



A new species of *Ceratozamia* (Zamiaceae) from Chiapas, Mexico

MIGUEL A. PÉREZ-FARRERA,¹ ANDREW P. VOVIDES^{2*} and CARLOS G. IGLESIAS²

¹*Escuela de Biología, Universidad de Ciencias y Artes del Estado de Chiapas, Calzada Samuel León Brindis 151, C.P. 29,000, Tuxtla Gutiérrez, Chiapas, México*

²*Instituto de Ecología, A.C., Apartado Postal 63, 91000, Xalapa, Veracruz, México*

Received April 2000; accepted for publication February 2001

Ceratozamia zoquorum sp. nov. from the northern mountains of Chiapas, Mexico, is described and illustrated. It has affinities with *C. miqueliana* Wendl. from Veracruz, but differs in leaf, male female cone and trunk morphology.

© 2001 The Linnean Society of London

ADDITIONAL KEY WORDS: *Ceratozamia miqueliana* complex - Chiapas - Cycad - Mesoamerica - Pleistocene refuges

INTRODUCTION

The northern zone of the state of Chiapas and neighbouring Tabasco has been explored and studied to some extent by Pérez & Sarukhan (1970) and López-Mendoza (1980). Breedlove (1981) reported this zone to be one of the least known botanically, although it has become one of the most transformed regions of Mexico, principally due to the spread of cattle pastures and coffee plantations. This has resulted in a great loss of primary vegetation cover, in which in the past a number of endemic species have been found. These include *Zamia lacandona* Schutzman & Vovides, *Z. cremnophila* Vovides, Schutzman & Dehgan (Tabasco) and *Yucca lacandonica* Gómez-Pompa to mention but a few. Under these circumstances we have concentrated our exploration efforts in this geographical zone; in recent years our field work has resulted in the discovery of a *Ceratozamia* species with hanging leaves and decumbent female cones growing on karstic cliffs. This species was cultivated along with *Ceratozamia miqueliana* Wendl., to which we believe it is related, in two climatic regimes - the biology school of the Universidad de Ciencias y Artes de Chiapas (UNICACH) at Tuxtla Gutiérrez, Chiapas (560 m elevation) and the Clavijero Botanic Garden of the Instituto de Ecología, A.C. at Xalapa, Veracruz (1250 m

elevation) for a period of at least 3 years. Observation of leaf, leaflet, cone morphology both in the field and under cultivation has led us to the conclusion that this is a new species.

DESCRIPTION

Ceratozamia zoquorum Pérez-Farrera, Vovides & Iglesias sp. nov.
(Fig. 1)

Truncus subcylindricus vel cylindricus, parvus, semi-hypogaeus vel hypogaeus, ramosus, humilis, 10-48 cm altus; cataphylla lanata, triangularia, stipulata, folia pinnata; petiolus 20-124 cm longus; rachis 40-156 cm longa, foliolis pendentibus et foliolis aculeatissimis; foliola opposita vel subopposita, 5-16 juga, linearia; strobilus masculinus lineari-cylindricus, 11.2-29 cm longus, pedunculo tomentoso 4-10.5 cm longo; strobilus femineus, decumbens 22-26 cm longus, pedunculo tomentoso 6-7 cm; semina 2.1-2.2 cm longa.

Holotypus. MEXICO, CHIAPAS, northern mountain range, M.A. Pérez-Farrera 1732 male 18. xi. 1998 (CHIP).

Isotypes. MEXICO, CHIAPAS, northern mountain range, M.A. Pérez-Farrera 905 female, 17. iv. 1996 (XAL; MEXU; MO).

Plant rupicolous at times, on deeper substrate, trunk

* Corresponding author. E-mail: vovidesa@ecologia.edu.mx

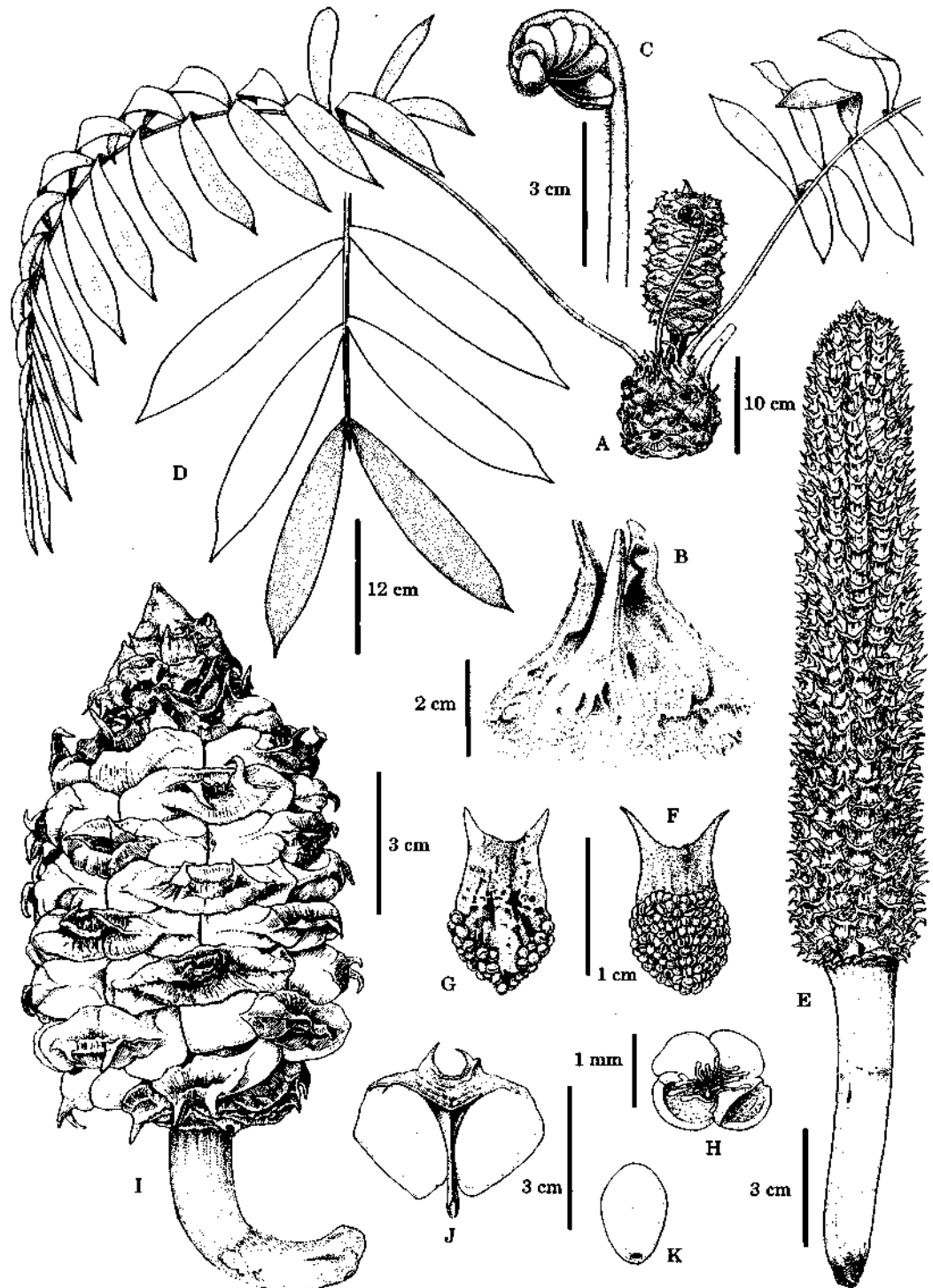


Figure 1. *Ceratozamia zoquorum* sp. nov. A, habit of plant; B, detail of leaf cataphyll; C, detail of emerging leaf (circinate vernation); D, leaf apex; E, mature male strobilus; F & G, detail of microsporophyll, abaxial and adaxial surfaces respectively; H, detail of microsporangia and associated red tomentum; I, mature female strobilus; J, megasporophyll with ovules; K, seed.

subglobose to cylindrical, partially subterranean, becoming branched with age, protected by an armour of persistent petiole bases, dark brown to reddish brown, 10–48 cm long, 13–48 cm diameter; cataphylls stipulate, tomentose at base, 3.5–5.5 cm long, 2.5–3.5 cm wide; leaves 1–5 ascending to decumbent, pinnate forming an open crown, 81.2–374 cm long, 42–75 cm wide, circinate vernation, pruinose blue-grey waxy bloom at emergence; petiole and rachis terete, pruinose, inerm, or with very few widely spaced short prickles diminishing from the petiole towards rachis becoming absent on old plants, petiole linear 20–124 cm, rachis 40–156 cm long; leaflets coriaceous, flat, pruinose, 5–16 pairs, oblong to oblanceolate, apical portion asymmetrical, apex acuminate, opposite to subopposite on distal portion of leaf, alternate to subalternate on median and proximal portions, margins entire, inferior tending to be more curved than the superior margin, subrevolute, dark green, bright, pruinose on adaxial surface, light green on abaxial surface with veins clearly visible, 23–38.5 cm long, 32–65 cm wide, number of veins 27–42, distance between veins 13–2 mm. Microstrobilus erect, olive-green to light-green at emergence, yellow, light-yellow to creamy when mature, 112–29 cm long, 2.9–4.3 cm diameter, peduncle tomentose, light-brown at emergence, brownish-red when mature, 4–10.5 cm long, 1.1–1.8 cm diameter; microsporophylls very numerous, spirally inserted forming apparent vertical rows, cuneiform, bicornuate at distal end, fertile portion covering 1/2 to 2/3 of the abaxial surface excluding horns, reddish tomentulum, 1.2–1.4 cm long, 0.7–0.9 cm wide; microsporangia indefinite in sori of 3–4 associated with red tomentum, longitudinally dehiscent. Megastrobilus cylindrical to barrel shaped, decumbent, dark-green at emergence, olive-green at maturity, 22–26 cm long, 9.5–9.8 cm diameter; peduncle tomentose, 6–7 cm long, 1.9–2 cm diameter. Megasporophylls numerous, spirally inserted forming apparent vertical rows, peltate, distal face hexagonal, bicornuate, with ochre-brown tomentulum on lobulate part near the horns, 1.5–2.3 cm long, distal face long axis 24–28 cm, short axis 1–1.2 cm. Seed ovate, sarcotesta white when immature, creamy-yellow at maturity, sclerotesta smooth, beige to clear beige with visible lines radiating from micropyle, 2.1–2.2 cm long, 1.6–1.7 cm diameter. Chromosome number $2n = 16$.

The closest affinity is with *Ceratuzamia miqueliana*. The specific epithet was chosen to honour the Zoque indigenous culture of this botanically little known region.

Other voucher examined. Chiapas, northern mountain range, 11. ix. 1981, *Breedlove 52686* (CAS).

HABITAT DESCRIPTION

The vegetation type where this cycad is found is evergreen tropical rain-forest according to Rzedowski (1978). It is subdivided into three strata. The upper canopy is dominated principally by *Brosimum ali-castrum* Sw., *Dialium guianense* (Aubl) Sandw., *Manilkera zapota* (L.) Royen., *Guatteria anomala* R. E. Fries., *Calophyllum brasiliense* Camb., *Puteria zapota* (Jacq.) H. E. Moore & Steran. and *Pterocarpus hayensii* Hemsl. The middle stratum, which consists of a more closed canopy, is dominated by *Bursera simaruba* (L.) Sarg., *Pimenta dioica* (L.) Merril, *Miconia trinervia* (Sw.) D. Donn ex Loud., *Oreopanax xalapensis* (Kuth) Decne. & PL, *Trophis racemosa* (L.) Urban., *Sauraria belizensis* Lund, *Dendropanax arboreus* (L.) Planch & Decne. The lower herbaceous/shrubby layer consists mainly of understory palms such as *Astrocaryum mexicanum* Burr., *Chamaedorea concolor* Martius, *Chamaedorea elegans* Martius, *Chamaedorea tepejilote* Liemb., *Chamaedorea arenbergiana* Wendl., the rattan-like *Desmoncus chinantlensis* Liebm. Associated herbaceous plants are *Begonia neblumiifolia* S. & C, *Anthurium pedatoradiatum* Schott, *A. schlechtendalii* Kunth, and climbing hemiepiphytes and epiphytes such as *Monstera deliciosa* Liebm., *Anthurium pentaphyllum* (Aubl.) D. Don. var. *bombacifolium* (Schott), *Tillandsia guatemalensis*, L. B. Smith and *Polypodium* sp.

There are two soil types present in the mountains of this area — calcareous or tropical rendzinas and red clay soils derived from lutites (López-Mendoza, 1980). The general topography is abrupt with steep slopes (70%). The karstic outcrops correspond to the Eocene continental marine strata with some Oligocene inclusions; topography is complex (López-Hernandez, 1994; Pérez & Sarukhan, 1970). *Ceratuzamia zoquensis* is found within the elevational range 520–1200 m.

DISCUSSION

The leaf morphology of *C. zoquensis* shares some similarity with *C. miqueliana*, both being flat but differing in leaf vernation as well as female cone habit, growth and indument (reddish) as well as shorter and thicker peduncles. The decumbent cone habit is also shared by *C. matudae* Lund. from Chiapas, *C. zaragozae* Medellín-Leal from San Luis Potosí and *C. mixeorum* Chemnick, Gregory & Salas from Oaxaca. However, there are differences in leaf, leaflet and trunk morphology. Circinate vernation of leaves is also shared by *C. moretti* Vázq. Torres & Vovides from Veracruz but the latter has a different cone morphology.

The morphological characteristics of *C. zoquensis* place it within the first group of the genus *Ceratuzamia* according to Stevenson, Sabato & Vázquez-Torres (1986). This includes *C. miqueliana*, *C. euryphillidia*

KEY SEPARATING *CERATUZAMIA ZOQUENSIS* FROM *C. MIQUELIANA* AND *C. EURYPHYLLIDIA*

- | | | |
|----|---|-------------------------|
| 1. | Leaflets oblong to oblanceolate, coriaceous; female cones decumbent at maturity.
Leaflets 3.2-6.5cm wide..... | <i>C. zoquensis</i> |
| 1. | Leaflets obovate to widely oblanceolate, translucent, papiraceous to membranaceous; female cones erect at maturity. | |
| 3. | Leaflets translucent, 9-16 cm wide..... | <i>C. euryphyllidia</i> |
| 4. | Leaflets papiraceous to membranaceous, 4-6.4 cm wide..... | <i>C. miqueliana</i> |

Vázquez Torres, Sabato & Stevenson, *C. latifolia* Miq., *C. moretti* Vázquez Torres & Vovides *C. microstrobila* Vovides & Rees. We consider that *C. zoquensis* forms part of a complex of populations in the northwestern mountains of the state of Chiapas which includes *C. miqueliana*, *C. robusta* Miq. and *C. euryphyllidia*. This mountainous region forms part of the Pleistocene refugia according to Toledo (1982, 1988) and Wendt (1993).

Locality information for this new species has been deliberately omitted in order to avoid decimation of its only known population by illegal collecting. We consider this species to be critically endangered according to the IUCN Red List (1994) unless further exploration uncovers new populations. It is suspected that this cycad and many other species will become extinct if habitat destruction continues in this area. Efforts are underway to bring this cycad under cultivation in the Clavijero botanic garden at Xalapa, at UNICACH and the botanic garden of the Institute of Biology of the National University of Mexico (UNAM).

ACKNOWLEDGEMENTS

The first author thanks Señor Lucas Vázquez Velasco and his nephew for assistance and guidance in the field. The authors also thank Jesús de La Cruz Rodríguez and Rigoberto Hernández Jonapá, Emerit Melendez Lopez, Tomas Acero Acero, Oscar Farrera Sarmiento and Francisco Hernandez Najarro for assistance in the field and processing of plants. Funding was made possible partly by Fauna and Flora International grant No. No 96/64/15, awarded to the first author and CONACYT grant No 29379N awarded to A. Vovides. Thanks are given to the US Tropical

Ecosystems Directorate and finally to the State Government of Chiapas via partial finance to the School of Biology at UNICACH for cycad monitoring studies within Chiapas. The authors thank Edmundo Saavedra for the excellent botanical illustration.

REFERENCES

- Breedlove D. 1981.** *Introduction to flora of Chiapas*. Location: California Academy of Science Press.
- IUCN. 1994.** *Red list categories of the IUCN*. GI and: IUCN.
- López-Mendoza R. 1980.** Tipos de vegetación y su distribución en el estado de Tabasco y norte de Chiapas. *Cuadernos Universitarios. Serie Agronomía No. 1*. Chapingo, México.
- López-Hernández ES. 1994.** La vegetación y la flora de la sierra de Tabasco. Universidad Juárez Autónoma de Tabasco, México, Villahermosa Tabasco.
- Pérez JA, Sarukhán J. 1970.** La vegetación de la Región de Pichucalco, Chiapas, Instituto Nacional de Investigaciones Forestales. *Publicación Especial 5*: 13-48.
- Rzedowski J. 1978.** *La Vegetación de México*. Mexico: Limusa.
- Toledo VM. 1982.** Pleistocene changes of vegetation in tropical Mexico. In: Prance GT, ed. *Biological diversification in the tropics*. New York: Columbia University Press, 93-111.
- Toledo VM. 1988.** La diversidad biológica de México. *Ciencia y Desarrollo XIV*: 17-30.
- Stevenson D, Sabato S, Vázquez-Torres M. 1986.** A new species of *Ceratozamia* (Zamiaceae) from Veracruz, Mexico with comments on species relationships, habitats, and vegetative morphology in *Ceratozamia*. *Brittonia 38*: 17-26.
- Wendt T. 1993.** Composition, floristic affinities and origins of the canopy tree flora of the Mexican Atlantic slope rain forests. In: Ramamoorthy T, Bye R, Lot A, Fa J, eds. *Biological diversity of Mexico: origins and distribution*. Oxford: Oxford University Press, 595-680.