

6. Peduncular bracts (4-) 5-10; leaves usually with some leaf blade sections fully divided and rarely with all sections but the innermost undivided.
7. Inflorescences almost always ascending, rarely slightly arching; peduncle 15-20 cm long; seeds irregular and misshapen; leaves with central abaxial split to within 1.5-13.0 cm of base. 10. *C. williamsii*.
7. Inflorescences arching to deflected; peduncle 20-50 cm long; seeds more or less spheroidal to rarely spheric-ellipsoidal; leaves with central abaxial split to within 0.5-5.0 (-8.5) cm of base.
8. Inflorescences with all but the basal-most rachis bracts falling as bud opens; basal rachis bracts (1.5-) 2-4 times as long as wide (when detached and flattened); peduncular bracts 4-6; rachis (12.5-) 20-50 cm long; first-order inflorescence branches 4.5-16.9 cm long; extreme south-eastern Mexico and northern Central America. 8. *C. stauracantha*.
8. Inflorescences with some non-basal rachis bracts persisting past anthesis; basal rachis bracts 1-2 times as long as wide (when detached and flattened); peduncular bracts (4-) 6-10; rachis 5-25 (-30) cm long; first-order inflorescence branches 3.1-6.9 (-8.4) cm long; central and south-eastern Panama, and northwestern Colombia.
9. Trunk (2.3-) 3.5-4.7 m long; densest concentration of root-spines usually more than 50 per 10 cm of stem; leaves with 37-43 (-47) segments; central segments 53.5-65.0 (-72.5) cm long and marginal segments (40.0-) 48.5-56.5 (-59.0) cm long; primary adaxial leaf blade splits usually all more or less equal in depth; prophyll 12.0-15.5 cm long; stamen tube  $\frac{1}{2}$ - $\frac{3}{4}$  of total filament length; fruit 12-14 mm long, 11-12 mm in diameter; seeds 6-7 mm in diameter (slightly immature); central Panama. 1. *C. bartlettii*.
9. Trunk 1.0-3.5 (-4.8) m long; densest concentration of root-spines usually fewer than 50 per 10 cm of stem; leaves with (37-) 43-56 segments; central segments 52.0-97.5 cm long and marginal segments 41.0-72.5 cm long; primary adaxial leaf blade splits usually increasing in depth from inner to outer splits; prophyll (8.5-) 10.0-13.0 cm long; stamen tube  $\frac{1}{2}$ - $\frac{3}{4}$  of total filament length; fruit (13-) 14-16 (-19) mm long, 12-17 mm in diameter; seeds 10-13 mm in diameter; Colombia and extreme southeastern Panama. 5. *C. kalbreyeri*.

**1. *Cryosophila bartlettii*** R. Evans, sp. nov.—TYPE: PANAMA. Panamá: ca. 20 m NW of road crossing natural limestone bridge over Río La Puente, ca. 1 km upriver from Lago Alajuela (Madden Lake), 09°11.5'N, 79°33.5'W, 80 m, 17 Jul 1990, *Evans & Grayum 184* (holotype: MICH!; isotype: MO!).

Common name: *guágara chica*.

Species *C. kalbreyeri* affinis; truncus (2.3-) 3.5-4.7 m longus, laminae segmentis 37-43 (-47), segmenta centralia 53.5-65.0 (-72.5) cm longa, segmenta marginalia (40.0-) 48.5-56.5 (-59.0) cm longa, axes principales inflorescentiae 32.0-47.0 (-62.5) cm longi, prophylla 12.0-15.5 cm longa, fructus 1.2-1.4 cm longi, 1.1-1.2 cm lati. A congeneribus, praeter *C. stauracantham*, fructibus minoribus differt; a *C. stauracantha* inflorescentiis plerumque minoribus, bracteis pedunculatis plerumque pluribus, ramis principalibus plerumque paucioribus brevioribusque differt.

Solitary or very rarely multistemmed palm. Trunk (2.3-) 3.5-4.7 m long, more or less erect, 3.7-7.3 (-10.3) cm DBH, armed with root-spines usually densest proximally and thinning distally; internodes 0.9-1.7 cm long. Root-spines 0-ca. 100 (-150+) per 10 cm of trunk, most to ca. 6 (avg. ca. 2-4) cm long, occasional

outliers to ca. 20 cm long, usually 1(-2)-times-branched, rarely unbranched, usually descending; basal adventitious roots growing into the soil, similar morphologically to root-spines above, only usually longer (including their branches), forming a cone to ca. 0.5 m high and ca. 0.25 m in diameter. Leaves 15-18, 4-6 distal to leaf through which youngest inflorescence emerges, additionally 3-9 marcescent; petiole (0.68-) 0.98-1.60 (-1.94) m long, 0.66-1.34 cm wide; hastula 0.8-1.4 cm long, (0.9-) 1.1-1.7 cm wide, 1.0-1.5 times as wide as long, very broadly triangular, more or less pointed, rarely bifid apically; blade 0.140-0.155 (-0.170) mm thick, adaxial surface dull, abaxial surface silvery pubescent; central segments 53.5-65.0 (-72.5) cm long; marginal segments (40.0-) 48.5-56.5 (-59.0) cm long, ( $\frac{3}{4}$ -)  $\frac{4}{5}$ - $\frac{7}{8}$  (-nearly) as long as central segments; central abaxial split to within 0.5-2.0 cm of base, dividing blade into two more or less equal halves of 18-24 segments each; primary adaxial splits less deep than central abaxial split with depth of splitting generally increasing from inner [( $\frac{3}{4}$ -)  $\frac{4}{5}$ -nearly to base] to outer splits or not, dividing each half into 4-5 (-6) sections of (2-) 3-6 segments each, with the central sections containing (4-) 5-6 segments each, the middle 2-3 (-4) sections of each half containing (2-) 3-5 (-6) segments each, and the marginal sections containing 4-6 segments each; secondary adaxial splits of central sections  $\frac{1}{4}$ - $\frac{2}{3}$  to base; central section of each half usually partially divided, very rarely undivided, the remaining sections with variable divisioning; marginal section undivided; widest segment 2.4-3.4 cm wide at its widest; longitudinal girdered veins usually 25-40 per half-segment, inconspicuous, (0.3-) 0.4-0.7 (-1.1) mm apart; longitudinal ungirdered veinlets (0-) 1 (-3) between adjacent veins, the larger superficially indistinguishable from veins, 0.2-0.5 mm apart; irregular transverse veins connecting lateral veins (or larger lateral veinlets) short, inconspicuous. Inflorescences with (1-) 2 (-3) orders of branching, each ascending at emergence through a split petiole base, then arching or deflected; primary axis 32.0-47.0 (-62.5) cm long, 0.67-1.14 (-1.52) cm in diameter; peduncle 22.0-44.0 cm long; prophyll 12.0-15.5 cm long, 1.8-3.2 cm wide; peduncular bracts 5-9, 13.0-20.0 (-26.0) cm long, ovate to narrowly ovate; internodes between peduncular bracts averaging (2.8-) 3.6-5.4 cm long; rachis 8.5-20.5 cm long,  $\frac{1}{4}$ - $\frac{2}{3}$  of total inflorescence length; rachis bracts 15-21, deciduous, but some persistent past anthesis, the basal bracts broadly ovate to ovate, 8.5-16.5 cm long; first-order branches to 2.5 cm long near base of rachis, shorter toward apex; rachillae to 3.9 cm long near base of rachis, shorter toward apex; rachillae bracteoles 3.2-4.8 mm long, 0.1-0.6 (-0.9) mm wide. Flowers 2.8-4.5 mm long, 2.0-3.5 (-4.1) mm in diameter; pedicel 0.3-1.2 mm long; floral bracteole 0.5-2.1 mm long, 0.3-0.7 mm wide; receptacle (0.2-) 0.3-0.5 (-0.6) mm long; sepals 2.4-4.1 mm long, connate basally to  $\frac{1}{2}$  their length; petals 2.3-3.1 (-3.7) mm long, 2.5-3.2 (-4.0) mm wide; filaments 2.3-3.1 mm long, connate basally  $\frac{1}{3}$ - $\frac{2}{3}$  their length; stamen tube 0.8-1.4 (-1.7) mm in diameter; anthers 1.2-1.8 mm long, (0.4-) 0.5-0.8 mm wide; ovary 1.0-1.6 mm long, (0.4-) 0.5-0.6 (-0.9) mm in diameter; stigmas+styles 1.0-2.2 mm long. Infructescence a dense, compacted mass of fruits with first-order branches obscured and indistinguishable. Fruit 1.2-1.4 cm long, 1.1-1.2 cm in diameter, usually more or less spheroidal, sometimes ovoidal to spheric-ellipsoidal; seed 0.6-0.7 cm (slightly immature) in diameter, more or less spheroidal.

Distribution (Fig. 21). Known only from limestone outcrops in the Lago Alajuela (Madden Lake) watershed in central Panama; ca. 100 m.

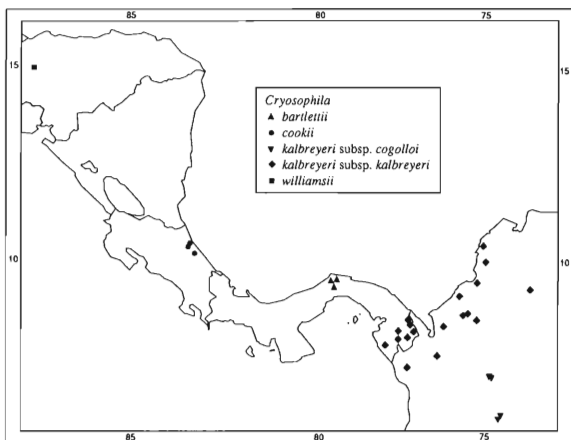


FIG. 21. Distribution of *Cryosophila bartlettii*, *C. cookii*, *C. kalbreyeri*, and *C. williamsii*.

**ADDITIONAL SPECIMENS EXAMINED.** **Panama.** PANAMÁ: natural bridge along Madden Lake, *Croat 12404* (MO, PMA); along rd crossing natural limestone bridge over Río La Puente, ca. 1 km upriver from Lago Alajuela (Madden Lake), 09°11.5'N, 79°33.5'W, *Evans 155* (EAP, F, JBGP, US), *Evans 156* (BH, COL, DUKE, INB, MICH, PMA), *Evans 157* (JAUM, MEXU, MICH, MO, NY), *Evans 158* (MICH), *Evans 159* (MICH), *Evans 160* (MICH), *Evans 161* (MICH), *Evans & Grayum 183* (MICH); along rd to Rojas (on the Río Boquerón) from Panama Hwy 3 (Transisthmus Hwy), ca. 150 m SW of Rojas (5.2 km NE of Salamanca, 17.3 km NE of intersection with Transisthmus Hwy—Panama City to Colón), 09°23'N, 79°31.5'W, *Evans & Grayum 188* (CAS, GH, MICH, MO, PMA), *Evans & Grayum 189* (MICH); upper Río Pequení, Madden Lake area, *Fairchild & Jobbins 2636* (MICH).

*Cryosophila bartlettii* is characterized by its small fruits and seeds. Only *C. stauracantha* typically has as small a fruit, but in *C. bartlettii* inflorescences are usually smaller with more peduncular bracts and fewer, shorter first-order branches. *Cryosophila bartlettii* is phenetically most similar to *C. kalbreyeri* from which it can be distinguished by its typically longer, more spiny stems, inflorescences with longer prophylls, and flowers with longer stamen tubes. Leaves of *C. bartlettii* are also often smaller than those of *C. kalbreyeri*.

Little undisturbed forest remains in the Lago Alajuela watershed area, and *C. bartlettii* is extremely rare. Presumably much of its original habitat was inundated by the rising waters of Lago Alajuela, formed by the damming of the Río Charges during construction of the Panama Canal. *Cryosophila bartlettii* is reportedly present on some of the small forested islands in Lago Alajuela located near the mouth of the Río La Puente, which enters the lake from the southeast.

This species is named for Harley H. Bartlett (1886–1960), who made a significant contribution to an understanding of *Cryosophila* taxonomy in his 1935 publication, and who first recognized *Cryosophila bartlettii* as a distinct taxon, as indicated by his annotation of the *Fairchild & Jobbins 2636* specimens at MICH.

2. ***Cryosophila cookii*** Bartlett, Carnegie Inst. Wash. Publ. 461: 39. 1935.—TYPE: COSTA RICA. Limón: Río Hondo, plains of Santa Clara, 100 m, 9 May 1903, *Cook & Doyle 635* (holotype: US 474505-6-7!; isotype: US!).

Common names: *súrtuba*, *escobón*.

Solitary palm. Trunk (7–) 11–14 m long, erect, (11–) 14–16 (–20) cm DBH, typically swollen at base up to ca. 0.5 m high, armed with root-spines forming a dense tangled mass usually 15–30 cm deep over lower the  $\frac{1}{3}$ – $\frac{2}{3}$  (–all) of trunk; internodes 2.1–4.7 cm long. Root-spines almost always 1(–3)-times-branched, rarely unbranched, usually descending; basal adventitious roots growing into the soil, similar morphologically to root-spines above; apical root-spines, when present, gradually changing to ascending in distal ca. 1 m of stem. Leaves (10–) 15–20 (–35), ca. 6 distal to leaf through which youngest inflorescence emerges, additionally 3–11 marcescent; petiole 1.42–3.02 m long, 2.48–3.29 cm wide; hastula 3.0–7.4 cm long, 2.4–4.9 cm wide, 0.9–2.3 times as long as wide, triangular to very broadly triangular, subpointed, briefly bifid apically; blade with marginal-most ca. 4 sections elevated from plane formed by petiole and central sections, 0.24–0.26 mm thick, adaxial surface glossy, abaxial surface chalk-white-pubescent; central segments 90.0–157.0 cm long; marginal segments 70.0–104.5 cm long,  $\frac{3}{5}$ – $\frac{3}{4}$  as long as central segments; central abaxial split to within 11.0–40.0 cm of base, dividing blade into two more or less equal halves of 33–40 segments each; primary adaxial splits usually deeper than central abaxial split with depth of splitting generally increasing from inner ( $\frac{4}{5}$ – $\frac{7}{8}$  to base) to outer splits, dividing each half into 6–8 sections of 1–12 segments each, with the central sections usually containing 7–10 segments each, the ca. 5 middle sections of each half containing ca. 5 segments each, and the marginal sections containing ca. 3 segments each; secondary adaxial splits of central sections  $\frac{1}{3}$ – $\frac{2}{3}$  to base; inner (3–) 4 sections of each half fully divided, the remaining 3 (–4) sections with secondary splitting decreasing toward the marginal section, which is almost always undivided, never fully divided; widest segment 4.5–7.0 cm wide at its widest; longitudinal un-girdered veins 6–11 per half-segment, very large, conspicuous, 1.5–4.3 mm apart; longitudinal un-girdered veinlets 5–15 between adjacent veins, extremely variable in size, only the larger discernible adaxially, all abaxially, 0.1–0.5 mm apart; irregular transverse veins connecting lateral veins (or larger lateral veinlets) usually long, conspicuous adaxially. Inflorescences with 1 order of branching, each ascending at emergence through split petiole base, then abruptly deflected; primary axis 78.5–128.0 cm long, 1.80–3.00 cm in diameter; peduncle 47.5–81.5 cm long; prophyll 21.0–23.5 cm long, ca. 5 cm wide; peduncular bracts 8–10, 27.5–38.0 cm long, ovate; internodes between peduncular bracts averaging 5.9–7.4 cm long; rachis 25.0–46.5 cm long, ca.  $\frac{1}{3}$  (–ca.  $\frac{1}{2}$ ) of total inflorescence length; rachis bracts ca. 15, caducous, all but basal-most usually falling as inflorescence bud opens, the basal bracts ovate, ca. 30 cm long; rachillae to 8.0 cm long near base of rachis, shortening to ca. 2.5 cm long toward apex, perpendicular to primary axis, densely crowded, sometimes briefly