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Checklist of the Bryophytes of Bogotá, D.C., Colombia

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Ključne besede: listnati mahovi, jetrenjaki, rogovnjaki, raznolikost, flora, urbano, mesto

Abstract

In Colombia, ecosystems such as the páramos and high Andean forests are characterized by their high diversity of bryophytes. These include mosses, liverworts and hornworts. They lack complex tissues, which contribute to their relatively small size and their ability to grow on various substrates, even in nutrient-poor or polluted environments such as cities. Bogotá, the capital of Colombia, is known for its plentiful water resources and cold climate. It also encompasses one of the world's largest paramo ecosystems. This study compiles specimen distribution data from databases and herbaria, refining the nomenclature to produce a list of 450 bryophyte taxa reported within Bogotá. Of these, 279 are mosses, 167 are liverworts and, for the first time, four species of hornwort have been reported. This study highlights Bogotá's significance as a refuge for important Neotropical bryophyte diversity.

Izvleček

Za ekosisteme v Kolumbiji, kot sta páramo in gozdovi visokih Andov, je značilna visoka raznolikost mahov. Ti vključujejo listnate mahove, jetrenjake in rogovnjake. Nimajo kompleksnih tkiv, zaradi katerih so majhni in so sposobni uspevanja na različnih substratih, tudi v s hranili siromašnih ali onesnaženih okoljih, kot so mesta. Bogotá, glavno mesto Kolumbije, je znana po številnih vodnih virih in mrzli klimi. Obsega tudi enega največjih páramo ekosistemov na svetu. V raziskavi smo zbrali podatke o razširjenosti vrst iz podatkovnih baz in herbarijev, pregledali nomenklaturo in pripravili seznam 450 taksonov mahov, zabeleženih v Bogoti. Od teh je 279 listnatih mahov, 167 jetrenjakov in prvič poročamo o štirih vrstah rogovnjakov. V članku izpostavljamo pomembnost mesta Bogotá kot pomembnega refugija za raznolikost neotropskih mahov.

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Introduction

Bryophytes are a group of plants that grow in environments with different humidity and contamination levels over substrates such as trunks, branches, foliage and roots of trees and in the soil, even concrete. As pioneer plants, bryophytes -including hornworts, liverworts, and mosses-, create a microhabitat that facilitates the establishment of other plants and contributes to soil development (Delgadillo et al., 2022).

Approximately 1650 taxa of bryophytes have been recorded in Colombia, including 932 species of mosses (Churchill, 2016), 705 liverworts, and 15 hornworts (Gradstein, 2021). The highest bryophyte diversity occurs within specific altitudinal ranges, predominantly in high Andean Forest and paramo ecosystems, between 2200 and 4000 meters above sea level (Churchill & Linares, 1995; Gradstein, 2021).

Floristic studies in Colombia have been conducted according to the administrative level: at the national scale (Churchill & Linares, 1995; Uribe & Gradstein, 1998; Churchill, 2016; Gradstein, 2021), the departmental scale (Sastre-De Jesús et al., 1986; Churchill & Hollaender, 1988; Parra et al., 2002; Ramírez & Churchill, 2002; Ramírez, 2013; Aponte-R. et al., 2022), and mostly at the local level (Avendaño & Aguirre, 2007; Gil et al., 2017; Martínez et al., 2019; Mejía et al., 2020). However, no studies have been conducted at the district level, so there is no inventory for Bogotá.

Bogotá is the capital city of Colombia and has also been considered the capital of Cundinamarca department. However, since the 1991 National Constitution, Bogotá has been recognized as a department itself, which explains the overlapping information about its diversity. Floristic research indicates that studies in Cundinamarca have included Bogotá's geographic area and specific ecosystems. Meanwhile, floristic records for Bogotá have been compiled in three photographic guide booklets (Aguirre, 2000; Santos & Alfonso, 2013; Gualteros et al., 2019), each containing fewer than 30 specimens, most of them identified at the genus level. Additionally, Franco & Betancur (1999) reported 176 bryophyte species for the Sumapáz paramo, which extends across four departments: Cundinamarca, Meta, Huila, and Bogotá.

The study of bryophytes in metropolitan areas has demonstrated that they serve as important refugia for these plants (Masimpaka et al., 1988; Pokorny et al., 2006; Brinda et al., 2007; Sabovljević & Grdović, 2009; Ardiles & Peñaloza, 2013; Aleffi, 2015). Even though Bogotá is one of the most populous cities in Latin America, it is situated within the Andean Forest and páramo ecosystems, which correspond with the areas with the highest presence of bryophytes in Colombia (Churchill, 1991; Gradstein, 2021).

The first author conducts the curatorial review of the bryological collection of the JBB Herbarium finding many specimens from Bogotá. The analysis of sampling representativity and taxonomic determination led to the discovery of a new national record (Aponte et al., 2022), paving the way for future research which can use the present checklist as a base for the accurate knowledge of bryophyte diversity in Bogotá.

Materials and methods

Area of Study

Bogotá, located in central Colombia, lies on the eastern edge of the northern Andes. The city maintains a stable average annual temperature of 14 °C, with minimal variation. Annual rainfall reaches approximately 1,000 mm, and relative humidity averages 73% (Appendix 1). Home to over 8 million inhabitants, Bogotá serves as Colombia's political, economic, administrative, and cultural capital.

Bogotá spans a total area of 1,775 km², with 378 km² forming the metropolitan region. Administratively, the city is divided into 20 localities (Table 1; Figure 1), each responsible for managing and delivering public services. The rural areas feature páramos, high Andean forests, rivers, and streams, while the urban zones include wetlands, parks, and the Bogotá Botanical Garden.

Table 1: Localities of Bogotá and their corresponding political nomenclature.
Tabela 1: Poimenovanje lokacij v mestu Bogotá.

Localities			
1. Usaquén	6. Tunjuelito	11. Suba	16. Puente Aranda
2. Chapinero	7. Bosa	12. Barrios Unidos	17. Candelaria
3. Santa Fé	8. Kennedy	13. Teusaquillo	18. Rafael Uribe-Uribe
4. San Cristóbal	9. Fontibón	14. Los Mártires	19. Ciudad Bolívar
5. Usme	10. Engativá	15. Antonio Nariño	20. Sumapáz

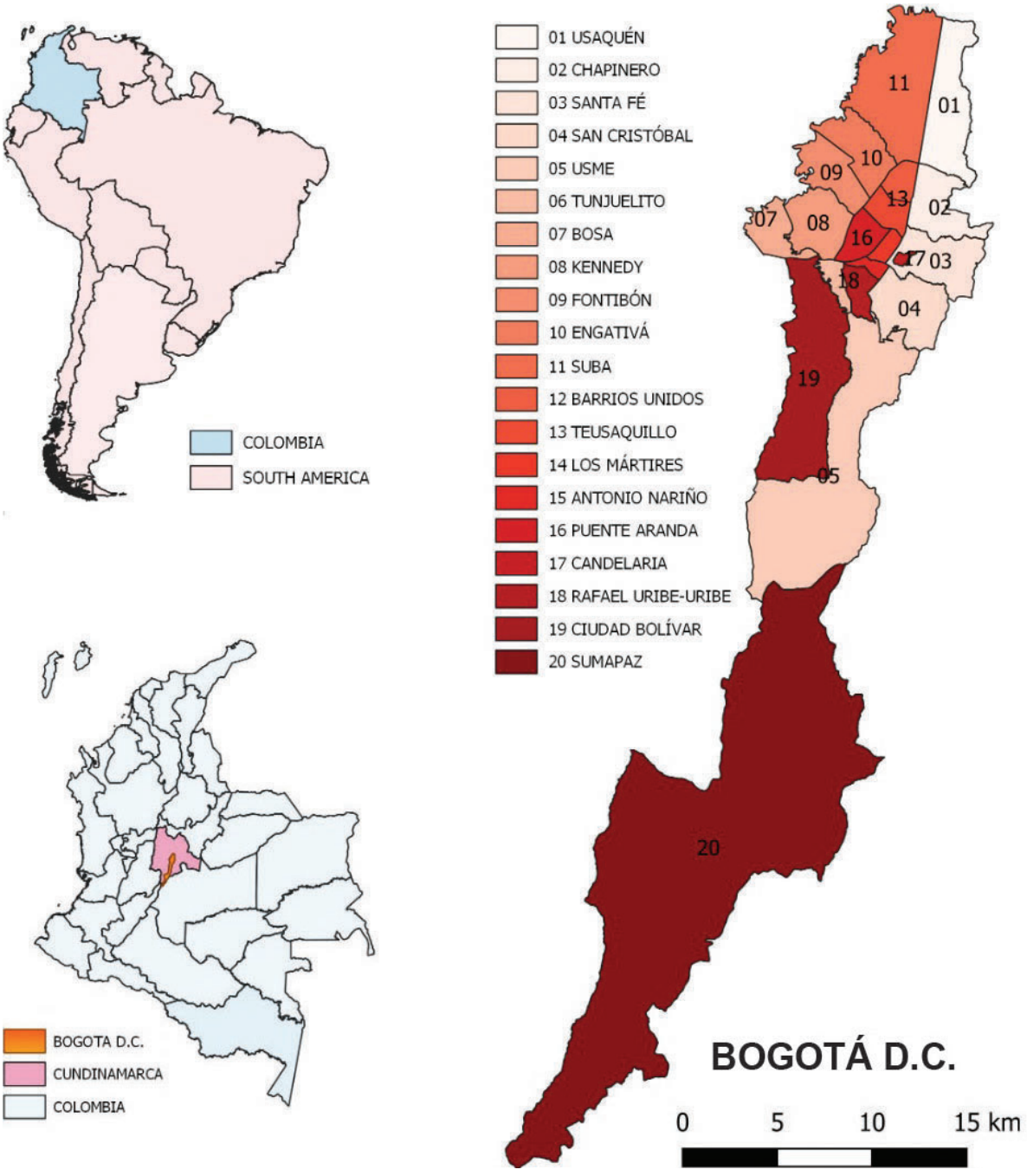

Figure 1: Administrative map of Bogotá.
Slika 1: Zemljevid administrativne ureditve mesta Bogotá.

Review of available information

This research compiles data from the Colombian National Herbarium (COL), the Herbarium of the Bogotá Botanical Garden (JBB), and the Tropicos (2025) database of the Missouri Botanical Garden.

The names of families, genera, species, and lower taxonomic ranks follow the latest catalogs for Colombia: Gradstein (2021) for liverworts and hornworts, and Churchill (2016) and Churchill et al. (2020) for mosses.

Results

The initial dataset comprised 2,111 specimens representing 633 species. Each name was linked to its biological group, family, source (COL-JBB or Tropicos), locality, and ecosystem of origin, assigned based on the predominant environment of the locality or label information. In exceptional cases, additional details such as threat category, historical collector, or unique specimen were included. The data were then refined and organized alphabetically by species. Some moss names have undergone taxonomic changes in relation to the most recent national catalog for Colombia (Churchill, 2016); however, their original classification was retained in this study.

Richness

The bryophyte diversity within the political jurisdiction of Bogotá's Capital District represents 25% of the total known at the national level. It includes 450 species – 279 mosses, 167 liverworts, and 4 hornworts (Table 2) – distributed across 178 genera (127 mosses, 49 liverworts, and 2 hornworts) and grouped into 80 families (50 mosses, 28 liverworts, and 2 hornworts).

Table 2: Bryophyte species recorded in Bogotá, along with the political nomenclature of the localities where they were collected. (L: Liverworts; H: Hornworts; M: Mosses).
Tabela 2: Mahovne vrste, zabeležene v mestu Bogotá in lokacije, kjer so bile zabeležene. (L: jetrenjaki; H: rogovnjaki; M: listanti mahovi).

	GROUP	FAMILY	TAXA	LOCALITIES
1	H	Dendrocerotaceae	*Nothoceros aenigmaticus* J.C. Villarreal & K.D. McFarland	3
2	H	Dendrocerotaceae	*Nothoceros vincentianus* (Lehm. & Lindenb.) J.C. Villarreal	2, 3
3	H	Notothyladaceae	*Phaeoceros carolinianus* (Michx.) Prosk.	10
4	H	Notothyladaceae	*Phaeoceros laevis* (L.) Prosk.	10
5	L	Lejeuneaceae	*Acanthocoleus aberrans* (Lindenb. & Gottsche)	19
6	L	Adelanthaceae	*Adelanthus lindenbergianus* (Lehm.) Mitt.	20
7	L	Anastrophyllaceae	*Anastrophyllum auritum* (Lehm.) Steph.	20
8	L	Anastrophyllaceae	*Anastrophyllum nigrescens* (Mitt.) Steph.	20, 5
9	L	Anastrophyllaceae	*Anastrophyllum piligerum* (Nees) Steph.	3
10	L	Anastrophyllaceae	*Anastrophyllum stellatum* R.M.Schust	20
11	L	Anastrophyllaceae	*Anastrophyllum tubulosum* (Nees) Grolle	3
12	L	Lejeuneaceae	*Anoplolejeunea conferta* (C.F.W. Meissn. ex Spreng.) A. Evans	19, 20
13	L	Lepidoziaceae	*Bazzania affinis* (Lindenb. & Gottsche) Trevis.	20
14	L	Lepidoziaceae	*Bazzania falcata* (Lindenb.) Trevis.	3, 20
15	L	Lepidoziaceae	*Bazzania hookeri* var. *hookeri* (Lindenb.) Trevis.	20
16	L	Lepidoziaceae	*Bazzania longistipula* (Lindenb.) Trevis.	20
17	L	Lepidoziaceae	*Bazzania stolonifera* (Sw.) Trevis.	2
18	L	Lejeuneaceae	*Blepharolejeunea incongrua* (Lindenb. & Gottsche) van Slageren & Kruijt	19
19	L	Lejeuneaceae	*Blepharolejeunea securifolia* (Steph.) R.M. Schust.	20
20	L	Blepharostomataceae	*Blepharostoma trichophyllum* (L.) Dumort.	20
21	L	Lejeuneaceae	*Brachiolejeunea laxifolia* (Taylor) Schiffn.	20
22	L	Calypogeiaceae	*Calypogeia andicola* Bischl.	3, 20
23	L	Calypogeiaceae	*Calypogeia laxa* Gottsche & Lindenb.	3
24	L	Calypogeiaceae	*Calypogeia peruviana* Nees & Mont.	3
25	L	Calypogeiaceae	*Calypogeia subintegra* (Gottsche, Lindenb. & Nees) Bischl.	19
26	L	Cephaloziaceae	*Cephalozia bicuspidata* (L.) Dumort.	19
27	L	Cephaloziaceae	*Cephalozia crossii* Spruce	19
28	L	Cephaloziellaceae	*Cephaloziella divaricata* (Sm.) Schiffn.	20
29	L	Cephaloziellaceae	*Cephaloziella fragillima* (Spruce) Fulford	19
30	L	Lejeuneaceae	*Cheilolejeunea acutangula* (Nees) Grolle	19
31	L	Lejeuneaceae	*Cheilolejeunea aurifera* (R.M. Schust.) W. Ye, R.L. Zhu & Gradst.	20
32	L	Lejeuneaceae	*Cheilolejeunea filiformis* (Sw.) W. Ye, R.L. Zhu & Gradst.	19
33	L	Lejeuneaceae	*Cheilolejeunea laevicalyx* (J.B. Jack & Steph.) Grolle	19

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34	L	Lejeuneaceae	*Cheilolejeunea lobulata* (Lindenb.) C.J. Bastos & Gradst.	19
35	L	Lejeuneaceae	*Cheilolejeunea paramicola* (Herzog) W. Ye, R.L. Zhu & Gradst.	20
36	L	Lejeuneaceae	*Cheilolejeunea xanthocarpa* (Lehm. & Lindenb.) Malombe	3
37	L	Lejeuneaceae	*Cololejeunea microscopica* (Taylor) Schiffn.	3
38	L	Lophocoleaceae	*Cryptolophocolea connata* (Sw.) L. Söderstr. & Váňa	19
39	L	Lophocoleaceae	*Cryptolophocolea guadalupensis* (Steph.) L. Söderstr. & Váňa	20
40	L	Lophocoleaceae	*Cryptolophocolea martiana* var. *martiana* (Nees) L. Söderstr., Crand.-Stotl. & Stotler	20
41	L	Lejeuneaceae	*Drepanolejeunea araucariae* Steph.	3
42	L	Lejeuneaceae	*Drepanolejeunea inchoata* (C.F.W. Meissn. ex Lehm.) Steph.	19
43	L	Lejeuneaceae	*Drepanolejeunea mosenii* (Steph.) Bischl.	2
44	L	Lejeuneaceae	*Drepanolejeunea orthophylla* (Nees & Mont.) Bischl.	19
45	L	Lejeuneaceae	*Drepanolejeunea pungens* Bischl.	20
46	L	Dumortieraceae	*Dumortiera hirsuta* (Sw.) Nees	3
47	L	Fossombroniaceae	*Fossombronia peruviana* Gottsche & Hampe	20
48	L	Frullaniaceae	*Frullania atrata* (Sw.) Nees ex Mont.	20
49	L	Frullaniaceae	*Frullania beyrichiana* (Lehm. & Lindenb.) Lehm. & Lindenb.	3
50	L	Frullaniaceae	*Frullania bogotensis* Steph.	3
51	L	Frullaniaceae	*Frullania brasiliensis* Raddi	2, 10
52	L	Frullaniaceae	*Frullania convoluta* Lindenb. & Hampe	19, 20
53	L	Frullaniaceae	*Frullania dusenii* Steph.	5
54	L	Frullaniaceae	*Frullania ecklonii* (Spreng.) Gottsche, Lindenb. & Nees	3
55	L	Frullaniaceae	*Frullania intumescens* (Lehm. & Lindenb.) Lehm. & Lindenb.	20
56	L	Frullaniaceae	*Frullania jelskii* Loitl.	19
57	L	Frullaniaceae	*Frullania lobatohastata* Steph.	20
58	L	Frullaniaceae	*Frullania macrocephala* (Lehm. & Lindenb.) Lehm. & Lindenb.	17
59	L	Frullaniaceae	*Frullania obscura* (Sw.) Nees ex Mont.	19, 10
60	L	Frullaniaceae	*Frullania paradoxa* Lehm. & Lindenb.	3
61	L	Frullaniaceae	*Frullania peruviana* Gottsche	20, 11
62	L	Frullaniaceae	*Frullania pluricarinata* Gottsche	3
63	L	Frullaniaceae	*Frullania riojaneirensis* (Raddi) Ångstr.	2, 10, 20
64	L	Frullaniaceae	*Frullania sphaerocephala* Spruce	20
65	L	Frullaniaceae	*Frullania tetraptera* Nees & Mont.	20
66	L	Frullaniaceae	*Frullania winteri* var. *vanderhammenii* (Haarbrink) Yuzawa	10
67	L	Cephaloziaceae	*Fuscocephaloziopsis pleniceps* (Austin) Váňa & L. Söderstr.	1
68	L	Southbryaceae	*Gongylanthus granatensis* (Gottsche) Steph.	20, 5
69	L	Southbryaceae	*Gongylanthus liebmannianus* (Lindenb. & Gottsche) Steph.	20, 5
70	L	Gymnomitriaceae	*Gymnomitrion bolivianum* (Steph.) Váňa	3
71	L	Gymnomitriaceae	*Gymnomitrion truncatoapiculatum* Herzog	3
72	L	Herbertaceae	*Herbertus bivittatus* Spruce	2, 20
73	L	Herbertaceae	*Herbertus juniperoideus* subsp. *acanthelius* (Spruce) K. Feldberg & Heinrichs	20
74	L	Herbertaceae	*Herbertus sendtneri* (Nees) A. Evans	19
75	L	Lophocoleaceae	*Heteroscyphus contortuplicatus* (Nees & Mont.) Grolle	2
76	L	Balantiopsidaceae	*Isotachis multiceps* (Lindenb. & Gottsche) Gottsche	19, 20
77	L	Balantiopsidaceae	*Isotachis serrulata* (Sw.) Gottsche	3
78	L	Pallaviciniaceae	*Jensenia spinosa* (Lindenb. & Gottsche) Grolle	3, 20
79	L	Lepidoziaceae	*Kurzia capillaris* subsp. *paramicola* Pócs	1
80	L	Trichocoleaceae	*Leiomitra flaccida* Spruce	20
81	L	Trichocoleaceae	*Leiomitra paraphyllina* (Steph.) R.M. Schust.	20
82	L	Trichocoleaceae	*Leiomitra tomentosa* (Sw.) Lindb.	3
83	L	Lejeuneaceae	*Lejeunea acanthogona* var. *cristulata* (Steph.) Gradst. & C.J. Bastos	3
84	L	Lejeuneaceae	*Lejeunea deplanata* Nees	3

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85	L	Lejeuneaceae	*Lejeunea flava* (Sw.) Nees	10, 20
86	L	Lejeuneaceae	*Lejeunea laetevirens* Nees & Mont.	2
87	L	Lejeuneaceae	*Lejeunea pallescens* Mitt.	20
88	L	Lepicoleaceae	*Lepicolea pruinosa* (Taylor) Spruce	20
89	L	Lepidoziaceae	*Lepidozia auriculata* Steph.	3
90	L	Lepidoziaceae	*Lepidozia cupressina* (Sw.) Lindenb.	20
91	L	Lepidoziaceae	*Lepidozia dendritica* Spruce	3
92	L	Lepidoziaceae	*Lepidozia macrocolea* Spruce	20
93	L	Lepidoziaceae	*Lepidozia reptans* (L.) Dumort.	19
94	L	Lepidoziaceae	*Lepidozia squarrosa* Steph.	3
95	L	Lophocoleaceae	*Leptoscyphus amphibolius* (Nees) Grolle	3
96	L	Lophocoleaceae	*Leptoscyphus cleefii* Fulford	20
97	L	Lophocoleaceae	*Leptoscyphus physocalyx* (Hampe & Gottsche) Gottsche	20
98	L	Lophocoleaceae	*Leptoscyphus porphyrius* (Nees) Grolle	19, 20
99	L	Lophocoleaceae	*Leptoscyphus trapezoides* (Mont.) L. Söderstr.	3
100	L	Lophocoleaceae	*Lophocolea aberrans* Lindenb. & Gottsche	2
101	L	Lophocoleaceae	*Lophocolea bidentata* (L.) Dumort.	19, 3
102	L	Lophocoleaceae	*Lophocolea fragmentissima* R.M. Schust.	20
103	L	Lophocoleaceae	*Lophocolea muricata* (Lehm.) Nees	10
104	L	Cephaloziellaceae	*Lophonardia jamesonii* (Mont.) L. Söderstr. & Váňa	20
105	L	Cephaloziellaceae	*Lophonardia laxifolia* (Mont.) L.Söderstr. & Váňa	20
106	L	Lunulariaceae	*Lunularia cruciata* (L.) Dumort. ex Lindb.	10, 3
107	L	Marchantiaceae	*Marchantia berteroana* Lehm. & Lindenb.	20
108	L	Marchantiaceae	*Marchantia breviloba* A. Evans	3
109	L	Marchantiaceae	*Marchantia chenopoda* L.	2, 10
110	L	Marchantiaceae	*Marchantia paleacea* Bertol.	3
111	L	Marchantiaceae	*Marchantia plicata* Nees & Mont.	3, 20
112	L	Marchantiaceae	*Marchantia polymorpha* L.	2, 10, 20
113	L	Metzgeriaceae	*Metzgeria albinea* Spruce	20
114	L	Metzgeriaceae	*Metzgeria chilensis* Steph.	20
115	L	Metzgeriaceae	*Metzgeria ciliata* Raddi	2, 19, 1, 5
116	L	Metzgeriaceae	*Metzgeria consanguinea* Schiffn.	2, 19, 20
117	L	Metzgeriaceae	*Metzgeria dorsipara* (Herzog) Kuwah.	19
118	L	Metzgeriaceae	*Metzgeria furcata* (L.) Corda	20
119	L	Metzgeriaceae	*Metzgeria lechleri* Steph.	3
120	L	Metzgeriaceae	*Metzgeria liebmanniana* Lindenb. & Gottsche	19
121	L	Metzgeriaceae	*Metzgeria polytricha* Spruce	20
122	L	Lejeuneaceae	*Microlejeunea bullata* (Taylor) Steph.	19
123	L	Lejeuneaceae	*Microlejeunea capillaris* (Gottsche) Steph.	19
124	L	Calypogeiaceae	*Mnioloma cellulosum* (Spreng.) R.M. Schust.	2
125	L	Calypogeiaceae	*Mnioloma cyclostipum* (Spruce) R.M. Schust.	20
126	L	Monocleaceae	*Monoclea gottschei* subsp. *gottschei* Lindb.	3, 1
127	L	Gymnomitriaceae	*Nardia succulenta* (Rich. ex Lehm.) Spruce	19
128	L	Noterocladaceae	*Noteroclada confluens* Taylor ex Hook. & Wilson	19, 20
129	L	Plagiochilaceae	*Plagiochila adianthoides* (Sw.) Lindenb.	19
130	L	Plagiochilaceae	*Plagiochila aerea* Taylor	19
131	L	Plagiochilaceae	*Plagiochila bifaria* (Sw.) Lindenb.	19
132	L	Plagiochilaceae	*Plagiochila cristata* (Sw.) Lindenb.	20
133	L	Plagiochilaceae	*Plagiochila exigua* (Taylor) Taylor	20
134	L	Plagiochilaceae	*Plagiochila fuscolutea* Taylor	20
135	L	Plagiochilaceae	*Plagiochila grandicrista* Steph.	3

	GROUP	FAMILY	TAXA	LOCALITIES
136	L	Plagiochilaceae	*Plagiochila guevarae* H.Rob.	20
137	L	Plagiochilaceae	*Plagiochila laetevirens* Lindenb.	8
138	L	Plagiochilaceae	*Plagiochila longispina* Lindenb. & Gottsche	20
139	L	Plagiochilaceae	*Plagiochila macra* Taylor	2
140	L	Plagiochilaceae	*Plagiochila macrostachya* Lindenb.	19, 20
141	L	Plagiochilaceae	*Plagiochila ovata* Lindenb. & Gottsche	19
142	L	Plagiochilaceae	*Plagiochila paraphyllina* Herzog	3
143	L	Plagiochilaceae	*Plagiochila punctata* (Taylor) Taylor	20
144	L	Plagiochilaceae	*Plagiochila raddiana* Lindenb.	2, 5
145	L	Plagiochilaceae	*Plagiochila superba* (Nees ex Spreng.) Mont. & Nees	5
146	L	Plagiochilaceae	*Plagiochila vincentina* Lindenb.	3
147	L	Porellaceae	*Porella brachiata* (Taylor) Spruce	20
148	L	Porellaceae	*Porella brasiliensis* (Raddi) Schiffn.	2
149	L	Porellaceae	*Porella crispata* (Hook.) Trevis.	2
150	L	Porellaceae	*Porella swartziana* (F.Weber) Trevis	3
151	L	Radulaceae	*Radula nudicaulis* Steph.	20
152	L	Radulaceae	*Radula quadrata* Gottsche	2, 19
153	L	Radulaceae	*Radula voluta* Taylor ex Gottsche, Lindenb. & Nees	20
154	L	Radulaceae	*Radula xalapensis* Nees & Mont.	3
155	L	Aneuraceae	*Riccardia cataractarum* (Spruce) Schiffn.	2
156	L	Aneuraceae	*Riccardia latifrons* subsp. *parasitans* (Steph.) Gradst. & Reeb	2
157	L	Aneuraceae	*Riccardia pallida* (Spruce) Meenks & C.De Jong	20
158	L	Aneuraceae	*Riccardia regnellii* (Ångstr.) K.G. Hell	2
159	L	Pallaviciniaceae	*Symphyogyna aspera* Steph. ex F.A. McCormick	2, 19, 20
160	L	Pallaviciniaceae	*Symphyogyna brasiliensis* Nees	19, 3
161	L	Pallaviciniaceae	*Symphyogyna brongniartii* Mont.	2
162	L	Pallaviciniaceae	*Symphyogyna podophylla* (Thunb.) Mont. & Nees	20
163	L	Adelanthaceae	*Syzygiella anomala* (Lindenb. & Gottsche) Steph.	3, 20
164	L	Adelanthaceae	*Syzygiella campanulata* Herzog	20
165	L	Adelanthaceae	*Syzygiella concreta* (Gottsche) Spruce	17
166	L	Adelanthaceae	*Syzygiella rubricaulis* (Nees) Steph.	2, 20
167	L	Adelanthaceae	*Syzygiella sonderi* (Gottsche) K. Feldberg, Váňa, Hentschel & Heinrichs	20
168	L	Adelanthaceae	*Syzygiella trigonifolia* (Steph.) Herzog	20
169	L	Adelanthaceae	*Syzygiella undata* (Mont.) K. Feldberg, Váňa, Hentschel & Heinrichs	20
170	L	Lepidoziaceae	*Telaranea nematodes* (Gottsche ex Austin) M. Howe	19, 3, 20
171	L	Herbertaceae	*Triandrophyllum subtrifidum* (Hook. f. & Taylor) Fulford & Hatcher	19
172	M	Bryaceae	*Acidodontium megalocarpum* (Hook.) Renauld & Cardot	20
173	M	Sematophyllaceae	*Acroporium pungens* (Hedw.) Broth.	2
174	M	Daltoniaceae	*Adelothecium bogotense* (Hampe) Mitt.	1
175	M	Amblystegiaceae	*Amblystegium serpens* (Hedw.) Schimp.	2
176	M	Bartramiaceae	*Anacolia laevisphaera* (Taylor) Flowers	3
177	M	Pottiaceae	*Anoectangium aestivum* (Hedw.) Spruce	3, 20, 5
178	M	Bryaceae	*Anomobryum julaceum* (Schrad. ex G. Gaertn., B. Mey. & Scherb.) Schimp.	2
179	M	Bryaceae	*Anomobryum prostratum* (Müll. Hal.) Besch.	20
180	M	Dicranaceae	*Aongstroemia julacea* (Hook.) Mitt.	20
181	M	Pylaisiadelphaceae	*Aptychella proligera* (Broth.) Herzog	20
182	M	Sematophyllaceae	*Aptychopsis pycnodonta Herzog*	20
183	M	Leucobryaceae	*Atractylocarpus longisetus* (Hook.) E.B. Bartram	19, 20
184	M	Polytrichaceae	*Atrichum polycarpum* (Müll. Hal.) A. Jaeger	2, 19, 3, 20
185	M	Pottiaceae	*Barbula arcuata* Griff.	2, 4

	GROUP	FAMILY	TAXA	LOCALITIES
186	M	Pottiaceae	*Barbula stenocarpa* Hampe	3
187	M	Bartramiaceae	*Bartramia brevifolia* Brid.	2
188	M	Bartramiaceae	*Bartramia longifolia* Hook.	20
189	M	Bartramiaceae	*Bartramia mathewsii* Mitt.	20
190	M	Bartramiaceae	*Bartramia potosica* Mont.	20
191	M	Bartramiaceae	*Bartramia strumosa* (Hampe) Mitt.	3
192	M	Seligeraceae	*Brachydontium flexisetum* (Hampe) Paris	3
193	M	Bryaceae	*Brachymenium consimile* (Mitt.) A. Jaeger	19
194	M	Bryaceae	*Brachymenium speciosum* (Hook. & Wilson) Steere	2
195	M	Splachnaceae	*Brachymitrion moritzianum* (Müll. Hal.) A.K. Kop.	20
196	M	Brachytheciaceae	*Brachythecium cirriphylloides* McFarland	20
197	M	Brachytheciaceae	*Brachythecium occidentale* (Hampe) A. Jaeger	20
198	M	Brachytheciaceae	*Brachythecium plumosum* (Hedw.) Schimp.	10
199	M	Brachytheciaceae	*Brachythecium rutabulum* (Hedw.) Schimp.	2, 19
200	M	Bartramiaceae	*Breutelia chrysea* (Müll. Hal.) A. Jaeger	20
201	M	Bartramiaceae	*Breutelia inclinata* (Hampe & Lorentz) A. Jaeger	19, 20
202	M	Bartramiaceae	*Breutelia karsteniana* (Müll. Hal.) A. Jaeger	20
203	M	Bartramiaceae	*Breutelia polygastrica* (Müll. Hal.) Broth.	20
204	M	Bartramiaceae	*Breutelia rhythidioides* Herzog	1
205	M	Bartramiaceae	*Breutelia squarrosa* A. Jaeger	19
206	M	Bartramiaceae	*Breutelia subarcuata* (Müll. Hal.) Schimp.	2, 20, 1
207	M	Bartramiaceae	*Breutelia tomentosa* (Sw. ex Brid.) Spruce	3, 20
208	M	Bartramiaceae	*Breutelia trianae* (Hampe) A. Jaeger	19, 20
209	M	Pottiaceae	*Bryoerythrophyllum campylocarpum* (Müll. Hal.) H.A. Crum	20, 1
210	M	Pottiaceae	*Bryoerythrophyllum jamesonii* (Taylor) H.A. Crum	4, 20, 1
211	M	Pottiaceae	*Bryoerythrophyllum subcespitosum* (Hampe) J.A. Jiménez & M.J. Cano	3
212	M	Leucobryaceae	*Bryohumbertia filifolia* (Hornsch.) J.-P. Frahm	20
213	M	Bryaceae	*Bryum andicola* Hook.	3
214	M	Bryaceae	*Bryum argenteum* Hedw.	2, 19, 10, 3, 11, 20, 13
215	M	Bryaceae	*Bryum capillare* Hedw.	19, 10, 4, 20
216	M	Bryaceae	*Bryum ellipsifolium* Müll. Hal.	20
217	M	Bryaceae	*Bryum laevigatum* Hook. f. & Wilson	20
218	M	Bryaceae	*Bryum microchaeton* Hampe	3
219	M	Bryaceae	*Bryum paradoxum* Schwägr.	20
220	M	Amblystegiaceae	*Campylophyllum sommerfeltii* (Myrin) Hedenäs	19, 3
221	M	Leucobryaceae	*Campylopus anderssonii* (Müll. Hal.) A. Jaeger	2, 19, 10, 3, 20
222	M	Leucobryaceae	*Campylopus areodictyon* (Müll. Hal.) Spruce	20
223	M	Leucobryaceae	*Campylopus argyrocaulon* (Müll. Hal.) Broth.	10, 4
224	M	Leucobryaceae	*Campylopus asperifolius* Mitt.	3, 20
225	M	Leucobryaceae	*Campylopus cavifolius* Mitt.	20
226	M	Leucobryaceae	*Campylopus cleefii* J.-P. Frahm	19
227	M	Leucobryaceae	*Campylopus concolor* (Hook.) Brid.	3, 20
228	M	Leucobryaceae	*Campylopus densicoma* (Müll. Hal.) Paris	2, 3
229	M	Leucobryaceae	*Campylopus edithae* Broth.	20
230	M	Leucobryaceae	*Campylopus fragilis* (Brid.) Bruch & Schimp.	2, 3, 20
231	M	Leucobryaceae	*Campylopus heterostachys* (Hampe) A. Jaeger	2, 20
232	M	Leucobryaceae	*Campylopus incertus* Thér.	20
233	M	Leucobryaceae	*Campylopus jamesonii* (Hook.) A. Jaeger	20
234	M	Leucobryaceae	*Campylopus nivalis* (Brid.) Brid.	3, 20
235	M	Leucobryaceae	*Campylopus oblongus* Thér.	3, 4
236	M	Leucobryaceae	*Campylopus pauper* (Hampe) Mitt.	20

	GROUP	FAMILY	TAXA	LOCALITIES
237	M	Leucobryaceae	*Campylopus pilifer* Brid.	3, 20
238	M	Leucobryaceae	*Campylopus pittieri* R.S. Williams	20
239	M	Leucobryaceae	*Campylopus reflexisetus* (Müll. Hal.) Broth.	20
240	M	Leucobryaceae	*Campylopus richardii* Brid.	3, 20
241	M	Leucobryaceae	*Campylopus tallulensis* Sull. & Lesq.	20
242	M	Leucobryaceae	*Campylopus trivialis* Müll. Hal. ex E. Britton	5
243	M	Leucobryaceae	*Campylopus zygodonticarpus* (Müll. Hal.) Paris	1
244	M	Hypnaceae	*Caribaeohypnum polypterum* (Mitt.) Ando & Higuchi	20
245	M	Catagoniaceae	*Catagonium brevicaudatum* Müll. Hal.	20
246	M	Ditrichaceae	*Ceratodon purpureus* (Hedw.) Brid.	1
247	M	Ditrichaceae	*Ceratodon stenocarpus* Bruch & Schimp.	3, 20
248	M	Dicranaceae	*Chorisodontium mittenii* (Müll. Hal.) Broth.	20
249	M	Dicranaceae	*Chorisodontium speciosum* (Hook. & Wilson) Broth.	20
250	M	Hypnaceae	*Chryso-hypnum diminutivum* (Hampe) W.R. Buck	1
251	M	Cryphaceae	*Cryphaea brevipila* Mitt.	3
252	M	Cryphaceae	*Cryphaea patens* Hornsch. ex Müll. Hal.	2, 10
253	M	Cryphaceae	*Cryphaea pilifera* Mitt.	10
254	M	Cryphaceae	*Cryphaea ramosa* (Mitt.) Mitt.	19
255	M	Hylocomiaceae	*Ctenidium malacodes* Mitt.	20
256	M	Pilotrichaceae	*Cyclodictyon roridum* (Hampe) Kuntze	20
257	M	Thuidiaceae	*Cyrto-hypnum arzobispoae* (Müll. Hal.) S.P. Churchill & E.L. Linares	3
258	M	Daltoniaceae	*Daltonia bilimbata* Hampe	3
259	M	Daltoniaceae	*Daltonia lindigiana* Hampe	3
260	M	Daltoniaceae	*Daltonia ovalis* Taylor	3
261	M	Cryphaceae	*Dendrocryphaea latifolia* D.G. Griffin, Gradst. & J. Aguirre	20, 5
262	M	Dicranaceae	*Dicranella bogotensis* (Hampe) Mitt.	20
263	M	Dicranaceae	*Dicranella vaginata* (Hook.) Spruce	20
264	M	Dicranaceae	*Dicranum frigidum* Müll. Hal.	2, 19, 3, 20, 1
265	M	Pottiaceae	*Didymodon australasiae* (Hook. & Grev.) R.H. Zander	2
266	M	Pottiaceae	*Didymodon pruinosus* (Mitt.) R.H. Zander	3
267	M	Pottiaceae	*Didymodon rigidulus* Hedw.	10, 3
268	M	Pottiaceae	*Didymodon tophaceus* (Brid.) Lisa	20
269	M	Hypnaceae	*Ditrichum bogotense* (Hampe) Broth.	3
270	M	Ditrichaceae	*Ditrichum crinale* (Taylor) Kuntze	1
271	M	Ditrichaceae	*Ditrichum difficile* (Duby) M. Fleisch.	3
272	M	Ditrichaceae	*Ditrichum gracile* (Mitt.) Kuntze	20
273	M	Ditrichaceae	*Ditrichum submersum* Cardot & Herzog	20
274	M	Amblystegiaceae	*Drepanocladus aduncus* (Hedw.) Warnst.	20
275	M	Amblystegiaceae	*Drepanocladus longifolius* (Wilson ex Mitt.) Broth. ex Paris	20
276	M	Amblystegiaceae	*Drepanocladus sordidus* (Müll. Hal.) Hedenäs	20
277	M	Entodontaceae	*Entodon beyrichii* (Schwägr.) Müll. Hal.	2, 10
278	M	Entodontaceae	*Entodon jamesonii* (Taylor) Mitt.	10
279	M	Funariaceae	*Entosthodon bonplandii* (Hook.) Mitt.	3
280	M	Entodontaceae	*Erythrodontium longisetum* (Hook.) Paris	10
281	M	Entodontaceae	*Erythrodontium squarrosum* (Hampe) Paris	10
282	M	Brachytheciaceae	*Eurhynchium pulchellum* (Hedw.) Jenn.	2
283	M	Fabroniaceae	*Fabronia ciliaris* (Brid.) Brid.	2, 10, 13
284	M	Fabroniaceae	*Fabronia jamesonii* Taylor	2, 10
285	M	Fissidentaceae	*Fissidens asplenioides* Hedw.	2
286	M	Fissidentaceae	*Fissidens bryoides* Hedw.	13
287	M	Fissidentaceae	*Fissidens crispus* Mont.	2, 19

	GROUP	FAMILY	TAXA	LOCALITIES
288	M	Fissidentaceae	*Fissidens curvatus* Hornsch.	10
289	M	Fissidentaceae	*Fissidens elegans* Brid.	2
290	M	Fissidentaceae	*Fissidens intramarginatus* (Hampe) A. Jaeger	2
291	M	Fissidentaceae	*Fissidens polypodioides* Hedw.	2, 3
292	M	Fissidentaceae	*Fissidens rigidulus* Hook. f. & Wilson	2
293	M	Fissidentaceae	*Fissidens wallisii* Müll. Hal.	2, 10
294	M	Fissidentaceae	*Fissidens weirii* Mitt.	10, 13
295	M	Fontinalaceae	*Fontinalis bogotensis* Hampe	20
296	M	Funariaceae	*Funaria calvescens* Schwägr.	10, 20
297	M	Funariaceae	*Funaria hygrometrica* Hedw.	10
298	M	Pottiaceae	*Gertrudiella glaucescens* (Hampe) J.A. Jiménez & M.J. Cano	3
299	M	Grimmiaceae	*Grimmia longirostris* Hook.	19
300	M	Hedwigiaceae	*Hedwigia nivalis* (Müll. Hal.) Mitt.	19
301	M	Hedwigiaceae	*Hedwigidium imberbe* (Sm.) Bruch & Schimp.	3, 20
302	M	Pilotrichaceae	*Helicoblepharum daltoniaceum* (Hampe) Broth.	2
303	M	Dicranaceae	*Holomitrium arboreum* Mitt.	19
304	M	Pottiaceae	*Hymenostylium recurvirostrum* (Hedw.) Dixon	3
305	M	Hypnaceae	*Hypnum amabile* (Mitt.) Hampe	3, 20
306	M	Hypnaceae	*Hypnum cupressiforme* Hedw.	20
307	M	Hypopterygiaceae	*Hypopterygium tamarisci* (Sw.) Brid. ex Müll. Hal.	10, 3, 11, 20
308	M	Brachytheciaceae	*Kindbergia praelonga* (Hedw.) Ochyra	2, 19, 10
309	M	Bartramiaceae	*Leiomela bartramioides* (Hook.) Paris	3
310	M	Pilotrichaceae	*Lepidopilum longifolium* Hampe	20
311	M	Pilotrichaceae	*Lepidopilum muelleri* (Hampe) Hampe	20
312	M	Meesiaceae	*Leptobryum pyriforme* (Hedw.) Wilson	10
313	M	Pottiaceae	*Leptodontium brachyphyllum* Broth. & Thér.	4
314	M	Pottiaceae	*Leptodontium capituligerum* Müll. Hal.	4, 3
315	M	Pottiaceae	*Leptodontium erythroneuron* Herzog	3, 20
316	M	Pottiaceae	*Leptodontium flexifolium* (Dicks.) Hampe ex Lindb.	20
317	M	Pottiaceae	*Leptodontium longicaule* Mitt.	19, 20
318	M	Pottiaceae	*Leptodontium luteum* (Taylor) Mitt.	2, 3, 20
319	M	Pottiaceae	*Leptodontium proliferum* Herzog	20
320	M	Pottiaceae	*Leptodontium pungens* (Mitt.) Kindb.	3
321	M	Pottiaceae	*Leptodontium viticulosoides* (P. Beauv.) Wijk & Margad.	4, 3
322	M	Pottiaceae	*Leptodontium wallisii* (Müll. Hal.) Kindb.	2
323	M	Lepyrodontaceae	*Lepyrodon tomentosus* (Hook.) Spruce	20
324	M	Leskeaceae	*Leskeadelphus angustatus* (Taylor) B.H. Allen	2, 4
325	M	Daltoniaceae	*Leskeodon cubensis* (Mitt.) Thér.	3
326	M	Orthotrichaceae	*Macromitrium cirrosum* (Hedw.) Brid.	20
327	M	Orthotrichaceae	*Macromitrium crosbyorum* B.H. Allen & Vitt	19, 10, 3, 20
328	M	Orthotrichaceae	*Macromitrium longifolium* (Hook.) Brid.	1
329	M	Orthotrichaceae	*Macromitrium punctatum* (Hook. & Grev.) Brid.	20, 1
330	M	Brachytheciaceae	*Meteoridium remotifolium* (Müll. Hal.) Manuel	10, 20, 5
331	M	Meteoriaceae	*Meteorium deppei* (Hornsch. ex Müll. Hal.) Mitt.	19, 1
332	M	Meteoriaceae	*Meteorium nigrescens* (Sw. ex Hedw.) Dozy & Molk.	20
333	M	Hypnaceae	*Mittenothamnium lehmannii* (Besch.) Cardot	20, 1
334	M	Hypnaceae	*Mittenothamnium loriforme* (Hampe) Cardot	2
335	M	Hypnaceae	*Mittenothamnium reptans* (Hedw.) Cardot	2, 1
336	M	Neckeraceae	*Neckera chilensis* Schimp.	19, 1
337	M	Neckeraceae	*Neckera obtusifolia* Taylor	3
338	M	Neckeraceae	*Neckera scabridens* Müll. Hal.	10, 11, 1

	GROUP	FAMILY	TAXA	LOCALITIES
339	M	Rhabdoweisiaceae	*Oreoweisia brasiliensis* Hampe	20
340	M	Rhabdoweisiaceae	*Oreoweisia erosa* (Hampe ex Müll. Hal.) Kindb.	4
341	M	Orthodontiaceae	*Orthodontium pellucens* (Hook.) Bruch & Schimp.	10
342	M	Neckeraceae	*Orthostichella rigida* (Müll. Hal.) B.H. Allen & Magill	4
343	M	Neckeraceae	*Orthostichella versicolor* (Müll. Hal.) Hampe	4
344	M	Orthotrichaceae	*Orthotrichum aequatoreum* Mitt.	2
345	M	Orthotrichaceae	*Orthotrichum diaphanum* Schrad. ex Brid.	13, 11
346	M	Orthotrichaceae	*Orthotrichum elongatum* Taylor	3
347	M	Orthotrichaceae	*Orthotrichum penicillatum* Mitt.	2
348	M	Orthotrichaceae	*Orthotrichum pungens* Mitt.	3
349	M	Orthotrichaceae	*Orthotrichum pycnophyllum* (Müll. Hal.) Lewinsky	2
350	M	Brachytheciaceae	*Palamocladium leskeoides* (Hook.) E. Britton	19, 1
351	M	Bartramiaceae	*Philonotis cernua* (Wilson) D.G. Griffin & W.R. Buck	3
352	M	Bartramiaceae	*Philonotis fontanella* (Mitt.) A. Jaeger	20
353	M	Bartramiaceae	*Philonotis sphaericarpa* (Hedw.) Brid.	3
354	M	Bartramiaceae	*Philonotis striatula* (Mitt.) A. Jaeger	3
355	M	Bartramiaceae	*Philonotis uncinata* (Schwägr.) Brid.	20
356	M	Phyllogoniaceae	*Phyllogonium viscosum* (P. Beauv.) Spruce	4
357	M	Leucobryaceae	*Pilopogon guadalupensis* (Brid.) J.-P. Frahm	3
358	M	Leucobryaceae	*Pilopogon laevis* (Taylor) Thér.	4
359	M	Lembophyllaceae	*Pilotrichella flexilis* (Hedw.) Ångstr.	2
360	M	Mniaceae	*Plagiomnium rhynchophorum* (Harv.) T.J. Kop.	3, 20
361	M	Plagiotheciaceae	*Plagiothecium novogranatense* (Hampe) Spruce	20
362	M	Hylocomiaceae	*Pleurozium schreberi* (Willd. ex Brid.) Mitt.	19, 3, 20
363	M	Polytrichaceae	*Pogonatum campylocarpum* (Müll. Hal.) Mitt.	19, 3
364	M	Polytrichaceae	*Pogonatum neglectum* (Hampe) A. Jaeger	3
365	M	Polytrichaceae	*Pogonatum perichaetiale* subsp. *oligodus* (Kunze ex Müll. Hal.) Hyvönen	3, 5
366	M	Mniaceae	*Pohlia elongata* Hedw.	10
367	M	Mniaceae	*Pohlia papillosa* (Spruce) Broth.	4, 5
368	M	Polytrichaceae	*Polytrichadelphus longisetus* (Brid.) Mitt.	2
369	M	Polytrichaceae	*Polytrichastrum tenellum* (Müll. Hal.) G.L. Sm.	20
370	M	Polytrichaceae	*Polytrichum ericoides* Hampe	19, 3, 20
371	M	Polytrichaceae	*Polytrichum juniperinum* Hedw.	19, 3, 20, 5
372	M	Neckeraceae	*Porotrichodendron lindigii* (Hampe) W.R. Buck	11
373	M	Neckeraceae	*Porotrichodendron superbum* (Taylor) Broth.	19
374	M	Neckeraceae	*Porotrichum expansum* (Taylor) Spruce	2
375	M	Neckeraceae	*Porotrichum korthalsianum* (Dozy & Molk.) Mitt.	20
376	M	Neckeraceae	*Porotrichum lancifrons* (Hampe) Mitt.	19
377	M	Neckeraceae	*Porotrichum longirostre* (Hook.) Spruce	2, 20
378	M	Neckeraceae	*Porotrichum mutabile* Hampe	20
379	M	Prionodontaceae	*Prionodon densus* (Sw. ex Hedw.) Müll. Hal.	19, 11, 20, 1
380	M	Prionodontaceae	*Prionodon fuscolutescens* Hampe	20
381	M	Prionodontaceae	*Prionodon luteovirens* (Taylor) Mitt.	20
382	M	Prionodontaceae	*Prionodon lycopodioides* Hampe	20, 1
383	M	Amblystegiaceae	*Pseudocalliergon trifarium* (F. Weber & D. Mohr) Loeske	20
384	M	Pottiaceae	*Pseudocrossidium replicatum* (Taylor) R.H. Zander	19
385	M	Pterobryaceae	*Pterobryon densum* (Hornsch.) Hornsch.	1
386	M	Ptychomitriaceae	*Ptychomitrium lepidomitrium* (Müll. Hal.) Schimp.	4
387	M	Pylaisiaceae	*Pylaisia falcata* Schimp.	20
388	M	Rhizogoniaceae	*Pyrrhobryum mnioides* (Hook.) Manuel	20
389	M	Grimmiaceae	*Racomitrium crispipilum* (Taylor) Spruce	3, 20

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390	M	Grimmiaceae	*Racomitrium cucullatifolium* Hampe	3
391	M	Grimmiaceae	*Racomitrium lanuginosum* (Hedw.) Brid.	3
392	M	Regmatodontaceae	*Regmatodon orthostegius* Mont.	3
393	M	Rhabdoweisiaceae	*Rhabdoweisia crenulata* (Mitt.) H. Jameson	20
394	M	Rhabdoweisiaceae	*Rhabdoweisia fugax* (Hedw.) Bruch & Schimp.	2
395	M	Rhacocarpaceae	*Rhacocarpus purpurascens* (Brid.) Paris	19, 20
396	M	Rhizogoniaceae	*Rhizogonium novae-hollandiae* (Brid.) Brid.	3
397	M	Bryaceae	*Rhodobryum grandifolium* (Taylor) Schimp.	19, 3
398	M	Bryaceae	*Rhodobryum huillense* (Welw. & Duby) Touw	19, 3
399	M	Bryaceae	*Rhodobryum perspinidens* (Broth.) Pócs	3
400	M	Bryaceae	*Rhodobryum procerum* (Schimp. ex Besch.) Paris	20
401	M	Brachytheciaceae	*Rhynchostegium conchophyllum* (Taylor) A. Jaeger	10
402	M	Brachytheciaceae	*Rhynchostegium scariosum* (Taylor) Spruce	10
403	M	Lembophyllaceae	*Rigodium toxarion* (Schwägr.) A. Jaeger	19
404	M	Mniaceae	*Schizymenium campylocarpum* (Arn. & Hook.) A.J. Shaw	4, 20
405	M	Mniaceae	*Schizymenium dolichothecum* (Herzog) A.J. Shaw & S.P. Churchill	20
406	M	Mniaceae	*Schizymenium gracilisetum* (Hampe) A.J. Shaw	20
407	M	Cryphaceae	*Schoenobryum concavifolium* (Griff.) Gangulee	10
408	M	Sematophyllaceae	*Sematophyllum cucullatifolium* (Hampe) Mitt.	20
409	M	Sematophyllaceae	*Sematophyllum fragilirostrum* (Hampe) Mitt.	3
410	M	Sematophyllaceae	*Sematophyllum swartzii* (Schwägr.) W.H. Welch & H.A. Crum	2, 19, 10
411	M	Sematophyllaceae	*Sematophyllum tequendamense* (Hampe) Mitt.	10
412	M	Leucobryaceae	*Sphaerothecium phascoideum* (Hampe) Hampe	20
413	M	Sphagnaceae	*Sphagnum compactum* DC	20
414	M	Sphagnaceae	*Sphagnum cuspidatum* Ehrh. ex Hoffm.	3, 20
415	M	Sphagnaceae	*Sphagnum cyclophyllum* Sull. & Lesq.	20
416	M	Sphagnaceae	*Sphagnum magellanicum* Brid.	2, 19, 20
417	M	Sphagnaceae	*Sphagnum meridense* (Hampe) Müll. Hal.	3
418	M	Sphagnaceae	*Sphagnum recurvum* P. Beauv.	20
419	M	Sphagnaceae	*Sphagnum sancto-josephense* H.A. Crum & Crosby	20
420	M	Sphagnaceae	*Sphagnum sparsum* Hampe	11
421	M	Sphagnaceae	*Sphagnum subsecundum* Nees	20
422	M	Sphagnaceae	*Sphagnum trollii* H.A. Crum	20
423	M	Splachnaceae	*Splachnum weberbaueri* Reimers	20
424	M	Brachytheciaceae	*Squamidium leucotrichum* (Taylor) Broth.	19
425	M	Brachytheciaceae	*Squamidium livens* (Schwägr.) Broth.	19, 20
426	M	Brachytheciaceae	*Squamidium nigricans* (Hook.) Broth.	1
427	M	Calliergonaceae	*Straminergon stramineum* (Dicks. ex Brid.) Hedenäs	20
428	M	Pottiaceae	*Streptopogon calymperes* Müll. Hal.	3
429	M	Pottiaceae	*Streptopogon erythrodontus* (Taylor) Wilson ex Mitt.	20
430	M	Pottiaceae	*Streptopogon lindigii* Hampe	3
431	M	Pottiaceae	*Syntrichia bogotensis* (Hampe) Mitt. ex R.H. Zander	10
432	M	Pottiaceae	*Syntrichia fragilis* (Taylor) Ochyra	2, 10, 3, 13
433	M	Pottiaceae	*Syntrichia papillosa* (Wilson ex Spruce) Spruce	2, 10, 13
434	M	Calymperaceae	*Syrrhopodon gaudichaudii* Mont.	3
435	M	Hypnaceae	*Taxiphyllum laevifolium* (Mitt.) W.R. Buck	3
436	M	Splachnaceae	*Tetraplodon mnioides* (Hedw.) Bruch & Schimp.	20
437	M	Pilotrichaceae	*Thamniopsis undata* (Hedw.) W.R. Buck	20
438	M	Neckeraceae	*Thamnobryum fasciculatum* (Sw. ex Hedw.) I. Sastre	2
439	M	Thuidiaceae	*Thuidium delicatulum* (Hedw.) Schimp.	3, 11, 20, 1
440	M	Thuidiaceae	*Thuidium peruvianum* Mitt.	19, 3, 20, 1

	GROUP	FAMILY	TAXA	LOCALITIES
441	M	Thuidiaceae	*Thuidium tomentosum* Schimp.	5
442	M	Brachytheciaceae	*Torrentaria aquatica* (Spruce) Ochyra	2
443	M	Pottiaceae	*Tortula muralis* Hedw.	2, 10
444	M	Pilotrichaceae	*Trachyxiphium subfalcatum* (Hampe) W.R. Buck	1
445	M	Pottiaceae	*Trichostomum lindigii* (Hampe) R.H. Zander	3
446	M	Amblystegiaceae	*Vittia pachyloma* (Mont.) Ochyra	2
447	M	Calliergonaceae	*Warnstorfia exannulata* (Schimp.) Loeske	20
448	M	Calliergonaceae	*Warnstorfia fluitans* (Hedw.) Loeske	3, 20
449	M	Orthotrichaceae	*Zygodon reinwardtii* (Hornsch.) A. Braun	20
450	M	Orthotrichaceae	*Zygodon rufescens* (Hampe) Broth.	3

Among mosses, the families with the highest species diversity are Pottiaceae, Leucobryaceae, Bartramiaceae, Bryaceae, and Brachytheciaceae. For liverworts, the most diverse families include Lejeuneaceae, Frullaniaceae, Plagiochilaceae, Lepidoziaceae, and Lophocoleaceae (Table 3). This study presents the first documented report of hornworts in Bogotá. The moss genera with the greatest species richness in the city are *Campylopus*, *Fissidens*, *Leptodontium*, and *Sphagnum*. Among liverworts, the genera with the highest taxonomic diversity are *Frullania*, *Plagiochila*, *Metzgeria*, and *Cheilolejeunea* (Table 4).

Information by localities

The specimens listed in this study come from 12 of Bogotá's 20 localities. For a detailed overview of the rural and urban extention of each locality, see Appendix 1. The most species-rich areas are Sumapáz, Santafé, Ciudad Bolívar, Chapinero and Engativá (Figure 2).

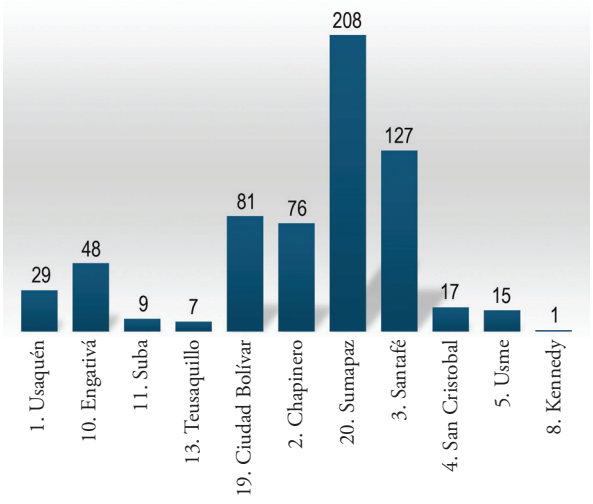

Figure 2: Distribution of bryophyte taxa across Bogotá's localities, highlighting variation in species richness.
Slika 2: Razširjenost mahovnih taksonov na lokacijah v mestu Bogotá, izpostavljena je variacija v vrstni pestrosti.

Table 3: Bryophyte families with the largest number of species in the city of Bogotá (M: moss; L: liverwort).
Tabela 3: Družine mahov z največjim številom vrst v mestu Bogotá (M: listnati mahovi; L: jetrenjaki).

Division	Family	Genus	Species
M	Pottiaceae	12	31
M	Leucobryaceae	5	28
L	Lejeuneaceae	9	25
M	Bartramiaceae	5	21
L	Frullaniaceae	1	19
L	Plagiochilaceae	1	18
M	Bryaceae	5	16
M	Brachytheciaceae	8	14
L	Lepidoziaceae	4	13
L	Lophocoleaceae	4	13
M	Neckeraceae	5	13
M	Orthotrichaceae	3	12
M	Fissidentaceae	1	10
M	Sphagnaceae	1	10

Table 4: Bryophyte genera with the largest number of species in the city of Bogotá (M: moss; L: liverwort).
Tabela 4: Rodovi mahov z največjim številom vrst v mestu Bogotá (M: listnati mahovi; L: jetrenjaki).

Division	Family	Genus	Species
M	Leucobryaceae	*Campylopus*	23
L	Frullaniaceae	*Frullania*	19
L	Plagiochilaceae	*Plagiochila*	18
M	Fissidentaceae	*Fissidens*	10
M	Pottiaceae	*Leptodontium*	10
M	Sphagnaceae	*Sphagnum*	10
M	Bartramiaceae	*Breutelia*	9
L	Metzgeriaceae	*Metzgeria*	9
L	Lejeuneaceae	*Cheilolejeunea*	7
L	Adelanthaceae	*Syzygiella*	7
M	Bryaceae	*Bryum*	7

The predominant ecosystems include páramo, high Andean forests, urban areas and urban forests (Table 5, Figure 3) as follows: Sumapáz (78,095 Ha) is a completely rural locality composed mostly of páramo; Santafé (4,517 Ha) is characterized by high Andean forest and the presence of the San Francisco River; Ciudad Bolívar (12,999 Ha) contains páramo, Andean and subxerophytic forest; Chapinero (3,816 Ha) presents high Andean forest and numerous streams; Engativá (3,588 ha) is associated with urban forests including the Botanical Garden and other metropolitan parks.

Table 5: Bryophyte taxa documented across Bogotá's principal ecosystems, with patterns of ecological distribution observed in this study.
Tabela 5: Taksoni mahov, zabeleženi v glavnih ekosistemih mesta Bogotá in vzorec njihove ekološke razširjenosti v raziskavi.

Locality	Ecosystem				No. of species	Percentage
	Páramo	High Andean Forest	Urban Forest (botanical garden)	Urban		
Sumapáz	208				304	67,5%
Ciudad Bolívar	81					
Usme	15					
Chapinero		76			249	55,3%
Santafé		127				
Usaquén		29				
San Cristobal		17				
Engativá			48		57	12,6%
Suba			9			
Teusaquillo				7	8	1,7%
Kennedy				1		
TOTAL	304	249	57	8		

Figure 3: Representative ecosystems of Bogotá sampled for bryophytes. A. Páramo (Sumapáz); B. Urban Forest (Bogotá Botanical Garden); C. Montane Forest (eastern hills).
Slika 3: Različni ekosistemi v mestu, kjer so vzorčili mahove. A. páramo (Sumapáz); B. urbani gozd (Botanični vrt Bogotá); C. montanski gozd (vzhodno hribovje).

As part of the research initiatives led by the curation of the bryophyte collection at the Bogotá Botanical Garden between 2021 and 2025, various areas within the localities of Chapinero, Santafé, Engativá, and Ciudad Bolívar were sampled, covering 15.23% of the city's territory and accounting for 51.59% of the total species recorded. However, a review of the databases revealed that only partial sampling has been conducted in Sumapáz, which comprises 47.2% of the territory. Despite this, Sumapáz harbors the highest diversity, representing 35.34% of the total species. In contrast, the localities of Usme and Suba, which together cover 19.29% of the territory, have been scarcely sampled and exhibit only 4% of the city's species richness. These findings underscore the need to expand the geographic coverage of sampling efforts, particularly in areas where the relation between territorial extent and species diversity is disproportionately low (Figure 4).

Additionally, analysis of the existing records reveals that *Bryum argenteum* accounts for 58% of the species representation across the city's territory. Meanwhile, 54% of the species analyzed have only been collected once, and it is estimated that 2.22% of the total corresponds to endemic species (Table 6).

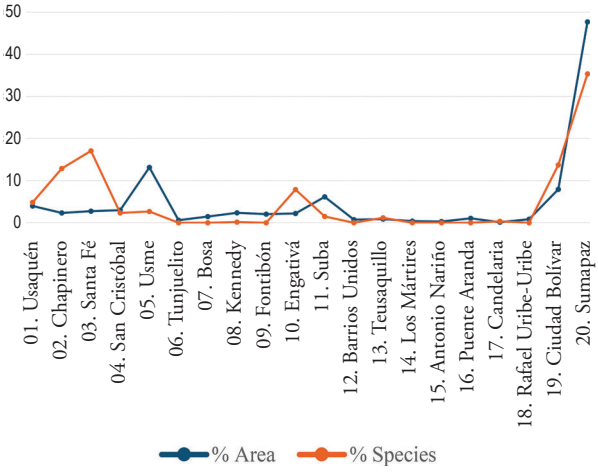

Figure 4: Correlation between the spatial extent of each locality and the diversity of bryophytes observed.

Slika 4: Korelacija med prostorskim obsegom posamezne lokacije in raznolikostjo opaženih mahov.

Table 6: Species recorded from only one voucher specimen, with herbarium acronyms indicate.
Tabela 6: Vrste, zabeležene samo z enim herbarijskim primerkom z oznako herbarija.

Division	Family	Specie	Herbarium
Liverwort	Lejeuneaceae	*Drepanolejeunea pungens*	NY
Liverwort	Frullaniaceae	*Frullania bogotensis*	G
Moss	Sematophyllaceae	*Aptychopsis pycnodonta*	JE
Moss	Pottiaceae	*Barbula stenocarpa*	BM
Moss	Thuidiaceae	*Cyrto-hypnum arzobispoae*	No information
Moss	Dicranaceae	*Dicranella bogotensis*	BM
Moss	Mniaceae	*Schizymenium dolichothecum*	JE
Moss	Leucobryaceae	*Sphaerothecium phascoideum*	PC
Moss	Sphagnaceae	*Sphagnum trollii*	M
Moss	Pottiaceae	*Trichostomum lindigii*	BM

Categorization

The number of species in the city known from a single specimen led to their classification under the criterion of "restricted extent of occurrence," one of the conditions for assigning a "Vulnerable" risk status (IUCN, 2012). In Colombia, bryophytes considered at risk of extinction (Linares & Uribe, 2002; Instituto Humboldt, 2019; Ministerio de Ambiente, 2024) include 24 species found within the city. Among these, *Cephaloziella divaricata* has been categorized as Critically Endangered (CR), *Metzgeria lechleri* as Endangered (EN) – both also present in other countries – and *Cyrto-hypnum arzobispoae* as Vulnerable (VU), a species endemic to the city (Table 7).

Sources of information

The 450 bryophyte species reported for Bogotá in this study are distributed as follows: 196 in COL, 227 in JBB, and 261 in Tropicos. Table 8 provides further insights into the relationships among these data sources.

Table 7: Conservation categories assigned to bryophyte species from Bogotá according to national assessments: Linares & Uribe (2002), Humboldt Institute (2019), and Ministry of Environment (2024). Status codes: VU – Vulnerable; LC – Least Concern; CR – Critically Endangered; DD – Data Deficient.

Tabela 7: Kategorije stanja ohranjenosti za posamezne vrste mahov v mestu Bogotá glede na nacionalne ocene: Linares & Uribe (2002), Humboldt Institute (2019) in Ministrstvo za okolje (2024). Oznake statusa vrst: VU – ranljiva; LC – najmanj ogrožena; CR – skrajno ogrožena; DD – podatkovno pomanjkljiva.

Group	Species	2002	2019	2024
L	*Cephalozia bicuspidata*	VU	LC	
L	*Cephaloziella divaricata*	VU	CR	CR
L	*Cheilolejeunea paramicola*		LC	
L	*Drepanolejeunea pungens*		DD	
L	*Frullania bogotensis*		LC	
L	*Metzgeria lechleri*	VU	EN	EN
M	*Aptychopsis pycnodonta*		DD	
M	*Bryoerythrophyllum subcespitosum*		LC	
M	*Cyrto-hypnum arzobispoae*	VU		VU
M	*Dicranella bogotensis*	CR	LC	
M	*Fontinalis bogotensis*		LC	
M	*Philonotis striatula*		DD	
M	*Helicoblepharum daltoniaceum*	VU	DD	
M	*Schizymenium dolichothecum*	VU	DD	
M	*Sematophyllum fragilirostrum*		DD	
M	*Sphagnum compactum*		LC	
M	*Sphagnum cuspidatum*		LC	
M	*Sphagnum cyclophyllum*		LC	
M	*Sphagnum magellanicum*		LC	
M	*Sphagnum meridense*		LC	
M	*Sphagnum recurvum*		LC	
M	*Sphagnum sancto-josephense*		LC	
M	*Sphagnum sparsum*		LC	
M	*Sphagnum subsecundum*		LC	
M	*Sphagnum trollii*		DD	
M	*Trichostomum lindigii*		DD	

Table 8: Bryophyte species counts by data source. COL: Colombian National Herbarium; JBB: Bogotá Botanical Garden Herbarium; TRO: Tropicos® database (Missouri Botanical Garden).

Tabela 8: Število mahovnih vrst z virom podatkov. COL: Nacionalni herbarij Kolumbije; JBB: Herbarij botaničnega vrta Bogotá; TRO: podatkovna baza Tropicos® (Botanični vrt v Missouriju).

Source of information			No. Species
COL	JBB	TRO	62
COL	JBB		31
COL			62
COL		TRO	41
	JBB	TRO	37
	JBB		97
		TRO	120
196	227	261	

Historical collectors and specimen records

The principal bryophyte collectors in Bogotá have included Alexander Lindig (1813–1882), John Weir (–1898), Ellsworth Killip (1890–1968), Carl Troll (1899–1975), José Cuatrecasas (1903–1996), Helene Bischler (1932–2005), Thomas van der Hammen (1924–2010), Steve Churchill (1948–2023), Antoine Cleef (1941), Jaime Aguirre (1951), and the first author. Notably, 60 species – representing 14% of those recorded in Bogotá – are known solely from one or two specimens collected by Lindig, Troll, or Weir in the 19th century. These specimens are housed in herbaria in Europe or the United States, due to the absence of national repositories at the time (Díaz-Piedrahíta, 2016).

Discussion

The bryophyte catalogs of Colombia (Churchill, 2016; Gradstein, 2021) recognizes a national richness of 1,652 species (932 mosses, 720 liverworts and hornworts). This study demonstrates that Bogotá, despite occupying less than 1% of Colombia's land area, harbors 25% of the country's bryophyte diversity. The families and genera with the greatest number of species in the city are similar to those reported for the tropical Andes (Gradstein et al., 2001) and paramo and high Andean forest ecosystems (Churchill, 1991; Churchill et al., 2020).

The high bryophyte species richness in Bogotá can be attributed to the presence of rural and mixed-use localities containing specialized ecosystems that serve as critical refuges for biodiversity. However, this richness is increasingly threatened by the rapid transformations typical of a capital city, including: the expansion of both legal and informal urban settlements; mining activities, both excavated and open-pit; tourism in protected areas; the advancement of agricultural frontiers; water and air pollution; waste management practices; and civic culture (Brown, 2012; Escobedo et al., 2015; Salamanca et al., 2023).

In urban localities, the resistance, resilience, and adaptability of bryophytes (Capozzi et al, 2016; Jovan et al., 2022) enable them to tolerate conditions of pollution and nutrient scarcity. These traits contribute to high species diversity and, in some cases, even endemism.

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Research data availability

All data supporting this study are included within the article and/or supporting materials. The information is also available as a search at https://www.tropicos.org/home, https://herbario.jbb.gov.co/especimen/simple and http://www.biovirtual.unal.edu.co/es/colecciones/search/plants/

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APPENDIX 1

Geographic characterization of each locality: rural and urban extent.
Geografske značilnosti posameznih nahajališč: ruralne in urbane površine.

Number of Locality	Locality	Total area (Ha)	Urban area (Ha)	Rural area (Ha)
1	Usaquén	6532	3807	2724
2	Chapinero	3816	1316	2500
3	Santafé	4517	697	3820
4	San Cristobal	4910	1648	3262
5	Usme	21507	3029	18477
6	Tunjuelito	987	987	0
7	Bosa	2394	2394	0
8	Kennedy	3859	3859	0
9	Fontibón	3327	3327	0
10	Engativá	3588	3588	0
11	Suba	10056	6271	3785
12	Barrios Unidos	1190	1190	0
13	Teusaquillo	1419	1419	0
14	Los Mártires	651	651	0
15	Antonio Nariño	488	488	0
16	Puente Aranda	1731	1731	0
17	La Candelaria	206	206	0
18	Rafael Uribe Uribe	1388	1388	0
19	Ciudad Bolívar	12999	3391	9608
20	Sumapáz	78095	0	78095