

# The Plant Press



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National Museum of Natural History

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## Botany Profile

# Wind Dispersal for the Win: New Fern Collections from the Marquesas Islands

By Eric Schuettpelz

Typical fern spores are less than one tenth of a millimeter in diameter and are readily carried to far off places by the wind. Having such small propagules certainly contributes to the disproportionate diversity of these plants on oceanic islands. Although ferns and lycophytes (collectively pteridophytes) only account for about 4 percent of the world's vascular plant species, they can easily represent 20 percent of the species on islands. Generally speaking, the more isolated the island, the more disproportionate the contribution of pteridophytes.

Located in the southern Pacific, about 5000 km from North America and more than 7000 km from Australia, the Marquesas Islands are farther from a continental land mass than any other archipelago. The constituent islands are well separated from the rest of French Polynesia and about 1400 km from Tahiti and the rest of the Society Islands. The 12 major Marquesas Islands are nearly all volcanic in origin, ranging in age from about 1 to 6 million years old. In total, the archipelago accounts for about 1050 km<sup>2</sup> of land area, which is roughly the same as the city of Los Angeles or the island of Tahiti and less than the Hawaiian island of Kaua'i. Three of the islands reach an elevation exceeding 1200 m.

A comprehensive flora of the Marquesas Islands has yet to be published. However, researchers based at the National Tropical Botanical Garden (led by David Lorence), the Smithsonian Institution (led

by Warren Wagner), and the Institut de Recherche pour le Développement (led by Jacques Florence) have been studying the plants inhabiting this archipelago for more than three decades. Much of their progress has been tracked on the *Flora of the Marquesas* website (<http://botany.si.edu/pacificislandbiodiversity/marquesasflora>) and this information is currently being developed into a two volume *Flora of the Marquesas Islands* to be published in late 2018. At present, 329 native vascular plant species are listed. Remarkably, ferns and lycophytes account for 99 (30 percent) of these. There are very few islands or archipelagos with proportions that are more skewed toward pteridophytes.

As a first step toward understanding the origins of this incredible pteridophyte diversity, I recently traveled to the Marquesas Islands, with funding from the Global Genome Initiative (<https://ggi.si.edu>) and the National Science Foundation, to collect herbarium specimens and silica-dried material for DNA extraction. I was joined by Ken Wood (National Tropical Botanical Garden) and Jean-François Butaud (Consultant in Forestry and Polynesian Botany).

The three of us met on the island of Tahiti late on October 28<sup>th</sup> and departed for the Marquesas early the next morning. After a short connection on the island of Nuku Hiva, the largest of the Marquesas Islands, we made our way via a small Twin Otter aircraft to Ua Pou, a somewhat smaller island characterized by its rocky

pillars. The summit of one of these pillars, Oave, at 1203 m, is among the highest points in the Marquesas.

We spent nine full days on Ua Pou, collecting pteridophytes, bryophytes, lichens, and even some flowering plants. The bulk of our time was spent in the higher parts of the island, which were generally accessible only by foot. We circled Poumaka, a prominent 500 m tall spire, and collected on the steep ridges and in the deep valleys around Poutetainu and Tekohepu. We also spent a considerable amount of time on the slopes adjacent to Oave, where Jean-François Butaud collected what are most likely two new species in the genera *Pilea* (Urticaceae) and *Kadua* (Rubiaceae). The pteridophytes on Ua Pou did not disappoint. We encountered large tree ferns (e.g., *Alsophila tahitensis* and *Sphaeropteris medullaris*) with leaves several meters in length, diminutive filmy ferns (e.g., *Crepidomanes minutum* and *Didymoglossum tahitense*) with leaves smaller than 1 cm, and everything in between.

On November 8<sup>th</sup>, we left Ua Pou for the somewhat larger island of Hiva Oa, where we spent seven full days. Much of our time on Hiva Oa was spent in the cloud forests in the vicinity of Temetiu, which, at 1276 m, is the highest point in the Marquesas. At the higher elevations, we encountered an impressive array of grammitid ferns (nine species in eight genera) among many other

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**Pedro Acevedo** traveled to São Paulo and Mato Grosso do Sul, Brazil (8/14 – 9/15) to conduct molecular research on Sapindaceae; to Mexico City, Mexico (10/22 – 10/28) to work with Sapindaceae at the National Herbarium of Mexico (MEXU) for the Flora of Puebla project; to Bronx, New York (11/1 – 11/3) to attend the Flora of the Guianas meeting at the New York Botanical Garden; and to São Paulo, Brazil (12/2 – 12/12) to conduct research and speak at meetings at the University of São Paulo and University of Campinas.

**Barrett Brooks** traveled to Orlando, Florida (10/31 – 11/17) to attend the Diving Equipment and Marketing Association Trade Show.

**Manuela Dal Forno** traveled to Graz, Austria (11/02 – 11/06) to present the talk, “First insights into the microbiome of different morphologies in the *Dictyonema* clade,” at a lichen genomics workshop; to Porto Alegre, Brazil (11/12) to participate in a doctoral defense at the Universidade Federal do Rio Grande do Sul; and to Minas Gerais, Brazil (11/21 – 12/01) to collect lichen specimens for her postdoc-

toral research.

**Stuart Davies** traveled to Malaysia and Singapore (11/25 – 12/7) to give a keynote address at a conference and to meet with the Asian School of the Environment as part of the Smithsonian Institution-Nanyang Technological University (SI-NTU) Partnership.

**Ashley Egan** traveled throughout Arkansas, Louisiana, Alabama, and Mississippi (9/25 – 10/16) to conduct population level sampling of *Phaseolus polystachios* (Fabaceae).

**Erika Gardner** traveled to Lafayette, Louisiana (10/23 – 10/26) to give a presentation to 10<sup>th</sup> graders at Lafayette Parish schools for the Gaining Early Awareness and Readiness for Undergraduate Programs (GearUP), a program of the U.S. Department of Education; and to Saint Louis, Missouri (11/13 – 11/16) to pack and ship Walter Lewis’ pollen slides from Washington University to the U.S. National Herbarium.

**Pedro Jiménez-Mejías** traveled to Bronx, New York (11/5 – 11/7) to study the collection of Neotropical *Carex* (Cyperaceae) at the New York Botanical Garden.

**Gabriel Johnson** traveled to Beltsville, Maryland (12/8) to learn about the extraction of rhizobia and DNA from the root nodules of a diversity of legumes at the U.S. Department of Agriculture’s National Rhizobium Collection laboratory.

**W. John Kress** traveled to Shenzhen, China (10/24 – 10/30) to deliver an invited lecture at the 12<sup>th</sup> International Conference on Genomics at the China National GeneBank.

**Marcelo Pace** traveled to São Paulo, Brazil (11/13 – 11/24) to teach a course, “Wood anatomy under a taxonomic and systematic approach,” organized by Veron-

ica Angyalossy at the University of São Paulo to students from Brazil, Guatemala, and Argentina; and to Cambridge, Massachusetts (12/5 – 12/10) to discuss collaborative research on Malpighiaceae, study the Malpighiaceae collection, and photograph the entire wood anatomical slides of Malpighiaceae and Nyctaginaceae from the Irwin Bailey Slide collection at Harvard University Herbarium

**Melinda Peters** traveled to Kennett Square, Pennsylvania (12/1 – 12/2) to deliver plant mounting supplies and pick-up plant specimens from Larry Owens, a volunteer plant mounter.

**Eric Schuettelpelz** traveled to the Marquesas Islands (10/28 – 11/19) to collect plant specimens.

**Laura Tancredi** traveled to Pittsburgh, Pennsylvania (10/11 – 10/13) to present a talk, “Cleaning up our act: Striving for quantity and quality in a rapid capture workflow,” at the 2017 Axiell North American User Conference.

**Alice Tangerini** traveled to San Francisco, California (10/11 – 10/15) to present a portfolio and give a workshop at the annual meeting of the American Society of Botanical Artists; and to Pasadena, California (11/1 – 11/6) to present a tour, serve on a panel discussion, give a workshop, and present a lecture at the Huntington Library, Art Collections, and Botanical Gardens.

**Jun Wen** traveled to Beijing, Hubei, and Taiyuan, China (11/25 – 12/12) to conduct collaborative research on sumac-aphid coevolution and *Vitis* systematics, and to participate in the Second Systematic Biology Forum in Beijing, in which she gave a speech on developing integrative systematics in the genomic and informatic era.



### The Plant Press

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#### Chair of Botany

Laurence J. Dorr  
(dorr1@si.edu)

#### EDITORIAL STAFF

##### Editor

Gary Krupnick  
(krupnickg@si.edu)

##### Copy Editors

Robin Everly, Bernadette Gibbons, and  
Rose Gullledge

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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: krupnickg@si.edu.

Web site: <http://botany.si.edu/>

### Visitors

**Yousheng Chen**, Chinese Academy of Sciences, China; Pan-Himalayan Cardueae and Gnaphalieae (Asteraceae) (12/31/16-12/30/17).

**Xu Su**, Qinghai University, China; Triticeae (Poaceae) (12/31/16-3/1/18).

**Yuan Xu**, South China Botanic Garden; *Androsace* (Primulaceae) (4/1/17-3/31/18).

**Muriel Poston**, National Science Foundation; Loasaceae (10/3).

**Ashley Field**, Queensland Herbarium & Australian Tropical Herbarium, Australia; Lycophytes (10/10-11/3).

**Julian Campbell**, Bluegrass Woodland Restoration Center, Kentucky; Flora of North America and *Monarda* (Lamiaceae) (10/11).

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## A Chameleon with a Very Long Tale

**O**uch! I discovered long ago that the best way to proof read a paper was to publish it. No matter how careful one is, no matter how many times you read a manuscript, no matter how many reviewers scrutinize your work, no matter how diligently editors check every line and fact, something slips through. How can an egregious error be so expertly camouflaged in typescript, but the moment the typescript is printed and made public it slaps you in the face?

Sometimes one can point the finger of blame elsewhere. The first botanical paper I published was a pollination biology study. The *American Journal of Botany* had accepted the manuscript and I was proud: perhaps too much so. I pored over every word in the manuscript. I took to heart the reviewers' criticisms and addressed them all: including correcting some minor statistical analysis. I checked the galley word by word. Then I waited until publication. I received my copy in the mail only to realize when I tore off the wrapper and opened up the journal that I had never seen proof of the running head. Of course, it read "Door – Pollination Ecology of *Zenobia*." Fate teaches humility.

Sometimes there is no one to blame but oneself. The first book I published was *Plant collectors in Madagascar and the Comoro Islands* (1997). It grew out of a need to understand who had collected in Madagascar, where they had collected, and what happened to their collections. Not every Malagasy herbarium specimen ended up in Paris: they were and are scattered across herbaria in Europe and the United States. The Royal Botanic Gardens, Kew agreed to publish the book with the stipulation that I find more portraits of the collectors. This proved to be challenging, but interesting detective work. Finally, after the book manuscript was submitted, reviewed, accepted, and two proofs had been generated and checked, I went to Kew to sit down with the book designers and work through the final proof and composition. I remember they made a mockup of the book as it would be printed and asked me to sign the cover accepting it as final. I did. It was perfect as far as I and they were concerned. Shortly after publication Rudi Schmid, who had received a copy to review for *Taxon*, wrote me and asked me who had published the book: Kew or the Smithsonian? Only then did I realize that my mockup of the title page had included my Smithsonian address, intended solely as a placeholder, but inadvertently overlooked and published. The spurious title page has fooled more than one library cataloger.

After this Madagascar fiasco one kind correspondent pointed me to what I term Ida K. Langman's lament. Langman, a bibliographer, published a massive bibliography titled *A selected guide to the literature on the flowering plants of Mexico* (1965). She included a page devoted to "Random thoughts on bibliographies," which might just as well have been random thoughts on

publication perfection or the lack thereof. Clearly, she understood the impossibility of completeness and perfection. Neither one exists. To focus on errors in publication and miss the value of content is like not seeing the forest for the trees.

So why the chameleon's tale? One of the plant collectors I included in the Madagascar book was Albert Mocquerys (1860-1926). He was enigmatic. I surmised that he was a Francophone and thought that he was Swiss because his Madagascar plant collections were in Geneva. It also was apparent that he was a commercial collector, a class of collectors who are often difficult to trace because they seldom leave a publication trail or have academic affiliations. Years later when I noticed his name on plant specimens collected in Venezuela, another part of the globe where I have spent time, I decided to dig deeper (*Harvard Papers in Botany* 22: 17-26; 2017). In Venezuela, at least, his patron was Baron Walter Rothschild who was assembling a natural history collection at Tring focused on insects and birds. I discovered correspondence where Mocquerys wrote Rothschild that he was sending him many natural history objects from Venezuela including "Un caméléon à très-longue queue." One sharp reader noticing my mistranslation using the incorrect homophone observed that "a chameleon with a very long tale" begs the question of who was doing the telling. Presumably not the chameleon.

What is the moral of this tale? We all make mistakes, inadvertent or unintentional, and they should not cloud our judgement of the merit of a research article or book. The same sharp reader replied when I acknowledged my error: "Yes, I know what you mean about the proofreaders coming out of cracks in the floor like roaches once you have published something." I think Langman would have happily included this in her "Random thoughts on bibliographies." In my case, the roaches would probably be Madagascar hissing or warty glowspot cockroaches.

Chair

With

A

View

L.J.  
Dorr



## Peer Recognition Awards

The National Museum of Natural History (NMNH) presented the 2017 Peer Recognition Awards on December 12, 2017. 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 14 NMNH staff members representing a cross-section of the entire museum community.

Fifteen awards were presented. Department of Botany staff and contractors, both current and former, were presented with three awards.

**Zachary Lynch** (NMNH Collections Program) received the “**Digitization Powerhouse Award**.” Digitization projects link specimen data and acquisition data, creating digital associations between analog card catalogs that allow these data to be more easily discoverable and accessible to collections staff and researchers here and around the world. When it comes to the hard work of transcribing data, nobody accomplishes more in a day than Zachary Lynch. Over the last year, Zachary has scanned and transcribed over



NMNH Sant Director Kirk Johnson (far left) stands with the recipients of the “Super Mentor League of NMNH Award” (left to right): Liz Zimmer, Torsten Dikow, Neal Woodman, Dave Hunt, and Cari Corrigan. (photo by the Smithsonian Institution)

53,000 Botany mounting tags and over 10,000 Division of Birds donor cards, which averages out to well over 200 cards per day. What was expected to take many months to accomplish was finished by Zachary in record time due to his skill and determination. Zachary has accomplished all of this with an incredibly low error rate

and an unshakeable, infectious enthusiasm for his job. Since Zachary’s start as a Project SEARCH employee in 2014, he has become an invaluable member of the NMNH community. His incredible work ethic has inspired his colleagues to tackle digitization projects that they previously considered too time-consuming to complete – no project is too big for this digitization powerhouse.

**Liz Zimmer** (Botany), along with Cari Corrigan (Mineral Sciences), Dave Hunt (Anthropology), Neal Woodman (Vertebrate Zoology), and Torsten Dikow (Entomology), received the “**Super Mentor League of NMNH Award**.” This team exemplifies the values of mentorship, community building, and teamwork. These super-stars form the fabric of the mentoring community for the Natural History Research Experiences (NHRE) intern program. Of the 95 NHRE mentors, this team stands apart: in 2017, they each mentored five or more interns in the program, and attended professional conferences to facilitate networking and disseminate their students’ research projects to the broader scientific community. Providing a life-time commitment, this league mentors former interns, providing letters of recommendation and guidance on follow-up projects. These individuals are the Super Mentor



Zachary Lynch (left), the recipient of the “Digitization Powerhouse Award,” stands with NMNH Sant Director Kirk Johnson. (photo by the Smithsonian Institution)

League of NMNH.

One hundred forty-two. That's the magic number of passionate curators, collections specialists, conservationists, educators, exhibition specialists, administrators, photographers, communications specialists, development specialists, and others who contributed to a remarkable new NMNH exhibition collaboration called Objects of Wonder. Telling the stories of our vast and varied collections through text, graphics, multimedia, and the objects themselves is no easy feat. Working together this team created a truly awe-inspiring exhibition which opened in March of 2017. Even after opening, members of the team continue to give tours, engage visitors, showcase it to potential donors and have already started planning object change outs. That "Oh Wow!" you hear outside of the glass sliding doors to the gallery is just a sample of the accolades this diverse team hears every day. The collaborations involves all NMNH departments and functions and this is truly a wonder. Receiving the "Wonder Team Award," from the Department of Botany are **Walter Adey, Robert Faden, Nancy Khan, John Kress, Gary Krupnick, Sue Lutz, Melinda Peters, Alice Tangerini, Warren Wagner, Ken Wurdack, and Stan Yankowski.**



## Plants and Pollinator Health are Focus of NAPPCC 2017 Conference

On October 18 and 19, the North American Pollinator Protection Campaign (NAPPCC) held its 17<sup>th</sup> annual conference, hosted at the American Farm Bureau Federation in Washington, D.C. The meeting highlighted past accomplishments of NAPPCC while the collaborative efforts of many people from all over North America worked tirelessly to work in conjunction to promote the health of all pollinators and their native plants.

This year's conference included diverse presentations from experts at

the forefront of pollinator issues. Topics ranged from the Endangered Species Act and the listing of *Bombus affinis*, to the importance of state apiarists, improvements in Canadian agriculture, pesticide issues, and the Million Pollinator Garden Challenge.

NAPPCC convened nine task forces that established yearlong objectives on specific pollinator issues. One task force is working to implement roadside habitat incentives including educational outreach and recognition of best practices. The Monarch task force will focus on engaging broad stakeholders to promote the health of monarch butterfly populations. **Gary Krupnick** (Smithsonian's Department of Botany) co-chaired a task force that focused on selecting plants for pollinators, defining plant material needs in context by looking at pollinator plants and determining best management practices.

An optional field trip to the National Museum of Natural History preceded the conference on October 17. Organized by Krupnick, the field trip included behind-the-scene tours of a number of museum research departments and its collections, including the Departments of Entomology (bees and butterflies), Vertebrate Zoology (birds), Botany, Anthropology, and Mineral Sciences. In addition, a guided tour of Smithsonian Gardens' Pollinator Garden gave insight into the best practices in establishing a garden that showcases natural plant/pollinator partnerships.

## The 2018 Smithsonian Botanical Symposium, May 18, to Explore Plants in the Past

The Department of Botany and the United States Botanic Garden will convene the 2018 Smithsonian Botanical Symposium, "Plants in the Past: Fossils and the Future," to be held at the National Museum of American History in Washington, D.C., on May 18, 2018.

Present-day plant diversity is remarkably rich and varied, but the vast majority

of plant species to have ever lived are now extinct. Knowledge of the past is key to understanding the origins of today's plant diversity and to illuminating the fundamental evolutionary processes that generate biodiversity. The study of prehistoric floras (the fields of paleobotany and paleoecology) also provides key evidence for subjects such as paleozoology, the formation of the Earth's atmosphere, and climate change.

The 16<sup>th</sup> Smithsonian Botanical Symposium, hosted by the Department of Botany and the United States Botanic Garden, will explore plants in the past, from their early origins to the more recent rise of the angiosperms. Speakers will address current trends and the future of paleobotanical research. The Symposium coincides with the development of the Natural History Museum's National Fossil Hall, which is scheduled to open to the public in 2019.

A full lineup of speakers will present their talks during the day at the National Museum of American History's Warner Bros. Theater, which is a change in location from past symposia as Baird Auditorium in the Natural History Museum undergoes renovation. The event will be followed by a reception and poster session in the U.S. Botanic Garden Conservatory that evening.

In addition, the 16<sup>th</sup> 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.

Abstracts for poster presentations may be submitted online at <http://botany.si.edu/sbs/>. The deadline for abstract submission is April 13.

There will be no registration fee this year, but attendees must register online

at <http://sbs18.eventbrite.com/> to attend the event. Visit the Symposium website, call 202-633-0920, or email [sbs@si.edu](mailto:sbs@si.edu) for more information.



## Stanwyn G. Shetler (1933-2017)

By L.J. Dorr with contributions  
from S. Shetler

Stanwyn G. Shetler passed away in Leesburg, Virginia on 4 December 2017 from complications related to Parkinson's disease. Shetler was born on 11 October 1933 in Johnstown, Pennsylvania. He grew up in rural Hollsopple about 15 miles southwest of Johnstown and graduated from Johnstown Mennonite High School (now Johnstown Christian School). His father, Bishop Sanford G. Shetler, a prominent leader in the Mennonite community, founded this high school and was its principal. This may explain why Shetler felt motivated to graduate Valedictorian of his class. Shetler acknowledged that his interest in natural history began with bird watching when he was in the sixth grade and was stimulated by a science teacher and fostered by his mother. He ultimately chose Botany as his profession, but Ornithology remained his lifelong avocation.

Shetler earned his Bachelor's and Master's degrees in 1955 and 1958, respectively, from Cornell University after first attending Eastern Mennonite College (now University) in Harrisonburg, Virginia. He came to the Department of Botany, National Museum of Natural History, Smithsonian Institution, in 1962 directly from graduate school at the University of Michigan where he was a student of Rogers McVaugh. Shetler joined the Smithsonian before completing all of the requirements for his doctoral degree, but eventually he defended his dissertation and received his Ph.D. in 1979 shortly before McVaugh retired. Both his thesis and his dissertation concerned problems related to the taxonomy of the genus *Campanula* (Campanulaceae).

Shetler began as an Assistant Curator in the Museum and rose to the rank of Curator. He had responsibility for North American plants, including the flora of the Washington, D.C. region. For a decade from 1984 to 1994, Shetler also was assistant to the Director of the Museum, which left him little time for research. As Associate and then Deputy Director, he served under three different directors: James C. Tyler, Robert S. Hoffman, and Frank H. Talbot. Shetler was highly regarded for his fairness and calm demeanor. One



**Stanwyn Shetler on Plummers Island, Maryland ca. 1970. (photo courtesy of the Washington Biologists' Field Club)**

administrative decision that continues to influence decision making in the Museum is the informal "Shetler Rule" regarding the procedure for replacement of staff who leave employment. Shetler retired in 1995 and received his final professional title, Curator Emeritus. He continued to work in the U.S. National Herbarium until 2010 when his health made commuting difficult.

Although Shetler's botanical interests were wide-ranging, he was most interested in the genus *Campanula*, commonly known as bellflowers, and the flora of the Arctic. He published many scientific, technical, and popular titles, including three books: *The Komarov Botanical Institute: 250 Years of Russian Research* (1967); *Variation and Evolution of the Nearctic Harebells: (Campanula subsect. Heterophylla)* (1982); and *Portraits of Nature: Paintings by Robert Bateman* (1987). The last title is a catalogue published to accompany a temporary exhibit in the

Museum organized by Shetler of 110 wildlife paintings by the noted Canadian realist painter.

Early in his career, Shetler was Program Secretary (1967-71) and then Program Director (1972) of the Flora North America Program, which pioneered the use of computers for taxonomic information and set the stage for the current and on-going effort to prepare a modern floristic treatment of North American plants. In recognition of these efforts, the editors of the *Flora of North America* will dedicate volume 18, which includes the Campanulaceae, to Shetler. Fortunately, they told him about this honor when they made their decision; the volume is still several years away from production. Fittingly, the California endemic *Campanula shetleri* Heckard, named in his honor in 1970 will be included in this volume.

Shetler became interested in Soviet and Russian Botany while he was a graduate

student at the University of Michigan. He began to study the Russian language then, too, and eventually exhausted the available classes. He visited the Soviet Union and/or Russia at least seven times in his career. Notably, in the 1980s, Shetler was involved in the U.S.-U.S.S.R Botanical Exchange Program, which involved a number of collecting trips to Soviet and later Russian republics (see below). Not surprisingly, he also subsequently became one of several general scientific editors for the English translations of the last eight volumes of the 30-volume *Flora of the USSR*. These appeared between 1997 and 2004.

Shetler's contributions to understanding the flora of the mid-Atlantic included the publication of an *Annotated Checklist of the Vascular Plants of the Washington-Baltimore Area* (2002) and an associated website (<http://botany.si.edu/DCFlora/>). He also co-authored (2006) a checklist of the vascular plants of Plummers Island, which sits in the Potomac River below the American Legion Bridge (I-495) and is studied and maintained by the Washington Biologists' Field Club. Years of recording the first flowering dates for spring-blooming plants in the Washington, D.C. area led to the publication of a co-authored paper in 2001 that documented a shift to earlier flowering times, phenological evidence for climate change.

His research travels took him across North America and to parts of South and Central America, Europe, Asia (Caucasus, Siberia, Tuva), and Australia. His visit to Tuva, a remote Soviet autonomous republic in southern Siberia, makes a cameo appearance in Ralph Leighton's *Tuva or Bust! Richard Feynman's Last Journey* (2000). The physicist and Nobel laureate Feynman and his friend Leighton had a running joke that they would be the first Americans to visit the most obscure country in the world (Tannu Tuva) and were surprised to learn that three American Botanists, Stanwyn G. Shetler, David Murray, and Thomas S. Elias, had anticipated them by visiting in 1983.

Shetler was a frequent lecturer, teacher, and consultant through the years. He served on the board of the Piedmont Environmental Council (1985-88) and several terms (latest, 2006) on the board of directors of the Audubon Naturalist Society, including three years (1974-77) as its president. He was a charter member

(1982) of the Virginia Native Plant Society and served on its state board of directors as Botany Chair (1996-2003) and director-at-large (2004-06). He taught plant identification courses for the U.S.D.A. Graduate School off and on beginning in 1963 and in the 1980s and 1990s at Northern Virginia Community College. For many years, he participated in the Christmas Bird Count sponsored by the National Audubon Society.

Shetler received a number of awards and honors for his research and service. In 1970, the Washington Biologists' Field Club elected him to membership. Eventually, he served as the club's vice president (1981-84) and president (1984-87). In 1981, he received the Piedmont Environmental Council's Individual Award for Contributions to Environmental Improvement for his role in drafting a Vegetation Preservation Policy for Loudoun County, Virginia. In 1988, the Chautauqua Institution in New York invited him to present the featured lecture at the celebration of the ornithologist Roger Tory Peterson's 80th birthday. In 1995, Shetler received the Paul Bartsch Award, which is the Audubon Naturalist Society's top award for contributions to natural history and conservation. In 1994, he was elected as fellow of the American Association for the Advancement of Science for his "contributions to the formation of electronic data banks and the computer registry of botanical specimens" and in 2002, he was elected a fellow of the Washington Academy of Sciences.

Survivors include Shetler's wife of 54 years Elaine, two children (Stephen Shetler and Lara Shetler Kizer), two sisters, a brother, a stepmother, and two grandchildren.

## Visitors

*Continued from page 2*

**Ingrid Ahlgren**, Australian National University; Ethnobotanic studies of Marshall Islands flora (10/12-10/13).

**Paul Berry**, University of Michigan; Euphorbiaceae (10/12-10/13).

**Lowell Urbatsch**, Louisiana State University; Identification of specimens (10/16-10/31).

**Kathy Hornberger**, Widener University; Flora of Colorado (10/17).

**Maria Ana Farinaccio**, Universidade Federal do Mato Grosso do Sul, Brazil; Asclepiadoideae (Apocynaceae) (10/23-11/3).

**Molly Hetherington-Rauth**, University of Toronto Mississauga, Canada; Island angiosperms and mainland congeners (North, Central, South America) (10/23-10/27).

**Gonzalo Bilbao**, Université de Montréal, Canada; Fabaceae (10/30-11/3).

**Laura Giraldo Kalil**, National Autonomous University of Mexico; *Nectandra* (Lauraceae) (10/30-11/1).

**Pedro Filho**, Universidad Federal do Rio Grande do Sul, Brazil; *Rhynchospora* section *Tenuis* (Cyperaceae) (11/3-11/9).

**Joy Winbourne**, Brown University; DNA Barcoding (11/6-11/10; 12/11-12/21).

**Raymund Chan**, Independent researcher, Singapore; Compositae (11/13-11/17).

**Jordan Brock**, Washington University; *Camelina* (Brassicaceae) (11/16).

**Pablo Moroni**, Instituto de Botánica Darwinion, Argentina; *Durantea* (Verbenaceae) (11/17-12/22).

**Guilherme Antar**, Universidade de São Paulo, Brazil; *Hyptidendron* (Hyptidinae; Lamiaceae) (11/20-12/22).

**Caroline Andrino**, Universidade de São Paulo, Brazil; *Paepalanthus* (Eriocaulaceae) (12/5/2017-1/5/2018).

**Josselyn Richards-Daniels**, College of the Atlantic; Biological illustration (12/8).

**Edgar Lobato**, Museu Paraense Emilio Goeldi, Brazil; Bamboo (Poaceae) (12/11-12/15).

**Robberson Setubal**, Universidade de São Paulo, Brazil; *Strychnos* (Loganiaceae) (12/11-12/15).

**Steven Sylvester**, Royal Botanic Gardens Kew, United Kingdom; Poaceae (12/11/2017-1/10/2018).

**Jessica Budke and Robin Lewis**, University of Tennessee; Bryophytes (12/18-12/19).

**Maryam Sedaghatpour**, University of California, Berkeley; Collections research (12/21).

## New Exhibit has Focus on Seeds

By Gary Krupnick

In November 2017, the Smithsonian's National Museum of Natural History in Washington, D.C. opened a new Garden Lounge—a public space to rest and recharge among live plants. This light-filled area displays a variety of plants and interpretative text focused on plant dispersal through seeds and spores. A special section of the lounge for young visitors features seating made from tree stumps and kid-friendly text and graphics. The Garden Lounge is a collaboration between the Office of Exhibits, the Department of Botany, and Smithsonian Gardens.

All our lives are intricately connected to plants. The Garden Lounge invites visitors to explore these connections and learn why and how plants “move” or disperse to survive and thrive. The evolution of seed-bearing plants is highlighted, and the parts of a seed are defined. Seed dispersal by wind, water, force, and animal (including humans) is described.

As visitors walk into the hallway on

the second floor of the museum, they can see into a light-filled, airy space featuring two large cycads in planters in front of windows, and a central large dragon tree with multiple staghorn ferns growing on its branches. Orchids, bromeliads, ferns, and mosses are displayed in planters below the windows.

A text panel depicts the U.S. National Seed Strategy for Rehabilitation and Restoration as a case study that illustrates the positive aspects of dispersing native seeds to restore and rehabilitate lands damaged by hurricanes, fires, and floods. Mounted on the text display panel are eight vials of native seeds showcasing a variety of shapes, sizes, and colors.

The exhibit was made possible by the work of the exhibit core team: **Gary Krupnick**, **Eric Schuettpelz**, and **Kenneth Wurdack** from the Department of Botany, Samantha Barry from the Office of Education and Outreach, and Lauren Kibbe, Mike Lawrence, Laura Donnelly-Smith, and Ally Silberkleit from the Office of Exhibits. Alex Thompson and Melanie Pyle of Smithsonian Gardens selected and will nurture the plants. Additional expertise was provided by Junko Chinen,

Stoy Popovich, Jonathan Zastrow, Sherod Mangum, David Hsu, Natalie Rey, Kevin Moyers, and Elizabeth Musteen.

## Updates from Botany Information Management Team

The U.S. National Herbarium is starting off 2018 having reached a new milestone. Half of the approximately 5 million specimens housed in the herbarium now have a digital record, with more than 2.5 million specimens databased (1.3 million are also imaged). These digital records are all available for searching and exploring on the Department of Botany's online specimen catalog (<https://collections.nmnh.si.edu/search/botany/>).

With more and more families joining the ranks of “completely digitized”, the herbarium is regularly updating its **Inventoried Plant Groups** list on the Department of Botany website (<http://botany.si.edu/colls/inventoriedgroups.htm>). If you have a question about whether a group has been inventoried, please visit the site, or contact **Laura Tancredi** (TancrediL@si.edu).

In October 2017, the Information Management Team resumed use of the conveyor belt to digitize specimens from select plant families. In the last quarter of 2017, the team completed the imaging of the following families: Lamiaceae, Solanaceae, and all eight families between Campanulaceae and Asteraceae. In the coming months, the conveyor belt team will be imaging Acanthaceae, the Boraginaceae group, Melastomataceae, and Ericaceae. If any researchers plan to work in these families between now and March 2017, please contact **Sylvia Orli** (OrliS@si.edu).

Digitization work also continues through the Smithsonian Transcription Center. After 3.5 years and over 70 crowdsourcing projects, the Euphorbiaceae are now fully inventoried and transcribed. Interested volunteers are needed to continue the transcribing of specimens. Please visit the Smithsonian Transcription Center <<http://transcription.si.edu/>> to view the herbarium's current projects, Hippocastanoideae and Santalaceae.

The Grass Reorganization Project is in full swing. The Poaceae will be reorganized phylogenetically and each genus has



The Garden Lounge at the National Museum of Natural History serves as a welcoming interior garden rest and recharge area for visitors featuring live plants and a relaxing atmosphere with botany content as a frame.





*Solanum aviculare*, collected in 1910 in Te Aroha, New Zealand, represents one of the recently digitized families, Solanaceae. Over 2.5 million specimens are now available for viewing in the Botany Specimen Catalog <<http://collections.nmnh.si.edu/search/botany/>>.

now been assigned a genus number. The contractors are finishing up the re-folding and annotating of subfamily Bambusoideae, and these pressed specimens will soon join the families mentioned above to be imaged by the conveyor belt team.

The grass reorganization team will continue processing the rest of the Poaceae in the coming year with completion of the project expected sometime in mid-2019. In the meantime, please expect some inconvenience while working in this family.

## Donation of Walter Lewis' Pollen Slide Collection

By Erika M. Gardner

In November 2017, Erika Gardner traveled to Washington University to pack and ship 225 slide boxes of Walter Lewis' systematic pollen slide collection, recently donated by Lewis and his wife, Memory Elvin-Lewis, to the Smithsonian's Department of Botany.

Lewis is a retired professor from Washington University in Saint Louis, Missouri. During his career at Washington

University, he was a prominent ethnobotanist, a pioneer in polyploidy research, and a palynologist. Lewis produced 37 palynology scientific journal publications and wrote *Airborne and Allergenic Pollen of North America* (1983). He also authored the books *Medicinal Botany: Plants Affecting Human Health* (2003) and *Polyploidy: Biological Relevance* (1980). These publications advanced our knowledge about the important relationships between plants and people.

The slide collection was stored at Washington University in three standard size herbarium cases. Each box was carefully prepared by Gardner with bubble wrap in order to prevent the glass slides from breaking during transit. It took three large rolls of bubble wrap to pack the

entire shipment. In total, 15 cardboard boxes of slide boxes were safely shipped to Washington, DC. The next phase will be to assess the quantity and quality of the slides, inventory, and then properly store and house the slides with the slide collection at the U.S. National Herbarium.

Lewis inspired many of his students to pursue careers in botany, including **Laurence Dorr**, Chair of the Department of Botany, who was a student in Lewis' Plant Systematics course in 1973. The Lewis's continue to publish from their offices at Washington University, where Walter Lewis is currently describing a newly discovered rose species from Texas to be named in honor of his wife, Memory Elvin-Lewis.



**Top: Memory Elvin-Lewis and Walter Lewis present three herbarium cases of Walter's lifelong work of systematic pollen slides. Bottom: The Lewis' proudly present a new rose species discovered in North America. Walter Lewis will name the rose in honor of Memory Elvin-Lewis. (photos by Erika Gardner)**

# First Comprehensive List of Vascular Plant Species of the Americas

-Adapted from the Missouri Botanical Garden and the University of Michigan

An international research team has assembled the first complete list of all known vascular plant species in the Americas. The searchable database contains nearly 125,000 species representing one-third of all known vascular plants worldwide.

In a project led by the Missouri Botanical Garden, 12 regional and national plant lists were merged into a single super-list for the Western Hemisphere. The basis for this larger checklist includes the checklists of Bolivia, Brazil, Colombia, Ecuador, the Guianas, Mexico, Peru, Venezuela, the West Indies, and the Southern Cone (Argentina, Chile, Paraguay, Uruguay). Two partially published datasets of the Flora of North America North of Mexico and the Flora Mesoamericana were also used. Twenty-four authors, including **Pedro Acevedo-Rodríguez** and **Mark Strong** from the Smithsonian Institution, contributed to the paper published in the journal *Science*.

"This is the first time we have a complete overview of the plants of the Americas," said lead author Carmen Ulloa Ulloa of the Missouri Botanical Garden. "It represents not only hundreds of years of plant collecting and botanical research, but 6,164 botanists who described species that appear on this list."

The new study includes a 2,600-page online plant checklist and a continuously updated, publicly searchable database on a Missouri Botanical Garden website. The Missouri Botanical Garden's plant database, Tropicos, was used as the project's data repository.

The plant checklist includes 124,993 native vascular plant species, which corresponds to one-third of the estimated 383,671 vascular plant species known worldwide. The members of this flora, which includes flowering plants, gymnosperms, ferns, horsetails, clubmosses and spikemosses, are categorized into 6,227 genera and 355 families.

The study shows that most of the



***Columellia oblonga*, a flowering plant in the family Columelliaceae, which is endemic to the Americas. (photo by Carmen Ulloa)**

Western Hemisphere's plant diversity is in South America. Brazil has the most diverse flora, with 33,161 species, followed by Colombia (23,104) and Mexico (22,969).

The most diverse plant family in the Americas is Orchidaceae, the orchid family, with 12,983 species. It is followed by Asteraceae (12,043 species), a family that includes everything from garden ornamentals such as daisies, marigolds and zinnias to economically important food crops such as artichokes, lettuce and sunflowers.

Temperate North America and the West Indies have the highest levels of endemism—69 and 67 percent, respectively, of vascular flora are found in those regions and nowhere else in the Americas.

Of the 124,993 native species in the Americas, 122 of them occur in all 12 of the countries and regions considered in the study, from Canada and the United States south to Chile and Argentina.

Over the past 25 years, the rate at which new plant species descriptions are added has averaged 744 annually for the Americas. At that rate, the total will reach about 150,000 by 2050, according to the authors of the *Science* paper.

The new study is "a monumental achievement that will be of enormous interest to conservation biologists, ecologists, evolutionary biologists, biogeographers, land managers, and government officials around the world," University

of Wisconsin botanist Thomas Givnish, who was not part of the study, wrote in a Perspectives article that accompanies the *Science* paper by Ulloa Ulloa et al.

Givnish said the new study is "a precious distillate" of the findings of thousands of individuals devoted to botanical exploration and research over the past 500 years. The first European accounts of New World plants included the first reports of tobacco, chili peppers and corn, which soon became widely used worldwide.

The Missouri Botanical Garden is now working with more than 40 other institutions on a larger project known as the World Flora Online. The goal is to fully document all known plant life by 2020.

## Preservation of a Chinese Plant and the Culture Around It

By Kayleigh Walters

A team of scientists have recently completed a six-year study on the economic and cultural importance of fireweed (*Gerbera delavayi*, Asteraceae) to the people of eight ethnic minority tribes in Southwest China. Fireweed is a plant species mainly found on plains, slopes, and woodlands between 1,800 and 3,200 meters of eleva-

tion in the Hengduan Mountains of southwestern China to northern Vietnam. It has fibers that are similar to cotton and can be easily lit on fire, which is how it comes by the names “igniting flower” and “fireweed.” The fibers can be removed from the leaves by hand, twisted into yarn, and used to make traditional clothes without being chemically processed. For over 500 years, fireweed has been used in making traditional clothes by minority groups in China, such as the Yi, Bai, and Lisu. Crafting with fireweed is part of the intangible cultural heritage of China.

Between 2010 and 2016, the authors of the study, Wei Zheng and X. Xu (Kunming University of Science and Technology), and **Jun Wen** (Smithsonian Institution), researched fireweed’s use as a textile. During the study, the authors conducted fieldwork in Yunnan and Sichuan Provinces, interviewed 150 women and 50 men on how they processed fireweed, what they used it for, and the prices of fireweed products in different regions and among various ethnic groups. As is the case with many traditional craftspeople, no one interviewed was below the age of 50. Few young people want to stay in the villages and master traditional crafts.

The authors of the article, published in a recent issue of the journal *Economic Botany*, found that fireweed is both culturally and economically important to the people who weave it. The leaves of the plant are collected as part of the most celebrated day of these tribes’ culture – the Torch Festival. For some of the tribes, such as the Yi People, fireweed takes on an even greater cultural importance. The

Yi consider fire the soul of their nationality, making fireweed a “lucky flower” and special cultural symbol to their people. For many of the other groups, fireweed fabric is either gifted or worn for important occasions – such as weddings or funerals.

Generally, fireweed fabrics come in two types. One type of fabric is durable, lightweight, and warm with a fresh scent. This is made from a blend of fireweed and hemp. The second is made from pure fireweed, and is typically preferred for clothes and quilts, as it is soft, comfortable, and allows for better airflow than the hemp-fireweed blend. Traditionally, wild flowers would also be used to dye the fireweed clothing. Of the eight ethnic minority tribes that make fireweed cloth, only three make the hemp-fireweed blend fabric, which is more complicated to make. It takes 9 hours to spin 50cm of hemp-fireweed cloth, and many months to make a single coat.

Although there is an increased demand for fireweed products due to a recent increase in interest from other Chinese people and foreigners, production has not increased. In most cases, women were and are the sources of knowledge on fireweed collection and textile production. However, with the changing roles of women, and the fact that they now have greater choice than to marry and live in their home villages for the rest of their lives, to gain an education and have a choice in jobs, fireweed craft is diminishing. They are no longer laborers for the traditional handcraft industry. With fewer young people able to make fireweed textiles, many concerned with this issue wonder how the



*Gerbera delavayi*. (photo from *Economic Botany* 2017)

cultural knowledge will be preserved. The Chinese government has started to put policies into motion to encourage young people to continue this traditional practice, but more options should be sought. For instance, if fireweed is bred to select for

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Textile products of fibers from *Gerbera delavayi* leaves in Southwest China. (photo from *Economic Botany* 2017)

# Hidden Inca Treasure: Remarkable New Tree Discovered in the Andes

Hidden in plain sight – that’s how researchers describe their discovery of a new genus of large forest tree commonly found, yet previously scientifically unknown, in the tropical Andes.

Botanist **Kenneth Wurdack** from the Smithsonian’s National Museum of Natural History and Wake Forest University graduate student William Farfan-Rios detailed their findings in a study just released in the journal *PhytoKeys*.

Named *Incadendron esseri* (literally “Esser’s tree of the Inca”), the tree is a new genus and species commonly found along an ancient Inca path in Peru, the Trocha Unión. Its association with the land of the Inca empire inspired its scientific name.

So how could a canopy tree stretching up to 100 feet tall and spanning nearly two feet in diameter go undetected until now?

“This tree perplexed researchers for several years before being named as new. It just goes to show that so much biodiversity is unknown and that obvious new species are awaiting discovery everywhere – in remote ecological plots, as well as in our own backyards,” said Wurdack.

“*Incadendron* tells us a lot about how little we understand life on our planet.

Here is a tree that ranges from southern Peru to Ecuador, that is abundant on the landscape, and yet it was unknown,” said Miles Silman, the Andrew Sabin Family Foundation Presidential Chair in Conservation Biology at Wake Forest. “Finding this tree isn’t like finding another species of oak or another species of hickory — it’s like finding oak or hickory in the first place.”

The tree belongs to the spurge family, Euphorbiaceae – best known for rubber trees, cassava, and poinsettias – and like many of its relatives, when damaged also bleeds white sap, known as latex, that serves to protect it from insects and diseases.

Its ecological success in a difficult environment suggests more study is needed to find the hidden secrets that are often inherent in newly discovered and poorly known biodiversity.

Currently *Incadendron* is common in several research plots under intensive study as part of the Andes Biodiversity and Ecosystem Research Group, an international Andes-to-Amazon ecology program co-founded by Silman.

“While *Incadendron* has a broad range along the Andes, it is susceptible to

climate change because it lives in a narrow band of temperatures. As temperatures rise, the tree populations have to move up to cooler temperatures,” said Silman.

For coauthor Farfan-Rios, who has been researching tropical forest dynamics and responses to changing environments along the Andes-to-Amazon elevational gradient, the discovery of *Incadendron* hits particularly close to home. Farfan-Rios is a native of Cusco, Peru. Not only is the new genus vulnerable to climate change, but it is also threatened by deforestation in nearby areas.

“It highlights the imperative role of parks and protected areas where it grows, such as Manu National Park and the Yanachaga–Chemillén National Park,” Farfan-Rios says. “Hopefully our ongoing study of *Incadendron* and the intensive long-term forest monitoring will contribute to best practices in reforestation and forest management.”

## ***Triphora* Orchid Found in Northeast Brazil**

By Kayleigh Walters

A team of botanists has discovered that *Triphora*, a genus of orchid made up of 19 species, has a larger range than previously known. Specifically, *T. amazonica*, a small orchid (7-14.5 cm) with 1-3 pink flowers, a wine-colored stem, and green, membranous leaves, was found in the northeast of Brazil, in the Atlantic Forest domain of Bahia. Previously, this orchid was known to exist in Florida, the West Indies, Guiana, and the northwestern Brazilian state of Amazonas. Authors **Tiago Luiz Vieira** (Smithsonian Institution), Climbiê Ferreira Hall (Museu Paraense Emílio Goeldi, Brazil), and Fábio de Barros (Instituto de Botânica, Brazil) published their findings in the journal *Hoehnea* (44: 246-250; 2017).

Historically, a member of a difficult to categorize and occasionally “anomalous” taxa, this finding has provided new information on *Triphora*’s distribution. In their article the scientists provide maps and commentary on the orchid’s expanded distribution. They state that the existence of *Triphora* and other similar geographically split species lend credence to the idea that the forest type which splits the distribution



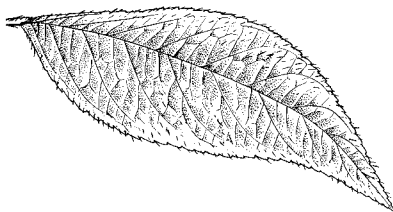
Habit, with paired branching and staminate inflorescences, of *Incadendron*. (photo courtesy of Jason Houston)



***Triphora amazonica*** (photo by Roger L. Hammer, copyright © 2018)

of this species, was formally all the same forest type.

*Triphora amazonica*'s conservation status is of Least Concern (LC), but the authors suggest that natural populations of the species may contain only a few individuals since there are few specimens in herbaria. In any case, the discovery of the increased range of *T. amazonica* is an interesting addition to the story of this odd orchid.



## Fireweed

*Continued from page 11*

longer fiber length, then it will be easier for it to be woven on machines, allowing the material, if not the cultural practice, to continue forward.

The idea of increased use comes with the caveat of conservation. Even with the current surge in interest over fireweed fabrics, the plant has been in serious decline due to over harvesting in the wild. If demand increases through the success of the cultural preservation programs, then greater conservation efforts will need to be made.

# A Successful Expedition Signifies the Palau Orchid Conservation Initiative is Officially Underway

By Benjamin J. Crain

The Palau Orchid Conservation Initiative is a collaborative program that focuses on the biology, ecology, conservation, and restoration of orchids and their associated fungi. The program was launched by the North American Orchid Conservation Center (NAOCC), a coalition of organizations established by the Smithsonian Environmental Research Center (SERC), the National Museum of Natural History's Department of Botany and the U.S. Botanic Garden, along with the U.S. Forest Service's Institute of Pacific Islands Forestry and researchers from Illinois College and the University of Hawaii. The program aims to improve our understanding of orchid communities, their biology, and distribution across Palau while acquiring detailed information on their co-occurrence with specific tree species, vegetation types, soil types, and habitats. The program also aims to explore the diversity of mycorrhizal fungi associated with orchids in Palau to determine how these symbiotic partners influence the

diversity, distribution, and abundance of orchid species there.

As a post-doctoral ecologist with NAOCC, I embarked on a two-month collecting expedition in September to document orchid and mycorrhizal diversity in Palau. Through the Palau Orchid Conservation Initiative, the research team aims to improve understanding of biodiversity while helping to sustain it amidst the growing threat of environmental change.

The Republic of Palau is an archipelago of tropical islands in the Pacific and a significant component of the Polynesia-Micronesia global biodiversity hotspot. Palauan islands are generally of two types. Babeldaob, the largest island of Palau is of volcanic origin and somewhat mountainous. The remaining islands, including the famed Rock Islands that are designated as a World Heritage Site, are composed of raised limestone with karst topography, although some persist as low coral atolls. The unique position of these islands between the Philippines and New Guinea results in a flora that is influenced by each

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**Taki Falls in Ngrardmau State, Babeldaob, Palau. Several terrestrial and epiphytic orchids were documented at this site. The trail leading to the waterfall is steep and passes through several distinct habitats that support a variety of orchid species.** (photo by Benjamin J. Crain)

## Palau

Continued from page 13

of these regions.

Substantial orchid diversity in Palau has been documented during past expeditions of researchers including Noriaki Fukuyama, Ray Fosberg, Agnes Rinehart, and Joan Canfield. The sizable collection of orchid specimens from Palau housed at the U.S. National Herbarium as well as records from the Royal Botanic Gardens Kew, New York Botanical Garden, Oakes Ames Orchid Herbarium, and Muséum National d'Histoire Naturelle proved critical in compiling a checklist of close to 100 orchid species collected on the islands. Despite the known diversity of orchids in Palau, a number of areas have yet to be surveyed and most areas that have been surveyed have not been visited in many years.

Accordingly, the primary objectives of the 2017 field excursion were to 1) document orchid diversity in Palau to facilitate geographic and floristic analyses, 2) collect orchids and leaf tissue samples from several sites for systematic studies, and 3) collect root tissue samples from orchids for isolation, identification, and analyses of symbiotic mycorrhizal fungi. In meeting these objectives, the team garnered quantitative data for long-term



**Collecting tissue samples and preparing specimens for pressing, drying, and mounting with reserve staff at the Ngardok Nature Reserve ranger station. (photo by Benjamin J. Crain)**

research aimed at informing residents and conservation managers. Collecting orchid specimens and preparing voucher specimens for the herbarium facilitated the research goals and added baseline data for understanding and monitoring orchid diversity in Palau.

The expedition began with roadside surveys where orchids had been previously documented. Several collections from the mid-1900s came from areas surrounding Palau's international airport in Airai State on Babeldaob. These areas yielded two species native to Palau, *Spathoglottis carolinensis* and *S. micronesiaca*, and one exotic species, *Arundina graminifolia*.

Ann Hillman Kitalong and staff members from the Belau National Museum joined the team for a collecting trip to Taki Nature Reserve in Ngardmau State (Babeldaob). Several orchid species were encountered along the rather steep trail from the preserve entrance leading to Ngardmau Falls. Epiphytes documented included *Appendicula reflexa*, *Bulbophyllum clandestinum*, *B. membrenaceum*, and *Dendrobium elongaticolle* (all natives), as well as *Phreatia palawensis* and the leafless *Taeniophyllum pallawense* (both endemic). Terrestrial orchids were also abundant at the site, including *Nervilia platychlila* (native), *Spathoglottis carolinensis*, *S. micronesica*, and *Moerenhoutia hosokawae* (endemic).

The following week marked the onset of extensive surveys in Babeldaob's Ngardok Nature Reserve, home to a newly established permanent forest dynamics monitoring plot currently proposed for



**"Botany Bay", a small cove on the limestone Rock Island, Ngeruktabel, where several unique species of epiphytic orchids were collected. (photo by Benjamin J. Crain)**

inclusion in the Smithsonian's Center for Tropical Forest Science global plot network, ForestGeo (CTFS-GEO). In addition to each of the species documented in Airai and at the Taki Reserve, dozens of others were sampled in the reserve. Noteworthy terrestrials included *Crepidium kerstingianum*, *C. setipes*, and *Zeuxine palawensis* (all endemics). Additional epiphytic species documented in Ngardok were *Acriopsis lillifolia*, *Agrostophyllum elongatum*, *Pseuderia micronesiaca* (natives), *Bulbophyllum hatusimanum*, *Dendrobium brachyanthum*, and *Dipodium freycinetioides* (endemics). Several other orchid species that lacked inflorescences were not collected but will be targeted on subsequent collecting trips.

Ron Leidich, a local naturalist, participated on an excursion to the Rock Islands of Koror State. After an hour-long boat trip, the team reached a rather remote site on the limestone island of Ngeruktabel. In addition to an abundance of *Dendrobium elongaticolle* and *Bulbophyllum clandestinum*, several other species were collected at this site. Two epiphytes, *Coelogyne guamensis* (native) and *Oberonia palawensis* (endemic), were particularly striking. At a site on the opposite side of the island, the group hiked into a small valley and



***Oberonia palawensis*, an endemic epiphytic orchid found on tree branches overhanging “Botany Bay” on the Rock Island, Ngeruktabel, Koror State, Palau. (photo by Benjamin J. Crain)**



***Crepidium setipes*, an endemic terrestrial orchid found at the Ngardok Nature Reserve on Babeldaob Island in Melekeok State, Palau. (photo by Benjamin J. Crain)**

located a large population of *Corymborkis veratrifolia*, a species whose native range extends from Australia and southeast Asia to Palau. The final stop of the day was at a limestone rock island called Ngerchaol. On the sheer cliff faces of this island, the group was able to spot two populations of *Sarcanthopsis warocqueana* (native) growing as lithophytes.

Over the course of the initial field excursion for the Palau Orchid Conservation initiative, the team was able to collect substantial amounts of data. In total, around 30 voucher specimens were collected that are to be deposited at the U.S. National Herbarium. Over 70 tissue samples were collected that will be used for genetic analysis. An additional 170 root samples were collected for isolation and identification of mycorrhizal fungi. Aside from these collections, over 800 individual plants were mapped as part of the long-term monitoring efforts planned for the orchids of Palau. These datasets represent only the initial samples for the project however, and with the newly gained experience, the group is hoping for even greater success during the second field excursion planned for early 2018.



***Dendrobium brachyanthum*, an endemic epiphytic orchid found at the Ngardok Nature Reserve on Babeldaob Island in Melekeok State, Palau. (photo by Benjamin J. Crain)**

## Marquesas

Continued from page 1

pteridophytes. Overall, on Ua Pou and Hiva Oa together, we collected 82 of the 99 pteridophytes species indigenous to the Marquesas Islands (based on our field determinations). Of the 17 species we missed, 11 had never been collected from either Ua Pou or Hiva Oa.

Fieldwork is never without at least a few unexpected logistical challenges, and this trip was no different. As our initial supply of newspaper, the preferred material for preserving botanical specimens, was quickly depleted over the course of a few days on Ua Pou, we sought to restock. Usually, this is a trivial endeavor, with plenty of options in various sizes piled up and awaiting reuse or recycling. However, none was to be found, for free or even for sale, on the island of Ua Pou. As it turns out, the sole distributor stopped bringing newspapers to the island a couple of years prior, presumably due to decreased demand as residents were increasingly able to access information on their mobile phones. Thankfully, we were able to quickly arrange for a dispatch from Tahiti of *La Dépêche de Tahiti*.

In the end, our team made a total of 306 collections of lichens, bryophytes, pteridophytes, and flowering plants. Each collection consisted of several duplicate herbarium specimens, plus silica-dried material. The more than 1000 duplicates we collected will be distributed to herbaria in Kalaheo (PTBG), Papeete (PAP), Paris (P), Réunion (REU), and Washington, D.C. (US). The silica-dried material, in turn, will be stored in the National Museum of Natural History biorepository. These botanical specimens and the accompanying silica-dried material will form the foundation for a variety of future evolutionary studies focused on oceanic plants as we continue to leverage the long history of collaboration between the Smithsonian Institution and the National Tropical Botanical Garden.

**Top: A young leaf of *Cranfillia vulcanica*.  
Bottom: Poumaka, a prominent 500 m tall spire on Ua Pou. (both photos by Ken Wood)**







Left: Indusiate sori of *Sphaeropteris medullaris*. (photo by Eric Schuettpelz)

Right: Poutetainu (foreground) and the Ua Pou airstrip (background). (photo by Jean-François Butaud)



Left: Jean-François Butaud (at arrow) collects what is most likely a new species of *Pilea* from the slopes below Oave.

Right: *Oleandra sibbaldii*. (both photos by Eric Schuettpelz)



Left: A windblown individual of the tree fern *Sphaeropteris feani*. (photo by Ken Wood)

Right: *Stenogrammitis subcoriacea*, an epiphytic grammitid. (photo by Eric Schuettpelz)

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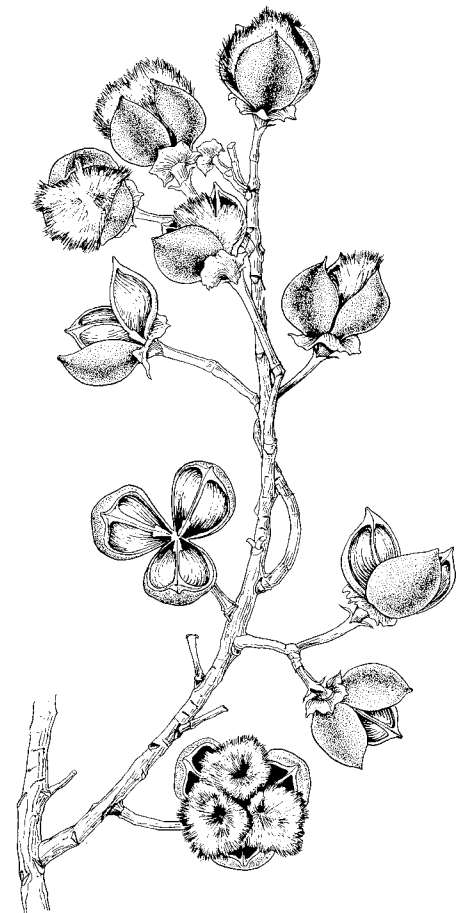
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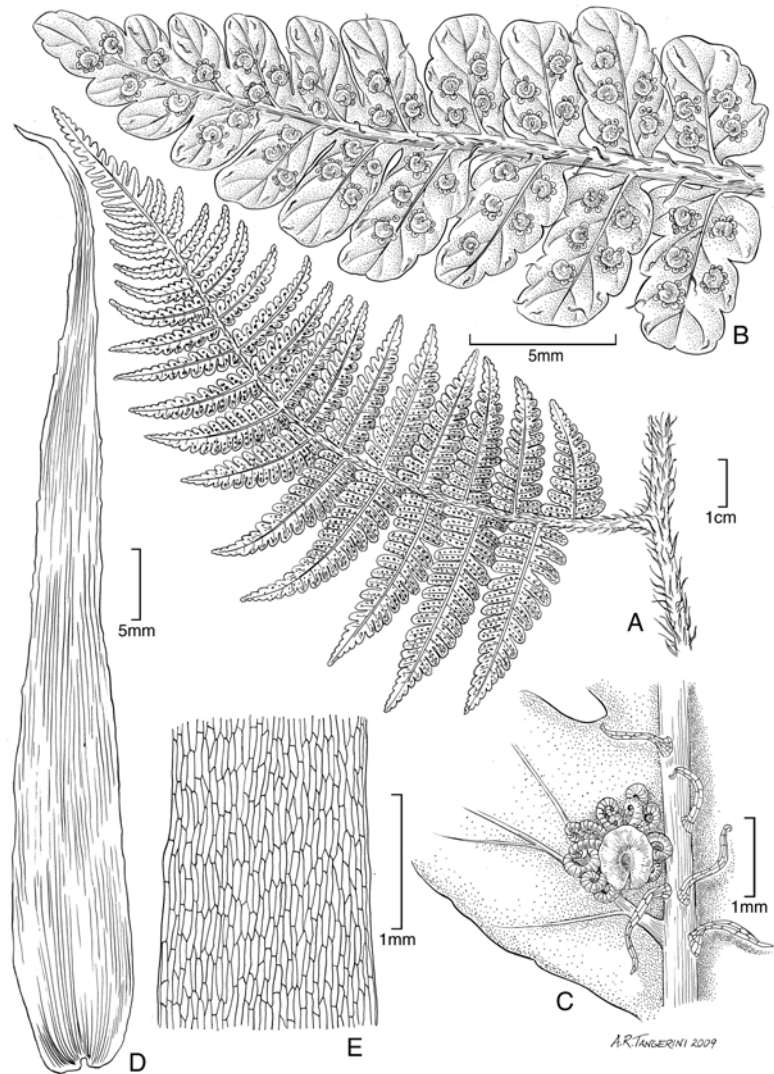
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Art by Alice Tangerini

***Dryopteris macropholis* Lorence & W.L. Wagner**

Fern diversity is high on the Marquesas Islands in the southern Pacific. On a recent trip to two islands, Ua Pou and Hiva Oa, researchers from the Smithsonian Institution, National Tropical Botanical Garden, and French Polynesia encountered 82 of the 99 indigenous pteridophyte species (see cover article). Among them was *Dryopteris macropholis*, an endangered species restricted to the mountains of Ua Pou and Hiva Oa, as well as Nuku Hiva, Ua Huka, and Tahuata (also in the Marquesas). Alice Tangerini illustrated this species from the type specimen and field photographs for a 2011 publication (*PhytoKeys* 4: 5–51) in which 11 new fern species were described from the Marquesas Islands. This plate was illustrated primarily in pen and ink, but additional stippling was added and parts were rearranged in Adobe Photoshop. The frond and stipe (too large to fit in with the details) appeared on a separate plate.



Smithsonian  
National Museum of Natural History

Department of Botany  
PO Box 37012  
NMNH, MRC-166  
Washington DC 20013-7012

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