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A data set of vascular epiphytes of Colombia: the importance of biological records

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A data set of vascular epiphytes of Colombia: the importance of biological records

Abstract: Colombia is globally recognized as one of the world's hotspots for vascular epiphytes, particularly orchids, ferns, and bromeliads, owing to its exceptional topographic complexity and climatic diversity. Biological records are essential for taxonomic research and biodiversity assessment, yet public databases often present taxonomic inconsistencies and low spatial resolution. Here, we present two complementary datasets of vascular epiphytes in Colombia. The first is a comprehensive species list including 6396 taxa, compiled from five major sources: national and regional floras (Colombia and Antioquia), a fern specialist checklist, the Global Biodiversity Information Facility (GBIF; an open-access international infrastructure that aggregates and standardizes biodiversity occurrence records from institutions worldwide), and EpiList 1.0 (a global checklist of vascular epiphytes integrating taxonomic concepts and distribution information across major lineages). The second is a curated occurrence dataset containing approximately 726 000 records, published by multiple institutions through GBIF, documenting 5091 species across 66 families, including 1348 endemics of Colombia. Post-processing included spatial accuracy checks, taxonomic validation, and synonym standardization to ensure data quality and usability. Given the frequent misclassification of plant life forms in biodiversity repositories, this curated dataset offers a robust reference for mapping epiphyte distributions and studying biogeographic patterns in the Neotropics. It provides a solid foundation for ecological and conservation research, enhancing biodiversity monitoring and informing conservation strategies in one of the world's most species-rich regions. By improving data accuracy and accessibility, this resource also facilitates the integration of epiphytes into broader studies of ecosystem function and resilience.

Keywords: community ecology; GBIF; hemiepiphyte; nomadic vines; plant habit; SiB Colombia

Un conjunto de datos de epífitas vasculares de Colombia: la importancia de los registros biológicos

Resumen: Los registros biológicos son esenciales para la investigación taxonómica y la evaluación de la biodiversidad, pero las bases de datos públicas suelen presentar inconsistencias taxonómicas y baja resolución espacial. Aquí presentamos dos conjuntos de datos complementarios sobre epífitas vasculares en Colombia. El primero es una lista de especies que incluye 6396 taxones, recopilada a partir de cinco fuentes principales: floras nacionales y regionales (Colombia y Antioquia), una lista anotada por especialistas en helechos, la Infraestructura Mundial de Información sobre Biodiversidad (GBIF) y EpiList 1.0. El segundo es un conjunto de datos de ocurrencia seleccionado que contiene aproximadamente 726 000 registros, publicado por múltiples instituciones a través de GBIF, que documenta 5091 especies de 66 familias, incluidas 1348 endémicas. El posprocesamiento incluyó verificaciones de precisión espacial, validación taxonómica y estandarización de sinónimos para garantizar la calidad y la usabilidad de los datos. Dada la frecuente clasificación errónea de las formas de vida vegetales en los repositorios de biodiversidad, este conjunto de datos seleccionados ofrece una referencia sólida para cartografiar la distribución de las epífitas y estudiar los patrones biogeográficos en el Neotrópico. Proporciona una base sólida para la investigación ecológica y de conservación, mejorando el seguimiento de la biodiversidad y aportando información para las estrategias de conservación en una de las regiones más ricas en especies del mundo. Al mejorar la precisión y la accesibilidad de los datos, este recurso también facilita la integración de las epífitas en estudios más amplios sobre la función y la resiliencia de los ecosistemas.

Palabras clave: ecología de comunidades; GBIF; hemiepífitas; lianas nómadas; hábito de la planta; SiB Colombia

Background and Extended Abstract

Colombia harbors one of the richest vascular epiphyte floras worldwide, yet comprehensive and standardized datasets for this group remain scarce. Biological records are essential for taxonomic, ecological, and conservation research, but public repositories often suffer from taxonomic inconsistencies, incomplete metadata, and spatial biases. We present two complementary open datasets on Colombia's vascular epiphytes designed to address these gaps at the national scale. The first is a curated species checklist compiled from five main sources: national and regional floras (Colombia and Antioquia), a fern specialist checklist, EpiList 1.0, and occurrence-backed names from GBIF. The second is a curated occurrence dataset derived from GBIF, compiling records published by multiple institutions. Together, these resources constitute the most comprehensive baseline available for Colombia's epiphytic flora.

Both datasets underwent harmonization and rigorous quality control to ensure fitness for use. We standardised scientific names and synonyms, reconciled taxonomic backbones, and normalised text encodings. For occurrences, we conducted geographic validation (coordinate–locality checks within Colombian boundaries and administrative units), flagged inconsistent records, and retained non-georeferenced entries only when complete and consistent administrative locality data were available. Because plant life forms are frequently miscoded in biodiversity portals, we applied an inclusive definition of epiphytes, encompassing holo- and (primary) hemiepiphytes and "nomadic vines", and documented implications for data interpretation. Holoepiphytes are plants that spend their entire life on host trees without contact with ground, and primary hemiepiphytes are plants that germinate and later establish contact with the ground through adventitious roots (Zotz, 2016). Nomadic vines are species that typically germinate in the soil and ascend by climbing host trees while maintaining permanent contact with the ground, previously referred to as secondary hemiepiphytes (Zotz et al., 2021b).

The curated checklist (SM1) comprises 6396 vascular epiphyte taxa from 66 families, representing the most comprehensive inventory of Colombian epiphytic flora. Orchidaceae is the most speciose family (3506 species; 54% of all taxa), followed by Araceae (534 species; 8%), Bromeliaceae (394 species; 6%), and Polypodiaceae (270 species; 4%). The dataset includes 1348 species classified as endemic to Colombia.

The occurrence dataset (SM2) contains approximately 726 000 records documenting 5091 species from the checklist. Spatially, records cover all six natural regions of Colombia (Andean

Caribbean, Pacific, Amazon, Orinoquia, Insular); with higher densities in the Andean and Caribbean regions (**Fig. 1**). A disproportionate number of specimens were recorded in the Andes region, reflecting both the location of major cities and research institutions, and the region's exceptional biodiversity (Rangel-Ch., 2015). Antioquia stands out with the highest number of records per province, likely due to the extensive work behind the *Catálogo de Plantas de Antioquia* (CPA; Ortiz & Idárraga Piedrahita, 2023). In contrast, eastern and southern Colombia have low record densities, influenced by factors such as armed conflict, limited resources for exploration, and fewer higher education institutions (Fernández, 2011; Torres-Rodríguez et al., 2020).

Temporally, collections span from 1863 to 2023, with marked increases in records from the 1980s onwards (**Fig. 2**). Data completeness varies by family and region, with notable gaps in Amazonian and Pacific lowland areas. Georeferenced records represent 82% of the dataset, and 94% of these passed geographic consistency checks. The datasets allow the identification of sampling hotspots and underrepresented taxa, supporting targeted fieldwork and conservation priorities.

We analyzed the overlap of species records among the five major data sources used to compile the Colombian epiphyte checklist. EpiList contained the highest number of species (5184; Zotz et al. 2021), followed by the *Catálogo de Plantas y Líquenes de Colombia* (CPLC; 4530 species; Bernal et al., 2016), the *Catálogo de Plantas de Antioquia* (CPA; 1523 species; Ortiz & Idárraga Piedrahita, 2023), and GBIF-derived records (654 species; GBIF, 2022). Most species (908) were unique to EpiList, not found in any other dataset. Overall, EpiList and CPLC contributed to the majority of species (95%), with 10% of the species from CPLC not previously reported in EpiList 1.0. Although EpiList and CPLC represented the most comprehensive sources, unique records from CPA, GBIF, and the unpublished fern checklist highlight the value of regionally focused and taxonomically specialized datasets (**Fig. 3**).

This analysis also revealed that 1270 species (17%) from the compiled checklist were not present in the occurrence repository, indicating a lack of associated occurrence records and highlighting the need for their inclusion in future digitization efforts. These 1270 species span 34 plant families. Orchidaceae accounts for the majority with 833 species, followed by Bromeliaceae (84) and Polypodiaceae (31). The remaining 31 families each contain between one and ten species, with Aspleniaceae and Cactaceae each contributing seven species, and Urticaceae and Rubiaceae one species each. This gap reinforces the importance of mobilizing herbarium data and ensuring that underrepresented taxa are made accessible through global biodiversity platforms.

Observation records, defined in the GBIF context as species occurrences recorded in nature without preserved specimens or associated media, account for most records (592 729; 80%), followed by preserved specimens (129 060; 18%) (**Fig. 2**). A single institution in Colombia, Empresas Públicas de Medellín (EPM), a utilities services company, has reported 92% of the human observations, based on epiphyte inventories conducted in 2019. While observations are an accessible way to report species, their taxonomic reliability depends on expert corroboration, and therefore preserved specimens remain a critical source of validated records.

The preserved specimens in this dataset originate from approximately 35 Colombian herbaria and 18 international institutions. In Colombia, physical herbarium collections contributing to the 70 175 preserved specimens include FMB (Instituto Humboldt), COL (Universidad Nacional de Colombia), JBB (Jardín Botánico de Bogotá), BOG (Universidad de La Salle), MEDEL (Jardín Botánico de Medellín), HUA (Universidad de Antioquia), CUVC (Universidad del Valle), ANDES (Universidad de los Andes), HPUJ (Pontificia Universidad Javeriana), COAH (Instituto SINCHI), HPN (Instituto de Investigaciones Ambientales del Pacífico), and

HVC (INCIVA), as well as additional accredited herbaria such as FAUC, UIS, TOLI, PSO, HPAM, HUMP, HUAZ, HUCO, HUIB, HUI, HLL, HPT, CHOCO, and UPTC. Internationally, most preserved specimens are housed in herbaria in the United States (52 711 records), including NY (New York Botanical Garden), US (Smithsonian Institution), MO (Missouri Botanical Garden), F (Field Museum), and UC/JEPS (University of California). The earliest biological record of epiphytes in Colombia dates to 1760, when José Celestino Mutis collected specimens. Over 39% of biological collections have been gathered within the last 30 years. A peak in 1988 reflects collections from multiple institutions and collectors, while fluctuations in the 2010s likely relate to regulatory measures by the Ministry of Environment, which oversees biological collections under a licensing system.

Among preserved specimens, 60% (77 437) have coordinates in GBIF, while 51 592 lack georeferencing. The absence of spatial data limits their utility for research, underscoring the need to collaborate with data-hosting institutions to improve record quality through georeferencing.

These datasets enable robust biogeographic and ecological analyses across spatial and temporal scales, including mapping epiphyte richness, quantifying sampling effort and gaps, identifying contributions of major families (e.g., Orchidaceae, Araceae, Ericaceae), and informing conservation planning for national endemic and under-represented taxa. We also detail known biases—taxonomic, spatial, and temporal—and provide reproducible workflows to facilitate reuse, extension, and integration with other Neotropical datasets. By improving data quality and accessibility, this resource supports evidence-based conservation, long-term biodiversity monitoring, and interdisciplinary synthesis across research, management, and policy domains.
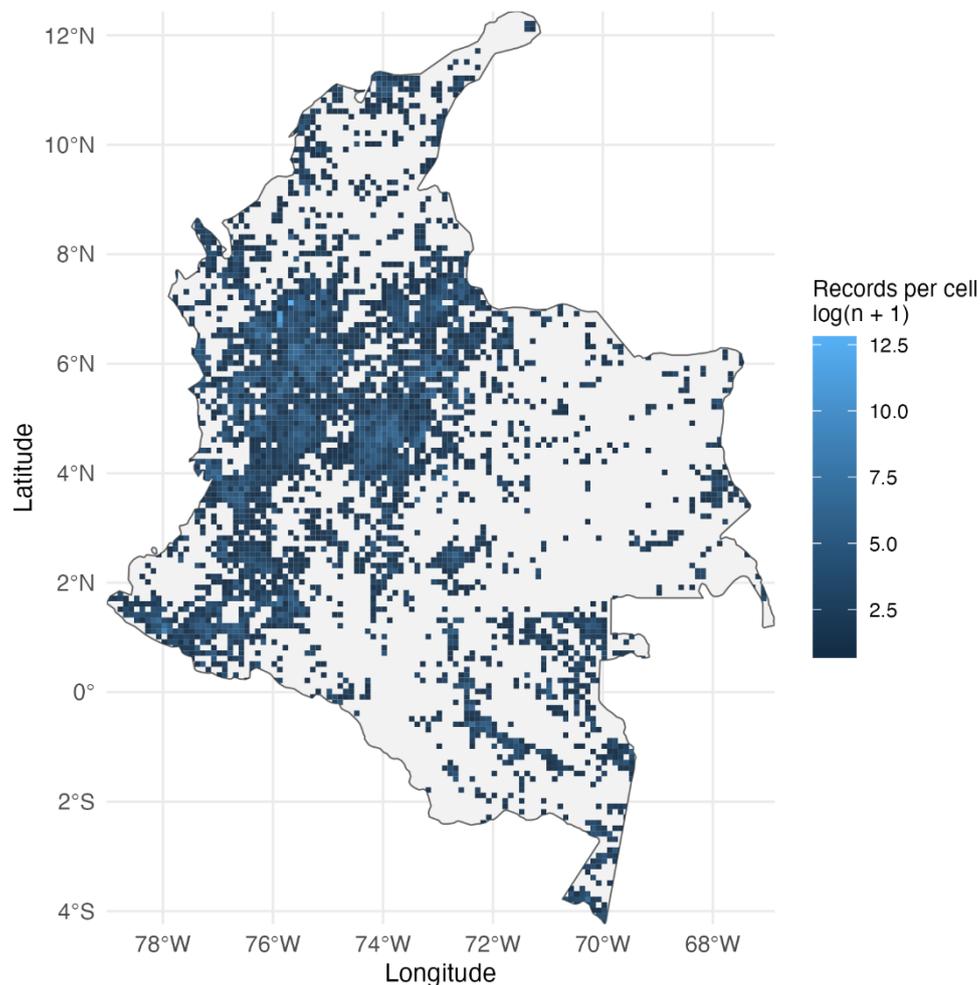

Figure 1. Spatial distribution of vascular epiphyte records in GBIF for Colombia aggregated on a regular grid (cell size = 0.1°). Only cells with ≥1 record are displayed; blank areas indicate lack of records and should not be interpreted as confirmed. absences.

Figura 1. Distribución espacial de los registros de epífitas vasculares en GBIF para Colombia agregados en una cuadrícula regular (tamaño de celda = 0,1°). Solo se muestran las celdas con ≥1 registro; las áreas en blanco indican la falta de registros y no deben interpretarse como ausencias confirmadas.
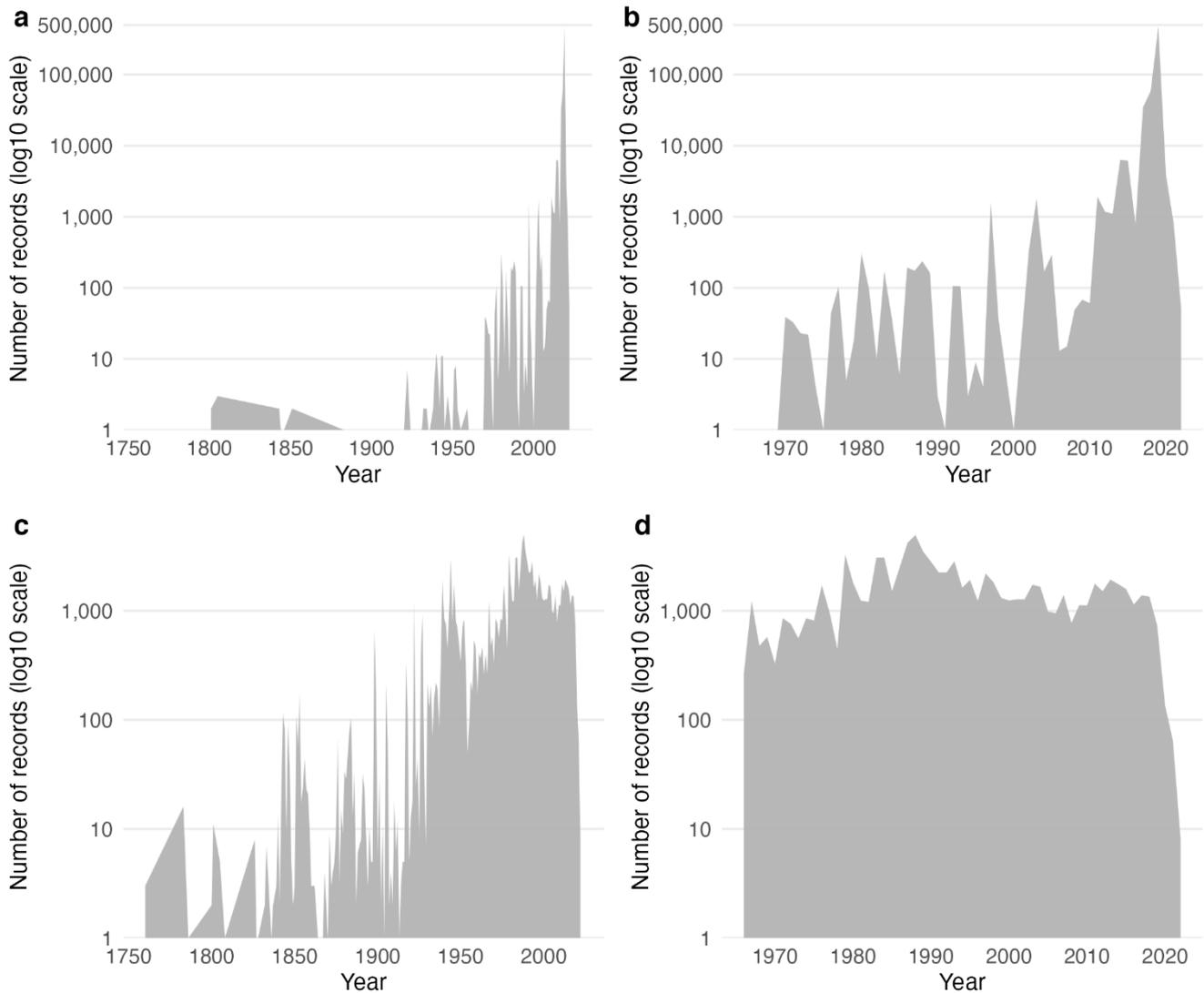
Figure 2. Temporal distribution of vascular epiphyte records in Colombia from GBIF. (**a**) Observation records from 1760 to 2022; (**b**) observation records from 1966 to 2022; (**c**) preserved specimen records from 1760 to 2022; and (**d**) preserved specimen records from 1966 to 2022. The y-axis is shown on a log10 scale to improve visualization and allow comparison across record types with strongly different magnitudes of annual records.

Figura 2. Distribución temporal de los registros de epífitas vasculares en Colombia. (**a**) Registros de observación desde 1760 hasta 2023; (**b**) registros de observación desde 1966 hasta 2022; (**c**) registros de especímenes conservados desde 1760 hasta 2023; y (**d**) registros de especímenes conservados desde 1966 hasta 2022. El eje y se muestra en una escala logarítmica 10 para mejorar la visualización y permitir la comparación entre tipos de registros con magnitudes muy diferentes de registros anuales.
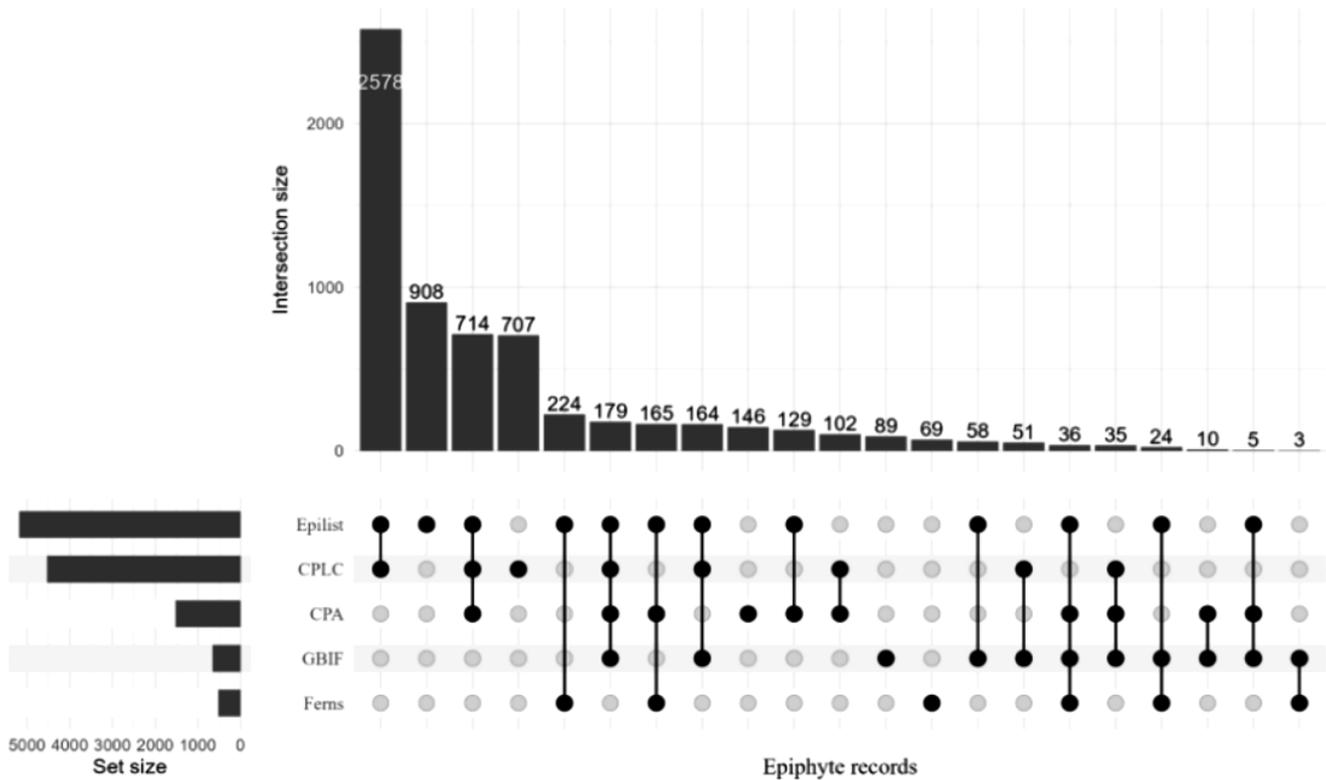
Figure 3. UpSet plot showing the intersection of epiphyte species records among five sources used to compile the Colombian checklist: EpiList 1.0 (EpiList), Catalogue of Plants and Lichens of Colombia (CPLC), Catalogue of Plants of Antioquia (CPA), GBIF, and an unpublished list of epiphytic ferns (Ferns). Vertical bars represent the number of species shared among specific combinations of sources (indicated by filled circles below), while horizontal bars represent the total number of species in each source.

Figura 3. Gráfico UpSet que muestra la intersección de especies de epífitas entre las cinco fuentes utilizadas para compilar el listado de Colombia: EpiList 1.0 (EpiList), Catálogo de Plantas y Líquenes de Colombia (CPLC), Catálogo de Plantas de Antioquia (CPA), GBIF y una lista inédita de helechos epífitos (Ferns). Las barras verticales representan el número de especies compartidas entre combinaciones específicas de fuentes (indicadas por los círculos rellenos en la parte inferior), mientras que las barras horizontales muestran el número total de especies en cada fuente.

Material and methods

Study area

These datasets compile records from Colombia. Coordinates. -0.567 to 8.43° Latitude; -78.133 to -69.896° Longitude.

Definition of Epiphytes

We adopted a broad definition of vascular epiphytes, following Zotz (2013a, 2016), encompassing holo- and (primary) hemiepiphytes, as well as "nomadic vines" (formerly denominated as secondary hemiepiphytes) such as certain Araceae that maintain soil contact while climbing host trees (Zotz et al., 2021b). The classification of plants into epiphytic life forms is debated, with various authors offering different criteria (Benzing, 1998; Zotz, 2013a, b, 2016; Batke et al., 2016; Flores-Palacios, 2016). Zotz (2013a, 2016) describes epiphytes as organisms that germinate and root non-parasitically on other plants without soil contact for at least part of their life cycle. The term may refer to individual plants or entire species (Hoeber & Zotz, 2022). In this sense, we adopt an inclusive interpretation: in recent decades, botanists and herbarium collectors have often applied "epiphyte" broadly to any plant growing on trees, without noting whether it has lost ground contact (Zotz 2013b). This encompasses "nomadic vines" such as some Araceae, which germinate on the forest floor and ascend host trees while maintaining a continuous soil connection (Zotz et al., 2021b). We do not distinguish between true, facultative, or accidental epiphytes due to insufficient data on the proportion of terrestrial versus epiphytic individuals for each species (Burns & Zotz, 2010).

Compilation of the Epiphyte Species List (SM1)

An Epiphyte Species List of Colombia (SM1) was compiled using five primary sources. First, species classified under the growth habits epiphyte and hemiepiphyte were extracted from two national catalogs: the Catálogo de Plantas Vasculares del Departamento de Antioquia (CPA) (Ortiz & Idárraga Piedrahita, 2023) and the Catálogo de Plantas y Líquenes de Colombia (CPLC) (Bernal et al., 2016). In parallel, a list of epiphytic ferns was contributed by the Ferns of Colombia research group. These

three sources were merged and cleaned to remove duplicate entries. We then incorporated EpiList 1.0, a global checklist of vascular epiphytes (Zotz et al., 2021a), using the rgbif package in R (Chamberlain, 2017) to extract only species recorded in Colombia. In addition, epiphyte species occurrence records from the Global Biodiversity Information Facility (GBIF) were included. We searched the GBIF database using the keywords "epiphyte" and "hemiepiphyte" in both Spanish and English, removed duplicates, and validated species names. To consolidate the final species list, all five sources were cross-referenced. Taxonomic standardization and synonym resolution were performed using the Leipzig Catalogue of Vascular Plants (LCVP) as the primary taxonomic backbone (Freiberg et al., 2020), accessed through the lcvplants R package for name matching. Synonyms were removed using the lcvplants package in R (Freiberg et al., 2020). Endemic species at the country level were flagged based on the CPA and CPLC. Growth habit data were extracted from the original databases, catalogs, and supporting references.

The final species list integrates data from the following sources:

- Zotz, G., Weigelt, P., Kessler, M., Kreft, H., & Taylor, A. (2021a). EpiList 1.0: A global checklist of vascular epiphytes. *Ecology*, 102(6), e03326. https://doi.org/10.1002/ecy.3326
- Bernal, R., Gradstein, S.R., & Celis, M. (Eds.). (2016). *Catálogo de plantas y líquenes de Colombia*. Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá [Accessed: 27 December 2021]. http://catalogoplantasdecolombia.unal.edu.co/
- Ortiz, R. del C. & Idárraga Piedrahita, A. (2023). *Catálogo de las Plantas Vasculares del Departamento de Antioquia*. Tropicos, Missouri Botanical Garden [Accessed: 6 October 2023]. http://www.tropicos.org/Project/Catalogo-de-Antioquia
- Unpublished list of epiphytic ferns provided by fern specialists Alejandra Vasco, Weston Testo, Michael Sundue, and Susana Vega.
- GBIF.org (06 September 2022). *GBIF Occurrence Download* [Accessed: 06-09-2022] https://doi.org/10.15468/dl.rk4z6u

Compilation of the Occurrence Dataset (SM2)

Finally, we retrieved records for each species in Colombia using the rgbif package in R (Chamberlain, 2017), including both georeferenced and non-georeferenced occurrences. All records associated with each species' gbifID were downloaded using the occ_download function. For SM2, we first described the process of consolidating epiphyte species from each consulted source, followed by an overview of the record composition—specifically, the number of entries derived from biological collections, human observations, and other data sources. We cleaned this downloaded database for consistency and technical errors, such as: (1) incorrectly entered fields, (2) several names associated with the same entity (verifying the accepted name), (3) state province and county mismatches, and (4) coordinates not matching the locality.

Quality Control

For SM1 and SM2, evaluations of data quality and filtering were carried out using a combination of QGIS 3.28 (QGIS.org, 2022), R 4.2.1 (R Core Team, 2022), OpenRefine 3.6.2 (OpenRefine Community, 2022), and Microsoft Excel. Taxonomic data cleaning was performed using string normalization routines in R and OpenRefine, which included the removal of invisible Unicode characters, normalization of whitespace, and conversion to plain ASCII text to ensure compatibility with external taxonomic services. Duplicate records and inconsistent entries were filtered through OpenRefine's faceted browsing and clustering tools.

Taxonomic validation involved cross-referencing species names against several authoritative sources. The Leipzig Catalogue of Vascular Plants (LCVP) served as the primary taxonomic backbone, accessed through the lcvplants R package (Freiberg et al., 2020) for synonym resolution and name standardization. Additional verification was conducted using GBIF's taxonomic backbone, the Catalogue of Life, and World Flora Online through the rgbif and taxize packages in R, particularly to detect mismatches or unresolved names. When automated matching failed across these services, names were manually validated using authoritative source URLs. Canonical names were harmonized for consistency across the final dataset.

For SM2, geographic validation was conducted using QGIS. Spatial filtering retained only those records with coordinates falling within the political boundaries of Colombia. Administrative fields such as department and municipality were cross-verified and corrected using official reference shapefiles and attribute tables. Records without coordinates were retained only if administrative-level locality information (e.g., municipality, department) was complete and consistent. Both datasets were subjected to manual review to correct anomalies in taxonomic hierarchy, geographic descriptors, and identifier consistency, ensuring a curated and reliable foundation for further analyses.

Data Integration

For SM1, all fields were formatted to Darwin Core 4.1 standards, with required fields (e.g., taxonID, scientificName, locality) and optional ecological descriptors (life form, endemic status). Species were assigned to Colombia's six natural regions (IAvH 2017) based on occurrence distribution, and gaps were supplemented with verified localities from SiB Colombia (Sistema de Información sobre Biodiversidad de Colombia).

Records and Data Availability and their Use

The datasets are publicly available via the Global Biodiversity Information Facility (GBIF) under open licenses and archived in stable repositories to ensure long-term accessibility.

Epiphyte Species Checklist (SM1)

- Data package title: Epiphyte Species List of Colombia: Integrated Multiple Sources
- Resource link: https://ipt.biodiversidad.co/sib/resource?r=jbm_lista_epifitas&v=1.0
- Format: CSV and Darwin Core Archive (DwC-A)
- License: Creative Commons Attribution 4.0 International (CC BY 4.0)
- Coverage: National (Colombia)
- Temporal coverage: Derived from sources published between 2016 and 2023
- Taxonomic coverage: 6396 vascular epiphyte taxa from 66 families
- Epiphyte Occurrence Dataset (SM2)
- Resource link https://zenodo.org/records/10070278
- Data set name: Dataset of vascular epiphytes in Colombia
- Language: Spanish
- Format: Darwin Core Archive (DwC-A), including metadata in XML
- License: Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0)
- Coverage: National (Colombia), with georeferenced and non-georeferenced records
- Temporal coverage: 1863–2023
- Taxonomic coverage: 5091 vascular epiphyte species from 66 families
- Format: CSV and Darwin Core Archive (DwC-A)

Technical Validation

The datasets underwent a multi-stage validation process to ensure reliability and fitness-for-use. Taxonomic names were cross-referenced with authoritative sources (GBIF Backbone Taxonomy, World Flora Online, Catalogue of Life) to resolve synonyms and detect misspellings. Records with unresolved names were flagged and retained only if verifiable through expert review. Georeferenced records were validated by comparing coordinates to declared locality fields. Records falling outside Colombian boundaries or mismatched to their administrative divisions were corrected when authoritative sources were available; otherwise, they were flagged and excluded from spatial analyses. Non-georeferenced records were included only if administrative locality data were complete and consistent.

Temporal validation included screening for implausible collection dates (e.g., post-publication years or pre-1800 entries). Duplicates were identified through a combination of collector name, collection number, and date, and were removed unless they represent distinct voucher specimens.

Potential biases include overrepresentation of Orchidaceae, concentration of records near major urban centers, and temporal clustering of collections during specific expeditions. While these biases limit certain analyses (e.g., unbiased richness estimation), they do not preclude robust comparative studies or gap analyses when properly accounted for.

Limitations involve the inclusion of occasional misidentified specimens, underrepresentation of canopy species that are difficult to access, and variation in collection effort across regions. These limitations are explicitly documented in the metadata to guide appropriate reuse. We explicitly documented variation in spatial precision across georeferenced records, which ranged from highly precise coordinates (e.g., 1.608282, –77.887434; 5.17168, –75.98658) to coarse decimal entries with reduced locational accuracy (e.g., 3.91, –73.08; 1.6, –75.650333). These differences reflect historical changes in georeferencing practices, varying GPS availability, and retroactive digitization of older specimens. Additional limitations include uneven herbarium integrity, with some institutions reporting specimens listed in digital catalogues that are no longer physically present, reducing verification accuracy. Likewise, Antioquia's strong institutional capacity has led to disproportionate collecting and digitization, making the Andean region better represented than Amazonian, Pacific, and eastern Colombia. Finally, some taxonomic inconsistencies may persist, particularly in dynamic groups such as Orchidaceae, because the LCVP backbone does not always incorporate recent revisions.

The combination of automated validation scripts, manual expert review, and transparent documentation ensures the datasets meet high technical standards, making them suitable for conservation planning, ecological modeling, and biogeographic research.

Authors' Contribution

Ana María Benavides contributed to the conceptualization and design of the study, prepared the DwC standard for SM1, curated data, conducted analyses, and led the writing of the original draft, as well as review and editing. **Daihana Arango** performed material preparation, data collection, and curation for SM2, carried out analyses, and contributed substantially to the writing of the original draft and subsequent revisions. **Maria Judith Carmona-Higuita** contributed to validation and manuscript review. **Alejandra Vasco**, **Weston Testo**, **Michael Sundue**, and **Susana Vega** contributed to data curation of the epiphytic fern

list, validation, and review and editing of the manuscript. All authors commented on and approved the final version of the manuscript.

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References

Batke, S., Cascante-Marín, A., & Kelly, D. (2016). Epiphytes in Honduras: A geographical analysis of the vascular epiphyte flora and its floristic affinities to other Central American countries. *Tropical Ecology, 57*(1), 663–675.

Benzing, D. H. (1998). Vulnerabilities of tropical forests to climate change: The significance of resident epiphytes. *Climatic Change, 39*, 519–540. https://doi.org/10.1023/A:1005312307709

Bernal, R., Gradstein, S. R., & Celis, M. (Eds.). (2016). *Catálogo de plantas y líquenes de Colombia*. Instituto de Ciencias Naturales, Universidad Nacional de Colombia [Accessed: 27 December 2021]. http://catalogoplantasdecolombia.unal.edu.co

Burns, K. C., & Zotz, G. (2010). A hierarchical framework for investigating epiphyte assemblages: Networks, meta-communities, and scale. *Ecology, 91*(2), 377–385. https://doi.org/10.1890/08-2004.1

Chamberlain, S. (2017). rgbif: Interface to the Global "Biodiversity" Information Facility "API" (R package version 0.9.8). CRAN. https://CRAN.R-project.org/package=rgbif

Fernández, F. (2011). The greatest impediment to the study of biodiversity in Colombia. *Caldasia, 33*(2), 2–5.

Flores-Palacios, A. (2016). Does structural parasitism by epiphytes exist? A case study between *Tillandsia recurvata* and *Parkinsonia praecox*. *Plant Biology, 18*(3), 463–470. https://doi.org/10.1111/plb.12406

Freiberg, M., Winter, M., Gentile, A., Zizka, A., Muellner-Riehl, A. N., Weigelt, A., & Wirth, C. (2020). LCVP, the Leipzig catalogue of vascular plants: A new taxonomic reference list for all known vascular plants. *Scientific Data, 7*(1), 1–7. https://doi.org/10.1038/s41597-020-00702-z

GBIF.org (06 September 2022). GBIF Occurrence Download [Accessed 06/09/2022]. https://doi.org/10.15468/dl.rk4z6u

Hoeber, V., & Zotz, G. (2022). Accidental epiphytes: Ecological insights and evolutionary implications. *Ecological Monographs, 92*(4), e1527. https://doi.org/10.1002/ecm.1527

Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. (2017). *Bio-regiones de Colombia: Una propuesta para la planificación ambiental*. Instituto Humboldt. https://reporte.humboldt.org.co/biodiversidad/2017/

OpenRefine Community. (2022). *OpenRefine*. https://openrefine.org/download.html

Ortiz, R. C. del, & Idárraga Piedrahita, A. (2023). *Catálogo de las plantas vasculares del departamento de Antioquia*. Tropicos, Missouri Botanical Garden [Accessed: 6 October 2023]. http://www.tropicos.org/Project/Catalogo-de-Antioquia

QGIS.org. (2022). *QGIS Geographic Information System* (Versión 3.26.3). QGIS Association. http://www.qgis.org

R Core Team. (2022). *R: A language and environment for statistical computing* (Versión 4.3.2). R Foundation for Statistical Computing. https://www.r-project.org/

Rangel-Ch., J. O. (2015). La biodiversidad de Colombia: Significado y distribución regional. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales, 39*(151), 176–200. https://doi.org/10.18257/raccefyn.136

Torres-Rodríguez, A. C., Binda, E., Ochoa Quintero, J. M., Garcia, H., Gómez, B., Soto, C., Martínez, S., & Clerici, N. (2020). Answering the right questions: Addressing biodiversity conservation in post-conflict Colombia. *Environmental Science & Policy, 104*, 82–87. https://doi.org/10.1016/j.envsci.2019.11.012

Zotz, G. (2013a). The systematic distribution of vascular epiphytes: A critical update. *Botanical Journal of the Linnean Society, 171*(3), 453–481. https://doi.org/10.1111/boj.12010

Zotz, G. (2013b). 'Hemiepiphyte': A confusing term and its history. *Annals of Botany, 111*(6), 1015–1020. https://doi.org/10.1093/aob/mct085

Zotz, G. (2016). *Plants on plants: The biology of vascular epiphytes*. Springer. https://doi.org/10.1007/978-3-319-39237-0

Zotz, G., Weigelt, P., Kessler, M., Kreft, H., & Taylor, A. (2021a). EpiList 1.0: A global checklist of vascular epiphytes. *Ecology, 102*(6), e03326. https://doi.org/10.1002/ecy.3326

Zotz, G., Almeda, F., Arias, S., Hammel, B., & Pansarin, E. (2021b). Do secondary hemiepiphytes exist? *Journal of Tropical Ecology*, 37(6): 286–290. https://doi.org/10.1017/S0266467421000407