

The Plant Press



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April-June 2016

Botany Profile

Trolling for Garden Genomes

By Morgan Gostel

If you've seen a blue, collapsible wagon being wheeled around the National Museum of Natural History (NMNH), Smithsonian's Museum Support Center (MSC), or traveling along the grounds of the mall between NMNH and the U.S. Botanic Garden, you're either catching a glimpse of the latest D.C. tourist transport, or – more likely – you're witnessing your friendly neighborhood genomic voucher preparation team! Upon closer inspection, you will notice a liquid nitrogen dewar among other more traditional tools of the botany trade. This wagon and its accompanying collection team are part of a new program aimed at collecting and preserving genomic tissues from a huge diversity of plants.

The Global Genome Initiative (GGI) <<http://ggi.si.edu>> recently began a new program with the Department of Botany and three other local Washington, D.C. partners called GGI-Gardens which is aimed at collecting all families and half of the genera from the world's plants. The program – initiated by Vicki Funk and now managed by GGI Buck post-doctoral fellow, Morgan Gostel – kicked off last summer (you may have read about it in the July 2015 edition of *The Plant Press*). Since this time, the GGI-Gardens team has been in a collecting frenzy visiting gardens and greenhouses in the metropolitan Washington, D.C. area, including the U.S. Department of Agriculture's U.S. National Arboretum, the U.S. Botanic Garden, and the Smithsonian Gardens.

Despite cooler weather, collections throughout the 2015/2016 winter

season have continued unabated, thanks especially to a partnership with the Smithsonian Gardens. The greenhouses maintained by the Smithsonian Gardens include remarkable angiosperm diversity. Of particular note is the orchid collection, which was recently expanded by ca. 2,000 specimens, and now includes more than 10,000 plants belonging to over 200 genera. GGI-Gardens has already sampled from more than 80 of these genera, bringing the total number of collected genera to more than 550 (of ca. 1,200 estimated genera available in partner gardens throughout the greater metropolitan Washington, D.C. area) and approximately 180 families (out of ca. 240 available).

The significance of this program is reflected by worldwide efforts to reconcile natural history collections with the methodological revolution occurring in the genomic era. Natural history collections are, and will continue to be, the foundation of biodiversity research. As genomic resources become an affordable, practical knowledge base, collections can help by providing access to not only traditional vouchers, but also those that preserve genome-quality DNA. GGI and GGI-Gardens are contributing to this effort by setting a target goal of collecting and preserving genome-quality tissue from at least one species belonging to every family and 50 percent of the genera of life on Earth (in our case, plant families and genera).

Toward this goal, GGI-Gardens is building a partnership network that has been growing quickly since November 2015. In addition to the three local garden

partners, GGI-Gardens has partnered with five other gardens in the United States, including the Chicago Botanic Garden, Denver Botanic Garden, Harold L. Lyon Arboretum, National Tropical Botanical Garden, and the New York Botanical Garden, and one international garden, Fairy Lake Botanical Garden in Shenzhen, China. Over the next year GGI-Gardens plans to not only partner with an additional ten or more gardens and arboreta, but train and prepare the partners to begin contributing samples to the GGI-Gardens program. GGI-Gardens should be finalizing several new partnerships in advance of a workshop coming up in June.

Although gardens themselves hold incredibly rich living collections of plant diversity, many taxa are simply beyond the reach of *ex situ* collections and likely will pose a challenge for traditional GGI-Gardens collecting efforts. In order to sample from these more challenging, rare, and perhaps locally endemic taxa, GGI has been supporting collecting expeditions to achieve their comprehensive taxonomic family and 50 percent genera sampling goals. Several members of the department, including Larry Dorr (PI), and co-PIs Ashley Egan, Ken Wurdack, Morgan Gostel, and Vicki Funk, were recently awarded funds through the SIBG-GGI Grants Program in support of expeditions to Madagascar. Here approximately 90 percent or more of the flora is endemic and highly threatened. Over the course of the next year this team will be traveling to Madagascar to collect from

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Travel

Pedro Acevedo traveled to San Juan, Puerto Rico (1/19 – 1/28) to present two talks about the photographs of Agustín Stahl and to attend a presentation on the Flora of Puerto Rico.

Barrett Brooks traveled to Dominica (3/7 – 3/15) to oversee diving operations for museum scientific divers.

Laurence Dorr and **Kenneth Wurdack** traveled to Bronx, New York (2/25 – 2/26) to study specimens of Malvaceae at the New York Botanical Garden.

Ashley Egan traveled throughout North Carolina, South Carolina, and Georgia (3/21 – 3/26) to collect legumes and monitor populations of endangered and invasive species.

Vicki Funk traveled to Madrid, Spain (1/18 – 1/23) to attend a board meeting of the International Association for Plant Taxonomy (IAPT); and throughout Argentina and Uruguay (3/4 – 3/20) to collect plants for Compositae and Global Genome Initiative (GGI) research, and to teach a Compositae class in Uruguay for

students from Chile, Argentina, Uruguay and southern Brazil.

W. John Kress traveled to San Jose, Costa Rica (3/7 – 3/12) to serve as the Smithsonian representative to the Organization for Tropical Studies (OTS) annual assembly of delegates, board of directors, and science committee meetings.

Gary Krupnick traveled to Richmond, Virginia (3/12) to present an invited talk about plant-pollinator interactions at the Virginia Native Plant Society's annual workshop.

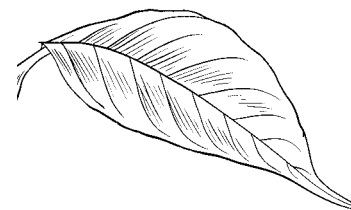
Robert Soreng traveled to Lincoln, New Zealand (2/27 – 4/8) to visit the Allan Herbarium (CHR) to study the genus *Poa*.

Alain Touwaide traveled to Los Angeles, California (1/4 – 3/4) to teach two classes on rare books on medicinal plants at the University of California Los Angeles, and the Getty Research Institute to deliver a public lecture at Loyola Marymount University; and with **Emanuela Appetiti** to organize a two-day international symposium on "Medical Traditions

for the 21st Century," where he delivered the opening keynote lecture and Appetiti chaired a session.

Warren Wagner traveled to Oahu and Kauai, Hawaii (1/3 – 1/15) to study specimens of *Melicope* (Rutaceae) at the Bishop Museum, and to collaborate on the Flora of the Marquesas Islands at the National Tropical Botanical Garden; and to Chicago, Illinois (2/18 – 2/21) to collaborate on the Dimension of Biodiversity project at the Chicago Botanic Garden.

Elizabeth Zimmer traveled to Concord, North Carolina (3/31 – 4/3) to give a talk at QuillCom II, which was held in conjunction with the annual meeting of the Association of Southeastern Biologists.



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Chair of Botany

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Visitors

Liang Zhao, Northwest Agriculture and Forestry University, China; *Dichocarpum*, *Pulsatilla*, *Trollius* (Ranunculaceae) and its close relatives (2/5/15 - 2/26/16).

Monica Carlsen, Missouri Botanical Garden; Araceae and Zingiberales (2/17/15 - 2/16/17).

Morgan Gostel, George Mason University; Compositae and GGI-Gardens Program (9/1/15 - 8/31/17).

George Wang, University of Louisiana at Lafayette; Plant-insect interactions (1/7 - 5/31).

Dave Gammon and 6 students, Elon University; Plant conservation and herbarium tour (1/13).

Diana Munn, Harvard University; Mexican field collections (1/13 - 1/18; 2/25 - 3/1).

David Goodman and 6 coworkers, Federal Reserve Board; Herbarium tour (1/14).

Michael Nee, Missouri Botanical Garden; *Solanum* (Solanaceae) (1/14).

Elliot Gardner, Chicago Botanic Garden; *Artocarpus* (Moraceae) (1/17 - 1/19).

Christian Feuillet, Oregon State University; Passifloraceae and Boraginaceae (1/21 - 3/8).

Genise Freire, Universidade Federal Rural do Rio de Janeiro, Brazil; *Paullinia* (Sapindaceae) (1/26 - 2/23).

John Mitchell, New York Botanical Garden; Anacardiaceae (1/29).

Tomas Fer, Charles University, Czech Republic; Zingiberales (2/1 - 6/3).

Stinger Guala and 14 coworkers, United States Geological Survey; Herbarium tour (2/3).

Jason Cantley, Bucknell University; *Coprosma* (Rubiaceae), *Solanum* (Solanaceae), and *Chenopodium* (Amaranthaceae) (2/10).

Wesley Knapp, Maryland Natural Heritage Program; Checklist for Flora of Maryland (2/10 - 2/11).

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Aphorisms for the Field Botanist, with Apologies to Linnaeus (and Poor Richard)

Continuing what I hope is a temporary transition, or detail in government speak, from field and herbarium botanist to manager, I find myself occasionally reflecting on what I learned earlier in my career, which I now realize with nostalgia and regret involved considerably more time outdoors than it does now. When I catch myself daydreaming I am surprised that I do not spend as much of my reverie thinking about science per se but rather more esoteric things related to science, especially those things that one tends not to write down. Scientific ideas and insights sooner or later get folded into published articles and books, and some of the knowledge I have gained about certain plants is best conveyed via annotations on specimens. Impressions of fellow botanists or insights into how one manages to overcome obstacles while traveling and in the field tend, however, to be conveyed in conversation. More often than not these glimpses into the secret life of Botanists are only shared among our fraternity and only after pouring a libation or two.

A few of the lessons I have learned can be distilled as maxims or aphorisms for the field botanist. I have struggled to grasp the distinction between these two words: both maxims and aphorisms generally are considered to be short pithy statements conveying some general truth. Examples of the former are well-known and include such famous maxims as Poor Richard's "a penny saved is a penny earned" (actually "a penny saved is two pence clear"). The definition of aphorism scarcely differs except that a secondary dictionary definition suggests that unlike a maxim an aphorism can also be a concise statement of a scientific principle, especially by an ancient classical author. Interestingly, Botany has a long tradition of aphorisms.

In the *Fundamenta Botanica* (1736) Linnaeus reduced his theory of Botany to 365 aphorisms. The full title of this book is *Fundamenta botanica, quae majorum operum prodromi instar theoriam scientiae botanicas per breves aphorismas tradunt*. This early treatise eventually morphed into his *Philosophia Botanica* (1751). I have discovered nothing about field work in the *Philosophia*, which focuses on Linnaeus's "philosophy" regarding naming plants, but there are occasional aphoristic gems that relate to herbaria such as: **"A herbarium is better than any illustration; every botanist should make one"** (as quoted in Stafleu, *Linnaeus and the Linnaeans*, p. 38). Linnaeus is famous for his Lapland journey undertaken in 1732 and which was clearly influential in ordering his career. It is a shame he did not share with us what principles he learned about field work. Nonetheless, having traveled a few miles over three continents in search of plants I can attest to having learned a few pithy things about how to conduct oneself in the field. Unlike Linnaeus I do not have an aphorism for each day, but I offer the

following brief selection with commentary.

My first aphorism for the field botanist is: **"When there is food eat because you never know when you will have food again."** This of course does not imply that I ever faced starvation although I do remember being very, very hungry a few times, and very, very thirsty a few other times. In the bush or in the mountains there are no supermarkets and few grocery stores and it can be a long time and a long way before you get to eat your next meal. One of my sons learned this lesson the hard way when we were in the Andes of Venezuela exploring the Páramo de Guirigay in Trujillo state. He did not like what was served in camp for dinner: spaghetti with mayonnaise sauce. He opted not to eat and that was that. Someone else ate his portion of food and there was nothing else to be had until breakfast twelve hours later. He went hungry, complained vociferously, and learned never to make that choice again. Alas, my clever field aphorism was anticipated by Poor Richard who observed much more succinctly that **"Hunger never saw bad bread."**

For some inexplicable reason I have also spent a good portion of my field time driving or riding in vehicles that if they had been horses would have been put out to pasture. My first extended trip in Madagascar took us from the capital Antananarivo west across the Tampoketsan d'Ankazobe to Ankarafantsika and then on to the port of Mahajunga. We had borrowed an old and tired, but mechanically sound Toyota Land Cruiser from the late Elwyn Simons (1930–2016), who was then director of the Duke Primate Center, and between flat tires (eleven), cyclones (one), burst dikes (one),

and other minor trials and tribulations we had enough misadventure to last a life time. The most difficult challenge was on our return leg home when our otherwise skillful driver Saturnin (left) got us stuck above the axles in a mud hole on the main highway. Our vehicle lacked a winch and even though there were five of us who put our shoulders to the task we could not push the Land Cruiser out of this deep hole. However, when the next vehicle on the road, a *taxi brousse*, caught up to us we were

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Saturnin sitting on the rear bumper of Elwyn Simon's Land Cruiser in Ampijoroa, Madagascar. (photo by L.J. Dorr)

Chair

With

A

View

L.J.
Dorr



[Handwritten signature]

Staff Research & Activities

Christian Feuillet was back at the National Museum of Natural History on January 21 through March 8 to work on Flora of the Guianas and Flora of Oregon projects, curate the Boraginaceae collection, and sort outstanding loans.

On March 12, **Alice Tangerini** gave three presentations on botanical illustration to middle school students at the Northern Virginia Community College in Annandale, Virginia as part of a “STEMtastics Program,” sponsored by the American Association of University Women. The program is designed to provide seventh and eighth grade girls an opportunity to meet women professionals in careers using science, technology, engineering, and math. Tangerini presented an overview of the Department of Botany and how an illustrator fits in with the research process. The talk was followed by a workshop on illustration using pen and ink on drafting film over photocopies of Tangerini’s sample drawings of flower details.

On March 16, Tangerini participated in “The Big Draw,” a yearly event at North Chevy Chase Elementary in Chevy Chase, Maryland. Over 20 art professionals participated, including several staff from the Smithsonian Institution. Tangerini instructed four classes of sixth graders. She demonstrated illustrating techniques using tracing films over sample drawings. Students were provided photocopies of plant outline drawings to complete by adding their own detail and stippling using fine pointed markers.

Liz Zimmer, Research Associate **W. Carl Taylor**, and Old Dominion graduate student **Peter Schafran** who is currently working with Zimmer, participated in “QuillCom II,” held in conjunction with the annual meeting of the Association of Southeastern Biologists meeting on March 31 - April 3, in Concord, North Carolina. Taylor gave the plenary lecture on species evolution and phylogeny of quillworts (*Isoetes*). Zimmer gave a talk entitled “DNA sequences identify cryptic species of quillworts (*Isoetes* L.).” Schafran gave a talk entitled “Toward a phylogeny of *Isoetes* in the southeastern United



Peter Schafran, winner of the Outstanding Student Contributed Paper Award

States,” which won the Outstanding Student Contributed Paper Award. After the symposium, they participated in a field trip “Working on the Rocks: Quillworts of the North Carolina Piedmont.”

Departures

Alain Touwaide and **Emanuela Appetiti**, after 14 years of fruitful collaboration, left the Smithsonian in April, together with their “*Historia Plantarum*” book collection and archives on history of botany and ethnobotany to pursue new research and educational opportunities.

New Faces

Four “Reflora” students from Brazil are visiting the Department of Botany for the next year. The students are here as part of a project to repatriate information on

Brazilian herbarium specimens held in herbaria throughout the world. Over the next year they will be digitizing pertinent specimens in the U.S. National Herbarium and spend time studying different angiosperm groups for their doctoral degrees. The students and their interests are **Herison Medeiros** (Sapindaceae), **Marco Pellegrini** (Commelinaceae), **Tiago Silva** (Orchidaceae), and **Valéria Sampaio** (Solanaceae). **Pedro Acevedo** and **Mark Strong** are serving as the principal departmental contacts for these students.

Gabriel Arellano recently joined the CTFS-ForestGEO group at the Smithsonian Institution as a post-doctoral fellow. The goal of his research project is to develop an improved understanding of the patterns and causes of tree mortality in tropical forests, based on analyses of existing CTFS-ForestGEO data and new field observations on tree mortality. The study aims to improve a new generation of Earth System Models that are being developed under the joint project “Next Generation Ecosystem Experiment for the Tropics.” This collaborative effort will reduce model uncertainty associated with projecting the response of tropical forest ecosystems to global change. Arellano completed his Ph.D. in tropical forest community ecology from Universidad Autónoma de Madrid (UAM) in 2013. His dissertation addressed floristic composition, beta-diversity, rarity/commonness, and community assembly in both Amazonian and Andean forests of the Madidi region, Bolivia. In 2014 he held a post-doctoral



The “Reflora” students (from left): **Tiago Silva**, **Valéria Sampaio**, **Marco Pellegrini**, and **Herison Medeiros**. (photo by Ingrid Lin)



New faces in the Department of Botany: Gabriel Arellano, Sara Pineda, and George Wang.

position at UAM where he developed a dominance-based framework for the analysis of species-rich communities, and conducted research on phylogenetic, functional, and taxonomic patterns of diversity along elevational and latitudinal gradients of the Andean flora.

Core Collections Management (CCM) was lucky to have **Sara Pineda**, a biology student from the Universidad Nacional Autonoma de Mexico (UNAM), return for two weeks during her winter break, in January 2016, to work on a few collection projects. Pineda was here last summer gaining experience in the collection by helping CCM to organize lichens and work on a few special plant mounting projects. Over her winter break, Pineda and **Meghann Toner** shifted 182 cases. She also filed newly mounted grasses in the permanent collection.

George Wang is a post-doctoral fellow conducting molecular work in the lab of **John Kress**. Wang first joined the Smithsonian in May 2014 as an Mpala post-doctoral fellow. He is an insect community ecologist interested in plant-herbivore interactions and their effects on community patterns. Wang received his Ph.D. from the University of Louisiana at Lafayette and has conducted post-doctoral work at the University of Missouri-St. Louis. He has been based at the Mpala Research Centre in Kenya for 18 months where he worked with **David Kenfack** and Scott Miller (Entomology Department) in sampling insects associated with the perennial shrub *Solanum campylacanthum*. In early

2016, Wang brought his specimens back to the Smithsonian. Wang will be using DNA barcoding to identify the insect species in his collection. His study aims to better inventory the biodiversity of African insects and understand their interactions with plants.



Chair with a View

Continued from page 3

blocking the highway and it could not pass. Consequently the dozen passengers and driver who had been stuffed into a tiny little Peugeot had no choice but to get out, pitch in, and help us push our vehicle out of the mud so that they could be on their way. The lesson (or aphorism) is obvious: **"If you break down on the road, break down and block it because then the next person who comes along has to help you."** Here I think I have Poor Richard beat. In searching his *Almanacks* (1732–1758) for key words such as road, path, wagon, and horse, I cannot find an analogous maxim or aphorism.

Anyone who has spent any time in the field also will appreciate: **"Do not go looking for trouble, enough trouble will find you."** I am sure that many of you could tell more harrowing tales than I can but I do remember once in a well-known South American capital looking for a store that sold an item that I desperately needed for the field. As my wife and I turned a corner in an unfamiliar neighborhood we saw a group of people throwing stones at an armored vehicle. Before we were able

to process what we were witnessing we heard the pow, pow, pow of tear gas canisters being fired in our general direction. This was definitely someone else's trouble and we were not interested in learning exactly what it involved so we turned and ran. We did not get the full measure of the riot experience but enough to learn that tear gas is not pleasant and should be avoided. Ben Franklin (aka Richard Saunders or Poor Richard) witnessed his share of political unrest but inasmuch as his *Almanack* (1732–1758) had run its course well before our War of Independence he provides us no pithy advice on how to avoid trouble while conducting field work (or revolutions).

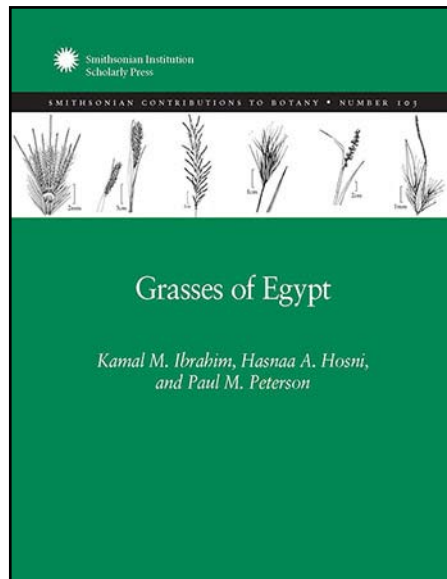
Ending my brief musings I wonder whether or not being an administrator will provide me with some of the same insight into human nature as did field work. Will I invent suitable managerial maxims or aphorisms to distill this experience? Probably, and if I remember I will detail at some future date the lessons learned while overseeing this Circus Maximus known as Botany and the U.S. National Herbarium.



The Grasses of Egypt

The grasses, with about 12,074 species worldwide, have played an important role in the daily life and economy of Egypt for more than 12,000 years. As part of the Fertile Crescent, Egypt lies within the cradle of civilization and the birthplace of agriculture. The cultivation of cereals for making bread and the use of grasses for making baskets, mats, arrows, and building materials has been handed down through humans for centuries. The systematic study of grasses in this region is particularly important since grasses are among the most difficult plants to identify; they often are highly polymorphic and have a generally streamlined morphology.

In "Grass of Egypt," a new publication in *Smithsonian Contributions to Botany* (103: 1–201; 2016), **Kamal M. Ibrahim**, Hasnaa A. Hosni, and **Paul M. Peterson** provide a vegetative key, glossary of terms, descriptions, index of common names (English and Arabic), and illustrations for 284 native and naturalized grasses that are known to occur in Egypt. In addition, a synopsis of the classification for all grass genera that occur in Egypt is provided and the authors have included a phytogeographical map dividing Egypt into 17 regions in which each grass species has been attributed to one or more regions.



Keys using floral characteristics are the most accurate way to identify grasses, but mature plants or portions of those plants without complete spikelets are often the only available fragment. Under such conditions conventional botanical manuals offer little assistance. Moreover, identification using floral characteristics requires special training in grass taxonomy that is not available to interested amateurs and field ecologists. Hence the need for alternative ways to make determinations. The authors, along with **Konstantin Romaschenko** and **Robert J. Soreng**, have recently initiated a DNA barcode survey of Egyptian grasses and currently have nuclear ribosomal internal transcribed

spacer sequences for 93 species (33 percent) and plastid *rpl32-trnL* sequences for 123 species (43 percent). They hope to gather the missing DNA sequences in the future allowing Egypt to be the first country with a complete set of barcode data to easily identify the grasses.

Specimen Digitization Update

The Botany Department's digitization conveyor project continues to run full speed ahead. The pteridophytes (ferns and fern allies) were completely imaged in mid-March, totaling 254,442 fern specimens processed through the conveyor. The project continues with Asteraceae and is currently moving at a rate of 3,000 - 4,000 specimens imaged and processed per day. Over 311,000 botanical specimens have been digitized. In addition, through Picturae (the Dutch-based digitization company), more than 100,000 labels from the digitized botanical specimens have been transcribed and are ready to import to the museum's specimen data catalog.

Additional funds provided by Smithsonian's Digitization Program Office (DPO) will allow the Botany Department to complete the entire Asteraceae family by Fall 2016 and then begin other families. The goal is to find funding to completely digitize the 4.5 million specimens in the



Sylvia Orli and Laurence Dorr (fourth and fifth from left) give Smithsonian Institution's Secretary Skorton (seventh from left) a tour of the Department of Botany's digitization conveyor project. (photo by Ingrid Lin)



The pteridiophyte collection at the U.S. National Herbarium as been completely imaged. Among the specimens is *Lygodium palmatum*, one of the relatively few fern species with vine-like climbing leaves. Uncommon throughout most of its range, this was the first plant to be protected by law in the United States in 1869.

U.S. National Herbarium – a lofty goal, indeed, but well worth the effort. The botanical specimens have many stories to tell, and with open access to the data and images, the collections can be queried and analyzed in ways not previously possible.

Sustaining and Restoring Plant Diversity

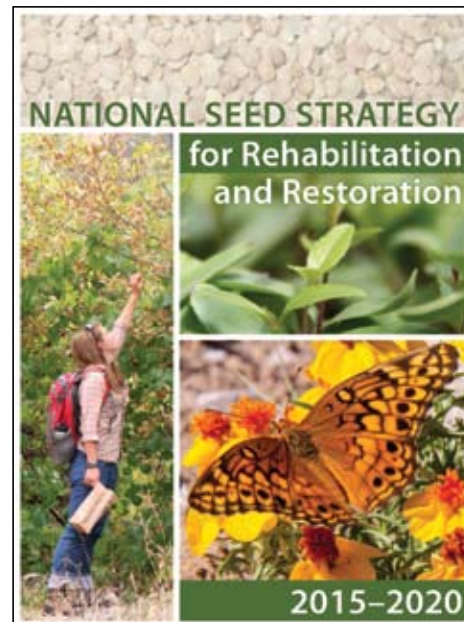
By Sara Oldfield

One of the important ways that botanists have responded to the global loss of biodiversity is by documenting the plight of rare and threatened species. The Smithsonian Institution has played a lead role in this task for 40 years or more since the early days of working with the International Union for Conservation of Nature (IUCN) on red listing plants. Collection data and herbarium specimens continue to be of primary value in assessing the conservation status of plant taxa - a task that is far from complete at a global level.

Conservation assessments help to stimulate action for priority threatened species, but with the unfolding impact of climate change, can we afford to ignore the more common elements of plant diversity?

In August 2015 the National Seed Strategy for Restoration and Rehabilitation was launched in Boise, Idaho. The Smithsonian Institution was one of the 12 Federal agencies involved in developing this Strategy. Also involved were over 300 non-federal co-operators of the Plant Conservation Alliance including commercial seed producers and plant nurseries. The National Seed Strategy responds to the national shortage of native seed required for ecological restoration. At a global level, United Nation biodiversity targets call for restoration of 15 percent of degraded land by 2020. In the US, as elsewhere, native seed is required to restore land impacted by fire, the spread of invasive species, overuse, mining, coastal flooding and soil erosion. These threatening factors increase the risk of extinction faced by rare species, but increasingly they impact common species too.

Restoring native plant communities using native plant species of appropriate provenance is a requirement of Federal policies relating to climate change, the need to restore healthy populations of pollinators, and the need to restore fire-



damaged sagebrush communities in the western United States. The National Seed Strategy recognizes the challenges of obtaining and delivering adequate quantities of appropriate seed to meet restoration needs which are often difficult to predict. The right seed, often of common “work-horse species,” needs to be available for use at the right time and in the right place. Understanding which plant species are appropriate for specific localities relies on an understanding of plant distributions

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Collecting seeds from woodbalm, *Lepechinia calycina*. Voucher specimens of all collections are deposited at the U.S. National Herbarium with duplicates in local herbaria (photo courtesy of Seeds of Success)

National Seed Strategy

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which in turn depend on collection data and herbarium records.

The National Seed Strategy builds on existing initiatives such as the Seeds of Success (SOS) program led by the Bureau of Land Management (BLM). Since 2001 SOS has made more than 16,000 native seed collections representing over 5,000 taxa. The emphasis is on collecting orthodox seed for restoration needs particularly of species most at risk of climate change and associated threats, and species representative of key ecological communities. The goal is to bank seeds of 14,000 native taxa. Voucher specimens of all SOS collections are deposited at the U.S. National Herbarium with duplicates in local herbaria.

Implementation of the National Seed Strategy will scale up seed collection, seed production and ecological restoration through a coordinated inter-agency approach. The first major step will be a comprehensive needs and capacity assessment followed by increased research and management tools to enhance production. Communication is considered a key component to ensure active participation of a diverse set of public and private partners. The urgent need to document and conserve rare and threatened plants remains. But now the botanical community has a broader role to play in ensuring that the importance of maintaining all native plant diversity is recognized, and that materials are developed for restoration of plant diversity at a landscape level.

For a copy of the Seed Strategy, visit <http://www.blm.gov/seedstrategy>.

New Cases for the Bulky Bamboo Collection

By Meghann Toner

The U.S. National Herbarium is in the midst of rehousing its unique bulky bamboo collection. Floyd McClure developed this collection in the 1940s. The collection grew and diversified over the next forty years thanks in part to researchers such as Thomas Soderstrom and Cleofé Calderón. Since the late 1980s, this important collection of 1,419 specimens have been stored



Bamboo specimens sit in swing space as they await their move to new metal herbarium cases. (photo by Amanda Grusz)

in wooden cases. The specimens are too large to press and prepare as typical herbarium sheets, and hold important information on the structure of bamboo culms, branch complements, and rhizomes.

Thanks to a generous grant from the Smithsonian's Collections Care and Preservation Fund (CCPF), 38 state-of-the-art metal herbarium cases, designed specifically for the bamboo collection, were purchased. These cases are currently being installed into the collection and the bulky bamboo specimens will soon be carefully moved to their new home. These new cases will insure that this valuable and unique collection will last well into the next century as a research resource.

Visitors

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Virginia Valcarcel, Universidad Pablo de Olavide, Spain; *Hedera* (Araliaceae) (2/15 - 3/13).

Deborah Woodcock, Clark University; Peruvian fossil woods (2/22).

John MacDougal, Harris-Stowe State University; *Passiflora* (Passifloraceae) (2/26).

Ansam Al Harthy, University of Ohio; Plant DNA barcode internship (2/29 - 3/4).

Raymund Chan, Singapore; Compositae (2/29 - 3/6).

Jessica Gregory, Christopher Newport University; Araceae internship (2/29 - 3/4).

Fabian Michelangeli and **Marcelo Reginato**, New York Botanical Garden; Melastomataceae (3/1 - 3/2).

JunYing Lim, University of California at Berkeley; Hawaiian *Peperomia* (Piperaceae) (3/2 - 3/3).

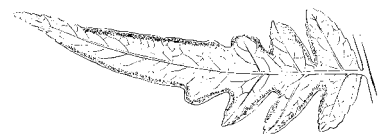
Susan Fawcett, University of Vermont; Pteridophytes (3/9 - 3/11).

Selene Castillo, Humboldt State University, and **Sheena Wang**, Johns Hopkins University; Plant DNA barcode internship (3/14 - 3/18).

Sai Samayamanthula, Fairfax, Virginia, and **Tijana Stanic**, Yale University; Plant DNA barcode internship (3/21 - 3/25).

Art Whistler, University of Hawaii, Manoa; Flora of Samoa (3/24).

Joel Cohen, Rockville, Maryland; Plant DNA barcode internship (3/28 - 4/1).



Botany in a New Era of Discovery

The Department of Botany is pleased to announce the opening of the new display, *Botany in a New Era of Discovery*. The display is found at the entrance of the U.S. National Herbarium, near the public space on the second floor of the National Museum of Natural History.

As habitats disappear at alarming rates, discovery of the remaining undescribed species on Earth has taken on a new sense of urgency. Although scientists continue their field expeditions to remote locations, many new species are discovered among the collections of preserved specimens in natural history museums. These specimens were collected decades ago, and sat waiting to be prepared, examined, and described. Other species have been well-known to local communities and indigenous groups who have given them unique names in their native language and have traded them in the marketplace, yet have never been described scientifically by taxonomists. Molecular genetics has shown that a single widely distributed species may in fact be a group of identical-looking yet distinct species.

In *Botany in a New Era of Discovery*



***Botany in a New Era of Discovery*, a new display at the National Museum of Natural History, tells the story of how new plant species are discovered, from work in the field and laboratory to discoveries in the marketplace and among historic collections. (photo by Ingrid Lin)**

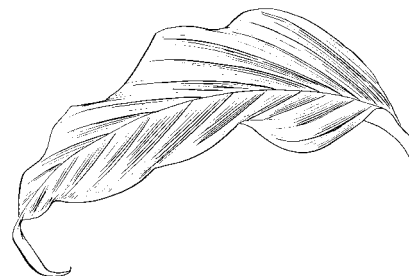
the museum's scientific collections play a starring role. Presented in the display are four case studies. One case displays the quillwort *Isoetes viridimontana*, in which

DNA sequencing confirmed the new species as well as its evolutionary relationship to other species of *Isoetes*. A highlight of this narrative is the large-scale 3-D models of the distinctly textured megaspores which were imaged by microscopy interns, Leah Greenstein and Leena Loo. The Weeping Goldsmith, *Globba sherwoodiana*, which was discovered being sold in a marketplace in Myanmar, is the focus of another case. One panel illustrates one of the smallest sedges yet to be discovered, *Eleocharis cryptica*, which was found during a collecting trip to western Mexico. The final panel showcases *Allophylastrum frutescens*, identified after close examination of a specimen collected from Guyana more than 100 years ago.

Nancy Khan, Gary Krupnick, Ida Lopez, Alice Tangerini, and design intern **Lola Ramirez** are the creative team behind the development of the display.



The creative team behind *Botany in a New Era of Discovery* at the opening reception for the display. From left: Nancy Khan, Gary Krupnick, Lola Ramirez, Ida Lopez, and Alice Tangerini. (photo by Ingrid Lin)



Focus on Research Associates It's Déjà Vu All Over Again!

By Sy Sohmer

The moment I pushed open the door to the Department of Botany at the National Museum of Natural History in November 2014, and began my reincarnation as a Research Associate, a flood of memories nearly knocked me over. First was the vision of Ray Fosberg and Marie Elaine Sachet greeting me there at the door on my very first visit to the Smithsonian Institution in 1973. I was there to meet with them and receive an orientation to the Flora of Ceylon project, and begin my post-doctoral fellowship. I would participate three times over the next decade on that project, and cement what became a wonderful friendship with both of those unique people. I was a newly tenured member of the Biology Department at the University of Wisconsin-La Crosse, an institution that allowed me a number of leave of absences so I could participate in the Ceylon Project (and many others over the next decade).

There they were at the door and they ushered me into the herbarium, and in quick succession I met Mason Hale, Dick Eyde, Aaron Goldberg, Dan Nicolson, Harold Robinson, Bob King, Joan Nowicke, Dieter Wasshausen, Larry Skog, etc.



Seymour Sohmer in 1989 preparing specimens during a Hunstein River expedition to Papua New Guinea, a National Geographic Society-supported project. (photo by Jay Dickman)



Map of the Islands of New Guinea. Papua New Guinea is at the right of the dividing line.

I had never met anyone as tall as Dick. And he had a green coat jacket on and I swear he looked like the Green Hornet! Anyway, it was a warm feeling being back and although most of those named people above had passed or retired, there are still some faces I knew from those early days: Debbie Bell, Rusty Russell, Alice Tangerini and others.

I was brought eventually to what would be my office in my days as a post-doc: the "Cave." That would be my home away from home during that year along with the many half cabinets that served as sorting tables in those days when there weren't as many full cabinets. I spent hours laying out specimens of *Psychotria* (Rubiaceae) and what had been the subject of my doctoral dissertation at the University of Hawaii: *Charpentiera* (Amaranthaceae). It was Ray Fosberg who nudged me into the study of *Psychotria*, and the first revision I undertook of that genus was for the Hawaiian Archipelago.

And so here I am getting back to the research I used to love doing after first running a program at the U.S. Agency for International Development (USAID) as Senior Biodiversity Adviser for three years, and then, spending over 20 years as the director of the Botanical Research Institute of Texas (BRIT), in Fort Worth, organizing an institution that began in a 10,000 sq. ft. warehouse. There were three

people, an herbarium of some 400,000 specimens, an annual budget of \$175,000, and a library of some 50,000 titles. When I left, there were 32 people, an annual budget of about \$4 million, an herbarium of over one million specimens, and, most importantly, all housed in a LEED Platinum building adjacent to the botanical garden, and with a library of some 150,000 titles and nearly a \$50 million endowment.

I now want to do my part for the Smithsonian's Botany Department as I wish to honor the memory of those who came before me, who were kind to me, and upon whose shoulders I am now standing. In this department are dedicated individuals who, whether they realize it or not, are helping to save global biodiversity by documenting the plant world.

My plans are to work with Papua New Guinea *Psychotria* where I left off with my 1988 publication of my monograph. Many more taxa are yet to be recognized. More studies are needed to fully understand the systematics, morphology, phylogeny and diversity of this genus in New Guinea. When I began doing this work I estimated that the number of taxa that is likely to be found in Papua New Guinea would be 200 to 300 (including the vines and the climbers). At present many new taxa have been described from the lowland rainforests to the high altitude forests, but many areas remain unexplored.

I will first sort out the general relationships between *Psychotria* from New Guinea and the Bismarck Archipelago and *Psychotria* from adjacent portions of Indonesia and the Philippines and try to come to grips with the sheer number of taxa in order to better determine the significance of a given morphological character in a series of taxa over widely separated geographic areas. I will attempt to illuminate the subgeneric relationships of these species (i.e., several taxa designated as *Uragoga* or *Cephaelis* that probably do not belong with *Psychotria*). *Psychotria* demonstrates a tendency for rapid speciation based on geographical isolation of its taxa in the rugged terrain of the country.

I will gather new collections, as well as new tools involving molecular analysis, that will extend our knowledge of the systematics of the group both at higher levels and at the species level. The Papua New Guinea National Herbarium (LAE) will support this work. LAE is part of the Papua New Guinea Forest Research

Institute (FRI), where my co-investigator in this work, Tiberius Jimbo, resides. Any new collections we make will be processed there and duplicates distributed to major herbaria, with the Smithsonian obtaining the second set after LAE. This proposed project will be supported by a team that has a working knowledge of all the techniques, including reliably working PCR primers and protocols, high-throughput sequencing and bioinformatics.

The goal is to produce taxonomic keys to the climbing and non-climbing *Psychotria* species in PNG, and publish papers on *Psychotria* morphological diversity, ecology, and molecular phylogeny. We also hope to develop a reference set of DNA sequences for molecular identifications and a database of images of representative specimens of the PNG species for future identifications.

Papua New Guinea encompasses the eastern half of New Guinea and its offshore islands (East/West New Britain, Manus, Bougainville and the Papua

Islands). Collecting and documenting flora from such highly diverse and difficult terrain is often arduous but worth the labor.

This will no doubt constitute my life's work. As I said, it is déjà vu all over again.

I celebrate being here and I can't thank my former employee at Bishop Museum, Warren Wagner, enough for making this possible for me.



20 May 2016
National Museum of Natural History

“Bats, Bees, Birds, Butterflies and Bouquets: New Research in Pollination Biology”

In collaboration with the United States Botanic Garden

Supported by the National Science Foundation and the Cuatrecasas Family Foundation

The act of pollination, transferring pollen from one flower to another, remains one of the most ecologically important interactions between plant and animal. It allows plants to produce seed and reproduce, and it provides pollen, nectar and other rewards to the animals that visit the flowers. Pollination is a keystone function of most terrestrial ecosystems, and an estimated 87 percent of flowering plants depend on animal pollination. Plant-pollinator interactions have led to the evolutionary diversification of major groups of both plants and animals. A diverse plate of foods for humans is a result of pollination as well: one out of every three bites of food we eat is the result of an animal pollinating a plant. Yet recent evidence shows that pollinator abundance and diversity is on the decline. What does the threat to the health of pollinators hold for the future of native plant populations and agriculture? Will plant and pollinator populations adapt to a changing climate, invasive species, and habitat loss?

The 14th Smithsonian Botanical Symposium, hosted by the Department of Botany and the United States Botanic Garden, will highlight current research in pollination biology, from plant physiology and ecology to evolution and animal behavior. New approaches to the study of plant-animal interactions may provide promise to safeguard biodiversity both here in the U.S. and around the world. The invited speakers will cover a wide range of approaches to illustrate the challenges in plant-pollinator relationships in a rapidly changing world.

The symposium is free to attend, but registration is required.
Information and registration at <http://botany.si.edu/sbs/>



Illustration of *Archilochus colubris* (ruby-throated hummingbird) visiting *Campsis radicans* (= *Bignonia radicans*, trumpet vine). From J.J. Audubon, *The Birds of America: from Drawings Made in the United States and Their Territories, 1840-1844*.

Herbarium

Schlagintweit: The Case of the Beheaded Botanist

By John Boggan

-Adapted from *DC Tropics* <<http://dctropics.blogspot.com/2016/02/the-beheaded-botanist.html>>

Sitting at our computers in our comfortable offices, handling herbarium specimens that are often well over a century old, we sometimes forget how dangerous it could be to collect these specimens in the 1800s, and how many of these collectors came to bad—and sometimes violent—ends. One such end inspired a story by Rudyard Kipling. “The Man Who Would Be King”—made into a 1975 movie with the same title—ends with a rather memorable scene of a man’s severed head in a bag, a scene loosely based on the true story of Adolphe Schlagintweit.

Kipling probably never met any of the Schlagintweit brothers—Hermann (1826-1882), Adolphe* (1829-1857), and Robert (1833-1885)—but I recently worked with some of the plant specimens

*Although most modern sources spell his name “Adolf”, “Adolphe” is the spelling used in the publications by the brothers themselves, as well as in contemporary reports about them.

these Bavarian explorers collected in the 1850s on a scientific expedition to Asia. Well-educated sons of a wealthy Munich ophthalmologist, Hermann and Adolphe moved to Berlin in 1849 shortly after receiving their doctorates in geography and geology, respectively. There they met the famous naturalist and explorer Alexander von Humboldt, then 80 years old and looking for younger men to continue his life’s work. Impressed by their previous work in the Alps, he recommended them for an expedition commissioned by the East India Company (and paid for in part, for reasons not clear to me, by the King of Prussia) to complete the Magnetic Survey of India and to collect geological, zoological, botanical, and anthropological specimens. In 1854, taking their younger brother Robert along as an assistant, they set off for India.

This expedition was significant for going into areas where no collectors had been before, and in many cases no westerners of any kind. For three years the brothers traveled both together and separately, with a retinue of assistants and servants, finally writing about their travels in a never-completed series of volumes, *Results of a Scientific Mission to India and High Asia*. For Adolphe, the botanist of the team, the publication was posthumous.

In the course of my work in the U.S. National Herbarium I’ve handled thousands of specimens, but the ones from the

Schlagintweit expedition are distinctive. All are mounted on paper that is both smaller and flimsier than standard herbarium sheets, with collection data preprinted directly on the sheets. The majority were collected in India (including areas now in Pakistan) with forays into Tibet and Nepal. British India and Tibet were both a bit fuzzy and disputed around the edges, and these uncertain boundaries, the political tensions they engendered, and ongoing territorial skirmishes among the various local tribes were among the obstacles the brothers had to contend with.

In December 1856 the brothers parted company one final time, with Hermann and Robert returning to Europe in early 1857. Adolphe stayed behind, traveling instead to Peshawar, with plans to go to Turkestan and Tibet before returning to Europe. That was the last they saw of him; in 1857 he disappeared and was reportedly murdered but for several years, his fate was uncertain.

The brothers were later able to ascertain that in August 1857, Adolphe made his way to Kashgar, a Tibetan city near the borders of present-day Tajikistan and Kyrgyzstan. The region was claimed by China but had been recently occupied by an invader from neighboring Kokand, the infamously cruel Khoja Vali Khan (Wali Khan in modern spellings). By all accounts Vali Khan was a brutal leader who took pleasure in beheading his enemies. Travelers returned with tales of severed heads stacked in roadside pyramids. Upon his arrival in Kashgar, Adolphe was taken prisoner and for reasons that are still uncertain, but possibly suspecting him of spying for China, Vali Khan ordered Adolphe beheaded.

The demise of Adolphe Schlagintweit was widely reported, first as a rumor with the hope that he might still turn up, and later as fact, in various natural history journals. Hermann and Robert gathered all the first-and second-hand reports that they could find on their brother’s fate (in particular from Adolphe’s assistants and servants, who had escaped), and like all of their scientific measurements and observations, published them all in excruciating and often redundant detail in the first and second volumes of their reports. The second volume included some last-minute new information on the recovery of Adolphe’s journal and head.



Die Gebrüder Schlagintweit, 1847 (source: Wikimedia)



A typical Herbarium Schlagintweit specimen in the U.S. National Herbarium.

A critical detail the modern stories leave out is that not one but two different heads were delivered to British officials in India as the remains of Adolphe. The first was produced by one of Adolphe's surviving servants but proved to be that of a native, albeit one who had been violently decapitated. The second head had been delivered by a Persian trader along with Adolphe's previously missing final journal.

It's not clear whether the second head was ever determined to be that of Adolphe. Neither is it clear what happened to either head, but these notorious stories would have been in recent memory when Rudyard Kipling arrived in India in the 1880s and he may well have met some of the officials directly involved. The story apparently resonated with Kipling, who used the delivery of a severed head to a British civil servant in India as a key detail in his 1888 story.

Although the Schlagintweit brothers' reports were deemed "unreadable" by one English reviewer, and the Magnetic Survey of India later fizzled into nothing, their collections remain an important contribution to science. The brothers collected an enormous number of specimens, in addition to hundreds of sketches and watercolors (Hermann in particular was apparently an excellent artist). The collections were sent to Berlin, with the bulk of them later sent to England for distribution.

Judging from the specimen numbering, ca. 13,000 plant collections were made. About 900 specimens are now housed in the U.S. National Herbarium, the majority having come from the John Donnell Smith herbarium. Of these, only about 75 have been inventoried so far. Hermann von Schlagintweit is often cited as the collector, apparently as the leader of the expedition, but the botanical specimens were made by Adolphe and his team

of collectors. The locality data must be handled very carefully as the country names printed on the specimens do not necessarily correspond to present-day boundaries. Many of the specimens collected in "India" came from Pakistan and some collections from "Tibet" were made in India.

When I started investigating this collection in the herbarium, only five were recorded as types; a bit of investigation turned up another dozen. Numerous new taxa were described from Schlagintweit collections, including about 20 taxa honoring Adolphe with epithets like "*schlagintweitii*" or "*schlagintweitiana*". Duplicates were apparently widely distributed and other herbaria with significant numbers of Schlagintweit types are BM, GH, HBG, JE, M, NY, P, and S with a few also at B, GOET, and W.

For a detailed discussion of the Schlagintweit brothers and their mission, see *Conquerors of The Künlün*? *The Schlagintweit Mission to High Asia, 1854-57*, by Gabriel Finkelstein.

Profile

Continued from page 1

4 of the 7 most highly endemic families in Madagascar (Asteraceae, Euphorbiaceae, Fabaceae, and Malvaceae) and preserve them for the GGI mission.

Locally, with spring now fully upon us, there is an amazing amount of untapped plant diversity awaiting collection and preservation in the NMNH Biorepository. GGI-Gardens has its hands full during its first spring collection season with assorted taxa, both rare and common. In fact, our gap analysis from local genera suggests that more than 650 genera remain to be sampled, and a big aim throughout 2016 is to comprehensively sample from these taxa. The next time you see the GGI-Gardens team toting around the big blue wagon of collecting material, say hello, ask how the program is going, and feel free to tag along and help collect.

There are several upcoming events in 2016 as GGI-Gardens continues to collect locally, partner internationally, and expand toward its lofty preservation targets. Several blog features are in the works along with content for the recently revamped GGI website (<http://ggi.si.edu/ggi-gardens>), including information about

Continued on page 14



Assorted orchid diversity (from left: *Bulbophyllum thiurum*, *Psychopsis papilio*, *Dendrochilum cobbianum*) among GGI–Gardens collections throughout the Spring 2016 collecting semester provides a view into the Smithsonian Gardens orchid greenhouses. (photo by Morgan Gastel)

Profile

Continued from page 13

the program, interactive content, best practices, and a list of growing garden partners. In June, GGI–Gardens will host a workshop for gardens and potential GGI–Gardens partners during the 2016 meetings of the Global Genome Biodiversity Network (GGBN) in Berlin. This meeting,

held in parallel with the 2016 meeting of the Society for the Preservation of Natural History Collections (SPNHC), will help address challenges associated with genome tissue preservation, implementing best practices and standards, and managing access and benefit sharing needs.

As the GGI–Garden network grows, if you know of a garden that might be

interested in joining the GGI–Gardens partnership, please tell them to contact us by visiting our website or emailing Morgan Gastel at gostelm@si.edu.

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GGI–Gardens team in front of the Smithsonian Castle with blue wagon-toted Funk dewar. From left: Morgan Gastel, and GGI–Gardens interns Kathryn Faulconer, Samantha Vo, and Maryam Sedaghatpour. (photo by Morgan Gastel)



GGI-Gardens interns (from left) Kathryn Faulconer, Maryam Sedaghatpour, and Samantha Vo with a specimen of *Musa textillis* Née collected for GGI-Gardens at the U.S. Botanic Garden, January 29, 2016. (photo by Morgan Gostel)

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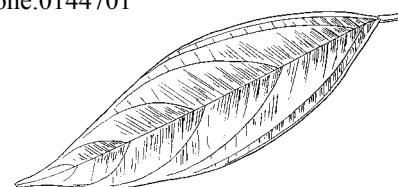
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Art by Alice Tangerini

***Musa violascens* Ridl.**

The Global Genome Initiative–Gardens has a goal of collecting genome-quality tissue from all living plant families and half of the living plant genera of the world. The GGI–Gardens team recently collected tissue from a specimen of *Musa textilis* at the U.S. Botanic Garden. Another species in the genus, *Musa violascens*, was illustrated for John Kress in 1997 at Lyon Arboretum in Oahu, Hawaii.

During a two week trip, Alice Tangerini worked on several genera from living material on the grounds of the Arboretum. With help from Lyon's manager, Ray Baker, Tangerini was able to locate and sketch a large banana tree growing in the Manoa hills. Baker collected the flowers and fruits for Tangerini to draw later back at the garden's education building. The *Musa* drawing was one of 12 illustrations for an exhibit in Singapore as part of the 1998 meeting of the Heliconia Society International.



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