The Cycad Newsletter

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The Cycad Society
Since 1977

Board of Directors

(Terms end December 31st of year shown)

COVERS:

Front: Zamia neurophyllidia *on Isla Bastimentos. (Photo by Jody Haynes, MBC)*
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President's Report
Tom Broome

I hope all of you have enjoyed being a member of the Cycad Society this year. Bart continues to produce great newsletters, and Roy has done very well with his new job as the seed bank coordinator. I know Bart can always use more articles for the newsletter, so I urge any of our members that think they might like to write something, to give it a try. Even if you don't think you write very well, Bart can work wonders with your text. If you are close, but undecided, send Bart an e-mail to talk about the possibility. I'm sure he would appreciate any input from you. Bart also loves high quality photos. Even if you don't want to write an article, feel free to send him your best cycad pictures. He may be able to use one on a cover sometime, or work it in with an article that someone else is writing. Roy has made a lot of good seeds available, and he has made this year the most successful year thus far for the seed bank. He could not have done it without your help! Thanks to everyone who has supported the seed bank this year. The distribution of seeds to our members helps greatly in cycad conservation because it reduces the demand for wild-collected plants. With the extra funds the seed-bank makes available, the society should be able to step up its conservation-oriented activities to the next level.

I want to congratulate the new and re-elected board members from our recent election. Our newly elected board members are Terrence Walters, R.L. Frasier, Craig Nazor, Fred Elsea, Greg Holzman, and myself. Thanks to all of you who are willing to use your time to support our society. I also want to thank all of our members who took the time to vote in our election. I want to especially thank Bruce Ironmonger for everything he has done for the society. He and his wife Suzi have supported the society with articles for the newsletter, donations of plants for our auctions, and Bruce helped with a great presentation at our last cycad symposium in Austin. Along with all this, he also spent a lot of time as a board member trying to improve our society. Bruce will be working with other cycad related projects apart from the society and will be sorely missed.

Editor's Message
Bart Schutzman

With the publication of this December issue of the Cycad Newsletter we are now "back on track" on what would have been our normally rigorous time schedule. Again, I sincerely apologize for this delay in getting the September issue to you and hope that Florida doesn't get four hurricanes in a single season again, at least during our lifetimes!

Also, I wish to reiterate what Tom said above about sending in articles - I prematurely stated in my March 2004 message that I had plenty of articles rolling in; unfortunately, this was a short-lived phenomenon, a "will-o'-the-wisp" as it were. So I would like now to make a new request to you all for materials. They will be appreciated by all of us. If you been on a sojourn anywhere in the subtropical or tropical regions of the world and found cycads, allow these to be vicariously enjoyed by all of our members! Those photos, whether they are lodged in your computer's hard drive or pasted into your scrapbook, won't ever be enjoyed by the information- and photo-hungry masses! In each issue I typically find one or two of my old slides that would be very useful in other peoples' articles, without much effort. Even if you don't have time to write an article, please send in just slides or photos if they are sharp and you can identify the species that are depicted.

I would also like to revisit some of the other cycad-related topics that have been in Cycad Newsletters of the past, such as depictions of cycads on stamps and coins, or art forms such as paintings, wood carvings, ceramics, etc. We could do a much better job with today's graphic technology showing these items to you now than the newsletter was able to in the past, so I think these would be enjoyable subjects. The more diversified our articles are, the more individuals we can interest in the society, the better TCS can be!

Cycads of the Sand: The Beach-dwelling Zamias of Bocas del Toro, Panama

Article and Photos by Greg Holzman[1] & Jody Haynes[2]

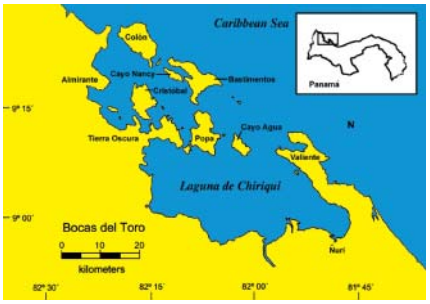


Fig. 1. Map of Bocas del Toro showing the major islands and place names on the mainland (after Fig. 1a of Anderson & Handley, 2002; used with permission).

Cycad expeditions tend to take on a life of their own once the players commit to the objective. This year the objective was to assess populations of the *Zamia skinneri*/Z. *neurophyllidia* complex of western Panama. Misunderstood and mysterious, these plants are among the most beautiful and wondrous of all Central American cycads.

Jody Haynes, Gregg Hamann, and Greg Holzman were to meet up with Dr. Alberto Taylor of the University of Panama in mid-September on a Montgomery Botanical Center(MBC)-sponsored expedition to investigate reports of cycads growing on beaches and near salt water on several islands in the Bocas del Toro Archipelago. None of us had ever seen a reference to salt tolerance in *Z. neurophyllidia* or *Z. skinneri*, yet these were the only cycads known in that part of Panama. The idea that an arborescent cycad could be growing on a Caribbean island's white sand beach was just too enticing to resist a look!

After months of extensive and careful planning, we set out to Bocas del Toro during a time of the year when we hoped the weather would allow us to reach our stated island objectives. It rains most of the year in this part of the world, and strong winds can create horrendous sea conditions. None of us wanted any part of rainy and stormy oceans, so the timing of the expedition was selected with help from Gregg, who has sailed the area often, and from Capt. Louis Anciaux, owner and operator of Panama Jet Boat Explorer and new inductee into the wonderful world of cycads. Weather was never a problem for us; instead, we were blessed with the best conditions of the year—light winds and no rain—for the entire ten-day trip.

Our primary goal was to assess the habitat, morphology, ecology, phenology, and conservation status of as many island populations as possible. Soil samples were to be taken and cones collected. What we discovered at one locality were perfect white sand beaches with literally tens of thousands of *Zamia* "trees" growing on them—in areas where waves are known to roll right through the populations three or four times a year and where winds blow 20-30 knots onshore, sending salt spray up the hills behind the beaches. Sometimes dreams do come true…and in this case, success was in every step we left on those beaches!

This is the story of the cycads of the sand…

Overview of the "Groove-leaved" Zamias

The genus *Zamia* currently contains seven named species with veins that are prominently sunken on the upper surface of the leaflets and protruding below, resulting in a corrugated appearance and texture that is technically referred to as "plicate." Two of these "groove-leaved" zamias, *Z. amplifolia* hort. Bull ex Mast. (1878) and *Z. wallisii* A. Braun (1875), are Colombian endemics, while *Z. roezlii* Linden (1873) occurs in Colombia and adjacent Ecuador, and *Z. urep* Walln. (1996) is restricted to central Peru. The other three represent a group of closely-related species from Panama (and possibly Costa Rica?), the oldest known being *Z. skinneri* Warsz. ex Dietrich (1851) and the newest named species being *Z. dressleri* D.W. Stev. (1993) and *Z. neurophyllidia* D.W. Stev. (1993). Even though *Z. skinneri* was discovered and named more than 150 years ago, it is remarkable that it is still

Fig. 2. Gregg Hamann (left) and the first author (right) try to contain their excitement in the midst of the Zamia neurophyllidia *colony on Playa Primera (a.k.a., Wizard Beach), Isla Bastimentos, Panama.*

Fig. 3. Female (A) and male (B) cones of Zamia neurophyllidia *at Wizard Beach.*

Fig. 4. The authors (left and right, respectively) and Gregg Hamann (center) next to a 4m specimen of Zamia neurophyllidia *at Wizard Beach.*

[1] Greg is the owner of Pacific Cycad Nursery on Kauai, HI, USA, and was nominated this year for the TCS Board of Directors.
[2] Jody is the Cycad Biologist at Montgomery Botanical Center in Miami, FL, USA, and is the TCS Secretary.

so incompletely known (Whitelock, 2003). Unfortunately, rather than clarify the confusion, the paper that described the two newer species in this group (Stevenson, 1993) and other subsequent reports have contributed to it.

The Central American "groove-leafed" zamias are often confused, particularly in cultivation and especially as seedlings. The following brief descriptions of the three species were compiled from Whitelock (2002), A. Taylor (pers. comm.), and personal observations.

The "true" *Z. skinneri*, as it is often called, is arborescent with trunks to 2+m tall, and has broad leaflets (to 50+cm long by 20+cm wide) and red-emergent leaves to 2m in length; adult plants in habitat typically hold 3-6 leaves; female cones densely red-brown tomentose and quite large, measuring 20-40cm long, 8-12cm in diameter, with a peduncle 2-7cm long; male cones usually number 1-4, are red-brown tomentose, and measure 4-15cm long, 1-2.5cm in diameter, with a peduncle 2-12cm long.

Seedlings and juveniles of *Z. dressleri* are sometimes confused with *Z. skinneri* because of their relatively large leaflets (although not as broad as *Z. skinneri*) and red-emergent leaves, but the former species is completely acaulescent and usually holds only a single erect leaf (rarely two to three leaves) in habitat; female cones are relatively small, wine-red to rust-red tomentose, 10-15cm long, 3-4cm in diam., with peduncle 4-6cm long; male cones usually solitary, cream to rust-red colored, 5-8cm long, 1-2cm in diam., with a prominently pointed apex (not found in the other two species) and peduncle 3cm long.

Zamia neurophyllidia is similar to *Z. skinneri* in stature, being arborescent with trunks over 2m tall, but the leaves are green emergent, the leaflets are much smaller and typically more numerous, and mature plants in habitat often hold 20 or more leaves; female cones tan to greenish brown, are often covered with brown to reddish-brown tomentum, may be erect to leaning or pendulous at maturity, and measure 21-27cm long, 6.5-7.5cm diam., with peduncle 7.5-20cm long (much longer than the other two species); male cones 2-10 in number, cream or light brown in color, 8-9cm long, 1.5-2.0cm diam., peduncle 5.5-7.0cm long.

Zamia neurophyllidia is by far the most common of the three species in cultivation, with *Z. skinneri* and *Z. dressleri* following at a far distant second and third, respectively. Ironically, with but a few exceptions, published reports and unpublished anecdotes suggest that *Z. neurophyllidia* is the most difficult of the three species to grow in cultivation. It is our hope that some of the discoveries summarized in this article will illuminate improved horticultural practices for this species.

The Cycads of Isla Bastimentos

Physical Environment

The Bocas del Toro Archipelago consists of six large islands and many smaller islets (Fig. 1). Isla Bastimentos is the third largest island, measuring approximately 52km^2. Isla Bastimentos and Isla Colón guard the mouth of a large bay, Laguna de Chiriquí, containing the four other main islands—Isla Popa, Isla San Cristóbal, Cayo Nancy, and Cayo Agua. This island group is geologically recent, having been formed by sea level rise beginning around 5,200ybp (Isla Colón) and continuing until around 1,000 ybp (Isla Popa and Isla San Cristóbal) (Anderson & Handley, 2002).

Bastimentos was definitely our favorite island in the group. As mere visitors, we were enveloped in its charm the minute we stepped off the water taxi. The inhabitants of Bastimentos are of African descent and are remnants of the banana trade that dominated the area in the early 20th century. They now make their living as subsistence farmers and fishermen, or from the tourism that is slowly making its way to their idyllic tropical paradise.

There are no roads on Bastimentos—which means no cars either, only walkways and boats for transportation—and we found this very calming upon our arrival to the island. For years, Bastimentos has been a backpacker's low-key getaway. Unfortunately, developers have recently made their way to the island and now see money to be made in subdividing the land, especially the beaches along the northern side of the island.

Population Characteristics

After a 20-minute walk through a cemetery and past several houses on top of the island (located on a hill that separates the south side, where the islanders prefer the protection from the unforgiving Caribbean waters, from the much harsher north side), we reached our destination: Playa Primera (also known as Wizard Beach), a white sand beach half a mile long adjacent to the most inviting aquamarine Caribbean water one could ever hope to see. Shaded by large trees was a low-lying beach strand vegetation just above the high-tide line containing what could only be described as a "lawn" of *Z. neurophyllidia* seedlings and small plants (Fig. 2). Straight away, Alberto commented that many large cycads he had seen near the trail-head three years prior had been cut down to make room for a shack that operated as a bar and restaurant during peak tourist season.

As we made our way eastward down the beach, the cycads got larger, some with two-meter trunks sticking out of the tropical vegetation. It was here that the first cones came into view (Fig. 3). Both female and male cones were present, but not in great quantities, though there were literally thousands of zamias in this one colony!

We were elated over our "find" until we came upon the second sign of cycad destruction. A large house was in the

Fig. 5. Leaf spot fungus, possibly Mycoleptodiscus indicus*, on a plant at Wizard Beach.*

Fig. 6. Larvae (A) and adult (B) of Eumaeus godartii*, an insect predator of* Zamia *species throughout Panama.*

process of being built right in the center of this amazing colony. No one was around that day, and construction was incomplete. But the most surprising thing was the size of the house; it was massive by even Florida or Hawaii standards. This was no villager's modest home, but rather the home of a person with money—and lots of it! The cycads had been cleared throughout the property, and we strolled by in utter silence as we were slammed with a huge dose of reality.

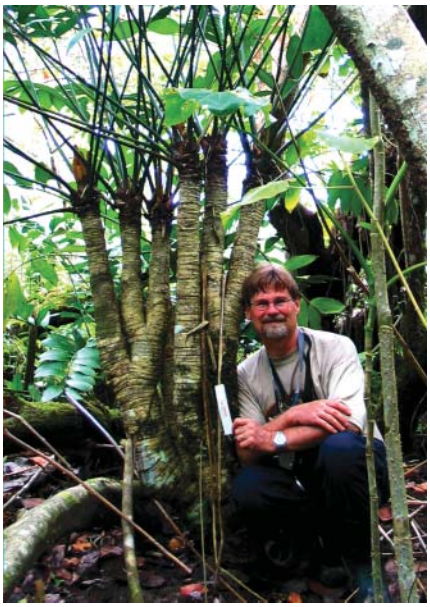


Fig. 7. Gregg Hamann posing next to a spectacular seven-headed male plant of Zamia neurophyllidia *at Wizard Beach; the multiple apices resulted from generations of being chopped by Bastimentos islanders.*

Fig. 8. Examples of the regenerative abilities of Zamia neurophyllidia *at Wizard Beach in response to human-induced damage: A) cut top rerooting in the sand, and B) cut trunk base resprouting leaves.*

We quickly realized that this population is threatened and that, unless something changes very quickly, we may never again see it in all its glory. Alberto was also feeling the pain, as he could no longer locate some of the more interesting specimens he wanted to show us. One plant, in particular, had become procumbent and had wrapped around a tree like a giant boa with leaves; but it was nowhere to be seen. We found more plants further down the beach where the vegetation became thicker and denser. Here, the plants were even more elegant, with darker green leaves and taller trunks—some reaching nearly four meters in overall height (Fig. 4)!

Another thing that became evident was that this population was growing in pure white sand covered with composted leaf matter. As soon as we walked 100 meters into the vegetation behind the high tide line—at the point where the sand stopped and the true soil started—the cycads abruptly ended their domination. In fact, not a single cycad could be seen growing further inland in the heavy, wet, clay-based soil.

We were also a bit surprised by the amount of seedling recruitment present in this colony—especially considering that *Z. neurophyllidia* was thought to be primarily a forest dweller of rich, lowland soils. The assumption was that this species grows in acidic, organically rich soil in nature—but nothing could be further from the truth in this population, as the calcareous-based sand is very low in organic content and is almost certainly alkaline. As propagators and growers of cycads, we realized that we had been trying to grow these plants in a soil mix that was too organically rich and too acidic. We had both had problems growing this species from seed—whereby large percentages of seedlings would die over time. The plants that did survive and were then potted up into "real" soil grew well enough, producing trunks and coning in ten years time. But it seems as though better results might be had by growing seedlings and small plants (at the very least) in an alkaline, sand-based medium.

Ecology

The beach strand habitat where *Z. neurophyllidia* grows on Bastimentos was dominated by sea grapes (*Coccoloba uvifera*) and coconut palms (*Cocos nucifera*) above and by a yellow-flowering "wedelia" groundcover (*Sphagneticola trilobata*) below. But from the perspective of their sheer numbers and imposing presence, the cycads were obviously the dominant plants in the area.

As we moved though the colony, we noticed a leaf spot fungus that looked like *Mycoleptodiscus indicus* (Fig. 5)—a new pest reported on zamias at Fairchild Tropical Botanic Garden just a couple of years ago (Tang, 2002) and occasionally observed on *Z. neurophyllidia* and other tropical zamias in cultivation. At times, this fungus can destroy entire sets of leaves in larger plants and can weaken young seedlings until they finally perish. Amazingly, it appeared as though this pest was having no significant impact on the health of the plants at Wizard Beach. It seemed to only affect plants in open situations that received more sunlight, so perhaps stress from excess sunlight plays a role in the susceptibility to this disease. It is also possible that seedlings that survived to reproduce in the wild are able to pass on some level of resistance to their offspring.

We also observed some minor leaf damage from a caterpillar, and we photographed larvae and adults of *Eumaeus godartii* (Fig. 6)—a relative of *E. atala*, the atala butterfly that feeds on coonties in Florida. The latter species has been problematic at MBC in recent years, where it has significantly broadened its host range to include more than 20 species of *Zamia* as well as species in several other cycad genera. Although obviously present on Bastimentos, *E. godartii* did not seem to be causing any noticeable adverse effects on the population.

Ethnobotany

In addition to the plants that had been killed or completely removed to make way for "progress," numerous other plants had been cut and had regrown. Some had been cut in the distant past and had regrown large trunks; others had been cut numerous times and developed into some really strange multi-headed creations. One plant to which we took a liking was a seven-headed male that possessed multiple scars as evidence of having been chopped by a machete or some type of axe. Four of the seven apices on this plant were in the middle of coning. Of course, we all wanted a picture next to this freak of "nature" (Fig. 7).

Some plants had been chopped fairly recently and their "tops" left on the

ground to re-root and continue their quest for survival (Fig. 8A), while the cut bases had sealed themselves and were beginning to re-sprout leaves (Fig. 8B). In one of the last areas on the beach that we checked, there was a path cut not long before through a large stand of plants, leaving only stumps and freshly cut tops of green leaves in the wake. It appeared as though a kind of harvesting was going on as all the trunks had been removed. By now, we were pretty sure that the people of Bastimentos were either directly involved or, at the very least, would know why the plants were being harvested. By this time, the steam seemed to come bellowing out of the jungle. So, with cold refreshments on our minds, we decided to head back to the bar where we started.

Upon our arrival at the little bar on the water, we sat down and ordered a cold beer. After some small talk with some of the locals, we took out a few photos of *Z. neurophyllidia* and asked the lady working at the bar about the use(s) of the plants. She had never seen the plants before, but she showed the photos to a few men at one of the other tables. We could not hear what was being said but they were all laughing and joking with the woman, who seemed quite amused by their answers. We continued to enjoy our beer, hoping for some sort of answer that could be of benefit to our trip. We had heard previously from Alberto that the Indians in other areas of Panama used the mucilage of *Z. skinneri* as glue in making folk guitars. But what we learned that day on Bastimentos was about as far from our wildest expectations as the hot sun would allow!

Our bartender came back with a great big smile on her face, and we ordered another round of beer in anticipation. She then told us that the plant was used to "make men strong," using her fist and arm for emphasis. We took another swig of our beer and said, "so it helps their muscles?" She shook her head and laughed, emphasizing the fist in the groin area. "No way!" we thought, as we looked over at the men who were by now quite interested in our reactions. We looked at them as though they must be kidding, but they didn't look like they were joking anymore. So we raised our beers in a toast and asked for more information.

To our astonishment, we learned that the trunks of the plant—which is known locally as 'guade teet'—are ground up and brewed into a tea, which is then drunk by the men for the purpose of prolonging erections. Needless to say, that was a great day for the expedition and for cycads in general! We all had some great laughs over how and who would investigate this on a scientific level. Graphs, charts, and "before and after" photos flashing on a screen in front of the peer review at the cycad conference in Mexico had us laughing until our stomachs hurt.

But we were still not completely convinced that the men of Bastimentos were telling the truth, even though they seemed sincere. On another island we observed plants bearing the same types of scars, but this time the Indians were reluctant to say any more than that the plants were used for the occasional headache and fever. It was on the island of Popa several days later that our apprehension in believing the "male sexual enhancement" story was shattered. An Indian man who called himself "Mama-Tata" (which literally means "mother and father") and who looked like Jesus—complete with a full beard and a white robe with a red cross on the sleeve—told us (after being paid $20.00 for his knowledge) that the plant is known as 'tadowa' by the Ngöbe-Bugle Indians and that both the men and women of Popa drink a tea made from ground up trunks as an aphrodisiac and sexual stimulant. Alas, we were convinced that the inhabitants of Bastimentos were telling the truth!

We feel it is important to note here that, "you should ***not*** try this at home!" Nearly every part of every cycad that has ever been tested has been shown to contain highly neurotoxic compounds like cycasin and BMAA (De Luca *et al.*, 1980, Charlton *et al.*, 1992, Audhali & Stevenson, n.d.). There was no apparent evidence of Parkinson's disease-like symptoms among the men of Bastimentos—similar to the cumulative symptoms that have been reported from Guam following long-term ingestion of *Cycas micronesica* seeds—but there was certainly evidence of long-term use, as many of the largest plants had been cut numerous times. We are currently working with a researcher at the Harvard Medical School to determine what kinds and how much of the toxins are present in *Z. neurophyllidia* stem tissue and if simply boiling the ground up trunk neutralizes the known toxins. Much more work needs to be done on cycad ethnobotany and on the possible medicinal uses of compounds associated with cycads.

Conservation

We are aware that *Z. neurophyllidia* occurs on many of the other islands and on the mainland in Bocas del Toro Province, but the population on Bastimentos is not only one of the largest populations of zamias we have ever seen but also one of the prettiest localities (Fig. 9). It is also one of the most threatened populations, as we learned toward the end of the trip that there are new plans being made to develop the beaches all along the north shore of the island (similar colonies exist at both Long Beach and Red Frog Beach to the east of Wizard Beach).

One of our hopes in writing this article and sharing the locality information with other cycad enthusiasts is so that others might go to Bastimentos and enjoy the plants and, while there, reach out and educate the island's community regarding the importance of the cycads to ecotourism and to the heritage of the people of Panama in general. Much thought has gone into how to best protect this area for the future, and it is our firm belief that it best serves the cycads to have this area protected though education as a form of conservation.

Not all populations of cycads would benefit from this approach, but in this case it is our hope that we will see these plants protected through a multi-layered approach focusing on education and awareness. We all need to do our part to preserve and protect cycads in the wild. This was the main reason for writing this article in the *Cycad Newsletter*.

References

Anderson, R.P. & C. O. Handley, Jr. 2002. Dwarfism in insular sloths: Biogeography, selection, and evolutionary rate. *Evolution* 56:1045-1058.

Audhali, N. & D. Stevenson. n.d. Ethnobotany of cycads. *In*: *The Cycad Pages* website (http://plantnet.rbgsyd.gov.au/PlantNet/cycad/ethn.html).

Charlton, T.S., A.M. Marini, S.P. Markey, K. Norstog & M.W. Duncan. 1992. Quantification of the neurotoxin 2-amino-3-(methylamino)-propanoic acid (BMAA) in Cycadales. *Phytochemistry* 31:3429-3432.

De Luca, P., A. Moretti, S. Sabato, & G. Siniscalco Gigliano. 1980. The ubiquity of cycasin in cycads. *Phytochemistry* 19:2230-2231.

Stevenson, D.W. 1993. The Zamiaceae in Panama with comments on phytogeography and species relationships. *Brittonia* 45:1-16.

Tang, W. 2002. Two new pests of *Zamia* in Florida. *Encephalartos* 69:26-28.

Whitelock, L.M. 2002. *The Cycads*. Timber Press, Portland, OR. (http://www.timberpress.com/books/isbn.cfm/0-88192-522-5)

(Modified and condensed from Phytologia 85(3), Sept. 1998)

A new *Zamia* (Zamiaceae, Cycadales) from central Panama

Article and photos by Bart Schutzman, Andrew P. Vovides and Russell S. Adams

(Editor's Note: A more detailed version of this paper with black and white photos appeared in Phytologia in 1999; we published an addendum in Bol. Soc. Bot. Méx. last summer to validate the species name because of a typographical error in the original publication. Zamia elegantissima *is often confused with* Z. fairchildiana *because of 1) the confusing events that led up to its description; 2) the fact that these two species are still misidentified and improperly described and figured in the internet resource "the Cycad Pages;"* Z. pseudomonticola, *a synonym of* Z. fairchildiana, is also incorrectly given species status. *I feel it is important to quickly clarify the three names and two species because more research efforts are now being directed to these species and it is more important than ever that new data be attributed to the correct taxa.)*

Zamia elegantissima Schutzman, Vovides & Adams was described from central Panama, and differentiated from closely related taxa *Z. fairchildiana* L.D. Gómez and *Z. tuerckheimii* J. Donn. Sm. The new species was previously considered part of *Z. fairchildiana*, but is morphologically and geographically distinct.

Whereas a proliferation of names caused confusion in earlier cycad taxonomies, especially *Zamia*, confusion regarding the identity of Panamanian and Costa Rican cycads have resulted mostly from scant and misinterpreted communications between workers. The well-known systematist Robert L. Dressler noticed the variation in the native Panamanian species of *Zamia* during his longstanding studies of orchids, and communicated some of his thoughts to other workers over the years. Unfortunately, none of them did the necessary fieldwork and other systematic study to develop a thorough, comprehensive treatment. The result of this was primarily the existence of unrecognized or improperly delimited species, one of which we highlight here.

Dressler had by the late 1970's rediscovered the then "nearly mythical epiphyte" *Zamia pseudoparasitica* Warscz. in Veraguas, Panama. He also informally referred to a *Z. "pseudo-pseudoparasitica"*, a little-known plant that was actually quite common in Central Panama, but confused with *Z. pseudoparasitica*. This central Panamanian plant was not an epiphyte, but an arborescent plant, with trunks often reaching three meters in height. Knowing that this terrestrial species of *Zamia* was undescribed, Dressler's intention was to name it for "Sandy" (Dr. A.G.B.) Fairchild. Dr. Fairchild was a well-known Isthmian entomologist and naturalist, in whose garden Dressler had observed several of the Panamanian cycads. He also was the son of David Fairchild, the famous, well-published plant explorer in the earlier part of the twentieth century and namesake of Fairchild Tropical Garden in Coral Gables, Florida. In an unpublished synopsis of Panamanian taxa, Dressler mentioned that he had wanted to avoid putting the name in writing before he actually described the species. Robert Wilson of the Las Cruces Botanical Garden in eastern Costa Rica, however, must have heard the name and assumed that the plants from his area belonged to the same species, because he distributed seeds and labeled them "*Z. fairchildii*." Gómez published the epithet in Phytologia in 1982, typifying the species with a specimen from a population of plants in the Osa Peninsula in southeastern Costa Rica. He included no etymology, but did mention to other workers, notably Dr. Knut Norstog (Norstog, pers. comm.) that he had named it after David Fairchild. The Costa Rican plants, which occur from sea level to 1500m in elevation in southeastern to central Costa Rica and also in extreme Western Panama, are only superficially similar to the central Panamanian plants, and are themselves a unique species.

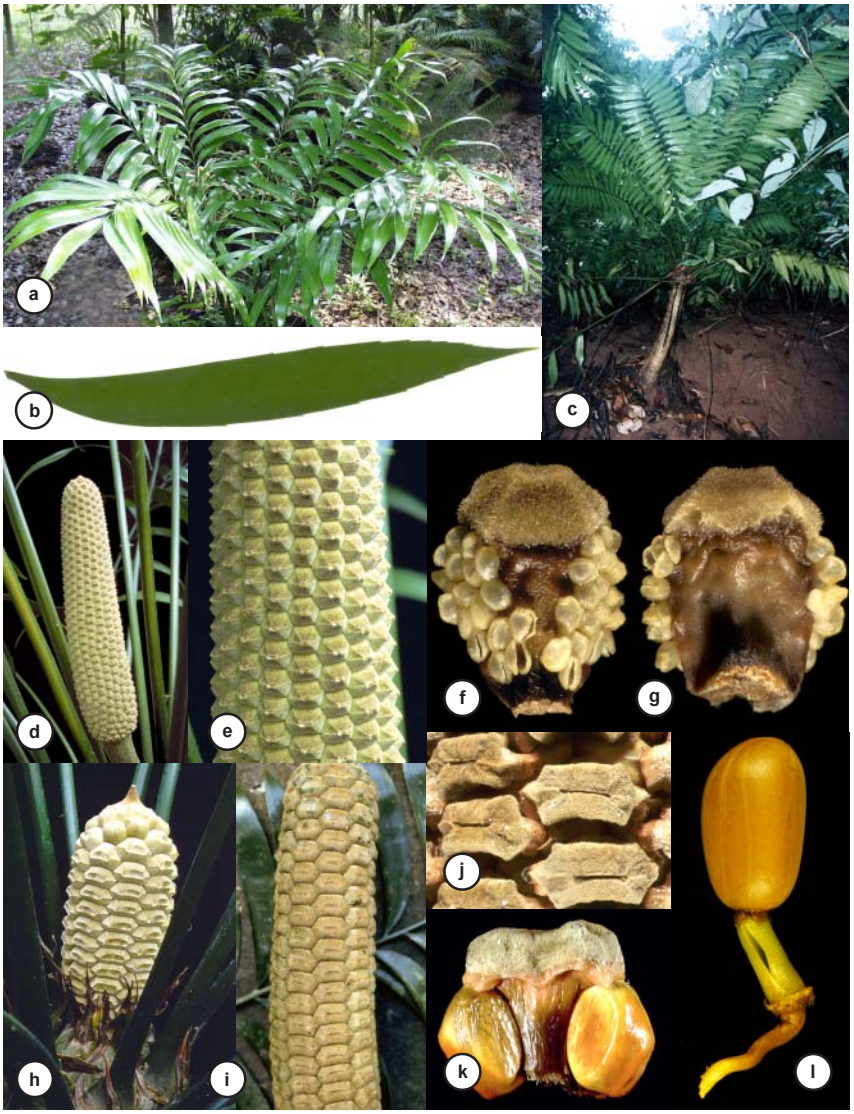


Fig. 1. Zamia elegantissima *Schutzman, Vovides & Adams. a) cultivated plant; b) leaflet; c) plant in habitat; d) microstrobilus; e) microstrobilus detail; f,g) microsporophyll abaxial, adaxial surface, respectively; h) emerging megastrobilus; i) megastrobilus in habitat; j) megasporophyll; k) mature megasporophyll with seeds; l) germinating seed.*

Seed were collected in 1983 and 1984 from along the Río Iguanita in Colón Province, and these have since grown to reproductive size. Microstrobili were produced in 1996 and megastrobili in 1997. The differences between Gómez' *Z. fairchildiana* and this Panamanian endemic became obvious from the eophyll (first seedling leaf) stage.

Stevenson, in his treatment of Panamanian zamias (1993), did not recognize the Panamanian populations as distinct. In it, the range of *Z. fairchildiana* is given as sporadic from southeastern Costa Rica to Cuna Yala in eastern Panama. Further investigation has not turned up populations of either the Costa Rican or Panamanian entity in the large intervening area between known populations (Fig. 2). So far as we know, the Panamanian species is exclusively found on the Atlantic and *Z. fairchildiana* on the Pacific side of the Sierra de Talamanca. So, the epithet *fairchildiana*, with which Dressler wished to honor Dr. A.G.B. Fairchild, graces a different species and informally honors David Fairchild instead. The plant from central Panama, which Dressler intended to describe, is therefore nameless, a condition we remedy here.

Description. Plants large, arborescent with trunks to 3m. Leaves usually many (30 or

more in cultivation), upright, to 170 cm long; leaflets lanceolate and slightly falcate, 20-22 cm long, 2.5 - 4.0 cm wide; apex short but not abruptly acuminate; margin denticulate from approximately the midpoint of the margin; marginal teeth 0.5 - 1.5 mm long; base attenuate, apple green when expanding, bright green, glabrous, and shining when mature; articulation with rachis 3-6 mm wide; petioles nearly unarmed, 43-44 cm long; prickles small and terete when present. Microsporangiate strobili erect, cylindrical, beige-yellow to light brown with green undertones; peduncle puberulent; microsporophylls oblong-obtriangular, the distal ends with protruding hexagonal faces; microsporangia covering abaxial surface of microsporophylls and absent on adaxial surface. Megasporangiate cylindrical with large pointed or rounded apiculate apex, tan to light brown with green undertones, tomentulose; peduncle tomentulose; megasporophylls with depressed central narrowly elliptic facet and margins folded back axially, 2.4 cm wide, 1.0cm high. Seeds 2.8 - 3.0 cm long, 1.6 - 1.8 cm wide, bright red, not visible between undehisced megasporophylls when mature. Chromosome number 2*n* = 20.

Etymology. The species is named for its extremely elegant appearance, large cultivated specimens bearing up to 40 or more large, shining, rather upright leaves. The beauty of these plants has made them prized elements in cycad collections.

Distribution and Ecology. Plants have been observed in primary lowland rainforest as well as secondary and other disturbed habitats. Strobili seem to occur more frequently on plants along stream banks where light conditions are better, and negligible in the forest understory, except in treefall areas where light could penetrate the canopy. All plants observed with strobili were female. The low rate of reproduction in *Z. elegantissima* is in contrast to *Z. fairchildiana* populations, which seem to be actively reproducing even in shaded habitats. In those populations, large numbers of coning specimens of both sexes were observed (R.S. Adams, pers. obs.). Dr. Alberto Taylor (1999) of the Universidad de Panamá reports extremely high seedling mortality in natural habitats.

Populations of *Zamia elegantissima* are extremely variable with respect to plant mature size and strobilus size. Coning female specimens have been observed with as little caudex girth as 5-10 cm. Individual female plant size in uncorrelated with strobilar size. Seed germination is also unusual in that the seeds seem to lack the inhibitors present in the sarcotesta of many cycad species. This allows ripe seed of *Zamia elegantissima* to germinate quickly in the presence of adequate moisture after dehiscence, rather than after various external factors result in the disintegration and/or disappearance of the sarcotesta. Coleorrhizae emerged directly through the sarcotestas within a few days after being placed in water. Coleorrhizae of the latest seeds collected were already breaking through the sarcotesta before even falling to the ground.

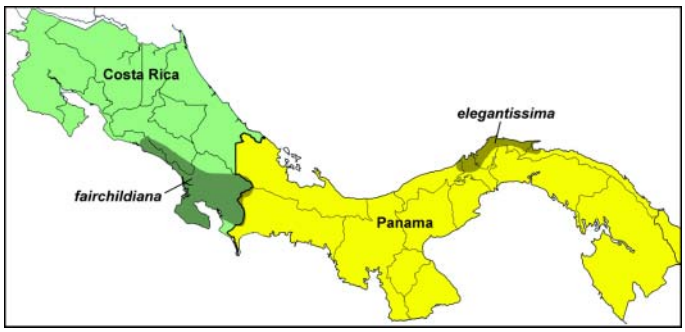


Fig. 2. Geographic distribution of Zamia fairchildiana *and* Z. elegantissima *in Panama and Costa Rica.*

Fig. 3. Comparison of average leaflets (top to bottom): Zamia elegantissima, Z. fairchildiana *and* Z. tuerckheimii.

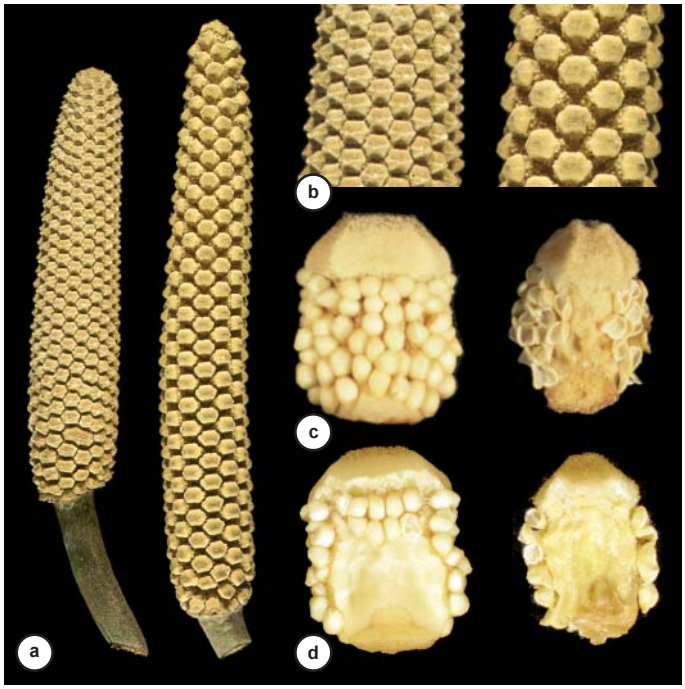


Fig. 4. Comparisons of Zamia fairchildiana *(left) vs.* Z. elegantissima *(right). a) microstrobilus; b) microstrobilus detail; c,d) abaxial and adaxial microsporophyll surface.*

Taxonomic relationships. The description of *Zamia elegantissima* increases to six the number of related species in Schutzman's (1998) putative *Z. fairchildiana* species group, which also includes *Z. acuminata* Oersted ex Dyer, *Z. fairchildiana* L.D. Gómez, *Z. inermis* Vovides & Rees, *Z. obliqua* A. Braun, *Z. soconuscensis* Schutzman, Vovides and Dehgan and *Z. tuerckheimii* J. Donn. Sm. The South American species *Z. encephalartoides* D.W. Stevenson and two undescribed species from Honduras and Belize appear to belong to this group, and would increase the count to nine. We consider *Z. pseudomonticola* to be conspecific with *Z. fairchildiana* as it differs in only one leaflet feature, which we believe to vary in a continuum between the extremes seen in several populations. It is conceivable that Gómez had not seen more than three populations *in toto*, as his publication only lists one specimen for *Z. pseudomonticola*, and two for *Z. fairchildiana*. Herbarium specimens annotated later by Gómez as *Z. pseudomonticola* are within our species concept of *Z. fairchildiana*.

Gomez has annotated other specimens of both Costa Rican and Panamanian origin as *Zamia fairchildiana*. The Panamanian populations near the Costa Rican border belong to *Z. fairchildiana*, but are disjunct and morphologically distinct from the central Panamanian plants, belonging in *Z. elegantissima*. The two species are alike in that plants of both may be large, pachycaulous and arborescent, and possess large strobili.

Leaf number and habit. Leaves of *Zamia elegantissima* are numerous both in habitat and in cultivation, often more than 30 in cultivation and erect, while those of *Z. fairchildiana* number 20 or fewer, and are arching. In habitat, we would expect leaf number to be correlated with light, soil and moisture conditions as they affect plant vigor. Leaves of the Guatemalan and Honduran species *Z. tuerckheimii* leaves are numerous and widely arching.

Reproductive features. Microsporophyll faces of *Z. elegantissima* as well as *Z. tuerckheimii* are pointed as compared to the more blunt hexagonal faces of *Z. fairchildiana* microsporophylls; the faces of *Z. elegantissima* microsporophylls are still hexagonal, only much smaller and seemingly protuberant (Figs 4a-d).

Megastrobili of *Z. fairchildiana* possess from 5 to 12 vertical rows of megasporophylls, whereas those of *Z. elegantissima* were much

longer, possessing from 14 to 20 rows. A significant difference between the two species is the visibility of ripe seed in undehisced megastrobili; in *Z. fairchildiana*, seed are visible and their enlargement pushes the megasporophylls far apart (Fig. 5), similar to the situation in *Z. tuerckheimii*, while the ripe seed of *Z. elegantissima* do not become visible until the disintegration of the megastrobilus. Megasporophylls are easily distinguished, those of *Z. fairchildiana* similar to *Z. tuerckheimii* and many other zamias in their relative flatness with some undulation at the peltate margin and a rather hexagonal face, while the *Z. elegantissima* megasporophyll has a margin folded back toward the strobilar axis, and a deep linear indentation in the face (Fig. 1j,k). Color of *Z. fairchildiana* megastrobili vary from light cream to tan to light brown due to variation in color of trichomes along with a varying amount of green underlying color from the megasporophylls themselves. Those of *Z. tuerckheimii* are tan to dark brown, but also have a green underlying megasporophyll color. The megastrobili of *Z. elegantissima* are lighter in color, ranging from cream through yellowish to tan.

Zamia fairchildiana is one of three species known to possess microsporangia on both ad- and abaxial microsporophyll surfaces. Another is *Z. cunaria* Stevenson & Dressler, a subterranean species from central Panama, and the third is a yet undescribed species reported by D.W. Stevenson (1999) from Colombia. Microsporophylls of *Z. elegantissima* only bear microsporangia on the abaxial surface, as do most other known *Zamia* species (Fig. 3A). Additionally, *Z. fairchildiana* microsporophylls bear microsporangia over the entire abaxial surface of the microsporophyll, lacking the interstitial area which splits the fertile region into two areas(Fig. 4C left), whereas in *Z. elegantissima*, this interstitial area may be greatly reduced but still is present at least near the microsporophyll apex. The interstitial area of *Z. tuerckheimii* microsporophylls is much wider, similar to that of most other *Zamia* species.

Stem. Trunk size differs substantially between and among populations of both *Z. fairchildiana* and *Z. elegantissima*, most likely depending heavily upon environmental conditions. Stems of *Z. elegantissima*, though extending above ground, always are found to possess at least 15cm of their stem length below the ground, when soil is ample enough to make this physically possible (A. Taylor, pers. comm.). Girth of stems is also a variable feature and overlaps significantly between the species. Stems of *Z. tuerckheimii* are often decumbent with as much or more trunk on the ground as extends upward.

Leaf characters. Petioles of *Z. fairchildiana* appear to be covered with dark brown tomentum when emerging, and these appear lighter when the leaf is fully expanded. Petioles of *Z. tuerckheimii* and *Z. elegantissima* are both glabrous when emerging and are bright green. Those of both *Z. elegantissima* and *Z. fairchildiana* seedlings are prickly, but petioles of older specimens of *Z. elegantissima* gradually become smoother until very few prickles are seen.

Leaflet characteristics (Figure 4). Leaflets of *Z. elegantissima* are somewhat falcate with marginal teeth beginning at the apex and usually extending somewhat below the midpoint, though in some cases, toothing may be almost absent. This feature often changes from one flush of growth to another. These leaflets also lack the conspicuous longitudinal creasing present in *Z. fairchildiana* leaflets. The leaflets of *Z. fairchildiana* are sigmoidal (curving in two directions), toothed sparingly only at the apex, and with conspicuous longitudinal convex crease. This creasing was first reported by Schutzman in *Z. standleyi* (1990), and also occurs in several other species including *Z. lindenii* and *Z. acuminata*, but tends to be lost in all of these species when herbarium specimens are made. The leaflets of *Z. fairchildiana* vary significantly from population to population. Those closer to Panama tend to possess a long-acuminate apex, often referred to as a "drip-tip." It is these plants with the abrupt but long acuminate apices that have been sporadically identified as *Z. pseudomonticola*. The plants at the type locality of *Z. fairchildiana* do not have an abrupt but elongate acuminate apex like those in more localities further east. *Zamia tuerckheimii* leaflets have a shape similar to and as variable as those of *Z. fairchildiana*, but do not possess the longitudinal convex crease. The color of *Z. elegantissima* leaflets is darker than that of *Z. fairchildiana* and similar to that of *Z. tuerckheimii*, but new growth of all three species is similarly a very light shade of green. No populations of any of the taxa tentatively thought to belong to this species group are known to possess plants with bronze or pink-emerging leaves, a feature common in other Mesoamerican and Caribbean taxa such as *Z. spartea* A.DC., *Z. loddigesii* Miq., *Z. splendens* Schutzman, *Z. standleyi* Schutzman, *Z. cremnophila*, *Z. lacandona*, *Z. purpurea* Vovides, Rees & Vazquez-Torres, and the *Zamia* species from the Bahamian islands of New Providence, Long Island and Eleuthera.

Chromosome number. Zamia elegantissima has 2*n*=20, the first report of that diploid number in *Zamia*. Chromosome numbers for other members of the tentative species group are not well-known. Norstog (1980) reports 2*n*=18 for *Z. obliqua*. Diploid number for *Z. tuerkheimii* is not known because the diploid number given for *Z. tuerckheimii* in Norstog's (1980) paper is actually that of *Z. standleyi* (voucher K. Norstog #80-3 from accession # FTG76-977). Both *Z. soconuscensis* and *Z. inermis* have 2*n*=16. This diversity in diploid chromosome number is quite unlike that seen in the *Z. splendens* group, in which all known species have 2*n*=16, though *Z. lacandona* also was found to have 2*n*=17 and 18 (Schutzman *et al.* 1998).

Seedling morphology. Zamia elegantissima seedlings are easily distinguishable from those of *Z. fairchildiana*. Eophylls (first leaves) of *Z. elegantissima* possess three or four leaflets and are 3-6" tall, while those of *Z. fairchildiana* hold two or rarely three leaflets and can be 8-12" tall. *Zamia tuerckheimii* seedlings have not been observed.

Literature Cited

Gómez, L.D. 1982. Plantae mesoamericanae novae. II. Phytologia 50: 401-404.

King, M. 1993. Species evolution: the role of chromosome change. Cambridge University Press, New York.

Levan, A., K. Fredga, and A.A. Sandberg. 1964, Nomenclature for centromeric position on chromosomes. Hereditas 52: 201-220.

Lima-de-Faria, A. 1983. Molecular evolution and organization of the chromosome. Elsevier, Amsterdam, New York, Oxford.

Moretti, A. 1990. Karyotypic data on north and central American Zamiaceae (Cycadales) and their phylogenetic implications. Amer. J. Bot. 77: 1016-1029.

Moretti, A. and S. Sabato. 1984. Karyotype evolution by centromeric fission in *Zamia* (Cycadales). Plant Syst. Evol. 146: 215-223.

Norstog, K. 1980. Chromosome numbers in *Zamia* (Cycadales). Caryologia 33: 419-428.

Schutzman, B. 1984. A new species of *Zamia* L. (Zamiaceae, CYCADALES) from Chiapas, Mexico. Phytologia 55: 299-304.

_____. 1989. A new species of *Zamia* from Honduras. Syst. Bot 14: 214-219.

_____ and A.P. Vovides. 1998. A new *Zamia* (Zamiaceae, Cycadales) from Eastern Chiapas, Mexico. Novon 8: 441-446.

_____, A.P. Vovides, and B. Dehgan. 1988. Two new species of *Zamia* (Zamiaceae, CYCADALES) from Southern Mexico. Bot. Gaz. (Crawfordsville) 149: 347-360.

Stevenson, D.W. 1993. The Zamiaceae in Panama with comments on phytogeography and species relationships. Brittonia 45: 1-16.

Taylor, A. S. 1999. Insect herbivore relationship in natural reproductive *Zamia* populations in Panama. Paper presented at the Fifth International Conference on Cycad Biology, Miami, Florida, August 7-10.

Vovides, A.P. 1983. Systematic studies on the Mexican Zamiaceae. I. Chromosome numbers and karyotypes. Am. J. Bot. 70: 1002-1006.

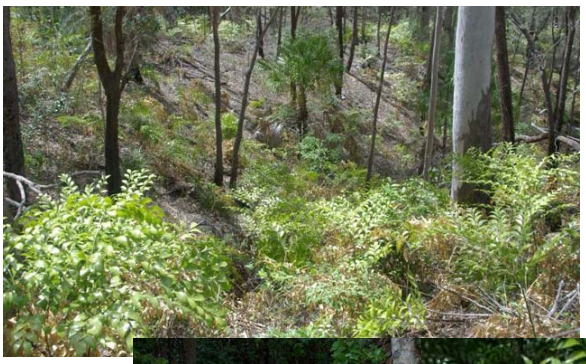
_____ and M. Olivares. 1996. Karyotype polymorphism in the cycad *Zamia-loddigesii* (Zamiaceae) of the Yucatan Peninsula, Mexico. Bot. J. Linn. Soc. 120: 77-83.

Fig. 5. Zamia fairchildiana *mature megastrobilus showing megasporophylls not folded back toward strobilar axis.*

Cycad Focus Focus Focus The Genus *Bowenia*

The Butcher's Fern - Genus Bowenia

Article and photos by Bruce and Suzi Ironmonger



Bowenia serrulata *with author Suzi Ironmonger*

Lush and delicate looking, the "butcher's fern" was hardy enough to last for days in the butcher shop display cases. It provided a nice green background to frame the meat displays. But few knew it was not a fern, but rather a cycad – *Bowenia serrulata*. Even today, many people visiting the Byfield Creek area still think that this lush green plant growing along the moist edges of the road and surrounding cane fields is indeed a fern. Thriving in areas of filtered light to dense shade, this unusual cycad looks nothing like the other more "palm-like" cycads found in Australia. Indeed some believe they are more closely allied to the South African *Stangeria*.

Currently, there are two described species of Bowenia and one undescribed species; all endemic to Queensland, from Rockhampton to north of Cairns and the Cape York Peninsula. These attractive, fern-like cycads are found mostly in high rainfall coastal areas. The genus is distinct in Australian cycads, as the plants have bipinnate (and tripinnate) leaves, a feature shared only with two species of *Cycas* from China.

Bowenia serrulata

The most southerly species is *Bowenia serrulata*, known in the trade as the "Byfield Fern". It is found north of Rockhampton near Yepoon and Byfield in habitats ranging from beach sand dunes to low gravelly hills.

Bowenia serrulata was originally described as *Bowenia spectabilis var. serrata* by F.M. Bailey in 1883 and as *Bowenia spectabilis var. serrulata* by W. Bull in 1878 from a cultivated plant. It was elevated to a distinct species by William Chamberlain in 1912, who described it as *Bowenia serrulata* following his visit to Australia in the early 1900's.

This species, like all *Bowenias*, form unusual underground tubers which are not at all like the stems of most cycads, but more similar to *Stangeria*. These tubers can range from the size of a small potato, up to 25-30 cm in diameter, with a crown of up to 30 leaves emerging from the tubers. The petioles range from 1-2 meters and the spreading branches are up to 1 meter wide. The subterranean tubers may lie dormant with no apparent leaves or carry one or more sets of leaves which appear out of the tubers from raised "necks", somewhat similar to "eyes" in a potato. From these "necks" arise the leaves and cones of the plant. The tubers may have one or more sections and may "colonize" an area. We have seen tubers which are "yam-like" in shape, tapering at the ends. Others are more compact and rounded. The leaflets, 10-40 on each branch, show the distinctive serrated edges and range from a deep green in shaded areas to a light lime green in sunny locations.

Much of the *Bowenia serrulata* habitat was destroyed years ago, with the planting of pine plantations for the wood chip industry. But large stands are still preserved within the Byfield National Park, sometimes growing amongst stands of *Macrozamia miquelii*.

Bowenia spectabilis

The northern species was described as *Bowenia spectabilis*. The original description was written by English botanist and Director of Kew Gardens, W.J Hooker, and published by his son J.D. Hooker in 1863.

Bowenia spectabilis occurs in tropical North Queensland, from Cardwell south of Cairns, and north to the Cooktown area. There is also a disjunct population further north on the Cape York Peninsula.

The most distinct difference between *Bowenia spectabilis* and *B. serrulata* is the lack of serrations on the leaflet edges of *B. spectabilis*. The main habitat for B. *spectabilis* is tropical rainforest. All the specimens we have seen in habitat have been understory plants in deep shade, often making them difficult to photograph. In several localities *B. spectabilis* is sympatric with *Lepidozamia hopei*.

Bowenia *sp. (Tinaroo)*

A third undescribed species of *Bowenia* occurs west of Cairnsin the Tinaroo area of the Atherton Tablelands. It is known in the trade as *Bowenia* sp. (Tinaroo) or *Bowenia* sp. (Mt. Haig), indicative of the location in which it is found. This variant has serrated leaflets similar to *Bowenia serrulata* and "school is still out" as to whether it merits specific status.

Bowenia spectabilis

Conservation Status of Bowenia

CITES recognizes *Bowenia* as an Appendix II species, which does allow for international trade. However the Queensland Government in their *Conservation Plant Series - Conservation and management of Protected plants in Queensland 2001-2005*, classes all *Bowenia* as "TYPE A – restricted species" which regulates and requires a permit for all plant, seed and foliage collection.

The foliage harvesting of leaves is restricted to plants with at least three fronds and no more that one-third of the leaves can be harvested. No harvesting is allowed on cone-bearing plants.

Uses of Bowenia

For many years in Australia, butcher shop displays were decorated with *Bowenia* leaves, a practice which has stopped since it was realized that the leaves are quite toxic and should not be mixed with foodstuffs.

Today, the leaves of this genus are still used extensively in floral arrangements as background or accent greenery. Bruce recently attended a wedding in Australia where the bride's bouquet contained *Bowenia serrulata* fronds.

We were also pleased to see that The Nob Creek Pottery at Byfield was utilizing depictions of local serrulata leaves in their unique lines of handmade ceramic items. They feature an attractive line of pottery including, wall tiles, dishes and hand basins (sinks) with *Bowenia serrulata* designs in pleasing earth tones.

Cultivation of Bowenia

Plants of *Bowenia* are easily grown in warm, humid areas with good protection. Here in Southern California, they can be grown in protected, frost-free gardens. The best specimens are usually found under palms and other plants, or in "fern grotto" surroundings where humidity levels are higher. Mulching can be of great benefit to these plants. The taller leaves are somewhat fragile and need some support or protection from the winds. They seem to prefer a well drained, but moist acidic soil mixture of loamy sand and humus. They also grow well in containers.

To date, none of our *Bowenia* have coned in cultivation. Loran Whitelock deems them to be "shy coners" but easily pollinated with good results. Average female cones develop about 25 to 35, round to oblong pale white seeds which darken with maturity to purplish hue. Seed embryos usually need to be allowed to fully develop after harvest for a period of four to 18 months, prior to being germinated.

Propagation of this genus may be by seed or tuber division. However, the species is prone to rotting, as the tubers are quite soft and easily bruised. They are quite different from the hardy *Stangeria* in this respect. Care must be taken to remove any and all damaged tissue and to fully seal off the exposed area, before replanting. Otherwise, they are a fairly trouble-free plant with the only other serious problem being Asian white scale. This means they are no longer a good garden plant for many parts of Florida, due to the current scale problem.

Bowenia *sp. (Tinaroo)*

Bowenia

Depiction of Bowenia *on bowls*

Cultivating Bowenia in Central Florida

Tom Broome

All *Bowenia* prefer to be grown in some shade. *Bowenia spectabilis* plants look especially good when shade grown. All the bowenias appear to be very cold hardy, but not very frost tolerant. Plants of *B. spectabilis, B. serrulata*, and the Tinaroo plants all tolerate 19F without leaf damage when covered to protect them from the frost. Plants not under a tree or some other cover burned during the same freeze. They all seem to react well to fertilizer applications. I use a time-release fertilizer for all my bowenias, just as I would to grow my zamias. They all grow well with regular irrigation. I water all my plants every other day.

Bowenia serrulata and the Tinaroo plants both grow in a sandy soil in habitat. *Bowenia spectabilis* seems to prefer an organic soil. Many years ago I planted seeds of all three plants in 19 inch deep citrus pots. The *B. serrulata* and Tinaroo plants had roots growing to the bottom of these pots in five weeks. The *B. spectabilis* plants had not totally rooted to the bottom of these pots even after a year. I have been told

that the Tinaroo plants are just a serrated leaf form of *B. spectabilis*, but from my own observations, I find this hard to believe. If anything, their root growth characteristics and soil preferences seem much more like those of *B. serrulata*. I have found that *B. serrulata* and the Tinaroo plants grow better in deeper pots, whereas *B. spectabilis* plants grow much faster when overpotted in both a wider and deeper pot. When I planted medium *B. spectabilis* plants in 15-gallon containers, they ultimately grew to twice the size as *B. serrulata* in the same size pots.

Growing bowenias in the ground in central Florida will get mixed results. I have known many people whose bowenias died when planted in the ground. Some people can grow *Bowenia serrulata* very well in the ground, but not *B. spectabilis*, while for others the exact opposite situation occurs, and *B. spectabilis* grows much better. The best *B. serrulata* plants I have seen growing in the ground here in Florida were under an oak tree on a sand mound. The sand had to be at least ten feet deep. Here in Florida, I would not suggest growing any of these plants in the ground until you have experimented on how they will do in your area.

I have grown all three plants for more than ten years. The *Bowenia spectabilis* plants produced male cones in six years, and my first female plant produced cones after eight years. After ten years, only a couple of male *B. serrulata* plants have produced cones, but no females. None of my Tinaroo plants have coned. All cones have dropped pollen or become receptive around September here.

Bowenia spectabilis is by far my favorite *Bowenia*. These plants grow really well for me, and can reach a height of over four feet tall after just a few years in a larger container. If you are going to grow bowenias in containers, I would strongly suggest starting out with this species.

Phenology of *Bowenia* in South Florida

Jody Haynes, MBC

The three species of *Bowenia* seem to have similar soil, light, and nutritional preferences—at least here in South Florida. Montgomery Botanical Center (MBC) is currently growing 51 total plants of *Bowenia* in the ground: 29 plants of *B. spectabilis* – representing 13 accessions and only a single population near Daintree Rainforest National Park; 16 plants of *B. serrulata* – representing four accessions and an unknown number populations; one of the populations is near Byfield, Queensland (hence the common name "Byfield fern" for this species); six plants of *B.* sp. "Tinaroo" – representing a single accession and the only known population near Lake Tinaroo, Queensland.

We have lost 18 (26%) plants of the three species over the years. I believe this is most likely due to the poor or inappropriate soil conditions in which the plants were growing. Most of our remaining plants are currently in our "Australia 1" bed—which is composed of pure silica sand—and they are all healthy and doing quite well.

Vegetative Phenology

Individual plants of all three species at MBC flush leaves during one or two time periods in any given year. These growth events often consist of one or two leaves emerging each month over a two to three month period. Major peaks of vegetative activity occur in midsummer, but leaf emergence has been observed in every month of the year except February (Fig. 1a).

Reproductive Phenology

Only two of our 29 (7%) *B. spectabilis* plants at MBC have coned, and both are male. Age at first coning of one of these plants was 11 years, while the age of the other is unknown. Based on a sample size of two, I can say (with very little confidence) that male *B. spectabilis* cones may emerge in April or May and may dehisce in June here in South Florida (Fig. 1b).

Five of our 16 (31%) *B. serrulata* plants have coned, and all are males. Age at first coning was from 9-13 years. Cones emerge March through May and dehisce in June (Fig. 1b; Fig. 2).

Of the six *B.* sp. (Tinaroo) plants in our collection, only one (17%) has coned (just this year!); it is a 6-year-old female. The cone emerged in May and was receptive in June (Fig. 3); it is still on the plant, although it did not get pollinated.

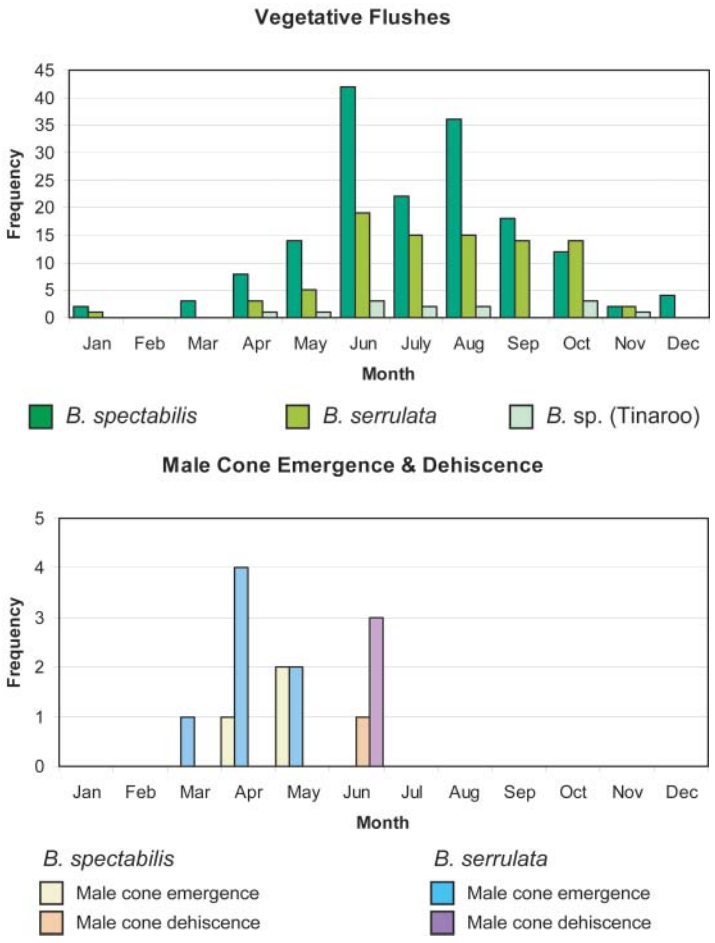


Fig. 1. Phenology of Bowenia *at MBC: a) vegetative flushes; b) male cone emergence and dehiscence.*

Fig. 2. Dehiscing male cone of Bowenia serrulata *(MBC Acc.# 94632*G).*

Fig. 3. Receptive female cone of Bowenia *sp. (Tinaroo) (MBC Acc.# 99127*C).*

Attempts at Cultivation of *Bowenia* in Southern California

Jeff Chemnick

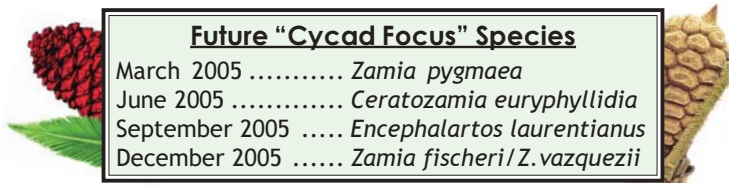
In the late 70's, I acquired three potted *Bowenia* of each species. They were greenhouse-grown and were spectacular in 5-gal. plastic pots! I was unable to successfully grow these plants outdoors in San Diego for even one year! During the exceptionally cold winter that followed, two of each species succumbed. I moved the remaining individuals into the greenhouse where they again began to flourish.

I tried once again to grow the remaining two *Bowenia* outdoors in 1981 when I moved to Santa Barbara, hoping that the winter would not be fatally cold. The potato-like caudex of this genus is subterranean and difficult to monitor. One day it can appear turgid and healthy to the touch, the next your finger might penetrate as if probing a mushy pear. Unfortunately, I was soon *Bowenia*-less in Santa Barbara. A few years later, I traded a few *Bowenia spectabilis* seedlings to GannaWalskaLotusLand. After several years, the curator, Virginia Hayes, decided to plant the largest one outside in the cycad garden. I tried to discourage her, citing my own difficulties. But she prevailed, and a very healthy individual was planted alongside the small koi pond next to the *Encephalartos woodii*. A chickenwire cage was placed around the plant to protect it from the ravages of gophers and a ground thermometer was stuck in the soil. It looked rather impressive and, incredibly, that cycad began to grow. For two years, the *Bowenia* produced new leaves and gave every indication of health and happiness. And, of course, every time Virginia and I toured the garden, the condition of the plant was pointed out to me! But, eventually the plant did realize it was living in California and not Queensland and went into steep decline. The *Bowenia* was removed from the garden and returned to the nursery where it is still recovering. Thus, my experience is that the genus *Bowenia* is not suitable as a garden plant in southern California, sadly, because healthy individuals are beautiful and are striking departures from the "typical" cycad look.

Growing *Bowenia serrulata* in Central Texas

Craig Nazor

This beautiful cycad is not the easiest plant to grow in the Austin area soils or climate. In a pot, this plant prefers sandy soils, and dislikes alkalinity, conditions that are hard to find in our local native soils unless one goes southeast into the coastal plain of south Texas. Our summer greenhouse temperatures (100ºF+) and intense sunlight appear to retard growth. I have observed the best growth in the greenhouse in the fall and spring, or outside in the summer under trees where the breeze and shade seem to take the edge off the heat. It's a good idea not to let the soil get too dry in the summer. Our winter temperatures are usually cold enough to damage the leaves, but this does not appear to set the plants back appreciably. If the plant is not happy, it will drop its leaves and stay dormant until conditions improve, so never assume the worst without checking the subterranean stem. At any rate, the beautiful leaves of *Bowenia serrulata* are definitely worth the trouble of supplying the correct horticultural conditions.



Future "Cycad Focus" Species

March 2005 ..... *Zamia pygmaea*
June 2005 ..... *Ceratozamia euryphyllidia*
September 2005 ..... *Encephalartos laurentianus*
December 2005 ..... *Zamia fischeri/Z.vazquezii*

Cycad Society of South Africa

The Cycad Society of South Africa is a nonprofit international organization that is based in South Africa. It is devoted to education and the conservation of cycads. Its quarterly magazine, "*Encephalartos*" is sent to members by airmail and *inter alia* contains information on the discovery of new cycad species. Please contact one of the following correspondents:

Paul Kennedy
21 Sierra Road
Engadine, NSW, 2233
Australia

William Tang
65 Corydon Drive
Miami Springs, Florida 33166,
USA

Montgomery Botanical Center

A Center for Plant Research Collections Emphasizing Palms and Cycads

Montgomery Botanical Center, a not-for-profit institution, is proud to report on the activities of its SeedBank Program as follows:

Summary of numbers of seeds distributed to educational and research institutions, governmental organizations, conservation agencies, national and international botanic gardens, and national and international societies.

1998 – 163,598 1999 – 528,301
2000 – 552,324 2001 – 681,005
2002 – 840,526 2003 – 745,556

TOTAL Number of Seeds Distributed
From 1998 to 2003 = 3,511,310
January to June 2004 Seed Distribution = 485,874

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Academy of Science, Moscow, Russia
Agropecuaria Vanguarda, Brazil
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Bogor Botanic Garden, Indonesia
Botanic Garden of Albras, Brazil
Botanic Garden of Indonesia
Botanical Garden of Brasilia, Brazil
Botanischer Garten, Germany
Brazil Botanic Garden
Broward Palm & Cycad Society, Florida
Cactus & Succulent Society of Zimbabwe
California Cycad Society
Canary Islands Palmetum, Spain
Cayman Islands, Department of Agriculture
Central Florida Palm & Cycad Society
Chicago Botanical Garden, Garfield Park Conservatory, Illinois
City of Lakeland, Florida
Colorado State University, Ft. Collins
Columbia University, New York
Coral Gables Fire Department, Florida
Coral Reef Senior High School, Florida
Crandon State Park, Florida
CRC for Tropical Plant Protection, Australia
Cycad Society
Denver Zoological Society, Colorado
Durbin Botanical Garden, South Africa
Fairchild Tropical Botanic Garden, Florida
Fairy Lake Botanical Garden, China
Fakahatchee Strand State Preserve, Florida
Flamingo Botanical Gardens, Florida
Florida International University
Florida International University, Conservatory
Florida Nursery, Growers and Landscape Association Dade Chapter
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Garfield Park Conservatory, Illinois
Harry P. Leu Botanical Gardens, Florida
Harvard University, Massachusetts
Houston Palm Society, Texas
Huntington Botanical Garden, California
Instituto Plantarum, Brazil
International Palm Society
John Hopkins University, Maryland
Kebun Raya Indonesia
Kirstenbosch Botanical Garden, South Africa
La Palaudiere, France
Louisiana Palm & Cycad Society
Lowveld Botanic Garden, South Africa
Marie Selby Botanical Garden, Florida
Master Gardeners of Dade County, Florida
McMaster University, Canada
Miami City Cemetery, Florida
Miami-Dade College, Florida
Miami Rare Fruit Council, Florida
Miami-Dade Metrozoo, Florida
Michigan State University, Lansing
Mississippi State University, Starkville
Missouri Botanical Garden
Moody Botanical Garden, Texas
Naples Botanic Garden, Italy
National Tropical Botanical Garden, Hawaii
New York Botanical Garden, Display Collection
New York Botanical Garden, Rainforest Exhibit
Nong Nooch Botanical Garden, Thailand
Palm & Cycad Society of Southwest Florida
Palm Beach Palm & Cycad Society, Florida
Palmetum of the Canary Islands, Spain
Panzhihua City Botanical Garden, China
Panzhihua City, Department of Gardening, China
Parks & Wildlife Commission, Northern Territory, Australia
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Pretoria National Botanical Garden, South Africa
Quail Botanical Garden, California
Rio Grande Botanical Garden, New Mexico
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South Florida Palm Society
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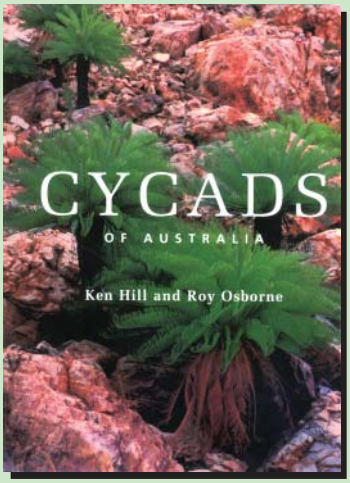

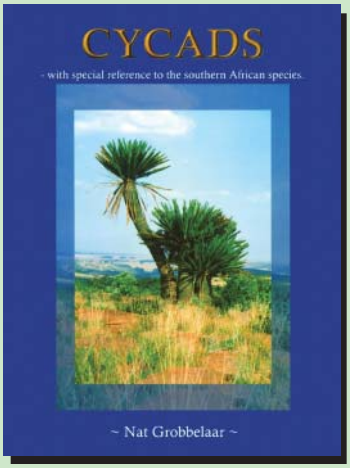

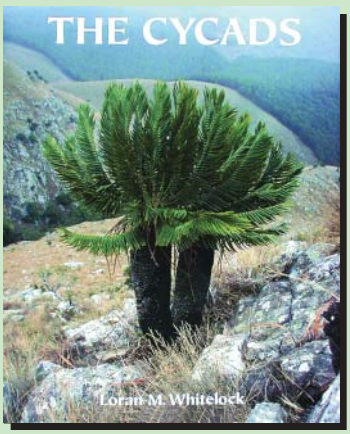

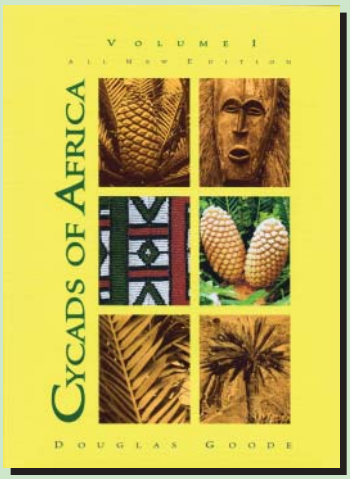

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