island, Shannon trail 11-12, *Salazar Allen 4328*.

Acknowledgements

Noris Salazar Allen thanks the first two coauthors for their interest in the liverwort flora of BCI and helping with identification of samples; the Smithsonian Tropical Research Institute (STRI) for financial support; and the late research assistant, Clementina Chung (†), for help in the field and in processing collected samples. Gregorio Dauphin's field work on BCI and travel to Panama were financed through a STRI Short Term Fellowship. We thank an anonymous reviewer and Tamás Pócs for his help with identification of *Cololejeunea* species and his constructive comments on the manuscript.

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Submitted on 30 September 2021;
accepted on 15 April 2022;
published on 29 July 2022.