TWO NEW SPECIES OF ZAMIA

CONTRIBUTIONS FROM THE HULL BOTANICAL LABORATORY 345

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(WITH SIX FIGURES)

Genera in the cycads are not only so distinct that they are easily recognizable, but they are so sharply defined that interrelationships within the family are uncertain. Sister MARY ALICE[1] constructed a key to the genera, based upon the leaflets. A similar key, impractical to apply, but nevertheless effective wherever material is available, could be based upon pollen tube structures. The usual keys, based upon cones, are very effective when cones are available.

Some species are almost as sharply limited as the genera; but others, especially in the larger genera, present such variation that identification is difficult, and it is likely that new species have been described when no new description was needed. In *Macrozamia* there is a plexus of forms, with *M. spiralis* as a center, which might afford a better study in variation than in taxonomy, for the description of species might degenerate into a description of individuals. There are similar centers in all the larger genera, especially in *Zamia*, which contains more than a third of all the species in the family. Consequently, one should exercise some caution in describing new species in cycads. Nevertheless, there are doubtless many new species of this family still waiting to be discovered and described. Two species of *Zamia*, from Mexico, are sufficiently distinct to be described as new. One I raised from a seed secured near Jalapa, and the other I dug up near Tuxtepec. The former has been under observation in my collection for nearly twenty years, and the latter for fifteen years.

Before venturing to describe these plants as new species, I examined all the *Zamia* material at Kew, both in the herbarium and in the greenhouses. I also had the pleasure of studying the collection in the greenhouse and herbarium of the New York Botanical Garden, doubtless the most extensive collection of *Zamia* in the world. Dr.

[1] LAMB, SISTER MARY ALICE, Leaflets of Cycadaceae. BOT. GAZ. 76:185–202. 1923.

N. L. BRITTON, Director of the Garden, went through the entire collection with me, giving the benefit of his extensive acquaintance with this genus in the field, and also of his long experience in taxonomy. Not being a taxonomist, I might have hesitated to describe the species without this assistance; but a description seemed necessary, since the species from the Jalapa neighborhood has been used in hybridizing, and is also being used in a cytological study of the determination of sex.

Zamia monticola

This species was grown from a seed collected on the steep mountain side about six or eight miles west of Jalapa, opposite the extinct crater of Naolinco. The mountain side is densely covered with shrubs and small trees, with a rich herbaceous undergrowth. A *Begonia* was found here with a leaf which measured a meter across. This is the best region for *Ceratozamia* encountered during several collecting trips in the Mexican tropics. *Ceratozamia* is very abundant on the steep slopes and it cones freely. In 1906, I picked up a great number of seeds of *C. mexicana*. Dr. C. R. BARNES and Dr. W. J. G. LAND were with me on that trip, and none of us noticed any *Zamia* in this region. When the seeds were planted, all the pots were marked *C. mexicana*, and not until the seedlings were well developed was *Ceratozamia* no. 10 noticed to be a typical *Zamia*.

On August 8, 1915, nearly eleven years from the planting of the seed, a male cone appeared, followed at intervals of about a week by three others. These were typical *Zamia* cones, appearing in succession, so that when the first cone was 8 cm. in length, exclusive of the peduncle, the others measured respectively 6, 4, and 3 cm. At the shedding stage, the first cone had reached a length of 16 cm., and its peduncle measured 17 cm. The other three cones were slightly smaller when they reached the shedding stage.

Since 1915 this plant has coned five times, producing four cones in 1918, six in 1920, six in 1922, two in 1923, five in 1924, and four in 1925. The cones are all large for the genus, the first cone in each set reaching a length of 12–16 cm. at the shedding stage. The peduncles, which are as long as the cones, are seldom erect; more often they are nearly horizontal and curved (fig. 1). Of the six cones produced in 1920, the first began to shed its pollen on December 14,

and the last on February 9, 1921; so that the period of shedding pollen, while not continuous, extended over about two months, a very favorable feature in securing hybrids.

The sporangia are in two rather widely separated groups, with 10–16 sporangia in a group. Nearly all the sporangia are in pairs,

FIG. 1.—*Zamia monticola*, cones of 1920: cone at left reached length of 16 cm. when pollen was shed; leaves in background belong to *Encephalartos;* negative taken in University of Chicago greenhouse by P. J. SEDGWICK.

so that there are only two sporangia in a sorus. Some of the sporangia are single, and, in a few cases, sori of three sporangia were noticed. Nearly all of the sporangia are in rows, with the dehiscence in the longitudinal axis of the sporophyll. All of these features are shown in fig. 2.

Ever since the plant began to cone, new leaves have been produced with each set of cones. In 1919 the crown consisted of six leaves, which reached a length of 1.7 m. The crown of 1923 contained eighteen leaves, and the latest crown, that of 1925, consists of twenty-one leaves, the largest of which are 1.7 m. in length.

The lower part of the petiole, below the lowest leaflets, is very spiny, but there are very few spines in the leafy portion. The number of leaflets varies from thirty to thirty-four, the upper twenty of which are approximately in pairs; three or four at the base are so

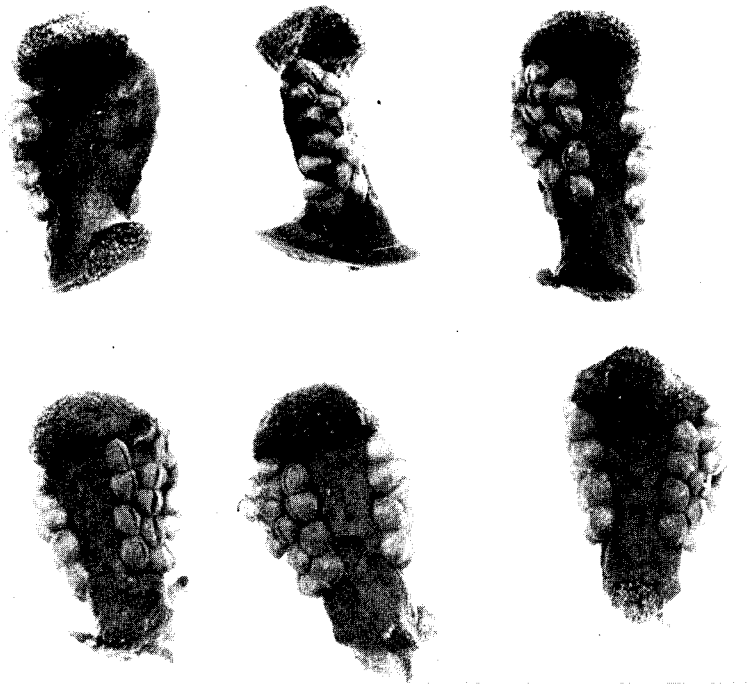

FIG. 2.—*Zamia monticola:* microsporophylls in various positions, all showing characteristic sori of two sporangia; middle sporophyll in top row shows one sorus with three sporangia; negative by C. Y. CHANG.

scattered that there is no indication of pairing; and the rest are intermediate between the alternate and the paired condition. The larger leaflets are 24–26 cm. in length, and 3.5–4 cm. in width. The lowest leaflet is sometimes as small as 7 cm. in length and 1.2 cm. in width, but there is no tendency to extreme reduction.

The number of veins, 1 cm. from the base of the leaflet, is about fifteen; and the widest part, about thirty. As the leaflet tapers from

the widest part to the tip, the veins are lost in the margin, usually with no tendency to produce serration, but sometimes producing a distinct serration near the tip (fig. 3). Most of the leaflets are as

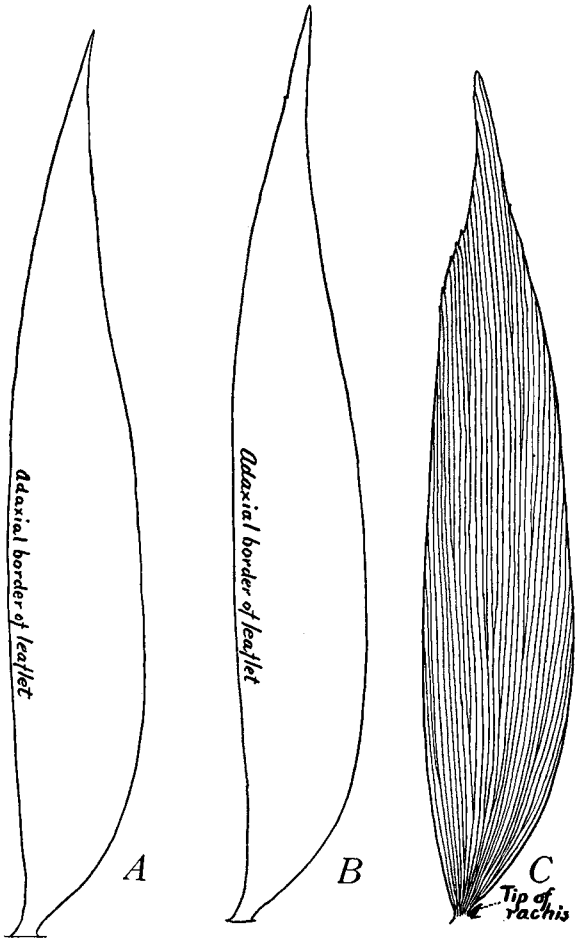

FIG. 3.—*Zamia monticola*, three leaflets: *A* (entire) and *B* (almost entire), below middle of leafy portion; *C*, one of terminal pair, showing almost maximum serration and also venation; one-half natural size.

entire as those of *Ceratozamia*, a feature which might be a partial excuse for not noticing earlier that the plant is a *Zamia*. The leaflets on the lower half of the leafy region are practically free from serration, and so far as their contour is concerned, many of them might

be mistaken for *Ceratozamia*, also accounting for not noticing a plant of *Zamia* in a patch of *Ceratozamia;* but in practically every leaf some of the upper leaflets show serration (fig. 3).

With so many large leaves in a crown, and crowns produced in such rapid succession, it is natural that the stem should develop rather rapidly. At present, the trunk above ground is 21 cm. high and 14 cm. in diameter. The armor is well developed on the part above ground, with no indication of being reduced, as in the tuberous species of the genus.

The characters described are summarized in the following diagnosis:

Zamia monticola, sp. nov.—Male cones oblong-ovoid, 12–16 cm. long; peduncles 10–17 cm. long, much expanded at base of cone and between horizontal and erect position. Microsporophylls hexagonal in surface view, sporangia in two widely separated groups with 10–16 sporangia in a group, sporangia mostly in pairs. Female cones not known. Leaves numerous, 20 or more in a crown, 1.3–1.7 m. in length, lower part of petiole spiny, 30–34 leaflets with upper 20 approximately in pairs and the rest scattered; larger leaflets 24–26 cm. long and 3.5–4 cm. wide, mostly entire but some serrate near the tip; about 30 veins in the widest portion. Stem arborescent.—On mountain side near Jalapa, Mexico, opposite the extinct crater of Naolinco.

Zamia sylvatica

This species was secured in September 1910 from the dense forest across the Papaloapan River south of Tuxtepec. The distance was probably not more than five miles beyond the river. A few miles farther on, *Dioon spinulosum* occurs in great abundance. It also has rather large leaves for a *Zamia*, those of this specimen reaching 1 m. in length, but produced sparingly, with only 2–4 in a crown, and coming at long intervals. At present the plant has only one leaf (fig. 4). The petioles are quite free from spines.

The next spring after the plant was set out, it produced two leaves; two more appeared in April 1915, and a crown of four leaves came in 1920. All of the leaves are about 1 m. in length. The average number of leaflets is about 34, and nearly all of them are more or less paired (fig. 4). The largest leaflets are 32–34 cm. long, and

2.3–2.6 cm. wide. The number of veins at the widest part of the leaflets varies from 40 to 46. The leaflet is entire below the middle, but is finely and sharply serrate near the tip (fig. 5). In the spring of 1921, four leaves and also a female cone appeared, which, without pollination, reached a length of 10 cm., with a peduncle 11 cm. long (fig. 6). Before taking this negative, some of the top soil was removed, and it became evident that the plant was a branching specimen, with two leaves on one branch and two leaves and the cone on the other.

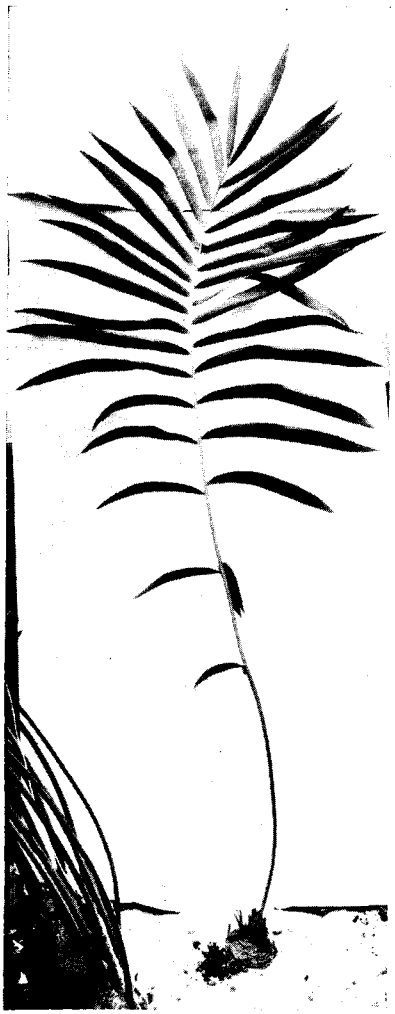

FIG. 4.—*Zamia sylvatica:* plant with one leaf, 1 m. in length, in University of Chicago greenhouse; negative by C. Y. CHANG.

The sporophylls, while spiral, show a longitudinal arrangement to an unusual degree. In surface view, the transverse ridge is a little above the middle of the sporophyll, and extends entirely across. From the ridge, the sporophyll slopes toward the top and the bottom, but about 1 mm. from the bottom the angle changes, and the final millimeter is parallel with the axis of the cone (fig. 6). Even in the illustration, which is about two-thirds natural size, the parallel portion can be distinguished. If pollination and fertilization had taken place, the cone would undoubtedly have been larger. All the ovules were abortive. Male cones are unknown. The larger branch of the stem is 8 cm. in diameter, and the smaller, which bears the cone, measures 5 cm.

The following diagnosis, while lacking the male cone and the seed, will serve to identify the species:

Zamia sylvatica, sp. nov.—Female cone cylindrical, 10 cm. or more in length, 5.5 cm. in diameter. Scales in surface view hexagonal

FIG. 5.—*Zamia sylvatica:* upper part of leaf, showing fine but sharp serration near tips of leaflets; negative by C. Y. CHANG.

FIG. 6.—*Zamia sylvatica:* upper portion of branched plant; one branch bearing two leaves, and the other two leaves and a female cone; cone 10 cm. in length, with peduncle nearly as long; negative by P. J. SEDGWICK.

with transverse ridge extending entirely across, and the lower millimeter of the lower part of the sporophyll parallel with the axis of the cone. Male cone unknown. Leaves about 1 m. in length, with 2–4 in a crown. Petiole smooth. Leaflets about 32, approximately in pairs, the longest leaflets 32–34 cm. in length and 2.3–2.5 cm. in width; number of veins in the widest part of the leaflet 40–46. Leaflets entire below the middle, finely and sharply serrate toward the tip. Stem subterranean.—In the forest about five miles south of the Papaloapan River at Tuxtepec, Mexico.

It is very probable that a careful examination of the regions cited for these two species of *Zamia* would yield other cycads, besides undescribed plants in other groups.

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