Celebrating 50 Years of Palms

Palms

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THE INTERNATIONAL PALM SOCIETY, INC.

The International Palm Society

Founder: Dent Smith

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FRONT COVER

Attalea cohune and *Sabal palmetto* in the garden of the late Dent Smith. See article by Ed Brown, page 27. Photo by Ed Brown.

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NEWS FROM THE WORLD OF PALMS

This year marks the 50th year of the publication of our journal, and this is the first part of Volume 50. The journal, at first Principes and now PALMS has grown, in 50 years from one of appeal to a largely Floridian membership to one that represents a truly international membership. As we look back over the 49 volumes we cannot but be amazed at the cornucopia of palm information that has been published. Early on in the history of the Society, our journal represented the only medium dedicated to the dissemination of palm information. Principes was very much a window on the world of palms. Early numbers of Principes carried a variety of articles ranging from taxonomic monographs to garden visits, but many of those older issues are rare or unavailable to many modern readers. Recently, the IPS Board approved a project to scan the back issues of Principes/PALMS, so that every issue and every article will be available as a PDF file. That work is now largely complete, and the Board's website committee is considering how to make these PDF files available to our membership and others. The information found in the back issues represents fifty years of investment in palm horticulture, education and research by the IPS. It continues to be of lasting value, and we often find ourselves pulling old volumes of Principes off the shelf for consultation. With back issues in electronic format, we hope to make those early articles available to an even wider audience.

During this 50th anniversary year, we shall have at least one article in every issue of PALMS looking back on the early years of the IPS, the persons and places associated with its early history and the impact of the IPS on palm horticulture, research, education and conservation. In this issue, IPS member Ed Brown takes a look at the garden of the late Dent Smith, the Society's founder. Thanks to the gracious hospitality of Mrs. Doris Smith, Ed was able to photograph Dent's palms that, like the Society, have grown to fruition.

Last November, the City of Sanremo was host to Dies Palmarum, the 4th European Palm Biennial. The theme of symposium, organized by IPS member Claudio Littardi, was "Palms of the genus *Phoenix*," and attendees heard over 25 presentations from an international slate of speakers. Simultaneous translation into four languages ensured that the audience was as international as the speakers. The topics ranged from anthropology and history to horticulture and conservation to religion and bio-mechanics. At the venue for the presentations, the elegant Villa Ormond, attendees enjoyed exhibits and posters about palms in art and culture, as well as a marvelous display of religious artifacts from Sardinia made entirely from *Phoenix dactylifera* leaves. These "palmorello" were intricately woven pieces of folk art, replete with Christian symbolism. Don Ignazio Orrù and Maria Nerina Dore demonstrated how a piece is made by hand from a single young palm leaf. The Comune di Sanremo and the Centro Studi e Ricerche per le Palme also awarded four more persons its highest honor for service to the palm world, the Cavalieri delle Palme. This year's recipients were Francesco Maria Raimondo, president of the Faculty of Science of the University of Palermo, Barnabé Moya Sanchez and José Plumed, co-authors (with Claudio Littardi) of *La Potatura delle Palme Ornamentale* and PALMS co-editor Scott Zona. Thanks to the efforts of Claudio and his staff, the European Palm Biennial is becoming one of the most enjoyable and eagerly anticipated conferences in the palm world.

THE EDITORS

GROWING PALMS

Horticultural and practical advice for the enthusiast

Edited by Randy Moore

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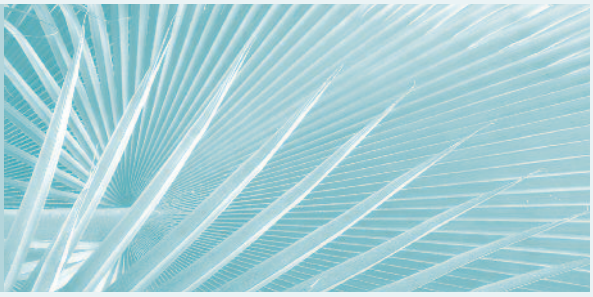

Cryosophila: a True Survivor

The dry deciduous forests in the Pacific coastal areas around Puerto Vallarta in central Mexico are the habitat of *Cryosophila nana*. It thrives on the slopes and the canyons in both shade and full sun. In these forests are also found *Chamaedorea potchutlensis* and the cycads *Dioon tomasellii* and *Zamia paucijuga*. Entire hillsides of the massive *Attalea cohune* hug the coast.

While some of this area is now protected from clearing, large amounts of the forest have been cut for housing and farming. A few of these farms grow *Agave* for the purpose of making tequila. Most of the large tequila farms are located many miles inland in high elevation volcanic valleys. However, several small-scale tequila farms have been carved out of the coastal forest to cater to bus tours that arrive from the major tourist hotels in nearby Puerto Vallarta.

1. Within an *Agave* farm, remnants stumps of *Cryosophila nana* regenerate. They had previously been cleared to the ground by machete.

Regeneration from Stumps

At one of these coastal tequila farms, in a cleared area that was once abundant with *C. nana*, is a demonstration of how this palm is a true survivor. The palm springs to back life from its cuttings and remnant stumps (Fig. 1). I know of no other palm that can be propagated through the rooting of its stem cuttings. It appears that any other palm species propagated by cuttings must first be air layered. The new growth will emerge from the center of the cut stem in mostly dry and fully exposed conditions. Odd palms can protrude from the stumps. Usually, a much smaller head emerges from the stump, giving the appearance of a spindle palm (Fig. 2). In unusual cases, a palm with multiple heads can also occur (Fig. 3).


2. Regrowth from the remnant stem following the cutting of a mature *Cryosophila nana*.

Rooting of Cuttings

One of the distinguishing features of the genus *Cryosophila* are the spines which cover the stem. The sharp spines are a result of roots that grow from the stem. When a cut stem is planted, the vertically erect spines on the stem will reverse direction and root into the soil. Robert Price, the Curator of The Botanical Gardens of Vallarta located 15 km south of Puerto Vallarta, has been rooting cuttings of *C. nana*. A demonstration bed containing about 50 cuttings is maintained at the garden (Fig. 4). The display demonstrates that cuttings can and should be rescued from land clearing operations.


3. An unusual five-headed *Cryosophila nana* is the result of the palm's stem being cut.


4. A bed of *Cryosophila nana* stems being rooted at The Botanical Gardens of Vallarta.

Rooting of Discarded Stems

During the clearing operations, many of the *C. nana* stems cut by machete are left lying on the ground or are piled in rubbish heaps. Amazingly, this gives the palm a third opportunity to regenerate. Apparently, the cut stem does not desiccate rapidly and can remain viable for many weeks. The root-spines may eventually begin to take hold. Roots will form from the spines along the portion of the stem that is touching the ground. Although the cut stem is laid horizontally on the ground, the newly emergent growth will bend vertically. Growth will progressively right the palm.

It is surprising that *Cryosophila* palms are not more common in cultivation. They are an excellent landscape plant for many subtropical areas. The palm appears to be highly adaptable to many different soil types (from decomposed granite to clay), is reasonably cold and drought hardy. In many locations, it will grow in shade to full sun. The only drawback may be that it is somewhat slow growing even in a cultivated environment with steady moisture and fertilizer.

This plant is truly an amazing survivor unlike any other palm. – *Dr. Felix Montes, Puerto Vallarta, Mexico*

Growth Stimulants

Growth stimulants are the "black magic" of palm growing. They include hormones, vitamins, alcohols and acids. Horticultural trade publications and gardening magazines are filled with advertisements that make claims about different growth stimulants. The shelves of most horticultural supply stores also abound with these products. New growth stimulants are constantly being introduced into the market. Few of these have been tested scientifically on large quantities of palms under controlled conditions; however, many large-scale growers and hobbyists faithfully use them based on the simple observation that they appear to make palms grow more rapidly and vigorously. Three growth stimulants commonly used by palm growers are seaweed, alfalfa and SuperThrive™.

Seaweed

Many palm growers are advocates of seaweed as a growth stimulant. Seaweed can be rich in minerals, amino acids, trace elements and hormones that should promote vigorous growth. In addition, seaweed is claimed to contain over 60 recognized elements, essential vitamins, enzymes, alginates, natural antibiotics and carbohydrate compounds. Advocates will attest to observing improved root growth (as much as 30 percent more roots) and fuller, greener foliage.

There are several different types of seaweed products available. The products are derived from seaweeds that come from different coastlines mostly in Norway (*Ascophyllum nodosum*) and New Zealand (*Pterocladia lucida*). Because of different growing environments, the seaweed will vary in composition. In the absence of extensive testing, however, no one type of seaweed-based product appears to produce superior results over another.

Three of the seaweed-based products used by palm growers are: Maxicrop Seaweed (www.maxicrop.com) is available in liquid or powder form in regular and high concentrations, GrowMore Seaweed Extract (www.growmore.com) is sold in liquid form by most retail horticultural suppliers and Response Natural Seaweed Extract (www.agresponse.com) which can be ordered on-line. These products can be used either as a soil drench or a foliar feed. The dilution rate is usually one tablespoon per gallon (15 ml per 3.8 l).

Alfalfa

Alfalfa contains the alcohol ester compound triacontanol which is a known growth stimulant. It makes the uptake of nutrients more efficient. It may even improve cold tolerance. Using alfalfa, many growers report a noticeable increase in both growth and vigor of palms.

Many gardeners use alfalfa meal as an organic fertilizer and to attract earthworms. Used in this way, it contains approximately 3% nitrogen, 1% phosphorus and 2% potassium. The most economical way to purchase it is in 50 lb. (22.7 kg) bags at a cost of about US$12 from a livestock feed store. Some growers use alfalfa pellets instead of meal. The steaming process used to compress the alfalfa into pellet form (used commercially to feed rabbits) may remove some of its beneficial ingredients.

An alfalfa tea can be made by soaking alfalfa meal in water. There are many different formulations. A weak mixture can be made by soaking one cup (237 ml) of alfalfa meal in five gallons (19 l) of water. Place the meal in a sock. Allow it steep for two to three days in a covered container. The finished tea will have a highly offensive smell. It is applied as a drench using about one-half gallon (2 l) on smaller palms and a full gallon (3.8 l) on medium-sized palms.

Since alfalfa tea is a growth stimulant, it should be applied starting at the beginning of the growth cycle. The palm should be kept constantly moist following application. Apply every 6–8 weeks. If the concentration is too high or it is used too frequently, it can burn roots and kill tender juvenile palms. Be careful not to overuse since it could cause adverse effects.

SuperThrive

A growth stimulant that is commonly used by many hobbyist growers and some commercial growers is SuperThrive™ (www.superthrive.com). Most growers are familiar with its very strange label that makes incredible claims about its horticultural benefits. While many use it, few are convinced that it is effective. At least, there are no known controlled scientific studies that compare the results achieved on palms when SuperThrive is added to a regimen of standard culture and nutritional practices. The label does cite large-scale studies that confirm its benefits. In our findings none of these results has appeared in peer-reviewed journals.

After over 50 years on the market, the ingredients in SuperThrive are still unknown. The label reads “50 instant biousables™ normal pure complexes from carbon-hydrogen-oxygen natural organic crystals.” A statement on the label indicates it contains 0.09% Vitamin B-1 and 0.048% 1-naphthyl acetic acid. B-1 is generally regarded as ineffective as a growth stimulant. Naphthyl acetic acid is used for rooting stem cuttings, but the concentration in SuperThrive is too low to be of value. SuperThrive was to have been developed in the 1940s under a grant from the U.S. Army to increase corn production during the war. Some horticulturalists believe that its base chemical may be extracted from alfalfa through a process of fermentation. This process might yield the alcohol triacontanol (see discussion above).

The label also indicates that SuperThrive comes in a highly concentrated solution. If used regularly with each watering, the recommended dilution is one drop per gallon of water (3.8 l). A one pint (480 ml) bottle will make 8,000 gallons (30,283 l). It is used by palm growers most frequently when potting bare root juvenile palms and in transplanting. In those cases, the suggested dilution is one ounce in 20 gallons (29.6 ml in 75.8 l).

According to Irvin McDaniel of Fallbrook, CA USA, an expert in soil amendments and a palm/cycad grower, "A product like this will not provide for the total health of the plants. It's like living on supplements and not eating a well balanced diet with proper exercise and rest. Nothing will ever replace having soil that is healthy and biologically active with proper structure to maximize growth and vigor." Richard Streeper of El Cajon, CA USA, a widely-respected consulting horticulturalist and rosarian, states, "Countless 'miracle' products on the market owe their existence to good marketing rather than good product results. Often noticeably absent from these products is a statement of contents or any data from controlled tests. I have concentrated on feeding the soil for several decades and avoid or limit products that harm the animal life in the soil." – *Horace Hobbs, Houston, Texas USA*

Packing and Shipping Small Palms

Small palms are vulnerable to many hazards while they are being transported. The risks are especially acute when parcel delivery services are used and shipping costs must be economical. Changes in temperature and humidity, rough handling and box damage are some of the dangers.

Since 1987, Floribunda Palms (www.floribundapalms.com) has shipped thousands of small palms worldwide from its nursery location in Hawaii. Small palms are those sized from seedlings to one-gallon (3.79 l) containers. (Note: Larger palms require different shipping methods.) Described below are the eight steps used to prepare a shipment of small palms:

Step 1. Barerooting the Palm

The palm is first barerooted from its current container (Fig. 1). Palms beyond the seedling stage can be shipped with some growing medium on the roots. The medium must be certified as sterile and cleared for export. Laws regarding shipment with growing medium vary by destination. Any loose medium is shaken off the rootball. However, the roots are not washed clean. Palm seedlings have very little root system to hold the medium, so they are completely barerooted.

Step 2. Wrapping the Roots in Sphagnum Moss

1. A seedling palm is unpotted.

Sphagnum moss harvested in Chile and New Zealand is purchased in compressed bales. The moss is hydrated by soaking for several hours in water mixed with SuperThrive™ growth stimulant. SuperThrive can be used at a stronger dosage than indicated in the label directions. Once the moss is loose and moist, it is wrung out like a washcloth. The moss is damp and ready for use. The rootball is blanketed with a layer of the damp sphagnum moss.

Step 3. Blanketing the Rootball with Foil

A thick layer of sphagnum moss is placed across a piece of foil wrap (Fig. 2). Heavy, commercial grade aluminum foil wrap (not the type found in kitchens) is used so that it will not tear. The rootball is placed on the blanket of foil and moss. It is then rolled around the rootball in a tublar fashion. Masking tape is used to secure the edge. The result is an aluminum pot for transporting the palm (Fig. 3). In cases

where the palm is a seedling too small to wrap in this fashion, a zip-lock plastic bag is used instead of foil wrap.

2. The rootball is wrapped in moist sphagnum moss and covered with heavy-weight aluminum foil.

Step 4. Spraying the Leaves with Antitranspirant

After the palm has been "potted" for shipping, the leaves are sprayed with an antitranspirant. It is important to spray the leaves only and not the roots. There are many commercial products sold for this purpose. Wilt-Pruf® Plant Protector (www.wiltpruf.com), Anti-Stress 2000 (www. polymerag.com), Cloud Cover and Vapor Guard (no web sites) are some of the products used by palm growers. The antitranspirant spray is milky white and makes the palm sticky. The coating does not appear to negatively affect photosynthesis. It improves the ability of the palm to tolerate changes in humidity and temperature during the shipment process. The use of antitranspirants has significantly improved the success rate of shipping small palms.

3. The foil "pot" is secured with tape.

Step 5. Sleaving the Palm in Plastic Netting

The entire palm is sleeved in plastic netting (Figs. 4 & 5). Green netting is sold in tube form. The palm is inserted by the potted end. As the leaves are netted, they are carefully bundled. The netting is then cut to length and tied at both ends. Netting the palm protects the leaves and provides better "pack out."

Step 6. Boxing with Shredded Paper

The palms are boxed with shredded paper so that the contents do not shift during transport. Depending on the time of year, a layer of insulation is also added to protect against cold temperatures. A heavy-duty cardboard box is used that can hold up to 75–80 lb. (34–36 kg) and not exceed 36 inches (91 cm) in length. The weight and size limitations may require the use of more than one box. However, in my experience, larger boxes are more likely to be crushed or otherwise damaged during shipping.

Step 7. Shipping the Palm

Boxes are shipped using an express parcel delivery company. United Parcel Service and Federal Express are two companies that provide economical, two-day delivery service within the United States. Aside from import/export permit issues, shipping palms internationally can take longer and be more complicated depending on the final destination.

4. The palm is slipped into a net sleeve. The ends of the net sleeve are secured with knots.

5. Depending on size, more than one seedling can be accommodated in a single net sleeve.

Step 8. Unpacking and Rehydrating Before Potting

The palms should be rehydrated after unpacking. The root system is immersed in water for 15–30 minutes. It may be beneficial to add a seaweed concentrate to the water when rehydrating. There are many products suitable for this purpose. Roots 2® With Iron is used to promote root growth and improve metabolic processes. SuperThrive™ is also commonly used as an alternative to a seaweed solution. No rooting hormones are used.

A broad spectrum fungicide is also recommended prior to potting the barerooted palm. It controls *Phytophthora* and other dampening-off and stem rot diseases. There are many products from which to choose. A suggested product is Banrot® Fungicide (available through www.yardiac.com). It should be used only as a soil drench and not as a foliar spray.

It is not necessary to wash off the antitranspirant coating on the leaves. While the leaves will remain sticky for several weeks, the coating will eventually wear off.

Successfully shipping small palms using parcel delivery services is challenging. During the process, palms face many fatal hazards. The method of packaging and shipping of small palms described above has been developed by Floribunda Palms through much trial and error. Following this process should maximize the success of transporting small palms. – *Jeff and Suchin Marcus, Mountain View, Hawaii USA*

Rhapis vidalii, A New Papyrus-like Palm from Vietnam

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1. *Rhapis vidalii* in its typical natural habitat.

***Rhapis vidalii*, an undergrowth palm newly discovered in the central part of northern Vietnam, is described as a new species. It is endemic to Vietnam and displays several morphological characteristics unusual in the genus. In this article the authors describe this remarkable plant and give information on its habitat.**

The palm flora of Vietnam is rich and peculiar, but still far from being well known. This is particularly true for limestone areas of the north, which hold important centers of ancient geographically very restricted plant endemism. The recently described *Trachycarpus geminisectus* Spanner, Gibbons, V.D. Nguyen & T.P. Anh (Gibbons et al. 2003) is an example of such local endemism. Another unusual palm was discovered recently in the limestone lowlands in the center of northern Vietnam. It is described here as new to science.

Rhapis vidalii Aver., H. T. Nguyen & L. K. Phan, **sp. nov.**, habitu subherbaceo eleganti, inflorescentia pauciramosa pendula filiformi, nec non floribus pedicellatis pendulis componente incrassato lignificato, cui ex parte axis floralis inter calycem et corollam locata formatus est. Typus: VIETNAM. N.Vietnam, Hoa Binh prov., Mai Chau distr., Van Mai municipality, Highway 7, 15 km post. Primary lowland, very dry broad-leaved forest on shale at lower elevation to rocky, karstic limestone outcrops with deep fissures, between points 20°35′26′′N 105°02′00′′E and 20°34′39′′N 105°02′23′′E at elev. about 300–350 m. Sympodial palm with single stem up to 1.5 m tall. Fruits white, fleshy. Among limestone rocky outcrops. Locally abundant. 12.12.2002, *D. Harder, N.T. Hiep, L. Averyanov et al., DKH 8123.* (holotypus HN; isotypus LE).

Sub-herbaceous undershrub with slender erect or slightly flexuous reed-like stems arranged commonly in loose groups with 3–6(10) individual growths of varying height. Stem very slender, unbranched, (0.3)0.5–1.5(2) m tall, 3–5 mm wide, with internodes 5–8(10) mm, covered in upper part with old leaf sheaths, terminated by a crown of 5–8(10) leaves, old stems bare in basal portion. Leaf sheaths narrow, 4–6 cm long, 4–6 mm wide, clasping and densely enveloping stem, their margins surrounding stem with a net of numerous flexuous anastomosing light yellowish-brown thin soft fibers; ligule broad, 1–2 cm long, light dull yellowish-brown, thin, papyraceous, early disintegrating into thin soft fibers. Petiole narrow, very slender, 15–20 cm long, about 1 mm broad, slightly curved at the base, ± straight toward the lamina, smooth along the margin, slightly flattened. Lamina suborbicular to fan-shaped (when young) in

2 (left). Steep rocky slopes of remnant ridges and hills composed with marble-like crystalline highly eroded limestone at elevations 300–700 m a.s.l. is home of *Rhapis vidalii.* 3 (right). Primary evergreen broad-leaved closed lowland dry warm-loving forests on limestone still support large populations of *Rhapis vidalii.*

outline, 20–30 cm across, palmately segmented from near the base into 6–8(10) segments, each segment linear to narrowly lanceolate, grass-like, 12–18(20) cm long, (2)3–5(6) mm wide, sparsely finely denticulate along the margins, commonly with 2 prominent longitudinal veins, longitudinally folded, sometimes slightly narrowing to the apex, irregularly toothed, with 2–3 unequal, short acute apical lobes; adaxial hastula semicircular or broad half-elliptic, erect, hairy on young leaves with numerous light yellowish-gray to dull yellow-brown soft, thin caducous hairs, on old leaves glabrous. Inflorescence 1(2), interfoliar, near the apex of the stem, sparsely and laxly branched, pendulous 20–30 cm long, with light dull brownish narrowly lanceolate smooth, glabrous basal bract 6–12(14) cm long, 3–4(6) mm wide; peduncle 6–12(14) cm long, 0.6–1 mm wide with 1–2 narrowly lanceolate bracts, 2–6 cm long, 1.5–2.5 mm wide; rachis very narrow, in apical portion filiform, 0.3–0.7 mm wide, flexuous, with (1)2–6(10) rachillae, each with filiform yellowish bracts at the base, 4–7 mm long, 0.2–0.3 mm wide; rachillae 3–8(10), flexuous, each with 1–14 distant, shortly pedicellate flowers; pedicels (0.6)0.8–1.4(1.6) mm long, 0.2–0.3 mm wide, at the base with filiform, narrowly triangular acuminate bract 1–1.5 mm long, 0.1–0.2 mm wide, at the apex bearing flower, jointed with thick articulation. Flowers unisexual, solitary, spirally arranged and 3–10 mm distant on rachillae, staminate and pistillate superficially similar; flower axis between attachment of sepals and petals developed into prominent thick, woody, deep green, cylindrical stalk, narrowing to the base, 5.5–7 mm long, about 1–1.6 mm wide at the middle; staminate flower with calyx campanulate, glabrous, dull light yellowish-brown, papyraceous, tubular in basal two thirds 1.2–1.4 mm long, 0.5–0.7 mm wide, at the apex with 3 free, broadly triangular, lobes, 0.5–0.7 mm long, 0.7–0.8 mm wide at the base, slightly incurved, acute to acuminate, outside sometimes indistinctly keeled; corolla broadly campanulate, petals 3, glabrous, dull yellowish-orange with green tips, scale-like, broadly triangular to semicircular, 1.4–1.6 mm long, 1.2–1.6 mm wide at the base, incurved, apiculate, outside slightly keeled; stamens 6, in two whorls, 3 stamens of outer whorl subsessile with very short filaments adnate to middle part of corolla cup, 3 stamens of inner whorl with thick, finely papillose filaments 1–1.2 mm long, 0.2–0.3 mm thick, adnate to the base of corolla cup, anthers oblong reniform, 0.4–0.5 mm long, 0.2–0.3 mm broad, dehiscing longitudinally along lateral margin; pistillode with 3 completely separate carpellodes, placed close to each other at the center of corolla bottom, each carpellode small, bottle-shaped, slightly oblique, about 0.2 mm long and 0.05–0.07 mm wide in basal part, each with only one abortive ovule. Pistillate flower not seen. Fruit spherical or broadly obovoid, white (from three carpels in each individual flower normally only one developing) 7–9 mm across, with one large seed; epicarp pure white, thin, glabrous and smooth, glossy, skin-like; mesocarp fleshy and juicy with few soft fibers; endocarp thin woody, deep brown, densely adpressed to the seed. Seed spherical, with narrow longitudinal lateral cavity (from adaxial side); endosperm of stony, pure white to light yellow, of marble texture. Fig. 1, 4, 5, 7–9.

DISTRIBUTION. Species endemic to north-eastern part of North Indochinese floristic province (Averyanov et al. 2003a, b). **Vietnam:** Hoa Binh prov. (Mai Chau district), Thanh Hoa prov. (Ba Thuoc and Quan Hoa districts). Fig. 6.

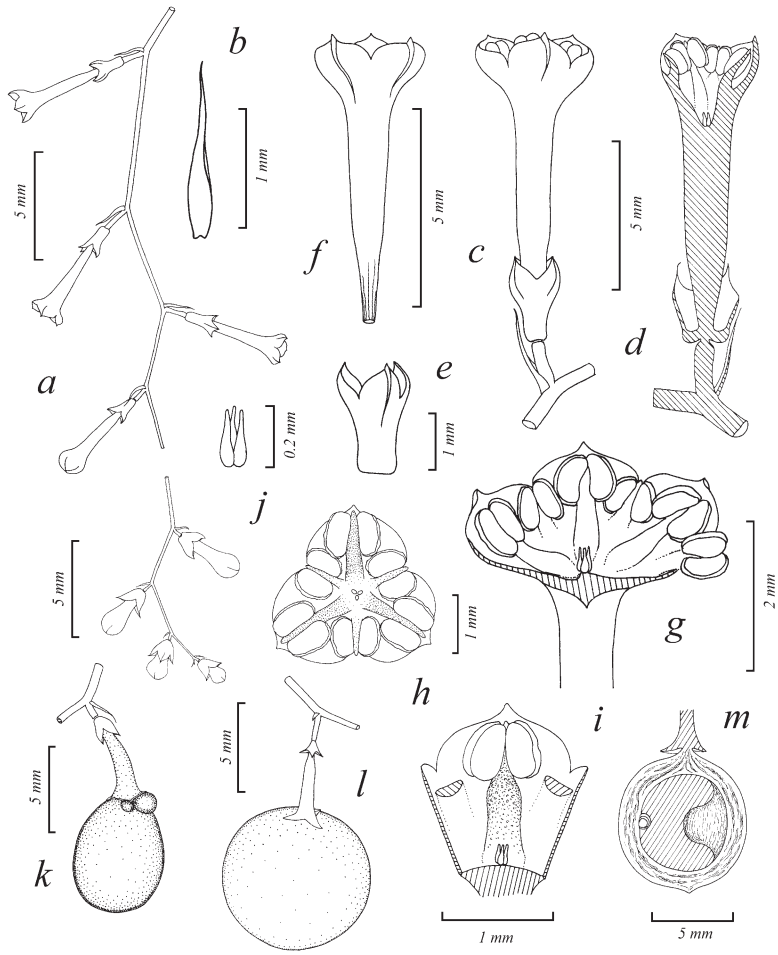
ETYMOLOGY. Species named after Prof. Jules E. Vidal, outstanding botanist and explorer of Indochinese flora.

NOTES. The species differs from all known species of *Rhapis* L.f. (Hastings 2003) in the extreme development of the stalk-like base of the corolla, formed by the fusion of the corolla to the receptacle. This type of pedicelliform corolla is known in other species of the genus such as *Rh. micrantha* (Beccari 1931, Dransfield pers. com.) but is nowhere so strongly developed as in this new species. After anthesis the cylindrical or narrowly conical deep green stalk-like corolla base becomes larger and bears on its widened apex a spherical, broadly obovoid or broadly ellipsoid drupe and 1–2 aborted carpels, which later degenerate. Eventually the solitary, juicy, milky-white fruit terminates the thick woody deep green stalk, having some superficial resemblance with the fleshy seeds of *Podocarpus* (Podocarpaceae).

FLOWERING PERIOD. Flowers and ripe fruits were observed in December.

ECOLOGY. Terrestrial semi-woody undershrub 0.5–1.5(2) m tall. Primary and secondary evergreen closed seasonal broad-leaved lowland and submontane rather dry forests on steep rocky slopes of remnant ridges and hills composed of marble-like crystalline, highly eroded limestone at elevations 300–700(800) m a.s.l. Fig. 2 & 3.

4. *Rhapis vidalii*. **a.** habit; **b.** apical part of the fruiting stem; **c.** leaf; **d.** leaf segment; **e.** fragment of leaf segment; **f.** base of leaf lamina with ligula (hastula). All drawn from *DKH 8123 & DKH 8188,* by Leonid Averyanov and Anna Averyanova.

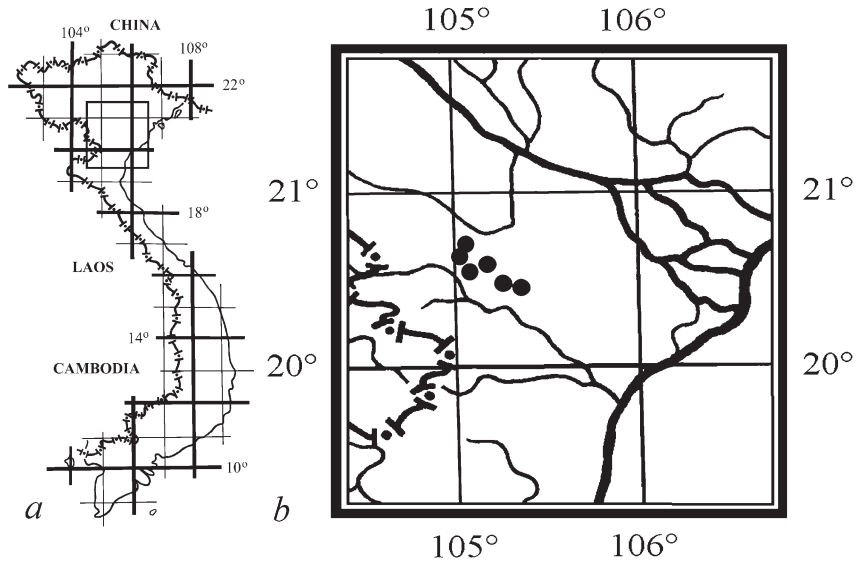


5. *Rhapis vidalii.* **a.** rachilla with flowers and flower buds; **b.** flower bract; **c.** flower and pedicel; **d.** flower, longitudinal section; **e.** calyx; **f.** corolla; **g.** flower, half-dissected and flattened; **h.** unfolded flower, view from the apex; **i.** sepal with stamen of internal whorl and gynoecium; **j.** gynoecium; **k.** young fruit; **l.** ripe fruit; **m.** longitudinal section of fruit and seed. All drawn from *DKH 8123 & DKH 8188*, by Leonid Averyanov and Anna Averyanova.

RELATED SPECIES. In flower structure, the species most resembles *Rh. micrantha* but vegetatively it is very distinctive.

DIAGNOSTIC FEATURES. From all other species of the genus it differs in slender subherbaceous habit, filiform pendulous few branched inflorescence and pendulous pedicellate flowers with thick woody stalk-like corolla base developing from flower axis between calyx and corolla.

Specimens examined: VIETNAM. N. Vietnam, Hoa Binh prov., Mai Chau distr., Van Mai municipality, Highway 7, 15 km post. Primary lowland, very dry broad-leaved forest on shale at lower elevation to rocky, karstic limestone outcrops with deep fissures, between points 20°35′26′′N 105°02′00′′E and 20°34′39′′N 105°02′23′′E at elev. about 300–350 m. Sympodial palm with single stem up to 1.5 m tall. Fruits white, fleshy. Among limestone rocky outcrops. Locally abundant. 12 December 2002, *D. Harder, N.T. Hiep, L. Averyanov et al., DKH 8123*. (holotype HN; isotype LE); along road between Van Mai and Thanh Hoa, approximately 2 km SW of Van Mai village around point 20°34′17′′N 105°01′58′′E at elev. 600–650m. Disturbed secondary and remnants of primary rather dry broad-leaved forest on upper ridge slopes on limestone and shale soils with large, anciently eroded marble-like crystalline limestone. Palm up to 2 m tall, forming small clumps, flowering and fruiting in light gaps in the canopy. Leaves deep green, buds green, flowers dull yellow-orange, green at tip. Locally abundant. 13 December 2002, *D.Harder, N.T. Hiep, L. Averyanov et al., DKH 8188*. Thanh Hoa prov., Ba Thuoc distr., Co Lung municipality, territory of Pu Luong protected area, near Pu Luong village, 20°27′01′′N, 105°11′03′′E. Primary very dry evergreen broad-leaved forest with *Burretiodendron hsienmu* along tops of remnant karst limestone ridge at elev. 500–550 m a.s.l.



6. *Rhapis vidalii*. Map of distribution.

Palm 0.5–1 m hg on rocky steep slope. Locally common. 13 April 2001, *N.T. Hiep, L. Averyanov, N.T. Vinh, D.T. Doan, HAL 929*; Khuyn village, around point 20°26′31′′N 105°14′55′′E. Primary evergreen seasonal broad-leaved lowland forest on slopes of crystalline marble-like highly eroded limestone ridge at elev. 300–400 m. Small shrub-like palm 0.5–1.2 m tall. Occasional. 18 September 2003, *L. Averyanov, D.T. Doan, J. Regalado, N.T. Vinh, HAL 3075*. Quan Hoa Distr., Phu Le Municipality, Hang village, around point 20°31′33′′N, 105°05′06′′E. Secondary and primary closed evergreen seasonal broad-leaved lowland forest on steep slopes of rocky ridge composed with crystalline marble-like highly eroded limestone at elev. 350–450 m. Palm 1–1.5 m tall on steep slope. Not common. 29 September 2003, *L. Averyanov, P.K. Loc, D.T. Doan, N.T. Vinh, HAL 3559*. Around point 20°32′29′′N, 105°04′32′′E. Primary closed evergreen seasonal broad-leaved submontane forest on very steep slopes and cliffs of rocky ridge composed with crystalline marble-like highly eroded limestone at elev. 700–800 m. Palm up to 1.5 m tall. Very common. Co-dominant of herb forest stratum, 4 October 2003, *L. Averyanov, P.K. Loc, D.T. Doan, N.T. Vinh, HAL 3899*.

NOTES. *Rhapis vidalii* was discovered for the first time by Dr. N.T. Hiep and Prof. Leonid Averyanov in April 2001 during a reconnaissance expedition as part of the exploration program of the American Orchid Society and Basic Research program in Life Sciences of Vietnam aimed at the investigation and inventory of orchids and conifers in remote areas of the country. This surprising palm was collected at first in low rocky hills just near Pu Luong village in the newly established Pu Luong protected area situated in Ba Thuoc district of Thanh Hoa Province. It was mentioned in field book as "*Rhapis cyperifolia, sp. nov.*" for its superficial resemblance with some large species of *Cyperus*. The very unusual semi-woody sedge-like habit of the palm left no doubt that it was new to science. However, all specimens collected at this time were sterile or with very young flower buds, insufficient for correct description.

A year later the plant was found in neighboring Hoa Binh province in Mai Chau district during collaborative expedition of U.S.A. National Geographic Society and U.S.A. National Science Foundation. In this area the new palm was observed as a common plant of forest understory. Collections that were made in December 2002 included both flowering and fruiting samples, as well as ripe fruits and seeds. These perfect collections were chosen as type material for description of the species.

Next autumn, during September – October 2003, studies of *Rhapis vidalii* were continued as a part of botanical survey in Pu Luong nature reserve supported by Vietnam Program of Fauna and Flora International. In a number of localities of limestone hills and low ridges this small elegant palm was observed as a common species, sometimes appearing as important co-dominant in herbaceous forest

stratum. Detailed studies of natural conditions, taxonomic composition and vegetation structure in habitats of *Rh. vidalii* will bring better understanding of the nature of this unique Vietnamese endemic with a very restricted distribution.

Wide-ranging field studies outlined the range of *Rhapis vidalii* as a very small area situated in north-eastern part of North Indochinese floristic Province of Indochinese floristic Region of Indomalesian Subkingdom of Paleotropic Realm (Averyanov et al. 2003a, b). This area lies along the border of Hoa Binh and Thanh Hoa administrative provinces of northern Vietnam and spreads from north-west to south-east as a narrow area not exceeding 50 km long and less than 15 km wide (Fig. 6). This is clear example of very strict calcium dependent plant endemism in the flora of Vietnam. In the case of *Rh. vidalii* it is associated with highly eroded rocky low limestone ridge systems, which run from Moc Chau plateau in a south-east direction ending to the SE of Cuc Phuong national park.

The limestone formations in the area of *Rh. vidalii* are represented by low highly eroded remnant hills and rocky ridges 900–1000 m a.s.l. (Figs. 2 & 3). They are composed of solid crystalline highly eroded marble-like mainly white or light gray limestone thought to be of Palaeozoic age (Dovzikov et al. 1965a, b). Steep slopes of remnant mesas and low ridges covered with primary vegetation support habitats of many rare species, including *Rh. vidalii* (Figs. 2 & 3).

A monsoon tropical climate with a cool winter and summer rains is typical for the area of *Rhapis vidalii* distribution (Nguyen Khanh Van et al. 2000). Dry winters with a drought period of 2–5 months, extending from December to February or March and wet summers with the peak rainfall in July and August are regularly observed here. Humidity approaches the average found in lowlands of northern Indochina. Nearest climate stations (Kim Boi and Moc Chau) record a mean annual rainfall of 2255.6 and 1559.9 mm at elevations 100 and 958 m above sea level respectively. Temperature regimes have a strong seasonality. Winter conditions with cool temperatures extend from November to April, with common temperatures 12°–18°C (with absolute minima at elevation 100 m 2.1°C and at elevation 958 m –1.5°C). Persistent misty drizzling rains, so called *craschen*, are very typical in the area from early February until the end of March. Summers are hot and humid, with common temperatures 22°–28°C and absolute maxima 35° and 40.5°C. Reported mean annual temperatures are 18.5° and 22.8°C.

7. In the limit of its distribution *Rhapis vidalii* is a common understory palm of the forest floor.

8. *Rhapis vidalii.* Young fruits deriving from three free carpels.

Primary vegetation in habitats of *Rhapis vidalii* are classified as closed evergreen seasonal tropical broad-leaved lowland, sometimes also submontane limestone forests (Averyanov et al. 2003a, b).

Tree dominants of the first forest stratum here reach 35–45 m tall and 60–110 cm in diameter with projected cover reaching 50–80% (Fig. 2, 3). Most common species here are *Allospondias lakonensis*, *Anogeissus acuminata*, *Burretiodendron hsienmu*, *Pometia pinnata*, *Dimocarpus longan*, *Dracontomelon duperreanum*, *Heritiera macrophylla*, *Millettia ichthyochtona*, as well as some species of such genera as *Aglaia*, *Diospyros*, *Ficus*, *Garcinia*, *Horsfieldia* and *Sterculia*. Some trees of this group, such as *Anogeissus acuminata*, *Heritiera macrophylla* and species of *Ficus* may reach heights of 50–55 m with trunks up to 2 m in diameter. Often these giant trees have plank buttress roots up to 3 m tall and 2.5 m long at the ground. They often appear as emergent trees in continuous matrix of the canopy of the first forest stratum.

Trees of the second forest stratum in habitats of *Rhapis vidalii* grow commonly 15–20 m high. The structure of this stratum may be simple including mono-dominant stands of *Streblus macrophyllus*, as observed on very steep and dry slopes (particularly south-facing). However, on more humid slopes species composition of this stratum is rich and comprises numerous tree species. Diameter of tree trunks in this stratum usually varies from 25–40 cm. Usual projected cover is 20–40%. Most common trees here are immature samples of species of first canopy stratum. Additionally there are other species that form natural integral elements of this stratum. Among them are *Castanopsis indica*, *Deutzianthus tonkinensis*, *Nageia wallichiana*, species of *Alstonia*, *Antidesma*, *Cinnamomum*, *Garcinia*, *Polyalthia*, *Pterospermum*, *Syzygium*, *Vitex* and numerous warm lowing representatives of such families as Euphorbiaceae, Fabaceae, Lauraceae, Meliaceae, Rubiaceae, Sapindaceae and Theaceae.

The height of the third forest stratum is usually 5–15 m with trees 10–25 cm diameter and projected cover 30–45%. *Streblus macrophyllus* is the most common co-dominant here. Other common associates in this stratum were trees such as *Celtis cinnamomea*, *Lagerstroemia balansae, Streblus tonkinensis*, as well as representatives of *Ailanthus*, *Archidendron*, *Camellia*, *Cinnamomum*, *Eurya*, *Litsea, Psychotria*, *Pterospermum*, *Schefflera*, *Syzygium, Zanthoxylum* and numerous species of Annonaceae, Bignoniaceae, Euphorbiaceae, Lauraceae, Rubiaceae and Theaceae. Large palms, such as *Arenga westerhoutii*, *Caryota bacsonensis* and *C. mitis,* are occasionally common in this stratum.

In the habitats of *Rhapis vidalii* numerous shrubs form a distinct fourth forest stratum 1.5–5 m tall. Projected cover of this stratum commonly varies from 10–30%. However, in some cases it may reach 60–80%. Most common dominant species here are saplings of trees and palms of the highest forest strata. Other species occurring here are genuine shrubs and small trees specific to forest understory including *Brassaiopsis phanrangensis*, *Caryota sympetala*, *Dendrocnide urentissima*, *Diospyros mollifolia*, *Flacourtia ramonchi*, *Leea indica*, *Polygala arillata*, *Silvianthus tonkinensis* and members of such genera as *Ardisia*, *Callicarpa*, *Camellia*, *Canthium*, *Clerodendrum*, *Euonymus*, *Eurya*, *Helicia*, *Illicium*, *Ixora*, *Jasminum*, *Myrsine*, *Pandanus*, *Phyllanthus*, *Psychotria*, *Sapium*, *Schefflera*, *Strychnos*, *Trevesia* and *Wrightia*.

The density of herbaceous cover in the limestone forest directly depends on humidity. It commonly develops projected cover up to 100% on wet slopes of shady valleys and may be hardly pronounced on dry steep south-facing slopes, where herb cover may be less than 1%. Indigenous herbs are most common dominants here. Among them are *Aglaonema* sp., *Alocasia macrorrhiza*, *Alpinia* sp, *Amischotolype hispida*, *Amomum* sp., *Amorphophallus* sp., *Ardisia* sp., *Aspidistra* sp., *Asystasia* sp., *Begonia balanseana*, *Begonia* sp., *Costus speciosus, C. tonkinensis*, *Curculigo* sp., *Cyrtococcum patens*, *Distichochlamys* sp., *Elatostema* sp., *Geophila repens*, *Hedychium*

9. *Rhapis vidalii.* Ripe fruits are long-lasting, pure white, pendulous drupes.

forrestii, *Hedyotis* sp., *Impatiens eberhardtii*, *I. claviger*, *I. albo-rosea*, *Impatiens* sp., *Mycetia balansae, Mycetia* sp., *Ophiopogon* sp., *Ophiorhiza* sp., *Peliosanthes teta*, *Pellionia* sp., *Pilea* sp., *Pollia* sp., *Stachyphrynium placentarium*, *Steudnera colocasiaefolia*, and *Strobilanthes* sp. In this herbaceous layer many species of ferns and their allies are also very common, such as *Adiantum philippense*, *Asplenium unilaterale* , *Cyclosorus* sp., *Diplazium* sp., *Polystichum* sp., *Pteris ensiformis*, *Pteris* sp., *Selaginella* sp., *Tectaria decurrens, Tectaria* sp. and *Thelypteris* sp. Many other rare species of herbs and undershrubs are associated with this stratum. Among them, many terrestrial and lithophytic orchids such as *Calanthe alismifolia*, *C. argenteo-striata*, *Corymborkis veratrifolia*, *Goodyera fumata, Habenaria ciliolaris*., *Habenaria medioflexa*, *Nervilia aragoana*, *N. plicata*, *Phaius mishmensis* and *Tropidia angulosa*.

Epiphytes in habitats of *Rhapis vidalii* are rather common. They often form large colonies in canopies of large trees and give a characteristic appearance to the forest. Tree stem and branch cover of epiphytic bryophytes and lichens regularly reaches here 80–100%. Among vascular plants orchids and ferns are most common epiphytic species. Most common orchids here are *Biermannia calcarata*, *Bulbophyllum guttulatum*, *B. xylophyllum*, *Bulbophyllum* sp., *Callostylis rigida*, *Cleisostoma fuersteinbergianum*, *C. melanorachis*, *C. striatum*, *Dendrobium aduncum*, *D. chrysanthum*, *D. dentatum*, *D. lindleyi*, *D. salaccense*, *D. spatella*, *Dendrobium* sp., *Eria globulifera*, *Eria* sp., *Flickingeria* sp., *Kingidium deliciosum* , *Luisia* sp., *Pelatantheria insectifera* and *Trichotosia pulvinata*. Among ferns and their allies regularly observed were species such as *Aglaomorpha coronans*, *Arthropteris* sp., *Asplenium nidus*, *Asplenium* sp., *Davallia* sp., *Lycopodium* sp., *Polypodium* sp., *Psilotum nudum*, *Pyrrosia lanceolata*, *Pyrrosia lingua*, *Pyrrosia* sp. and *Vittaria* sp.

Numerous rocky outcrops of parent limestone rocks are very typical on steep slopes in habitats of *Rhapis vidalii*. Density of lithophytes varies from 5–10% of projected cover on steep, dry, south-facing slopes to 100% on wet, shady slopes of narrow valleys and canyons. Lithophytic bryophytes and lichens are dominant in all studied habitats often forming cover up to 100% of rock surface. Among flowering plants and ferns in lithophytic communities commonly observed were such species as *Adiantum philippense*, *Aglaonema* sp., *Amorphophallus* sp., *Antrophyum callifolium*, *Antrophyum* sp., *Arisaema* sp., *Aspidistra* sp., *Asplenium anthrophioides*, *A. prolongatum*, *A. saxicola*, *A. thunbergii, Asplenium* sp., *Begonia cucphuongensis*, *Calanthe argenteo-striata, Chirita hamosa*, *Chirita* sp., *Cleisostoma rostratum, Davallia* sp., *Disporum* sp., *Drynaria bonii*, *Elatostema* sp., *Goodyera hispida*, *Hedyotis* sp., *Lepisorus* sp., *Liparis averyanoviana, L. cordifolia, L. distans, L. latilabris, L. stricklandiana, Liparis* sp., *Malaxis acuminata, Nephrolepis cordifolia*, *Odontochilus elwesii*, *Paphiopedilum hirsutissimum*, *Pilea* sp., *Polygonatum odoratum*, *Polystichum* sp., *Procris* sp., *Pyrrosia lanceolata*, *P. lingua* and *Pyrrosia* sp.

Many kinds of lianas form an integral component of the forest in habitats of *Rhapis vidalii*. They belong to three groups – woody vines, herbaceous vines and creeping vine epiphytes. The most common woody vines here are species of genera such as *Acacia*, *Actinidia*, *Albizzia*, *Alyxia*, *Ampelopsis*, *Bauhinia*, *Caesalpinia*, *Celastrus*, *Dalbergia*, *Embelia*, *Entada*, *Jasminum*, *Luvunga*, *Smilax*, *Stauntonia*, *Strychnos*, *Tetrastigma* and *Ventilago*. Some of them grow to 40–45 m long and have sometimes flat undulating stems up to 40 cm wide. Herbaceous vines are usually much shorter and more typical in open precipitous habitats. They belong to such genera as *Cardiopteris*, *Ceropegia*, *Dioscorea*, *Merremia*, *Mucuna*, *Paederia*, *Thunbergia* and *Trichosanthes*. In more humid places are very typical creeping epiphytic vines like *Epipremnum* sp., *Piper* sp., *Pothos grandis*, *Pothos* sp., *Rhaphidophora decursiva* and *Scindapsus* sp. Some species of this group have relatively short stems and commonly occur in canopies of large trees. Among them are *Callostylis rigida* and species of *Aeschynanthus*, *Dischidia* and *Hoya*.

Plants of specific life forms like giant strangler lianas (*Ficus sarmentosa*, *Ficus* sp.), climbing trees (*Poikilospermum suaveolens*), numerous canopy semi parasites (*Viscum ovalifolium*, *Loranthus* sp.) and achlorophyllous ground root parasites (*Balanophora fungosa*, *B. laxiflora* and *Balanophora* sp.) are very typical for warm-loving, lowland limestone flora in the area of *Rhapis vidalii*.

Soils here consist of gray-brown, brown, light brown to red-brown (on low elevations, particularly on steep slopes) clayey, friable well structured layer, 8–10 cm. It covers a highly weathered limestone gravel horizon overlying parental rocks of crystalline, solid, marble-like, highly eroded, whitish or yellowish to light

gray limestone. Due to good drainage the ground does not hold much water, even during torrential summer rains. Leaf litter layer varies from 0 to 10 cm thick and may reach 35–50 cm in crevices, depressions and deep karst pockets.

Rhapis vidalii grows in its natural habitat as a terrestrial or lithophytic subherbaceous undershrub on steep shady slopes in an elevation belt at 300–700 m a.s.l. It may commonly be seen as scattered loose groups of few clumps (Fig. 1). The species finds its ecological optimum under deep shade of intact primary forest, where it sometimes forms large colonies with thousands of individual groups. In some studied model plots (chosen for the description of vegetation) this species reach 40–50% of coverage in the forest understory and appeared as main co-dominant in the herbaceous forest stratum (Fig. 7). Regularly adult stems have a height of 1–1.5 m, rarely reaching 1.8–2 m tall.

Very few fertile samples of *Rhapis vidalii* were observed in the field during 2001–2003. They rate less than 0.1% of all observed adult trunks. Flowering or fruiting plants were commonly observed in areas with relatively more light, particularly on very steep rocky slopes, near vertical cliffs, near to light gaps formed by large fallen trees.

Full flowering and ripe fruits were observed in nature during December. This demonstrates that maturation of fruits needs a whole year. Germination of ripe seeds collected in nature approaches 100%. Seedlings in cultivation grow quite well, but very slowly. We estimated that the largest stems found in nature may be 20–25 years old.

Rhapis vidalii has a very distinctive appearance with its elegant stems terminated by lax crowns of 6–10 deep green, graceful leaves palmately dissected into linear segments. Small plants superficially resemble young plants of *Cyperus papyrus,* but are more compact, darker and rigid. Older plants appear as miniature, pretty, almost toy-like palm with attractive milky white, long-lasting, pendulous fruits. There is no doubt that this newly discovered palm has outstanding horticultural potential, particularly for miniature rocky gardens of Japanese style.

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PALM LITERATURE

FLORA DE PALMERAS DE BOLIVIA. Mónica Moraes Ramírez. Herbario Nacional de Bolivia, Instituto de Ecología, Carrera de Biología, La Paz, Bolivia. ISBN: 99905-0-609-4. Hard cover. Pp 250; 51 distribution maps, 8 color plates. (In Spanish)

For over two centuries, the study of neotropical palms was led mostly by botanists from Europe or the United States, with only a few exceptions, including the Brazilian João Barbosa Rodrigues and the Colombian Armando Dugand. The last few decades have seen a flowering of palm research conducted by scientists native to neotropical countries. The *Flora de Palmeras de Bolivia* is the result of long-time research on the palms of this South American country conducted by the Bolivian botanist Mónica Moraes. Based on extensive field work and on the study of hundreds of herbarium specimens, this flora is an exhaustive treatment of the 80 species currently known in Bolivia. Identification of the species is facilitated through the user-friendly keys, in which the author has succeeded to keep cryptic characters to a minimum, relying mostly on easily observed structures. Additionally every species is illustrated with a line drawing showing habit and details of leaf, inflorescence, flowers and fruits. Furthermore, about one fourth of all species are illustrated with color photographs.

Each species has a detailed botanical description, followed by extensive information on its distribution and ecology, and on the common names applied to the species in Bolivia, including names in several indian languages. Then comes a lengthy paragraph presenting the specimens studied, cited in the format of traditional floras, including detailed localities, collectors, date, and herbarium citation. For common and frequently collected species like *Chamaedorea pinnatifrons*, this citation of specimens results in almost two pages of text. Useful as this information may be, it adds a little bit of noise to the taxonomic and ecological information, and is somewhat redundant with the information presented in the maps, the paragraph on distribution and the list of *exsiccatae* presented at the end of the book. Although many botanists still find it difficult to get rid of these detailed citation of specimens, some recent floras have reduced them to a minimum or have omitted them altogether, without losing their usefulness.

Fifty-one distribution maps illustrate the range of each Bolivian palm species. These maps make a nice combination of the actual localities documented by herbarium specimens (marked by dots) and the general area of distribution of the species, as inferred by the author, and they provide a valuable tool for management and conservation planning.

All in all, this book is an excellent contribution to our understanding of South American palms. Its rich information will make it useful not only to botanists, but to anyone interested in this fascinating family.

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CLASSIFIED

The Many Names for Coconut Varieties in Florida

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Botanical characters are used to classify varieties of coconut (*Cocos nucifera* L.) into Tall, Semi-tall, Semi-dwarf and Dwarf. In particular, in Florida the name "Malayan Semi-dwarf" is proposed as preferable to "Malayan Dwarf" for *Nyior gading* in Florida. Average rates of trunk growth are given to illustrate variety differences.

"Why does it get so high if it's called a dwarf?" "Is the Samoan better than Fiji?" "Is the Maypan taller than Jamaica Tall?" So many names! I am constantly being asked here in Florida to put a variety name to a coconut palm or select the "correct" name out of several synonyms.

It interests me that all types of coconut palm are contained in the species *Cocos nucifera* L., notwithstanding clear heritable differences in fruit components, flowering pattern, fruit shape, germination speed and petiole color, to name just a few characters. The different coconut types cross readily. However, it appears that the many named species of *Syagrus* also interbreed, and the named species of *Coccothrinax* or *Livistona* are similarly interfertile.

In this paper I adhere to the classification of coconut varieties given in my booklet (Romney 1996), but now I shall attempt to distinguish between varieties and cultivars: this may bring objections on to my head, but if these challenges further clarify the situation, I welcome them.

Every country capable of growing coconut palms has one or more Tall strains. The main characteristics of Talls are fast vertical growth, long fronds, late onset of bearing and a tendency for female flowers to become receptive after the males have dehisced. There are often subtle differences between Talls from different geographical areas; hence we have names, such as Malayan Tall, Jamaican (or West Indian or Atlantic) Tall, Panama Tall, Seychelles Tall, Thailand Tall and Laguna Tall (Philippines). These I regard as geographical cultivars. Yield improvement of Talls by mass selection has been tried, but little has been achieved, because Talls are mainly outcrossing.

The Talls can be subdivided into *Niu kafa* type or *Niu vai* type (Harries 1978). The former have triangular or spindle-shaped fruits,

relatively late-germinating seeds, thick pericarp (husk), copra oil content of 70–72% of dry weight and little resistance to lethal yellowing. They were taken by Europeans to West Africa, Puerto Rico and Brazil (thence to the entire American east coast and Caribbean islands). *Niu vai* are found in the Pacific and Indo-China; they have spherical fruits, early germination, thin pericarp, copra oil content of 65–68% and moderate resistance to LY. The Spanish brought them to the American west coast.

There are also Semi-talls, Semi-dwarfs and Dwarfs, along with variations such as Spicata Semi-dwarf (Romney 1998) and Makapuno Tall (Cannon & Romney 1992). These (and the Talls as a group) I venture to call varieties, because their differences appear to be greater than those between Tall cultivars.

Finally, within all these cultivars and varieties there are differences in the color of the petiole, inflorescence spikelets and immature fruit epidermis. Talls are green or shades of brown-green (called bronze by many coconut workers). Less than 1% of Talls in East Africa are yellow (butter-colored) or red (deep apricot or orange). The terms yellow and red are used in most coconut countries, but in Florida the red coconut is often called golden. Tall colors are dominant in a cross with Semi-dwarfs (a very useful tool in distinguishing hybrids). Among the Semi-dwarfs, green is dominant to yellow and red, whilst red is dominant to yellow (Whitehead et al. 1964). Thus yellow Semi-dwarfs are homozygous for color and probably have more reliable LY resistance. A putative green Semi-dwarf may show, after a few years of vigorous growth, that it is in fact a green hybrid of unknown male parentage.

The best known Semi-tall is the King Coconut in Sri Lanka. This cultivar resembles Talls, but the female flowers open during the male phase (which leads to in-breeding), and the immature fruits are orange-red. It does not occur in Florida.

Semi-dwarfs include Malayan (*Nyior gading*), *Chowghat* (in India), *Rangiroa* and Spicata. Malayan Semi-dwarf is commonly called Malayan Dwarf, and this accounts for much of the confusion. It is also called Malay or Malaysian (although it was named long before the country of Malaya became renamed Malaysia). Semi-dwarfs have slimmer trunks than Talls grown under the same conditions and, unlike Talls, have little or no bole (swollen trunk base). Semi-dwarfs have shorter fronds than Talls, shorter inflorescence stalks, earlier onset of flowering, more female flowers and more but smaller fruits. Copra oil content is 65–68%. One of the main distinguishing factors is their flowering pattern: Whitehead (1965) showed that over 90% of Malayan Semi-dwarfs are selfing. Malayan and *Chowghat* Semi-dwarfs may be green, yellow or red. Spicata is yellow or red, and *Rangiroa* is red, as far as I know. Malayan Semi-dwarfs in Florida are mainly green but with some red and yellow, probably because most of the seeds were originally brought from St. Lucia whose first imports (around 1939) comprised seven

Table 1. The names of coconut varieties used in Florida with synonyms.

Correct Name	Other Names
Atlantic Tall	West Indian Tall, Jamaica Tall, San Blas Tres Picos, *Niu kafa* type
Panama Tall	*Redondo*, *Niu vai* type
Makapuno	Makapuno Tall, Makapuno (strain of Laguna Tall)
Spicata Semi-dwarf	Spicata, Spicata Dwarf
Malayan Semi-dwarf	Malayan or Malaysian or Malay Dwarf, *Nyior gading*
Red (Semi-dwarfs)	Golden
Bronze (Talls)	Yellow
Fiji Dwarf	Samoan Dwarf, Niu leka
Fiji-Malayan	Malayan Semi-dwarf × Fiji Dwarf late-generation hybrid
Maypan hybrid	Maypan, Malaypan

Table 2. Mean rates of trunk growth of coconut varieties.

Variety	Age 6 years (cm/yr)	Age 30 years (cm/yr)
Talls, e.g. Jamaica Tall, Panama Tall	100	20
Dwarf × Tall hybrids, e.g. Maypan	75	15
Semi-dwarfs, e.g. Malayan	50	10
Dwarfs, e.g. Fiji	30	5

green, two yellow and one red. In Jamaica in the 1960–80s, Malayan, *Chowghat* and Spicata Semi-dwarfs showed high LY resistance after years of field testing, but the *Rangiroa* was highly susceptible. The Malayan has been spread around the world a great deal because of its early bearing and LY resistance.

The best known Dwarf is the *Niu leka*, commonly called Fiji or Samoan in Florida; these palms also grow in Tonga. The few Mahina Dwarfs in Tahiti are, in my view, the same. Vertical growth of Dwarfs is very slow, the leaf scars on the trunk being only 3 cm or less apart. The trunk is thick with little bole. Leaflets are very wide and tend to overlap resulting in dense shade under the palm. *Niu leka* palms were brought to Jamaica from Fiji (by Whitehead in 1967), and thence to Florida. He described their colors there as 10YR5/6 (yellow-brown) or 10Y5/5 (light olive) on the Munsell scale. However, the few *Niu leka* palms in Florida include some that look green. The resistance to LY has not been thoroughly tested, but some resistance exists, and late-generation Malayan Semi-dwarf × Fiji crosses in Jamaica had good resistance. Analysis of genetic diversity using microsatellite DNA (Meerow et al. 2003) suggested that some selfing occurs, making it easier to operate a *Niu leka* seed garden, but that considerable selection would be needed to obtain suitably uniform parents.

Coconut hybrids have been made and performance-tested to incorporate resistance to LY into a commercially desirable variety or to improve yields using hybrid vigor. The Malayan Semi-dwarf has usually been the female parent, because its early bearing and numerous fruits appear to be dominant in the hybrid progeny and because of its recessive colors. A number of such crosses were made and tested for LY resistance in Jamaica, the best being the Maypan (Harries & Romney 1974), the name being a combination of the Malayan Semi-dwarf mothers and Panama Tall pollen parent, with the female being put first, as is the custom. A Panmay would thus have a Panama Tall mother and Malayan Semi-dwarf father. In Ivory Coast at Port Bouet, numerous hybrids were made, notably PB121 (Malayan Semi-dwarf × West African Tall), and planted in several countries. In Malaysia, the hybrid Malayan Semi-dwarf × Malayan Tall (called MaMa) has been planted there widely; this hybrid, of course, is similar to Maypan, since Panama Tall resembles Malayan Tall. In Table 1, I have recommended the term "Maypan hybrid" to emphasize that it is a cross and will not breed true.

Another common misconception in Florida about coconut palms (indeed all palms) is inherent in the question "At what height does it top out?" Many laymen do not understand that the central bud produces new leaves until it dies. I therefore proffer Table 2 to indicate the relative heights of different coconut cultivars with increasing age. The rate of vertical growth depends on growing conditions, of course.

NOTES. (1) The information on LY resistance given above was collected before the apparently new strain of LY recently affected the east coast of Jamaica.

(2) I have emphasized the term Semi-dwarf for *Nyior gading* (frequently called Malayan Dwarf) and similar types because, understandably, the Florida public cannot reconcile the name dwarf with its vertical rate of growth.

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CLASSIFIED

Dent Smith's Garden

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1. The view of the garden from the house.

Dent Smith, our Society's founder, grew palms enthusiastically in Florida. His garden boasts mature specimens of many unusual palms.

I never knew Dent Smith. I write these words with equal measures of regret and lament. Yet like so many other folks I was profoundly affected by him. Instead of acquaintance and friendship, I have only the legacy of his written words and the palms in his garden. Those words, about growing palms outside of tropical climates, ring ever more true after almost 20 years of my visits to Dent's garden.

I first visited his garden in 1987, a few months after his passing. At that time, I had been in the International Palm Society only a few years. Record freezes of 1983 and 1985 had dampened my resolve and effectively arrested my optimism for growing palms. His widow, Doris, had graciously opened the garden for the Central Florida Palm Society. The visit to the garden, only 129 km (80 miles) south of my own garden, did much to restore the interest and wonderment that have sustained me for the past 20 years. There, I saw what one could grow in these northern subtropical climes. Dent Smith (1986) wrote of growing more than 150 species in his garden (Fig. 1). Many of his palms are still growing vigorously in his Daytona Beach garden.

This garden dates from the 1940s and boasts mature specimens of *Attalea*, *Copernicia*,

Brahea, *Hyphaene*, tropical *Sabal* and *Livistona* species. Doris has repeated the courtesy of opening her garden to the society and me many times over the years. She wants to keep his legacy alive, although she still laments the change of the journal name from the original Principes.

Dent Smith listed several species of *Attalea* hardy to zone 9b. There are three specimens in his garden. These palms have survived the rigors of three freezes in the 1980s. Over the last 20 years I have watched them prosper from emergent trunks to substantial trees with several meters of trunk. This one (Front Cover) appears to be *A. cohune* based upon the absence of fibers on the leaf bases. This species is similar to *A. butyracea* in that both have leaflets in a single plane; however *A. cohune* lacks the petiole fibers and the branches bearing male flowers are less than 15 cm long. Both species grow in the garden.

Dent Smith listed six species of *Copernicia* hardy to this location in Florida (Smith 1986), but only this specimen of *C. hospita* remains. I have recollections of seeing *C. alba*, *C. baileyana* and *C. macroglossa* during visits over the years. This plant retains remnants of the beautiful *Copernicia* architecture of its leaf-bases.

The garden retains two large specimens of *Hyphaene coriacea*, one at the entrance and a second down by the seawall (Fig. 2). This plant is fully hardy here and has survived freezes to -6°C (21°F). It still flowers but produces sterile

2. This enormous specimen of *Hyphaene coriacea* is one of two on the property.

3. Two specimens of *Sabal causiarum* guard the entrance to the garden.

fruit. I have attempted to grow this palm in Jacksonville, but small plants are killed at -6°C (21°F).

The garden has several species of *Sabal*, not counting the native species. Dent Smith's garden is home to the largest specimen of *Sabal domingensis* that I know in Florida. I have seen equivalent specimens only in the Dominican Republic. It is frequently confused with *S. causiarum*, but it is readily distinguished by its fruit shape and size (Zona 1990). I also note a difference in the leaves: *S. domingensis* has a fuller crown of leaves, which are larger and fuller than those of *S. causiarum*. This plant may have originated from a group of seedlings of this species distributed by Dent Smith (Wait 1965) during a Palm Society tour of his garden. I wonder what became of those other seedlings. A pair of *Sabal causiarum* grows at the entrance to the garden (Fig. 3). It is flanked by *Hyphaene coriacea* and a very blue *Serenoa repens*. Note the beautiful cement gray color of the trunk as well as smaller crown compared to that of *S. domingensis*. The fruits and seeds are perhaps about half the size of those from *S. domingensis*.

4 (upper left). *Sabal bermudana* is slow growing. 5 (upper right). *Roystonea regia* growing as far north as it is likely ever to grow. 6 (lower left) *Brahea aculeata*, a Mexican species that is hardy. 7 (lower right). *Coccothrinax argentata* growing at the limit of its hardiness.

8. ×*Butiagrus nabonnandii*, a hybrid palm.

Sabal bermudana; native of Bermuda, is distinguished by its short, stout trunk and fully costapalmate leaves (Fig. 4). Its identity is confirmed by the inflorescence morphology. The inflorescence is branched to two orders, and the second branches are very short (Zona 1990). The smaller seeds differentiate it from *S. maritima*.

Smith's specimen of *Roystonea regia* is the northern-most Royal Palm that I know (Fig. 5). This specimen is a survivor of the rigors of the 1980s freezes. *Roystonea* was reported by William Bartram to grow in the 18th Century as far north as the mouth of the St. Johns River, near Astor, Florida.

A respectable and very old specimen *Brahea aculeata* still graces the garden (Fig. 6). It is differentiated from its ten sister species of *Brahea* by the widely spaced teeth on its petiole and the deep splits of its leaf blade. This species is hardy to -6°C (21°F) and prospers farther north in Jacksonville. Dent Smith probably collected the seeds of this species during his 1961 trip to Mexico with Robert H. Nelson, who wrote an engaging account of the trip in Principes (Nelson 1961).

After all these years, there is still a small plant of *Coccothrinax argentata* at what must be the absolute northern-most limit of the genus (Fig. 7). This species is native to Florida and Caribbean and naturally occurs no farther north than Palm Beach County. Dent Smith (1986) listed the genus as hardy to 10a, yet this plant has survived in Smith's 9b garden during all the freezes of the 1980s and persists to this day.

The garden has two mature mule (hybrid) palms. This one pictured (Fig. 8) is located at the seawall. It has survived all the freezes and weathered assaults of recent hurricanes Charlie and Frances. This hybrid was created by Nabonnande over a 100 years ago (Wilcox 2001). It is the hybrid between *B. capitata* and *Syagrus romanzoffiana*.

9. *Livistona mariae* ssp. *rigida*.

A stout, slow-growing fan palm in the garden is *Livistona mariae*. Its leaves are stiff and dull blue green, held in a dense crown. Rodd (1998) revised the genus and combined three species of *Livistona* into a single *L. mariae* with two subspecies. Smith's plant (Fig. 9) appears to be *L. mariae* subspecies *rigida*. This subspecies is differentiated from *L. mariae* ssp. *mariae* by its leaves, which are shiny green above and glaucous beneath (Jones 1984).

I salute Dent Smith's legacy a full score of years after his death and more than a half century after the inauguration and founding of the IPS. His garden still inspires everyone who sees it, and his palms are still a tribute to his undying spirit.

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Lepidorrhachis

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1. Aerial view of Lord Howe Island, showing Mt. Gower (far right) and Mt. Lidgbird to the left. Photo: Ian Hutton.

***Lepidorrhachis mooreana* must surely rate as one of the most narrowly distributed of all palms.**

Not only is this monotypic genus endemic to the remote Pacific island of Lord Howe (Fig. 1), 580 km off the eastern coast of Australia, but it is also restricted to the summits of the island's two mountains, Mt. Gower (875 m) and Mt. Lidgbird (777 m), where it occurs above 750 m in dwarf mossy forest. Less than 0.5 km^2 out of Lord Howe's total land surface area of 12 km^2 is located above the 750 m contour. The broad summit plateau of Mt. Gower (Fig. 2) accounts for most of the available habitat and sustains the majority of *Lepidorrhachis* individuals. In contrast, Mt. Lidgbird attenuates dramatically into a narrow

ridge surrounded by precipitous cliffs and provides only a very small area with suitable conditions for the genus. The low canopy of the forest in which *Lepidorrhachis* grows includes some extraordinary endemics such as the pumpkin tree (*Negria rhabdothamnoides*), an arborescent member of the African violet family Gesneriaceae, and the giant epacrid *Dracophyllum fitzgeraldii* (Ericaceae). The understorey is notable for its many endemic ferns, and the canopy and forest floor are thick with moss. The Mt. Gower plateau is also of global importance for birds, being the main nesting locality for the providence petrel (*Pterodroma solandri*), which nests in burrows on the forest floor, often among groves of palms, and is a stronghold for the woodhen (*Tricholimnas sylvestris*), an endemic, flightless member of the rail family currently returning from the brink of extinction.

Lepidorrhachis, known to locals as the little mountain palm, is one of three genera endemic to Lord Howe Island. The most well-known of these, *Howea*, comprises two species distributed from sea level to around 400 m, including the famous Kentia palm of the horticultural industry, *H. forsteriana*. The third genus, *Hedyscepe*, contains a single species *H. canterburyana* (big mountain palm), a robust upland palm that grows from 400 m to the mountain summits, overlapping slightly with *Howea* at lower altitudes and co-occurring with *Lepidorrhachis* at the upper part of its range.

The distinctive habit of *Lepidorrhachis* (Figs. 3, 4) cannot be confused with that of *Hedyscepe*. As the local names suggest, *Lepidorrhachis* is much smaller than *Hedyscepe*, its dumpy trunk rarely exceeding 2 m. The stiff, arching leaves resemble those of *Hedyscepe*, but differ in their leaf sheaths, which are relatively short and form a rather indistinct crownshaft, the older leaf sheaths to the exterior splitting longitudinally to the base (Figs. 3–5). The outer surface of the sheaths are coated in a dense layer of buff-colored fuzz, more officially termed indumentum. *Hedyscepe*, on the other hand, bears a stout and well defined crownshaft with a glistening waxy-white coating. Between August and December, *Lepidorrhachis* comes into bloom, some individuals producing several densely branched inflorescences along with abundant

2. Mt. Gower from the south, showing the summit plateau, the primary locality for *Lepidorrhachis*. Photo: Ian Hutton.

3. *Lepidorrhachis* sometimes grows in exposed cliff-top locations. Photo: Bill Baker.

crops of marble-sized, red fruit from the previous year's flowering (Fig. 5; Back Cover).

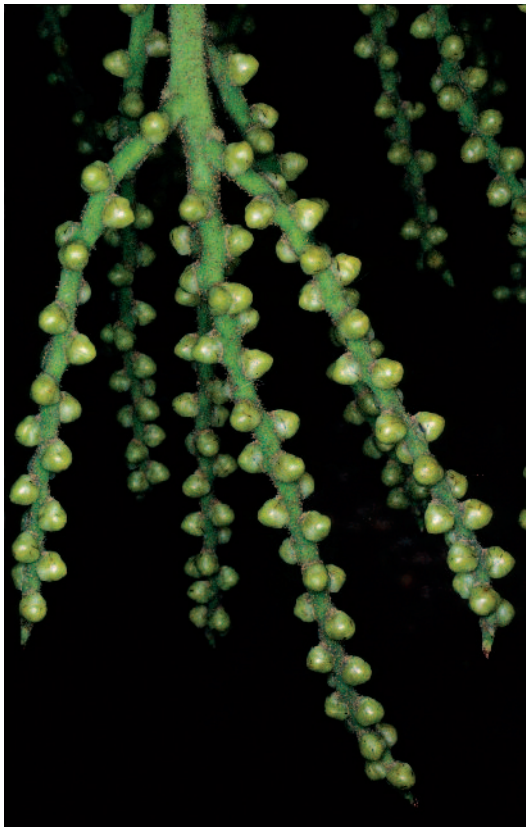
During fieldwork on Lord Howe in 2003, we observed that the inflorescences of *Lepidorrhachis* are unisexual (Figs. 6, 7) and that inflorescences of both sexes are borne on the same individual. The production of unisexual inflorescences is common in palms, but the majority of cases occur in dioecious genera in which individuals bear inflorescences of one sex only. The presentation of both male

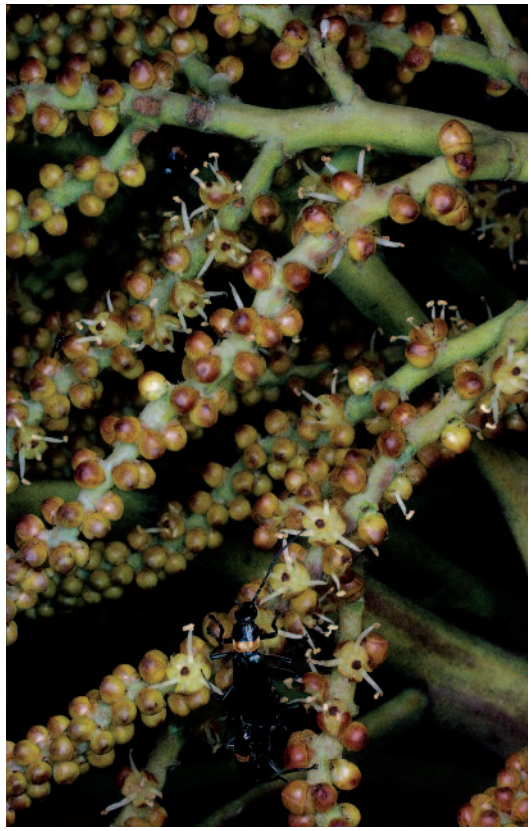
4. Mossy forest on the Mt. Gower summit plateau, with *Lepidorrhachis* in the foreground. Photo: Bill Baker.

5. Sheaths and inflorescences of *Lepidorrhachis mooreana*. Note the deeply split leaf sheath with dense indumentum. Inflorescences with almost ripe fruit and one female inflorescence are visible. Photo: Bill Baker

and female inflorescences on the same individual is known elsewhere only in *Arenga*, *Wallichia*, *Wettinia*, *Marojejya* and *Elaeis*. The condition has not been reported previously in *Lepidorrhachis*.

Being a member of subfamily Arecoideae, *Lepidorrhachis* was expected to present its flower in groups of three, known as triads, with two male flowers flanking a solitary female flower. In *Lepidorrhachis*, however, we noted that inflorescences produced either solitary female flowers or pairs of male flowers; complete triads were not found. In one unusual inflorescence, some branches bore male flowers only, while others bore females alone. This inflorescence was otherwise very distorted and was regarded as aberrant. Microscopic examination of the rachillae from typical inflorescences reveals that the female flower is subtended by a rachilla bract and three bracteoles, the same number of bracts and bracteoles as occurs in a complete triad. Thus, the solitary female flower appears to be equivalent to a triad in which the two male flowers have not developed. There is no evidence, such as a scar or a vestigial structure, of a male flower itself. The bracteoles within clusters of male flower pairs are indistinct, but there is no evidence of a remnant female flower or a juvenile female bud which might develop at a later stage, as occurs in *Howea* and related genera. The diagnostic plate in *Genera Palmarum* (Uhl & Dransfield 1987; fig. 135b, p. 426), which suggests somewhat schematically that *Lepidorrhachis* produces complete triads, does not correspond with our observations. We suspect that the occurrence of complete triads has been inferred by the artist, rather than observed.





6 (left). Flowers on female inflorescence of *Lepidorrhachis*. *7* (right). Flowers on male inflorescence of *Lepidorrhachis*, with Lord Howe rooting bugs. Photos: Bill Baker.

Lord Howe Island has eroded very rapidly since its formation during a volcanic episode 6.9–6.4 million years ago and it is likely that *Lepidorrhachis*, or at least its ancestors, may have once occupied larger montane areas that have long since disappeared. Unless *Lepidorrhachis* can adapt to life at lower elevations, it is doomed to be eroded to extinction in a few million years time. However, this palm faces more imminent threats, despite being protected within a UNESCO World Heritage Site and a permanent park preserve. Introduced rats (*Rattus rattus*) are common throughout the island and have a very detrimental effect on the fruit yield of *Lepidorrhachis*. At one time, inflorescences were caged to prevent fruit predation, but an active rodent control program on the summit of Mt. Gower has rendered this practice unnecessary. Young seedlings now abound, but the legacy of the rat can be seen in the uneven age structure of the *Lepidorrhachis* population. A more sinister threat comes from global climate change. The habitat occupied by *Lepidorrhachis* is dependent on the conditions created by near-permanent cloud cover on the mountain tops. If climate change causes the cloud base to rise, the vegetation of the summits will alter radically and numerous endemic plant species, *Lepidorrhachis* included, and the animals that depend on them will inevitably become extinct.

Acknowledgments

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Palms at the Botanical Garden of Geneva, Switzerland

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1. Constructed in 1911, the Jardin d'hiver, is probably the most important landmark of the Geneva Botanical Garden. *Chamaerops humilis* and *Phoenix canariensis* in foreground.

With its 25 hectares and a history of almost 200 years, the Botanic Garden of Geneva is by far the largest and one of the oldest botanic gardens in Switzerland. The palm collection is also the largest Swiss public collection in terms of number of individuals and taxonomic diversity.

In order to establish the main scientific lines that will frame the future development of the palm family in the Botanical Garden of Geneva, the history of the palm collection was surveyed and an inventory of all species cultivated in the greenhouses and outdoors was completed between April and December of 2004. As a result, critical notes on the history of the whole collection were obtained and all individuals identified and names updated.

History of the collection

Tracking the history of the living palm collection in the Geneva Botanical Garden has not been easy. Our research in the archives and library of the Conservatory showed that almost no original manuscripts have survived. In fact, the few lists of plants that where published are rather incomplete or mainly focused on the description of species that were considered of ornamental value. As we will see below, it is principally John Briquet, director of the garden between 1896 and 1931, who did most to record the history of the garden accurately.

In 1568 the first botanical garden in Geneva was founded by the so called father of botany, Jean Bauhin (1541–1612). This garden was mostly used for teaching medical botany but did not continue for long after Bauhin definitively left the city in 1570 (Burdet 1990). Another important attempt goes back to the early 19th Century, at the time when Augustin-Pyramus de Candolle (1778–1841), the first of three generations of prominent Genevan botanists, decided to create a garden, property of the Geneva municipality. Since the beginning, the double job of A.-P. de Candolle, director of the garden and professor to the Academy of Geneva (future University), linked the two institutions. The garden was founded on the site today called "Bastions," not far from the historical center of the town, and according to Burdet (1990), it already had an orangery and some greenhouses in 1817. Our

2. The "Serre tempérée" is home of about 30 palms and protects this individual of *Trachycarpus fortunei* from the freezing windy winters of Geneva.

research did not find a list of plants originally cultivated in these locations. However, Briquet (1896) indicated that at that time some palms were already cultivated in the eastern wing of the orangery and later on reported the donation to the garden of a fabulous specimen of *Phoenix canariensis* by Baron de Viry (Briquet 1900).

In 1904 the garden was subject to major changes. In this year the garden moved from its original location in the Bastions to the place called "La Console;" nevertheless, the plant collections had to wait until the completion of construction planned in the new garden (Briquet 1908). In 1908, a group of three greenhouses received the first collections of ferns, and some Orchidaceae, Bromeliaceae, Nepenthaceae and Araceae (Briquet 1909c). In the same year, a collection of young palms was purchased from the Haage and Schmidt House, in Erfurt (Briquet 1909a).

In 1910, one year before the construction of the "Jardin d'hiver" in the new garden, the complex of greenhouses of the Bastions was destroyed. The so-called "old botanical garden" was then selected as the place for what has become one of Geneva's most famous landmarks – the "Reformers Wall" – a monument featuring the main founders of the Protestant faith.

During the early 20th Century, the space available in the new garden was not sufficient for all the collections. Only a small group of plants originating in the old garden could be included in the facilities of "La Console," the rest of the plants being temporarily scattered in three different localities. According to Briquet (1909b) these were the public park "Mon Repos," the basements of the Ariana Museum and the conservatory of the Villa Revilliod. All these plant collections were reunited in 1911, the year in which the "Jardin d'hiver" (Fig. 1) and additional greenhouses were finally completed (Briquet 1911). According to Briquet (1913) a specimen of *Phoenix dactylifera* and one of *Washingtonia filifera*, bought from M. Ruby in Fréjus, were planted in 1913 in the "Jardin d'hiver."

It is well known that the plants of the garden suffered of poor maintenance during the First World War (1914–18). The reduced supply of fuel for the heating system, especially during the winter of 1917–1918, caused the loss of many plants, among others the complete collection of Nepenthaceae. Nevertheless during this period some individuals of *Chamaerops* were offered by M. Putzardt from Geneva (Briquet 1918). No new records of palm are registered until 1983 when at least five species were added to the palm collection – *Chamaerops humilis*, *Livistona chinensis*, *Phoenix canariensis* and *P. roebelenii* and *Trachycarpus fortunei* (Hug 1983).

In spite of the long tradition of the garden, the true starting point and consolidation of the current collection is rather young and goes back to the late 1980s. During this period the garden obtained a new complex of greenhouses, including an imposing Mediterranean greenhouse called "Serre tempérée" (Fig. 2). This fact, together with a strong personal affinity for palms, encouraged the third author (currently chief gardener of the greenhouses) to increase both the taxonomic diversity and number of individuals in the collection.

Taxonomic composition

The palm collection is composed of 221 individuals belonging to four subfamilies: Arecoideae, Calamoideae, Ceroxyloideae and Coryphoideae. About 39 genera and 76 species

3. The large entire-bifid leaves of *Phoenicophorium borsigianum* are always of great interest to the visitors of the "Serre Exposition."

Table 1. List of palm species cultivated in the Geneva Botanical Garden.

Localities in the garden and number of individuals for each species are indicated. Abbreviations: CF: Children facility; JI: Jardin d'hiver; NOE: North-West Exposition of the Serre exposition; R: "Rempotoir" (gardeners working area); SE: Serre exposition; SP: Serre Pregny; ST: Serre tempérée, STE: outdoor area of the "Serre tempérée"; TJI: Terrace Jardin d'hiver; TO: Terrace of the "orangerie."

Arecoideae

Adonidia merrillii (Becc.) H.E. Moore	SE(5), SP(7)
Archontophoenix alexandrae (F. Muell.) H. Wendl. & Drude	JI(1), SP(1)
A. cunninghamiana (H. Wendl.) H.Wendl. & Drude	ST(3)
Areca catechu L.	JI(1)
Arenga engleri Becc.	SP(6)
A. obtusifolia Mart.	SP(1)
Butia capitata (Mart.) Becc.	SP(2)
Chamaedorea elegans Mart.	JI(1)
C. glaucifolia H. Wendl.	ST(1)
C. metallica O.F. Cook ex H.E. Moore	SE(2)
C. microspadix Burret	ST(3)
C. pinnatifrons (Jacq.) Oerst.	JI(1)
C. pochutlensis Liebm.	SE(1)
C. radicalis Mart.	SE(2), ST(1), SP(1)
C. seifrizii Burret	SE(1)
C. tepejilote Liebm.	ST(4)
C. zamorae D.R. Hodel	SE(3)
C. cf. woodsoniana L.H. Bailey	SE(1)
Cyrtostachys renda Blume	SE(3), SP(1)
Dictyosperma album (Bory) Scheff.	SE(1)
Dypsis decaryi (Jum.) H. Beentje & J. Dransf.	R(1), SE(2), SP(1)
D. lutescens (H. Wendl.) H. Beentje & J. Dransf.	JI(3), R(1), TO(1)
D. madagascariensis (Becc.) H. Beentje & J. Dransf.	SE(1)
Elaeis guineensis Jacq.	JI(1)
Gaussia princeps H. Wendl.	JI(1), R(1), SP(1)
Howea forsteriana (C. Moore & F. Muell.) Becc.	SP(2), ST(2), TO(2)
Hydriastele beguinii (Burret) W.J. Baker & Loo	SP(2)
Hyophorbe lagenicaulis (L.H. Bailey) H.E. Moore	SE(2), SP(9)
H. verschaffeltii H. Wendl.	SE(2), SP(3)
Jubaea chilensis (Molina) Baill.	SE(1), SP(2)
Phoenicophorium borsigianum (K. Koch) Stuntz	SE(1)
Pinanga coronata (Blume ex Mart.) Blume	JI(1)
Rhopalostylis baueri (Hook. f. ex Lem.) H. Wendl. & Drude	ST(1)
R. sapida (Sol. ex G. Forst.) H. Wendl. & Drude	ST(2)
Roystonea regia (Kunth) O.F. Cook	JI(4)
Sommieria leucophylla Becc.	SP(1)
Syagrus romanzoffiana (Cham.) Glassman	SP(4), ST(2)
S. schizophylla (Mart.) Glassman	ST(1)

Wodyetia bifurcata A.K. Irvine	SE(1), SP(1)
Calamoideae	
Calamus viminalis Wild.	JI(1)
Ceroxyloideae	
Pseudophoenix vinifera (Mart.) Becc.	SP(1)
Coryphoideae	
Brahea armata S. Watson	SP(8)
B. edulis H.Wendl ex S. Watson	SP(3)
Caryota cumingii Lodd. ex Mart.	ST(1)
C. mitis Lour.	JI(3)
C. obtusa Griff.	ST(3)
C. urens L.	ST(1)
Chamaerops humilis L.	NOE(1), SP(1), TJI(4)
Coccothrinax crinita (Griseb. & H. Wendl. ex C.H. Wright) Becc.	SP(1)
Latania lodiggesii Mart.	SP(1)
L. lontariodes (Gaertn.) H.E. Moore	SE(1)
Licuala grandis H. Wendl.	SE(2)
L. peltata Roxb. ex Buch.-Ham.	SP(2)
L. spinosa Wurmb	ST(1)
Livistona chinensis (Jacq.) R.Br. ex Mart.	SP(2)
L. lorophylla Becc.	ST(1)
L. cf. humilis R.Br.	ST(2)
L. sp.	ST(1)
Phoenix canariensis Chabaud	CF(1), TJI(1)
P. dactylifera L.	ST(1)
P. loureiroi Kunth	SP(4)
P. pusilla Gaertn.	SP(2)
P. roebelenii O Brien	JI(2)
Rhapis exelsa (Thunb.) Henry	ST(2)
R. multifida Burret	JI(1)
Sabal palmetto (Walter) Lodd. ex Schult. & Schult f.	ST(1), SP(2)
S. mauritiiformis (H. Karst.) Griseb. & H. Wendl.	SP(8)
S. minor (Jacq.) Pers.	SP(4)
Serenoa repens (W. Bartram) Small	ST(4)
Trachycarpus fortunei(Hook.) H. Wendl.	CF(1), NOE(1), STE(2), TJI(5), TO(3)
T. wagnerianus Hort. ex Becc.	NOE(3), ST(1), TJI(1)
Trithrinax brasiliensis Mart.	SP(5)
Washingtonia filifera (Linden ex André) H. Wendl. ex de Bary	SP(3), ST(1)
W. robusta H. Wendl.	ST(2)
W. sp.	CF(2)
Zombia antillarum (Desc.) L.H. Bailey	SP(3)

are present (Table 1). Arecoideae, the largest palm subfamily, is the best represented group in the collection with 114 individuals and 39 species. Within this subfamily the genus *Chamaedorea*, the largest neotropical genus, is especially well represented with 22 individuals belonging to 11 species. Most species of *Chamaedorea* seem to be particularly well

adapted to the greenhouse conditions and continuously produce new leaves and inflorescences.

The other three subfamilies present in the collection are Calamoideae (1 individual, 1 species), Ceroxyloideae (1 individual, 1 species) and Coryphoideae (105 individuals, 35 species) (Table 1). Efforts are now being made to include of representatives of Nypoideae and Phytelephantoideae.

Distribution of the palms in the garden

The palms of the collection are grouped in the three different greenhouses according to more or less similar growth conditions. In general, the choice of species so far has been made to show morphological diversity and less to represent taxonomic groups or geographic areas. The 221 palms are almost equally distributed in the four main greenhouses (Table 1).

The "Serres d'exposition" is characterized by permanent conditions of high temperature and atmospheric humidity, environmental factors that have in general terms enabled the display of an artificial lowland rainforest. Not only have the 25 palms cultivated there taken advantage of those conditions, but there is also a rich collection of Araceae and Bromeliaceae. Majestic individuals of *Phoenicophorium borsigianum* (Fig. 3), combining a densely spiny stem with huge entire-bifid leaves, *Dictyosperma album* (Fig. 4), *Dypsis decaryi* and *Adonidia merrillii* already reach the top of the greenhouses. *Cyrtostachys renda*, *Licuala grandis* (Fig. 5) and *Wodyetia bifurcata* are some of the most interesting palms in this place.

4. *Dictyosperma album* is one of the most beautiful palms present in the "Serre Exposition."

The collection of plants of the "Jardin d'hiver" (Fig. 1) has been organized in a rather educational and aesthetic fashion. The visitor will observe a large number of ornamental plants that are commonly cultivated in tropical gardens. Several individuals of *Roystonea regia* and a compact group of *Phoenix roebelenii* (the oldest palm cultivated in the palm collection), are the main elements of this greenhouse. An increasing interest has been addressed to the cultivation of useful palms in the "Jardin d'hiver," and species such as *Areca catechu* and *Elaeis guineensis* are commonly used as examples of multipurpose palms in the guided visits.

The "Serre tempérée" (Fig. 2), inaugurated in 1987, comes just after the "Serres d'exposition" in number of individuals and palm species (Table 1). Most individuals displayed here are rather young but already show healthy growth. Stairs provide access to the upper levels of the greenhouses making it possible to appreciate the large crowns of *Washingtonia filifera* and *W. robusta*, certainly the most impressive palms in the garden. Several plantlets of *Rhapis excelsa, Serenoa repens* and small-sized species of *Chamaedorea* grow under well established individuals of *Archontophoenix cunnighamiana, Caryota urens* and *Syagrus romanzoffiana*. Apart from the species present in the garden, many taxa are also cultivated in an external facility, mostly involved with the propagation of plant material, called "Serres de Pregny." This complex of greenhouses was constructed by Joseph Paxton in 1860 and traditionally belonged to the family Rothschild (Matille 1988). In 1987 the complex was donated to the Botanic Garden of Geneva and from then renovated until completed in 1994.

The outdoor palm collection consists at the moment of only *Chamaerops humilis* (Fig. 6), *Trachycarpus fortunei* (Fig. 2) and *T. wagnerianus*, species that are always cultivated in areas protected from the frozen wind that

characterizes Geneva during the winter. The low temperature during the months of January and February is certainly the most limiting factor for the outdoor cultivation of palms; however, increasing experience with cold hardiness may enable the enrichment of the collection in a relatively short time. As indicated by Gibbons and Spanner (1999) and Jacquemin (1999), about ten palm species resist temperatures as low as -15°C and therefore should be suitable for outdoor cultivation in Geneva. Two of these species, *Nannorrhops ritchiana* and *Rhapidophyllum hystrix*, might even survive to -20°C (Gibbons & Spanner 1999, Jacquemin 1999). *Butia capitata*, *Jubaea chilensis* and *Trachycarpus takil* do survive to -15°C and should be tested without winter protection (Jacquemin 1999), whereas *Brahea armata*, *Sabal minor* and *S. palmetto*, do not survive below -12°C and should be cultivated with winter protections (Jacquemin 1999). As we will see below with the case of *Trachycarpus fortunei*, the outdoor cultivation of exotic palms should nevertheless be attempted with caution.

Notes on *Trachycarpus fortunei* in Switzerland

Because of its easy germination, fast growth and good resistance to freezing temperatures the Chinese windmill palm or Chusan palm (*Trachycarpus fortunei*) has traditionally been quite attractive for Swiss gardeners (Fig. 2). However, because of its apparently uncontrolled spread in some regions of southern Switzerland it has become recently of great concern for local biologists and professionals interested in the conservation of the native flora. *Trachycarpus fortunei* is originally from central-east China, and apparently first brought to Europe (Holland) in 1830, and almost 20 years later to England by Robert Fortune (Reynolds 1997).

5. *Licuala grandis* combines spectacular palmate leaf blades with an elegant pendant infructescence.

6. *Chamaerops humilis* is successfully cultivated outdoor in large-sized pots.

An exact date of introduction and first cultivation of this species in Switzerland is not clear. Some reports from the early 20th Century followed by detailed remarks for the Canton Tessin, in the southernmost region of Switzerland, during the 1950s and the 1960s (e.g. Anliker 1966) already confirmed its presence in several private gardens and some local forests of the most temperate valleys. Interesting long term research carried out by Gian-Reto Walther (e.g. Walther 1999, 2003) on the ecology and history of this species in Tessin suggested that milder winters have favored the naturalization of this palm and other exotic evergreen broad-leaved species in the native deciduous forest of that region.

Our visits to the area certainly confirm that the species is, at least at a local level, invasive on the forested slopes of mountains such as Monte San Salvatore and Monte Bre near Lugano and Monte Caradada near Locarno (Fig. 7). Additionally we have observed the palm widely cultivated in almost all lowland Swiss cities, and according to Walther (1999) from ca. 1980 its cultivation has increased in gardens in Zurich where planted individuals survive recent winters unprotected and produce flowers. The apparently uncontrolled spread of the palm has been noticed by the Swiss Commission for Wild Plant Conservation (2004) and has included the species in the so called "watch list," which includes all introduced plants that do not present a current danger to the native flora but which require close monitoring.

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7. *Trachycarpus fortunei* growing in the understory of the Monte Cardada slopes (Canton Tessin, southern Switzerland). Photo Dr. Peter Voser.

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PHOTO FEATURE

Raphia australis at Kosi Bay, South Africa

DR. JONATHAN SLEATH
The Villa, Kingstone,
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1. A dense stand of the rare and spectacular *Raphia australis* at Kosi Bay, South Africa.

2 (above). A forest of *Raphia australis* wth ferns carpeting the forest floor. 3 (below). A house constructed of petioles and rachises of *Raphia australis*.

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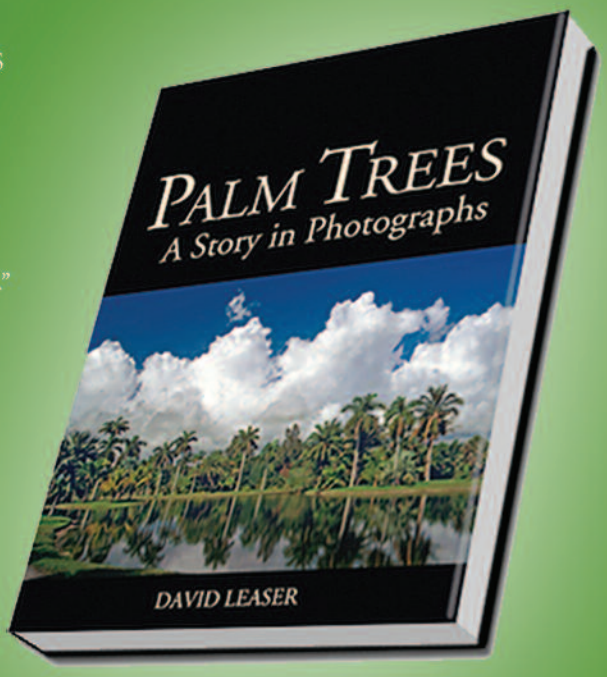

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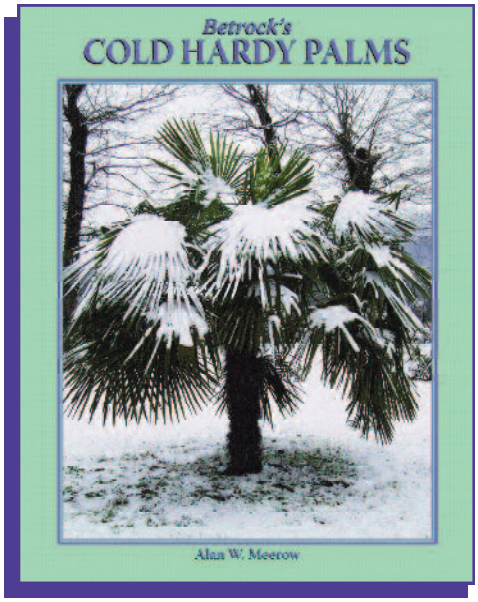

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