8. CERATOZAMIA Brongn.

Brongniart, A., Ann. Sci. Nat. sér. 3, 5:5-9 (1846); Miquel, F. A. W., Prodr. Syst. Cycad. 10-11, 22-23 (1861); De Candolle, A., Prodr. 16[2]:546-547 (1868); Standley, P. C., Contr. U. S. Nat. Herb. 23[1]:49 (1920); Schuster, J., Pflanzenreich 4[1]:130-132 (1932).

Stem aerial and columnar, rarely branched, seldom more than 1 m. high, covered by an armor of persistent leaf bases in which large stipules play a conspicuous part. Leaves in large plants 10-20 in a crown, up to 1-2 m. long; petiole with scattered spines, except in C. kuesteriana. Leaflets lanceolate or linear, entire, jointed at the rachis, with "parallel" (dichotomous) venation. Vernation of rachis somewhat circinate, of leaflets straight or slightly curved.

Male cones solitary, long cylindric, tapering toward the apex, long stalked. Microsporophylls peltate, broadly cuneate, tapering to a narrow stalk, with two stout horns on the flat hexagonal top. Microsporangia covering the entire lower surface without a sterile line except at the exposed tip. Female cones solitary, cylindric, long stalked. Megasporophylls peltate, with a narrow stalk and two stout horns on the flat hexagonal top. Both kinds of sporophylls seem to be arranged in regular rows. Seeds white. Ceratozamia is the only cycad known to have but one cotyledon.

The genus includes at least 6 species and is probably confined to Mexico. Name from κέρας (horn) and Zamia. Type species: C. mexicana Brongn. The presence of two horns on the sporophylls is a distinctive feature of the genus. The species, especially C. mexicana, are so variable, that detailed field studies must precede any final diagnoses.

Key to the Species

I. Petiole very spiny near the base, less so above

A. Leaflets 10–20 mm. wide . . . . . 1. *C. mexicana*

B. Leaflets 3–7 mm. wide . . . . . 2. *C. purpusii*

II. Petiole sparsely spinescent

A. Leaflets 7–15 mm. wide . . . . . 3. *C. matudai*

B. Leaflets more than 3 cm. wide

1. Leaflets 30–40 cm. long, 3–5 cm. wide . 4. *C. latifolia*

2. Leaflets 20–30 cm. long, 5–7 cm. wide . 5. *C. micueliana*

III. Petiole unarmed . . . . . 6. *C. kuesteriana*

1. Ceratozamia mexicana Brongn.

Brongniart, A., Ann. Sci. Nat. ser. 3, 5:8 (1846) Bot.;
Chamberlain, C. J., Bot. Gaz. 53:1-19 (1912).

Stem seldom more than 1 m. high, rarely branched, often bent or prostrate. Leaves in adult plants 15-20 in a crown, the larger ones 1.5-2 m. long, dark green and glabrous. Petiole 35-60 cm. long, average length about 50 cm., subterete, very spiny near the base, less spiny higher up. Stipules large and fleshy. Rachis with two grooves on the upper side and a few spines on the lower side. Leaflets 30-50 on each side, more or less opposite, long lanceolate to linear, very acute, narrowed at the base, 30-50 cm. long, 10-20 mm. wide; veins averaging 15.

Male cones subcylindric, tapering gradually toward the apex, about 20 cm. long and 7 cm. in diameter just before shedding pollen, then elongating to two or three times this length with scarcely any increase in diameter; peduncle tomentose. Microsporophylls cuneate, 17 mm. long and 12 mm. wide, the stalk 2 mm. long. Microsporangia about 240, in sori of 3 or occasionally of 4, covering the entire unexposed lower surface except for a small notch at the apex. Female cones cylindric, smooth, 26-33 cm. long, 9-11 cm. in diameter; peduncle about 6 cm. long, sometimes up to 13 cm. Megasporophylls in 8-14 vertical rows of 9-13 each; the peltate top transversely hexagonal, 1-3.7 cm. wide, 0.9-1.7 cm. high, brownish hairy on the lower exposed portion. Seeds pubescent when young, smooth and white when mature, up to 2.6 cm. long and 1.8 cm. in diameter.

Geographic distribution: State of Veracruz--abundant on steep mountain side opposite Naolinco, near Jalapa; Almolongo Valley and Chiltoyas, near Jalapa; Mirador; Huatusco. Across the Papaloapan

River at Tuxtepec, State of Oaxaca. Growing in deep shade in moist rain-forests.

The leaves of C. mexicana are so variable that species, varieties, and forms have been based upon them. A crown of leaves produced, in 1936, by a plant in the University of Chicago Greenhouse had leaflets averaging 41 cm. long and 15 mm. wide, while the crown produced in 1938 had leaflets averaging 35 cm. long and 11 mm. wide. In both years a cone was produced with the crown of leaves.

Ceratozamia longifolia Miq. should not be regarded as a distinct species. Seeds of typical C. mexicana, taken from the same cone, will produce both C. mexicana and C. longifolia, the latter with leaflets 50 cm. long when grown in the ground in moist shady parts of the greenhouse. C. robusta Miq. may also be a variant of C. mexicana.

In the herbarium of the Chicago Natural History Museum are a number of specimens of Ceratozamia, consisting of leaves and microsporophylls, collected in the Sierra de los Cuchumantes, Department of Huehuetenango, Guatemala. Those from the trail between Catarina and San Andrés have leaflets about 1 cm. wide, in this and other respects corresponding to C. mexicana. Other specimens, from wooded slopes opposite the river from Finca Soledad, 8 kilometers southeast of Barillas, and along the Río Amelco below Finca San Raphael, have leaflets 2-3 cm. wide and may belong to another species.

2. Ceratozamia purpusii Rose sp. nov.

Stem, in the only specimens available, not more than 40 cm. high[1], covered by a rough armor of leaf bases. Leaves 1.2-1.6 m.

[1] Dr. Purpus says it is "the smallest stem in the genus."

long. Petiole 20-25 cm. long, very spiny below, less spiny above. Rachis up to 1.3 m. long, somewhat spiny in lower half, nearly smooth above. Leaflets 50-70 on each side, opposite or alternate, linear, 25-45 cm. long, 3-7 mm. wide, with 5 or 6 veins; curving until almost round in drying unless strongly pressed. Male cones about 22 cm. long before elongating at shedding of pollen, 6-7 cm. in diameter. Microsporophylls 15 mm. long, 7 mm. wide. Microsporangia about 130, mostly in sori of 3, covering the entire unexposed lower surface of the sporophyll. Female cones cylindrical, 20-39 cm. long, 9-11 cm. in diameter. No mature seeds available.

Geographic distribution: Chiapas, near Hacienda de Montserrato; in pine forests at slightly higher elevations than Dioon pinoi.

This species was distributed under the name of C. purpursii by J. N. Rose, who died before he had an opportunity to describe it. The foregoing description is based on specimens sent by Dr. Rose to various institutions, from notes and microsporophylls sent to me by C. A. Purpus, who collected all of Dr. Rose's material, and from plants collected by Edward Howard in Chiapas and grown under cultivation at Coronado Beach, Los Angeles, and San Marino, California. Since Dr. Purpus identified a leaf from the Coronado Beach plant as C. purpusii and stated that it is the only Ceratozamia in the region from which he and Mr. Howard made their collections, there seems to be no doubt that the specimens which Rose distributed and these living plants belong to the same species.

3. Ceratozamia matudai Lundell

Lundell, C. L., Lloydia 2:75 (1939)

Stem 30-50 cm. tall, 15-20 cm. in diameter. Leaves 75-122 cm. long, yellow-green, glabrous. Petiole armed with few short stout spines, subterete, the broad base densely and persistently tomentose, otherwise glabrous. Rachis flattened and shallowly bisulcate above, bearing a few short stout prickles, excurrent at the apex. Leaflets 23-44 on each side, subopposite to alternate, linear-lanceolate, subarcuate-patent, tapering to a long slender point, widest above the constricted base, 20-38 cm. long, 7-15 mm. wide, the basal and apical leaflets shortest; veins 6-11, prominent beneath, obscure above.

Male cones cylindric-oblong, slightly narrowed toward the apex, abruptly and stoutly apiculate, 8-16 cm. long, 3-4.5 cm. in diameter; peduncle 8-11 cm. long, covered with small red scales, appressed hirsute at base, thick at apex, gradually narrowed to the contracted base. Microsporophylls 10-21 mm. long, 8-10 mm. wide, broadest at the center; fertile part 6-12 mm. long, cuneate, sterile part 3.5-10 mm. long including horns, truncate-pyramidal, the two pointed horns 1.5-4 mm. long at apex, suberect to strongly divaricate. Female cones ellipsoidal, about 15 cm. long, 9 cm. in diameter; peduncle longer than cone, up to 22 cm. long, stout, rarely armed, appressed hirsute and red scaly at first, glabrescent with age. Top transversely hexagonal, up to 3.5 cm. wide, 1.8 cm. high, base tomentose and red scaly, medially bicornute, the horns strongly divaricate, glabrous, their base red scaly, elevated. Seeds obovoid, about 3 cm. long, 2.3 cm. in diameter.

Type in the Herbarium of the University of Michigan, Fizi Matuda 2645, staminate plant, collected in broad-leaved forest on

northern slope of Mt. Ovando, Chiapas, Mexico, February 1939; alt. 1,000 m. C. matudai may be readily separated from C. mexicana Brongn. and C. kuesteriana Regel by its much longer peduncles and larger microsporophylls. On the basis of leaflet venation, it is nearest C. kuesteriana, but differs, aside from the characteristics mentioned, in having an armed petiole and rachis. The foregoing description is quoted, almost verbatim, from Lundell.

4. Ceratozamia latifolia Miq.

Miquel, F. A. W., Tijdschr. Wis. en Nat. 1:206 (1846), Prodr. Syst. Cycad. 11, 23 (1861).

Stem about the same size and shape as in C. mexicana and similarly covered with leaf bases. Leaves in plants 10 cm. high not so numerous as in C. mexicana, about 1-1.6 m. in length. Petiole 50-65 cm. long, terete, not so spiny as in C. mexicana. Rachis 60-100 cm. long, spiny in lower portion but nearly smooth above. Stipules large, fleshy, and more closely appressed than in C. mexicana, making the stem comparatively smooth. Stipules developing so early that they are fractured by the growing apex of the leaf and permanently surround base of leaf, forming a considerable part of the armor. Leaflets on plants with stems 10 cm. high not so numerous as in C. mexicana but much larger, 18-20 on each side, approximately paired, more or less evenly lanceolate but often with the upper border curved toward the tip, sharply acuminate, 30-40 cm. long, 3-5 cm. wide, with 20-30 veins. Cones not available.

In seedlings with two leaflets the petiole is smooth, with four leaflets it has a few small spines, and the spiny condition increases with the age of the plant. In seedlings with six leaflets spines have not yet appeared on the rachis. In seedlings with two leaflets the leaflets average 13 cm. long and 3.7 cm. wide; with six leaflets the lowest ones average 18 cm. long and 2.7 cm. wide.

Geographic distribution: In Zacuapan, Huatusco, Colipa, Miradór, and Jacala, Mexico; growing in shady forests. This species resembles C. migueliana H. Wendl., but its leaflets are longer and somewhat narrower.

5. Ceratozamia miqueliana H. Wendl.

Wendland, H., Index Palm., p. 68 (1854); Miquel, F. A. W., Prodr. Syst. Cycad., 22 (1861); Dyer, W. T. T., in Hemsley's Biol. Centrali-amer. Bot. 3:192 (1882-86).

Leaves 1-1.5 m. long, glaucous and pilose when young, becoming glabrous. Petiole about 45 cm. long, subterete, sparsely spinescent toward the base; rachis up to 90 cm. long, rounded below, flattened above. Leaflets 20-30 on each side, opposite or subopposite, lanceolate, subfalcate, abruptly acuminate, cuneate at base, 20-30 cm. long, 5-7 cm. wide; veins 35-40. Male cones long cylindric, gradually tapering toward the apex, about 25 cm. long, 3 cm. in diameter at base. Female cones ellipsoid, about 11 cm. long, 6.5 cm. in diameter. Peltate top of megasporophyll with distinct ridge; horns somewhat longer than in C. mexicana.

Geographic distribution: Mexico, locality unknown. All descriptions are based on cultivated material.

6. Ceratozamia kuesteriana Regel

Regel, E. von, Bull. Soc. Nat. Moscow 30:187 (1857), Gartenfl. 25:259 (1876).

Stem short and thick, covered with leaf bases, smooth. Leaves up to 1.5 m. long, erect, bright green on both sides, hirsute when young, becoming glabrous. Petiole 50-60 cm. long, subterete, unarmed or with an occasional small spine. Rachis 50-70 cm. long, terete except for two grooves on the upper side, unarmed. Leaflets about 20 on each side, rather crowded and mostly opposite, long lanceolate, straight or falcate, acuminate, tapering at the base to a 4-5 mm. insertion, margins revolute; 20-30 cm. long, 13-15 mm. wide; veins 9-11, very prominent below. Male cones narrow cylindric, tapering sharply at the apex, about 10 cm. long before the sudden elongation at shedding of pollen when length may become two or three times greater, 4 cm. in diameter, short stalked. Microsporophylls 7 mm. long, the upper half sterile; horns 2-3 mm. long. Female cones not available.

Geographic distribution: Known only from La Guazacana, Mexico.