



**MEMORIAS DE LA**

**VIII**

**Ecuador 2025**

**CONFERENCIA CIENTÍFICA DE  
ORQUÍDEAS ANDINAS**

**Proceedings of the VIII Scientific  
Conference on Andean Orchids.**



## Archivos Académicos USFQ

Número 58

### Memorias de la VIII Conferencia Científica de Orquídeas Andinas / Proceedings of the VIII Scientific Conference on Andean Orchids

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### USFQ PRESS

Universidad San Francisco de Quito USFQ  
Campus Cumbayá USFQ, Quito 170901, Ecuador  
Octubre 2025, Quito, Ecuador

ISBNe: 978-9978-68-330-9

Catalogación en la fuente: Biblioteca Universidad San Francisco de Quito USFQ, Ecuador

Conferencia Científica de Orquídeas Andinas (8° : 2025 : Quito, Ecuador)  
Memorias de la VIII Conferencia Científica de Orquídeas Andinas =  
Proceedings of the VIII Scientific Conference on Andean Orchids /  
[editor, Tom Miranda ...[y otros]] – Quito : USFQ Press, ©2025.  
p. cm. ; (Archivos Académicos USFQ, ISSN: 2528-7753 ; no. 58  
(octubre 2025))

ISBNe: 978-9978-68-330-9

1. Orquídeas – Andes (Región) – Congresos, conferencias, etc. – 2.  
Estudios académicos – Orquídeas. – I. Miranda, Tom, ed. – II. Título. – III.  
Serie monográfica.

CLC: QK495.O64 C66 2025  
CDD: 584.4

OBI-216

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*Citación recomendada de toda la obra:* Miranda, T., Martínez Moscoso, J., Portilla, J., Gerlach, G., Bogarín, D., Flanagan, N., Ticktin, T., Keach, J., (Eds.). (2025). *Memorias de la VIII Conferencia Científica de Orquídeas Andinas / Proceedings of the VIII Scientific Conference on Andean Orchids*. Archivos Académicos USFQ, 58, 1–94.

*Citación recomendada de un resumen:* Niissalo, M. (2025). Native orchids in a city—orchid conservation in Singapore. Archivos Académicos USFQ, 58, pp. 65.

**Archivos Académicos USFQ**

ISSN: 2528-7753

*Archivos Académicos USFQ* es una serie monográfica multidisciplinaria dedicada a la publicación de actas y memorias de reuniones y eventos académicos. Cada número de *Archivos Académicos USFQ* es procesado por su propio comité editorial (formado por los editores generales y asociados), en coordinación con la editora de la serie. La periodicidad de la serie es ocasional y es publicada por USFQ PRESS, el departamento editorial de la Universidad San Francisco de Quito USFQ.

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## **Memorias de la VIII Conferencia Científica de Orquídeas Andinas**

Tom Mirenda, Juan Pablo Martínez Moscoso, José Portilla Andrade,  
Günter Gerlach, Diego Bogarín, Nicola Sian Flanagan,  
Tamara Tickin, James Keach  
**Editores**



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## Comité científico

**Tom Mirenda** es un experto en orquídeas y horticultor con más de 20 años de experiencia en el cultivo y la conservación de estas plantas. Actualmente, es el presidente de la American Orchid Society (AOS) y ha servido en la Junta Directiva de la AOS en diversos roles. Durante 17 años, fue curador de orquídeas en el Jardín Botánico de los Estados Unidos en el Smithsonian Institution en Washington, D.C., donde gestionó una de las colecciones de orquídeas más prestigiosas del mundo. Mirenda es conocido por su labor educativa y de divulgación, escribiendo la columna “Orchid Digest” durante más de una década y contribuyendo a publicaciones científicas y de aficionados. Además, es un defensor activo de la conservación de hábitats naturales de orquídeas y colabora con jardines botánicos, organizaciones de conservación y proyectos internacionales para preservar la biodiversidad de estas plantas a nivel global.

**Günter Gerlach** es un botánico alemán conocido por su trabajo en la taxonomía y ecología de orquídeas, especialmente las del género *Stanhopea*. Ha sido curador en el Jardín Botánico de Múnich y se ha especializado en la biología reproductiva y la polinización de orquídeas. Gerlach ha descrito numerosas especies nuevas y ha contribuido significativamente al conocimiento de la diversidad y ecología de las orquídeas neotropicales, además de publicar extensamente sobre la biología de estas plantas y colaborar en proyectos de conservación en América Latina.

**Diego Bogarín** es un botánico costarricense especializado en la sistemática y conservación de orquídeas. Trabaja en el Jardín Botánico Lankester de la Universidad de Costa Rica, donde se dedica a la investigación y descripción de nuevas especies de orquídeas. Con numerosos artículos publicados, su trabajo se centra en la biodiversidad de orquídeas en América Central y su conservación. Además, Bogarín participa activamente en proyectos de conservación y educación para la protección de los ecosistemas tropicales y colabora con instituciones internacionales en el estudio de la flora neotropical.

**Nicola Sian Flanagan** es botánica y profesora en la Pontificia Universidad Javeriana Cali, especializada en ecología y conservación de plantas. Con un enfoque en la diversidad de ecosistemas tropicales, su investigación abarca la ecología de comunidades vegetales, la conservación de orquídeas y la restauración ecológica. Ha publicado en colaboración con redes internacionales y participa en proyectos de restauración en Colombia, promoviendo la educación ambiental y la conservación de la biodiversidad a través de la participación comunitaria.

**Tamara Ticktin** es una ecóloga y profesora en la Universidad de Hawái en Manoa, especializada en la ecología aplicada a la conservación y manejo sostenible de plantas útiles. Su investigación se centra en la intersección entre ecología, conservación y prácticas tradicionales de manejo de recursos en comunidades locales, especialmente en regiones tropicales. Ticktin colabora con comunidades indígenas y rurales para entender cómo las prácticas tradicionales contribuyen a la conservación de la biodiversidad y la resiliencia de los ecosistemas, publicando ampliamente sobre manejo sostenible y conservación basada en el conocimiento ecológico tradicional.

**James Keach** es un especialista en ornamentales y agente de extensión en el programa Master Gardener con más de 15 años de experiencia en horticultura y mejora de cultivos. Actualmente, trabaja en el College of Tropical Agriculture and Human Resources (CTAHR) de la Universidad de Hawai'i, donde coordina el programa Master Gardener en Kaua'i desde 2019. En este rol, ha ofrecido cursos anuales de capacitación y conferencias estatales sobre temas como propagación de plantas y cultivo de vegetales en Hawai'i. Keach cuenta con una sólida formación académica, con un título en Ciencias, una maestría en Ciencias de Cultivos y un doctorado en Mejoramiento Genético de Plantas. Su investigación se centra en el mejoramiento de cultivos con resistencia a enfermedades.

**Andrea Encalada** es una ecóloga ecuatoriana reconocida por su labor en conservación de la biodiversidad y el desarrollo sostenible. Actualmente, es Vicerrectora y profesora en la Universidad San Francisco de Quito (USFQ), donde lidera proyectos académicos y científicos orientados a la protección ambiental. Con un doctorado en Ecología de Agua

Dulce de Cornell University, Encalada ha impulsado la investigación en conservación a través de la creación del Instituto de Investigación BIOSFERA en 2016. También co-presidió el Science Panel for the Amazon, promoviendo la protección a largo plazo de la cuenca amazónica. Ha publicado más de 70 artículos científicos y fue galardonada como Científica del Año en Ecuador en 2015.

**Juan Pablo Martínez** es biólogo especializado en gestión y conservación de biodiversidad con más de una década de experiencia docente en biodiversidad y gestión ambiental. Actualmente, trabaja como asesor de conservación en la empresa Ecuagenera y la Fundación Ángel Andreetta, donde promueve estrategias de sostenibilidad y conservación. A lo largo de su carrera, ha combinado la gestión ambiental con el desarrollo sostenible y la responsabilidad social, enfocándose en la interacción entre las sociedades humanas y el medio ambiente desde una perspectiva cultural. Ha desempeñado roles clave en el sector público, construyendo alianzas público-privadas y colaborando con comunidades campesinas e indígenas.

## Keynote Speakers

Alfonso Doucette

Generative Artificial Intelligence as a Tool for Taxonomic Research: A Case Study with  
*Lepanthes artificialis* (Orchidaceae)

Fundación Angel Andreetta

Nicola Flanagan

From Herbarium to Habitat: Mapping distributions and conservation risk for Vanilla species  
across the neotropics.

Biodiversity & Bioeconomy Research Group; Orchid Specialist Group IUCN

Günter Gerlach

Coeliopsidinae, a Neotropical subtribe with a perfume syndrome

Botanischer Garten München-Nymphenburg

James Keach

The Orchid Pod: Podcasting as an educational tool for orchid outreach

Department of Tropical Plant & Soil Sciences, College of Tropical Agriculture & Human  
Resilience, University of Hawai'i – Mānoa

Hong Liu

What does sustainable use of orchids look like? Examples from East Asia

Institute of Environment, Florida International University

Juan Pablo Martínez Moscoso

Redefining Conservation Paradigms: The Role of Ethical Commerce in the conservation of  
Andean Orchid Diversity. The case of Ecuagenera.

Ecuagenera orquídeas del Ecuador, Fundación Ángel Andreetta

Melissa McCormick

Drivers of orchid distribution and rarity, an example from the Republic of Palau

Principal Investigator, Senior Scientist. Smithsonian Environmental Research Center

Rebeca Menchaca García

Etnobotánica de orquídeas: Más allá de su uso ornamental.

Universidad Veracruzana

Alelí Morales Martínez

An approach to Cuban orchids: the genus *Lepanthes*

National School of Horticulture and Landscaping, National Botanical Garden of Cuba,

University of Havana, President, Cuban Botanical Society

María Isabel Mujica

Conservation of Chilean orchids: using ecological knowledge and citizen science

Directora del Jardín Botánico de la Universidad Austral de Chile.

Carlos Ossenbach

Rudolf Schlechter's Andean orchids

Lankester Botanical Garden, University of Costa Rica, Research Associate

Emerson R. Pansarin

The natural history of Neotropical Vanilla and its implication for selection of favorable genotypes for vanilla production

University of São Paulo, Faculty of Philosophy, Sciences and Literature of Ribeirão Preto,

Department of Biology, Laboratory of Molecular Biology and Systematics of Plants

Edicson Parra-Sanchez

Orchids in the Anthropocene: Anthropogenic Drivers Shaping Today's Orchid Diversity

Department of Plant Sciences and Centre for Global Wood Security, University of

Cambridge, Cambridge, UK

Daniel Piedrahíta

Turning a hobby into a way of life

Alma del Bosque

Juan Pablo Suárez, Stefania Cevallos, Paulo Herrera

Diversity of Mycorrhizal Fungi Associated with Tropical Epiphytic Orchids in Ecuador

Ecología y Evolución de Sistemas Microbianos, Departamento de Ciencias Biológicas y Agropecuarias, Universidad Técnica Particular de Loja

Tamara Ticktin

Local use, trade, and conservation of wild orchids

School of Life Sciences, University of Hawai'i at Mānoa, Honolulu, Hawai'i

Lawrence W. Zettler

Saving Orchids - One Conference at a Time.

Illinois College (Professor of Biology), and Chicago Botanic Garden (Research Associate)

## **Generative Artificial Intelligence as a Tool for Taxonomic Research: A Case Study with *Lepanthes artificialis* (Orchidaceae)**

Alfonso Doucette  
Fundación Ángel Andreetta

Generative artificial intelligence (AI), particularly large language models (LLMs), has shown potential to support structured scientific writing, including taxonomic species descriptions. This study presents a case example using the newly described orchid species *Lepanthes artificialis* to evaluate the potential of generative AI in modern taxonomic practice. Draft descriptive text—including the diagnosis, comparative discussion, and initial species description—was generated using an LLM based on structured collection data, morphological measurements, and curated taxonomic comparisons. All outputs were reviewed and revised by the author to ensure accuracy, clarity, and compliance with the International Code of Nomenclature.

The case of *Lepanthes artificialis* highlights the ability of AI to expedite the early drafting phase of descriptive writing while maintaining the necessity of expert oversight for interpretation and validation. In addition to taxon-specific results, this study reviews applications of generative AI in biology, including literature synthesis, comparative analyses, image captioning, and public science communication. The process demonstrates how AI can support taxonomists by reducing the time required for repetitive, formulaic tasks while allowing researchers to focus more on diagnostic precision and interpretation of morphological variation.

Importantly, this study also addresses ethical considerations related to authorship, transparency, and potential misuse of AI-generated content in scientific publications. The importance of disclosing AI involvement and ensuring human accountability is emphasized, particularly in disciplines such as taxonomy, where precision and verifiability are critical. Broader implications are discussed for the integration of AI tools into botanical workflows and for their future in supporting underserved fields with limited funding or linguistic barriers.

This case study emphasizes that generative AI tools are best used as augmentative resources within a framework of critical scientific rigor. The name *Lepanthes artificialis* serves not only to identify a novel species, but also to reflect on the evolving role of artificial systems in botanical research, raising important questions about creativity, authorship, and the future of scientific collaboration.

**Keywords:** Generative artificial intelligence, taxonomic research, *Lepanthes artificialis*, scientific writing, authorship.

## **From Herbarium to Habitat: Mapping distributions and conservation risk for *Vanilla* species across the neotropics**

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The IUCN Red List system provides a standardized, quantitative framework for assessing species extinction risk and informing conservation strategies. In the absence of population demographic data, assessments rely on species' occurrence records, applying Criterion B to evaluate extinction risk based on geographic range size. However, translating these assessments into effective conservation actions is frequently constrained by a lack of quantitative evidence on habitat loss or degradation. Species of *Vanilla* subg. *Xanata* sect. *Xanata*, distributed across the neotropics, comprise the wild relatives of the vanilla crop. Conservation strategies for this valuable agrobiodiversity are hindered, principally by ambiguities regarding the species' natural distribution across spatial scales. We aimed to collate and curate the occurrence data for species of vanilla crop wild relatives to determine species distributions and conservation status using three spatial metrics—the Extent and Area of Occupancy (EAO and AOO) central to the IUCN Red List assessments, and the Area of Habitat (AOH), also known as extent of suitable habitat. We selected 16 species of *Vanilla* subg. *Xanata* sect. *Xanata* representative of the phylogenetic diversity in the section, and with varied distributions patterns across the neotropical region from Mexico to southern Brazil. We compiled and curated data widely from herbaria, personal observations and research grade observations in the iNaturalist citizen science digital platform. As *Vanilla* species are frequently misidentified in herbaria as well as in the wild and in *ex situ*

collections, all accessions included in this study were visually examined and the taxonomic identity verified. Global and national assessments of species conservation status were determined according to the IUCN Red List guidelines. Area of Occupancy (AOO) and Extent of Occurrence (EOO) were calculated using the ConR software. We further quantified the Area of Habitat (AOH) as the suitable habitat within a species' range that accounts for ecological preferences such as habitat type and elevation. We applied forest cover maps from Global Forest Watch to exclude deforested and non-forested areas, given that most *Vanilla* species are restricted to forested habitats. Elevational limits were derived from curated occurrence records and applied using digital elevation models (DEMs), with spatial buffers of 1000 m for habitat and 100 m for elevation to account for georeferencing uncertainty. The resulting habitat masks were intersected with species distributions to estimate AOH values aligned with IUCN guidelines. We compiled 2009 registers of occurrence data for the selected species. The number of records per species ranged from 8 for *Vanilla penicillata* to 438 for *V. pompona*. *Vanilla* specimens were collated from 105 herbaria. The platform iNaturalist contributed 28% of these records. Conservation risk assessments that incorporate Area of Habitat (AOH) evaluation enable more precise targeting of field surveys, generating crucial data to inform and implement conservation strategies. Relevant actions include population sampling to support *ex situ* conservation, establishing long-term monitoring for *in situ* conservation, and facilitating *circa situm* approaches. Critically, for vanilla crop wild relatives, identifying localities within the AOH also supports the designation of Other Effective Area-Based Conservation Measures (OECMs), enhancing protection of these priority species in their natural habitats.

**Keywords:** Area of Habitat, Conservation planning, IUCN Red List, Other Effective Area-Based Conservation Measures (OECM), Species distributions

## ***Coeliopsidinae*, a Neotropical subtribe with a perfume syndrome**

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The subtribe *Coeliopsidinae*, sister to the *Stanhopeinae*, consists of the three genera *Coeliopsis*, *Lycomormium*, and *Peristeria*, with approximately 12 species distributed from Costa Rica to Bolivia and Brazil and the island of Trinidad. Their habitat is wet forests from sea level up to an altitude of 2300 m. As in the *Stanhopeinae*, all species are pollinated by male Euglossini bees collecting perfumes from the flowers.

They are differentiated from the *Stanhopeinae* by their morphology. They have pollinaria without stipes, roots with fine hairs, and balloon-type seeds. The three genera of *Coeliopsidinae* are easily differentiated by their floral morphology. *Peristeria*, the largest genus, has a mobile epichile on the labellum; the remaining two have a fixed one. *Coeliopsis* has an entire and three-lobed labellum, whereas *Lycomormium* has it divided into a hypochile and an epichile.

As in the *Stanhopeinae*, the pollination mechanisms are very particular, thus contributing to the very precise adherence of the pollinarium onto the pollinator's body. A unique composition of the floral aroma of the different species of these orchids restricts the euglossine species attracted to the flowers; therefore, there are unique pollinators or few bee species per *Coeliopsidinae* species.

The objective of the presentation is to elucidate the link between pollinators and the flowers of the *Coeliopsidinae*, to illuminate the importance of the chemical composition of their floral aromas, and to present a more complete picture of the subtribe at this time.

**Keywords:** *Coeliopsidinae*, *Stanhopeinae*, Euglossini bees, pollination, floral morphology.

## The Orchid Pod: Podcasting as an educational tool for orchid outreach

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In recent years podcasts (recorded digital audio programs) have become a popular form of media. Their versatility in distribution, with options to download listen on phones, smart speakers, computers, and even televisions, makes them useful for areas where radio signals are weak or buffered video streaming may exceed local bandwidth. This popularity skyrocketed during the pandemic and Buzzsprout, a dedicated podcast hosting platform, reports over 92 million downloads in a month. While some podcasts focus on news or popular culture, others have become useful sources of educational information on a global level.

While a range of podcasts on flowers and botany exist, there were previously no ongoing podcasts on orchids. Realizing a need, we created a partnership between a commercial orchid grower and an academic specializing in orchids, both of whom are American Orchid Society judges, with audio production from a former radio host-turned-orchid grower. We have expanded from episodes on specific types of orchids to episodes on events, interviews with experts, and episodes answering questions sent in from listeners. We currently have listeners from 28 countries, and have received feedback that, despite doing audio programs on a highly visual plant, listeners enjoy learning about new orchids or concepts while having their eyes free to do other activities, like repotting plants. Integrating feedback from listeners and educators, we are working to expand and tailor our programming to continue to educate in a more targeted way.

**Keywords:** Podcasting, educational tool, orchid outreach, digital audio, science communication.

## What does sustainable use of orchids look like? Examples from East Asia

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In general, achieving sustainable use of orchids has three approaches: sustainable wild harvest schemes, artificial cultivation, or a combination of the two. Allowing wild harvest can contribute to local livelihood and cultural tradition and is therefore desirable when possible. The key is to identify the biological, ecological and socioeconomic conditions under which wild harvest is sustainable. To this end, the IUCN Orchid Specialist Group published a sustainable harvest framework for orchids, which examines how orchids can be harvested sustainably, considering factors such as critical life history traits and market demand.

One example of a potentially sustainable harvest example is *Bulbophyllum kwangtunnense*, a medicinal orchid used in folk medicine and traded in local markets in southern China for centuries. Yet the species is still recorded in more than 55 national and provincial nature reserves and listed as Least Concern on the recent Chinese Red List. The wild harvest of this species can be sustainable because the trade is local and small-scale, and the species has many short rhizomes (i.e. pseudobulbs) that render partial harvest possible, a life history trait that enable sustainable harvest schemes. The second sustainable use approach, i.e. artificial cultivation, involves artificial propagation and cultivation of orchids, which can alleviate wild harvest pressure for species with very high market demand. For example, the white butterfly orchid (*Phaenopsis aphrodite* var. *formosana*), native to Taiwan, is propagated and used in artificial hybridization to generate huge quantities of potted *Phalaenopsis* plants sold annually worldwide. This lucrative orchid production does not rely on wild-collected orchids and thus can be considered sustainable. However, this production system was built on historical collection of wild individuals of *P. aphrodite* and the native populations of *P. aphrodite* in Taiwan remain on the verge of extinction and require restoration. In addition, wild-sourced *P. aphrodite* and other orchids of horticultural value are still being imported to Taiwan from less developed countries such as the Philippines.

For orchids species whose wild-sourced materials are of high market value and in high demand, such as certain TCM *Dendrobium* orchids, a third approach may work to achieve sustainable use, whereby cultivation is carried out in situ to restore and augment the wild populations. This restoration-friendly cultivation within the species' native habitat, accompanied by a certification scheme, can potentially regulate the market specifically for conservation outcomes. In summary, achieving the sustainable use of orchids requires the input of multiple stakeholders with diverse expertise and tools.

**Keywords:** Podcasting, educational tool, orchid outreach, digital audio, science communication.

## **Redefining Conservation Paradigms: The Role of Ethical Commerce in the conservation of Andean Orchid Diversity. The case of Ecuagenera.**

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The article presents the case of Ecuagenera to challenge the traditional dichotomy between commercial activity and biodiversity preservation. Ecuador is a global megadiverse country, holding approximately 15% of the world's orchid species, many of which are micro-endemic and highly vulnerable to habitat loss, climate change, and illegal trade. The central thesis is that ethical, scientifically-grounded commercial production of orchids is not a threat, but a powerful and pragmatic tool for conservation.

The Ecuagenera model integrates *in situ* and *ex situ* conservation, scientific research, and community engagement, funded directly by its commercial operations. A cornerstone of its philosophy is strict adherence to the CITES convention, ensuring all trade is legal, transparent, and traceable through meticulous documentation of artificially propagated plants. This approach alleviates pressure on wild populations.

As a major private *ex situ* conservation center, Ecuagenera propagates over 50% of orchid species on Ecuador's National Red List and nearly 10% of the world's threatened orchids. The organization proactively cultivates newly described species, which are often critically endangered due to extreme range-restriction, providing a crucial safeguard before formal threat assessments are completed.

The revenue generated from these activities funds a robust *in situ* conservation program, including the management of over 2,700 hectares of private nature reserves in critical ecosystems. This creates a virtuous cycle where scientific reintroduction projects are conducted using laboratory-propagated plants, and collaborations with local communities ensure the long-term sustainability of these efforts. The Ecuagenera model demonstrates that a private entity can act as a central force in biodiversity preservation, transforming market demand into a direct engine for conservation.

**Keywords:** Conservation paradigms, Ethical commerce, Orchidaceae, Ecuador, Biodiversity hotspot, *In situ* conservation, *Ex situ* conservation, CITES, Sustainable use, Private conservation.

## **Drivers of orchid distribution and rarity, an example from the Republic of Palau**

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There have been many studies that have aimed to determine whether or how mycorrhizal specificity relates to orchid rarity, but that question is far from settled. In a study of 30 epiphytic and terrestrial orchid species in the Republic of Palau that had different range sizes and levels of abundance in the island nation of Palau, we found that endemic orchids were associated with specific fungi, while orchids that were rare in Palau, regardless of whether they were endemic or widespread or how specific their fungal associations were, associated with fungi that were uncommon. This demonstrates how an approach that combines both mycorrhizal specificity and abundance of appropriate fungi can help to explain orchid distribution and rarity.

**Keywords:** Orchid distribution, rarity, mycorrhizal specificity, Republic of Palau, endemic orchids.

## **Ethnobotany of orchids: Beyond their ornamental use**

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Due to their beauty, the use of orchids is mostly associated with their ornamental characteristics. However, little is known about the great potential that these plants hold for other diverse uses. The relationship between orchids and people ranges from traditional historical uses to their cultural, social, and economic significance, reflected in everyday life. The main idea of this work was to disseminate knowledge about uses of orchids beyond their ornamental value, and to propose strategies for their sustainable utilization. A bibliographic review, field observations, interviews, and the collection of testimonies with artisans and anthropologist were conducted. Support was provided to small-scale producers through the propagation and donation of seedlings of several orchid species for different uses, and proposals were developed for the sustainable use of Orchids. A total of 77 species with medicinal uses were recorded, along with 14 species used as adhesives, six species used in religious rituals, four species with culinary uses, two species used in perfumery, and one species with apotropaic cultural use. Orchids possess specialized metabolites (mainly phenols and terpenes), whose properties are related to uses dating back to pre-Hispanic times, including medicinal purposes and aromatherapy. They also have been used as adhesives for musical instruments and feather art, as ingredients in confectionery or as condiments in some foods. They have been also used in the creation of religious images, and as gargoyle-like protective elements with supposed magical properties. This study found that many of these reported uses remain present in certain regions of Mexico. Although orchids have provided diverse uses to human communities, there is still a lack of sufficient strategies for their propagation and for preventing the overharvesting of wild species, situation that implies challenges for developing effective conservation actions. At the University Orchidarium of

Centro de Investigaciones Tropicales (Universidad Veracruzana, Mexico), small-scale producers are advised on in vitro and nursery propagation of orchid species in rural communities. Besides, hybrid vanilla plants with genetic variability have been distributed for their field cultivation, and efforts are ongoing to develop proposals for large-scale propagation and research on medicinal orchids.

**Keywords:** Cultural heritage, medicinal plants, Orchidaceae, sustainability.

## **An approach to Cuban orchids: the genus *Lepanthes***

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This lecture offers a review of the *Orchidaecae* family in Cuba, with an emphasis on the genus *Lepanthes*. An analysis was conducted of the distribution of orchid species registered in Cuba, as well as their threat categories according to those offered by the IUCN. Additionally, a study is offered of herbarium materials of the genus *Lepanthes* from 15 institutions in Cuba and around the world, including the type material of 22 taxa. The entire literature on the 41 species names of this genus cited for Cuba was reviewed. Leaf shape, including the apex, base, and venation, as well as floral characteristics, allow for the discrimination of the 33 *Lepanthes* species recorded for the Cuban archipelago, including the most recent, *L. macrolabia*.

**Keywords:** taxonomy, conservation, threatened species.

## **Conservation of Chilean orchids: using ecological knowledge and citizen science**

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Orchidaceae is one of the most diverse plant families in the world, occurring on every continent except Antarctica and inhabiting nearly all habitat types. Despite this wide distribution at the family level, many orchid species have highly restricted geographic ranges and small populations. Globally, orchids face severe conservation threats. Conservation strategies for orchids include *in situ* protection of existing populations, *ex situ* storage of tissues, and restoration programs—all of which require a thorough understanding of each species' ecology and specific requirements. This is particularly challenging for orchids due to their complex life histories and reliance on interactions with other organisms, notably pollinators and mycorrhizal fungi. Orchid seeds are extremely small and lack energy reserves, making them dependent on compatible orchid mycorrhizal fungi (OMF) for the nutrients and carbon necessary for germination and early development.

The conservation outlook for Chilean orchids mirrors the global trend. Although fewer than 20% of native species have been formally assessed, all evaluated species are listed under some category of threat. This underscores the need for a multifaceted approach to their conservation. In this study, we sought to advance the conservation of two native species—*Gavilea longibracteata* and *G. odoratissima*—by combining ecological research on mycorrhizal associations with citizen science to document their distribution, population size, and threats. Eleven populations were sampled, OMF communities were characterized through metagenomic analyses, and abiotic conditions were measured. Our results revealed a high diversity of mycorrhizal fungi associated with both species, with soil properties and litter layer conditions playing a key role in shaping fungal community composition.

In parallel, a nationwide citizen science monitoring project launched in 2020 engaged over 1,700 volunteers, generating 490 verified observations of the two species. These records, combined with personal and herbarium data, were used to model their ecological niches and assess potential threats under global change scenarios. Although still ongoing, this work highlights how integrating scientific research with citizen participation can generate critical knowledge for biodiversity conservation while fostering public engagement in environmental stewardship.

**Keywords:** orchid mycorrhizas, *Gavilea*, citizen science, conservation.

## Rudolf Schlechter's Andean orchids

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This lecture describes and illustrates the work of Rudolf Schlechter on the Andean orchid flora of South America. It follows the sequence of Schlechter's well-known series of books which he named "Die Orchideenfloren der Südamerikanischen Kordillerenstaaten" [= *The orchid floras of the South American Andean states*], published between 1919 and 1922 in this order: Venezuela, Colombia, Ecuador, Peru, and Bolivia. Additionally, the orchid floras of Chile and Argentina and their history are briefly described.

Each country is introduced by a short description of its history and geography, followed by short biographies of the most important botanists and orchid collectors who visited these countries.

**Key words:** Rudolf Schlechter, Andean Orchids, biography, history of botany, South America.

## The natural history of Neotropical *Vanilla* and its implication for selection of favorable genotypes for vanilla production

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With more than 60 species, the Neotropics is the most species rich region among *Vanilla*. Currently, many Brazilian species have been described or rediscovered, and taxonomic realignments have been carried out based on integrative taxonomy. The accuracy in species delimitation is important for studies on phylogeny and ecology, and because some Brazilian vanilla seems to be inappropriate to human consumption. *Vanilla* is monophyletic, with three main lineages, two of which occur throughout the Neotropics. The pollination system of Neotropical *Vanilla* is not species-specific, and their flowers are commonly adapted to pollination by euglossine males. The pollination mechanism of euglossinophilous *Vanilla* is based on a combination of perfume collection and nectar seeking. At least one species, *V. palmarum*, is pollinated by hummingbirds representing an evolutionary disruption in the pollination system among *Vanilla*. With regards to seed dispersal, the mesocarp of species with dehiscent fruits are rich in raphid idioblasts that can be harmful to seed dispersers. For this reason, in *Vanilla* with dehiscent fruits, birds and mammals commonly access the sclerotic seeds through fruit valves. Seeds of *Vanilla* with indehiscent fruits are dispersed by terrestrial herbivores. Besides the nutritive rewards, fruits are rich in polyphenols that can be toxic or unpalatable to omnivores. The chemical scarification of seed coat by the digestive acids is crucial for synchronizing the biological processes involved in seed germination. The understanding of the processes involved in *Vanilla* reproduction is very important in the selection of favorable genotypes for commercial vanilla production.

**Keywords:** Neotropics, Pollination, Seed dispersal, Reproductive biology, Phylogeny, Systematics.

## Turning a hobby into a way of life

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This presentation explores the personal journey of transforming a lifelong passion for birdwatching and orchids into a comprehensive lifestyle project. Set against the backdrop of Colombia's extraordinary biodiversity, it highlights the potential of combining personal interests with conservation, education, and scientific contribution.

The main objectives were to build a world-class orchid collection, promote environmental awareness, and create educational platforms that inspire both specialists and the general public to appreciate and conserve biodiversity. The project was developed through long-term cultivation of orchids, systematic documentation of species, participation in exhibitions, and collaboration with local and international study groups. Digital platforms, including social media and an online school, were also implemented to expand outreach. Fieldwork, genetic conservation initiatives, and restoration efforts complemented these strategies.

Alma del Bosque currently houses over 25,000 plants, representing 5,000 species, with 1,000 regularly flowering. The collection has received multiple international awards, with over 87% of exhibited plants earning recognition. Educational outcomes include an online orchid school with monthly live classes, workshops, and international collaborations. Social media impact has been significant, with several videos surpassing millions of views. The project has also been nominated for COP16, emphasizing its role in biodiversity conservation.

The experience demonstrates that hobbies, when cultivated with discipline and vision, can evolve into lifestyle projects with scientific, cultural, and environmental relevance. Alma del Bosque serves as a model of how passion, conservation, and education can converge to preserve biodiversity while inspiring global audiences.

**Keywords:** Orchids, Biodiversity, Conservation, Education, Lifestyle

# Orchids in the Anthropocene: Anthropogenic Drivers Shaping Today's Orchid Diversity

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The Orchidaceae family represents one of the most diverse plant lineages globally, yet it faces unprecedented threats from anthropogenic activities, with recent estimates suggesting 4,342 species are threatened with extinction. This review synthesizes findings from three pivotal studies conducted in the Tropical Andes, a critical biodiversity hotspot, to examine how contemporary anthropogenic pressures are restructuring orchid diversity. My research has found that neutral processes, particularly dispersal limitation, dominate orchid community assembly in human-modified landscapes, overriding traditional niche-based mechanisms. Furthermore, this research demonstrated deforestation is fundamentally altering biogeographic diversity patterns, with mid-elevation zones experiencing the most severe losses. Perhaps most alarmingly, analysis reveals that land-use change is driving biotic homogenization across taxa, with orchids showing particular vulnerability due to their specialized ecological requirements. Three emblematic microendemic species — *Porroglossum parsonsii*, *Pleurothallis sp.nov.*, and *Lepanthes cordillerana*— serve as case studies to illustrate these threats, each facing imminent extinction due to habitat fragmentation and overcollection. Our findings underscore the urgent need for innovative conservation strategies that bridge scales, from micro-reserves to landscape-level connectivity planning, to safeguard these evolutionarily unique taxa in the face of accelerating global change.

**Keywords:** Orchidaceae, Tropical Andes, microendemics, habitat fragmentation, climate change, conservation prioritization.

## Diversity of Mycorrhizal Fungi Associated with Tropical Epiphytic Orchids in Ecuador

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This review summarizes the studies carried out by the authors aimed to understand the diversity of mycorrhizal fungi associated with tropical epiphytic orchids, particularly in Ecuador, and how these vital partnerships contribute to orchid's ecology. The study was conducted to investigate the composition and ecological role of root-associated fungi and orchid mycorrhizal fungi from various epiphytic orchid species across several sites in Ecuador, including the Reserva Biológica San Francisco, Podocarpus National Park, Cajas National Park and other locations. During these studies, samples from numerous orchid species were collected, encompassing a wide range such as *Stelis* spp., *Pleurothallis* spp., *Teagueia* spp., *Cyrtochilum* spp., *Epidendrum* spp and more. Additionally, a seedling-trap experiment was set up using *in-vitro* orchid's seedlings. The most significant findings revealed that all sampled epiphytic orchids consistently formed mycorrhizal associations, underscoring the fungi's critical role in their survival. Through various analytical methods, including light and electron microscopy, fungal isolation, and advanced DNA sequencing techniques, our studies identified key fungal groups like Serendipitaceae, Tulasnellaceae, Ceratobasidiaceae, and Atractiellales as major orchid mycobionts. The research highlighted that methodological approaches, particularly the choice of DNA primers, significantly influenced the observed fungal diversity, with different primers favoring the detection of distinct fungal groups. These findings are crucial for conservation, as identifying appropriate fungal partners is essential for programs aimed at enhancing seed germination and propagating endangered Ecuadorian orchid species, thereby contributing to the persistence of the region's extraordinary orchid diversity threatened by deforestation and climate change.

**Keywords:** Rhizoctonia, symbiosis, saprophytic, DNA sequencing, ecology.



## Local use, trade, and conservation of wild orchids

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Orchids are best known for their horticultural value, but many wild orchid species also play important roles as foods and medicines, and in cultural and religious practices. However, little is known about patterns of harvest and trade of these species, nor about their conservation status. Drawing on a systematic review of the literature and research conducted by my lab and our collaborators, I (i) present examples key wild-harvested orchid species that are locally or globally culturally important, and then review what we know and don't know about (ii) trade dynamics and (iii) the ecological impacts of wild-harvest. By integrating knowledge of orchid ethnobotany, local trade patterns, and orchid population dynamics, I present and provide examples of conservation solutions in which wild orchid harvest and use are compatible with orchid conservation.

**Keywords:** Wild orchids, ethnobotany, trade dynamics, conservation, sustainable use.

## Saving Orchids - One Conference at a Time

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Of the estimated 31,500 described species of orchids worldwide, about half are now considered vulnerable to extinction. To conserve members of this remarkable plant family, scientists must overcome daunting challenges. Academicians have been told to ‘publish or perish’, but considering so many orchids face extinction, it is time to modify the phrase to read, “*Publish, but don’t let what you study perish*”. New techniques have emerged in recent years that have improved our ability to carry out, understand and conserve orchids. Conferences are often effective at bringing together experts to share their knowledge with others who are eager to learn more, and when we depart, we often feel upbeat and energized with a renewed sense of purpose. Yet, conferences have limited outreach because we may be ‘preaching to the choir’. To effectively conserve orchids, our message must reach a wider audience. This paper discusses how some modern techniques (*e.g.*, digital camera traps, amplicon sequencing) have enriched orchid conservation efforts in recent years, especially when blended with time-tested techniques, education and public outreach. The intent here is to remind conference attendees and readers that orchid conservation has its share of positives, not just negatives. Not everything is doom and gloom.

**Keywords:** conservation, digital camera traps, amplicon sequencing, pollination, mycorrhizal fungi.

## ORAL PRESENTATIONS

Tatiana Arias, et. Al.

Integrative Taxonomy and Phylogenomics of *Lepanthes* (Orchidaceae): Species Discovery, Flower Polymorphism, and Evolutionary Insights in the Northern Andes

Marie Selby Botanical Gardens

Tatiana Arias

Orchids for Peace: Bridging Biodiversity Conservation and Community Resilience in the Neotropics

Orchids for Peace Foundation, Research Group in Evolution, Systematics, and Conservation of Neotropical Epiphytic Orchids

Noelia Belfort Oconitrillo, et. Al.

Clarifying the true diversity of 'frog' *Pleurothallis* in Costa Rica

Lankester Botanical Garden, University of Costa Rica

Deborah Boersma

Sobralias The Exotic Ephemerals of Central and South America

American Orchid Society, Great Lakes Judging Center, Ann Arbor, Michigan

Ramón Alexis Calderón-Álvarez

Orchid-Phorophyte Interactions in Highly Transformed Landscapes in the Colombian Andean-Amazon Transition

Facultad de Ciencias Básicas, Universidad de la Amazonia, Florencia, Colombia

Frank Cervera

The Unique Ecology of the Non-Andean Species of *Phragmipedium* and the impact on conservation

Biology, Independent, Westtown, United States

Ian Chalmers

"Accepted species" Academic (DNA) vs "Practical"

Registrar NSW /Australian Orchid Council, Sydney, Australia - President of the Australasian Native Orchid Society

Alina Furtak

Beauty from the Andes: How two Andean orchids changed the slipper horticulture landscape Primary hybrids of *Phragmipedium kovachii* and *Phragmipedium besseae* Comparison Study

American Orchid Society Accredited Judge, Toronto Judging Centre, Canada

Aurora Garzón, Nelson Álvarez

The Cattleya trianae Orchidarium: A Space for the Development of Scientific Skills and Environmental Conservation at Francisco Torres León Educational Institution, Restrepo, Meta.

Francisco Torres León School Puente Amarillo Restrepo Meta Colombia

Heiko Hentrich, et al.

Legwork for pollination: orchid bees and the half-closed flowers of *Paphinia subclausa*

R.L.Dressler (Stanhopeinae)

Department of Molecular Cell Biology, Joseph Gottlieb Kölreuter Institute of Plant Science (JKIP), Karlsruhe Institute of Technology, Karlsruhe, Germany

Monika M. Lipińska

It takes two to tango... but does it really? Introducing the ORCHIDBIOM project

University of Gdańsk, Gdańsk, Poland

David R. Mathers

Ex situ Conservation: Caring for Six National Collections of Orchids

The Mathers Foundation

Hugo Medina, Jose Portilla, Juan Pablo Martínez

Expanding Orchid Diversity: Seventy-One New Species Described from Ecuador Between 2017 and 2025

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Ecuagenera

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Orchidarc, University of Tokyo, University of Sheffield

Camila Oderay Rodríguez Cabezas

Identification of Key Areas for the Conservation of Ecuador's Endemic Orchid Species Under Climate Change Scenarios: A Case Study of *Dracula trigonopetala* and *Dracula erythrodom*

Fundación EcoMinga, Quito, Ecuador

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The Orchid Conservation Alliance Invites Collaboration on Orchid Habitat Preservation

The Orchid Conservation Alliance, Encinitas, CA 92024, USA

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Somatic Embryogenesis of *Dracula vampira*, an Alternative for Its Propagation

Orquiplanet, Ibarra, Ecuador

Sascha Wetters, Heiko Hentrich, Boris Schlumberger

Phylogeny of *Paphinia* (Lindl.): First glance on the biogeographic and evolutionary history of a large-flowered epiphytic Andean orchid genus

Department of Molecular Cell Biology, Joseph Gottlieb Kölreuter Institute of Plant Science (JKIP), Karlsruhe Institute of Technology, Karlsruhe, Germany

Ricardo Zambrano Cevallos, Ariatna Villarreal Jaramillo

Protecting Andean biodiversity: ex situ conservation and research at the Quito Botanical Garden

Jardín Botánico de Quito

## **Integrative Taxonomy and Phylogenomics of *Lepanthes* (Orchidaceae): Species Discovery, Flower Polymorphism, and Evolutionary Insights in the Northern Andes**

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Recent field expeditions across five Andean regions of Colombia led to the documentation of 95 of the 377 *Lepanthes* species reported for the country, and the discovery of six species new to science. One of the most intriguing findings was a case of floral polymorphism previously misinterpreted as distinct species—*Lepanthes silverstonei* and *L. licrophora*—now recognized as intraspecific variants. In parallel, a plastome-scale phylogenomic study based on genome skimming and targeted gene amplification (matK, rITS) across newly sequenced and publicly available data clarified the evolutionary relationships within *Lepanthes*, with a focus on subgenus *Marsipanthes*. The plastomes analyzed (157,185–158,260 bp) revealed six hypervariable regions, including *ycf1*, with potential

DNA barcoding utility for this genus. Phylogenetic analyses exposed the non-monophyly of traditionally recognized subgenera, highlighting substantial morphological homoplasy confirmed through PCA. A well-supported clade composed of early-diverging taxa from the eastern Andes and a derived, poorly resolved polytomy of taxa from the Chocó region, indicate complex biogeographic and evolutionary histories. Together, these studies reinforce the importance of integrating field-based taxonomy and plastome phylogenomics to unravel the diversity and evolution of this hyper-diverse Neotropical genus. The results provide new species descriptions, refined taxonomic boundaries, and a framework for future evolutionary and conservation research.

**Keywords:** *Lepanthes*, Andes, plastome phylogenomics, flower polymorphism, taxonomy.

## **Orchids for Peace: Bridging Biodiversity Conservation and Community Resilience in the Neotropics**

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Orchids for Peace is a grassroots conservation initiative that uses Neotropical epiphytic orchids as flagship species to integrate biodiversity preservation with community-led resilience and sustainable development. Our approach is grounded in collaborative research and fieldwork across biodiversity hotspots, particularly the Andean-Amazonian foothills, where we have contributed to floristic inventories, species discovery, and conservation assessments. By combining in situ actions—such as the establishment of community reserves and orchid monitoring networks—with ex situ strategies like native orchid nurseries, seed banking, and micropropagation, we promote the recovery and sustainable use of threatened species. In parallel, Orchids for Peace implements training programs that empower youth, rural families, and Indigenous communities with skills in orchid horticulture, including manual pollination, seed viability testing, and tissue culture techniques. Our conservation model also fosters alternative livelihoods through responsible orchid cultivation, legal trade, and the co-creation of orchid-focused ecotourism experiences. These include interpretive trails, biodiversity field guides, and immersive educational activities that connect visitors with local ecosystems and cultures. Through ongoing partnerships with scientists, educators, and local leaders, the initiative supports *circa-situm* conservation practices rooted in traditional ecological knowledge, while leveraging modern genomic tools for conservation planning and prioritization. Orchids for Peace thus positions orchids not only as icons of biological beauty, but as catalysts for peacebuilding, environmental education, and bioeconomic innovation across the Neotropics.

**Keywords:** Bioeconomies, Orchid Conservation, Community-based Horticulture, Ecotourism, Neotropics.



## Clarifying the true diversity of ‘frog’ *Pleurothallis* in Costa Rica

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*Pleurothallis* is the fourth most diverse genus in the Pleurothallidinae, the most species-rich subtribe of Neotropical orchids. Over more than twenty years of systematic study, we have undertaken in Costa Rica a comprehensive revision of a taxonomically difficult group of *Pleurothallis*, the so-called "frog" complex. "Frog" *Pleurothallis* are mainly characterized by their small vegetative habits—specifically, plants with ramicauls shorter than 20 cm and leaves typically under 10 cm in length, and diminute flowers. So far, our study has revealed 26 species within this group, a significant increase from the six or seven species previously recognized in the region. This revision highlights the considerable underestimation of biodiversity in this group, emphasizing the difficulties in distinguishing species due to subtle morphological differences and the ephemeral nature of their floral structures. Our results suggest that the true diversity of "frog" *Pleurothallis* in Costa Rica is at least four times greater than previously recognized—a finding that could potentially be extrapolated across the Neotropics, revealing levels of speciation unimaginable with the current record. This work helps improve the understanding of this complex and taxonomically challenging lineage of tiny orchids.

**Keywords:** Biodiversity, Orchid taxonomy, Pleurothallidinae, Systematic revision.

## ***Sobralia*: Ephemeral Jewels of Central and South America -Exploring Trait Modeling and Conservation**

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*Sobralia*, a genus of orchids native to Central and South America, offers a compelling lens through which to explore ecological resilience, constrained diversification, and conservation strategies. With approximately 45 species documented in Ecuador alone, *Sobralia* exemplifies both botanical richness and vulnerability. This paper examines sustainable cultivation practices, trait-based restoration, and evolution-aware conservation approaches. Emphasis is placed on floral morphology and pollination strategies, which reveal cytogenetic diversity, niche conservatism, and pollinator-driven speciation—challenging climate-centric assumptions. Broad ecological patterns and habitat associations help clarify evolutionary timelines and species distributions. As habitat pressures intensify, species-specific conservation and ex situ cultivation become essential to ensure *Sobralia*'s continued presence in both natural ecosystems and curated collections. These orchids reflect biodiversity and embody the delicate interplay between adaptation and care.

**Keywords:** Hybridizing, conservation.

## **Orchid-Phorophyte Interactions in Highly Transformed Landscapes in the Colombian Andean-Amazon Transition**

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Epiphytic orchids of the neotropical region have generated a series of evolutionary adaptations that have allowed them to thrive in complex tropical ecosystems. Their diversity in the Andean-Amazonian region of Colombia is related to a series of vital interactions, in which host phorophytes stand out. In the Orteguaza River Basin (Caquetá-Colombia), an investigation was carried out to evaluate the mechanisms of association between orchids and their phorophytes in order to understand their host preferences and interaction dynamics in transformed landscapes. Forty-five orchid morphospecies were identified, being *Scaphyglottis stellata* Lodd. ex Lindl. As orchid host phorophytes 64 tree species were identified with *Helicostylis towarensis* (Klotzsch & H.Karst.) C.C.Berg harboring the highest number of orchids. Differences in orchid species richness were found according to the level of vegetation cover, and orchid preferences for phorophytes were related to the structure of the host tree and its bark. Regarding the network structure, a higher intensity of interactions between phorophytes and orchids was found in the low cover category, due to the lack of phorophytes that meet the requirements of orchids for their establishment. Areas with higher vegetation cover may have better habitat quality conditions with ideal phorophytes to be colonized by orchids.

**Keywords:** Caquetá, Orteguaza river basin, Diversity, Plant - plant interaction.

## **The Unique Ecology of the Non-Andean Species of *Phragmipedium* and the impact on conservation**

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*Phragmipedium* ecology throughout the Andes Mountains is relatively consistent due to several factors, including annual weather patterns, year-round rainfall, sunlight levels, and the topography of the Andes, which informs conservation efforts regarding how and where to establish conservation sites and enable *ex-situ* propagation programs. These consistencies include commonalities in the ecology of *Phragmipedium* species found across the Andes, from Southern Mexico to Peru. Three species of *Phragmipedium* can only be found outside the Andes and present unique challenges in establishing and maintaining *ex-situ* conservation programs and horticultural breeding initiatives intended to alleviate pressure on natural populations. Each inhabits an ecosystem unique to its species concept. Importantly, these three species do not share ecological commonalities with any other *Phragmipedium* species. The species are *Phragmipedium vittatum*, *Phragmipedium lyndleyanum*, and *Phragmipedium klotzchianum*.

This study aimed to quantify and understand the unique ecology of various species of *Phragmipedium*. What makes each habitat ecologically distinctive, and how can we leverage our findings to inform and support *ex-situ* conservation and propagation programs? Lastly, a confusing and often contradictory taxonomic classification of *Phragmipedium lyndleyanum* was evaluated against natural populations. Natural populations revealed errors in our taxonomic classification of that species, necessitating its reclassification under a single name. To achieve these goals, the known habitats of each *Phragmipedium* species found only outside the Andes were visited and studied over a period of thirty (30) years. Ecological indicators were assessed, along with the annual weather cycle and local geography and compared to their Andean cousins. Non-Andean *Phragmipedium* are seasonal and partially xerophytic, setting them apart from their Andean counterparts not only by geography and

vast distances but by significant differences in overall light levels, rainfall, and temperature, as well as by unique ecological distinctions inherent to each species concept. An expanded sample size, combined with direct in-situ observations of natural populations of *Phragmipedium lyndleyanum*, *Phragmipedium sargentianum*, and *Phragmipedium kaieteurum*, did not support the previous taxonomic classification, leading to the synonymization of *Phragmipedium sargentianum* and *Phragmipedium kaieteurum* with *Phragmipedium lyndleyanum*.

**Keywords:** *Phragmipedium*, ecology, biology, taxonomy, habitat, conservation.

## “Accepted species” Academic (DNA) vs. “Practical”

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The system of binomial nomenclature was introduced by Carl Linnaeus to introduce a protocol to enable each, and every organism would have one scientific name which would be used by everyone to identify an organism. It was intended to be standardized naming system to be used by everyone to identify an organism.

Definition: A species is an organism belonging to a group, or populations of individuals, sharing common features and/or ancestry, generally the smallest group that can be readily and consistently recognized. *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code)*.

The traditional method of identifying orchids is by using morphology, more recently the emphasis has been on DNA. The DNA studies identify the common ancestry relationships to develop clades of relationships.

The issues and confusion are caused by the lack of consensus on the method of defining the groupings of genera and species.

The process tries to put species into neat boxes however orchids don't fit into neat boxes, in many cases one species merges into the next with many integrates occupying the area of overlap. In reading the DNA reports very little is commented on the variation within a species or where on the continuum each sample exists.

The current academic interpretation of DNA is leading to proposals sink some genera to make larger genera greater numbers of species. This process has not been applied consistently with multiple species being lumped into *Dendrobium* and *Bulbophyllum* while splitting *Eria*. The lumping of species into *Coelogyne*, *Lycaste*, *Calanthe* and *Eulophia* is not helpful and creates a lack of clarity.

Many of the amalgamations are contrary to the experience and knowledge of growers and breeders, this creates confusion and arguments, the binomial system is supposed to reduce confusion.

Any proposals to change nomenclature needs to consider the users of the system and how the nomenclature is used.

**Keywords:** Species, Morphology, DNA.

**Beauty from the Andes: How two Andean orchids changed the slipper horticulture landscape Primary hybrids of *Phragmipedium kovachii* and *Phragmipedium besseae* Comparison Study**

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This comparison study investigates the impact of two Andean orchid species, *Phragmipedium besseae* and *Phragmipedium kovachii*, on the development of the *Phragmipedium* genus through hybridization. By analyzing primary hybrids of these species, we assess their current contributions and future potential for breeding within the genus and preservation of their genetic material. The research examines the diverse color forms of *Phragmipedium besseae* and *Phragmipedium kovachii* hybrids, exploring their genetic trait inheritance and prospects for future hybridization programs. Our findings reveal how these species have introduced vibrant, previously unavailable colors, sparking renewed interest in *Phragmipedium*, and increased awareness of the endangered habitats they occupy.

**Keywords:** Phragmipedium hybrids, hybridization, conservation, trait inheritance.

## **The *Cattleya trianae* Orchidarium: A Space for the Development of Scientific Skills and Environmental Conservation at Francisco Torres León Educational Institution, Restrepo, Meta**

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The research project “*Cattleya trianae* Orchidarium” has been conceived as a pedagogical space to foster scientific competencies at Francisco Torres León Educational Institution (Puente Amarillo), located in Restrepo, Meta, Colombia. Its purpose is to raise awareness among teachers, students, and parents about environmental conservation, biodiversity, and the significance of orchids in the ecosystem. Orchids are vascular plants with high ecological and aesthetic value, known for their complex floral architecture and mechanisms for attracting pollinators. The term “orchid” comes from the Greek “orchis” (testicle) and “idea” (form), referring to the similarity of their pseudobulbs to the reproductive organs of bulls, a concept used as a pedagogical tool in teaching. This project arises in response to the need to protect orchids from threats such as illegal trafficking, deforestation, indiscriminate use of insecticides, and agricultural expansion, factors that have affected their natural reproduction. Since 2015, the orchidarium has been driven by the collaboration of the educational community, including teachers, students, and parents, who have developed pedagogical strategies for studying and conserving Colombia's national flower. Regarding its methodology, the project is based on action research with a mixed approach (qualitative and quantitative). Through living scenarios, students receive theoretical and practical training, strengthening their environmental awareness and respect for biodiversity. Teaching is structured around topics such as ecology, taxonomy, habitat, pollination, conservation, and orchid cultivation. Since 2025, the process has been extended to 4th-grade students, incorporating workshops and educational outings to reinforce scientific skills such as observation, inquiry, and creativity. This strategy has facilitated interdisciplinary integration with subjects such as literature, English, natural sciences, mathematics, social sciences, and art. The “*Cattleya trianae* Orchidarium” has become a pedagogical benchmark in the region,

promoting environmental education and generating a positive impact on the community. Its innovative approach transforms learning into a meaningful experience, driving nature conservation and the development of a sustainable environmental culture.

**Keywords:** orchidarium, scientific skills, environmental conservation, educational project.

## Legwork for pollination: orchid bees and the half-closed flowers of *Paphinia subclausa* R.L.Dressler (Stanhopeinae)

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*Paphinia* Lindl. is a small orchid genus in the *Stanhopeinae* subtribe. In contrast to other orchids in the subtribe, most *Paphinia* flowers do not smell to humans. Nevertheless, male orchid bees (Euglossini) have been observed collecting VOCs at the flowers and are assumed to be their pollinators. We studied the reproductive biology of a *P. subclausa* population in the Palo Seco Forest Reserve, Changuinola, Panama (740 m asl). Together with *P. seegeri*, *P. subclausa* stands out in the genus due to its half-closed flowers. The question was therefore whether the plants have a different pollination mechanism than the other species in the genus. We carried out an inventory of the population and observed the floral visitors (20 hours at six days from 9:30-12:30 AM). Flowers were examined under a SEM and stained in neutral red to localize the scent-emitting tissue. We counted 31 adult and about 30 juvenile plants. Ten plants produced flowers (1-4; Median: 2), 19 plants produced fruits of different ages (1-3 per infructescence; Median: 1). Fruit set was high (0-100 %; Median: 67%). Flower visitors (n = 43 visits) were *Euglossa dodsonii*, *E. gorgonensis* (83,7 %; indistinguishable from each other during observations), *E. allosticta* (11,6 %), and *E. imperialis* (4,7 %). The bees landed on the tepals and either entered the flowers from above via the cilia of the lip or from below via the column. VOC-collecting behavior was observed at the axial and abaxial side of the tepals and the callus appendages, but had a main focus on the cilia of the lip, the proximal part of the column, and the column foot. Pollination was not observed, but an *E. dodsonii* or *E. gorgonensis* bee carried a *Paphinia* pollinarium at the femur of its right hind leg with one pollinium missing. We therefore suggest a pollination mechanism where the bee picks up the pollinarium when crawling on the column for collecting VOCs at the column base and the column foot. This does not exclude the possibility of a pollination mechanism such as in *P. cristata* with a transfer of the pollinarium on the scutellum. The results were supported by

the micromorphological examinations. All flower parts, where the bees were observed collecting VOCs-stained red. Cilia of the lip, callus appendages, column, and column foot featured papillose osmophore tissue. The base of the column and the column foot had the largest papillae with the highest density.

**Keywords:** Euglossini, floral micromorphology, osmophores, perfume orchid, reproductive success.

## **It takes two to tango... but does it really? Introducing the ORCHIDBIOM project**

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For a long time, plants were regarded as isolated organisms, functioning independently within their ecosystems. However, advances in ecology and plant biology have revealed a far more intricate reality—plants exist in complex networks of interactions with other life forms, including fungi, bacteria, and insects. These relationships are essential, as microorganisms can profoundly influence plant physiology, growth, reproduction, and even geographic distribution. Among these interactions, one area of increasing interest is the floral microbiome, the diverse community of bacteria and fungi that reside within flowers. Traditionally, pollination was viewed as a relatively straightforward process, involving the direct interaction between plants and their pollinators. However, recent research has shown that pollination is far more intricate, with the floral microbiome playing a significant role. Microorganisms can alter a flower's attractiveness by modifying its scent, nectar composition, and even structural characteristics, ultimately influencing pollinator behaviour. Understanding the role of the floral microbiome in pollination is crucial for unravelling the complexities of plant reproduction and species interactions. Orchids, in particular, exemplify the complexity of pollination systems. These plants have evolved an extraordinary diversity of reproductive strategies, making them an ideal model for studying plant-pollinator interactions. Despite their popularity among scientists and enthusiasts alike, many aspects of orchid pollination—especially in tropical regions—remain poorly understood. One fascinating mode of pollination in orchids is ornithophily, or bird pollination, which is often associated with flowers that are red or orange, bell-shaped, and rich in sucrose but lacking strong scent and nectar guides. It is widely hypothesized that bird pollination evolved from bee pollination, yet the ecological and evolutionary factors driving this transition remain unclear. Our research aims to investigate these dynamics by characterizing and comparing

the floral microbiomes of bee- and bird-pollinated orchids. By analyzing how microbial communities influence floral chemistry, nectar properties, and pollinator visitation patterns, we seek to better understand the mechanisms underlying these pollination systems. Through extensive fieldwork and laboratory analyses, we hope to uncover the evolutionary pressures that shape floral traits and microbial assemblages in different pollination syndromes. Ultimately, our findings will provide valuable insights into the ecology and conservation of orchids, shedding light on the broader role of floral microbiomes in orchid reproduction and biodiversity.

**Keywords:** floral microbiome, melitophily, orchids, ornithophily, pollination.

## ***Ex situ* Conservation: Caring for Six National Collections of Orchids**

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Opened in 2019, The Mathers Foundation, a registered UK charity (aka ‘not for profit’) is responsible for six of the UK’s National Plant Collections®: *Oncidium*, *Pleione*, *Stanhopea* & *Acineta*, *Anguloa*, *Masdevallia* and *Cymbidium*. The plants are grown in ~1,000 sq. m. of greenhouse space in Sussex, England, divided into six different climatic zones under computer control of the heating, shading, venting and fogging systems. Heating is provided by biomass boilers and air source heat exchangers while rainwater capture ensures that the nursery is largely self-sufficient in its water usage. Climate change is resulting in increased environmental pressure from longer, hotter Summers in England, necessitating greater use of under and overbench fogging systems and other glasshouse adaptations, as well as increased rainwater storage. For each genus, TMF looks to maintain multiple plants of as many of the species as possible, as well as a representative sample of the key hybrids. Plants are propagated aymbiotically in our laboratory and surplus plants are sold to raise funds, as well as being donated to botanic gardens. Details of the plants are logged in the Persephone database maintained by Plant Heritage, the UK charity under the patronage of His Majesty King Charles III that oversees the UK’s 700 National Plant Collections®. Our work was recognised last year by Plant Heritage with the Brickell Award for excellence in cultivated plant conservation. The Foundation also supports *in situ* conservation with an annual donation to the La Reserva Orquideas maintained by the SCO in Colombia.

**Keywords:** *Oncidium*, *Pleione*, *Stanhopea*, *Anguloa*, *Masdevallia*, *Cymbidium*, Plant Heritage, Persephone, *ex situ*, conservation, culture.

## **Expanding Orchid Diversity: Seventy-One New Species Described from Ecuador Between 2017 and 2025**

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Ecuador remains one of the most orchid-diverse countries on Earth, owing to its complex topography, varied climates, and exceptional number of microhabitats. Between 2017 and 2025, a total of 71 new orchid species have been formally described through the collaborative efforts of researchers, field botanists, and institutions committed to conservation and taxonomy. This presentation highlights the progress made during this period, underscoring the importance of continuous exploration and documentation in biodiversity hotspots.

The discoveries span a broad range of ecosystems, from coastal regions to high-altitude forests and lowland Amazonia, reflecting the adaptive radiation and ecological specialization that characterize Ecuador's orchids. Many of these species exhibit highly restricted distributions and specific habitat requirements, reinforcing the role of geographic and climatic factors in shaping patterns of endemism.

Through sustained scientific work and the support of private conservation initiatives, such as those led by Ecuagenera and the Fundación Ángel Andreetta, it has been possible to integrate taxonomy with long-term conservation strategies. The recent launch of the scientific journal *Andreettana* in 2025 has further enabled the formal publication of new species, contributing to the broader understanding of Ecuador's botanical richness and emphasizing the urgency of protecting fragile ecosystems under increasing threat from environmental change.

**Keywords:** Orchidaceae, Ecuador, biodiversity, taxonomy, conservation.

## ***Catasetum dupliciscutula* Senghas (1991): A Bolivian Jewel of the Genus *Catasetum***

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*Catasetum dupliciscutula* Senghas (1991) is a rare and emblematic orchid species of the subtribe Catasetinae, native to Bolivia and northern Brazil. This study highlights its taxonomic position, distribution, morphological traits, and conservation relevance. The species is epiphytic, typically found in Amazonian forests at elevations of 500–600 meters. It develops fleshy pseudobulbs, deciduous leaves, and exhibits floral sexual dimorphism, with male and female flowers differing in shape and coloration. Due to its restricted distribution and the growing threat of deforestation in the Amazon basin, *C. dupliciscutula* is rarely observed in cultivation and remains poorly represented in collections. Its rarity and ornamental appeal make it a species of high scientific and horticultural value. Promoting its study and propagation is key to safeguarding Bolivian biodiversity and reinforcing the role of orchids as ambassadors of Andean natural heritage.

**Keywords:** *Catasetum dupliciscutula*, Bolivian orchids, Amazon Forest, epiphytic orchids, orchid biodiversity, conservation, Catasetinae, rare species, orchid morphology, orchid cultivation.

## **Cloud Forest Treasures: New Orchid Discoveries and Conservation Priorities in Northwestern Ecuador**

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The cloud forests of northwestern Ecuador, particularly in the provinces of Carchi and Imbabura, are renowned for their remarkable plant richness and high levels of endemism, especially in Orchidaceae. This region, however, is under increasing pressure from agricultural and livestock expansion, mining activities, and the illegal wildlife trade, which threatens its ecological integrity. Between 2018 and 2024, botanical expeditions were conducted in two private conservation areas managed by Fundación EcoMinga: the Dracula Reserve and the Río Manduriacu Reserve. These expeditions employed the rapid botanical inventory approach developed by the Field Museum, which involves short, intensive fieldwork in underexplored areas, with a focus on the collection, photographic documentation, and preliminary identification of species across diverse habitats. In the Dracula Reserve, over a decade of research has contributed to an updated inventory of 352 orchid species. From 2018 to 2024, four species new to science were described (*Lepanthes tulcanensis*, *Pseudolepanthes bihuae*, *Platystele finleyae*, *Pleurothallis markgruinii*), and five additional species previously known only from Colombia were recorded in Ecuador for the first time, expanding their known distribution ranges. In the Río Manduriacu Reserve, 60 orchid species have been documented since 2018, including two new species (*Masdevallia purocafeana* and *Lepanthes inesmanzanoae*). These findings reaffirm the importance of these reserves as critical refuges for orchid diversity and endemism. Continuous floristic documentation, particularly of hyperdiverse groups like orchids, is essential to guide conservation strategies, inform public policy, and raise awareness of the need to protect cloud forest ecosystems. The difference in species richness between the two reserves highlights the need to strengthen research in under-surveyed areas and replicate similar studies in other ecologically comparable zones in northwestern Ecuador, many of which remain unexplored.

Expanding these efforts could significantly contribute to the recognition and preservation of Andean biodiversity amid ongoing anthropogenic pressures.

**Keywords:** field exploration, orchid conservation, plant diversity, rapid inventory, biodiversity assessment, underexplored ecosystems.

## Native orchids in a city—orchid conservation in Singapore

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Over the last two centuries, Singapore’s landscapes have been transformed almost beyond recognition, with only small remnants of primary forest left standing. This dramatic habitat loss has already cost an estimated 34% of the nation’s vascular plant species. Orchids have suffered more than most plants. Once boasting a remarkable flora of 224 orchid species in 78 genera, Singapore now retains just 76. Yet the story is not one of decline alone: species once thought extinct have been rediscovered, and new national records continue to emerge, showing that even the tiniest forest fragments can safeguard surprising levels of diversity. Still, the long-term outlook remains uncertain, as the drivers of extinction debt—habitat requirements, population dynamics, pollinator availability and germination conditions—are still poorly understood.

Conservation therefore requires an active approach. Through the National Parks Board’s Native Orchid Conservation and Reintroduction Programme and Species Recovery Programme, the Singapore Botanic Gardens has propagated many of the country’s rarest orchids previously only known from a few individuals. These species, along with species that are already nationally extinct, are now being reintroduced into both streetscapes and nature reserves, where some have found new roles as contributors to the urban aesthetic. Parallel efforts continue to map their distributions and strengthen ex situ collections. With forest fragmentation accelerating across the tropics, Singapore provides an early case study: a glimpse of how orchid diversity can collapse under extreme pressure, but also of how determined management can give even the smallest populations a fighting chance.

**Keywords:** habitat loss, Singapore, native orchids.

## Asymbiotic *in vitro* culture of six understudied native orchid species from Ecuador

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The Orchidaceae family, one of the most diverse among vascular plants, faces a population decline that necessitates the development of efficient conservation methods. The *in vivo* germination of orchid seeds is a well-known challenge due to the absence of endosperm, strict mycorrhizal association, and specific nutritional requirements. Therefore, asymbiotic *in vitro* culture using media with varying nutritional compositions is proposed. In this study, six native orchid species from Ecuador *Caucaea olivacea*, *Oncidium pentadactylon*, *Govenia tingens*, *Epidendrum jamiesonis*, *Elleanthus capitatus*, and *Pleurothallis pulchella* were examined to evaluate the optimal culture medium for their germination and vegetative development. For all species, the following media were tested: Phytamax (Phy), modified Murashige & Skoog (MS), and Knudson-C (KC), with or without activated charcoal (AC) and gibberellic acid (GA<sub>3</sub>) for seed germination.

For subsequent development, the culture media that yielded the best germination results for each species were employed. In the case of *O. pentadactylon*, *G. tingens*, and *C. olivacea*, the best results were obtained with Phy medium, achieving average germination rates of 98.6%, 87.2%, and 91.7%, respectively. Conversely, the most effective media for *E. jamiesonis*, *P. pulchella*, and *E. capitatus* were KC + AC (72.9%), ½ Murashige & Skoog (AM) (33.2%), and KC + AC + GA<sub>3</sub> (58.8%), respectively. During the subsequent development stage, regardless of the culture medium used, only between 15% and 30% of the formed protocorms succeeded in developing into seedlings across all species. This result is particularly significant given the limited development these plants exhibit under natural conditions. This research highlights the potential of asymbiotic *in vitro* culture for understudied orchid species in Ecuador and underscores the need for further exploration of

the factors involved in their development for research, propagation, and conservation purposes.

**Keywords:** orchids, native species, *in vitro* culture, asymbiotic germination.

## A subgeneric reclassification of *Masdevallia* (Orchidaceae: Pleurothallinidae) based on genetic data

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The horticulturally important genus *Masdevallia* is one of the most species-rich groups in the Pleurothallidinae (Orchidaceae) subtribe. Historically, species assigned to the genus have been classified under various, sometimes conflicting, generic and sub-generic systems. None of which have been supported by molecular data, prompting instability in the nomenclature of this challenging group of species. In this study, we evaluate the phylogenetic position of 124 species of *Masdevallia* based on ITS sequences and matk sequences analyzed using Bayesian inference and maximum likelihood. Previously proposed generic and subgeneric segregates are evaluated and mostly found to be inconsistent and non-monophyletic. Both the Bayesian inference and Maximum Likelihood analyzes reflect little support for most *Masdevallia* segregates. Phylogenetic relationships are found to be highly correlated with geographic distribution, while floral morphology is often found to result from convergence rather than relatedness. Genus *Masdevallia* is recircumscribed in a broad sense, with highly supported clades prompting the recognition of 4 subgenera and 15 sections established based on their phylogenetic relationships, carefully redified using morphological and ecological features. Biogeographically the "true *Masdevallias*" *Masdevallia* have been located in the Andes, so it would be better to segregate the genus so that *Masdevallia* is exclusive to the Andes.

**Keywords:** Andean orchids, Carlyle August Luer, *Diodonopsis*, Biogeographic distribution.

## Innovative Hybridization of Orchids: Navigating Pollination Barriers and Cultivation Techniques for Commercial Varieties

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The hybridization of orchids stands at the intersection of botanical science and horticultural innovation. Overcoming reproductive barriers between genera, managing micropropagation, and cultivating viable hybrids requires a sophisticated understanding of orchid biology and long-term technical commitment. This presentation highlights the achievements of Ecuagenera in developing complex artificial hybrids, including trigeneric and miniature taxa, many of which are now formally registered in international databases.

Hybrid development often involves navigating significant biological challenges such as intergeneric incompatibility, pollination difficulty, seed viability, and demanding cultivation requirements. The successful creation of complex hybrids—including those combining genera with drastically different floral morphologies and ecological needs—demonstrates a high level of technical precision. Moreover, the hybridization of miniature orchids (e.g., *Lepanthes*, *Stelis*, *Platystele*) presents additional hurdles due to the microscopic size and fragility of the flowers, requiring advanced manual pollination techniques and controlled flasking protocols.

Among Ecuagenera's registered achievements are hybrids such as *Paphinopea* 'Ecuagenera', *Dracuvallia* 'Gualaquiza', and *Lepanthes* 'Andean Flame', which exemplify the company's capacity to overcome complex genetic and physiological obstacles. These efforts not only contribute to ornamental horticulture and commercial markets but also to the conservation and study of Andean biodiversity, as many of the parental species are native to threatened habitats.

This presentation offers an overview of hybridization strategies, technical barriers, and solutions applied in Ecuagenera's breeding program, reinforcing the importance of innovation in both scientific and commercial orchid cultivation.

**Keywords:** Orchid hybridization, intergeneric crosses, Ecuagenera, micropropagation, horticultural innovation.

## Diversity and Evolution of Bioadhesives in Orchidaceae: A Physicochemical Approach to Viscidium Functionality

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Adhesion is a crucial biological mechanism in plant survival and reproduction. Within Orchidaceae, adhesion plays a central role in pollination through the viscidium, a specialized bioadhesive structure enabling pollen transfer. While the ecological and morphological dynamics of orchid pollination are well-studied, the viscidium's material composition and mechanical diversity remain poorly understood. This study aims to understand the chemical and mechanical characteristics of the viscidium and viscarium. It investigates the adhesives of 17 orchid genera via Fourier-transform infrared spectroscopy (FTIR) and tensile testing. Results identify four distinct adhesive categories: lipid-based (e.g., *Phalaenopsis*), polysaccharide-based (e.g., *Galeandra*), mixed-composition (e.g., *Vanda*), and thermal phase-changing adhesives (e.g., *Acineta*). Each displaying genus-level chemical conservation and variable mechanical performance. Lipid-based adhesives exhibit viscoelastic, reusable properties, while thermal adhesives show temperature-dependent behavior akin to glass transitions. The mechanical diversity among adhesives is not strictly correlated with pollinator type or environment, suggesting genetic constraints and floral development patterns are stronger drivers. These findings underscore the functional evolution of orchid adhesives, offering potential templates for biomimetic materials with tunable adhesion and environmental responsiveness.

**Keywords:** Orchidaceae, viscidium, bioadhesion, FTIR spectroscopy, biomimicry.

# Identification of Key Areas for the Conservation of Ecuador's Endemic Orchid Species Under Climate Change Scenarios: A Case Study of *Dracula trigonopetala* and *Dracula erythrodrom*

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The orchids *Dracula trigonopetala* and *Dracula erythrodrom* are endemic to Ecuador and are found in conservation areas such as the Río Manduriacu Reserve, Junín, Bosque Protector Los Cedros, and Reserva Drácula, located in the provinces of Carchi and Imbabura in the Tropical Andes of the western mountain range. However, climate change, habitat loss, illegal species extraction, extractive activities such as legal and illegal mining, and land-use change threaten their conservation. This study models the current and future distribution of *Dracula trigonopetala* and *Dracula erythrodrom* under climate scenarios RCP 4.5 and RCP 8.5 to identify key areas for their conservation.

The objectives of this research are to model the potential distribution of *D. trigonopetala* and *D. erythrodrom*, assess the impact of climate change on their habitat, and identify priority areas for conservation. MAXENT software was used to model the distribution of the species using presence data, and bioclimatic and biophysical variables were considered under the SSP126 and SSP585 scenarios. Model quality was evaluated using the AUC curve and True Skill Statistics (TSS).

The results generated allowed for the identification of key distribution areas for these critically endangered species, located in ecosystems where climatic and ecological conditions are more stable. The tools used will help identify and establish priority areas for research and conservation through the application of Geographic Information Systems (GIS).

**Keywords:** *Dracula trigonopetala*, *Dracula erythrodrom*, climate change, conservation, species distribution modeling.

## **The Orchid Conservation Alliance Invites Collaboration on Orchid Habitat Preservation**

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The Orchid Conservation Alliance (OCA) was established in 2004 as a California corporation with federal tax- exempt status. The organization is based on developing a membership of orchid growers concerned about orchid conservation and the ongoing destruction and degradation of orchid rich habitats around the world. The focus of the OCA is to collaborate with local partners to purchase and conserve land in orchid rich regions of the world. We donate funds to foundations and organizations based in countries where desirable habitat is located to help them purchase land and obtain permanent, legal conservation status. As of March 2025, we have raised and contributed nearly USD 858,000 to conserve over 5100 acres (2060ha) of orchid rich habitat. To date, we have supported reserves in Ecuador, Colombia and Brazil, but we are not limited to those geographic locations. We are interested in hearing from non-profit organizations about opportunities for creating or expanding orchid reserves. Through our website, please tell us about your organization, what you will be protecting, where you are working, and how you will manage protection of the orchid habitat. Note that we do not fund reforestation, reintroduction of orchids, applications from an individual, or applications for establishment of nurseries or businesses. Comprehensive details regarding the activities of the OCA, including fundraising initiatives, project support applications, Orchids in the Wild Ecotours, and information on our board of directors, are available on our website.

**Keywords:** Orchid habitat, orchid habitat protection, conserving orchid habitat, orchid habitat funding, orchid eco-tourism, orchid tourism.

## Somatic Embryogenesis of *Dracula vampira*, an Alternative for Its Propagation

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*Dracula vampira* is an endemic orchid from Ecuador, highly valued by orchid enthusiast and conservationist. However, its propagation is challenging due to its reliance on a specific pollinator and mycorrhizal fungi for seed germination. This study explores somatic embryogenesis as a potential *in vitro* propagation strategy. Leaf explants and protocorms from *in vivo* and *in vitro* plants, respectively, were used. Leaves were surface-sterilized with sodium hypochlorite (NaClO) at concentrations of 0.5%, 1%, and 2% for different exposure times. Protocorms, being derived from sterile culture media, did not require disinfection. Cultures were established on modified ½ Murashige & Skoog medium with different cytokinin and auxin treatments. Explant survival, embryogenic callus formation, and somatic embryo production were evaluated. Results indicated that sterilization with 0.5% NaClO for 20 minutes was the most effective for maintaining explant viability. Leaf explants failed to develop viable structures leading to somatic embryos, whereas protocorms successfully formed embryogenic callus within 28 days and generated somatic embryos in 100 days. The best developmental response was observed in cultures supplemented with 2 mg/L 2,4-D and 2 mg/L BAP. These findings suggest that somatic embryogenesis from protocorms is a viable approach for the *in vitro* propagation of *Dracula vampira*, offering potential applications for its conservation and large-scale production.

**Keywords:** Conservation, In Vitro, Orchid, Tissue Culture, Explants, Protocorms, Cytokinins, Embryogenic Callus.

## Phylogeny of *Paphinia* (Lindl.): First glance on the biogeographic and evolutionary history of a large-flowered epiphytic Andean orchid genus

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With currently 16 accepted species, the genus *Paphinia* (Lindl.) is one of the smallest genera in the Neotropical subtribe *Stanhopeinae*, but, when completely spread, *Paphinia*-flowers are among the largest in the whole orchid family. *Paphinia* species are distributed from Costa Rica to Brazil and grow in very wet but well-ventilated habitats, from the lowlands up to mountain forests at 1500 m above sea level. The genus has its greatest biodiversity in the Andean border region between Ecuador and Colombia with several endemic species, while two species from the Amazon basin display a relatively large distribution area. To date, there is no molecular phylogenetic framework for this genus. We therefore apply DNA-barcoding markers to our *Paphinia* library to infer the phylogenetic relationship and evolutionary history of this orchid genus. A significant split into East- and West-Andean groups was observed in both, nuclear (*internal transcribed spacer* (ITS)) and plastidic (*psbA-trnH*, *rbcLa*, *ycf1b*) phylogenies, reflecting the geographic distribution of *Paphinia* species. The plastidic regions show only low diversification rates, however, we were able to resolve the relationship of *Paphinia* taxa to the species level using the nuclear ITS region. The geographically isolated Costa Rican species *P. subclausa* is phylogenetically located within the West-Andean group (including *P. neudeckeri* and *P. hirtzii*) and displays a more distant relation to the East-Andean group (including *P. cristata* and *P. herrerae*). We further uncovered that closed flowers (in *P. seegeri* and *P. subclausa*) do not share a common ancestor but have rather evolved twice independently in the genus. Based on this first phylogenetic framework for the genus *Paphinia* and the positioning of Costa Rican species *P. subclausa*, we calibrated the ITS-phylogeny to the Isthmus of Panama and hereby estimate the evolutionary age of *Paphinia* to a maximum of 6,5 million years and carefully discuss putative evolutionary origins and possible spreads to extant distribution of the genus.

**Keywords:** *Paphinia*, Flower Morphology, Phylogeny, Evolution, Biogeography, Plant-Pollinator-Interaction, Orchid.

## **Protecting Andean biodiversity: ex situ conservation and research at the Quito Botanical Garden**

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The Quito Botanical Garden serves as a key center for scientific conservation and environmental education focused on Ecuador's native flora. Since 2022, with support from Botanic Gardens Conservation International, the garden has led an ex-situ conservation initiative targeting species from the Ecuadorian Cloud Forest, an ecosystem of exceptional biodiversity increasingly threatened by deforestation, illegal mining, and unregulated agriculture. The project seeks to raise public awareness of the ecological value of these forests while establishing a representative living collection under controlled conditions. Expeditions conducted in the cloud forests of Nono, Mashpi, and Cosanga led to the collection of 254 specimens from 20 botanical families, mainly Orchidaceae, Araceae, and Bromeliaceae. Among the most significant outcomes was the discovery of four undescribed species of Araceae. These plants were propagated and incorporated into the Montane Orchid House, accompanied by informative displays addressing their taxonomy, ecology, distribution, and ecological roles. Species-specific propagation protocols were developed and tested, yielding promising results in germination, acclimatization, and long-term cultivation. These advances provide valuable knowledge for future conservation efforts and possible species reintroduction programs. This initiative has reinforced the role of the Quito Botanical Garden as a living laboratory for threatened montane flora and as an educational platform that bridges science and public engagement in the heart of Ecuador's capital.

**Keywords:** Native plants, greenhouse cultivation, field collection, plant diversity, public education.

## POSTER SESSIONS

Frank Cervera

*Phragmipedium caricinum*; Clarification of One-Hundred Fifty Years of Confusion and Errors  
Biology, Independent, Westtown, United States

James Keach

Use of invasive tropical tree species as orchid substrate  
Department of Tropical Plant & Soil Sciences, College of Tropical Agriculture & Human  
Resilience, University of Hawai'i – Mānoa

Juan Pablo Martínez, José Portilla, Hugo Medina

Beyond Orchids: Integrated Conservation in Ecuador's Private Reserves from the Coast to the  
Amazon  
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Andreettana: A New Platform for Research and Conservation of Neotropical Biodiversity  
Ecuagenera, Fundación Ángel Andreetta

Amanda Fricensaft Baracat, et al.

Combining Distribution Models of Orchids and Their Pollinators to Map Gaps in the Knowledge of  
Ecological Interactions  
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E-Pollinaria: A modern system for documenting and using orchid pollinaria.

Franco Pupulin & Grettel Salguero.  
Lankester Botanical Garden, University of Costa Rica

Andres E. Ramos Roldán<sup>1</sup>, Adam P. Karremans<sup>2</sup>, David A. Gregory<sup>3</sup>, Chris Holland<sup>3</sup>

Characterisation of Novel Lipid-based Adhesives from Orchidaceae

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<sup>2</sup>(Universidad de Costa Rica)

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Ana Beatriz Rintá Piñeros

Orchidarium, a Strategy to Bring Scientific knowledge Closer to the School Population

Francisco Torres León School Puente Amarillo Restrepo Meta Colombia

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Scientific Illustration and Anatomical Dissections as Tools for the Taxonomic Description of New  
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University of Costa Rica, San José, Costa Rica

Ricardo Zambrano Cevallos

Unveiling the elevational dynamics of *Anthurium* in the Andean Chocó

Jardín Botánico de Quito

## ***Phragmipedium caricinum*; Clarification of One-Hundred Fifty Years of Confusion and Errors**

Frank Cervera

*Phragmipedium caricinum* has become rare in cultivation. Once common at orchid exhibitions and in botanical gardens, this species has nearly vanished from collections, commercial offerings, and *Phragmipedium* breeding lines. Many plants marketed as *Phrag. caricinum* and seen in private and public collections are hybrids or mislabeled. The flowers are generally larger and darker than those of the commonly seen *Phrag. pearcei*, boasting a taller, more upright inflorescence that branches more freely. Thus, this species holds significant untapped potential, which could greatly benefit *Phragmipedium* breeding programs and the greater *Phragmipedium* community. Not rare in its natural habitat, *Phragmipedium caricinum* is not particularly difficult to cultivate. *Phrag. caricinum* is part of section *Phragmipedium*, subsection *Himantopetalum*, alongside closely related sister species such as *Phrag. hirtzii*, *Phrag. pearcei*, *Phrag. cabrejosii*, *Phrag. richteri*, and *Phrag. klotzschianum*. Perhaps due to its rarity in cultivation, *Phrag. caricinum* has not yet been categorized into multiple distinct species or natural hybrids. However, *Phragmipedium caricinum* does have a very limited natural range and ecology that complicate *ex-situ* conservation efforts. Its known natural habitats are increasingly encroached upon by humans seeking more space and natural resources.

This study aimed to examine in detail one hundred fifty years of literature concerning this species, literature which contains contradictory statements and errors regarding its definition, natural range, and biology, while remaining silent on its ecology and topography. A thirty-year study of natural populations of *Phrag. caricinum* provided a definitive means to quantify what *Phrag. caricinum* truly is. Errors in the literature are highlighted to ensure that future generations of botanists and taxonomists do not repeat them. Additionally, the unique ecology and habitat of this species were investigated and documented, allowing for a better understanding of the restrictive nature of its habitat range. This knowledge seeks to empower

both *ex-situ* conservation programs and commercial breeding efforts to alleviate pressure on natural populations.

**Keywords:** *Phragmipedium*, ecology, biology, taxonomy, habitat, conservation.

## Use of invasive tropical tree species as orchid substrate

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The majority of the international commercial orchid trade is epiphytic orchids, many of which grow on trees in their native habitats. In cultivation many are grown using wood chips or bark, mostly sourced from conifers, or occasionally mounted directly on woody substrates. While many commercial growers in the US rely on imported bark, availability has fluctuated in recent years and recent policy changes have made the economics of import less feasible. However, as the ‘Invasive Species Capitol of the World’, Hawai‘i has a wide range of invasive tree species, including pines and tree ferns - relatives of species already popular in orchid cultivation.

Here we outline our preliminary results in growing seedlings of a range of orchids on several invasive tree species found in Hawai‘i. These are mostly Vandaceous or *Cattleya* Alliance, but we also share anecdotal examples of other orchid types. Data generated from these experiments will be shared with invasive species control groups, conservation programs, and orchid growers, with the hope of expanding options for local cultivation, reducing reliance on imported media, and helping control the spread of invasive species. We hope to expand this work to include a wider range of substrates and species, and continue to collect data as the plants reach flowering size.

**Keywords:** Invasive tree species, Orchid cultivation, Epiphytic substrate, Hawaii, Growing media alternatives

## **Beyond Orchids: Integrated Conservation in Ecuador's Private Reserves from the Coast to the Amazon**

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This poster presents the integrated conservation strategies developed by Ecuagenera and the Fundación Ángel Andreetta, which jointly manage a network of 17 private reserves encompassing over 2,700 hectares of priority ecosystems across seven provinces in Ecuador. These reserves span a wide ecological gradient, including Chocó humid forests and coastal dry forests, montane and foothill forests on both flanks of the Andes, high-altitude páramo, and both terra firme and seasonally flooded Amazonian forests.

While initially established to protect wild orchid populations and other endangered plant species in areas of exceptional endemism and diversity, these reserves have also proven crucial for the conservation of rare and threatened fauna. Recent findings include the presence of *Pudu mephistopheles* (Northern pudu), *Tapirus pinchaque* (mountain tapir), and *Tremarctos ornatus* (spectacled bear) within the southeastern Andean páramo and montane forest reserves, emphasizing the broader ecological value of these protected areas.

The poster highlights how a plant-focused conservation approach has led to a broader integrative strategy that supports the protection of entire ecosystems. Visual examples of habitat types, rare species, and ongoing conservation efforts illustrate the critical role of privately managed reserves in Ecuador.

**Keywords:** Private reserves, orchid conservation, Ecuador, biodiversity hotspots, endangered species.

## **Andreettana: A New Platform for Research and Conservation of Neotropical Biodiversity**

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In January 2025, the Ángel Andreetta Foundation and Ecuagenera officially launched *Andreettana*, a peer-reviewed scientific journal dedicated to the research, conservation, and sustainable management of Neotropical biodiversity, with a focus on the tropical Andes. Named in honor of Father Ángel Andreetta—an early pioneer in Ecuadorian orchid research and conservation—the journal represents a new stage in the long-standing efforts to protect and study Ecuador’s extraordinary natural heritage.

*Andreettana* emphasizes the description of new species, especially orchids, while also covering a wide range of topics including taxonomy, ecology, biogeography, ecological restoration, horticulture, and ethnobotany. With over 1,000 species described through the joint work of Ecuagenera and the Ángel Andreetta Foundation over the past three decades, the journal consolidates this legacy and provides an international platform for original research that supports global conservation efforts.

As a bridge between scientific knowledge and practical conservation, *Andreettana* fosters public engagement and highlights the relevance of biodiversity to culture, sustainability, and ecosystem resilience. The journal also aims to inspire new generations of researchers and conservationists by showcasing the biological richness of Ecuador—a country home to approximately 4,400 orchid species, accounting for 15% of the world's total orchid diversity. This poster presents the vision, scope, and inaugural contributions of *Andreettana*, underlining its role as a reference for scientists, conservation practitioners, and biodiversity managers throughout the Neotropics.

**Keywords:** Andreettana, scientific publishing, Ecuador, orchid research, Neotropical biodiversity.

## **Combining Distribution Models of Orchids and Their Pollinators to Map Gaps in the Knowledge of Ecological Interactions**

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The distribution of orchid species relying on mutualistic partners can be constrained by their partners' distribution. Nonetheless, biotic interactions are often overlooked when estimating the distributions of species. In the Tropics, the abundance of highly specific interactions provides a promising model to test the extent of these limitations, but regional geographic and knowledge gaps hinder this potential. Here, we combine interaction data with niche models to identify such gaps and recommend targets to natural history studies and future sampling efforts. We compiled occurrence records for a dataset of pollination interactions of orchids from Tropical America exclusively pollinated by male euglossine bees. We calibrated individually-tuned niche models for 37 plants and 39 bee species. We compared the potential distribution overlaps across plants and their respective pollinators and discussed their interpretation in relation to different indicators of knowledge gaps. Overlap between the potential distribution of orchids and their pollinators varied across species and regions. Among the plant species modelled, 62% had insufficient information on their pollinator distribution or identity. The overlapping potential distribution of plant-pollinators was positively related to the proportion of known pollinators included in our models.

Species more often focused on by articles were also associated with higher numbers of reported pollinators. Northern South America and the Amazon basin were identified as the major gaps. Despite extensive research on plant-bee interactions in this system, significant sampling gaps persist. Considering the high plant richness, a surprisingly low proportion of species (ca. 1.5%) had pollinator identities and distributions sufficiently documented. We provide a framework to identify and map such gaps. Our study evidences the need to improve sampling and digitization efforts in poorly documented regions and taxa. This can be

extended to other systems, improving biodiversity documentation and conservation monitoring on orchids.

**Keywords:** pollination, knowledge gaps, species distribution models (SDMs), Neotropics, conservation biogeography.

## Characterisation of Novel Lipid-based Adhesives from Orchidaceae

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Plants employ adhesion for multiple purposes, ranging from substrate attachment to pollen transfer. Orchids are a superb example, as they are not only the most diverse family of flowering plants, but they demonstrate complex reproductive strategies through adhesion of their pollinarium to a variety of pollinators. Yet despite a detailed understanding of the morphological and ecological aspects of pollinarium-pollinator interactions, the composition and mechanics of the viscidium, the adhesive component of the pollinarium, remains unclear. This study systematically characterises the viscidia adhesives of 18 orchid genera using Fourier-Transform Infrared (FTIR) spectroscopy and mechanical testing. The adhesives were classified into four main categories based on their chemical composition: lipid-based adhesives (e.g., *Phalaenopsis*), polysaccharide-based adhesives (e.g., *Galeandra*), intermediate adhesives containing both lipids and polysaccharides (e.g., *Vanda*), and thermal adhesives exhibiting temperature-dependent phase changes (e.g., *Acineta*). Mechanical testing revealed significant variability in adhesive strength and failure modes among the different genera, which we relate to their composition and adaptation to their environment and pollinator interactions. Our findings highlight the evolutionary diversification of orchid adhesives in response to ecological pressures. Understanding the diversity and functionality of these natural adhesives not only enhances knowledge of orchid biology but also offers insights for developing novel, bio-inspired adhesives.

**Keywords:** Orchidaceae, viscidium, bioadhesion, FTIR spectroscopy, biomimicry.

## **Orchidarium, a Strategy to Bring Scientific knowledge Closer to the School Population**

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Education in Latin America does not study the context in which students are immersed, despite being a region rich in biodiversity. By 2006, the Francisco Torres León Puente Amarillo school, immersed in the Llanero foothills, a biological transition zone, saw the great wealth of flora and fauna species around it, and thus adopted the study of them. It was surrounded by bromeliads, ferns, tropical flowers, orchids, beetles, and other species. It was urgent to align it with the curriculum. The "orchidarium" research scenario was created, allowing for the understanding and appreciation of orchid biodiversity in the department of Meta, as well as identifying the environmental issues affecting their conservation, understanding their biological cycle, and valuing the ecosystem services of pollinators. A curriculum was designed that successfully studied some elements of flora and fauna. Preschool students began the process of studying the soil, first graders studying earthworms, then beetles, and so on. Each grade chose a species of flora or fauna. Third graders selected the orchids, and thus, in 2015, the orchidarium was built at school on a 700 m<sup>2</sup> plot of land. They expanded their bibliography, participated in conferences, talks, and workshops until achieving a structured conceptual framework. This framework identified the species, the parts of the plant, the function of each one, the substrate, and the medium in which they reproduce. The research path connected families and teachers from different municipalities who began to arrive at the institution and understand the importance of this project in the lives of students. A training program was held at school, in which different teachers were invited, linking the Department of Education and Environmental Management. This is how 20 orchidariums were established in 20 educational institutions in the department. During the pandemic, the project stalled, but was resumed in 2021. Countries with high biodiversity should include scientific study to value and conserve their flora and fauna. Teachers should

be trained on biodiversity issues. The curricula of educational institutions make sense to the extent that the richness of the environmental context is studied.

**Keywords:** Biodiversity, curriculum, context, orchids, knowledge.

## Scientific Illustration and Anatomical Dissections as Tools for the Taxonomic Description of New Orchid Species

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As part of our ongoing efforts in orchid conservation and taxonomy, we present the visual and methodological workflow used in the description of new orchid species, particularly those from the Andean region. This poster highlights the standardized dissection of floral structures as a critical step for accurate morphological documentation. Each dissection is photographed following a consistent protocol to ensure clarity and comparability between specimens.

In parallel, high-quality botanical illustrations are produced using standardized techniques that emphasize diagnostic traits essential for species identification. These illustrations, paired with photographs, enhance the precision and accessibility of taxonomic work. Through selected visual examples, we demonstrate how these methods support both scientific publication and conservation outreach.

This collaborative initiative, supported by Ecuagenera, and the Fundación Ángel Andreetta, invites further partnerships to expand orchid habitat preservation efforts through accurate documentation and public awareness.

**Keywords:** Orchidaceae, floral dissection, botanical illustration, taxonomy, conservation.

## Reintroducing neotropical epiphyte *Guarianthe skinneri* through fungal symbiotic cultures

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Orchid seed germination and seedling development in the wild, is highly dependent on mycorrhizal fungal associations. Although more than 70% of Orchidaceae species are epiphytes, most of the research on their mycobionts is focused on terrestrial orchids. Identification and application of these fungi is relevant to understand orchid ecology, their propagation, and conservation. Several studies have shown positive effects of mycorrhizal fungi inoculation on *in vitro* orchid development. This methodology has been recently recommended for the reintroduction of endangered orchids into native forests. In Costa Rica, the national flower, *Guarianthe skinneri*, is a threatened Neotropical species, with few known existing populations. Therefore, we identified the fungal communities of wild populations using molecular techniques and isolated the mycobionts from their roots. Finally, in order to produce better adapted plants for reintroduction, we evaluated the effect of symbiotic cultivation of mycorrhizal and putative fungi with *G. skinneri* seedlings. Our results contribute to the development of methodologies for the reintroduction of threatened orchids in Costa Rican native forests.

**Keywords:** Mycorrhizal fungi, reintroduction, *in vitro*, propagation, mycobiont.

## Unveiling the elevational dynamics of *Anthurium* in the Andean Chocó

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Montane forests in the tropical Andean Chocó exhibit high biodiversity and endemism, yet the elevational patterns of plant diversity remain insufficiently characterized for many key groups, including *Anthurium* (Araceae). We analyzed how *Anthurium* diversity varies across an 800-meter elevational gradient (500–1,300 m) in a montane forest in northwestern Ecuador. A total of 2,276 individuals representing 55 species were recorded, including 16 endemics to Ecuador. Alpha diversity peaked at mid-elevations, while beta diversity revealed high species turnover between zones. The middle elevation zone showed the greatest overlap with adjacent zones, acting as a transitional belt, whereas the low and high zones harbored more distinct assemblages. Elevation, forest structure, historical landscape dynamics, and dispersal limitations influence *Anthurium* distribution. The coexistence of both widespread and range-restricted species underscores the ecological importance of elevational corridors and highlights the conservation value of heterogeneous montane landscapes.

**Keywords:** Alpha diversity, Araceae, Beta diversity, Distribution patterns, Species composition, Species turnover.

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