

CERATOZAMIA MIXEORUM (ZAMIACEAE), A NEW SPECIES FROM OAXACA, MEXICO WITH COMMENTS ON DISTRIBUTION, HABITAT, AND SPECIES RELATIONSHIPS

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ABSTRACT

Ceratozamia mixeorum spec. nov., from Oaxaca, México is described and illustrated. The species differs from others in the genus by the presence of both remarkably long peduncles bearing the megastrobili and microstrobili, and large, arching leaves with numerous, wide leaflets. Its affinity is unresolved at present, but it is likely to be close to *C. matudae*. *Ceratozamia mixeorum* is known only from cloud forest on montane peaks of the Sierra Mixes in central Oaxaca, ranging in elevation from 1440 m to 1895 m.

KEY WORDS: *Ceratozamia*, *Zamiaceae*, Mexico, Oaxaca, systematics

Ceratozamia mixeorum Chemnick, Gregory, & S. Salas-Morales, *spec. nov.*
TYPE: MEXICO. Oaxaca: Vicinity of Juquila Mixes, May 1997, *Chemnick, Gregory, & S. Salas-Morales*. HOLOTYPE: HNT; Isotypes: to be distributed to FTG and XAL.

Truncus semihypogaeus, ad 48 cm altus; folia pauca, usque 8, glabra; petiolus teresve, 61-81 cm longus, parte infima dilatatus, pauca spinis armatus; rachis subteres, supra bisulcata, in dimido inferiore, paucis spinis armata, supra fere inermis vel inermis, in cuspidem 10-25 mm longam excurrent; foliola opposita vel subopposita, 30-40 juga, lanceolata vel falcata, 27-37 cm longa, 23-27 mm lata, coriacea, falcata, basi attenuata, apicam lanceolata acuminata, margine integerrima, revoluta; strobilus microsporangiatibus lineari-cylindricus, 22-24 cm longus, 70-75 mm latus; pedunculus tomentosus, 13.5-15.0 cm longus, 18-20 mm latus; strobilus megasporangiatibus cylindricus pendulus, apice mucronatus, 24.0-30.6 cm longus, 12.2-15.2 cm latus; pedunculus tomentosus, 12.5-23.0 cm longus, 1.5-1.9 latus.

Stems mostly solitary, semihypogeous, cylindric 34-125 cm long, 14-18 cm in diameter, smooth, medium brown, with no protruding leaf bases, approximately 20-25% of the mature plants bifurcate, some individuals with up to 4 branches of nearly equal length originating below grade, branches originate from subterranean procumbent stems that are often gnarled and in varying degrees of decomposition; leaves 1.46-1.98 m long, usually in whorls of 5-11, ascending pendulous, recently-emerged and juvenile leaves bright pea-green, turning dark green with age, glabrous, slightly lighter in color on abaxial surface, adult plants with up to 3 crowns of leaves; petiole 45-85 cm long, green, round with an expanded base that is dark reddish brown and forms a distinct ridge at junction with the petiole, 25 mm in diameter at petiole base tapering to 10 mm in diameter at the mid-way point, moderately armed with simple spines 3-5 mm long gradually decreasing in frequency distally, adaxial surface shallowly bisulcate with grooves arising just above the petiole base and extending distally to the first pair of leaflets; rachis round, arching, 50-85 cm, sparsely armed with spines 3-5 mm long gradually decreasing in frequency distally, nearly unarmed on the distal 25%; leaflets linear-lanceolate, acuminate, often falcate, moderately coriaceous with margins slightly revolute and turned upward, with veins neither conspicuously raised nor visible, flat to deflexed on rachis except basal 3-5 "pairs" that are keeled, the median leaflets 24-39 cm long and 21-29 mm wide decreasing slightly in length towards apex, total number of leaflets 49-77 arising opposite to subopposite along rachis inserted 3-4 cm apart; microsporangiata strobilus elongate-conical, solitary, 22-24 cm in length, 7.0-7.5 cm in diameter, tapering gradually towards apex, microsporophylls 14-15 mm wide and 7-8 mm long, yellow green, peduncle 13.5-15.0 cm in length and 18-20 mm in diameter, green but covered with reddish-brown tomentum; megasporangiata strobilus cylindrical, 23.5-30.5 cm in length and 12-15 cm in diameter with mature megasporophylls arranged in 12 vertical "columns" and 8 horizontal "rows", solitary, apiculum truncate, megasporophylls 24-28 mm long and 42-50 mm wide, green suffused with yellow, horns 5 mm long and inserted 10 mm apart, decumbent at tip, with a 3 mm long by 3 mm wide triangulate process evident on the upper facet of the megasporophyll between the horns; megastrobilus horizontal at receptivity and pendant at maturity; peduncle 12.5-23.0 cm in length and 15-20 mm in diameter, green with reddish-brown tomentum; sclerotesta ovoid, smooth, tan, 25-32 mm in length and 18-20 mm in diameter; initial seedling leaf usually with 4 leaflets. Developing strobili of both sexes appear orange in color from a distance due to the concentration of dark red tomentum on light yellow green scales and are borne on peduncles of nearly mature length even when the immature strobili are only 6-7 cm long.

Etymology: The species is named for the people inhabiting the region of distribution.

DISTRIBUTION AND HABITAT

Ceratozamia mixeorum is known only from cloud forest covering the peaks of two adjacent mountains in the extreme eastern Sierra Norte de Oaxaca (Sierra Mixes), ranging in elevation from 1440 m to 1895 m. Precipitation occurs throughout the year.

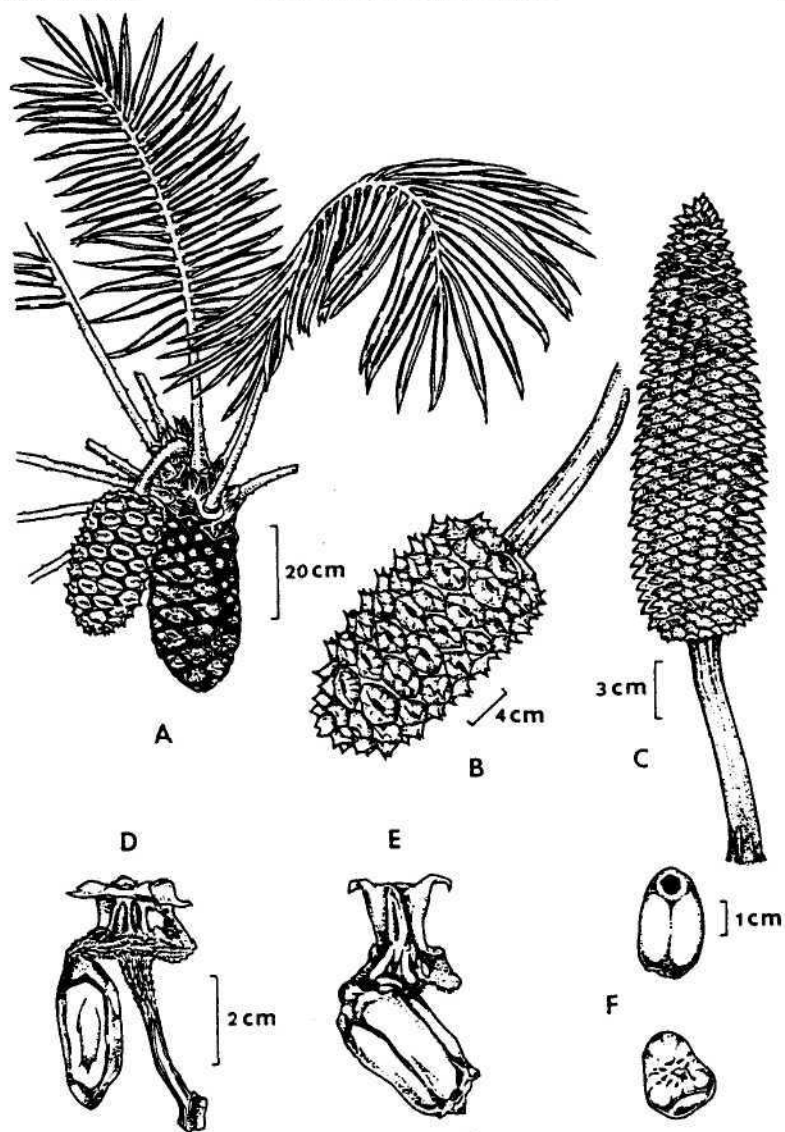


Figure 1. *Ceratozamia mixeorum*. A. Habit of plant with megasporangiate strobilus. B. Megasporangiate strobilus. C. Microsporangiate strobilus. D & E, Megasporophyll with attached seed at maturity in two aspects showing details of sarcotesta. F, Seed showing details of sclerotesta in two aspects.

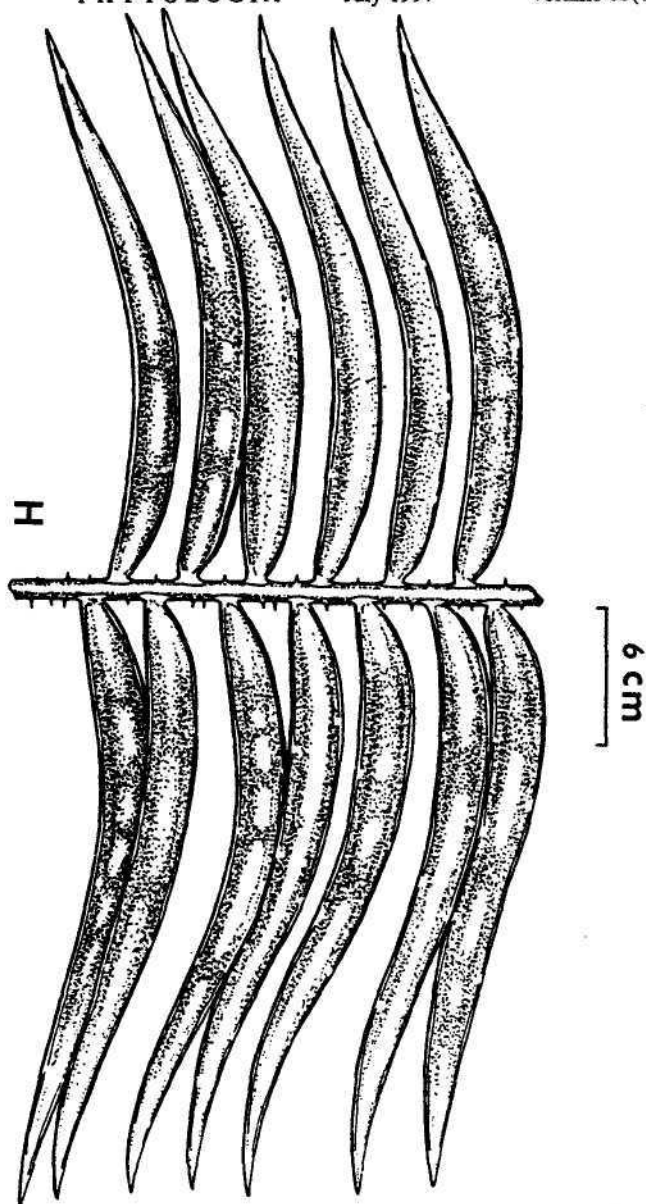


Figure 2. *Ceratozamia mixeorum*. H, Leaf detail; section from mid-rachis.

Habitat consists of very steep slopes with small pockets of remnant primary forest now interdigitated with coffee and secondary growth. The cloud forest consists of two arboreal strata. The upper canopy is comprised chiefly of *Weinmannia pinnata*, *Liquidambar styraciflua*, *Cyathea mexicana*, *Alchornea latifolia*, *Ticodendron incognitum*, *Clethra mexicana*, *Oreopanax xalapensis*, *Quercus excelsa*, and *Dendropanax*. The understory consists mainly of *Hedyosmum mexicanum*, *Phyllonoma laticuspis*, *Rondeletia*, and *Ternstroemia oocarpa* among others. *Ceratozamia mixeorum* is the dominant bushy plant accompanied in the higher elevations of its range by *Eugenia*. Though there is a paucity of herbaceous ground cover, the overstory is laden with an abundance of epiphytes, predominantly orchids and bromeliads. *Ceratozamia mixeorum* occurs on heavily shaded east- and west-facing slopes in primary forest with *Chamaedorea*, *Geonoma*, *Melastoma*, *Acanthus*, *Ficus*, *Begonia*, and *Selaginella*. The substrate consists of a light-colored crumbly, rocky clay soil with a pH of 5 and outcroppings of sedimentary rock.

The entire locality is rapidly being cleared and planted almost to the tops of the peaks and thus this cycad must be considered threatened. Local prohibition of further deforestation to protect the watershed is a likely benefactor for this species as well. Since *ex situ* specimens of *Ceratozamia mixeorum* are unknown, it appears that habitat destruction is currently the sole threat to its existence. We have withheld the exact locality to protect it from the depredations of collectors. In our most recent survey of the locality in May, 1997, we observed approximately 500-1000 plants during one day of field work. Seedlings were abundant. Continuous recruitment into the population was evidenced by the occurrence of many juvenile and older plants in a gradation of size up to coning plants. Nearby peaks of the surrounding mountains are likely to contain additional populations of *C. mixeorum* but their existence is yet to be determined because accessibility is difficult. It is noteworthy that numerous individuals persist in the dense scrublike secondary growth just below the primary forest of the mountain tops. The local name of *C. mixeorum* is "carrete" (ox cart) because the children play with the microstrobilus in a related manner.

RELATIONSHIP TO OTHER SPECIES OF *CERATOZAMIA*

Ceratozamia mixeorum is most likely allied to *C. matudae* Lundell (1939) because both taxa possess a long peduncle that is atypical for the genus. Apparently there are several populations of *C. matudae*-like plants with long peduncles that occur in Chiapas currently under investigation (Miguel A. Perez Farrera, pers. comm.). The occurrence of various populations of *Ceratozamia* with elongated peduncles suggests a complex that ranges throughout Chiapas and into central Oaxaca. The Sierra Madre Sur contains several peaks of a similar elevation between the known localities of *C. mixeorum* and *C. matudae* and further field studies will undoubtedly uncover new populations of plants in what is emerging as the "*C. matudae* complex".

Ceratozamia matudae occurs in cloud forest and is characterized by pendant cones borne on elongated peduncles as in *C. mixeorum*. However, the leaves are much shorter and the leaflets narrower in *C. matudae* and the cones are much smaller. *Ceratozamia zaragozae* Medellin-Leal (1963) is characterized by a small, pendant

megastrobilus borne on an elongated peduncle and its leaves are small, spirally ascending, and unarmed. Additionally, *C. zaragozae* occurs in a much drier habitat far to the north. The other known *Ceratozamia* with elongated peduncles have larger leaves than does *C. matudae* but are still much smaller than the leaves of *C. mixeorum*. Vegetatively, *C. mixeorum* is similar to the various *C. mexicana* Brongniart (Vovides *et al.* 1983; Stevenson *et al.* 1986) ecotypes by the presence of large, arching leaves. However, the cylindrical-long shape, smooth texture, and branching habit of the stems are distinct. The peduncle length, combined with the size of the leaf and character of the stem, are diagnostic for *C. mixeorum* and thus it is easily separated from the other similar species of *Ceratozamia* that occur in Oaxaca, *C. robusta* Miquel (Vovides *et al.* 1983; Stevenson *et al.* 1986), and *C. whitelockiana* Chemnick-Gregory (1995).

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