A NEW ZAMIA (ZAMIACEAE, CYCADALES) FROM EASTERN CHIAPAS, MEXICO

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NOVON
VOL 8, NO. 4, 1998
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A new *Zamia* (Zamiaceae, Cycadales) from Eastern Chiapas, Mexico

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**Abstract.** *Zamia lacandona*, a member of the *Z. splendens* species group is described from the Selva Lacandona of eastern Chiapas. It is distinguished from *Zamia splendens* Schutzman by its usually single arcuate leaf with falcate leaflets, erect short-peduncled megasporangiate strobili, decumbent microstrobili, and chromosome number 2n=16,17, or 18.

When *Zamia splendens* was described (Schutzman, 1984), collections from the Selva Lacandona of eastern Chiapas were recognized as somewhat more robust and possibly distinct, but were still ascribed to *Z. splendens* in the publication, and a collection cited from that area. During two subsequent botanical expeditions to southern Mexico, one in 1984 by the first author and a second collaborative expedition in 1993 between the second author and Dr. Terrence Walters and Charles Hubbuch of Fairchild Tropical Garden, specimens were collected in the vicinity of Maya ruins in the Selva Lacandona. Schutzman’s (1984) earlier decision to include the eastern populations was a conservative one because it was not known at that time whether a continuum in morphological features would bridge the morphological “gap” or discontinuity between the western and eastern Chiapan populations. Three significant facts clarified the question. First, specimens collected by the first author in the Lacandona forest produced cones for the first time in 1993, demonstrating differences in cone morphology and habit from *Z. splendens*. Second, *Z. splendens* plants almost identical to the type specimen were discovered in nearby Tabasco during the above-mentioned 1993 expedition, extending the distribution range of the “typical” *Z. splendens*; this greatly reduced the possibility that a morphological continuum of one large variable species existed. And last, the Lacandona plants have distinct cytological features to distinguish them from *Z. splendens*. Thus, it was decided that the Lacandona plants are, indeed, worthy of specific status. The large, normally solitary, robust-petioled leaf held per plant and relatively small caudex distinguishes this species from its other congeners in the wild, but in cultivation, these features can change and should only be used to distinguish species in conjunction with other characteristics, such as the finely toothed leaflets and cone habit characters (discussed below).

*Zamia lacandona* Schutzman and Vovides, *sp. nov.*

**Type**: Mexico, Chiapas, Selva Lacandona, July, 1984 (male), Schutzman 517 (holotype, FLAS; isotype, XAL). Figure 1a-h.

Haec species *Z. splendenti* Schutzman affinis sed apice strobilorum feminineorum apiculato, erecto, folioliis novis xerampelinis et non roseis, et dentibus foliolarum tenuibus et non grossis differt.

Plants dioecious, 15-60cm tall. Caudex subterranean, 17—40cm long, 4.5—8cm diam. Leaves usually 1, occasionally 2, depending upon condition of the plant and its environment, arcuate, sparingly pubescent upon emergence, 30—100cm long, 34—80cm wide; leaflets 7—12 pairs per leaf, opposite to subopposite on a single leaf, linear-lanceolate to slightly oblanceolate, proximal leaflets subfalcate, 13—42cm long, 1.5—5cm wide; apex acuminate, equal to unequal; margin subrevolute; marginal teeth in upper half of leaf, 1.0—1.25mm; base attenuate, reddish-brown when expanding, dark green when mature; articulation with rachis dark brown, 5—10mm wide; petiole semi-terete, dark greenish-brown covered with brown tomentum, spine through approximately 3/4 of its length from the base, 20—70 cm long, 10 mm—20 mm diam.; spines terete, 0.8—4mm long, 0.5—1mm diam.; petiole base massive and almost encompassing entire apex of caudex, 1.5—3cm wide; cataphylls chartaceous, elongate triangular, cone cataphylls narrow-triangular, pubescent, 2.8—6.3cm long, 0.4—1.2cm wide, leaf cataphylls deltoid with aristate apex, 2.2—3.4cm long, base 2.3—3.8cm wide. Microsporangiate strobili decumbent, cylindrical to conic, dark beige to light brown, apiculate, tomentulose, 6.5—7.4cm long, 1.8—2.5cm diam.; peduncle puberulent, 10—12cm long, 0.5—0.8cm diam.; microsporophylls cuneiform, puberulent, the distal ends truncate-hexagonal with a short hexagonal-truncate protuberance; microsporangia spheroidal, 14—18 (usually 16) per sporophyll, eight proximal to each margin of fertile area of sporophyll, aggregated into sori of two microsporangia each, dehisced by longitudinal sutures. Megasporangiate strobili cylindrical, barrel-shaped with an apiculate apex, chocolate brown with lighter beige hexagonal protruding facets, tomentulose, 12—14cm long, 6—7cm diam.; peduncle puberulent, 10—11cm long, 0.8—1.0cm long, megasporophylls cuneiform-peltate, the distal ends...
hexagonal-truncate with a short hexagonal-truncate protuberance with horizontal groove, 1.7—2.0cm long, 1.7—2.2cm wide, short axis 1.1—1.6cm tall; ovules two per megasporophyll. Seed irregularly angular, turning bright red at maturity, 1.6—1.8cm long, 1.4—1.6cm diam; sclerotesta smooth, light brown. Chromosome number 2n = 16, 17, 18.

**Etymology.** The species is named for the Lacandona rainforest (“Selva Lacandona”) of eastern Chiapas, which itself is named for the Lacandona Indians of Mayan descent who inhabit the forest.

**Distribution and ecology.** The species is found in the Selva Lacandona in eastern Chiapas and adjacent areas, where it is found in primary forest, secondary successional regrowth such as abandoned cornfields, and continually disturbed areas such as roadside, which are burned yearly to clear dead brush and tall grass. Regrowth of the plant is quite noticeable, as its large reddish-brown new leaf makes it clearly distinguishable from other vegetation. The vegetation type of the undisturbed areas in which it is found is the “bosque tropical perennifolio” of Rzedowski (1978), or “selva alta perennifolia” of Miranda and Hernandez X. (1963). This species’ subterranean caudex protects it from destruction by the slash-and-burn agricultural practices of subsistence farmers; arborescent species such as *Z. inermis* Vovides, Rees & Vázquez-Torres and *Z. socomusensis* Schutzman, Vovides & Dehgan disappear entirely from cultivated areas because they cannot regenerate, making them all the more vulnerable to extinction. Subterranean species such as *Z. lacandona* are more apt to be decimated by commercial collection than by slash-and-burn agriculture, a fact which leads us to obscure the exact locality in this description.

**Taxonomic relationships.** The description of *Zamia lacandona* increases to five the number of closely related species in this group, which also includes *Z. splendens* Schutzman, *Z. cremnophila* Vovides, Schutzman & Dehgan, *Z. purpurea* Vovides Rees & Vázquez-Torres, and *Z. standleyi* Schutzman.

**Emergent leaf color.** Whereas *Z. splendens* emerges bright pink or green, depending on the population examined (one or both colors may be found in a single population), *Z. purpurea* leaves are strictly deep reddish-purple upon emergence. The leaves of *Z. standleyi* are brown, bronze or light green when emerging. Those of *Z. lacandona* are reddish to purplish-brown.

**Leaf habit.** Both *Z. standleyi* and *Z. lacandona* possess arcuate leaves, while those of *Z. cremnophila* are pendent. *Z. splendens* and *Z. purpurea* have relatively more erect leaves, with leaflets slightly arching.

**Habit of strobili.** (Fig. 2). *Zamia lacandona* and *Z. standleyi* both have sexual dimorphism in the habit of micro- and megasporangiophorous strobili. The microsporangiate strobili are decumbent, while the megasporangiophorous strobili are erect. *Z. splendens* and *Z. purpurea*, however, have decumbent micro- and megasporangiophorous strobili, and the mega- and microsporangiate strobili of *Z. cremnophila* are erect.

**Color of strobili.** The microsporangiate strobili of *Z. lacandona* are beige to light brown, while those of *Z. standleyi* are darker brown, and the remaining three species have even darker, coffee-colored microsporangiate strobili. The megasporangiophorous strobili of *Z. lacandona* are two-toned, with darker protuberant hexagonal megasporophyll apices.

**Caudez.** The caudex of *Z. lacandona* is distinctive, as it is the smallest relative to leaf size of any other Mesoamerican species thus far examined. All the others in this group, and the other more distantly related Mesoamerican species appear to possess larger caudices while supporting the same amount of vegetative growth. This could be related to the rainforest habitat of *Z. lacandona*.

**Leaflet shape and denticulation.** The leaflet shapes and toothing of the five species are almost sufficient by themselves to distinguish the five members of this group of species. (see Fig. 3). The major differences between the species are length/width ratio, marginal denticulation, and how falcate each species is. *Z. cremnophila, Z. standleyi* and *Z. lacandona* have falcate leaflets, while those of *Z. purpurea* and *Z. splendens* are not.

**Other leaflet characteristics.** *Z. standleyi* is the only member of the group to possess longitudinal “folding” of the leaflets, and *Z. purpurea* is readily identifiable by its pronounced and often elevated leaflet venation.

**Chromosome number.** With the exception of *Z. lacandona* (2n=16, 17, or 18), all known members of this species group have diploid chromosome number of 2n=16.

**Chromosomal studies.** Root tip mitosis was studied according to the technique of Schutzman et al. (1988). Six individuals from three localities were examined and herbarium vouchers deposited at XAL. Counts of 2n=16, 17 and 18 were obtained. Camera lucida drawings were made from the best metaphase cells where measurements were taken of the chromosomes and arranged in putative pairs to construct the idiograms. Classification of the chromosomes was according to Levan et al. (1964) modified by Schlarbaum and Tsuchiya (1984). Photomicrographs were taken Kodak Plus-X 125 ASA film by a Zeiss Photomicroscope (Fomi III) fitted with a x63 planapochromatic objective and phase contrast optics.

The new species differs in cytology with respect to *Z. splendens* and *Z. cremnophila* which are both 2n=16. Centric fissions and/or Robertsonian changes, as found in *Z. paucijuga* (Moretti and Sabato, 1984) and *Z. loddigesii* (Vovides and Olivares, 1996) appear to have occurred also in *Z. lacandona*,
Fig. 2. Comparison of strobilar habit and morphology between *Zamia lacandona* and *Z. splendens*. —A. decumbent microstrobili of *Z. lacandona* vs. pendent microstrobili of *Z. splendens*. —B. erect, short-peduncled megastrobilus of *Z. lacandona* vs. decumbent or pendent, long-peduncled megastrobili of *Z. splendens*. Photos courtesy of Loran Whitlock.
leading to at least three distinct cytotypes with somatic numbers of 16, 17 and 18. This presents a varying chromosome morphology with $1M + 7m + 2msm + 1sm + 1st + 4T$; $1M + 5m + 3msm + 2sm + 6T$, and $2M + 6m + 2sm + 1st + 7T$, respectively. It appears that centric fissions occur on some of the larger mesocentric chromosomes to give rise to telocentrics with part of the centromere present; thus, isochromosomes are formed. According to Lima-de-Faria (1983) these isochromosomes are stable and become easily incorporated into the normal complement. A break in a mesocentric chromosome with elongated kinetochore to form the cytotype $2n=17$ can easily be envisioned, likewise for the $2n=17$ cytotype to give rise to $2n=18$.

Chromosome change is the manifestation of an evolutionary process that may be a response to changing environment. For example, a report on the present day distribution of chromosome races of the shrew *Sorex araneus* in Great Britain interprets it to be a product of colonizing radiations and retreats to refugia associated with climatic changes. In another case, it was found that the number of metacentric chromosomes of the grasshopper *Caledia captiva* increased on one side of a hybrid zone of chromosome races of this species during mesic years and that the number of acrocentrics increased during dry years (King, 1993).

**Paratypes.** MEXICO. Chiapas, Selva Lacandona, July 1984: Schutzman 510-514 (XAL), Schutzman 515-520 (XAL), Schutzman 521-525 (XAL); June 1968: J. Chavelas P., G.
Alanis, M. Martinez ES-3015 (ENCB).

Acknowledgments. We thank the curators and staff of FLAS and XAL for loans and/or access to herbarium materials which made this study possible, and to Edmund Saavedra for his superb illustrations, which have always facilitated clear and unambiguous identification. We also thank Bijan Dehgan, Walter S. Judd and Thomas J. Sheehan for reviews of the manuscript. This article is Florida Agriculture Experiment Station Journal Series No. R-05925.

Literature Cited


