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A Revision of *Calyptronoma* (Arecaceae)

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Although uncommon in cultivation and restricted to habitats that are not always readily accessible, *Calyptronoma* palms nevertheless are of great interest. *Calyptronoma* is clearly a member of the tribe Geomeae of the subfamily Arecaceae, and like all members of that tribe it has triads of flowers borne in pits in the rachillae. Although its tribal placement is without controversy, the disposition of the genus and the enumeration of its species have endured shifting botanical tides for over a century. The taxonomic and nomenclatural confusion surrounding these palms has obscured two important points: *Calyptronoma* is a genus of palms confined entirely to the Greater Antilles, and one of its species is threatened in Puerto Rico.

Because of the intrinsic interest of this group of palms and because of my own long-standing interest in Caribbean plants, I welcomed the opportunity to collect and study the genus while in the Greater Antilles. Particular effort was made to find reliable characters by which the species can be distinguished and to establish with confidence the distribution of the species. The results of this study are presented here.

Taxonomic History

The history of the genus *Calyptronoma* is brief but tortuous. Species now included in *Calyptronoma* began their nomenclatural life in genera as diverse as *Geonoma* and *Elaeis*, and over the years, *Calyptronoma* itself has suffered what de Nevers and Henderson (1988) politely called a "checkered taxonomic history."

Grisebach (1863) published, without description, the name *Geonoma* (*Calyptronoma*) *swartzii* Griseb. & H. Wendl., citing the place of publication as his Flora of the British West Indies (1859-1864), where the genus and description were published in 1864 as *Calyptronoma swartzii* Griseb. It appears that Grisebach (1863) inad-

vertently anticipated the publication of the new genus and its sole species, *C. swartzii*. The 1863 publication was intended to be a nomenclatural transfer of *Calyptronoma* into *Geonoma*, although it was invalid because the basionym had not yet been published. In effect, Grisebach changed his mind on *Calyptronoma* even before he had published the genus as new. Subsequently, Grisebach (1866) validated the combination in *Geonoma*, although is not clear whether or not he intended for *Calyptronoma* to have subgeneric status.

After such an inauspicious and uncertain beginning, *Calyptronoma* continued to endure the ignominy of changing opinions. Wendland (in Kerchove 1878) recognized *Calyptronoma*. Hooker (in Bentham and Hooker 1883) transferred *Calyptronoma* to *Calyptrogyne* H. Wendl., an opinion echoed by Gomez Maza (1889). Drude (1889) reinstated *Calyptronoma*, but Beccari (1912) and Burret (1930) sank the species into *Calyptrogyne*. Bailey (1938) revived *Calyptronoma*, but six years later, it was again sunk into *Calyptrogyne* by León (1944). It was resurrected by Hawkes (1949) and Moore (1966), but sunk by Wessels Boer (1968), only to be reinstated again by Moore (1973).

The genus *Cocops* O. F. Cook, was proposed by Cook (1901) to accommodate vegetative specimens of a Puerto Rican palm, but once fertile material was known, *Cocops* was merged with *Calyptronoma*.

Current authorities (Uhl and Dransfield 1987) recognize *Geonoma*, *Calyptronoma*, and *Calyptrogyne* as distinct, and the characters given by Moore (1966) and Uhl and Dransfield (1987) seem adequate for recognizing these taxa at the generic level. Clearly, *Calyptronoma* is a monophyletic group; morphological and anatomical characters distinguish it from *Calyptrogyne*. Whether the distinctive *Calyptronoma* clade is embedded within the genus *Calyptrogyne* is a question that must await further studies on generic relationships within the Geomeae.

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The meaning of the name *Calyptronoma* was not given by Grisebach. Its roots are in the Greek *kalyptra*, a cap or lid (in reference to the corolla which falls off as a cap), and *nomos*, district or custom. More likely, it is a combined form of *kalyptra* and *Geonoma* ("colonist"), a genus with which it has obvious affinities. *Calyptronoma* is "the capped *Geonoma*."

The initial confusion regarding *Calyptronoma* species from the islands of the Greater Antilles is understandable, given fragmentary collections and incomplete floristic knowledge of the time. Grisebach (1864) initially believed that all the Antillean species of *Calyptronoma* were conspecific, as did Beccari (1912) and Burret (1930). Subsequently, nine taxa, variously treated as *Calyptronoma* or *Calyptrogyne*, were recognized by Wendland (in Kerchove 1878), Gomez Maza (1889), Cook (1901), Bailey (1938), León (1944), and Muñiz and Borhidi (1982). The most recent participant to wade into the fray was Lourteig (1989), who proposed a nomenclatural change to accommodate a name from *Geonoma* long regarded as confused and uncertain as to its application.

In the last revisionary treatment of the species (as *Calyptrogyne* subgenus *Calyptronoma*), Wessels Boer (1968) recognized three species, but in his key, he noted that "the material available was insufficient to reach any definite conclusions." He ended his discussion of these species by saying that "further study is needed in this subgenus."

Materials and Methods

The following treatment is based on herbarium holdings, plants in cultivation at Fairchild Tropical Garden, and observations made during the course of field work in the Greater Antilles.

For scanning electron microscopy (SEM), pollen was removed from herbarium specimens, sputter-coated with gold-palladium, and observed using an ISI Super IIIA SEM. Pollen terminology follows Harley (1990). Leaf material for SEM was fixed in FAA in the field and later transferred to glycerin-alcohol (Martens and Uhl 1980), dehydrated in ethanol, infiltrated with Hemo-De (Fisher Scientific, Pittsburg, PA), and air-dried. Samples were sputter-coated and observed as above.

Morphology

Stems and Leaves. Unlike most *Geonomeae*, which are understory palms (with the notable

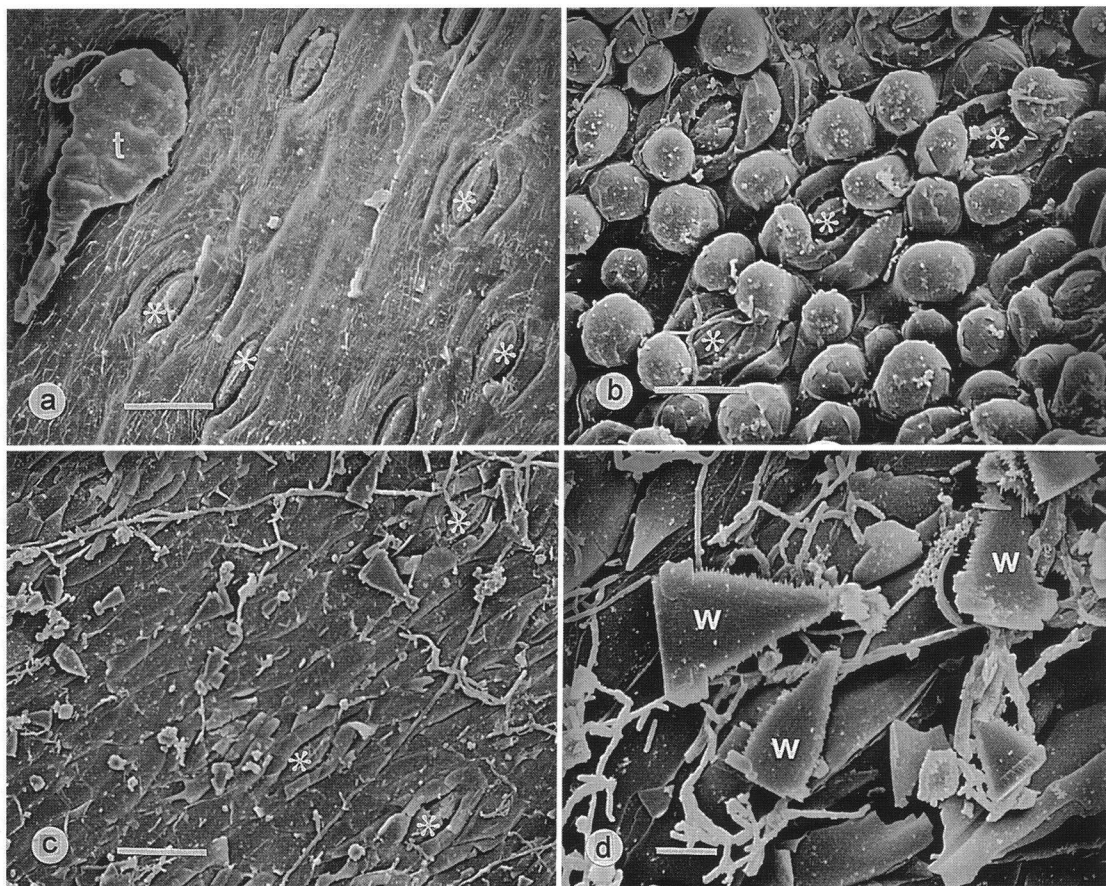
exception of *Welfia*), *Calyptronoma* is a genus of tall, robust, emergent species. The trunk is solitary, 15–30 cm in diameter. The original description of *Geonoma plumeriana* Mart. (= *C. plumeriana*) mentioned multiple trunks, but Lourteig (1989) attributed this error to seedlings growing at the base of a parent tree. The trunk bears prominent leaf scars and vertical fissures.

Leaf bases are not persistent, and no crownshaft is present. The leaf base is fibrous at its margins, and a short petiole is present. Leaves are uniformly divided into similarly-sized segments. The leaf segments of *Calyptronoma* are linear-lanceolate, with a single primary vein and several secondary veins. The larger veins bear chaffy scales on the abaxial side to varying degrees.

Because dried leaf segments often split and/or curl lengthwise, working with them is both challenging and frustrating. The splitting of leaf segments has led to the erroneous observation that some species have entire segment apices and others have bifid apices (León 1944, Muñiz and Borhidi 1982). The apices of all species are entire and acute.

The fine structure of the abaxial surface of the lamina exhibits variation that is taxonomically useful. The outer walls of the abaxial epidermal cells are strongly convex in *C. rivalis* (Fig. 1b), but in other species, they are flat (Fig. 1a,c). This characteristic is best observed in fresh material, under high magnification with obliquely incident light, or with an SEM, although with some practice, one can observe this characteristic even with only a hand lens. Multicellular trichomes are common on intercostal areas of the undersides of the leaf segments of *C. occidentalis*. They have also been observed in some specimens (juveniles?) of *C. plumeriana* (e.g., Baker and Dimmock 4822) but not in *C. rivalis*. These trichomes are scattered, sunken into the surface, relatively flat, and tapered on one side (Fig. 1a). They are very difficult to observe with the dissecting microscope and are often obscured by epiphyllous organisms and dust. Platy wax deposits were observed on *C. plumeriana* (Fig. 1c,d); however, the micromorphology of the deposits as observed (Fig. 1d) may be an artifact of the specimen preparation. Surface waxes, when recrystallized by solvents, may not assume their *in vivo* configuration (Jeffree et al. 1976).

Populations of *Calyptronoma* exhibit some variability in the color of their leaves, peduncular bract interior, and sepals. In some populations,



1. Scanning electron micrographs of abaxial surfaces of leaf segments of *Calyptronoma* (stomata are marked by asterisks). a. *C. occidentalis* (Zona & Salzman 455). Note multicellular trichome (t) in upper right. Scale = 25 μm . b. *C. rivalis* (Salzman 253). Scale = 25 μm . c. *C. plumeriana* (Zona & Salzman 478), note platy wax deposits. Scale = 25 μm . d. Platy wax deposits (w). Scale = 5 μm . Filamentous structures in c and d are fungal hyphae.

these structures are coppery red or even dark purplish red, rather than green or brown. The color is most obvious in the leaf rachis and petiole (Fig. 2). In the Dominican Republic, where *Calyptronoma* is known as "manaca," palms with reddish coloring are known as "manaca colorada." These color variants, however, do not warrant taxonomic rank. All species exhibit this coloration, and the variation is continuous.

Inflorescences. Inflorescences are borne singly in the axil of each leaf. They have three (very rarely, four) orders of branching. A prophyll is present, and a single peduncular bract attached to the base of the peduncle. The peduncular bract is enclosed by the prophyll at its base, but distally, it is free and expanded.

The axes of the inflorescence are covered with arachnoid pubescence when young but are glabrescent at maturity. Rachillae are borne in clusters on the proximal part of the rachis, but are borne singly in the distal portion. Proximal (basal) rachillae are longer than distal (terminal) rachillae. The number of rachillae borne in the lowermost clusters was believed to be taxonomically significant (Wessels Boer 1968); however, there is broad overlap among the species. In *C. occidentalis*, the tips of the rachillae may be sterile for a few centimeters; however, this character is not constant.

As with all Geonomeae, the flowers are borne in pits. Each pit is enclosed by a pit bract. The morphology of the pit bract is variable in *Calyptronoma*. In *C. occidentalis*, the pit bract is



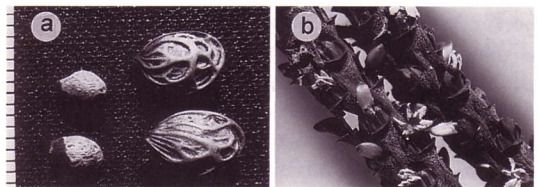
2. Variation in leaf color (green morph not illustrated). a. *Calyptronoma plumeriana* (grown as *C. microcarpa*) dark purplish red form, at the Jardín Botánico Nacional, Cuba. b. *C. plumeriana*, coppery red form (Zona & Salzman 478).

strongly reflexed, becoming perpendicular to the rachilla axis, in dried specimens. In contrast, the pit bracts of *C. plumeriana* and *C. rivalis* are recurved, often rolling back in dried specimens.

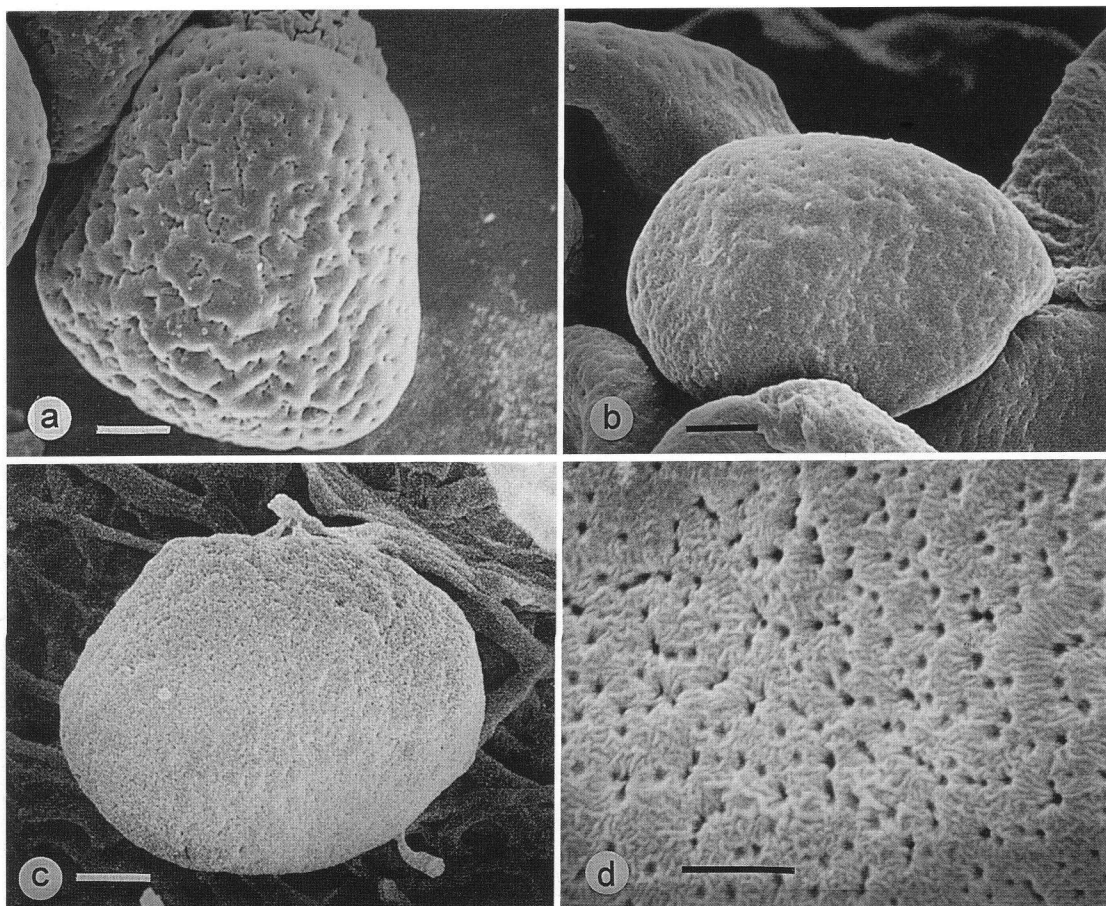
Flowers and Fruits. Flowers are arranged in triads of one pistillate flower flanked by two staminate flowers. Staminate flowers have three free sepals, each with a dark, pigmented keel. The dorsal sepal is generally smaller and narrower than the other two. There are three petals, which are partially connate and open by valvate lobes in *C. occidentalis* and *C. plumeriana*. In *C. rivalis* (Fig. 3b), they are completely connate and fall away as a cap by means of a circumscissile zone of dehiscence (e.g., Henderson and Aubry 1185). Calyptrate corollas in staminate flowers are not known anywhere else in the palm family. The stamens are six, connate into a fleshy, funnelliform tube, with short free filaments at its apex. The androecium is exerted beyond the perianth, and

the filaments are reflexed at anthesis. The anthers are sagittate and dorsifixed near the base but not versatile. The connective is pigmented. The pistillode is minute.

Pollen of the geonomoid palms was examined using light microscopy by Punt and Wessels Boer (1966), who found that the pollen of *C. occidentalis* differed from the pollen of *C. clementis* (= *C.*



3. a. Endocarps of *Calyptronoma plumeriana* (Jack 7849), right, and *C. rivalis* (Sanders et al. 1711 p.p.), left. Scale divisions = 1 mm. b. Staminate flowers of *Calyptronoma rivalis* (Henderson & Aubry 1185) showing calyptrate corolla (arrow). Scale as in a.



4. Scanning electron micrographs of *Calyptronoma* pollen. a. *C. occidentalis* (Salzman & Zona 152). Scale = 5 μ m. b. *C. rivalis* (Liogier 28727). Scale = 5 μ m. c. *C. plumeriana* (León 13169). Scale = 5 μ m. d. *C. plumeriana* (León et al. 10066). Scale = 2.5 μ m.

plumeriana) and *C. intermedia* (= *C. plumeriana*). Pollen grains are monosulcate (rarely trichotomosulcate), tectate (Harley 1990) and elliptical in outline. Examination by SEM revealed consistent differences in the tectum surface patterning. The tectum surface of *C. occidentalis* is perforate-insulate (Fig. 4a); while that of *C. rivalis* is densely and finely perforate (Fig. 4b) and *C. plumeriana* is densely and finely perforate (Fig. 4c) with micro-striations (Fig. 4d). These differences are taxonomically significant.

Pistillate flowers have sepals that are essentially identical to those of the staminate flowers. The petals are united throughout their length and open by means of a circumscissile zone of dehiscence. The staminode is tubular and bears six minute lobes. At anthesis, the distal portion of the stam-

inode is inflated and extends beyond the perianth. In older flowers, the distal portion of the staminode is absent, and only the basal tubular portion remains. It appears as if the staminode also possesses a circumscissile zone of dehiscence. The gynoecium is composed of three fused carpels, with a long, slender style and a three-lobed stigma. One carpel is conspicuously smaller than the other two and contains a smaller, probably sterile, ovule.

The fruit of *Calyptronoma* is a drupe, with clearly differentiated epicarp, mesocarp, and endocarp. Fruits are obovoid, somewhat dorsiventrally compressed, with basal stigmatic remains. The epicarp is smooth, changing from green to red to purple-black as the fruit ripens. The mesocarp is juicy. The endocarp is fragile, free from the seed, and net-like in *C. occidentalis* and *C.*

plumeriana (Fig. 3a, right). In *C. rivalis*, it is obscurely net-like and strongly adherent to the seed (Fig. 3a, left).

The seed is spheroid to ellipsoid, somewhat dorsiventrally compressed, with a smooth, brown-black testa and an encircling unbranched raphe and small basal hilum. The embryo is more or less basal, and the endosperm is homogeneous. There is no taxonomic significance to slight variation in embryo position, as was believed by Muñiz and Borhidi (1982). Germination is adjacent-ligular, and the eophyll is bifid.

Taxonomic Treatment

CALYPTRONOMA Grisebach, Fl. Brit. West Ind. Isl. 518. 1864. *Calyptrogyne* H. Wendl. subgen. *Calyptronoma* (Griseb.) Wessels Boer, Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Reeks 58: 63. 1968. Type: *Calyptronoma swartzii* Griseb. [= *C. occidentalis* (Sw.) H. E. Moore].

Cocops O. F. Cook, Bull. Torrey Bot. Club 28: 568. 1901. Type: *Cocops rivalis* O. F. Cook [= *Calyptronoma rivalis* (O. F. Cook) L. H. Bailey].

Solitary, unarmed, pleonanthic, monoecious palms. Stem smooth, gray-brown, fissured, with prominent leaf scars. Leaves spirally arranged, pinnately divided; leafbase clasping, its margins fibrous; crownshaft absent; petiole less than 50 cm long; segments linear-lanceolate, reduplicate plicate, borne in 1 plane; apex acute; chaffy scales borne on the abaxial surface of major veins. Inflorescence interfoliar, solitary in the axil of each leaf, with 3 (rarely, 4) orders of branching; prophyll bicarinate, obscured by subtending leaf base; peduncular bract erect, coriaceous, splitting longitudinally on the abaxial side, attached near the base of the peduncle; peduncle elliptical in cross-section, bearing several vestigial bracts; rachillae borne in clusters on short stalks basally, solitary distally, each subtended by a short bract and bearing arachnoid tomentum when young, becoming glabrescent when mature. Flowers borne in triads, sunken into pits closed by pit bracts. Staminate flower sessile; sepals 3, unequal, imbricate, linear-elliptical and with a conspicuous, pigmented keel; margins denticulate, hyaline; petals 3, basally adnate to the staminal tube and connate for ca. ¼–½ their length or entirely connate, distally valvate or calyptrate, thin and membranous, white

drying brown; staminal tube funnelliform, fleshy, white, bearing 6 short, narrowly triangular filaments at its apex; anthers 6, sagittate, with darkly pigmented connective, dehiscence introrse; pistillode minute. Pistillate flower sessile; sepals 3, imbricate, linear-elliptical with a conspicuous, pigmented keel; margins denticulate, hyaline; petals 3, membranous, connate, opening by a circumscissile zone of dehiscence; staminode membranous, tubular-cupulate, with distal end inflated and 6, minute marginal lobes; gynoecium composed of 3 fused carpels, superior; stigmatic lobes 3; style slender, apically attached to the 3-lobed ovary; ovules anatropous. Fruit a drupe, spheroid to obovoid, somewhat dorsiventrally compressed, with a smooth epicarp, fleshy mesocarp, and a crustaceous endocarp bearing a raised branched vascular trace. Seed spheroid, somewhat dorsiventrally compressed, brown, shiny, bearing a conspicuous, encircling, unbranched raphe and an obscure hilum; embryo basal to suprabasal, minute; endosperm homogeneous. Eophyll bifid.

Key to the Species of *Calyptronoma*

1. Longest rachillae usually greater than 25 cm long; pit bracts reflexed and divaricating in dried specimens; tectum perforate-insulate (Jamaica) 1. *C. occidentalis*.
1. Longest rachillae usually 25 cm or less long; pit bracts recurved or rolled back in dried specimens; tectum finely perforate 2
2. Outer cell walls of the abaxial leaf epidermis smooth; petals of staminate flowers partially connate, opening by valvate lobes; endocarp mostly free from the seed; endocarp fibers distinct and net-like (Cuba, Hispaniola) 2. *C. plumeriana*.
2. Outer cell walls of the abaxial leaf epidermis convex; petals of staminate flower entirely connate, opening by circumscissile zone of dehiscence; endocarp adherent to the seed; endocarp fibers indistinct (Hispaniola, Puerto Rico) 3. *C. rivalis*.

1. ***Calyptronoma occidentalis*** (Sw.) H. E. Moore, Gentes Herb. 9: 252. 1963. *Elaeis occidentalis* Swartz, Fl. India Occ. 1: 619. 1979. *Calyptrogyne occidentalis* (Sw.) Gomez Maza, Noc. Bot. Sist. 50: 1893. *Calyptronoma swartzii* Griseb. & H. Wendl. ex Griseb., Flora Brit. W. Ind. 518. 1864. (as *C. schwartzii* in H. Wendl., Kerch. Palm. 238. 1878.) *Geonoma* (*Calyptronoma*) *swartzii* (Griseb.) Griseb. & H. Wendl. in Griseb., Cat. pl. Cub. 222. 1866. *Calyptrogyne swartzii* (Griseb.) Becc., Pomona Coll. J. Econ. Bot. 2: 356. 1912. Neotype: Jamaica, St. Ann, vicinity

of Hollymount, Mt. Diablo, 750 m, *Maxon* 2327 (neotype, designated here, US!)

Calyptrogyne victorinii León, Contrib. Ocas. Museo Hist. Nat. Col. "La Salle" 3: 4. 1944.

Type: Jamaica, from the mountains of the interior, May 1941, *León & Marie Victorin* 20067 (holotype: HAC!; isotypes: GH!, NY!)

Stem to 15 m tall, 8.8–30 cm in diam. Leaf 2.8–4.3 m long, with ca. 60 segments; segments 52–95 cm long, 2.1–4.5 cm wide, bearing inconspicuous multicellular trichomes on the abaxial intercostal surface. Prophyll 35.5–63 cm long, 5–8(–13) cm wide. Peduncle 39–98.5 cm long and 1–2.8 cm wide; rachillae (21–)26–35.5 cm long, 4.3–6.8 mm in diam, with (6–)7(–8) rows of pits; proximal rachillae borne in clusters of up to 3–4(–6) on stalks 0.7–4.1 cm long, 0.5–0.9 cm wide, clustered rachillae borne for ca. ½ the length of the rachis; pits 1.7–4.1 mm long, 1.8–3.6 mm wide, longitudinal distance between pits (lip to lip) 4.2–9.8 mm. Staminate flowers 5–5.9 mm long; sepals 3.3–4.4 mm long, 0.9–1.1 mm wide; petals 3.5–5.7 mm long, 1.1–2.2 mm wide; staminal tube 3–5.2 m, anthers 1.1–1.6 mm long. Pistillate flowers 4.9–6.5 mm long; sepals 3.4–4 mm long, 1–1.3 mm wide; corolla not seen; staminode not seen; gynoecium ca. 6.7 mm long, style ca. 5.1 mm long; ovary 1–1.2 mm long. Fruit 9.8–15.8 mm long, 5.9–8.5 mm in diam.; endocarp free from seed, strongly net-like; seed (5.1–)5.8–8.6 mm long, (3.9–)4.4–5.8 mm diam.

The type of *C. swartzii* was given by Grisebach (1864, 1866) as *Wright* 1466; however, Swartz's *Elaeis occidentalis* of specifically cited as a synonym. In the 1864 publication of the genus name, Grisebach wrote that this genus was "constructed upon the *Elaeis occidentalis* Sw." Thus, the name *C. swartzii* is nomenclaturally superfluous, and the type of *C. swartzii* must be the type of *E. occidentalis*. No Swartz collections of *E. occidentalis* have been found at BM, G, LD, S, S-Linn, or SBT (T. Zanoni, pers. comm.), hence, a neotype is designated here.

Although three collections were cited by León (1944) in the publication of *Calyptrogyne victorinii*, I consider the specimen annotated by León to be the holotype.

This species is characterized by having the longest rachillae in the genus. When dry, the pit bracts are divaricating. The pollen is also distinctive. This species is tolerant of a broad range of environmental conditions. In its native Jamaica,

it grows in swamps near sea level, in upland marshes (Mason River Field Station), and along mountain streams at more than 700 m above sea level. It is also the species most amenable to cultivation in southern Florida.

Distribution: Endemic to wet habitats in Jamaica (Fig. 5).

Local Name and Uses: Long thatch. Leaves are used for thatch, and stems are used for construction.

Phenology: This species flowers in June through December; fruits have been collected throughout the year, with a peak in early spring.

Additional Specimens Examined: **JAMAICA**: CLARENDON. Chapelton to Bull Head, below summit of Bull Head, *Underwood* 3415 (NY); Mason River Field Station, 720 m, near Kellits, *Gentry & Kapos* 28308 (MO), 650 m, *Zona & Salzman* 452 (FLAS). PORTLAND. Upper Swift River, near Mossman's Peak, Blue Mountains, 850 m, *Bretting* J-255 (NY); Stoney River base camp, 380 m, *Morley & Whitefoord* 693 (BM, MO, US); Nanny Town site, 640 m, *Morley & Whitefoord* 775 (A, BM, MO, US); 0.8 km SSW of Lancaster House, 975–1000 m, *Proctor* 34636 (MO). ST. ANN. Hollymount, *Bailey* 712 (BH); Albion, road to Alexandra, 450 m, *Read* 1673 (BH, BM, US). ST. ELIZABETH. Morass near Middle Quarters, *Bailey* 15049 (BH), *Bailey* 213 (BH), *Britton* 1631 (NY); 7 km E of Black River along road to Santa Cruz, 10 m, *Zona & Salzman* 455 (FLAS, RSA); near Black River, *Harris* 9842 (BM, NY, US). WESTMORLAND. Between Newmarket and Darlston, *Britton* 1462 (NY); vicinity of Negril, *Britton & Hollick* 2110 (NY, HAC), *Salzman & Zona* 152 (FLAS). ST. THOMAS. Corn Puss Gap trail, 460 m, *Read* 1693 (S, US); Cuna Cuna Pass, *Fredholm* 3254 (NY, US), 610–820 m, *Maxon* 1759 (US). TRELAWNY. Tyre, *Britton* 537 (NY, US).

2. *Calyptronoma plumeriana* (Martius) Lourteig, *Phytologia* 65: 484. 1989. *Geonoma? plumeriana* Martius, *Palm. Orbig.* 34. 1843. Type: Plumier's Catal. Gen. Tab. 1 habit excl. details and MSS 7, icones 7, 8, 9, 10.

Calyptronoma dulcis (Wright ex Griseb.) L. H. Bailey, *Gentes Herb.* 4: 168. 1938. *Geonoma dulcis* Wright ex Griseb., *Cat. Pl. Cub.* 222. 1866. *Calyptrogyne dulcis* (Wright ex Griseb.) Gomez Maza, *Dicc. Bot.* 72. 1889. Type: Cuba,

1865, *Wright 265* (holotype: GOET!; isotypes: GH!).

Calyptronoma intermedia (Griseb. & H. Wendl.) H. Wendl. in Kerch. Palm. 238. 1878. *Geonoma intermedia* Griseb. & H. Wendl., Sauville Fl. Cub. 153. 1873. *Calyptrogyne intermedia* (Griseb. & H. Wendl.) Gomez Maza, Noc. Bot. Sist. 50. 1893. Type: Cuba, Pinar del Río, banks of Taco Taco River, *Wright 3972* (holotype: GOET!; isotypes: A!, GA!, NY!, US!)

Calyptronoma clementis (León) A. D. Hawkes ssp. *clementis*, *Phytologia* 3: 145. 1949. *Calyptrogyne clementis* León, *Contrib. Ocasión. Mus. Hist. Nat. Col. "de la Salle"* 3: 11. 1944. Type: Cuba, Oriente [Guantánamo], Loma San Juan de Buena Vista, S of Hongo-losongo, Sierra Maestra, 900 m alt., Nov. 1940, *León 17964* (holotype: HAC!; isotype: GH!)

Calyptronoma microcarpa (León) A. D. Hawkes, *Phytologia* 3: 145. 1949. *Calyptrogyne microcarpa* León, *Contrib. Ocasión. Mus. Hist. Nat. Col. "de la Salle"* 3: 10. 1944. Type: Cuba, Las Villas [Sanctis Spiritus], Topes de Collantes, Trinidad Mts., 800 m, Nov. 1938, *León 18574* (lectotype: HAC!; isolectotypes: GH!, HAC!)

Calyptronoma clementis ssp. *orientensis* Muñiz & Borhidi, *Acta Bot. Acad. Sci. Hung.* 28: 342. 1982. Type: Cuba, Oriente [Holguín?], Monte Centeno, Moa, 12 Nov 1945, *Acuña 13019* (holotype: HAC!).

Stem 10 m or more tall, 15–20.3 cm in diam. Leaf 1.9–4.6 m long, with 100–160 segments; segments 44.5–92 cm long, 2.2–6.8 cm wide, sometimes bearing inconspicuous multicellular trichomes on the abaxial intercostal surface. Prophyll 27.5–41 cm long, 6–9.5 cm wide. Peduncle 44–78 cm long and 1.1–2.6 cm wide; rachillae 12.5–24(–26) cm long, 3–6.7 mm in diam., with (5–)6(–7) rows of pits; proximal rachillae borne in clusters of up to 4–7(–10) on stalks 0.9–5 cm long, 0.4–1.2 cm wide, clustered rachillae borne for $\frac{2}{3}$ or more the length of the rachis; pits 2.4–4.7 mm long, 1.8–3.3 mm wide, longitudinal distance between pits (lip to lip) 5.4–12 mm. Staminate flowers 5.1–8.5 mm long; sepals (3.6–4.7 mm long, 0.8–1.7 mm wide; petals 4.7–6.2 mm long, 1.2–1.6 mm wide; staminal tube 3.4–7 mm long, 1.3–1.7 mm wide; filaments 1.1–1.5 mm long; anthers 1–2.3 mm long. Pistillate flowers 3.4–6.7 mm long; sepals 3.2–4.9 mm long, 0.7–1.5 mm wide; petals 3.2–5.4 mm long, ca. 1.2 mm wide; staminode 7.5–7.7 mm long, 3.1–3.4

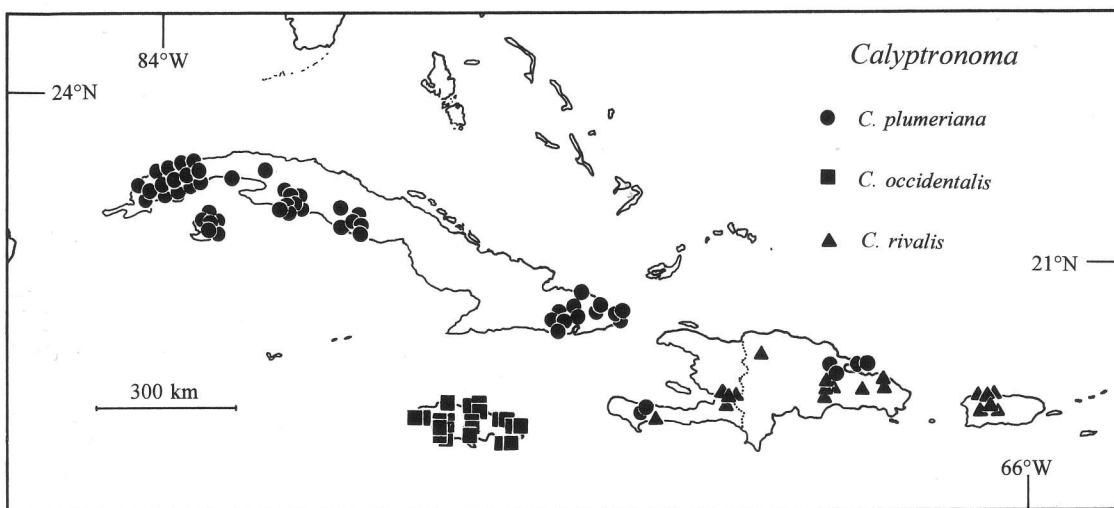
mm wide; gynoecium 4.8–5.1 mm long, style ca. 5.3 mm long; ovary 0.7–0.8 mm long. Fruit 6.8–12.2 mm long, 4.8–7.8 mm in diam.; endocarp free from seed, strongly net-like; seed 3.8–6 mm long, 2.8–4.8 mm diam.

Although I take no pleasure from synonymizing the well known name *C. dulcis*, the change is necessary in light of Lourteig's lectotypification and circumscription of *Geonoma plumeriana*. According to Lourteig, *G. plumeriana* can be referred to a species of *Calyptronoma* from Hispaniola, but it is now clear that two taxa on *Calyptronoma* are present on that island. The question then becomes: To which taxon does *G. plumeriana* apply?

The two Hispaniolan taxa are readily distinguished by fruit and seed size. The original description of *G. plumeriana* noted that its fruits were "the size of cherries" ("baccis cerasi magnitudine"). This characterization, although vague and inexact, more likely refers to the taxon long known as *C. dulcis* (fruits 4.8–7.8 mm in diameter). The Hispaniolan taxon with smaller fruit (3.6–4.6 mm in diameter) is *C. rivalis*.

When Grisebach described *G. dulcis*, the type was designated as "Wr. a. 1865." Subsequently, "Wright no. 1865" was designated as a type (Bailey 1938; Glassman 1972), but this is in error. As pointed out by León (1944), "1865" is the date of the collection not the collection number. The specimen corresponding to the year 1865 is *Wright 265*, and this is taken to be the type. The material at GOET, presumably seen by Grisebach, is the holotype. In the original description of *Calyptrogyne microcarpa*, León designated two syntypes: *León 18574* with fruits and *León 18449* with flowers. As the epithet describes the fruit size, I have selected *León 18574* as the lectotype.

In the original description of *C. clementis*, León cited a previously published name, *Calyptrogyne swartzii*, as used by Beccari (1912) and Grisebach (1866), excluding the synonyms cited by those authors and implicitly excluding the type of *C. swartzii* (see Art. 63.1 and 2 of the ICBN). León clearly gave these citations as misapplications of the name *C. swartzii*, which he knew to be a synonym of *Calyptrogyne occidentalis* (León 1944, p. 3). He in no way proposed *C. clementis* as a new name for the palm that was called *C. swartzii*. *Calyptrogyne clementis* is therefore interpreted as a new species (as León intended), not as a nomenclatural synonym of *C. occidentalis*.



5. Distribution of *Calyptronoma* in the Greater Antilles.

A useful character for distinguishing the two taxa of *Calyptronoma* in Hispaniola is the shape of the outer walls of the cells of the abaxial epidermis of the leaf. The outer walls of the abaxial epidermal cells of *C. rivalis* are strongly convex; while those of *C. plumeriana* (and *C. occidentalis* of Jamaica) are smooth (Fig. 1). This character is extremely valuable for identifying sterile, mature specimens; however, its usefulness with seedlings has not been tested.

Distribution: Native to stream banks and arroyos in the hills and mountains of Cuba and Hispaniola (Fig. 5).

Local Names and Uses: Flor de confite, manaca, manaca colorada, manacla, palma de arroyo, palma manaca (Cuba, Dominican Republic); palm a vin (Haiti). "Palma justa," the local name for *Prestoea montana* (Graham) Nicholson in Cuba, has been misapplied (León 1944). Leaves are used for thatch. The flowers and fruits are said to have a sweet flavor, and the terminal bud ("cabbage") is edible (Roig y Mesa 1928; Alain 1961).

Phenology: Records indicate that this species flowers from April to November in Cuba. Fruits have been collected throughout the year in Cuba. Available data from Hispaniola suggest that this species flowers in July and fruits in December.

Additional Specimens Examined: **CUBA.** CIENFUEGOS. Sierra de San Juan, SE of Cumanayagua, 300–400 m, *Hodge & Howard* 4506 (A); San Blas, *Bailey* 12395 (BH), 180–240 m, *Jack* 6973 (A, US), 240 m, *Rehder* 1243 (A), *Jack* 7084 (A, US); La Sierra, 150–240 m, *Jack*

7580 (A, S, US), *Jack* 7849 (A, BH, NY, S, US), 180–240 m, *Rowe* 7585 (A, BH). GUANTANAMO. Monte Verde, N of Guantánamo, *Wright* 1466 (FI, GH, GOET, MO, NY); Baracoa, *Horn* 3050 (FI, NY, US); Yateras, La Prenda, *Hioram* 4754 (GH, HAC); Yateras, 500 m, *Maxon* 4464 (US). HOLGUIN. Sierra de Cristal, Mayarí, banks of Río Lebisa, *Alain et al.* 5720 (GH, HAC); Sierra de Nipe, La Plancha, *León & Alain* 17999 (GH, HAC, NY, US); Sierra de Nipe, Río Piloto, *Ekman* 9682 (S), *Ekman* 2109 (S), Monte Centeno, Moa, *Acuña* 13019 (HAC). ISLA DE LA JUVENTUD (ISLA DE PINOS). Vicinity of Santa Barbara, *Britton et al.* 14761 (GH, NY, US); near Nueva Gerona, *Curtiss* 485 (A, GH, HAC, NO, NY, US), *León* 17463 (GH, HAC), *León & Marie Victorín* 18785 (GH, HAC); San Francisco de las Piedras, *León (& Seifriz)* 17531 (GH, HAC, US); near San Juan, *León & Marie Victorín* 18891 (GH, HAC, US); Arroyo del Hatillo, *León* 17899 (HAC). LA HABANA. Batabanó, *León* 13619 (HAC). MATANZAS. Zarabanda, *León & Marie Victorín* 19549 (GH, HAC, US). PINAR DEL RIO. Consolación del Sur, *Bailey* 324 (BH), *León & Alain* 19379 (GH, HAC, US); 4 km W of Consolación del Sur, *Dahlgren* 22823 (HAC); vicinity of Herradura, *Britton* 6482 (NY), *van Herman* 875 (FI, HAC), *van Herman* 745 (HAC); Sierra de Cabra, *Britton et al.* 9818 (NY); Taco Taco River valley, *León* 16531 (BH); Santa Cruz de los Pinos, *León* 16630 (BH, GH, HAC, US); Pan de Azúcar, Viñales, *León* 17900 (GH, HAC), *León* 19538 (GH, HAC, US); Viñales, *León* 19298

(GH, HAC, US); N of San Diego de los Baños, León 4379 (BH, HAC, NY), Palmer & Riley 529 (US); N of Pinar del Río, Shafer 317 (GH, HAC, MO, NY); Paso Real, van Herman 767 (NY); San Luis, Roig 3580 (HAC), Roig 2462 (HAC); El Roble, mpio. Bahía Honda, Zona et al. 631 (FTG, HAJB); near Mameyal, Zona et al. 624 (FTG, HAJB); between San Andrés and La Palma, near Loma del Americano, Zona et al. 630 (FTG, HAJB). SANCTI SPIRITUS. Trinidad Mountains, Topes de Collantes, 800 m, León 18574 (GH, NY, US), León 18449 (HAC), León 19072 (HAC); Buenos Aires, Trinidad Mountains, 762–1,066 m, Jack 7018 (AS, US); Banao Mountains, León 19380 (GH, HAC, US), León & Roca 7869 (NY). SANTIAGO DE CUBA. SE of Paso Estancia, Shafer 1748 (A, NY); Piedra Gorda to Río Seboruco, Shafer 3654 (NY); near Santiago, 550 m, Taylor 412 (NY); vicinity of Loma del Gato, Cobre Range, León et al. 10066 (NY). VILLA CLARA. Trinidad Mountains, Heradura, 320 m, Britton & Britton 5018 (NY, US).

DOMINICAN REPUBLIC. DUARTE. S side of Quito Espuela above Los Brasitos, Arroyo Guaconejo, 410 m, Zona & Salzman 478 (FLAS, JBSD). EL SEIBO. Sabana de la Mar, El Limpio, ca. 300 m, Ekman H15685 (S, US). SAMANA. Vicinity of Laguna, Pilón de Azúcar, 100–500 m, Abbott 406 (US). SAN CRISTOBAL. Monte Plata, Jiménez s.n. (BH).

HAITI. GRAND 'ANSE. Massif de la Hotte, along road between Jérémie and Les Cayes, 4.5 km S of Rivière Glace, 810 m, Judd & Skeeon 8669 (FLAS). SUD. Road from Camp Perrin to Beaumont, at Tete Morne Gefferd, Henderson & Aubry 1179 (NY).

3. Calyptronoma rivalis (O. F. Cook) L. H. Bailey, Gentes Herb. 4: 171. 1938. *Cocops rivalis* O. F. Cook, Bull. Torrey Bot. Club 28: 568. 1901. *Calyptrogyne rivalis* (O. F. Cook) León, Contrib. Ocasión. Mus. Hist. Nat. Col. "de la Salle" 3: 12. 1944. Type: Puerto Rico, road from Lares to San Sebastián, 18 Jun 1901, Underwood & Griggs 89 (lectotype: US!).

Calyptronoma quisqueyana L. H. Bailey, Gentes Herb. 4: 169. 1938. *Calyptrogyne quisqueyana* (Bailey) León, Contrib. Ocasión. Mus. Hist. Nat. Col. "de la Salle" 3: 12. 1944. Type: Haiti, Ouest, Morne Saut d'Eau, Chaîne des

Matheux, beyond and above Ville Bonheur, 29 Mar 1937, Bailey 229 (lectotype: BH!).

Stem to 15 m tall. Leaf 3.1–5 m long; segments 54–107 cm long, 3–6 cm wide, glabrous on the abaxial intercostal surface. Prophyll 35–61 cm long, 6–10 cm wide; penduncular bract 66–77 cm long, ca. 8.5 cm wide. Peduncle 39–77 cm long and 1.3–3 cm wide; rachillae 17–23(–26) cm long, 3.7–5.4 mm in diam., with 6(–7) rows of pits; proximal rachillae borne in clusters of up to 3–5(–7) on stalks 1.4–5.2 cm long, 0.6–0.9 cm wide, clustered rachillae borne for $\frac{1}{2}$ – $\frac{2}{3}$ the length of the rachis; pits 2.4–3.5 mm long, 1.7–2.9 mm wide, longitudinal distance between pits (lip to lip) 5.3–10.5 mm. Staminate flowers 4.8–5.1 mm long; sepals 3–3.6 mm long, 1.1–1.2 mm wide; petals completely connate; staminal tube 4.1–4.5 mm long, 1.5–1.6 mm wide; filaments 0.8–1.2 mm long; anthers 1.6–1.7 mm long. Pistillate flowers not seen. Fruit 4.6–7 mm long, 3.6–4.6 mm in diam.; endocarp adherent from seed, obscurely net-like; seed 3.8–4.9 mm long, 2.9–3.5 mm diam.

Cook designated no type for his *Cocops rivalis*, but the specimen at US collected by Underwood and Griggs the same year in which the name was published is annotated as the type by R. Read. I concur with his choice of lectotype. The type named by Wessels Boer (1968), *Cook s.n.*, does not exist.

Bailey designated two syntypes in his original description of *C. quisqueyana*. Bailey 229 is a fertile collection from a mature palm; whereas, Bailey 229a is a vegetative collection from a nearby palm that was specifically collected to supplement 229 ("Collected to show leaf tip"). The more complete collection, Bailey 229, is therefore taken as the lectotype.

The existence of *C. rivalis* outside of Puerto Rico has some bearing on its conservation status. It has been listed as Threatened by the U.S. Fish and Wildlife Service since February, 1990. In Puerto Rico, this palm is confined to a small area, the type locality, between Lares and San Sebastián. Additional populations are said to exist in nearby watersheds (e.g., the Tanama River gorge [Little and Woodbury 1980]), but I have seen no specimens. Its continued protection in Puerto Rico is recommended. In Hispaniola, this species is found over a wide area from Haiti to eastern Dominican Republic. It does not appear threatened in Hispaniola.

On Hispaniola, where this species co-occurs with *C. plumeriana*, the two species do not appear to flower at the same time. Data from herbarium specimens indicate that Hispaniolan populations are reproductively isolated.

The calyptrate corollas of the staminate flowers, small fruits with adherent endocarps, and convex outer walls of the abaxial epidermal cells (see above under *C. plumeriana*) distinguish *C. rivalis* from all other species.

Distribution: Native to stream banks and arroyos in the hills and mountains of Hispaniola and western Puerto Rico (Fig. 5).

Local Names and Uses: Manaca, manacla, palma manaca, palmilla (Puerto Rico, Dominican Republic); palm a vin (Haiti). Leaves are used for thatch.

Phenology: Data from Puerto Rico are scarce but indicate that this species flowers in April. Fruit collections are known from May and August. In Hispaniola, flowers have been collected in October, December through February, and April. Fruits have been encountered in April, August, and November.

Additional Specimens Examined: **DOMINICAN REPUBLIC.** EL SEIBO. Guamira, between Hato Mayor and Sabana de la Mar, *Jiménez 4111* (US); 15 km al N de Hato Mayor, 400 m, *Liogier & Liogier 27738* (NY, UPR); 1.8 km S of El Valle on road to Hato Mayor, Arroyo Manacla, 135 m, *Zona & Salzman 479* (FLAS, JBSD, RSA). SAN CRISTOBAL. 15–18 km NE of Bayaguana along Río Comatillo, 50–100 m, *Sanders et al. 1711* (pro parte) (BH, FTG); 8.5 km from Comatillo on road to Cruce de Pilación at Arroyo Pilación, 160 m, *Zanoni & Mejía 16410* (JBSD, MO); along Río Comatillo, Bayaguana, 150 m, *Liogier & Liogier 21256* (NY); *Liogier et al. 27564* (NY). SANTIAGO RODRIGUEZ. Monción, Cordillera Central, al sur de La Meseta, arroyo Manguanita, 485 m, *García et al. 2630* (NY).

HAITI. OUEST. Near Saut d'Eau, ca. 300 m below waterfall, *Henderson & Aubry 1185* (NY); Masif des Matheux, Mirebalais, Morne Saut d'Eau, ca. 400 m, *Ekman H5498* (NY, S, US); Morne Saut d'Eau, above Ville Bonheur, *Bailey 229a* (BH). SUD. Morne de la Hotte, *Ekman H167* (S).

PUERTO RICO. Between San Sebastián and Lares, *Bailey 45* (BH, MO), *Britton & Hess* (FI, GH, MO, NY, US), *Liogier & Vivaldi 28727* (NY, UPR, US); valley about 4 km E of San

Sebastián, *Horn s.n.* (BH); near Camuy, *Sintenis 6061* (US).

CULTIVATED. PUERTO RICO. Río Piedras, University of Puerto Rico Botanic Garden, *Salzman 253* (spirit collection) (FTG).

Doubtful and Excluded Names

Calyptronoma kalbreyeri (Burret) L. H. Bailey, *Gentes Herb.* 4: 166. 1938. = *Pholidostachys synanthera* (Mart.) H. E. Moore.

Calyptronoma robusta Trail, *J. Bot.* 14: 330. 1876. = *Pholidostachys synanthera* (Mart.) H. E. Moore.

Calyptronoma synanthera (Mart.) L. H. Bailey, *Gentes Herb.* 4: 166. 1938. = *Pholidostachys synanthera* (Mart.) H. E. Moore.

Calyptronoma weberbaueri (Burret) L. H. Bailey, *Gentes Herb.* 4: 166. 1938. = *Pholidostachys synanthera* (Mart.) H. E. Moore.

Geonoma (Calyptronoma) swartzii Griseb. & H. Wendl. in Griseb., *Mem. Amer. Acad. ser.* 8(2): 531. 1863. nomen nudum, but later validated in Grisebach (1866).

Palma pinao Aublet, *Hist. Plant. Guiane Franç.* 2: 974. 1775. Lourteig (1989) cited this name as a synonym for *Calyptronoma plumeriana*, because Aublet cited Plumier's Catalog. It must be noted however, that Aublet's taxon, "Palma pinao dactylifera, palustris," is a polynomial given under the genus heading of *Phoenix*. It also predates the name for which Lourteig said it was a synonym. Fortunately, Aublet's polynomial is invalid under the code and need not be given further consideration.

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