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ABSTRACT
The Bogotá Botanical Garden, founded in 1955 and named after José Celestino Mutis, has played a central role in the conservation of Andean and páramo flora. Covering 19.5 hectares, the garden houses 34 living collections classified into systematic, ecosystemic, thematic, and taxonomic groups. These collections support scientific research, education, and biodiversity conservation, showcasing species from various ecosystems such as páramos, subxerophytic zones, cloud forests, Andean forests and wetlands. They also emphasize the conservation of species like in the Magnoliaceae, Lamiaceae, and Orchidaceae, highlighting endangered and endemic plants. Research efforts include the *ex-situ* propagation of endangered species such as *Senecio carbonellii* S. Díaz and *Puya* spp., as well as ecological studies on their native habitats. Spaces like the Arboretum, the medicinal plants garden, and the agroecological garden demonstrate sustainable and educational practices. The garden plans to enhance its collections by prioritizing threatened species and developing new exhibits, such as Rubiaceae. The garden mission aligns with national and international conservation strategies, reinforcing its role as a center for research, education, and cultural heritage. With 70 years of achievements, the Bogotá Botanical Garden remains a significant example for biodiversity conservation in Colombia.

KEY WORDS
Andean ecosystems, endemic species, *ex-situ* conservation, germplasm, propagation.

RÉSUMÉ

Les collections vivantes du Jardin Botanique de Bogota José Celestino Mutis : 70 ans consacrés à la biodiversité et à sa conservation.

Le Jardin botanique de Bogotá, fondé en 1955 et nommé en l'honneur de José Celestino Mutis, a joué un rôle central dans la conservation de la flore andine et des páramos. Couvrant 19,5 hectares, le jardin abrite 34 collections vivantes classées en groupes systématiques, écosystémiques, thématiques et taxonomiques. Ces collections soutiennent la recherche scientifique, l'éducation et la conservation de la biodiversité, en mettant en valeur des espèces issues d'écosystèmes variés, comme les páramos, les zones subxérophiles, les forêts de nuages, les forêts andines et les zones humides. Elles soulignent également la conservation d'espèces comme dans les Magnoliaceae, les Lamiaceae et les Orchidaceae, en mettant l'accent sur les plantes menacées et endémiques. Les recherches incluent la propagation *ex-situ* d'espèces en danger, telles que *Senecio carbonellii* S. Díaz et *Puya* spp., et des études écologiques sur leurs habitats natifs. Des espaces comme l'Arboretum, le jardin des plantes médicinales et le jardin agroécologique démontrent des pratiques durables et éducatives. Le jardin projette d'enrichir ses collections en priorisant les espèces menacées et en développant de nouvelles expositions, telles que les Rubiaceae. La mission du Jardin s'aligne sur des stratégies de conservation nationales et internationales, renforçant son rôle comme centre de recherche, d'éducation et de patrimoine culturel. Avec 70 ans de réalisations, le Jardin botanique de Bogotá demeure un exemple significatif pour la biodiversité en Colombie.

MOTS CLÉS
Banques de germoplasme, conservation *ex-situ*, écosystèmes des Andes, espèces endémiques, propagation.

INTRODUCTION

Founded in 1955, the José Celestino Mutis Botanical Garden of Bogotá (JBB for its Spanish acronym) has become a reference point for the conservation of high Andean and páramo flora (Morales-Rozo & Hurtado-M 2018). Since its foundation, the JBB has transformed into a space where science, nature, and the community intersect. The year 2025, marks its 70th anniversary, inviting us to reflect on its journey and contributions to the conservation of Bogotá's biodiversity and its surrounding ecosystems. The JBB is named in honor of José Celestino Mutis (1732-1808), an astronomer and botanist who dedicated his life to the study of natural sciences in the territory of Nueva Granada. In 1783, Mutis founded Colombia's first botanical garden, which aimed to acclimatize and propagate economically important plants, such as coffee and cinchona (Ruiz 1977). In 1932, Enrique Pérez Arbeláez revived this botanical tradition by establishing the National Herbarium and the Institute of Natural Sciences, as well as cofounding the Academy of Exact, Physical and Natural Sciences (Mutis-Duran 2000). Due to his significant efforts, the JBB was established on 6 August 1955, receiving support from Mayor Roberto Salazar Gómez and the Administrative Council of Bogotá (Díaz-Piedrahita 1998).

Botanical gardens not only maintain documented collections of living plants for research, conservation, exhibition, and education purposes (Smith & Harvey-Brown, 2017) but also positively impact society by collaborating with a variety of environmental and social stakeholders (Samper Alvarado 2015). In the case of the JBB, its commitment to protecting local flora aligns with the objectives of the National Plant Conservation Strategy (García *et al.* 2010), and the Global Strategy for Plant Conservation (GSPC 2012) and the Convention on Biological Diversity (CBD 2022), demonstrating its relevance at both local and global levels. In addition, the garden is certified by the Ministry of Science and Technology.as a research center (Minciencias 2022).

The JBB is located in the capital of Colombia at an altitude of 2555 meters above sea level and covering an area of 19.5 ha. It features 34 living collections, including the Tropical Glasshouse, scientifically classified into five themes: 1) systematic; 2) ecosystemic; 3) taxonomic; 4) ornamental and exotic; and 5) thematic collection categories (Fig. 1) (Cadena-Vargas *et al.* 2019). These collections aim to support scientific research and the preservation of native species while serving as an educational resource to protect and showcase some of the most vulnerable ecosystems, the floristic richness and diversity of Bogotá region (Zuluaga-Carrero *et al.* 2020). Additionally, research has been conducted within these collections on the fauna associated with the city's vegetation (Echeverry 2005; Cueva 2018; Rodríguez *et al.* 2021; Salazar-Fillippo *et al.* 2024).

In this context, this paper aims to document the 31 current living collections at the JBB, excluding those in the Tropical Glasshouse, which were detailed in a previous publication (Morales-Rozo *et al.* 2022). It highlights their scientific, ecological, and cultural importance.

1) Systematic collections:

- A, Cryptogam collection
- B, Gymnosperm systematic collection
- C, Angiosperm systematic collection

2) Ecosystemic collections:

- D, Wetland garden
- E, Sub-Andean forest "Mora-Osejo"
- F, Páramo
- G, High Andean forest
- H, Subxerophytic environment
- I, Cloud forest
- J, Sub-Andean forest

3) Thematic collections:

- K, Introductory garden
- L, Arboretum
- M, Health herb garden
- N, Agroecological garden
- O, Cold-climate fruit trees

4) Taxonomic collections:

- P, Andean forest with emphasis on magnolias
- Q, Lamiaceae collection
- R, Propagation greenhouse for cold-climate bromeliads and orchids
- S, Propagation greenhouse for warm-climate bromeliads and orchids
- T, Palm collection
- U, Melastomataceae collection
- V, Andean forest with emphasis on quinas
- W, Andean forest with emphasis on oaks
- X, Andean forest with emphasis on Lauraceae
- Y, Andean forest with emphasis on gaque
- Z, Colombian pine collection

5) Ornamental and exotic collections

- AA, Exotic aquatics
- AB, Landscaping area/ exotic ornamentals
- AC, Rose garden
- AD, Exotic tree collection
- AE, Pergola of passionflowers and climbers

Fig. 1. — Map illustrating the current zoning of the living collections at the Bogotá Botanical Garden. This layout highlights the spatial distribution and organization of the collections, reflecting their ecological, thematic, and taxonomic groupings across the garden's grounds. On the left, an inset map of Colombia shows a zoomed-in view of Bogotá, with a white star marking the location of the botanical garden. Images of Colombia and Bogota from Airbus, Maxar Technologies, CNES/Airbus, 2024. Map data from Google. Scale bars: Botanical Garden Map, 100 m; Bogotá map, 10 km; Colombia map, 300 km.

THE JBB COLLECTIONS

The living collections at the José Celestino Mutis Botanical Garden of Bogotá (JBB) hold significant heritage value for both the capital and the country. They play an essential role in the *ex-situ* conservation of plant species, supporting the goals of preservation, research, and education. These collections not only provide germplasm to tackle the environmental challenges faced by the city and the nation, offering knowledge and benefits to both the scientific community and the public.

The JBB houses a collection of nearly 190 plant families, 730 genera, and 1500 species that represent high Andean and páramo ecosystems grouped into five thematic groups described below.

Systematic collections

They are comprised of carefully curated groups of species organized according to a taxonomic classification system that highlights their evolutionary relationships. Currently, the JBB houses three systematically organized collections that showcase the intricate process of evolution. These collections are regularly updated to incorporate the latest taxonomic revisions and discoveries ensuring that they reflect the most current understanding of biological diversity. Below is a detailed description of each collection and significance of the species they contain.

Cryptogam systematic collection

This collection showcases various botanical groups including bryophytes, lichens, lycophytes, and ferns. Currently, it is primarily represented by ferns and is organized according to the classification system established by the Pteridophyte Phylogeny Group (PPG I 2016). Covering an area of 5281 m² (Figs 1A; 2A), the collection's humid and shaded environment facilitates the observation of diverse growth forms. These include tree ferns such as (*Dicksonia karsteniana* (Klotzsch) T.Moore, *Cyathea* spp.), aquatic ferns like *Marsilea ancylopoda* A.Braun, *Salvinia auriculata* Aubl., epiphytic ferns including *Serpocaulon sessilifolium* (Desv.) A.R.Sm. and *Pleopeltis macrocarpa* (Willd.) Kaulf., as well as terrestrial ferns such as *Adiantum raddianum* C. Presl and *Asplenium myriophyllum* (Sw.) C.Presl. This collection has also served as a valuable resource for various research projects focused on the conservation of tree ferns (Fig. 3A; Alfonso-Moreno *et al.* 2011) and their traditional uses (Vargas 2024).

Gymnosperm systematic collection

It comprises a diverse group of plants that reproduce through naked seeds, which are not enclosed within a fruit. This collection encompasses approximately 6000 m² (Fig. 1B) and features specimens from various global regions, such as the araucarias from Brazil (*Araucaria angustifolia* (Bertol.) Steud.), the bunya-bunya from Australia (*Araucaria bidwillii* Hook.) and *Ginkgo biloba* L. from China. Additionally it includes representatives from notable families such as Cupressaceae, Cycadaceae, Pinaceae, and Podocarpaceae.

Angiosperm systematic collection

This collection is designed to represent the taxonomic classification of angiosperms which constitute the most diverse group of plants, encompassing all flowering plants. The collection spans an area of 8536 m² and is organized according to the APG IV (2016) classification system (Fig. 1C). It reflects not only taxonomic classification through certain plant groups but also encompasses a wide range of life forms such as trees, shrubs, aquatic plants, and epiphytic plants. Key families represented in this collection include Asteraceae, Solanaceae, Myrtaceae, and Lauraceae. Beyond its taxonomic significance, this collection has served as the setting for research, such as the study conducted by Orejuela & Celis (2019), which describes the genera of angiosperms and gymnosperms present in the JBB.

Ecosystemic collections

The ecosystemic collections are designed to highlight the flora of specific Colombian ecosystems. These collections showcase species that are characteristic of the ecosystems they represent, considering how these plants adapt to urban environments and their significance in the landscape of the ecosystem. Currently, the following collections can be found at the JBB.

Wetland garden

The Wetland Garden collection covers an area of 1255 m² and forms part of the flora of the JBB's Main Lake (Figs 1D; 2E). Its primary objective is to strengthen the conservation of aquatic flora from Bogotá's wetlands through an *ex-situ* conservation strategy, which includes research on the propagation (Fig. 3B), monitoring, and establishment of plants within the living collections, while also promoting the creation of habitats for birds (Martínez Peña & Jaimes Sánchez 2015; Camelo-Mendoza *et al.* 2016). Additionally, it aims to raise awareness and provide environmental education about wetland ecosystems. The collection includes native emergent species, meaning plants found along wetland edges, such as *Bidens laevis* (L.) Britton, Sterns & Poggenb., *Typha latifolia* (L.), *Schoenoplectus californicus* (C.A.Mey.) Soják, and *Ludwigia peruviana* (L.) H.Hara. It also features species with reduced populations in wetlands within the city, including *Marsilea ancylopoda* A.Braun, *Begonia fischeri* Irmsch., *Juncus microcephalus* Kunth, and *Gratiola bogotensis* Cortés ex Pennell (Rodríguez 2000; Martínez Peña & Jaimes Sánchez 2015). Research has also been conducted on the propagation of the endemic and threatened species *Senecio carbonellii* S.Díaz (Martínez-Peña *et al.* 2024).

Sub-Andean forest "Mora Osejo"

This collection covers an area of 3553 m² (Fig. 1E) and is named in honour of the Colombian botanist Luis Eduardo Mora Osejo, who made significant contributions to the study of the morphology and physiology of Colombian flora (Piedrahita 2005; Mora-Osejo 1984; Mora-Osejo 1987; Mora-Osejo & Sturm 1995; Mora-Osejo 2001). The collection aims to represent the flora of the country's sub-Andean forests, located in the Andes mountain range

at altitudes between 1000 and 2400 m (Cuatrecasas 1989). It includes representative species such as *Clethra fagifolia* Kunth, *Quercus humboldtii* Bonpl., and *Viburnum tinoides* Kunth (Reina *et al.* 2010).

Páramo

The páramo is a high-mountain ecosystem where approximately 90% of its flora is endemic (Rivera & Rodríguez 2011). It is located at altitudes between 3000 and 5000 m, spanning from high Andean forests to the lower edge of perpetual snow (Rivera & Rodríguez 2011). The collection representing this ecosystem covers an area of 3193 m² and aims to showcase the flora of the paramo (Fig. 1F), characterised by low temperatures ranging from 2 to 10 °C, high relative humidity of 80% to 98%, and organic-rich soils with high water and nutrient retention capacity (Llambí *et al.* 2012). The vegetation in this collection includes herbaceous species, low trees, and shrubs, featuring formations such as tussock grasslands, rosettes, and shrublands (Molinillo & Monasterio 2002). The collection includes endemic páramo species such as *Puya bicolor* Mez, *Puya loca* Madriñán, and *Polylepis quadrijuga* Bitter, along with representative species like *Hypericum juniperinum* Kunth and *Lachemilla orbiculata* (Ruiz & Pav.) Rydb. Conservation efforts have prioritized *Puya* species, which have successfully flowered and produced seeds under *ex-situ* conditions (BGCI 2023). Additionally, studies have been conducted in the collection's lake to evaluate the establishment of vegetation on floating islands (Martínez Peña & López-Candela 2018).

High Andean forest

The High Andean Forest collection covers an area of approximately 5218 m² and, within the garden, corresponds to the strip surrounding the Páramo collection (Fig. 1G). This collection aims to represent the ecosystems found in the Colombian Andes and the Sierra Nevada de Santa Marta, within the altitudinal range of 2800 to 3250 meters above sea level, in areas with temperatures between 8 and 14 °C (Avella-M *et al.* 2014). The collection includes representative species such as *Drimys granadensis* L.f., *Hesperomeles ferruginea* (Juss. ex Pers.) Benth., *Macleania rupestris* (Kunth) A.C.Sm., *Myrsine dependens* (Ruiz & Pav.) Spreng., *Oreopanax bogotensis* Cuatrec., and *Weinmannia pubescens* Ruiz & Pav.

Subxerophytic environment

This collection covers an area of 5990 m² and represents subxerophytic zones of the Bogotá Savannah (Fig. 1H), located between 2550 and 2900 meters above sea level, such as the areas surrounding the La Herrera Lagoon in the southwest of the city and Suesca in the north. These ecosystems exhibit a high evapotranspiration rate that surpasses the precipitation, creating dry conditions throughout the year. The vegetation is adapted to arid conditions through morphological modifications such as spines, small leaves, and succulent stems. At the JBB, the collection includes characteristic species such as *Lantana camara* L., *Masdevallia coriacea* Lindl., *Salvia bogotensis* Benth., *Stelis pulchella* Kunth, *Salvia sphacelioides* Benth., and *Dalea coerulea* (L.f.) Schinz & Thell. Due to the reduction in the natural area of these environments and the pressures they face, this collection is of great importance for the conservation of endemic species and those adapted to subxerophytic conditions, contributing to the preservation of endangered biodiversity.

Cloud forest

Covering an area of 2390 m² (Fig. 1I), the collection representing the cloud forest, or montane rainforest, includes species such as *Quercus humboldtii*, *Magnolia hernandezii* (Lozano) Govaerts, *Ceroxylon quindiuense* (H.Karst.) H.Wendl., and *Anthurium bogotense* Schott. This collection focuses on the *ex-situ* conservation of species with some degree of threat or endemism, promoting their establishment, adaptation, and research. This ecosystem is characterised by high relative humidity, typically exceeding 90%, and constant cloud presence (Bruijnzeel & Hamilton 2001). In Colombia, cloud forests are distributed between 1500 and 3800 meters above sea level across the Andes, the Sierra Nevada de Santa Marta, and certain mountain ranges (Armenteras *et al.* 2007). The plants in this ecosystem play a crucial role in water capture, making them an important water source for nearby areas. Additionally, many plants in this ecosystem exhibit a high degree of endemism, particularly epiphytic plants (Armenteras *et al.* 2007). At the JBB, research has been conducted on the flora associated with seed germination in *Bomarea* species (Acosta *et al.* 2004), which are present in this collection.

Sub-Andean forest

The collection representing the sub-Andean forest at the Bogotá Botanical Garden covers an area of 8891 m² (Fig. 1J). This ecosystem, found at altitudes between 1000 and 2500 meters above sea level, is characterized by an average temperature of 16°C to 23°C and annual rainfall ranging from 1000 to 4000 mm. At the JBB, the collection includes more than 1000 individuals from 200 species, including *Cedrela montana* Moritz ex Turcz., *Quercus humboldtii*, *Billbergia nutans* H.Wendl., *Dendropanax arboreus* (L.) Decne & Planch., and *Ceroxylon vogelianum* (Engel) H.Wendl. Due to anthropogenic pressure, these forests are undergoing constant transformation and are considered one of the most threatened ecosystems in Colombia (Rudas *et al.* 2007). The conservation of this collection is a priority to protect its biodiversity and to study and preserve the endemic and threatened species of these ecosystems.

Thematic collections

Thematic collections are groups of plants that do not represent a specific ecosystemic or taxonomic interest. The collections include the following.

Introductory garden

The Introductory Garden collection spans an area of 9243 m² and aims to welcome and introduce visitors to the botanical garden (Fig. 1K). It features various growth habits of vegetation representing the organisation's mission-related ecosystems. Visitors can observe tree species such as guayacán (*Lafoensia*

acuminata (Ruiz & Pav.) DC.), magnolias (*Magnolia hernandezii* (Lozano) Govaerts, *M. caricifragrans* (Lozano) Govaerts), and palms (*Ceroxylon* spp.), shrubs such as boxwood (*Buxus sempervirens* L.), ornamental herbs like clivia (*Clivia miniata* (Lindl.) Verschaff.), climbers, and epiphytic orchids such as *Maxillaria rodriguesii* Cogn., *Epidendrum* sp., and *Cyrtochylum* sp.

Arboretum

The arboretum at the JBB spans an area of 1.81 hectares and contains various native tree species from Andean forests (Fig. 1L). These species originate from ecosystems located between 1000 and 4000 meters above sea level, with average temperatures of 16°C to 23°C and annual rainfall ranging from 1000 to 4000 mm. The arboretum serves not only to promote the *ex-situ* conservation of these species through the maintenance of various adult specimens but also contributes to visitor enjoyment and botanical education through practical activities with students of all levels. Representative species in this collection include *Quercus humboldtii*, *Juglans neotropica* Diels, *Cedrela montana*, *Ceroxylon quindiuense* (H.Karst.) H.Wendl., and *Styloceras laurifolium* (Willd.) Kunth.

Health herb garden

Covering an area of 823 m², the Health Herb Garden features a variety of medicinal plants that serve as a resource for the development and synthesis of various medicinal compounds (Fig. 1M). Notable plants in this collection include mastranto (*Salvia palifolia* Kunth), pennyroyal (*Clinopodium brownei* (Sw.) Kuntze), peppermint (*Mentha* × *piperita* L.), fennel (*Foeniculum vulgare* Mill.), rue (*Ruta graveolens* L.), chamomile (*Matricaria chamomilla* L.), marigold (*Calendula officinalis* L.), and rosemary (*Salvia rosmarinus* Spenn.). This collection, arranged in a circular design around a glass dome, is both a visual attraction and an educational space for visitors.

Agroecological garden

The Agroecological Garden is a pedagogical and demonstrative collection spanning 3140 m² (Figs 1N;2B). It prioritizes species with potential uses in urban agriculture and strengthens educational activities conducted with communities in urban gardens within the city. The collection aims to research and implement technologies adapted for agroecology, as well as to recover and conserve rustic agro-food seed varieties. It includes a vegetable garden where edible, aromatic, medicinal, and culinary plants are grown, a vermiculture area, and a seed center with an agroecological focus. Native plants in this garden include Bogotá tea (*Symplocos theiformis* (L.f.) Oken), Andean cereals such as amaranth (*Amaranthus caudatus* L.) and quinoa (*Chenopodium quinoa* Willd.), and commercially important vegetables such as lettuce (*Lactuca sativa* L.) and Swiss chard (*Beta vulgaris* L.).

Cold-climate fruit trees

This collection covers an area of 2278 m² and showcases cold-climate fruit trees, including both native and cultivated species (Fig. 1O). Native species in the collection include the tree tomato (*Solanum betaceum* Cav.), cherimoya (*Annona cherimola* Mill.), mountain papaya (*Vasconcellea pubescens* A.DC.), and arrayán (*Myrcianthes leucoxyla* (Ortega) McVaugh). Cultivated exotic species include peach (*Prunus persica* (L.) Batsch), apple (*Malus domestica* (Suckow) Borkh.), feijoa (*Feijoa sellowiana* (O.Berg) O.Berg.), fig (*Ficus carica* L.), and plum (*Prunus domestica* L.).

TAXONOMIC COLLECTIONS

The taxonomic collections highlight the rich diversity of prioritized taxonomic groups found in Colombia, in alignment with the mission of JBB. These collections encompass the following.

Andean forest with emphasis on magnolias

This collection spans an area of 2801 m² and is composed of species from the family Magnoliaceae, primarily from the genus *Magnolia* (Fig. 1P). This family was prioritized because, with its 42 species, Colombia is the Neotropical country with the greatest diversity of magnolias (Serna-Gonzaléz *et al.* 2024). The collection aims to conserve threatened high-Andean flora and highlight the importance of magnolias as a priority group for conservation. This collection is part of the JBB's Specialized Collections for Conservation (CEPAC).

Lamiaceae collection

The Lamiaceae collection was originally established as a duplicate of the collection from the Institute of Natural Sciences at the National University for research on essential oils. Currently, the collection covers an area of 462 m² and showcases some species of the family Lamiaceae (Fig. 1Q), known for its wide distribution and production of essential oils (Haas *et al.* 2024). The collection includes approximately 29 species from the genera *Salvia*, *Mentha*, *Ocimum*, and *Rosmarinus*. This collection is part of the JBB's Specialized Collections for Conservation (CEPAC) (Santos *et al.* 2009).

Propagation greenhouse for cold-climate bromeliads and orchids

This collection is housed within a 419.24 m² greenhouse that provides ideal conditions of humidity (ranging from 28% to 98.4%) and temperature (from 12.4°C to 32.7°C) for the propagation and conservation of cold-climate bromeliads and orchids (Figs 1R, 3D). The greenhouse includes four botanical families: Araceae, Bromeliaceae, Cactaceae, and Orchidaceae, with a total of 85 genera, 213 species, and approximately 646 individuals, with Bromeliaceae being the most representative family. Many of the species in this collection are endangered, such as *Dracula gorgonella* Luer & R.Escobar, *Masdevallia caudata* Lindl., *Masdevallia ignea* Rchb.f., and *Dracula severa* (Rchb.f.) Luer. Research on the *Masdevallia ignea* plants in the collection resolved fundamental aspects of their reproduction (Chavarro-Rodríguez *et al.* 2005). The collection also includes some exotic species of high ornamental value.

Fig. 2. — Five of the most iconic living collections at the Bogotá Botanical Garden: **A**, cryptogam systematic collection; **B**, agroecological garden; **C**, palm collection; **D**, rose garden; **E**, wetland garden.

Propagation greenhouse for warm-climate bromeliads and orchids
The greenhouse housing the collection of warm-climate bromeliads and orchids spans 102.12 m² and was designed to maintain lowland species under appropriate humidity and temperature conditions (Figs 1S, 3C). The greenhouse features a mist irrigation system and sun protection with shade mesh. It contains approximately 32 genera and 47 species from the families Araceae, Passifloraceae, and Orchidaceae, with orchids being the most representative group, comprising 1013 individuals. Charismatic species such as *Cattleya trianae* Linden & Rchb.f., *Cattleya quadricolor* B.S.Williams, and *Cattleya mendelii* Dombrain are notable, many of which are in threat categories. This collection focuses on the research and exhibition of these charismatic species.

Palm collection
Given that Colombia is one of the countries with the greatest diversity of palms, boasting 44 genera and 231 species (Galeano & Bernal 2010), the family Arecaceae has its own dedicated collection: the Palm Collection. This collection spans an area of approximately 5218 m² and includes specimens of native species under some degree of threat (Figs 1T; 2C). Examples include various wax palm species such as *Ceroxylon quindiuense*, *Ceroxylon alpinum* Bonpl. ex DC., *Ceroxylon ventricosum* Burret, and *Ceroxylon sasaimae* Galeano. Research on threatened species at the JBB has shown that *Ceroxylon quindiuense* is one of the species with the highest number of individuals in the living collections (Cadena-Vargas *et al.* 2019).

Melastomataceae collection
Colombia is the second most diverse country in terms of species belonging to the family Melastomataceae, with its richness primarily represented in the ecosystems of the Andes, the Chocó Biogeographic Region, and the Amazon (Posada *et al.* 2016). For this reason, the JBB allocated an area of 3259 m² for a collection showcasing the diversity of species within this family (Fig. 1U). Some of the represented genera include *Axinaea*, *Blakea*, *Brachyotum*, *Bucquetia*, *Centronia*, *Leandra*, *Meriania*, *Tibouchina*, *Miconia*, *Monochaetum*, and *Chaetolepsis*, as well as ornamental species from the genera *Heterocentrum* and *Medinella*.

Andean forest with emphasis on quinas
The Andean Forest collection with an emphasis on quinas aims to represent species of the genus *Cinchona*, associated with Andean quina. These are tree species globally recognised for their significant medicinal properties (Díaz-Piedrahíta 2003). In Colombia, five species are distributed: *Cinchona antioquiae*, *Cinchona barbacoensis*, *Cinchona lancifolia*, *Cinchona pitayensis* (Wedd.) Wedd., and *Cinchona pubescens*. This collection spans an area of 7426 m² and currently includes individuals of *Cinchona pubescens* Vahl (Fig. 1V).

Andean forest with emphasis on oaks
Oak forests are defined as vegetation formations dominated by individuals of *Quercus humboldtii* and *Trigonobalanus excelsus* Lozano, Hern. Cam. & Henao (Parra *et al.* 2011). These ecosystems are highly important for the conservation of biological diversity, as they provide a variety of essential habitats for fauna and other flora species (Avella & Cárdenas 2010). Additionally, they offer ecosystem services such as water regulation, soil protection, and refuge for threatened species (Segura *et al.* 2020). At the JBB, the collection spans an area of 3164 m² (Fig. 1W) and includes the two oak species found in Colombia (*Q. humboldtii* and *T. excelsus*).

Andean forest with emphasis on Lauraceae
The Lauraceae family is characterised by a high level of morphological complexity and disagreements in its classification (Christophel *et al.* 1996; Gomes-Bezerra *et al.* 2018). This family includes trees such as avocado (*Persea americana* Mill.), bay laurel (*Laurus nobilis* L.), cinnamon (*Cinnamomum verum* J.Presl), and camphor (*Cinnamomum camphora* (L.) J.Presl). In Colombia, Lauraceae is among the most important families in the Andean region, found at altitudes between 1800 and 2800 m. Some species are endemic and fall into threatened categories (Cárdenas & Salinas 2007). At the JBB, this collection spans an area of 15 262 m² (Fig. 1X) and includes individuals of *Beilschmiedia sulcata* (Ruiz & Pav.) Kosterm., *Persea caerulea* (Ruiz & Pav.) Mez, *Aniba robusta* (Klotzsch & H.Karst ex Meisn.) Mez, and *Ocotea macrophylla* Kosterm.

Andean forest with emphasis on gaques
The Clusiaceae family has a wide distribution in the tropics and is often used in traditional medicine to treat health issues such as hypertension, cardiovascular disorders, headaches, syphilis, infant oral candidiasis, rheumatism, and as an analgesic (Anholeti *et al.* 2015). At the JBB, this family is represented in an area of 475 m² with species such as *Clusia multiflora* Kunth, *Clusia orthoneura* Standl., and *Clusia magnifolia* Cuatrec. (Fig. 1Y).

Colombian pine collection
Retrophyllum rospigliosii (Pilg.) C.N.Page, commonly known as pino romerón, is primarily distributed in the Andean Cordilleras and grows at altitudes between 1200 and 3750 meters (Escobar *et al.* 2023). It is classified as Near Threatened due to its extensive use in cabinetry and carpentry (Vásquez & Alcántara 2009). Additionally, it is used ornamentally in urban and rural areas and for soil conservation, including erosion control, water body protection, shade for agricultural crops, and shrub species (Mahecha Vega *et al.* 2010). Given its ecological and cultural importance, this collection covers an area of 347 m², representing this species (Fig. 1Z).

Ornamental and exotic collections
These collections include species used for ornamental purposes, featuring a diverse selection of exotic and native species. The collections listed below are part of this.

Exotic aquatics
Established in 2015, the Exotic Aquatics collection showcases ornamental and commercially significant aquatic plants. Currently, it covers an area of 533 m² (Fig. 1AA) and features a

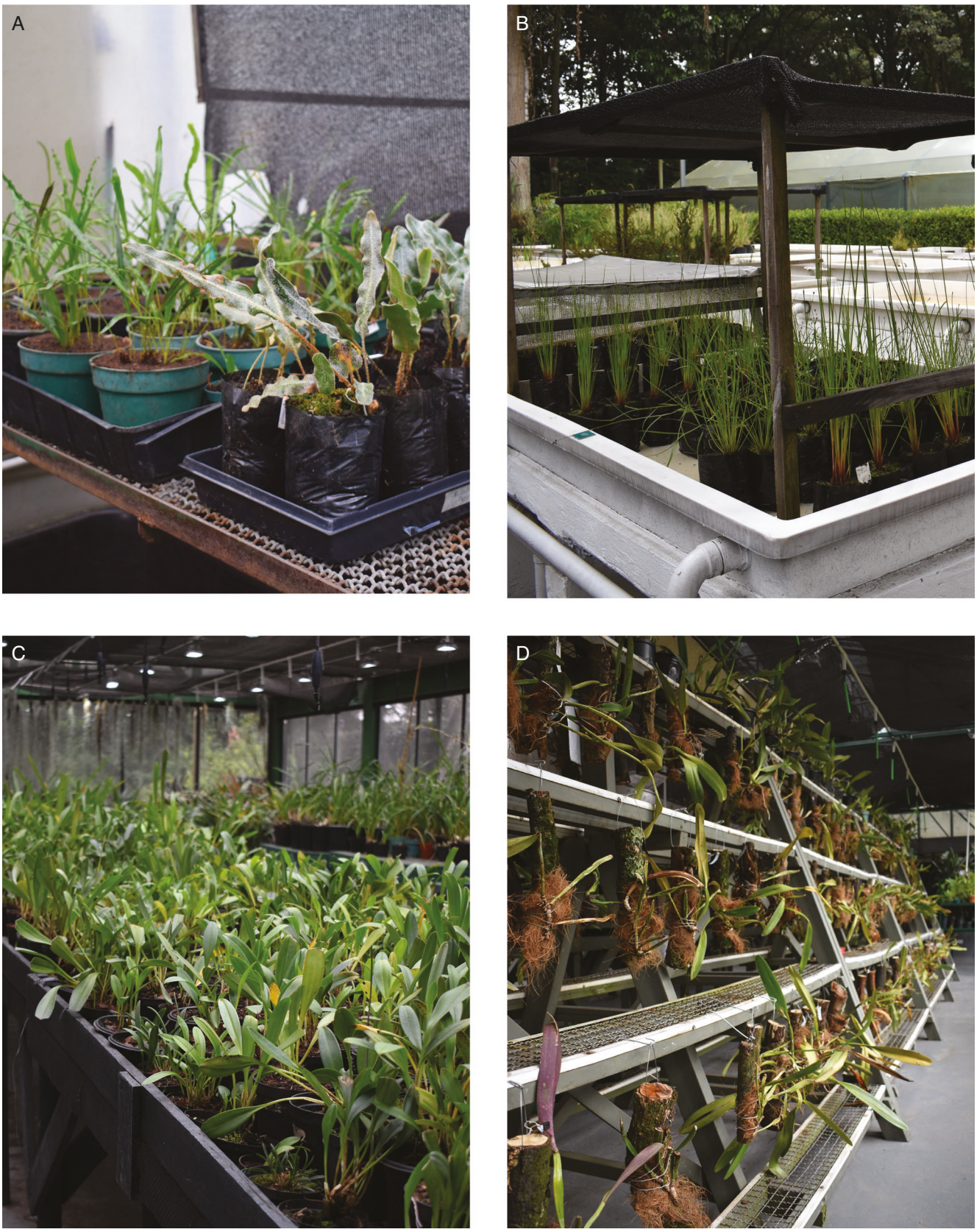

Fig. 3. — Four germplasm collections, illustrating the interior of selected greenhouses at the Bogotá Botanical Garden: **A**, germplasm collection of the genus *Elaphoglossum* Schott ex J.Sm.; **B**, germplasm collection of aquatic plants of the genera *Juncus* L. and *Fuirena* Rottb.; **C**, germplasm collection of adult cold-climate orchids of the genus *Masdevallia* housed in the Propagation Greenhouse for Cold-Climate Bromeliads and Orchids; **D**, germplasm collection of adult warm-climate orchids of the genus *Cattleya* housed in the Propagation Greenhouse for Warm-Climate Bromeliads and Orchids.

variety of aquatic herbs, particularly species and varieties of the genus *Nymphaea*, such as *Nymphaea micrantha* Guill. & Perr., *Nymphaea* cv. 'Colonel A.J. Welch', and *Nymphaea* cv. 'Rhonda Kay'. Additionally, the collection includes other ornamental plants such as *Zantedeschia aethiopica* (L.) Spreng., *Pontederia lanceolata* Roxb., and *Nymphoides indica* (L.) Kuntze (Orejuela & Celis 2019).

Landscaping area/exotic ornamentals
This 3789 m² collection showcases introduced plant species selected based on aesthetic, commercial, and ornamental criteria (Fig. 1AB). It features species such as agapanthus (*Agapanthus praecox* Willd.), bergenia (*Bergenia crassifolia* (L.) Fritsch), chamomile (*Chamaemelum nobile* (L.) All.), Indian shot (*Canna indica* L.), and Quito lily (*Lilium candidum* L.), among others. Although this collection is an exhibition of exotic species, its design adds aesthetic and harmonious value to the JBB, highlighting the exuberance of the flowers and the diversity of the species.

Rose garden
The JBB Rose Garden spans an area of 2331 m² and is dedicated to the exhibition of various species and varieties of the genus *Rosa* (Figs 1AC; 2D). These species originate mainly from Asia and Europe, with many varieties resulting from hybridisations between allopatric species (Vukosavljev *et al.* 2013). The collection is maintained through the constant renewal of plants, ensuring a stock in optimal phytosanitary conditions. This collection is a major attraction for visitors. The Rose Garden exemplifies the Botanical Garden's effort to maintain ornamental species under suitable conditions for public exhibition and enjoyment.

Exotic tree collection
The JBB features a collection of exotic trees originating from other continents, including Europe, Asia, and Africa. These trees are used ornamentally and are part of the urban tree landscape (Orejuela & Celis 2019). The collection spans an area of 3585 m² (Fig. 1AD) and includes species such as *Cotoneaster pannosus* Franch., *Liquidambar styraciflua* L., *Magnolia grandiflora* L., *Melaleuca citrina* Craven, *Metrosideros excelsa* Sol. ex Gaertn., *Myrtus communis* L., *Pittosporum undulatum* Putt., *Prunus serotina* Ehrh., and *Syzygium jambos* (L.) Alston.

Pergola of passionflowers and climbers
This collection covers an area of 327 m² and is dedicated to showcasing species of the genus *Passiflora*, commonly known as passionflowers (Fig. 1AE). These climbing plants are renowned in the region for their striking flowers and edible fruits, such as the banana passionfruit (*P. tarminiana* Coppens & V.E.Barney), granadilla (*P. ligularis* Juss.), and passionfruit (*P. edulis* Sims). The collection includes 20 species distributed across various areas of the garden, including the Lauraceae Forest and the Agroecological Garden. Many species in the collection are classified as threatened due to habitat loss (IUCN 2024). The Botanical Garden has undertaken research on the *ex-situ* conservation and propagation of endemic and threatened *Passiflora* species to enrich the living collections and provide guidelines for their management (Caleño-Ruiz & Morales-Liscano 2019; Caleño-Ruiz *et al.* 2024).

PROPOSAL FOR NEW COLLECTIONS

In order to enhance our *ex-situ* conservation strategy and incorporate broader perspectives from other significant botanical groups relevant to the JBB mission ecosystems, we are planning the consolidation of the following living collections:

Rubiaceae collection
To enhance the diversity and representation at the Botanical Garden, it is proposed to update the "Andean Forest with Emphasis on Quinas" collection into a broader collection encompassing the entire family Rubiaceae. This family is one of the largest and most diverse plant families (Mendoza *et al.* 2004). The expanded collection will allow visitors to explore a wide range of species with medicinal and ecological properties (Bernal *et al.* 2011) and will contribute to the conservation and study of Andean biodiversity.

Threatened plants collection
This new collection is proposed to strengthen the representation of threatened species from the Andean region and will be established in the area currently occupied by the "Sub-Andean Forest" Collection. This initiative will facilitate research, and the development of environmental education and conservation strategies aligned with the Action Plan of Colombia's Plant Conservation Strategy (Castellanos-Castro *et al.* 2017).

Pedro Ortiz Valdivieso, S.J. Pathway
This collection began development in 2017 with the aim of showcasing a portion of the Andean orchid and bromeliad collection of the Bogotá Botanical Garden, with a particular focus on epiphytic species. Currently, this space houses species from the genera *Elleanthus*, *Epidendrum*, *Gomphichis*, *Masdevallia*, *Maxillaria*, *Pleurothallis*, *Prescottia*, *Sobralia*, and *Stelis*, which are either endemic or native. In addition to orchids, the pathway features bromeliads from the genus *Guzmania*, heliconias, *Gunnera*, and members of the Araceae family, further enriching its biodiversity.

FUTURE PERSPECTIVES OF THE LIVING COLLECTIONS

Over the past 70 years, the Bogotá Botanical Garden has made significant progress in conserving floral diversity. These achievements stem from carefully organization, enrichment, and maintenance of its living collections. By consistently introducing new species and individuals, the garden has dramatically improved the representation of several botanical groups. This work not only protects the genetic diversity of Colombia's botanical heritage but also addresses critical challenges related to biodiversity loss.

The future of living collections at the Bogotá Botanical Garden promises to be a pivotal component in advancing conservation efforts and enhancing our understanding of biodiversity.

To improve the representation of native and threatened species from Bogotá's flora, a list was compiled of species that are categorized as Critically Endangered, Endangered, Near Threatened, or Vulnerable by the International Union for Conservation of Nature (IUCN 2024). This list focused on species that are either native or endemic aligning with the mission of José Celestino Mutis Botanical Garden (JBB). The process involved the following steps: 1) the taxonomic information for the list of species in Bogotá (Flora de Bogotá 2024) and within the botanical garden was reviewed and validated using the *World Checklist of Vascular Plants* (POWO 2024) as a reference; 2) the threat category for each species was identified using the database of The International Union for Conservation of Nature (IUCN 2024); and 3) the distribution of the species was reviewed, and native and endemic species of Colombia were selected (Raz & Agudelo Zamora 2023). As a result, 45 species from 21 families were prioritized. Among these, seven species are classified as Critically Endangered, 16 as Endangered, 15 as Vulnerable, and seven as Near Threatened (see Appendix 1). The species outlined will be prioritized for inclusion in the living collections plan that will guide the next decade of activities at the José Celestino Mutis Botanical Garden of Bogotá (JBB), focusing on the conservation of native plant diversity found in the high Andean forests and páramos surrounding the capital. This approach will focus on enhancing, curating, and managing these collections while also promoting research and educational programs related to the environment. Our commitment is to contribute to the overarching conservation of national biodiversity by emphasizing endemic and endangered species over the next ten years.

The preservation, conservation, and adaptation of species within the living collections of the José Celestino Mutis Botanical Garden constitute a complex but vital undertaking. This effort enables comprehensive research into the ecophysiological and adaptive processes of various species, generating essential insights to enhance conservation and adaptation strategies. Furthermore, it fosters new collaborations with research institutions and strengthens the collections' role as an educational resource, promoting public awareness about the significance of protecting plant diversity.

As the Bogotá Botanical Garden celebrates this historic milestone, it invites everyone to join in commemorating its seventieth anniversary – a moment to honor past accomplishments and embrace the challenges ahead in the pursuit of biodiversity conservation.

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Appendix 1. — Potential list of species for enrichment of the Living Collections.

Family	Especie	IUCN Category	Status in Colombia
Araceae	*Philodendron leyvae* García-Barr.	Vulnerable	Endemic
Asteraceae	*Achyrocline mollis* Benth.	Critically Endangered	Native
Asteraceae	*Ageratina latipes* (Benth.) R.M.King & H.Rob.	Near Threatened	Endemic
Asteraceae	*Espeletia barclayana* Cuatrec.	Near Threatened	Endemic
Asteraceae	*Espeletia cabrerensis* Cuatrec.	Vulnerable	Endemic
Asteraceae	*Espeletia cayetana* (Cuatrec.) Cuatrec.	Endangered	Endemic
Asteraceae	*Espeletia chocontana* Cuatrec.	Endangered	Endemic
Asteraceae	*Espeletia miradorensis* (Cuatrec.) Cuatrec.	Critically Endangered	Endemic
Asteraceae	*Espeletia summapacis* Cuatrec.	Endangered	Endemic
Asteraceae	*Gynoxys hirsuta* Wedd.	Vulnerable	Endemic
Asteraceae	*Gynoxys hirsutissima* Cuatrec.	Critically Endangered	Endemic
Begoniaceae	*Begonia tropaeolifolia* A.DC.	Endangered	Native
Berberidaceae	*Berberis carupensis* L.A.Camargo	Critically Endangered	Endemic
Berberidaceae	*Berberis sumapazana* L.A.Camargo	Endangered	Endemic
Berberidaceae	*Berberis tabiensis* L.A.Camargo	Vulnerable	Endemic
Berberidaceae	*Berberis uribei* L.A.Camargo	Critically Endangered	Endemic
Bignoniaceae	*Handroanthus chrysanthus* (Jacq.) S.O.Grose	Vulnerable	Native | cultivated
Bromeliaceae	*Pitcairnia petraea* L.B.Sm.	Endangered	Endemic
Bromeliaceae	*Tillandsia breviturneri* Betancur & Néstor García	Endangered	Endemic
Bromeliaceae	*Tillandsia chartacea* L.B.Sm.	Critically Endangered	Endemic
Bromeliaceae	*Tillandsia fusiformis* L.B.Sm.	Endangered	Native
Brunelliaceae	*Brunellia racemifera* Tul.	Endangered	Endemic
Caprifoliaceae	*Valeriana secunda* B.Eriksen	Endangered	Native
Clethraceae	*Clethra rugosa* Steyerm.	Vulnerable	Native
Clusiaceae	*Clusia cundinamarcensis* Cuatrec.	Vulnerable	Endemic
Cunoniaceae	*Weinmannia karsteniana* Szyszyl.	Near Threatened	Native
Dryopteridaceae	*Elaphoglossum sodiroi* (Baker) Christ	Critically Endangered	Native
Ericaceae	*Gaultheria santanderensis* A.C.Sm.	Near Threatened	Endemic
Ericaceae	*Plutarchia guascensis* (Cuatrec.) A.C.Sm.	Vulnerable	Endemic
Fabaceae	*Lupinus colombiensis* C.P.Sm.	Vulnerable	Endemic
Lamiaceae	*Salvia cocuyana* Fern.Alonso	Endangered	Endemic
Melastomataceae	*Meriania mutabilis* (Gleason) Humberto Mend. & Fern.Alonso	Vulnerable	Endemic
Melastomataceae	*Meriania mutisii* (Bonpl.) Humberto Mend. & Fern.Alonso	Near Threatened	Endemic
Melastomataceae	*Miconia annulata* (Naudin) Triana	Vulnerable	Endemic
Melastomataceae	*Miconia miocarpa* Naudin	Endangered	Endemic
Melastomataceae	*Miconia parvifolia* Cogn.	Vulnerable	Endemic
Melastomataceae	*Miconia reclinata* (Bonpl.) Naudin	Vulnerable	Endemic
Orchidaceae	*Masdevallia racemosa* Lindl.	Vulnerable	Endemic
Plantaginaceae	*Aragoa corrugatifolia* Fern.Alonso	Vulnerable	Endemic
Plantaginaceae	*Aragoa cupressina* H.B. & K.	Endangered	Endemic
Plantaginaceae	*Aragoa perez-arbelaeziana* Romero	Endangered	Endemic
Primulaceae	*Ardisia sapida* Cuatrec.	Near Threatened	Endemic
Sapindaceae	*Allophylus goudotii* (Triana & Planch.) Radlk.	Near Threatened	Endemic
Viburnaceae	*Viburnum subsessile* Killip & A.C.Sm.	Endangered	Endemic
Viburnaceae	*Viburnum suratense* Killip & A.C.Sm.	Endangered	Endemic