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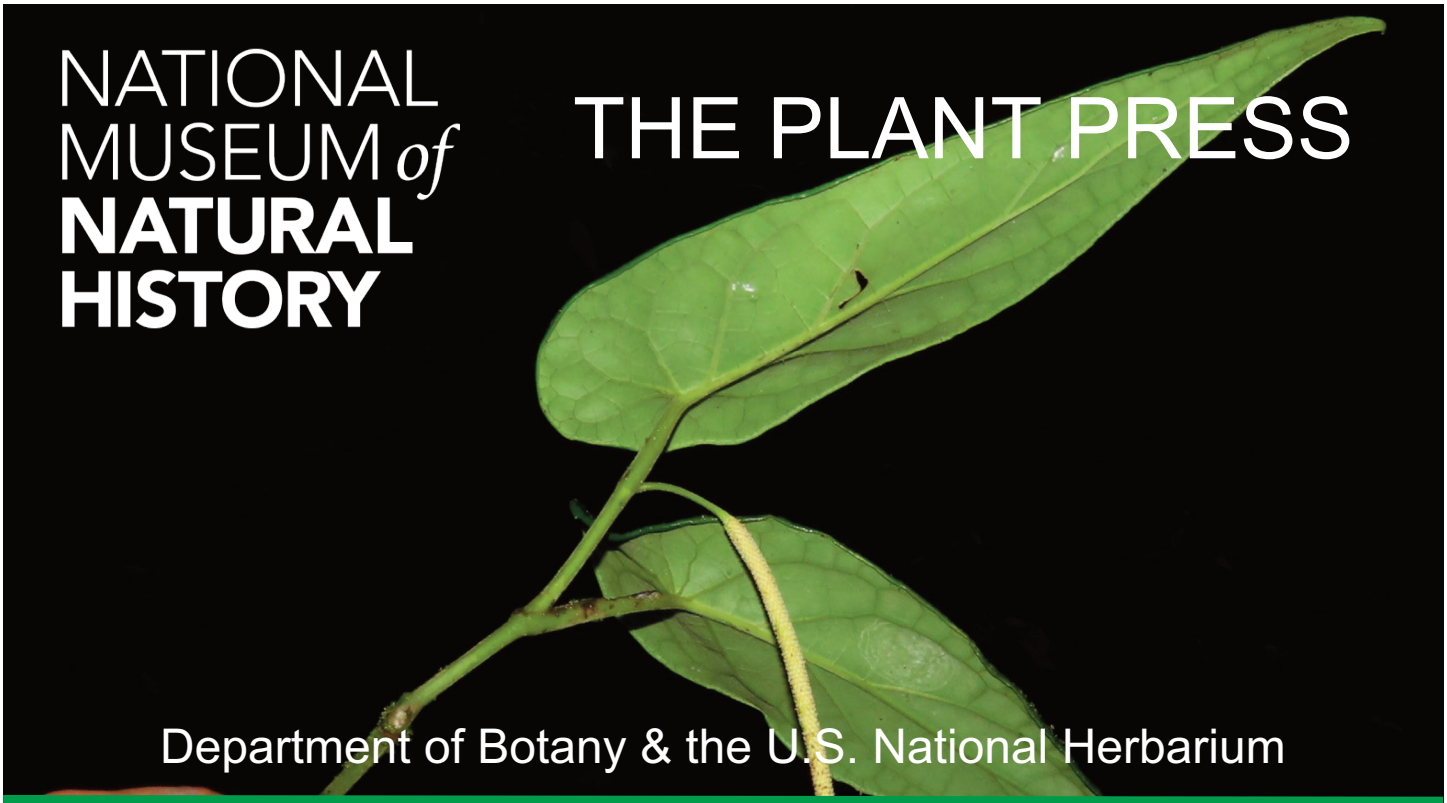

Department of Botany & the U.S. National Herbarium

New Series - Vol. 26 - No. 3 July-September 2023

Welcome to the jungle: Symposium explores Neotropical plants

By Gary A. Krupnick

The Smithsonian's Department of Botany and the United States Botanic Garden (USBG) convened the 20th Smithsonian Botanical Symposium, "New Horizons in the study of Neotropical Floras," at the National Museum of Natural History (NMNH) in Washington, D.C., on May 19, 2023. The hybrid event brought together five engaging speakers who presented their research to both in-person and virtual audiences from around the world. The invited speakers included scientists specializing in the natural history, geographic diversity, evolution, and conservation of plants in the Neotropics. The origins, evolution, and even species composition of the Neotropical flora are far from understood and are the subject of active research in the face of ongoing habitat loss and climate change.

Eric Schuettpelz, NMNH Chair of Botany, welcomed the audience to the symposium by highlighting the mission of the Smithsonian as well as the immense collections housed in the museum and especially the U.S. National Herbarium. Susan Pell, USBG Executive Director, also provided opening remarks and gave an orientation to the USBG, including its history, a description of the living collections, current online and in-person programming, and their scientific and conservation partnerships.

Laurence Dorr, NMNH Department of Botany, then presented the José Cuatrecasas Medal for Excellence in Tropical Botany to Rafaela Campostrini Forzza, an accomplished scientist, science administrator, and educator. While Forzza was unable to attend in person, she accepted the award through a recorded video which was shared with the

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"I see hope in restoration projects. I think we have to work big time in bringing things back and keeping the things that are there connected."

- Paola Pedraza-Peñalosa, in answering the panelist question, "where do you see hope in Neotropical plant conservation?

Symposium

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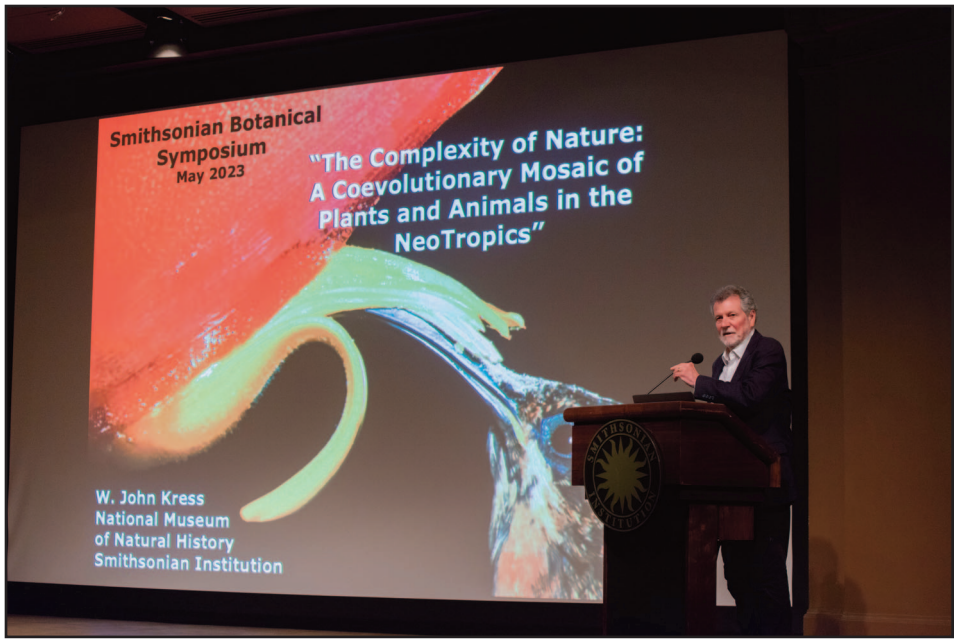
audience. In the recording she described how her work on Neotropical plants has focused on research, collections, conservation, and collaborations with local communities and policy makers. She expressed her thanks and gratitude to those who share her passion, colleagues who have inspired and supported her research, communities that have welcomed her into their homes and landscapes, and the plants and animals that have inspired her with their beauty and resilience.

The first presentation of the symposium was delivered by W. John Kress from the Smithsonian's National Museum of Natural History. His talk, "The complexity of nature: A coevolutionary mosaic of plants and animals in the Neotropics," explored the ecology and evolution of tropical plants and the animals they interact with, focusing specifically on heliconias and hummingbirds. He also described a DNA barcoding study examining the interactions between Costa Rican Zingiberales and their herbivorous beetles, showing a complex interaction involving specialists and generalists. He then shifted to hummingbirds and showed videos of bird bills fitting precisely in the shape of *Heliconia* flowers.



W. John Kress discusses the relationship between *Heliconia* and hummingbirds. (photo by Ken Wurdack)

Kress described in detail a study system in the Eastern Caribbean—two species of *Heliconia* and one species of hummingbird. What he found was a complex sexual specialization of pollinators. The hummingbird, *Anthracothorax jugularis*, is sexually dimorphic with males having large bodies and straight bills feeding exclusively on *Heliconia caribaea*, and females being smaller with curved bills feeding exclusively on *H. bihai*. In addition to sexual and trait dimorphism, Kress also found behavioral dimorphism, with females as trapliners and males as territorial defenders using the *Heliconia* in their territory as bait for females. The study site of Dominica is where these two *Heliconia* species come together, but the study system becomes much more complex as you look north where only *H. caribaea* is found or south where only *H. bihai* is found—in those regions, the plants become compatible with both male and female hummingbirds and the plant size changes as well. Kress then presented an hypothesis of the speciation events that gave rise to the Caribbean *Heliconia* species. He concluded his talk with mention of the Anthropocene and the impacts of altered habitats and invasive species.

The second speaker of the day was M. Alejandra Jaramillo from Universidad Militar Nueva Granada in Colombia, who spoke about, "*Piper* evolution and ecology: A peppery tale from the understory." She presented three "tales": species descriptions, tropical diversity in the mountains, and a witch tale. She began with a focus on the Emerald Forest, Serrania de las Quinchas in Boyaca, Colombia and the genus *Piper*, a group with 2,000 species. She described the natural history of *P. quinchasense* with its peltate leaves, the high-elevation *P. alwynii*, and *P. piluliferum*, *P. globosurachis*, and *P. nudilimbum*, each with globulous inflorescences. She spoke about the phylogenetic classification of *Piper*, once having 11 Neotropical groups but now with additional smaller groups that have been identified using new samples, new sequences, and teamwork.

Jaramillo then discussed how diversity is distributed along a gradient in the mountains. She described a biogeographic study involving three altitudinal zones: 5,00-1,100 m, 1,300-1,600 m, and >2,000 m. She found that species richness is a good proxy for phylogenetic diversity and functional diversity, with the lowlands being more diverse than the uplands. She addressed questions about how communities are assembled, the roles of morphology and physiology, and how climate

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One the cover: *Piper quinchasense* (photo by M. Alejandra Jaramillo)

change affects diversity in tropical mountain systems. She wrapped up her talk with a story about witches' broom and a tri-trophic interaction among plants, herbivores, and bacteria. When phytoplasma bacteria infect a plant's phloem, symptoms include the production of multiple small leaves or the modification of floral organs into leafy tissues. She addressed how prevalent phytoplasmas are in nature, their role in maintaining populations, and the impacts of climate change and deforestation. She concluded with a tribute to female tropical botanists.

Gregory W. Stull from the Smithsonian's National Museum of Natural History then spoke on, "Plant migrations and the assembly of the Neotropical flora: insights from the Mesoamerican-eastern North American biogeographic disjunction pattern." Stull focused his talk on the strong but understudied floristic connections of Mesoamerica with the mesic forests of eastern North America, how Mesoamerica represents a refuge for boreotropical lineages, and the disjunction that exists between these two regions. He described the boreotropical flora as a thermophilic forest that grew across the northern hemisphere from around 66 to 34 million years ago (the end of the Eocene) during a period of global warming. As the climate cooled from the Oligocene onward, the boreotropical forests started to deteriorate and were replaced by more distinctly temperate and deciduous forests.

M. Alejandra Jaramillo peppers her talk with stories about the natural history of *Piper*. (photo by Ken Wurdack)

Stull explained how the montane regions of Mesoamerica represent an important refuge for the boreotropical flora. He described lines of evidence for this refuge which include Mesoamerican lineages that have boreotropical fossil records and how the oldest fossil evidence of North American taxa comes from boreotropical forests.

Stull described the disjunction pattern between eastern North American and Mesoamerica as coming in two forms: within-species disjunctions and closely-related lineage disjunctions. Stull explained that this study system has the potential to answer questions about species responses to climate change, speciation dynamics, and discovery of undocumented biodiversity. Stull suggested that this disjunction pattern originated about 15 million years ago after the Mid-Miocene Climatic Optimum, making it a relatively young disjunction pattern. While the eastern North American populations occur at lower elevations and are more geographically continuous, the Mesoamerican populations are at higher elevations (above 1,000 m) and are more spatially fragmented. This has implications for speciation events and population genetic diversity in cloud forests. Stull addressed topics ranging from the number of taxa that show a disjunction pattern (over 100 examples), insights and limitations from the fossil record (a general North-to-South migration pattern of these lineages from eastern North America to Mesoamerican highlands), and insights from molecular data (similar migration patterns as those revealed in the fossil record). Stull concluded by talking about future directions and ways that this study system might explain how plants respond to climate change.

Gregory W. Stull describes disjunction patterns between the flora of eastern North American and Mesoamerica. (photo by Ken Wurdack)

Alejandra Vasco from the Botanical Research Institute of Texas spoke next about, "Accelerating lineage discovery to document Neotropical fern diversity." Vasco says that with more than 1,450

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Symposium

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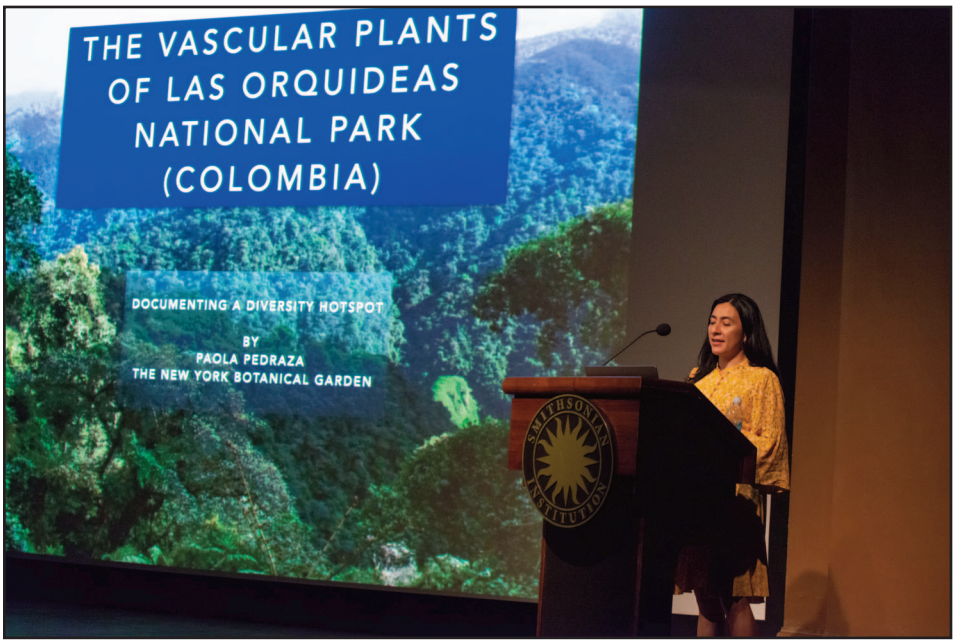
known fern species, Colombia's fern diversity is unparalleled elsewhere in the Americas, and yet, fern diversity in Colombia remains poorly known. Vasco spoke about the Ferns of Colombia project, which aims to improve our understanding of how many ferns exist in Colombia, where the ferns occur, how many of them are threatened with extinction, how to train the next generation of fern botanists, and the importance of spreading the love for ferns and nature. She talked about two recent large expeditions and four smaller expeditions that resulted in 1,300 new collections and thousands of photographs. Some collections were of species that hadn't been collected for 150 years while others were new records for Colombia.

Vasco spoke about a web portal that her team developed that unifies the taxonomic resources for the ferns of Colombia. Her project is also producing genomic resources though the banking of silica-dried tissue and the generation of target-capture sequence data for all Colombian fern species. Another goal is to accelerate the pace of taxonomy and lineage discovery, and thus, she spoke about leveraging taxonomic and genomic resources, training students, and developing collaborations. Vasco described a strategy employing next-generation lineage discovery in three focal groups—*Elaphoglossum*, *Pleopeltis*, and *Pityrogramma*. This strategy will uncover cryptic diversity, such as polyploids and hybrids. She finished her talk with a discussion about IUCN conservation assessments and about community outreach using a curated iNaturalist project and a project that combines art with science (art exhibitions and YouTube videos).

Alejandra Vasco delves into the science of Neotropical ferns. (photo by Ken Wurdack)

The final invited speaker of the day was Paola Pedraza-Peñalosa from the New York Botanical Garden who spoke on "Documenting the flora of a diversity hotspot: Las Orquideas National Park, Colombia." The Las Orquideas National Park sits at the confluency of two important diversity hotspots–the tropical Andes and the Chocó biogeographic regions. Pedraza shared her main objectives: to catalogue the park's vascular flora, to increase botanical knowledge of its priority areas, to enhance data accessibility, and to develop tools for conservation. She described the sharp gradient of altitude found within the park, with the Chocó rainforest at 300–1,000 m, the premontane forest at 1,000–2,000 m, and the montane forest at 2,000–3,100 m. Since most historical collections have been along accessible areas, she described the need to explore more remote locations. She described six large expeditions which had a goal of collecting plant groups that are either hard to identify in the field, hard to collect, very labor intensive, or very diverse such as ferns and orchids.



Paola Pedraza-Peñalosa gives insights into the flora of Las Orquideas National Park. (photo by Ken Wurdack)

The expeditions described by Pedraza led to the discovery of a rare new ecosystem in the park: the first known paramo (3,100–3,400 m) at the locality. Overall, three years of field work and herbarium work uncovered a flora of 176 families, 756 genera, and 2,476 species of vascular plants. More species are yet to be documented, however, since Pedraza's team was unable to explore at elevations below 800 m, and the team had a difficult time collecting tall trees and epiphytes and identifying difficult taxonomic groups. Among the most prominent plant families

in Las Orquideas are the Orchidaceae, Rubiaceae, Melastomataceae, and Ericaceae. Unlike the Amazon, only 5-10% of the taxa are large woody species, while 50% are non-woody plants or epiphytes. Over 50% of the genera are monospecific, and thus the flora has many unique lineages. Pedraza's group has since produced a dynamic electronic checklist, gifted Colombian herbarium specimens to many herbaria around the world, and made plant identification guides for school children and park visitors.

The final session of the Symposium was a panel discussion with all five speakers and the moderator Susan Pell (USBG). Questions from the in-person and virtual audiences and the moderator included: where do you see hope in Neotropical plant conservation and plants abilities to survive in their changing climate?; is there a future of using drones to assist in collecting in tropical areas?; why does the Andean flora consist of 50% monospecific genera?; can you describe the power and value of sharing your research in public forums like art exhibits?; and, what are the next areas that need to be explored in the Neototropics? To hear the fascinating responses to these questions by all five speakers, a video of the panel discussion is available on YouTube.

The talks ended with Kirk Johnson, NMNH Sant Director, delivering concluding remarks. Johnson emphasized that museums play an important role in research with its collections, scientists, scholars, students, and their role in communication. He warned that, "if we don't work to save the Amazon basin and the biodiversity and the surrounding areas, we're going to lose the planet." Johnson highlighted how museums need to come together to combine efforts to tackle these challenges. He spoke about some of his paleobotanical research and gave recognition to successful activities and accomplishments happening at NMNH, such as the complete digitization of the US National Herbarium.

The Symposium concluded with evening events at the U.S. Botanic Garden's Conservatory, including a closing reception and a poster session.

An optional field trip before the symposium allowed attendees the opportunity to partake in two behind-the-scenes tours of the Joseph F. Cullman 3rd Library of Natural History, an event hosted by Smithsonian Libraries. Located at NMNH, the library featured a wide selection of stunning books highlighting historic publications in the study of Neotropical flora. Leslie Overstreet, Curator of Natural History Rare Books, presented such books as Hans Sloane's A Voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica (1707), Nicolai Josephi Jacquin's Selectarum Stirpium Americanarum Historia (1763), and set number one of Botanica Magnifica (2008), a five-volume, double-elephant folio-sized work of two hundred fifty photographic images of plants by photographer Jonathan Singer and botanists John Kress and Marc Hachadourian.

The symposium attracted an audience of 260 attendees, with roughly half in-person and half online. Those who viewed the proceedings virtually watched from 22 countries from around the world. All speaker presentations, opening remarks, the presentation of the José Cuatrecasas Medal, and the roundtable panel discussions were recorded and are available for viewing on NMNH's Natural History for Scientists YouTube < https://www.youtube.com/watch?v=HETRpJkrhAk&list=PLQmxS2U3B6Kbo8GKodMg6FB6K5EHaBaVI&index=19&t=2s> page.

The 21st Smithsonian Botanical Symposium is tentatively scheduled to take place at the National Museum of Natural History and the U.S. Botanic Garden on Friday, May 17, 2024. The topic is still to be determined. Check the Department of Botany's website for updates.

"So much emphasis is put on lab work. We need to move into the future with a balanced approach. One method is not going to help us understand how nature works. We have to keep up the field work and balance that with new technologies and new ways to analyze things."

- W. John Kress, in answering the panelist question, "what are the next areas that need to be explored in the Neotropics?"

Kirk Johnson delivers closing remarks and spoke about the role museums can play in Neotropical botanical research, education, and outreach. (photo by Ken Wurdack)

Rafaela Campostrini Forzza receives the 20th Cuatrecasas Medal

The José Cuatrecasas Medal for Excellence in Tropical Botany is named in honor of Dr. José Cuatrecasas, a pioneering botanist and taxonomist, who spent nearly a half-century working at the National Museum of Natural History. Cuatrecasas had a distinguished career devoted to systematic botany and plant exploration in tropical South America, especially in the Andes, and this award serves to keep vibrant his accomplishments and memory. The Department of Botany and the U.S. National Herbarium present this award at the Smithsonian Botanical Symposium to a botanist and scholar of international stature who has contributed significantly to advancing the field of tropical botany. The award consists of a bronze medal bearing an image of José Cuatrecasas on the front with the recipient's name and date of presentation on the back.

This year the 20th José Cuatrecasas Medal for Excellence in Tropical Botany was presented to Rafaela Campostrini Forzza, an accomplished scientist, science administrator, and educator.

Forzza earned an undergraduate degree in Biological Sciences from Universidade Federal de Juiz de Fora and a Master's and PhD in Biological Sciences (Botany) from Universidade de São Paulo. Since 2002, she has been a researcher at the Jardim Botânico do Rio de Janeiro and curator of the Herbário Dimitri Sucre.

Her impact has been impressive on several different scales. She has contributed immeasurably to our knowledge of the Brazilian flora through her leadership role in Reflora (a virtual herbarium for images of Brazilian plants housed in foreign herbaria), which has transformed floristic research in Brazil and spurred an amazing amount of research activity in plant systematics, taxonomy, and conservation in South America's largest country. In addition to managing this Herculean task, which involved sending students to image Brazilian specimens in foreign herbaria (including four hosted here in the U.S. National Herbarium), creating nomenclatural and specimen databases for the Brazilian flora, and coordinating a checklist of the plants and fungi of Brazil, her personal research on Bromeliaceae and related families often in conjunction with students also has been rich and of the highest caliber. In addition to phylogenetic research, she has authored or co-authored close to 100 species of Bromeliaceae publications, including *Encholirium agavoides*.

Laurence Dorr presented the medal to Forzza at the 20th Smithsonian Botanical Symposium at the National Museum of Natural History in Washington, DC, on May 19, 2023.

Past recipients of the Cuatrecasas Medal are Rogers McVaugh from the University of North Carolina at Chapel Hill (2001); P. Barry Tomlinson from Harvard University (2002); John Beaman from the Royal Botanic Gardens, Kew (2003); David Mabberley from the University of Leiden, The Netherlands, and the Royal Botanic Gardens, Sydney (2004); Jerzy Rzedowski and Graciela Calderón de Rzedowski from Instituto de Ecología del Bajío, Michoacán, Mexico (2005); Sherwin Carlquist from Rancho Santa Ana Botanic Garden and Pomona College (2006); Mireya D. Correa A. from the University of Panama and Smithsonian Tropical Research Institute (2008); Norris H. Williams from the Florida Museum of Natural History and the University of Florida, Gainesville (2009); Beryl B. Simpson from the University of Texas at Austin (2010); Walter S. Judd from the University of Florida at Gainesville (2012); Ana Maria Giulietti Harley from the Universidade Estadual de Feira de Santana, Brazil (2013); H. Peter Linder from Zurich University (2014); Paulo Günter Windisch from Universidade Federal do Rio Grande do Sul, Brazil (2015); Kamal Bawa from the University of Massachusetts Boston (2016); Robin B. Foster from the Field Museum (2017); Alan K. Graham from the Missouri Botanical Garden (2018); Sandra Knapp from the Natural History Museum in London (2019); Sebsebe Demissew from the Gullele Botanic Garden and Addis Ababa University, Ethiopia (2021); and Fabián Michelangeli from the New York Botanical Garden (2022).

Rafaela Campostrini Forzza accepts the 20th José Cuatrecasas Medal for Excellence in Tropical Botany.

Abstracts from the speakers of the 20th Smithsonian Botanical Symposium

The 20th Smithsonian Botanical Symposium, "New Horizons in the Study of Neotropical Floras," was held on 19 May 2023. The invited speakers specialize in natural history, geographic diversity, evolution, and conservation of plants in the Neotropics. Below are the abstracts from the papers that were presented by the invited speakers.

W. John Kress
National Museum of Natural History

"The complexity of nature: A coevolutionary mosaic of plants and animals in the Neotropics"

The complexity of life on Earth is a product of the diversity of species multiplied by the diversity of their interactions. The quantification of species diversity, which requires both correct identification and resolved evolutionary patterns, is a prerequisite to accurately interpret their interactions. I will focus on one charismatic group of neotropical plants in the genus *Heliconia* and the ecology of the hummingbird pollinators with which they have coevolved. These ecological interactions between the plants and pollinators reveal their intricate patterns of evolutionary history and also how these species may respond to today's rapidly changing planet.

M. Alejandra Jaramillo
Universidad Militar Nueva Granada

"*Piper* evolution and ecology: A peppery tale from the understory"

The genus *Piper* is one of the largest lineages of flowering plants. It is also a dominant element of the forest understory in the Neotropics (but also common and diverse in Asian tropics). *Piper* is also diverse locally. In a forest reserve like La Selva, you can find 40 different species. In a small circle plot of 10 m diameter, you can encounter 25 plants and up to 7 species! Molecular phylogenetics has been instrumental in consolidating an infraspecific classification and as a frame to ask ecological questions with an evolutionary framework. Chemistry and the interconnection with herbivores are key for *Piper* species co-existence. As part of the spectrum, we cannot discard the role of plant growth forms and co-existing microorganisms. Species diversity is highest at mid-elevation (ca. 1,000 m in elev.), and the Andes foothills seem crucial for the genus's extensive diversification. We try to avoid overwhelming ourselves with the large numbers of species in the genus. Still, new taxa pop up in the forest or the herbarium cabinet every time we dare to look closely. We are using the immense diversity of this genus to ask all types of questions about the tropical forest understory. I will tell you a few peppery stories to tickle your curiosity.

Eric Schuettpelz (second from left), Chair of the Botany Department, and Susan Pell (far right), USBG Deputy Executive Director, join the speakers of the 2023 Smithsonian Botanical Symposium at the National Museum of Natural History (from left): Alejandra Vasco, M. Alejandra Jaramillo, W. John Kress, Paola Pedraza-Peñalosa, and Gregory W. Stull. (photo by Ken Wurdack)

Gregory W. Stull
National Museum of Natural History

"Plant migrations and the assembly of the Neotropical flora: insights from the Mesoamerican-eastern North American biogeographic disjunction pattern"

The assembly of the present-day Neotropical flora has been greatly influenced by plant migrations into the region from different parts of the globe throughout the Cenozoic (66 to 0 mya). The highlands of Mesoamerica (including central and southern Mexico and Central America) harbor remarkable levels of plant diversity including an unusual mix of species with 'tropical' and 'temperate' ancestries. The latter includes numerous species showing a geographic disjunction between Mesoamerican (MAM) cloud forests and mesic temperate forests of eastern North America (ENA), separated by vast expanses of arid habitat across northern Mexico and the southwestern USA. These MAM-ENA disjuncts have been of interest for over 75 years, but there have been remarkably few recent studies attempting to document the number of species showing this disjunction pattern or the evolutionary and geologic history underlying its formation. In this talk, I will provide an overview of this poorly studied disjunction pattern. Recent work has revealed >100 examples of this disjunction pattern in seed plants alone, including both species with disjunct populations as well as sister species (or lineages) disjunct between these regions. The examples documented so far span the phylogenetic breadth of seed plants and represent the gamut of plant growth forms and life history strategies. Preliminary work also suggests that many cloud forest populations likely represent undescribed species, but the vast majority of these disjuncts have been entirely unstudied in the

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Abstracts

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context of this biogeographic pattern. Overall, the MAM-ENA disjunction pattern represents an excellent system for studying how plant migrations between Mesoamerica and North America contributed to the historical assembly of diverse (and imperiled) forest ecosystems in these regions. More broadly, this disjunction pattern represents an incredibly rich system for studying the evolutionary and ecological responses of American temperate forests to climate change over short (Pleistocene) and longer (Cenozoic) time scales. I will conclude by outlining promising avenues for future research on this biogeographic pattern that involve bolstering relationships among US, Mexican, and Central American botanists with the goal of tackling urgent problems in biodiversity science and conservation across the Americas.

Alejandra Vasco
Botanical Research Institute of Texas

"Accelerating lineage discovery to document Neotropical fern diversity"

The process of documenting and describing biodiversity often cannot keep up with the rate of habitat loss and the extinction of species. This is especially true in tropical regions of the world, where the number of undescribed and poorly known species is highest, and biodiversity is most severely threatened. This project aims to contribute to documentation of Earth's plant diversity by studying the diversity of ferns in Colombia, one of the most species-rich countries on Earth. The proposed research is documenting Colombian fern diversity within a unified taxonomic and evolutionary context, primarily through four interrelated activities. First, we are addressing major gaps in our understanding of species distributions by conducting expeditions to understudied regions of Colombia and examining collections at major Colombian and US herbaria. Second, we are expanding resources for Pteridoportal, a Symbiota portal that serves as a publicly available, specimen-driven taxonomic resource for fern diversity research. Third, we are generating genomic resources for all species of ferns in Colombia, including a DNA and leaf-tissue bank for all collections, ploidy estimates, and target capture sequence data to conduct comprehensive phylogenomic analyses. Finally, we are integrating the data and resources generated through this work to detect and describe yet-overlooked diversity.

Acknowledgments

The success of the Symposium was due to the significant time and efforts of the following people:

Organizing committee: Pedro Acevedo, Amy Bolton, Joy Columbus, Laurence Dorr, Rose Gulledge, Gary Krupnick, Susan Pell, Paul Peterson, Eric Schuettpelz, Kenneth Wurdack, and Elizabeth Zimmer

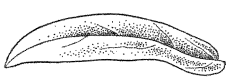
Administrative support: MaryAnn Apicelli, David Jenkins, Tisha Lee, the José Cuatrecasas Botanical Fund, and the Mellon Foundation

The symposium's speakers participate in a panel discussion: (from left) Alejandra Vasco, M. Alejandra Jaramillo, W. John Kress, Paola Pedraza-Peñalosa, and Gregory W. Stull. (photo by Ken Wurdack)

Paola Pedraza-Peñalosa
The New York Botanical Garden

"Documenting the flora of a diversity hotspot: Las Orquideas National Park, Colombia"

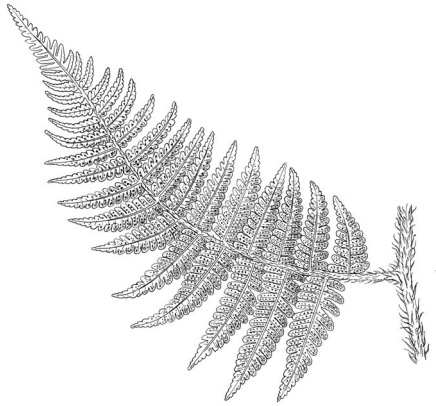
Western Colombia is regarded as one of the most exciting frontiers for botanical exploration in the Neotropics because of its known levels of diversity and endemic species. In analyzing Neotropical diversity, the areas with the highest angiosperm biodiversity were specifically found in the Colombian Western Cordillera (Andes) and Chocó region. Unfortunately, floristic studies of these regions are insufficient and outdated. In general, multi-institutional explorations of the Colombian flora based on modern field and herbarium work have been rare for decades and Colombian species are conspicuously underrepresented in monographic and phylogenetic works. Las Orquídeas National Park, strategically located in western Colombia, comprises vegetation from both the Tropical Andes and adjacent Chocó. Its vascular plants were recently documented through the implementation of a holistic approach to field work that prioritized unexplored localities, encouraged specialized collecting, as well as balanced tree and non-tree sampling. As result, more than 2,000 species of vascular plants were identified, including numerous exciting new species. Also significant is the impact of the herbarium collections: those from the megadiverse northern Andes and Chocó regions were doubled at NY, while the electronic vouchers of the park increased by more than 600% at the Colombian virtual herbarium (COL).



A diplomatic solution: Demissew receives physical Cuatrecasas Medal

In May 2021, Professor Sebsebe Demissew was awarded the Cuatrecasas Medal for Excellence in Tropical Botany by the Smithsonian's National Museum of Natural History (NMNH). He was recognized for his life's work in conserving and recording the very diverse Ethiopian flora with its many endemic species, and for his leadership of the Ethiopian Flora Project and the National Herbarium. Normally the engraved medal is presented in person to the recipient at the beginning of the annual Smithsonian Botanical Symposium, which NMNH hosts in concert with the U.S. Botanic Garden (USBG). The pandemic, however, forced NMNH and USBG to hold a virtual symposium and travel from Ethiopia to Washington was not feasible. Fortunately, Demissew joined the symposium remotely via Zoom and he spoke briefly after it was announced that he was the medal recipient.

Safely conveying the physical medal to Demissew, however, stymied the award committee until they described their dilemma to Carolyn Glassman, the U.S. Department of State's liaison to the Smithsonian Institution. Glassman contacted the U.S. Embassy in Addis Ababa and they agreed to allow the medal to be sent via diplomatic pouch. Embassy staff then went above and beyond the committee's expectations by organizing an early afternoon reception on the botanical garden-like Embassy grounds where Ambassador Tracey Ann Jacobson presented the medal to Demissew. A little magic with cell phone technology and Microsoft Teams allowed some members of the committee in Washington to observe the ceremony and they happily conveyed once again to Demissew their appreciation for his contributions to tropical botany. The committee was also very pleased that Ambassador Jacobson and the U.S. Embassy recognized the importance of his research for Ethiopia and the world.



Left: Sebsebe Demissew. (photo by The Royal Society, London)
Above: Ambassador Tracey Ann Jacobson presents the José Cuatrecasas Medal for Excellence in Tropical Botany to Sebsebe Demissew. (image courtesy of the U.S. Embassy Addis Ababa)

Cherry and grape hunting in the southeast USA

By Richie Hodel, Alicia Talavera, Jun Wen

Recently, Curator **Jun Wen**, and postdoctoral fellows **Alicia Talavera** and **Richie Hodel**, undertook a 12-day collecting trip (3,800 miles) in the southeastern United States with the goal of collecting and conducting field studies on several species of wild grapes (*Vitis* spp.) and cherries (*Prunus* spp.), as well as associated species. The trip was designed to fill in the collection gaps in South Carolina, Georgia, Alabama, the panhandle of Florida, Tennessee, and North Carolina.

The wild relatives of two economically and ecologically important plant lineages, grapes and cherries, are distributed throughout much of North America. Wen's research has focused on both the grape genus (*Vitis*, Vitaceae) and the cherry genus (*Prunus*, Rosaceae) because both represent lineages that have successfully radiated throughout temperate North America and are model systems for studying the diversification and biogeographic history of forest species. Furthermore, both groups are also excellent taxonomic models to tackle species delimitations integrating morphological, phylogenomic, and ecological data.

Alicia Talavera, Jun Wen, and Richie Hodel after successfully finding populations of wild cherries and grapes in oak-hickory-pine forests near Pine Mountain, Georgia. (photo by A. Talavera)

Talavera is interested in the evolutionary diversification of North American *Vitis* especially the *Vitis cinerea* species complex and the *Vitis aestivalis* species complex. Hodel is studying the biogeography of the entire cherry genus, as well as the genome-phenome-environment connection within selected cherry species in North America.

Alicia Talavera and Jun Wen collecting wild grape, *Vitis simpsonii,* near Quincy, Florida. (photo by R. Hodel)

Wen and Hodel collected several hundred accessions of focal species in the cherry genus. Specifically, Hodel is researching the mechanisms that allow the widespread *Prunus serotina* (black cherry) to occupy diverse habitats across North America, as well the regional variation within the species complex. This trip was particularly fruitful because it improved our collections of *Prunus serotina* from southeastern habitats. But more importantly, extensive sampling in the southeast US revealed that *Prunus serotina* ssp. *alabamensis* (the Alabama cherry; or *Prunus alabamensis*) is sympatric with the widespread *Prunus serotina*, and it is likely reproductively isolated from the widespread black cherry, based on phenology.

Another important goal of the trip was to further build the collections of North American *Vitis*, especially collecting populations of *Vitis cinerea* and *Vitis aestivalis* species complexes, the latter of which frequently share its habitat with

Prunus serotina spp. *alabamensis*. These collections and the field observations are essential for the development of Talavera´s postdoctoral research. Wen and Talavera will utilize a widely sampled species which covers most of the distribution of these species to clarify the complex evolutionary history of North American *Vitis*.

Wen, Talavera, and Hodel left Washington, D.C. on May 20, traveling directly to South Carolina, where they collected specimens immediately upon arrival, in areas near Greenville and Lexington. After South Carolina, they traveled to several locations in central and northern Georgia before traversing Alabama from the north to the south, with subsequent stops in southern Georgia, before reaching the southernmost destination of the trip, the panhandle region of Florida. The three then headed to western Alabama, Tennessee, and North Carolina, target collecting the grape and cherry populations as they traveled, before returning home to D.C. on May 31.

Several botanists kindly facilitated the collections made during this field trip. Alvin Diamond, Curator of the Troy University Herbarium (TROY), spent a full day showing the group field sites surrounding Troy, Alabama. Dan Spaulding, Curator of the Herbarium at the Anniston Museum of Natural History, helped the team collect from relict natural forests on the grounds of the museum in Anniston, Alabama. The team also spent several hours working in the Troy University Herbarium and visited the Troy University Arboretum. The visit to TROY was especially fruitful for checking the records of several species, e.g., *Vitis mustangensis* (Mustang grape), *Vitis cinerea* (graybark grape), and taxa of the *Prunus serotina* complex. Wen helped annotate c. 100 *Vitis* collections at TROY. Prior to the field trip, Jimmy Triplett at Jacksonville State University (JSU) also provided important information on the Alabama cherry and loaned specimens from the JSU Herbarium.

This field opened up many new questions on the evolutionary diversification and systematics of both grapes and cherries in North America. These collections will inspire research on the biodiversity assembly of grapes and cherries in North America and help untangle the complex taxonomy of several species complexes.

***Vitis mustangensis* or Mustang grape in its easternmost distribution range in Wilcox Co., Alabama. (photo by J. Wen)**

Request for plant exudate samples

By Jorge A. Santiago-Blay and Joseph B. Lambert

For the past 25 years, Jorge Santiago-Blay, a Research Associate in the National Museum of Natural History's Department of Paleobiology, and Joseph Lambert, Trinity University, have had a long-standing collaboration on the analyses of plant exudates, the usually sticky and organic substances that many plants produce.

Although the chemical variation of these materials is enormous, as far as the team knows, plant exudates come in a surprising limited number of molecular types, as revealed by nuclear magnetic resonance spectroscopy (NMR). The three most common types are: 1) resins, whose molecular building block is isoprene, a five-carbon molecule; 2) gums, whose molecular units are monosaccharides; and 3) phenolics, whose molecular unit is phenol. Amber, a fossilized resin, is a material noted for its beauty, human uses, and amazing preservation of biological materials. The term "latex", given for the milky substance that some plants produce, is a chemically meaningless term. Thus far, all "latexes" the team has examined are resins.

Santiago-Blay and Lambert continue to analyze these materials and write scientific papers in peer-reviewed venues. Some recent papers include the study of exudates from ferns, cycads, ginkgo, and gnetophytes (*Life: The Excitement of Biology* 4: 215-232; 2016), the resinous cargo of a Java Sea shipwreck (*Archaeometry* 59: 949-964; 2017), and the characterization of phenolic plant exudates by nuclear magnetic resonance spectroscopy (*Journal of Natural Products* 84: 2511-2524; 2021).

If you come across these products out in nature or in collections, please contact Santiago-Blay and Lambert so that they may analyze the exudates via NMR. Santiago-Blay may be reached at blayj@si.edu, and Lambert may be reached at jlambert@trinity.edu.

Example of a plant exudate. Resin dripping from an almond tree. (photo by Yintan; licensed under CC BY 4.0)

Edward S. Ayensu (1935-2023)

Former Chair of the Department of Botany, **Edward S. Ayensu**, passed away on April 22, 2023. He was a distinguished scholar who dedicated his life to science and sustainable development. His contributions to the field of environmental science, biodiversity conservation, and photography are immeasurable.

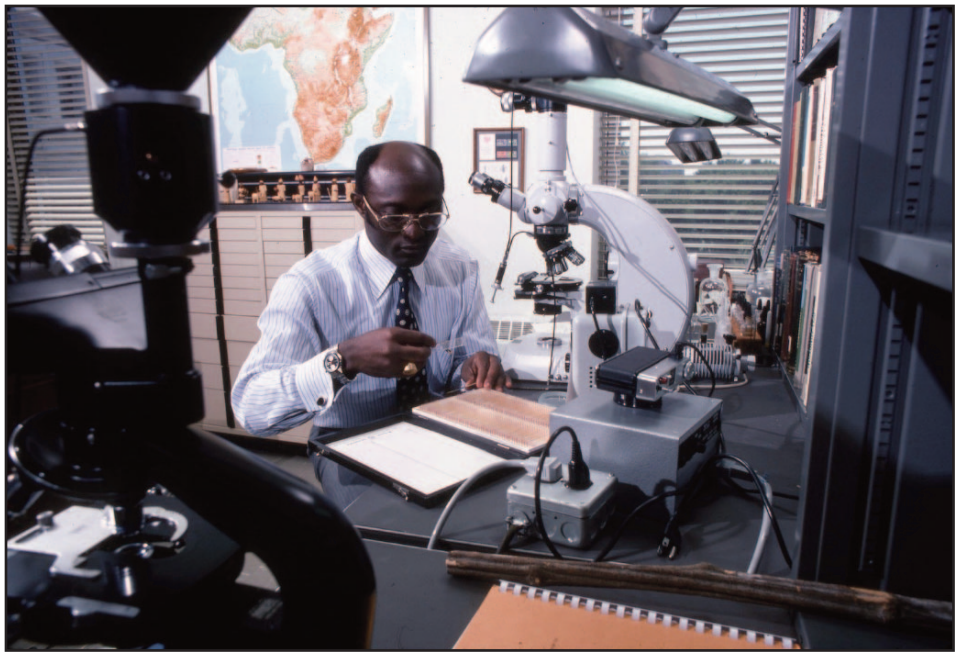
Ayensu joined the Smithsonian Institution as an Associate Curator of Botany in 1966 and became Chair of Botany in 1970. In 1978, the Smithsonian Office of Biological Conservation was established with Ayensu as Director. The responsibility of this office was to coordinate the various environmental conservation activities already in progress in the Institution and encourage a variety of new projects related to environmental conservation, especially within the area of staff interest. In 1978, Ayensu and Botanist Robert DeFilipps authored a Smithsonian Institution reference book entitled *Endangered and Threatened Plants of the United States*.

In 1985, he left the Smithsonian taking on a variety of positions in Africa, including the following: Chairman and President of the Pan African Union for Science and Technology, Chairman of the World Bank Inspection Panel, Chairman of Sustainable Forestry Management Ghana Limited, Chairman of the African Institute of Mathematical Sciences Ghana, and President of the Energy Globe Foundation.

Here are two reflections from former Smithsonian colleagues:

Dr. Edward S. Ayensu was my first Chairman in the Department of Botany and instrumental in my being hired. I had worked previously for him for a few summers doing contract work through Dr. Lyman Smith, who cowrote papers with Ayensu on the Velloziaceae. I learned to illustrate leaf anatomy sections in the Vellozias and make dissections of the flowers for their publications.

My first illustration for the department was in the summer of 1968; it was a new species in Bromeliaceae drawn for Smith who named it *Ayensua uaipanensis*. After I was hired in 1972, I continued to illustrate papers by Ayensu and Smith on the Velloziaceae. I also illustrated other plant families for Ayensu including the Passifloraceae (for *Smithsonian Magazine*, March 1973) and Sapotaceae.



Edward Ayensu at the National Museum of Natural History in 1975. (photo by Smithsonian Institution)

One of my most memorable assignments came from Ayensu to draw bat skulls of bat species that fed on or pollinated certain plant species in West Africa. The publication, "Plant and Bat Interactions in West Africa," for the *Annals of Missouri Botanical Garden* 6(3), 1974, provided me with experience in illustrating bat skulls in different views using photographs and the skulls as research material.

Ayensu's interest in medicinal plants led to his books, *Medicinal Plants of West Africa* (1978) and *Medicinal Plants of the West Indies* (1981), which featured my illustrations and those of Mary Monsma and Cathy Pasquale. Ayensu also provided funding for my initial professional illustrator meetings where my interaction with illustrators from other institutions proved invaluable for information on illustration techniques.

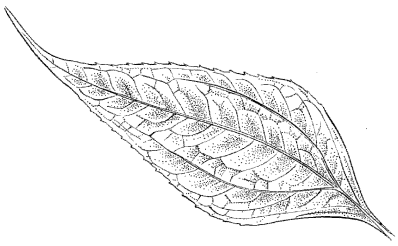
Those first six years under Ayensu gave me the background in botanical illustration and in experience in working in a variety of plant families.

- Alice Tangerini

In 1962, Eddie and I were graduate students at The George Washington University, where he was finishing his master's degree in biological sciences. From what I recall, he was a very good student, well-liked by the professors and his peers. After graduation, we both were employed the Department of Botany at the Smithsonian Institution. I still remember the times Eddie would receive visitors from Ghana or attend functions in his native clothing in the offices of Robert Kennedy across Constitution Avenue. He looked very impressive and suave.

Later in our careers, Eddie and I undertook field work in Dominica in the Caribbean. We spent a month together making botanical collections on the island. At that time, he was very interested in floral pollination and would spend hours waiting for suitable visitors to visit these showy plants. These photographs that he took are still in exhibition in the Department of Botany. During our stay, we established wonderful rapport—this was due entirely to Eddie's cool, level-headed demeanor. He made our stay a pure delight. Later Eddie's interest diverged into habitat and species conservation efforts which he correctly determined as being vital.

- Dieter Wasshausen



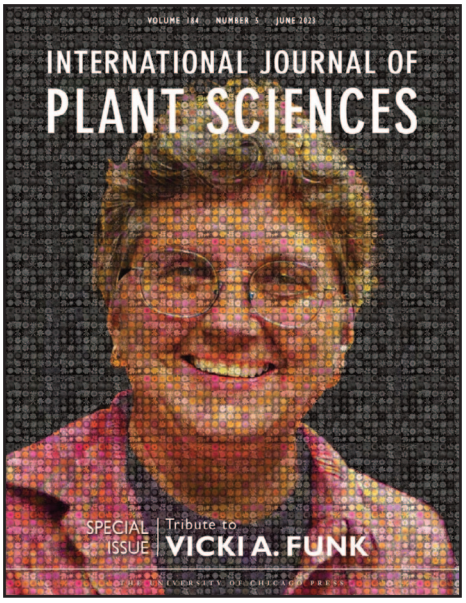
New issue of *International Journal of Plant Sciences* honors Vicki Funk

A special issue of the *International Journal of Plant Sciences* just published (volume 184, number 5; 2023) honors Dr. Vicki Ann Funk (November 26, 1947–October 22, 2019), who passed away after a battle with an aggressive cancer. **Vicki Funk** was an inspirational evolutionary biologist and a champion for collections-based systematics and biogeography. She had broad influence on the way we perform our collections-based systematics today, especially with the development of phylogenetic systematics in botany in the early 1980s and throughout her career.

Funk was one of the most active, enthusiastic, and passionate professional botanists of our time. She combined these qualities with a quick mind and glowing wit, with new ideas or opinions that she was eager to share with anyone who would listen, and be willing to enter an engaging dialogue.

During her distinguished career, Funk achieved preeminence in the fields of phylogenetic methods, systematics, biogeography, and biodiversity conservation. She devoted a significant part of her career to mentoring the next generation of botanists and working with groups to tackle larger areas of research, especially Compositae systematics, phylogenetics, and biogeography.

The special issue organized by Jennifer Mandel, Erika Moore-Pollard, Mauricio Bonifacino, **Jun Wen**, and **Warren Wagner** consists of eight papers on Compositae (Asteraceae) systematics by various colleagues, two more on collections for botanical systematics, and concludes with a tribute to her career and contributions by Wagner and Wen.



The cover image of the *International Journal of Plant Sciences* (volume 184, number 5; 2023) features Vicki A. Funk in a photo dated 2008 and seen through a mosaic composed of images of capitula representing all major groups of Compositae.

NEW FACES

Nicolli Cabello joined the ForestGEO team in April 2023. She is an intern of **David Kenfack** doing data management and monitoring for the List of Threatened Species of Plants in the Korup's plot in Cameroon, Africa. Over the next 6 months, she will complete the same conservation status monitoring for all the species in ForestGEO's Africa plots. Cabello is a Brazilian forest engineer interested in tropical forests, the Amazon, Lecythidaceae, and biogeography. These foci set her up to work on the recensus of a 100 ha plot in Central Amazon between 2018 and 2019, where she helped to identify, measure, tag, and georeference more than 15,000 Lecythidaceae trees. Once she completes her internship, Cabello plans to apply for a PhD program and continue studying the same botanical family.

Isabella (Bella) Valli joined the ForestGEO team in May 2023 as an Administrative and Programs Assistant. She received her bachelor's degree in Environmental Science, with Minors in Animal Behavior and French Studies, from Indiana University in 2022. Before coming to ForestGEO, Bella worked with the U.S. Fish & Wildlife Service of the Chesapeake Bay performing fieldwork geared towards the preservation of marshland and its threatened and endangered species (avian species in particular) and authoring refuge proposals. In her new role, Valli is able to use her scientific background to support the science that ForestGEO does by ensuring administrative tasks run smoothly and enhancing community outreach.

VISITORS

Zhiqiong Lan, Chengdu University of Traditional Chinese Medicine, China; Chinese medicinal plants (3/1-12/22).

Alice Fornasiero, **Maria Navarrete Rodriguez**, and **Rod Wing**, King Abdullah University of Science and Technology, Saudi Arabia; *Oryza* (Poaceae) (3/21-4/3).

Jim Luteyn, New York Botanical Garden; Ericaceae (4/3-4/5).

Claudenice Dalastra, Universidade Federal do Rio Grande do Sul, Brazil; *Agarista* (Ericaceae) (4/3-4/7).

Tiago Vierira-Silva, Harvard University; Orchidaceae (4/4-4/7).

Craig Barrett, West Virginia University; Poaceae (4/13).

Kira Lindelof, North Carolina State University; *Houstonia* sect. *Amphiotis* (Rubiaceae) (4/17-4/18).

Takuro Ishihara and **Yasuyuki Murakami**, Suntory Flowers Innovation Field, Japan; Apocynaceae and Solanaceae (4/21).

Molly Hardy, National Endowment for the Humanities; History of herbaria, Asa Gray (4/26-4/27).

Doug Daly, New York Botanical Garden; Burseraceae and Anacardiaceae (4/28).

Hannah Marx, University of New Mexico; Conyzinae (Asteraceae; Asteroideae; Astereae) (5/1-5/2).

Victoire Thierree, Villa Albertine, France; Photography and research for a sculpture project (5/4-5/5).

Daniela Canelon Barraez and **Santos Miguel Nino**, Universidad Nacional Experimental de los Llanos Ezequiel Zamora, Venezuela; Flora of Guaramacal (5/8-6/15).

Bertrand Black, University of Vermont; Ferns (5/11).

Steven Manchester, University of Florida; Burseraceae (5/11-5/12).

Emily Beech, Botanic Gardens Conservation International, **H. David Clarke**, University of North Carolina Asheville, and **Bruce Hoffman**, Amazon Conservation Team-Suriname; Global Tree Assessments of the Guiana Shield (5/17-5/19).

Alejandra Vasco, Fort Worth Botanic Garden; Ferns (5/17-5/19).

Jordan Nikkel, Iowa State University; *Leptoloma* (=*Digitaria* sect. *Pennatae*) (Poaceae) (5/18-5/24).

Maria Alejandra Jaramillo, Universidad Militar Nueva Granada, Colombia; *Piper* (Piperaceae) (5/19-5/26).

Jeronimo Morales-Toledo and **Kate Morrison**, University of Michigan; Paleobotany (5/22-5/26).

Mark Mullinger, University of Vermont; Poaceae (5/30-6/1).

Maria Tereza Rodrigues Costa, Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Brazil; Malvaceae (5/30-6/2).

Juliana Santos Silva, Universidade do Estado da Bahia, Brazil; *Brownea* (Fabaceae) (6/9-6/14).

Savannah Mapes, Virginia Institute of Marine Science; Harmful algal blooms and Expert Is In cart (6/12-6/16).

Jeanmaire Molina, Pace University; Vitaceae (6/12).

Riley Rees, Ohio University; Caryophyllaceae (6/12-6/14).

Fabio Andrés Ávila Castillo, New York Botanical Garden; Neotropical Proteales and Asteraceae (6/13-6/16).

Zhengxu Ma, University of Wisconsin-Madison; Araceae, Aristolochiaceae, Ebenaceae, Pandanaceae, and Proteaceae (6/20-6/23).

TRAVEL

Stuart Davies traveled to Singapore and Malaysia (5/25 – 6/02) for the XPRIZE review panel meeting and to visit two Malaysian ForestGEO plots and meet with their partners.

Erika Gardner, **Carol Kelloff**, and **Meghann Toner** traveled to San Francisco, California (5/27 – 6/3) to attend and give presentations at the annual meeting of the Society for the Preservation of Natural History Collections (SPNHC).

Laurence Skog traveled to Gainesville, Florida (4/21 – 4/22) to visit the University of Florida to identify specimens of Gesneriaceae utilizing the online data and images of specimens of the plant family at US.

Robert Soreng traveled to Geneva and Lausanne, Switzerland (5/30 – 6/12) to study the G-BOIS collections from Boissier's Flora Orientalis (focusing on the Flora of Turkey grasses: *Bellardiochloa*, *Catabrosa*, *Catabrosella*, *Hyalopodium*, *Paracolpodium*, *Poa*) at the Geneva Herbarium (G), to visit Gaudin's herbarium (LAU), and to collect *Poa* (bluegrasses) in the Alps in Valais Canton.

Jun Wen, **Richie Hodel**, and **Alicia Talavera** traveled throughout the southeast United States (5/20 – 5/31) to conduct field work on native grapes and cherries and to collect eastern North American and eastern Asian disjunct plants.

Ken Wurdack traveled to St. Louis, Missouri (5/23 – 5/30) to work on Euphorbiaceae collections at the Missouri Botanical Garden.

STAFF ACTIVITIES

Savannah Mapes, Virginia Institute of Marine Science (VIMS) graduate student and NMNH-Department of Botany

Savannah Mapes at an Expert Is In session in the Ocean Hall, NMNH on June 16, 2023.

summer intern, shared research on phytoplankton at an Expert Is In session in the Ocean Hall, NMNH on Friday, June 16. She talked about the important role phytoplankton play in our everyday lives and showcased the ecological and financial impact of harmful algal blooms. Though microscopic, they play an enormous role in sustaining life on Earth. There was a lot of interest from school aged children to adults. The microscopes with live algal cultures were a hit as well as Mapes' bioluminescent phytoplankton costume!

As part of her graduate research, Mapes studies the life cycle of *Alexandrium monilatum*, a bioluminescent species of dinoflagellate that produces toxic blooms in the lower Chesapeake Bay. She hopes to uncover clues in the life stages to determine why this species creates harmful blooms.

On May 24, **Sylvia Orli** gave the presentation "Digitizing the US Herbarium" virtually in the DigiTIPS 2023 meeting series. Digitizing to International Imaging Performance Standards (DigiTIPS) is a series of seminars organized by the Society for Imaging Sciences and Technology (IS&T). Orli's talk was part of the Innovations and Special Projects session which highlighted organizations and practitioners using innovative or specialized methods for digitization, as well as those working with unique or unusual collections, or under special circumstances.

Laurence Skog and **Judith Skog** (Research Associate) continue to spend most Wednesdays volunteering in the herbarium at George Mason University (GMUF) as they have since the beginning of the pandemic in 2020.

PUBLICATIONS

Colli-Silva, M., J.R. Pirani, and **L.J. Dorr**. 2023. (2950) Proposal to conserve the name *Cacao sylvestris* (*Theobroma sylvestre*) (Malvaceae: Byttnerioideae) with a conserved type. *Taxon* 72(2): 438-440. https://doi.org/10.1002/tax.12925

Dikow, R.B., J.T.B. Ekwealor, W.J.B. Mattingly, M.G. Trizna, E. Harmon, T. Dikow, C.F. Arias, **R.G.J. Hodel**, J. Spillane, M.T.N. Tsuchiya, L. Villanueva, A.E. White, M.G. Bursell, T. Curry, C. Inema, and K. Geronimo-Anctil. 2023. Let the records show: attribution of scientific credit in natural history collections. *Int. J. Plant Sci.* 184(5): 392-404. https://doi.org/10.1086/724949

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Prado, J., W. Applequist, K.L. Wilson, K. Marhold, V. Malécot, **J.H. Wiersema**, W. Greuter, P.S. Herendeen, J. McNeill, J.C. Zamora, and A.M. Monro. 2023. (218–220) Proposals to authorize binding decisions to be implemented upon General Committee approval of a recommendation, subject to ratification by a later International Botanical Congress. *Taxon* 72(2): 453-454. https://doi.org/10.1002/tax.12906

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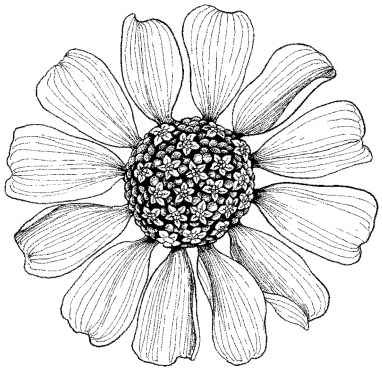
Wen, J., L. Xie, Z.Y. Zhang, Y. Liang, and S. Ge. 2023. Collections-based systematics in the new age of discovery: Celebrating the legacy and life of Professor Wen-Tsai Wang. *J. Syst. Evol.* 61(1): 1-10. https://doi.org/10.1111/jse.12945

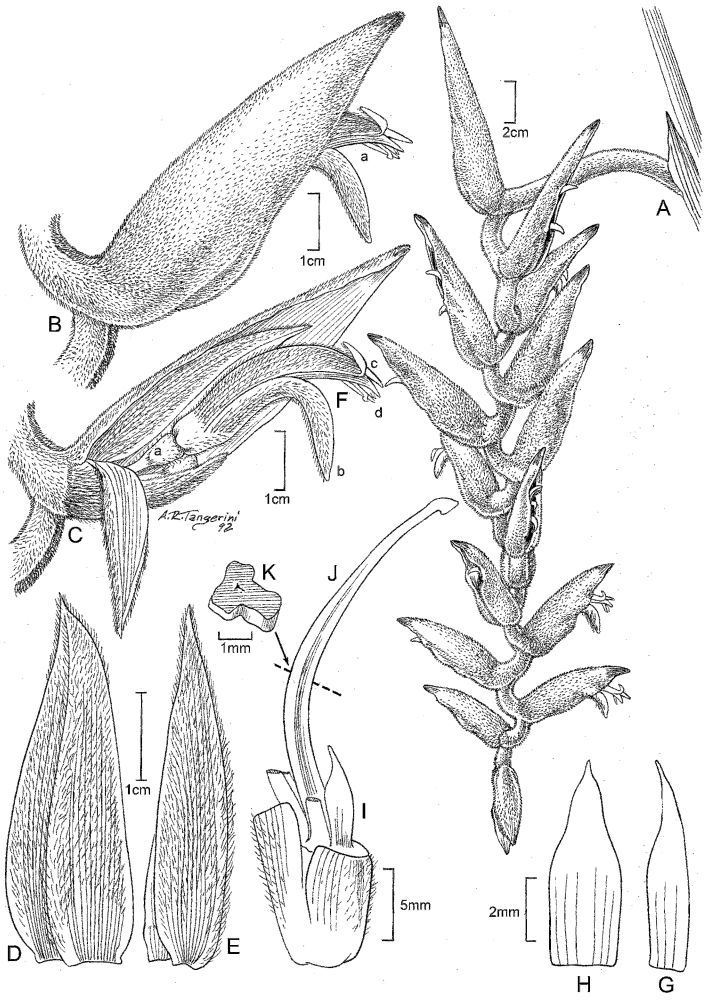
Zimmer, E.A., J.A. Berg, and M.R. Dudash. 2023. Genetic diversity and population structure among native, naturalized, and invasive populations of the common yellow monkeyflower, *Mimulus guttatus* (Phrymaceae). *Ecol. Evol.* 13(4): e9596. https://doi.org/10.1002/ece3.9596



ART BY ALICE TANGERINI

Heliconia terciopela W.J.Kress & Betancur

The Neotropical flora was the theme of the 20th Smithsonian Botanical Symposium, which was held on May 19, 2023. One species among the flora is *Heliconia terciopela*, which is endemic to a small region of lowland wet forest on the Pacific coast of Colombia. The name "terciopela" is Spanish for "velvet," which refers to the smooth, short, uniform pubescence that covers the inflorescence. It also signifies the primary forest habitats where this species of *Heliconia* and the highly poisonous snake *Botrops asper*, locally known as "terciopelo" or fer-de-lance, are both found. Alice Tangerini drew this illustration in 1992 using unmounted dried specimens including leaves and an inflorescence. She reconstructed it into its more natural appearance with the help of slides of the living plant. Dissections were made with the Wild M5 microscope and reduced to fit the page format. The finished drawing was in pen and ink on Cronaflex drafting film without any digital recomposition. A partial detail of stamens was cut from the final inked image as it did not reveal any necessary information. The illustration was included along with four other drawings of *Heliconia* in the 1993 issue of *Caldasia*.



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