

Hemithrinax ekmaniana, Jewel of the Cuban Palms

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The Cuban endemic *Hemithrinax ekmaniana* is easily one of the most unusual, recognizable and yet little-known palms in the world. Here we update its description, provide information about its history, habitat and phenology and discuss threats to its survival.

Joseph Dalton Hooker erected the genus *Hemithrinax* in 1883, basing it on the previously named species *Trithrinax compacta*, which August Heinrich Rudolf Griesbach and Hermann Wendland had named in 1866 (Griesbach 1866). This species was based on a

collection that Charles Wright had made in Cuba (Wright 3222). Max Burret named the amazing *Hemithrinax ekmaniana* in 1929, one of four species in the endemic Cuban genus, basing it on a collection that the Swedish botanist and explorer Erik Leonard Ekman had



1 (top). *Hemithrinax ekmaniana* is endemic to the Mogotes de Jumagua, a set of eight, karst limestone hills surrounded by agricultural fields near Sagua La Grande, Villa Clara. 2 (bottom). Mogote no. 4 is one of three of the set of eight mogotes that has *Hemithrinax ekmaniana*. Note the barely visible palms on the north (right) side of the hill (Photos by D.R. Hodel).

made in 1924 in central Cuba (Ekman 18536). Borhidi and Muñiz (1985) transferred it to *Thrinax* but later Lewis and Zona (2008), using mostly molecular data, returned it to *Hemithrinax*.

Ekman on his herbarium specimens and Burret in his article cited the locality of *Hemithrinax ekmaniana* as “Sagua La Grande.” A few years later, in 1940, Leon made a collection of this species and cited the location as “Caguaguas-



3. *Hemithrinax ekmaniana* is an unarmed, solitary, tree palm, to 7 m tall. The green, living and brown, dead, persistent leaves form an obovoid-shaped canopy (Photo by D.R. Hodel).

Sagua la Grande," a community near the east end of Mogotes de Jumagua, a few kilometers from the city of Sagua La Grande (a *mogote* is

a hill of karst limestone, which is typically composed of uneven, multi-sized limestone rocks with extremely sharp, fissured, pitted



4. Leaf bases of *Hemithrinax ekmaniana* are split at the base (Photo by D. Suárez).

surfaces). When publishing his treatment of *Hemithrinax* in his series on Cuban palms, Leon (1941) gave the more precise location where *H. ekmaniana* grew, the “Mogotes de Jumagua,” currently in the province of Villa Clara, municipality of Sagua La Grande.

Mogotes de Jumagua is a set of eight, connected, upper Cretaceous, karst limestone hills belonging to the geological formation known as Alturas Heights in the northern Cordillera of Las Villas, about five kilometers from Sagua La Grande (Fig. 1). The connected hills, which attain a maximum height of 86.8 masl, are arranged in a liner fashion in a more or less southeast to northwest orientation. In the 19th century, Pezuela (1866) stated that they were known as “the Hills of the Jumagua” and described them as “...calcareous in character, that running north are separated to the O. [west] by a marshy terrain between

mountains called by navigators Mogotes...” The eight hills are in two groups separated by a small valley and are crisscrossed and connected by an extensive network of caves. In the southeast one group has hills 1 and 2 while to the northwest the second group has hills 3, 4 (Fig. 2), 5, 6, 7 and 8.

In 1976, a quarry was established on one of the hills of Mogotes de Jumagua for the mining and extraction of limestone aggregates. This activity, which was responsible for destruction and significant loss of biodiversity at the site, drew the attention of the speleological and archaeological group Sabaneque in early 1977. Based on the site’s natural and historical value, Sabaneque made the successful case for protecting the Mogotes de Jumagua from mining and other destructive activity, and it was soon declared an ecological reserve as part of the National System of Protected Areas of Cuba. Conservation activity began in 1984 when it was formally named the Mogotes de Jumagua. In 2008 the Council of State of the Republic of Cuba legally established Mogotes de Jumagua, designating 453 ha as an area of national significance because of its interesting flora and fauna and its archaeological, paleontological and historical value (CNAP 2011–2015). The Mogotes de Jumagua contains 442 species of vascular plants belonging to 302 genera of 106 families (Castañeda 1996). In addition to *Hemithrinax ekmaniana*, another endemic of exceptional merit at the site is the small tree *Tabebuia saxicola*.

Materials and Methods

During the last ten years, we observed and collected data on *Hemithrinax ekmaniana* at the Mogotes de Jumagua on multiple occasions. We reviewed the literature, including the original account of the species (Burret 1929), and located herbarium specimens, including Ekman’s types, in Cuban and foreign herbaria (GB, HAC, HAJB, ULV, NY and S). We cite herbarium acronyms according to Index Herbariorum (Thiers 2012).

We defined three basic stages of plant development to describe population structure accurately: seedling (leaves only, without visible stem); juvenile (with visible stem but non-reproductive); and adult (reproductive).

We used a Garmin® GPS (62s series, accuracy ± 5 m) to determine the spatial area of the population of *Hemithrinax ekmaniana*. We collected phenological data monthly from 100 individuals. We obtained floral measurements

using a stereo-microscope Comecta SA at 200X magnification and measured and recorded data from 10,000 fruits and seeds. For fruit, seed and stem diameters (the latter 1.3 m above ground) we used a metric micrometer (accuracy ± 0.05 mm) and weighed fruits and seeds on a Gibertini balance (EU-C5001, precision ± 0.1 g). Depending on palm size and location, we used a Suunto hypsometer (0.1 m accuracy) or 10-meter tape (mm and cm fractional units) to determine height and annual growth rate.

We followed Borhidi and Muñiz (1986) to describe the phytogeographic location and Capote and Berazaín (1984) to define the type of plant formation where *Hemithrinax ekmaniana* occurs. We obtained companion species information from Castañeda (2006) and Falcón et al. (2013–2014). For conservation status, we supplemented our data with information from Berazaín et al. (2005), Borhidi and Muñiz (1983), Dransfield et al. (1988), IUCN-BGCS (1989), Johnson et al. (1996), Peña et al. (1998), Walter and Gillet (1998) and Zona et al. (2007) and determined the conservation category on criteria from IUCN (2012). The laboratory of the “Marta Abreu” Central University of Las Villas identified pests associated with *H. ekmaniana*.

Results and Discussion

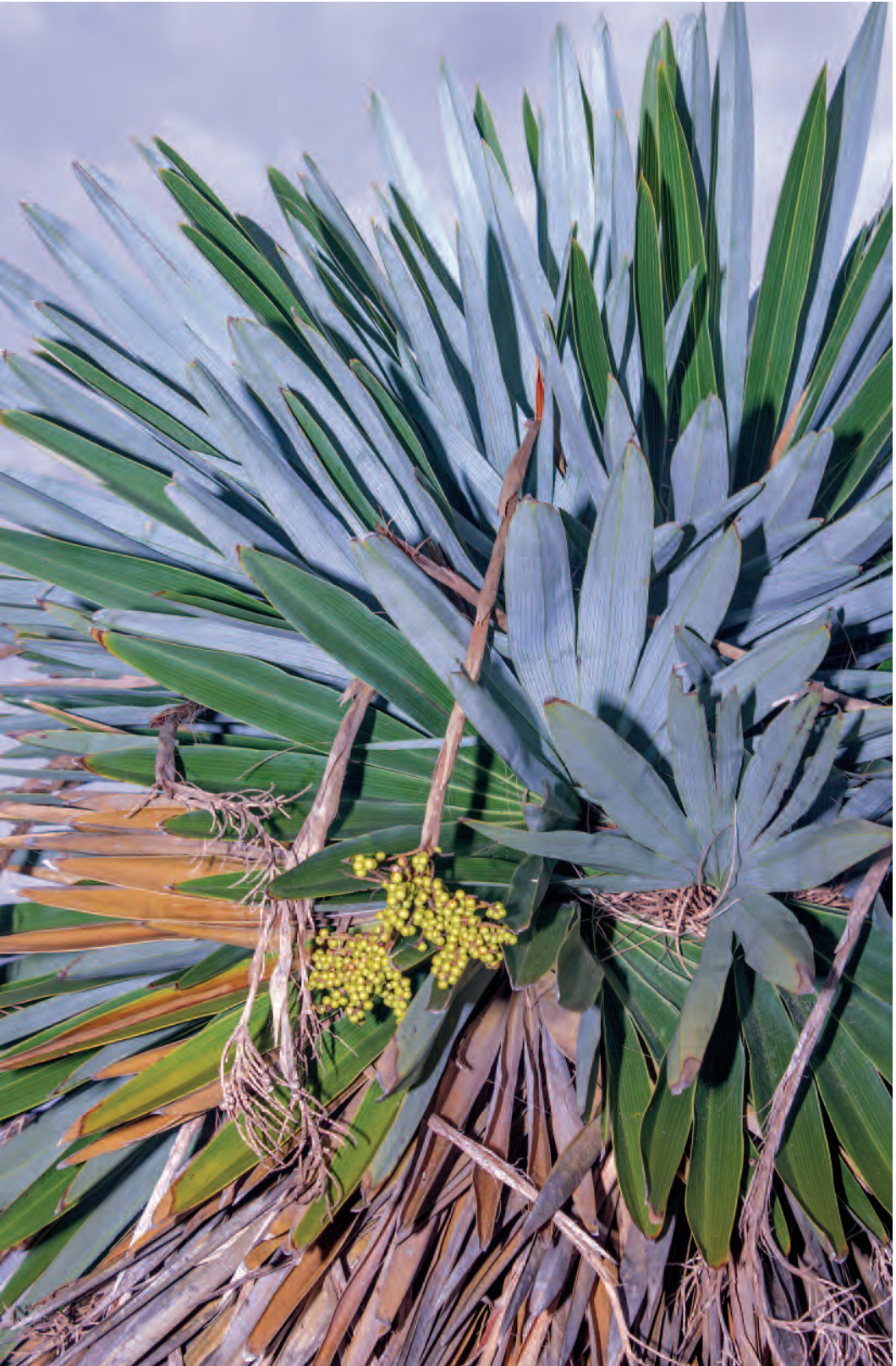
Hemithrinax ekmaniana Burret, Kongl. Svenska Vetensk. Acad. Handl., n. s., 6(7): 9. 1929. Type: Cuba. Villa Clara: Sagua La Grande, “on steep rock,” 20 February 1924, *Ekman 18536* (S05-5546) lectotype (here designated) S (photo!); isolectotypes (S-R-2860, S05-5547, S05-5548) S (photos!), NY (photo!), GB.

Thrinax ekmaniana (Burret) Borhidi and O. Muñiz, Acta Bot. Hung. 31: 227. 1985.

Unarmed, solitary, tree palm, to 7 m tall but attaining maturity and fruiting when less than 1 m tall (Fig. 3). Trunk erect, 6.4–7.6 cm diam. at base and 5.1–6.9 cm diam. at 1.30 m above ground, smooth, very faintly ringed, grayish. Leaves palmate, very densely inserted, ca. 40–60 green and 50–70 brown persistent, forming an obovoid-shaped canopy (Fig. 3); base 18–22 cm long, 13–15 cm wide, proximal part split (Fig. 4), this 14.1–17.8 cm long, 10 cm wide where attached to trunk, proximal margin composed of slender, grayish, unbranched fibers 13–16 cm long, 0.8–1.3 mm diam., arranged in 2 densely woven layers, distal margins composed of slender, cream-colored, unbranched fibers 45–65 cm long, 1–2 mm thick, becoming thread-like distally and

5. Distal margins of the leaf bases of *Hemithrinax ekmaniana* are composed of slender fibers 45–65 cm long that protrude conspicuously from among the leaves (Photo by D.R. Hodel).





6. The interfoliar inflorescences of *Hemithrinax ekmaniana* are ascending to spreading in flower and drooping in fruit (Photo by D.R. Hodel).



7 (top). Inflorescences in flower of *Hemithrinax ekmaniana* are ascending in flower. Note the densely placed flowers (Photo by D. Suárez). 8 (bottom). Fruits of *Hemithrinax ekmaniana* are yellow to creamy at maturity and densely placed (Photo by D.R. Hodel).

protruding conspicuously from among the leaves (Fig. 5); petiole to 10 cm long, 1.6 cm wide and 8 mm thick at base, 1.3 cm wide and

6 mm thick at apex, biconvex, green, margins sharp and with deciduous hairs; hastula adaxially triangular, light green, to 1.4 cm high

Table 1. Population Age Structure of *Hemithrinax ekmaniana*, Mogotes de Jumagua, Villa Clara, Cuba, 2004–2014.

Mogote	Seedling		Juvenile		Adult		Total	
	2004	2014	2004	2014	2004	2014	2004	2014
4	7	3	0	0	5	6	12	9
6	59	63	102	108	243	247	404	418
7	11	12	6	7	50	58	77	77
Total	77	78	118	115	298	311	493	504

with 0.8 mm apical point, 2 cm wide and 8 mm thick at base, abaxially +/- triangular, pale green, to 3 mm high with 0.5 mm apical point, 1.8 mm wide and 0.7 mm thick at bases; blade cuneate to broadly cuneate, 50 cm wide, rigid, pale green to slightly waxy green adaxially, conspicuously waxy silvery gray abaxially (Fig. 5), composed of 28–32 segments, these with thickened margins, midrib impressed adaxially, raised abaxially, 6–9 conspicuous primary nerves on each side of midrib, transverse veinlets barely visible, central segments 36–42 cm long, connate in proximal 1/3 and free in distal 2/3, narrowing to bifid apex to 1 cm long, rarely to 7 cm long, lateral segments to 27 cm long, connate in proximal 3 cm only, otherwise free, a filament-like appendage 8.9–14.6 cm long, 0.1–0.3 mm diam. frequently arising from the junction of adjacent segment margins. Inflorescences interfoliar, 60–80 cm long, slightly shorter than subtending leaf in flower to exceeding the subtending leaf in fruit, ascending to spreading in flower, drooping in fruit (Figs. 6 & 7); peduncle to 64.5 cm long, 0.8 cm diam. at base, clothed with 6–8, tubular, tomentose, densely striated bracts, prophyll to 11.5 cm long, acute at apex, peduncular bracts 8.3–13.0 cm long, acuminate at apex, distal most bract exceeding the peduncle and extending on to rachis; rachis 8–12 cm long with 1–3 primary branches, these 21–28 cm long, 3.5 mm diam. at rachis, secondary branches 1–3 per primary branch, 0.9–1.1 cm long, 2 mm diam. at primary branch and subtended there by a thin, deciduous bracteole 0.8 mm wide; rachillae up to 9 per inflorescence, 4–5 cm long, 1.5–1.8 mm diam., each averaging 42 flowers, each subtended by a deciduous bracteole to 0.6 mm long. Flowers solitary, densely and irregularly placed (Fig. 7), sessile on a short tubercle-like pedicel, whitish, lacking bracteoles; perianth cupular, 2 mm wide, 6 lobed, lobes small, ovate; stamens 6, sessile, filaments lacking,

bases connate; anthers oblong, 0.7 mm long with a very broad connective. Fruit averaging 233 per infructescence, 28 per rachilla, densely but irregularly placed (Fig. 8), 4.5–5 mm diam., globose, yellow to creamy at maturity, placed on a on a short tubercle-like pedicel; seed 3.9–4.0 mm diam., depressed-globose, seed 3.9–4 mm in diameter, hilum basal, endosperm homogenous, embryo subapical.

Additional Specimens Examined: Cuba. Villa Clara: Caguaguas-Sagua la Grande, Mogotes de Jumagua, 5 April 1940, *León, Carabia & Marie-Victorin 17637* (HAC); April 1992 *Henderson & Galeano s.n.*, (NY, [photo]); 26 March 1992 *Castañeda 4567* (ULV); 2 November 1994, *Castañeda 5188* (ULV); 5 October 1996, *Morici 350* (HAC); 12 October 1998, *Castañeda 1914* (ULV); 28 February 2012, *Borsch et al. 5196* (HAJB, B, ULV); 18 January 2013, *Rodríguez & Suárez 42764* (AJBC); 12 October 2013, *Pérez-Obregón 10701* (ULV); 26 September 2015, *Rodríguez 10991* (ULV).

Distribution and Ecology

Hemithrinax ekmaniana is endemic to Mogotes de Jumagua, Sagua La Grande, Villa Clara, about 16 km from the northern coast of Cuba, where it grows mostly on north-facing cliffs at and near the tops of mogotes 4 (Fig. 2), 6 and 7 only, from 20 to 80 masl. There it is perhaps the most conspicuous element of the semi-deciduous, mesic forest and Mogote Vegetation Complex.

This area, which is exposed to the prevailing north and northeast winds, has a pronounced and lengthy dry season, and native plants at the site, including *Hemithrinax ekmaniana*, are predominantly xerophytes. Indeed, Morici (2000) referred to *H. ekmaniana* as the most xerophytic species of the genus. Extreme drought, warm temperatures, wind, high solar radiation and a porous substrate characterize the site. For six months the palms survive with



9. Senior author Milián Rodríguez stands with several of the more than 300 adults and a few of the more than 100 juveniles at the Mogotes de Jumagua (Photo by D.R. Hodel).

only about 20% of the already low annual rainfall; average rainfall for the last 10 years is about 1,020 mm in the rainy season (May 20 to October 15) and only about 270 mm for the dry season (CMPVC 2015). That the palms are mostly on the sides of north-facing cliffs where solar radiation is lower and even shade is present for part of the year, especially when they are young and establishing, undoubtedly helps with their survival.

Companion species include *Agave legrelliana* Jacobi (Asparagaceae), *Capparis grisebachii* Eichler (Capparaceae), *C. cynophallophora* L. (Capparaceae), *Forestiera segregata* (Jacq.) Krug & Urb. (Oleaceae), *Guapira discolor* (Spreng.) Little (Nyctaginaceae), *Hybanthus havanensis* Jacq. (Violaceae), *Hyperbaena racemosa* Urb. (Menispermaceae), *Malpighia pallens* Small (Malpighiaceae), *Philodendron lacerum* (Jacq.) Schott (Araceae), *Picramnia pentandra* Sw. (Picramniaceae), *Pseudocarpidium ilicifolium* (A. Rich.) Millsp. (Lamiaceae), *Selenicereus grandiflorus* (L.) Britton & Rose (Cactaceae), *Sideroxylon foetidissimum* Jacq. (Sapotaceae), *Tabebuia myrtifolia* (Griseb.) Britton (Bignoniaceae), *T. saxicola* Britton (Bignoniaceae) and *Trichostigma octandrum* (L.) H. Walter (Phytolaccaceae).

Population Age Structure

Table 1 shows the age distribution of the population of *Hemithrinax ekmaniana* for 2004 and 2014. The 2014 census counted 311 adults (Fig. 9), 115 juveniles and 78 seedlings, figures that differed little from the 2004 census, indicating that the population has remained stable over the 10-year period.

Phenology

Hemithrinax ekmaniana initiates flowering at the beginning of the rainy season, about late May, and continues until the middle of September, while fruits are produced from late June to the middle of October to (Albert and López 1993). Fruit maturation averages about three months. Fruits can persist on the tree for up to one year (Morici 2000). The average weight and volume of 1000 fruits are 56.58 g and 86 cm³, respectively. The average weight and volume of 1000 seeds are 42.70 g and 64 cm³, respectively. The growth rate is slow, about 1.27cm of trunk per year.

Conservation Status

The narrow, restricted range of *Hemithrinax ekmaniana* increases its susceptibility to a random, single, disruptive event, like a

hurricane (tropical cyclone), and to potential damage from weeds, animals, disease and human activity. A large plain with extensive agricultural activity surrounds the Mogotes de Jumagua, where *H. ekmaniana* is endemic. This agricultural activity could threaten fragile biotic relationships and the entire *mogote* ecosystem. Construction of an agricultural drainage canal at the base of the north side of the *mogotes* has altered surface water runoff patterns. On the south side of the *mogotes* the use of agricultural pesticides can negatively affect local fauna, mainly insects, including pollinating beetles (Coléoptera: *Carybrychus* sp.). We have also observed insect-predated seeds and termites in trunks of *H. ekmaniana*, both of which could be affected by nearby pesticide use. Another threat is the common occurrence of summer thunder storms, which in the past have killed five individuals of *H. ekmaniana* with lightning strikes.

With a single population occupying only 2.3 ha of a 10-ha site, *Hemithrinax ekmaniana* is one of the most narrowly distributed and vulnerable Cuban palms. Fortunately, because it is located in a legally protected area with difficult access, well preserved vegetation and soils unsuitable for agriculture, we do not predict a decline in its population size; thus, we confirm its inclusion in the vulnerable category, Vu (D1-2), according to IUCN (2012) criteria, which González-Torres et al. (2016) confirmed.

Ex Situ Conservation

Hemithrinax ekmaniana is cultivated in several botanical gardens in Cuba, including the National Botanical Garden (Havana), Cienfuegos Botanical Garden, Las Tunas Botanical Garden and the Botanical Garden of the "Marta Abreu" Central University of Las Villas. Outside Cuba it is cultivated in the Palmetum of Santa Cruz de Tenerife in the Canary Islands, Spain; Orto Botanico di Messina in Italy; and Fairchild Tropical Botanic Garden and the Montgomery Botanical Center in Florida, USA (Palmpedia 2015). It is also cultivated in a few private gardens in Sagua La Grande, Cuba and South Florida, USA.

Ornamental Potential

Because of its unique habit and leaves, *Hemithrinax ekmaniana* has great ornamental potential and would be especially suitable for subtropical and tropical gardens in areas with a pronounced and lengthy dry season and poor, rocky and/or limestone soils. Although

slow growing, it is easily propagated from seeds and cultivated using traditional nursery methods.

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