Key to the Species of *Ceratozamia*

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Preamble

The genus *Ceratozamia* consists of 23 currently recognized species distributed mostly along the Atlantic slope of Mexico and northern Central America as well as the Pacific slope of southern Mexico. There is considerable variation in habit and leaflet form as well as overall size. This key is designed to enable workers to distinguish species primarily using vegetative characters owing to the paucity of reproductive structures both in the field and under cultivation. However, in some cases the use of cones to separate species is necessary. This key is intended for purposes of identification only and should not be interpreted as a statement of phylogenetic relationship.

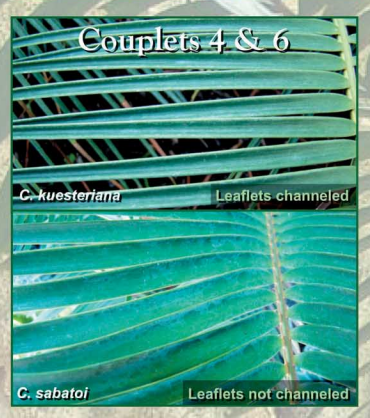
Dimensions given for all aspects of *Ceratozamia* morphology are likely to be broader in range than the measurements given in the species descriptions due to the extreme variability of plants grown under cultivation around the world. Because geographic range alone will identify any of the known ceratozamias, the intent of this key is primarily to aid in the identification of plants *ex situ*. Eophylls are not treated herein and workers should be aware that seedling leaves often bear little resemblance to those of mature plants. In most cases, eophyll leaflets are shorter, broader and fewer in number than the leaflets on mature leaves.

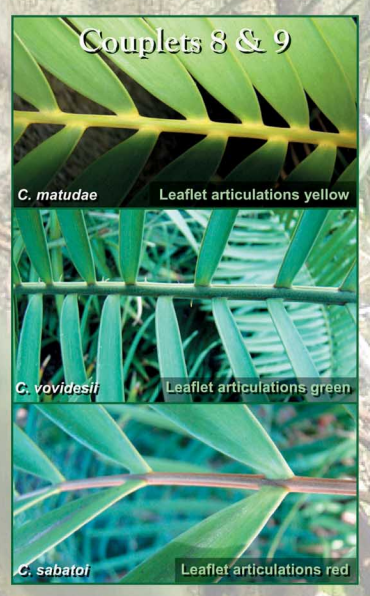
Some degree of variation exists within most species. The more wide-ranging taxa can show dramatic differences between populations and even between different cohorts of leaves on the same plant. Additionally, it is important to be flexible when interpreting the key to understand that any given plant may differ considerably from the "type" at different points in time. Leaves and leaflets can continue to change even after the initial "hardening off" has ended. Individual plants may differ from year to year as well. Be sure to allow for the broadest possible range of form.

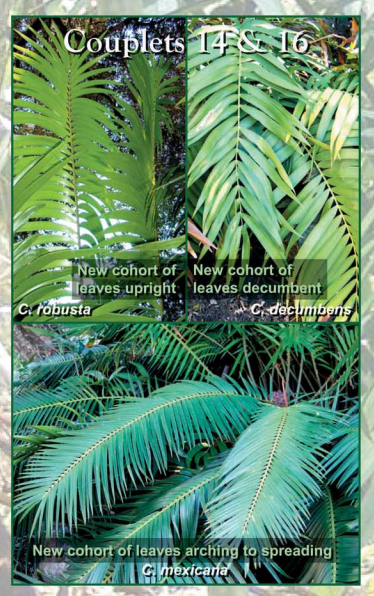
Several species are quite rare in cultivation and are, therefore, unlikely candidates at this point in time should they "key out" as such. Species rarely encountered outside of habitat include *Ceratozamia euryphyllidia*, *C. hondurensis*, *C. alvarezii*, *C. huastecorum*, *C. becerrae*, *C. mixeorum* and *C. vovidesii*. Also uncommon in cultivation are *C. decumbens*, *C. morettii*, *C. zoquorum* and *C. matudae*. Of course the availability of seed/seedlings of these species is likely to increase over time.

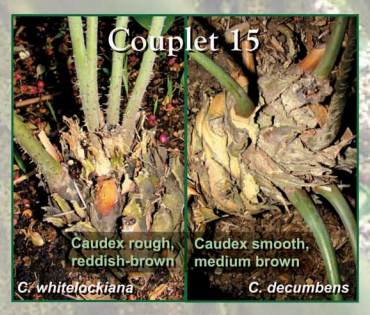
Lastly, plants from several populations of *Ceratozamia* are in cultivation though their taxonomic disposition is currently unsettled. Such forms are usually known informally by the locality of origin or some distinguishing character. Several of these populations are treated briefly, below the key.

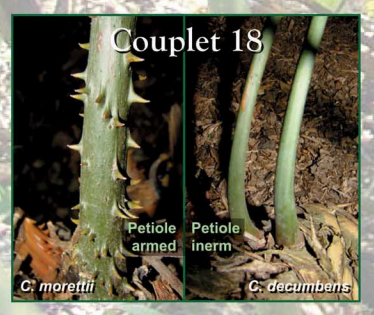
Couplet Illustrations











Diagnostic Key

1A. Leaflets fasciculate, or if not fasciculate, in opposite to sub-opposite pairs, papyraceous; leaves usually erect, 80-180 cm long; petiole unarmed to slightly armed; caudex subterranean or only slightly above grade ..... *C. hildae*

1B. Leaflets not fasciculate, or not as above

2A. Leaflets < 2 cm wide

3A. Rachis twisted; leaflets ≤ 0.6 cm wide, appearing spirally arranged

4A. Petiole and rachis heavily armed; leaves 5-15 per cohort; leaflets channeled; caudex rough, not subterranean, usually solitary ..... *C. norstogii*

4B. Petiole and rachis unarmed; leaves 2-5 per cohort; leaflets not channeled; caudex subterranean, frequently suckers ..... *C. zaragozae*

3B. Rachis not twisted; leaflets generally > 0.6 cm wide or not appearing spirally arranged

5A. Petioles unarmed or with few small prickles

6A. Leaflets distinctly channeled, less than 0.8 cm wide ..... *C. kuesteriana*

6B. Leaflets flat or only slightly channeled, 1-1.5 cm wide ..... *C. sabatoi*

5B. Petioles armed

7A. Leaves ≤ 1.2 m long

8A. Leaflets with yellow articulations; female cone pendent at maturity ..... *C. matudae*

8B. Leaflets with green or reddish articulations; female cone erect or nearly so, not pendent at maturity

9A. Leaflets 0.4-0.9 cm wide; petiole, rachis and articulations greenish ..... *C. alvarezii*

9B. Leaflets 1.2-2.4 cm wide; petiole, rachis and articulations reddish ..... *C. sabatoi*

7B. Leaves > 1.2 m long

10B. Leaflets ≥ 1.4 cm wide ..... *C. mexicana*[6]

10A. Leaflets ≤ 1.4 cm wide

11A. Leaflets channeled; female cone erect at maturity ..... *C. mirandae*

11B. Leaflets flat; female cone pendent at maturity ..... *C. vovidesii*

2B. Leaflets ≥ 2 cm wide

12A. Median leaflets generally 2-3.2 cm wide

13A. Leaflet length-to-width ratio 5:1 to 8:1; petioles inerm or nearly so ..... *C. microstrobila*[7]

13B. Leaflet length-to-width ratio > 8:1; petioles usually armed

14A. Petioles armed with prickles ≥ 5 mm long; most recent cohort of leaves erect and straight ..... *C. robusta*[8]

14B. Petioles armed with prickles < 5 mm long; most recent cohort of leaves not erect or, if erect, arching slightly at the apex

15A. Caudex reddish-brown with rough-textured, persistent leaf bases and cataphylls; leaves 2-2.5 m long; leaflets papyraceous, pruinose emergent; petioles generally ≥ 50% of overall leaf length ..... *C. whitelockiana*

15B. Caudex pale-medium brown with smoother surface; leaves generally < 2 m long; leaflets coriaceous, not pruinose; petioles < 50% of overall leaf length

16A. Leaves arching or, if erect, with a slight arch at the apex (not straight)

17A. Leaflet length-to-width ratio 8:1 to 15:1; cone peduncles of both sexes > 12 cm long, often much longer; female cone pendent at maturity ..... *C. mixeorum*

17B. Leaflet length-to-width ratio 15:1 to 26:1; cone peduncles of both sexes < 10 cm long; female cone erect, becoming decumbent at maturity ..... *C. mexicana*[6]

16B. Leaves prostrate to pendent

18A. Leaflets ≥ 25 cm long, green emergent, moderately coriaceous with conspicuous revolute margin, veins translucent; petioles often densely armed, rarely inerm, lacking persistent tomentum ..... *C. morettii*

18B. Leaflets < 25 cm long, bronze emergent, thickly coriaceous, lacking conspicuous revolute margin, veins opaque; petioles inerm or nearly so (prickles few and greatly reduced, never densely armed), covered in persistent beige tomentum ..... *C. decumbens*

12B. Median leaflets generally > 3.2 cm wide

19A. Petioles inerm

20A. Leaflets pruinose emergent, length-to-width ratio 5:1 to 7:1 ..... *C zoquorum*

20B. Leaflets not pruinose emergent, length-to-width ratio 2:1 to 3:1 ..... *C. becerrae*

19B. Petioles armed

21A. Leaflets coriaceous; green, bronze or red emergent; not pruinose

22A. Leaves < 0.8 m long; veins translucent ..... *C. huastecorum*

22B. Leaves ≥ 0.9 m long; veins opaque ..... *C. latifolia*[7]

21B. Leaflets papyraceous or membranous, pruinose emergent

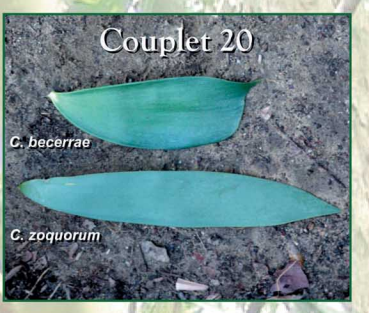
23A. Leaflets 5-7 cm wide, papyraceous ..... *C. miqueliana*

23B. Leaflets ≥ 9 cm wide, membranous

24A. Leaflets strongly asymmetric, widely obovate, nearly equal in length and width; leaf bases pubescent ..... *C. euryphyllidia*

24B. Leaflets nearly symmetric, oblanceolate, obviously longer than wide; leaf bases glabrous ..... *C. hondurensis*

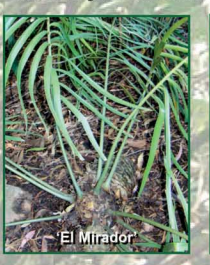
Couplet Illustrations



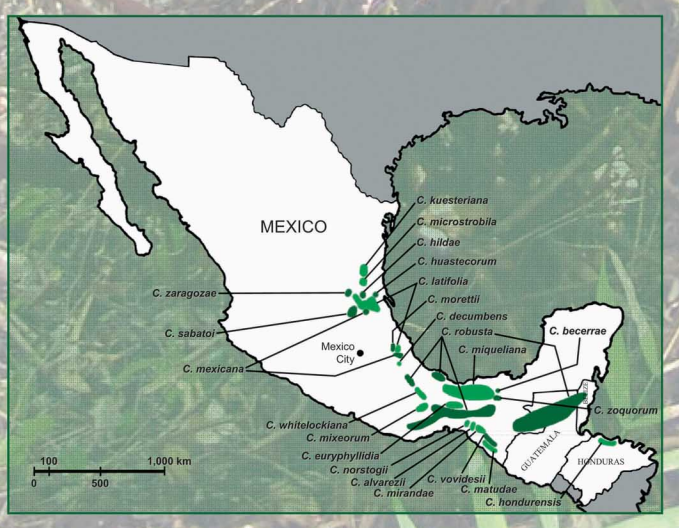
8 *Ceratozamia robusta* ranges widely over southern Mexico in the states of Veracruz, Oaxaca and Chiapas, as well as into Guatemala and Belize. Such a wide-ranging species encompasses considerable variation. Further examination may determine that *C. robusta* actually consists of several taxa, but all are treated herein as a single species. Various forms exist in cultivation. Stevenson neotypified *C. robusta* with a plant from the vicinity of Sumidero Canyon in Chiapas. The leaflets of the Chiapan plants lack the conspicuously translucent veins characteristic of plants from Veracruz. Forms of *C. robusta* that are particularly well-known in cultivation include plants from Santiago Tuxtla in Veracruz, from the Pacific slope of the Sierra Sur in Oaxaca, and the giant form from Belize.

IF IT DOESN'T KEY OUT: Representatives of several *Ceratozamia* populations that are known in cultivation do not correspond precisely within the concept of the described species, and, thus, will not easily key out. Such forms are likely to become new taxa upon further review. But, because they are represented in cultivation, the following forms are herein depicted:

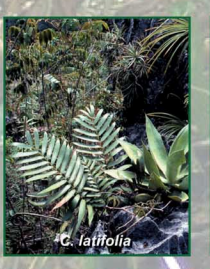
- El Mirador: Known from the vicinity of El Mirador, Veracruz. Large plants with long, arching leaves and broad, light green leaflets; sparsely armed petioles with reduced prickles; smooth, brown caudex.
- Palma Sola: Known from the foothills west of Palma Sola, Veracruz. Large plants with long, spreading (not arching), keeled leaves; medium green leaflets with conspicuously translucent veins; well-armed petioles.
- Redback: Thought to occur in Puebla and/or Hidalgo. Large plants with long, arching leaves and broad leaflets that are red emergent and retain red veins on the abaxial surface.



Distribution



Select Plants in Habitat



[6] There are various forms of *Ceratozamia mexicana* currently in cultivation. These may prove to be separate taxa after further evaluation but are herein included with *C. mexicana*. The typical form occurs just north of Xalapa, Veracruz, and has green-emergent leaves. Another form that occurs near Molango, Hidalgo, has red-emergent leaves and leaflets that tend to remain reddish on the abaxial surface.

[7] *Ceratozamia microstrobila* and *C. latifolia* are confused taxa. Because no type specimen existed for *C. latifolia*, Stevenson neotypified the species in 1986 with a plant belonging to a population from northern San Luis Potosí because he felt it most closely matched Miquel's sparse original Latin description of 1848 (Stevenson & Sabato, 1986). Coincidentally, the population from which Stevenson's type was designated (Mexico, San Luis Potosí, W of Antiguo Morelos; Hill & Stevenson, 2007a) happened to be one and the same as the type locality for *C. microstrobila* (San Luis Potosí, Municipio Cuidad del Maiz, Ejido las Abritas; Hill & Stevenson, 2007b). Therefore, until such time as a revision is published, *C. microstrobila* is now apparently invalid and two schools of thought must be considered. One would hold that *C. latifolia* in the *sensu strictu* is synonymous with *C. microstrobila* and that the small, broad-leafleted plants with small cones and inerm (or nearly so) petioles from northern San Luis Potosí are correctly consigned to *C. latifolia*. Furthermore, the many populations of larger, broad-leafleted plants with well-armed petioles ranging widely over central and southern San Luis Potosí, northern Veracruz, and even into parts of Hidalgo and Querétaro, that have long been informally regarded as *C. latifolia*, may, in fact, constitute one or even several undescribed taxa. The other school would allow that *C. latifolia* in the *sensu latu* encompasses not only *C. microstrobila* as designated by the neotype, but the many aforementioned populations as well.

Glossary

abaxial. Side of organ facing away from central axis, *e.g.* lower side of leaf or leaflet.
armed. Having spines or prickles. *Cf.* **inerm.**
articulation. Node or joint at point of leaflet attachment.
channeled. With raised longitudinal edges to form a channel.
cohort. Group of leaves that all emerge at the same time.
coriaceous. Leathery in texture.
decumbent. Of stems, lying along the ground; of cones, leaning (not erect).
fasciculate. Arranged in a whorl.
glabrous. Smooth surface, without hair of any kind. *Cf.* **pubescent.**
glaucous. Surface covered by bluish-gray, waxy or powdery substance.
holotype. Single herbarium specimen or illustration of the type collection used or designated by the author of the name.
inerm. Without spines or prickles; unarmed. *Cf.* **armed.**
keeled. Vee-shaped; resembling a boat keel.
membranous. Thinly textured, as in a membrane.
neotype. New material designated to replace a missing **holotype** when no original material remains in a herbarium collection.
oblanceolate. Lance-shaped, longer than broad; wide apex, tapered base and widest above the center.
obovate. Egg-shaped in outline but broadest above the middle.
opaque. Allows no light through.
papyraceous. Papery in texture.
pendent. Hanging downwards.
prickle. Small, sharp protuberance of epidermal origin, usually green and irregularly distributed.
prostrate. Trailing or lying along the ground but not rooting.
pruinose. With surface covered by a waxy bloom.
pubescent. Densely covered with fine short hairs.
rachis. Section of leaf axis where leaflets are attached.
revolute. Margin rolled abaxially.
sensu latu. In a broad or all-encompassing sense.
sensu strictu. In the narrow or restricted sense.
translucent. Allows some light through; neither opaque nor transparent.
tomentum. Covering of fine hairs.

Note: All definitions from Walters & Osborne (2004), except "keeled" (Jones, 2002).

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