Palms

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The International Palm Society

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FRONT COVER

The colorful infructescences of *Oenocarpus bacaba* were seen on a tour of Amazon palms. See article by B. Emery and M. Smukall, p. 27. Photo by Jack Sayers.

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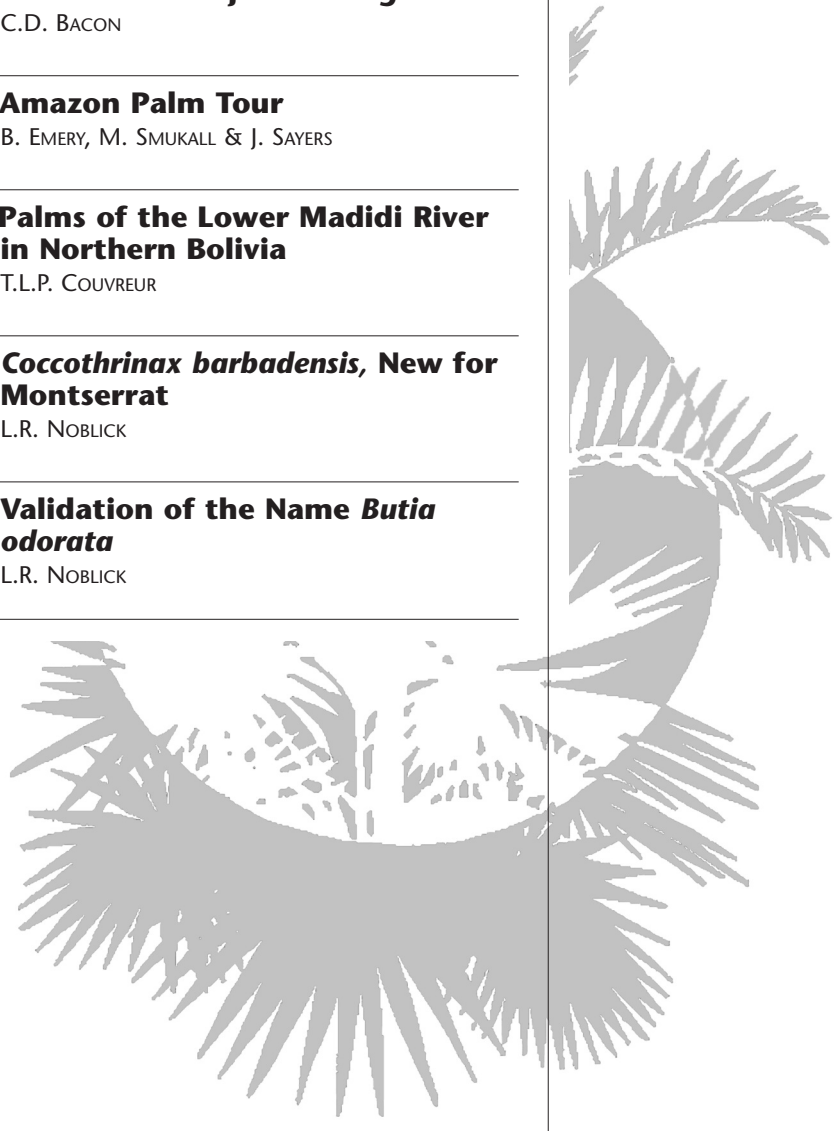
CONTENTS

Features



BACK COVER

Cyphosperma tanga near Navai village on Viti Levu, Fiji. See article by C. Bacon, p. 21.

PALM NEWS


John Dransfield

Yet more new palms have been discovered in Madagascar. In a paper in Kew Bulletin (Rakotoarinivo, M. & J. Dransfield. 2010. New species of *Dypsis* and *Ravenea* (Arecaceae) from Madagascar. Kew Bulletin 65: 279–303.), Mijoro Rakotoarinivo and John Dransfield described twelve new species of *Dypsis* and two of *Ravenea*. Many of these new species were found during field work by the authors targeted at areas not previously visited by palm botanists. Among the new taxa are some striking ornamentals such as *Dypsis gronophyllum* (left) that in stature and praemorse leaflet tips bears an uncanny resemblance to the New Guinea palm previously known as *Gronophyllum pinangoides* (now *Hydriastele pinangoides*), *D. metallica* with a large leathery metallic blue-green leaf with a central pale yellowish stripe and *D. dracaenoides*, which occurs in two forms, one with an undivided leaf and the other with a finely divided leaf, the latter form then appearing from a distance like a species of *Dracaena*. *Dypsis andilamenensis* is a climber, only the second climbing palm to be recorded for Madagascar. *Dypsis anjae*, is one of the smallest palms in Madagascar – a beauty with an entire bifid leaf, while *D. culminis*, also with an entire bifid leaf, is much larger, clustered and occurs on ridgetops. *Dypsis reflexa* has strongly reflexed inflorescence branches. *Dypsis jeremei*, *D. gautieri* and *D. betsimisarakae* are moderate-sized undergrowth palms with irregularly arranged leaflets, while *D. vonitrandambo* is a squat palm with piassava from the old leaf sheaths and beautiful broad leaflets that emerge dark purplish-red in color. Finally *D. sancta* is a solitary medium-sized tree palm with strongly curved leaves. *Ravenea hypoleuca* resembles *R. albicans* in the presence of indumentum on the undersurfaces of the leaves but lacks the tiger-stripes on the petioles so striking in the latter. *Ravenea beentjei* is distinct in being the first species of *Ravenea* to be discovered with twelve rather than six stamens in the male flower. Further field work by the two authors in an area in southeast Madagascar not previously visited by palm botanists in September 2010 uncovered yet four more new palms, which are awaiting description and names.

A new paper by Richard A. Minnich, Ernesto Franco-Vizcaíno and Mario Salazar-Ceseña shows how **the imaging capability of Google Earth can be used to locate and identify palms** in the desert ecosystems of Baja California (Mexico) and adjacent southern California (USA). They inventoried 15,216 populations containing an estimated 1.31 million individuals of *Brahea armata* (right), *B. brandegeei, Washingtonia filifera* and *W. robusta*. Google Earth imagery showed that native fan palms are widespread in mountains of the entire Baja California peninsula. The authors documented significant extensions in the distributions of both *Washingtonia* species, as well as 66 hitherto unreported *W. robusta* oases in Baja California. They also recorded thousands of upland populations of dwarf *B. armata*. The project demonstrated how Google Earth can be used for botanical discovery, even in areas that are seldom visited by botanists. The work, "Distribution and regional ecology of California palm oases interpreted from Google Earth™ Images" was published in Aliso 29: 1–12. 2011. Contact: richard.minnich@ucr.edu.


Ben Lowe

The Palms of Monserrate, Sintra, Portugal

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1. Dome of Monserrate seen behind *Trachycarpus fortunei* and *Phoenix canariensis*.

The garden of Monserrate in Portugal contains a wealth of fine trees planted mostly in the second half of the nineteenth century including giant Araucarias, Kauri pines, Banyans and *Metrosideros*. The collection of palms is particularly rich and has great historical significance since the palms at Monserrate were among the first specimens of their kind planted in the open air in Europe. Today there are some seventy or more species of palm growing at Monserrate, twenty-four of them representing historic plantings (Fig. 1).

Sintra, near Lisbon, Portugal, enjoys one of the mildest climates in Europe, comparable only to the southern-most coasts of Spain and Italy and some islands of the Mediterranean. However, its position at the western-most point of continental Europe gives it a wholly Atlantic outlook with abundant winter rains and cool, misty summers. Winter minimum tempera-tures on the northern slopes of the Serra de Sintra are warmer than those of surrounding areas, with frost-free conditions that allow plants classified for USDA Zone 10b to be grown. The soils are composed of decayed granite and abundant organic material.

Monserrate is an historic garden founded in the late 18th century by Gerard de Visme, a wealthy English merchant who had made his fortune in trade with Brazil. He built a neo-gothic house that quickly fell to ruin during the Napoleonic invasions and ensuing civil war in Portugal (1807–1834). Lord Byron saw the ruined house and garden in 1809 and wrote about them in *Childe Harold's Pilgrimage*. Such was the effect of this poet's fame that the gardens instantly became an obligatory destination visited by all Grand Tourists of the nineteenth century.

One such wealthy traveller was the young Francis Cook returning from a tour of Greece, Turkey, Egypt, Italy and the Iberian Peninsula. Arriving in Lisbon he had letters of introduction to his father's trading partners and was entertained in Sintra by English merchants who had their summer houses there. He met and fell in love with Emily Lucas, daughter of one of these families and tradition has it that they discovered the ruins of Monserrate on their honeymoon in August 1841.

Cook was the second son of William Cook, one of Britain's largest traders in all kinds of silk, linen, woolen and cotton goods. When his elder brother Francis died in 1852 the family firm became Cook, Son & Co. He then decided it was time to begin making his garden in Portugal and planted the first Araucarias at Monserrate in the same year. Re-building of the house was begun in 1856 and completed by 1860.

In 1869 he inherited a fortune of two million pounds.

Francis Cook was a collector. All things rare and wonderful fascinated him. His garden contained Etruscan sarcophagi and Mughal arches, Roman and Renaissance sculpture, Chinese urns and Iznik tiles. The house, built on de Visme's gothic castle walls, was decorated in "Moorish style" with an amalgam of Indian and Venetian and Florentine Renaissance details – the palace of a Nabob in the words of one visitor. It contained works of art in every room: paintings, sculpture, arms, books, textiles, rugs, even stuffed birds and tiger-skin rugs. Later he became Sir Francis Cook, Bt. and Visconde de Monserrate, renowned as the greatest art collector of his age, guided by Sir J. C. Robinson, keeper of pictures to Queen Victoria, and founder of the Victoria & Albert Museum, London.

Naturally he began to fill the garden with exotic and expensive plants. This was the age of great Victorian glasshouses filled with the treasures of uncharted lands – Brazil, Australia, New Zealand, South Africa, China and Japan. Cook's ambition was to make a garden at Monserrate that would rival the greatest botanical collections of Europe. In England he lived on Richmond Hill, close to the epicenter of Victorian plant exploration, the Royal Botanic Gardens at Kew, where he maintained a close relationship with the directors William and Joseph Hooker. At Monserrate the garden was to contain a greater variety of plants than any other garden in Europe – except Kew!

All of this was to be grown in the open air. "Imagine," said Dr. David Moore (director of Glasnevin botanic garden) in 1867, "imagine a piece of ground a thousand times the size of the palm house at Kew," wholly dedicated to the culture of exotic plants.

It was David Moore that gave us the first record of some of the successful plantations of palms from when the garden was first established. These were listed as *Areca sapida*, *Chamaerops martiana*, *Chamaerops fortunei*, *Seaforthia elegans*, *Latania borbonica* and *Phoenix dactylifera*. Here we are confronted with a problem that dogs all those interested in the history of Victorian horticulture – the complexity of synonymy and inaccurate botanical nomenclature, even when used by the most eminent botanists. This is not surprising when one considers the remote origins of the palms and the difficulty that scientists had in procuring flowering specimens for taxonomic examination. The sheer size of the inflorescences made even making herbarium sheets a daunting prospect.

Throughout this article the names of plants are referred to as cited by original authors.

2. Palms growing between two giant Araucarias, including *Livistona australis* and *L. chinensis*, *Washingtonia robusta*, *Archontophoenix cunninghamiana* and *Phoenix canariensis*.

Please refer to Table 1 for modern accepted names in accordance with the Kew World Check List of Selected Plant Families (http://apps.kew.org/wcsp/home.do). There are however situations in which the treatment of horticultural names does not agree with botanical synonymy. An example would be *Latania borbonica* Hort. as opposed to *Latania borbonica* Lam. The first, as undoubtedly intended by Dr. Moore in 1867 is equivalent to *Livistona chinensis* (Jacq.) R.Br. ex Mart., whereas the latter is botanically considered synonymous with *Latania lontaroides* (Gaertn.) H.E. Moore.

3. Monserrate: main entrance to the house with *Archontophoenix cunninghamiana*.

Garden making in Portugal in the mid-nineteenth century was dominated by two aristocratic figures. Foremost was Ferdinand Saxe-Coburg and Gotha, king-consort of Queen Maria II and regent during the infancy of his sons Pedro V and Luis I. He was a cousin of Queen Victoria's husband Albert and nephew of Leopold of Belgium. In Portugal he became known as Dom Fernando II. Secondly there was the Duke of Palmella, Dom Pedro de Sousa Holstein, an important figure in the long period of civil war, protector of Queen Maria, and briefly prime minister of Portugal.

Dom Fernando II made a number of gardens in Portugal, the most important being that surrounding his castellated palace of Pena on top of the Serra de Sintra, but also others in Lisbon at the Palace of Necessidades and in royal residences such as Alfeite on the southern margin of the Tagus River and at Mafra, north of Sintra. He is famous amongst palm enthusiasts for the fantastic *Jubaea* that he planted outside at Necessidades in 1858, but in fact the vast majority of his palms in this garden were grown in his wonderful domed palm house built in 1857. Before the *Jubaea*, only *Cocos flexuosa* and *Phoenix dactylifera* were to be found out in the park. The greenhouse may be visited today; unfortunately it is totally bereft of plants, and sadly the *Jubaea* no longer exists.

The Duke of Palmella had in his service two exceedingly competent plantsmen, the botanist Friedrich Welwitsch and the gardener Jacob Weiss. Together they made a series of fantastic gardens on the Duke's estates, the most important of which, at Lumiar in Lisbon, is today a public park. The first palms were brought to Lumiar in 1856 and were later planted in the open air. These were *Jubaea spectabilis*, *Chamaerops ghiesbreghtii*, *Chamaerops excelsa*, *Livistona sinensis*, *Phoenix leonensis* (*P. spinosa*), *Copernicia* sp. from Bahia, Brazil, *Rhapis* sp. aff. *flabelliformis*, *Rhapis aspera*, *Chamaerops tomentosa*; *Seaforthia elegans*; *Sabal umbraculifera*, and of course, *Phoenix dactylifera* and *Chamaerops humilis*. *Livistona australis* was also planted in this garden, though somewhat later.

So it was against this aristocratic background that Francis Cook began to plant his garden at Monserrate. His palms soon grew to impressive dimensions as recorded by another botanical

4. Young *Archontophoenix cunninghamiana* growing next to *Nolina longifolia.*

visitor, Professor T. C. Archer from Edinburgh, who wrote up his *Botanical Notes on the Garden of Montserrate, Portugal* in 1870. Archer considered that Monserrate surpassed even Kew since "the whole of the plants at Montserrat have no other covering than the azure sky above."

On the western side of the upper lawn he saw "a large grove of palms, on the borders of which are magnificent specimens of *Cycas revoluta* and *Cycas circinalis*, the former with two immense cones of ripe fruit. The palms are chiefly *Areca sapida*, *Latania borbonica*, *Seaforthia Elegans*, *Chamærops Fortunei* and *Martiana*, each about forty-five feet high, *Corypha australis*, *Sabal Blackburniana*, and the date palm."

Forty-five feet high, or nearly fourteen meters is a tremendous height for any garden palm in Europe at this time. The palm house at Kew is 66 feet (20 m) at its highest, but outside what was there to rival these dimensions? As a direct comparison the very first *Trachycarpus fortunei* planted in the palm house at Kew had reached only 28 feet by 1860. Prince Albert's specimen planted out at Osborne House (Isle of Wight)

Table 1. Historic Palm Collection at Monserrate.

Dates refer to Literature Cited. 1867 = D. Moore. 1870 = T.C. Archer

Species	Date	Most likely match	Currently Accepted Name (World Checklist, Kew)
Areca sapida	1867	*Areca sapida* Sol. ex G. Forst.	*Rhopalostylis sapida* (Sol. ex G. Forst.) H. Wendl. & Drude
Brahea Roezlii	1929	*Brahea roezlii* Linden	*Brahea armata* S.Watson
Butia capitata	1946	*Butia capitata* (Mart.) Becc.	*Butia capitata* (Mart.) Becc.
Caryota urens	1885	*Caryota urens* L.	*Caryota urens* L.
Chamaedorea elatior	1929	*Chamaedorea elatior* hort. ex H. Wendl.	*Chamaedorea pochutlensis* Liebm. in Mart.
Chamaerops Fortunei	1867	*Chamaerops fortunei* Hook.	*Trachycarpus fortunei* (Hook.) H. Wendl.
Chamaerops humilis	1946	*Chamaerops humilis* L.	*Chamaerops humilis* L.
Chamaerops martiana	1867	*Chamaerops martiana* Wall. ex Mart.	*Trachycarpus martianus* (Wall. ex Mart.) H. Wendl.
Cocos plumosa	1885	*Cocos plumosa* Hook. f.	*Syagrus romanzoffiana* (Cham.) Glassman
Cocos Weddelliana	1885	*Cocos Weddelliana* H. Wendl.	*Lytocaryum weddellianum* (H. Wendl.) Toledo
Corypha australis	1870	*Corypha australis* R. Br.	*Livistona australis* (R. Br.) Mart.
Diplothemium arenarium	1946	*Diplothemium arenarium* (Gomes) Vasc. & Franco	*Allagoptera arenaria* (Gomes) Kuntze
Euterpe edulis	1885	*Euterpe edulis* Mart.	*Euterpe edulis* Mart.
Howea (Kentia) Belmoreana	1885	*Kentia belmoreana* C. Moore & F. Muell.	*Howea belmoreana* (C. Moore & F. Muell.) Becc.
Howea Forsteriana	1885	*Howea Forsteriana* (F.Muell.) Becc.	*Howea forsteriana* (F. Muell.) Becc.
Jubaea spectabilis	1923	*Jubaea spectabilis* Kunth in HBK	*Jubaea chilensis* (Molina) Baill.
Latania borbonica	1867	*Latania borbonica* hort., non Lam.	*Livistona chinensis* (Jacq.) R. Br.
Latania lontaroides	1923	*Latania lontaroides* (Gaertn.) H.E. Moore	*Latania lontaroides* (Gaertn.) H.E. Moore

Table 1, continued.

Livistona Hoogendorpii	1885	*Livistona Hoogendorpii* Teijsm. & Binn. ex Miq.	*Livistona saribus* (Lour.) Merr. ex A. Chev.
Phœnix sylvestris	1891	*Phoenix sylvestris* (L.) Roxb.	*Phoenix sylvestris* (L.) Roxb.
Phœnix dactylifera	1867	*Phoenix dactylifera* L.	*Phoenix dactylifera* L.
Phoenix loureirii	1946	(misidentification)	*Phoenix roebelenii* O'Brien
Phœnix reclinata	1885	*Phoenix reclinata* Jacq.	*Phoenix reclinata* Jacq.
Phœnix rupicola	1885	*Phoenix rupicola* T. Anderson	*Phoenix rupicola* T. Anderson
Phœnix tenuis qui sont des P. Canariensis	1891	*Phoenix tenuis* Verschaff.	*Phoenix canariensis* Chabaud
Pritchardia fillifera	1891	*Pritchardia filifera* Linden ex André	*Washingtonia filifera* (Linden ex André) H. Wendl. ex de Bary
Ptychosperma Alexandræ (Archontophoenix Alexandræ)	1885	*Archontophoenix Alexandrae* (F. Muell.) H. Wendl. & Drude	*Archontophoenix alexandrae* (F.Muell.) H. Wendl. & Drude
Rhapis excelsa	1946	*Rhapis excelsa* (Thunb.) Henry	*Rhapis excelsa* (Thunb.) Henry
Rhopalostylis (Areca) Baueri	1885	*Areca baueri* Hook.f.	*Rhopalostylis baueri* (Hook. f.) H. Wendl. & Drude
Sabal Blackburniana	1870	*Sabal blackburniana* Glazebrook	*Sabal palmetto* (Walter) Lodd. ex Schult. & Schult.f.
Seaforthia elegans	1867	*Seaforthia elegans* R. Br.	*Ptychosperma elegans* (R. Br.) Blume
Seafortia elegans	1867	*Seaforthia elegans* Hook.	*Archontophoenix cunninghamiana* H. Wendl. & Drude
Trithrinax brasiliensis	1929	*Trithrinax brasilensis* Mart.	*Trithrinax brasiliensis* Mart.
Washingtonia robusta	1929	*Washingtonia robusta* H. Wendl.	*Washingtonia robusta* H. Wendl.

and thought to be the largest of its species grown without shelter in Europe, was at this time only ten feet tall.

Archer tells the story of how Cook's gardener had transplanted a giant date palm. "It is supposed to be some centuries old, and formerly grew at Cascaes, a place twelve miles distant, whence it was removed by Mr Burt, the gardener at Montserrat, across the intervening Serra with great difficulty. Its leaves were tied up, and its roots protected, and twenty-four oxen worked for a whole week to bring it to the paradise in which it now so proudly flourishes ... The stem of this prince of palms is seven feet six inches in girth, and the height not less than thirty feet, — the beautiful crown of leaves being at least ten feet more."

The first *Areca sapida* (*Rhopalostylis sapida*) flowered in the palm house at Kew in 1859. The following year the French *Revue Horticole* was appealing to "la liberalité anglaise" so that seeds might be supplied to southern gardens for experimentation with outdoor culture. By 1861 Messrs. Veitch & Son had the plant on sale in London and the plant was "tolerably well known in gardens." On the French Riviera it was not until 1882 that this palm reached flowering maturity.

Latania borbonica is not what it seems. This name was used by Victorian gardeners for *Livistona chinensis* (Jacq.) R. Br. in the mistaken belief that this Chinese palm originated from the French Island of Réunion (Île Bourbon). Perhaps the first open air planting of this species was at Hyères in 1846, on the French Riviera some ten years before it was cultivated in Portugal.

Seaforthia elegans is another problematic gardeners' synonym, almost certainly what is intended is *Archontophoenix cunninghamiana* H. Wendl. & Drude. Some descriptions of Monserrate list both *Seaforthia elegans* and *Ptychosperma cunninghamiana* as growing side by side. So we should perhaps consider the possibility that *Ptychosperma elegans* (R. Br.) Blume was also cultivated at Monserrate. However there is none growing there today and the *Archontophoenix* is still seen throughout the gardens (Figs. 3 & 4). Not a particularly hardy palm, what probably prompted the experimentation with *Archontophoenix* at this early date was its ready availability by seed imported from Sydney. *Archontophoenix cunninghamiana* is very sensitive to cold and although widely planted on the French Riviera in the nineteenth century it often succumbed to cold winters without reaching impressive dimensions.

Corypha australis, in this context should be interpreted as *Livistona australis* (R. Br.) Mart. Seeds placed casually as drainage material in the bottom of Wardian cases sent by Cunningham were found to have germinated on arrival at Kew in 1824. Conrad Loddiges then used this technique to import large numbers of seeds and the palm became quickly established in the greenhouses of Europe. This palm was among the first contenders for acclimatisation since it is the southernmost palm occurring on the Australian continent. Small plants were growing in the open at the Naples Botanic garden at by 1867, and it was included in a list of palms that were "reasonably common" at Nice in 1869.

Sabal blackburniana was first cultivated under glass in Europe by a Mr. Blackburn who had his plant from Lord Petre in 1737. It was probably grown from seeds collected in Georgia (USA) by William Bartram. A multiplicity of other names makes it difficult to determine when this palm was first cultivated outdoors. In fact, the earliest records use a wholly erroneous designation: *Corypha umbraculifera*. Famously large specimens grown under glass are frequently referred to by this name. Messrs. Huber of Hyères on the French Riviera planted out a very young specimen of *Sabal blackburniana* in the summer of 1864 and it was successfully over wintered.

Encouraged by these early successes: "Mr. Cook ... has lately experimented with Palms that he was chary of trying at first; a list of those that are healthy will, therefore, be valuable. They are *Phœnix reclinata*, *Ptychosperma Alexandræ* (*Archontophoenix alexandrae*), *Cocos plumosa* and *Weddelliana*, *Howea* (*Kentia*) *Belmoreana*, and *Rhopalostylis* (*Areca*) *Baueri*." This list appeared in 1885 written by C.A.M. Carmichael in a long two-part article for *The Gardeners' Chronicle*. By then *Seaforthia elegans*, *Livistonia borbonica* and *Corypha australis* were the tallest palms in the garden.

In another part of the garden known as "Mexico" Carmichael found that "Aloes and Yuccas of every kind abound, and monotony is avoided by inserting Palms." He gave the following list: "*Areca* (*Rhopalostylis*) *sapida*, one leaf of which measured 12 feet; two wide-spread Date Palms, the circumference of the branches of one was 39 paces; *Phœnix rupicola*,

Caryota urens, *Livistona Hoogendorpii*, *Howea Forsteriana*, and *Euterpe edulis* were among the most prominent or worthy of notice for being grown in the open."

Amongst this list are a number of palms that even today's enthusiasts of hardy palms would be surprised to encounter. How many European gardens today are growing *Lytocaryum weddellianum* (H.Wendl.) Toledo or *Euterpe edulis* Mart. in the open? The *Euterpe* and *Cocos insignis* were still thriving in 1910 as described by the French forester Léon Pardé.

The warm growing conditions found at Monserrate are indicated by the presence of such delicate palms as *Howea belmoreana*, rated zones 10 and 11 by Robert Lee Riffle and Paul Craft in their *Encyclopedia* and *Archontophoenix alexandrae* rated 10b and 11. Both species are growing today at Monserrate. Recently planted *Caryota urens* (adapted only to zones 10b and 11 and marginal in 10a) has come through the difficult winter of 2009/2010 and is making new growth at the time of writing (March 2010).

Sir Francis Cook died in 1901, appropriately at the close of the Victorian era. He was succeeded by his son Frederick, who was little interested in horticultural affairs but who had the good sense to entrust the garden to Henri Navel, trained at the Ecole de Versailles and at Kew and who was later appointed head gardener at the Lisbon botanic garden. The gardens were visited during his tenure, as mentioned above, by Léon Parde. His extensive botanical descriptions indicate however that the palm collection at this time was essentially that planted by Sir Francis.

Only when the third baronet, Sir Herbert Cook, appointed Walter Oates as his head gardener was the collection to see new development. Walter Oates wrote *Monserrate: A Short Guide to the Gardens* in 1923, shortly after he had arrived as new head gardener He had been working previously on the Italian Riviera and was well acquainted with hardy palms.

Oates remained at Monserrate for the rest of the decade and wrote a well-illustrated article for the Gardeners' Chronicle in 1929 in which he lists many plants. He includes a list of palms: "Palms are very numerous, and mention of only a few of the best must suffice*: Cocos flexuosa. C. romanzoffianum, Washingtonia robusta,* the tallest palm in the garden, about 70 feet high*; Kentia belmoreana, K. forsteriana,* with trunks 25 ft. high; *Phoenix canariensis, P. dactylifera, P. reclinata,* with seven well-furnished trunks from one root; *Brahea roezlii, Areca baueri, A. sapida, Jubaea spectabilis, Seaforthia elegans, Sabal blackburniana* and *Sabal umbraculifera."* At other points in the article he also mentions *Trithrinax brasilensis*, and *Chamaedorea elatior* plants not mentioned in any previous description of the garden and presumably from his own introduction.

Sir Herbert died in 1939. Following the Second World War, the Monserrate estate was sold by the fourth baronet, who shared his name with his great grandfather, Sir Francis Cook. The garden eventually passed into the hands of the Portuguese state, managed by the Forest Service. The gardens continued as a great tourist attraction into the 1960s but were better known for their rhododendrons and camellias than the exotic plants of the Victorian era. The palms continued to grow, but slowly many were lost either through old age or more significantly through competition from invasive trees species such as *Acacia melanoxylon* and *Pittosporum undulatum*.

Following the 1974 Portuguese Revolution circumstances had changed so radically that it

Visiting Gardens

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was impossible to maintain the garden. Staff were reduced to three people: one collecting tickets on the gate, one sweeping up around the house and the last of the old gardeners, José Luis, who faced with the forests of invasive plants that occupied the garden, retreated to the broken glasshouse and nursery.

In 1987 a group of young Canadian landscape architects and horticulturists from the Royal Botanical Gardens of Hamilton, Ontario began to work on the restoration of the gardens. This was the beginning of a long and difficult process that has yet to be completed. Today the gardens are managed by a state-owned, but self-funding organization called the Parques de Sintra – Monte da Lua. There is a comprehensive restoration project underway of both house and gardens, co-ordinated by Prof. Antonio Lamas, the organization's president.

And the palms? Twenty-four species have managed to survive from the original plantings, some of them centenarian and of monumental dimensions. In addition, clearing work and reconstruction have enabled a program of replanting of the garden's botanical heritage. This includes the palm collection which today includes some 70 different taxa. A new head gardener has been appointed, Tim Stretton, who trained at Kew. One hopes the day will soon be here when Monserrate will once again resemble the palm house of Kew. But under the azure sky above!

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New Palm Hosts for the Red Palm Weevil, *Rhynchophorus ferrugineus*, in Sicily

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The invasive Red Palm Weevil (RPW), *Rhynchophorus ferrugineus* (Olivier), is native to southern Asia and Melanesia. In 1985, this pest was accidentally introduced and established in the northern United Arab Emirates and has become widespread in that country (Ferry and Gomez 2002). It spread to Iran, Savaran region, in 1990 (Faghih 1996) and Egypt in 1993 (Cox 1993). In the same year, the weevil crossed into Europe, at first into southern Spain (Cox 1993, Barranco et al.1995) and a decade later into Italy (Longo and Tamburino 2005), many southern European countries, and Turkey (Malumphy & Moran 2007). Recently, the RPW was detected in the Dutch Antillies and California, USA (USDA 2009, Ferry 2010).

The RPW is a key pest of coconut, *Cocos nucifera* L., in South and Southeast Asia (Maxwell-Lefroy 1906, Brand 1917, Viado and Bigornia 1949, Nirula 1956, Faliero 2006) and has attained major pest status on date palm in the Middle Eastern region since the 1980s (Abraham et al.1998). A report of the RPW on date palm, *Phoenix dactylifera* L., from Iraq in 1920 (Buxton 1920) needs confirmation. Recently the RPW has become a very damaging insect of *P. canariensis* hort. ex Chabaud, in the Mediterranean Basin. Infestations of the RPW on ornamental palms in Italy seem to have originated from large, landscape palms that were imported into many European countries from Egypt and North Africa in violation of phytosanitary regulation (Conti et al. 2008).

Damage and symptoms of RPW infestations have been reported mainly on young palms, i.e., those below the age of 20 years (Nirula 1956, Abraham et al. 1998). Damaged palms exhibit the following symptoms: a) presence of tunnels in the trunk and at the base of frond petiole, oozing out a thick brown fluid, b) accumulation in and around tunnel openings of chewed plant tissues (and frass) giving off a typical fermented odor, c) presence of fallen empty pupal cases and dead adults at the base of heavily infested palms, and d) toppling of the crown and collapse of the trunk, in cases of severe and prolonged infestations (Fig. 1). In date palms, infested offshoots become dry, whereas, in coconut palms, wilting or yellowing of inner fronds may occur (Abraham 1998). In the field, these symptoms can be perceived visually, and the weevil can be detected by the sound of feeding grubs as well as the smell of the fermented frass.

Before 2003, the known host range of RWP included only the 18 palm species listed in Table 1, and the most often reported host species were the economically important coconut, *C. nucifera,* and date palm, *P. dactylifera* (Abraham et al. 1998). Because the RPW is spreading in many countries including the Western Hemisphere (Dutch Antillies and California), it is very important to obtain information on the host range of this invasive weevil. This information is crucial for regulatory purposes and the implementation of RPW exclusion programs. The objective of this note is to report new host data for the RPW obtained in Sicily from 2005 to 2009. These data are the result of extensive surveys conducted by the Sicilian Regional Plant Protection Services in botanical parks, downtown gardens and historic villas on the island. The surveys documented: 1) the spread of the insect infestations in the island; 2) the response and host status of palm species naturally infested by the RWP by assessing the insect population levels on selected palms soon after their death. The results of these studies are presented in this note.

Materials and Methods

A total of 20,000 palms, consisting mainly of *P. canariensis* and a small number of other species, was visually inspected from October 2005 to December 2009, at 450 sites within eight provinces (Agrigento, Caltanissetta, Catania, Enna, Messina, Palermo, Ragusa, Syracuse) in Sicily. Fieldworkers using a basket crane (a device with an open bucket or cage at the end of a hydraulic lifting system from which a worker can repair electrical lines, prune trees or perform other tasks high above

Table 1. Known hosts of the red palm weevil before 2003 (Esteban-Duran et al. 1998).

Areca catechu L.	*Livistona decipiens* Becc.
Arenga pinnata (Wurmb.) Merrill	*Metroxylon sagu* Rottb.
Borassus flabellifer L.	*Phoenix canariensis* hort. ex Chabaud
Caryota maxima Blume	*P. dactylifera* L.
C. urens L. (= *C. cumingii* Lodd. ex Mart.)	*P. sylvestris* (L.) Roxb
Cocos nucifera L.	*Roystonea regia* (Kunth) O.F. Cook (= *Oredoxa regia* Kunth)
Corypha utan Lam. (= C. *elata* Roxb. and *C. gebanga* Blume)	*Sabal umbraculifera* (Jacq.) Mart.
C. umbraculifera Jacq.	*Trachycarpus fortunei* H. Wendl.
Elaeis guineensis Jacq.	*Washingtonia* sp.

1. Severe damage to the crown of *Washingtonia* sp.

2. Bucket crane used to observe the crown of an infested *Jubea chilensis*.

street level) examined the palm crowns and trunks for presence of larvae, cocoons and adults and for symptoms induced by the RPW (Fig. 2).

Fifteen naturally infested, dying palms belonging to nine species (Table 2) were selected to determine the insect population levels in the fronds, crown and trunk of each plant. The fronds and trunk of these dying plants were pruned, cut in pieces and coarsely ground in order to remove the insect developmental stages (larvae, pupae and adults) that were embedded in the palm tissues (Fig. 3). Plants were also ranked by height (from the base of the trunk to the crown) before chopping down the fronds and trunk. The insects were dislodged from the chopped plant tissues and the fermented frass that resulted from larval feeding activity; then their number and life stages were recorded. The insect population levels were expressed as number of postembryogenic life stages per tree and per meter of trunk.

Results and Discussion

The number of infested palm trees increased 260-fold during the 5-year period from 2005 to 2009. Mortality induced by the RPW reached 85% of the infested palms (Fig. 4).

All of the palms listed in Table 2 were hosts for the RPW. Four palm species, *Chamaerops humilis* L., *Brahea armata* S.Watson, *B. edulis*

3. Large cocoon (upper left), adult (upper right) and larva (lower center) of the Red Palm Weevil.

S.Watson, *Howea forsteriana* (F.Muell.) Becc. and *Jubaea chilensis* Baill. are new host records. There was great variability in the population levels of the RPW observed among the palm species and also for individuals of the same species (Table 2). The highest insect populations per tree and per meter of trunk were observed in specimens of *P. canariensis*, *B. armata* and *B. edulis* (Table 2). Weevils at all final population levels were able to kill the 15 infested palms. The small number of replicates in this study prevents a meaningful statistical comparison of the final insect densities on the various palm species or a valid host rating. The variability in the trunk diameter of the palms caused an imprecise assessment of the final

4. Red palm weevil infestations in ornamental palms and consequent mortality observed in Sicily from 2005 to 2009. Note, the palms found infested at the time of the survey did not survive the insect's invasion.

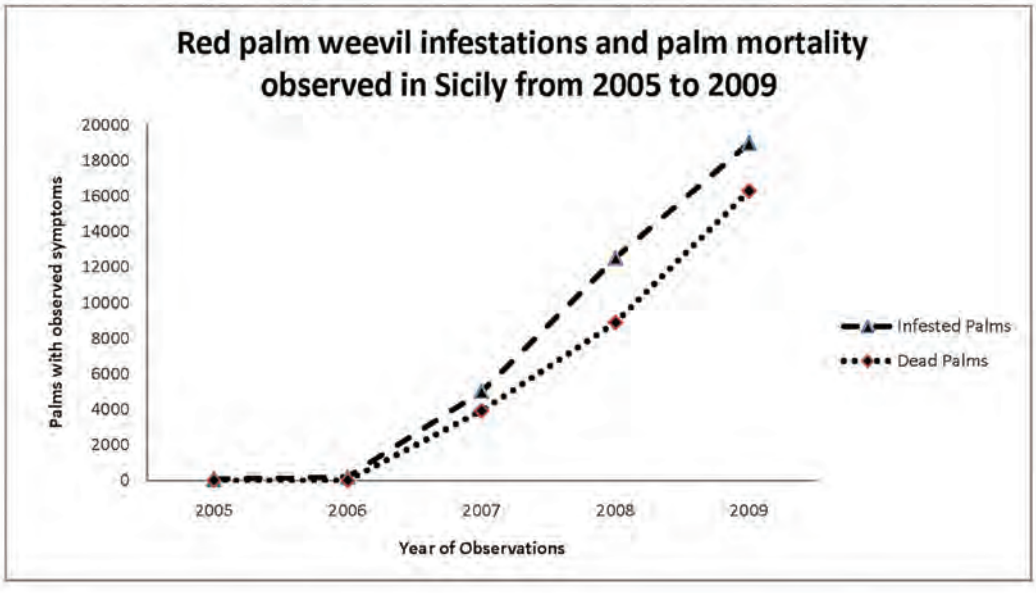

Table 2. Red palm weevil population levels in naturally infested declined palm species naturally infested with sever symptoms in Sicily.

		RPW life stages/tree or (meter of trunk)			
Palm species	height (m)	Larvae	Pupae	Adults	Total
*Chamaerops humilis**[Z]	1.50	2 (1)	3 (2)	3 (2)	8 (5)
*Brahea armata**	2.00	83 (42)	383 (192)	200 (100)	666 (333)
*B. edulis**	4.00	83 (21)	383 (192)	200 (50)	666 (333)
*Howea forsteriana**[Z]	3.00	3 (1)	18 (6)	5 (2)	26 (7)
*Jubaea chilensis**	7.00	83 (12)	73 (10)	37 (5)	193 (27)
Phoenix canariensis	2.00	130 (65)	435 (213)	170 (85)	725 (362)
P. canariensis	1.00	72 (72)	85 (85)	96 (96)	252 (252)
P. canariensis	1.60	15 (9)	385 (240)	196 (123)	596 (373)
P. canariensis	6.60	150 (23)	85 (13)	97 (15)	332 (50)
P. canariensis	12.00	90 (8)	25 (2)	35 (3)	150 (13)
P. canariensis	10.00	47 (5)	95 (10)	48 (5)	190 (19)
Sabal sp.	1.50	13 (9)	23 (15)	6 (4)	42 (28)
Sabal sp.	1.00	7 (7)	18 (18)	12 (12)	37 (37)
Trachycarpus fortunei	3.00	14 (5)	20 (7)	6 (2)	40 (13)
Washingtonia filifera	6.00	27 (5)	33 (6)	8 (1)	68 (11)
W. robusta	4.00	13 (3)	33 (8)	10 (3)	56 (14)

*New RPW hosts.

[Z] Plants concomitantly infested by the weevil *Paysandisia archon*.

insect density per unit of trunk height. However, these field observations show a broad host range of the RPW among palm species.

From field observations, it appears that palm mortality depends on which anatomical tissues are infested by the RPW larvae. If the apical meristem is not damaged by the weevil, the palm may survive even if the insect colonizes other parts of the trunk and/or the fronds. However, if the meristem becomes infested, eventually the palm will be irreparably damaged by the insect. On rare occasions, infestations localized at the base of the tree occurred and resulted in the toppling of apparently healthy plants.

In *Sabal* sp. palms, the RPW larvae burrow into the basal portion of the stem just above the roots and pupate in specialized chambers consisting of roots and soil. This behavior is reported for other palm weevils such as *Rynchophorus palmarum* (L.). We would like to add that agave (*Agave americana*) is reported as a host for the RPW (Barranco et al. 2000); however, our attempts to rear Sicilian populations of the RPW on agave have failed.

Our findings are of special interest for many countries where palms are major components of their agricultural industry or where palms have great landscape value. In Florida, where *Sabal palmetto* (Walter) Lodd. ex Schult. & Schult. f. is the state tree, the accidental introduction of the RPW could jeopardize the landscape of the state as we know it today. The ability of the RPW to infest *C. humilis* may have devastating consequences for the survival of this palm, one of two native and endemic palm species in the Mediterranean region.

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The Palms of Fiji and Tonga

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1. *Pritchardia pacifica* in cultivation at University of the South Pacific, Fiji.

Although not the richest in the region, the palm floras of both Fiji and Tonga are very exciting and were the focus of a recent collecting expedition in November of 2009.

The islands of Fiji are home to about 25 palm species, at least 84% of which are endemic to the island nation. At the generic level, Fiji's palm flora shares its closest relationship with Vanuatu (60%), which is well above its shared distributions with the Solomon Islands (27%), the Bismarck Archipelago (25%), and Samoa (15%; Watling 2005). For eight (75%) of Fiji's indigenous palm genera, Fiji is the southern or eastern limit of their ranges. Fiji has a native

2. *Pritchardia thurstonii* population at bottom center of coastal cliff in the 'Eua National Park, 'Eua Island, Tonga.

palm flora comprising 11 genera – *Alsmithia*, *Balaka*, *Calamus*, *Clinostigma*, *Cyphosperma*, *Heterospathe*, *Hydriastele*, *Metroxylon*, *Neoveitchia*, *Physokentia*, *Pritchardia* and *Veitchia*.

The islands of Tonga are mostly coralline in origin, rather than volcanic (Whistler 1992). Tonga has a very similar flora as its northern neighbor, Samoa, because of their geographic proximity and both are also part of the "Fijian Region" that extends from the Santa Cruz Islands and Vanuatu to Niue (Takhtajan 1969). *Veitchia joannis*, *Pritchardia pacifica* and *P. thurstonii* are the only native palms in Tonga. *Areca catechu*, *Cocos nucifera*, *Livistona chinensis*, *Metroxylon warburgii, Pinanga coronata* and *Ptychosperma macarthurii* are commonly cultivated in Tonga, as they are in Fiji.

Pritchardia

The primary goal of our expedition was to sample *Pritchardia pacifica* (Fig. 1) in both Fiji and Tonga. *Pritchardia pacifica* is an interesting species because it is known only from cultivation and appears to grow strictly around human activity. It is found from the Marshall Islands in the northwest Pacific, south to the Solomon Islands, Vanuatu, Fiji and Tonga, and further east to Niue, Samoa and the Tuamotu Islands of French Polynesia. It is a spectacular palm with a rich history. Many legends surround the palm, but dispute about its origin remains, with Tonga as the most commonly cited origin (Watling 2005). We sampled individuals of *P. pacifica* from across the main island of Tonga, Tongatapu, as well as on the main island of Fiji, Viti Levu, to test the hypothesis of a Tongan origin. We also plan to gather samples from across the Pacific and use molecular phylogenetics to test the historical expansion of the species. One potential issue with testing hypotheses about *P. pacifica* is that is has most probably been transported from island to island by sea-faring Polynesians, therefore the molecular results would track human movement rather than range expansion from seed dispersal and island colonization. One way to address this would be to create alternative hypotheses of human movement through the Pacific and test whether the palms follow human movement and colonization.

3. *Balaka microcarpa* from Colo-i-Suva National Forest Park, outside of Suva, Fiji.

The second goal of our expedition was to collect *P. thurstonii* (Fig. 2) in its native habitat. Hodel (2007) recently recognized populations growing on 'Eua (Tonga), on the Sovu islets in the northern Lau island group (Fiji) and on Ogea and Vulaga of the Southern Lau group (Fiji) as belonging to this species. *Pritchardia thurstonii* is an interesting species because in a tribal-level analysis (Bacon et al., in prep.) it was resolved as sister to the Hawaiian radiation of approximately 26 currently recognized species (Hodel 2007). Study of *P. thurstonii* and other South Pacific *Pritchardia* species helps us understand what the historical distributions of the genus were and potentially what the Hawaiian colonizers looked like with respect to seed size and other morphological attributes.

Moreover, *P. thurstonii* was sampled in the field at the population level. Sampling at this level is important because populations on both Tonga and Fiji are not as severely affected by rat predation on seeds in comparison to Hawaii, where the Hawaiian species are barely able to self-replace due to the devastation of seed banks by rats. Our collections may help establish a baseline estimate of genetic diversity held within and between populations and can further be compared to Hawaiian estimates to quantify endangerment and possibly identify populations of special conservation concern.

Morphological characters used to distinguish *P. pacifica* and *P. thurstonii* include the length of the inflorescences in comparison to the leaf petiole, the number of inflorescences that are born on the tree and their insertion in the crown, and presence of lepidia on the abaxial surface of the leaf (Watling 2005, Hodel 2007). Sampling both *Pritchardia* species is essential to test species boundaries using molecular evidence, which is one goal of my dissertation work.

In Tonga, *P. thurstonii* is found in the 'Eua National Park on the island of 'Eua, which is an easy excursion from the main island of Tongatapu, where the capital city Nuku'alofa is located. Either a three-hour boat ferry or an eight-minute flight gets one to 'Eua, where a four-wheel drive and National Park guide can be hired to access the populations. 'Eua is geologically different from the rest of the Tongan islands and it appears to be significantly older (Whistler 1992). The national park is located on the southeastern escarpment of the island. There are

4. *Veitchia vitiensis* from Colo-i-Suva National Forest Park, outside of Suva, Fiji.

approximately 250 *P. thurstonii* individuals, including juveniles, in two populations separated by steep cliffs and ocean. We were able to sample the largest population, but the other was largely inaccessible, and our guide flatly refused to help navigate to the population. The smaller population was seen from the southernmost end of the main population (Fig. 2) and was estimated to consist of approximately 85 individuals.

We found two individuals of *P. thurstonii* outside of the 'Eua National Park, one in the northern extreme of the island and the other in the southwest. Upon visiting both of these single trees, we observed that they were growing at the mouths of caves. In the north, the cave was small and near the top of the sea cliffs, whereas the tree in the southwest was growing near a large cave system that forms at the base of the sea cliffs. Human remains have been found in both the above-mentioned Tongan caves. In Hawaiian traditional culture, people placed the remains of their ancestors in caves on sea cliffs, an important detail because customs between islands in the Pacific are hypothesized to be related because of their common Polynesian ancestors. So why are these *Pritchardia* growing at the mouths of these caves that hold human remains? We speculated that *Pritchardia* was deliberately planted at the mouths of caves. But why? We asked a 'Eua shaman elder whether any traditional uses for *P. thurstonii* were known,

5. Flowers of *Physokentia petiolata* from the Tomaniivi Forest Reserve, near Navai village, on Viti Levu, Fiji.

6. *Balaka longirostris* flowers from the Tomaniivi Forest Reserve, near Navai village, on Viti Levu, Fiji.

and he explained that the stem of *P. thurstonii* was crushed and the liquid derived from it was drank to keep "death spirits" away. Of course, much of the traditional meaning of local plant use can be lost in translation and through modernization of island peoples. We do not know if the traditional use of the palm accounted for its presence at the mouth of the caves. We can only report that the association between palms and sea caves seems to be more than just coincidental.

Due to economic misfortune, the national Fijian airline recently went out of business, so we were unable to visit the populations of *P. thurstonii* in the Sovu Islets of Fiji. The only current means of traveling there is a ferry that leaves once a month, although it has not been running reliably since September 2009. Instead of collecting *P. thurstonii* as we had originally planned, we turned our attention to collecting as many palm species on the main Fijian island of Viti Levu as possible.

Fijian palms

Our Fijian expedition focused on higher elevation palms found in the mountain range where the highest peak, Mt. Victoria, is located. Viti Levu, the largest island in Fiji, has the greatest number of species among all the islands of Fiji because larger islands harbor larger numbers of species and because the topographic variability provides for greater habitat diversity. Viti Levu has experienced a recent boom in tourism, and many forest tracks along the popular southern Coral Coast

7. Emergent *Clinostigma exorrhizum* population in the Tomaniivi Forest Reserve, near Navai village, on Viti Levu, Fiji.

area have been highly affected by development and deforestation. This human activity has caused populations of *Balaka longirostris*, *Cyphosperma* sp. nov. 'naboutini,' *Heterospathe phillipsii*, *H. vitiensis*, *Metroxylon vitiensis*, *Physokentia petiolaris*, *Veitchia joannis* and *V. vitiensis* to decline and some to near extinction (Johnson 1996, Watling 2005). Forest usage is prevalent across the whole island, with local villages using the understory and forest edges for plantations of taro, sweet potato, manioc, banana and guava, amongst many others. In the northern areas, development is less severe because the King's Road is not paved in some areas and the coast is less desirable for resort speculators.

We spent a day northeast of the Fijian capital of Suva in the Colo-i-Suva National Forest Park. Established in 1872, the Colo-i-Suva is renowned for its easy access from Suva, its verdant rainforests and its bird diversity. The Colo-i-Suva has about 4.5 km of trails and a series of natural waterfalls formed by the Waisila Creek (upper Waimanu River). The park was planted with African mahogany in the 1940s and 1950s, destroying some areas of the park, but some areas are still very nicely preserved. We were rewarded with two palm species there, *Balaka microcarpa* (Fig. 3) and *Veitchia vitiensis* (Fig. 4).

After two days of driving, we conducted field work from the Navai Village at the foot of Fiji's highest peak, Mt. Victoria. Near Navai, we saw the endemic *Cyphosperma tanga*, a critically endangered palm of which the Navai village is very proud (see Back Cover). Scattered *Veitchia vitiensis* individuals were found close to the *C. tanga* population. In assessing the *C. tanga* population, we recorded many seedlings and juveniles, so even though there is only one population remaining, it has apparently been able to maintain its numbers.

In the book, *Palms of the Fiji Islands,* Watling (2005) reported a legend about how *C. tanga* got to Navai, which we confirmed with many of the village elders. The story goes that two chiefs were traveling in the Navai area with a whale's tooth (*tabua*) wrapped in the leaves of the *C. tanga*, locally known as *taqwa*. They stopped to rest and decided to bury the wrapped sacred tooth. From that exact spot grew the *taqwa* palm, and today it is only found in that one locality. Traditionally in Fiji *tabua* was made from teeth from the upper

jaw of a sperm whale and are regarded as perhaps the most important cultural items in Fijian society. When the practice became more widely known in the early 1800s thousands of fake teeth made from ivory and walrus tusks came on the market, and mass-production led to the development of the European art of scrimshaw.

On the next day collecting from Navai village we set out to find the majestic *Clinostigma exorrhizum* populations. Scaling steep terrain in the upper montane forest of the Tomaniivi Nature Reserve, we were amazed by the skill of our guide and his dogs, which were able to hunt a wild piglet without any spoken words or weapons. Along the trail we collected *Physokentia petiolata* (Fig. 5), distinctive with its round and dark black fruits, and *Balaka longirostris* (Fig. 6), which the local Navai villagers use to make spears for hunting. Nearing the top of the ridge we came upon the beautiful *C. exorrhizum* (Fig. 7), as it usually found only above 700 m in elevation. This is the largest palm I had ever collected and stands around 20 m in height. None of the individuals we were able to collect had mature fruits, but it has been reported that one individual infructescence can produce up to 14,000 seeds (Watling, 2005).

Overall, the trip was a success and important collections were made for my dissertation research. My specific goals for the material collected from this field work are to discover not only the origin of the enigmatic *Pritchardia pacifica*, but also test species boundaries in the genus, as well as look at patterns of genetic diversity and how it is organized on the landscape. It is from field work such as this, that biologists like myself get lots of ideas and I look forward to report more results in future reports. I also collected material for future projects on the biogeography of Pacific palms. The biogeography of this region is extremely interesting with respect to patterns of diversification and adaptive radiation, and there is still so much to uncover.

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Amazon Palm Tour

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1. The party poses for a group portrait at the start of the cruise.

Andrew Henderson guided 22 IPS members on a 10-day expedition into the Amazon rain forest. We traveled along the Amazon River system in search of Brazilian palms, along with other flora and fauna. Over the course of our travels, we saw close to 50 different species of palms. Our travels held both pleasure and pain. Bug bites, rashes, heavy rainfall and nearly getting lost in the rain forest could not even come close to drowning our spirits on this amazing trip.

The Amazon Palm Tour began when I collected my baggage from the airport in Manaus, Brazil. After leaving the baggage area, we found tour leader, Dr. Andrew Henderson, waiting for us with a few other members of the expedition. After a few introductions, we left on a bus to a nearby dock situated on the Rio Negro, where we boarded our home for the next 10 days. After the crew finished loading all of the baggage and supplies onto *The Dorhina*, we untied from the dock and headed off into the Rio Negro with Captain Mo at the helm. The members of the expedition, which will be referred to as "The Party" for the remainder of

the story, were 24 travelers from all over the world, citizens from Australia, Brazil, Thailand and the US (Fig. 1).

The Dorhina, aptly named after the captain's lovely wife, was a 75-foot long boat with three decks. The front of both the first and second deck was filled with small, two-person cabins which housed the party and crew. Bunk beds, a wooden dresser and a small bathroom made up our tight but quaint cabin. The third deck was wide open, lined with tables and chairs for the party to sit and watch the scenery.

The first leg of our expedition took the party into the muddy waters of the Amazon River. After leaving port on the Rio Negro we soon came across the meeting of the Rio Negro and Amazon Rivers, a color change that can be seen from space, where the black, cola-colored water of the Rio Negro meets the muddy, tan waters of the Amazon. We spent the first three days of our expedition on the Amazon River.

The Amazon River rain forest was thick and dense. Most of the rain forest we explored on the Amazon was secondary forest, cleared long ago for farming and lumber and since re-established. Almost all of the palms we encountered along the Amazon were in small villages or dense understory rain forest. Small villages dot the rivers shores, some of which we visited and met with the locals. Though rural, the villages have electricity supplied by the government to keep residents from moving out of the Amazon.

While on the Amazon River we located 17 different palm species or variations on our daily expeditions. Below is a list of all the palms we identified and any important local information the party gathered on them.

Astrocaryum aculeatum: Known locally as *tucuma*. This is a large spiny solitary or sometimes clustering palm that we occasionally came across in our travels. It produces plum-sized, orange fruits, which the villagers clean leaving behind a hard wooden endocarp. The endocarps are carved into small sculptures or ornaments.

Astrocaryum jauari: A large heavily armed palm, *A. jauari* was spotted frequently growing along the Amazon River banks, both as solitary and clumping specimens, thrusting their crowns above the thick vegetation. *Jauari* is the Amazonian Indian name for this palm.

2. The party gets a close-up look at *Bactris bidentula*, this one partially submerged by the river. Dr. Henderson is standing.

3. *Euterpe precatoria*.

Astrocaryum murumuru: This is a great-looking member of the genus with evenly spaced, pinnate leaves, giving it an elegant appearance and making it easy to distinguish from other *Astrocaryum* species in the Amazon. During our three days along the Amazon we spotted only a few of these growing on both dry land and along the river. A large colony was found growing in heavy canopy on dry land; the population included a few dozen juveniles in the process of losing their juvenile bi-fold leaves.

Attalea speciosa: This is a large towering solitary palm. We first came across this palm planted along a dock to a small village. Andrew explained that *A. speciosa* is not native to this area, but a villager said it was found and transplanted to the dock from a nearby forest. We often spotted these palms dotting the landscape in large open fields of farm land.

Bactris bidentula: This spiny *Bactris* which stood out from others in genus by having a silvery coloration to the underside of its leaflets, which is uncommon for *Bactris*. We commonly found this palm growing along both the river banks of the Amazon and Rio Negro, sometimes with most of their trunks completely under water (Fig. 2). One clump was found growing away from an island 3 m (10 ft.) underwater.

We also saw *Bactris bifida*, *B. concinna*, *B. maraja* and *B. riparia*. Of course, we saw plenty of *B. gasipaes* along the village canals. They are grown by the local people as a food source for palm hearts

Desmoncus sp.: The strange little *Desmoncus* is found under heavy canopy within the forest. Resembling other members of its genus, it climbs other plants with grappling hook-like spines. Andrew could not identify it in habitat or after further research, and thought it might be an undescribed species.

Euterpe oleracea: A very prevalent palm within the Amazon River villages, it is planted for its fruits, which are used to make a nutritious drink. It was difficult to differentiate *E. oleracea* from *E. precatoria*, which grew in close proximity (Fig. 3). Andrew pointed to the naturally clumping nature of the *E. oleracea*, and solitary nature of the *E. precatoria* as a way to distinguish the two. The endocarps inside the fruit are also a different shape. Both *Euterpe* species are referred to as *açaí* palms by the locals. During one expedition, a crew member climbed a *E. oleracea* and cut down some fruits for the party to taste. The *açaí* fruits were not the most popular snack food on the trip.

Euterpe sp. "Floating Island": During one expedition the party was told we are headed to a "Floating Lake," known by the local

4. A dwarf form of *Euterpe oleracea* growing on a floating island

villagers as "Enchanted Lake." The trip is taken via canoe into a manmade canal system, carved into large floating mats of aquatic trees. The aquatic trees float on the surface of the water creating large floating islands on which other plants establish themselves. These islands were home to a colony of *Euterpe* palms identified by Captain Mo as *E. oleracea*, but Andrew was not sure since there were some visual differences including overall height. He thought they could be either hybrids or *E. catinga*. We wondered whether the unique environment circumstances of the Enchanted Lake might have caused dwarfism in this population of *E. oleracea* (Fig 4). Since the floating islands are actually floating during the rainy season and grounded during the dry season, this population of palms is exhibiting the traits necessary to survive the seasonal transformation. Standard *E. oleracea* that reaches heights exceeding 9 m (30 feet) would likely fall over without being firmly rooted during the rainy season. Further research should be considered on this unique locality of *Euterpe* palms.

Geonoma laxiflora: A small attractive understory palm with simple undivided leaves that emerge red (Fig. 5), *G. laxiflora* is a rare palm in the area, we located only one small colony growing in shade.

Oenocarpus mapora: The most distinctive trait of this palm was the large bright red inflorescence that hung from the crownshaft like a horse's tail, hence the local name "Horse Tail Palm." These palms were very prevalent within the villages, as the palms are farmed for their fruits, which are used to make a nutritious tea. Although often found growing in villages on cleared land, some specimens were observed growing naturally under full canopy, causing the petioles and leaflets to elongate. These shade-grown plants looked almost like a completely separate species.

After completing our time on the Amazon River the party headed back into the Rio Negro, and began the second leg of our expedition. The party spent the rest of the trip exploring

5. *Geonoma laxiflora*, showing a reddish new leaf.

6 (top). *Astrocaryum gynacanthum*. 7 (bottom). An unidentified *Attalea* species.

the rain forests along the Rio Negro, or "Black River."

The rain forest along the Rio Negro is similar to the rain forest of the Amazon River. There are fewer villages and less cleared land, but we still came across mostly secondary forest. The shoreline turned from muddy banks to mineral sand beaches. At one point we reached a vast area of primary forest. The area of primary forest had trees so massive it is hard for us to give an adequate feeling for their size. The understory forest is very dense and similar to the Amazon River forests. We found almost all of the palms along the Rio Negro in heavily shaded understory forests. The elevation was slightly higher, with short hills making some areas high enough to avoid seasonal flooding.

During one expedition we explored the "Amazon Desert," as Captain Mo called it, or an area of the Amazon that does not flood. The landscape began to change as we hiked away from the river, where thick forest transformed into a drier more open area with smaller trees, brush and a wide variety of aroids, orchids, bromeliads, philodendrons, cyclanths and vines.

8. *Bactris hirta* inhabited dry sites.

During our five days exploring the rain forest of the Rio Negro we found 40 different palm species and variations, including 33 species we did not observe along the Amazon River. Below is a list of all the palms we identified and any important local information we learned about them.

Astrocaryum acaule: We found only a few of these on our expeditions growing in open understory forests. We were lucky to find fruit clusters laden with creamy yellow fruits.

Astrocaryum gynacanthum: This is a medium-sized, solitary, armed palm with attractive, pinnate leaves (Fig. 6). Large, expansive colonies occurred throughout the forests along the Rio Negro. Mature specimens were often found with in fruit. Andrew explained that the brown fruits pop open after ripening, exposing a bright orange pulp that attracts birds, which disperse the seeds. We also found an odd variation of *A. gynacanthum* with an undivided leaf.

Attalea sp./*Syagrus* sp.: During our hike through the "Brazilian Desert," we found a small trunkless palm with attractive pinnate leaves and bright orange fruits (Fig. 7). Andrew was unsure to what genus the palm belonged. At first he hypothesized an undescribed species of *Syagrus* and then *Attalea microcarpa*. We never did find the exact identity of the palm, but we found large colonies of them growing throughout the open scrub forests.

We also found *Attalea maripa* and other colonies of palms that we positively identified as *A. microcarpa*.

Bactirs hirta: This is a short, heavily armed understory palm that we often found growing away from the river banks on drier land (Fig. 8). Very narrow pinnate leaves and birdshot-sized, bright red fruits made this palm easy to identify.

We also found *Bactris acanthocarpa*, *B. macroacantha*, *B. oligocarpa*, *B. schultesii*, B. *simplicifrons* and *B. tomentosa*. *Desmoncus orthacanthos*, which is closely related to *Bactris* but is a climber, was also present.

Euterpe catinga: This is a medium-sized, solitary palm, similar in appearance to other members in the genus. We come across this palm at a few locations in thick, swampy, understory forests. A bright orange crownshaft makes for easy identification, standing out from the dark greens and browns of the forest (Fig 9).

9 (top). *Euterpe catinga* has a bright orange crownshaft. 10 (bottom). Dr. Henderson shows off *Geonoma deversa* and its colorful new leaf.

Geonoma aspidiifolia: Although we came across this species on only one hike, it was visually impressive, dominating the open understory forest, giving the landscape color, with its bright red or pink, emerging leaves.

Geonoma deversa: Large colonies were located on hikes, dominating the landscape with high numbers of stems, easily spotted by the newly emerged red or pink leaves (Fig. 10).

Geonoma maxima: Throughout the rain forest of the Rio Negro, we observed several different variations of *G. maxima*. A wildly variable palm, *G. maxima* can range from solitary to clumping, pinnate to simple leaves and tall or

11. A juvenile *Iriartella setigera*.

short. We also found *Geonoma leptospadix*, *G. macrostachys* and *G. stricta*.

Hyospathe elegans: This small, understory palm looks like a *Geonoma* but is unrelated.

Iriatella setigera: This is a medium-sized, stilt root palm with large fishtail-shaped leaflets which clusters sparsely via subterranean offshoots, similar to members of the genus *Rhapis*. We often found small, bright orange fruits developing in small clusters. During our hikes throughout hilly understory forests, we saw high numbers of *I. setigera* but never in close proximity to one another (Fig. 11).

Leopoldinia major: This is a very rare palm due to its limited habitat. *The Dorhina* traveled a

12. *Leopoldinia major* grew at the river's edge.

13. *Leopoldinia pulchra* growing on a sandy river bank.

full day and night to reach its locality. We spotted the first clump of *Leopoldinia major* growing right out of the river, with most of the trunks completely under water (Fig 12). We found large stands of *Leopoldinia major* growing along the river, reaching heights over 7 m (25 ft.). We traveled a mile or so along the river bank viewing vast clumps of *Leopoldinia major* before their population abruptly ended.

Leopoldinia pulchra: An unusual solitary palm with slender pinnate leaflets and a heavy layer of thatch covering the trunk, *L. pulchra* is usually found growing along the river banks, quite often with their trunks submerged under water (Fig. 13). We observed them growing in a wide range of sizes, from seedlings to mature palms with a full complement of oval, red fruits. After cleaning some fruits we found the odd endocarps, resembling a peach pits, covered with small ridges that help catch air to float the seeds down river. A large stand of *Leopoldinia pulchra* was found growing under heavy canopy, causing elongation of the petioles and a much different appearance.

Manicaria saccifera: This rare and unique palm was growing in one locality along a small feeder canal to the Rio Negro in a swampy, almost flooded understory forest. It had a thick trunk and large upright undivided leaves (Fig. 14). They appear unkempt because leaf litter accumulates in their crowns.

Mauritia carana: A rare and large solitary palm similar in appearance to *M. flexosa*, *M. carana* keeps only 5–7 large fan leaves in its crown, unlike *M. flexosa* which may have 20 leaves on its crown. The most unusual and distinctive aspect of this palm was a thick layer of fibers that covered the trunk and crown, much like *Coccothrinax crinita*. A hard-to-find palm, it was seen in only two areas.

Mauritia flexuosa: A truly massive palm often observed growing near or in the river, this is by far our favorite palm on the trip. The most memorable specimens were two colossal palms growing next to each other by the entrance of a small village. Both male and female inflorescence could be seen on the adjacent palms. Brownish red, scaly fruits the size of a small apple were developing on the female palm.

Maurittiela armata: Large, bluish green fan leaves made this palm easy to identify. It was often found growing in cleared areas, along the river banks and emerging through the canopy of secondary forests (Fig 15). Large-scaled, reddish brown fruits were often found on the forest floor.

14 (left). *Manicaria saccifera*. 15 (right). *Mauritiella armata*.

We saw two species of *Oenocarpus*, *O. bacaba* (Front Cover) and *O. batua*.

Socratea exorrhiza: Though not in high numbers, *S. exorrhiza* is not uncommon in thick understory forests. Many seemed in a race to break through the canopy, including a 9–12-m (30–40-foot) giant that fell over and began to right itself, growing back towards the sun.

On day 10 the party awoke in Manaus after traveling through the night. It was time to pack up and take off to our next location around the world. Some party members traveled back home and others onto Rio de Janeiro for the Biennial.

All in all, it was an amazing experience. I would highly recommend it to anyone who has a sense of adventure and an appreciation for nature.

Palms of the Lower Madidi River in Northern Bolivia

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The Madidi River in Bolivia has its origins high in the Andes but quickly flows down into the Amazon basin, where it is bordered by lowland rain forest and large savannas. Here I provide an overview of the palm flora from an isolated and poorly collected region of Bolivia.

Madidi National Park, perched in the cloudy northwestern Bolivian Andes, is well known for its remarkable wildlife and flora. The park is also home to a newly described Titi monkey (Wallace et al. 2006), the scientific name of which (*Callicebus aureipalatii*) was auctioned for $650,000 and the proceeds used for the conservation of the park. The white water of the Madidi River begins its journey in the park. After rushing down the Andes, the river enters the Amazon basin where it starts to meander for over 250 km, its curly course dynamically shaped by the continuous carving and sedimentation in the soft channels. The Madidi River finally fuses with the larger Beni River, the waters of which will eventually reach the Atlantic Ocean, some 1500 km away.

Although Madidi National Park has been the focus of numerous botanical and zoological explorations, the fauna and flora of the rain forest and savanna bordering the river in the lowland Amazon is poorly known (Fig. 1). In an effort to characterize the fauna and flora of the lower Madidi and develop justifications for a new conservation unit in the area, the Wildlife Conservation (WCS) Society of New York (WCS) and the New York Botanical Garden have undertaken several trips to different parts of the river. I participated in an expedition in October 2009. The collections made during this trip represent the first specimens from that area.

We flew from La Paz to Rurrenabaque in a small 19-passenger plane. Rurre (as it is known in Bolivia) is a small village at the crossroads between the Andes and the Amazon basin (Fig. 1). From there we drove to Ixiamas, the last village on the map, where we met up with WCS personnel, notably WCS zoologist and expedition leader Guido Ayala, and local guides. Also on the trip was Freddy Zentero-Ruiz, or Zen for short, a botanist from the National Herbarium of Bolivia, and Milenuisz Spanowicz, a professional wildlife photographer. The expedition, now some twelve men and one woman strong, departed on a sunny afternoon for the Madidi River along a newly opened logging road. As the weather

1. Map showing the different Camps sites along the Madidi River and the road to get there.

was dry, the road was in good condition but very dusty, and we reached the Madidi River after 4 hours. We then boarded a motorized boat called a *peque peque* and navigated down the river for a few hours to the first camp. The plan for this expedition was to have one permanent camp and four mobile camps where members of the team would spend a week at a time. I was to accompany the expedition for the first three mobile camps (Fig. 1). The camps were built from scratch along the river and were surrounded by nice tropical rain forest. The river is quite spectacular, especially during sunsets and sunrises.

During the day I would go out collecting plants with my guide Roberto. He is the best guide I ever had and deserves a few words of recognition. He was hard-working, pro-active (a rare quality for a guide, at least in my experience) and most importantly an excellent tree climber. There wasn't one tree in the forest he couldn't climb with his bare hands. He was also the boat pilot and owner, and he showed masterful skills while steering the boat up and down the Madidi River, be it in the pitch dark of the night, under the blazing sun of mid-day, or under pounding rain. This, together with the overall excellent weather, made my trip very pleasant and successful.

Palms in this region are not very diverse in numbers of species (Table 1), but they are a very conspicuous element in the forest, as was shown in a previous study done lower down the river (Zentero-Ruiz 2009). Besides my general collecting, I collected a total of 19 palm species in 12 genera during 23 days of field work. *Bactris* was the genus most strongly

represented, with six species (Table 1). The small and spiny caespitose *Bactris concinna* was the most dominant palm in the understory (Fig. 2). It does not occur in dense populations but rather was uniformly spread out across the forest. Most of the individuals I saw were sterile at that time, but at Camp 3 (Fig. 1) individuals were generally at the end of the fruiting period. I was lucky to find one individual in flower. The pale yellow spicate inflorescence was full of small red-and-black beetles and weevils covered in pollen. Also, hidden between the peduncular bract and the inflorescence was a huge hairy-legged weevil in the genus *Odontoderes*. Less common was *Bactris chaveziae*, a small, short-stemmed palm with sigmoid pinnae and black and white spines (Fig. 3). I saw this palm a few times, but it was never locally abundant. Even less common is *Bactris major*, a mid-sized palm vaguely resembling *B. concinna* but taller and with branching inflorescences.

Several times we stumbled upon large populations of *Geonoma deversa* known locally as *jatata*. The bifid leaves of this small palm are widely used in the region for thatching. This makes very attractive roofs. These *jatata* populations contain around 50 individuals, which completely dominate the understory.

Four arborescent palm species were common in the forest: *Astrocaryum ulei* (a tall solitary palm), *Attalea phalerata*, *Euterpe precatoria* and the stilt-rooted *Socratea exorrhiza*. The orange sweet-smelling fruits of *Astrocaryum ulei* are generally eaten by squirrels and tapirs. In one particular spot, we came across a small population of the spectacular palm *Oneocarpus bataua* with its large horsetail-like inflorescence. In that same spot but less frequent, we also saw another species of that genus: *Oenocarpus mapora*. This latter is smaller and slender with smaller inflorescences.

At all camps we were just a few kilometers away from the *pampas*. These are large, naturally-occurring savannas that are inundated for part of the year. These extensive stretches of low vegetation provide a welcome breath of fresh air when stumbling out of the stuffy understory of the jungle. Some parts of the pampas are dominated by the Palma Real (the royal palm, *Mauritia flexuosa,* Fig. 4). This species is widely distributed in the Amazon basin (Henderson 1995), growing in marshes and other waterlogged regions. As we were at the end of the dry season, the ground was dry, which allowed me to walk easily around the population. These majestic palms are vitally important for several macaw and mammal species, providing food as well as shelter from the blazing sun. Several macaw species nest in the old hollow trunks of the palm (Fig. 4). At one point we came too near to a nest and a couple of yellow-and-blue macaws flew over our heads squawking loudly. They circled a few times, sometimes so close we had to duck. After an intimidating display, they flew away still squawking as if proud of their actions. It is funny how such a lovely bird can make such a terrible sound! The palms generally grow in small clumps of 2–5 individuals. Each clump also harbors several other plants, such as *Heliconia* and *Costus* species. Less conspicuous was *Mauritiella armata* (Fig. 4), the sister genus to *Mauritia*, also growing in small clumps scattered across the pampas. Another common palm of the pampas is *Acrocomia aculeta*. Although I didn't see it in the pampas near the Madidi river, I did spot it near Ixiamas, some 60 km from the river.

The transition forests leading from the rain forest into the pampas contained several interesting palm species. *Phytelephas*

Table 1. Species collected during the trip and deposited at the New York Botanical garden (NY) and Herbario Nacional de Bolivia (LPB).

Acrocomia aculeata (Jacq.) Lodd. ex Mart.
Allagoptera leucocalyx (Drude) Kuntze
Astrocaryum ulei Burret
Astrocaryum huaimi C. Mart.
Attalea phalerata Mart. ex Spreng.
Bactris chaveziae A.J. Hend.
Bactris concinna Mart.
Bactris gasipaes var. *chichuagui* (H. Karst.) A.J. Hend.
Bactris glaucescens Drude
Bactris major Jacq.
Bactris riparia Mart.
Desmoncus mitis Mart.
Euterpe precatoria Mart.
Geonoma deversa (Poit.) Kunth
Mauritia flexuosa L.
Mauritiella armata (Mart.) Burret
Oenocarpus bataua Mart.
Oenocarpus mapora H. Karst.
Socratea exorrhiza (Mart.) H. Wendl.

2. *Bactris concinna*. Top left: whole individual. Top right: detail of inflorescence. Bottom left: detail of the large pollination weevil from the genus *Odontoderes*. Bottom right: detail of fruits.

3. *Bactris chaveziae*. Top: habitat. Bottom: detail of young fruits.

macrocarpa, the vegetable ivory (or *marfil* in Spanish, Fig. 5), was found growing in small numbers along the edge of the forest. The solidified endosperm is used in Bolivia, as across South America, to make crafts. Roberto was quick to harvest a few kilos of the hard-to-find seed that he painfully carried back to the boat. In that same area, we came across a small population of wild Peach Palms, *Bactris gasipaes* var. *chichagui* (Fig. 6). I didn't recognize this species immediately mainly because of its impressive height, growing up to 25 m, much taller and more robust than those I had seen in North Western Ecuador (Couvreur et al. 2006). We decided to sample one individual, and Roberto started cutting the palm at its base. The trunk was so hard that Roberto's machete ended up all twisted and deformed. I was a bit embarrassed as the machetes are the most important tool for the guides. The hard, white-spotted black "wood" of *Bactris gasipaes* (wild or domesticated) is often used for crafts

4. *Mauritia flexuosa* (top) and *Mauritiella armata* (bottom) in the pampas.

and building throughout the Amazon basin. Several individuals lacked spines on their trunks, an unusual morphology for wild individuals. Clumps usually contained three to four stems; however some single stems were also seen in agreement with other observations in Brazil for example (da Silva and Clement 2005). When we examined the inflorescences we noticed that an opening 3 cm in diameter was made in the peduncle covering the inflorescences. The soft young rachillae were all eaten. Apparently, this was the case for all individuals seen as we never saw any opened inflorescences or fruits. It is unclear what animal could have done this because the peduncles are always heavily protected by

densely packed spines. Because of the lack of fruits or flowers it was impossible to classify this population into one of the three groups recognized by Henderson (2000) based of fruit size and shape. I also encountered another close relative to the Peach Palm, *Bactris riparia*. This palm generally grows in waterlogged regions near rivers in the Amazon Basin. This population was located near a small tributary of the Madidi river called Inbarbura. Once again, because we were at the end of the dry season, making collections was fairly easy, if you don't count the spines. This collection extends the known distribution of *B. riparia* in Bolivia significantly into the southwest (Moraes 2004). Finally, at the very edge of the savanna we collected *Astrocaryum huaimi*, a mid-sized cespitose palm (Fig. 7), as well as *Desmoncus mitis* and *Allagoptera leucocalyx*.

Even though the forests and savannas bordering the Madidi River are remote, evidence of human presence was seen during the whole trip. All of our camps were built on old logging campsites. Trails in the forest were still visible as well as old logs of precious timber species like mahogany. In spite of this, the wildlife was fantastic. We saw snakes big and small (but all non-venomous), caymans, macaws, toucans, spider and howler monkeys, the new Titi monkey species, peccaries (wild pigs), a giant anteater, giant otters, agoutis and capybaras, most of these from really close up. This, together with its diverse flora, makes these forests and savannas particularly important for biodiversity conservation yet very vulnerable without further protection.

In total we spent over three weeks collecting plants. On the 6th of November it was time to go home, but the Madidi is a tough place to leave. On the day of our departure it started to rain. We spent the whole day on the boat under a blue tarp, leaving at 6 a.m. and reaching the road at 11 p.m. Because these were the first true rains in a few weeks, the river was very low and dead trees and branches were sticking up everywhere increasing our chances of capsizing. But Roberto maneuvered the boat very skillfully and safely. The next morning we departed for Ixiamas, but the rain had already taken its toll on the road and after a few minutes we got stuck in the mud. It took five men and two hours to push the car out of the ditch. The rest of the day was spent in a similar manner: pushing the car out of the mud. Several times I thought to myself that we would be stuck for days. It took us 12 hours to do 80km that day. We arrived to Ixiamas covered in mud and dead tired, but relieved actually to have made it! The next day we returned to Rurrenabaque. Unfortunately, it

5. *Phytelephas macrocarpa* (foreground) and *Attalea phalerata* (background) in the transition forest near the pampas.

6. *Bactris gasipaes* var. *chichagui* in transition forest near pampas.

7. *Astrocaruym huaimi*. Top: habitat. Bottom: details of fruits.

was raining there too, and the flights to La Paz had been cancelled for five straight days (the dirt runway became a mud bath too…). So we rented a car and set off along the most dangerous road in the country. During the 15-hour drive we had two flat tires and arrived in La Paz at 2 a.m., four days after leaving camp.

Acknowledgments

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Coccothrinax barbadensis, New for Montserrat

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***Coccothrinax barbadensis* is recorded for the first time on Montserrat.**

Coccothrinax barbabensis naturally occurs on Trinidad and Tobago and several islands in the Lesser Antilles: Saba, Barbuda, Antigua, Guadeloupe, Marie Galante, Dominica, Martinique, St. Lucia and Barbados (Comeau et al. 2003) and also occurs in Puerto Rico, the Virgin Islands and Venezuela (Margarita Island) according to Henderson et al. (1995). Its leaves have been widely used to make brooms and to thatch houses, but over-collecting on some islands has greatly reduced this species' ability to maintain reproductively successful populations.

Details of the new record for Montserrat are as follows:

Coccothrinax barbadensis

Montserrat: Leeward Islands: Trants Estate: rocky hillside just west of the former W.H. Bramble Airport area, ca. 140 m. 16°45'17.9"N, 62°09'49"W. Coastal dry scrub forest. Growing on a very rocky slope, with thorny shrubs. 15 Jul 2010, *Larry Noblick 5561* (FTG, Herbarium at the Montserrat National Trust). Collected with Philemon Mappie Murrain (MNT) and Glenford James (Department of the Environment).

The palm is confined to a relatively small area with ca. 20 individuals and some seedlings. Virtually no seed was found at this time of the year. Palms grow in older decomposed volcanic soils, but new volcanic ash is apparent on the ground in this area, which has recently experienced several pyroclastic events including the most recent eruption of February, 2010. I was informed that this is the largest population of this species on the island with only a few on the northern shore. That makes this the most endangered native palm species on Montserrat. It is found only on the steep rocky slope adjacent to the pyroclastic and mud flows (Figs. 1 & 2).

This is the first record of *Coccothrinax barbadensis* for the island of Montserrat. The palm was discovered by Philemon Mappie Murrain of the Montserrat National Trust, who often explored the eastern slopes of Montserrat as a young man by hunting the neighbors' goats with his dogs and returning them to their owners. Finding *C. barbadensis* on Montserrat is not unexpected. According to Henderson's map (1995), it is well within the expected range. Nevertheless, this is the first recorded collection on Montserrat. *Syagrus amara* and *Prestoea acuminata* var. *montana* are the only other native palms on that island, which is still volcanically active. Luckily this population appears to lie just high enough on the slope to keep it out of harm's way from the heat and ash from pyroclastic flows.

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1 (top). Steep rocky slope with *Coccothrinax barbadensis* and pyroclastic flow covering the former W.H. Bramble International Airport on Montserrat. 2 (bottom). Crown of a *Coccothrinax barbadensis* with pyroclastic debris field below near Trants Estate, Montserrat.

Validation of the Name *Butia odorata*

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***Butia odorata* has had a convoluted journey to becoming a valid name.**

Butia odorata (Barb. Rodr.) Noblick, **comb. nov.**

Basionym: *Cocos odorata* Barb. Rodr., Pl. Jard. Rio de Janeiro 1: 11, t. 4a, 5c. 1891.

The true *Butia capitata* was first described and named by Martius as *Cocos capitata* in 1826. It was discovered in the state of Minas Gerais by Martius near the town of Montes Claros and is a *cerrado*-loving palm endemic to the central *planalto* region of Brazil. It is a very different palm from the more robust coastal plane or *restinga*-loving "*Butia capitata*" of Uruguay (Fig. 1) and Rio Grande do Sul, Brazil. Barbosa Rodrigues (1891, 1903) described and named the southern one as *Cocos odorata* and wrote that it inhabited fields in Rio Grande do Sul and on the Isla de los Padres near the Rio Cebollatí [Lagoa Mirim], Uruguay. Beccari (1916) half-heartedly accepted Barbosa Rodrigues' name when he created *Butia capitata* var. *odorata* (Barb. Rodr.) Becc. Glassman (1979) synonymized both of these names under *Butia capitata* expressing a need for further study. Henderson (1999), reiterating my own view, wrote that "They [the southern population] should perhaps be recognized as a separate species, in which case *Butia odorata* would be the correct name (Larry Noblick, pers. comm.)." Since then, others have supported, but failed to transfer *Cocos odorata* to *Butia odorata*. In his PhD thesis, Marcato (2004) created the name *Butia odorata* (Barb.Rodr.) Noblick ex Marcato, but he never published his thesis nor the name. Lorenzi et al. (2004) published the name *Butia odorata* (Barb.Rodr.) Noblick & Pirani, but it lacked a proper basionym reference, and the transfer failed. Finally, Lorenzi et al. (2010) published *Butia odorata* Noblick & Lorenzi, but it had an erroneous basionym reference that rendered the name illegitimate. Therefore, let the above transfer be considered the final, legal and official transfer of *Cocos odorata* Barb. Rodr. to *Butia*, with its correct basionym reference.

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1. The robust *Butia odorata* growing near Rocha close to Castillos, Uruguay.

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Raymond F. Baker (1945–2010)

It is with great sadness that we report the loss of Raymond F. Baker, who died on 29 November 2010 of respiratory failure after a five-year battle with pulmonary fibrosis. He dedicated 38 years of his life to the Harold L. Lyon Arboretum and is chiefly responsible for creating its world-class palm collection of more than 800 species. Ray was driven to increase the diversity of plants at the Lyon and was passionate about making it accessible to the community.

Ray was born in September 1945 in Passaic, New Jersey. He graduated from the University of Michigan with a BS in Geology after which he enlisted in the US Marine Corps, eventually becoming a Captain. After returning from service in Vietnam, he was based in Kane'ohe, Hawai'i, for two years. It was there that his interest in plants blossomed. After six years in the Marines he resigned his commission and entered graduate school at the University of Hawai'i at Manoa. He took a job as a helper at Lyon Arboretum, the only university botanical garden located in a tropical rainforest in the United States, and quickly became deeply enamored with it. Because Ray wanted a full-time position at the Arboretum so badly, he prolonged his graduate studies for seven years until there was a job opening.

Seated in 194 acres of wet tropical rainforest spread over challenging terrain with an average rainfall of 4190 mm (165 inches), Lyon Arboretum is a unique and exacting place in which to work. Working in the forest is far from glamorous or leisurely. Ray took the rugged terrain, voracious mosquitoes and frequent rainfall all in his stride. Though the weeds at Lyon are truly a force to be reckoned with, Ray never gave up against the constant and overwhelming onslaught. During much of his tenure there he worked ten-hour days, seven days a week. He inspired Arboretum staff and colleagues by his constant, steadfast nature. No matter how bad he may have felt on any one day, one would never have known from his attitude. He seemed to see the good side of all things, especially in the face of unexpected setbacks.

1. Ray Baker at the base of his favorite *Ficus variegata*.

Ray came to memorize the exact location and even the accession number of each plant in the Arboretum, thus becoming intimately acquainted with over 5000 species. He studied their morphology and phenology, sharing his findings with researchers around the world. He was fascinated by botanical diversity and was unceasingly curious to learn new things about plants. Ray was an invaluable resource to researchers, making himself available to accompany visiting scientists and was very generous with material and data. He had a talent for facilitating the movement of information and strengthening the ties among botanists, horticulturists and members of the community at large. Ray also designed much of the network of trails and pathways to make the collections more accessible to visitors, and chose the location of each new plant with an artist's eye.

One of Ray's great loves was palms. His goal was to have all the palm taxa represented, and today the Arboretum holds approximately 167 genera and 801 species. He personally collected 34 different accessions of palms from the wild, from Costa Rica, Ecuador and Venezuela, and worked with Bob Hirano to bring in many more. Ray cultivated relationships of trust and reciprocity with commercial palm growers and seed collectors such Jeff Marcus, Rolf Kyburz and De Armand Hull, resulting in the addition of over 700 accessions to the Arboretum. With Ray as the driving force, Lyon Arboretum staff became heavily involved in the IPS Seed Bank in the early 1990s. Thousands of seeds were collected from Lyon's mature fruiting trees, cleaned, and shipped around the world. As fruit of this participation 133 more palm accessions were integrated into the garden. In 2009, Don Hodel named *Pritchardia bakeri*, a species from the Ko'olau Mountains on O'ahu, to honor Ray.

Ray served on the Boards of both the International Palm Society and Heliconia Society International (HSI). He was a founding member of HSI in 1985 and worked to make the Arboretum a major repository in Hawai'i for most of the world's species from this group (the Zingiberales). His intensive work with this group helped him become and international expert on Zingiberales. He also worked closely with other botanists to care for and study the many accessions of rare and endangered gingers brought to the Arboretum.

Education was very important to Ray. He was always willing to reach out to individuals and help them identify palms. He began teaching classes on palms, gingers, heliconias, aroids, and Ficus at Lyon as early as 1982 and continued doing so until 2010. He also led many upper-Arboretum hikes for visitors. He organized the activities for volunteers and community groups at Lyon and spent weekends working with them to chip away at the herbaceous and woody weeds. His knowledge and supervision was essential when it came to making sure that less knowledgeable volunteers did not unwittingly pull up or chop down rare plants.

Ray's deteriorating health forced him to retire in September 2010. That same month it was announced that he had taken the extraordinary decision to create a fund to support the grounds and living collections of the Arboretum with a gift of $50,000 to start. Ray leaves an incredible legacy in what he cultivated and in the countless lives that he has inspired through his work, but with this generous endowment his dedication to the collections is immortalized. It is hard to imagine how a person like Ray could have been any more dedicated to and deeply invested in a cause. Ray's ashes were deposited at the buttressed base of his favorite *Ficus variegata* at the arboretum. In the words of his wife Joyce, "His spirit lives on in all the plantings, all the rocks and streams, in the very air of his beloved Arboretum." We will miss you, Ray.

Contributions to the Ray Baker Fund at Lyon Arboretum can be made in two ways. Funds for immediate needs can be made at: www.uhfoundation.org/RayBaker. Funds in support of the permanent endowment can be made at: www.uhfoundation.org/RayBaker Endowed. For further information, please contact Emily Fay at the University of Hawai'i Foundation (808) 956-5665 or e-mail emily.fay@uhfoundation.org.

The author thanks Joyce Baker, Liz Huppman, Karen Shigematsu, David Orr, David Lorence and John Mood for their help in composing this obituary.

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