Journal of the Professional Association for Cactus Development

State of the Art and Research Trends on the *Rhipsalis* Genus: A Bibliometric Analysis

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Abstract. The genus *Rhipsalis* belongs to the Cactaceae family and comprises 33 registered species that exhibit unique biological and evolutionary characteristics, reflecting their wide biogeographical distribution. The objective of the present study was to evaluate the current state and research trends on this genus. A bibliometric analysis of 110 records published from 2001 to 2024 in Scopus and Web of Science (WOS) was performed using the R Bibliometrix package. Co-occurrence networks, collaboration networks, and factor analyses were used to study authors, countries, keywords, and references. The results do not suggest a clear trend in scientific output or the number of citations; however, the publication of reports remained constant throughout the period. The primary source of publications is Brazilian institutions, which exhibit a high rate of self-collaboration. Among the 25 most cited references, topics related to biology and cactus systematics predominate. Three thematic clusters correlated with the keywords were identified: the first on ecology and evolution, the second on ethnobotanical and pharmacological uses, and the third on molecular and phylogenetic studies. The results suggest that the field may be entering a consolidation phase, focused on resolving complex taxonomic and evolutionary questions while simultaneously prompting metabolite bioprospecting with therapeutic potential. Active lines of research are using *Rhipsalis baccifera*, considered a relevant species within the genus, as a model organism. Phytochemical characterization is being conducted to support its use in traditional medicine and its antitumor, antimicrobial, and anti-inflammatory potential. This study synthesizes the main research advances in genetics, offering a framework to guide future explorations and their potential applications.

Keywords: *taxonomy, scientific production, epiphytic cacti, phytochemistry, collaboration*

Cite: Alejandre-Rosas, J.A., Ramírez-Trejo, L., Rivas-García, T., Murillo-Amador, B., Alvarado-Mávil, A. and Hernández-Ramírez, F. 2026. State of the Art and Research Trends on the *Rhipsalis* Genus: A Bibliometric Analysis. *Journal of the Professional Association for Cactus Development. 28*:28-46. https://doi.org/10.56890/jpacd.v28i.608

Associate Editor: Pablo Preciado-Rangel.

Technical Editor: Sandra Patricia Maciel-Torres.

Received date: 20 December 2025.
Accepted date: 24 January 2026.
Published date: 04 February 2026.

Introduction

Rhipsalis Gaertn is a genus with a broad worldwide biogeographical distribution, comprising 33 species (5 subgenera) and belonging to the Cactaceae family (Barthlott and Taylor, 1995). Most of this group is distributed across the Neotropics, ranging from northern Argentina and Uruguay to southern Mexico, Florida (USA), and the Caribbean (Anderson, 2001). *Rhipsalis baccifera* maintains an additional natural presence in tropical Africa, Madagascar, and Sri Lanka, making it the only cactus with a disjunct native distribution. This situation has led to alternative hypotheses regarding its origin and distribution (Cota-Sánchez and Bomfim-Patricio, 2010). These theories include transoceanic dispersal events mediated by birds or through continental drift. Therefore, *R. baccifera* is suggested to possess an exceptional capacity for colonization and long-distance dispersal, favored by the attractive characteristics of its fruits (Barthlott, 1983). In contrast, *Rhipsalis hoelleri* is considered critically endangered due to its restricted distribution and micro endemic status in the state of Espírito Santo, Brazil (Cardoso *et al.,* 2021).

Most species in this genus are epiphytic, while some are lithophytic, reflecting their adaptability to their environments and explaining their distinctive morphology within the cactus family (Anderson, 2001). Their stems exhibit unique characteristics, including cylindrical, terete, filamentous, ribbed, or flattened structures. Another distinctive feature is their stomata indentation, which varies among species. *Rhipsalis grandiflora* and *Rhipsalis paradoxa* exhibit indentations, while *Rhipsalis cereoides* and *Rhipsalis teres* do not (Calvente *et al*., 2008). Its flowers and fruits are small (Cota-Sánchez and Bomfim-Patrício, 2010; Calvente *et al*., 2011A) and have a ring nectary characteristic of the genus (Almeida *et al*., 2013). Its flowers are pollinated by moths and bees of the genus *Trigona*, which favors cross-pollination. However, species, such as *R. baccifera* (Sol.) Stearn, *Rhipsalis micrantha* DC. and *Rhipsalis floccosa* Salm-Dyck ex Pfeiff exhibit self-pollination (Grosse-Veldmann *et al*., 2016). Their seed dispersal is mediated by small Neotropical passerine birds (*Euphonia* spp.) (Crestani *et al*., 2021), which represents an adaptive strategy that enables them to reach suitable microsites for establishment on host branches (Guaraldo *et al*., 2013). Additionally, this genus employs crassulacean acid metabolism (CAM), a key adaptation for survival in arid environments and dry niches within tropical forests (Kluge *et al*., 2001).

Although research on the genus *Rhipsalis*, particularly on *R. baccifera*, which has been highlighted as a model species in studies of geographic distribution, morphology, ethnobotany, and pharmacology, among others, exists, it remains fragmented and scattered. This lack of integration limits understanding and hinders the identification of new research trends, thematic gaps, and emerging opportunities. Therefore, the objective of the present study was to evaluate and map research results published in the Scopus and Web of Science databases during 2001-2024 using bibliometric analysis, thereby providing comprehensive information on the genus.

Material and Methods

Extraction of data

A comprehensive bibliographic search was conducted using the Web of Science (WoS) and Scopus databases. The analysis was restricted to the period 2001-2024, with no restrictions on document type or language. The database query was performed on August 16, 2025. For Scopus, the following search syntax was applied, TITLE-ABS-KEY ("*Rhipsalis baccifera*" OR "Rhipsalis") AND NOT (Alga OR Algae OR "seaweed" OR "macroalgae") AND PUBYEAR > 1999 AND PUBYEAR < 2025. For WoS, the search was conducted using TS= ("*Rhipsalis baccifera*" OR "Rhipsalis") NOT TS= (Alga OR Algae OR "seaweed" OR "macroalgae") and refined by Publication Years (2000-2024). The records obtained were exported in BibTeX format for both platforms, then processed in R (v.4.5.1) using the Bibliometrix package (Aria and Cuccurullo, 2017). The BibTeX formats were merged into a single database using the mergeDbSources() function, and duplicate records were deduplicated.

Bibliometric analysis

Metadata standardization and processing were performed (authors, affiliations, countries, sources, keywords, cited references) using the bibliometrix functions metaTagExtraction() and mergeKeywords(). Descriptive and citation analyses were conducted using biblioAnalysis(),

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summary() and citations() to assess scientific production and citation patterns. Bibliometric relationship analyses were performed using biblioNetwork() to construct adjacency matrices for co-occurrence, co-citation, collaboration, and bibliographic coupling. Network statistics and visual exploration were supported by networkStat() and networkPlot(), while conceptual structure and thematic patterns were examined using conceptualStructure() and thematicMap(), based on both standardized keywords and terms extracted from abstracts using termExtraction(). The information was extracted from repositories and based on publicly available data, so obtaining ethical approval was not necessary. The present bibliometric analysis was performed in accordance with PRISMA guidelines (Supplementary material 1) (Page *et al*., 2021).

Spatial and altitudinal distribution graphs of R. baccifera

Records of the presence of *Rhipsalis baccifera* were obtained from the Global Biodiversity Information Facility (GBIF), accessed on January 19, 2026. The data were filtered according to the basisOfRecord field, retaining only direct observations and georeferenced specimens (HUMAN_OBSERVATION, OBSERVATION, OCCURRENCE, LIVING_SPECIMEN, and MACHINE_OBSERVATION). For each record, longitude, latitude, and elevation were selected, and all analyses were conducted using the WGS84 geographic coordinate reference system (EPSG:4326). Before spatial analyses, records lacking valid geographic coordinates (missing longitude or latitude values) were excluded (2602 records were used). To estimate elevation for records lacking altitudinal information from GBIF, the global elevation layer from WorldClim version 2.1 (GeoTIFF format) was used, with a spatial resolution of 30 arc-seconds (Fick and Hijmans, 2017). All data processing, spatial analyses, and visualizations were performed in R (v.4.5.1).

Results

Annual publications and citation trends

A total of 110 records were found as a result of bibliometric analyses during the examined 2001-2024 period (Figure 1). A total of 27 documents were registered in the 2001-2010 period, with a minimum of one and a maximum of five articles per year. A significant increase was observed from 2011 to 2020, with a total of 61 articles; 2020 was the year with the highest number of publications (9 records), while the 2021 to 2024 period recorded 22 articles, indicating sustained growth of the topic.

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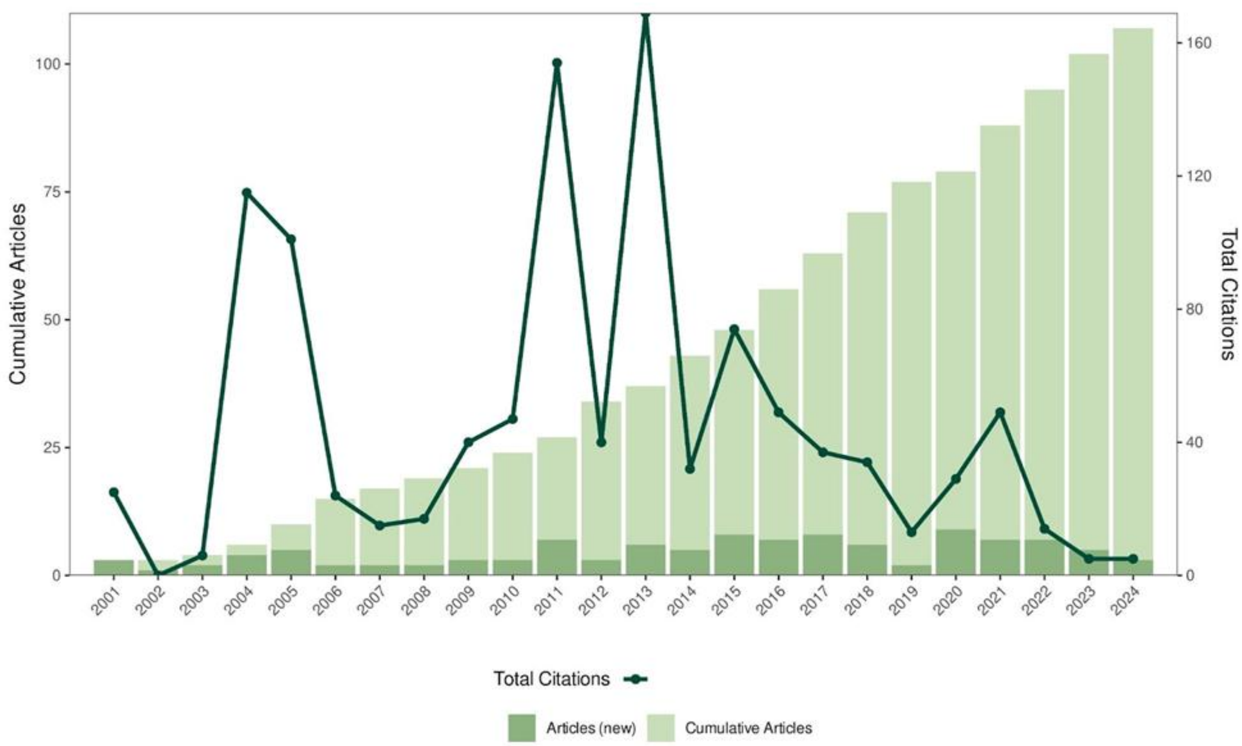

Figure 1. Annual scientific production and citation trends in *Rhipsalis* research based on the merged dataset from Web of Science and Scopus, accessed on January 19, 2026. *Bars represent the cumulative number of published articles and new articles per year, while the line indicates the total number of citations per year, shown on a secondary y-axis.

In reference to the total citation numbers per year during the analyzed period (Y-axis of the graph), no constant trend was observed. The greatest number (169) was reported in publications during 2013, in which the central topics were the species' evolutionary adaptation to perform activities such as pollination, seed dispersion, epiphytic life, and floral morphology. The articles published in 2011 have received a maximum of 154 citations, ranking second among the most published works, followed by 2004 with 105 citations and 2005 with 101 citations.

Contribution by countries/regions and institutions

The contribution results for *Rhipsalis* publications showed participation from 35 countries, with Brazil leading with 54 reports, followed by Germany and Mexico with 6 and 4 articles, respectively. One participation was evident in a minor proportion (< 3 articles) from some other countries, including the United Kingdom, Argentina, China, Ecuador, and France. Regarding citations per country, Brazil stands out again with the highest number (341), followed by Germany and Finland with 118 and 93 citations, respectively. Brazil shows a strong dominance as the principal producer of articles on *Rhipsalis*. The institutions in Brazil with the most publications are "El Jardín Botánico de Río de Janeiro" (7), the Universidad Federal de São Paulo (5), and other universities in the same region (5). On the other hand, the institutions with the most citations are Helsinki University (Finland) with 186 citations, Saskatchewan University (Canada) and Jodrell Laboratory in Kew (United Kingdom) with 159 and 154 citations, respectively. Figure 2A and Figure 2B illustrate multiple-country publications and single-country publications on *Rhipsalis*-related topics, respectively. Although Brazil is the country with the most articles, its collaboration has focused mainly on national institutions (Figure 2B-C), and

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it does not maintain a high level of collaboration with other countries (except the United Kingdom). Figure 2C also shows that Brazilian institutions account for the largest share of production and collaboration within the clusters, while universities in other countries have low production and collaboration.

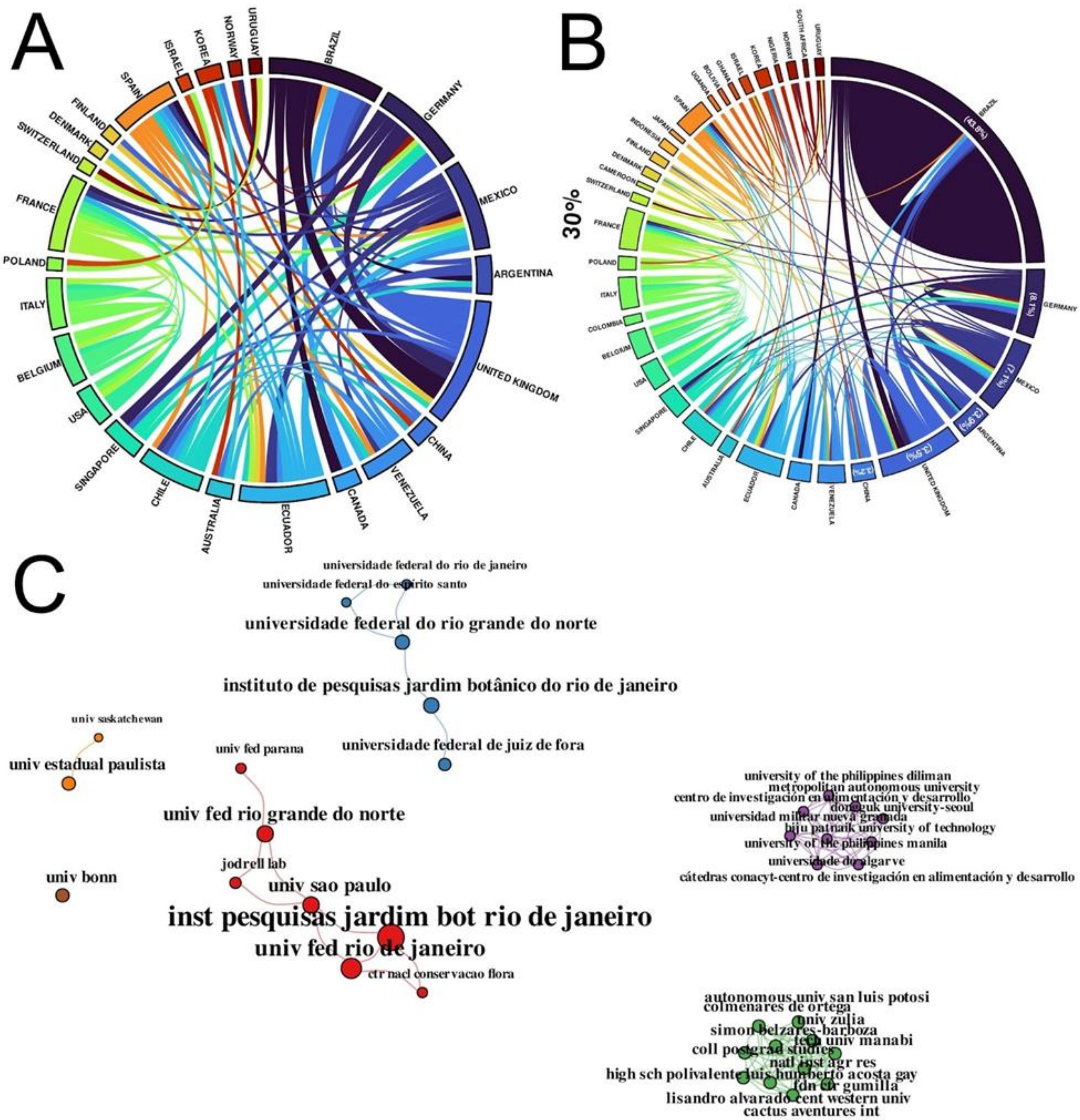

Figure 2. Collaboration networks between countries/regions and universities/institutions. Country-level collaboration data were extracted using the bibliometrix package. Panels (**A**) and (**B**) show multiple-country publications and single-country publications, respectively, along with each country's share of scientific production on *Rhipsalis*. The visualizations were generated using the circlize package (Gu et al., 2014) in R. Panel (**C**) depicts the institutional collaboration network, where clusters were identified using the Walktrap algorithm and node size represents institutional productivity.

Distribution of co-cited authors and collaboration authors

The results of the present bibliometric analysis regarding co-cited and collaborating authors investigating *Rhipsalis* are shown in Figure 3. Particularly, Figure 3A shows the relevance of some studies, such as the Barthlott and Taylor (1995) investigation, which is not found in the studied period and is considered essential for the articles that constitute them. Similarly, the works of Anderson (2001), Hunt (2006), Calvente (2011), and Bauer and Korotkova (2021) receive significant citations because they are considered basic and highly relevant studies in later investigations.

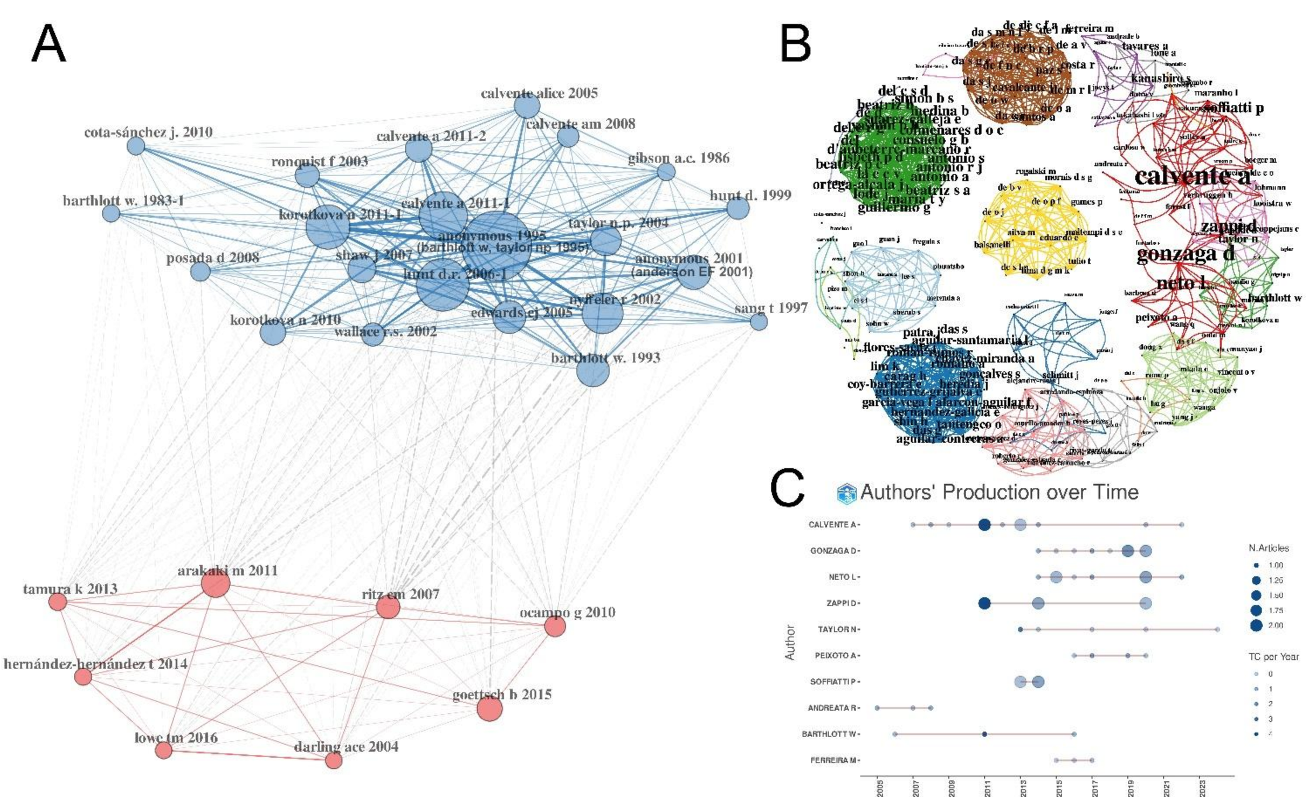

Figure 3. Bibliometric networks and temporal dynamics of author productivity. Author co-citation network of cited references organized using the Fruchterman-Reingold layout (**A**). Author collaboration network based on co-authorship relations, visualized with the Kamada-Kawai layout and clustered using the Walktrap algorithm (**B**). Temporal evolution of scientific output of the top 10 most productive authors (**C**).

The authors with the greatest scientific production in this theme are Calvente, in first place, affiliated with the Vegetable Systematic Laboratory of the University of São Paulo in Brazil, with 11 publications. In second place is Gonzaga, affiliated with the Escuela Nacional de Botánica Tropical of the Instituto de Pesquisas Jardín Botánico de Rio de Janeiro in Rio de Janeiro, Brazil, with nine publications, and third is Neto of the Universidad Federal de Juiz de Fora, Brazil, with eight articles. The working groups with the most citations in 2001-2024 are shown in Figure 3B, where Calvente and Gonzaga are again observed as leading authors in solid work on *Rhipsalis* systematics and phylogeny (red cluster). Additionally, other authors, such as Neto and Taylor, show a continuous stream of articles on *Rhipsalis* (Figure 3C).

Highly cited reference analysis

This section presents results from the highly cited references, showing the 25 most cited sources (Figure 4A) in biology and Cactaceae. The greatest numbers were those published by Barthlott and Taylor (1995) titled “Notes towards a Monograph of Rhipsalideae (Cactaceae)”, as mentioned in the distribution section of the Co-cited authors and collaborators. The present manuscript focuses on a key study of the Rhipsalideae tribe, in which a systematic list was presented and commented on, encompassing the genera *Lepismium*, *Rhipsalis* (recognizing 5 subgenera and 33 species), *Hatiora*, and *Schlumbergera*. This article included species descriptions, new combinations of names and documentation on geographic and ecological distribution. This classification was later adopted in essential reference works, such as “The New Cactus Lexicon” (Hunt *et al*., 2006), which offers a widely accepted description of the cactus family, recognizing 124 genera and 1438 species (currently approximately 130 genera and 1438-1870 species).

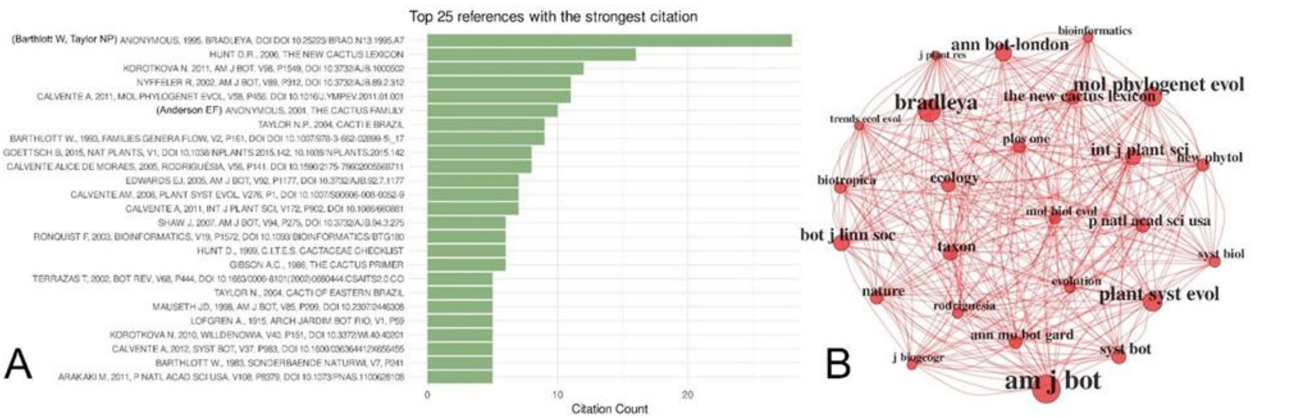

Figure 4. Influential references and journal co-citation structure of the research field. Top 25 most cited references based on total citation counts within the dataset (**A**). Journal co-citation network derived from cited sources, visualized using the Fruchterman-Reingold layout (**B**).

Among the classical references, Barthlott and Taylor (1995) stand out, as well as Gibson and Nobel (1986, in “The Cactus Primer”), which contributed to the morpho-anatomical and ecological bases of Cactaceae. Other studies that stand out are Korotkova (2012), Nyffeler (2002), and Calvente *et al*. (2011B), centered on molecular and evolutionary phylogeny of Cactaceae, especially the Cactoideae subfamily. Overall, this group of sources indicates that the most cited works focus on phylogeny, taxonomy, morphology, and systematics, consolidating the modern conceptual framework.

The nodes that stand out most correspond to the American Journal of Botany, Plant Systematics and Evolution, Molecular Phylogenetics and Evolution, and Taxon within the co-citation network of journals that comprise the thematic nucleus (Figure 4B), demonstrating that investigations on Cactaceae are found in specialized publications in molecular and botanical systematics.

Keyword analysis

Keywords represent the conceptual and thematic structure of the investigation into the *Rhipsalis* genus. The correspondence analysis (CA) (Figure 5A) revealed three great thematic groups. The blue cluster concentrates terms related to ecological and evolutionary aspects, such as pollination, seed dispersal, phylogeny, diversity, flora taxonomy, conservation, and the Atlantic Forest, indicating interest in reproductive biology, ecology, and, primarily, in *Rhipsalis* conservation. The second one

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(red cluster) groups keywords related to ethnobotany and pharmacology, such as medicinal plant, plant extract, and an unclassified drug, detecting interest in potential and unclassified drugs and highlighting the interest in therapeutics of the bioactive compounds of *Rhipsalis*. Finally, a third group (in green) integrates molecular and phylogenetic terms (phylogenetic relationships, plastid genome, molecular phylogeny), reflecting advances in genetic and phylogenetic analyses.

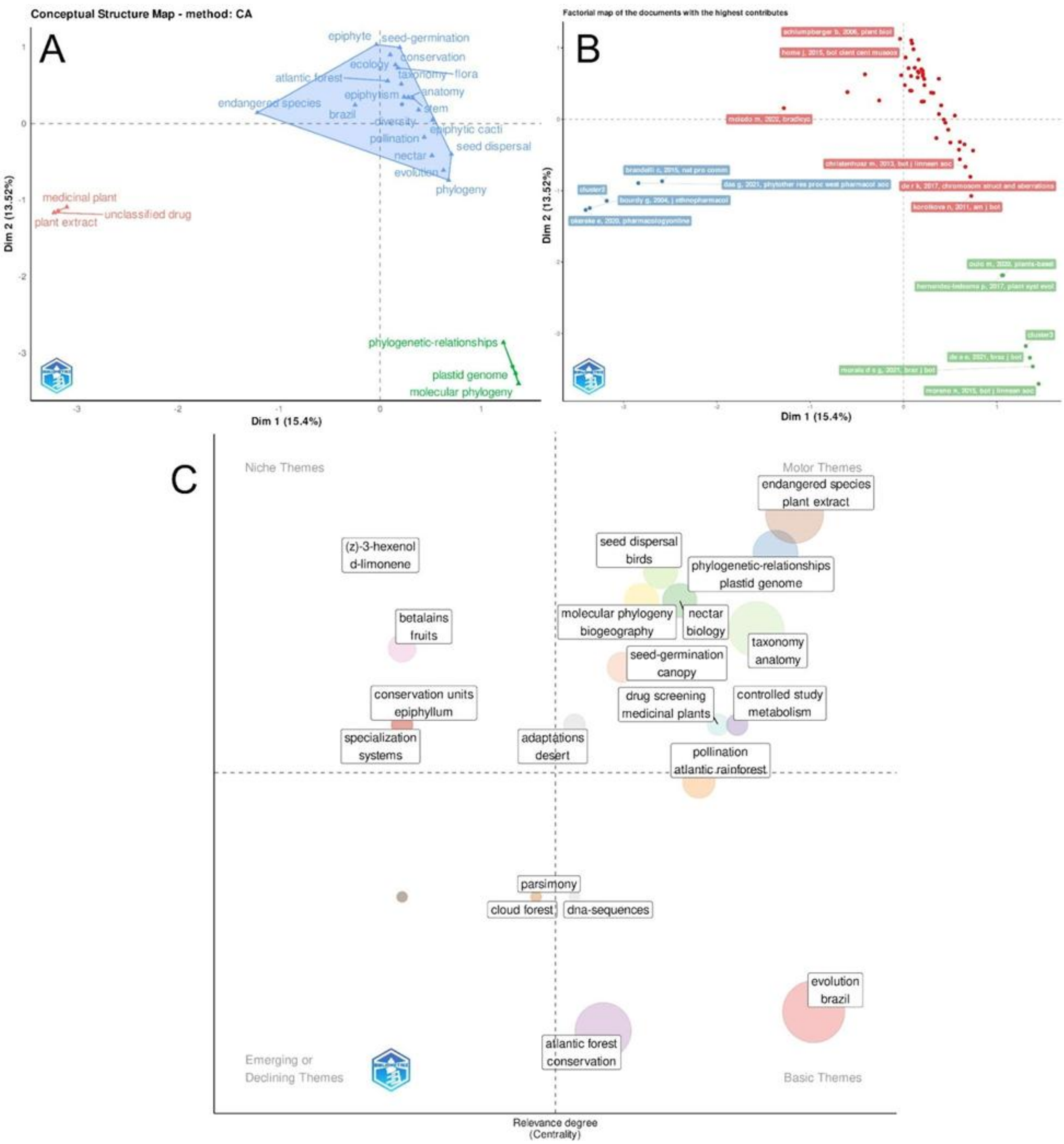

Figure 5. Factorial and thematic analysis of keywords. Conceptual structure of merged keywords from Scopus and Web of Science obtained through correspondence analysis (CA) (**A**). Factorial map of the documents with the highest contribution to the conceptual space (**B**). Thematic map of keywords illustrating the main research themes and their relationships (**C**). The analysis was conducted using a minimum keyword frequency threshold (minDegree = 3) and clustering into three groups.

The factorial analysis of the documents with the greatest contribution allowed visualization of the principal references that structure the current field of *Rhipsalis*, as shown in Figure 5B. Three groups are observed: one related to pharmacology and ethnobotany (in blue); another focused-on systematics, taxonomy, and plant biology (in red); and a third focused on phylogenetics and genomic studies (in green). These results demonstrate that the literature on *Rhipsalis* sustains a multidisciplinary basis that includes both biology and ecology, as well as pharmacological applications.

The thematic map (Figure 5C) classified keywords by their relevance and field development. In the “motor themes” area, endangered species, plant extract, and phylogenetic relationships are located, indicating that these topics promote *Rhipsalis* investigation. In the “basic themes” area, pollination, Atlantic Forest, evolution, and Brazil appear, demonstrating their importance as structural axes in the *Rhipsalis* field. On the other hand, in the region “emerging or declining themes”, such as parsimony, cloud forest, and DNA sequences were identified, which could represent areas of ascent or decline. Finally, in the “niche themes” region, specific terms such as betalains, fruits, epiphyllum, desert adaptations, and specific metabolites stand out, suggesting the existence of very specialized research lines.

The map suggests that the investigation into *Rhipsalis* is part of a diversification and consolidation process. Motor themes indicate a strong interest in conservation, systematics, and phylogeny, evidencing that it is a relevant model for understanding both evolution and biological diversity within Cactaceae. The basic topics indicate that studies in reproductive ecology, biogeography, and evolution constitute the current foundation of knowledge. On the other hand, these maps also show a transition in research, with emerging topics presented using molecular and ecological approaches, possibly associated with new genetic tools or a shift in study priorities. Finally, the niche topics point to highly specialized lines such as physiological adaptation, secondary metabolites, or ecological relationships that, although less explored, offer considerable potential to expand functional understanding.

Rhipsalis baccifera case study

During the analyzed period, *R. baccifera* was observed to be the most studied species within the *Rhipsalis* genus; thus, investigations have been performed in phytogeography, cytogenetics, ecological studies, ethnobotanical and pharmacological applications, among others. However, taxonomic and morphological studies have been more relevant, since the species is the only cactus with a discontinuous transatlantic distribution pattern. In these works, Rhipsalideae have been described as predominantly epiphytic and/or lithophytic cacti, and rarely terrestrial; they mainly exhibit a hanging or semi-straight, shrubby habit, angular or plain, and sometimes almost leaf-like (Korotkova, 2012).

According to Cota-Sánchez (2010), *R. baccifera* has hanging stems and teretes (5 mm in diameter and up to 100 cm long), as shown in Figure 6, although these may vary depending on the area where they grow. In moist forests of tropical America, eastern tropical Ceylon and Africa, *R. baccifera* presents stems without terete leaves up to 1 m long and 0.5 in diameter, as shown in Figure 6A. Adventitious roots are produced at the stem base, in the nodes where they make contact with the substrate, and sometimes at their long aerial positions (North and Nobel, 1994). Figure 6D shows the flower of this species, characterized by being individualized in a white-yellow or pinkish colored bell shape. These flowers show numerous stamens with yellowish rings (Figure 6E). The fruit is spherical, fleshy, with a high humidity content, and an oval, thick wall with seeds in its interior (Cota-Sánchez,

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2004); it presents a white, pink, or red color and a diameter of approximately 0.5 cm (Figure 6B). The seeds are black and have a mussel shape, with a lustrous, smooth surface lacking visible external structures. They are small, approximately 0.86 to 1.48 mm long and 0.38 to 0.88 mm wide (Figures 6B and 6C). However, they may vary depending on ploidy; in other words, polyploid seeds are generally larger (Cota-Sánchez, 2010). Ichsanti *et al*. (2023) showed the importance of fruit dispersion, as they are dispersed by birds that use them as food. Additionally, Figure 6I shows subulate leaves, as well as their components, such as podarium (Figure 6F), areola wool (Figure 6G) and areola (Figure 6H).

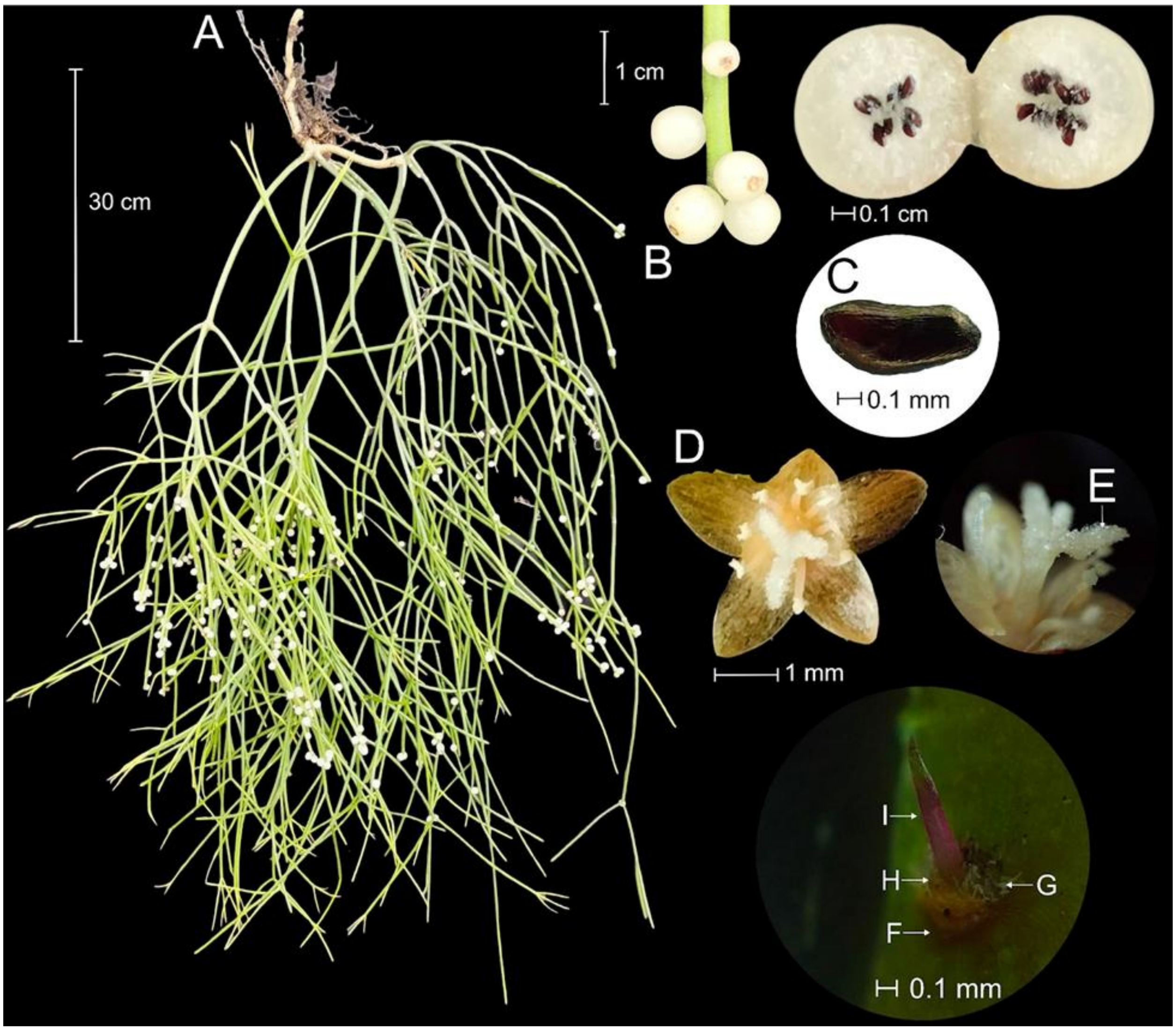

Figure 6. *Rhipsalis baccifera* morphology. Complete plant (**A**) stems and fruits (**B**), seeds, flower (**D**), stigma (**E**), podarium (**F**), areola wool (**G**), areola (**H**) and subulate leaves (**I**).

Another relevant characteristic of *R. baccifera*, as revealed by the present analysis, is its exceptional geographic distribution, which is unique not only within the genus *Rhipsalis* but also across the Cactaceae family. This species exhibits a pantropical distribution, occurring beyond the Americas (Figure 7). Its current range includes tropical regions of the Americas and Africa, as well as Madagascar and Sri Lanka. Within the Americas, *R. baccifera* is distributed from southern Mexico through Central America and the Caribbean, and extends across broad areas of South America, including Brazil, Bolivia, Paraguay, and Peru.

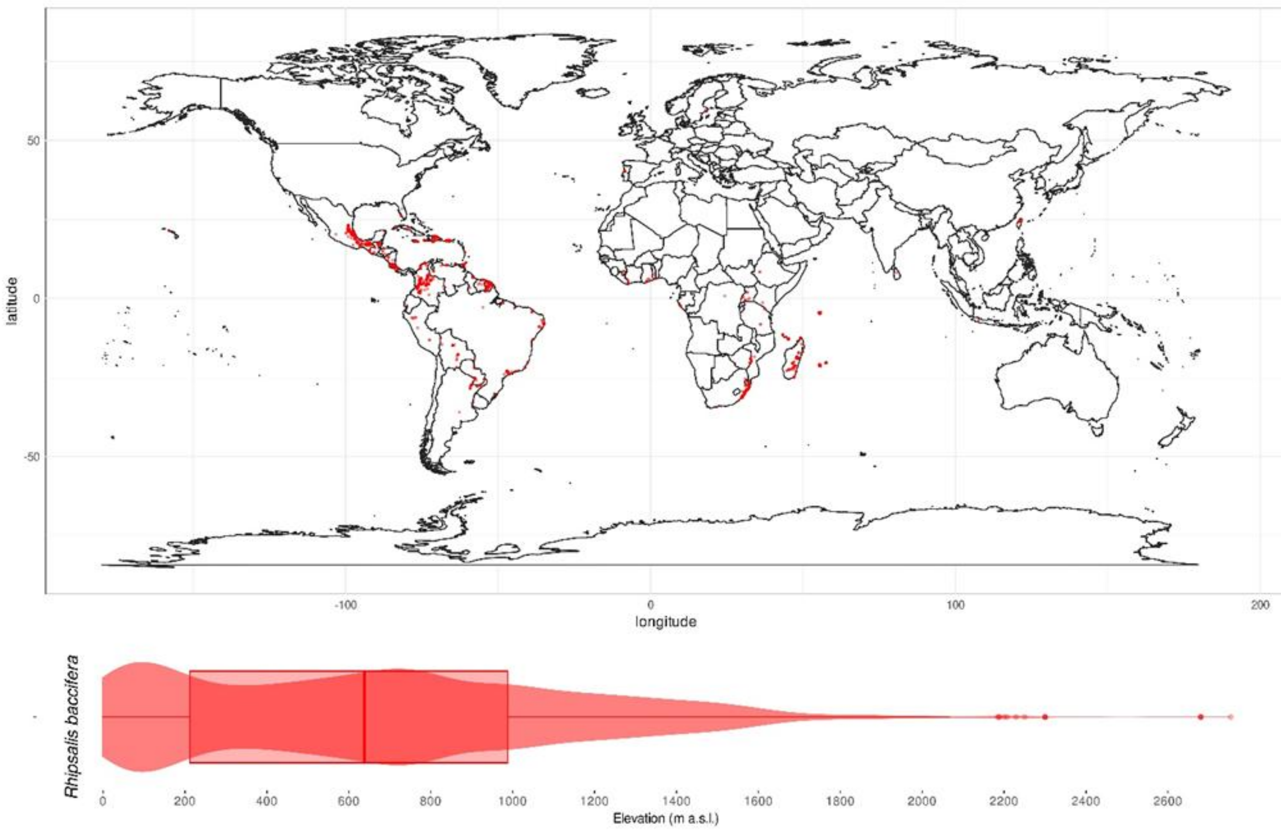

Figure 7. *Rhipsalis baccifera* geographic distribution and variation of its recorded altitude. Data were obtained from Global Biodiversity Information Facility (GBIF), accessed on January 19, 2026.

Other relevant *R. baccifera* points are not only within the *Rhipsalis* genus but also within the Cactaceae family, including their evolutionary history, unique geographic distribution, and bioactive potential. In this sense, the growing interest in *R. baccifera* is sustained by its metabolic diversity and by accumulated evidence on its pharmacological properties, which partially support the ethnobotanical uses attributed to the species (Bourdy *et al*., 2004; Niño *et al*., 2011; Das *et al*., 2021). Phytochemical studies have revealed a complex composition of secondary metabolites, among which stand out tannins, saponins, alkaloids, flavonoids, and terpenes (Figure 8), compounds widely recognized for their role in plant defense and therapeutic potential (Bautista *et al*., 2017).

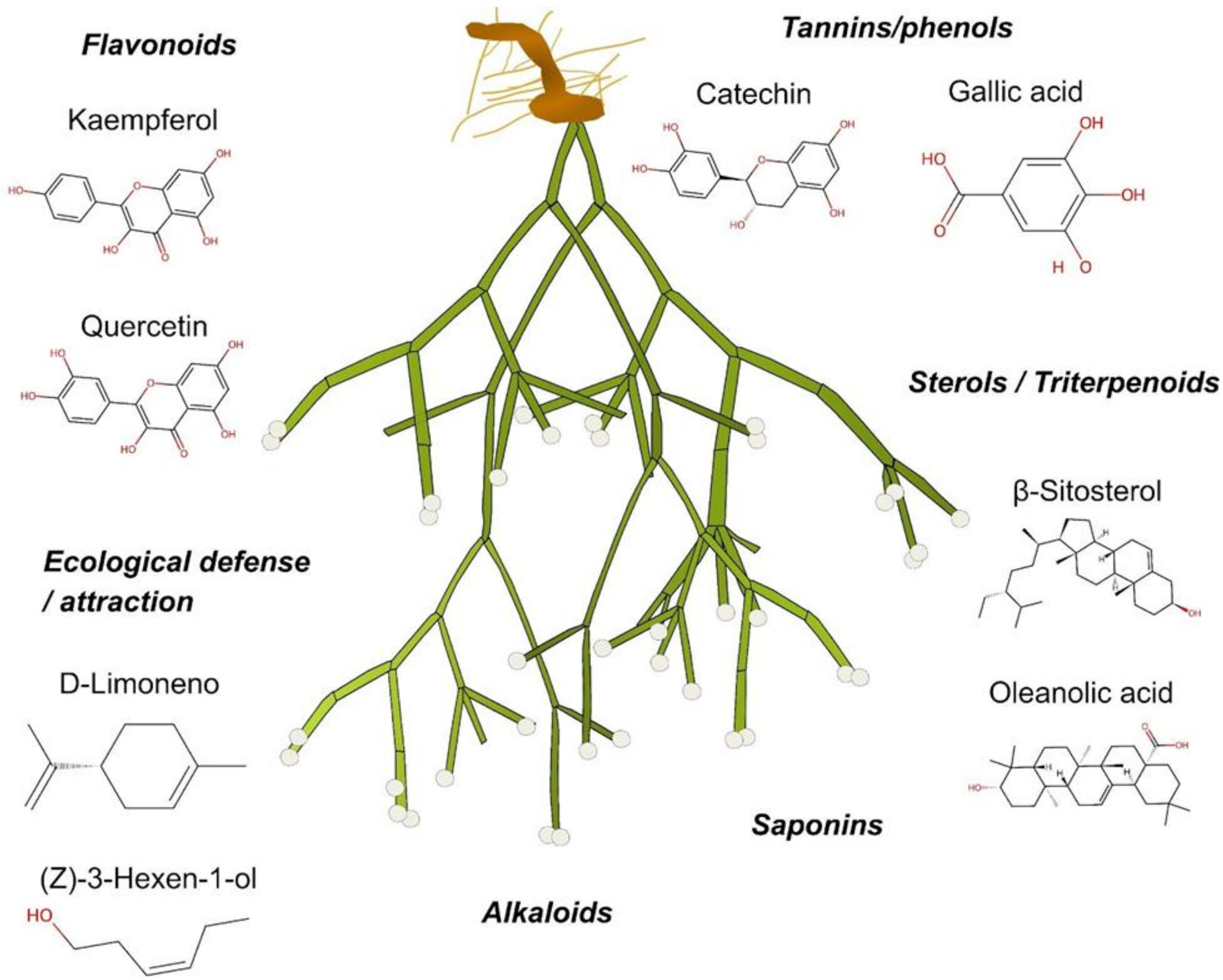

Figure 8. *Rhipsalis baccifera* phytochemical studies.

Discussion

This bibliometric analysis provides a broad overview of the *Rhipsalis* genus over the 23 years analyzed. As a result, the scientific works were published in different themes. Knowledge frontiers were projected graphically, allowing a scientific assessment, analyzed starting from the information obtained, including trends of annual publications and citations, contributions of the countries and institutions, distributions of co-cited authors or collaborators, references with the greatest number of citations, keyword analysis; the relevance of *R. baccifera* species within the genus in different themes are included, as well as morphology, geographic distribution, ethnobotany studies, phytochemistry and pharmacological application, phytogenetics, among others.

The first articles of the period were related with diverse topics and photosynthetic plant plasticity with Crassulacean Acid Metabolism (CAM) (Kluge *et al*., 2001), vulnerability and hydraulic recovery in epiphyte Cactaceae (Stevenson and Mauseth, 2004) and the micro-morphological analysis of the seeds and their importance for taxonomic classification at gender and species level (Cota-Sánchez and Bomfim-Patrício, 2010).

The number of publications per year fluctuates, with 2013 having the highest (9) during the entire evaluation period. These investigations include taxonomic and nomenclature studies of *R. rhombea* (Bauer and Korotkova, 2021), name conservation, studies of the chloroplast genome of *R. baccifera* (Oulo *et al*., 2020), and studies of the immunomodulatory potential of *R. neves-armondii* (Okereke *et al*., 2020). Distribution and conservation studies in Brazil have recorded the presence of 14 species in the Serra da Mantiqueira (Gonzaga *et al*., 2020), 15 species in Boa Nova National Park, Bahia (Simões *et al*., 2020), and studies of genotoxicity and its impact on vascular epiphytes (Costa *et al*., 2020).

The highest number of citations were obtained from publications in 2013, which addressed topics in reproductive biology and floral taxonomy (Almeida *et al*., 2013), as well as the anatomy of some species in the subgenus *Erythrorhipsalis* (Silva *et al*., 2013). In that same year, topics in ecology and evolution were also addressed, including the specialized dispersal capacity of its seeds by birds of the genus Euphonia and convergent adaptation strategies (Christenhusz and Chase, 2013; Guaraldo *et al*., 2013).

In reference to the contributions of countries and collaboration in different topics of their research institutions, a global contribution network was observed, above all for the case of *R. baccifera*, because transatlantic academic and governmental institutions require collaboration mainly with specialists in gender diversity in Brazil, followed by some North American countries, such as Mexico. In the same manner, constant participation by European countries, such as Germany and the United Kingdom, was observed in issues such as taxonomy and phylogenetics. Recently, contributions in biotechnology and genomics were observed from China, Mexico, and Australia.

The distribution analyses of the co-cited authors and collaborators revealed the importance of Barthlott and Taylor (1995) work on the publications of the studied period, because the Rhipsalideae (Cactaceae) tribe is described, and at the same time provides bibliographic data and typification, as well as a summary of geographic distribution on taxonomy and evolution. From the current trend, authorship distribution is characterized by collaboration chains Brazil-Europe/North America in the case of systematics and dense collaboration groups within Brazil in biological and pharmacological activity studies.

The study of highly cited references revealed fundamental work on relevant topics in *Rhipsalis* genus taxonomy, biogeography, evolution, and biological potential. Trends in the most frequent citation in works, although some not about the studied period, are fundamental for later studies, such as those of Barthlott and Taylor (1995). Anderson (2001) publication has been frequently cited by general taxonomic classification of the Cactaceae family and gender distribution. Other frequently cited works are specialized in their thematic, such as Hunt and Voit (2000) seed morphology studies; Loefgren (1915) proposes that Southern Brazil is one of the centers of Rhipsalidae origin and evolution; Britton and Rose (1923) recognize 57 *Rhipsalis* species. The themes of the most published journals are from *Rhipsalis* in Botany systematics, Brazilian florist, and phytochemical/pharmacology. From these journals, the ones that stand out are Rodriguésia, Haseltonia, Bradleya, Polybotanics, Fitotecnia Mexicana, Natural Resources for Human Health, Plant Systematics and Evolution, Phytotaxa, International Journal of Plant Sciences, and Botanical Journal of the Linnean Society.

The analyses of keywords revealed that investigations on *Rhipsalis* are organized around three principal thematic axes: genetic evaluation (polyploidy), morphological variation, and, specifically in *R.*

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baccifera, the validation of pharmacological potential and taxonomic and floristic contributions. Among the main findings, morphophysiological studies of the ecological plasticity of *R. baccifera* stand out. This plasticity is favored by self-fertilization (Cota-Sánchez and Bomfim-Patrício, 2010), effective germination due to the high sensitivity of its seeds to light (De La Rosa Manzano and Briones, 2010), its morphophysiological adaptations, such as shallow adventitious roots for water absorption from the canopy, population-level variations in polyploidy and stomatal density (Barthlott *et al*., 1995; Cota-Sánchez and Bomfim-Patrício, 2010), xeromorphic adaptations (druses, thickened cuticle and mucilage cells) and its CAM metabolism (Calvente *et al*., 2008; Lüttge, 2010; Andrade, 2024).

Future research using omics sciences and functional ecology will solidify the role of *R. baccifera* as a representative model for studying adaptation and diversification processes in epiphytic cacti. Currently, this species is positioned as a robust evolutionary model, and its research is in a transitional phase toward a biotechnological approach, particularly in the biomedical field.

The comprehensive utilization of the rich phytochemical profile of *R. baccifera*, along with its high biomass availability and wide ecological distribution, presents a promising scenario for the development of sustainable biotechnological applications. Future research should focus on identifying and characterizing the bioactive compounds responsible for its therapeutic potential, and on validating their molecular mechanisms through integrative approaches that include omics studies, molecular modelling, and functional biology. Similarly, its low toxicity profile (Paes *et al*., 2025) positions it as a viable candidate for the development of natural pharmaceuticals and complementary therapies.

Overall, research on *Rhipsalis* suggests that it may be entering a consolidation phase, focused on resolving complex taxonomic and evolutionary questions. Likewise, recent studies confirm the thematic shift towards the bioprospecting of *R. baccifera* metabolites that support its ethnobotanical activity.

Conclusions

The bibliometric analysis shows that *Rhipsalis* investigation is organized around three principal axes (1): ecology, evolution, and conservation; (2) pharmacological and ethnobotanical uses; and (3) molecular and phylogenetic studies. Altogether, these results suggest that knowledge about gender is in a phase of consolidation, characterized by a gradual transition toward integrating basic and applied approaches. In this context, *R. baccifera* emerges as the most representative and multifaceted species, standing out for its evolutionary and ecological relevance, as well as for preliminary advances in its phytochemical characterization and the identification of potential bioactivities. These findings position *R. baccifera* as a model species with high potential for biotechnological and pharmacological applications, while also opening new perspectives for its sustainable use.

ETHICS STATEMENT
Not applicable.

CONSENT FOR PUBLICATION
Not applicable.

AVAILABILITY OF SUPPORTING DATA

The corresponding author may provide processing of data derived from the analysis upon reasonable request.

COMPETING INTERESTS

The authors declare no conflicts of interest.

FUNDING

This work received no funding from public or academic institutions, commercial organizations, or non-profit entities.

AUTHOR CONTRIBUTIONS

Conceptualization, J.A.A.R., T.R.G. and B.M.A; methodology and validation, F.H.R., J.A.A.R. and L.R.T.; research, F.H.R., L.R.T. and A.A.M; writing: preparation of the original draft, revision and editing; supervision, J.A.A.R., F.H.R., L.R.T., B.M.A and T.R.G.

ACKNOWLEDGMENTS

The authors extend their gratitude to the Faculty of Chemical Sciences of Veracruzana University.

References

Almeida, O.J., Cota-Sánchez, J.H. and Paoli, A.A. 2013. The systematic significance of floral morphology, nectaries, and nectar concentration in epiphytic cacti of tribes Hylocereeae and Rhipsalideae (Cactaceae). *Perspectives in Plant Ecology, Evolution and Systematics*. *15*(5): 255-268. https://doi.org/10.1016/j.ppees.2013.08.001

Anderson, E.F. 2001. The Cactus Family. Timber Press, Portland, USA.

Andrade, J.L. 2024. *Rhipsalis baccifera*: A graceful epiphytic cactus that has jumped to the old world. In: The First 100 Years of Research on Barro Colorado: Plant and Ecosystem Science. H.C., Muller-Landau and S.J. Wright (Eds.). Smithsonian Institution Scholarly Press, Washington, DC, USA. *2*: 765-767. https://doi.org/10.5479/si.26880883

Aria, M. and Cuccurullo, C. 2017. Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*. *11*(4): 959-975. https://doi.org/10.1016/j.joi.2017.08.007.

Barthlott, W. 1983. Biogeography and evolution in neo-and paleotropical Rhipsalinae (Cactaceae). In: Dispersal and distribution: an international symposium. K. Kubitzki (Ed.). Sonderband des Naturwissenschaftlichen Vereins in Hamburg. *7*: 241-248.

Barthlott, W. and Taylor, N.P. 1995. Notes towards a monograph of Rhipsalideae (Cactaceae). *Bradleya*. *13*: 43-79.

Bauer, R. and Korotkova, N. 2021. Neotypification of *Rhipsalis rhombea* (Rhipsalideae, Cactaceae) and its taxonomic history. *Haseltonia*. *27*(1): 95-101. https://doi.org/10.2985/026.027.0111

Bautista-San Juan, A., Cibrián-Tovar, J., Salomé-Abarca, L.F. and Soto-Hernández, R.M. 2017. Composición química del aroma de tallos y frutos de *Rhipsalis baccifera* (J. Miller) Stearn. *Revista Fitotecnia Mexicana*. *40*(1): 45-54. https://doi.org/10.35196/rfm.2017.1.45-54

Bourdy, G., Oporto, P., Gimenez, A. and Deharo, E. 2004. A search for natural bioactive compounds in Bolivia through a multidisciplinary approach: Part VI. Evaluation of the antimalarial activity of plants used by Isoceno-Guaranı Indians. *Journal of Ethnopharmacology*. *93*(2-3): 269-277. https://doi.org/10.1016/s0378-8741(01)00270-7

Brandelli, C.L.C., Vieira, P.D.B., Macedo, A.J. and Tasca, T. 2013. Remarkable anti-trichomonas vaginalis activity of plants traditionally used by the Mbyá-Guarani indigenous group in Brazil. *BioMed Research International*. *13*: 826370. https://doi.org/10.1155/2013/826370

Britton, N.L. and Rose, J.N., 1923. Rhipsalis. In: The Cactaceae: descriptions and illustrations of plants of the cactus family. Dover Publications, New York. *3*(4): 219-247.

Calvente, A. 2012. A new subgeneric classification of *Rhipsalis (Cactoideae, Cactaceae). Bradleya.* (30): 75-90. https://doi.org/10.1600/036364412X656455

Calvente, A.D.M., Freitas, M.D.F. and Andreata, R.H.P. 2005. Listagem, distribuição geográfica e conservação das espécies de Cactaceae no Estado do Rio de Janeiro. *Rodriguésia*. *56*(87): 141-162.

Calvente, A.M., Andreata, R.H. and Vieira, R.C. 2008. Stem anatomy of *Rhipsalis* (Cactaceae) and its relevance for taxonomy. *Plant Systematics and Evolution*. *276*(1): 1-7. https://doi.org/10.1007/s00606-008-0052-9

Calvente, A., Zappi, D.C., Forest, F. and Lohmann, L.G. 2011A. Molecular phylogeny, evolution, and biogeography of South American epiphytic cacti. *International Journal of Plant Sciences*. *172*(6): 902-914. https://doi.org/10.1086/660881

Calvente, A., Zappi, D.C., Forest, F. and Lohmann, L.G. 2011B. Molecular phylogeny of tribe Rhipsalideae (Cactaceae) and taxonomic implications for Schlumbergera and Hatiora. *Molecular Phylogenetics and Evolution*. *58*(3): 456-468. https://doi.org/10.1016/j.ympev.2011.01.001

Cardoso, W.C., Negrão, R., Dutra, V.F. and Sakuragui, M. 2021. Rediscovering *Rhipsalis hoelleri* (Cactaceae), a critically endangered species from Brazilian Atlantic forest. *Phytotaxa*. *498*(1): 63-68. https://doi.org/10.11646/phytotaxa.498.1.8

Cavalcantea, J.A., Maia Neto, L.D.S., Figueiredo, A.L.D.C., Oliveira, W.F.D., de Seixas, J.R.P.C., Guedes, C.C.D.S., Rodrigues, P.M.D.B., de Almeida, V.S., de Medeiros Rolim, L.A.D., Santos, A.A., Alves da Silva, J.K., Dantas da Cruz, R.C., Oliveira Costa, R.J., de Lira Moura, T.M., Morais de Oliveira, A.F., Tavares Paz, S., de Figueiredo Neta, C.R. and de Souza, I.A. 2021. Phytochemical profile, toxicological evaluation of *Rhipsalis baccifera* (Sol.) Stearn (Cactaceae) extract and their antitumor activity in Ehrlich carcinoma-bearing mice. *Natural Resources for Human Health*. *1*(2): 63-77. https://doi.org/10.53365/nrfhh/142159

Christenhusz, M.J. and Chase, M.W. 2013. Biogeographical patterns of plants in the Neotropics–dispersal rather than plate tectonics is most explanatory. *Botanical Journal of the Linnean Society*. *171*(1): 277-286. https://doi.org/10.1111/j.1095-8339.2012.01301.x

Costa, G.M., Graeff, V., Marcon, C., Mottin, I.G., Schmitt, J.L. and Droste, A. 2020. Genotoxicidade do ar atmosférico e epífitos vasculares em uma Unidade de Conservação de uma Região Metropolitana no sul do Brasil. *Revista Brasileira de Geografia Física*. *13*(06): 2515-2530. https://doi.org/10.26848/rbgf.v13.6.p2515-2530

Costa, G.M., Graeff, V., Marcon, C., Mottin, I.G., Schmitt, J.L. and Droste, A. 2020. Genotoxicidade do ar atmosférico e epífitos vasculares em uma Unidade de Conservação de uma Região Metropolitana no sul do Brasil. *Revista Brasileira de Geografia Física*. *13*(06): 2515-2530. https://doi.org/10.26848/rbgf.v13.6.p2515-2530

Crestani, A.C., Pizo, M.A., Fontanella, A.B., Herrera, M.L.G. and Cruz-Neto, A.P. 2021. Sugar and nitrogen digestive processing does not explain the specialized relationship between euphonias and low-quality fruits. *Journal of Avian Biology*. *52*(11). https://doi.org/10.1111/jav.02873

Das, G., Lim, K.J., Tantengco, O.A.G., Carag, H.M., Gonçalves, S., Romano, A., Das, S.K., Coy-Barrera, E., Shin, H.-S., Gutiérrez-Grijalva, E.P., Heredia, J.B. and Patra, J.K. 2021. Cactus: Chemical, nutraceutical composition and potential bio-pharmacological properties. *Phytotherapy Research. 35*(3): 1248-1283. https://doi.org/10.1002/ptr.6897

De La Rosa Manzano, E. and Briones, O. 2010. Germination response of the epiphytic cactus *Rhipsalis baccifera* (JS Miller) Stearn to different light conditions and water availability. *International Journal of Plant Sciences*. *171*(3): 267-274. https://doi.org/10.1086/650159

DeFilipps, R.A., Maina, S.L. and Crepin, J. 2004. Medicinal plants of the guianas (Guyana, surinam, French guiana). Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, DC Accessed: January 27, 2026. https://www.si.edu/object/siris_sil_724771

Fuentes, V.R. 2005. Etnobotánica de cactaceae en Cuba. In: Memorias del taller conservación de cactus cubanos. Jardín Botánico Nacional, Universidad de La Habana, Cuba. L.R. González-Torres, A. Palmadora, and A. Rodríguez, A. (Eds.). 15-24.

Fick, S.E. and Hijmans, R.J. 2017. WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology*. *37*(12): 4302-4315. https://doi.org/10.1002/joc.5086

Global Biodiversity Information Facility (GBIF) Secretariat. 2023. *Rhipsalis baccifera* (J.S. Muell.) Stearn. In *GBIF Backbone Taxonomy* (Checklist dataset). https://doi.org/10.15468/39omei

Gonzaga, D.R., Menini-Neto, L. and Peixoto, A.L. 2020. Cactaceae na Serra da Mantiqueira, Brasil. *Rodriguésia*. *71*: e02572018. https://doi.org/10.1590/2175-7860202071080

Grosse-Veldmann, B., Abrahamczyk, S., Mutke, J., Barthlott, W. and Weigend, M. 2016. *Rhipsalis* (Cactaceae): loss and gain of floral rewards is mirrored in range sizes and distribution patterns of species. *Botanical Journal of the Linnean Society*. *180*(4): 491-503. https://doi.org/10.1111/boj.12388

Gu, Z., Gu, L., Eils, R., Schlesner, M. and Brors, B. 2014. Circlize implements and enhances circular visualization in R. *Bioinformatics*. *30*(19): 2811-2812. https://doi.org/10.1093/bioinformatics/btu393

Guaraldo, A., Boeni, B. and Pizo, M.A. 2013. Specialized seed dispersal in epiphytic cacti and convergence with mistletoes. *Biotropica*. *45*(4): 465-473. https://doi.org/10.1111/btp.12041

https://www.jpacd.org Electronic ISSN: 1938-6648

Hunt, D.R., Taylor, N.P. and Charles, G. 2006. The new cactus lexicon. Milborne Port: dh books.

Ichsanti, D.R., Aziz, S.A. and Efendi, D. 2023. *Rhipsalis baccifera* cuttings growth with different cutting segment numbers and planting media. In *IOP Conference Series: Earth and Environmental Science. 1133*(1): 012001. https://doi.org/10.1088/1755-1315/1133/1/012001

Kluge, M., Razanoelisoa, B. and Brulfert, J. 2001. Implications of genotypic diversity and phenotypic plasticity in the ecophysiological success of CAM plants, examined by studies on the vegetation of Madagascar. *Plant Biology*. *3*(03): 214-222. https://doi.org/10.1055/s-2001-15197

Korotkova, N. 2012. Phylogeny and Evolution of the Epiphytic Rhipsalideae (Cactaceae). Ph.D. Thesis, University of Bonn, Bonn, Germany.

Kugaperumal, S.D., De Silva, R.D., Karunarathne, T.D., Gunasekara, C.P. and Samarakoon, D.N.A.W. 2021. Antimicrobial activity of *Rhipsalis baccifera* and *Drymoglossum piloselloides* against Methicillin Resistant *Staphylococcus aureus* and drug-resistant *Acinetobacter baumanii. International Journal of KIU*. *2*(1): 32-40. https://doi.org/10.37966/ijkiu2021021011

Loefgren, A. 1915. O gênero *Rhipsalis.* Arquivos do Jardim Botânico*,* Typografia da Directoria Geral de Estatistica, Rio de Janeiro, Brazil. *1*: 1-97.

Lüttge, U. 2010. Ability of crassulacean acid metabolism plants to overcome interacting stresses in tropical environments. *AoB Plants*. *2010*: plq005. https://doi.org/10.1093/aobpla/plq005

Mucunguzi, P. 2007. Diversity and distribution of hemi-epiphytes and facultative herbaceous epiphytes in Kibale National Park, Uganda. *African Journal of Ecology*. *45*(Suppl.1)*:* 57-64. https://doi.org/10.1111/j.1365-2028.2007.00739.x

Niño, J., Correa, Y., Cardona, G. and Mosquera, O.M. 2011. Antioxidant and antitopoisomerase activities in plant extracts of some Colombian flora from La Marcada Natural Regional Park. *Revista de Biología Tropical. 59*(3): 1089-1097.

Nyffeler, R. 2002. Phylogenetic relationships in the cactus family (Cactaceae) based on evidence from trnK/matK and trnL-trnF sequences. *American Journal of Botany*. *89*(2): 312-326.

Okereke, E.K., Isiogugu, O.N., Obi, B., Abonyi, U.C. and Akunne, T.C. 2020. Immunomodulatory potentials of *Rhipsalis* Neves-Armondii K. Schum. (cactaceae) aerial parts. *Pharmacologyonline.* (2): 146-155. https://doi.org/10.3732/ajb.89.2.312

Ornelas, J.F. and Rodriguez-Gomez, F. 2015. Influence of Pleistocene glacial/interglacial cycles on the genetic structure of the mistletoe cactus *Rhipsalis baccifera* (Cactaceae) in Mesoamerica. *Journal of Heredity*. *106*(2): 196-210. https://doi.org/10.1093/jhered/esu113

Oulo, M.A., Yang, J.X., Dong, X., Wanga, V.O., Mkala, E.M., Munyao, J.N. and Wang, Q.F. 2020. Complete chloroplast genome of *Rhipsalis baccifera*, the only cactus with natural distribution in the old world: genome rearrangement, intron gain and loss, and implications for phylogenetic studies. *Plants*. *9*(8): 979. https://doi.org/10.3390/plants9080979

Paes, C.F.D.C.G., de Barros, S.C.L., de Oliveira, M.A., da Silva, M.S., Arruda, M.G.M., da Silva, R.L. and de Souza, I.A. 2025. Perfil fitoquímico, toxicológico e atividade antitumoral do extrato etanólico de *Rhipsalis baccifera* (JM Muell) stearn. Frente ao sarcoma 180 em camundongos albinos Swiss (*Mus musculus*). *Cuadernos de Educación y Desarrollo*. *17*(5): e8387-e8387. https://doi.org/10.55905/cuadv17n5-078

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P. and Moher, D. 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ.* 372. https://doi.org/10.1136/bmj.n71

Raihandhany, R. and Wicaksono, A. 2022. *Rhipsalis* baccifera (JS Muell) Stearn, an epiphytic cactus of Bandung City, Indonesia: The field examination on the biological features and host distribution. *Philippine Journal of Science*. *151*(1): 205-213.

Rivas-García, T., Córdova-Pérez, D., Arredondo-Espinoza, R., Murillo-Amador, B., González-Estrada, R.R., Reyes-Pérez, J.J. and Alejandre-Rosas, J. 2024. Optimization of DNA Extraction for ITS/U4U3 analysis of *Rhipsalis baccifera*. *Journal of the Professional Association for Cactus Development*. *26*. https://doi.org/10.56890/jpacd.v26i.563

Seca, A.M. and Pinto, D.C. 2018. Plant secondary metabolites as anticancer agents: successes in clinical trials and therapeutic application. *International Journal of Molecular Sciences*. *19*(1): 263. https://doi.org/10.3390/ijms19010263

Silva, C.D., Calvente, A., Soller, A., Maranho, L.T., Boeger, M. R.T. and Soffiatti, P. 2013. Anatomy of *Rhipsalis* subgenus *Erythrorhipsalis* A. Berger (Rhipsalideae, Cactaceae). *Iheringia Série Botânica. 68*(2): 249-259.

Simões, S.D.S., Zappi, D.C. and Aona, L.Y.S. 2020. A família Cactaceae no Parque Nacional de Boa Nova, Estado da Bahia, Brasil. *Hoehnea*. 47: e1102019. 10.1590/2236-8906-110/2019

Stevenson, J. F. and Mauseth, J. D. 2004. Effects of environment on vessel characters in cactus wood. *International Journal of Plant Sciences*. *165*(3): 347-357. https://doi.org/10.1086/382807

Taylor, N.P. and Zappi, D.C. 2020. (2774) Proposal to conserve the name *Rhipsalis baccifera* against *Cactus parasiticus* (Cactaceae). *Taxon*. *69*(5): 1011-1012. https://doi.org/10.1002/tax.12339

Torres, C.A., Zamora, C.M.P., Nuñez, M.B. and González, A.M. 2023. Ethnobotanical uses and potential pharmaceutical applications of the Cactaceae family. In: Ethnobotany. J.L. Martinez, A. Maroyi and M.L. Wagner (Eds.). CRC Press, Boca Raton, USA. *1*: 63-99. https://doi.org/10.1201/9781003200147

Tyagi, S., Mondal, D., Ghosh, T., Kumar, A., Bhura, M.R.G., Chiangkata, R. and Pathak, V. 2024. An experimental study on phytochemical screening and in-vivo anti-inflammatory activity of *Rhipsalis baccifera*. *Romanian Journal of Diabetes, Nutrition and Metabolic Diseases. 31*(1): 115-122. https://doi.org/10.46389/rjd-2024-0115