NATIONAL MUSEUM of NATURAL HISTORY

THE PLANT PRESS

Department of Botany & the U.S. National Herbarium

New Series - Vol. 24 - No. 2 April-June 2021

A botanical cliff-hanger

By Nancy Khan and Warren Wagner

Dramatic cliffs along the northern coast of Guam rise over 190 m to form a broad limestone plateau that encompasses the most diverse native plant communities of this small Micronesian island. Until recently the biological diversity of Micronesia was not fully understood, but it is now thought that this region contains a higher percentage of endemic plant species per square kilometer land area than any other hotspot of biodiversity. With an area of about 541 km^2 Guam is the largest and southernmost of the Mariana Islands, but exhibits the lowest percent of endemism of the archipelago (*Micronesica* 43: 51–100; 2012). This bleak account inspired further investigation of an intriguing, yet unidentified specimen collected in 1994 as part of a floristic inventory for an environmental assessment of Andersen Air Force Base sponsored by the U.S. Fish and Wildlife Service (USFWS).

Most of the Guam National Wildlife Refuge (GNWR), about 22,456 acres, is an "overlay refuge" (land that is under the primary jurisdiction of one Federal agency and the refuge purpose is superimposed as a secondary interest) formed by two units: Andersen Air Force Overlay and the Navy Overlay Unit. Although the military mission comes first on these overlay lands, the USFWS assists in protecting native species and habitats. Together with the 1,217 acre Ritidian Unit which is managed solely by the USFWS they comprise the GNWR which was established in 1993 when the area was determined to be critical habitat for six species of plants and animals listed as endangered pursuant to the Endangered Species Preservation Act of 1966.

A previous collection made within the GNWR by Derral Herbst (USFWS) in 1982 guided botanists Steve Perlman and Ken Wood (National Tropical Botanical Garden) to the un-

Continued on page 2

A phylogenetic reconstruction revealed that while there is superficial resemblance to patchouli (*Pogostemon cablin*), the mystery plant was a new species native to Guam and closely related to three species with origins on the Indian subcontinent.

Guam

Continued from page 1

usual plant. The pair searched sharp, jagged cliffs along the coast, repeatedly rappelling down vertical escarpments, eventually locating five subpopulations totaling 113 individuals. Field identification tentatively likened it to patchouli, *Pogostemon cablin* (Lamiaceae), however it lacked the aromatic oils characteristic of the patchouli plant. Six new collections were made by Wood and Perlman to document the distribution and morphological variation of the subpopulations. Subsequent expansion of the military installation and development of cooperative but parallel conservation plans by the USFWS and the U.S. Air Force hindered opportunities to re-visit the site for further exploration.

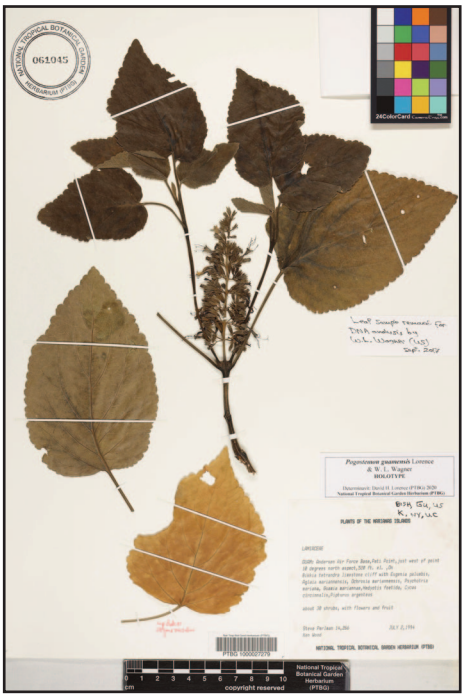
The six specimens seemed likely to remain an enigma until Smithsonian Department of Botany lab technician Gabe Johnson became involved. He applied molecular techniques to determine the identity of the plant. Small fragments were removed from four of the specimens collected in 1994. Initial extraction indicated that the DNA was highly degraded, but the application of a precise and intricate methodology yielded two samples with 2 regions each of sequenceable DNA that could be compared to known sequences obtained from GenBank (*Molecular Phylogenetics and Evolution* 98: 184–200; 2016). A phylogenetic reconstruction of the genus *Pogostemon* revealed that while there is superficial resemblance to *Pogostemon cablin*, the mystery plant was a new species native to Guam and more closely related to three species with origins on the Indian subcontinent.

In 2020 the species was published as *Pogostemon guamensis* Lorence & W.L. Wagner (*PhytoKeys* 169: 61–73), a rare endemic considered by the authors to be critically endangered primarily due to the limited population size, imperiled habitat, and high levels of alien herbivory and seed predation. As noted by the authors, "in many of the specimens examined flowers and nutlets had been eaten by herbivorous insects in the field". An accompanying illustration by Alice Tangerini deftly captures the range of diagnostic characters despite the impediment posed by such deterioration across the limited number of herbarium specimens.

Coastal limestone cliffs of northeastern Guam. (photo courtesy of Toni Mizerek, from Lorence et al. 2020)

Prior to this discovery the only federally listed plant species on Guam was the critically endangered tree, *Serianthes nelsonii* (Fabaceae). A specimen of this tree was first collected in the late 1800s but not described until 1919 albeit from a holotype that was destroyed during a World War II bombing raid in Manila. Of the six mature trees ever known to exist on the island, the population has been reduced to one remaining individual at Ritidian Point.

Thanks to the persistent effort of the many boots on the ground that have contributed to its identification and assessment over the preceding 28 years and those who will continue to serve as its stewards in the future, it is hopeful that this 12th endemic to be added to the native flora of Guam can persist in its precarious cliffside location.



***Pogostemon guamensis* Lorence and W.L. Wagner (Perlman & Wood 14266, holotype PTBG-061045).**

Rare lichen unique to Florida discovered in museum collections, may be extinct

-Adapted from the Florida Museum of Natural History

Scientists have found a new species of fleshy verdigris lichen, thanks to DNA analysis of museum specimens. Misidentified by its original collectors, the lichen is only known from 32 specimens collected in North and Central Florida scrubland between 1885 and 1985. Now the hunt is on to find it in the wild – if it still exists.

The lichen, named *Cora timucua* in honor of Florida's Timucua people, is critically endangered, even more so than the federally protected Florida perforate reindeer lichen, and possibly extinct. Researchers are holding out hope that *C. timucua* may persist in undisturbed pockets of the state's dwindling pine scrub habitat, though recent searches came up empty.

"The million-dollar question is 'Where is this lichen?'" said Laurel Kaminsky, a digitization manager at the Florida Museum of Natural History and co-author of the study. "The optimist in me says it's still out there."

Kaminsky said the sparse information recorded by the lichen's collectors makes it difficult to retrace their steps. More widespread in the early 20th century, *C. timucua* was collected only from the Ocala National Forest and O'Leno State Park after 1968, two of Florida's last remaining scrub ecosystems. Citrus groves and urban developments have replaced up to 90 percent of the state's sand pine scrub.

"If it's anywhere, it's going to take a lot of looking in very specific habitats to find it," Kaminsky said.

Affectionately dubbed "Timucua heart lichen," the new species resembles a shelf fungus and is about the size of a sand dollar with scalloped edges. It can be distinguished from wood-rotting fungi by its texture: felty and papery with curved lobes and a cracked underside.

But its color is an enigma. The lichen is light gray when dry, but specimens turn a deep blue-green and bleed a reddish-brown pigment when wet in a laboratory setting. Without photos and detailed descriptions of the lichen in nature, scientists don't yet know how it reacts to moisture in the wild.

"In general, people take nature for granted, and the Timucua heart lichen story might tell us sometimes we are too late," said **Manuela Dal Forno**, co-author of the study and a lichenologist at the Botanical Research Institute of Texas and a research associate at the Smithsonian's National Museum of Natural History. "Right now, we need everybody's help in trying to locate this lichen in Florida."

Kaminsky said Timucua heart lichen likely prefers old-growth pine scrub habitat, which has taller trees and established populations of native Florida plants, such as rusty lyonia, a shrub characterized by reddish fibers lining its leaves. But hikers should avoid collecting any potential specimens they find: Instead, they can photo-

Continued on page 4

Heart lichens belong to the genus *Cora*, whose name is derived from the Latin prefix for "heart," a reference to the shape of their lobes. (photo courtesy of Robert Lücking)

The Plant Press

New Series - Vol. 24 - No. 2

Chair of Botany
Eric Schuettpelz
(schuettpelze@si.edu)

EDITORIAL STAFF

Editor
Gary Krupnick
(krupnick@si.edu)

Copy Editors
Robin Everly, Bernadette Gibbons, and Rose Gulledge

The Plant Press is a quarterly publication provided free of charge. To receive notification of when new pdf issues are posted to the web, please subscribe to the listserve by sending a message to listserv@si-listserv.si.edu containing only the following in the body of the text: SUBSCRIBE PLANTPRESS-NEWS Firstname Lastname. Replace "Firstname Lastname" with your name.

If you would like to be added to the hard-copy mailing list, please contact Dr. Gary Krupnick at: Department of Botany, Smithsonian Institution, PO Box 37012, NMNH MRC-166, Washington, DC 20013-7012, or by E-mail: krupnick@si.edu.

Web site:
https://naturalhistory.si.edu/research/botany

On the cover: Flowers of patchouli, *Pogostemon cablin*, at Pali o Waipio, Maui, Hawaii. A newly described species from Guam, *P. guamensis*, has a superficial resemblance to *P. cablin*. Molecular evidence, however, shows that *P. guamensis* is in a well-supported clade containing *P. hirsutus*, *P. wightii*, and *P. mollis*, and separate from that containing *P. cablin*. (photo by Forest & Kim Starr, CC-by-3.0 US)

Lichen

Continued from page 3

graph the lichen and upload images to the Timucua Heart Lichen Project on the community science platform iNaturalist for identification.

Lichens are partnerships between fungi and photosynthesizing organisms and play a key role in their ecosystems by enriching soils and cycling nutrients. But much of the world's lichen diversity remains hidden. A chronic shortage of lichen experts led to the delay in Timucua heart lichen's discovery, Kaminsky said. She added that Florida could harbor as many as 1,000 lichen species, many of which remain undescribed and whose populations could also be imperiled.

A previous survey of South Florida's Fackahatchee Strand Preserve led by Robert Lücking, a curator at Berlin's Botanical Garden and Botanical Museum and lead author of the *C. timucua* study, found more than 400 lichen species in about 250 acres. Of the 400 species, 18 were new to science and 100 had yet to be recorded in North America.

"This emphasizes how little we know about lichen diversity and their genetic information, as well as the importance of digitization projects," said Dal Forno. "There are so many lichens out there, but not enough lichenologists to study them."

Timucua heart lichen belongs to the genus *Cora*, a group of nearly 200 tropical lichens – once thought to be a single species – typically found in mountain habitats. Its discovery in Florida is the northernmost record of a *Cora* species, and the new species is the sole representative of its genus in the U.S.

If *Cora timucua* still exists, it is most likely living in pockets of undisturbed pine scrub habitat in Florida's Ocala National Forest, pictured here, and O'Leno State Park, researchers said. (photo courtesy of Dani Tinker, CC BY-NC 2.0)

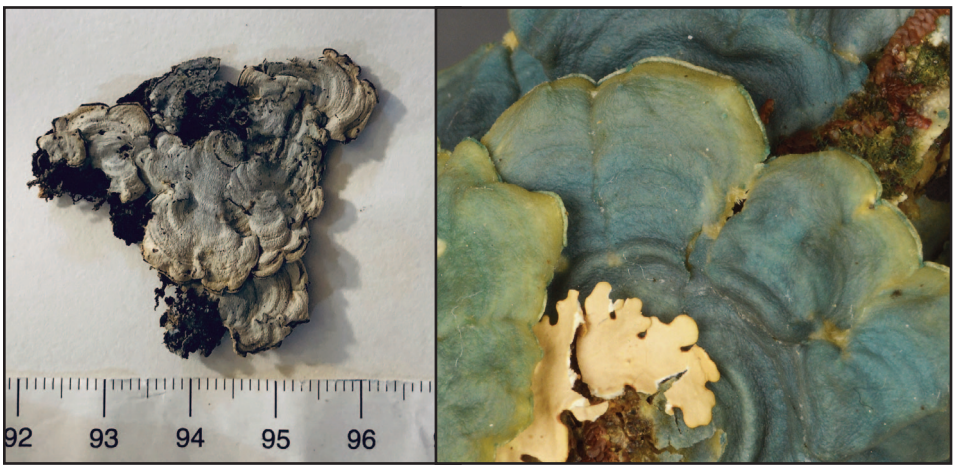
Even if the species is extinct, studying its DNA could help scientists understand how the species arrived in Florida. Timucua heart lichen's closest known relatives are in Colombia and Brazil, raising questions about how *C. timucua* was able to grow in a habitat so different from its sister species, Dal Forno said.

Increasingly, researchers need not pack a tent and head into the field to find new species. Instead, they can search online databases of specimen data from museums around the world. In 2012, a National Science Foundation grant helped scientists digitize lichens from the University of Florida herbarium, uploading basic specimen information and images to two international data networks, the Global Biodiversity Information Facility and the Consortium of North American Lichen Herbaria.

It was on the web that Lücking and Gary Perlmutter, acting curator of lichens at the University of North Carolina at Chapel Hill herbarium and a study co-author, spotted clusters of Florida *Cora* specimens, far outside the genus's known range. They contacted Kaminsky, suspecting DNA analysis would uncover misidentified specimens.

"I knew we had these specimens, but I just thought everybody else knew," Kaminsky said. "The digitization just opened it up for other people to find it and do cool things with it."

The study was published in *The Bryologist*. James Lawrey of George Mason University also co-authored the study.



Left: Timucua heart lichen's rich blue and green colors are visible only when it's damp, said lichenologist Manuela Dal Forno. When dry, the lichen is gray to black. (photo courtesy of Manuela Dal Forno)
Right: Scientists also found that Timucua heart lichen bleeds a rust-colored pigment when wet in a lab. Because the new species has yet to be studied in the wild, researchers don't know how it reacts to moisture in nature. (photo courtesy of Robert Lücking)

PolliNation DC to document urban buzz

Community gardens are a valuable social, ecological, and environmental resource, but we currently know very little about the pollinator species visiting them, their ecology, and the impact of human activity on their populations in Washington, DC. Intentionally or not, organic community gardens provide food and shelter for wildlife such as birds, mammals, snails and slugs, insects, spiders and even roly poly crustaceans. Gardeners are intricately connected to nature and in one sense are wildlife managers.

A new citizen scientist project, PolliNation DC, is being launched on April 30, 2021. The project encourages DC community garden volunteers to record the bee, butterfly, wasp, fly, moth, beetle, ant, and other insect species visiting flowers and acting as pollinators for both native and non-native plants in DC community garden sites. The DC Department of Parks and Recreation manages 35 community gardens across the 8 Wards of the District. The native plant gardens at the Smithsonian's National Museum of Natural History (NMNH) and the U.S. Botanical Garden (USBG) will serve as control sites. The collected data will help the research team understand which insect species are visiting which native and non-native plant species in an urban environment.

The iNaturalist app <https://www.inaturalist.org/projects/pollination-dc> is a place for the public to record their observations and to browse those of others at other DC community garden locations. PolliNation DC encourages the public to document urban pollinators and all other wildlife in the gardens to share with the community, and to take some satisfaction getting to know native wildlife. The project site has a journal for recent updates and information.

The launch of PolliNation DC, which will run for the entire growing season, coincides with the City Nature Challenge. The four-day Challenge, from April 30 – May 3, is an international effort for people to find and document wildlife in cities across the globe. Citizen scientists will look for all signs of life in local parks, neighborhoods, and backyards to see what plants and animals share their environment. Please visit the City Nature Challenge website and find out if a city near you is participating in the Challenge. Everyone in a participating metropolitan area with access to a camera and the internet can participate using the iNaturalist app.

The PolliNation DC research team is comprised of Robert Costello (NMNH National Outreach Program Manager), **Gary Krupnick** (NMNH Head of the Plant Conservation Unit), and Simon Bird (Center for Sustainable Development and Resilience, University of the District of Columbia).

Brown-belted bumble bee (*Bombus griseocollis*) visiting common milkweed (*Asclepias syriaca*). (photo by Gary Krupnick)

Pasoh pigs as agents of forest diversity: A "silver swining"

A new study published in *Proceedings of the Royal Society B* (288: 20210001; 2021) identifies the role that wild pigs play in maintaining the hyperdiverse structure of tropical forests, challenging the one-dimensional characterization of pigs as destructive enemies of the ecosystem.

When pigs are preparing to give birth, they create a nest using 200-300 tree saplings. In 1996 and 1998, Kalan Ickes (a co-author on the paper) excavated pig nests at ForestGEO's Pasoh forest dynamics plot in Malaysia and recorded all tree census tags he found. FRIM (Forest Research Institute Malaysia) has managed and led the Pasoh plot in partnership with ForestGEO since 1985, and field crews have conducted a total of seven censuses there. By using ForestGEO census data alongside the pig nest surveys, they were able to determine the size, species, and original location of 1,672 stems that pigs used in the construction of their nests. They found that pigs typically nested in flat dry sites and that this habitat preference determined which tree species were killed. The interesting twist was that common tree species habitat associations also tended to favor the flat dry sites where pigs prefer to give birth. As a result, pigs increased the mortality of common species and consequently increased species evenness at the stand-scale.

Although the pigs are native to Malaysia, oil palm plantations on the boundaries of Pasoh provide a consistent food source, and the pig population is now unusually large. As such, their role in maintaining diversity through nesting may be undercut by sheer volume of these impacts.

"While pigs may contribute to diversity, these findings must be viewed in context," said **Stuart Davies**, director of the ForestGEO program and a co-author of the study. "One has to remember, the hyperabundance of wild boar in a number of Asian forests is dramatically reducing tree regeneration, while supporting lianas, and this is likely altering the functional composition of these forests. This may have long-term deleterious consequences for Asian rainforests."

Highlighting the importance of better understanding pigs' habits, lead author **Matthew Luskin** said, "Pigs have become the most common large wild mammals on earth, so any new behaviours or impacts may have immense repercussions in Asia and globally."

Luskin is a former postdoc with ForestGEO and the Asian School of the Environment at Nanyang Technological University in Singapore. ASE-NTU funded Luskin's joint appointment as part of the collaboration between ForestGEO and the university, a partnership that was formalized through a Memorandum of Understanding signed in 2015. Luskin is now continuing his work in wildlife ecology in Australia at the University of Queensland's School of Biological Sciences.

In November 2020, Luskin gave a presentation on this work as part of ForestGEO's Virtual Seminar Series. If you would like to request access to a recording of his talk, please contact Caly McCarthy, ForestGEO Program Assistant at mccarthyc@si.edu.

United States Botanic Garden

National Museum of Natural History
Smithsonian

Registration opens for the 2021 Smithsonian Botanical Symposium

Registration is now open for the 18th Smithsonian Botanical Symposium, "Plant symbiosis: The good, the bad, and the complicated," to be held 13-14 May 2021. This symposium will be held in a virtual setting and be spread over two days.

If you wish to attend both days of the symposium, be sure to register for each day:

Thursday, May 13, 2021: https://smithsonian.zoom.us/webinar/register/WN_4oSefPMrToecWGgkIn62sQ

Friday, May 14, 2021: https://smithsonian.zoom.us/webinar/register/WN_kZLs2Iv5S8aQCl5OI87ZPA

Plants, like all organisms, exist in collaboration and competition with other life forms. As primary producers, plants form the basis of most food webs. In many cases they also depend on insects, vertebrate animals, bacteria, and/or fungi to survive and reproduce. Sometimes these interactions are especially close and long lasting and such symbioses are among the most fascinating relationships in the natural world. The 18th Smithsonian Botanical Symposium will explore current research in the diversity of plant symbioses, examining the relationships plants have with insects, fungi, bacteria, and even other plants. Speakers will include botanists, ecologists, microbiologists, and geneticists whose research unravels the complicated relationships that plants have with their collaborators and competitors in the natural world.

In addition, the 18th José Cuatrecasas Medal in Tropical Botany will be awarded at the Symposium. This prestigious award is presented annually to an international scholar who has contributed significantly to advancing the field of tropical botany. The award is named in honor of Dr. José Cuatrecasas, a pioneering botanist who spent many years working in the Department of Botany at the Smithsonian and devoted his career to plant exploration in tropical South America.

Schedule for Thursday, May 13, 2021 (Eastern Time)

1:00 pm – Welcome
1:10 pm - Presentation of the José Cuatrecasas Medal
1:20 pm - Naomi Pierce (Harvard University), "Context dependent evolution of the African ant acacia, *Vachellia drepanolobium*, and its multitude of symbionts"
1:40 pm - Jay Bolin (Catawba College), "*Hydnora* from fungus to foul flower: the natural history of the strangest plants in the world"
2:00 pm - Posy Busby (Oregon State University), "Assembly and function of the leaf microbiome"
2:20 pm - Panel Discussion

https://smithsonian.zoom.us/webinar/register/WN_4oSefPMrToecWGgkIn62sQ

Schedule for Friday, May 14, 2021 (Eastern Time)

1:00 pm – Welcome
1:10 pm - Leonora Bittleston (Boise State University), "Convergent interactions in carnivorous pitcher plant microcosms"
1:30 pm - Dong Wang (University of Massachusetts Amherst), "Indentured servitude: host control of intracellular bacteria in the nitrogen-fixing symbiosis"
1:50 pm - Manuela Dal Forno (Fort Worth Botanic Garden | Botanical Research Institute of Texas), "The lichen dilemma: unveiling diversity in multi-species symbioses"
2:10 pm - Panel Discussion

https://smithsonian.zoom.us/webinar/register/WN_kZLs2Iv5S8aQCl5OI87ZPA

The botanical pressed specimen sheet – an artform in itself

By Sylvia Orli and Erika Gardner

We appreciate the botanical pressed specimen for so many reasons–the plant, the taxonomy, the genetic material, the history, and the incredible value it provides to science. We have also come to appreciate the pressed botanical sheet for itself, the beauty and brilliance that the collection can engender by simply being secured onto paper with a label. The U.S. National Herbarium has now created over 3.5 million botanical specimen images, and they are magnificent because of the skillfully crafted botanical sheets.

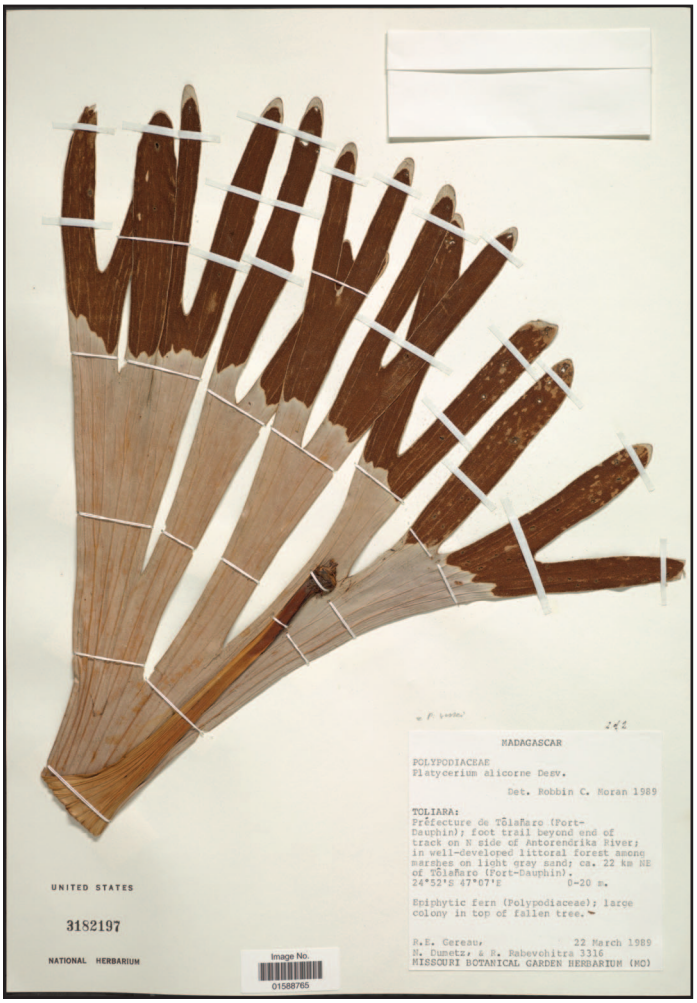
The specimens at the Herbarium are mounted by a skillfully trained team of 21 volunteers. This team carries on a special tradition of best practices and standards, which have been in existence since the 18th century. Our plant mounters do not have any formal training in Botany, but they possess special skills that transfer well in the specimen preparation realm. Many of our mounters are excellent needle crafters! These skills are highly desirable in the specimen preparation room.

The first step to mount a specimen is to arrange it on an 11"x 18" archival herbarium sheet of paper. In its post-mortem state, the plant should look very similar to how it was growing in the wild. Challenges ensue when the plant is larger than the standard herbarium sheet. The plant must be mounted skillfully and arranged creatively for it to be a valuable specimen for scientific investigation. It is a beautiful balancing act where art and science blend seamlessly on a sheet of paper.

Very seldom do we encounter the unconventional specimen, examples include, the "oh, so rare happy face" specimen, the heart shaped specimen, or even the railroad track specimen. These creations tend to produce a chuckle and sometimes a post on social media, but for the serious researcher these works of rogue pieces of art are highly discouraged.

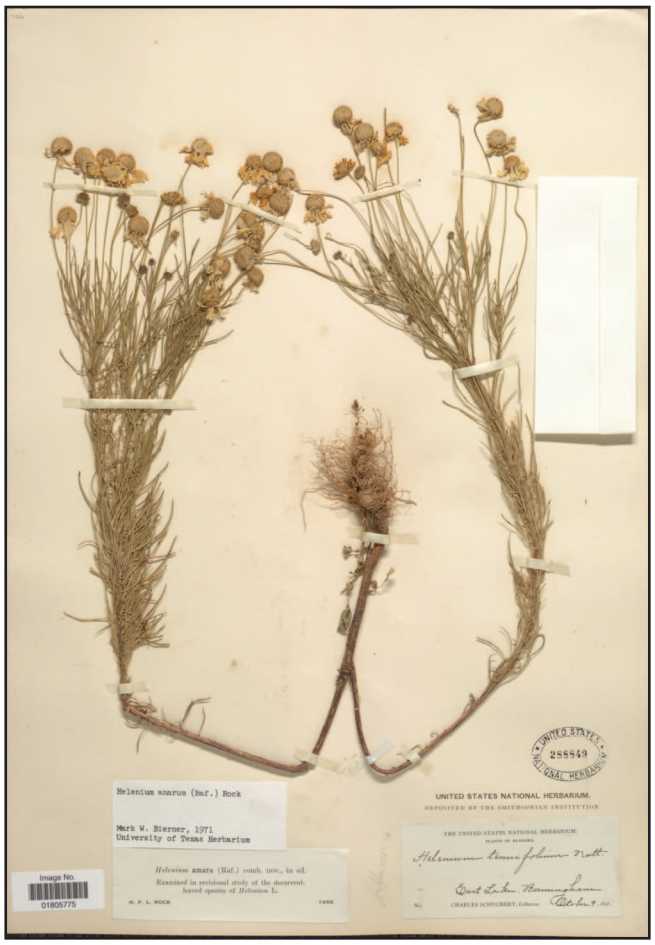
A small sample appears on this page and the next two pages.

Continued on page 8



The *Platycerium*, or staghorn fern, captures the imagination with its outreaching tines. In this image, you can imagine an elk horn or fingers stretched out. Collection: Gereau 3316, Madagascar, March 1989.

Perhaps the mounter never intended for the ghostly look of this *Opuntia dillenii* specimen, but it emotes the arid and tough habitat of the cactus. Not a place for tender plants. Many species of Cactaceae are endangered, and thus the specific location on the label of this collection has been covered to dissuade predatory human poachers. Collection: Rose 3309, Antigua and Barbuda, February 1913.



Top left: *Oenothera stubbei* is sold in nurseries as a rather stubby plant, but this specimen captures the grace of the wild collected plant. It is artfully placed on the sheet to display the elongate stems. Collection: Olvera 1784, Mexico, September 2017.

Top right: *Helenium amarum*, a native of the southern U.S., typically has vibrant yellow flowers, but these colors fade after several years on a sheet. When originally mounted on a sheet in 1896, one can imagine the mounter forming a heart sign out of these bright yellow flowers. This playfulness is highly discouraged today, but botanists were often their own plant mounters a century ago. Collection: Schuchert s.n., Alabama, United States, October 1896.

Bottom: The *Merremia* sp. is a twining vine, and the specimen seeks to display that twining habit. It unintentionally forms the letter N, which may be the first thing observers see. The New York Botanical Garden has made a webpage for the Specimen Alphabet, with A-Z of all the accidental letter specimens (http://sweetgum.nybg.org/science/the-hand-lens/explore/narratives-details/?irn=7240). Collection: Acevedo-Rodriguez 16675, Brazil, September 2017.

John Axel Nannfeldt (1904-1985) was a Swedish botanist known for his study of fungi and vascular plants. He was also known for his whimsical plant mounts, creating amusing designs out of his collections. Collections (clockwise from top left): *Taraxacum ceratolobum*, Nannfeldt 8680, Sweden, July 1946; *Centaurium vulgaris*, Nannfeldt 12151, Sweden, July 1952; *Euphrasia frigida*, Nannfeldt s.n., Sweden, July 1934; *Sedum villosum*, Nannfeldt s.n., Norway, August 1934.

Notable women in science: Women of the United States National Herbarium

By Rose Gulledge

March was Women's History Month. The Department of Botany and the U.S. National Herbarium joined our Federal partners in commemorating and encouraging the study, observance, and celebration of the vital role of women in American history.

Historically, botany has been one of the few attainable fields in science for women, most commonly in the areas of scientific illustration and field collection (assisting male botanists who oftentimes were their husbands). The twentieth century saw more women in the sciences including botany, with increasing numbers in curator and researcher positions despite being challenging to attain.

Searching for "women in botany" is bound to yield a number of web pages on **Mary Agnes Chase**. Known for her work on the grasses at the United States National Herbarium (USNH), she did not start her career there, nor was she actually employed by the Smithsonian Institution. This agrostologist (and suffragist) started her botany career at the United States Department of Agriculture as a Scientific Illustrator and worked her way up to Assistant Botanist. Her 1922 book, "*The First Book of Grasses: The Structure of Grasses Explained for Beginners*" was used to teach botany students in Latin America for years. She worked at the USNH as an Honorary Custodian of the Grasses (not a curator) from 1936 until her death in 1963. She became an Honorary Fellow of the Smithsonian Institution in 1959 at the age of 90.

Less information, however, is available about other notable women of the United States National Herbarium and their careers.

Mary Agnes Chase (SI Archives)

Tillie E. Hollis Berger was a Museum Technician and plant mounter (1935-1977). She is acknowledged in the 1945-1946 *Report on the Progress and Condition of the US National Museum* for her contribution of 5000 mounted plants added to the herbarium collections.

Velva E. Rudd, a specialist in tropical Leguminosae, began her career in the Botany Department as a technician (1948-1973). She was later promoted to Assistant Curator and eventually to Curator. Her extensive work on legume taxonomy is exemplified in a six-part monograph in *Contributions from the United States National Herbarium* (1955-1968). The Mexican legume genus, *Ruddia*, was named in her honor.

Kittie F. Parker, a Professor of Botany at George Washington University, became a Research Associate at the USNH (1959-1989) who worked on Mexican and South American Asteraceae as well as weeds of the southwestern United States. Her comprehensive 1972 book, "*An illustrated guide to Arizona weeds*" is widely available.

Marie-Hélène Sachet, Associate Curator (1968-1986), is known for her work on the botany and ecology of Pacific coral islands. She initially joined the Smithsonian as a special advisor in tropical botany. Her research is exhibited in the 1975 publication, "Flora of the Marquesas, 1: Ericaceae-Convolvulacae." *Smithsonian Contributions to Botany* 23: 1-34. *Abutilon sachetianum*, a rare tree from the Marquesas Islands, was named after her.

The 1970s were an era of change for women in the work-force, and the establishment of the Smithsonian Institution

Left to right: Velva Rudd, Kittie Parker, Marie-Hélène Sachet (All photographs SI Archives)

Left to right: Beryl Simpson (Smithsonian Exposition Books), Joan Nowicke (SI Archives), Maria Faust (Smithsonian Institution)

Women's Council in 1972 helped lead that change for women at the Smithsonian. The following decades saw women joining the staff of the Botany Department as curators.

Beryl B. Simpson, Associate Curator (1972-1978), worked on the phylogenetics and biogeography of American Southwest, Mexican, and Central and South American Compositae. She has been commended for her 1975 publication, "Pleistocene changes in the flora of the high tropical Andes." *Paleobiology* 1: 273-294. She is the recipient of the Asa Gray Award (2003) and the José Cuatrecasas Medal for Excellence in Tropical Botany (2010).

Joan W. Nowicke, Curator (1972-1999), was a palynologist who specialized in pollen morphology and its relation to systematics. She gained international recognition in the 1980s for her work on the bizarre "Yellow Rain" of Southeast Asia, "Yellow rain — a palynological analysis." *Nature* 309: 205–206 (1984).

Maria A. Faust, Associate Curator (1987-2010), was a microbiologist who specialized in tropical marine dinoflagellate taxonomy and ecology. She began her career at the Smithsonian Radiology Laboratory in 1970 moving to the Botany Department in 1987. Her most notable publication is "Identifying Harmful Marine Dinoflagellates." *Contributions from the United States National Herbarium* 42: 1-144 (2002).

Vicki A. Funk, Curator and Senior Research Botanist (1981-2019), was an expert on the taxonomy and biogeography of the Compositae; her career and legacy is larger than life. Her groundbreaking book, "Systematics, Evolution, and Biogeography of the Compositae" (2009), is the authoritative reference for this plant family. In 2018 she was awarded the Asa Gray Lifetime Achievement Award, and in 2019 was presented with the Linnean Medal. Her work and passion continues to influence students and colleagues. The species *Xenophyllum funkianum* J.Calvo from the Ecuadorian Andes is just one species named in her honor.

Jeanine L. Olsen, Associate Curator (1989-1990), was hired as a marine algal researcher. Her tenure at NMNH was brief before she accepted a professor position at the University of Groningen, The Netherlands.

Elizabeth A. Zimmer, Curator and Research Botanist (1990-present), studies the patterns and processes of molecular evolu-

Continued on page 12

Left to right: Vicki Funk (Smithsonian Institution), Jeanine Olsen (University of Groningen), Liz Zimmer (Smithsonian Institution)

Notable women

Continued from page 11

tion of green plants, in particular, among lineages of early flowering plants. She is the co-recipient of the 2018 Richard and Minnie Windler Award in Systematics for the publication, "A whole chloroplast genome phylogeny of diploid species of Isoetes (Isoetaceae, Lycopodiophyta) in the southeastern United States." *Castanea* 83: 224-235 (2018).

Paula T. DePriest, Associate Curator (1991-2004), studied the systematics and phylogeny of lichen-forming fungi in the southern Appalachians and the southeastern United States. She also researched the formation and origins of lichen-algal symbiosis. She currently is the Deputy Director of the Smithsonian's Museum Conservation Institute.

Jun Wen, Curator and Research Botanist (2005-present), works on the systematics, biogeography and ethnobotany of the Araliaceae and the Vitaceae. Her studies center on understanding the taxonomy, patterns, and processes of diversification of disjunct plant groups. This work is best represented in the 1999 paper, "Evolution of eastern Asian and eastern North American disjunct distributions in flowering plants." *Annual Review of Ecology and Systematics* 30: 421-455.

Ashley N. Egan, Assistant Curator (2013-2017), worked on the biodiversity of legumes and their wild relatives through evolutionary genetics and genomics. Her research is highlighted in the 2016 publication, "Parsing polyphyletic *Pueraria*: Delimiting distinct evolutionary lineages through phylogeny." *Molecular Phylogenetics and Evolution* 104: 44-56.

Searching for information about the women of the USNH and their work has been difficult since not all have an extensive web presence. Responsive to the gender gap in Wikipedia, Dr. Vicki Funk, as advisor to the American Women's History Initiative, helped create the Funk List, a list of over 125 names of Smithsonian women in science who have not been fully recognized in Wikipedia.

Created to highlight the importance of recovering the stories and contributions of women in science, the Funk List has grown to over 400 names with the work of Dr. Elizabeth Harmon, digital curator at the SI Archives. This growth and awareness led to the June 2020 web-based Wikipedia edit-a-thon to edit pages for women in science, including women's biographies, women's works, and women's issues. Another training event edit-a-thon recently was held on March 25, 2021: Wikipedia & Women in Science: Smithsonian Groundbreakers Edit-a-thon. Anyone can join the effort to help get these stories written. See Wikipedia's women in science to-do list <https://en.wikipedia.org/wiki/Wikipedia:Meetup/DC_30/To-do_list> to find links to articles that need improvements or articles that need to be created.

By the numbers

The staff of the Department of Botany continues to make a strong push to make the U.S. National Herbarium's collection of over 5 million specimens available online. The Botany Specimen Catalog is available at https://collections.nmnh.si.edu/search/botany/?ti=2. As the current pandemic continues, Botany staff sequestered in their homes continue to accomplish the goals of a fully accessible catalog of specimens. Below are some notable numbers and figures from the digitization project.

4,140,000
The number of catalog records online

3,600,000
The number of catalog images

577,000 and **635,000**
The number of catalog records and images, respectively, added in 2020

95%
The percentage of all pressed sheets that have a catalog record

325,000
The number of cryptogam (lichens and bryophytes) catalog records coming online soon

Top 5
The country with the most collections is the United States, followed by Brazil, Mexico, Colombia, and Peru.

Left to right: Paula DePriest, Jun Wen, Ashley Egan. (all photographs Smithsonian Insitution)

"E.D." and the elusive *Bidens*

By Julia Beros

Here is a new lawn of grass; which means here also are clovers and violets, arabidopsis, interloping purslane, a line of cherry trees, stalky earthbound lamiales, some broadleaf plantains, sagewort, and some type of vetch. "My brother operates that type of crane at his job," he begins as he points across the grassy lawn to fields of industry, spotted with clusters of these cranes sprouting upward as they lattice the sky with their branching arms appointed with yellow hooks that sway gently in the wind. The points hang downward like the achened barb awns of *Bidens bidentoides*, burrs ready to claw their way into a new spot of dirt.

"He once saw a new guy lift a shipping container up for the first time," the story continues, "but he forgot to lock it properly and it tipped in the air. One by one, brand new BMW cars came sprinkling out." He bobs his head in dismay at the very story he has surely told before and continues on his walk around the park leaving our conversation as seamlessly as he entered. I look out to the edge of the bike path and watch the waves of the Delaware River like pleats unfolding as they enter New Jersey. Now the site of a 5-acre green space and playground, Cooper's Poynt park in Camden, was once the site of a jail, and before then a site of growing industry in a push to increase the use of these ports. And before that this was the site where Elias Diffenbaugh plucked a branching cluster of yellow-topped *Bidens bidentoides* just before their achenes could sprinkle to the ground. While on site installing a public art piece invoking the history of the changing ports and illegal industrial dumping, attracting the attention of park-goers and passersby, I wondered too about the ecological history of this site defined by urbanization: how has this landscape been defined by botany?

"Beggarticks," or just *Bidens*, is an estuarine composite genus with a wide temperate and tropical global distribution. *Bidens bidentoides* is an increasingly rare species confined to just a straggling few pockets of tidal marsh in the Northeastern United States: the Delaware estuary, the Hudson estuary, and (somewhat debatably) the Chesapeake estuary. In a genus with a diversity described as "chaotic," *B. bidentoides* itself made its way through three name revisions, described first by Nuttall as *Diodonta bidentoides*, then revised as *Coreopsis* by Torrey and Gray, and finally landing in *Bidens* under Britton's description. A plant that grows in mostly disturbed areas, often observed growing among detritus and decaying wood, this species is distinguished from other local ones by its lack of ray florets, simple lanceolate leaves, and antrorsley barbed awns (Smith 2014). As its seed dispersal is adapted to local diffusion near the parent plant, *B. bidentoides'* greatest threat is habitat destruction. Clusters of remaining plants remain isolated from each other as well, diminishing the gene diversity which could heighten the vulnerability of this species to extirpation.

***Bidens bidentoides*, E.D. s.n., New Jersey, U.S., September 1868**

Noted in Smith's (2014) discussion of a recovery plan for *B. bidentoides*, the species has not been well studied and while it clearly remains a rare species on decline little is understood about its life cycle and role within these estuary ecosystems. In 1990 an "Element Stewardship Abstract" was written for the New Jersey Division of Parks and Forestry outlining the need to protect *B. bidentoides*. It is clearly not a new practice or idea to protect native species, but over 20 years later the state of *B. bidentoides* seems to remain ambiguously vulnerable yet understudied and unmanaged. However, as part of a recent revision of Gleason and Cronquist's 1991 *Manual of Vascular Plants* and an ongoing conservation assessment of the Hudson River estuary at the New York Botanical Garden, Rob Naczi's work on Northeastern American flora is bringing species like *B. bidentoides* to the forefront of research. While *B. bidentoides* and other estuarine species are uniquely adapted for these highly disturbed areas, it is unclear how viable they are under the rapid changes and industry of urbanization. Gathering more data about estuarine species, many of which are endemic and highly vulnerable to habitat destruction, can deliver trends and insight into the ways we can better support these ecosystems as human intervention alters their habitat. *Bidens bidentoides* is particularly elusive, with few collections held in a handful of herbaria, and a recorded decline in collections and sightings, this species and the information it carries remain vulnerable to erasure.

The U.S National Herbarium holds 13 *B. bidentoides* specimens (plus one that was annotated by J. Reveal in 1979 as "definitely NOT bidentoides") with only one collection from within the last 30 years. Two of these specimens are from Camden, New Jersey and one of these was collected by "E.D." on September 20, 1868 from "Cooper's bridge". "E.D." who "is almost certainly Elias Diffenbaugh" was a native of Lancaster County, Pennsylvania and an avid plant collector. His obituary appears in v.12 of the May 1870 *Gardener's Monthly* edited by Thomas Meehan and available for "two dollars per Annum, invariably in advance." He is described as "a journey-

Continued on page 14

Bidens

Continued from page 13

man printer by profession [who] imbibed a love of flowers," and it is believed that his passion for botany helped to prolong his life after being stricken with consumption as it afforded him plenty of fresh air and activity. His work collecting made such great contributions to botanical research that he was even elected as a life member of the Academy of Natural Sciences of Philadelphia (without paying the fee). This single collection of *B. bidentoides* along the Delaware in Camden, now neatly stacked in the depths of the U.S. National Herbarium and digitally translated, links the history of this landscape through a botanical lens. Diffenbaugh's collecting work in and around the Delaware River estuary in the late 19th century built a foundation for present day research on the species of this region. With each pressed specimen is a unique moment captured and catalogued in the herbarium, with it offering clues and a glimpse into a grander view of the natural world.

Here is an estuarine landscape whose history has been layered by human disturbance; a history that spans the lives of the indigenous Lenape people, a short stint by the Dutch West India Company, a growing Quaker colony, the Coopers the Kaighns and the Mickels, the increased rail and waterways of the Industrial Revolution, Walt Whitman's lyrical musings, Elias Diffenbaugh's botanical excursions, the Campbell's soup factory, the Victor Talking Machine Company, more bridges, a gift of cherry trees, and a hollowing out of industry that lands in a liminal moment swaying between the past and the potential. Today the Camden community seeks to revitalize the waterfront and define this landscape, beginning with this reclamation of space along the river. A landscape that embodies prosperity, movement, industry, trade, and a source of life itself, the waterfront is a site with its own deeply embedded history. The identity of place is largely characterized by its ecology, the life that underlines and roots a place below the torrent of human potentials and ambitions, be them benign, beneficial, or damaging, and warrants an understanding of how it relates to the present. To reclaim space requires a thorough investigation of its history and the evolution of our relationship to it beginning with the ecological infrastructure, and to rebuild a relationship with the nature of a place acknowledges ways in which humans have altered and shifted its habitual for our own means. What was here, what is here, and what should be here? Through one lonely specimen of *B. bidentoides* over 100 years old, Diffenbaugh has invoked this line of reflection and questioning in reconnecting with an ecological system that has and will continue to be at the will of human disturbance. It is from our herbaria collections, that serve as a record of biological history and provide various data about species, that we can also be reminded to continue a conscious learning and cultivation of our relationship to the natural world. Within what we believe to be intimately known is room for discovery.

AWARDS & HONORS

The National Museum of Natural History presented the 2020 Peer Recognition Awards on January 28, 2021. Award recipients are individuals and teams who have given their time and talent to the museum above and beyond what their jobs call for, and to those who have done something that makes a difference in the outside community, for the museum, or for the larger Smithsonian community. The Peer Recognition Award Committee is composed of 10 Museum staff members representing a cross-section of the entire museum community.

Twelve awards were presented during the online Zoom ceremony, hosted by Kirk Johnson (Sant Director of the National Museum of Natural History) and Bob Corrigan (Office of the Deputy Director). Two staff members of the Department of Botany were proud recipients of 2020 Peer Recognition Awards.

The Treasurer and Secretary Team Award

Serving as the treasurer of the Senate of Scientists (SOS) for the last six years and secretary for the last seven, **Gary Krupnick** (Department of Botany) and Briana Pobiner (Department of Anthropology), respectively, have gone above and beyond even their volunteer SOS duties in the last year. The Senate's activities—from business meetings to lightning talks and dinner forums—run as smoothly as they do because of the dedication and efficiency of these two colleagues. Keeping vital channels of communication flowing, handling countless details, and transitioning to online activities are only some of the challenges that they have made look easy. The Senate and the museum community has benefited greatly from their leadership and dedication.

The Digitization Hero Award

Since the museum's closure in March 2020, **Sue Lutz** (Department of Botany) has had the enormous responsibility of completing most necessary Botany Collection work that must be done in the building. In addition to ensuring the safety of the collections and keeping up with tasks normally assigned to everyone, she volunteered to continue prepping specimen folders for the mass digitization conveyor belt project. The project had been up and running since July but was slowly running out of prepared material to image. Because of her efforts the project will be able to continue on schedule to the delight of botanists and researchers around the globe.

PUBLICATIONS

Abiem, I., I. Dickie, **D. Kenfack** and H. Chapman. 2021. Conspecific negative density dependence does not explain coexistence in a tropical Afromontane forest. *J. Veg. Sci.* 32(1): e12990. https://doi.org/10.1111/jvs.12990

Arellano, G., **D. Zuleta, D.** and **S.J. Davies**. 2021. Tree death and damage: A standardized protocol for frequent surveys in tropical forests. *J. Veg. Sci.* 32(1): e12981. https://doi.org/10.1111/jvs.12981

Fischer, F.J., N. Labrière, G. Vincent, B. Hérault, A. Alonso, H. Memiaghe, P. Bissiengou, **D. Kenfack**, S. Saatchi and J. Chave. 2020. A simulation method to infer tree allometry and forest structure from airborne laser scanning and forest inventories. *Remote Sens. Environ.* 251: 112056. https://doi.org/10.1016/j.rse.2020.112056

Fortuna-Perez, A.P., C.R. Marinho, **M. Vatanparast**, W. de Vargas, J.R.V. Iganci, G.P. Lewis, E.S. Cândido, T.M. de Moura, T.C.E. Monteir, S.T.S. Miotto and S.P. Teixeira. 2021. Secretory structures of the *Adesmia* clade (Leguminosae): Implications for evolutionary adaptation in dry environments. *Perspect. Plant Ecol. Evol. Syst.* 48: 125588. http://doi.org/10.1016/j.ppees.2020.125588

Freitas, J., F. González, O. Poncy, **C. Feuillet** and A. Alves-Araújo. 2020. Floral geometric morphometrics unveils a new cauliflorous species of *Aristolochia* (Aristolochiaceae) from the Guiana Shield. *Phytotaxa* 474(1): 1-14. http://doi.org/10.11646/phytotaxa.474.1.1

Gillespie, L.J., W.M. Cardinal-McTeague and **K.J. Wurdack**. 2020. *Monadelpha* (Euphorbiaceae, Plukenetieae), a new genus of Tragiinae from the Amazon rainforest of Venezuela and Brazil. *PhytoKeys* 169: 119-135. http://doi.org/10.3897/phytokeys.169.59244

Grusz, A.L., M.D. Windham, **K.T. Picard**, K.M. Pryer, **E. Schuettpelz** and C.H. Haufler. 2021. A drought-driven model for the evolution of obligate apomixis in ferns: evidence from pellaeids (Pteridaceae). *Am. J. Bot.* 108(2): 263-283. http://doi.org/10.1002/ajb2.1611

Hodel, R.G.J., R. Massatti, S.G.D. Bishop and L.L. Knowles. 2021. Testing which axes of species differentiation underlie covariance of phylogeographic similarity among montane sedge species. *Evolution* 75(2): 349-364. http://doi.org/10.1111/evo.14159

Khoury, C.K., D. Carver, S.L. Greene, K.A. Williams, H.A. Achicanoy, M. Schori, B. Leon, **J.H. Wiersema** and A. Frances. 2020. Crop wild relatives of the United States require urgent conservation action. *Proc. Natl. Acad. Sci. USA* 117(52): 33351-33357. http://doi.org/10.1073/pnas.2007029117

Kunert, N., J. Zailaa, V. Herrmann, H.C. Muller-Landau, S.J. Wright, R. Pérez, S.M. McMahon, R.C. Condit, S.P. Hubbell, L. Sack, **S.J. Davies** and K. Anderson-Teixeira. 2021. Leaf turgor loss point shapes local and regional distributions of evergreen but not deciduous tropical trees. *New Phyt.* 230(2): 485-496. https://doi.org/10.1111/nph.17187

Li, Q.Q. and **J. Wen**. 2021. The complete chloroplast genome of *Geum macrophyllum* (Rosaceae: Colurieae). *Mitochondrial DNA B Resour.* 6(2): 297-298. http://doi.org/10.1080/23802359.2020.1861562

Liu, F., Z. Ma, **M.A. Caraballo-Ortiz**, H. Zhang, X. Su and Y. Liu. 2020. Chemical constituents of *Pedicularis longiflora* var. *tubiformis* (Orobanchaceae), a common hemiparasitic medicinal herb from the Qinghai Lake Basin, China. *Phyton-Int. J. Exp. Bot.* 89(4): 1083-1090. http://doi.org/10.32604/phyton.2020.011239

Lorence, D.H., **W.L. Wagner**, K.R. Wood and **G. Johnson**. 2020. *Pogostemon guamensis* Lorence & W.L.Wagner (Lamiaceae), a new species from Guam, Mariana Islands. *PhytoKeys* 169: 61-73. http://doi.org/10.3897/phytokeys.169.58107

Lücking, R., L. Kaminsky, G.B. Perlmutter, J.D. Lawrey and **M. Dal Forno**. 2020. *Cora timucua* Hygrophoraceae, a new and potentially extinct, previously misidentified basidiolichen of Florida inland scrub documented from historical collections. *Bryologist* 123(4): 657-673. http://doi.org/10.1639/0007-2745-123.4.657

Luskin, M.S., D.J. Johnson, K. Ickes, T.L. Yao and **S.J. Davies**. 2021. Wildlife disturbances as a source of conspecific negative density-dependent mortality in tropical trees. *Proc. R. Soc. B* 288(1946): 20210001. https://doi.org/10.1098/rspb.2021.0001

Medeiros, H., J. de Carvalho Lopes, **P. Acevedo-Rodríguez** and R.C. Forzza. 2020. A new species of *Thinouia* (Paullinieae, Sapindaceae) from the Amazon and its phylogenetic placement. *PhytoKeys* 165: 115-126. http://doi.org/10.3897/phytokeys.165.57341

Medina, M.C., M.S. Sousa-Baena, E. Prado, **P. Acevedo-Rodríguez**, P. Dias and D. Demarco. 2021. Laticifers in Sapindaceae: Structure, evolution and phylogenetic importance. *Front. Plant Sci.* 11: 612985. http://doi.org/10.3389/fpls.2020.612985

Nash, M.C., **W. Adey** and A.S. Harvey. 2020. High magnesium calcite and dolomite composition carbonate in *Amphiroa* (Lithophyllaceae, Corallinales, Rhodophyta): further documentation of elevated Mg in Corallinales with climate change implications. *J. Phycol.* 57(2): 496-509. http://doi.org/10.1111/jpy.13098

Orton, L.M., P. Barberá, M.P. Nissenbaum, **P.M. Peterson**, A. Quintanar, **R.J. Soreng** and M.R. Duvall. 2021. A 313 plastome phylogenomic analysis of Pooideae: Exploring relationships among the largest subfamily of grasses. *Mol. Phylogenet. Evol.* 159: 107110. http://doi.org/10.1016/j.ympev.2021.107110

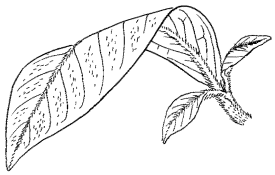
Siniscalchi, C.M., **R.D. Edwards**, J.L. Gomez, E.R. Moore and J.R. Mandel. 2021. Photosynthesis metabolism in the Compositae: Current knowledge and future directions. *Taxon.* http://doi.org/10.1002/tax.12426

Su, C., L. Duan, P. Liu, J. Liu, Z. Chang and **J. Wen**. 2021. Chloroplast phylogenomics and character evolution of eastern Asian *Astragalus* (Leguminosae): Tackling the phylogenetic structure of the largest genus of flowering plants in Asia. *Mol. Phylogenet. Evol.* 156: 107025. http://doi.org/10.1016/j.ympev.2020.107025

White, A.E. 2020. Deep learning in deep time. *Proc. Natl. Acad. Sci. USA* 117(47): 29268-29270. http://doi.org/10.1073/pnas.2020870117

White, A.E., K.K. Dey, M. Stephens and T.D. Price. 2021. Dispersal syndromes drive the formation of biogeographical regions, illustrated by the case of Wallace's Line. *Glob. Ecol. Biogeogr.* 30(3): 685-696. http://doi.org/10.1111/geb.13250

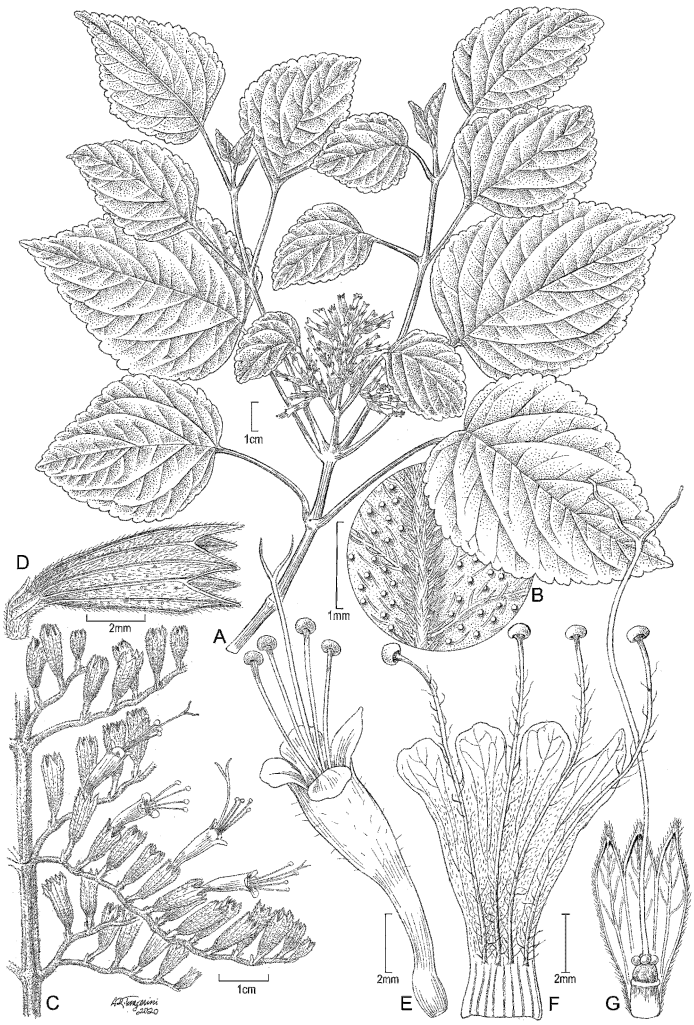
Yu, J., X. Wu, C. Liu, S. Newmaster, S. Ragupathy and **W.J. Kress**. 2021. Progress in the use of DNA barcodes in the identification and classification of medicinal plants. *Ecotoxicol. Environ. Saf.* 208: 111691. http://doi.org/10.1016/j.ecoenv.2020.111691



ART BY ALICE TANGERINI

Pogostemon guamensis Lorence & W.L.Wagner

Illustrating this new species of *Pogostemon* required some intricate back and forth with the authors Warren Wagner and Dave Lorence as well as careful dissection of the few pressed specimens sent from Kaua`i. Alice Tangerini found images on the web of patchouli (*Pogostemon cablin*) which helped to reconstruct positions of the leaves and flowers of the new species. Interpretation of tiny hairs on the flower and calyx were crucial and aided by closeup images of Lorence's initial dissection of the flowers. The final inking was done in Tangerini's home, then scanned and labeled and figures manipulated in Photoshop back in her office at the National Museum of Natural History. This drawing was the first one completed after the museum restricted access to staff in 2020 due to the Covid-19 pandemic but set the process in place for all following illustrations done since then.



NATIONAL MUSEUM of NATURAL HISTORY
Smithsonian

MRC 166 P.O. Box 37012
Washington DC 20013-7012
Official Business Penalty for Private Use $300