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# A New Species of *Ceratozamia* (Zamiaceae, Cycadales) from Chiapas, Mexico

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**ABSTRACT.** A new species of cycad, *Ceratozamia alvarezii* (Zamiaceae) from Chiapas, is described and illustrated. This species has affinities with *C. matudai* from Chiapas and *C. sabatoi* from Queretaro and Hidalgo. It differs from these species with regard to trunk, leaf habit, and male and female cones. It differs from *C. norstogii*, also from Chiapas, in that the latter is a much larger unbranched plant with a spirally twisting leaf rachis.

**RESUMEN.** Se describe e ilustra una nueva especie, *Ceratozamia alvarezii* (Zamiaceae). Esta especie presenta afinidad con *C. matudai* y *C. sabatoi* de Queretaro e Hidalgo. Esta especie difiere de las anteriores por la hoja, hábito de los estróbilos y morfología del tronco. También difiere de *C. norstogii* dado que la última es una planta más grande, no ramificada y la ráquis torcida espiralmente.

During the course of botanical explorations in one of the natural areas of Chiapas that has recently been decreed as a Biosphere Reserve, we collected a species of *Ceratozamia* with a unique combination of trunk, leaf, and cone characters.

We believe that the new species is close to *Ceratozamia matudai* Lundell. Specimens of the new plant and *C. matudai* were cultivated under the same conditions for comparison purposes for a period of two years, in which time new leaf flushes and cones occurred. The plants under cultivation continued to present the same characteristics as those of the natural habitat. The cones of *Ceratozamia alvarezii* differed from those of *C. matudai* as well as those of *C. norstogii* Stevenson, which also is from Chiapas; *C. norstogii* also differs in its much larger habit, and in having an erect non-branching trunk and leaves with a spirally twisted rachis.

***Ceratozamia alvarezii* Perez-Farrera, Vovides & Iglesias, sp. nov.** TYPE: Mexico. Chiapas: Sierra Madre of Chiapas, 4 Mar. 1996, M. A. Perez-Farrera 889 ♂ (holotype, CHIP; isotypes, F, MEXU, MO). Figure 1.

Planta tronco subgloboso ad cylindricum semihypogaeo ad hypogaeum, ramoso, 10–50 cm alto; cataphyllis lanatis triangularibus, stipulatis. Folia pinnata; petiolo 14–42 cm longo; rachidi 25–66 cm longa; foliolis oppositis ad subopposita, 24–62-jugis, lineari-lanceolatis. Strobilus masculinus lineari-cylindricus 11–31 cm longus pedunculo tomentoso 4–5 cm longo insidens; strobilus feminineus 14.5–19 cm longus pedunculo tomentoso 4.5–6.5 cm longo insidens; seminibus 1.7–2.5 cm longis.

Trunk subglobose, 10–50 cm long, partially subterranean, becoming cylindrical with age, branching freely, 8.9–17.5 cm diam. and protected by persistent petiole bases. Cataphylls stipulate, lanulose, 2.1–5 cm long, 1.5–3 cm wide, brown. Leaves 4–18, pinnate, spirally arranged forming an open crown, 54–109 cm long, 31.5–61 cm wide. Petiole 14–42 cm long, rachis 25–66 cm long, both ascending, tomentose, especially at the base, armed with short stout prickles 2–5 mm, which decrease toward the apical part of the rachis, occasionally mildly twisted. Leaflets 24–62, linear-lanceolate, opposite to subopposite, flat, coriaceous, margins entire, pubescent when immature, glabrous with age, adaxial surface dark green, abaxial surface light green, 16–32.5 cm long, 4–9 mm wide, venation visible on the abaxial surface, number of veins 5–9, distance between veins 0.05–1 mm. Microstrobilus cylindrical to conical, light green to olive green upon emergence, light yellow to creamy yellow when mature, 11–31 cm long, 2.5–4.5 cm diam., peduncle tomentose, 4–5 cm long, 1–1.8 cm diam. Microsporophylls numerous, inserted spirally with vertical rows, cuneiform, 1.4–1.7 cm long,

0.6–0.9 cm wide, bicornate in the distal part, with the fertile portion covering ½–⅔ of the abaxial surface excluding the horns. Microsporangia numerous in sori of 3–4, longitudinally dehiscent. Megastrobilus cylindrical to barrel-shaped, olive green upon emergence, brown ochre when mature, 14.5–19 cm long, 5.7–10.5 cm diam., peduncle tomentose, 4.5–6.5 cm long, 1.8–2.2 cm diam. Megasporophylls numerous, peltate, inserted spirally on the cone axis forming apparent vertical rows, 2.8–4.5 cm long, 1.5–2.9 cm wide, distal end hexagonal, bicornate, with brown ochre tomentum on the lobulate part around the horns. Seed ovate, sarcotesta white when immature and creamy yellow when mature, sclerotesta smooth and beige in color, 1.7–2.5 cm long, 1.7–2.0 cm diam. with 7–9 radial ridges. Chromosome number  $2n = 16$ .

*Paratype.* MEXICO. **Chiapas:** Sierra Madre de Chiapas, 2 Oct. 1996, *Perez-Farrera 1260* ♀ (XAL).

*Other specimens examined.* MEXICO. **Chiapas:** Sierra Madre de Chiapas, *Perez-Farrera 64, 67* (CHIP), *Castillo-Hernandez 624, 445* (CHIP), *Breedlove 70956, 60309* (CAS).

*Ceratozamia alvarezii* principally occurs in oak forest as described by Rzedowski (1978) at an altitude of 950 m. This forest has an overstory of *Quercus magnifolia* Nee, *Quercus elliptica* Nee, and *Pinus oocarpa* Schiede above a shrubby layer dominated by *Calliandra houstoniana* (Mill) Standley and *Canavalia hirsuta* (Martens & Galeotti) Standley. The herbaceous layer consists mainly of *Anthurium cerrobaulense* Matuda, *Lisiacis procerima* (Hackel) Hitchcock, *Elaphoglossum sartorii* (Liebmann) Mickel, *Polypodium furfuraceum* Schlechtendal & Chamisso, and *Polypodium sanctae-rosae* (Maxon) C. Christensen.

DISCUSSION

The specific epithet was chosen to honor the late Miguel Alvarez del Toro, in recognition of his tireless pioneering efforts in conservation, which led to the establishment of the first biological reserves in the state of Chiapas.

Specific locality information for this species is being purposely omitted to avoid potential illegal collection and the possible decimation of its populations. We have only located two populations of this species in a single geographical area in the Sierra Madre de Chiapas. Even though leaf characteristics occasionally display morphological similarities between *Ceratozamia matudai* and *C. alvarezii* (both have flat linear and linear-lanceolate leaflets), the two species differ with respect to the growth habit and the female cones. The peduncle

of the female cone of *C. alvarezii* is thick and erect, while that of *C. matudai* is long, thin, and decumbent. *Ceratozamia sabatoi* Vovides, Vázquez Torres, Schutzman & Iglesias (Vovides et al., 1993) differs from *C. alvarezii* by having wider, longer leaflets and blue-green to blue-brown megastrobili. *Ceratozamia norstogii* is a much larger plant with an unbranching trunk and a spirally twisted leaf rachis. The consistent differences in cone and vegetative habit led us to consider *C. alvarezii* as a separate species. The chromosome count for the new species ( $2n = 16$ ) appears consistent with members of this genus investigated so far. We consider *C. alvarezii* to be endangered, since the oak forests in which it occurs are being transformed for agricultural expansion.

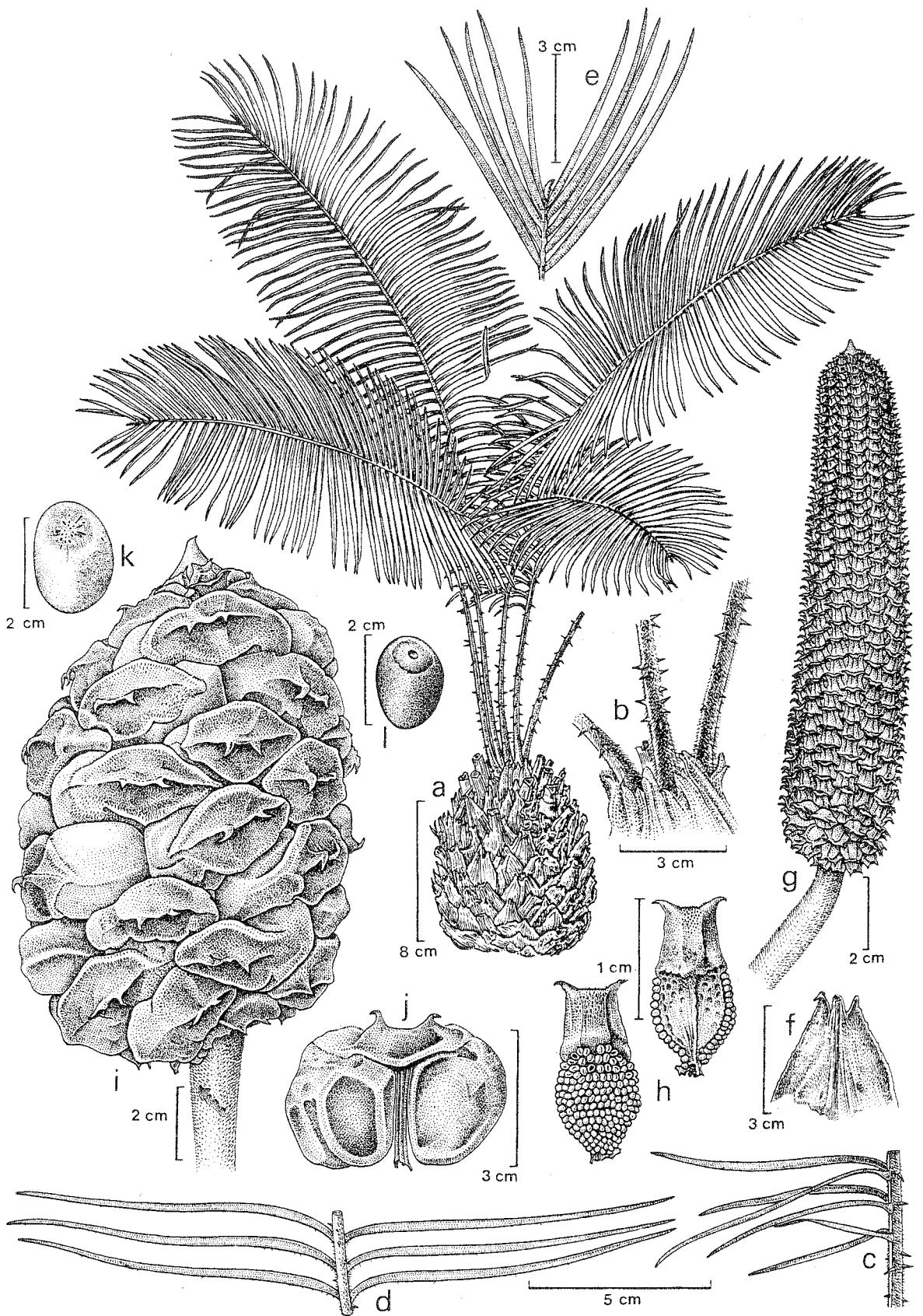
The following key separates *Ceratozamia alvarezii* from *C. matudai*, *C. sabatoi*, and *C. norstogii*.

DIAGNOSTIC KEY

- 1a. Leaf rachis spirally twisted . . . . . *C. norstogii*
- 1b. Rachis not twisted.
  - 2a. Leaflet articulation yellow . . . . . *C. matudai*
  - 2b. Leaflet articulation green.
    - 3a. Leaflet lanceolate, narrowly obovate to subulate; leaflet veins 9 to 14 . . . . . *C. sabatoi*
    - 3b. Leaflet linear lanceolate; leaflet veins 5 to 9 . . . . . *C. alvarezii*

Due to the morphological characteristics that the new species presents, coriaceous linear-lanceolate leaflets with long-attenuate tips, we include it within the second group within *Ceratozamia* described by Stevenson et al. (1986), which includes *C. mexicana* Brongniart, *C. zaragozae* Medellin, *C. matudai*, *C. kuesteriana* Regel, *C. robusta* Miquel, *C. sabatoi*, and, in our opinion, *C. whitelockiana* Chemnick & Gregory.

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Figure 1. *Ceratozamia alvarezii* Perez-Farrera, Vovides & Iglesias. —a. Adult plant. —b. Detail of petioles. —c–e. Leaf details. —f. Cataphyll. —g. Microstrobilus. —h. Detail of microsporophyll and microsporangia. —i. Megastrobilus. —j. Megasporophyll. —k. Seed. —l. Seed with sclerotesta removed. Based on living collection (from type locality) at Clavijero Botanic Garden, Xalapa; accession number 96-012.01. Female cone, *Perez Farrera 1260* (XAL); male cone, *Perez Farrera 1260* (XAL).