Montgomery Botanical NEWS

Advancing research, conservation, and education through scientific plant collections.

Spring 2007 Volume 15, Number 1

URUGUAY 2006 | ON EXPEDITION FOR CONSERVATION

For years I have studied various coconut-related palm genera, including *Butia* and *Syagrus*. Originally, *Syagrus* was thought to have its origin in a *Butia*-like ancestor. However, my recent work suggests it was just the opposite—*Butia* evolved from a grass-like *Syagrus* ancestor. To fully explore those questions, I needed more collections of *Butia*, more field observations, and more field measurements.

What better place to collect *Butia* than Uruguay where more than half the native palm species are *Butia*. I had seen dried collections and images of *Butia* from populations in Argentina and southern Brazil that did not fit known species. I thought those species might extend into Uruguay. So, at the long-standing invitation of my Uruguayan friends, I collected the palms of Uruguay in 2006. From my journal, I recount two days during which I saw most of Uruguay's palm species.

SATURDAY, MARCH 11, 2006

We arrived in Rivera on the Brazilian border in late afternoon. The area (once natural pastures) is being turned into eucalyptus forest. Our guide from the lumber company took us on a dirt road southwest of Rivera to see a curious multi-stemmed *Butia*. We climbed a steep slope to view one under a large overhanging rock. It had seven fire-damaged stems and I encountered only five seeds. This species also grows in the southwest corner of Rio Grande do Sul, Brazil, and I have been curious about it for years. Its unusual multiple short trunks and pendant leaves form an attractive "palm dome". We did not have time to explore the area as we needed to get to Cerro de Mirinaque before nightfall.

On the way back to the main road, we spotted a near perfect specimen of the same palm in an open field. It was identical to the images I had seen from Rio Grande do Sul, Brazil! This *Butia* probably represents a sixth species for Uruguay and a new species for science. We continued on to Cerro de Mirinaque where *Butia paraguayensis* had been collected.

Arriving at dusk, we hurried up the flat-topped mount. The sides of Mirinaque are steep and broken. The palm grows on its flat top, the remains of an ancient eroded plain. I only had time to take a few measurements, collect a specimen, and descend the steep rocky slope before nightfall. A full moon aided our descent.

A spectacular population of *Butia yatay* in Quebracho.

We drove until midnight to Paysundu, on the frontier with Argentina, in order to be closer to our location for collecting the following day. By the time I finished taking measurements, pressing and bagging my plant material in alcohol, it was 4:30 a.m. Fortunately, daylight saving time was changing to standard time that very night, so I had an extra hour to rest before setting out at 8:00 a.m. the next day.

(continued on page 3)

To advance science, education, conservation and horticultural knowledge of tropical plants, emphasizing palms and cycads, Montgomery Botanical Center collects seeds from wild plant populations around the world and grows the resulting plants in population-based, documented, scientific collections, for use by botanists, scientists, and educators, in a 120-acre botanical garden exemplifying excellent design.

Montgomery Botanical Center (originally The Montgomery Foundation) is a tax-exempt, nonprofit institution established by Nell Montgomery Jennings in memory of her husband, Colonel Robert H. Montgomery, and his love of palms and cycads.

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Masthead photo of *Veitchia arecina* (formerly *V. montgomeryana*) by Harvey Bernstein.

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From the Executive Director

As this issue of Montgomery Botanical News came together, an informal theme of conservation emerged. This makes sense, as conservation is a large part of Montgomery Botanical Center's mission.

Conservation is increasingly prominent in the goals of botanic gardens. There is a growing awareness of the rate and impact of plant extinctions worldwide. With expertise in botany and horticulture, gardens affect conservation in many ways. And there are diverse approaches to this goal—as many approaches as there are institutions. Each of these helps.

At Montgomery Botanical Center, our commitment to conservation is best seen in our long-term commitment to our scientific collections. The best and most effective use of MBC's resources is in documenting, collecting, and maintaining live populations of palms and cycads. Those plant collections are the foundation from which all our other functions emerge.

These pages illustrate how our work advances palm and cycad conservation. Dr. Noblick's cover story highlights dwindling ancient palm groves in Uruguay. MBC's collections provide a way for these imperiled seedlings to survive. Our research associate, Cristina Lopez-Gallego, discusses her work on the responses of cycads to degraded habitat. Her studies in Costa Rica brought back important conservation material for MBC's collections. MBC seedbank coordinator, Judy Kay, discusses her development of methods to produce pure seeds in *Zamia*, propagating these cycads to ensure the continued survival of imperiled species.

I am also pleased to introduce the new members of the MBC team (please see page 7). This new talent greatly enhances MBC's ability to meet our mission. 2007 looks to be a great year.

Pictured: Dr. Griffith with Coccothrinax scoparia, *Sierra de Bahoruco, Dominican Republic, during the 2006 International Palm Society Biennial.*

Developing
Our Collections

Uruguay 2006
ON EXPEDITION FOR CONSERVATION *(continued from front page)*

SUNDAY, MARCH 12, 2006

We drove along the scenic Uruguay River and continued north to Quebracho. Along several dirt roads we saw healthy populations of *Butia yatay*. Young *B. yatay*, with their persistent, long, spiny petioles, defend themselves well against cattle. However, at germination, the unarmed seedlings are just as vulnerable as the coastal *Butia capitata* var. *odorata* which, because of herbivory, have few young plants to reinvigorate the aging palmetums. Since the arrival of cattle, the seedlings have all been eaten, and the old palms are often not replaced

A possible new *Butia* species near Rivera forming a "palm dome".

naturally. Uruguayans believe the aging palmetums may be 400 years old. We collected several population seed samples.

After spending quality time with the *Butia yatay*, we returned to Paysandu and headed south. When we reached the bridge over Arroyo Rabon, we stopped at a small population of *Trithrinax campestris*. We found one plant with flowers, but most had immature fruit. I searched under the plants, rooting like a feral pig, to find a few old seed. Crawling under *T. campestris* is dangerous business as the leaflet tips of the stiff fan leaves are like spears and I had the bloodstained cap and forehead to prove it. I was only able to identify about 20 "good" seed after my float test. Once again, it was early morning before I finished processing the plants.

View from the top of Cerro de Mirinque with a relic population of *Butia paraguayensis*. *(Photo, courtesy Dr. Mauricio Bonifacio)*

ADVANCING CONSERVATION

I am pleased to report that seven *Trithrinax campestris*, one *Butia paraguayensis* (from Mirinaque), and, so far, 16 *B. capitata* var. *odorata* have germinated in Montgomery Botanical Center's nursery. There is still time for the new *Butia* and *B. yatay*, which, historically, can take a couple

Trithrinax campestris with its stiff spine-tipped fan leaves and inflorescence with inflated bracts.

of years to germinate. It takes diligence in the field and patience in the nursery to build a scientifically valuable palm collection. I am proud to be a part of the Montgomery Botanical team playing an important role in the conservation of these species.

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Zamia fairchildiana in Costa Rica
Long-Term Population Monitoring

Montgomery Botanical Center (MBC) conducts expeditions to collect germplasm for its scientific plant collections. Equally important is crucial data collected on provenance, habitat, and conservation status of species. For expeditions to Costa Rica in 2005 and 2006, MBC targeted a single species, *Zamia fairchildiana,* and gathered population-specific ecological data which enhance the collections' value.

Zamia fairchildiana populations grow in the luxurious rainforest of Corcovado National Park and its environs on the Osa Peninsula. In the central region of the Osa Peninsula there is patchy distribution of many large populations (several hundred individuals) usually associated with watersheds of rough topography at low (up to 100 m.) elevations. With MBC support, I established long-term monitoring of eight colonies of *Z. fairchildiana* in Corcovado National Park.

In other areas of the Osa Peninsula, *Zamia fairchildiana* populations are present on flat terrain, on the coast, inland (at sea level), and on nearby islands. Outside the Osa region, there are reported populations along the Pacific coast and in the Talamanca mountains, growing in lowland and premontane forests up to 1,400 meters. *Zamia fairchildiana* populations from the northern Osa Peninsula, the Golfito region, and the Talamanca mountains are now represented at MBC thanks to the 2004 Costa Rica expedition led by Michael Calonje. Montgomery Botanical Center's *Z. fairchildiana* collections now represent populations in Costa Rica varying in elevation, topography, and proximity to the coast. Consequently, Montgomery Botanical's collections are of enormous value for population-level studies.

Z. fairchildiana in habitat, adult and seedlings.

Montgomery Botanical's *Zamia fairchildiana* collections from Corcovado National Park come from colonies I am monitoring. *Zamia fairchildiana* is one of few species of *Zamia* with extensive populations in both native habitats and degraded forests and, therefore, is an excellent model for understanding effects of habitat degradation on cycad biology. Disturbed forests on the Osa Peninsula have lower canopy cover from logging and other anthropogenic activity. Light-limited rainforest cycads are very sensitive to changes in canopy openness, and the data collected in *Z. fairchildiana* colonies suggest colonies have a different life-history strategy in disturbed habitats compared to native habitats. In disturbed habitats, plants grow faster, reproduce earlier, and invest more in reproduction. Long-term consequences of life-history changes on population viability remain to be explored.

One aspect of *Zamia fairchildiana* (and many other cycads) that is poorly explored is the impact of associated organisms on the fitness of individuals and viability of populations. In the colonies I monitor, leaf production is concentrated at the beginning of the rainy season (April-May) and at this time, some plants are attacked by the specialist herbivore, *Eumaeus mynias* (a Lycaenid butterfly). I observed the larvae, pupae, and emergence of adult butterflies. Around ten percent of plants within a colony lost most new leaves in the 2006 growing season due to herbivory. This tends to be higher in disturbed habitats.

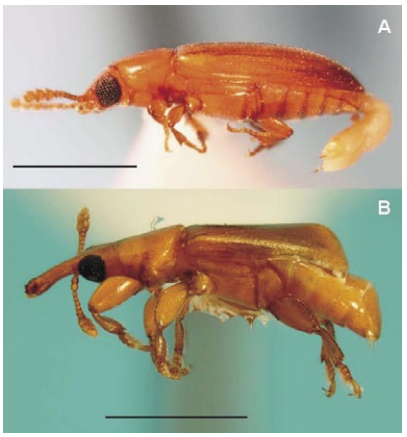
Reproductive adults start producing cones in the middle of the rainy season (August-September) and pollination happens at the beginning of the dry season (December). I

collected samples of the pollinators within the study populations and sent them to William Tang who identified them as two new species of the genera *Rhopalotria* and *Pharaxonotha*. The availability of pollinators and whether their behavior is changing in the disturbed habitats are questions to pursue. I also hope to further explore impacts of associated organisms on the life history of *Zamia fairchildiana.*

Seeds mature in 10-11 months and are dispersed (mostly by gravity) at the end of the rainy season (November). Seeds persist in the ground (growing a rhizome) during the 4-5 months of the dry season and produce a first leaf as the first rains start. Germination and seedling survival rates differ between habitats. I performed a germination experiment at MBC to explore whether light and/or water availability could explain some of these differences. The results from this experiment suggested that *Zamia fairchildiana* seeds can not germinate well with low water availability and that light has a strong effect on germination rate and seedling size, similar to the results of a germination experiment carried out in the field. Genetic and maternal effects may explain why seeds from disturbed habitat germinate and survive better in high light and vice versa.

Eumaeus mynias in field populations of *Zamia fairchildiana*.

Detailed analyses from long-term monitoring, genetic, and evolutionary studies of *Zamia fairchildiana* populations will be presented in scientific publications. The 2005 and 2006 cycad expeditions sponsored by MBC allowed me to gather much information on ecology and life history of this species.



Field-collected *Zamia fairchildiana* pollinators Genera: *Rhopalotria* (A), *Pharaxonotha* (B). Bars=1mm. Photos, courtesy William Tang

As part of the MBC collections, these plants are available, long term, for future study. I look forward to working with MBC on comparative ecological and evolutionary studies in *Z. fairchildiana* and other cycad species. Comparing the MBC-grown populations with plants growing *in situ* will be of interest.

The Montgomery Botanical Center collections, along with MBC's technical and logistical support, helped immensely in my research and I enjoyed a very productive collaboration with MBC. I thank MBC for supporting my research in Costa Rica, and especially thank Vickie Murphy, Jody Haynes, and Patrick Griffith for their help.

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Hand-Pollinating for Cycad Conservation

As seedbank coordinator, I am privileged to work with one of the finest and most extensive cycad collections in the world. Montgomery Botanical Center's (MBC) Cycad Collection has 7,090 plants in 257 taxa.

I started as a volunteer at MBC, working on the pollination team. Larry Krauss led the team, with the experience and expertise in cycad pollination gained from his years at the Garfield Park Conservatory. MBC owes Mr. Krauss a huge debt of gratitude for sharing his knowledge. After several years, he entrusted the pollination work to me and MBC volunteer Vivian Jordan.

PROCESSING POLLEN

Once cycad cones begin to shed pollen, they are harvested. In my experience, *Stangeria eriopus* is one exception—delaying harvest one week yields more of its rare pollen.

If pollen is not used immediately, it is processed for storage. The pollen is cleared of debris, sealed in small envelopes and placed in sealed glass jars containing desiccant. Desiccated, pollen can remain refrigerated for several days. If frozen at less than 32 degrees Fahrenheit, pollen will last longer. Using an aniline blue stain, I found *Encephalartos* pollen remained viable for three years; *Cycas* pollen for four years; and *Dioon* pollen was more than 90 percent viable at five years.

Power outages place these pollen stores in peril. We hope to soon solve this problem with an ultra-low freezer. While most pollen is used on site, MBC shares pollen when requested.

POLLINATOR EXCLUSION FOR ZAMIA

I always leave an unpollinated control cone to check for exotic pollinators. Since zamias have a native pollinator in Florida, they require pollinator exclusion to ensure parentage. Over three years, I experimented with different techniques hand-pollinating Montgomery Botanical's cycads to develop the best practice to ensure their certain paternity.

In my first attempt, I covered ten female *Zamia furfuracea* cones with Orthene; wrapped Orthene-saturated cotton strips beneath the cones; and secured pollination bags over the cones. At harvest, the cones were covered with dead weevils and contained hundreds of viable seeds—as many seeds as the control cones!

Zamia furfuracea cones covered with pollination bags.

The second year, I sealed the peduncles with 100% lanolin and covered the cones with various wraps (children's tights, women's hosiery, or men's socks). The control cones each had 200-300 viable seeds. The excluded cones yielded 0-40 viable seeds.

In 2006, pollinator exclusion was successful. This time, I covered the peduncles with an insect-trapping adhesive and the cones with infants' leggings closed with electrical ties. Zero viable seed were produced. *Zamia* seed produced by hand pollination at Montgomery Botanical Center is now of certain paternity.

A CONTINUING CONSERVATION SUCCESS

Since 1998, Montgomery Botanical Center has distributed 88,538 hand-pollinated cycad seeds to nurseries, botanical gardens, scientific institutions, universities, and cycad societies. Through our distribution to the Florida Nursery, Growers and Landscape Association, the south Florida community has received many of these plants. Although hand-pollination is labor intensive, it is important for cycad conservation.

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MBC Team News

Carrie Schreiber joined MBC as cycad curator in November 2006. Carrie holds a B.S. in ecology and conservation, and is completing a master's in botany. Carrie brings experience in conservation, plant care, research, and botanical fieldwork, in addition to scholarly work and professional editing experience. As her first major project, Carrie is tackling an increased cycad scale population following a humid, warm winter.

Chad Husby became MBC's new collections manager and botanist on January 8, 2007. Leading MBC's Collections Development department, Chad brings a background in plant exploration, collections management, and botanical research.

Carrie Schreiber, Chad Husby, and Michael Calonje.

Ideally suited for MBC's current and future needs, Chad holds a B.S. in biology and mathematics, an M.S. in horticulture, a second master's in applied statistics, and is currently completing his Ph.D. in botany. Chad has a strong record of successful grantsmanship and local and international collaboration; research experience in horticulture, statistics, ethnobotany, morphology, and plant physiology; and a serious commitment to scientific plant collections.

Michael Calonje is well known to readers of this newsletter. In 2004 and 2006, Michael detailed three MBC-contracted international expeditions in these pages—his collections are already growing at MBC. Michael joined MBC as cycad biologist on February 8, 2007.

Michael's M.S. thesis covered *ex situ* conservation of cycads. He has worked for various botanic gardens internationally, in management, collections, horticulture, and plant records. Michael has extensive experience in field botany, computer applications, and has authored a number of field guides. He is also known for submitting excellent data, documentation, and reports.

One by One to 10,000

From past inventories, I knew Montgomery Botanical Center (MBC) had over 10,000 accessioned plants. Since MBC was not able to perform grounds inventory in 2005 due to the unusually active hurricane season, we expected a number of interesting finds in the field in 2006.

Annual grounds inventory ensures that each plant remains solidly associated with its data. Each plant's label and mapped location work together and provide redundancy for this all-important linkage: inventory verifies the plant's labeled identity and its location.

We also locate misplaced labels or labels without plants. Interestingly, we may even find "once-dead" plants that have resurrected, resprouting long after a hurricane has passed, for example. If what we see in the field differs from our database, we search for answers. Information, such as the plant's health or name change, is essential for curation.

During inventory we also examine the condition of the plants' labels, label wires, and stakes. Depending on the location, shape, and size of a plant, we may rewire the labels around the trunk. Yearly inspection ensures plants do not outgrow the wires holding their labels.

Montgomery Botanical Center has 5,233 palms, 2,905 cycads, and 2,243 other plants in its grounds collection for a total of 10,381 plants. You can access additional inventory statistics on the Collections page of our website: www.montgomerybotanical.org

Keeping accurate data on over 10,000 living, growing plants requires constant vigilance. I want to thank MBC team members Steve Chickillo, Charmaine Kappler, Vickie Murphy, Dr. Larry Noblick, Randy Russ, Arantza Strader, Hostilio Torres, Laura Vasquez, and MBC volunteer Victoria Strader, for their help with our 2006 inventory.

Montgomery Botanical Center
2006 Collection Inventory

	Palms	Cycads	Other
Total Taxa	428	257	405
in ground	358	220	377
in nursery	143	141	38
Total Accessions	2,356	1,752	1,974
in ground	1,803	1,173	1,920
in nursery	600	672	57
Total Plants	15,383	7,090	2,970
in ground	5,233	2,905	2,243
in nursery	10,150	4,185	727

"Other" includes tropical conifers and tropical flowering trees.
In this inventory, taxa counts are of species, subspecies, and varieties.
An accession is a collection of seeds from one source or locality.

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The Nuts & Bolts of a Botanic Garden

Nuts grow on trees and plants bolt in the spring, but the usual meaning of "nuts and bolts" also applies to a botanic garden. Heavy equipment provides the power for our work caring for Montgomery Botanical Center's (MBC) specialized conservation collections.

Foremost in the MBC fleet of "yellow iron" are the backhoe, the front-end loader, and the skidster—technically, the Combination, the Integrated Tool Carrier, and the Skip Loader. When the Combination was conceived back in 1953, it was a truly revolutionary concept, combining capabilities of both a loader in front for handling bulk materials such as soil or gravel, and a digging bucket attached to an articulated arm behind. A standard tractor chassis served as the base for both. With this single piece of equipment, one individual could do the same work that previously had required three workers and three separate pieces of equipment.

The Combination is widely used in resort and residential development projects for an entire spectrum of activities from infrastructural work, to roads, to construction and landscaping. MBC plant curators find the equipment essential in debris processing, material hauling, and large specimen plantings.

The Integrated Tool Carrier, developed for large-scale agricultural and logging operations, is an extremely versatile machine. By virtue of a system of pin-on accessories, it can be used during the course of any given day to move heavy loads of material over long distances, turn around and lift large trees and palms with its extending tree boom, and then finish out a productive afternoon removing entrenched root balls from planting beds (a seemingly ongoing legacy of the 2005 hurricane season).

The Skip Loader, with its zero-radius turning capability, was developed for the mining industry to load material into narrow-gauge rail containers, known as "skips," in the cramped confines of a mineshaft. MBC curators find this agility ideal for auguring planting holes in tight spaces, and placing soil and mulch into planting beds.

Daily care and maintenance of the heavy equipment, as well as our smaller tractors, mowers, and electric utility vehicles (not to mention the upkeep of nine buildings and an extensive semi-automated irrigation system), keep the five-person facilities maintenance team—Jack Bauer, Juan Corona, Martha Lagos, Ansel Thomas, and Marino Valcourt—busy while providing vital, behind-the-scenes service supporting the high level of horticultural care expected of Montgomery Botanical Center's curatorial staff.

Montgomery Botanical Center was able to obtain this very useful heavy equipment through the funding and generous support of Loyd Kelly and Kelly Tractor.

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Under Montgomery Botanical's Palms

Sometimes overlooked, mulch is an important part of a garden. At Montgomery Botanical Center (MBC), mulch benefits the palm collections directly by providing nutrients, retaining soil moisture, and keeping weeds in check. In my experience, regular mulching seems to help our palms flower and fruit. I am developing a simple experiment to test this.

Expanded mulch beds—moving the turf boundary away from the plants—protect palms and cycads from potential damage caused by a lawn mower passing through the fronds or driving over the roots. The wider mulch beds also reduce the amount of fuel used at MBC by reducing the turf area to be mowed. Moreover, these wide mulch beds help the palms' appeal to the eyes by framing the plants for display.

There are certain factors to consider for proper mulching. For example, spreading mulch during the warmer summer months allows mulch to decompose more readily, providing valuable nutrients to the plants. Keeping mulch the right distance from the bases of the palms and cycads is important for the health of the trunks. We have found that, for certain palms, composted mulch is better. The strong odor of composted mulch suggests its rich nutrient content.

We recycle all the plant debris we produce at MBC, using it for mulch or compost. Regular mulching over a period of years builds up rich topsoil, which is important for MBC. Under the palms, but not overshadowed—good mulching and composting can help to make great palms.

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Montgomery Botanical Center apologizes for any omissions or errors in accuracy.

Montgomery Botanical Receives Grant for Conservation Expedition

Montgomery Botanical Center was recently awarded a generous grant by the South Florida Palm Society. The funding is being used for basic phytogeographic research and to collect live plant material to advance conservation of Caribbean palm populations. Montgomery Botanical and the South Florida Palm Society share a deep commitment to conservation through cultivation.

Focusing on What Matters

Montgomery Botanical Center is known for its strong focus on scientific plant collections. Our efforts are concentrated where they belong. Plant collections are at the heart of conservation, vital for research and essential for education. You are our important partners in this mission.

Last year, I challenged the MBC team to keep our resources vigorously focused on our mission. Scott Massey, MBC's grounds supervisor, set ambitious targets for fuel conservation with the equipment fleet. MBC facilities supervisor, Jack Bauer, continuously finds additional savings in utilities. Charmaine Kappler (funding & communications) found efficiencies which cut bulk mailing costs in half. And, anyone here will tell you, I keep all meetings nice and short—we get more done working than talking.

We have many important plants to care for and our collections keep growing (please see page 7). I highlight this continuing focus on our plant collections to illustrate how much we accomplish with your support. Montgomery Botanical Center accomplishes research, conservation, and education through your partnership. Your donations sustain unique, irreplaceable collections of palms and cycads, undiluted by parallel pursuits—an ongoing, long-term commitment to what matters.

Please support our efforts through your donation. MBC is a tax-exempt 501(c)(3) nonprofit institution, and your gift is fully deductible as allowed by law. We conserve your gift as wisely as we conserve our plant collections—seeking the maximum benefit, with no wasted efforts, and no extra costs. For information on donating to Montgomery Botanical Center, please contact me at any time.

M. Patrick Griffith, Ph.D., Executive Director
(305) 667-3800 ext. 105
grif@montgomerybotanical.org

Supporting Montgomery Botanical Center

Please consider helping, in whole or in part, with the following Montgomery Botanical Center needs. We greatly appreciate your support. Your contribution is deductible to the extent allowed by law.

Support the Montgomery Internship Program	$ 5,000.
Support Collections Development Expeditions	$ 6,000.
Support the Montgomery Archive	$ 6,000. – $10,000.
Support Montgomery's Pollen Program (ultra-low temperature freezer for the conservation of pollen)	$15,000.

I would like to support Montgomery Botanical Center's commitment to scientific plant collections for conservation, research, and education.

Enclosed is my tax-deductible contribution for:

❑ $100 ❑ $250 ❑ $500 ❑ $2,500 ❑ $5,000 ❑ $_____

Please make your check payable to *Montgomery Botanical Center* and mail to:
Montgomery Botanical Center, 11901 Old Cutler Road, Miami, Florida 33156 USA

Restricted Gifts

If you would like your contribution applied to a specific Montgomery Botanical Center program or need, or if your contribution is in honor or memory of someone, please write that designation in this space.

MBC is a tax-exempt 501(c)(3) nonprofit institution and your contribution is deductible to the extent allowed by law.

FROM THE MONTGOMERY ARCHIVE

This *Phoenix canariensis* infloresence and spathe was photographed in April, 1947, on the Montgomery Estate. Note the metal botanist's collecting case in the lower left corner of the photo. It is a vasculum, a tool used by plant collectors as early as the 1700s. The vasculum was widely used by botanists in the United States during the post-Civil War era through the 1940s.

Colonel Montgomery's collections at the Coconut Grove Palmetum were always useful to botanists—Montgomery Botanical Center continues this tradition of supporting research through live plant collections.

MONTGOMERY BOTANICAL CENTER
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