

**Keys to the flora of Florida - 32,
Zamia (Zamiaceae)**

Daniel B. Ward

Department of Botany, University of Florida
Gainesville, Florida 32611, U.S.A.
danielbward@outlook.com

ABSTRACT

Zamia (Zamiaceae) in Florida is represented by two species. The native *Zamia integrifolia* is treated as consisting of five varieties, with var. *umbrosa* differently aligned, var. *floridana* reranked, var. *silvicola* reaffirmed but re-ranked, and var. *broomei* described as new. *Zamia furfuracea* is accepted as a naturalized introduction. Justification is given for the new taxa and new ranks. A recent nomenclatural change is explained. An amplified key is provided to the Florida taxa recognized here. Published on-line www.phytologia.org *Phytologia* 98(3): 170-178 (July 6, 2016). ISSN 030319430.

KEY WORDS: *Zamia*, *Zamiaceae*, *Florida flora*.

INTRODUCTION

Although the cycads (Cycadaceae, Stangeriaceae, Zamiaceae) are of ancient origin, with fossil traces deep into the Pennsylvanian and abundant presence throughout the Jurassic, the rise of other conifers followed by the now-omnipresent angiosperms has greatly reduced their significance among the world's flora. Even more, recent human actions, either by displacement through land-clearing or by selective removal, have caused most species to become rare or endangered. Yet their very rarity, together with their unique structure and botanical properties, has augmented their interest to both horticulture and to science and justifies the importance that we understand the characteristics of the different taxa, the names that they bear, and their distribution.

The genus *Zamia* (Zamiaceae) has recently been reported to consist of 71 species, with eight species native to the West Indies and Bahamas (Osborne et al., Mem. N.Y. Bot. Gard. 2012). These taxa appear to be of quite recent origin (Nagalingum et al., Science 334. 2011), at least relative to the primordial status of their progenitors, perhaps a consequence to the geological recency of the islands of the West Indies with separation and isolation of small soon-speciating populations, reinforced by the heavy seeds, ill adapted to cross-water migration. Unquestionably the arrival of a new vector -- aboriginal man -- facilitated the shuffling of these discrete populations, with many species, possibly of those most utilized as a food source, now found on more than a single island. The resultant variability permitted an early author (DeCandolle, 1868) to recognize 14 species from the region. It is from this melange that the cycads native to Florida must have come.

These Florida cycads have attracted a series of thoughtful investigations: early history and taxonomy of *Zamia* within the state (J. K. Small, J. N.Y. Bot. Gard. 22: 121-137. 1921; *ibid.* 27: 121-129. 1926; *Manual S.E. Flora.* 1933); Florida taxa treated as threatened (D. B. Ward, *Rare & Endangered Biota of Florida*, 5: 123-124. 1979); taxonomy of the West Indian entities (J. E. Eckenwalder, J. Arnold Arbor. 61: 701-722. 1980); a modern review of Florida *Zamia* (D. W. Stevenson, J. Arnold Arbor., suppl. ser. 1: 367-384. 1991); a popular overview of Florida *Zamia* (T. H. Broome, *The Coontie of Florida*. Online. 1998); a floristic treatment (R. P. Wunderlin & B. E. Hansen, *Flora of Florida*. 2000). But over the years misunderstandings of typifications and simple differences in taxonomic judgment have left a trail of often contradictory views.

Two species of *Zamia* -- one of them introduced -- are now found in Florida. Though these plants are instantly recognizable as to genus, the native population is variable, with several scientific names

applied at different times. Three names are currently in use for the single native species: *Zamia pumila* L. (1762), *Zamia integrifolia* L.f. in Ait. (1789), and *Zamia floridana* A. DC. (1868). The present task is to examine these and other names that have been used here, to determine their legitimacy, to apply them to appropriate natural populations within the state, to name and describe a taxon believed to be new, and to construct a key that will permit these populations to be identified.

History

Although plants that we would now recognize as members of the genus *Zamia* were in cultivation in Holland and perhaps elsewhere in Europe by the end of the 17th century, the first species to be given a scientific name under the practices that are now codified as the *International Code of Botanical Nomenclature* (I.C.B.N.) was *Zamia pumila*, described and named by Carl Linnaeus in 1762. Linnaeus in the mid-18th century, flush with the prestige and credibility won by his earlier publications and especially his landmark *Species Plantarum* ed 1 (1753), by then a professor at the University of Uppsala, Sweden, and far from the lush gardens of Holland where he had studied and worked as a young man, was still in pursuit of his goal of naming and describing all the plant species of the world. But of *Zamia* he had no specimen. His only resource must have been his memory and perhaps notes of the plants grown in Leiden and Amsterdam, and those books by other authors that described the plants he wished to include.

Linnaeus then followed the practice employed by him in his 1753 publication: when no specimen was available -- paraphrase. By adroitly selecting words and phrases from these "pre-Linnaean" authors, by assigning an appropriate single word as the epithet, and by citing earlier works as his source, he could create concise accounts that were quite usable in identifying and naming the intended plant.

This is the course Linnaeus pursued in addressing his perhaps half-forgotten cycad in *Species Plantarum* ed 2 (1762). He named the new genus "*Zamia*," gave it a brief description, and cited four earlier publications with appropriate descriptions and illustrations. For the species itself he gave no description other than the epithet *pumila* or "dwarf." [This epithet was no doubt chosen in contrast to a much larger cycad he had known when in Holland, named by him *Cycas frondibus pennatis* (1737) and later by his son as *Zamia furfuracea* L.f. in Ait. (1789).] He thus created the name and circumscription of *Zamia pumila* L. (1762).

Other authors recognized that the West Indies and Bahamas hosted a wide range of related forms; many were soon named (DeCandolle, 1868; Osborne et al., 2012). And the name *Zamia pumila* was variously applied, depending on individuals' interpretations. Stability of a sort was gained by Eckenwalder (1980: 702) who defined the species as "the common West Indian cycad that has traditionally been known (in part) by that name." The ambiguity of this formulation is the more striking in that Eckenwalder also chose to treat all West Indian cycads as a single species.

Eckenwalder (1980: 715) also recorded the many names applied to West Indian cycads, citing types or designating lectotypes as needed. He lectotypified *Zamia pumila* L. by one of the references cited by Linnaeus, that of Jan Commelijn (1697). The plate included as part of this reference is of a five-leaved plant with narrowly ovate, long-tapering leaflets, the apex acute and the margins bearing widely spaced small teeth.

Specimens corresponding to Commelijn's plate are rare. None were located (by a hurried on-line search) in North American herbaria. But the herbarium of Kew Gardens, London, has an ancient specimen identified as *Zamia pumila*. [Faint writing indicates it had come from the Leiden Botanical Garden, Netherlands, which in the early 18th century had participated in a vigorous program of plant acquisition from the West Indies.] This specimen consists of two sheets, bearing the upper and lower halves of a large leaf, and each detail of the leaflets -- the acute apex, sharp-toothed margins -- closely matching Commelijn's drawing.

Commelijn stated his plant to have come from "*Insulae Hispaniolae*" (Dominican Republic, Haiti). No plant of that form is now known from the West Indies. It is unclear whether the plant of the

illustration (and of Kew) had come originally from Hispaniola and is now extinct, or if its source was perhaps Central America where plants of similar form are known (cf. *Zamia fischeri* Miq.). But the Commelijn plate, designated as lectotype by Eckenwalder, confirmed by the biological reality of a known plant form, and wholly unlike any plant known from Florida, absolutely excludes the name *Zamia pumila* from application to any member of the state's native flora.

Nomenclature

In contrast to the unquestionably non-Florida origin of the type of *Zamia pumila*, both *Z. integrifolia* and *Z. floridana* are typified by Florida materials. *Zamia integrifolia*, the older name (1789), was based on a cultivated plant from "East Florida" (probably not a geographic designation, but the political district at that time of all peninsular Florida). *Zamia floridana* (1868) was based on a specimen collected at "Fort Brooke," near present-day Tampa on the west coast of peninsular Florida. The type specimens underlying *Zamia integrifolia* and *Z. floridana* are so similar that a recent author (Stevenson, *Encephalartos* 9: 3-7. 1987) could "not find a substantial difference between the two." Thus these two names must represent only a single species.

There has been dispute as to the correct name to be used for the Florida plant. The earlier name, *Zamia integrifolia* (1789), would seemingly prevail, under the rules for priority. Yet the present author has long held that *Zamia integrifolia* L.f. in Ait. (1789) was nomenclaturally superfluous when published. It was believed that Linnaeus filius (in Aiton) had erred (by modern rules) by citing in his synonymy an available pre-existing name, *Zamia pumila* L. (1762). The I.C.B.N. (Art. 52.1) states that if an old name cited in synonymy should have been used for the new taxon, the new name is superfluous and illegitimate. Further, the I.C.B.N. (Art. 6.4) mandates that a name illegitimate when published cannot (barring special actions) later become legitimate. A full argument in support of the name *Zamia floridana* was then presented (Ward, *Phytologia* 9: 95-104. 2009).

However the I.C.B.N. permits an override of its rules by appeal to a standing professional committee. Two taxonomists who favored the earlier name, D. W. Stevenson and J. L. Reveal (*Taxon* 60: 594-595. 2011), petitioned the Special Committee for Spermatophyta (as established by the International Association for Plant Taxonomy); they asked that the name *Zamia integrifolia* be conserved. Their justification was, in essence, that *Z. integrifolia* has been used more frequently than *Z. floridana* and its preservation will provide nomenclatural stability. The Committee ruled in favor of the petition, thereby negating the dicta of the I.C.B.N. and establishing that *Z. integrifolia* is the correct binomial for the familiar Florida Coontie.

Zamia integrifolia

Within *Zamia integrifolia* (s.l.), as observed in Florida, there is sufficient variability to have attracted taxonomic attention. Notably, J. K. Small (1933) divided the Florida plants into four species -- *Z. integrifolia* (s.s.), *Z. angustifolia*, *Z. silvicola*, and *Z. umbrosa*. These names and the discrete populations they presumably represent have not wholly withstood the test of further examination.

Zamia angustifolia Jacq. (1789) is a legitimate name, correctly applied to plants of the Bahamas and West Indies (Osborne et al., 2012), and used by Small (1933) for plants of the Everglade hammocks; he characterized these plants as having leaflets 3-6 mm. wide (a trait found somewhat widely in the peninsula). But Small stated he made this identification without access to ovulate cones. True *Zamia angustifolia* is characterized by dark gray to black strobili with short-acuminate sterile apices (Stevenson, *Fairchild Trop. Gard. Bull.* 42: 23-27. 1987). [*Z. integrifolia* has reddish-brown ovulate strobili with truncate or blunt apices.] And no plants identifiable as true *Z. angustifolia* appear to be known to South Florida botanists.

Observation of Florida *Zamia*, both in cultivation and in the wild, has convinced the present writer that the morphological differences to be observed in this genus are discrete and consistent within a given population and not simple developmental variability. Intermediates are encountered, but the great bulk of the total population can be assigned to just a few recognizably distinct morphotypes. These

imperfectly dissimilar groupings are best studied by being given varietal recognition. They are here presented here in order of descending confidence.

Var. *integrifolia*

The typical variety of *Zamia integrifolia* must rest on the type employed by Linnaeus filius in 1789. At that time Linnaeus' son was working in London with William Aiton, the "King's Gardener." Aiton was then compiling a treatment of the many plants in cultivation at Kew, and Linnaeus assisted by preparing selected groups, including the cycads.

The material used by Linnaeus -- almost certainly an entire living plant -- is now represented (Natural History Museum - BM) by a single leaf with 26 leaflets and a male strobilus. The leaflets are narrow, about 8 mm. wide, but uniformly slightly spatulate. This leaflet-form can be matched only occasionally within the widespread, presumably typical Florida *Zamia*, and apparently not within the other varieties recognized here. But, considering that the plant grew in greenhouse conditions in a northern latitude, there seems no merit in suggesting the widely distributed Florida variant is improperly typified.

The exact source of the Kew plant is not recorded, but can be deduced. In 1767 a plant of *Zamia* was given to Alexander Garden of Charleston, and hence to Aiton at Kew, by Andrew Turnbull, the founder of New Smyrna, Volusia County (Small, 1921). The port of St. Augustine would have been familiar to Dr. Turnbull; his plantation lay isolated some 110 km. to the south. Years of disturbance near St. Augustine has eliminated any semblance of undisturbed vegetation. But just west of New Smyrna, in the thin sandy woods near the abandoned fields where Dr. Turnbull's Minorcan serfs raised indigo, plants of *Zamia* still thrive. Collections from this source may serve as topotypes of *Z. integrifolia* var. *integrifolia* (cf. S.C. Provost s.n., Nov. 2015 - FLAS).

With the source of Aiton's greenhouse-grown *Zamia integrifolia* plausibly near New Smyrna, a better understanding may be given to its typical form. A midwinter survey (Dorothy Leeper Spruce Creek Reserve, by S.C.P.) found plants with parallel-margined leaflets 13-14 cm. long, \pm 13 mm. broad, and mature cones 6-8 cm. long.

Var. *umbrosa*

Zamia umbrosa Small (1921) is a legitimate name assigned to a Florida cycad. This name has generally been disregarded or assigned to synonymy under *Z. integrifolia* (Osborne et al., 2012). But it is here argued once again that the name represents a population worthy of taxonomic acknowledgment.

Appreciation by botanical collectors that there were two entities of *Zamia* in Florida began well before the second taxon was formally named. In the early 20th century, H. J. Webber (U.S. Dept. Agric. bull. 1: 81. 1901; Small's *Flora S.E. U.S.* 1903: 32) identified two species, one as *Zamia floridana* with a stated range of "southern peninsular Florida," the second as *Zamia pumila* from "middle peninsular Florida, particularly on the east coast." They were distinguished largely by leaflet width, as 3-7 mm. vs. 8-16 mm. Clearly Webber's taxa were the present *Z. integrifolia* and *Z. umbrosa*. Small himself noted (1921: 134) that there was a sheet in the Torrey herbarium (now NY) bearing leaves "representing two species of zamia;" the collectors were known but not their sources.

The present author has maintained for many years (Ward, 1979) that the variant of *Zamia* found primarily in the upper eastern Florida peninsula was distinguishable at some level from the more widespread, largely more western and southern taxon. In the late 1960s and early 1970s an effort was made to establish and maintain greenhouse plants of *Zamia* from throughout their Florida ranges. [This study has been briefly reported elsewhere (Ward, Novon 11: 360-365. 2001), justifying the formation of the combination *Z. floridana* var. *umbrosa*.] At peak, 29 plants were held, from five counties (Citrus, Dixie, Flagler, Glades, Marion), each presumed to represent a different population. At midwinter yearly intervals, measurements were taken of 5 leaves per plant, of one leaflet per leaf. Leaflet length and width were measured, and their l/w ratios were recorded.

The experimental design followed here permitted the partitioning of variance among populations, among plants per population, and among leaves per plant. [The present author had a deep appreciation of such statistical manipulation, stemming from his graduate studies involving *Sisyrinchium* (Ward, 1959).] As expected, no significance in leaflet width was demonstrated among leaves per plant, nor among plants per population. But significance was found *among* populations. A range test saw no difference among four populations (Citrus, Dixie, Glades, Marion), but found a significant difference (at 5%) separating the fifth population (Flagler). The Flagler population was within the geographic range ascribed to *Z. umbrosa*; the other populations fell within the distribution of *Z. integrifolia*.

A more sophisticated study of leaf measurements by S. J. Newell (Amer. J. Bot. 76: 1518-1523. 1989) addressed plants from five populations of *Zamia* in Florida (and three populations in Puerto Rico). Two of Newell's Florida populations were located in northeastern coastal counties (St. Johns, Flagler); three populations were in the southernmost peninsula (Dade County), two of which (Long Pine Key) were chosen to reflect shade and full-sun aspects of the habitat. Though some of Newell's comparisons showed significance, others did not. Notably, her two northern populations showed mean leaflet widths (10.8 mm., 12.5 mm.) greater than her three southernmost populations (7.1 mm., 5.9 mm., 8.6 mm.). Again, the St. Johns and Flagler plants were within the range of *Z. umbrosa*; the others corresponded to *Z. integrifolia*.

A character useful in determination of *Zamia umbrosa* is the presence on many leaflets of small protuberances on and near the leaflet apex. These have been termed "teeth" or "callous bumps." But unlike the structures called "teeth" among angiosperms, these small hardened projections from the leaf margin are not an inherent part of the leaf architecture. Rather, in *Zamia* they are protruding tips of the veins. From soon after the veins pass out of the rachis and into the blade of the leaflet, they no longer interconnect; they continue as simple, parallel strands until they terminate at the leaflet margin. This pattern of xylem/phloem bundles has been termed "multiple parallel (non-anastomosing) first-order venation." The "callous teeth" are the tips of these bundles, made apparent by the shrinkage or ablation of the intervening mesophyll tissue. This anatomical structure, aberrant to the forms of venation described elsewhere (Hickey, Amer. J. Bot. 60: 17-33. 1973), merits greater investigation than is appropriate here.

One must be wary of the significance of a possible developmental stage that is manifest in one presumed taxonomic entity but is absent or less evident in other closely related entities. Yet the presence of these curious "callous bumps," together with the demonstrated wider leaflets, and supported by the allopatric upper east coast distribution, justifies the judgment of earlier authors that Small's *Zamia umbrosa* merits taxonomic recognition.

Zamia umbrosa has elsewhere been treated at varietal rank (Ward, Novon 11: 363. 2001), as *Z. floridana* var. *umbrosa*. But the replacement of *Zamia floridana*, through conservation, by *Zamia integrifolia*, requires the procedure be repeated, with a corrected basis.

Zamia integrifolia L.f. in Ait. var. *umbrosa* (J. K. Small) D. B. Ward, comb. nov. Basionym: *Zamia umbrosa* J. K. Small, J. New York Bot. Gard. 22: 136. 1921. TYPE: U.S.A. Florida: Volusia Co., hammock between Volusia and Ocean City, 4 May 1921, *Small 8679*: lectotype (designated by Eckenwalder, 1980), NY; isoelectotypes, DUKE, FLAS, GH.

Var. **broomei**

A variant of *Zamia integrifolia* occasionally encountered in the wild is characterized by narrow leaflets, about half the width commonly seen in the more widespread, presumably typical form. Plants of this form are often locally frequent in the lower Suwannee River basin -- Dixie, Gilchrist, Levy, Alachua counties, in northwest peninsular Florida. Habitats observed are dry oak hammocks and sandy "high pine." The narrow leaflets produce sparse foliage, and only rarely are such plants seen in cultivation. The distinguishing characters given here do not permit separation from Small's interpretation of *Zamia angustifolia* as seen in the southernmost peninsula; further observations will be necessary before the

relationship of these two populations is understood. That this more northern variant may carry a defined taxonomic property, the following new variety is here described.

Zamia integrifolia L.f. in Ait. var. *broomei* D. B. Ward, var. nov. TYPE: U.S.A. Florida: Infrequent in dry second-growth oak hammock, 9700 block, S.W. 44th Ave. (Haile Plantation), southwest Alachua County, 2 Jan 2015, *Ward 10791*: holotype, FLAS; isotype, NY. Differs from type of the species in leaflets narrow (5-7 mm. wide), leaves borne erect. Named in acknowledgment of services to the cycad community by Thomas H. Broome, owner of The Cycad Jungle, Lakeland, FL.

Var. **floridana**

Zamia floridana A. DC. (1868), as noted above, is a legitimate name, though no longer correct when applied at specific rank. But since priority applies only within rank, the epithet remains available at varietal rank.

Observations in western peninsular Florida have encountered plants that appear to differ in one quantitative character, and possibly in habitat, from plants here treated as typical var. *integrifolia*; larger strobili and a shell-mound substrate. These plants have long been known in Levy County, especially in the vicinity of Cedar Key, but no record seems to have been made of their relatively massive female strobili, which reach 18 cm. in length and 8 cm. in diameter. [A smaller cone 10 cm. long held 34 seeds beneath 62 partially nonfunctional megasporophylls.] In contrast, strobili seen elsewhere are smaller, those of the eastern coast no more than half these dimensions.

These large-cone populations have been found only on Native American (probably Calusa) shell middens. The significance of this substrate -- in contrast to the thin sands underlying typical *Zamia integrifolia* -- lies in the source of the type of *Z. floridana*. The collector, Gilbert Hulse, in the early 1830s was stationed at Fort Brooke, a Seminole war military encampment at the head of Tampa Bay on the west coast of peninsular Florida. And Fort Brooke was located on an extensive Indian midden, composed primarily of oyster and other marine shells! The edaphic conditions of Fort Brooke must have been very similar to the shell middens presently seen near Cedar Key. Indeed, one of the plants sent to John Torrey by Hulse was stated to have been found "upon the beds of oyster shells" (Small, 1921: 133).

It is difficult to resist the possibility that the Calusa, builders of other massive shell mounds along the Florida gulf coast, brought with them a strain of cycad from the West Indies that differed from variations grown elsewhere in Florida. [This commerce between Florida and the West Indies continued into historic times; in June 1774 William Bartram (*Travels*, 1791: 227), while on the lower Suwannee River, met a party of Calusa just returned from Cuba.]

Rather than coin a new epithet for the large-cone Levy County cycad, it seems preferable to retain one of known provenance even though of uncertain equality. The strobilus of Hulse's *Zamia* is unknown to us; DeCandolle's description noted it to be 2.5 cm. long, an immature or otherwise unmeaningful dimension. (The type itself cannot presently be accessed; Stevenson's 1987 observation omitted this datum.) Assignment of an epitype permits the Levy County strobilus dimensions to be associated with the Tampa Bay type.

Zamia integrifolia L.f. in Ait. var. *floridana* (A. DC.) D. B. Ward, comb. et stat. nov. Basionym: *Zamia floridana* A. DC., *Prodromus* 16(2): 544. 1868. TYPE: U.S.A. Florida: Hillsborough Co., "Fort Brooke," *Hulse s.n.* Lectotype, G-DC; isotype, NY (noted by Eckenwalder, 1980). Epitype, Florida, Levy County, "Shell Mound," *Ward 10796*, FLAS (with female strobilus).

Var. **silvicola**

Zamia silvicola Small (1926) is also a legitimate name, though its application to a Florida population is uncertain. Small described the species without an exact source, and Eckenwalder (1980: 716) identified a collection from "Spanish Mound" (now Crystal River Archaeological State Park), Citrus

County as the holotype. But Small also gave photographs of his new species in hammocks of the Everglades, Dade County. He noted it to be "the most robust *Zamia* in Florida," and characterized it by relatively long (12-17 cm.), broad (10-15 mm.) leaflets. Quite uniformly, this name has been dismissed as a synonym of *Z. integrifolia*. However plants closely corresponding to Small's description are known, both in the wild and in cultivation. Their frequent use in horticulture is surely a response to their luxuriant, close-spaced, broad-leaflet foliage (quite the antonym of words describing var. *broomei*). The presumption is the cultivated specimens have been selected from the native Florida population. They are rather uncertainly distinguished from the more widespread, presumably typical variant by the longer, often broader leaflets (and often longer leaves). But the possibility that they represent merely robust, older specimens has not been wholly excluded. A varietal rank for *Z. silvicola* will encourage further attention and understanding.

But Small's epithet, "*silvicola*," may not have priority at varietal level. J. Schuster (in Engler, Pflanzendr. IV, 1: 151. 1932) formed the name *Zamia floridana* var. *purshiana*, a name Eckenwalder (1980: 716) placed in synonymy with *Z. silvicola*. Though later in date than Small's 1926 name, the I.C.B.N. does not permit priority to apply outside of rank; thus Schuster's epithet is prior when used as a variety. But without knowledge of his type and with uncertainty as to its application, it has seemed best to reject the Schuster name.

Zamia integrifolia L.f. in Ait. var. *silvicola* (J. K. Small) D. B. Ward, comb. et stat. nov.
 Basionym: *Zamia silvicola* J. K. Small, J. New York Bot. Gard. 27: 128. 1926. TYPE: U.S.A.
 Florida: Citrus Co., "Spanish Mound" near Crystal River, 20 Nov 1921, *Small, Small & DeWinkeler 10060*: holotype (noted by Eckenwalder, 1980), NY.

Zamia furfuracea

Zamia furfuracea, the "Cardboard Palm," as this introduced species is commonly called, has become a popular dooryard and landscape ornamental in South Florida. Its red seeds are well understood to be poisonous and from time to time the local papers tell of a dog fatality, though seemingly not of humans. The seeds are abundantly produced and, even without an effective dispersal mechanism, often become lodged in nearby waste areas. Perhaps the first recognition of this cycad outside of cultivation was in 2000 (Wunderlin & Hansen, *Flora of Florida* 1: 302). Records of naturalization are now known from several south peninsula counties, within the range permitted this cold-sensitive plant. This Mexican species must now be accepted as a member of the Florida flora.

Distribution of Florida taxa

Plants native to Florida fall largely into recognizable geographic zones or areas. There are the northern species, subject perhaps to chilling requirements and thus limited in their southern extension into the state. The tropical species are restrained by thermal limits, often extending farther north along the coasts than within the peninsula. Endemics especially occur on the Apalachicola River bluffs, with others along the panhandle gulf coast. There are many exceptions, but commonly a species long-present in the state will have a distribution that at least approximates other native species.

Introduced species, that is, species arriving in the state after European contact, commonly will have erratic distributions. They may be abundant in one area, yet absent in other areas of similar edaphic factors. It is apparent that introduced species often have not yet reached all suitable sites.

Zamia integrifolia is unquestionably a native of Florida; it was certainly here centuries before European contact. Yet its distribution within the state suggests that of a recent introduction, with plants abundant in one area yet wholly absent in other seemingly suitable areas. And within the species the varieties are similarly inconsistent in their distribution. It is a simple, yet likely correct deduction that these weakly defined varieties are the consequence of multiple introductions from the West Indies, limited in the rate of their spread by their heavy seeds and restricted movements of their vectors, the Native American tribes.

The five varieties of *Zamia integrifolia* recognized here certainly differ in their distribution. Typical var. *integrifolia* is widespread in the peninsula, though often absent in areas where it might be expected. It is present on both coasts, more sparingly in the interior, and extending down the east coast to the vast stands once found on the Dade County rocklands. It seems to be this variety that is most heavily represented by the many thousands of commercial plants now planted on highway medians and landscaping. Var. *umbrosa* in nature is restricted to the upper eastern peninsula. [Small (1921: 137) noted plants in cultivation in Gainesville and Ocala. A Gainesville plant surely seen by him was still present into 2014.] Var. *broomei* appears confined to thin sandy woods of the lower Suwannee River basin. Var. *floridana* thus far has been seen only in Levy County, on the upper gulf coast, though to be expected further south on extant shell mounds. And var. *silvicola* has a questioned disjunct distribution between coastal Citrus County and the everglades of Dade County.

Zamia furfuracea, as a cold-sensitive plant of recent introduction, is to be expected in any south peninsula, non-hydric site wherever chance has yet placed its seeds.

Concluding remarks

Persons who study and grow Florida cycads fall into two camps. There are the taxonomists, few in number, experienced in determining workable classifications, seemingly inflexible in their judgment that all Florida *Zamia* constitute only a single taxon. And there are the horticulturists, intimately familiar with the plants both in the field and in cultivation, who maintain there are several *Zamia* in Florida that can be distinguished by anyone who takes the time to look. This present treatment attempts to place a foot in both camps, by giving systematic recognition to some of the insecurely defined populations believed in by growers and enthusiasts. (Even here, not all forms are addressed; there is said to be a "deciduous" plant, one whose leaves turn brown and die in the fall.) But perhaps the present paper pushes professional judgment as far as is defensible.

Amplified key

Taxonomic judgments based on gross morphology are appreciably less reliable in the cycads than is encountered with other vascular species. The length of a pinecone, size of an apple, width of a maple leaf is relatively independent of the size and age of the supporting plant. But the *Zamia* cone and the length of its leaf clearly are influenced by the age -- and presumably energy storage -- of the host. Thus simple linear measurements may mislead. Ratios (length/width ratios, as used in the following key) may minimize these distortions.

ZAMIA L. Coonties

1. Petioles with stout prickles; leaflets 25-50 mm. wide ($l/w = \pm 3$), thick and rigid, ovate, apically erose (with many protruding vein-tips); seeds red (orange). Trunk erect, stocky (pachycaulous), unbranched, to 1.5 m. Waste areas, disturbed scrubland. South peninsula (n. to Lake); rare and scattered.

CARDBOARD PALM.

Zamia furfuracea L. f. in Ait.

1. Petioles without prickles; leaflets 5-16 mm. wide, firm but flexible, oblong to linear; seeds orange. Trunk subterranean or low emergent, sometimes dichotomous-forked, forming mounds. [*Zamia pumila*, misapplied]

FLORIDA COONTIE, FLORIDA ARROWROOT.

Zamia integrifolia L. f. in Ait.

- a. Leaflets usually with slightly protruding vein-tips ("teeth," "callous bumps") on and near rounded apex; median leaflets 12-16 mm. wide ($l/w = \pm 8$); leaves to 1.5 m. long, dark green; older plants massively multistemmed, forming large clumps. Dry woodlands. Upper east peninsula (St. Johns, Putnam, e. Marion=Juniper, s. to Brevard); infrequent. Long in cultivation in northeast Florida, under the name "Palatka Giant." [*Zamia umbrosa* Small; *Zamia floridana* var. *umbrosa* (Small) D. B. Ward]

EAST COAST COONTIE.

var. **umbrosa** (Small) D. B. Ward

- a. Leaflets without protruding vein-tips on acute to obtuse apex; leaves to 1.0 m. long, medium green.
 b. Median leaflets linear, 5-8 mm. wide ($l/w = \pm 18$); female strobili 8-10 cm. long; foliage generally erect; plant rarely multistemmed. Dry oak hammocks, sandy high pine. Upper west peninsula (Alachua=Haile, San Felasco); infrequent. var. **broomei** D. B. Ward
 b. Median leaflets narrowly oblong to spatulate, 8-16 mm. wide; foliage generally spreading; plant usually multistemmed.
 c. Median leaflets 14-18 cm. long, 12-16 mm. wide ($l/w = \pm 10$); female strobili "9-14 cm. long" (Small, 1926). Moist hammocks, river bluffs. Upper west peninsula (Levy=Fanning Springs; Citrus=Crystal River), apparently disjunct to south peninsula (Dade); rare. *Zamia silvicola* Small
 var. **silvicola** (Small) D. B. Ward
 c. Median leaflets 8-12 cm. long, 8-14 mm. wide ($l/w = \pm 12$).
 d. Female strobili 8-18 cm. long; substrate shell mounds. Aboriginal shell middens. Upper west peninsula (Levy=Cedar Key); rare. [*Zamia floridana* A. DC.]
 var. **floridana** (A. DC.) D. B. Ward
 d. Female strobili 4-8 cm. long; substrate sandy soils. Pinelands, thin woodlands. Widespread: upper west peninsula (Taylor, Suwannee, w. Marion, south along west coast (Pinellas, Charlotte), upper east coast (Volusia), to south peninsula (Highlands, St Lucie, Dade); frequent. Formerly abundant in southeast peninsula, the basis for a large arrowroot starch industry. Now in common use as groundcover, foundation plantings, etc.
 FLORIDA COONTIE (typical). var. **integrifolia**

1.

This paper is a continuation of a series begun in 1977. The "amplified key" format employed here is designed to present in compact form the basic morphological framework of a conventional dichotomous key, as well as data on habitat, range, and frequency. Amplified keys are being prepared for all genera of the Florida vascular flora; the present series is restricted to genera where a new combination is required or a special situation merits extended discussion.

I have been helped in the field by Kim M. Cordasco, Robert T. Ing, Steven C. Provost, Sylvia W. Schultz, and Gordon C. Ward, and with observations or suggestions by Tom H. Broome, Alan W. Meerow, Bart M. Schutzman, and Dennis W. Stevenson.